



Disaster Recovery Guide for Cisco Prime Network Registrar IPAM 8.0- Using MySQL Replication

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1 Introduction

1.1 Overview

NOTE: This document describes functionality that is available only in Cisco Prime Network Registrar IP Address Management (IPAM) 8.0 and higher.

NOTE: This document describes Disaster Recovery support for the Cisco Prime Network Registrar IPAM Executive running on supported Unix-based platforms, including Red Hat Linux and Solaris. Disaster Recovery for the Cisco Prime Network Registrar IPAM Executive is not supported on Microsoft Windows platforms.

Environmental disasters, equipment failure, and power outages are scenarios that can completely halt a company's IT infrastructure. As part of the Cisco Prime Network Registrar IPAM comprehensive Business Continuity and Disaster Recovery (DR) solution, Cisco Prime Network Registrar IP Address Management (IPAM) offers a complete set of script utilities that enables customers to easily transition to backup systems during an emergency - thus preventing negative impact to normal business operations.

1.2 Major Functions

As part of the standard installation, Cisco Prime Network Registrar IPAM already provides facilities for DHCP Failover and Secondary DNS server configuration. These facilities ensure continuous operation of these critical network services. During a DR event in which the Cisco Prime Network Registrar IPAM Executive is affected, the DHCP/DNS services continue to run autonomously, so end clients will continue to operate. However, if the Executive is unavailable, then configuration changes for DHCP/DNS cannot be made. To address this need, the Cisco Prime Network Registrar IPAM Executive can be configured for redundancy using the DR guidelines and scripts described herein.

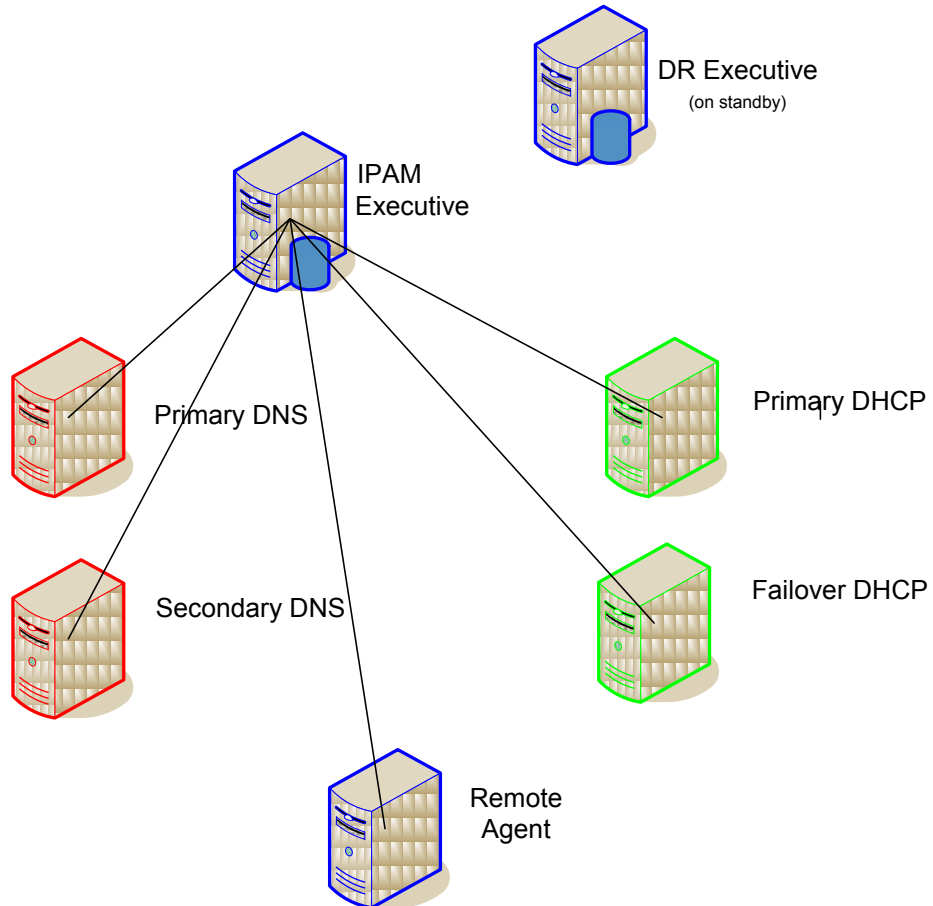
The following core functionality is provided with Cisco Prime Network Registrar IPAM Disaster Recovery (DR) support:

- Ability to mirror a Production Executive database
- Switch remote agents between Production and DR executives

2 System Configuration

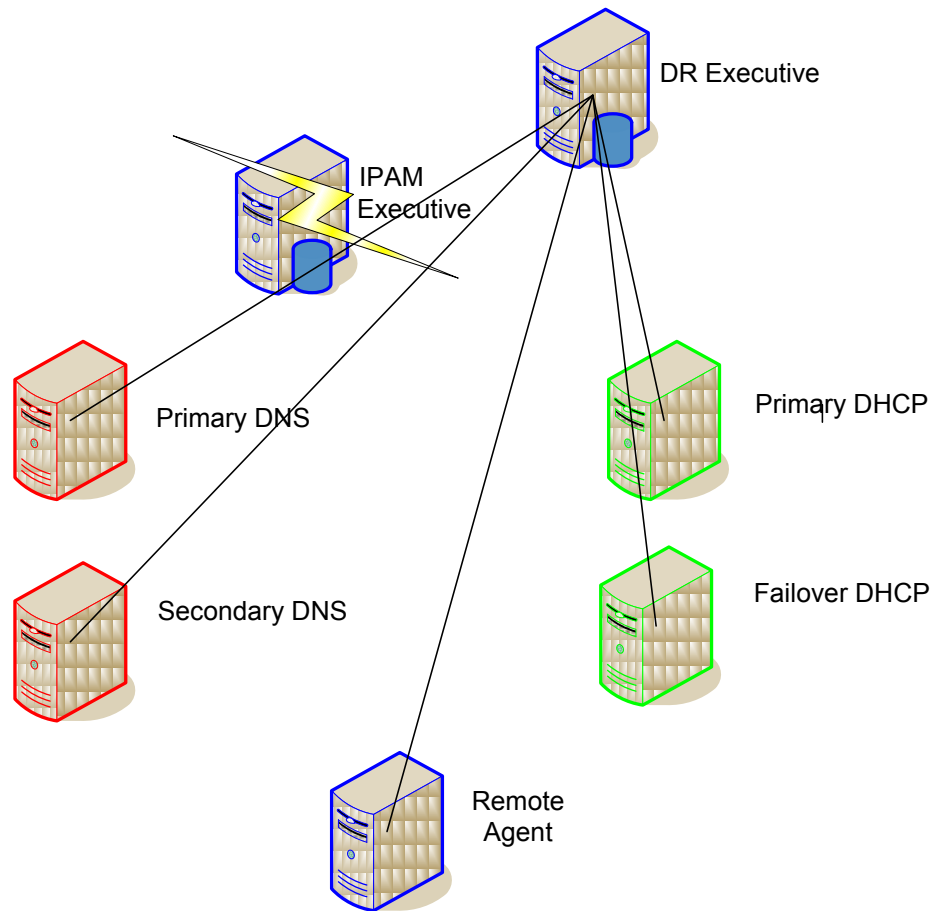
2.1 Production Server Configuration

During normal operations, the Production Executive database is being mirrored on the DR Executive at regular intervals.



