

Oracle® Solaris Cluster Data Replication Guide for Oracle GoldenGate

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Using This Documentation

- **Overview** – Provides procedures for administering Oracle GoldenGate data replication with Oracle Solaris Cluster disaster recovery framework (formerly called Geographic Edition) software.
- **Audience** – Experienced system administrators with extensive knowledge of Oracle software and hardware.
- **Required knowledge** – Knowledge of the Oracle Solaris operating system, of Oracle Solaris Cluster software, and expertise with the volume manager software that is used with Oracle Solaris Cluster software.

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Setting Up Oracle GoldenGate Protection Groups

This chapter describes how to configure data replication with Oracle GoldenGate software in an Oracle Solaris Cluster disaster recovery framework environment (formerly called Geographic Edition). It covers the following topics:

- [“Overview of the Oracle GoldenGate Software” on page 9](#)
- [“Overview of Oracle GoldenGate Replication” on page 10](#)
- [“Initial Configuration of Oracle GoldenGate Replication” on page 12](#)
- [“Planning an Oracle GoldenGate Protection Group” on page 14](#)
- [“Creating and Validating an Oracle GoldenGate Protection Group” on page 15](#)
- [“Replicating an Oracle GoldenGate Protection Group Configuration to a Partner Cluster” on page 24](#)

Overview of the Oracle GoldenGate Software

Oracle GoldenGate is a data replication software for databases. It takes changes from a source database and replicates them to a target database. Oracle GoldenGate consists of the following processes:

- Manager
- Extract
- Replicat
- Server

The manager controls the other processes, including the start and stop functions.

The extract process pulls data out of a database and stores it either locally or remotely. If the extract process has to store the data locally, it does so by writing it to a file. If the extract

process has to store the data remotely, it communicates with a remote server process and gets the server to store the data in files. The files that contain the data are called `trails`.

The server process is started automatically by the manager process, if a remote process contacts the manager to send data. Once the server process is started, communication takes place only between the sending extract process and the server process. The manager ceases to have any role in the communication between the sending extract process and the receiving server process. The server process takes the data from the sending extract process and stores it into a remote `trail`. Currently, there is no interface in the Oracle GoldenGate software to stop a server process. Hence, these processes must be killed manually.

A replicat process picks up the information from a `trail` and stores it into a target database. To achieve this, the replicat process must be able to make a local connection to the database.

A healthy Oracle GoldenGate instance has at least the manager up and running. Although such an instance is valid, it cannot process any data. A fully working Oracle GoldenGate instance has at least an extract process or a replicat process with the corresponding server up and running. You need at least two Oracle GoldenGate instances; one to serve as a sender and the other to serve as the receiver.

You can have different kinds of source and target databases. For example, you can have replication between MySQL and Oracle Database in either direction. The replication itself is always asynchronous. Synchronous replication is not possible using Oracle GoldenGate.

Note - The Oracle GoldenGate instance cannot exist on its own and must always be co-located with a database.

Overview of Oracle GoldenGate Replication

This section provides an overview of the Oracle GoldenGate replication resource groups. A protection group that secures Oracle GoldenGate with Oracle GoldenGate replication consists of the following two resource groups securing a third resource group that is not part of the protection group on each cluster:

- [“Oracle GoldenGate Resource Groups” on page 11](#)
- [“Oracle GoldenGate Replication Resource Groups” on page 11](#)
- [“Application Resource Groups” on page 11](#)

The Oracle GoldenGate resource group holding Oracle GoldenGate is the foundation underneath the protection group. Hence, strong positive affinities with failover delegation must exist from the Oracle GoldenGate replication resource groups in the protection group and the Oracle GoldenGate resource group.

Using Oracle GoldenGate for replication allows the databases to be writable on both sides.

Oracle GoldenGate Resource Groups

The Oracle GoldenGate resource group typically contains the following resources:

- Storage resource, which makes the storage for the database and Oracle GoldenGate highly available
- Logical host resource, which provides the address to connect with the Oracle GoldenGate replication
- HA for Oracle GoldenGate resource, requires the logical host resource and the storage resource to make Oracle GoldenGate highly available locally
- Database resource, which protects the database to be replicated with Oracle GoldenGate

The resource group hosting the Oracle GoldenGate resource must contain a logical host resource which provides the address to connect to a replication target. The logical host in the database or in the Oracle GoldenGate resource group is the replication target for Oracle GoldenGate to replicate between the clusters. Hence, if you want to replicate between two clusters, you need to have a logical host to make the Oracle GoldenGate daemons accessible in case of a failover of the resource group containing Oracle GoldenGate and the database. The logical host can be used for communication between the application and the database as well.

On single-node clusters, the storage resource can be omitted, if for instance you use the root file system for storage. The creation of the database resource group and its resources is the topic of [Oracle Solaris Cluster Data Service for Oracle GoldenGate Guide](#).

The database resource group and its objects can have different names across the clusters.

Oracle GoldenGate Replication Resource Groups

The Oracle GoldenGate replication resource group contains the Oracle GoldenGate replication resource. This resource does not start or stop any process. Its only purpose is to monitor the status of the Oracle GoldenGate replication.

Application Resource Groups

Depending on the application configuration and the underlying database, the application resource group can contain a logical host, with or without the application resources.

Since the application resource group and the database or the Oracle GoldenGate resource group need not be co-located, you will need two logical hosts - one in the application resource group and the other in the database or the Oracle GoldenGate resource group.

If you do not plan to include a real application in the application resource group, but plan to leave it with the logical host only for accessing the database, then there must be a strong positive affinity between the application resource group and the database resource group. The database connectivity features determine whether you need the logical host to connect to the database or not.

If the application resides on a replicated storage, you must configure a separate protection group containing this storage replication and the application.

Note - The application resource cannot be in the Oracle GoldenGate resource group.

Initial Configuration of Oracle GoldenGate Replication

This section describes the steps you need to perform to configure the Oracle GoldenGate software on the primary and secondary clusters:

- [“Installing Oracle GoldenGate and Configuring the Oracle GoldenGate Resource Group” on page 12](#)
- [“Configuring the Oracle GoldenGate Application Resource Group” on page 14](#)

Installing Oracle GoldenGate and Configuring the Oracle GoldenGate Resource Group

You can install Oracle GoldenGate and configure both clusters as described in [Oracle Solaris Cluster Data Service for Oracle GoldenGate Guide](#).

The resource group and its resources do not have to have the same name on both clusters.

When you configure the Oracle GoldenGate resource, keep the following restrictions in mind:

- Configuration of a database resource as a Service Management Facility (SMF) component on top of a failover container resource is not allowed.
- Oracle GoldenGate replication between the two clusters must be the only Oracle GoldenGate replication configured between the two databases.

Configuration Restrictions



Caution - Your replication configuration might not be supported if you do not observe these restrictions.

For restrictions that apply to all other Disaster Recovery Framework replications, see the release notes for your release of Disaster Recovery Framework. The following configuration restriction applies only to Oracle GoldenGate.

- Since Oracle GoldenGate replication must be configured only in the active-active topology, it is essential to have replication conflict detection and resolution (CDR). For example, a replication conflict could occur when the same record with the same key entry is inserted in a unique key on both sides at the same time. CDR is an Oracle GoldenGate configuration task and cannot be performed by Oracle Solaris Cluster.
- Although HA for Oracle GoldenGate supports multiple master deployments, Oracle GoldenGate replication in the Disaster Recovery Framework does not support such a deployment. Replicating a multiple master configuration in an active-active topology is not supported.
- The Oracle GoldenGate resource must be co-located with the database resource. To achieve this in a failover configuration, you can always place them in the same resource group. If you do not want the resources in the same resource group, define strong positive affinities or strong positive affinities with failover delegation between the resource groups.
- Ensure that the Oracle GoldenGate user login process is not interactive. For example, the `su - gg-user` command must not require any additional inputs from the user.

