HP Network Automation

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Multimaster Distributed System on Oracle User's Guide

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Contents

1   Getting Started

This chapter contains the following topics:

Terminology

The following terms are used throughout this guide:

- **NA Core** — A single NA Management Engine, associated services (Syslog and TFTP), and a single database. An NA Core can manage multiple Partitions.

- **Partition —** A set of devices with unique IP addresses. A Partition is managed by one (and only one) NA Core. Multiple Partitions can be managed by a single NA Core. For information about segmenting devices, see the *NA User's Guide*.

- **NA Mesh** — Multiple NA Cores connected via multimaster replication.

- **Multimaster replication** — Replication where all data is kept consistent across all database servers.

- **Master Definition Site** — Oracle replication requires that one database in a multimaster replication NA Mesh hold the definition of the replication setup. This database is called the Master Definition Site.

Overview

The NA Distributed System on Oracle is a multimaster system where the data from each NA Core in an NA Mesh is accessible to all other NA Cores. This provides a comprehensive view of your data and allows for redundant data and failover in the event of a problem with a single NA Core. The multimaster features include both database data and certain file system data, such as software images and device driver packages. Keep in mind that software images and device driver packages are also replicated across the NA Mesh.

The following comprises the NA Distributed System:

- A NA Core and a Site:

  — A device is associated with a single Site.

  — A Site is associated with a single NA Core.

  — A task is associated with a specific NA Core.

- Multimaster replication on Oracle:

  — Conflict resolution in the event that the same piece of data is modified almost simultaneously on two separate NA Cores. This conflict is typically resolved using the latest timestamp method.

  — Replication monitoring and conflict notification is built into NA. You can manage Oracle replication conflicts and view replication job statuses from within the NA UI.

  — The NA scheduler is multi-core aware. You can schedule group tasks containing devices that are associated with different NA Cores. The system will run these tasks on the correct NA Core. You do not have to schedule tasks on the appropriate NA Core.

System setup requires a thorough understanding of Oracle and NA. Installation includes number of steps that must be performed on the various servers. In addition, certain network changes may be necessary to allow connections between the servers. Once setup is complete, you will need to partition your devices into Sites to ensure proper NA Core access to devices. For information about segmenting devices, see the *NA User's Guide*.

Architecture

The following figure shows a typical two-NA Core Multimaster Distributed System installation. The installation enables failover from one NA Core to another, while the remaining NA Core continues to manage all devices.
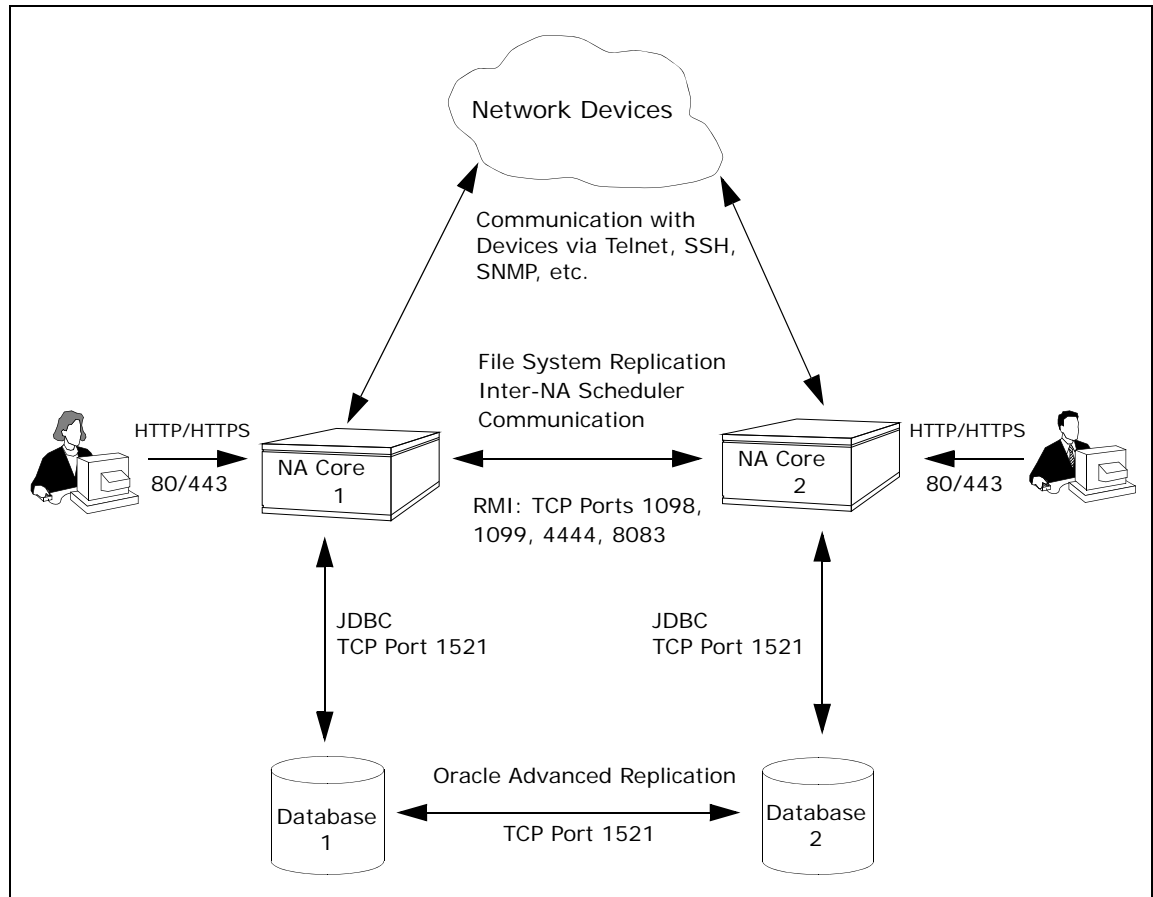
Keep in mind that some installations might have two separate network device collections that are inaccessible from the non-managing NA Core. These installations still provide data redundancy and scaling benefits, however.

Note that the database data transport uses standard Oracle Advanced Replication. For details on how replication works, see System Administration on page 49.

The communication between the NA Cores is done using Java's Remote Method Invocation (RMI). RMI is used to ensure:

- Certain file system objects, such as software images and driver packages, are in sync.
- NA tasks are scheduled and run on the correct NA Core.

NA does not replicate NA Core specific options, including:

- TFTP server information
- TACACS server information
- Scripting language settings
- Hop Box definitions

- Driver directory
- Install directory
- Local Gateway information
- SWIM proxy server
- Active Directory settings
- Scheduler (concurrent task limits)

What is Horizontal Scalability?

Horizontal Scalability is the ability to combine multiple NA Cores with a single database so that they work as a single logical unit to improve the performance of the overall system. NA Horizontal Scalability can be configured in different ways, depending on how you use your system and where bottlenecks are apt to occur. For installation and configuration information, see the *NA Horizontal Scalability User's Guide*.

NA Internal Monitoring: Oracle Advanced Replication

Oracle Advanced Replication can be configured to automatically handle certain types of conflicts. Where possible, NA uses Oracle's built-in conflict handling software. For example, for most tables with *update/update* conflicts, NA installs the default Oracle "latest timestamp wins" handler.

When it is not possible to use Oracle's default handler, NA either adds a stored procedure to handle the conflict (in particular, for *update/delete* conflicts), or adds additional code inside the application with logic that attempts to correct the error. If the error is uncorrected through that logic, NA alerts the NA administrator to the issue using NA' standard event notification emailing functionality. For information about configuring email notification, see the *NA User's Guide*.

▶ When a second NA Core is used as a standby for failover and not for normal operation, you should not encounter *update/update* conflicts.

For detailed information about NA monitors, see Understanding Oracle Replication on page 49.

In addition, in Oracle, NA monitors on a regular schedule the following on each NA Core for the database transport (i.e., replication):

- Push jobs that handle moving data from one NA Core to another. If the monitor check fails and the Push job is found to be broken, NA will attempt to restart it.

- Purge jobs that successfully clear pushed data from the push queue, and attempts to restart the Push queue each time the check fails.

- The deferred transaction queue for any transactions that could not be applied to the local database due to a conflict. NA applies additional application logic to attempt to correctly apply the transaction. If unsuccessful, NA alerts the NA administrator via email notification.

- Unrecoverable uniqueness conflicts. NA alerts the NA administrator in the event of unrecoverable uniqueness conflicts. Typically, there is no way to automatically correct these types of issues.

- Both the DEFTRAN and DEFLOB queue size. These queues hold pending data that needs to be pushed to other servers. Typically, if replication is working, but is beginning to backup, these queues will begin to grow. This can occur if the connection between databases is congested. NA alerts the NA administrator to this issue via email notification. The system will continue to push data. However, it could take a long time to catch up depending on network conditions.

▶ For information about configuring email notification, see the *NA User's Guide*.

NA Internal Monitoring: Inter-NA Core Communication

In addition to replication monitoring, NA also monitors the following between each NA Core:

- RMI connectivity
- NA server timestamp differences

These monitors generate events during error conditions. The events can be emailed to the NA administrator or Oracle DBA using a standard event rule in NA. For information about configuring email notification, see the *NA User's Guide*. For detailed information about NA system events, see NA Generated Events on page 51.

▶ NA includes an example event rule that can be updated as necessary.

2   Installation, Setup, and Upgrading

The chapter contains the following topics:

For information about troubleshooting an NA Mesh, see Troubleshooting on page 65.

System Requirements

For information about database version and server hardware requirements for the NA Multimaster Distributed System on Oracle software, see the *NA Support Matrix*.

Prepare for Initial Replication

To properly install the Distributed System software, you must first complete:

- Device partitioning planning across NA Cores

- Network configuration planning for connectivity between NA servers and devices. For example, what network connectivity is required to support failover for device access? The ability of an NA Mesh to failover for device access depends in part on proper network setup to ensure access to devices. In some cases, you might not want to have failover work for complete device access, but instead have it ensure access to data while corrective action is taken to restore the network connectivity to the affected NA Core.

- Network configuration planning for connectivity and bandwidth between the different servers (NA and database) that comprise the NA Mesh and between the NA Management Engines and devices. The NA Cores in the NA Mesh will also need bandwidth between them equal to the bandwidth provided between a single NA server and its database in a single NA Core. For more information, see Architecture on page 9.

- Network configuration planning for bandwidth usage by the NA Mesh. The bandwidth required between an NA Management Engine and its database depends on the size of the deployment, including the number of devices, average configuration size, and the number of concurrent users. The bandwidth available between the Oracle databases should be as large as between the NA Management Engine and the database. For a deployment of 14,000 devices with an average 10K configurations that change once a week, the bandwidth requirements could conservatively be on the order of 1Mb/s. Peak bandwidth requirements could be higher, depending on usage.

- Oracle server setup planning. Keep in mind that the database properties required for replication can be set on initial database creation. You do not need to wait until replication setup to set these parameters.

Keep in mind that during setup, data is dumped from an existing NA server. This could take time and use disk space as the database is copied. In addition, when data is copied from one database to another, there must be ample bandwidth between the two (or more) servers. It will also take time to import the exported database into the other NA Cores.

You can estimate the time it will take to copy data from server to server given the bandwidth between the servers. You can also calculate the disk space requirements for the export (and subsequent import) operations by knowing the size of your database. Note that if you want to export or import data from the same server as the database, the disk space requirement is twice the size of your database.

▶ Estimating time for the import and export operations could be difficult. You should allocate a lengthy time frame to complete this work. In addition, the NA server(s) must be off during the export and import steps. A sufficiently long maintenance window should be planned for.

You will also have to ensure:

- Time synchronization setup for the NA servers in the NA Mesh

- Users are instructed to login to their "closest" NA Core

- Access to an Oracle DBA to support the NA Distributed System installation

To assist in planning, please note the following limitations and suggestions concerning the NA Distributed System:

- The NA database user name must be a custom value (not SYSTEM).

- NA currently does not support joining multiple existing NA installations into an NA Mesh. You can only create an NA Mesh from a single existing NA server, adding new NA Cores as appropriate. You can also create an NA Mesh from scratch.

- Users should not share logon accounts. Due to the replication system used to share data across NA Cores, two users should never use the same login name to connect to two different NA Cores at the same time. If they do so, the system will likely require additional work by the system administrator to ensure that the affected user's profile is properly synchronized across the NA Mesh.

- NA currently assumes that all servers in the Mesh (NA and database) share a single timezone.

- Future NA upgrades will take longer and require more downtime due to the need to both update the replication setup and to update all servers in the NA Mesh. NA does not support rolling upgrades where one part of the NA Mesh is running a version of NA while the rest of the NA Mesh is running a different version.

- The ReplicationScript.sql script updates the RN_CORE table. When the replication script runs, the RN_CORE table changes. There is no need for it to UPDATE and INSERT into the RN_CORE table on both Cores because replication is already running. The database

changes will be pushed via replication to the second database. The contents of the RN_CORE tables on both databases should match whatever is set up in *ReplicationScript.sql*.

Planning

This section includes information for initial replication setup on a Master Definition Site (Master 1) and one additional Master Site (Master 2). NA will be offline during initial replication. It is recommended that you carefully read the following sections so as to streamline the replication process. A new database instance on Master 2 is manually created when running initial replication setup.

When initially setting up replication, complete the following table before starting. Be sure to save this information. You will need it each time you upgrade in the future.

Table 1   Distributed System Server Information

Information to Collect	NA Core 1	NA Core 2
Replication User (default: repadmin)		
Replication User Password		
Timezone Offset from UTC		Same for all servers in the NA mesh
Application Server Data	**NA Application Server 1**	**NA Application Server 2**
NA App Server FQDN		
NA App Server RMI Port		
Database Server Data	**Master 1 (Database Server 1)**	**Master 2 (Database Server 2)**
Database Server FQDN		
Oracle Listening Port		
Database SID		
Database User		Same as for Master 1
Database Password		Same as for Master 1

Protocols, Databases, and Ports

NA communicates with devices using a combination of the following protocols, databases, and ports. If you use a given protocol, NA requires access to the corresponding port. Specifically, if NA communicates with devices protected by firewalls, these ports must be open. For more information, see Architecture on page 9.

Protocol/Database/Port	From/To
NA server (running the Mgmt Engine, Syslog, TFTP) and network devices	
Telnet (port 23)	From the NA server to network devices.
SSH (port 22)	From the NA server to network devices.
TFTP (port 69/udp)	From network devices to the NA server.
Syslog (port 514/udp)	From network devices to the NA server.
SNMP (port 161/udp)	From the NA server to network devices.
Between the database servers	
Oracle (port 1521)	In a Distributed System configuration, the Oracle processes connect to each other on port 1521.
Between the NA servers	
JNDI (ports 1098, 1099)	NA server to NA server. You can change this by editing the NA configuration files. Please contact Customer Support for assistance.
RMI (ports 4444 and 8083)	NA server to NA server. You can change this by editing the NA configuration files. Please contact Customer Support for assistance.
Between the NA server and the database server	
Oracle (port 1521)	From the NA server to an Oracle database server.
NA server and NA users	
HTTPS (port 443)	From the NA server to NA users. You can change this by editing the NA configuration files. Please contact Customer Support for assistance.
Telnet (port 23 - Windows or 8023 - Solaris/Linux)	From the NA client to the NA server. This can be changed from the Administrative Settings option.
SSH (port 22 - Windows or 8022 - Solaris/Linux)	From the NA client to the NA server. This can be changed from the Administrative Settings option.

