Understand and Configure 5G APN on Cellular Gateways and PIMs

Contents

Introduction

This document describes APNs on 5G Cellular Gateway and PIM modules. It also describes how to configure profiles on these two different devices.

Prerequisites

Requirements

It is recommended that you have a Subscriber Identity Module (SIM) card provisioned by your carrier and the proper Access Point Name (APN) which is also provided by your carrier.

Components Used

The information in this document is based on these software and hardware versions:

- Cisco Cellular Gateway CG522 on Cisco IOS® XE 17.6.4
- Cisco P-5GS6-R16SA-GL PIM inserted to Cisco IR1101 router on Cisco IOS® XE 17.15.1a

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

The scope of this document is limited to define profiles and APNs as well as describe the process to configure them on 5G Cisco devices, including CG522 and PIM modules P-5GS6-R16SA-GL and P-5GS6-GL.

Basic Concepts

Every 5G Cisco device requires a profile used by the embedded modem to connect to the carrier's network. This profile consists of these elements:

- Profile ID.
- APN
- PDP type
- Authentication type

Profile ID

This is an integer value ranging from 1 to 16, used to identify and differentiate between various profiles. Each 5G Cisco device can have up to 16 profiles created. Most carriers require only one profile, although a few specific carriers need more than one. The 5G device allows you to associate a profile with a SIM slot. There are two types of profiles: Attach profile and Data profile. Typically, carriers use one profile for both attach and data purposes, but some specific carriers separate them into different profiles:

- **Attach profil**e: It is used by the User Equipment (UE) to register with the cellular network. The attach procedure is the initial step that allows the device to access network services. It's Packet Data Network) (PDN) type must be IPv6. It is important to notice that this profile state remains in Inactive state, it is only used to complete the attach procedure. It ensures that only authorized devices can connect to the carrier's network. It is used by the carrier's network to manage and control how devices access their network.
- **Data profile**: Also known as Default Profile, is the profile which state is ACTIVE, once the device is completely connected to the carrier's network. This is the profile receiving an IP address from the cellular provider. It dictates how a device handles data connections and defines the parameters necessary for establishing and maintaining data connections.

APN

Stands for Access Point Name. It is the name of the access point used by a mobile device to connect to a cellular carrier's data network and subsequently to the internet. Using the correct APN ensures that your device provides the settings necessary to establish a successful connection, receiving the correct IP address, and other technical details. It is mandatory to configure the correct APN assigned by your carrier to the SIM card; otherwise, it results in the inability to access the carrier's network. APNs are carrier-specific. One carrier could have different APNs depending on the type of IP you intend to use, whether dynamic or static.

PDP Type

PDP stands for Packet Data Protocol. This protocol controls and manages data communication over a cellular network. This specifies the type of address used for the data connection:

- IPv4: Referring to the older but most used version 4 of the Internet Protocol.
- IPv6: Referring to the newer version 6 of the Internet Protocol.
- IPv4v6: When setting this value, means that the 5G modem handles both IP versions, 4 and 6.

Authentication Type

This is the method used to authenticate the device to access the network. It is directly related to the APN. The correct authentication type, with its corresponding username and password must be provided by the carrier. The options are:

- **Password Authentication Protocol (PAP)**: The basic authentication method that sends the username and password in plain text.
- **Challenge Handshake Authentication Protocol (CAP)**: Is a more secure method as it uses a challenge-response mechanism. Encrypts the authentication process.
- **None:** Frequently: most of the 5G carriers won't require an authentication mechanism.

Configure

Profile APN Configuration Process

Cellular Gateway CG522

Step 1: Enter controller cellular 1 configuration mode:

```
CellularGateway#conf terminal
CellularGateway(config)#controller cellular 1
```

Step 2. Select the SIM slot you want to configure, 0 or 1. In this example SIM 0 is selected. If you want to select SIM 1, change the 0 for 1:

```
CellularGateway(config-cellular-1)#sim slot 0
```

Step 3. Enter the command profile, followed by the profile ID number, APN, PDN type and authentication if applicable:

```
CellularGateway(config-slot-0)# profile id 4 apn apn.test pdn-type ipv4v6 authentication none
```

In this example, you are creating profile ID number 4, with APN apn.test, PDN type IPv4 and IPv6 and no authentication.