Configuration Requirements



Caution - Configuration requirements represent actions that you must perform. If your replication configuration does not satisfy these requirements, the replication configuration might not be supported.

For requirements that apply to all replications in Disaster Recovery Framework, see [Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4](#).

The following configuration requirements apply only to Oracle GoldenGate.

- Use HA for Oracle GoldenGate to make Oracle GoldenGate highly available. For more information, see [Oracle Solaris Cluster Data Service for Oracle GoldenGate Guide](#).
- Oracle GoldenGate must be configured only in the active-active topology for your database. For information on how to configure Oracle GoldenGate for your database, see the [Oracle GoldenGate](#) documentation.

- Failed extracts and replicats between clusters or within a cluster must be restarted automatically by Oracle GoldenGate.

Configuring the Oracle GoldenGate Application Resource Group

Create the application resource groups on the primary and the secondary clusters and set the `Auto_start_on_new_cluster` to `false`. This resource group hosts application resources for the application that used the database that Oracle GoldenGate is replicating. You also need to add the logical host resources as the replicated database requires them for connection. See the appropriate data services chapter for details on the installation and configuration of your data service.

The following commands show creation of the resource group while setting the `Auto_start_on_new_cluster` property to `false` and the creation of a logical host resource on the primary cluster, `cluster-paris`:

```
phys-paris-1# clresourcegroup create -p Auto_start_on_new_cluster=false usa-rg
phys-paris-1# clreslogicalhostname create -g usa-rg cluster-usa
```

The following commands show creation of the resource group while setting the `Auto_start_on_new_cluster` property to `false` and the creation of a logical host resource on the secondary cluster, `cluster-newyork`:

```
phys-newyork-1# clresourcegroup create -p Auto_start_on_new_cluster=false usa-rg
phys-newyork-1# clreslogicalhostname create -g usa-rg cluster-usa
```

Planning an Oracle GoldenGate Protection Group

An Oracle GoldenGate resource group can belong to only one protection group.

The Oracle GoldenGate geographic replication was developed with the script-based plug-in module of Disaster Recovery Framework, so it must comply with all rules of the script-based plug-in. For each protection group, you must provide a script-based plug-in configuration file on each node. In addition, the Oracle GoldenGate geographic replication brings in its own configuration file, which is needed only at registration.

The Oracle GoldenGate geographic replication creation is an automated process that takes the Oracle GoldenGate geographic configuration file as input and performs the necessary actions. The essential content of this file consists of the following `key=value` pairs.

Key	Explanation of Value
PS	Name of the partnership.
PG	Name of the protection group to create.
REPCOMP	Name of the replication component to create in this protection group.
REPRS	Name of the replication resource.
REPRG	Name of the replication resource group.
DESC	Description for the protection group.
CONFIGFILE	Absolute path for the script-based plug-in configuration file.
APPRG	Name of the application resource group.
REALGGRG	Resource group names that contain the Oracle GoldenGate resource on the clusters. If the resource group names on the clusters differ, provide a comma-separated list.
REALGGRS	Resource names configured as the Oracle GoldenGate resources. If the resource names on the clusters differ, provide a comma-separated list.
GGGROUPS	List of Oracle GoldenGate extracts or replicats forming the replication between the databases. The format for one group is <i>clustername:group name</i> . For multiple groups, provide a comma-separated list.
PINGTIME	Timeout for the extensive ping test. The default is 60 seconds if this variable is unset. This timeout is used at <code>check_takeover</code> where it must be verified if the remote site is unavailable.

Note - You must use the any keyword in the script-based plug-in configuration file for Oracle GoldenGate.

Note - The script-based plug-in configuration file must be in the same location on all cluster nodes on the primary and the secondary cluster.

Creating and Validating an Oracle GoldenGate Protection Group

Protection group names are unique in the global Disaster Recovery Framework namespace. You cannot use the same protection group name in two partnerships on the same system. In addition, you can replicate the existing configuration of a protection group from a remote cluster to a local cluster. For more information, see [“Replicating an Oracle GoldenGate Protection Group Configuration to a Partner Cluster”](#) on page 24.

This section contains the following information:

- [“How to Create and Configure an Oracle GoldenGate Protection Group”](#) on page 16

- [“Validating an Oracle GoldenGate Protection Group” on page 18](#)
- [“Adding an Application Resource Group to an Oracle GoldenGate Protection Group” on page 20](#)
- [“Adding a Replication Component to an Oracle GoldenGate Protection Group” on page 23](#)

▼ How to Create and Configure an Oracle GoldenGate Protection Group

Before You Begin Ensure that the following conditions are met:

- The local cluster is a member of a partnership.
- The protection group you are creating does not already exist.
- All extracts and replicats that form the active-active topology have the status RUNNING on both clusters. Using the `ggsci` utility and as an Oracle GoldenGate user, do the following:

```
$ ggsci
GGSCI (nodename) > info all
GGSCI (nodename) > start er *
```

Note - The `start er *` command might not be appropriate for all configurations.

- Oracle GoldenGate resources and resource groups must exist on the primary and the secondary cluster.
- The application resource groups must exist on the primary and the secondary cluster.
- You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. **Log in to a cluster node of the primary cluster.**
2. **Copy the `goldengate_geo_config` file to a different location.**

For example:

```
phys-paris-1# cp /opt/ORCLscGoldenGate/geocontrol/util/goldengate_geo_config /var/tmp/geo
```

3. **Specify the following variables in `/var/tmp/geo/goldengate_geo_config`.**
This list uses sample values.


```

PS=goldengate-ps
PG=goldengate-pg
REPCOMP=goldengate.sbp
REPRS=goldengate-rep-rs
REPRG=goldengate-rep-rg
DESC="goldengate replication pg"
CONFIGFILE=/geo-config/geo-gg-config
REALGGRG=paris-rg,newyork-rg
REALGGRS=paris-gg-rs,newyork-gg-rs
GGGROUPS=paris:mysqllex1,paris:mysqlre2,newyork:mysqllex2,newyork:mysqlre1
APPRG=usa-rg
PINGTIME=

```

4. Create the script-based plug-in configuration file on all nodes of all clusters.

Assuming that the nodes of the primary cluster, cluster-paris, are phys-paris-1 and phys-paris-2, on each node of cluster-paris, you would issue the following commands:

```

phys-paris-1# mkdir /geo-config
phys-paris-1# echo "goldengate.sbp|any|phys-paris-1,phys-paris-2" \
> /geo-config/geo-gg-config

```

Assuming that the nodes of the secondary cluster, cluster-newyork, are phys-newyork-1 and phys-newyork-2, on each node of cluster-newyork, you would issue the following commands:

```

phys-newyork-1# mkdir /geo-config
phys-newyork-1# echo "goldengate.sbp|any|phys-newyork-1,phys-newyork-2" \
> /geo-config/geo-gg-config

```

5. Execute the goldengate_geo_register script on the primary cluster.

For example:

```

phys-paris-1# ksh /opt/ORCLscGoldenGate/geocontrol/util/goldengate_geo_register \
-f /var/tmp/geo/goldengate_geo_config

```

6. Replicate the protection group to the partner cluster.

Note - You can also accomplish this step by using the Oracle Solaris Cluster Manager GUI. Click Partnerships, click the partnership name, highlight the protection group name, and click Get Protection Groups. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

The final messages of the registration script outline the required `geopg get` command. You must log in to one node of the partner cluster and execute that exact command. For example:

```
phys-newyork-1# geogg get -s goldengate-ps goldengate-pg
```

Validating an Oracle GoldenGate Protection Group

When the configuration status of a protection group is displayed as Error in the `geoadm` status output, you can validate the configuration by using the `geogg validate` command. This command checks the current status of the protection group and its entities.