2.2 Disaster Recovery (DR) Event Configuration

During a Disaster Recovery event or exercise, the Cisco Prime Network Registrar IPAM Executive server is cut off from the main network. Redundant systems are brought online and the DR Executive box will assume the place of the unreachable Production Executive.



2.3 Replication of data from Production to DR Executive

2.3.1 Database replication

For installations that use the MySQL database provided with Cisco Prime Network Registrar IPAM, replication is accomplished using MySQL's built-in replication system. The Production Executive serves as the replication master, while the DR Executive serves as the replication slave. Specifically the Production Executive will be configured as an Active Master, while the DR Executive will be configured as a Passive Master. The Active-Passive Master setup means that both servers are configured as masters and slaves of each other. The Passive Master is then configured as a "read-only" server.

When the roles need to be reversed it is simple to toggle the read-only flag on each server. Thus, this configuration allows for an easier transition of roles if that becomes necessary.

For installations that use Oracle, please contact your Oracle database administrator for information regarding Oracle database replication.

2.3.1.1 Replication setup for new install of both Production and DR Executives

There are three distinct steps to set up MySQL replication on the Production and DR Executives. First, you must configure the Production Executive to begin logging any changes made to the database. Next, you must configure the DR Executive to “listen” for changes on the Production Executive and to become a “read-only” server. Finally, you must complete the loop by setting up the Production Executive to listen for changes on the DR Executive and to begin monitoring the state of replication. All three of these steps are handled by scripts provided with Cisco Prime Network Registrar IPAM. These scripts are detailed below.

2.3.1.1.1 \$INCHOME/etc/support/prepmaster.sh

Run this script on the Production Executive to grant access to the DR Executive replication account and update the configuration file, my.cnf, to support replication. After making the appropriate changes to the configuration file, the master is restarted. The script then creates the starting point for replication, using mysqldump. This starting point, or dump file, will be created in the current directory. When the script completes, it will display the steps necessary to configure the slave (or Passive Master). This includes the correct parameters to pass to the prepslave.sh script on the DR Executive.

2.3.1.1.2 \$INCHOME/etc/support/prepslave.sh

Run this script on the DR Executive to update the configuration file, my.cnf, to support replication. It also loads the starting point for the database from the master. In order to configure the slave, you will **need** the Log File Coordinates provided when the prepmaster.sh script was run on the master server. When this script completes it will display the appropriate parameters to pass to the connect_to_passive.sh script on the Production Executive.

2.3.1.1.3 \$INCHOME/etc/support/connect_to_passive.sh

Run this script on the Production Executive to complete the connection between the master and slave servers. It defines the Active Master as a slave to the Passive Master. In addition it configures the appropriate settings to run the MySQL Replication Monitor utility, and starts this utility.

2.3.1.1.4 Example Configuration

To see an annotated example of configuring a Production and DR Executive for MySQL Replication please refer to Appendix A.

2.3.1.2 *Adding a DR Executive and replication to existing Production Executive not logging for replication*

This describes the case where a Production Executive is already in use, but MySQL replication is not being used. Follow the same steps as described in the previous section “Replication Setup for new install of both Production and DR Executives.”

2.3.1.3 *Adding a DR Executive and replication to existing Production Executive already logging for replication*

Follow the instructions in the previous sections with one exception. You should include the ‘-d’ command line parameter when running the prepmaster.sh script on the Production Executive. This will skip the steps of modifying the mysql configuration and will essentially just dump the existing database and provide the Log File Coordinates necessary to configure the slave (or Passive Master).

2.3.2 Startup and status scripts

The Cisco Prime Network Registrar IPAM installation includes two scripts used frequently by administrators to start and stop the Cisco Prime Network Registrar IPAM services and to check the status of the currently running services.

2.3.2.1 *\$INCHOME/etc/default.incontrol*

This file contains entries for each of the Cisco Prime Network Registrar IPAM services, specifying which

individual services are started/stopped when the `$(INCHOME)/etc/incontrol start/stop` script is run. It is important for the DR Executive has a copy of this file from the Production Executive, so that the same environment can be duplicated on the DR machine.

After initial Replication implementation and at any time the `default.incontrol` file is modified on the Production Executive for any reason the updated file *must* be copied to `$(INCHOME)/etc/default.incontrol.primary` on both the Primary and the DR Executive. This file is required for the automated `PromoteExec` script that is utilized during a DR scenario on either the DR Executive or back to the Primary when all conditions are corrected after a failover event.

2.3.2.2 `$(INCHOME)/etc/incstatus`

This script is used to check which Cisco Prime Network Registrar IPAM services are running on the system. Generally, this file is kept in sync with the `default.incontrol` file above. That is, when a new service is added or removed from starting/stopping in `default.incontrol`, it is also added or removed from the list of services that are checked by the `incstatus` script.

After initial Replication implementation and at any time the `incstatus` file is modified on the Production Executive for any reason the updated file *must* be copied to `$(INCHOME)/etc/incstatus.primary` on both the Primary and the DR Executive. This file is required for the automated `PromoteExec` script that is utilized during a DR scenario on either the DR Executive or back to the Primary when all conditions are corrected after a failover event.

2.4 Other Considerations

2.4.1 License Key

The Cisco Prime Network Registrar IPAM license key is a unique key generated for your organization, which is locked to a single, physical Cisco Prime Network Registrar IPAM Executive using the machine's `hostid`. In a DR scenario, you will need a special license key that can be shared between two Executives. Please contact your Account Representative for further details.

2.4.2 DNS Listener

If you run the DNS Listener on your Cisco Prime Network Registrar IPAM production Executive, then you will want to start the DNS Listener on the DR Executive upon failover. Additionally, when configuring the master DNS servers which are transferring updates to the DNS Listener, you should include the IP addresses of both the Production Executive and the DR Executive in the 'also-notify' access match lists for the dynamic zones that are to be updated.

3 DR Configuration Options

This section details the options for Disaster Recovery (DR) of Cisco Prime Network Registrar IPAM Executive services.

