



flashgrid

FlashGrid[®] Cluster for Oracle Database and Oracle RAC on Google Cloud

Deployment Guide

rev. 24.11-2024.12.10

Table of Contents

- 1 Introduction 3
- 2 Prerequisites 4
 - 2.1 Uploading Oracle Installation Files to a Storage Bucket 4
 - 2.2 Preparing the VPC 4
- 3 Deploying a Cluster 5
- 4 After Deploying a Cluster 6
 - 4.1 Verifying cluster status 6
 - 4.2 OS user accounts 6
 - 4.3 Finalizing cluster configuration 7
 - 4.4 Enabling deletion protection 7
 - 4.5 Installing an additional database home 7
 - 4.6 Use of anti-virus and other third-party software 7
 - 4.7 Use of automatic configuration tools 7
 - 4.8 Security hardening 7
- 5 Monitoring Cluster Health 8
- 6 Before Going Live 8
- 7 Deleting a cluster 9
- 8 Additional Documentation 9
- 9 Contacting Technical Support 9

1 Introduction

FlashGrid Cluster is an engineered cloud system that enables active-active database high availability infrastructure in public clouds. This guide provides step-by-step instructions for system and database administrators deploying FlashGrid Cluster with Oracle RAC on Google Cloud Compute Engine VMs.

Key components of FlashGrid Cluster on Google Cloud:

- FlashGrid Storage Fabric software
- FlashGrid Cloud Area Network software
- Oracle Database (19c, 18c, 12.2.0.1, 12.1.0.2, or 11.2.0.4)
- Oracle Grid Infrastructure (19c)
- Operating System:
 - **Oracle Linux:** 9
 - **Red Hat Enterprise Linux (RHEL)** 8, or 9
- Compute Engine VM types:
 - **General-purpose:** c3-standard, c3-highmem, c3-highcpu, c3d-standard, c3d-highmem, c3d-highcpu, c4-standard, c4-highmem, c4-highcpu
 - **Memory-optimized:** m3-ultramem, m3-megamem
- Disks: Hyperdisk Balanced and Balanced Persistent Disks

FlashGrid Cluster is delivered as Google Cloud Deployment Manager templates that automate configuration of multiple components required for a database cluster. FlashGrid Launcher is an online tool that simplifies the deployment process by guiding through the cluster configuration parameters and generating Deployment Manager templates.

2 Prerequisites

2.1 Uploading Oracle Installation Files to a Storage Bucket

During cluster initialization Oracle installation files will be downloaded from a storage bucket. The list of files that must be placed in the storage bucket will be shown in FlashGrid Launcher. The same storage bucket can be used for deploying multiple clusters. If any of the required Oracle files is missing or inaccessible, then the cluster initialization will fail.

Enabling public access to the bucket allows FlashGrid Launcher tool to verify that all required files are accessible. To enable public access, add *allUsers* with *Storage Object Viewer* (or *Storage Legacy Object Reader*) to the bucket permissions.

If allowing public access to the bucket is not possible then create the bucket with *Bucket Policy Only*, create a service account *FlashGrid Cluster VM*, and add this service account to the bucket's permissions with *Storage Object Viewer* role. This will allow the cluster node VMs to download the required Oracle files. You can find the default compute engine service account in IAM console.

2.2 Preparing the VPC

When creating a new cluster, you have two options:

- **Automatically create a new VPC.**
This option is usually used for test clusters isolated in their own sandbox VPCs. A VPC will be created together with the required subnets and firewall rules. By default, the VPC will be created with CIDR 10.100.0.0/16
- **Create the cluster in an existing VPC.**
This option is used for majority of production deployments where other systems (e.g. app servers) share the same VPC as the cluster. In the FlashGrid Launcher tool you will need to provide name of the subnet where the cluster will be placed. Existing *Legacy* networks are not supported.