If the protection group and its entities are valid, then the configuration status of the protection groups is set to OK. If the `geogg validate` command finds an error in the configuration files, then the command displays an error message, and the configuration remains in the Error state. In such a case, you can fix the error in the configuration, and rerun the `geogg validate` command.

This section provides the following information:

- [“Data Replication Layer Process for Validating the Application Resource Groups and Data Replication Entities” on page 18](#)
- [“How to Validate an Oracle GoldenGate Protection Group” on page 19](#)

Data Replication Layer Process for Validating the Application Resource Groups and Data Replication Entities

During protection group validation, the Oracle GoldenGate data replication layer validates the application resource groups and the data replication entities by verifying that an application resource group in the protection group has its `Auto_start_on_new_cluster` property set to `false`.

When you bring a protection group online on the primary cluster, Disaster Recovery Framework brings the application resource groups participating in that protection group online on the same primary cluster. Setting the `Auto_start_on_new_cluster` property to `false` prevents the Oracle Solaris Cluster resource group manager from automatically starting the application resource groups. In this case, the startup of resource groups is reserved for the Disaster Recovery Framework software.

Application resource groups should be online only on the primary cluster when the protection group is activated.

The Oracle GoldenGate `geocont rol` module supplies a script that is used by the script-based plug-in module. The script entry points require the same set of arguments. These arguments are validated for semantics and completeness. The following validation checks are performed:

- Are all of the mandatory arguments defined?
- Is the configured Oracle GoldenGate resource defined?
- Is the specified replication resource configured with a correct start command, if the resource exists already?
- Is the PINGTIME interval numeric?

When the validation is complete, the Disaster Recovery Framework software creates and brings online the replication resource group and its resources if they don't already exist. If a resource group or resource of the same name already exists, the Disaster Recovery Framework software might modify its properties. The software cannot create a new resource group or a resource of the same name if one already exists. After creating the necessary resources, the software adds the application resource group to the protection group.

▼ How to Validate an Oracle GoldenGate Protection Group

The `geogg validate` command validates the configuration of the protection group on the local cluster only. To validate the protection group configuration on the partner cluster, rerun the command on the partner cluster.

Note - You can also accomplish this procedure by using the Oracle Solaris Cluster Manager GUI. Click Partnerships, click the partnership name, highlight the protection group name, and click `Validate`. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

Before You Begin Ensure that the following conditions are met:

- The protection group you want to validate exists locally.
- The common agent container is online on all nodes of both clusters in the partnership.

● Validate the configuration of the protection group on the local cluster only.

```
# geogg validate protection-group
```

```
protection-group
```

The unique name of a single protection group.

Example 1 Validating the Configuration of a Protection Group

In the following example, the configuration of a protection group is validated:

```
# geogg validate goldengate-pg
```

Adding an Application Resource Group to an Oracle GoldenGate Protection Group

To make an application highly available, the application must be managed as a resource in an application resource group.

Perform this procedure to add an existing application resource group to the list of application resource groups in a protection group. At protection group creation time, if you specified application resource groups in the `goldengate_geo_config` configuration file and executed the `goldengate_geo_register` script, such application resource groups were added to the protection group.

All of the entities that you configure for the application resource group on the primary cluster, such as application data resources, application configuration files, and resource groups, must be replicated manually on the secondary cluster. The resource group names must be identical on both clusters. Also, the data that the application resource uses must be replicated on the secondary cluster.

▼ How to Add an Application Resource Group to an Oracle GoldenGate Protection Group

You can add an existing application resource group to the list of application resource groups in a protection group.

Note - You can also accomplish this procedure by using the Oracle Solaris Cluster Manager GUI. Click Partnerships, click the partnership name, click the protection group name, and in the Resource Groups section click Add Resource Groups. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

Before You Begin Before you add an application resource group to a protection group, ensure that the following conditions are met:

- The protection group is defined.
- The resource group to be added already exists on both clusters and is in an appropriate state.
- The `Auto_start_on_new_cluster` property of the resource group is set to `false`. You can view this property by using the `clresourcegroup show` command. For example:

```
# clresourcegroup show -p Auto_start_on_new_cluster apprg1
```

You can set the `Auto_start_on_new_cluster` property to `false` as follows:

```
# clresourcegroup set -p Auto_start_on_new_cluster=false apprg1
```

Setting the `Auto_start_on_new_cluster` property to `false` prevents the Oracle Solaris Cluster resource group manager from automatically starting the resource groups in the protection group. In the case where the entire cluster is rebooted, once the Disaster Recovery Framework software starts and communicates with the remote cluster to ensure that the remote cluster is running and that the remote cluster is the secondary cluster for that resource group, the software will not automatically start the resource group on the primary cluster.

Application resource groups should be online only on the primary cluster when the protection group is activated.

- The `Nodelist` property of the failover application resource group that has affinities with a replication component defined by the resource must contain the same entries in identical order as the `Nodelist` property of the protection group.
- If the application resource group must have dependencies on resource groups and resources that are not managed by this protection group, ensure that the `External_dependencies_allowed` property of the protection group is set to `TRUE`.

The protection group can be activated or deactivated, and the resource group can be either online or unmanaged. If the resource group is unmanaged and the protection group is activated after the configuration of the protection group has changed, then the local state of the protection group becomes `Error`. If the resource group to add is online, and the protection group is deactivated, the request is rejected. You must activate the protection group before adding an online resource group.

- You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. **Log in to a cluster node.**
2. **Ensure that the `Auto_start_on_new_cluster` property of the resource group is set to `False`.**

```
# clresourcegroup show -p Auto_start_on_new_cluster resource-group
```

If necessary, change the property to `False`.

```
# clresourcegroup set -p Auto_start_on_new_cluster=False resource-group
```

3. **If the application resource group must have dependencies on resource groups and resources that are not managed by this protection group, ensure that the `External_dependencies_allowed` property of the protection group is set to `TRUE`.**

```
# geopg show protection-group | grep -i external_dependency_allowed
```

If necessary, change the property value to True.

```
# geopg set-prop -p External_dependency_allowed=TRUE protection-group
```

4. Start the protection group or change the state of the application resource group to a state that is required for the addition to be allowed.

Disaster Recovery Framework requires that the application resource group be in an unmanaged state on the secondary cluster. If the protection group is stopped on the primary cluster, the application resource group must be unmanaged on the primary cluster also. If the protection group is active on the primary cluster, the application resource group must be in an unmanaged or in an online state on the primary cluster.

5. Add an application resource group to the protection group.

```
# geopg add-resource-group application-resource-group protection-group
```

In this syntax, *application-resource-group* specifies the name of the application resource group. You can specify more than one resource group in a comma-separated list. In addition, *protection-group* specifies the name of the protection group.

This command adds an application resource group to a protection group on the local cluster. Then, if the partner cluster contains a protection group of the same name, the command propagates the new configuration information to the partner cluster.

For information about the names and values that are supported by Disaster Recovery Framework software, see [Appendix B, “Legal Names and Values of Disaster Recovery Framework Entities,”](#) in *Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*.

After the application resource group is added to the protection group, the application resource group is managed as an entity of the protection group. The application resource group is now affected by protection group operations such as start, stop, switchover, and takeover.

