FlashGrid® Server

for Oracle Database on AWS

Deployment Guide

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1 Introduction

FlashGrid Server is an engineered cloud system for running Oracle Databases in public clouds. This guide provides step-by-step instructions for system and database administrators deploying FlashGrid Server with Oracle Database on AWS cloud.

1.1 Key Components

Key components of FlashGrid Server on AWS:

- FlashGrid Storage Fabric software
- FlashGrid Cloud Area Network software
- FlashGrid Diagnostics software
- FlashGrid Health Checker software
- Oracle Database: 19c
- Oracle Grid Infrastructure: 19c
- Operating Systems:
    - **Oracle Linux:** 8 (UEKR7), or 9 (UEKR7)
    - **Red Hat Enterprise Linux (RHEL):** 8, or 9

    Note: Contact FlashGrid support if new deployment with RHEL 7 or Oracle Linux 7 is required.

- Amazon EC2 instances:
    - **General purpose:** M8i, M8a, M8azn, M7i, M7a, M6i, M6in, M6a
    - **Memory optimized:** R8i, R8a, R7i, R7iz, R7a, R6i, R6in, R6a, R5b, High Memory, X8i, X8aedz, X2idn, X2iedn, X2iezn, Z1d
- Disks: EBS GP3 volumes, EBS GP2 volumes (AWS Outposts only)
- AWS regions: all available regions.

1.2 Infrastructure-as-Code Deployment

FlashGrid Server is delivered as an AWS CloudFormation or Terraform template that automates configuration of multiple components required for a database. FlashGrid Launcher is an online tool that simplifies the deployment process by guiding through the system configuration parameters and generating CloudFormation or Terraform templates.

2 Prerequisites

2.1 Required Knowledge

Working knowledge of the following AWS services is required for successful deployment of FlashGrid Server on AWS: EC2, VPC, EBS, CloudFormation, S3, IAM, Marketplace.

2.2 Getting access to FlashGrid Server AMI from AWS Marketplace

To be able to create an instance, your AWS account must have an active subscription to the selected FlashGrid AMI. Otherwise deployment will fail when creating EC2 instances. The FlashGrid AMIs are based on either Oracle Linux or RHEL.

To get access to the FlashGrid AMI

1. Open FlashGrid product page in Marketplace:
   - Oracle Linux 8 based AMI
   - Oracle Linux 9 based AMI
   - RHEL 8 based AMI
   - RHEL 9 based AMI
2. Click ***View Purchase Options*** button
3. Click ***Accept Terms*** button

Software fees charged through AWS Marketplace include FlashGrid software license and 24x7 Mission-Critical support plan. The fees are charged per instance and depend on the selected EC2 instance type and size. *Hourly* and *Annual* subscription models are available. Pricing information is available on the AWS Marketplace product pages – see the links above.

2.3 Uploading Oracle installation files to S3

During instance initialization Oracle installation files will be downloaded from an S3 bucket. The list of files that must be placed in the S3 bucket will be shown by the FlashGrid Launcher tool. The same S3 bucket can be used for deploying multiple instances.

Please refer to the KB article https://support.flashgrid.io/hc/en-us/articles/1500011175802-Uploading-Oracle-Installation-Files-to-S3 for the steps to upload Oracle installation files to S3.

2.4 Preparing the VPC

When creating a new instance, you have two options:

- **Automatically create a new VPC.**
  This option is usually used for test systems isolated in their own sandbox VPCs. A VPC will be created together with the required subnet and security groups. By default, the VPC will be created with CIDR 10.100.0.0/16

- **Create the instance 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 instance. You will need to provide the VPC ID in the FlashGrid Launcher tool and subnet ID and security group IDs in the CloudFormation Manager.

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

- 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 have to use VPC with CIDR that overlaps with 192.168.0.0/16 then please request a customized configuration file from FlashGrid technical support.
- The VPC has a subnet in the availability zone used for the instance.
- The VPC has an S3 endpoint configured (required unless public IPs can be enabled for access to S3)
- If you choose to enable Public IPs on the EC2 instance, then the VPC must have Internet Gateway configured.
- The VPC has a security group with the following ports open for inbound traffic:
  - TCP port 22 for SSH access to the instance
  - TCP port 5901 if you choose to use VNC for creating a database using DBCA in GUI mode
  - TCP port 1521 for database client and application server access

