APN-OI-Replacement for Gn-SGSN

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                      Network Type: IP
  Access Tech: WCDMA UTRAN
  callid: 01317b21                       msid: 262090426000193
  state: Connected
  connect time: Sun Apr 24 12:20:44 2016 call duration: 00h00m11s
  idle time: 00h00m00s
  Imsimgr Instance: 1                    Temporary Imsimgr instance: 0
  Operator Policy Name: policy1
…
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.