Unpacking the Replication Script Installation Bundle

The setup files for the NA Multimaster Distributed System are the standard setup files for a normal NA installation, with the addition of the `OracleReplicationScriptToolBundle.zip` file. This file should be unzipped onto a standard NA application server. The setup files include a Java program that you run to generate a replication setup SQL script. This program uses the Java runtime that is available on the NA application server.

Oracle 11g: Set Up Initial Replication

Oracle 11g introduces a change that requires recreation of the database schema after exporting that schema for use on another database server. This procedure accomodates the new behavior of Oracle 11g.

NA can already be installed on one application server and database server (a single NA core). Alternatively, you can complete the first NA core installation as part of setting up initial replication.

This procedure uses the following identifiers:

- NA application servers: `NA1` and `NA2`
- Oracle database SIDs:
  - `SID1` on database server Master 1
  - `SID2` on database server Master 2
- NA database user for both databases: `nauser`
- Password for the NA database user: `napass`
- NA tablespace: `NAORA`
- Script to create the NA database user: `create_nauser.sql`
- NA schema export file: `NAEXP.dmp`

To use a different identifier, substitute the actual value for each instance of the example value within the procedure.

To set up initial replication between two NA cores, complete the following tasks:

- Task 1: Verify Prequisites (Oracle 11g)
- Task 2: (New Installations Only) Create the NA Schema on Master 1 (Oracle 11g)
- Task 3: Prepare Master 1 for Replication (Oracle 11g)
- Task 4: Prepare Master 2 for Replication (Oracle 11g)
- Task 5: Configure Replication (Oracle 11g)
- Task 6: Configure the NA Application Servers for Replication

Task 1:　Verify Prequisites (Oracle 11g)

Prepare two database servers and two application servers. For best performance, each application server-database server pair should be co-located. Additionally, the application server-application server link and the database server-database server link should each be a high-speed connection.

Verify that the following prerequisites have been met:

- The two database servers are running Oracle 11g with the following configuration:

  — Unique SIDs

    ▶ One SID *cannot* be a subset of the other SID, for example NARp and NARpBU. Instead, use SIDs that stand alone, for example NARp1 and NARp2.

  — The following parameters:

    – global_names = TRUE

    – open_links = at least 4 (increase this by 1 for each additional server in the NA Mesh beyond 2)

    – open_links_per_instance = at least 4 (same as open_links)

    – parallel_min_servers = 2

    – shared_pool_size = increase current value by 40m to support replication

    – job_queue_processes = at least 2

    ▶ The parameters must be set on each database in the NA Mesh. The parameters could be set up when the database is first created. If not, they must be modified at this point. You can view the current value of these parameters using Oracle Enterprise Manager or SQLPlus with the "SHOW PARAMETERS" or "SELECT NAME, VALUE FROM v$parameters" commands (where NAME = <parameter_name>, for example, global_names).

- The two application servers that will run NA have working hostnames. Note the following:

  — Each application server should have a high-speed connection to one of the database servers.

  — For application server hardware and operating system requirements, see the *NA Support Matrix*.

- It is recommended that the host names of both database servers and both application servers are in the `hosts` file on each application server. This file is located as follows:

  — *Windows*: `<Drive>:\Windows\System32\drivers\etc\hosts`

  — *UNIX*: `/etc/hosts`

- All database servers and application servers are set to use the same time and timezone.

- If NA is already installed on one NA core, verify that the database user in place for this core has at least the permissions listed in NA Database User Creation Script (Oracle 11g) on page 26.

Task 2: (New Installations Only) Create the NA Schema on Master 1 (Oracle 11g)

If NA has not yet been installed, create the NA schema on the Master 1 database server by following these steps:

1 Log on to Master 1 as the SYS user, and then create a new tablespace dedicated to NA on Master 1.

   For example, create the NAORA tablespace for SID1 by using the following command:

   - *Windows*:

     ```
     CREATE TABLESPACE NAORA DATAFILE 'C:\APP\ADMINISTRATOR\ORADATA\SID1\
     NAORA.DBF' SIZE 200M REUSE AUTOEXTEND ON NEXT 50M;
     ```

   - *UNIX*:

     ```
     CREATE TABLESPACE NAORA DATAFILE '/u01/app/oracle/oradata/SID1/
     NAORA.DBF' SIZE 200M REUSE AUTOEXTEND ON NEXT 50M;
     ```

2 Create a script for creating the NA database user as follows:

   a Using a text editor such as WordPad or vi, copy the text in NA Database User Creation Script (Oracle 11g) on page 26 into a new text file, for example `create_user.sql`.

   b Customize the script to your environment by making the following changes:

      — Replace `NAORA` with the tablespace name created in step 1.

      — Replace each instance of `nauser` with the desired NA database user name.

      — Replace `napass` with the desired password for the NA database user.

   c Place a copy of the script on Master 1 and Master 2.

      — *Windows*: Place the file in `C:\`.

      — *UNIX*: Place the file in the `$ORACLE_HOME/bin` directory, for example `/u01/app/oracle/product/11.2.0/dbhome_1/bin`.

3 On Master 1, create a new NA database user with the privileges listed in NA Database User Creation Script (Oracle 11g) on page 26 that uses the tablespace name created in step 1:

   a Log on to Master 1 as the SYS user.

   b At the `sqlplus` prompt, run the user creation script.

      For example: `do @create_user.sql`

4 Install NA on the first application server (`NA1`).

   During installation, supply the following database credentials:

   - For the database IP address or hostname, enter the hostname of Master 1.

   - For the database port, enter the port of Master 1 that NA will use to communicate with the database.

   - For the database SID, enter the SID on Master 1 (for example, `SID1`).

   - For the database user name and password, enter the name and password of the NA database user created in step 3, for example, `nauser` and `napass`.

5 After NA installation is complete, log on to NA (as user `nauser`) to ensure that it works as expected.

6   Stop the NA management engine on NA1:

- *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Stop**.

- *UNIX*: Run the following command:

  ```
  /etc/init.d/truecontrol stop
  ```

Task 3:   Prepare Master 1 for Replication (Oracle 11g)

To create the database export and finish preparing the database on Master 1, follow these steps:

1   On Master 1, create a directory to receive the tablespace export. For example, `C:\NA_data1` or `/tmp/NA_data1`.

- Ensure that the database user, for example `nauser`, has read-write access to this directory.

- If NA was running prior to beginning this configuration procedure, ensure that this directory has more available disk space than the NA tablespace consumes.

2   Log on to Master 1 as the NA database user, and then associate the new directory with the datapump directory in preparation for the tablespace export. For example:

- *Windows*:

  ```
  sqlplus nauser/napass@SID1
  create DIRECTORY datapump AS 'C:\NA_data1';
  exit
  ```

- *UNIX*:

  ```
  sqlplus nauser/napass@SID1
  create DIRECTORY datapump AS '/tmp/NA_data1';
  exit
  ```

3   Log on to Master 1 as the SYS user, and then grant the NA database user read-write access to the datapump directory. For example:

   ```
   sqlplus / as sysdba
   GRANT READ,WRITE ON DIRECTORY datapump to nauser;
   exit
   ```

4   On Master 1, verify that `$ORACLE_SID` is set to the SID for the NA database (for example, `SID1`).

5   With the NA management engine on NA1 shut down, on Master 1 and outside of SQLPlus, use the Oracle Data Pump Utility to export the NA database schema. For example:

   ```
   expdp nauser/napass TABLES=RN_% DIRECTORY=datapump DUMPFILE=NAEXP.dmp
   LOGFILE=NAEXP.log
   ```

6   Examine the export log file, for example `NAEXP.log` in the `NA_data1` directory.

- If the export was successful, continue to step 8 of this task.

- If the export was not successful, resolve the problems causing the failure, and then repeat step 5 of this task.

7   If you did not run the user creation script to create the database user, identify this user's complete set of permissions. You will use this information to re-create the user in step 10 of this task.

8   With the NA management engine on NA1 shut down, log on to Master 1 as the SYS user, and then delete the NA database user while retaining the NA tablespace.

For example, in the Oracle Enterprise Manager (preferred), delete `nauser`, or at the `sqlplus` prompt, enter the following command:

```
DROP USER nauser CASCADE;
```

> Use the cascade delete option to completely delete the user and empty its tablespace.

9   Verify that the NA tablespace is now empty.

10 Log on to Master 1 as the SYS user, and then recreate the NA database user:

*   To use the user creation script, run commands similar to the following example:

    ```
    sqlplus / as sysdba
    do @ create_user.sql
    exit
    ```

*   Otherwise, recreate the user with the permissions collected in step 7 of this task.

The newly-created NA database user connects to the existing NA tablespace. You might see an RMI error during the connection process. This error should clear after a few minutes, and the user-tablespace connection should occur without intervention.

11 On Master 1, outside of SQLPlus, use the Oracle Data Pump Utility to import the NA database schema for the NA database user. For example:

```
impdp nauser/napass DIRECTORY=datapump TABLES=RN_% DUMPFILE=NAEXP.dmp
LOGFILE=NAIMP1.log
```

> *UNIX only*: Verify that the export file permissions are at least 755.

12 Examine the import log file, for example `NAIMP1.log` in the `NA_data1` directory.

*   If the import was successful, continue to Task 4: Prepare Master 2 for Replication (Oracle 11g).

*   If the import was not successful, do the following:

    —   Resolve the problems causing the failure.

        Verify that the permissions for the user created in step 10 of this task match the user permissions collected in step 7 of this task.

    —   Drop the NA database user as described in step 8 of this task.

    —   Repeat step 11 of this task.

Task 4:   Prepare Master 2 for Replication (Oracle 11g)

To import the Master 1 database onto Master 2, follow these steps:

1   Log on to Master 2 as the SYS user, and then create the NA tablespace with the same name and parameters as the NA tablespace on Master 1. For example:

*   *Windows*:

    ```
    sqlplus nauser/napass@SID2
    CREATE TABLESPACE NAORA DATAFILE 'C:\APP\ADMINISTRATOR\ORADATA\SID2\
    NAORA.DBF' SIZE 200M REUSE AUTOEXTEND ON NEXT 50M;
    exit
    ```

- *UNIX*:

```
sqlplus nauser/napass@SID2
CREATE TABLESPACE NAORA DATAFILE '/u01/app/oracle/oradata/SID2/
NAORA.DBF' SIZE 200M REUSE AUTOEXTEND ON NEXT 50M;
exit
```

2   Log on to Master 2 as the SYS user, and then create the NA database user:

- To use the user creation script, copy the script to Master 2 and then run commands similar to the following example:

```
sqlplus / as sysdba
do @ create_user.sql
exit
```

- Otherwise, create the user with the permissions collected in step 7 on page 20.

The newly-created NA database user connects to the existing NA tablespace. You might see an RMI error during the connection process. This error should clear after a few minutes, and the user-tablespace connection should occur without intervention.

3   On Master 2, create a directory to hold the tablespace export. For example, `C:\NA_data2` or `/tmp/NA_data2`.

Ensure that the database user, for example `nauser`, has read-write access to this directory.

4   Copy the tablespace export file (for example, `NAEXP.dmp`) to the new directory on Master 2.

Ensure that the export file owner and group are those for the Oracle user for the operating system.

5   Log on to Master 2 as the NA database user, and then associate the new directory with the datapump directory in preparation for the tablespace export. For example:

- *Windows*:

```
sqlplus nauser/napass@SID2
create DIRECTORY datapump AS 'C:\NA_data2';
exit
```

- *UNIX*:

```
sqlplus nauser/napass@SID2
create DIRECTORY datapump AS '/tmp/NA_data2';
exit
```

6   Log on to Master 2 as the SYS user, and then grant the NA database user read-write access to the datapump directory. For example:

```
sqlplus / as sysdba
GRANT READ,WRITE ON DIRECTORY datapump to nauser;
exit
```

7   On Master 2, verify that `$ORACLE_SID` is set to the SID for the NA database (for example, `SID2`).

8   On Master 2, outside of SQLPlus, use the Oracle Data Pump Utility to import the NA database schema for the NA database user. For example:

```
impdp nauser/napass DIRECTORY=datapump TABLES=RN_% DUMPFILE=NAEXP.dmp
LOGFILE=NAIMP2.log
```

> *UNIX only*: Verify that the export file permissions are at least 755.

9   Examine the import log file, for example `NAIMP2.log` in the `NA_data2` directory.

- If the import was successful, continue to Task 5: Configure Replication (Oracle 11g).

- If the import was not successful, do the following:

  — Resolve the problems causing the failure.

  — Drop the NA database user as described in step 8 of Task 3: Prepare Master 1 for Replication (Oracle 11g).

  — Repeat step 8 of this task.

Task 5:   Configure Replication (Oracle 11g)

To configure replication between the Master 1 and Master 2 databases, follow these steps:

1   On Master 1, add the Master 2 database information to the local `TNSNAMES.ora`. Verify that the Master 1 database information also exists in the `TNSNAMES.ora`. If the Master 1 database information does not exist, add it in the same format as the other entries.

> You might also need to make modifications to the `LISTENER.ora` and `SQLNET.ora` files depending on how the Oracle servers are configured. In particular, in certain environments the `NAMES.DEFAULT_DOMAIN` property needs to be commented out in `SQLNET.ora`. For more information, contact your Oracle DBA.

2   On Master 2, add the Master 1 database information to the local `TNSNAMES.ora`. Verify that the Master 2 database information also exists in the `TNSNAMES.ora`. If the Master 2 database information does not exist, add it in the same format as the other entries.

> You might also need to make modifications to the `LISTENER.ora` and `SQLNET.ora` files depending on how the Oracle servers are configured. In particular, in certain environments the `NAMES.DEFAULT_DOMAIN` property needs to be commented out in `SQLNET.ora`. For more information, contact your Oracle DBA.

3   On `NA1`, unpack the `OracleReplicationScriptToolBundle.zip` file to a known location, for example the `NA_data` directory used earlier in this procedure.

> On Windows systems, unpack the replication bundle to a location with low security, for example, `C:\tmp`.

4   From the known location of step 3, customize the `ReplicationScriptTool.properties` file for your environment:

a   In a text editor such as WordPad or vi, open the `ReplicationScriptTool.properties` file.

b   Search for and replace the text `README` with the appropriate value for that variable.

  — Use the fully-qualified hostnames to identify the database and application servers.

  — For example:

```
db.server.0=Master1.example.com
db.port.0=1521
db.name.0=SID1
db.username.0=nauer
db.password.0=napass
app.server.0=NA1.example.com
app.rmiport.0=1099
app.corename.0=Core1
```

```
db.server.1=Master2.example.com
db.port.1=1521
db.name.1=SID2
db.username.1=nauser
db.password.1=napass
app.server.1=NA2.example.com
app.rmiport.1=1099
app.corename.1=Core 2
```

c   Set `timezone_offset` to the value that matches the time zone setting for all servers in the distributed system.

d   Verify that `mode` is set to `initial`.