There are three configurations of the Production and DR Executives that can support a DR scenario:

1. DR Executive assumes the IP of Production Executive
2. Production and DR Executive use different IPs
3. Production and DR Executives share a SAN/NAS or mirrored database and share a virtual IP

3.1 DR Executive assumes the IP of the Production Executive

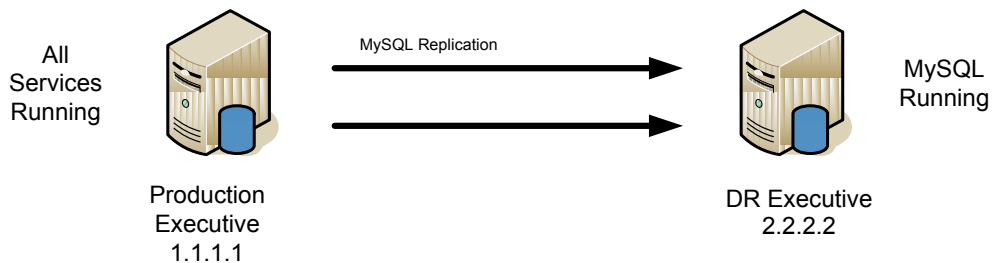


Figure 1. Server configuration prior to DR Event

As shown in Figure 1, the DR Executive database will be updated on a regular basis using MySQL replication. Only the MySQL database service is running on the DR Executive. When the Production Exec fails, the DR Exec assumes the Production Executive's IP address and starts all services using a script as shown in Figure 2.

Note: For this scenario to succeed a VLAN needs to be in place or the DR Executive needs to be on the same subnet.

All deployed agents will continue to point to the same IP address as before so no agent-side changes are required.

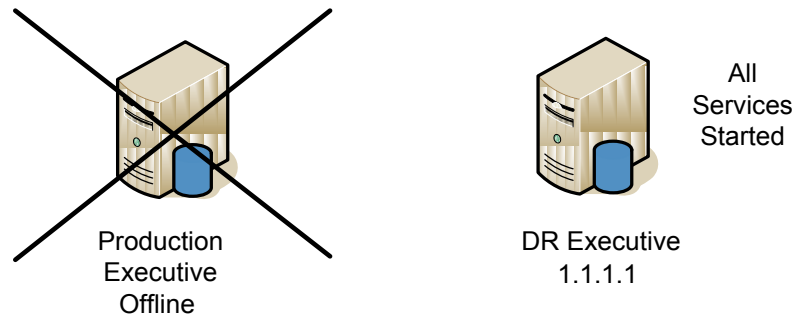


Figure 2. DR Executive Online

3.1.1 Prerequisites

The following prerequisites must be met in order to support a DR event or exercise under this scenario.

3.1.1.1 Installation of the DR Executive

During the installation of the Cisco Prime Network Registrar IPAM software on the DR Executive, you should enter the IP address of the Production Executive when prompted for the IP address of the system and executive on the initial setup screen. This will minimize the number of changes that are required during a DR event or exercise.

3.1.1.2 Only MySQL database is running on DR Executive

The only Cisco Prime Network Registrar IPAM service that should be running on the DR Executive during normal operations is the MySQL database. This is required for MySQL replication to keep the Cisco Prime Network Registrar IPAM database updated from the Production Executive.

The DemoteExec.sh script provided in the \$INCHOME/etc/support directory of the Cisco Prime Network Registrar IPAM installation handles reconfiguration of the active services:

```
> $INCHOME/etc/support/DemoteExec.sh
```

3.1.1.3 Updated copies of default.incontrol and incstatus

As indicated previously, you must keep current copies of the default.incontrol and incstatus files from the

Production Executive on both the Primary and the DR Executive. Both files are located in `$INCHOME/etc`. When copied on the Primary and to the DR Executive, they must be named `default.incontrol.primary` and `incstatus.primary`, respectively.

3.1.2 Disaster Recovery Procedure

This section describes the procedure necessary to initiate a DR event or exercise under this scenario.

3.1.2.1 Change the IP of the DR Executive

3.1.2.1.1 Linux/Solaris

Change the IP address and associated parameters, including netmask and gateway, for the network interface using the accepted method of defining IP addressing information on that platform. For example, on Red Hat this can be done using `system-config-network`. The IP address must be set to the IP address of the failed Production Executive, which must be offline.

3.1.2.2 Promote the DR Executive to Active Master

If the Production Executive is down, then the current Active Master database on it is down as well. Therefore the DR Executive must assume control and become the new Active Master. This is accomplished by calling the `promote_master.sh` script using the `'-c'` command line option:

1. Log into the DR Executive as `incadmin`.
2. Run the `promote_master.sh` script as follows:
 - `$INCHOME/etc/support/promote_master.sh -c`

3.1.2.3 Promote the DR Executive to Production status

Promoting the DR Executive to Production status involves updating the `default.incontrol` and `incstatus` files on the DR Executive from copies of these files from the Production Executive (see section 3.1.1.3). This configures the DR Executive to start all services required for normal operation.

3.1.2.3.1 Linux/Solaris

In order to “promote” the DR Executive so that it may become the Production Cisco Prime Network Registrar IPAM Executive, you must run the `PromoteExec.sh` script provided

in the `$INCHOME/etc/support` directory of the Cisco Prime Network Registrar IPAM installation:

```
> $INCHOME/etc/support/PromoteExec.sh
```

3.1.2.4 Restart the DR Executive Cisco Prime Network Registrar IPAM services

3.1.2.4.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to restart all services on the DR Executive:

```
> $INCHOME/etc/incontrol restart
```

Choose **Stop Cisco Prime Network Registrar IPAM**, wait for the services to stop, then choose **Start Cisco Prime Network Registrar IPAM**.

3.1.3 Return to Normal

This section describes the procedure necessary to return to normal operation where the Production Executive is in use, and the DR Executive is in standby mode.

3.1.3.1 Change the IP of the DR Executive

Follow the same procedure described above to change the IP of the DR Executive back to its original IP.

3.1.3.2 Prepare the Active Master on the DR Executive for demotion

The Active Master database running on the DR Executive must be demoted so that it no longer accepts any changes. But this demotion cannot take place until the database on the Production Executive is back in synch with the Active Master on the DR Executive. This requires that we dump the current state of the database on the DR Executive in order to load the data on the restored Production Executive. To accomplish this, the `premaster.sh` script provided in the `$INCHOME/etc/support` directory must be run with the `-d` command line option. This will cause the database to be dumped and the appropriate options for the `preslave.sh` script will be generated.

3.1.3.3 Synchronize the database on the Production Executive

Once the Active Master on the DR Executive is prepared for demotion, we need to ensure that the database on the Production Executive is synchronized with it. This requires copying and loading the database dump file generated in the previous step. The simplest way to do this is to prepare the database on the Production Executive to be a Passive Master, or a slave to the DR Executive. To accomplish this, first copy the dump file from the DR Executive to the Production Executive. Then, on the Production Executive, run the `prepslave.sh` script provided in the `$INCHOME/etc/support` directory using the parameters generated when the `prepmaster.sh` script was executed on the DR Executive in the previous step. This will load the database dump file and make the appropriate MySQL changes to create a Passive Master. In addition, it will generate the correct command line options for the `connect_to_passive.sh` script to be run on the DR Executive.

