



OmniHSS



OmniHSS 4G LTE (EPC) IMS (IP) (HSS)
OmniHSS

OmniHSS Elixir Erlang VM



HSS LTE IMS

-
-
-
-
-
- (EIR)



- S6a** - LTE/EPC
- Cx** - IMS
- Sh** - IMS
- S13** - (OmniHSS EIR)
- Gx** - (OmniHSS PCRF)
- Rx** - IMS (OmniHSS PCRF)
- PLMN IMS
- MSISDN** -
- RESTful API** - API (OmniHLR)
- Web** -



OmniHSS

- **MME** () - LTE ()
- **P-GW** (PDN) - OmniHSS (PCRF)
- **P-CSCF** () - IMS ()
- **I-CSCF** (CSCF) - IMS ()
- **S-CSCF** (CSCF) - IMS ()
- **AS** () - IMS ()
- **OmniHLR** - API OmniHSS HLR

()

()

()

- - Diameter ()
- - ()
- - ()

()

- - Web ()
- - ()
- - ()
- **API** () - API ()
- **Webhooks** - ()

()

- - EPC IMS APN ()
- - ()
- - Diameter ()
- **PCRF** - (Gx/Rx QoS VoLTE)
- **EIR** - (S13 IMEI ())
- **MSISDN** **IMSI** - IMSI

()

()

() (Web ())

URL: https://[hostname]:7443

() Diameter ()

API ()

URL: https://[hostname]:8443

RESTful API

- config/runtime.exs - (Diameter)
- priv/cert/ - HTTPS Diameter TLS

1. -
2. **Diameter** - Diameter
3. - API /api/subscriber/imsi/:imsi
4. - SQL

stdout/stderr (systemd/supervisord)

- **Diameter** - Diameter
- - runtime.exs
- -

- **API** - GET /api/status
- -
- - SQL

- **TLS** - API HTTPS
- - priv/cert/
- - runtime.exs
- - Diameter
- **API** -

???

??

????????????????????

- ? ???? ? ? ? ? ? ? ? ? ? ?
- ? ? ???? ? ? ? ? ? ? ? ?
- ? ? ???? ? ? ? ? ? ? ?
- ? ? API ?? ? ? ? ? ? ? ? ?

???? 1.0
??? Omnitouch ? ? ? ?



EIR



HSS EIR IMEI



- **S13** Diameter
- **IMEI** IMEI/IMEISV
- IMEI/IMEISV IMSI
-
-
- **REST API** CRUD EIR

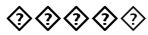


Diameter

ID
S13 16,777,252 MME/SGSN



EIR



- whitelist -
- blacklist -
- greylist -

IMEI/IMEISV IMSI



0
1
2

S13

ECR/ ECA

MME/SGSN → HSS EIR

MME

AVP

- Session-Id
- Origin-Host, Origin-Realm
- Destination-Realm
- Auth-Session-State
- Terminal-Information
 - IMEI15
 - Software-Version2
- User-NameIMSI
- Vendor-Specific-Application-Id

EIR

1. IMEI Software-Version IMSI
2. IMSI
 -
 -
3. **IMEISV** IMEI + Software-Version
 - **IMEI** IMEI
 - **IMSI**
 -
- 4.

AVP

- Session-Id
- Result-Code: 2001
- Equipment-Status: 0/ 1/ 2

- Experimental-Result: 5422/
- Experimental-Result: 5012

???

???

EIR ?

1. IMEISV + IMEI + Software-Version

↓

2. IMEI

↓

3. IMSI

↓

4.

???

1 IMEISV

- IMEI + Software-Version "35979139461611" + "08" = "3597913946161108"
- EIR
- "whitelist" "blacklist" "greylist"

2 IMEI

- IMEI "35979139461611"
- EIR
-

3 IMSI

- IMSI "999999876543210"
- EIR
-
-

4

- eir_unknown_equipment_behaviour
- :whitelist -
 - :blacklist -
 - :greylist -
 - :reject_unknown_equipment - 5422

????????

 ?? ?? ??
"35979139461650" ?? IMEI ??/?
"3597913946165.*" IMEI ??/?
"3597913946161108" ?? IMEISV ??/?
"999999876543210" IMSI ??/?
"359791.*" TAC ?? ??/?

?????

?? **1**???? - ???? **IMEI**

?? **2**???? - ???? **IMEI**????

?? **3**???? - ?????????

?? **4**???? - ?????????

?? **5**???? - ?????

?? **6**???? - **IMEISV** ??

?? **7**???? - **IMSI** ??

REST API

EIR ?????

?????/api/eir/rule

???? **EIR** ?????

???

GET /api/eir/rule

???HTTP 200??

```
{
  "data": [
    {
      "id": 1,
      "action": "whitelist",
      "regex": "3597913946165.*",
    }
  ]
}
```



```
{
  "data": {
    "id": 3,
    "action": "blacklist",
    "regex": "35979139461640"
  }
}
```

HTTP 400

```
{
  "errors": {
    "regex": [""]
  }
}
```

EIR

PATCH /api/eir/rule/{id}
Content-Type: application/json

```
{
  "action": "greylist"
}
```

HTTP 200

```
{
  "data": {
    "id": 3,
    "action": "greylist",
    "regex": "35979139461640"
  }
}
```

EIR

PUT /api/eir/rule/{id}
Content-Type: application/json

```
{
  "action": "whitelist",
  "regex": "359791394616.*"
}
```

HTTP 200

```
{
  "data": {
    "id": 3,
    "action": "whitelist",
    "regex": "359791394616.*"
  }
}
```

EIR

DELETE /api/eir/rule/{id}

HTTP 204

Diameter

S13 config/runtime.exs

```
%{
  application_name: :hss_s13,
  application_dictionary: :diameter_gen_3gpp_s13,
  vendor_specific_application_ids: [
    %{vendor_id: 10415, auth_application_id: 16_777_252}
  ]
}
```

config/runtime.exs

```
config :hss, :eir,
  unknown_equipment_behaviour: :whitelist
```

- :whitelist -
- :blacklist -
- :greylist -
- :reject_unknown_equipment - Diameter 5422

???

- ??/??:whitelist - ?????
- ?????:whitelist - ?????
- ?????:greylist - ?????
- ?????:reject_unknown_equipment - ?????

????

2001	??	DIAMETER_SUCCESS	?????
5422	??	DIAMETER_ERROR_EQUIPMENT_UNKNOWN	????????
5012	??	DIAMETER_ERROR_UNKNOWN	????

??

1. ?????

?????

???

```
POST /api/eir/rule
{
  "action": "blacklist",
  "regex": "35979139461640" # ?? IMEI
}
```

?????

2. ?????

?????

???

```
POST /api/eir/rule
{
  "action": "whitelist",
  "regex": "359791394.*" # ???/? TAC
}
```

?? TAC ?????

3.

?

```
POST /api/eir/rule
{
  "action": "blacklist",
  "regex": "999999876543210" # IMSI
}
```

◆◆◆◆◆ SIM ◆◆◆◆◆

4.














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```
POST /api/eir/rule
{
  "action": "greylist",
  "regex": "35979139.*" # 35979139 TAC
}
```


5. $\diamond \diamond \diamond \diamond \diamond \diamond$

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```
POST /api/eir/rule
{
  "action": "blacklist",
  "regex": "359791394616.*05"  # IMEI 0000000000000000 + 0000000000000000 05
}
```

IMEI "05"

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EIR

- **S13** - ECR/ECA
- - IMEI/IMEISV/IMSI
- **EIR** -
- **REST API** -

1. **IMEISV** IMEI +
2. **IMEI** IMEI
3. **IMSI** IMSI
- 4.

