



# APN-OI-Replacement for Gn-SGSN

- [Feature Description, on page 1](#)
- [How It Works, on page 2](#)
- [Monitoring and Troubleshooting, on page 4](#)

## Feature Description

### Overview

Beginning with release 19.4, in compliance with 3GPP TS 29-003, decoding of the APN-OI-Replacement IE is supported by Cisco Gn-SGSNs using either a Gr MAP or an S6d Diameter interface.

The Gn-SGSN accepts the APN-OI-Replacement field included as part of the GPRS subscription. Typically, the field value, stored at the HLR/HSS as part of the subscription data, is a domain name for a specific GGSN. The value in the APN-OI-Replacement field is intended to replace the APN-OI (derived from the IMSI) during the GGSN selection process. The replacement results in the construction of a fully qualified domain name (FQDN) APN, for a preferred GGSN, to be used for DNS resolution.

### Supported Functions

#### UE-Level

- The Gn-SGSN supports decoding of a UE-level APN-OI-Replacement IE from the HLR/HSS via either MAP or Diameter interface.
- The Gn-SGSN stores the UE-level APN-OI-Replacement value as a subscription database record.
- The Gn-SGSN uses the APN-OI-Replacement only for DNS translation in selection of a Home GGSN.
- The APN sent to other entities (GGSN/SGSN, CGF) is not affected by APN-OI replacement.

#### APN-Level

- The Gn-SGSN supports decoding of a APN-level APN-OI-Replacement IE from the HLR/HSS via either MAP or Diameter interface.
- The Gn-SGSN stores the APN-level APN-OI-Replacement value *per APN* as a subscription database record.

- The Gn-SGSN uses the APN-level APN-OI-Replacement, even when a UE-level APN-OI-Replacement is present, because the APN-level APN-OI-Replacement has higher priority.
- The Gn-SGSN uses the APN-OI-Replacement only for DNS translation while accessing Home GGSN.
- The APN sent to other entities (GGSN/SGSN, CGF) is not affected by APN-OI replacement.

### Gn-SGSN

- The Gn-SGSN indicates APN-level and UE-level APN-OI replacements received in subscriptions as part of the output generated by the **show subscriber gprs-only | sgsn-only full all** command.
- The Gn-SGSN applies APN-level APN-OI-Replacement when both APN-level and UE-level APN-OI replacement are available for a PDP context.

### Benefits

This feature makes it possible for the operator to use UE-level and/or APN-level APN-OI replacement to substitute an APN-OI per UE or per APN and then redirects the PDP session to a different GGSN.

This fully-compliant 3GPP functionality enables operators to differentiate service or customer UE and/or APN levels based on the HLR/HSS subscription.

### Limitations

The Gn-SGSN does not handle EPS subscription. This means that even though the Gn-SGSN supports S6d, the APN-OI-Replacement in an EPS subscription is not applicable.

### Related Product Support

Decoding of this AVP is supported by both the Cisco S4-SGSN and MME for EPS subscriptions.

### License Information

This feature is enabled by default and does not require a feature license.

### Configuration

Because this feature is 3GPP compliant and does not require enabling or configuration, there are no CLI commands or keywords specific to this feature.

## How It Works

The Gn-SGSN supports decoding of the UE and/or APN level APN-OI-Replacement IE received in GPRS subscriptions on either the Gr interface or the S6d interface.

In accord with 3GPP TS 23.060:

- UE-level APN-OI-Replacement field values are conditionally stored as permanent data in the HSS/HLR and the SGSN.
- APN-level APN-OI-Replacement field values are conditionally stored as permanent data in the HSS and the SGSN.

- APN-level APN-OI-Replacement has the same role as UE-level APN-OI-Replacement. If both the APN-level APN-OI-Replacement and the UE-level APN-OI-Replacement are present, the APN-level APN-OI-Replacement has a higher priority than UE-level APN-OI-Replacement.

The format of the domain name used in the APN-OI-Replacement field (as defined in 3GPP TS 23.060 and 3GPP TS 23.401) is the same as the default APN-OI except that it may be preceded by one or more labels, each separated by a dot.

- Example 1: province1.mnc012.mcc345.gprs
- Example 2: ggsn-cluster-A.provinceB.mnc012.mcc345.gprs

The APN-OI-Replacement handling is case insensitive.

The APN constructed using the APN-OI-Replacement field is only used for DNS translation to locate the Home GGSN. DNS translation for other entities is unaffected.

### Flow

1. During a 2G/3G Attach procedure, the Gn-SGSN receives an Insert Subscriber Data (ISD) during UGL/ULR from the HLR/HSS.
2. APN-OI-Replacement IE is present in the Subscription-Data AVP sent in an Insert-Subscriber-Data-Request (IDR) if the UE-level APN-OI-Replacement has been added or modified in the HSS.  
APN-OI-Replacement IE is present in the GPRS-Subscription-Data sent in an Insert-Subscriber-Data (ISD) if the UE-level APN-OI-Replacement has been added or modified in the HLR.
3. APN-OI-Replacement IE is present in the PDP-Context AVP sent within an Insert-Subscriber-Data-Request (IDR) if the APN-level APN-OI-Replacement has been added or modified in the HSS.  
APN-OI-Replacement IE is present in the PDP-Context IE in the GPRS-Data-List sent within an Insert-Subscriber-Data (ISD) if the APN-level APN-OI-Replacement has been added or modified in the HLR.
4. After receiving an APN-OI-Replacement from an HLR/HSS,
  - the Gn-SGSN decodes the IE,
  - the Gn-SGSN replaces the stored information (if any) with the received APN-OI-Replacement under the subscription dB record for the subscriber on the SGSN,
  - during activation of the PDP context, the Gn-SGSN presents this replacement APN-OI to be used for the DNS resolution to determine the GGSN.
5. The HLR (MAP) removes the UE-level APN-OI-Replacement by setting the "APN-OI-Replacement withdraw" bit of the Delete-Subscriber-Data (DSD), sent over Gr.  
The HSS removes the UE-level APN-OI-Replacement by setting the "APN-OI-Replacement" bit of the Delete-Subscriber-Data-Request (DSR) flag field of S6d.

# Monitoring and Troubleshooting

## Monitor Protocol

Monitor Protocol functionality is supported for this feature and can be used by enabling MAP (55), Diameter (36), and DNS Client (70).



### Caution

Protocol monitoring can be intrusive to subscriber sessions and could impact system performance. We recommend that you contact your Cisco Support Representative prior to using it for troubleshooting.

## Output of "show" Commands

The Gn-SGSN displays received UE-level APN-OI-Replacements under GPRS subscriptions and APN-level APN-OI-Replacements under PDP subscription data of the output generated by the **show subscriber [ gprs-only | sgsn-only ] full imsi imsi** commands.

## Quick Check

To quickly check for APN-OI-Replacement use the following **grep** command with either the **gprs-only** or the **sgsn-only** keyword:

```
show subscribers gprs-only full imsi imsi | grep Repl
```

The following illustrates the type of output generated by the above command. The first line is for UE-level replacement information and the second line illustrates APN-level replacement information:

```
APN OI Replacement : abc.ggg.mnc009.mcc262.gprs
APN OI Replacement: : ggg.mnc009.mcc262.gprs
```

## Full Display

To generate the full output, use the same command without the **grep** option:

```
show subscribers gprs-only full imsi imsi
```

The following is a limited sample of the display that is generated. The entries for APN-OI-Replacement are in bold:

```
show subscribers sgsn-only full all

Username: 491740460103
Access Type: sgsn
Access Tech: WCDMA UTRAN
callid: 01317b21
state: Connected
connect time: Sun Apr 24 12:20:44 2016
idle time: 00h00m00s
Imsimgr Instance: 1
Operator Policy Name: policy1

Network Type: IP
msid: 262090426000193
call duration: 00h00m11s
Temporary Imsimgr instance: 0

...
EPS Subscription:
None:

GPRS Subscription:
APN OI Replacement : abc.mnc009.mcc262.gprs
PDP Subscription Data:
```

```
PDP Context Id: 1
APN: WAP98.TESTNETZ-VD2.DE
APN OI Replacement:                : op1.mnc009.mcc262.gprs
PDP Type: IPv4
PDP Address Type: Dynamic
Charging Characteristics: Normal Billing
VPLMN Address Allowed : Not Allowed
...
...
```

The "APN OI Replacement" field under the GPRS Subscription section lists the information for a UE-level APN-OI-Replacement.

The "APN OI Replacement" field under the PDP Subscription Data section lists the information for an APN-level APN-OI-Replacement.