3.1.3.4 Complete the connection between Executive databases

Since the Active Master is currently running on the DR Executive, it must be informed about the Passive Master settings used on the Production Executive. This is accomplished by running the `connect_to_passive.sh` script located in the `$INCHOME/etc/support` directory using the parameters generated by the `prepslave.sh` script run on the Production Executive.

3.1.3.5 Demote the database on the DR Executive

Now that the Active-Passive Master configuration is setup, it is now a simple matter to reverse their roles. Simply run the `demote_master.sh` script located in the `$INCHOME/etc/support` directory on the DR Executive. Later you will run the `promote_master.sh` script on the Production Executive using the parameters generated by this script.

```
> $INCHOME/etc/support/demote_master.sh
```

3.1.3.6 Stop Cisco Prime Network Registrar IPAM Services on DR Executive

3.1.3.6.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to stop all services on the DR Executive:

```
> $INCHOME/etc/incontrol stop
```

3.1.3.7 Demote the DR Executive to standby status

Revert the DR Executive to standby by running the “demote” script which will configure the system to start only MySQL.

```
> $INCHOME/etc/support/DemoteExec.sh
```

3.1.3.8 Start Cisco Prime Network Registrar IPAM Services on DR Executive

3.1.3.8.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to start all services on the DR Executive:

```
> $INCHOME/etc/incontrol start
```

3.1.3.9 Promote the database on the Production Executive

Now that the DR Executive is back to being a Passive Master, we need to promote the database on the Production Executive back to an Active Master. To do this, simply run the `promote_master.sh` script located in the `$INCHOME/etc/support` directory using the parameters generated by the `demote_master.sh` script run on the DR Executive:

```
> $INCHOME/etc/support/promote_master.sh -l  
<binary logfile name> -s <logfile position>
```

3.1.3.10 Restart Cisco Prime Network Registrar IPAM Services on Production Executive

3.1.3.10.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to restart all services on the Production Executive:

```
> $INCHOME/etc/incontrol restart
```

Choose **Stop Cisco Prime Network Registrar IPAM**, wait for the services to stop, then choose **Start Cisco Prime Network Registrar IPAM**.

3.2 Production and DR Executive using different IPs

In this DR scenario the failed Production Executive is replaced by the DR Executive, but the machines maintain separate IP addresses because they are not on the same subnet or there is no VLAN in place and no virtual IP technology is used. All deployed Agents are configured with the IP addresses of both the production and DR executive using a “failover” setup.

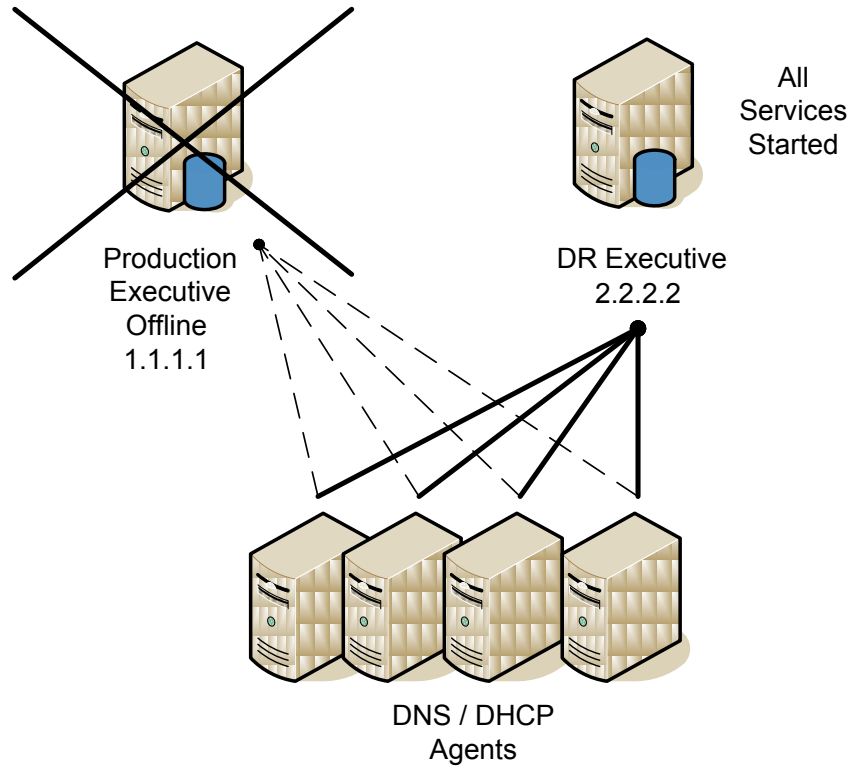


Figure 1. Agents “failover” from Production to DR Executive

3.2.1 Prerequisites

The following prerequisites must be met in order to support a DR event or exercise under this scenario.

3.2.1.1 Cisco Prime Network Registrar IPAM 8.0 Agent Only Environment

This DR scenario is supported for Cisco Prime Network Registrar IPAM Agent installations running in 8.0 Agent-only mode.

Run the following command on the Production Executive to switch to 8.0 Agent-only mode:

```
> $INCHOME/etc/support/removeSwiftMQSupport
```

After this is complete, you must restart all Cisco Prime Network Registrar IPAM services on the Production Executive.

3.2.1.2 Remote Agent Configuration

3.2.1.2.1 Linux/Solaris

In order to support “failover” from the Production Executive to the DR Executive when different IP addresses are used, two files must be edited on each remote Agent, to define both IP addresses and the failover configuration.

Please note that although some of the property name=value pairs below appear on multiple lines in this document, they must appear on one line in the actual configuration files.

1. \$INCHOME/classes/jndi.properties

Replace

```
connection.ActiveMqConnectionFactory.url =  
    ssl://1.1.1.1:61617
```

With

```
connection.ActiveMqConnectionFactory.url =  
    failover://(ssl://1.1.1.1:61617,ssl://2.2.2.2:61617)?  
    randomize=false
```

2. \$INCHOME/activemq/conf/activemq.xml

Replace

```
<networkConnector name="incx-broker"  
    uri="static://(ssl://1.1.1.1:61617)"/>
```

With

```
<networkConnector name="incx-broker"  
    uri="static://(failover://(ssl://1.1.1.1:61617,ssl://  
    2.2.2.2:61617)?randomize=false)"/>
```

After modifying these files on the Agent, all Cisco Prime Network Registrar IPAM services must be restarted on the Agent machine.

3.2.1.3 Only MySQL database is running on DR Executive

The only Cisco Prime Network Registrar IPAM service that should be running on the DR Executive during normal operations is the MySQL database. This is

required for MySQL replication to keep the Cisco Prime Network Registrar IPAM database updated from the Production Executive. This can be accomplished using the DemoteExec.sh script provided in the \$INCHOME/etc/support directory of the Cisco Prime Network Registrar IPAM installation:

```
> $INCHOME/etc/support/DemoteExec.sh
```

3.2.1.4 Updated copies of default.incontrol and incstatus

As indicated previously, you must keep current copies of the default.incontrol and incstatus files from the Production Executive on the DR Executive. Both files are located in \$INCHOME/etc. When copied to the DR Executive, they must be named default.incontrol.primary and incstatus.primary, respectively, and located in \$INCHOME/etc.

3.2.2 Disaster Recovery Procedure

This section describes the procedure necessary to initiate a DR event or exercise under this scenario.

3.2.2.1 Demote the Production Executive database, if possible

If this is a planned DR exercise where the Production Executive will eventually resume its role as the Active Master database, then demoting the Production Executive database at the start is preferable. To do this, execute the demote_master.sh script located in the \$INCHOME/etc/support directory on the Production Executive:

```
> $INCHOME/etc/support/demote_master.sh
```

This script will ensure that no unintended writes will occur on the Production Executive database and will help with a smooth transition back to “normal” operation. In addition it will generate the appropriate parameters to call the promote_master.sh script on the DR Executive.

3.2.2.2 Promote the database on the DR Executive to Active Master

At this point, we will assume that either the Production Executive is down, or that the Production Executive database has been demoted to a Passive Master. Therefore, we need to promote the database on the DR Executive to an Active Master. The process varies slightly dependent upon if the Production Executive was demoted. If it was demoted we will use the parameters generated from the demote_master.sh

script. If not, we will call the promote_master.sh script with the '-c' parameter.

If Production Executive database was demoted:

```
> $INCHOME/etc/support/promote_master.sh -l  
<logfile> -s <logfile position>
```

If Production Executive is down, or database was not demoted:

```
>$INCHOME/etc/support/promote_master.sh -c
```

3.2.2.3 Promote the DR Executive to Production status

Promoting the DR Executive to Production status involves updating the default.incontrol and incstatus files on the DR Executive from copies of these files from the Production Executive (see section 3.3.1.3). This configures the DR Executive to start all services required for normal operation. In addition, the promote operation will update the Cisco Prime Network Registrar IPAM database with the IP address of the DR Executive for the Executive and Task Manager IP address System Properties, and IP address of the Executive Agent.

3.2.2.3.1 Linux/Solaris

In order to “promote” the DR Executive so that it may become the Production Cisco Prime Network Registrar IPAM Executive, you must run the PromoteExec.sh script provided in the \$INCHOME/etc/support directory of the Cisco Prime Network Registrar IPAM installation:

```
> $INCHOME/etc/support/PromoteExec.sh
```

3.2.2.4 Restart the DR Executive Cisco Prime Network Registrar IPAM services

3.2.2.4.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to restart all services on the DR Executive:

```
> $INCHOME/etc/incontrol restart
```

Choose **Stop IPControl**, wait for the services to stop, then choose **Start IPControl**.

3.2.3 Return to Normal

This section describes the procedure necessary to return to normal operation where the Production Executive is in use, and the DR Executive is in standby mode.

3.2.3.1 Stop Cisco Prime Network Registrar IPAM Services on DR Executive

3.2.3.1.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to stop all services on the DR Executive:

```
> $INCHOME/etc/incontrol stop
```

3.2.3.2 Demote the DR Executive to standby status

Revert the DR Executive to standby by running the “demote” script which will configure the system to start only MySQL:

```
> $INCHOME/etc/support/DemoteExec.sh
```

3.2.3.3 Start Cisco Prime Network Registrar IPAM Services on DR Executive

3.2.3.3.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to start all services on the DR Executive:

```
> $INCHOME/etc/incontrol start
```

3.2.3.4 Restore the Production Executive Database

The next step depends upon what state the Production Executive database was in when the DR Executive assumed control and whether the original Production Executive is being replaced.

3.2.3.4.1 Reuse of Demoted Production Executive

If the Production Executive database was demoted before the DR Executive assumed control then the steps are fairly simple. We simply need to demote the DR Executive database, record the Log file coordinates, and finally run promote the database on the Production Executive using these coordinates.

3.2.3.4.1.1 Demote the DR Executive Database

Run the demote_master.sh script located in the \$INCHOME/etc/support directory.

```
> $INCHOME/etc/support/demote_master.sh
```

This script will generate the necessary parameters to use with the promote_master.sh script to be run on the Production Executive.

3.2.3.4.1.2 Promote the Production Executive Database

On the Production Executive, run the `promote_master.sh` script located in the `$INCHOME/etc/support` directory using the parameters generated by the `demote_master.sh` script on the DR Executive.

```
> $INCHOME/etc/support/promote_master.sh -l  
<logfile> -s <logfile position>
```

3.2.3.4.2 Reuse of Crashed Production Executive

If the Production Executive database went down in an unplanned fashion, and therefore was not “demoted” prior to the DR Executive database being “promoted”, and the original Production Executive is being reused, the following steps should be followed.

In essence, we will temporarily be setting up the Production Executive as a Passive Master in order to allow it to synchronize with the DR Executive database. Once we have the servers serving in these roles and synchronized, we will switch roles so that the Active Master will be running on the Production Executive and the Passive Master will be running on the DR Executive.

Effectively we will be running the steps laid out in the “Adding a DR Executive and replication to existing Production Executive already logging for replication” section of this document, except we will be reversing the roles of the Production and DR Executives.

3.2.3.4.2.1 Run `prepmaster.sh` on DR Executive

We will need to dump the database on the DR Executive to later be loaded onto the Production Executive. The simplest way to accomplish this and to generate the Log File Coordinates is to run the `prepmaster.sh` script on the DR Executive:

```
> $INCHOME/etc/support/prepmaster.sh -d
```

3.2.3.4.2.2 Prepare Production Executive Database as a Passive Master

The database on the Production Executive must be synchronized with the data on the DR Executive. Therefore

we need to copy the database dump file that was generated on the DR Executive with the prepmaster.sh script. One such way is to use the 'scp' utility, but you are free to use whatever method suits your environment.

Example of copying database dump file:

```
> scp
incadamin@drexec:/opt/incontrol/etc/support/dbfor
repl.sql .
```

Once the database dump file has been copied to the Production Executive, the prepslave.sh script should be run to load the file and configure the database to be a Passive Master connected to the Active Master running on the DR Executive.

```
> $INCHOME/etc/support/prepslave.sh -l <logfile>
-s <logfile position> -h <IP Address of Active
Master> -d <location of dbforrepl.sql>
```

3.2.3.4.2.3 Connect Active Master to Passive Master on DR Executive

Once the database on the Production Executive is acting as a Passive Master, we must point the Active Master running on the DR Executive to the Passive Master. This will make the upcoming switch of roles a simple matter. To accomplish this you must run the connect_to_passive.sh script located in the \$INCHOME/etc/support directory on the DR Executive using the parameters generated by the prepslave.sh script on the Production Executive.

```
> $INCHOME/etc/support/connect_to_passive.sh -l
<logfile> -s <logfile position> -h <IP Address of
Passive Master>
```

3.2.3.4.2.4 Demote the database on the DR Executive to Passive Master

Now that the databases on the Production and DR Executives are synchronized, we can switch their roles so that the Active Master will now run on the Production Executive and the Passive Master will run on the DR Executive as originally intended.