Step 4. Verify the profile has been configured as needed:

```
CellularGateway# show cellular 1 profile
PROFILE ID   APN       PDP TYPE     STATE      AUTHENTICATION USERNAME PASSWORD
--------------------------------------------------------------------------------
4            apn.test  IPv4v6       INACTIVE   None            -        -
```
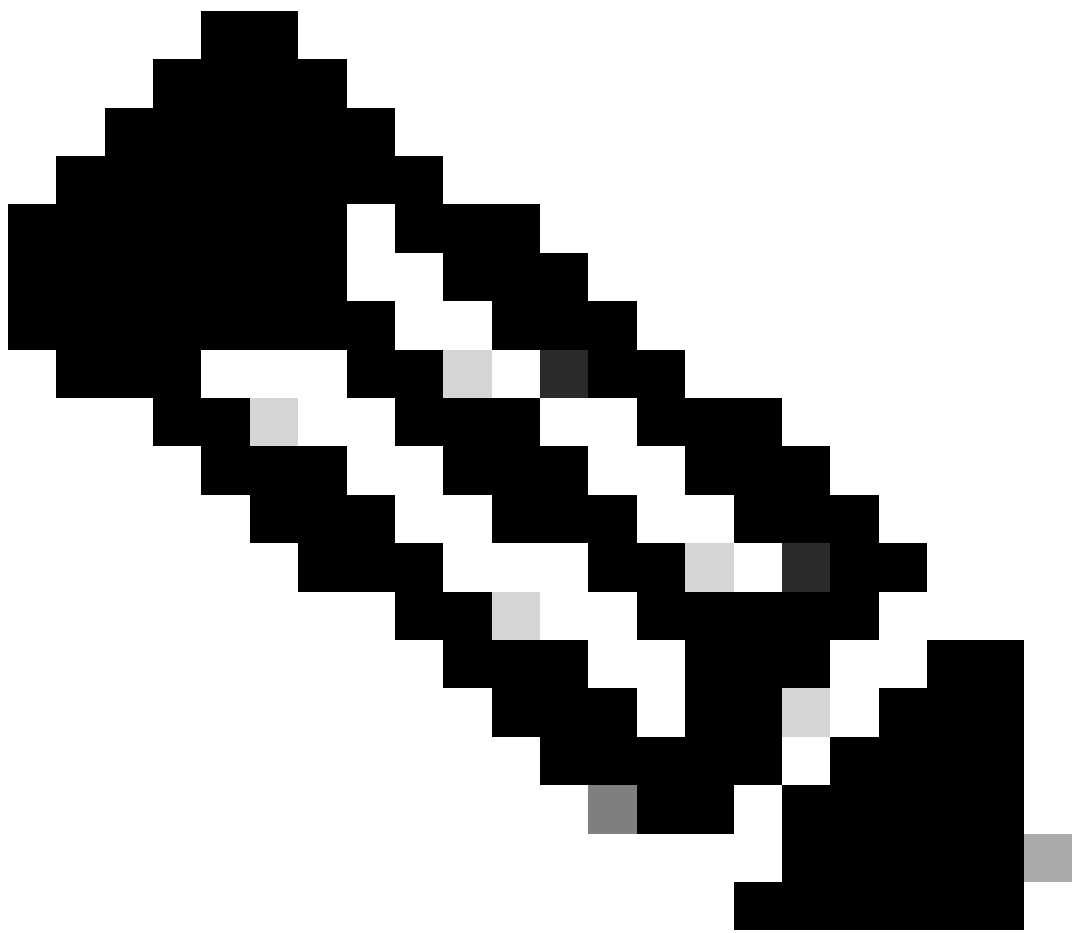
Note: The profile state remains in INACTIVE state until it receives an IP address from the carrier, at that point the state changes to ACTIVE.