- whitelist -
- blacklist -
- greylist -
- reject_unknown_equipment -

IMEI

IMEI EIR

- IMEI
-
- API

EIR ID

```
1 "359791.*" "whitelist"
2 "35979139461640" "blacklist"
```

- S13 ECR
- REST API EIR
- IMEI

- Diameter - S13
- API - API
- - HSS
- -

◆◆◆IMEI◆◆◆

IMEI 15

35 9791 394616 1
├── 2 2 2 2 Luhn 2 2 2
├── 2 2 2 2 6 2 2 2 2
├── FAC 2 2 2 2 2 2 2 2 4 2 2 2 2
└── TAC 2 2 2 2 2 2 2 2 2 2 8 2 2 2 2 RBI 2
 ├── RBI 2 2 2 2 2 2 2 2 2 2 2
 └── 2 2 2 2 / 2 2 2 2 6 2 2 2 2

IMEISV    **16**    

```

35 9791 394616 1 08
└─┬──┴──┬──┴──┬──┐
    IMEI ? 15 ? ? ? ?   ? ? ? ? ? 2 ? ? ? ?

```






IMEI/IMEISV

??

??

359791394616108 3597913946161.*  TAC+FAC+ 359791394616* 
359791394616140 35979139461614.  359791394616141-9 
35979139461640 35979139461640  IMEI 
3597913946163008 3597913946163008  IMEISV IMEI + SV



PCRF



HSS PCRF
LTE QoS PCRF



- **Gx** PGW/PCEF / QoS
- **Rx** IMS IP QoS
- RAR
- **VoLTE** QoS
- TFT
- **REST API**



Diameter

ID
Gx 16,777,238 PGW (PCEF) PDN QoS
Rx 16,777,236 P-CSCF (AF) IMS



PCRF PDN VoLTE

Gx



1. - CCR-I

PGW PDN

AVPs

- Session-Id
- Origin-Host, Origin-Realm
- Subscription-Id IMSI

- Called-Station-Id   
- IP-CAN-Type        
- RAT-Type       
- Framed-IP-Address  IP   

PCRf

1. IMSI
2. APN QoS
- 3.
4. APN QoS

AVPs

- Result-Code: 2001 $\diamond$ DIAMETER_SUCCESS $\diamond$
- QoS-Information $\diamond$ APN $\diamond \diamond \diamond \diamond \diamond \diamond \diamond$
- Default-EPS-Bearer-QoS $\diamond$ QCI $\diamond$ ARP $\diamond \diamond \diamond \diamond \diamond$
- Bearer-Control-Mode

2. - CCR-U

 PGW

PCRF

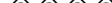
- [illegible]

Result-Code 2001

3. $\diamond\diamond\diamond\diamond\diamond\diamond - \diamond\diamond\diamond\text{CCR-T}\diamond$

◆◆◆PGW ◆◆ PDN ◆◆

PCRf

1.  ID 
2. 
3. 

Result-Code 2001

4. **RRR**

$\diamond \diamond \diamond \text{PCRF} \rightarrow \text{PGW} \diamond \text{HSS} \diamond \diamond \diamond$

?

- IMS ☐☐☐☐☐ Rx AAR ☐☐ Gx RAR ☐
- IMS ☐☐☐☐☐ Rx STR ☐☐ Gx RAR ☐
- ☐☐ REST API ☐☐☐☐☐☐

RAR AVPs

- Session-Id?PGW ? ID?
- Auth-Application-Id: 16,777,238
- Re-Auth-Request-Type?0 = ? ? ? ?
- Charging-Rule-Install/Remove
- QoS-Information? ? ? ? ? ? ? ?

PGW

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PCRF TFT

- $\begin{array}{|c|c|c|c|c|c|} \hline ? & ? & ? & ? & ? & ? \\ \hline \end{array} - \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|} \hline ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? \\ \hline \end{array}$
- $\begin{array}{|c|c|c|c|} \hline ? & ? & ? & ? \\ \hline \end{array} - \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|} \hline ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? \\ \hline \end{array}$
- $\begin{array}{|c|c|c|c|c|c|c|c|} \hline ? & ? & ? & ? & ? & ? & ? & ? \\ \hline \end{array} - \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|} \hline ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? & ? \\ \hline \end{array} \text{ OoS}$

-  Gx RAR
- 
-  5  /  IP  /  TFT 

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- ? ? ? - ? ? ? ? ? Spotify WhatsApp Facebook ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? - ?
- ? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? SLA - ? ? ? ? ? ? ? ? ? QoS

QoS

◆◆◆◆ **QoS** ◆◆◆ APN ◆◆◆◆

```
{
  "QoS-Class-Identifier": 9,           // QCI 9 = 00000
  "APN-Aggregate-Max-Bitrates-UL": 50000, // kbps
  "APN-Aggregate-Max-Bitrates-DL": 100000, // kbps
  "Allocation-Retention-Priority": {
    "Priority-Level": 8,
    "Pre-emption-Capability": 1,       // 0000
  }
}
```

```

    "Pre-emption-Vulnerability": 1    // 0000
}
}

```

0000 **QoS**000 VoLTE00

```

{
  "QoS-Class-Identifier": 1,          // QCI 1 = 0000
  "Max-Requested-Bandwidth-UL": 128000, // bps
  "Max-Requested-Bandwidth-DL": 128000, // bps
  "Guaranteed-Bitrate-UL": 128000,
  "Guaranteed-Bitrate-DL": 128000
}

```

Rx 00

000000

1. AA 000**AAR**0/ **AA** 000**AAA**0

000P-CSCF 00 IMS 0000000000VoLTE 000000

00 **AVPs**0

- Session-Id0P-CSCF 0000000
- Subscription-Id0IMSI 0 SIP URI0
- Media-Component-Description
 - Media-Type00000000
 - Max-Requested-Bandwidth-UL/DL
 - Codec-Data
 - Flow-Description05 00000000000
- AF-Application-Identifier

PCRF 000

1. 00 IMSI 0 SIP URI 000000
2. 00000 IMS 00
3. 0000000000000000000000000000
4. 00000000000
5. 00 **Gx RAR** 0 **PGW** 00000000
6. 00 Gx RAA 00
7. 00 Rx AAA 000000

00 **AVPs**0

- Result-Code: 200100000 506300000000

2. STR/ STA

P-CSCF IMS

PCRF

1. P-CSCF ID
2. Gx RAR PGW
- 3.
4. STA

Result-Code 2001

1 PDN

2 VoLTE Rx AAR → Gx RAR

3 VoLTE Rx STR → Gx RAR

4 PDN

5 PDN

6 REST API

REST API

PCRF

POST /api/operation/pcrf_re_auth

Gx

APN
QoS -

```
{  
  "imsi": "999999876543210",  
  "apn": "ims"  
}
```

HTTP 200

```
{
  "data": "Gx Re-Auth Request for 999999876543210 sent to
pgw.epc.mnc999.mcc999.3gppnetwork.org, Result-Code: 2001"
}
```

HTTP 400

```
{
  "error": "Unable to send Re-Auth Request for 999999876543210 on APN
ims, no active PDN Session found"
}
```

API

PCRF APN QoS REST API

APN QoS QCI AMBR ARP PGW Gx RAR

APN → APN QoS → APN
 ↓ ↓ ↓
 "internet" QCI, AMBR, ARP

1. APN

APN IP

POST /api/apn/identifier

```
{
  "apn_identifier": {
    "apn": "internet",
    "ip_version": "ipv4v6"
  }
}
```

IP

- "ipv4" - IPv4
- "ipv6" - IPv6

- "ipv4v6" - 1 IPv4 1 IPv6
- "ipv4_or_ipv6" - 1 IPv4 1 IPv6

HTTP 201

```
{
  "data": {
    "id": 1,
    "apn": "internet",
    "ip_version": "ipv4v6"
  }
}
```

- apn 1-254
- ip_version 1-2

APN GET /api/apn/identifier

2. APN QoS

QoS QCI

POST /api/apn/qos_profile

```
{
  "apn_qos_profile": {
    "name": " ",
    "qci": 9,
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 100000,
    "apn_ambr_ul_kbps": 50000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}
```

QoS

name	string 1-254	QoS 1-4 = GBR 5-9 = GBR ARP 1 =
qci	integer 1-254	
allocation_retention_priority	integer 1-15	

apn_ambr_dl_kbps	integer 1-4,294,967,293	APN ? ? ? ? ? ? ? ? ? ? ? kbps ?
apn_ambr_ul_kbps	integer 1-4,294,967,293	APN ? ? ? ? ? ? ? ? ? ? ? kbps ?
pre_emption_capability	boolean true/false	? ? ? ? ? ? ? ? ? ? ? ?
pre_emption_vulnerability	boolean true/false	? ? ? ? ? ? ? ? ? ? ? ?

QCI

- 1 - VoLTE - GBR 100ms
- 2 - - GBR 150ms
- 5 - IMS - GBR 100ms
- 9 - - GBR 300ms

HTTP 201

```
{
  "data": {
    "id": 1,
    "name": " ",
    "qci": 9,
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 100000,
    "apn_ambr_ul_kbps": 50000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}
```

QoS GET /api/apn/qos_profile

3. APN

APN QoS

POST /api/apn/profile

```
{
  "apn_profile": {
    "name": " APN",
    "apn_idenfier_id": 1,
    "apn_qos_profile_id": 1
  }
}
```

???

- name????????????
- apn_identifier_id??? [APN](#) ??? ID
- apn_qos_profile_id??? [APN QoS](#) ??? ID

???HTTP 201??

```
{
  "data": {
    "id": 1,
    "name": "??? APN",
    "apn_identifier_id": 1,
    "apn_qos_profile_id": 1
  }
}
```

???

- apn_identifier_id ? apn_qos_profile_id ?????
- ?? APN ???? QoS ?????

?? **APN** ???GET /api/apn/profile

??????

?? **1??? IMS APN** ???**VoLTE**

```
# 1. ?? APN ???
curl -X POST https://hss.example.com:8443/api/apn/identifier \
-H "Content-Type: application/json" \
-d '{
  "apn_identifier": {
    "apn": "ims",
    "ip_version": "ipv4v6"
  }
}'
# ???{"data": {"id": 2, ...}}

# 2. ?? QoS ???IMS ???
curl -X POST https://hss.example.com:8443/api/apn/qos_profile \
-H "Content-Type: application/json" \
-d '{
  "apn_qos_profile": {
    "name": "IMS ?? QoS",
    "qci": 5,
    "allocation_retention_priority": 2,
    "apn_ambr_dl_kbps": 5000,

```


5. API

100 QoS ID 1 " " APN 100 API 150 Mbps / 75 Mbps

APN QoS APN PDN

```
DELETE /api/apn/identifrier/{id}
DELETE /api/apn/qos_profile/{id}
DELETE /api/apn/profile/{id}
```

- APN APN QoS
- APN

100 Mbps / 50 Mbps

```
{
  "apn_qos_profile": {
    "name": " ",
    "qci": 9,
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 100000,
    "apn_ambr_ul_kbps": 50000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}
```

500 Mbps / 100 Mbps

```
{
  "apn_qos_profile": {
    "name": " ",
    "qci": 8,
    "allocation_retention_priority": 5,
    "apn_ambr_dl_kbps": 500000,
    "apn_ambr_ul_kbps": 100000,
    "pre_emption_capability": true,
    "pre_emption_vulnerability": false
  }
}
```

◆◆◆/M2M◆◆◆◆◆

```
{
  "apn_qos_profile": {
    "name": "◆◆◆ M2M",
    "qci": 9,
    "allocation_retention_priority": 10,
    "apn_ambr_dl_kbps": 1024,
    "apn_ambr_ul_kbps": 512,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}
```

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```
{
  "apn_qos_profile": {
    "name": "◆◆ APN",
    "qci": 5,
    "allocation_retention_priority": 1,
    "apn_ambr_dl_kbps": 10000,
    "apn_ambr_ul_kbps": 10000,
    "pre_emption_capability": true,
    "pre_emption_vulnerability": false
  }
}
```

◆◆

Diameter ◆◆◆◆

Gx ◆◆◆config/runtime.exs◆◆

```
%{
  application_name: :hss_gx,
  application_dictionary: :diameter_gen_3gpp_gx,
  vendor_specific_application_ids: [
    %{vendor_id: 10415, auth_application_id: 16_777_238}
  ]
}
```

Rx ◆◆◆config/runtime.exs◆◆

```
%{
  application_name: :hss_rx,
  application_dictionary: :diameter_gen_3gpp_rx,
  vendor_specific_application_ids: [
```

```
%{vendor_id: 10415, auth_application_id: 16_777_236}  
]  
}
```

QoS

QoS

- APN
 - apn_qos_profile.qci QoS
 - apn_qos_profile.apn_ambr_ul_kbps
 - apn_qos_profile.apn_ambr_dl_kbps
 - apn_qos_profile.priority_level
- Rx AAR
 - QCI 1
 - Max-Requested-Bandwidth AVPs
 - Flow-Description AVPs

2001	DIAMETER_SUCCESS	
5001	IMSI	
5002	PDN	
5063	IMS	

PCRF

- PDN - APN
- VoLTE - IMS
- QoS - APN
-

PCRF

- Gx
- TFT

- [? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?](#)
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[? ?](#) TFT [? ? ? ? ? ? ? ?](#)

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- [Diameter](#) [? ?](#) - [? ? ? ? ? ? ?](#)
- [API](#) [? ?](#) - [? ?](#) API [? ?](#)
- [? ?](#) - [? ?](#) HSS [? ?](#)
- [? ? ? ? ?](#) - [? ? ? ? ?](#) Diameter AVP [? ? ?](#)



API

[← !\[\]\(130eb552b7f729639752562c836f911d_img.jpg\) !\[\]\(51c3bd9318d7b4f5837800cf94c892d7_img.jpg\) API !\[\]\(e934f2452533f3bb214f09c8740ba68b_img.jpg\) !\[\]\(e1b731f679c000ceb6732b45ad169607_img.jpg\)](#)

- [!\[\]\(7d39ae17ca7a5457348eb0c76c018379_img.jpg\) !\[\]\(31936900750b0e1213250ae89b772fd1_img.jpg\) !\[\]\(2ae16ca04f2dbe4b7d6598421310a230_img.jpg\) !\[\]\(7c7d0741680f855d38ee68fc18a6cabf_img.jpg\) !\[\]\(ffbedf0308537b9a52e7ceebb8c950f3_img.jpg\) !\[\]\(4f8168548d14bd9606699aea625b764d_img.jpg\)](#)
 - [!\[\]\(e28976e32ee24dae0b7c7674bf2dd102_img.jpg\) !\[\]\(29623c9b227c6aa4c5463241776fe4c5_img.jpg\) !\[\]\(2b47868cc4e5acb9c091e034c238db79_img.jpg\) !\[\]\(fdef84e23617df0b4da27674d3b07ec3_img.jpg\) !\[\]\(10abfcb77a6dd4a7f3c8158d5cf799fe_img.jpg\) !\[\]\(2a4873e52f6b87703d5f8bc72be42150_img.jpg\)](#)
-

400    

```
{  
  "error": "Invalid JSON format"  
}
```

- JSON    
-      
-      

404   

```
{  
  "error": "Resource not found"  
}
```

-     /     /    
- URL   ID   

422       

```
{  
  "errors": {  
    "imsi": ["has already been taken"],  
    "key_set_id": ["does not exist"]  
  }  
}
```

}

???

- ????
- ????????
- ???????

500 ??????