5   From the known location of step 3, run the ReplicationScriptTool:

```
java -classpath . ReplicationScriptTool
```

This command creates a script for starting replication. By default, the script is named `ReplicationTool.sql`.

> The following error message can mean that Java does not have permission to run the replication tool:
>
> ```
> Could not find the main class: ReplicationScriptTool.
> ```
>
> Move all files from the replication bundle to a directory with lower security, and then run the `java` command from that directory.

6   On Master 1, ensure that SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the `CONNECT <USER>/ <PASSWORD>@<SID>` command for each different SID in the Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

7   Copy the replication script created in step 5 (for example, `ReplicationScript.sql`) from the known location to the server indentified in step 6.

   — *Windows*: Place the file in `C:\`.

   — *UNIX*: Place the file in the `$ORACLE_HOME/bin` directory, for example `/u01/app/ oracle/product/11.2.0/dbhome_1/bin`.

> Make sure that files named `*_spool.txt` do not exist in the directory. When run, the script will log its actions to a file with that suffix.

8   On Master 1, open two SQLPLus windows.

   • In one window, connect as the NA database user (for example, `nauser`).

   • In the other window, connect as the SYS user.

9   On Master 2, open a SQLPlus window connected as the SYS user.

10   In the SQLPlus window for the NA database user, run the replication script. For example:

```
do @ReplicationScript.sql
```

11   Follow the instructions provided by the script at several points as it runs. This will involve running other commands in the SQLPlus windows for the SYS user to verify that certain operations necessary for later steps in the script have completed.

At the first and second pauses, run the same command in each of the SYS user windows to verify the configuration for both of the databases.

At the third pause, run the command in the SYS user window on Master 1 only. When the `SELECT STATUS,REQUEST,ONAME FROM DBA_REPCATLOG;` statement returns "0 rows selected," replication setup is almost completed. Finish the process in the NA database user window.

> If you see errors during replication setup, before performing initial replication setup again, see Removing Replication Across the Entire NA Mesh on page 39.

12 After the replication script completes, close both SQLPlus windows to ensure that all actions are logged to the spool file.

13 Verify that the replication is working correctly. Make sure:

- The spool file generated by running the replication SQL script contains no errors.

- The RN_CORE table in each database contains the appropriate list of servers in the NA Mesh. To check the RN_CORE table, using SQLPlus, enter the following command on each server:
  `SELECT * FROM RN_CORE;`

- Verify (using the Oracle Enterprise Manager) that each database in the NA Mesh has replication set up, is in the NORMAL state, and has purge, push, and repcat_admin jobs installed correctly. Contact your Oracle DBA for assistance.

- Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
  UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
  CoreID=1;
  COMMIT;
  ```

  wait 10 to 30 seconds

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
  SELECT Comments from RN_CORE where CoreID=1;
  ```

  Enter this from every NA Core in the NA Mesh. Check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

- The following command must return 'no rows selected' and not 'ready':

  ```
  SELECT STATUS,REQUEST,ONAME FROM DBA_REPCATLOG;
  ```

14 Install NA on the second application server (NA2).

During installation, connect NA to the database on Master 2. When prompted for the database credentials, choose: use existing database.

Task 6:   Configure the NA Application Servers for Replication

1 Stop the NA management engine on NA2:

- *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Stop**.

- *UNIX*: Run the following command:

  ```
  /etc/init.d/truecontrol stop
  ```

2   Copy the `distributed.rcx` file from the known location of step 3 of Task 5: Configure Replication (Oracle 11g) to the following directory on both application servers, NA1 and NA2:

- *Windows*: `<NA_HOME>\jre`

- *UNIX*: `<NA_HOME>/jre`

3   Start the NA management engines on both application servers, NA1 and NA2:

- *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Start**.

- *UNIX*: Run the following command:

      `/etc/init.d/truecontrol restart`

4   Connect to the NA console on both application servers, NA1 and NA2, (as user `nauser`), and ensure that there are no issues.

> An RMI error message at this point can mean that NA is unable to identify the localhost. For more information, see RMI Errors in the NA Console on page 65.

5   Verify the NA installation:

a   Edit an object on one NA server (for example, a Comments field for a device).

b   Wait a minute and then verify that the updated comment exists on the second server.

c   Check the status of the Oracle Distributed Monitor in the NA console to ensure that no problems are being reported. (For information, see Distributed Monitor Results Page on page 55.) It could take up to five minutes for this monitor to initially run.

NA Database User Creation Script (Oracle 11g)

```
set echo on
spool NA_User_Creation.txt

/*Create a new user with a default tablespace*/
CREATE USER nauser IDENTIFIED BY napass DEFAULT TABLESPACE NAORA;

/*grant Role equivalent to a system user (only choose public if you choose to provide basic
privileges)*/
GRANT DBA to nauser WITH ADMIN OPTION;

/*grant permissions for normal NA operation*/
GRANT CREATE SEQUENCE, CREATE SESSION, CREATE TABLE, CREATE PROCEDURE, SELECT ANY
DICTIONARY, CONNECT, CREATE VIEW TO nauser;
GRANT EXECUTE ON SYS.DBMS_REPCAT_ADMIN TO nauser;
GRANT EXECUTE ON SYS.DBMS_DEFER_SYS TO nauser;
GRANT CREATE PUBLIC DATABASE LINK TO nauser;
GRANT CREATE DATABASE LINK TO nauser;
GRANT CREATE USER TO nauser;
GRANT CREATE ANY PROCEDURE TO nauser;

/*For normal operation of a NA Core in a replication environment:*/
GRANT EXECUTE ON SYS.DBMS_REPUTIL TO nauser;
GRANT SELECT ON SYS.DBA_CONSTRAINTS TO nauser;
GRANT SELECT ON SYS.DBA_CONS_COLUMNS TO nauser;
GRANT SELECT ON SYS.DBA_REPCOLUMN TO nauser;

/*For replication deletion:*/
GRANT DROP USER TO nauser;
GRANT DROP PUBLIC DATABASE LINK TO nauser;
```

```
GRANT DROP ANY PROCEDURE TO nauser;

/*grant permissions for system level*/
GRANT CREATE MATERIALIZED VIEW, GLOBAL QUERY REWRITE, SELECT ANY TABLE to nauser;
GRANT UNLIMITED TABLESPACE to nauser WITH ADMIN OPTION;
commit;
```

Oracle 10g: Set Up Initial Replication

1   Be sure you have the following:

     a   A current NA 9.10 database.

     b   A NA application server (NA Core 1) connected to the database.

     c   A database with no data or NA schema setup (Master 1).

     d   A database with no data or NA schema setup (Master 2). The database identifier (SID) needs to be different from the database on Master 1.

> One SID *cannot* be a subset of the other SID, for example NARp and NARpBU. Instead, use SIDs that stand alone, for example NARp1 and NARp2.

     e   A network connection from the Master 1 servers to the Master 2 servers (and vice-versa) that enables ports 1521 (Oracle only), 1098, 8083, 1099, and 4444 (or appropriate variations) to be connected between these servers. Port 1521 must be open between the Oracle servers. The remaining ports must be open between the NA servers.

     f   The *ReplicationScriptTool bundle* files installed on a Java-capable system (such as NA Core 1).

2   Obtain the following information (see Planning on page 15):

     a   Login/password/database identifier for NA into the two databases (on Master 1 and Master 2).

     b   Decide on a replication password. The user "repadmin" will be created and assigned this password by default. You can use a different replication username if needed. This user will be used to manage replication in your system.

     c   NA application server hostname, NA application server RMI listening port, database server hostname, and database listening port for Master 1 and Master 2.

     d   The timezone offset (integer from UTC) for the entire NA Mesh. This must be a constant across the NA Mesh. Do not consider daylight savings time when setting this value.

3   Set (or verify) the following database parameters on each Master database:

- global_names = TRUE

- open_links = at least 4 (increase this by 1 for each additional server in the NA Mesh beyond 2)

- open_links_per_instance = at least 4 (same as open_links)

- parallel_min_servers = 2

- shared_pool_size = increase current value by 40m to support replication

- job_queue_processes = at least 2

> The parameters must be set on each database in the NA Mesh. The parameters could be setup when the database is first created. If not, they must be modified at this point. You can view the current value of these parameters using Oracle Enterprise Manager or SQLPlus with the "SHOW PARAMETERS" or "SELECT NAME, VALUE FROM v$parameters" commands (where NAME = <parameter_name>). For example, <parameter_name> could be global_names from the list above.

4   Ensure that all database server and NA server systems are set to use the same time and time zone.

5   Unpack the *OracleReplicationScriptToolBundle.zip* file on NA Core 1 (or any NA installation).

6   Update the following variables for Master 1 and Master 2 in the *ReplicationScriptTool.properties* file located in the directory where *OracleReplicationScriptToolBundle.zip* was unpacked.

- Replication user

- Password

- Replication group name

- Timezone offset

Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment. For the app.server values, specify the IP address of the appropriate NA application server. In addition, make sure the mode property is set to "initial". These properties are described in detail in the *ReplicationScriptTool.properties* file.

7   If you want to run NA servers under a non-SYSTEM user on Oracle, run the scripts listed in Oracle 10g Setup and Upgrade Permissions on page 30.

8   Run the ReplicationScriptTool via the following command:
```
java -classpath . ReplicationScriptTool
```

9   Create the database on Master 2. This database should have a different database identifier (SID) from the database on Master 1. It should also have the same schema name and database user login name as the database on Master 1.

> if you are setting up Replication on a Oracle 11g database, you also need to create a database for Master 1.

10   Add Master 2's database information to the local *TNSNAMES.ora* on Master 1. Verify that Master 1's database information exists in the local *TNSNAMES.ora* on Master 1. If Master 1's database information does not exist, add it same way as other entries.

> You may need to make modifications to the *LISTENER.ora* and *SQLNET.ora* files depending on how your Oracle servers are configured. In particular, in certain environments the NAMES.DEFAULT_DOMAIN property needs to be commented out in *SQLNET.ora*. Consult with your Oracle DBA, if needed.

11   Add Master 1's database information to the local *TNSNAMES.ora* on Master 2. Verify that Master 2's database information exists in the local *TNSNAMES.ora* on Master 2. If Master 2's database information does not exist, add it same way as other entries. (Refer to the note above.)

12   Ensure that you have a server and a directory (typically on one of the database system), where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the `CONNECT <USER>/ <PASSWORD>@<SID>` command for each different SID in the Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

13   Copy the newly generated SQL file (typically named *ReplicationScript.sql* depending on what value was set in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

> ➤   Make sure that files named **_spool.txt* do not exist in the directory. When run, the script will log its actions to a file with that suffix.

Implementation (Oracle 10g)

1   Stop the NA Management Engine that is accessing the database on Master 1.

> ➤   On Oracle 10g, steps 2 to 4 below could be done more efficiently by using Oracle's Data Pump Utility. For information, see Oracle 10g Data Pump Utility on page 81.

2   Dump the Master 1 database using the following command on the database server for Master 1:

```
EXP <USER>/<PASSWORD>@<MASTER1_SID> TABLES=RN_% FILE=<filename>
```

where `<USER>`, `<PASSWORD>`, and `<MASTER1_SID>` were collected in Step 2.

> ➤   Log the output of this command to a file for examination later if there are errors.

3   Copy the file from Step 2 to the database server for Master 2.

4   Import into the Master 2 database using the following command on the database server for Master 2:

```
IMP <USER>/<PASSWORD>@<MASTER2_SID> TABLES=RN_% FILE=<filename>
```

where `<USER>`, `<PASSWORD>`, and `<MASTER2_SID>` were collected in Step 2.

5   On either Master 1 or Master 2, ensure that you have two SQLPLus windows open before running the script: One connected as the NA user and one connected as the SYSTEM user.

6   Run the replication script in the SQLPlus window connected as the NA user using `@ReplicationScript.sql`.

7   Follow the instructions provided by the script at several points as it runs. This will involve running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

> ➤   If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing initial replication setup again, see Removing Replication Across the Entire NA Mesh on page 39.

8   Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

9   Verify that the replication is working correctly. Make sure:

- The spool file generated by running the replication SQL script contains no errors.

- The RN_CORE table on each database contains the appropriate list of servers in the NA Mesh. To check the RN_CORE table, using SQLPlus, enter the following command on each server:
  ```
  SELECT * FROM RN_CORE;
  ```

- Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up, is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

- Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
  UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
  CoreID=1;
  COMMIT;
  ```

  wait 10 to 30 seconds

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
  SELECT Comments from RN_CORE where CoreID=1;
  ```

  You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

10   Install an NA server, pointing it to an existing database on Master 2.

11   Stop the NA Management Engine running on Master 2.

12   Copy the *distributed.rcx* file to each NA server in the NA Mesh (in the same location as *appserver.rcx*).

13   Start the NA Management Engine on NA Core 1.

14   Start the NA Management Engine on NA Core 2.

15   Verify the NA installation:

a   Edit an object on one NA server (for example, a Comments field for a device).

b   Wait a minute and then verify that the updated comment exists on the second server.

c   Check the status of the Oracle Distributed Monitor in the NA console to ensure that no problems are being reported. (For information, see Distributed Monitor Results Page on page 55.) It could take up to five minutes for this monitor to initially run.

Oracle 10g Setup and Upgrade Permissions

The following permissions are required for the NA Distributed System setup process and operation if you are running the NA servers under a non-SYSTEM user on Oracle 10g.

▶   The standard user account used to access NA cannot be used for replication. The user "repadmin" is created by default to manage replication in your system.

In this list of commands to grant permissions, NAUSER is the Oracle username that NA uses to access the database, typically the Oracle schema name. This name must be the same on all NA Cores in the NA Mesh. Replace NAUSER with the username your NA server uses to access the database.

For replication setup and upgrade:

```
GRANT EXECUTE ON "SYS"."DBMS_REPCAT_ADMIN" TO "NAUSER";
GRANT EXECUTE ON "SYS"."DBMS_DEFER_SYS" TO "NAUSER";
GRANT CREATE PUBLIC DATABASE LINK TO "NAUSER";
GRANT CREATE DATABASE LINK TO "NAUSER";
GRANT CREATE USER TO "NAUSER";
GRANT CREATE ANY PROCEDURE TO "NAUSER";
```

For normal operation of an NA Core in a replication environment:

```
GRANT EXECUTE ON "SYS"."DBMS_REPUTIL" TO "NAUSER";
GRANT SELECT ON "SYS"."DBA_CONSTRAINTS" TO "NAUSER";
GRANT SELECT ON "SYS"."DBA_CONS_COLUMNS" TO "NAUSER";
GRANT SELECT ON "SYS"."DBA_REPCOLUMN" TO "NAUSER";
```

For replication deletion:

```
GRANT DROP USER TO "NAUSER";
GRANT DROP PUBLIC DATABASE LINK TO "NAUSER";
GRANT DROP ANY PROCEDURE TO "NAUSER";
```

For normal NA operation:

```
GRANT CREATE SEQUENCE TO "NAUSER";
GRANT CREATE SESSION TO "NAUSER";
GRANT CREATE TABLE TO "NAUSER";
GRANT CREATE PROCEDURE TO "NAUSER";
GRANT SELECT ANY DICTIONARY TO "NAUSER";
GRANT CONNECT TO "NAUSER";
```

Oracle 11g: Adding a New NA Core to an Existing NA Mesh

Master 1 is the existing Master Definition Site and Master 3 is the new NA Core being added.

