

FlashGrid® Cloud Area Network™

Version 17.05

Deployment Guide
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Table of Contents

- 1 Introduction 3
- 2 OS Compatibility..... 3
- 3 Defining CLAN Subnets..... 3
- 4 Client to Database Connectivity Options 4
- 5 Configuring Base Network 4
- 6 Installing FlashGrid CLAN Software..... 5
- 7 Configuring FlashGrid CLAN 5
 - 7.1 Automated vs. manual configuration 5
 - 7.2 User account for configuring CLAN 5
 - 7.3 Viewing current CLAN configuration..... 6
 - 7.4 Adding a CLAN client node..... 6
 - 7.5 Removing a CLAN client node 7
 - 7.6 Manually creating CLAN cluster configuration 8
- 8 Updating FlashGrid CLAN software..... 8
- 9 Contacting FlashGrid Technical Support 9

1 Introduction

This document is intended for system administrators who deploy and maintain FlashGrid Cloud Area Network™ (CLAN) software. FlashGrid CLAN enables running high-speed clustered applications, such as Oracle RAC, in public IaaS clouds or multi-datacenter environments with the efficiency and control of a Local Area Network.

Examples in this document are focused on Oracle RAC deployments in the public IaaS clouds. However, the same general principles are applicable in other environments.

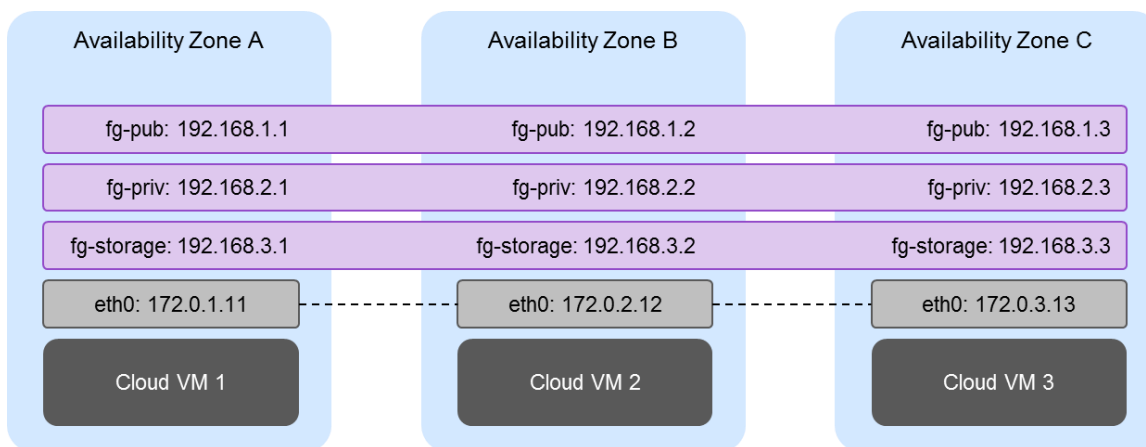


Figure 1. FlashGrid CLAN Architecture

Network capabilities enabled by FlashGrid CLAN:

- Each type of traffic has its own virtual LAN with a separate virtual NIC, e.g. *fg-pub*, *fg-priv*, *fg-storage*
- Minimum guaranteed bandwidth allocation for each traffic type while accommodating traffic bursts
- Low latency of the cluster interconnect in the presence of large volumes of traffic of other types
- Transparent connectivity across availability zones or data centers
- Transparent VIP failover
- Multicast support

2 OS Compatibility

- Oracle Linux 7.2/7.3/7.4 or Red Hat Enterprise Linux 7.2/7.3/7.4
- Red Hat kernel version 3.10.0-514.el7.x86_64 or later
- Oracle UEK R4 Update 3 kernel version 4.1.12-94.el7uek or later
- Network Manager is not compatible with FlashGrid CLAN and must be uninstalled

3 Defining CLAN Subnets

A typical Oracle RAC cluster in a public cloud will have the following CLAN subnets configured:

- *fg-pub*: public network with host IPs, VIPs, and SCAN VIPs
- *fg-priv*: Oracle private network (or Private+ASM in case of Flex ASM configuration)
- *fg-storage*: used by FlashGrid Storage Fabric

Different types of nodes require different sets of CLAN subnets:

- Database/ASM nodes: fg-pub, fg-priv, fg-storage
- Quorum nodes: fg-pub, fg-storage
- Client nodes (typically application servers):
 - fg-pub if connecting via SCAN address
 - no CLAN if connecting directly to database servers via VPC private IP addresses

4 Client to Database Connectivity Options

Two options are available for connecting clients to RAC database nodes:

- DB clients that have fg-pub CLAN subnet configured can connect via SCAN address. In case a database node goes down, the SCAN VIPs move to the surviving database node(s). This allows instantaneous and transparent client connectivity to the surviving database node(s).
- DB clients that do not have CLAN configured can connect to the database nodes via their VPC private IP addresses. This option allows higher degree of isolation between the client and database nodes by placing them in different network subnets or security groups and enabling firewall between them.

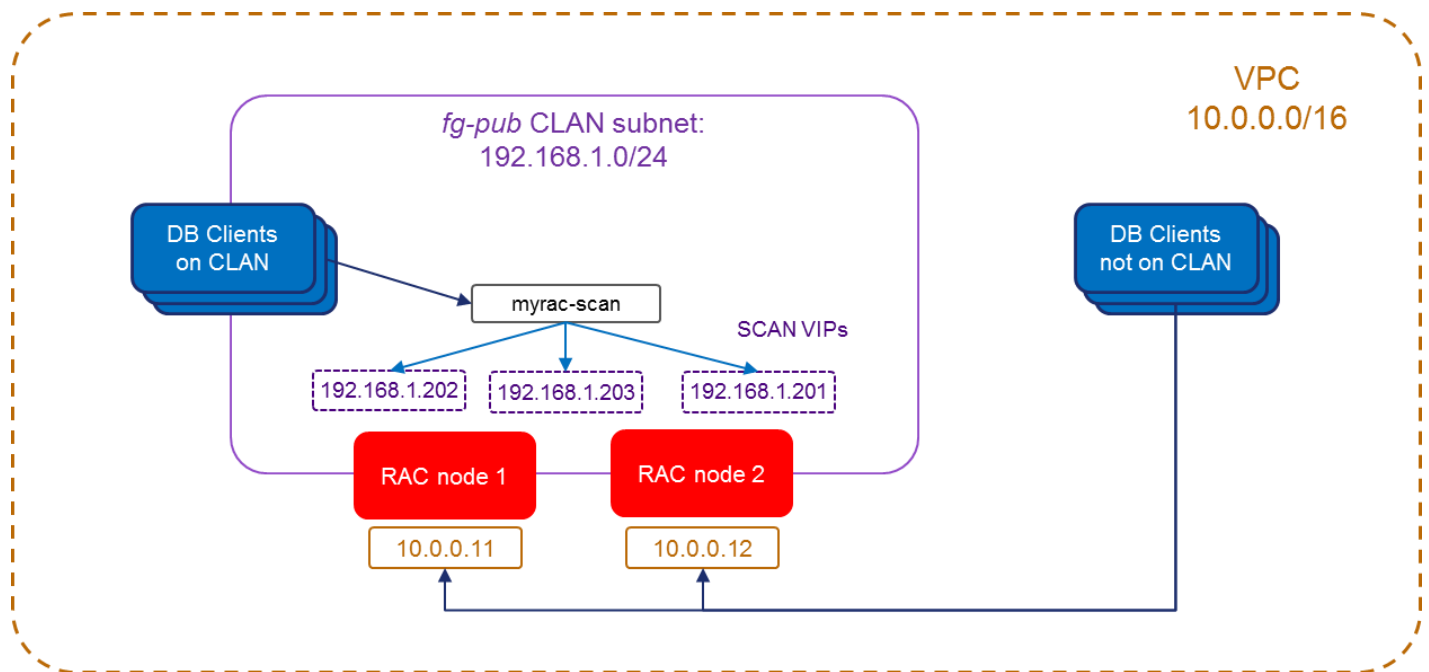


Figure 2. Database client connectivity

5 Configuring Base Network

The base network must provide IPv4 connectivity between nodes. FlashGrid CLAN uses UDP as an underlying transport. Each CLAN subnet uses a separate UDP port determined by the *net_id* of the subnet. The UDP port number is 4789 + *net_id*. The corresponding UDP ports must be open between the nodes.

Example 1: App server with a single *fg-pub* CLAN subnet with *net_id* = 1 must have UDP port 4790 open.