```
{  
  "error": "Internal server error"  
}
```

???

- ???????
- ????????

??????

[← ?? API ??](#)



API

[← API](#)

- [API](#)
 - [API IP](#)
-

jq JSON apt-get install jq brew install jq

- [API](#)
- [APN](#)
- [EPC](#)
- [API](#)

```
# 1.
KEY_SET_ID=$(curl -k -X POST https://hss.example.com:8443/api/key_set \
-H "Content-Type: application/json" \
-d '{
  "key_set": {
    "ki": "0123456789ABCDEF0123456789ABCDEF",
    "opc": "FEDCBA9876543210FEDCBA9876543210",
    "authentication_algorithm": "milenage"
  }
}' | jq -r '.data.id')
```

```
# 2. APN QoS
APN_QOS_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/
qos_profile \
-H "Content-Type: application/json" \
-d '{
```

```

    "apn_qos_profile": {
      "name": "????? QoS",
      "qci": 9,
      "allocation_retention_priority": 8,
      "apn_ambr_dl_kbps": 50000,
      "apn_ambr_ul_kbps": 25000
    }
  }' | jq -r '.data.id')

```

3. ?? APN ???

```

APN_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/
identifier \
-H "Content-Type: application/json" \
-d '{
  "apn_identifier": {
    "apn": "internet",
    "ip_version": 2
  }
}' | jq -r '.data.id')

```

4. ?? APN ?????

```

APN_PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/
apn/profile \
-H "Content-Type: application/json" \
-d "{
  \"apn_profile\": {
    \"name\": \"???? APN\",
    \"apn_identifier_id\": $APN_ID,
    \"apn_qos_profile_id\": $APN_QOS_ID
  }
}" | jq -r '.data.id')

```

5. ?? EPC ?????

```

EPC_PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/
epc/profile \
-H "Content-Type: application/json" \
-d '{
  "epc_profile": {
    "name": "?????",
    "ue_ambr_dl_kbps": 100000,
    "ue_ambr_ul_kbps": 50000
  }
}' | jq -r '.data.id')

```

6. ?????

```

SUBSCRIBER_ID=$(curl -k -X POST https://hss.example.com:8443/api/
subscriber \
-H "Content-Type: application/json" \

```

```
KEY_SET_ID=$(curl -k -X POST https://hss.example.com:8443/api/key_set
\
-H "Content-Type: application/json" \
-d '{
    "key_set": {
        "ki": "0123456789ABCDEF0123456789ABCDEF",
        "opc": "FEDCBA9876543210FEDCBA9876543210",
```

```
        "authentication_algorithm": "milenage"
    }
}' | jq -r '.data.id')
```

2. APN QoS

```
APN_QOS_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/
qos_profile \
-H "Content-Type: application/json" \
-d '{
    "apn_qos_profile": {
        "name": "IoT APN",
        "qci": 9,
        "allocation_retention_priority": 8,
        "apn_ambr_dl_kbps": 10000,
        "apn_ambr_ul_kbps": 5000
    }
}' | jq -r '.data.id')
```

3. APN

```
APN_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/
identifier \
-H "Content-Type: application/json" \
-d '{
    "apn_identifier": {
        "apn": "internet",
        "ip_version": 0
    }
}' | jq -r '.data.id')
```

4. APN

```
APN_PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/
apn/profile \
-H "Content-Type: application/json" \
-d "{
    \"apn_profile\": {
        \"name\": \"IoT APN\",
        \"apn_identifier_id\": $APN_ID,
        \"apn_qos_profile_id\": $APN_QOS_ID
    }
}" | jq -r '.data.id')
```

5. APN IP

```
STATIC_IP_ID=$(curl -k -X POST https://hss.example.com:8443/api/epc/
static_ip \
-H "Content-Type: application/json" \
-d "{
    \"static_ip\": {
        \"apn_profile_id\": $APN_PROFILE_ID,
```

```
    \"ipv4_static_ip\": \"100.64.1.100\"
  }
}" | jq -r '.data.id')
```

6. EPC

```
EPC_PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/epc/profile \
-H "Content-Type: application/json" \
-d '{
  "epc_profile": {
    "name": "IoT ",
    "ue_ambr_dl_kbps": 10000,
    "ue_ambr_ul_kbps": 5000
  }
}' | jq -r '.data.id')
```

7. MSISDN

```
MSISDN_ID=$(curl -k -X POST https://hss.example.com:8443/api/msisdn \
-H "Content-Type: application/json" \
-d '{
  "msisdn": {
    "msisdn": "14155551000"
  }
}' | jq -r '.data.id')
```

8. IP