On the DR Executive run the demote_master.sh script located in the \$INCHOME/etc/support directory.

```
> $INCHOME/etc/support/demote_master.sh
```

This script will generate parameters for the promote_master.sh script. Record these parameters for the next step.

3.2.3.4.2.5 Promote the database on the Production Executive to Active Master

Now that the database on the DR Executive is running as a Passive Master, we can promote the database on the Production Executive to run as an Active Master.

On the Production Executive, run the `promote_master.sh` located in the `$INCHOME/etc/support` directory using the parameters generated in the previous step.

```
> $INCHOME/etc/support/promote_master.sh -l  
<logfile> -s <logfile position>
```

At this point, the database servers on the Production and DR Executives should now be operating in their proper roles.

3.2.3.5 Restart Cisco Prime Network Registrar IPAM Services on Production Executive

3.2.3.5.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to restart all services on the Production Executive:

```
> $INCHOME/etc/incontrol restart
```

Choose **Stop Cisco Prime Network Registrar IPAM**, wait for the services to stop, then choose **Start Cisco Prime Network Registrar IPAM**.

3.3 Production and DR Executives share a SAN/NAS or mirrored database and share a virtual IP

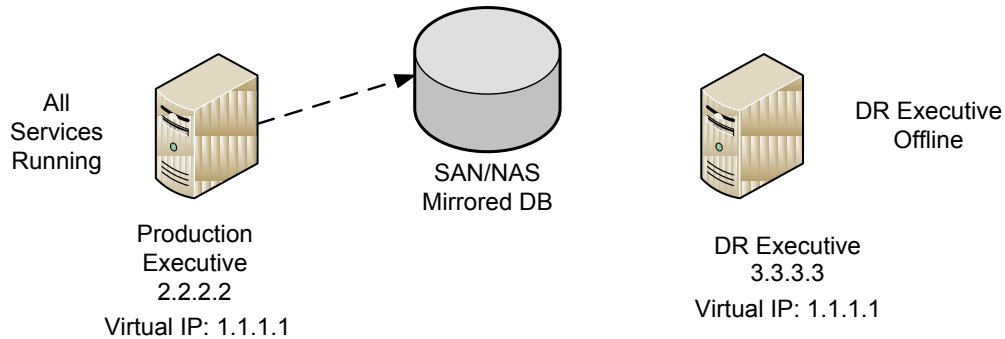


Figure 3. Server configuration prior to DR Event

All communications to the Executive occur over the virtual IP address, which is configured on both the Production and DR Executives. As shown in Figure 3, the database resides on a SAN/NAS or otherwise mirrored database that is accessible by both the Production and DR Executives. The DR Executive remains offline during normal operations. When the Production Executive fails, the DR Executive is brought online, and all Cisco Prime Network Registrar IPAM services are started. The DR Executive takes over the virtual IP address previously used by the Production Executive. All deployed agents will continue to point to the same, virtual, IP address as before so no agent-side changes are required.

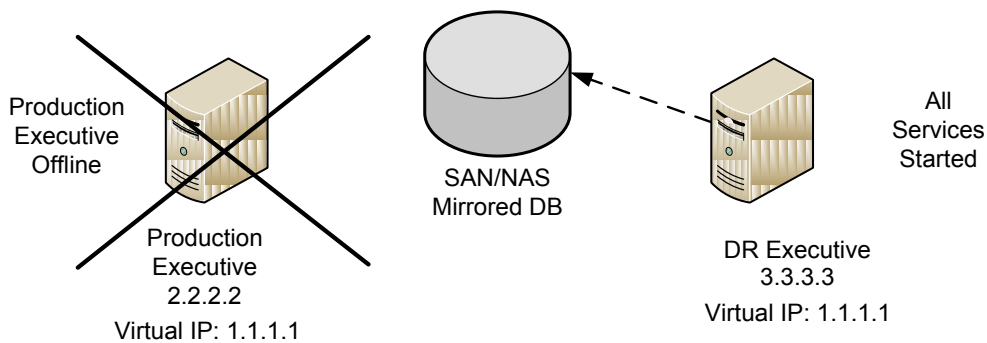


Figure 4. DR Executive Online

3.3.1 Prerequisites

The following prerequisites must be met in order to support a DR event or exercise under this scenario.

3.3.1.1 **Configure Virtual IP address on Production and DR Executives**

Select a single, virtual IP address that is routable to both the Production and DR Executives. Configure this virtual IP address, in addition to each machine's "real" IP address, on the network interface connected to the management subnet. The management subnet is the segment in which the Cisco Prime Network Registrar IPAM Agents are connected. Configure the virtual IP address using the accepted method of defining IP addressing information on that platform. For example, on Red Hat this can be done using `system-config-network`.

3.3.1.2 **Installation of Cisco Prime Network Registrar IPAM on Production and DR Executives**

During the installation of the Cisco Prime Network Registrar IPAM software on both the Production and DR Executive, you should enter the *virtual* IP address when prompted for the IP address of the system and executive on the initial setup screens.

3.3.1.3 **Updated copies of default.incontrol and incstatus**

If the Cisco Prime Network Registrar IPAM Executive software is installed and running directly from shared storage device, this prerequisite is not required. This is required if only the database itself is mirrored.

As indicated previously, you must keep current copies of the default.incontrol and incstatus files from the Production Executive on the DR Executive. Both files are located in `$INCHOME/etc`. When copied to the DR Executive, they must be named default.incontrol.primary and incstatus.primary, respectively.

3.3.2 Disaster Recovery Procedure

This section describes the procedure necessary to initiate a DR event or exercise under this scenario.

3.3.2.1 Bring the DR Executive online

Enable the IP connectivity of the DR Executive by either physically connecting it to the network, or by enabling the switch port to which it is connected.

3.3.2.2 Start all Cisco Prime Network Registrar IPAM services on the DR Executive

3.3.2.2.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to start all services on the DR Executive:

```
> $INCHOME/etc/incontrol start
```

3.3.3 Return to Normal

This section describes the procedure necessary to return to normal operation where the Production Executive is online, and the DR Executive is offline.

3.3.3.1 Take the DR Executive offline

Disable the IP connectivity of the DR Executive by either physically disconnecting it from the network, or by disabling the switch port to which it is connected.

3.3.3.2 Bring the Production Executive online

Enable the IP connectivity of the Production Executive by either physically connecting it to the network, or by enabling the switch port to which it is connected.