3 Deploying FlashGrid Server

The FlashGrid Launcher tool simplifies instance deployment in AWS by automating the following tasks:

- Creating and configuring EC2 VPC, subnet, security group (optional)
- Creating EBS volumes and launching an EC2 instance
- Installing and configuring FlashGrid software
- Installing and patching Oracle Grid Infrastructure software
- Configuring Grid Infrastructure
- Installing and patching Oracle Database software
- Creating ASM disk groups

To create an instance with CloudFormation

1. Log in to AWS Management Console with a user account that has the following privileges:
    - AWSCloudFormationFullAccess
    - AmazonEC2FullAccess
    - AmazonVPCFullAccess (required only if creating a new VPC)
2. Open FlashGrid Launcher tool:
    - Start with one of the standard configurations at https://www.flashgrid.io/products/flashgrid-for-oracle-db-on-aws/
    - or, if you have a custom configuration file, upload it at https://2603.cloudprov.flashgrid.io
3. Configure parameters for the deployment
4. Click *Validate Configuration* button
5. If verification passes then click *Launch* button, which will take you to AWS CloudFormation Manager
6. Click *Next*
7. Select your SSH key
8. If using an existing VPC, then select subnet and security group.
9. Click *Next*
10. On the *Options* page:
    - If you added tags in FlashGrid Launcher then **do not** add the same tags in CloudFormation Manager
    - If the instance is for production use then expand the *Advanced* options and enable *Termination Protection*
11. Click *Next*
12. Click *Create*
13. Wait until the status of the stack changes to *CREATE_COMPLETE*
14. If creating the stack fails:
    a) Check for the cause of the failure on the *Events* tab
    b) Correct the cause of the error
    c) Delete the failed stack
    d) Repeat the steps for creating a new stack
15. Use EC2 Management Console to get IP addresses of the instance
16. SSH to the instance as user *ec2-user*
17. The welcome message will show the current software initialization status: in progress, failed, or completed.
18. If software initialization is still in progress then wait for it to complete. You will receive a broadcast message when software initialization completes or fails. Software initialization takes approximately 30 minutes, this includes Oracle software installation and configuration.

Note: for deploying FlashGrid Server 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

4.1 Verifying an Instance Status

On an instance run `flashgrid-health-check` command to verify that the instance status is *Good* and all checks are passing.

```
[fg@myhostname ~]$ flashgrid-health-check

HealthCheck 20.9.1.57074 #7226b34d571618368a70c9af809e5f150f8c67ba
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Check: ASM DiskGroup status
    myhostname: OK
      ------------------------------------------------------------------------------------------------------------
      GroupName  Status  Mounted   Type    TotalMiB  FreeMiB  OfflineDisks  LostDisks  Resync  ReadLocal  Vote
      ------------------------------------------------------------------------------------------------------------
      DATA       Good    AllNodes  EXTERN  6144      6028     0             0          No      Enabled    N/A
      FRA        Good    AllNodes  EXTERN  6144      6040     0             0          No      Enabled    N/A
      GRID       Good    AllNodes  EXTERN  5120      5020     0             0          No      Disabled   N/A
      ------------------------------------------------------------------------------------------------------------

Check: Alerts in Storage Fabric logs in the last 7 days
      myhostname: OK

Check: Available memory
      myhostname: OK : avail mem: 27.7%

Check: Check db memory settings
      myhostname: OK

Check: Check local_listener for each db
      myhostname: OK

Check: Check tnsnames.ora
      myhostname: OK

Check: Flashgrid CLAN check
      myhostname: OK

Check: Free system disk space
      myhostname: OK : /u01: avail 66%, /: avail 90%

Check: Kernel taint check
      myhostname: OK

Check: SF node status
      myhostname: OK

Check: Swap disabled
      myhostname: OK : Swap disabled

Check: System config file modifications
      myhostname: OK

Check: System services
      myhostname: OK

Check: Unexpected or 3rd party RPMs installed
      myhostname: OK

Check: Unexpected or 3rd party services enabled
       myhostname: OK
```

4.2 OS User Accounts

During software initialization the following OS user accounts are created:

- *ec2-user* - the user account used to SSH to the EC2 instance with the SSH key that was selected when creating the instance configuration. The user has sudo rights.
- *fg* – can be used for running FlashGrid Storage Fabric or FlashGrid Cloud Area Network utilities. The user *fg* has sudo rights.
- *grid* - Grid Infrastructure 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 an instance.