To add an NA core to an existing NA mesh, follow these steps:

1 System Setup:

- A current NA 9.10 database on Master 1.

- NA application server of NA Core 1 connected to the database on Master 1.

- A database with no data or NA schema setup on Master 3. The database identifier (SID) needs to be different from the existing databases in the NA Mesh.

- A network connection from the Master 1 servers to the Master 3 servers (and vice-versa) that enables ports 1521 (Oracle only), 1098, 8083, 1099, and 4444 (or appropriate variations) to be connected between these servers. Port 1521 must be open between the Oracle servers. The remaining ports must be open between the NA servers.

- The *ReplicationScriptTool bundle* files installed on a Java-capable system.

- All database servers and application servers are set to use the same time and timezone.

2 Obtain the following information:

- Login/password/database identifier for NA into the two databases (on Master 1 and Master 3).

- The replication password for the existing repadmin user.

- NA server hostname, NA server RMI listening port, database hostname, and database listening port for Master 3.

- The timezone offset (integer from UTC) for the entire NA Mesh. This must be a constant across the NA Mesh.

- The existing replication group name.

3 Set (or verify) the following database parameters for Master 3:

- global_names = TRUE

- open_links = at least 5 (increase this by 1 for each additional server in the NA Mesh beyond 2)

- open_links_per_instance = at least 5 (same as open_links)

- parallel_min_servers = 2

- shared_pool_size = increase current value by 40m to support replication

- job_queue_processes = at least 2.

  ▶ The parameters must be set on each database in the NA Mesh. The parameters could be set up when the database is first created. If not, they must be modified at this point. You can view the current value of these parameters using Oracle Enterprise Manager or SQLPlus with the "SHOW PARAMETERS" or "SELECT NAME, VALUE FROM v$parameters" commands (where NAME = <parameter_name>, for example, global_names).

4 Stop the NA management engine on all NA application servers:

- *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Stop**.

- *UNIX*: Run the following command:

      /etc/init.d/truecontrol stop

5 As the **repadmin** user, enter the following command using SQLPlus on Master 1 to quiesce the replication group:

      EXEC DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY('<replication_group_name>');

where <replication_group_name> is from Step 2.

6 Wait for the replication group to quiesce. Do this by executing the SELECT GNAME, STATUS FROM DBA_REPGROUP; command to check on the status. Wait until the status is listed as QUIESCED.

7 Create the Master 1 database export and finish preparing the database on Master 1 as described in Task 3: Prepare Master 1 for Replication (Oracle 11g) on page 20.

8 Import the Master 1 database onto Master 3 as described in Task 4: Prepare Master 2 for Replication (Oracle 11g) on page 21.

Substitute "Master 3" for each reference to "Master 2."

9   Configure replication between the Master 1 and Master 3 databases as described in
    Task 5: Configure Replication (Oracle 11g) on page 23 and Task 6: Configure the NA
    Application Servers for Replication on page 25.

Note the following differences:

- Substitute "Master 3" for each reference to "Master 2."

- For step 4 on page 23, if you still have the ReplicationScriptTool.properties file
  from setting up initial replication you can use it. Otherwise, use the file from the most
  recent unpacking of the OracleReplicationScriptToolBundle.zip file.

    — Verify or edit the server information for the initial core and second master site.

    — Uncomment the Additional Master site configuration area, and replace the text
      README with the appropriate value for that variable. Use the fully-qualified
      hostnames to identify the database and application servers. For example:

      ```
      db.server.1=Master3.example.com
      db.port.1=1521
      db.name.1=SID3
      db.username.1=nauser
      db.password.1=napass
      app.server.1=NA3.example.com
      app.rmiport.1=1099
      app.corename.1=Core 3
      ```

    — Set the mode to add_server.

    — For step 13 on page 25, the spool file contains the following acceptable warning
      that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY
      command:
      ```
      'ORA-23326: object group <yourgroup>.<your_replication_ group>
      is quiesced'
      ```

- Carry out step 3 on page 26 and step 4 on page 26 on all NA application servers in the
  NA mesh.

Oracle 10g: Adding a New NA Core to an Existing NA Mesh

Master 1 is the existing Master Definition Site and Master 3 is the new NA Core being added.

1   System Setup:

- A current NA 9.10 database on Master 1.

- A NA server of NA Core 1 connected to the database on Master 1.

- A database with no data or NA schema setup on Master 3. The database identifier
  (SID) needs to be different from the existing databases in the NA Mesh.

- A network connection from the Master 1 servers to the Master 3 servers (and vice-
  versa) that enables ports 1521 (Oracle only), 1098, 8083, 1099, and 4444 (or
  appropriate variations) to be connected between these servers. Port 1521 must be
  open between the Oracle servers. The remaining ports must be open between the NA
  servers.

- The *ReplicationScriptTool bundle* files installed on a Java-capable system.

2 Obtain the following information:

- Login/password/database identifier for NA into the two databases (on Master 1 and Master 3). This is necessary for Steps 5, 6, 11, 13, and 14 below.

- The replication password for the existing repadmin user. This is necessary for Steps 9 and 14 below.

- NA server hostname, NA server RMI listening port, database hostname, and database listening port for Master 3. This is necessary for Step 14 below.

- The timezone offset (integer from UTC) for the entire NA Mesh. This must be a constant across the NA Mesh. This is necessary for Step 14 below.

- The existing replication group name. This is necessary for Steps 9 and 14 below.

3 Set (or verify) the following database parameters for Master 3:

➤ These parameters could have been be set up when the database is first created. If not, they must be modified at this point.

- global_names = TRUE

- open_links = at least 5 (increase this by 1 for each additional server in the NA Mesh beyond 2)

- open_links_per_instance = at least 5 (same as open_links)

- parallel_min_servers = 2

- shared_pool_size = increase current value by 40m to support replication

- Job_queue_processes = at least 2.

4 Increase the open_links and open_links_per_instance on existing databases in the NA Mesh.

5 Add Master 3's database information to the local *TNSNAMES.ora* on Master 1. Verify that Master 1's database information exists in the local *TNSNAMES.ora* on Master 1. If Master 1's database information does not exist, add it same way as other entries.

➤ You may need to make modifications to the *LISTENER.ora* and *SQLNET.ora* files depending on how your Oracle servers are configured. In particular, in certain environments, the NAMES.DEFAUL_DOMAIN property needs to be commented out in *SQLNET.ora*. Consult with your Oracle DBA, if needed.

6 Add Master 1's database information to the local *TNSNAMES.ora* on Master 3. Verify that Master 3's database information exists in the local *TNSNAMES.ora* on Master 3. If Master 3's database information does not exist, add it same way as other entries. (Refer to the note above.)

➤ You may need to make modifications to the *LISTENER.ora* and *SQLNET.ora* files depending on how your Oracle servers are configured. Consult with your Oracle DBA.

7 Ensure that all database server and NA server system are set to use the same time and timezone.

8 Turn off all NA servers in the existing NA Mesh.

9   As the **repadmin** user, enter the following command using SQLPlus on Master 1 to
    quiesce the replication group:

    `EXEC DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY('<replication_group_name>');`

    where `<replication_group_name>` is from Step 2.

10 Wait for the replication group to quiesce. Do this by executing the `SELECT`
    `GNAME,STATUS FROM DBA_REPGROUP` command to check on the status. Wait until the
    status is listed as QUIESCED.

    ▶   On Oracle 10i, steps 11 to 13 below could be done more efficiently by using Oracle's
        Data Pump Utility. For information, see Oracle 10g Data Pump Utility on page 81.

11 Dump the Master 1 database using the following command on the database server for
    Master 1:

    `EXP <USER>/<PASSWORD>@<MASTER1_SID> TABLES=RN_% FILE=<filename>`

    where `<USER>, <PASSWORD>, and <MASTER1_SID>` were collected in Step 2.

12   Copy the file <filename> to the database server for Master 3.

13 Import into the Master 3 database using the following command on the database server
    for Master 3:

    `IMP <USER>/<PASSWORD>@<MASTER3_SID> TABLES=RN_% FILE=<filename>`

    Where <USER>, <PASSWORD>, and <MASTER3_SID> were collected in step 2.

14 Update the variables for all masters in the *ReplicationScriptTool.properties* file. Ensure
    that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties*
    file with the appropriate values for your environment.

    ▶   The master being added must be the last master entry and Master Definition Site
        must be the first entry. In addition, be sure to update the replication user,
        password, replication group name, and timezone offset in the
        ReplicationScriptTool.properties file if needed. Make sure the "mode" property is
        set to "add_server". All other masters should also be listed.

15 Run the ReplicationScriptTool via the following command:
    `java -classpath . ReplicationScriptTool`

16 Ensure that you have a server and a directory (typically on one of the database system),
    where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To
    verify this, connect to one database with SQLPlus and issue the `CONNECT <USER>/`
    `<PASSWORD>@<SID>` command for each different SID in the NA Mesh. This is necessary
    because the script issues CONNECT commands to change which database it is running
    procedures against.

17 Copy the newly generated SQL file (typically named *ReplicationScript.sql* depending on
    what value was set in the *ReplicationScriptTool.properties* file), from the
    ReplicationScriptTool working directory to the server and directory where you plan to run
    SQLPlus.

    ▶   Make sure that files named **_spool.txt* do not exist in the directory. When run, the
        script will log its actions to a file with that suffix

18 Ensure that you have two SQLPLus windows open before running the script: One
    connected as the NA user and one connected as the SYSTEM user.

19 Run the replication script copied in the previous step in the SQLPlus window connected
    as the NA user using `@ReplicationScript.sql`.

20 Follow the instructions provided by the script at several points as it runs. This will involve running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

> ▶ If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing initial replication setup again, see Removing Replication Across the Entire NA Mesh on page 39.

21 Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

22 Verify that the replication is working correctly. Make sure:

- The spool file generated by running the replication SQL script contains no errors, other than the following warning:
  `'ORA-23326: object group <yourgroup>.<your_replication_ group> is quiesced'` that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command.

- The RN_CORE table on each database contains the appropriate list of servers in the NA Mesh. To check the RN_CORE table, using SQLPlus, enter the following command on each server:
  `SELECT * FROM RN_CORE;`

- Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up and is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

- Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
  UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid3' where
  CoreID=1;
  COMMIT;
  ```

  wait 10 to 30 seconds

  ```
  CONNECT <USER>/<PASSWORD>@<MASTER3_SID>;
  SELECT Comments from RN_CORE where CoreID=1;
  ```

  You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

23 Install an NA server. Be sure to point it to an existing database on Master 3.

24 Add the *distributed.rcx* file to the new NA server in the NA Mesh (in the same location as *appserver.rcx*).

25 Start all of the NA servers in the NA Mesh.

26 Verify the NA installation. To do this:

- Edit an object on one NA server (for example, a Comments field for a device).

- Wait a minute and then verify that the updated comment exists on the second server.

- Check the status of the Oracle Distributed Monitor in the NA UI to ensure that no problems are being reported. (For information, see Distributed Monitor Results Page on page 55.)

Removing an NA Core from an Existing NA Mesh

⚠   After you remove an NA Core from an NA Mesh, the data in that NA Core's database will no longer remain in sync with the data in the rest of the NA Mesh. The data cannot be merged back into the NA Mesh.

To remove an NA Core from an NA Mesh:

1   If the NA core you want to remove is the Master Definition Site, change the Master Definition Site to be another NA Core as described in Changing the Master Definition Site on page 39.

2   Install the *ReplicationScriptTool bundle* files on a Java-capable system.

3   Ensure that all NA devices belong to Sites on NA Cores that are not going to be removed.

4   Modify all Sites to point to an NA Core that is not going to be removed. (Alternatively, you can remove those Sites.)

5   Turn off the NA server from the NA Core that is being removed.

6   Delete the RN_CORE entry that was removed using the following commands using SQLPlus:

▶   To identify the Core ID of the NA Core to delete, enter the `SELECT*FROM RN_CORE` command.

```
UPDATE RN_SITE SET OwningCoreID = 1 WHERE OwningCoreID = <coreID>;
UPDATE RN_SITE SET ManagingCoreID = 1 WHERE ManagingCoreID = <coreID>;
UPDATE RN_SCHEDULE_TASK SET CoreID = 1 WHERE CoreID = <coreID>;
DELETE FROM RN_CORE WHERE CoreID = <coreID>;
COMMIT;
```

7   Update the variables for all masters in the *ReplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

▶   The master being deleted must be the last master entry and the Master Definition Site must be the first entry. In addition, update the replication user, password, and replication group name in the *ReplicationScriptTool.properties* file if needed. Make sure the "mode" property is set to "delete_server".

8   Run the ReplicationScriptTool via the following command:
`java -classpath . ReplicationScriptTool`

9   Ensure that you have a server and directory (typically on one of the database systems) where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the `CONNECT <USER>/ <PASSWORD>@<SID>` command for each different SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

10 Copy the newly generated SQL file (typically named *ReplicationScript.sql* depending on what value was set in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

> ➤ Make sure that files named "*_spool.txt" do not exist in that directory. When run, the script will log its actions to a file of that suffix.

11 Ensure that you have two SQLPLus windows open before running the script: One connected as the NA user and one connected as the SYSTEM user.

12 Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using `@ReplicationScript.sql`.

13 Follow the instructions provided by the script at several points as it runs. This will involve running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

14 Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

15 Verify that the replication is working correctly. Make sure:

— The spool file generated by running the replication SQL script contains no errors.

— The RN_CORE table on each database contains the appropriate list of servers in the NA Mesh. To check the RN_CORE table, using SQLPlus, enter the following command on each server:
`"SELECT * FROM RN_CORE;"`

— Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up, is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

— Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

```
CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
CoreID=1;
COMMIT;
```

wait 10 to 30 seconds

```
CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
SELECT Comments from RN_CORE where CoreID=1;
```

You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

16 Uninstall the NA server from the NA Core that was removed.

17 Restart the NA servers in the NA Mesh.

Changing the Master Definition Site

It may be necessary to change the Master Definition Site in the event of failure of that Site or when you want to remove an NA Core from the NA Mesh. To change the Master Definition Site:

1 If the old Master Definition Site is accessible (for example in the case where it is being removed from the NA Mesh), as the "repadmin" user on the existing Master Definition Site, enter the following command using SQLPlus:

```
BEGIN
     DBMS_REPCAT.RELOCATE_MASTERDEF (
                                     gname => '<REPLICATION GROUP NAME>',
                                     old_masterdef => '<OLD MASTERDEF SID>',
                                     new_masterdef => '<NEW MASTERDEF SID>',
                                     notify_masters => TRUE,
                                     include_old_masterdef => TRUE);
END;
/
COMMIT;
```

2 If the old Master Definition Site is not accessible (for example in the case of failure of the Master Definition database server), as the "repadmin" user on the existing Master Definition Site, enter the following command using SQLPlus on any other NA Core in the NA Mesh:

```
BEGIN
     DBMS_REPCAT.RELOCATE_MASTERDEF (
                                     gname => '<REPLICATION GROUP NAME>',
                                     old_masterdef => '<OLD MASTERDEF SID>',
                                     new_masterdef => '<NEW MASTERDEF SID>',
                                     notify_masters => TRUE,
                                     include_old_masterdef => FALSE);
END
/
COMMIT;
```

3 For both cases, as the NA database login user, modify the RN_CORE table entries:

```
UPDATE RN_CORE SET IsMasterDef = 0 WHERE CoreID = <ID OF OLD MASTERDEF>;
COMMIT;

UPDATE RN_CORE SET IsMasterDef = 1 WHERE CoreID = <ID OF NEW MASTERDEF>;
COMMIT;
```

Removing Replication Across the Entire NA Mesh

⚠️ All NA servers participating in the NA Mesh will now operate as independent NA installations. The data cannot be merged once they are no longer in sync.

To remove replication across the entire NA Mesh:

1 Make sure that the *ReplicationScriptTool bundle* files are installed on a Java-capable machine.

2 Turn off the NA server on all NA Cores.

3   Update the variables for all masters in the *ReplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

> ➤   The Master Definition Site must be the first entry. In addition, update the replication user, password, and replication group name in that file if needed. Make sure the "mode" property is set to "delete".

4   Run the ReplicationScriptTool via the following command:
    `java -classpath . ReplicationScriptTool`

5   Ensure that you have a server and directory (typically on one of the database systems) where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the `CONNECT <USER>/<PASSWORD>@<SID>` command for each different SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

6   Copy the newly generated SQL file (typically named *ReplicationScript.sql* depending on what value was set in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

> ➤   Make sure that files named "*_spool.txt" do not exist in that directory. When run, the script will log its actions to a file of that suffix.

7   Ensure that you have two SQLPLus windows open before running the script: One connected as the NA user and one connected as the SYSTEM user.

8   Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using `@ReplicationScript.sql`.

9   Follow the instructions provided by the script at several points as it runs. This will involve running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

10 Exit SQLPlus after the script completes (this ensures that all actions are logged to the spool file).

11 Verify that the replication has been removed correctly. Make sure:

   • The spool file generated by running the replication SQL script contains no errors.

   • Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh does not have replication setup. Consult your Oracle DBA for assistance.

12 For each server, ensure that devices are deleted or associated with Sites that map to the local NA Core as needed.

13 Remove the `distributed.rcx` file from each NA application server.

14 Restart the NA servers.

15 For each database, remove all entries from RN_CORE except for the local NA Core system's entry.

16 Restart each NA server to enable the NA Core changes to take effect.

Upgrade the NA Mesh

During the NA upgrade process, the NA Cores must be completely offline. You will be upgrading the:

- NA application servers
- NA database schema
- Replication between the database cores

Note the following:

- The NA mesh upgrade path is as follows:

  (NAS 7.0 or NAS 7.2) to NA 7.50 to NA 7.60 to NA 9.00 to NA 9.10

  Enter this path at your current version of NA.

- At each step on the NA mesh upgrade path, upgrade all NA cores in the NA mesh before moving to the next step in the upgrade path.

- For instructions for upgrading from NAS 6.0 to NAS 7.0, see the *NAS 7.0 Multimaster Distributed System on Oracle User's Guide*.

For upgrade instructions, see the following topics:

Upgrading from NAS 7.0/7.2 to NA 7.50

To upgrade from NAS 7.0/7.2 to NA 7.50, be sure that:

- A current NAS 7.0/7.2 database is installed on all Masters.

- The *ReplicationScriptTool* bundle files for NA 7.50 are installed on a Java-capable system (on one of the NA systems).

- You have the following information:

  — Login/password/DatabaseIdentifier (SID) for NA into all databases in the NA Mesh

  — Replication password for the existing repadmin user

  — DatabaseIdentifier (SID), NA server hostname, NA server RMI listening port, database server hostname, and database listening port for all Masters

  — The timezone offset (integer from UTC) for the entire NA Mesh (This must be a constant across the NA Mesh.)

  — The existing replication group name

1   Shut down all NA Management Engines in the NA Mesh.

2 Update the variables for all Masters in the *ReplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

➤ All servers should be listed in the *ReplicationScriptTool.properties* file. Make sure the mode property is set to the appropriate value for the upgrade you want to perform. For example, if you are upgrading from NAS 7.0 to NA 7.50, this value should be set to "upgrade_from_7_0". If you are upgrading from NAS 7.2 to NA 7.50, this value should be set to "upgrade_from_7_2".

3 Run the ReplicationScriptTool. Enter:
```
java -classpath . ReplicationScriptTool
```

4 Ensure that you have a server and a directory (typically on one of the database systems), where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the CONNECT <USER>/ <PASSWORD>@<SID> command for each unique SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

5 Copy the newly generated SQL file (typically named *ReplicationScript.sql,* depending on what value was set to in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

➤ Make sure that files named *_spool.txt do not exist in the directory. When run, the script will log its actions to a file with that suffix.

6 Ensure you have two SQLPLus windows open before running the script: One window connected as the NA user and the other window connected as the SYSTEM user.

7 Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using @ReplicationScript.sql.

8 Follow the instructions provided by the script at several points as it runs. This will include running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

➤ If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing the upgrade, see Removing Replication Across the Entire NA Mesh on page 39.

9 Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

10 Verify that the replication is working correctly. Make sure:

• The spool file generated by running the replication SQL script contains no errors, other than the following warning: 'ORA-23326: object group <yourgroup>.<your_replication_ group> is quiesced' that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command.

• Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up and is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

• Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

```
CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
```

```
CoreID=1;
COMMIT;
```

wait 10 to 30 seconds

```
CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
SELECT Comments from RN_CORE where CoreID=1;
```

You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

11 Upgrade each NA server using the NA 7.50 Service Pack Installer. The NA 7.50 Service Pack Installer upgrades the NA server to NA 7.50. The scripts for the database upgrade have already been handled by running the replication script in Step 7.

12 Verify the NA installation:

a   Edit an object on one NA server (for example, a Comments field for a device).

b   Wait a minute and then verify that the updated comment exists on the second server.

c   Check the status of the Oracle Distributed Monitor in the NA UI to ensure that no problems are being reported. (For information, see Distributed Error List on page 56.)

Upgrading from NA 7.5x to NA 7.60

To upgrade from 7.5x to NA 7.60, be sure that:

- A current NA 7.60x database is installed on all Masters.

- The *ReplicationScriptTool* bundle files for NA 7.60 are installed on a Java-capable system (on one of the NA systems).

- You have the following information:

  — Login/password/DatabaseIdentifier (SID) for NA into all databases in the NA Mesh

  — Replication password for the existing repadmin user

  — DatabaseIdentifier (SID), NA server hostname, NA server RMI listening port, database server hostname, and database listening port for all Masters

  — The timezone offset (integer from UTC) for the entire NA Mesh (This must be a constant across the NA Mesh.)

  — The existing replication group name

1   Shut down all NA Management Engines in the NA Mesh.

2   Update the variables for all Masters in the R*eplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

> All servers should be listed in the *ReplicationScriptTool.properties* file. Set the mode property to "upgrade_from_7_5".

3   Run the ReplicationScriptTool. Enter:
```
java -classpath . ReplicationScriptTool
```

4   Ensure that you have a server and a directory (typically on one of the database systems), where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the CONNECT <USER>/<PASSWORD>@<SID> command for each unique SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

5   Copy the newly generated SQL file (typically named *ReplicationScript.sql,* depending on what value was set to in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

> ▶   Make sure that files named *_spool.txt do not exist in the directory. When run, the script will log its actions to a file with that suffix.

6   Ensure you have two SQLPLus windows open before running the script: One window connected as the NA user and the other window connected as the SYSTEM user.

7   Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using @ReplicationScript.sql.

8   Follow the instructions provided by the script at several points as it runs. This will include running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

> ▶   If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing the upgrade, see Removing Replication Across the Entire NA Mesh on page 39.

9   Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

10 Verify that the replication is working correctly. Make sure:

- The spool file generated by running the replication SQL script contains no errors, other than the following warning: 'ORA-23326: object group <yourgroup>.<your_replication_ group> is quiesced' that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command.

- Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up and is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

- Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

```
CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
CoreID=1;
COMMIT;
```

  wait 10 to 30 seconds

```
CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
SELECT Comments from RN_CORE where CoreID=1;
```

  You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

11 Upgrade each NA server using the NA 7.60 Service Pack Installer. The NA 7.60 Service Pack Installer upgrades the NA server to NA 7.60. The scripts for the database upgrade have already been handled by running the replication script in Step 7.

12 Verify the NA installation:

a   Edit an object on one NA server (for example, a Comments field for a device).

b   Wait a minute and then verify that the updated comment exists on the second server.

c   Check the status of the Oracle Distributed Monitor in the NA UI to ensure that no problems are being reported. (For information, see Distributed Error List on page 56.)

Upgrading from NA 7.60 to NA 9.00

To upgrade from 7.60 to NA 9.00, be sure that:

*   A current NA 7.60 database is installed on all Masters.

*   The *ReplicationScriptTool* bundle files for NA 9.00 are installed on a Java-capable system (on one of the NA systems).

*   You have the following information:

    — Login/password/DatabaseIdentifier (SID) for NA into all databases in the NA Mesh

    — Replication password for the existing repadmin user

    — DatabaseIdentifier (SID), NA server hostname, NA server RMI listening port, database server hostname, and database listening port for all Masters

    — The timezone offset (integer from UTC) for the entire NA Mesh (This must be a constant across the NA Mesh.)

    — The existing replication group name

1   Shut down all NA Management Engines in the NA Mesh.

2   Update the variables for all Masters in the *ReplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

▶   All servers should be listed in the *ReplicationScriptTool.properties* file. Set the mode property to "upgrade_from_7_6".

3   Run the ReplicationScriptTool. Enter:
    ```
    java -classpath . ReplicationScriptTool
    ```

4   Ensure that you have a server and a directory (typically on one of the database systems), where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the CONNECT <USER>/ <PASSWORD>@<SID> command for each unique SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

5   Copy the newly generated SQL file (typically named *ReplicationScript.sql,* depending on what value was set to in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

▶   Make sure that files named *_spool.txt do not exist in the directory. When run, the script will log its actions to a file with that suffix.

6   Ensure you have two SQLPLus windows open before running the script: One window connected as the NA user and the other window connected as the SYSTEM user.

7   Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using @ReplicationScript.sql.

8   Follow the instructions provided by the script at several points as it runs. This will include running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

> If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing the upgrade, see Removing Replication Across the Entire NA Mesh on page 39.

9   Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

10   Verify that the replication is working correctly. Make sure:

   • The spool file generated by running the replication SQL script contains no errors, other than the following warning: 'ORA-23326: object group <yourgroup>.<your_replication_ group> is quiesced' that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command.

   • Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up and is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

   • Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

```
CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
CoreID=1;
COMMIT;
```

   wait 10 to 30 seconds

```
CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
SELECT Comments from RN_CORE where CoreID=1;
```

   You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

11   Upgrade each NA server using the NA 9.00 Service Pack Installer. The NA 9.00 Service Pack Installer upgrades the NA server to NA 9.00. The scripts for the database upgrade have already been handled by running the replication script in Step 7.

12   Verify the NA installation:

   a   Edit an object on one NA server (for example, a Comments field for a device).

   b   Wait a minute and then verify that the updated comment exists on the second server.

   c   Check the status of the Oracle Distributed Monitor in the NA UI to ensure that no problems are being reported. (For information, see Distributed Error List on page 56.)

Upgrading from NA 9.00 to NA 9.10

To upgrade from NA 9.00 to NA 9.10, be sure that:

- A current NA 9.00 database is installed on all Masters.

- The *ReplicationScriptTool* bundle files for NA 9.10 are installed on a Java-capable system (on one of the NA systems).

- You have the following information:

  — Login/password/DatabaseIdentifier (SID) for NA into all databases in the NA Mesh

  — Replication password for the existing repadmin user

  — DatabaseIdentifier (SID), NA server hostname, NA server RMI listening port, database server hostname, and database listening port for all Masters

  — The timezone offset (integer from UTC) for the entire NA Mesh (This must be a constant across the NA Mesh.)

  — The existing replication group name

1 Shut down all NA Management Engines in the NA Mesh.

2 Update the variables for all Masters in the R*eplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

> All servers should be listed in the *ReplicationScriptTool.properties* file. Set the mode property to "upgrade_from_9_5".

3 Run the ReplicationScriptTool. Enter:
```
java -classpath . ReplicationScriptTool
```

4 Ensure that you have a server and a directory (typically on one of the database systems), where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to one database with SQLPlus and issue the CONNECT <USER>/ <PASSWORD>@<SID> command for each unique SID in the NA Mesh. This is necessary because the script issues CONNECT commands to change which database it is running procedures against.

5 Copy the newly generated SQL file (typically named *ReplicationScript.sql,* depending on what value was set to in the *ReplicationScriptTool.properties* file), from the ReplicationScriptTool working directory to the server and directory where you plan to run SQLPlus.

> Make sure that files named *_spool.txt do not exist in the directory. When run, the script will log its actions to a file with that suffix.

6 Ensure you have two SQLPLus windows open before running the script: One window connected as the NA user and the other window connected as the SYSTEM user.

7 Run the replication script copied in the previous step in the SQLPlus window connected as the NA user using @ReplicationScript.sql.

8 Follow the instructions provided by the script at several points as it runs. This will include running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

> If you skipped or misconfigured any of the above steps, and as a result see errors during replication setup, before performing the upgrade, see Removing Replication Before Upgrading the Database on page 73.

9   Exit from SQLPlus once the script completes. This ensures that all actions are logged to the spool file.

10 Verify that the replication is working correctly. Make sure:

    •   The spool file generated by running the replication SQL script contains no errors, other than the following warning: 'ORA-23326: object group <yourgroup>.<your_replication_ group> is quiesced' that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command.

    •   Verify (using Oracle's Enterprise Manager) that each database in the NA Mesh has replication set up and is in the "Normal" state, and has purge, push, and repcat_admin jobs installed correctly. Consult your Oracle DBA for assistance.

    •   Verify that the replication of data is working correctly. To verify that replication is working between all NA Cores in the NA Mesh, enter the following commands:

        ```
        CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
        UPDATE RN_CORE SET COMMENTS = 'Test from sid1 to sid2' where
        CoreID=1;
        COMMIT;
        ```

        wait 10 to 30 seconds

        ```
        CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
        SELECT Comments from RN_CORE where CoreID=1;
        ```

        You should enter this from every NA Core in the NA Mesh. Be sure to check the values each time on all of the other NA Cores to ensure that the links between each database in the system are working correctly.

11 Upgrade each NA server using the NA 9.10 Service Pack Installer. The NA 9.10 Service Pack Installer upgrades the NA server to NA 9.10. The scripts for the database upgrade have already been handled by running the replication script in Step 7.

12 Verify the NA installation:

    a   Edit an object on one NA server (for example, a Comments field for a device).

    b   Wait a minute and then verify that the updated comment exists on the second server.

    c   Check the status of the Oracle Distributed Monitor in the NA UI to ensure that no problems are being reported. (For information, see Distributed Error List on page 56.)

3 System Administration

This chapter contains the following topics:

Getting Started

In general, an NA server that is part of a Distributed System NA Mesh should be transparent to users. However, there are a number of operations that the system administrator may need to do to keep the Distributed System NA Mesh functioning properly.

Understanding Oracle Replication

Oracle replication uses three types of jobs:

- **Transaction Push Job** — Each NA Core will have a Transaction Push job for each of the other NA Cores in the NA Mesh. For example, if you have two NA Cores, each NA Core has one Transaction Push job. If you have three NA Cores, each NA Core has two Transaction Push jobs for the two destination NA Cores. These jobs are identified in Oracle's Enterprise Manager or from DBA_JOBS by the `DBMS_DEFER_SYS.PUSH()` command string.

- **Transaction Purge Job** — Each NA Core will have one Transaction Purge job for cleaning out successfully pushed transactions. These jobs can be identified in Oracle's Enterprise Manager or from DBA_JOBS by the `DBMS_DEFER_SYS.PURGE ()` command string.

- **Replication Administration Job** — Each NA Core will have one Replication Administration job. These jobs are not used in normal NA operation. It is used if the replication setup is changed. These jobs can be identified in Oracle's Enterprise Manager or from DBA_JOBS by the `DO_DEFERRED_REPCAT_ADMIN()` command string.

NA automatically monitors all three jobs and attempts to restart any job that fails. You can monitor the jobs using Oracle's Enterprise Manager or by viewing DBA_JOBS. Using SQLPlus, enter: `SELECT * FROM DBA_JOBS;`

To view specific job IDs and if they are broken, enter: `SELECT JOB, BROKEN, WHAT FROM DBA_JOBS;`

On Oracle, NA monitors on a regular schedule the following on each NA Core for the database transport (i.e., replication):

- Push jobs that handle moving data from one NA Core to another. If the monitor check fails and the Push job is found to be broken, NA will attempt to restart it.

- Purge jobs that successfully clear pushed data from the push queue, and attempts to restart the Push queue each time the check fails.

- The deferred transaction queue for any transactions that could not be applied to the local database due to a conflict. NA applies additional application logic to attempt to correctly apply the transaction. If unsuccessful, NA alerts the NA administrator via email notification.

- Unrecoverable uniqueness conflicts. NA alerts the NA administrator in the event of unrecoverable uniqueness conflicts. Typically, there is no way to automatically correct these types of issues.

- Both the DEFTRAN and DEFLOB queue size. These queues hold pending data that needs to be pushed to other servers. Typically, if replication is working, but is beginning to backup, these queues will begin to grow. This can occur if the connection between databases is congested. NA alerts the NA administrator to this issue via email notification. The system will continue to push data. However, it could take a long time to catch up depending on network conditions.

  ▶ For information about configuring email notification, see the *NA User's Guide*.

In addition to replication monitoring, NA also monitors the following for each of the NA Cores:

- RMI connectivity between each NA Core

- NA server timestamp differences between each NA Core

These monitors will generate events during error conditions. The events can be emailed to the NA administrator or Oracle DBA using a standard event rule in NA.

▶ NA includes an example event rule that can be updated as necessary.

How NA Removes In-Memory and Database Information

There could be a delay in removing or cancelling a task because NA must communicate with the appropriate owning NA Core to perform this operation. To ensure proper removal of all in-memory and database information, and to avoid replication conflicts due to matching timestamps, NA active tasks are automatically deleted on the NA Core with which they are associated. An active task is any task that does not have the "Succeeded," "Failed," "Duplicate", "Skipped", or "Warning" status.

Keep in mind that deleted tasks could be displayed in task lists for a few moments while the replication process pushes the deletes to other NA Cores in the system. In addition, if the NA Core from which the task originated is not accessible, the delete will fail.

Suspending Replication for Database Maintenance

To suspend replication because you are bringing down one or both database servers for maintenance, complete the following procedure as user repadmin from the masterdef database site:

1   Shut down the NA managment engine on all NA application servers:

   - *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Stop**.

   - *UNIX*: Run the following command:

         /etc/init.d/truecontrol stop

2   CONNECT repadmin/<PWD>@<MASTER1_SID>;

3   EXEC DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY(<REPGROUP>);

NA Generated Events

By default, NA generates system events. Event rules can alert you to certain error conditions requiring attention. Each event is listed below, along with an explanation and required action to be taken. You should examine the default "Distributed System" event rule to ensure all of the events are included in the event rule and that the event rule is configured to send the email notification to the appropriate administrator.

For information about configuring email notification, see the *NA User's Guide*.

Broken Replication Job

Event format:

```
Job ID: <ID>
Job Type: <push to <host>, purge, or repcat admin>
Database Host: <hostname>
Database SID: <SID>
Stalled: <true or false>
```

Broken jobs can occur because an Oracle server cannot push transactions to another server due to that server being down or in the event of a network connectivity loss. Replication jobs can also become broken because they stall. Stalled replication jobs represent a hang in an internal Oracle process. This event is sent only once for each broken replication job (unless the NA server is restarted, in which case the event will be resent if the job is still broken). If a stalled replication job is detected, it is best to restart the Oracle server.

For broken replication jobs that are not stalled, the course of action depends on the job type. If the job type is "purge" or "repcat admin," consult with your Oracle DBA. Failure of these jobs represents an internal problem or resource limit in the Oracle server that will need to be investigated.

For "push to <host>" job types, the typical failure will be loss of connectivity to the other host, either through a network problem, outage of the Oracle server, or outage of the database host system itself. NA will restart this job automatically once the connectivity problem has been remedied.

To troubleshoot this problem, make sure:

1 The host that the server cannot connect to is up and running.

2 The Oracle instance on that host is running.

3 From a command line enter `ping <host>` to ensure that network connectivity exists between servers.

4 From a command line enter `tnsping <OTHER_SID>` to ensure that Oracle is accepting connections.

5 Ensure that database links are working:

- Using SQLPlus, enter `SELECT CURRENT_TIMESTAMP FROM DUAL@<OTHER_SID>;`

- Using SQLPlus, enter `SELECT DBLINK FROM DBA_REPSITES;`

Failures of any of these steps will point to corrective actions needed.

Fixed Replication Job

Event format:

```
Job ID: <ID>
Job Type: <push to host, purge, or repcat admin>
Database Host: <hostname>
Database SID: <SID>
```

This event is sent when the system detects that a previously broken job is now working correctly. This could happen when network connectivity is restored between two database servers, allowing data to be replicated. No action is required when this happens.

This event is only sent when the correction occurs while NA is running. If NA is stopped while the problem is corrected, when NA is restarted no event is sent.

Replication Errors

Event format:

```
TransactionID: <id>
Call Number: <n>
Table Name: <TABLE_NAME>
Transaction Type: UPDATE
NA Source Host: <hostname>
DB Destination: <SID>
```

NA sends this event when it encounters a replication error that it cannot resolve on its own. In general, NA attempts to resolve conflicts automatically. Certain conflict types cannot be resolved using Oracle's built-in methods, but can be resolved by NA after they occur. In particular, UPDATE conflicts due to out-of-order transactions, causing a primary key or foreign key constraint violation, can be resolved by re-executing the transaction after a short wait.

Additionally, conflicts due to UPDATES of items that have already been deleted can by resolved by removing the failed transaction. These two actions are taken by NA during its regular replication monitoring run, which happens at several minute intervals. If these corrective actions do not fix the problem, an event is sent.

Typically, to fix an UPDATE error requires editing the object in question to set its values to those expected by the transaction, and then re-executing the transaction (also known as retrying the error). To do this:

1   Open the View Distributed Error page and click the Details option in the Actions column. All of the database attributes of the affected object are displayed. See Distributed Conflict List on page 57.

2   Locate the object in the NA system (or simply update the database directly using SQLPlus or some other tool), and change all of its attributes to those listed in the Original Value column on the View Distributed Error Details page.

3   Retry the error.

Uniqueness Conflict

```
Event format:
Server: <host>
Object: <Object>
Conflicting Value: <value>
Refer to the replication documentation for instructions on correcting
this conflict.
```

This event is sent when NA detects a conflict in a uniqueness constraint. You will receive an event per NA Core, since the conflicts are local to each NA Core. To correct a naming conflict, go to one NA Core and update the names for the affected objects. Both the renamed <NAME>.<SID> and <NAME> should be edited to force an update on the other NA Cores.

To correct a rule priority conflict, go to the Device Password Rule Priority Reset page click the Reset Priority button. See Device Password Rule Priority Reset Page on page 59.

If this does not solve the problem, you will need to manually edit the rules on each NA Core, setting the priority order correctly and verifying existence of correct rules. When finished, return to the Device Password Rule Priority Reset page and click the Reset Priority button.

Time Synchronization Warning

Event format:

```
Time difference: <N> seconds
Local Core: <hostname>
Remote Core: <hostname>
```

NA replication conflict resolution depends on a latest timestamp method. To work correctly, this requires different NA servers' clocks to differ by only a small amount. To correct this problem, make sure that the time is synchronized on the NA server systems across the NA Mesh.

RMI Error

Event format:

```
Local Core: <hostname>
Remote Core: <hostname>
Error: <Exception text>
```

This error typically occurs when there are network problems between the NA servers. To troubleshoot this problem, make sure:

1   The host that the server cannot connect to is up and running.

2   The NA instance on that host is running.

3   From a command line, enter `ping <host>` to ensure that network connectivity exists between servers.

4   From a command line, enter `telnet <host>` to port 1099 (or whatever your RMI listen port is set to) to ensure that RMI connections are being accepted. If working correctly, you should get back some data that includes the text string "java.rmi.MarshalledObject".

Failures of any of these steps will point to corrective actions needed, such as updating the RMI port being used in the Edit NA Core page, or restarting NA to make sure that the RMI port has been bound correctly and is not being used by another application.

Deferred Transactions Exceed Threshold

Event format:

```
Exceeded number of deferred transactions in threshold.
```

This event occurs when NA determines that the deferred transaction queue, as reported by the DEFTRAN view, exceeds a certain threshold. This typically means that the NA Core reporting this event cannot push transactions quickly enough to other NA Cores.

To troubleshoot this issue:

1   Verify that network connectivity exists between the database servers in the NA Mesh.

2   Verify that the network connections between the database servers in the NA Mesh are not experiencing bandwidth congestion or other network issues.

Correcting these issues should enable the databases to catch up with their transaction pushes. In addition, reducing the amount of tasks or other operations on the NA Cores can help the system recover more quickly.

Deferred LOBs Exceed Threshold

Event format:

```
Exceeded number of deferred LOBs in threshold.
```

This event is identical to Deferred Transactions Exceed Threshold event, except the view being monitored is the DEFLOB view.

Using the NA Distributed System Pages

When you install the Distributed System software, the NA user interface includes specific Distributed System pages to help you monitor and administer the system.

Distributed Monitor Results Page

The Distributed Monitor Results page displays the overall health of the Distributed System. By default, the Distributed monitor runs every five minutes.

To open the Distributed Monitor Results page, on the menu bar under Admin select Distributed and click Monitor Results. The Distributed Monitor Results page opens.

NA monitor several properties necessary for proper functioning of the Distributed System, including:

- **RMI Connections** — RMI (Remote Method Invocation) is Java's remote procedure call protocol. The distributed system makes RMI calls between NA servers in the NA Mesh to transfer information about scheduled tasks, system settings, software images, and so on.

- **Scheduled Jobs** — Oracle contains a job scheduler. Replication requires certain jobs be setup using that job scheduler. In particular, there are jobs on each NA Core database that:

  — Push transactions

  — Purge previously pushed transactions from the log

  — Handle administrative commands for replication

- **Error Transactions** — Error transactions are transaction that have been pushed from a remote server and for some reason were not able to execute correctly on the local server.

- **Uniqueness Conflicts** — Certain NA database constraints restrict columns to unique values. In a distributed environment, these constraints can be violated when updates are made on two different NA Cores where the unique column is set to the same value. These conditions are captured by the Replication Conflict Resolution System and logged. NA cannot automatically resolve these conflicts. They must be resolved manually.

- **Local NA Core Definition** — The local NA Core must be able to determine which entry in the RN_CORE table it is. If the "The *local core for this system is undefined.*" error message is displayed, the CoreHostname property needs to be updated for the NA Core. This can be done using the Edit Core page. For information, see Edit Core Page on page 59.

  > When this condition occurs, the NA Management Engine's log file will contain the following text: "*Fatal error - could not assign local core.*"

The CoreHostname value can be either the DNS, *etc/hosts* value, or an IP address. If you are using an NA server with multiple IP addresses, you might need to tell NA which IP address to use. This is done by adding the following setting to the *distributed.rcx* file:

```
<option name="distributed/NA_server_local_ip">A.B.C.D</option>
```

> The *distributed.rcx* file is located in the same location as the *appserver.rcx* file. For the location of the files, see Oracle 11g: Adding a New NA Core to an Existing NA Mesh on page 31 or Oracle 10g: Adding a New NA Core to an Existing NA Mesh on page 33.

The value A.B.C.D should be replaced with the appropriate NAT IP address for the NA server and should match the RN_CORE table's CoreHostname value for that NA Core.

Distributed Error List

The Distributed Error List page displays distributed transaction errors on the current NA Core. This information is useful for finding error conditions that require administrative action. Keep in mind that all conflicts are displayed until they are:

- Manually resolved

- Automatically resolved by NA

- Manually deleted without resolution (not recommended)

To open the Distributed Error List, on the menu bar under Admin select Distributed and click Error List. The Distributed Error List opens.

Distributed Error List Page Fields

Field	Description
Transaction ID	The ID of the transaction that was placed in the deferred error queue due to the conflict.
Call No.	A transaction can update more than one row in the database. Each row will have a separate call number. For example, for a transaction that updates seven rows, there will be seven entries with the same Transaction ID, but different call numbers.
Package Name	The name of the table on which the conflict occurred.
Proc Name	The type of transaction, for example UPDATE or DELETE.
Source	The database from which the transaction originated.
Status	Statuses can include: • new — This is a new error. The system has not attempted to deal with it yet. Keep in mind that certain types of errors require waiting for other transactions to complete before they can be retried. • alert_sent — The system has sent an alert. • to_retry — The system has noted this error and is waiting before retrying. • old — The system noted the error and retried it. However, the retry did not work.
Actions	You can select the following options: • Detail — Opens the View Distributed Error page, where you can view details about the transaction in that row. • Delete — Deletes the error from the database. • Retry — Re-execute the transaction.

View Distributed Error Page

The View Distributed Error page displays the detail for a particular distributed transaction error. This information is useful for providing the details necessary to correct the error.

To open the View Distributed Error page:

1   On the menu bar under Admin select Distributed and click Error List. The Distributed Error List opens.

2   In the Actions column, click the Detail option. The View Distributed Error page opens. The Details section displays the column(s) from the table named in the Package Name field that contains conflicting data.

Distributed Conflict List

The Distributed Conflict List page displays the uniqueness constraint conflict list. This provides information about uniqueness conflicts that will need to be manually corrected to ensure that the databases in the NA Mesh are in sync.

To open the Distributed Conflict List, on the menu bar under Admin select Distributed and click Conflict List. The Distributed Conflict List opens.

Distributed Conflict List Page Fields

Field	Description
Object	The database table on which the conflict occurred.
Site Name	The core in the NA Mesh for which the conflict occurred (actually the database SID).
Value	The value of the column for which there was a uniqueness conflict. Keep in mind that NA does not automatically resolve uniqueness conflicts. NA simply appends the name of the NA Core from which the transaction originated to the conflicting value so that the transaction can complete.
Create Date	The Date the conflict occurred.
Status	Statuses include: • new — This is a new conflict. The system has not yet alerted the system administrator. • alert_sent — The system has sent an alert.
Actions	You can select the following options: • Detail — Opens the View Distributed Conflict page, where you can view details on an individual uniqueness constraint. See View Distributed Conflict Page on page 58. • Delete — Deletes the conflict from the database.

View Distributed Conflict Page

The View Distributed Conflict page provides details on a specific uniqueness constraint.

To open the View Distributed Conflict page:

1   On the menu bar under Admin select Distributed and click Conflict List. The Distributed Conflict List opens.

2   In the Actions column, click the Detail option. The View Distributed Conflict page opens.

Table Name is the name of the database table on which the uniqueness conflict occurred. Object IDs are the primary keys of the objects in the database.

If a key has only one column, it is displayed in Object ID 1 field. Some keys are formed from multiple columns. Consequently, those values are displayed in the Object ID 1, Object ID 2, and Object ID 3 fields.

Site Reassignment Page

The Site Reassignment page allows the Site-to-NA Core mapping to be modified. This is useful for failover of Sites from one NA Core to another and for restoring Sites back to their original NA Core.

To open the Site Reassignment page, on the menu bar under Admin select Distributed and click Site Reassignment. The Site Reassignment opens. You can select NA Cores from the drop-down menu.

List Cores Page

The List Cores page lists all NA Cores in the NA Mesh. This page provides information to properly manage the Distributed System.

To open the List Cores page, on the menu bar under Admin select Distributed and click Core List. The List Cores page opens.

List Cores Page Fields

Field	Description
Name	The NA Core's name.
Core Hostname	The hostname of the NA Core's NA server.
Is Master?	Is the NA Core the Master Definition? (Yes or No)
Timezone Offset	The timezone offset of the actual NA Core server.
Status	Currently, there is only Normal status.
Realm	The default Realm for the NA Core.
Actions	You can select the following option:
	• Edit — Open the Edit Core page. See Edit Core Page on page 59.

Edit Core Page

The Edit Core page enables you to edit the NA Core definition.

To open the Edit Core page:

1   On the menu bar under Admin select Distributed and click Core List. The List Cores page opens.

2   In the Actions column, click the Edit option. The Edit Core page opens.

You can complete the following fields:

*   Name — Enter the NA Core name.

*   Database Identifier — Enter the Database Identifier. This is the name of the NA Core's database as it appears in the *tnsnames.ora* file. The Database Identifier is corresponds to Oracle's SID (System Identifier). This information is needed to make connections to a particular Oracle instance on a server. Multiple instances may be running on any given server, but each will have different SIDs.

*   Core Hostname - Enter the hostname of this NA Core's server.

*   RMI Port — Enter the RMI port. RMI (Remote Method Invocation) is Java's remote procedure call protocol. The distributed system makes RMI calls between NA servers in the NA Mesh to transfer information about scheduled tasks, system settings, software images, and so on.

*   Database hostname — Enter the Database hostname.

*   Database Port — Enter the port on the database server with which NA communicates with the database.

*   Timezone Offset — Select a Timezone offset from the drop-down menu.

*   Replication Admin User — Enter the name of the Replication Admin user. The Replication Admin user is created and used by the Oracle database to manage replication.

*   Replication Password — Enter the Replication Admin user's password.

*   Confirm Replication Password — Re-enter the Replication Admin user's password.

*   Comments — Add any comments about the NA Core.

*   Realm Name — Enter the Realm in which the NA Core resides. For information about segmenting devices, see the *NA User's Guide*.

Device Password Rule Priority Reset Page

The Device Password Rule Priority Reset page enables you to reset device password rule priorities in the event that a uniqueness constraint conflict occurs for those objects.

To open the Reset Password Priority page, on the menu bar under Admin select Distributed and click Device Password Rule Priority Reset. The Device Password Rule Priority Reset page opens.

Click the Reset Priority button to reset the device password rule priorities.

Renew Configuration Options Page

The Renew Configuration Options page enables you to reset the configuration options when the configuration options on an NA Core become out-of-sync with other servers in the NA Mesh.

To open the Renew Configuration Options page, on the menu bar under Admin select Distributed and click Renew Configuration Options. The Renew Configurations Options page opens.

Click the Renew Config Options button to ensure that all options on the NA Core are in sync with the rest of the NA Mesh.

4   Failover and Recovery

This chapter contains the following topics:

Failover

When the network has been configured to failover, if an NA Core fails, users can continue to access all data in the system using a different NA Core. All Sites that were originally managed by the failed NA Core can be pointed to a new NA Core using the Site Reassignment page. For information, see Site Reassignment Page on page 58. Procedures for system recovery will vary depending on how the remote server failed.

Recovery

There are three basic recovery scenarios:

- Loss of network connectivity

- Loss of an NA server

- Loss of a Database server

Loss of Network Connectivity

In the case of lost network connectivity, failover occurred due to network issues. No problems occurred with the NA server or with the Oracle database server. Recovery consists of the following steps:

1   Resolve the network issues.

2   Reset Sites that had been reassigned back to their original NA Core. This can be accomplished in NA. See Site Reassignment Page on page 58.

3   If any drivers have been added to the system during the outage, click the "Reload Drivers" button on the Start/Stop Services page. This action reloads the driver files and pushes them across to other NA Cores in the NA Mesh. This action should be performed on the NA server where the drivers were added. For information, see the *NA User's Guide*.

4   If any system settings have been modified during the outage, use the "Renew Config Options" page to make sure options are synced across the NA Mesh. See Renew Configuration Options Page on page 60.

5   If any NA Cores have lost connectivity for a long period of time, restart the NA Core
    server that lost connectivity after data sync so as to reload certain Site data and avoid
    exception errors due to obsolete data.

Once the network issues are resolved, the system should recover as replication syncs data
between the databases.

Loss of an NA Server

In cases where the NA server suffers a failure that requires re-installation of the server,
recovery consists of the following steps:

1   During NA installation, select the "Use existing database" option. In addition, the
    database selected should be the one the failed server was previously using.

2   Add the *distributed.rcx* file from the *ReplicationScriptToolBundle* to the directory where
    the *appserver.rcx* file resides.

3   Re-add any NA Core-specific special case options for patches and support issues.

4   Restart NA.

5   Reset Sites that had been re-assigned back to their original NA Core. This can be
    accomplished in NA. See Site Reassignment Page on page 58.

6   If any drivers have been added to the system during the outage, click the "Reload Drivers"
    button on the Start/Stop Services page. This action reloads the driver files and pushes
    them across to other NA Cores in the NA Mesh. This action should be performed on the
    NA server where the drivers were added. For information, see the *NA User's Guide*.

7   If any system settings have been modified during the outage, use the "Renew Config
    Options" page to make sure options are synced across the NA Mesh. See Renew
    Configuration Options Page on page 60.

8   Edit the original NA Core to modify any parameters that may be different (perhaps the
    installation happened on a new server with a different hostname).

9   Copy the software images repository from a good NA Core to the recovered NA Core.

Loss of a Database Server

In the case of a lost database server, the NA server is still running but cannot access the
database. The database will need to be rebuilt and replication setup again on the database.
Recovery consists of the following steps:

1   Pause or delete any tasks that appear to be stuck waiting or pending and not running
    because they are associated with the lost server. You can perform this action on another
    NA server in the NA Mesh.

2   If the server that was lost is the Master Definition server for replication, the procedure
    described for relocating the Master Definition server should performed. See Changing the
    Master Definition Site on page 39.

3   For instructions on adding a new NA Core, see Oracle 11g: Adding a New NA Core to an
    Existing NA Mesh on page 31 or Oracle 10g: Adding a New NA Core to an Existing NA
    Mesh on page 33.

4   Reset Sites that had been reassigned back to their original NA Core. This can be
    accomplished in NA. See Site Reassignment Page on page 58.

5   In NA, edit the NA Core that was recovered to make sure all information is correct for the new setup. For information, see the *NA User's Guide*.

5   Troubleshooting

This chapter contains the following topics:

RMI Errors in the NA Console

An RMI error that prevents NA console logon or inhibits use of the NA console can mean that NA is unable to identify the localhost. To correct the problem, update the localhost section of the `hosts` file on each NA application server as follows:

➤ This solution is for static IP environments only.

1   In a text editor such as WordPad or vi, open the following file:

- *Windows*: `<Drive>:\Windows\System32\drivers\etc\hosts`
- *UNIX*: `/etc/hosts`

2   Set the localhost line to read:

        127.0.0.1 localhost

3   For each NA application server, add a line in the following format:

        <xx.xx.xx.xx> <NA.example.com> <NA>

- Replace `<xx.xx.xx.xx>` with the IP address of the NA application server.
- Replace `<NA.example.com>` with the fully-qualified domain name of the NA application server.
- Replace `<NA>` with the short hostname of the NA application server.

4   Repeat step 3 until the `hosts` file includes all NA application servers in the distributed system environment.

5   To use the updated hosts information, restart the NA application server.

Oracle Replication Setup

The Oracle replication setup process is complicated. The following guidelines help prevent problems with replication setup.

- Ensure that the *tnsnames.ora* file is setup correctly on each system. You can verify correct setup by running SQLPlus on each system to make certain that you can connect to other databases. For example, if you have two systems (A and B), run SQLPlus on A to connect to the database on B using the following command: `sqlplus USER/PWD@DATABASE_B`.

- It may be necessary to remove or comment out the `NAMES.DEFAULT_DOMAIN` property entry from the *sqlnet.ora* file for the appropriate connections to work. Consult with your Oracle DBA if you have questions.

- If the replication setup process fails at any step, it is recommended that you follow the process for removing replication from the entire NA Mesh (see Removing Replication Across the Entire NA Mesh on page 39), and then follow the replication setup sets again (see Oracle 10g: Set Up Initial Replication on page 27).

Replication Tools and Commands

The following tools and commands can help to isolate problems with replication setup.

To ensure that database links are working:

- Using SQLPlus, enter: `SELECT CURRENT_TIMESTAMP FROM DUAL@<OTHER_SID>;`

- Using SQLPlus, enter: `SELECT DBLINK FROM DBA_REPSITES;`

- From a command line, enter: `tnsping <OTHER_SID>`

- From a command line, enter: `ping <HOST>`

To ensure the replication group is working:

- Using SQLPlus, enter: `SELECT GNAME,STATUS FROM DBA_REPGROUP;`

To ensure there are no errors for replication admin requests:

- Using SQLPlus, enter: `SELECT STATUS,REQUEST,ONAME FROM DBA_REPCATLOG;`

Common Errors

Some errors can occur during replication setup. Ones that have been reported are noted below, with suggested corrective action. In some cases, it might be necessary to remove replication across the NA Mesh and re-setup replication. For information, see Removing Replication Across the Entire NA Mesh on page 39.

Error

```
SQL> EXEC DBMS_REPCAT.RESUME_MASTER_ACTIVITY(gname=>'
<REPGROUP_NAME>');BEGIN DBMS_REPCAT.RESUME_MASTER_ACTIVITY
(gname=>'<REPGROUP_NAME>'); END;

*

ERROR at line 1:

ORA-23419: regenerate replication support before resuming master
activity

...
```

Corrective Action

An internal Oracle error has prevented replication support from being generated correctly for one or more objects. To correct this, it will be necessary to remove and re-setup replication for the NA Mesh.

Error

```
ORA-23374: object group "PUBLIC"."REPLNA" already exists
ORA-06512: at "SYS.DBMS_SYS_ERROR", line 95
ORA-06512: at "SYS.DBMS_REPCAT_MAS", line 798
ORA-06512: at "SYS.DBMS_REPCAT", line 548
```

Corrective Action

An internal Oracle error has prevented replication support from being generated correctly for one or more objects. To correct this, it will be necessary to remove and re-setup replication for the NA Mesh. For information, see Removing Replication Across the Entire NA Mesh on page 39.

Error

```
BEGIN DBMS_REPCAT.DROP_MASTER_REPOBJECT('SYSTEM',
'RN_DEVICE_VIEW','TABLE',FALSE)
; END;

*

ERROR at line 1:

ORA-00060: deadlock detected while waiting for resource

...
```

Corrective Action

Rerun the deletion script you were running when this occurred. You may see other errors due to certain actions already having been done, but that is expected.

Error

```
BEGIN DBMS_REPCAT.DROP_MASTER_REPOBJECT('SYSTEM','
RN_DEVICE_VIEW','TABLE',FALSE)
; END;

*

ERROR at line 1:

ORA-23308: object SYSTEM.RN_DEVICE_VIEW does not exist or is invalid

...
```

Corrective Action

Rerun the deletion script you were running when this occurred. You may see other errors due to certain actions already having been done, but that is expected.

A   Restoring NA Replication After Upgrading to Oracle 11g

This appendix describes the process for upgrading the database of an HP Network Automation Software (NA) Multimaster Distributed Sytem from Oracle 10g to Oracle 11g, including how to restore NA replication after the upgrade. At a high level, the process involves the following steps:

1   Remove replication, which creates standalone NA cores.

2   Upgrade the database.

3   Set up replication using the database from only one of the NA cores.

➤   If you also plan to upgrade the NA software, do not mix that upgrade with the database upgrade. Upgrade NA to version 9.10 and verify that replication works correctly before upgrading the database.

Prerequisites

Before upgrading the Oracle database in an NA Multimaster Distributed System, verify that the following prerequisites have been met:

- The existing NA database user name is a custom value (not SYSTEM). If the NA schema is currently owned by the SYSTEM user, consider doing a fresh installation of the NA Multimaster Distributed System on Oracle 11g.

- NA database replication is correctly configured and working with Oracle 10g for all cores in the NA mesh.

- The ReplicationScriptTool bundle files are installed on a Java-capable system.

- The information listed in Table 1 on page 15 is available. If the NA mesh is larger than two cores, also collect the information for the additional cores.

Database Upgrade Process

To upgrade the database from Oracle 10g to Oracle 11g within an NA mesh, follow this process:

1   Stop the NA management engine on all NA application servers:

- *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Stop**.

- *UNIX*: Run the following command:

```
/etc/init.d/truecontrol stop
```

2   Remove all replication from the NA mesh.

a   If the NA mesh consists of three or more cores, remove the additional cores as described in Removing an NA Core from an Existing NA Mesh on page 37.

Note the following:

— On each NA application server, move the `distributed.rcx` file to a location outside of `<NA_HOME>`.

— Do not uninstall the NA application.

b   Remove replication from the final two cores in the NA mesh as described in Removing Replication Across the Entire NA Mesh on page 39.

Note the following:

— On each NA application server, move the `distributed.rcx` file to a location outside of `<NA_HOME>`.

— Do not uninstall the NA application.

3   Verify that each NA core behaves as a standalone instance of NA:

Enter the following commands:

```
CONNECT <USER>/<PASSWORD>@<MASTER1_SID>;
UPDATE RN_CORE SET COMMENTS = 'Test2 from sid1' where CoreID=1;
COMMIT;
```

wait 10 to 30 seconds