Example 2 Adding an Application Resource Group to a goldengate Protection Group

In the following example, the application resource groups `apprg1` and `apprg2`, are added to the `goldengate-pg` protection group.

```
# geopg add-resource-group apprg1,apprg2 goldengate-pg
```

Adding a Replication Component to an Oracle GoldenGate Protection Group

A protection group is the container for the application resource groups, which contain data for services that are protected from disaster. The Disaster Recovery Framework software protects the data by replicating it from the primary cluster to the secondary cluster. By adding a replication component to a protection group, the software monitors the replication status of Oracle GoldenGate. The software also controls the role and state of the Oracle GoldenGate extract and replicat processes during protection group operations such as start, stop, switchover, and takeover.

▼ How to Add a Replication Component to an Oracle GoldenGate Protection Group

Perform this procedure to add an existing Oracle GoldenGate configuration to the list of Oracle GoldenGate configurations in a protection group. At protection group creation time, the Oracle GoldenGate configuration that you specified in the `goldengate_geo_config` file was added when you executed the `goldengate_geo_register` script.

Before You Begin Ensure that the following conditions are met:

- The protection group is defined on the local cluster.
- The protection group is offline on the local cluster and the partner cluster, if the partner cluster can be reached.
- The underlying Oracle GoldenGate resources exist on both the local cluster and the partner cluster.
- You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. **Log in to a cluster node.**
2. **Add a replication component to the protection group.**

The following command adds a replication component to a protection group on the local cluster and propagates the new configuration to the partner cluster if the partner cluster contains a protection group with the same name.

```
# geopg add-replication-component \  
-p property [-p...] goldengate-replicated-component protection-group
```

In this syntax, *-p property* specifies the properties of the replication component group. You can specify the following script-based plug-in properties:

- *switchover_args* — Specifies the command-line arguments for the switchover script
- *takeover_args* — Specifies the command-line arguments for the takeover script
- *start_replication_args* — Specifies the command-line arguments for the *start_replication* script
- *remove_config_args* — Specifies the command-line arguments for the *remove_configuration* script
- *create_config_args* — Specifies the command-line arguments for the *create_configuration* script
- *stop_replication_args* — Specifies the command-line arguments for the *stop_replication* script



Caution - Make sure that the command-line arguments are the same for all scripts.

For more information about the properties you can set, see [“Property Descriptions for Script-Based Plug-Ins” in *Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

Also in this syntax, *goldengate-replicated-component* specifies the name of the new replication component, and *protection-group* specifies the name of the protection group that contains the Oracle GoldenGate replicated component.

For information about the names and values that are supported, see [Appendix B, “Legal Names and Values of Disaster Recovery Framework Entities,” in *Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

For more information about the *geopg* command, refer to the [geopg\(8\)](#) man page.

Note - Because the add operation for the replication component is performed during the scripted registration, an example is not provided here.

Replicating an Oracle GoldenGate Protection Group Configuration to a Partner Cluster

Before you replicate the configuration of an Oracle GoldenGate protection group to a partner cluster, ensure that the following conditions are met:

- The protection group is defined on the remote cluster, not on the local cluster.
- The Oracle GoldenGate resources in the protection group on the remote cluster exist on the local cluster.
- The application resource groups in the protection group on the remote cluster exist on the local cluster.
- The `Auto_start_on_new_cluster` property of the application resource groups is set to `false`. You can view this property by using the `clresourcegroup show` command, as follows:

```
# clresourcegroup show -p auto_start_on_new_cluster apprg1
```

Then, set the `Auto_start_on_new_cluster` property to `false` as follows:

```
# clresourcegroup set -p Auto_start_on_new_cluster=false apprg1
```

Setting this property to `false` prevents the Oracle Solaris Cluster resource group manager from automatically starting the resource groups in the protection group. In the case where the entire cluster is rebooted, once the Disaster Recovery Framework software restarts and communicates with the remote cluster to ensure that the remote cluster is running and that the remote cluster is the secondary cluster for the resource group, the software does not automatically start the resource group on the primary cluster.

Application resource groups should be online only on the primary cluster when the protection group is activated.

1. Replicate the protection group configuration to the partner cluster.

Use the following command to retrieve the configuration information of the protection group from the remote cluster and create the protection group on the local cluster.

```
# geopg get -s partnership-name goldengate-pg
```

In this syntax, the `-s partnership-name` option specifies the name of the partnership from which the protection group configuration information is retrieved. In addition, `goldengate-pg` specifies the name of the protection group.

Note - Resynchronizing a protection group updates only entities that are related to Disaster Recovery Framework. To update Oracle Solaris Cluster resource groups, resource types, and resources, use the `cluster export -t rg,rt,rs` command to generate an XML cluster configuration file, modify the XML file for the expected configuration on the secondary cluster, and run the `clresource create` command with the `-a` option to apply the configuration updates.

For more information, see [“How to Configure Oracle Solaris Cluster Software on All Nodes \(XML\)”](#) in *Installing and Configuring an Oracle Solaris Cluster 4.4 Environment* and the `cluster(8CL)` and `clresource(8CL)` man pages.

EXAMPLE 3 Replicating an Oracle GoldenGate Protection Group to a Partner Cluster

In the following example, `paris-newyork-ps` is a partnership between the `cluster-paris` and `cluster-newyork` clusters. The `goldengate-pg` protection group is replicated to the `cluster-newyork` cluster. The configuration of the protection group is retrieved from the remote cluster `cluster-paris` and then validated by the data replication subsystem on the local cluster `cluster-newyork`.

```
# ssh -l root cluster-newyork
phys-newyork-1# geogg get -s paris-newyork-ps goldengate-pg
```

If the validation is successful, the configuration status is set to OK, and the protection group is created on the local cluster. This protection group contains a replicated component and an application group that are configured almost identically to the replicated component and application group on the remote cluster. If the validation fails, the protection group is not created on the local cluster. Fix the cause of the error, and replicate it again.

Administering Oracle GoldenGate

This chapter contains information about administering Oracle GoldenGate. It covers the following topics:

- “Administering Oracle GoldenGate Application Resource Groups” on page 27
- “Administering Oracle GoldenGate Replication Components” on page 28
- “Recovery After a Takeover of an Oracle GoldenGate Protection Group” on page 31
- “Debugging an Oracle GoldenGate Replication Configuration” on page 35

Administering Oracle GoldenGate Application Resource Groups

This section describes how to delete an application resource group from an Oracle GoldenGate protection group.

▼ How to Remove an Application Resource Group From an Oracle GoldenGate Protection Group

You can remove an application resource group from a protection group without altering the state or contents of the application resource group.

Note - You can also accomplish this procedure by using the browser interface. Click Partnerships, click the partnership name, click the protection group name, highlight the resource group name, and click Remove. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

Before You Begin Ensure that the following conditions are met:

- The protection group is defined on the local cluster.
- The resource group to be removed is part of the application resource groups of the protection group.
- You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. Log in to a cluster node.

2. Remove the application resource group from the protection group.

The following command removes an application resource group from a protection group on the local cluster. If the partner cluster contains a protection group with the same name, the application resource group is also removed from the protection group on the partner cluster.

```
# geopg remove-resource-group resource-group-list protection-group
```

In this syntax, *resource-group-list* specifies the name of the application resource group. You can specify more than one resource group in a comma-separated list. In addition, *protection-group* specifies the name of the protection group.

If the resource group that is being removed shares dependencies with other resource groups in the protection group, then you must also remove all other resource groups that share dependencies with the resource group that is being removed or you must set the protection group's `External_dependency_allowed` property to TRUE.