If using an existing VPC then make sure that the following pre-requisites are met before creating a cluster:

- The VPC may have any CIDR that does not overlap with 192.168.0.0/16, for example 10.100.0.0/16. If you must use VPC with CIDR that overlaps with 192.168.0.0/16 then please request a customized configuration file from FlashGrid support.
- The VPC has a subnet in the target region.
- The subnet has [Private Google Access configured](#). Without *Private Google Access* configured enabling *External IPs* is required for access to the storage bucket with Oracle files.
- Firewall rules allow ingress traffic on the following ports:
 - Inbound and Outbound: All traffic between members of the security group (cluster nodes).
 - Inbound: TCP ports 1521, 1522 for SCAN and Local Listener access to the database nodes from app servers and other database clients. These are default port numbers that can be changed in the FlashGrid Launcher tool.
 - Inbound: TCP port 22 for SSH access to the cluster nodes
 - Inbound: TCP port 5901 if you choose to use VNC for creating a database using DBCA in GUI mode with direct connection (vs. SSH tunnel)
 - Inbound access to the ports listed above must be allowed only from those security groups or IP ranges that require such access. Do not configure *Anywhere* or *0.0.0.0/0* as allowed sources.
- FlashGrid Cluster nodes are configured to use VPC's MTU settings. For the best performance, it's recommended to set the maximum transmission unit (MTU) of the VPC to 8896. However, ensure that these MTU settings do not interfere with other resources using the VPC.

3 Deploying a Cluster

The FlashGrid Launcher tool simplifies deployment of Oracle RAC clusters on Google Cloud Compute Engine by automating the following tasks:

- Creating and configuring VPC, subnet, and firewall rules (optional)
- Creating block storage volumes and launching VMs for all nodes in the cluster
- Installing and configuring FlashGrid Cloud Area Network
- Installing and configuring FlashGrid Storage Fabric
- Installing and patching Oracle Grid Infrastructure software
- Configuring Grid Infrastructure cluster
- Installing and patching Oracle Database software
- Creating ASM disk groups

To create a cluster

1. Log in to GCP Console with a user account that has the following privileges:
 - Compute Admin
 - Deployment Manager Editor
2. Open FlashGrid Launcher tool:
 - Start with one of the standard configurations at <https://www.flashgrid.io/products/flashgrid-for-oracle-rac-on-gcp/>
 - or, if you have a custom configuration file, upload it at <https://2411.cloudprov.flashgrid.io/>
3. Configure parameters of the cluster
4. Click *Validate Configuration* button
5. If verification passes, then click *Generate Template* button
6. Copy the cloud shell command and run it in Google Cloud Shell to create the cluster deployment
7. Wait until creating the deployment completes
8. SSH to the first (as it was specified on the cluster configuration page) cluster node with your username
Note: If you selected to create a new VPC and connecting through a public IP address then need to edit VPC Network attached to the database nodes. In the *Firewall Rules* section select the rule corresponding to *tcp:22*, edit it, and add your client system IP to the *Source IP ranges* field.
9. The welcome message will show the current initialization status of the cluster: in progress, failed, or completed.
10. If initialization is still in progress, then wait for it to complete (this includes Oracle software installation and configuration). You will receive a broadcast message when initialization completes or fails. Cluster initialization takes 1 to 2 hours depending on configuration.

Note: for deploying FlashGrid Cluster with **SELinux** please refer to the following knowledge base article: <https://support.flashgrid.io/hc/en-us/articles/26368224225687-How-to-enable-disable-SELinux>

4 After Deploying a Cluster

4.1 Verifying cluster status

On any of the cluster nodes run `flashgrid-cluster` command to verify that the cluster status is *Good* and that all checks are passing.

```
[fg@rac1 ~]$ flashgrid-cluster
FlashGrid 18.07.10.46032 #95f2b5603f206af26482ac82386b1268b283fc3c
License: via Marketplace Subscription
Support plan: 24x7
~~~~~
FlashGrid running: OK
Clocks check: OK
Configuration check: OK
Network check: OK

Querying nodes: quorum, rac1, rac2 ...

Cluster Name: myrac
Cluster status: Good
-----
Node      Status  ASM_Node  Storage_Node  Quorum_Node  Failgroup
-----
rac1     Good   Yes       Yes           No           RAC1
rac2     Good   Yes       Yes           No           RAC2
racq     Good   No        No            Yes          QUORUM
-----
-----
GroupName  Status  Mounted  Type      TotalMiB  FreeMiB  OfflineDisks  LostDisks  Resync  ReadLocal  Vote
-----
GRID       Good   AllNodes  NORMAL    12588     3376     0              0           No     Enabled    3/3
DATA       Good   AllNodes  NORMAL    2048000   2048000  0              0           No     Enabled    None
FRA        Good   AllNodes  NORMAL    1024000   1024000  0              0           No     Enabled    None
-----
```

4.2 OS user accounts

During cluster initialization the following OS user accounts are created:

- *fg* - the user account for running some of the FlashGrid Storage Fabric or FlashGrid Cloud Area Network utilities. The user *fg* has sudo rights. It also has key-based passwordless SSH configured between all nodes of the cluster, which makes it easy to move between the nodes.
- *grid* - Grid Infrastructure (GI) owner. GI environment variables are preconfigured.
- *oracle* - Database home owner. Database environment variables, except `ORACLE_SID` and `ORACLE_UNQNAME`, are preconfigured. After creating a database, you can configure `ORACLE_SID` and `ORACLE_UNQNAME` by editing `/home/oracle/.bashrc` file on each database node.

Note that no passwords are configured for any users. Also, password based SSH authentication is disabled in `/etc/ssh/sshd_config`. Key-based authentication is recommended for better security. Creating passwords for any user is not recommended.

User *fg* has sudo rights and allows switching to any other user without requiring a password (which is not configured by default). Example:

```
$ sudo su - grid
```

Users *fg*, *grid*, and *oracle* have key-based SSH access configured between the nodes of the cluster. The corresponding key pairs are generated automatically during cluster initialization. For example, if you are logged in to *node1* as user *fg* then you can SSH into *node2* by simply running `'ssh node2'` without entering a password or providing a key.

4.3 Finalizing cluster configuration

See knowledge base articles for performing the following steps:

1. Creating a database: <https://support.flashgrid.io/hc/en-us/articles/1500011215081>
2. Connecting clients to a database: <https://support.flashgrid.io/hc/en-us/articles/1500011176122>

Note: ACFS support on RHEL may require the additional Oracle Clusterware patch. Please refer to Oracle Doc ID 1369107.1 for ACFS patch information.

4.4 Enabling deletion protection

If the cluster is for production use, then it is strongly recommended to enable deletion protection for each VM.

4.5 Installing an additional database home

In most cases manual installation of database software is not required. However, if you need to install an additional database home, then follow Oracle Database documentation for installing the database software.

4.6 Use of anti-virus and other third-party software

If anti-virus software must be used, then it is recommended to configure it in a way that avoids putting any files in quarantine. Automatic quarantine of files creates risk of the cluster downtime in case of a false positive detection on a critical system file on multiple nodes of the cluster.

Any proprietary kernel modules installed by third-party software create risks to reliable operation of the system. Such proprietary kernel modules are not tested or supported by FlashGrid, Red Hat, or Oracle. Proprietary kernel modules may consume kernel resources and may create instability, especially under high load. Symptoms may include kernel crashes, network disruptions, storage i/o disruptions, node evictions, and cluster brown-out. If such reliability issue is encountered and no other root cause can be readily identified, FlashGrid support reserves the right to request removal of all proprietary kernel modules before continuing investigation.

4.7 Use of automatic configuration tools

Automatic configuration tools (e.g. Ansible, Salt, etc.) must be used with extra care. Incorrect modification of a critical system file (e.g. /etc/resolv.conf) on multiple cluster nodes may cause cluster downtime. Note that many critical system configuration files are protected with immutable attribute and have warnings in them. Do not remove the immutable attribute or allow automatic modification of such files unless absolutely necessary.

4.8 Security hardening

For applying security hardening to the OS using CIS aligned security profiles, see <https://support.flashgrid.io/hc/en-us/articles/5883226799639>

For applying a different hardening profile, the following steps are recommended:

- 1) Request FlashGrid support to review the list of required changes.
- 2) Back up all cluster nodes: <https://support.flashgrid.io/hc/en-us/articles/1500011175542>
- 3) Implement the required changes on all nodes.
- 4) Restart the entire cluster: <https://support.flashgrid.io/hc/en-us/articles/4404886607383>
- 5) Verify health of the cluster as user *fg*:

