# Magma Federation Gateway

| Sl. No. | Document Name | Version | Authors |
|---------|---------------|---------|---------|
| 1. | Installation | 0.1 | Athira Vinod |
| 2. | Integration with HSS | In Progress | |

The federated gateway provides remote procedure call (GRPC) based interfaces to standard 3GPP components, such as HSS (S6a, SWx), OCS (Gy), and PCRF (Gx). The exposed RPC interface provides versioning & backward compatibility, security (HTTP2 & TLS) as well as support for multiple programming languages. The Remote Procedures below provide simple, extensible, multi-language interfaces based on GRPC which allow developers to avoid dealing with the complexities of 3GPP protocols. Implementing these RPC interfaces allows networks running on Magma to integrate with traditional 3GPP core components.

## Architecture
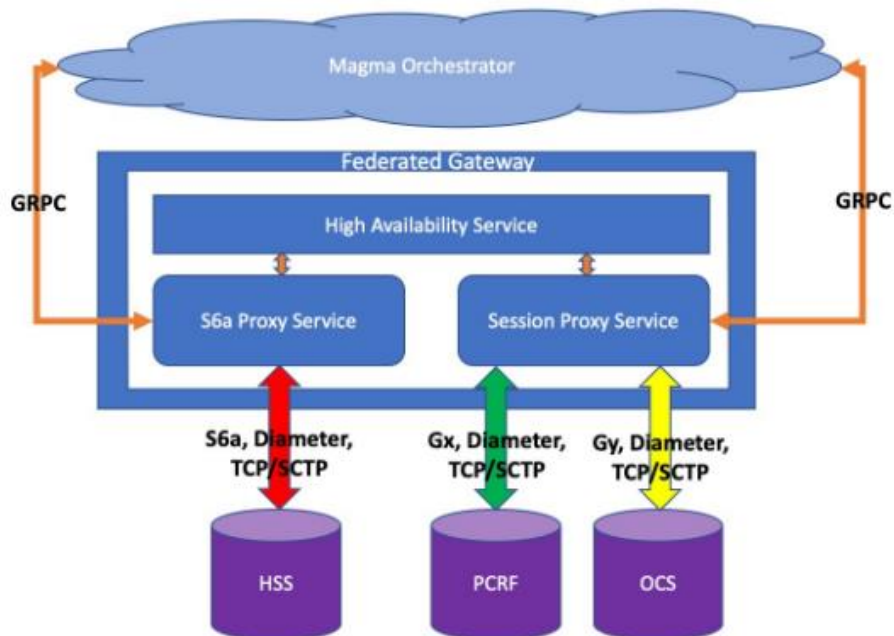


The Federated Gateway supports the following features and functionalities:

1. Hosting centralized control plane interface towards HSS, PCRF, OCS and MSC/VLR on behalf of distributed AGW/EPCs.
2. Establishing diameter connection with HSS, PCRF and OCS directly as 1:1 or via DRA.
3. Establishing SCTP/IP connection with MSC/VLR.
4. Interfacing with AGW over GRPC interface by responding to remote calls from EPC (MME and Sessiond/PCEF) components, converting these remote calls to 3GPP compliant messages and then sending these messages to the appropriate core network components such as HSS, PCRF, OCS and MSC. Similarly, the FeG receives 3GPP compliant messages from HSS, PCRF, OCS and MSC and converts these to the appropriate GRPC messages before sending them to the AGW.

**Federated Gateway Services & Tools**

The following services run on the federated gateway:

- s6a_proxy - translates calls from GRPC to S6a protocol between AGW and HSS
- session_proxy - translates calls from GRPC to gx/gy protocol between AGW and PCRF/OCS
- csfb - translates calls from GRPC interface to csfb protocol between AGW and VLR
- swx_proxy - translates GRPC interface to SWx protocol between AGW and HSS
- gateway_health - provides health updates to the orc8r to be used for achieving highly available federated gateway clusters
- radiusd - fetches metrics from the running radius server and exports them

Ref: https://magma.github.io/magma/docs/next/feg/architecture_overview

# Installation

Ref:

1. https://magma.github.io/magma/docs/next/feg/deploy_install
2. https://github.com/wavelabsai/magma-general-utility/blob/master/install_utils/fegInstallGuilde.md

**Step 1:** Create a Vagrant VM

Sample Vagrant file content:

```ruby
# -*- mode: ruby -*-
# vi: set ft=ruby :

Vagrant.configure("2") do |config|
config.vm.box = "ubuntu/focal64"
```

```
config.vm.define :feg, autostart: false do |feg|
feg.vm.hostname = "feg"
feg.vm.network "private_network", ip: "192.168.60.186", nic_type: "82540EM"
#feg.vm.network "private_network", ip: "192.168.129.84", nic_type: "82540EM"

feg.vm.provider "virtualbox" do |vb|
vb.name = "feggw"
vb.linked_clone = true
vb.customize ["modifyvm", :id, "--memory", "6144"]
vb.customize ["modifyvm", :id, "--cpus", "4"]
vb.customize ["modifyvm", :id, "--nicpromisc2", "allow-all"]
end
end
end
```

**Step 2: Bring** up the VM.

*$ vagrant up feg*

**Step 3:** SSH into the VM.

*$ vagrant ssh feg*

**Step 4:** Clone the magma repo.

*vagrant@feg:$ git clone -b v1.8 [https://github.com/magma/magma.git](https://github.com/magma/magma.git)*

**Step 5:** Navigate to directory *magma/orc8r/tools/docker*.

*vagrant@feg:$ cd magma/orc8r/tools/docker*

**Step 6:** Place these files in this directory. Location of these files and sample content is given below.

1. rootCA.pem  ( /var/opt/magma/cert/)
2. control_proxy.yml  (magma/feg/gateway/configs/)
3. . env (magma/feg/gateway/docker/)

Sample Content

1. rootCA.pem

```
-----BEGIN CERTIFICATE-----
MIIDNTCCAh2gAwIBAgIURv+k+fgomv2qIh22+llISonsucIwDQYJKoZIhvcNAQEL
BQAwKTELMAkGA1UEBhMCVVMxGjAYBgNVBAMMEXJvb3RjYS5tYWdtYS50ZXN0MCAX
```

DTIzMDkyOTA5MTEzOFoYDzMwMjMwMTMwMDkxMTM4WjApMQswCQYDVQQGEwJVUzEa
MBgGA1UEAwwRcm9vdGNhLm1hZ21hLnRlc3QwggEiMA0GCSqGSIb3DQEBAQUAA4IB
DwAwggEKAoIBAQDB1XVwSYLPdFA0w6+GeKFsE0o49xJviXpGn8r7KGhpT2dGZ+aZ
0IbSRS3m64EDRHFZsTlNtMUyFQUqKEjp7F+Beszt8BEIf8OB5GPDVifvaArk//1M
4HkjcNF94RyCEmTDYO3vbgUf3AcARw1ZThUYTa0VHBcUu6IUo7bh+vIEFvWWFhtb
BonDLRdRNNMlk69im814by/YGM/FnPihAL/CKLjaC/6X4RNSXw+6JLheWsbeESEJ
5oCjf9M7Jvc2YmVlPnoMjLmPaYTPZxuybAcWHZpLUcR1oG2eZZghN+qeM/sxc5/J
wqq9xuVOOVdI6dzS1d0pX31L+79OiXVnwaWbAgMBAAGjUzBRMB0GA1UdDgQWBBRm
eHXXxZT2wXrHbgYpB9hZf80UFjAfBgNVHSMEGDAWgBRmeHXXxZT2wXrHbgYpB9hZ
f80UFjAPBgNVHRMBAf8EBTADAQH/MA0GCSqGSIb3DQEBCwUAA4IBAQBFK7QGcCJ2
tAB87vmhPF1QDgBXWNNJ1ysXix89KOVHdo61soizBabirj9UFrIKlj2dqOLnsYBk
gksBx9wSO1RtzvQfOymnmltJnA0niokdpdbffCJ9mYMxbpSofiTRKt3T+ucxmQzn
FX3kKkB19cUuFpDEm2BdReXa40hoYRJaB6+/a8jm1FRp7UM3QfJD/8ovGonJKwrJ
rdZtsX5uGm3BE3SyMe312yGq7fMxgNmToaoHLH3ssWiOMfNB8CLmewzcmFDaAwnb
MRz1KZBYUlK9mv7aohmRUL/ZG3VwPb/6iCQuibV0WaQ45mYs9OULfR0h/F3dzh2o
xpsMLUxUh15h
-----END CERTIFICATE-----

2. control_proxy.yml

```
# nghttpx config will be generated here and used
nghttpx_config_location: /var/tmp/nghttpx.conf

# Location for certs
rootca_cert: /var/opt/magma/certs/rootCA.pem
gateway_cert: /var/opt/magma/certs/gateway.crt
```

```
gateway_key: /var/opt/magma/certs/gateway.key

# Listening port of the proxy for local services. The port would be closed
# for the rest of the world.
local_port: 8443

# Cloud address for reaching out to the cloud.
cloud_address: controller.magma.test
cloud_port: 7443

bootstrap_address: bootstrapper-controller.magma.test
bootstrap_port: 7444

fluentd_address: fluentd.magma.test
fluentd_port: 24224

# Option to use nghttpx for proxying. If disabled, the individual
# services would establish the TLS connections themselves.
proxy_cloud_connections: True

# Allows http_proxy usage if the environment variable is present
allow_http_proxy: True
```

3.env

```
COMPOSE_PROJECT_NAME=feg

DOCKER_REGISTRY=linuxfoundation.jfrog.io/magma-docker/
IMAGE_VERSION=1.8.0
```

```
GIT_HASH=v1.8

DOCKER_USERNAME=
DOCKER_PASSWORD=

ROOTCA_PATH=/var/opt/magma/certs/rootCA.pem
CONTROL_PROXY_PATH=/etc/magma/control_proxy.yml

SNOWFLAKE_PATH=/etc/snowflake
CONFIGS_DEFAULT_VOLUME=/etc/magma
CONFIGS_TEMPLATES_PATH=/etc/magma/templates

CERTS_VOLUME=/var/opt/magma/certs
CONFIGS_VOLUME=/var/opt/magma/configs

LOG_DRIVER=journald
```

**Step 6: Add these lines in** */etc/hosts*

```
10.0.2.2                                    controller.magma.test
10.0.2.2                                     fluentd.magma.test
10.0.2.2 bootstrapper-controller.magma.test
```

**Step 7:** Run the feg install script.

*vagrant@feg:~/magma/orc8r/tools/docker$ sudo ./install_gateway.sh feg*

In the output we can see:



**Step 8:** Check whether it is successful

*vagrant@feg:~/magma/orc8r/tools/docker$ docker ps -a*

Expected Output:

```
vagrant@feg:~/magma/orc8r/tools/docker$ sudo docker ps -a
CONTAINER ID   IMAGE                                                      COMMAND               CREATED          STATUS
     PORTS       NAMES
41a2e93f2b96   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     eap_aka
73e990f4f8a3   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     swx_proxy
3b59a44e7c48   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     session_proxy
5829e5905531   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     aaa_server
c08dd2b0e41f   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     s6a_proxy
cd0b71df2fd6   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     csfb
1cc7c6d7e332   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     feg_hello
cc5471a2a32b   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     radiusd
922210602eed   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     health
9356444d4afe   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     eap_sim
fb48c58f2143   linuxfoundation.jfrog.io/magma-docker/gateway_go:1.8.0     "envdir /var/opt/mag…"  34 seconds ago   Up 11 seconds
     s8_proxy
9d409633b1f5   linuxfoundation.jfrog.io/magma-docker/gateway_python:1.8.0  "python3.8 -m magma.…"  4 minutes ago    Up 4 minutes
     magmad
78d6f6c83110   linuxfoundation.jfrog.io/magma-docker/gateway_python:1.8.0  "python3.8 -m magma.…"  4 minutes ago    Up 4 minutes
     eventd
d4a1c7233580   linuxfoundation.jfrog.io/magma-docker/gateway_python:1.8.0  "/bin/bash -c '/usr/…"  4 minutes ago    Up 4 minutes
     redis
b99727a96f6d   linuxfoundation.jfrog.io/magma-docker/gateway_python:1.8.0  "/bin/bash -c '/usr/…"  4 minutes ago    Up 4 minutes
     control_proxy
e997152f2871   linuxfoundation.jfrog.io/magma-docker/gateway_python:1.8.0  "/bin/bash -c '/usr/…"  4 minutes ago    Up 4 minutes (healt
hy)    td-agent-bit
```

# Troubleshooting Guide

**ISSUE 1:**

**cp: cannot overwrite non-directory '/etc/magma' with directory '/tmp/magmagw_install/magma/feg/gateway/configs'**

**SOLUTION:**

Remove magma folder from */etc*

*$rm -rf  /etc/magma*

**ISSUE 2:**

**This 'install_gateway.sh' script has changed...**

**Please copy this file from /tmp/magmagw_install/magma/orc8r/tools/docker/install_gateway.sh and re-run.**

**SOLUTION:**

Copy and run again the installation command.

**ISSUE 3:**

**WARN[0000] The "GY_SUPPORTED_VENDOR_IDS" variable is not set. Defaulting to a blank string.**

**WARN[0000] The "GY_SERVICE_CONTEXT_ID" variable is not set. Defaulting to a blank string.**

**WARN[0000] The "DISABLE_REQUESTED_SERVICE_UNIT_AVP" variable is not set. Defaulting to a blank string.**

**WARN[0000] The "USE_GY_FOR_AUTH_ONLY" variable is not set. Defaulting to a blank string.**

**service "s6a_proxy" refers to undefined volume gwcerts: invalid compose project**

**SOLUTION:**

This issue will be coming if you skip Step 6 of installation. This will ensure that when your Magma Federation Gateway or other Magma components on your machine attempt to communicate with these services, they reach the expected IP addresses.