```
CONNECT <USER>/<PASSWORD>@<MASTER2_SID>;
SELECT Comments from RN_CORE where CoreID=1;
```

Enter this from every NA Core in the NA Mesh. Check the values each time on all of the other NA Cores to ensure that no replication exists among the databases that were formerly in the system.

4   Upgrade each database server to a supported version of Oracle 11g.

5   Prepare Master 1 for replication as described in Task 3: Prepare Master 1 for Replication (Oracle 11g) on page 20.

6   Prepare Master 2 for replication as follows:

a   With the NA management engine on NA2 shut down, log on to Master 2 as the SYS user, and then delete the NA database user while retaining the NA tablespace.

For example, in the Oracle Enterprise Manager (preferred), delete `nauser`, or at the `sqlplus` prompt, enter the following command:

```
DROP USER nauser CASCADE;
```

▶   Use the cascade delete option to completely delete the user and empty its tablespace.

b   On Master 2, verify that the NA tablespace is now empty.

c   Beginning with step 2 on page 22, complete the steps of Task 4: Prepare Master 2 for Replication (Oracle 11g).

▶   The NA tablespace exists from the prior replication setup. Do not create it at this time.

7   Prepare additional database servers by repeating step 6 for each database server that was previously in the NA mesh.

8   Configure replication between Master 1 and Master 2 as described in Task 5: Configure Replication (Oracle 11g) on page 23.

   In the `ReplicationScriptTool.properties` file, `mode` should be set to `initial`.

   ▶   Do *not* install the NA application.

9   With the NA management engines on NA1 and NA2 shut down, on each of NA1 and NA2, move the `distributed.rcx` file from the known location outside of `<NA_HOME>` to the following directory:

   •   *Windows*: `<NA_HOME>\jre`

   •   *UNIX*: `<NA_HOME>/jre`

10 Start the NA management engines on both application servers, NA1 and NA2:

   •   *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Start**.

   •   *UNIX*: Run the following command:

      `/etc/init.d/truecontrol restart`

11 Connect to the NA console on both application servers, NA1 and NA2, (as user `nauser`), and ensure that there are no issues.

   ⚑   An RMI error message at this point can mean that NA is unable to identify the localhost. For more information, see RMI Errors in the NA Console on page 65.

12 Verify the NA installation:

   a   Edit an object on one NA server (for example, a Comments field for a device).

   b   Wait a minute and then verify that the updated comment exists on the second server.

   c   Check the status of the Oracle Distributed Monitor in the NA console to ensure that no problems are being reported. (For information, see Distributed Monitor Results Page on page 55.) It could take up to five minutes for this monitor to initially run.

13 For each additional database server that was previously in the NA mesh, configure replication as described in Task 5: Configure Replication (Oracle 11g) on page 23.

   Note the following differences:

   •   Substitute "Master 3" for each reference to "Master 2."

   •   For step 4 on page 23, use the `ReplicationScriptTool.properties` file from setting up replication between Master 1 and Master 2.

      —   Verify the server information for the initial core and second master site.

      —   Uncomment the Additional Master site configuration area, and replace the text `README` with the appropriate value for that variable. Use the fully-qualified hostnames to identify the database and application servers. For example:

      ```
      db.server.1=Master3.example.com
      db.port.1=1521
      db.name.1=SID3
      db.username.1=nauser
      db.password.1=napass
      app.server.1=NA3.example.com
      ```

```
app.rmiport.1=1099
app.corename.1=Core 3
```

— Set the mode to add_server.

— For step 13 on page 25, the spool file contains the following acceptable warning that occurs after the DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY command:
```
'ORA-23326: object group <yourgroup>.<your_replication_ group>
is quiesced'
```

14 With the NA management engine on the newly added NA application servers shut down, on each newly added NA application server, move the distributed.rcx file from the known location outside of <NA_HOME> to the following directory:

*   *Windows*: <NA_HOME>\jre

*   *UNIX*: <NA_HOME>/jre

15 Start the NA management engine on each newly added NA application server:

*   *Windows*: Open the **Services** control panel. In the list of services, right-click **TrueControl ManagementEngine**, and then click **Start**.

*   *UNIX*: Run the following command:

    /etc/init.d/truecontrol restart

16 Connect to the NA console on each newly added application server (as user nauser), and ensure that there are no issues.

> An RMI error message at this point can mean that NA is unable to identify the localhost. For more information, see RMI Errors in the NA Console on page 65.

17 Verify the NA installation:

a   Edit an object on one NA server (for example, a Comments field for a device).

b   Wait a minute and then verify that the updated comment exists on the other servers in the NA mesh.

c   Check the status of the Oracle Distributed Monitor in the NA console to ensure that no problems are being reported. (For information, see Distributed Monitor Results Page on page 55.) It could take up to five minutes for this monitor to initially run.

18 Optional. Add new cores (up to the supported limit) to the NA mesh as described in Oracle 11g: Adding a New NA Core to an Existing NA Mesh on page 31.

B   Restoring NA Replication After Upgrading to Oracle 10g

This appendix includes the steps for upgrading from Oracle 9i (9.2.0.1) to Oracle 10g (10.2.0.4), including how to restore NA replication after the upgrade.

Getting Started

Before upgrading from Oracle 9i (9.2.0.1) to Oracle 10g (10.2.0.4), do the following:

1   Make sure that a current NAS 7.0 Oracle 9i (9.2.0.1) database is running on all Masters.

2   Make sure that the *ReplicationScriptTool bundle* files are installed on a Java-capable system.

3   Obtain the following information:

   •   Login/password/SID for NA into all databases in the NA Mesh.

   •   The replication password for the existing 'repadmin' user.

   •   DatabaseIdentifier (SID), NA server hostname, NA server RMI listening port, database hostname, and database listening port for all Masters.

   •   The time zone offset (integer from UTC) for the entire NA Mesh. This must be a constant across the NA Mesh.

   •   The existing replication group name.

Removing Replication Before Upgrading the Database

To remove replication across the entire NA Mesh, do the following:

1   Modify all NA Sites to point to a NA Core that is the Master Definition Site.

2   Shut down all NA management engines so as to remove replication across the entire NA Mesh.

3   Update the variables for all Masters in the *ReplicationScriptTool.properties* file. Ensure that you modify all "REPLACEME" text entries in the *ReplicationScriptTool.properties* file with the appropriate values for your environment.

   ▶   The Master Definition Site must be the first entry. In addition, be sure to update the replication user, password, and the replication group name as needed. Also, make sure the "mode" property is set to "delete".

4   Run the ReplicationScriptTool using the following command:
   ```
   java -classpath . ReplicationScriptTool.
   ```

5   Make sure that you have a server and directory (typically on one of the database systems) where you can run a copy of SQLPlus that can access all NA Cores in the NA Mesh. To verify this, connect to a database with SQLPlus and issue the `CONNECT <USER>/ <PASSWORD>@<SID>` command for each unique SID in the NA Mesh. This is necessary because the script issues `CONNECT` commands to change which database it is running procedures against.

6   Copy the newly generated SQLPlus file (typically named *ReplicationScript.sql,* depending on what value was set in the *ReplicationScriptTool.properties* file), from the *ReplicationScriptTool* working directory to the server and directory where you plan to run SQLPlus.

> ▶ Make sure any files named "*_spool.txt" do not exist in the directory. When run, the script will log its actions to a file with that suffix.

7   Ensure that you have two SQLPlus windows open before running the script: One SQLPlus window connected as the NA user and one connected as the SYSTEM user.

8   Run the replication script copied in Step 6 above in the SQLPlus window connected as the NA user using `@ReplicationScript.sql`.

9   Follow the instructions provided by the script at several points as it runs. This includes running other commands in the second SQLPlus window to verify that certain operations necessary for later steps in the script have completed.

10   Exit SQLPlus once the script completes. This ensures that all actions are logged to the Spool file.

11   Verify that the replication has been removed correctly. Make sure:

   - The Spool file generated by running the replication SQLPlus script contains no errors.

   - Verify (using the Oracle Enterprise Manager) that each database in the NA Mesh does not have replication setup. If needed, consult your Oracle DBA for assistance.

12   Remove the *distributed.rcx* file from each NA server.

> ▶ Only the Master Definition Site database is used for restoring replication.

13   Restart the NA servers that point to the Master Definition Site. Make sure all of the NA Core changes are complete. Check to see that the devices are associated with NA Sites that map to the NA Core, as needed.

14   Once again, shut down the NA management engines that point to the Master Definition Site.

15   Upgrade the Oracle database from 9i (9.2.0.1) to 10g (10.2.0.4), including the database for the Master Definition Site. If needed, consult your Oracle DBA for assistance.

Restoring NA Replication After Upgrading to Oracle 10g

To restore NA replication, do the following:

1   Dump the Master Definition Site database using the following command:
    `EXP <USER>/<PASSWORD>@<MASTER1_SID> TABLES=RN_% FILE=<filename>`
    where `<USER>`, `<PASSWORD>`, and `<MASTER1_SID>` were collected in Step 3 in the
    "Getting Started" section. For information, see Getting Started on page 73. (For
    information about the Data Pump Utility, see Oracle 10g Data Pump Utility on page 81.)

    ➤   Log the output of this command to a file for examination later if needed.

2   Set up replication again with the existing data from Step 1 above. For instructions on how
    to set up initial replication, see Oracle 10g: Set Up Initial Replication on page 27.

    ➤   Create a NAS 7.0 database on Oracle 10g (10.2.0.4) so as to have an up-to-date
        NAS 7.0 database for replication. This is an added step in Prepare for Initial
        Replication on page 13. You could receive an error message regarding the
        RN_CORE table during initial replication setup. You can ignore this error
        message. However, you will need to manually update the *RN_CORE* table after
        restoring replication.

        Use the following command to create a NAS 7.0 database on Oracle 10g (10.2.0.4):

        `IMP <USER>/<PASSWORD>@<MASTER2_SID> TABLES=RN_% FILE=<filename>`
        where `<USER>`, `<PASSWORD>`, and `<MASTER2_SID>` were collected in the initial
        replication setup.

3   After finishing initial replication setup, update the RN_CORE table on one of the NA
    Cores to make sure it includes the correct information in all columns regarding the new
    replication system. If needed, consult your Oracle DBA for assistance.

C Extracting Data from the NA Database

This appendix includes the steps for extracting information about the Multimaster Mesh from the NA database.

➤ This information is also available on the appropriate Edit Core page. For information, see Edit Core Page on page 59.

To extract this data from the NA database, run the following SQL queries against the NA database. The query will return multiple rows, one row for each database core.

For the NA application server hostname, run the following:

```
SELECT CoreHostname FROM RN_CORE;
```

For the NA application server RMI listening port, run the following:

```
SELECT CoreRMIPort FROM RN_CORE;
```

For the Database Identifier (SID), run the following:

```
SELECT DatabaseIdentifier FROM RN_CORE;
```

For the NA database server hostname, run the following:

```
SELECT DatabaseHostname FROM RN_CORE;
```

For the NA database server listening port, run the following:

```
SELECT DatabasePort FROM RN_CORE;
```

For the Timezone offset, run the following:

```
SELECT TimezoneOffset FROM RN_CORE;
```

For the Replication User Name, run the following:

```
SELECT ReplicationAdminUser FROM RN_CORE;
```

For example, in a two NA Core Multimaster Mesh, run the following queries:
```
SELECT CoreHostname FROM RN_CORE;
SELECT CoreRMIPort FROM RN_CORE;
SELECT DatabaseIdentifier FROM RN_CORE;
SELECT DatabaseHostname FROM RN_CORE;
SELECT DatabasePort FROM RN_CORE;
SELECT TimezoneOffset FROM RN_CORE;
SELECT ReplicationAdminUser FROM RN_CORE;
```

You will receive the following:

```
SQL> SELECT CoreHostname FROM RN_CORE;
COREHOSTNAME
----------------------------
10.255.132.177
10.255.136.203
SQL> SELECT CoreRMIPort FROM RN_CORE;
CORERMIPORT
----------------------------
1099
1099
SQL> SELECT DatabaseIdentifier FROM RN_CORE;
DATABASEIDENTIFIER
----------------------------
core1
core2
SQL> SELECT DatabaseHostname FROM RN_CORE;
DATABASEHOSTNAME
----------------------------
10.255.55.30
10.255.56.30
SQL> SELECT DatabasePort FROM RN_CORE;
DATABASEPORT
----------------------------
1521
1521
SQL> SELECT TimezoneOffset FROM RN_CORE;
TIMEZONEOFFSET
----------------------------
-8
-8
SQL> SELECT ReplicationAdminUser FROM RN_CORE;
REPLICATIONADMINUSER
----------------------------
repadmin
repadmin
```

From this data, you can start filling out the *ReplicationScriptTool.properties* file as follows:

```
# This .0 server will be the master definition site, and is the default
# initial core installed.
db.server.0=10.255.55.30
db.port.0=1521
db.name.0=core1
db.username.0=admin
db.password.0=rendition
app.server.0=10.255.132.177
app.rmiport.0=1099
app.corename.0=Core 1

# Second Master site
db.server.1=10.255.56.30
db.port.1=1521
db.name.1=core2
db.username.1=admin
db.password.1=rendition
app.server.1=10.255.136.203
app.rmiport.1=1099
app.corename.1=Core 2

# From UTC
timezone_offset=-8
replication_user=repadmin
replication_password=<YOU WILL NEED TO GET THIS FROM YOUR DBA>
replication_group_name=<YOU WILL NEED TO GET THIS FROM YOUR DBA>
```

D   Oracle 10g Data Pump Utility

For Oracle 10g databases, Oracle supports the Data Pump Utility. You can use the Data Pump Utility to transfer data from one database to another without staging the data on the disk. This improves performance dramatically over the Export/Import Utility.

To transfer data between two NA Cores and two Oracle 10g databases:

1   Edit the *tnsnames.ora* files for two databases in two NA Cores to include database information to the other NA Core. Run the following commands:

```
sqlplus SYSTEM/<SYS_PASSWORD>@<MASTER2_SID>

CREATE DIRECTORY <DIR_NAME> AS '<DIR_PATH>';
GRANT ALL ON DIRECTORY <DIR_NAME> TO PUBLIC;
CREATE DATABASE LINK <DBLINK> CONNECT TO <USER>
IDENTIFIED BY <PASSWORD> USING '<CONNECTSTRING>';
```

Where:

- `<DIR_NAME>` and `<DIR_PATH>` is a directory for logs.

- `<USER>` is the user NA uses to connect the database.

- `<MASTER2_SID>` is the SID of the destination NA Core.

- `<SYS_PASSWORD>` and `<PASSWORD>` are the appropriate passwords.

    ▶   The connect string can be found with Oracle Net Manager.

2   Run the Data Pump Utility on the destination database where you want to import data.

```
$ IMPDP <USER>/<PASSWORD>@<MASTER2_SID> TABLES='<USER>.RN_%'
DIRECTORY=<DIR_NAME> NETWORK_LINK=<DBLINK>
```

    ▶   `<DBLINK>` is the name of the remote database link to the source system that you created with `CREATE DATABASE LINK` in Step 1.

Be sure to check the logging information under the directory `<DIR_NAME>` for any Data Pump Utility error messages.

3   To complete the setup, return to

Index

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Feedback: