Magma
NMS Installation & Configuration

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VERSION 1.0

NMS Guide

Network Management System

PURPOSE:

Step by step instructions on how to install, setup and configure the Magma Network Management System

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Network Management System (NMS)

1. Introduction

The Network Management System (**NMS**) is the UI for managing, configuring, viewing health status and monitoring networks.

At a high level, Magma is comprised of a set of Access Gateways (AGW) or LTE base stations managed by a centralized controller called the Orchestrator. The Network Management System (NMS) receives network metrics via RESTful API's.

Magma is an open source platform for building access networks (LTE, 2G, Wifi, etc.). Magma gives network operators an open, flexible and extendable mobile core network solution. It's a distributed core and extends mobile data services and wireless access networks. Magma provides network services as pluggable modules for building such networks. Network services in this context can be authentication, metering, subscriber management, IP allocation, mobile edge computing services, etc.

Purpose

The purpose of this document is to provide step by step instructions on how to install, setup and configure the Magma Network Management System (NMS) onto a Linux server environment.

- High level architecture diagram
- Prerequisites for NMS Installtion
- Explanation of the Key Components
- Configuration of Devices

Scope & Audience

Scope of this document is limited to describe Magma's NMS installation and device configuration process. This document is intended for Magma Business Partnerts, Mobile Network Operators, System Integrators, Mobile Network Engineers and or anyone wanting to deploy a Magma Fixed Wireless Access (FWA) network.

Resources

- Introduction to Magma
- GitHub Open Source Code

2. NMS Prerequisites & Hardware Recommendations

Magma Network Management System (NMS) prerequsites and recommended hardware is as follows:

- An installed and running Magma Network; Orchestrator, eNodeB, AGW
  Once the NMS is up and running, adding, configuring and monitoring of eNodeB's and AGW's is enabled.

- Install Docker https://docs.docker.com/install/
  Docker compose is used to run the Magma container and configure application services

- Add xplat to hg sparse profiles (tools/scm/sparse/xplat/base)

- The NMS and the E2E must be IP reachable from each other.
- The NMS must be IP reachable from each of the nodes.
- The NMS must be capable of being deployed as a private cloud solution within an ISP network.

3. NMS Setup

To setup access to the Magma NMS, enter the following commands in a Terminal window on your laptop. Firefox or Chrome is recommended. Unlike the GitHub repo where the NMS is located in the `magma` directory, internally the Magma NMS lives in `fbsource/xplat/fbc/fbcnms-projects/magmalte`

Runnng NMS Setup 1

```
git clone git@github.com:facebookexternal/magma.git
cd magma/nms/fbcnms-projects/magmalte/
docker-compose build magmalte
docker-compose up
docker-compose exec magmalte yarn run setAdminPassword
testuser@mydomain.com password1234
```

Runnng NMS Setup 2

1. Run setup_nms.sh within magma/fb/cloud. This will automatically set up the .env file for magmalte using magma certs.

```
$ cd ~/fbsource/fbcode/magma/fb/cloud
$ ./setup_nms.sh
```

2. If your magma or magmalte directories live somewhere else other than `~/fbsource/fbcode/magma` and `~/fbsource/xplat/fbc/fbcnms-projects/magmalte`, you can run `setup_nms.sh` with flags `-m` and `-n` respectively to specify different directories.

Running the NMS

In the `magmalte` directory, start docker containers and create a test user:

```
$ cd ~/fbsource/xplat/fbc/fbcnms-projects/magmalte
$ docker-compose build magmalte
$ docker-compose up -d
$ ./scripts/dev_setup.sh
```

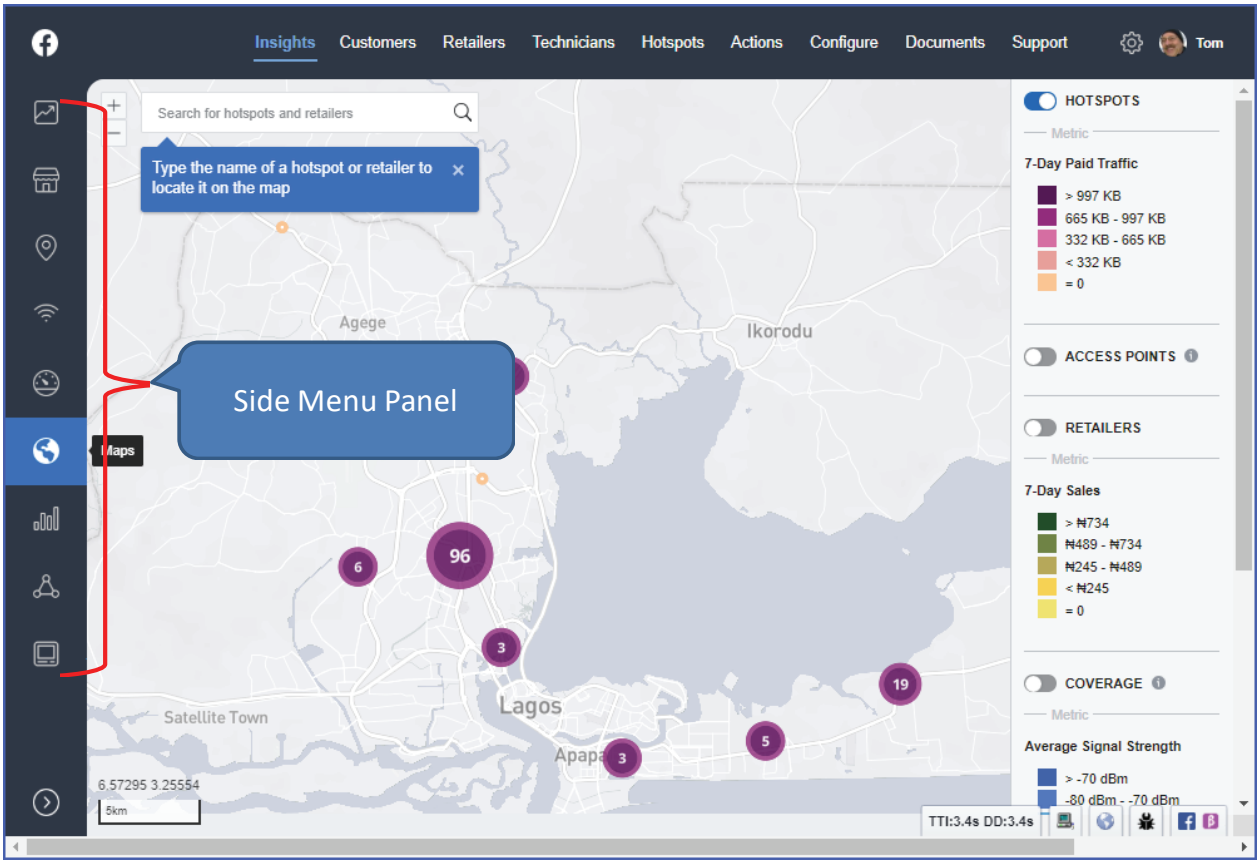
You may get an error if you run `dev_setup.sh` immediately after `docker-compose up -d`. To resolve this, wait a bit before running the script to let migrations run.

Once you have started the docker containers and created a test user, go to https://localhost and login with test credentials `admin@magma.test` and `password1234`.

Note: if you want to name a user other than `admin@magma.test`, you can run `setAdminPassword`, like so:
`$ docker-compose run magmalte yarn run setAdminPassword admin@magma.test password1234`

The Magma NMS opens to the Maps screen. The left side menu panel provides tabs to the following management and configuration pages:

- Map
- Metrics
- Alerts
- Subscribers
- Gateways
- eNodeB Devices
- Configure



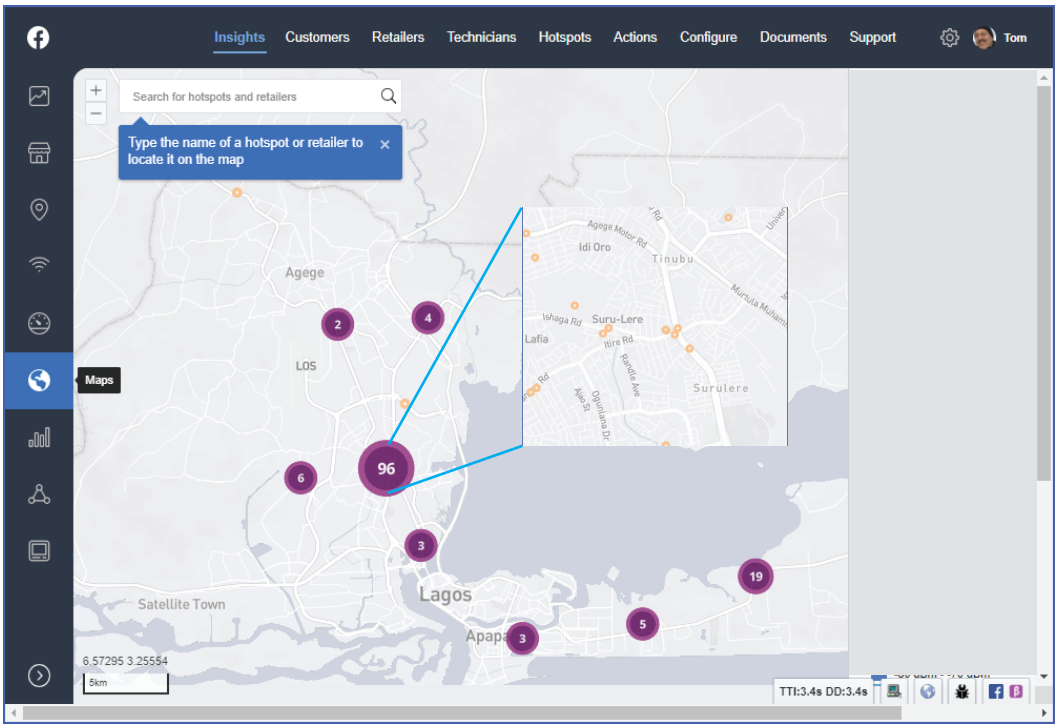
resource: https://our.internmc.facebook.com/intern/wiki/MagmaGuide/setup-magmalte-nms/

4. Map

The Map page displays a map of the Magma network with all active devices shown at their specific GPS location. Devices include; Access Gateways and eNodeB's. The NMS captures the End-to-End (E2E) controller input file for the Global Positioning Satellite (GPS) coordinate information of the radios and leverages OpenStreetMap to show the locations of the radio nodes.

1. With the map zoomed out, circles indicate AGW loactions and the number within that area.

2. Zoom in for more location detail



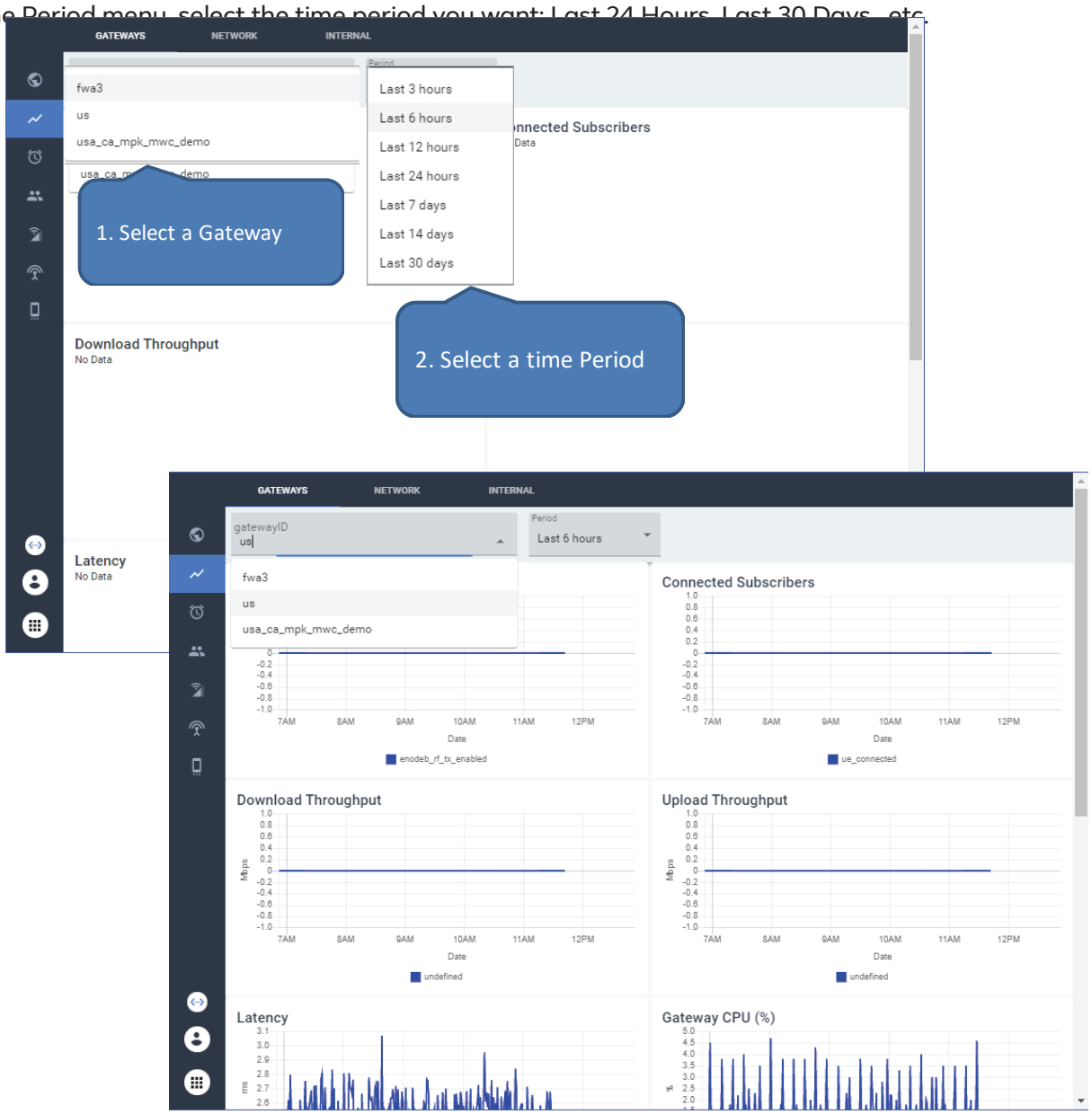
5. Metrics

The Metrics page shows information about the Magma Gateways, this includes:

- eNodeB Status
- Connected Subscribers
- Download & Upload Throuhput
- Latency
- Gateway CPU (%)
- Temperature (^{0}C)
- Disk (%)
- s6a Auth Access & Failure

Viewing Network Status & Health

1. From the Device menu, select GATEWAYS to view status of a specific AGW
2. From the Period menu, select the time period you want: Last 24 Hours, Last 30 Days, etc.



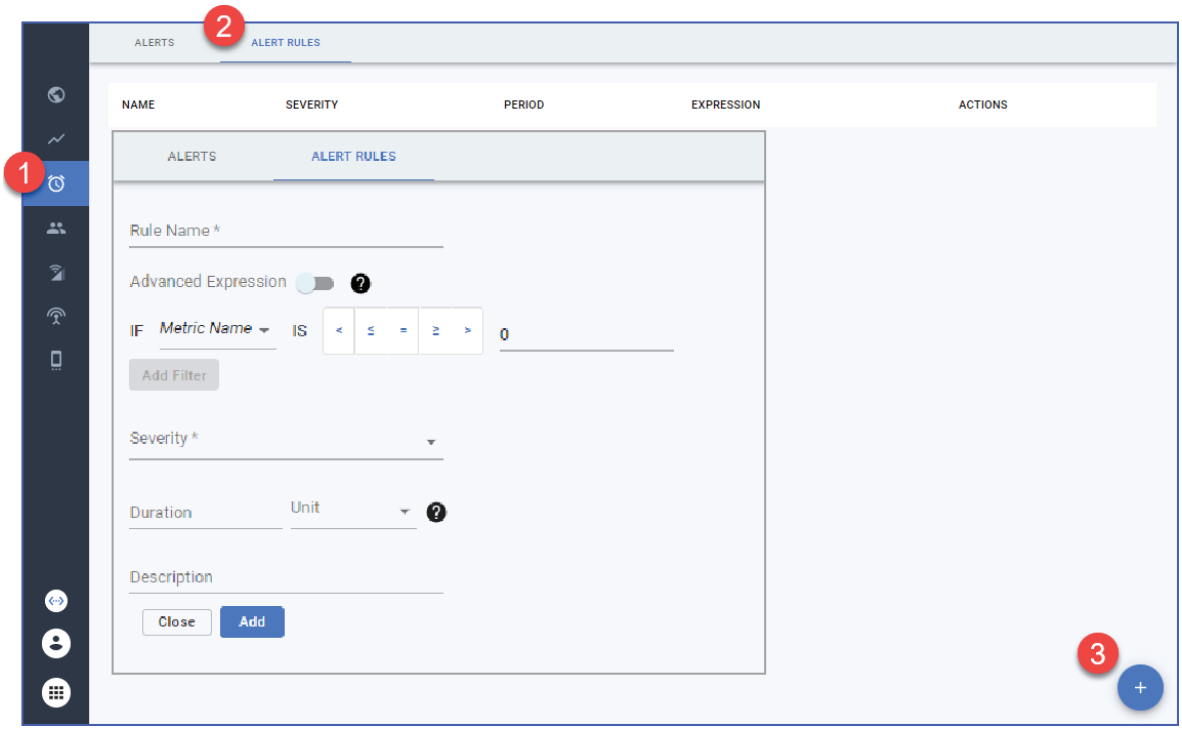
6. Alerts

The Alerts Page allows the Magma NMS Administrator or Mobile Network Operator to create and establish alerts or events. Alerts help Operators respond to degraded network conditions faster and improve overall service availability as well as network availability.

A selection of Events can be set by the Operator to trigger an Alert or Alarm. An Alert is set by the Operator for its level of severity (Warning, Alarm, and Critical), which may lead to an automatic email/message sent to the Operator.

How to Create an Alert Rule

1. Begin from the Alerts Page
2. From the top tab bar, select ALERT RULES
3. In the lower left of screen, click the blue plus sign (+)
4. Complete the required information
   a. Enter a **Rule Name** (example: Service Down
   b. Create an **Advanced Expression** (optional)
      Switch the toggle on to write an arbitrary alerting expressionin PromQL.
      To learn more about how to write alert expressions, click on the help icon to open the prometheus querying basics guide.
   c. Create a built-in **Expression** (example: backhaul latency is greater than .5 seconds)
      Selet an IF Metric Name, select an Expression and an expected result
   d. Create a **Filter**
      Select a Label (gateway or service), select a Value (the network name)
   e. Select a **Severity** (CRITICAL, MAJOR, MINOR, WARNING, INFO, NOTICE)
   f. Select a **Duration** and **Unit** (seconds, minutes, hours)
   g. Enter a **Description** and click Add



7. Subscribers

The Subscribers Page allows the following functions:

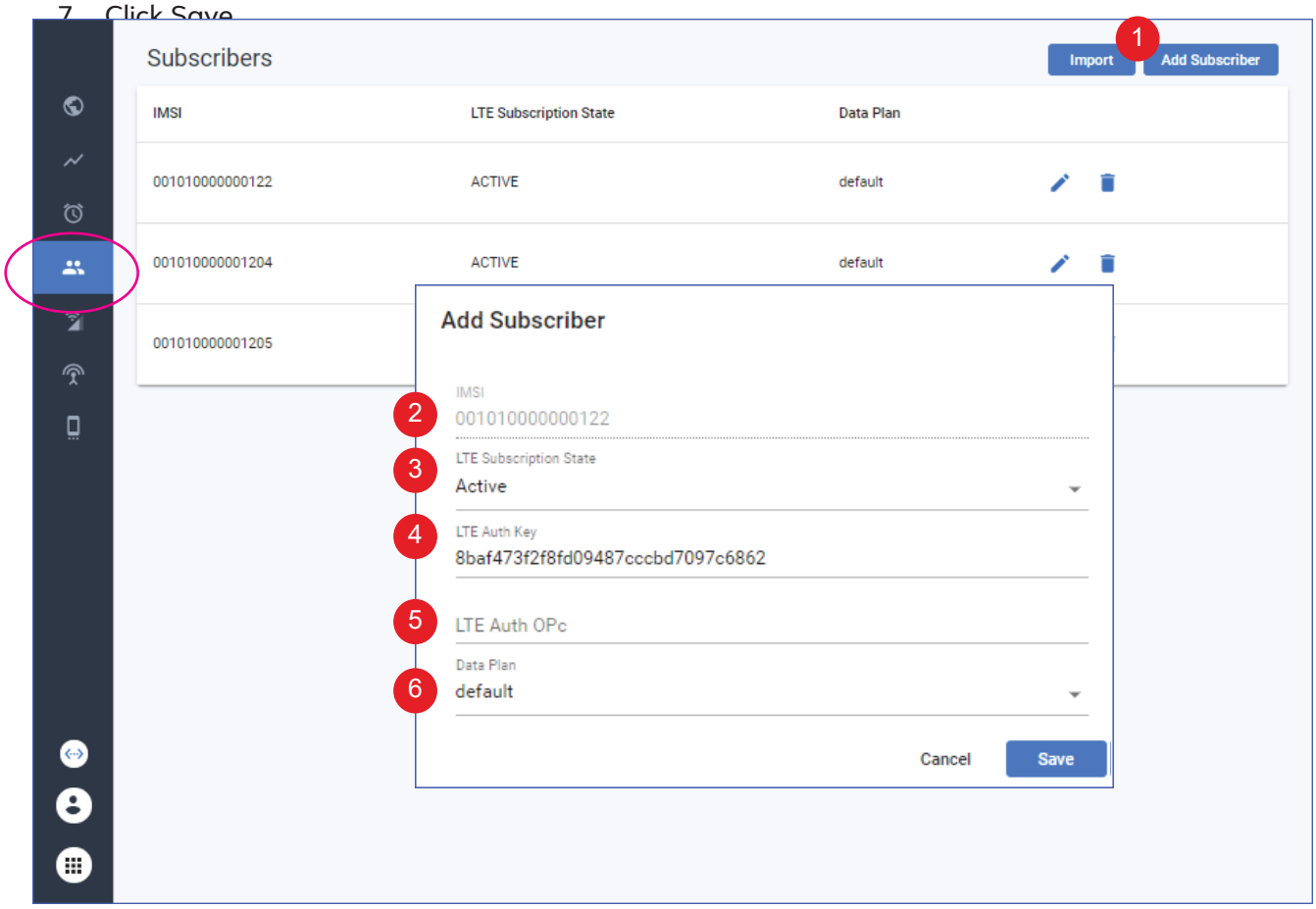
- View all system Subscribers (Users)
- Add & Delete Subscribers
- Upload Subscriber File

Viewing Subscribers List

1. From the side menu panel, click the Subscribers icon to view the System list.

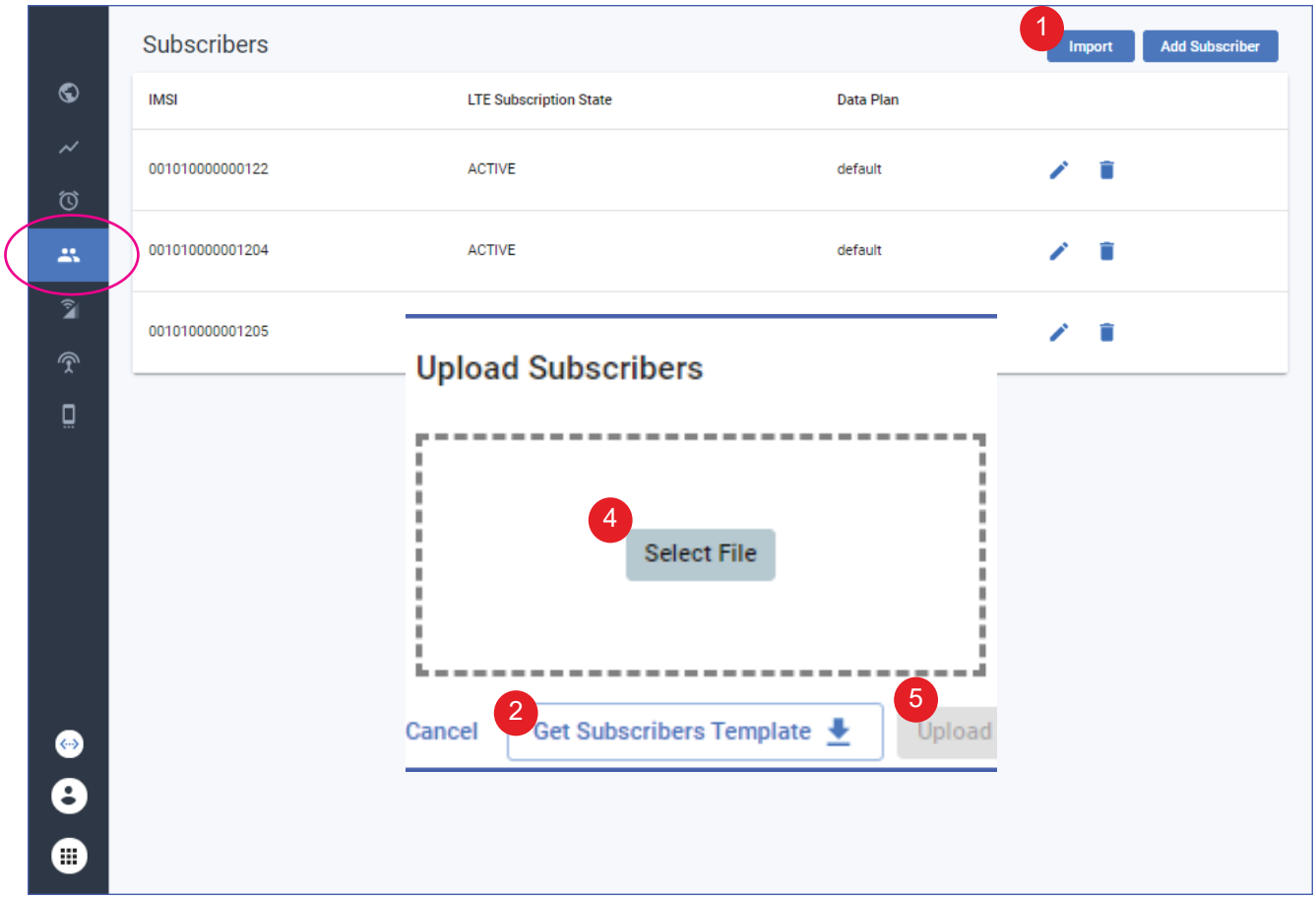
Adding Subscribers

1. From the Subscribers page, click Add Subscriber
2. Enter an **IMSI**, the International Mobile Subscriber Identity (IMSI) ID number
3. Enter the **LTE Subscription State**, select Active.
4. Enter the **LTE Auth Key**, the LTE Authentication key.
5. For **LTE Auth OPc**, select LTE Auth OPc. If OP is used instead of OPc, this field should be left blank, OP is set in Network Configurations.
6. Select a **Data Plan**, or select default.
7. Click Save



Adding Subscribers from a File Upload

1. From the Subscribers page, click Import
2. Click on **Get Subscribers Template** to download the sample CSV file of the expected layout to upload
3. Enter Subscribers into the CSV file in the format shown
4. Save the file and click **Select File** to upload
5. Click Upload



	A	B	C	D	E	F	G
1	imsi	lte_state	lte_auth_key	lte_auth_opc	sub_profile		
2	"200056789012345"	ACTIVE	20000000001234567890ABCDEFABCDEF	21111111111234567890ABCDEFABCDEF	low rate 1		
3	"200056789012346"	INACTIVE	20000000001234567890ABCDEFABCDEF	21111111111234567890ABCDEFABCDEF	default		
4							
5							
6							
7							
8							

3

8. Gateways

The Gateways Page allows the followng funtions:

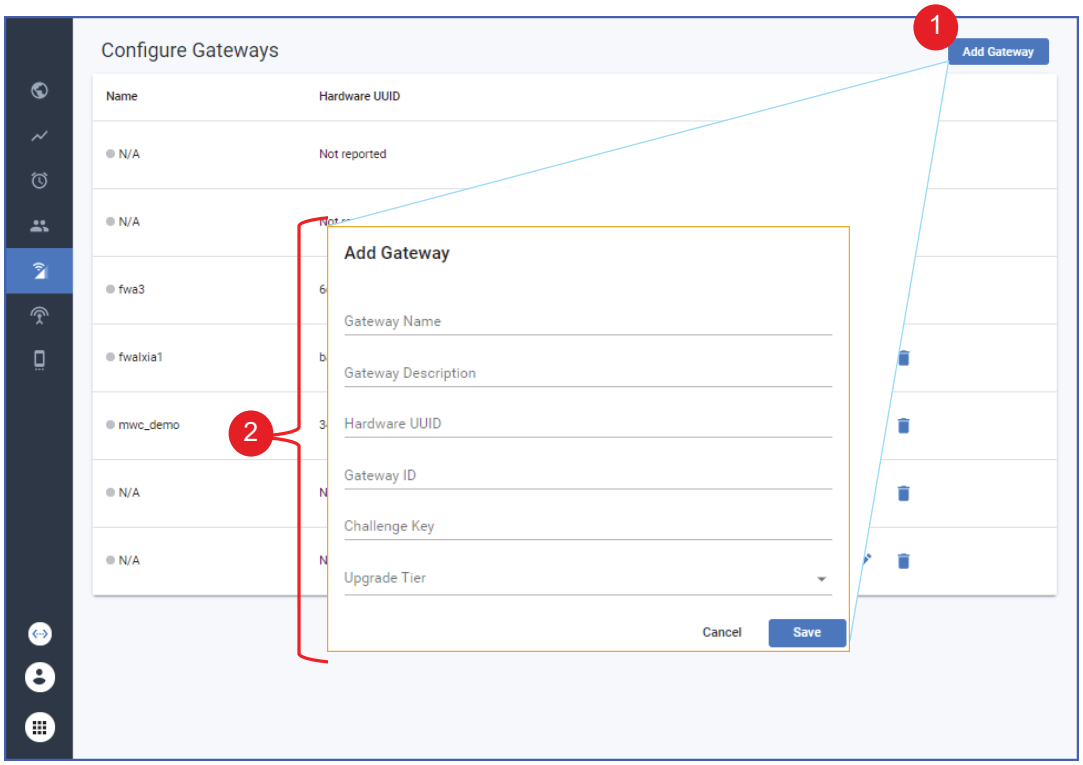
- Add Access Gateways (AGW)
- Configure
- Sit gateways.

From the side menu panel, select the Gateways icon. The Configure Gateways page appears.

Adding a Gateway (AGW)

Prerequistes:
The Hardware ID and the Public Key from the gateway are required. To obtain the ID and Key open a Terminal window and run: `show_gateway_info.py`

1. From the Gateways page, click Add Gateway. The Add Gateway screen appears.
2. Complete the requird iformation:
   Enter a **Gateway Name**, a meaningful name that describes the gateway.
   - Enter a **Gateway Description**
   - Enter a **Hardware UUID**, the Hardware ID for your gateway.
     Use the Hardware ID you receivd using `show_gateway_info.py`
   - Enter the **Gateway ID**, the gateway ID you want. Choose a meaningful name, such as country, organization, location, or site number.
   - Enter a Challenge Key, the gateway Public Key.
     Use the Public Key you received using `show_gateway_info.py`
3. Verify that the new AGW appears on the Configure Gateways page.



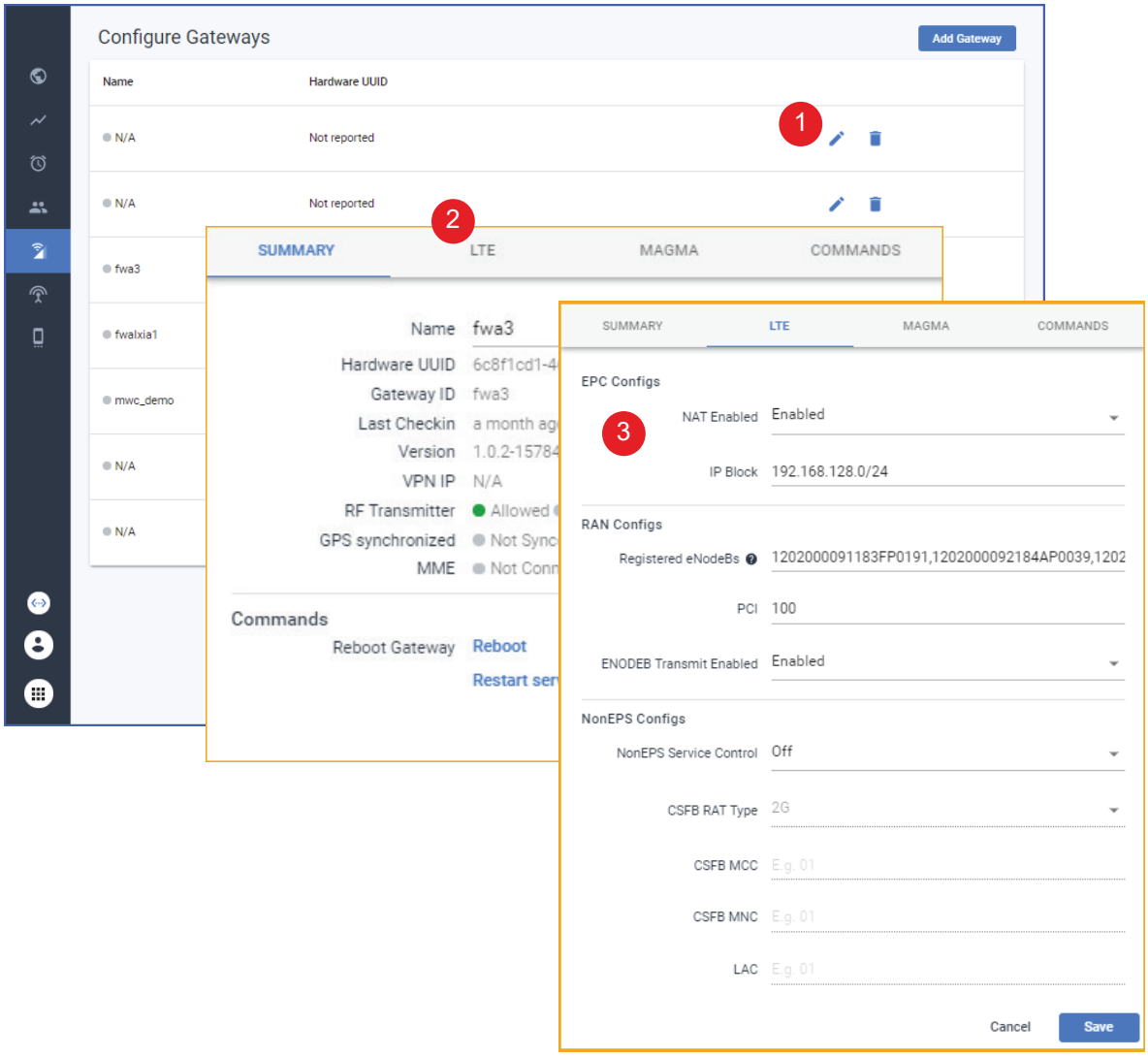
Editing a Gateway (AGW)

To Edit, Change or Update an Access Gateways settings, use the following steps.

1. From Gateways Page, click the Edit icon to open the configuration dialog.
2. Select the LTE tab
3. Under EPC Configs:
   Set NAT enabled to Enabled
   Set IP Block to the IP address and mask you want, for example: 192.168.128.0/24

   Under RAN Configs:
   Set PCI to 260.
   Set Enodeb Transmit Enabled to Enabled.

   Under NonEPS Configs:
   Set NonEPS Service Control to Off
4. Click Save

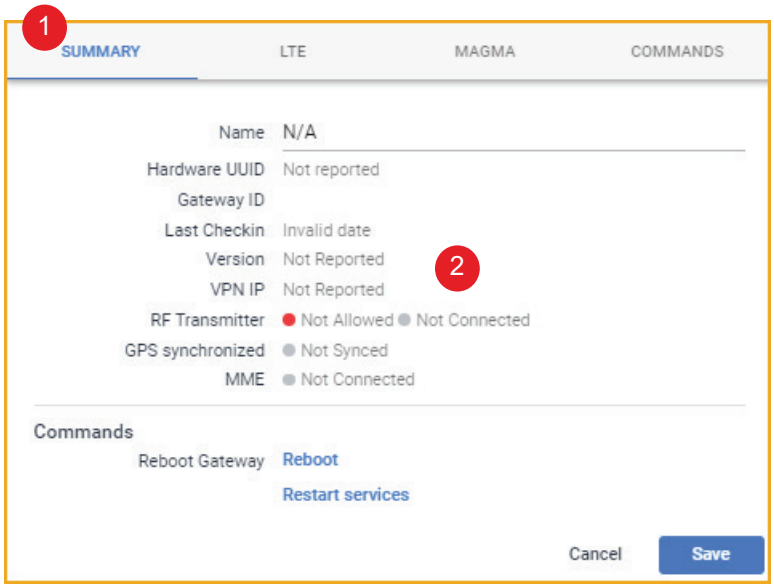


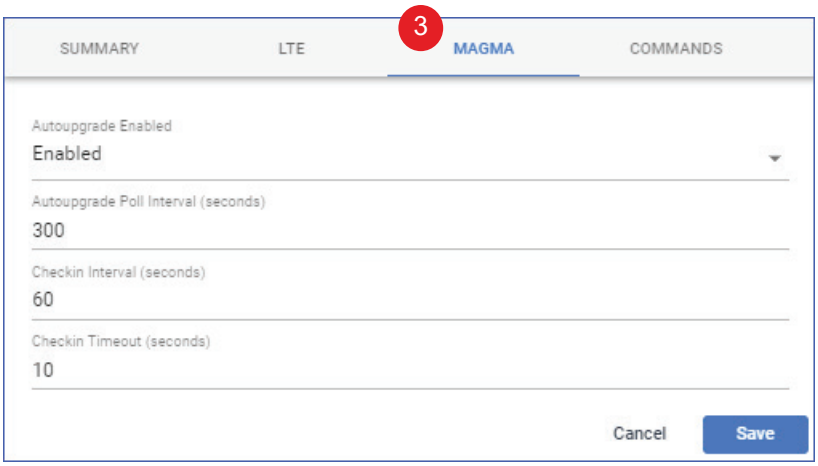
Verrifying Gateway Configuration

To verify a Gateway Configuration and CheckIn.

1. Click the Summary tab.
2. Verify the AGW checks in to Orchestrator
   Verify the **Last Checkin** time was in the last few minutes
   Note: This may take up to 10 minutes to update.
3. If the AGW does not check in to Orchestrator

   Run `checkin_cli.py` on the gateway to debug
4. Click on the Magma tab
   Verify that the Autoupgrade fields and the Checkin fields are set as you want them.





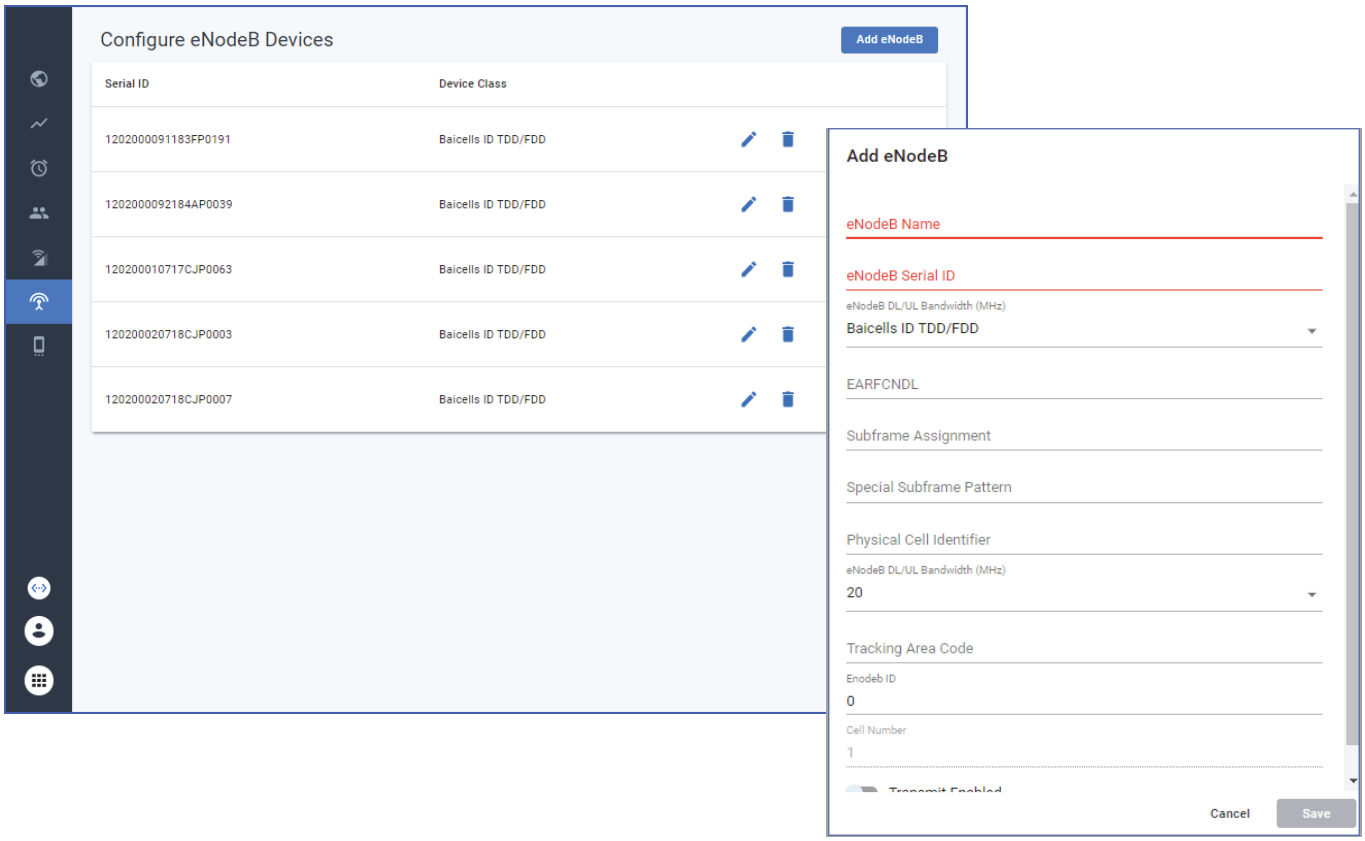
9. eNodeB Devices

The Magma system is comprised of AGW's connecting to eNodeB's. The NMS can monitor the eNodeB's when they are registered by adding to the NMS.

Adding an eNodeB

1. From the eNodeB Devices page, click on Add eNode
2. Enter a **eNodeB Name**: a unique name
3. Enter the **eNodeB Serial ID** or Serial Number - a unique number
4. Select the **eNodeB DL/UL Bandwidth (MHz)**
   A list of tested and Magma proven eNodeB's appears

5. Enter the **EARFCNDL** (E-UTRA Absolute Radio Frequency Channel Number Down Link)
   The range is 0 to 65535
6. Enter the **Subframe Assignment** - The range is 0 to 6
7. Enter the **Special Subframe Pattern** - The range is 0 to 9
8. Enter the **Physical Cell Identifier** - The range is 0 to 504
9. Select the **eNodeB DL/UL Bandwidth (MHz)** - The range is 3, 5, 10, 15, or 20
10. Enter the **Tracking Area Code** - The range is 0 to 65535
11. Enter the **eNodeb ID** - a unique number
12. The **Cell Number** is displayed, a numerial counter
13. Select **Transmit Enabled** if the device is configured, tested and prepared to make active.



10. Configure

The Configure Page allow for setting up and managing Data Plans, Speeds, Policies, Upgrades and more. It consists of four tabs:

- Data Plans
- Network Configuration
- Updates
- Policies

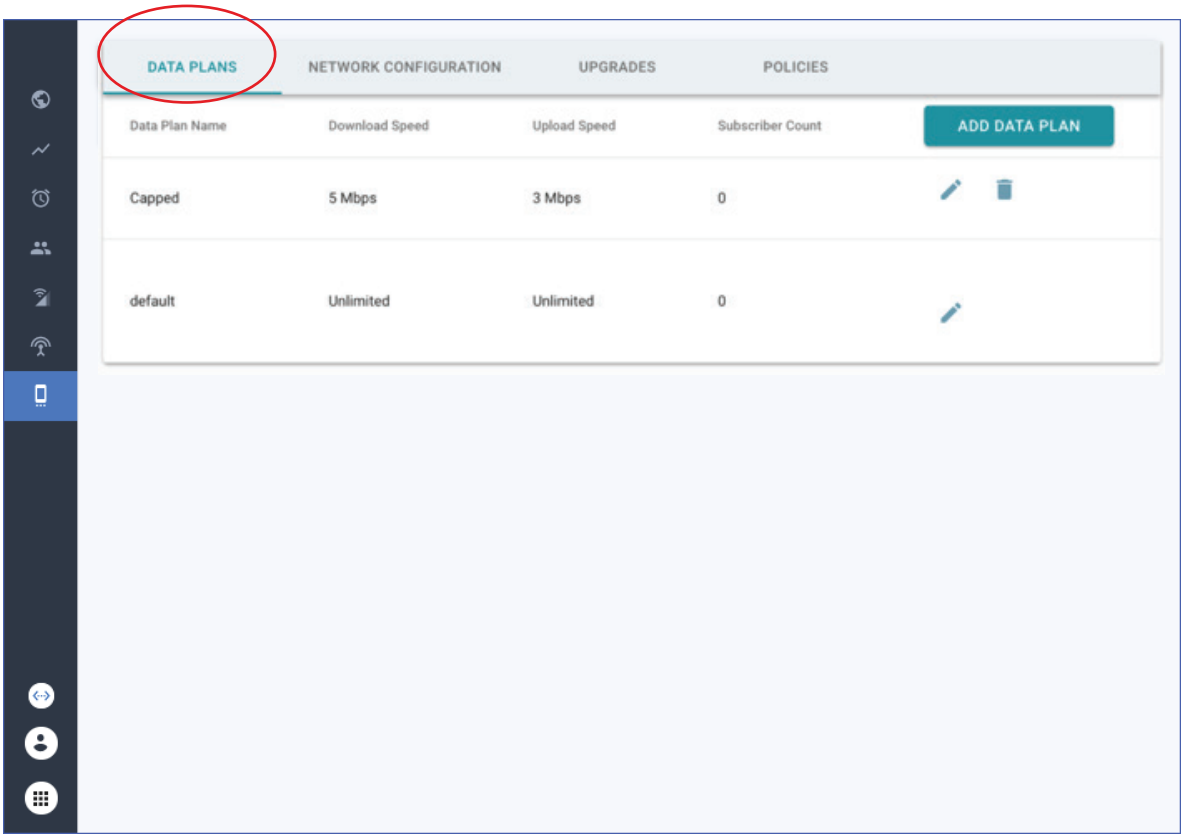
From the side menu panel, select the Configure icon. The Configure Page appears.

Data Plans

A Data Plan is used to specify the rate limits for download and upload data transfers for subscribers.

- Users with administration level privileges can create and modify Data Plans, and can can assign Subscribers to existing data plans.

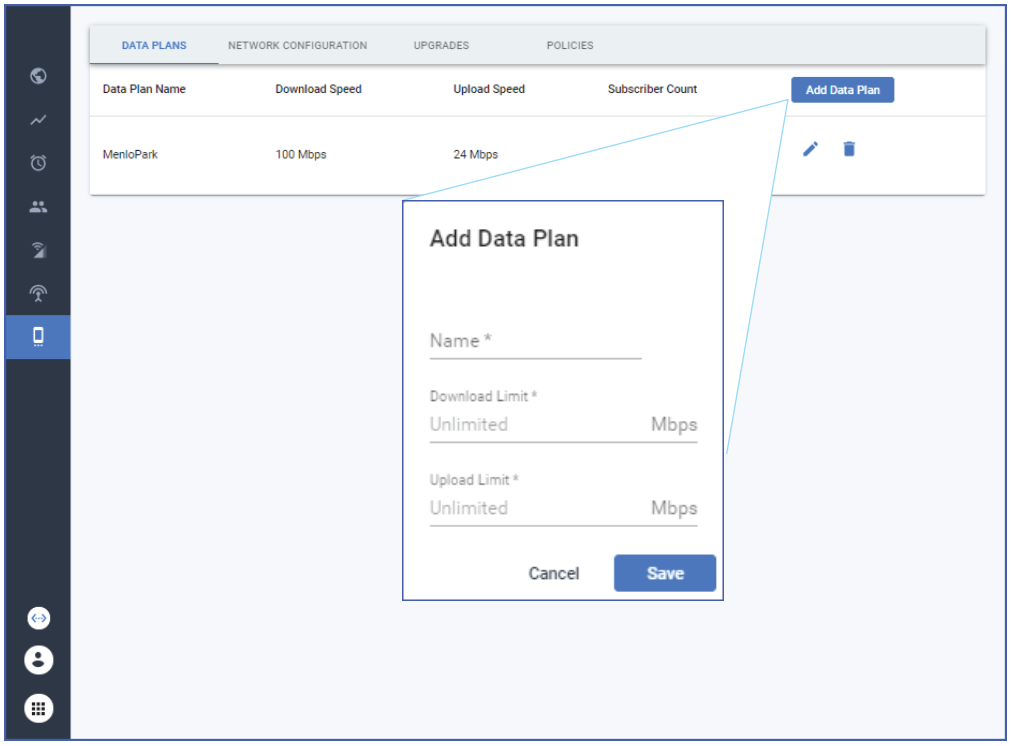
- The Download Limit (Mbps) and the Upload Limit (Mbps) fields specify the maximum data transfer rates for the Subscriber that is assigned to the Data Plan.



Adding a Data Plan

To Add a Data Plan:

1. From the Data Plan page, click Add Data Plan The Add Data Plan screen appears.
2. Enter a Name, the name you want for the Data Plan.
3. Enter a Download Limit, the maximum transfer rate (in Mbps) for downloads that you want a UE to have under this plan. Zero (0) equals unlimited.
4. Enter an Upload Limit, the maximum transfer rate (in Mbps) for uploads that you want a UE to have under this plan. Zero (0) equals unlimited.



Editing a Data Plan

To Edit a Data Plan:

1. On the Data Plan page, click the edit icon for the Data Plan you want to edit.
2. Enter the new values that you want.

Removing a Data Plan

To Remove a Data Plan:

1. Click the trash icon for the Data Plan you want to delete.

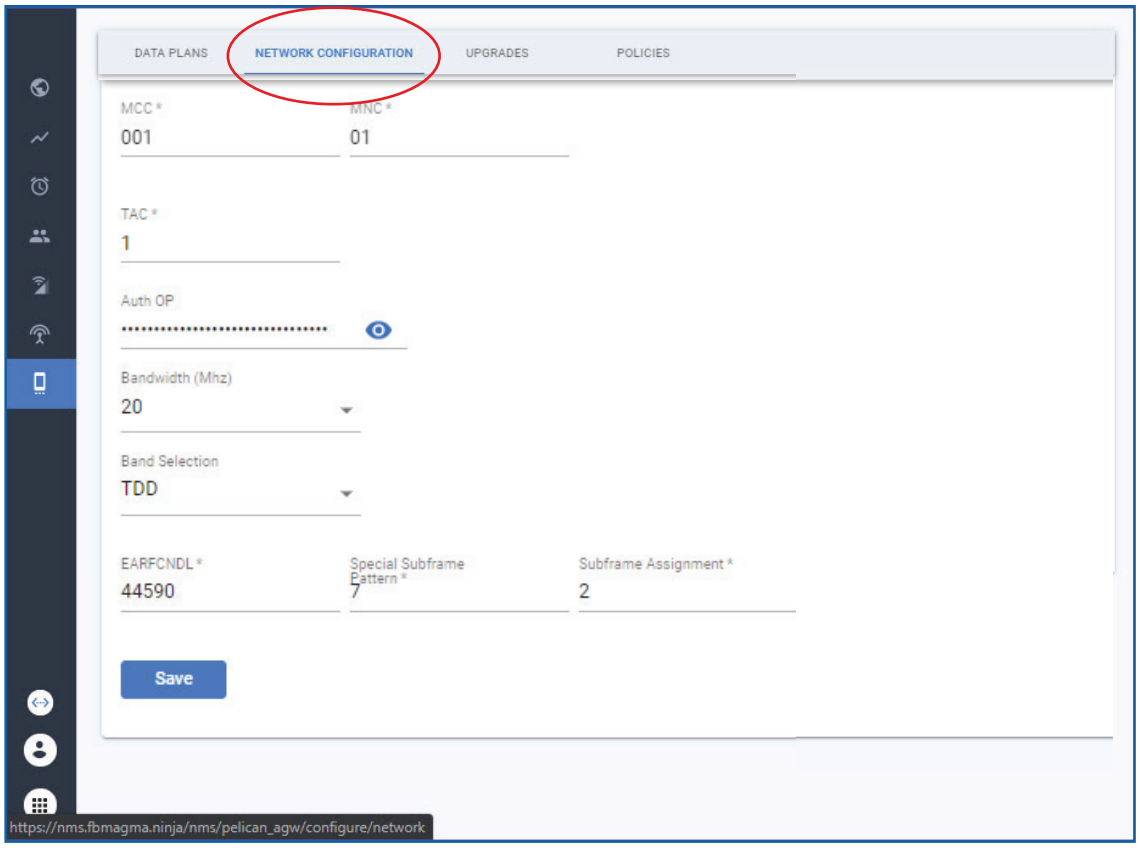
Network Configuration

The Network Configure Page, allows for configuring the network settings for a Magma network.

To configure a network, proceed as follows:

1. Enter the MCC, the Mobile Country Code (MCC)for the network
   Enter the MNC, the Mobile Network Code (MNC) for the network

   To view a complete list of MCC and MNC go to https://www.mcc-mnc.com/
2. Enter the TAC (Tracking Area Code) for the network
3. Enter the Auth OP (Authentication Operation Code)
4. Select the bandwidth MHz block you want
   The range is 3Mhz - 20Mhz
5. Select the Band Selection
   Choose TDD (Time Division Duplex) or FDD (Frequency Division Duplex)
6. Enter the EARFCNDL (E-UTRA Absolute Radio Frequency Channel Number Down Link)
   The range is 0 to 65535
7. Enter a Special Subframe Pattern
   The range is 0 - 9
8. Enter the Subframe Assignment
   The range is 0 - 6



Upgrades

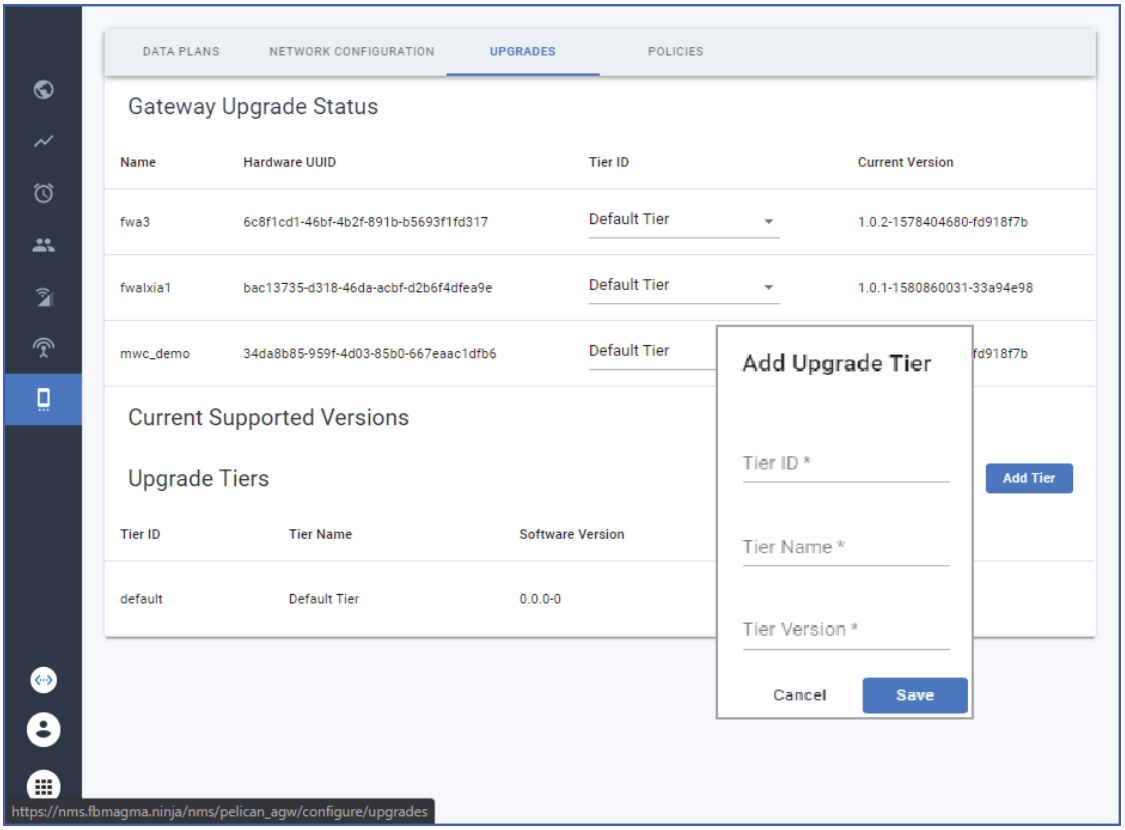
The Gateway Upgrade Status page displays information about currently supported releases and upgrade tiers. Upgrade tiers allows Mobile Operators, System Integrators and Wireless Internet Service Providers to offer different levels of service to customers.

To Add a new Tier:

1. Click the Add Tier button
2. Enter a Tier ID; numbers, letters or any combination
3. Enter a Tier Name; any descriptive title
4. Enter a Tier Version; example 1.0.0

To Assign a Tier to a network:

1. From the Tier ID dropdonw, select the Tier ID you want for that gateway.

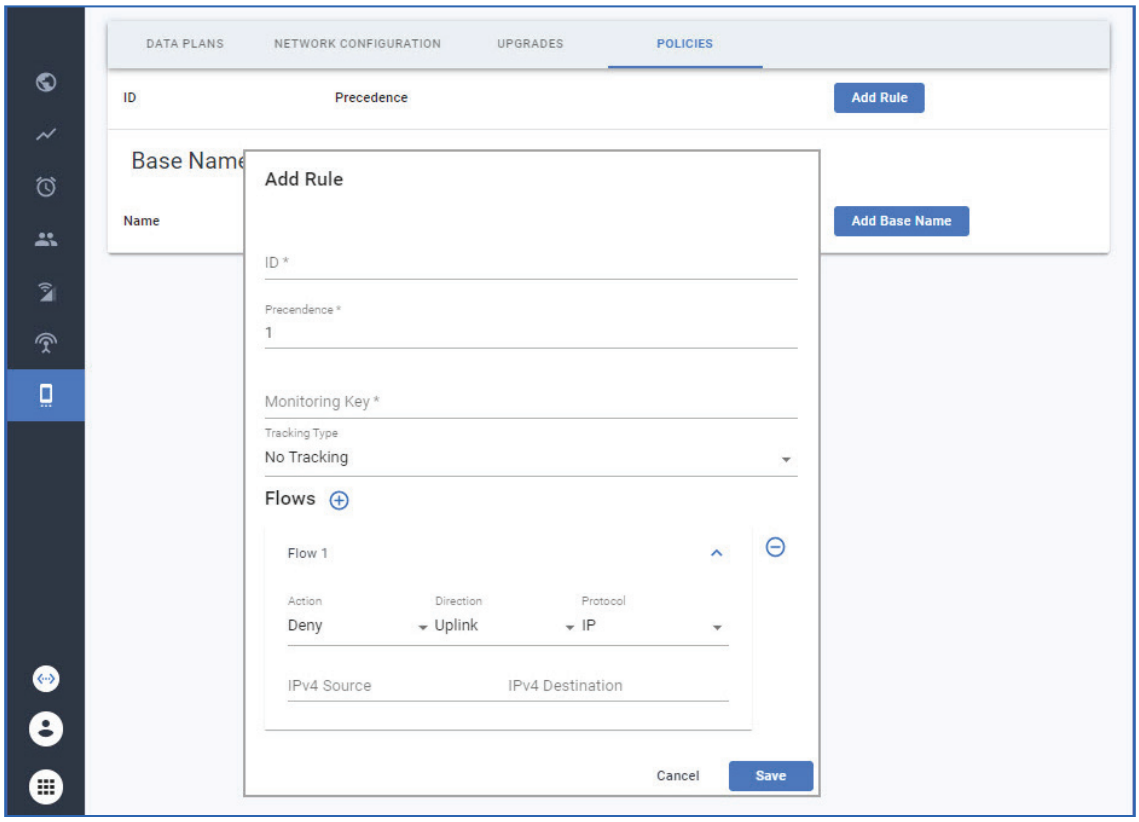


Policies

The Policies Page lets you add and define network flow polices for the gateway.

To Add and Configure new Policy:

1. Click Add Rule. The Add Rule screen appears.
2. Enter an **ID** for the rule.
3. Set the **Precedence** (priority) for the rule.
4. Enter the **Monitoring Key**
5. Enter the **Tracking Type**
   Select Only OCS, Only PCRF, OCS and PCRF or No Tracking
6. Click the plus sign to the right of **Flows**
7. Click the dropdown for Flow 1 and select parameters:
   Action: select Permit or Deny
   Direction: select Uplink or Downlink.
8. Select a Protocol; IP, UDP, TCP, or ICMP.
9. Enter the IPv4 Source and IPv4 Destination addresses.
10. Click SAVE.



To Add and a Base Name

1. Click Add Base Name.
2. Enter a **Base Name**
3. Enter a **Rules Name** commas separated file (.csv)

11. Administrative Tools

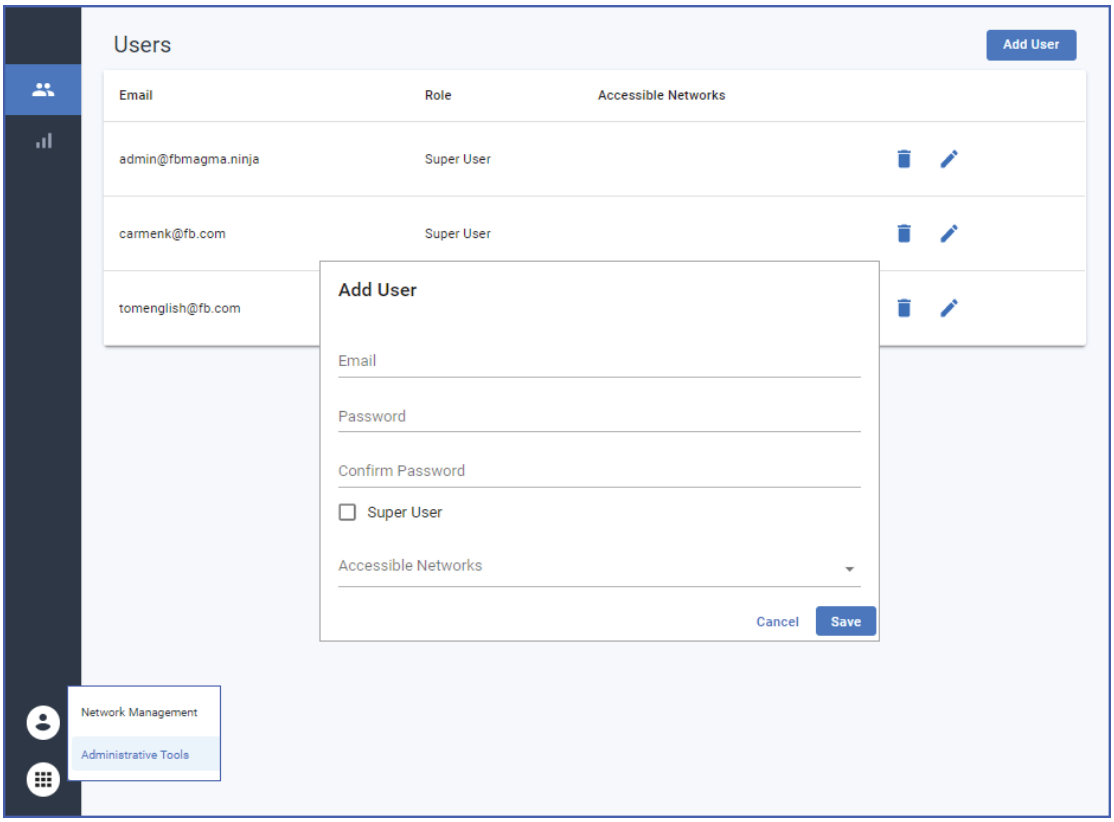
To enter Adminstrative tools or to switch back to the NMS, click the tools icon in the lower left side menu panel. Select Admininstrative Tools or Network Management.

Adding NMS Adminstrators

1. Click Add User. The Add User screen appears.
2. Enter the Users **Email** address.
3. Enter a **Password** for the User.
4. Select **Super User** if the user is to have full control of the system.
   Super Users have access to all networks by default
5. Select **Accessible Networks** and choose the network accessible to the User.

Removing Admins

1. Click the Trash Can to remove a User.



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