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.

Users *ec2-user* and *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
```

4.3 Finalizing Software 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 an additional Oracle Clusterware patch. Please refer to Oracle KB129209 for ACFS patch information.

4.4 Enabling Termination Protection

If termination protection was not enabled when creating the instance and if the instance is for production use then it is strongly recommended to enable termination protection:

- Enable instance termination protection
- Enable termination protection for the CloudFormation stack

4.5 Installing an Additional Database Home

In most cases manual installation of database software is not required. However, if you need an additional software 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 system downtime in case of a false positive detection on a critical system file on a EC2 instance.

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 Linux. 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, and server 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) may cause system 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

The system is deployed using RHEL or Oracle Linux images that have main security best practices implemented by default. The following steps are recommended, in case additional security hardening is required:

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 an instance: https://support.flashgrid.io/hc/en-us/articles/1500011214581-FlashGrid-Server-non-clustered-on-AWS-Backup-Best-Practices
3) Implement the required changes
4) Restart the instance: https://support.flashgrid.io/hc/en-us/articles/4404887458327-Rebooting-FlashGrid-Server-System-
5) Verify health of the instance as user *fg*:

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

6) In case of errors, roll back the changes or restore the instance from backup

4.9 Convert RHEL PAYG to BYOS License

If RHEL is used, the EC2 instance is provisioned with a RHEL PAYG license attached. To adopt BYOS, the RHEL license must be converted as per the procedure documented by AWS, following server deployment.

5 Monitoring Instance Health

The following methods of monitoring system 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 system or could help with troubleshooting. It is recommended for manual checks only.
- *FlashGrid Node Monitor* service is part of the *flashgrid-diags* package. It provides monitoring of various system health indicators, including CPU utilization, available memory, and clocks.
- Alerts about failures are recorded in system log and can be analyzed by 3rd-party tools.
- Email alerts can be configured in FlashGrid Launcher and sent to one or several email addresses. See the Knowledge Base article Configuring email for FlashGrid notifications.
- *FlashGrid Node Monitor* can send alerts and diagnostic uploads via HTTP/HTTPS to a remote endpoint, with support for routing through an HTTP proxy. Node Monitor detects a condition, then sends either an email alert and/or an HTTP/REST request to a monitoring/alerting service.
- ASM disk group monitoring and alerting via Oracle Enterprise Manager.

6 Before Going Live

Before switching the instance to live use:

1. Apply the latest FlashGrid, OS, and Oracle software and security updates:
    - https://support.flashgrid.io/hc/en-us/articles/4404881233943
    - https://support.flashgrid.io/hc/en-us/articles/4404886257431-Updating-OS-AWS-
    - https://support.flashgrid.io/hc/en-us/articles/4405037064855-Applying-Grid-Infrastructure-and-Database-patches
2. Confirm that only minimally required access is allowed in the security groups used by the cluster node instances. Remove unnecessary access.

The commands below should be run as user *fg*:

3. Verify health of the instance: `$ flashgrid-health-check`
4. Confirm that email alerts are configured and delivered: `$ flashgrid-node test-alerts`
5. Upload diags to FlashGrid support: `$ flashgrid-diags upload-all`
6. Stop the instance and back it up: https://support.flashgrid.io/hc/en-us/articles/1500011214581-FlashGrid-Server-non-clustered-on-AWS-Backup-Best-Practices
7. Start the instance and do final check of the instance health: `$ flashgrid-health-check`

7 Deleting an Instance

To delete an instance

1. Disable instance termination protection if it was enabled
2. Open AWS CloudFormation Manager console
3. Disable termination protection for the corresponding CloudFormation stack if it was enabled
4. Delete the stack corresponding to the instance
5. If any EBS volumes were added after deploying the instance, those volumes must be deleted separately
6. If any AMI images or volume snapshots were created after deploying the instance, those AMIs and snapshots must be deleted separately

8 Additional Documentation

Knowledge Base: https://support.flashgrid.io/hc/en-us/categories/1500001538061-FlashGrid-Server-on-AWS

Backup and Restore Best Practices on AWS: https://support.flashgrid.io/hc/en-us/articles/1500011214581-FlashGrid-Server-non-clustered-on-AWS-Backup-Best-Practices

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 Technical Support

For technical help with FlashGrid Server 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.

Support Tiers and SLA details: https://www.flashgrid.io/docs/FlashGrid_technical_support_services.pdf