If the remove operation fails on the local cluster, the configuration of the protection group is not modified. Otherwise, the configuration status is set to OK on the local cluster. If the configuration status is OK on the local cluster but the remove operation is unsuccessful on the partner cluster, the configuration status is set to Error on the partner cluster.

Example 4 Removing Two Application Resource Group From a Protection Group

In the following example, two application resource groups, `apprg1` and `apprg2`, are removed from the `goldengate-pg` protection group.

```
# geopg remove-resource-group apprg1,apprg2 goldengate-pg
```

Administering Oracle GoldenGate Replication Components

This section describes the following tasks for administering replication components in an Oracle GoldenGate protection group:

- [“How to Modify an Oracle GoldenGate Replication Component” on page 29](#)
- [“How to Remove a Replication Component From an Oracle GoldenGate Protection Group” on page 30](#)

For details about configuring an Oracle GoldenGate protection group, see [“How to Create and Configure an Oracle GoldenGate Protection Group” on page 16](#).

▼ How to Modify an Oracle GoldenGate Replication Component

Note - You can also accomplish this procedure by using the browser interface. Click Partnerships, click the partnership name, click the protection group name, click the data replication component name, and click Edit. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

Before You Begin You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. **Log in to a cluster node.**
2. **Modify the replication component.**

The following command modifies the properties of a replication component in a protection group on the local cluster. Then, the command propagates the new configuration to the partner cluster if the partner cluster contains a protection group with the same name.

```
# geopg modify-replication-component \  
-p property [-p...] goldengate-replicated-component protection-group
```

In this syntax, the `-p property` option specifies the properties of the replication component.

For more information about the properties you can set, see [“Property Descriptions for Script-Based Plug-Ins” in *Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

Also in this syntax, `goldengate-replicated-component` specifies the name of the replication component, and `protection-group` specifies the name of the protection group that will contain the new replication component.

▼ How to Remove a Replication Component From an Oracle GoldenGate Protection Group

Note - You can also accomplish this procedure by using the browser interface. Click Partnerships, click the partnership name, click the protection group name, highlight the data replication component name, and click Remove. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface” in *Administering an Oracle Solaris Cluster 4.4 Configuration*](#).

Before You Begin Before you remove a replication component, ensure that the following conditions are met:

- The protection group is defined on the local cluster.
- The protection group is offline on the local cluster and the partner cluster, if the partner cluster can be reached.
- The replication component is managed by the protection group.
- You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

For information about deleting protection groups, refer to [“Deleting Protection Groups and Data Replication Components” in *Administering the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

1. **Log in to a cluster node.**
2. **Remove the replicated component.**

```
# geopg remove-replication-component goldengate-replicated-component protection-group
```

In this syntax, *goldengate-replicated-component* specifies the name of the replication component, and *protection-group* specifies the name of the protection group.

Example 5 Deleting a Replicated Component From an Oracle GoldenGate Protection Group

In the following example, the `goldengate-dg` replication component is deleted from the `goldengate-pg` protection group.

```
# geopg remove-replication-component goldengate.sbp goldengate-pg
```

Recovery After a Takeover of an Oracle GoldenGate Protection Group

After a successful takeover operation, the secondary cluster becomes the primary for the protection group and the services are online on the secondary cluster. After the recovery of the original primary cluster, the services can be brought online again on the original primary by using a process called failback. The protection group on the original primary cluster has either the primary role or secondary role depending on whether the original primary cluster can be reached during the takeover from the current primary cluster.

The disaster recovery framework software supports the following kinds of failback:

- Failback-switchover - During a failback-switchover, applications are brought online again on the original primary cluster after the data of the original primary cluster is resynchronized with the data on the secondary cluster.
- Failback-takeover - During a failback-takeover, applications are brought online again on the original primary cluster and the current data is used on the original primary cluster. Any updates that occurred on the secondary cluster while it was acting as primary are discarded.

You can check for the status with the following command:

```
# geoadm status
```

The recovery after a takeover involves the following actions:

1. Configuring the original primary cluster to run as a secondary cluster.
2. Manually starting the extracts and replicats on the original primary cluster.
3. Resynchronizing the protection group to switch the role.

▼ How to Perform a Failback-Switchover on a System That Uses Oracle GoldenGate Replication

Use this procedure to restart an application on the original primary cluster, `paris`, after the data on this cluster has been resynchronized with the data on the current primary cluster, `newyork`.

Note - You can also accomplish [Step 6](#) and [Step 8](#) by using the browser interface. Click Partnerships, click the partnership name, and highlight the protection group name. Click Update Protection Group and when the update is completed click Start Protection Group. For more information about Oracle Solaris Cluster Manager, see [Chapter 12, “Using the Oracle Solaris Cluster Manager Browser Interface”](#) in *Administering an Oracle Solaris Cluster 4.4 Configuration*.

1. Log in to a node on the original primary cluster.

You must be assigned the Geo Management RBAC rights profile to complete this procedure. For more information, see [“Securing Disaster Recovery Framework Software” in *Installing and Configuring the Disaster Recovery Framework for Oracle Solaris Cluster 4.4*](#).

2. Check the status of the original primary cluster to ensure that it is running and has the status Deactivated.

```
# geoadm status
```

3. Ensure that the Oracle GoldenGate resource and the underlying database have the status onLine on the original primary cluster.

```
# clresource status
```

4. Start the extracts and replicats.

```
GGSCI (node)> start extract name  
GGSCI (node)> start replicat name
```

5. Verify that the extracts and replicats are running.

```
GGSCI (node)> info all
```

If the extract or the replicats are not running, fix the root cause, and retry the operation. As a last resort, you can take a backup from the current primary cluster and perform a fresh Oracle GoldenGate setup.

Connect to a node of the original primary cluster and update the protection group to change the role from a deactivated primary cluster to a secondary cluster.

6. Resynchronize the protection group.

```
# geopg update protection-group
```

7. From one node in each cluster, validate the configuration locally for each protection group.

Note - Ensure that the protection group is not in an Error state. You cannot start a protection group when it is in an Error state.

```
# geopg validate protection-group
```

For more information, see [“How to Validate an Oracle Data Guard Protection Group” in *Oracle Solaris Cluster Data Replication Guide for Oracle Data Guard*](#).

8. **From one node of either cluster, start the protection group globally.**

```
# geopg start -e global protection-group
```

9. **(Optional) From one node of either cluster, perform a protection group switchover to make the original primary the current primary.**

```
# geopg switchover -m cluster-paris protection-group
```

▼ How to Perform a Failback-Takeover on a System That Uses Oracle GoldenGate Replication

Use this procedure to restart an application on the original primary cluster and use the current data on the original primary cluster. Any updates that occurred on the secondary cluster while it was acting as primary are discarded.

Note - This procedure assumes that the original primary cluster was down at the time of the takeover from the original secondary and that the original secondary cluster remains down.

1. **Check the status of the original primary cluster on a node of the current primary cluster to ensure that it is down.**

```
# geoadm status
```

2. **Before you boot the original primary cluster, stop the protection group on the current primary cluster.**

```
# geopg stop -e local protection-group
```

3. **Disable the database and the Oracle GoldenGate resource on the current primary cluster.**

```
# clresource disable GoldenGate-resource  
# clresource disable Database-resource
```

4. **Boot the original primary cluster.**

5. **Disable the database and the Oracle GoldenGate resource on the original primary cluster.**

```
# clresource disable Goldengate-resource  
# clresource disable Database-resource
```

6. **Take an offline backup of the original primary and redeploy it on the current primary cluster.**
7. **Enable the database and the Oracle GoldenGate resource on both the clusters.**

```
# clresource enable Goldengate-resource  
# clresource enable Database-resource
```

8. **Re-deploy the Oracle GoldenGate configuration.**
 - a. **Delete the Oracle GoldenGate groups.**
 - b. **Delete the remaining trail files.**
 - c. **Redeploy the Oracle GoldenGate groups on both the clusters.**

Make sure that all relevant groups are up and running after you start them.