Step 5. Make sure the profile is in Active state and received an IP address from the carrier:

```
CellularGateway# show cellular 1 profile
PROFILE ID   APN                PDP TYPE   STATE    AUTHENTICATION    USERNAME    PASSWORD
--------------------------------------------------------------------------------------
4            apn.test           IPv4v6     ACTIVE   none              -           -

CellularGateway#



CellularGateway# show cellular 1 connections
Profile ID = 4
---------------------------
APN = apn.test
Connectivity = Attach and Data
```

```
Session Status = Connected
IPv4 Address = 10.xxx.xxx.xxx
IPv4 Gateway Address = 10.xxx.xxx.xxx
IPv4 Primary DNS = 200.xxx.xxx.xxx
IPv4 Secondary DNS = 200.xxx.xxx.xxx
Tx Packets = 9481, Rx Packets = 0
Tx Bytes = 1809884, Rx Bytes = 0
Tx Drops = 0, Rx Drops = 0
Tx Overflow Count = 0, Rx Overflow Count = 0
CellularGateway#
```

## 5G PIM Module P-5GS6-GL and 5GS6-R16SA-GL

Step 1. Identify the interface number with show commands. In this example, the interface is Cellular 0/1/0:

<#root>

```
Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0/0 unassigned YES NVRAM down down
FastEthernet0/0/1 unassigned YES unset down down
FastEthernet0/0/2 unassigned YES unset down down
FastEthernet0/0/3 unassigned YES unset down down
FastEthernet0/0/4 unassigned YES unset down down
GigabitEthernet0/0/5 unassigned YES unset down down
GigabitEthernet0/0/6 unassigned YES unset down down

Cellular0/1/0 unassigned YES IPCP up up


Cellular0/1/1 unassigned YES NVRAM down down
Async0/2/0 unassigned YES unset up down
Async0/3/0 unassigned YES unset up down
Async0/3/1 unassigned YES unset up down
Async0/3/2 unassigned YES unset up down
Async0/3/3 unassigned YES unset up down
Vlan1 192.xx.xx.x YES NVRAM up down
```
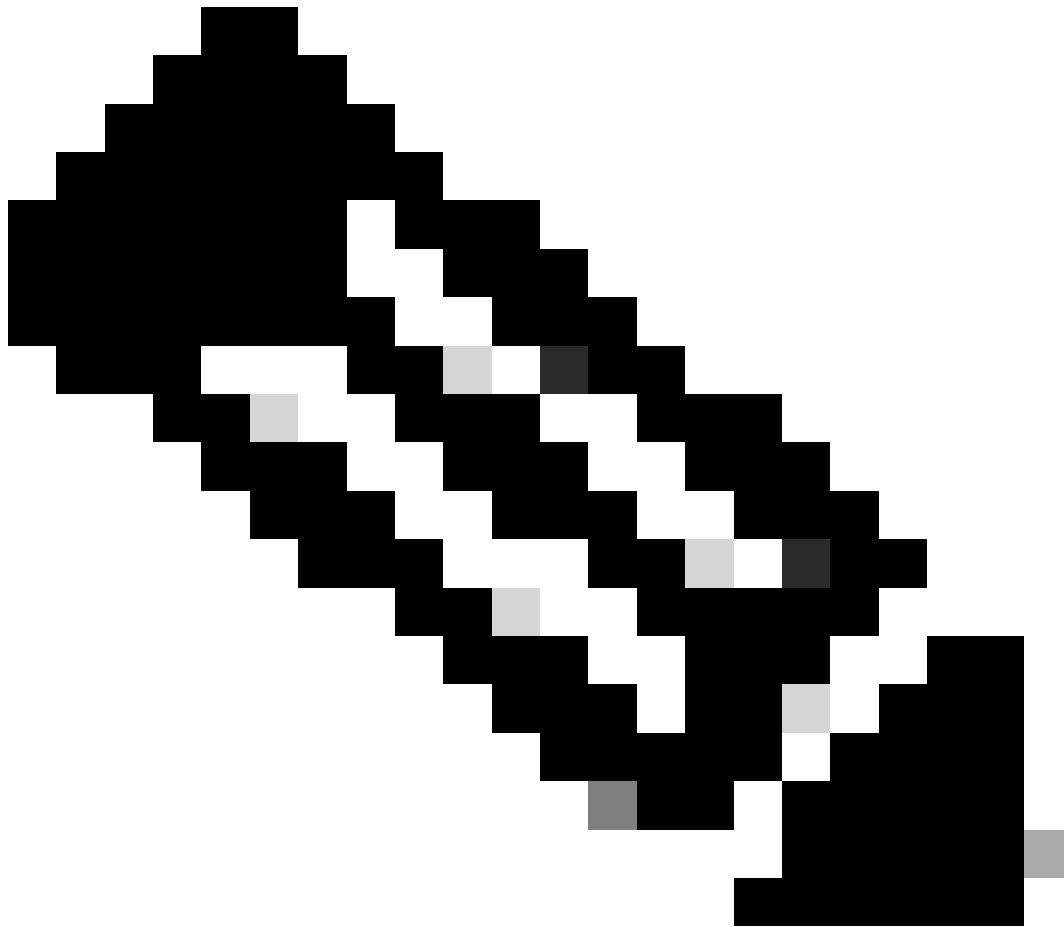
Note: For PIM modules, the unit argument identifies the router slot, subslot and port separated by slashes, example 0/1/0.

Step 2. Enter to controller level configuration:

```
Router#config t
Router(config)#controller cellular 0/1/0
```

Step 3. Enter the cli command profile, followed by profile ID number, APN, PDN type and authentication if needed. Make sure to specify the SIM slot you are configuring by entering slot followed by the corresponding number:

```
Router(config-controller)# profile id 1 apn apn.test pdn-type ipv4v6 authentication none slot 0
```

Step 4. Verify the profile has been configured as needed:

```
Router#show cellular 0/1/0 profile
Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = apn.test
Authentication = None
```

Step 5. Make sure the profile is in Active state and received an IP address from the carrier:

```
Router#show cellular 0/1/0 profile
Profile Information
===================

Profile 1 = ACTIVE* **
--------
PDP Type = IPv4v6
PDP address = 10.xxx.xxx.xxx
IPv4 PDP Connection is successful
Access Point Name (APN) = apn.test
Authentication = None
```

<#root>

```
Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0/0 unassigned YES NVRAM down down
FastEthernet0/0/1 unassigned YES unset down down
FastEthernet0/0/2 unassigned YES unset down down
FastEthernet0/0/3 unassigned YES unset down down
FastEthernet0/0/4 unassigned YES unset down down
GigabitEthernet0/0/5 unassigned YES unset down down
GigabitEthernet0/0/6 unassigned YES unset down down

Cellular0/1/0 10.xxx.xxx.xxx YES IPCP up up


Cellular0/1/1 unassigned YES NVRAM down down
Async0/2/0 unassigned YES unset up down
Async0/3/0 unassigned YES unset up down
Async0/3/1 unassigned YES unset up down
Async0/3/2 unassigned YES unset up down
Async0/3/3 unassigned YES unset up down
Vlan1 192.xxx.x.x YES NVRAM up down
```

Profile Association

Some carriers need more than one profile, one is the attach profile while the other one acts as the data or default profile. If that is the case, you can create both profiles as explained before and then associate those profiles accordingly. Your carrier must confirm whether you need to configure separate profiles for attach

and data, or if a single profile is sufficient. If you configure separate profiles, the selected profile number does not matter as long as they are properly associated.

Cellular Gateway CG522

Step 1. Enter to controller cellular level configuration:

```
CellularGateway#conf terminal
CellularGateway(config)#controller cellular 1
```

Step 2. Select the SIM slot you want to configure, 0 or 1. In this example SIM 0 is selected. If you want to select SIM 1, change the 0 for 1:

```
CellularGateway(config-cellular-1)#sim slot 0
```

Step 3. Configure the attach profile. In this example, profile 4 is associated as attach profile:

```
CellularGateway(config-slot-0)#attach-profile 4
```

Step 4. Configure the data or default profile. In this example, profile 4 is associated as data profile:

```
CellularGateway(config-slot-0)#cellular 1/1 4
```

Step 5. Verify the profiles are associated as needed:

```
CellularGateway#show cellular 1 connections
Profile ID = 4
--------------------------
APN = apn.test
Connectivity = Attach and Data
Session Status = Connected
IPv4 Address = 10.xxx.xxx.xxx
IPv4 Gateway Address = 10.xxx.xxx.xxx
IPv4 Primary DNS = 200.xxx.xxx.xxx
IPv4 Secondary DNS = 200.xxx.xxx.xxx
Tx Packets = 803, Rx Packets = 0
Tx Bytes = 153362, Rx Bytes = 0
Tx Drops = 0, Rx Drops = 0
Tx Overflow Count = 0, Rx Overflow Count = 0
```

5G PIM Module P-5GS6-GL and 5GS6-R16SA-GL

Step 1. Enter to controller configuration level:

```
Router#config t
Router(config)#controller cellular 0/1/0
```

Step 2. Associate the profiles as needed. In this example, profile 1 is associated as attach profile, while profile 3 is associated as data profile, for SIM slot 1:

```
Router(config-controller)# lte sim data-profile 3 attach-profile 1 slot 1
```

Step 3. Verify the profiles are associated as needed and the data profile is in Active state with an IP address assigned:

```
Router#show cellular 0/1/0 profile
Profile Information
===================

Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = ims
Authentication = None

Profile 3 = ACTIVE*
--------
PDP Type = IPv4v6
PDP address = 10.xxx.xxx.xxx
IPv4 PDP Connection is successful
Access Point Name (APN) = apn.test
Authentication = None

* - Default profile
** - LTE attach profile

Configured default profile for active SIM 0 is profile 3.
```
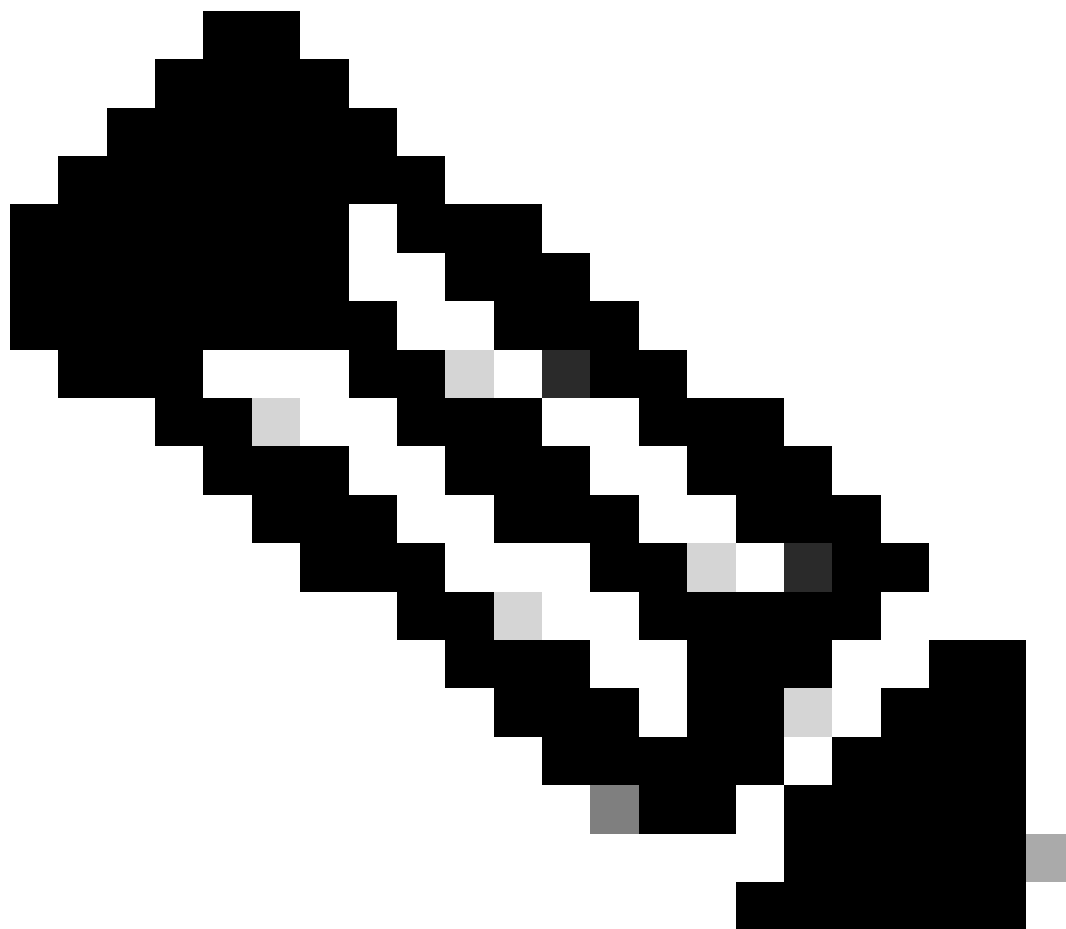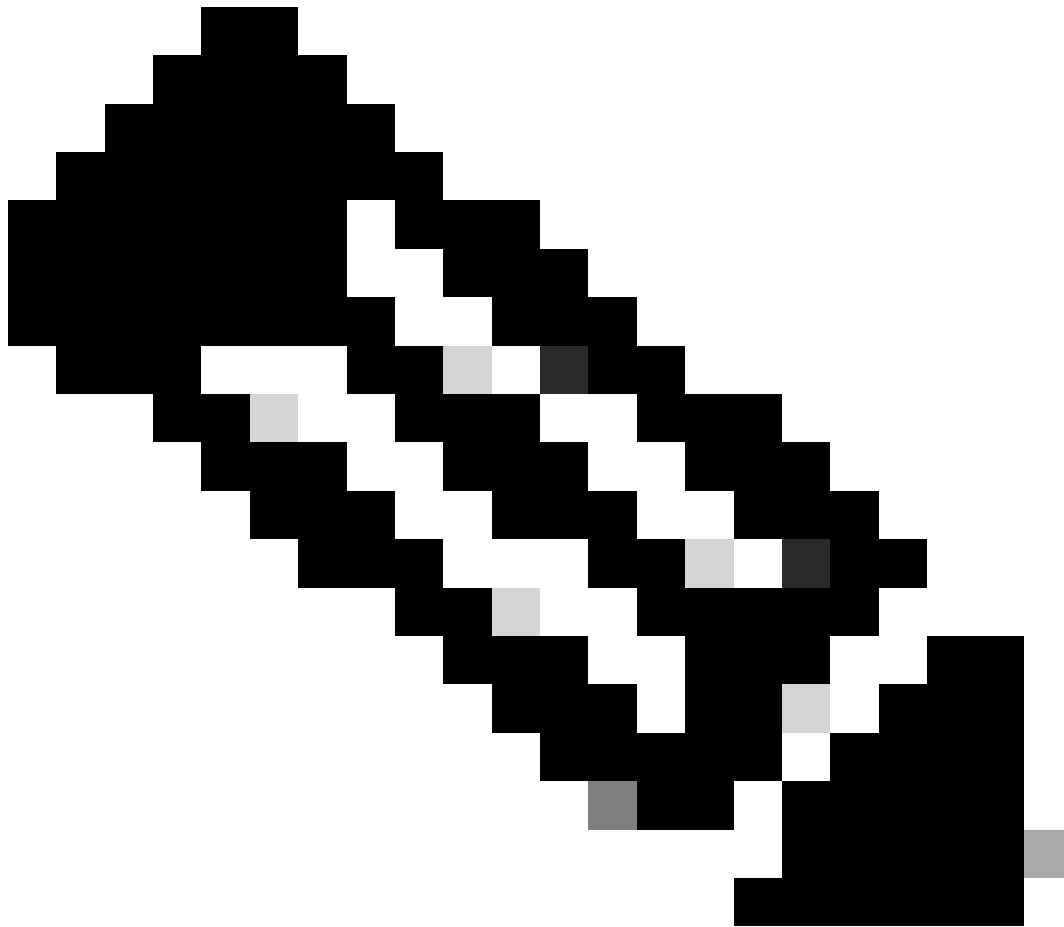
Note: Only one profile is active at a given time.

Note: In 5G PIM modules, one asterisk symbol is placed in front of the data/default profile, while two asterisk symbols are placed in front of the attach profile.

This completes the APN configuration and association and at this point the 5G link must be in up/up state, with an IP address assigned and forwarding traffic.