```
$ flashgrid-health-check
```

- 6) In case of errors, roll back the changes or restore the nodes from backup.

5 Monitoring Cluster Health

The following methods of monitoring cluster health are available:

- *flashgrid-health-check* utility checks multiple items including database configuration, storage, OS kernel, config file modifications, errors in the logs, and other items that may affect health of the cluster or could help with troubleshooting. It is recommended for manual checks only.
- *flashgrid-cluster* utility displays status of the storage subsystem (FlashGrid Storage Fabric and ASM) and its main components. The utility can be used in monitoring scripts. It returns a non-zero value if status of the cluster is *Warning* or *Critical*.
- Alerts about failures are recorded in system log and can be analyzed by 3rd-party tools.
- Email alerts can be sent to one or several email addresses.
- ASM disk group monitoring and alerting via Oracle Enterprise Manager.

To test email alerts

1. On all nodes (including quorum node) run:

```
$ flashgrid-node test-alerts
```

2. Check that test alert emails were received from all cluster nodes at each of the configured email addresses.

To modify the list of email alert recipients

As user *fg* on any database node run:

```
$ flashgrid-cluster set-email-alerts name1@host1 name2@host2 ...
```

Note that by default the *From* address is set to *flashgrid@localhost.localdomain*. This will ensure that delivery failure notifications are sent to root's mailbox on the originating node, which can help with troubleshooting delivery issues. It is recommended to add this address to the whitelist of senders on the receiving email server and in the email clients.

6 Before Going Live

Before switching the cluster to live use (run commands as user *fg*):

1. Verify health of the cluster: `$ flashgrid-health-check`
2. Confirm that email alerts are configured and delivered: `$ flashgrid-node test-alerts`
3. Upload diags to FlashGrid support: `$ flashgrid-diags upload-all`
4. Stop the cluster and back up all cluster nodes:
<https://support.flashgrid.io/hc/en-us/articles/4404882534423-Shutting-down-entire-cluster-GCP->
5. Start the cluster and do final check of the cluster health: `$ flashgrid-health-check`

7 Deleting a cluster

To delete a cluster

1. Disable VM deletion protection for each cluster node if it was enabled
2. Open *Deployment Manager* console
3. Select deployment corresponding to the cluster
4. Click *Delete*

8 Additional Documentation

Knowledge Base: <https://support.flashgrid.io/hc/en-us/categories/1500001520262-FlashGrid-Cluster-on-GCP>

Backup Best Practices on Google Cloud: <https://support.flashgrid.io/hc/en-us/articles/1500011175542>

FlashGrid Storage Fabric CLI Reference Guide: <https://support.flashgrid.io/hc/en-us/articles/1500011214681>

FlashGrid Cloud Area Network CLI Reference Guide: <https://support.flashgrid.io/hc/en-us/articles/1500011214661>

9 Contacting Technical Support

For technical help with FlashGrid Cluster please open a support request at <https://www.flashgrid.io/support/>

To expedite troubleshooting please also collect and upload diagnostic data to the secure storage used by FlashGrid support by running the following command as user *fg*:

```
$ flashgrid-diags upload-all
```

For reporting *emergency* type of issues that require immediate attention please also use the 24/7 telephone hotline: +1-650-641-2421 ext 7. Please note that use of the 24/7 hotline is reserved for emergency situations only.

Copyright © 2016-2024 FlashGrid Inc. All rights reserved.

This document is provided for information purposes only, and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document, and no contractual obligations are formed either directly or indirectly by this document.

FlashGrid is a registered trademark of FlashGrid Inc. Google and Google Cloud are registered trademarks of Google LLC. Oracle and Java are registered trademarks of Oracle and/or its affiliates. Red Hat is a registered trademark of Red Hat Inc. Other names may be trademarks of their respective owners.