9. **Re-synchronize the protection group.**

Run the following command from the original primary cluster.

```
# geopg update protection-group
```

10. **From one node in each cluster, validate the configuration locally for each protection group.**

Note - Ensure that the protection group is not in an Error state. You cannot start a protection group when it is in an Error state.

```
# geopg validate protection-group
```

For more information, see [“How to Validate an Oracle Data Guard Protection Group”](#) in *Oracle Solaris Cluster Data Replication Guide for Oracle Data Guard*.

11. **Check the status of the configuration on one node.**

```
# geoadm status
```

12. **Start the protection group globally.**

```
# geopg start -e global protection-group
```

13. **(Optional) Perform a switchover.**

```
# geopg switchover -e global protection-group
```

▼ How to Recover After a Replication Error

When an error occurs at the replication level, the error is reflected in the status of the replication status resource of the relevant remote replication component. This corresponding changed status appears in the data replication status field in the relevant protection group's section in the output of the `geoadm status` command.

1. **From one node of either cluster, stop the protection group globally.**

```
# geopg stop -e global protection-group
```

2. **Fix the root cause of the error in Oracle GoldenGate.**

You might need to take a backup of the primary cluster and apply it to the secondary cluster.

- a. **Delete the Oracle GoldenGate groups.**
- b. **Delete the remaining trail files.**
- c. **Redeploy the Oracle GoldenGate groups on both the clusters.**

3. **Start the protection group globally.**

```
# geopg start -e global protection-group
```

4. **(Optional) To ensure that the secondary cluster is able to master the protection group after the changes, perform a switchover and a switch back.**

```
# geopg switchover -f -m cluster-newyork protection-group
# geopg status protection-group
# geopg switchover -f -m cluster-paris protection-group
# geopg status protection-group
```

Debugging an Oracle GoldenGate Replication Configuration

- Debugging the replication status resource by obtaining extensive logging and a korn shell trace.

```
pnycb # clrs set -p debug_level=2 rep-rs
pnycb # ksh -x /opt/ORCLscGoldenGate/geocontrol/bin/goldengate_geo_replication_probe
-R rep-rs -G rep-rg -T \
ORCL.GoldenGate_geo
```

- Setting the `debug_level` property to 3 results in extensive debug messages for the replication status resource in the following file:

```
/var/cluster/logs/DS/ORCL.GoldenGate_geo/message_log.resource name
```

For more information about the `debug_level` property, see the [ORCL.gds\(7\)](#) man page.

- Debugging the SBP control scripts by obtaining extensive logging and a korn shell trace for a script.

- In the file `/opt/ORCLscGoldenGate/geocontrol/etc/config`, set the variable `SET_DEBUG` to `ALL` or set it to the replication component that you are debugging on the node that you want to debug. On this node, call the SBP control script that you want to debug.

```
ksh -x /opt/ORCLscGoldenGate/geocontrol/bin/goldengate_geo_control
-O gg-comp -r rep-rs -g rep-rg -R gg-rs -G mys-rg -T 60 -o
nyc:mysqlre1,nyc:mysqlre2,sfo:mysqlre2,sfo:mysqlre1
function=create_configuration pg=gg-pg
validate_parameters=false currentRole=PRIMARY is Modify=false
```

- To obtain all the SBP controls and its parameters, scan the cacao log.

```
/var/cacao/instances/default/logs
```

Deployment Example: Configuring Oracle GoldenGate Replication in Disaster Recovery Framework

This chapter provides a deployment example of how to configure Oracle GoldenGate replication in Disaster Recovery Framework.

Example Overview

In this example, the following assumptions are made:

- You have two two-node clusters with MySQL installed, and the disaster recovery framework already configured with partnership `gg-ps`.
- The Oracle GoldenGate resources are configured in the MySQL resource group `mys-rg`.
- For replication, a separate network is dedicated between the clusters. This is optional. However, if it is done this way you will need separate logical hosts for the replication network.
- The nodes on cluster `nyc` are `pnyca` and `pnycb`.
- The logical host used for replication on cluster `nyc` is `nyc-gg`.
- The nodes on cluster `sfo` are `psfoa` and `psfob`.
- The logical host used for replication on cluster `sfo` is `sfo-gg`.
- The logical hosts used by the Disaster Recovery Framework are on clusters `nyc` and `sfo`, so we need the IP aliases for logical hosts to be created automatically such that `nyc` is on cluster `nyc` and `sfo` is on cluster `sfo`.
- Both MySQL databases listen on port 3306.
- The shared storage are two ZFS file systems - `/mys` for MySQL and `/gg` for Oracle GoldenGate on the nodes.
- Both clusters have the HAStoragePlus resources, `mys-hsp-rs` and `gg-hsp-rs`, already configured.

- The application is in the resource group `app-rg`. In this case, it is only a logical host named `app`.
- The logical host for applications, `app-rg`, are defined on both clusters.

This deployment example results in the following:

- A highly available Oracle GoldenGate installation in an active-active replication topology.
- A protection group `gg-pg` providing business continuity capabilities consisting of:
 - A replication component, `gg-comp`.
 - A replication status resource group, `rep-rg`.
 - A replication status resource, `rep-rs`.

Preparing the MySQL Database for Oracle GoldenGate

Follow the instructions in this section to prepare the MySQL database for Oracle GoldenGate Usage on both clusters.

1. On cluster `nyc`, add the following information to the `my.cnf` configuration file:

```
log-bin=/mys/data/logs/bin-log

# additional Oracle GoldenGate requirements
log-bin-index=/mys/data/logs/bin-log.index
max_binlog_size=4096
binlog-format=ROW

# for active-active configurations, set auto-increment
auto-increment-increment=2
auto-increment-offset=1

# additional Oracle GoldenGate requirements end
```

2. Restart the MySQL server.

```
pnycb# clrs disable mys-rs
pnycb# clrs enable mys-rs
```

3. On cluster `sfo`, add the following information to the `my.cnf` configuration file.

```
log-bin=/mys/data/logs/bin-log

# Additional Oracle GoldenGate requirements
log-bin-index=/mys/data/logs/bin-log.index
```

```

max_binlog_size=4096
binlog-format=ROW

# For active-active configurations, set auto-increment
auto-increment-increment=2
auto-increment-offset=2

# Additional Oracle GoldenGate requirements end

```

- Restart the MySQL server.

```

psfob# clrs disable mys-rs
psfob# clrs enable mys-rs

```

- On both clusters, create a database to be replicated and a database user gg for Oracle GoldenGate.

In this example, make the Oracle GoldenGate user gg as a database administrator.

Cluster nyc:

```

root@pnycb:~# /usr/local/mysql/bin/mysql -S /tmp/mysql.sock -uroot -proot
mysql> use mysql
mysql> GRANT ALL ON *.* TO 'gg'@'localhost' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnyca' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnycb' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfoa' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfob' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'nyc-gg' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'sfo-gg' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfo' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnyc' IDENTIFIED BY 'gg';
mysql> create database golden;
mysql> exit

```

- Create a table to test your replication.

Once Oracle GoldenGate is configured, just manipulate data in this table and check the content on both sites.