Example 2: Database server with *fg-pub* (net_id = 1), *fg-priv* (net_id = 2), *fg-storage* (net_id = 3) CLAN subnets must have UDP ports 4790, 4791, 4792 open.

Setting maximum supported MTU size is recommended for best performance.

In an AWS or Azure environment do not configure multiple NICs per instance. The total available network bandwidth will not be increased by adding extra NICs. Same applies to other environments that have fixed network bandwidth allocation per instance (vs. per NIC).

In AWS the node instances running FlashGrid CLAN must have *Enhanced Networking* and *EBS Optimized* mode enabled.

6 Installing FlashGrid CLAN Software

The FlashGrid CLAN software is provided as a single RPM package. Additional open-source RPMs required by the FlashGrid software are provided in YUM repositories and as TAR packages. All RPMs must be installed on every node in a FlashGrid CLAN cluster including database nodes, storage nodes, quorum nodes, and CLAN client nodes.

To install the FlashGrid CLAN software, complete the following steps on each node

1. Download and install FlashGrid open source repository RPM from flashgrid.io/downloads/

```
# yum install flashgrid-oss-local-repo-17.05-1.noarch.rpm
```

2. Download the FlashGrid CLAN software RPM from flashgrid.io/downloads/

3. Erase Network Manager RPM if it is installed

```
# yum erase NetworkManager
```

4. Use YUM to install the downloaded RPMs and their dependencies:

```
# yum install flashgrid-clan-17.05.*.rpm
```

7 Configuring FlashGrid CLAN

7.1 Automated vs. manual configuration

FlashGrid Automated Cloud Provisioning tool for Oracle RAC creates core CLAN cluster configuration automatically for all database, storage, and quorum nodes. Client nodes that require connectivity to database nodes via SCAN address may need to be added manually to the core CLAN configuration.

In environments other than Oracle RAC, FlashGrid CLAN configuration must be created manually for all nodes.

7.2 User account for configuring CLAN

CLAN configuration tool performs cluster-wide operations across the cluster nodes. Such operations require passwordless SSH access between all cluster nodes.

FlashGrid Automated Cloud Provisioning for Oracle RAC creates user `fg@` for performing CLAN configuration operations. In other environments creating user `fg@` is recommended with the following capabilities:

- passwordless SSH configured between all nodes in the CLAN cluster
- sudo privileges for running any command without entering password

If the required sudo privileges are not allowed then manual copying of the CLAN cluster configuration file will be needed for applying changes in the core CLAN cluster configuration.

7.3 Viewing current CLAN configuration

To view core CLAN cluster configuration

```
$ flashgrid-clan-cfg
```

Example:

```
[fg@rac1 ~]$ flashgrid-clan-cfg
Reading config from racq ...
Reading config from rac2 ...
Comparing configs from: rac1, rac2, racq
-----
Name  IPAddr          Role      ID
-----
rac1  10.100.101.177  database  1
rac2  10.100.102.85   database  2
racq  10.100.103.9    quorum    3
-----
```

7.4 Adding a CLAN client node

Two options are available for adding a CLAN client node to a CLAN cluster:

- **Without adding the client to the core CLAN cluster configuration**
This option is recommended in most cases. It provides maximum flexibility and allows adding or removing CLAN clients without changing the core CLAN cluster configuration.
- **Client added to the core CLAN cluster configuration**
This option may be used only when no frequent additions or removals of CLAN client nodes are anticipated. For transparent configuration updates across all nodes, user fg@ must have sudo privileges for executing any command with no password and passwordless SSH access configured between database/storage/quorum nodes of the cluster.

To add a CLAN client without adding it to the core CLAN configuration (recommended in most cases)

1. On any database node, create configuration file for the new client

```
$ flashgrid-clan-cfg create-client-config <client-ID> <client-IP-address>
```

The *client-ID* must be a unique integer between 100 and 254.

client-IP-address is the private IP address in the base network, e.g. VPC in AWS or VNET in Azure.

Example:

```
$ flashgrid-clan-cfg create-client-config 123 11.12.13.14
```

2. Copy the resulting client node configuration file `/tmp/flashgrid-clan-node.<client-ID>.cfg` to `/etc/flashgrid-clan-node.<client-ID>.cfg` on the client node.