3.3.3.3 Start Cisco Prime Network Registrar IPAM Services on Production Executive

3.3.3.3.1 Linux/Solaris

Run the Cisco Prime Network Registrar IPAM script to start all services on the Production Executive:

```
> $INCHOME/etc/incontrol start
```

4 Appendix A

4.1 MySQL Replication Disaster Recovery Scenarios

<i>Scenario</i>	<i>Seq</i>	<i>Original Production Executive</i>	<i>DR Executive</i>	<i>New Production Executive</i>
New Setup	1	prepmaster.sh (creates dump file)		
	2		scp dump file from Production Executive	
	3		prepslave.sh using coordinates from Production Executive	
	4	connect_to_passive.sh using coordinates from DR		
Scheduled Downtime for Production Executive	1	demote_master.sh		
	2		promote_master.sh using coordinates from Production Executive	
	3	Bring System Down		
Scheduled Downtime for Production Executive – Recovery	1	Bring System Back Up		
	2		demote_master.sh	
	3	promote_master.sh using coordinates from DR Executive		
DR – Change IP	1	System Goes Down		

<i>Scenario</i>	<i>Seq</i>	<i>Original Production Executive</i>	<i>DR Executive</i>	<i>New Production Executive</i>
of DR Executive				
	2		Change IP Address to Production Exec. IP	
	3		promote_masters.sh -c	
	4		Operate until Prod. Exec. Is stabilized or new one is obtained.	
DR – Fail Back with Change of IP	1		Change IP Address back to original DR Exec. IP	
	2		prepmaster.sh -d (creates dump file)	
	3	Power On		
	4	scp dump file		
	5	prepslave.sh using coordinates from DR		
	6		connect_to_passive.sh using coordinates From Prod. Exec.	
	7		demote_master.sh	
	8	promote_master.sh		
DR – Change IP of DR Exec, New Prod. Exec.	1	System Goes Down		
	2		Change IP Address to Production Exec. IP	
	3		promote_master.sh -c	
	4		Operate until new box is obtained	
	5		Change IP back to original DR Exec. IP	
	6		prepmaster.sh -d (creates dump file)	
	7			Assign IP of Prod. Exec.
	8			Install IPC Exec. S/W
	9			scp dump file from DR Exec.
	10			prepslave.sh using coordinates from DR Exec.
	11		connect_to_passive.sh using coordinates from new Prod. Exec.	
	12		demote_master.sh	
	13			promote_master.sh
DR – No Change of	1	System Goes Down		

<i>Scenario</i>	<i>Seq</i>	<i>Original Production Executive</i>	<i>DR Executive</i>	<i>New Production Executive</i>
IP Address				
	2		promote_master.sh -c	
	3		Operate until new box is obtained.	
	4		prepmaster.sh -d (creates dump file)	
	5			Install IPC Exec. S/W
	6			scp dump file from DR Exec.
	7			prepslave.sh using coordinates from DR Exec.
	8		connect_to_passive.sh using coordinates from new Prod. Exec.	
	9		demote_master.sh	
	10			promote_master.sh
DR Database – Out of Sync	1		Database goes out of synch with the Active Master	
	2	resync_master.sh		
	3		Scp dump file from Prod. Exec	
	4		resync_slave.sh using coordinates from Prod. Exec.	

4.2 MySQL Replication Setup Examples

4.2.1 Setting up Replication for the First Time

The following shows an example of setting up MySQL Replication on existing Production and Disaster Recovery Executive systems. The values used for the log coordinates and IP Addresses will vary with every installation. They are shown here for demonstration purposes only.

4.2.1.1 Define Active Master on the Production Executive

In order to begin the process of setting up replication, we need to prepare the Active Master on the Production Executive. So we run the following command on the Production Executive.

```
> ./prepmaster.sh
```

```
Creating replication monitor database with: CREATE DATABASE IF NOT EXISTS REPLMON
```

```
Configuring Active Master Settings ...
```

```
Backed up /opt/incontrol/mysql/my.cnf to  
/opt/incontrol/mysql/my.cnf.pre_replication
```

```
Configuration file updated: /opt/incontrol/mysql/my.cnf
```

```
Restarting MySQL daemon ...
```

```
Stopping MySQL Database Server...
```

```
MySQL Database Server stopped.
```

```
Waiting 5 seconds before starting...
```

```
Starting MySQL Database Server...
```

```
MySQL Database Server started.
```

```
Waiting 10 seconds for mysql to start ...
```

```
Stopping replication slave process with: STOP SLAVE
```

```
Disconnecting from old master with: CHANGE MASTER TO MASTER_HOST=''
```

```
Resetting slave with: RESET SLAVE
```

```
Dumping the master database and getting Log File Coordinates ...
```

```
Master Log File Coordinates:
```

```
MASTER_LOG_FILE='mysql-bin.000001'
```

```
MASTER_LOG_POS=2645
```

```
Dump File: dbforrepl.sql
```

```
Replication Setup Step 1 of 3 complete!
```

```
- Copy the Dumpfile: dbforrepl.sql to the slave server.
```

```
- Record the Active Master Log File Coordinates and log in to the passive master system.
```

```
- Navigate to /opt/incontrol/etc/support.
```

- Once there, run the prepslave.sh script using the coordinates as follows:

```
./prepslave.sh -l mysql-bin.000001 -s 2645 -h 192.168.196.45 -d <location of dbforrepl.sql>
```

Once the slave is configured, return to this system and run the connect_to_passive.sh script to complete the setup.

4.2.1.2 Define Passive Master on the DR Executive

First, we need to copy the dump file from the Production Executive to the DR Executive. From the DR Executive, we ran the following:

```
>scp incadmin@192.168.196.45:/opt/incontrol/etc/support/dbforrepl.sql .
```

```
incadmin@192.168.196.45's password:
```

```
dbforrepl.sql
100% 390KB 390.1KB/s 00:00
```

We now run the prepslave.sh script.

```
>./prepslave.sh -l mysql-bin.000001 -s 2645 -h 192.168.196.45 -d dbforrepl.sql
```

```
Loading dumpfile: dbforrepl.sql ...
```

```
Creating replication user with: GRANT REPLICATION SLAVE, REPLICATION CLIENT ON *.* TO repl@'192.168.196.45' IDENTIFIED BY 'fake_password'
```

```
Granting replication user rights to replication monitor db (any host) with: GRANT SELECT ON REPLMON.* TO repl@'192.168.196.45' IDENTIFIED BY 'fake_password'
```

```
Configuring Slave as a Passive Master ...
```

```
Backed up /opt/incontrol/mysql/my.cnf to /opt/incontrol/mysql/my.cnf.pre_replication
```

```
Configuration file updated: /opt/incontrol/mysql/my.cnf
```

```
Restarting MySQL daemon ...
```

```
Stopping MySQL Database Server...
```

```
MySQL Database Server stopped.
```

```
Waiting 5 seconds before starting...
```

```
Starting MySQL Database Server...
```

```
MySQL Database Server started.
```

```
Waiting 10 seconds for mysql to start ...
```

```
Connecting to master with: CHANGE MASTER TO MASTER_HOST='192.168.196.45',MASTER_USER='repl',MASTER_PASSWORD='fake_password', MASTER_LOG_FILE='mysql-bin.000001',MASTER_LOG_POS=2645
```

```
Starting slave process with: START SLAVE
```

```
Passive Master Log File Coordinates:
```

```
LOG_FILENAME='mysql-bin.000001'
```

```
LOG_START_POS=2645
```

```
Replication Setup Step 2 of 3 complete!
```