Cluster nyc

```

root@pnycb:~# /usr/local/mysql/bin/mysql -h nyc-gg -ugg -pgg
mysql> use golden
mysql> create table tab1 (row1 int not null, row2 char(64));
mysql> create unique index ind1 on tab1(row1);
mysql> exit;

```

Cluster sfo

```

root@psfob:~# /usr/local/mysql/bin/mysql -S /tmp/mysql.sock -uroot -proot
mysql> use mysql
mysql> GRANT ALL ON *.* TO 'gg'@'localhost' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnyca' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnycb' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfoa' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfob' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'nyc-gg' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'sfo-gg' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'psfo' IDENTIFIED BY 'gg';
mysql> GRANT ALL ON *.* TO 'gg'@'pnyc' IDENTIFIED BY 'gg';
mysql> create database golden;
mysql> exit

```

7. Create a table to test your replication.

Once GoldenGate is configured just manipulate data in this table and check the content on both sites.

```

root@psfob:~# /usr/local/mysql/bin/mysql -h sfo-gg -ugg -pgg
mysql> use golden
mysql> create table tabl (row1 int not null, row2 char(64));
mysql> create unique index ind1 on tabl(row1);
mysql> exit

```

8. On both clusters, set the MySQL database socket in the `my.cnf` file.

```

socket=/tmp/mysql.sock

# Restart the mysql database.
# clrs disable mys-rs
# clrs enable mys-rs

```

Preparing the Oracle GoldenGate User

1. On all cluster nodes, create the user `gg`.

Ensure that the user `gg` has access to the MySQL log directories. Use the same group as that of the MySQL owner.

```

root@pnyca:~# useradd -u 2000 -g dba -m -s /usr/bin/bash -d /export/home/gg gg
root@pnycb:~# useradd -u 2000 -g dba -m -s /usr/bin/bash -d /export/home/gg gg

```



```
root@psfoa:~# useradd -u 2000 -g dba -m -s /usr/bin/bash -d /export/home/gg gg
root@psfob:~# useradd -u 2000 -g dba -m -s /usr/bin/bash -d /export/home/gg gg
```

2. Add LD_LIBRARY_PATH to the environment of gg on all nodes.

In this example, the /gg entry is the only one in the .profile file.

```
LD_LIBRARY_PATH=/gg
export LD_LIBRARY_PATH
```

3. Sync all the home directories with the new .profile file.

```
root@pnycb# scp -rp /export/home/gg root@pnyca:/export/home
root@pnycb# scp -rp /export/home/gg root@psfoa:/export/home
root@pnycb# scp -rp /export/home/gg root@psfob:/export/home
```

Installing and Configuring Oracle GoldenGate

1. Allow user gg to modify the /gg directory.

```
pnycb # chown -R gg:dba /gg
psfob # chown -R gg:dba /gg
```

2. As user gg, untar the Oracle GoldenGate binaries in /gg on psfob and /gg on pnycb, assuming they have shared storage.

```
gg@pnycb:/gg$ tar xvf /var/tmp/ggs_Solaris_sparc_MySQL_64bit.tar
gg@psfob:/gg$ tar xvf /var/tmp/ggs_Solaris_sparc_MySQL_64bit.tar
```

3. Create the sub-directories.

Cluster nyc

```
gg@psfob:/gg$ ./ggsci
GGSCI (psfob) 1> create subdirs
GGSCI (psfob) 1> exit
```

Cluster sfo

```
gg@pnycb:/gg$ ./ggsci
GGSCI (pnycb) 1> create subdirs
GGSCI (pnycb) 1> exit
```

4. Configure the manager on cluster nyc.

```
gg@pnycb:/gg$ ./ggsci
GGSCI (pnycb) 3> edit params mgr
```

```
PORT 7809
DYNAMICPORTLIST 7810-7820
AUTORESTART ER *, RETRIES 4, WAITMINUTES 4
STARTUPVALIDATIONDELAY 5
PURGEOLDEXTRACTS /gg/dirdat/mm*, USECHECKPOINTS, MINKEEPHOURS 2
GGSCI (pnycb) 3>
```

5. Configure the manager on cluster sfo.

```
gg@psfob:gg$ ./ggsci
GGSCI (psfob) 3> edit params mgr
PORT 7909
DYNAMICPORTLIST 7910-7920
AUTORESTART ER *, RETRIES 4, WAITMINUTES 4
STARTUPVALIDATIONDELAY 5
PURGEOLDEXTRACTS /gg/dirdat/mm*, USECHECKPOINTS, MINKEEPHOURS 2
```

6. Add the checkpoint table on both clusters.

Cluster nyc

```
GGSCI (pnycb) 10> dblogin sourcedb golden userid gg
GGSCI (pnycb) DBLOGIN as gg) 11> add checkpointtable mysql.checkpoint
```

Cluster sfo

```
GGSCI (psfo) 10> dblogin sourcedb golden userid gg
GGSCI (psfo) DBLOGIN as gg) 11> add checkpointtable mysql.checkpoint
```

7. Define the IPv6 policy on both Oracle GoldenGate installations and also specify the checkpoint table.

Cluster nyc

```
GGSCI (pnycb) > edit params ./GLOBALS
```

```
USEIPV6
CHECKPOINTTABLE mysql.checkpoint
```

Cluster sfo

```
GGSCI (psfob) > edit params ./GLOBALS
```

```
USEIPV6
CHECKPOINTTABLE mysql.checkpoint
```

Configuring the First Replication Direction

1. Configure extract 1 on cluster nyc.

```
GGSCI (pnycb) 9> edit param mysqllex1
EXTRACT mysqllex1
DBOptions Host nyc-gg
SourceDB golden UserID gg Password gg
TranLogOptions AltLogDest /mys/data/logs/bin-log.index
TranLogOptions filtertable mysql.checkpoint
DISCARDFILE /gg/mysqllex1.dsc, PURGE
RMTHOST sfo-gg, MGRPORT 7909
RMTTRAIL /gg/dirdat/XX
TABLE golden.*;
```

2. Add extract 1 on cluster nyc.

```
GGSCI (pnycb) > Add Extract MySQLEX1 TranLog Begin now
```

3. Add remote trail 1 on cluster nyc.

```
GGSCI (pnycb) > Add RmtTrail /gg/dirdat/XX extract MySQLEX1
```

4. Configure replicat 1 on cluster sfo.

```
GGSCI (psfob) 11> edit param mysqlre1
REPLICAT mysqlre1
DBOptions Host sfo-gg
TargetDB golden USERID gg PASSWORD gg
DISCARDFILE /gg/mysqlre1.dsc, PURGE
REPERROR DEFAULT, ABEND
AssumeTargetDefs
Map golden.*, Target golden.*;
```

5. Add replicat 1 on cluster sfo.

```
GGSCI (psfob) 11> Add Replicat MySQLRE1 exttrail /gg/dirdat/XX checkpointtable
mysql.checkpoint
```

Configuring the Reverse Replication Direction

1. Configure extract 2 on cluster sfo.

```
GGSCI (psfob) 9> edit param mysqllex2
EXTRACT mysqllex2
```

```
DBOptions Host sfo-gg
SourceDB golden UserID gg Password gg
TranLogOptions AltLogDest /mys/data/logs/bin-log.index
TranLogOptions filtertable mysql.checkpoint
DISCARDFILE /gg/mysqllex2.dsc, PURGE
RMTHOST nyc-gg, MGRPORT 7809
RMTTRAIL /gg/dirdat/YY
TABLE golden.*;
```