To add a CLAN client to the core CLAN configuration

1. On any database node, add client to the core CLAN configuration as user fg@

```
$ sudo flashgrid-clan-cfg add-client <client-name> <client-IP-address>
```

client-IP-address is the private IP address in the base network, e.g. VPC in AWS or VNET in Azure.

Example:

```
$ sudo flashgrid-clan-cfg add-client app2 11.12.13.14
```

2. Copy the resulting client node configuration file `/tmp/flashgrid-clan-node.cfg.<client-name>` to `/etc/flashgrid-clan-node.cfg` on the client node.

To start CLAN on the client node

1. Open UDP port 4790 (assuming that `net_id=1` for fg-pub network) for traffic between the database nodes and the client node.

2. On the client, install flashgrid-clan RPM if it is not installed yet

```
# yum install flashgrid-clan-17.05-*.rpm
```

3. On the client, enable and start *flashgrid-clan* service

```
# systemctl enable flashgrid-clan; systemctl start flashgrid-clan
```

4. On the client, verify that the *flashgrid-clan* service started successfully

```
# systemctl status flashgrid-clan
```

5. On the client, verify that the new virtual NIC (typically *fg-pub*) is now available

```
$ ip a
```

6. Verify that the client node can ping all database nodes via the CLAN virtual NIC. Example:

```
$ ping 192.168.1.1
```

```
$ ping 192.168.1.2
```

7.5 Removing a CLAN client node

To remove a CLAN client node

1. If the client node is part of the core CLAN configuration, as user fg@ on any database node remove the client from the core CLAN configuration

```
$ sudo flashgrid-clan-cfg remove-client <client-name>
```

2. On the client, stop *flashgrid-clan* service

```
# systemctl stop flashgrid-clan
```

3. On the client, uninstall flashgrid-clan RPM

```
# yum erase flashgrid-clan
```

4. On the client, remove CLAN node configuration file

```
# rm /etc/flashgrid-clan-node.cfg
```

7.6 Manually creating CLAN cluster configuration

To manually configure CLAN cluster

1. Request FlashGrid support to provide you with a CLAN cluster configuration file *flashgrid-clan.cfg* for your environment
2. Place the file as `/etc/flashgrid-clan.cfg` on one of the database nodes
3. On the same database node, as user `fg@` deploy the configuration to all nodes of the CLAN cluster using force option

```
$ sudo flashgrid-clan-cfg deploy-config -f
```

4. On all nodes of the CLAN cluster, enable and start `flashgrid-clan` service and verify its status

```
# systemctl enable flashgrid-clan; systemctl start flashgrid-clan; systemctl status flashgrid-clan
```

5. Verify that the required virtual network interfaces were created

```
# ip link
```

8 Updating FlashGrid CLAN software

The following procedure applies to minor updates. Minor updates are those that have the same first two numbers in the version number, for example, from 17.5.31 to 17.5.50. However, update from 17.1 to 17.3 is considered major and may require a different procedure. Contact FlashGrid support for assistance if you need to do a major version update.

To update FlashGrid CLAN software in a running cluster repeat the following steps on each node, one node at a time

1. If the node has ASM running then stop Oracle CRS:
2. If the node is a member of a FlashGrid Storage Fabric cluster then stop the FlashGrid Storage Fabric services:

```
# crsctl stop crs
```

```
# flashgrid-node stop
```

3. Update the FlashGrid CLAN RPM using yum or rpm tool

4. Restart FlashGrid CLAN

```
# systemctl restart flashgrid-clan
```

5. If the node is a member of a FlashGrid Storage Fabric cluster then start the FlashGrid service

```
# flashgrid-node start
```

6. If the node has ASM installed on it then start OHASD and then CRS:

```
# systemctl start oracle-ohasd
```

```
# crsctl start crs -wait
```

7. Wait until all disks are back online and resyncing operations complete on all disk groups before updating the next node. All disk groups must have zero offline disks and *Resync = No*.

```
# flashgrid-cluster
```


9 Contacting FlashGrid Technical Support

For help with troubleshooting an issue on an existing FlashGrid cluster please use Technical Support Request form located at <https://www.flashgrid.io/support/>

Customers with Mission-Critical SLA subscription may also use the 24x7 telephone hotline for reporting critical issues that require immediate attention: +1-650-641-2421 ext 7