- Record the Passive Master Log File Coordinates and return to the master system.
- Navigate to /opt/incontrol/etc/support.
- Once there, run the connect_to_passive.sh script using the coordinates as follows:

```
./connect_to_passive.sh -l mysql-bin.000001 -s 2645 -h 192.168.196.46
```

4.2.1.3 Connect the Active Master to the Passive Master

Now we have to complete the loop by connecting the Active Master to the Passive Master. This step also includes the startup of the MySQL Replication Monitor. From the Production Executive, we run the following:

```
>./connect_to_passive.sh -l mysql-bin.000001 -s 2645 -h 192.168.196.46
Creating replication user with: GRANT REPLICATION SLAVE, REPLICATION CLIENT ON
 *.* TO repl@'192.168.196.46' IDENTIFIED BY 'fake_password'
Granting replication user rights to replication monitor db (passive master
 host) with: GRANT SELECT ON replmon.* TO repl@'192.168.196.46' IDENTIFIED BY
 'fake_password'
Connecting to passive master with: CHANGE MASTER TO
 MASTER_HOST='192.168.196.46',MASTER_USER='repl',MASTER_PASSWORD='fake_password
 ', MASTER_LOG_FILE='mysql-bin.000001',MASTER_LOG_POS=2645
```

```
Starting slave process with: START SLAVE
Modifying IP Addresses in /opt/incontrol/mysql_replication_monitor.properties
Turning on control of the replication monitor.
IPControl MySQL Replication Monitor install successful.
Starting the replication monitor ...
IPControl MySQL Replication Monitor is already stopped.
Waiting 5 seconds before starting...
```

```
Starting IPControl MySQL Replication Monitor...
IPControl MySQL Replication Monitor started.
```

```
Replication Setup Step 3 of 3 complete!
```

4.2.2 Scheduled Downtime for Production Executive

This section outlines the steps to be used when the MySQL server running on the Production Executive is to be brought down for some reason, and the DR Executive MySQL database is to assume the role of Active Master.

4.2.2.1 Demote the Active Master

On the Production Executive, we simply have to execute the demote_master.sh script as follows:

```
>./demote_master.sh
Stopping the MySQL Replication Monitor

Stopping IPControl MySQL Replication Monitor...
IPControl MySQL Replication Monitor stopped.
IPControl MySQL Replication Monitor remove successful.
Adding the read_only option to configuration file ...
Turning on read_only flag with: set @@global.read_only := 1
Master Log File Coordinates:
MASTER_LOG_FILE='mysql-bin.000001'
MASTER_LOG_POS=87592

Promotion / Demotion Step 1 of 2 complete!
If you plan to promote an existing slave (Passive Master) follow these steps:

- Record the Active Master Log File Coordinates and log in to the existing
  Passive Master system.
- Navigate to /opt/incontrol/etc/support.
- Once there, run the promote_master.sh script using the coordinates as
  follows:

./promote_master.sh -l mysql-bin.000001 -s 87592
```

4.2.2.2 Promote the Passive Master

On the DR Executive, we need to run the promote_master.sh script using the coordinates provided by the demote_master.sh script executed on the Production Executive (or Active Master).

```
>./promote_master.sh -l mysql-bin.000001 -s 87592
Waiting for Passive Master to catch up to Active Master using SELECT
      MASTER_POS_WAIT('mysql-bin.000001', 87592) ...
+-----+
| MASTER_POS_WAIT('mysql-bin.000001', 87592) |
+-----+
|                                     0 |
+-----+
Removing read_only option from configuration file ...
Turning off read_only flag with: set @@global.read_only := 0
IPControl MySQL Replication Monitor install successful.
```

```
IPControl MySQL Replication Monitor is already started.  
Starting the replication monitor failed.
```

```
Promotion / Demotion Step 2 of 2 complete!
```

4.2.3 Resynchronize Passive Master

Even with the MySQL Servers configured properly it is possible for the Passive Master to drift out of synch with the Active Master. One method for resolving this is to start over with a fresh database dump from the master. This section covers the procedure necessary to accomplish this.

4.2.3.1 Dump Active Master Database

On the Production Executive we need to run the `resync_master.sh` script located in `$INCHOME/etc/support`.

```
>./resync_master.sh
```

```
Dumping the master database and getting Log File Coordinates ...
```

```
Master Log File Coordinates:  
MASTER_LOG_FILE='mysql-bin.000001'  
MASTER_LOG_POS=14158333
```

```
Dump File: dbforrepl.sql
```

```
Resynchronization Setup Step 1 of 2 complete!
```

- Copy the Dumpfile: `dbforrepl.sql` to the slave server.
- Record the Active Master Log File Coordinates and log in to the passive master system.
- Navigate to `/opt/incontrol/etc/support`.
- Once there, run the `resync_slave.sh` script using the coordinates as follows:

```
./resync_slave.sh -l mysql-bin.000001 -s 14158333 -h 192.168.196.45 -d  
<location of dbforrepl.sql>
```

4.2.3.2 Copy Dump File from Active Master to Passive Master

The database dump file created by the `resync_master.sh` script in the previous step needs to be copied to the Passive Master box. In this example, we will use the 'scp' command to accomplish this.

```
>scp incadmin@192.168.196.45:/opt/incontrol/etc/support/dbforrepl.sql .  
incadmin@192.168.196.45's password:  
dbforrepl.sql 100% 391KB 391.2KB/s 00:00
```

4.2.3.3 Reload the Dump File and Set Coordinates

On the Passive Master we need to load the database dump file from the previous step and set the log file coordinates. To accomplish this run the `resync_slave.sh` script using the coordinates provided by the `resync_master.sh` script on the Production Executive.

```
>./resync_slave.sh -l mysql-bin.000001 -s 14158333 -h 192.168.196.45 -d
dbforrepl.sql
Stopping replication slave process with: STOP SLAVE
Disconnecting from old master with: CHANGE MASTER TO MASTER_HOST=''
Resetting slave with: RESET SLAVE

Loading dumpfile: dbforrepl.sql ...

Connecting to master with: CHANGE MASTER TO
MASTER_HOST='192.168.196.45',MASTER_USER='repl',MASTER_PASSWORD='replpass1',
MASTER_LOG_FILE='mysql-bin.000001',MASTER_LOG_POS=14158333
Starting replication slave process with: START SLAVE

Resynchronization Step 2 of 2 complete!
```