2. Add extract 2 on cluster sfo.

```
GGSCI (psfob) > Add Extract MySQLX2 TranLog Begin now
```

3. Add remote trail 2 on cluster sfo.

```
GGSCI (psfob) > Add RmtTrail /gg/dirdat/YY extract MySQLX2
```

4. Configure replicat 2 on cluster nyc.

```
GGSCI (pnycb) 11> edit param mysqlre2
REPLICAT mysqlrep2
DBOptions Host nyc-gg
TargetDB golden USERID gg PASSWORD gg
DISCARDFILE /gg/mysqlre2.dsc, PURGE
REPERROR DEFAULT, ABEND
AssumeTargetDefs
Map golden.*, Target golden.*;
```

5. Add replicat 2 on cluster nyc.

```
GGSCI (psfob) 11> Add Replicat MySQLRE2 exttrail /gg/dirdat/YY checkpointtable
mysql.checkpoint
```

6. Start the manager on both clusters.

```
Cluster nyc
```

```
GGSCI (pnycb) > start mgr
```

```
Cluster sfo
```

```
GGSCI (psfob) > start mgr
```

7. Start the extract and replicat processes on both clusters.

```
Cluster nyc
```

```
GGSCI (pnycb) > start er *
```

```
Cluster sfo
```

- ```
GGSCI (psfob) > start er *
```
8. Check if everything is running on both clusters.  
Cluster nyc  
GGSCI (pnycb) > **info all**  
Cluster sfo  
GGSCI (psfob) > **info all**
  9. Stop the extract and replicat processes on both clusters.  
Cluster nyc  
GGSCI (pnycb) > **stop er \***  
Cluster sfo  
GGSCI (psfob) > **stop er \***
  10. Stop the manager process on both clusters.  
Cluster nyc  
GGSCI (pnycb) > **stop mgr !**  
GGSCI (pnycb) > **exit**  
Cluster sfo  
GGSCI (psfob) > **stop mgr !**  
GGSCI (psfob) > **exit**
  11. Assuming the root role, kill the server process on both clusters.  
Cluster nyc  
pnycb # **kill -f server**  
Cluster sfo  
psfob # **kill -f server**
  12. Assuming the root role, create the Oracle GoldenGate resources.  
Cluster nyc

```
pnycb # clrs create -d -g mys-rg \
-t GoldenGate \
-p user=gg \
-p Basepath=/gg \
-p port=7809 \
-p parameter_file=/gg/dirprm/mgr.prm \
-p database_resource=mys-rs \
-p resource_dependencies=mys-rs,nyc-gg \
-p resource_dependencies_offline_restart=mys-hsp-rs,gg-hsp-rs \
gg-rs
```

Cluster sfo

```
psfob # clrs create -d -g mys-rg \
-t GoldenGate \
-p user=gg \
-p Basepath=/gg \
-p port=7909 \
-p parameter_file=/gg/dirprm/mgr.prm \
-p database_resource=mys-rs \
-p resource_dependencies=mys-rs,sfo-gg \
-p resource_dependencies_offline_restart=mys-hsp-rs,gg-hsp-rs \
gg-rs
```

13. On both clusters, enable the Oracle GoldenGate resource.

```
pnycb # clresource enable gg-rs
psfob # clresource enable gg-rs
```

## Creating the Oracle GoldenGate Replicated Component

Assuming the root role, follow the instructions in this section to create the application resource group on both clusters.

1. On one node of both clusters, define the application rg with one logical host, app, at least.

Cluster nyc

```
pnycb # clresourcegroup create app-rg
pnycb # clreslogicalhostname create -g app-rg app
pnycb # clresourcegroup set -p Auto_start_on_new_cluster=false app-rg
```

Cluster sfo

```
psfob # clresourcegroup create app-rg
psfob # clreslogicalhostname create -g app-rg app
psfob # clresourcegroup set -p Auto_start_on_new_cluster=false app-rg
```

---

**Note** - Leave the resource group app-rg unmanaged on both clusters.

---

2. Create the Disaster Recovery Framework configuration file.
  - a. On all nodes of both clusters, create a sbp directory to contain the /sbp/geo-config configuration file.

```
pnyca # mkdir /sbp
pnycb # mkdir /sbp
psfoa # mkdir /sbp
psfob # mkdir /sbp
```

- b. On both nodes of the nyc cluster, create the /sbp/geo-config file with the listed content.

```
cluster nyc
```

```
pnyca # echo "gg-pg|any|pnyca,pnycb" >/sbp/geo-config
pnycb # echo "gg-pg|any|pnyca,pnycb" >/sbp/geo-config
```

- c. On both nodes of the sfo cluster, user create the /sbp/geo-config file with the listed content.

```
Cluster sfo
```

```
psfoa # echo "gg-pg|any|psfoa,psfob" >/sbp/geo-config
psfob # echo "gg-pg|any|psfoa,psfob" >/sbp/geo-config
```

3. Create the registration configuration file on one node of the primary cluster.

```
pnycb # cp /opt/ORCLscGoldenGate/geocontrol/etc/goldengate_geo_config /var/tmp/geo
PS=gg-ps
PG=gg-pg
REPCOMP=gg-comp
REPRS=rep-rs
REPRG=rep-rg
DESC="GoldenGate replication component"
CONFIGFILE=/sbp/geo-config
REALGGRG=mys-rg
REALGGRS=gg-rs
GGROUPS=nyc:mysqlre1,nyc:mysqlre2,sfo:mysqlre2,sfo:mysqlre1
```

```
APPRG=app-rg
```

```
PINGTIME=
```

4. Register on one node of the primary cluster.

```
pnycb # ksh /opt/ORCLscGoldenGate/geocontrol/util/goldengate_geo_register \
-f /var/tmp/geo/goldengate_geo_config
```

5. Update the secondary cluster.

```
psfob # geopg get -s gg-ps gg-pg
```

6. Start the protection group.

```
psfob # geopg start -e global gg-pg
```

7. Perform a switchover of the protection group.

```
psfob # geopg switchover -m sfo gg-pg
```

8. Stop the protection group.

```
psfob # geopg stop -e global gg-pg
```

9. Status check on one cluster.

```
psfob # geoadm status
```



## Oracle GoldenGate Replication Extension Properties

---

This section describes the extension properties for the resource type `ORCL.GoldenGate_geo`. This resource type represents the Oracle GoldenGate application in an Disaster Recovery Framework configuration.

The Disaster Recovery Framework software automatically creates resource of the `ORCL.GoldenGate_geo` type for each configured Oracle GoldenGate replication component, and internally manages the properties for such resources. You must not edit the values of these properties directly.

For details about system-defined properties, see the [r\\_properties\(7\)](#) man page and the [rg\\_properties\(7\)](#) man page.

The extension properties of the `ORCL.GoldenGate_geo` resource type are as follows:

### Goldengate\_rs

This property indicates the Oracle GoldenGate instance resources.

|                  |               |
|------------------|---------------|
| <b>Category</b>  | Required      |
| <b>Data type</b> | String        |
| <b>Default</b>   | " "           |
| <b>Tunable</b>   | When disabled |

### Goldengate\_rg

This property indicates the Oracle GoldenGate instance resource group.

|                  |          |
|------------------|----------|
| <b>Category</b>  | Required |
| <b>Data type</b> | String   |

---

|                |               |
|----------------|---------------|
| <b>Default</b> | ""            |
| <b>Tunable</b> | When disabled |

Goldengate\_groups

This property indicates the Oracle GoldenGate instance replication groups.

|                  |               |
|------------------|---------------|
| <b>Category</b>  | Required      |
| <b>Data type</b> | String        |
| <b>Default</b>   | ""            |
| <b>Tunable</b>   | When disabled |

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