```
SUBSCRIBER_ID=$(curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d "{
  \"subscriber\": {
    \"imsi\": \"001001999999999\",
    \"key_set_id\": $KEY_SET_ID,
    \"epc_profile_id\": $EPC_PROFILE_ID,
    \"msisdns\": [$MSISDN_ID],
    \"static_ips\": [$STATIC_IP_ID]
  }
}" | jq -r '.data.id')
```

echo "IoT "

echo " ID: \$SUBSCRIBER_ID"

echo " IMSI: 001001999999999"

echo " MSISDN: 14155551000"

echo " IPv4: 100.64.1.100 (' ' APN)"

IoT

1. [□□□□](#) ([□□□](#)) - [□□□□□□](#)
2. **APN** [□□](#) ([APN \[□□□□\]\(#\)](#)) - “[□□□](#)”[□□□](#)
3. [□□](#) **IP** [□□](#) ([□□ IP](#)) - [□□□](#) IPv4 [□□](#) 100.64.1.100
4. [□□□□□□□□](#) ([EPC \[□□□□\]\(#\)](#)) - IoT [□□□□□□□□](#)
5. [□□□□](#) ([MSISDN](#)) - [□□□□□□](#)
6. [□□□□](#) ([□□](#)) - [□□□□□□□□](#)

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[□□□□□□□□□□□□□□□□](#)“[□□□](#)” APN [□□□□□□□□□](#) IP [□□](#) 100.64.1.100[□□□□□□□□](#)
[□](#) DHCP [□□□](#)

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- [□□□□□□](#) IP [□□□](#) APN[□□□□](#) APN [□□□□](#) 2-5
- [□□□□□□□□□□□□□□](#) [IMS \[□□□□□\]\(#\)](#)
- [□□□□□□□□□□□□](#) [□□□□□□□□](#)
- [□□□□](#) SIM[□□□□□□□□](#) [SIM](#)

[□□□](#)

- [□□ IP \[□□\]\(#\)](#) - [□□□□□□](#) IP [□□](#)
- [□□□□□□□□□□](#) - [□□□□](#) IP [□□□□□□](#)
- [□ MSISDN \[□□\]\(#\)](#) - [□□□□□□□□□□](#)

[← \[□□ API \\[□□\\]\\(#\\)\]\(#\)](#)



OmniHSS API

[← !\[\]\(5c7324a8d07fe4c744ffbf92786c8d53_img.jpg\)!\[\]\(793378a52ed8d5c9c5aee698a3bdf295_img.jpg\)!\[\]\(36937d9dfe4bc6dfac63e1a0e1ee9efc_img.jpg\)!\[\]\(93d1d1463037f795d435c986da6e3b2d_img.jpg\)!\[\]\(3b3bc4d7ccf5b7b68be1087fc44595ff_img.jpg\)!\[\]\(91e94b29f8a9c2b05d638e8793b18864_img.jpg\)](#)



- [API !\[\]\(11dfef7c64d18724c0f534f44b65d14a_img.jpg\)!\[\]\(bddddd795c45053a4fc7633e3bd3ed2c_img.jpg\)](#)
- [!\[\]\(3464c9164696fb9e028696ac287946ec_img.jpg\)!\[\]\(ac196a42dcc785a428c381ee4ef6ea06_img.jpg\)!\[\]\(9634c4ff47250ffa2bbc4629bb833887_img.jpg\)!\[\]\(db6c29145632e90bdf119dae313b9ead_img.jpg\)](#)
- [!\[\]\(63083f2323e38fcd4f8608865e3e7d41_img.jpg\)!\[\]\(8a3be3289426ffe7b4051b44e63d6515_img.jpg\)!\[\]\(635c84c47528dda18910a201c46df602_img.jpg\)!\[\]\(a2d6559cc7c73535d1cda0654414883d_img.jpg\)](#)
- [MSISDN !\[\]\(002eb1b92c4d441a64e8273e7ee86db2_img.jpg\)!\[\]\(7eeeb4b8617d5857da18129f81687841_img.jpg\)](#)
- [SIM !\[\]\(f8de79928032eb19acd26445ace8f328_img.jpg\)!\[\]\(5fc72b388169c98bf44dd30aff112d50_img.jpg\)](#)
- [!\[\]\(58837f3a11c9582f9c357fa6fcca0f9c_img.jpg\)!\[\]\(fdd66f2519f21ca1b5e22c3e3c815c44_img.jpg\)!\[\]\(302ac7cacf6ff3e5fa6cad97a81d36ad_img.jpg\)!\[\]\(dbd787f1a18c537674c088fa72190f25_img.jpg\)!\[\]\(7c3ece3bfbc0bdabd483ac953591b239_img.jpg\)](#)
- [!\[\]\(f386960453f062e2be073c334bcabd44_img.jpg\)!\[\]\(5ba6bc5d69ea176f31a92ddd6017112a_img.jpg\)!\[\]\(3f34f8115552fd2fe921bb776dedfa4e_img.jpg\)!\[\]\(d639f2efa07779090b51a0868fbc5872_img.jpg\)!\[\]\(651ff377fb965075f43a0cecef4771c7_img.jpg\)!\[\]\(a6f74b805af7609ea40f5aac6a226a1a_img.jpg\)](#)
- [!\[\]\(aa8327218b91e4ffe07d77ce73a34a5e_img.jpg\)!\[\]\(d1c3a33586403b4d85dc338574e69281_img.jpg\) IP !\[\]\(8b39006c7634ba8974a6279353b2acea_img.jpg\)!\[\]\(aaff68873d52592bca8f6de23055f9d6_img.jpg\)](#)
- [!\[\]\(6537e31a28929d87079629d8cd0a8165_img.jpg\)!\[\]\(93d8ea1fd6ebe9f3d3c99ce1ce5c5488_img.jpg\)!\[\]\(0e553781ca1fff53657fa61bb5ad35d9_img.jpg\)!\[\]\(62fecd70083b648548f415819b0ab330_img.jpg\)](#)
- [EIR !\[\]\(5abc68e3b3060b53cd8391be903feac5_img.jpg\)!\[\]\(c715a26fa631b6f04189bf3c5c71f49e_img.jpg\)](#)
- [!\[\]\(0b1707900124666ffb6d7fd66d049529_img.jpg\)!\[\]\(9974ead2484ce397a543aa83cb491f03_img.jpg\)!\[\]\(97fd2cbe95c0037a49b0d47fb178bc24_img.jpg\)!\[\]\(980b0dfe1b08d4b8a195877ff3161a2e_img.jpg\)!\[\]\(da59621fba94398f37e34aeac11aecf6_img.jpg\)](#)
- [!\[\]\(9394cfefb36ab18630ccebbb6ed20c19_img.jpg\)!\[\]\(3b7370fdd43d967cee5c04bcc6f4928f_img.jpg\)!\[\]\(682773abf3058cb0e299c56f0c1b3b68_img.jpg\)!\[\]\(3e15b5f85663439937196097b8d745c5_img.jpg\)](#)
- [API !\[\]\(05bd6023060dc96efd47938c46e1f6b5_img.jpg\)!\[\]\(f308eb19065afcfc42c213ab9a4f036d_img.jpg\)!\[\]\(90f635edaac9e2bcdbcaabecd2b46044_img.jpg\)!\[\]\(2ada12777ec1cd06a08dbc07cc7e0c46_img.jpg\)](#)

API

URL

https://[hostname]:8443/api



- **Content-Type:** application/json
- :  HTTPS
- : 8443



 JSON

:

```
{  
  "data": { ... }  
}
```

```
{
  "data": [
    {
      "id": 1,
      "imsi": "001001123456789",

```

```

        "enabled": true,
        "ims_enabled": true,
        "sim_id": 1,
        "key_set_id": 1,
        "epc_profile_id": 1,
        "ims_profile_id": 1,
        "roaming_profile_id": 1,
        "custom_attributes": {},
        "inserted_at": "2025-10-15T10:30:00Z",
        "updated_at": "2025-10-15T10:30:00Z"
    }
]
}

```

❖❖ ID ❖❖❖❖

❖❖❖❖❖ ID ❖❖❖❖❖❖❖

❖❖: GET /api/subscriber/:id

❖❖❖❖:

❖❖ ❖❖ ❖❖
id integer❖❖❖❖❖ ID

❖❖❖❖:

```
curl -k https://hss.example.com:8443/api/subscriber/1
```

❖❖ IMSI ❖❖❖❖

❖❖❖ IMSI ❖❖❖❖❖

❖❖: GET /api/subscriber/imsi/:imsi

❖❖❖❖:

❖❖ ❖❖ ❖❖ ❖❖
imsi string❖❖❖❖❖❖❖❖❖ 14-15 ❖❖❖

❖❖❖❖:

```
curl -k https://hss.example.com:8443/api/subscriber/imsi/001001123456789
```

❖❖: ❖❖❖ IMSI ❖❖❖❖❖❖❖❖❖❖❖❖❖❖❖

MSISDN



```
❖❖: GET /api/subscriber/msisdn/:msisdn
```

◆ ◆ ◆ ◆ ●●

$$\begin{array}{ccccccc} \diamond\diamond & \diamond\diamond & & \diamond\diamond & & \diamond\diamond & \\ \text{msisdnstring} & \diamond\diamond\diamond & \text{ISDN} & \diamond\diamond & \text{1-15} & \diamond\diamond\diamond & \end{array} \quad (\text{E.164})$$

◆ ◆ ◆ ◆ ●●

```
curl -k https://hss.example.com:8443/api/subscriber/msisdn/14155551234
```

◆ ◆ ◆ ◆

❖❖: POST /api/subscriber

◆ ◆ ◆ ●●

```
{
  "subscriber": {
    "imsi": "001001123456789",
    "enabled": true,
    "ims_enabled": true,
    "sim_id": 1,
    "key_set_id": 1,
    "epc_profile_id": 1,
    "ims_profile_id": 1,
    "roaming_profile_id": 1,
    "custom_attributes": {
      "note": "?????"
    }
  }
}
```

◆ ◆ ◆ ◆ ●●

- imsi - 14-15
- key_set_id -
- epc_profile_id - EPC

◆◆◆◆:

- enabled - ◆◆: true
- ims_enabled - ◆◆: true
- sim_id - ◆◆ [SIM](#) ◆
- ims_profile_id - ◆◆ [IMS](#) ◆◆◆◆◆IMS ◆◆◆◆◆
- roaming_profile_id - ◆◆ [◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆](#)
- msisdns - [MSISDN](#) ID ◆◆◆◆◆◆◆◆◆◆
- static_ips - ◆◆ APN ◆◆◆ [◆◆ IP](#) ID ◆◆
- custom_attributes - ◆◆◆◆◆◆◆◆◆◆

◆◆:

- [◆◆◆◆◆◆◆◆◆◆](#) - ◆◆◆◆◆◆◆◆◆◆
- [◆ MSISDN ◆◆](#) - ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- [◆◆ IP ◆◆](#) - ◆◆◆ IP ◆◆◆ APNs

◆◆◆◆:

```
curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d '{
  "subscriber": {
    "imsi": "001001123456789",
    "key_set_id": 1,
    "epc_profile_id": 1
  }
}'
```

◆◆◆◆:

◆◆◆◆

◆◆◆◆◆◆◆◆◆◆

◆◆: PUT /api/subscriber/:id

◆◆◆◆:

◆◆ ◆◆ ◆◆
id integer◆◆◆◆◆◆ ID

◆◆◆:

```
{
  "subscriber": {
    "enabled": false,
    "ims_enabled": false,
```

```

    "epc_profile_id": 2,
    "custom_attributes": {
        "note": "❖❖❖❖"
    }
}
}

```

❖❖❖❖❖:

- enabled - ❖❖/❖❖❖❖❖❖
- ims_enabled - ❖❖/❖❖ IMS ❖❖
- sim_id - ❖❖ [SIM](#) ❖❖
- key_set_id - ❖❖ [❖❖❖❖❖❖❖❖❖❖](#)
- epc_profile_id - ❖❖ [❖❖❖❖❖❖❖❖❖❖](#)
- ims_profile_id - ❖❖ [❖❖❖❖❖❖❖❖❖❖](#)
- roaming_profile_id - ❖❖ [❖❖❖❖❖](#)
- msisdns - ❖❖❖❖❖❖❖❖ [❖❖❖❖❖](#)
- static_ips - ❖❖❖❖❖ APNs ❖❖ [❖❖ IP](#)
- custom_attributes - ❖❖❖❖❖❖❖❖

❖❖❖❖:

- imsi - ❖❖❖❖ IMSI❖❖❖❖❖❖❖❖❖❖❖❖

❖❖:

- [❖❖❖❖❖❖❖](#) - ❖❖❖❖❖❖❖❖❖❖

❖❖❖❖:

```

curl -k -X PUT https://hss.example.com:8443/api/subscriber/1 \
-H "Content-Type: application/json" \
-d '{
  "subscriber": {
    "enabled": false
  }
}'

```

❖❖:

- ❖❖❖❖❖❖❖: {"enabled": false}
- ❖❖❖❖❖❖❖❖: {"ims_enabled": false}
- ❖❖❖❖❖❖❖❖❖: {"epc_profile_id": 2}❖❖ [EPC](#) ❖❖❖❖❖❖❖❖
- ❖❖❖❖❖❖❖❖: {"roaming_profile_id": 3}❖❖ [❖❖❖❖❖❖❖](#)

❖❖❖❖❖

❖❖❖❖❖❖❖❖❖❖❖❖


```

"message": "?????????",
"imsi": "001001123456789",
"destination_host": "mme01.operator.com",
"destination_realm": "epc.operator.com"
}
}

```

???? (404 ??):

```

{
  "error": "????????? MME ??"
}

```

?:

- ???? MME ? S6a CLR (subscriber_state.last_seen_mme)
- ?? Cancellation-Type: subscription_withdrawal?????
- ?? CLR-Flags: {s6a_indicator: 1, reattach_required: 1} UE ???
- last_seen_mme ? null??? 404
- ???? **IMSI** ???? **MSISDNs**????/SIM?

?:

- ??: ?
- ??: ?
- ??: ? MME ?
- ??: ?
- ??: ?

? **IMSI** ?:

?? MSISDN ???? CLR ?

1. ?? **MSISDN**??? **IMSI**:

```

// ???? IMSI 001001123456789 ? MSISDNs ["+1234567890",
"+9876543210"]
POST /api/subscriber/cancel_location
{"imsi": "001001123456789"}

// ?: ???? CLR??? MSISDN ?????

```

2. ??? **IMSI**s?????:

```

// ?????? MSISDN ???? IMSIs????
// ?? A: IMSI 001001111111111, MSISDN "+1234567890"
// ?? B: IMSI 001001222222222, MSISDN "+1234567890"

```

// ☐ ☐ : ☐ ☐ ☐ A ☐ ☐ ☐ ☐ ☐ ☐ B ☐ ☐ ☐ ☐

- **MSISDN**: IMSI CLR IMSI MSISDN
- **MSISDN**: CLR IMSI CLR MME
- **MME**: MME CLR HSS
- **IMSI**: IMSI

- 10 unknowns
- IMSI
- S6a

MSISDN
 MSISDN

SIM

SIM SIM ICCID PIN/PUK OTA
SIM

:

- IMSI - SIM

SIM

SIM

: GET /api/sim

:

```
curl -k https://hss.example.com:8443/api/sim
```

SIM

SIM

: GET /api/sim/:id

:

```
curl -k https://hss.example.com:8443/api/sim/1
```

SIM

SIM

: POST /api/sim

:

```
{
  "sim": {
    "iccid": "8991101200003204510",
    "sim_vendor": "Gemalto",
    "batch_name": "2025-Q1-Batch-01",
    "is_esim": false,
    "pin1": "1234",
    "pin2": "5678",
    "puk1": "12345678",
    "puk2": "87654321",
    "adm1": "admin-code-1",
```



```

    "authentication_algorithm": "milenage",
    "ota_counter": 0
  }
}

```

⬢⬢⬢⬢⬢

⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢

⬢⬢: POST /api/key_set

⬢⬢⬢:

```

{
  "key_set": {
    "ki": "0123456789ABCDEF0123456789ABCDEF",
    "opc": "FEDCBA9876543210FEDCBA9876543210",
    "amf": "8000",
    "sqn": 0,
    "authentication_algorithm": "milenage"
  }
}

```

⬢⬢⬢⬢:

- ki - 128 ⬢⬢⬢⬢32 ⬢⬢⬢⬢⬢⬢⬢⬢⬢
- opc ⬢ op⬢OPC ⬢⬢⬢ OP ⬢⬢⬢
- authentication_algorithm - ⬢⬢⬢⬢⬢ "milenage"

⬢⬢⬢⬢:

- amf - ⬢⬢: "8000"
- sqn - ⬢⬢: 0
- ota_counter - ⬢⬢: 0

⬢⬢⬢⬢:

- ⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢⬢
- Ki⬢OPC⬢OP: 32 ⬢⬢⬢⬢⬢⬢⬢⬢⬢128 ⬢⬢
- AMF: 4 ⬢⬢⬢⬢⬢⬢⬢⬢⬢16 ⬢⬢

⬢⬢⬢⬢:

```

curl -k -X POST https://hss.example.com:8443/api/key_set \
-H "Content-Type: application/json" \
-d '{
  "key_set": {
    "ki": "0123456789ABCDEF0123456789ABCDEF",
    "opc": "FEDCBA9876543210FEDCBA9876543210",

```

```
    "authentication_algorithm": "mileneage"
  }
}'
```

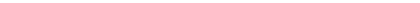
QUESTION: What are the steps to implement a REST API?

◆ ◆ ◆ ◆ ◆



◆◆: PUT /api/key_set/:id





:



































❖❖: DELETE /api/key_set/:id








EPC

EPC

◆◆ EPC ◆◆◆◆

❖❖: GET /api/epc/profile

◆◆ EPC ◆◆◆◆

⬢⬢: GET /api/epc/profile/:id

◆◆ EPC ◆◆◆◆

❖❖: POST /api/epc/profile

◆ ◆ ◆ :

{

```

"epc_profile": {
  "name": "???",
  "ue_ambr_dl_kbps": 100000,
  "ue_ambr_ul_kbps": 50000,
  "network_access_mode": 0,
  "tracking_area_update_interval_seconds": 54
}
}

```

??:

	??	??	??	??
name		???	??	???
ue_ambr_dl_kbps		???	Kbps	10000-1000000
ue_ambr_ul_kbps		???	Kbps	5000-500000
network_access_mode		???	0=??2=?+??	
tracking_area_update_interval_seconds	TAU	???	54	???

????:

```

curl -k -X POST https://hss.example.com:8443/api/epc/profile \
-H "Content-Type: application/json" \
-d '{
  "epc_profile": {
    "name": "?? 100Mbps",
    "ue_ambr_dl_kbps": 100000,
    "ue_ambr_ul_kbps": 50000
  }
}'

```

??:

- [???](#) - ???
- [???](#) - ??? EPC ???

?? EPC ???

?: PUT /api/epc/profile/:id

?: EPC ? [??](#) ?

?? EPC ???

?: DELETE /api/epc/profile/:id

?: ? [??](#) ?

IMS

IMS IP - IFC IMS

IMS

GET /api/ims/profile

IMS

POST /api/ims/profile

:

```
{
  "ims_profile": {
    "name": "VoLTE",
    "ifc_template": "<IMS-XML- ->"
  }
}
```

:

- IFC
- IMS

APN

APN

1. APN - APN IP
2. APN QoS -
3. APN - QoS EPC

QoS PCRF APN

APN

GET /api/apn/identifier

APN

POST /api/apn/identifier

:

```
{
  "apn_identifier": {
    "apn": "internet",
    "ip_version": 2
  }
}
```

IP 类型:

- 0 - IPv4
- 1 - IPv6
- 2 - IPv4v6
- 3 - IPv4 或 IPv6

APN QoS

GET /api/apn/qos_profile

APN QoS

POST /api/apn/qos_profile

响应:

```
{
  "apn_qos_profile": {
    "name": " ",
    "qci": 9,
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 50000,
    "apn_ambr_ul_kbps": 25000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}
```

APN

GET /api/apn/profile

APN

POST /api/apn/profile

响应:

```
{
```

```

"apn_profile": {
  "name": "??? APN",
  "apn_identifier_id": 1,
  "apn_qos_profile_id": 1
}
}

```

?:

- apn_identifier_id - ???? APN ?
- apn_qos_profile_id - ???? APN QoS ?

?:

- ? - ? APN ?
- EPC - APN ? EPC ?

IP

? IP ? APN ? APN ?
 ? IPv4 ?/? IPv6 ? DHCP ?

?:

?:

?? - APN ?:

?? S6a ? APN-? AVP ?

?:

1. ??: ? APN ?012...
2. ??: ? apn_identifier.apn ? "internet" ? "ims" ?
3. **PDN** ??: ? apn_identifier.ip_version ? ipv4=0 ipv6=1
 ipv4v6=2 ipv4_or_ipv6=3 ?
4. **QoS** ??: ? apn_qos_profile ?
5. **AMBR** ??: ? 1000 kbps → bps ?
6. **IP** ??: ? + APN ? IP ?
 - ??: subscriber.static_ips → ? apn_profile_id ? → ? IP
 - IP ? apn_identifier.ip_version ?
7. **VPLMN**-?: ? 0 - ? IP ?

?:

?:

- **Static IP**
- **Static IP** **APN**
- **Static IP**

Static IP:

Static IPv4 IPv6

Static IPv4	✓	-	{ "ipv4_static_ip": "100.64.1.1" }
Static IPv6	-	✓	{ "ipv6_static_ip": "2606:4700:4700::1111" }
Static	✓	✓	{ "static_ip": { "apn_profile_id": 5, "ipv4_static_ip": "100.64.1.1", "ipv6_static_ip": "2606:4700:4700::1111" } }

Static IP:

Static IPv4 Static IP:

```
curl -k -X POST https://hss.example.com:8443/api/epc/static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1"
  }
}'
```

Static IPv6 Static IP:

```
curl -k -X POST https://hss.example.com:8443/api/epc/static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 6,
    "ipv6_static_ip": "2606:4700:4700::1111"
  }
}'
```

Static Static IP:

```
curl -k -X POST https://hss.example.com:8443/api/epc/static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1",
    "ipv6_static_ip": "2606:4700:4700::1111"
  }
}'
```

Static Static (201 Static):

```
{
  "data": {
    "id": 1,
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1",
    "ipv6_static_ip": "2606:4700:4700::1111",
    "inserted_at": "2025-11-15T10:30:00Z",
    "updated_at": "2025-11-15T10:30:00Z"
  }
}
```

◆ ◆ ●●

- $\diamond \diamond \diamond$ IP $\diamond \diamond \diamond \diamond \diamond$ - $\diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond$
- APN $\diamond \diamond \diamond \diamond$ - $\diamond \diamond$ APN $\diamond \diamond$

◆◆◆◆ IP

 IP


```
⬢⬢: PUT /api/epc/static_ip/:id
```

◆◆◆◆●●

id integer IP ID

◆ ◆ ◆ ●●

```
{
  "static_ip": {
    "ipv4_static_ip": "100.64.1.2",
    "ipv6_static_ip": "2606:4700:4700::1112"
  }
}
```

◆ ◆ ◆ ◆ ◆ ∴

- `ipv4_static_ip` - IPv4
- `ipv6_static_ip` - IPv6
- `apn_profile_id` - APN

◆ ◆ ◆ ◆ ●●

- id -


:





 IP









 PDN




 PDN








 IP










```
static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1",
    "ipv6_static_ip": "2606:4700:4700::1111"
  }
}' | jq -r '.data.id')
```

```
# 2: IP
curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d "{
  \"subscriber\": {
    \"imsi\": \"001001123456789\",
    \"key_set_id\": 1,
    \"epc_profile_id\": 1,
    \"static_ips\": [$STATIC_IP_ID]
  }
}"
```

IP:

```
curl -k -X PUT https://hss.example.com:8443/api/subscriber/1 \
-H "Content-Type: application/json" \
-d '{
  "subscriber": {
    "static_ips": [1, 2]
  }
}'
```

IP APNs:

IP IP APN

```
# "internet" APN IP
INTERNET_IP=$(curl -k -X POST https://hss.example.com:8443/api/epc/
static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1"
  }
}' | jq -r '.data.id')
```

```
# "ims" APN IP
IMS_IP=$(curl -k -X POST https://hss.example.com:8443/api/epc/
```

```
static_ip \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "apn_profile_id": 6,
    "ipv4_static_ip": "100.64.2.1"
  }
}' | jq -r '.data.id')

# 3 IP 3333
curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d "{
  \"subscriber\": {
    \"imsi\": \"001001123456789\",
    \"key_set_id\": 1,
    \"epc_profile_id\": 1,
    \"static_ips\": [$INTERNET_IP, $IMS_IP]
  }
}"
```

3333:

- ✓ 33: 3333 APNs 3333 IP
- ✗ 33: 3333 APN 3333 IP

3333 - 33 APN:

```
# 333333 IP 333333 APN333333
curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d '{
  "subscriber": {
    "imsi": "001001123456789",
    "static_ips": [1, 2]
  }
}'

# 333333:
{
  "errors": {
    "static_ips": [
      "333333 APN 333 IP 333333333333333333333333 internet 3333
IP 100.64.1.1 3 100.64.1.2"
    ]
  }
}
```

33:


```
{
  "roaming_rule": {
    "name": "?? AT&T",
    "mcc": "310",
    "mnc": "410",
    "data_action": 0,
    "ims_action": 0
  }
}
```

?:

- mcc - ????3 ??
- mnc - ????2-3 ???
- data_action - ?? (0) ?? (1) ???
- ims_action - ?? (0) ?? (1) IMS/???

?:

- [????](#) - ?????
- [????](#) - ?????

EIR ??

OmniHSS ?? S13 ????EIR???EIR ??? IMEI ?????

????S13 ???? IMEI ???? [EIR???](#)

?? EIR ??

?: GET /api/eir/rule

?? EIR ??

?: POST /api/eir/rule

?:

```
{
  "eir_rule": {
    "name": "?? iPhone 6",
    "imei_regex": "^35[0-9]{6}0[0-9]{7}$",
    "action": 1
  }
}
```

??:

- name - ????????
- imei_regex - ?? IMEI ????????
- action - ??? (0)???? (1) ???? (2)

???:

- 0 - ???????
- 1 - ???????
- 2 - ????????

?:

- ??????? IMEI?
- ??????? TAC ??????
- ????????

?:

- [????](#) - S13 ? ? EIR ? ? ?
- [????](#) - OmniHSS EIR ? ?

???

???????

- [????](#) - API ?????
- [????](#) - ??????
- **[API](#)** ? ? ? - ? ? ? ? ? ? ?

[← ?????](#) | [???; ? ? ? ? →](#)



API

[!\[\]\(b0a516cdc4e728db5de551bf16c5a26f_img.jpg\) !\[\]\(de05f324d2ce2c77147b7cea91eb02fd_img.jpg\) !\[\]\(cc292e6396db3567e1bf7968a791f19f_img.jpg\) API !\[\]\(b33b8a04d8ee9a58bb09765344d7d280_img.jpg\) !\[\]\(4bd80c2075264c885dd4fb83882c5d06_img.jpg\)](#)



  API 

 GET /api/status



```
curl -k https://hss.example.com:8443/api/status
```



```
{  
  "status": "ok"  
}
```

[!\[\]\(79e06214067bdb5b59865fb8fd052c24_img.jpg\) !\[\]\(e81f93b3034453765c092d2219206470_img.jpg\) !\[\]\(0c5edc7d7b3378acca5c946bdbf81e41_img.jpg\) API !\[\]\(bf8094347ed6a59f26ea2b25aa73a74b_img.jpg\) !\[\]\(b58a514599af057559f43205d3d2abc7_img.jpg\)](#)



OmniHSS

[← !\[\]\(3c6cb66f3e9abf97c232d5b8fab5147e_img.jpg\)!\[\]\(b8da1dde207a58541e8b75a3b26d743f_img.jpg\)!\[\]\(373408270aeb2ed30c066963f479f3a0_img.jpg\)!\[\]\(4381878f2077ccf8f5ddb715e26c58b8_img.jpg\)!\[\]\(12fc424e1e10abb66d35276c2b8bc426_img.jpg\)](#)



- [!\[\]\(3597484a99bd380d5d36f5a55fa482e8_img.jpg\)!\[\]\(2a05291db8873c0e77597490da276484_img.jpg\)!\[\]\(f54b0b6da3657ab1e6df9995e205a650_img.jpg\)!\[\]\(9747daf84ffd19acce00ef03c82cc892_img.jpg\)](#)
- [!\[\]\(285db7b2c54726348a2fc306a83a9faf_img.jpg\)!\[\]\(c8c88fd388058ba8b3dfe72f35bc0b1e_img.jpg\)!\[\]\(3679072ffdf3786f6e154d740f0badd3_img.jpg\)!\[\]\(616af006d716c8abff985065e70a89ab_img.jpg\)](#)
- [Diameter !\[\]\(0b88707dfa2fbeac6cb7f485ba29f98f_img.jpg\)](#)
- [!\[\]\(f4517cb3b7421ec75afe09684243b4a5_img.jpg\)!\[\]\(49ca9e8c71e398ad06f2ae1d96a4d467_img.jpg\)!\[\]\(af0bb4b5437adf36b3fde5ecf0dc095e_img.jpg\)](#)
- [!\[\]\(68a950c98ced893c0609a67a4937c9d3_img.jpg\)!\[\]\(9f1bc8b347c5cf0e6740b71cc092ade3_img.jpg\)!\[\]\(aa97e671eb31b7c00989031433ba4567_img.jpg\)](#)
- [!\[\]\(ca52c0d9d8de7bc803405a89dea137c5_img.jpg\)!\[\]\(6bac7c5f4b606b96857487db96a5697b_img.jpg\)!\[\]\(8ce1ce5824f1b359d94dc50ebcf2c28a_img.jpg\)!\[\]\(7e78bdcc961b358269c5bf3e97be9b1f_img.jpg\)](#)
- [!\[\]\(9e89eba3aafc1bb48c5a991a9de9fe2b_img.jpg\)!\[\]\(31e0902bee3f8bbb5a656683a272d5d2_img.jpg\)!\[\]\(9614724910de68d2d129238800fd11d4_img.jpg\)!\[\]\(98fdcb988852b4974f2e97f90e0fbc3e_img.jpg\)](#)



OmniHSS  Elixir  Erlang/OTP 






Diameter

 Diameter  S6a Cx Sh S13 Gx Rx DiameterEx 


1.  **DiameterEx**  -  Diameter  ID
2.  -  AVP
3.  - 
4.  -  AVP  Diameter 
5.  -  Diameter 

Diameter

Diameter

OmniHSS       Diameter        

Diameter

S6a (LTE/EPC)

  LTE         

Cx (IMS)

  IMS      

Sh (IMS

  IMS                

Gx (

                     [PCRF !\[\]\(e11765147f1bad50acd6c1cc3b579045_img.jpg\) !\[\]\(bba922e90708c6b7b1d5f638d04f50c3_img.jpg\)](#)

Rx (IMS

  IMS     VoLTE               [PCRF !\[\]\(d9282266a15550324807e56fcde42794_img.jpg\) !\[\]\(eb50342d8a014dad876fa07143b0281c_img.jpg\)](#)

S13 (EIR)

           IMEI           [EIR !\[\]\(1f3cbd6bd73d2a9ef2768a47e8a17e92_img.jpg\)](#)

???

??????

Ecto ?????

?????

?? Diameter ?????????????????????????????????

????

API ??

?????

????

?????

??????

????????????????

??????

1. ???

- Erlang/OTP ?????????
- ??? Diameter ???????
- ?????????????

2. ???

- ?? Diameter ?????????
- ?????????
- ?????????

3.

-   Diameter        
-               
-       

4.

-              
-            
-      

5.

-          
-          
- Diameter      
-          



OmniHSS

[← !\[\]\(b4d277f4ba473acc69ba88cacc0b2f72_img.jpg\)!\[\]\(d16fddd1ebf78bb687e41052aa0f9e8f_img.jpg\)!\[\]\(36c4e844787c8a1d3a2b404844335ea8_img.jpg\)!\[\]\(486979f9f0b8f36213dd4885072f1b33_img.jpg\)!\[\]\(272d68e80a90a955bdd875f423318a74_img.jpg\)](#)



- [!\[\]\(f3ff5f1decd46cc92940ed34b8e098be_img.jpg\)!\[\]\(924e710e3f6640277b0f86f71f23c067_img.jpg\)!\[\]\(19762ac0eda9fbfb9176800dc8bc2fcd_img.jpg\)!\[\]\(dc8c0377125b193572c4bc1bea0e092c_img.jpg\)!\[\]\(d6fe6d6be0943d9273f99b499a7751df_img.jpg\)!\[\]\(fcfed51f2858903b5f0f965fed9d721e_img.jpg\)](#)
 - [!\[\]\(5e1246691e3155e97dfbc1ebe00eab98_img.jpg\)!\[\]\(1eb8a3b220b29e53c03971b689c0337d_img.jpg\)!\[\]\(01a2fab142f39c3bb2eda30b0235bb44_img.jpg\)!\[\]\(4af64d8e75ef53cfc47be7d6b8678e64_img.jpg\)!\[\]\(dbc1625ba4969e6fe8e741cf8a7d4843_img.jpg\)](#)
 - [!\[\]\(eed8f5f5b002a5a050ee4571b9670ead_img.jpg\)!\[\]\(7d3ee68a0d3ab0940a28f3ce44183719_img.jpg\)!\[\]\(cd7831973fe9fdda22ccae37b3009186_img.jpg\)!\[\]\(744ff49f43392788eeca561933e990d2_img.jpg\)!\[\]\(33757fcbff0f35bd6a9dbb19d5bf38cc_img.jpg\)](#)
 - [Diameter !\[\]\(2585673393f0279355bc65eab8f356da_img.jpg\)!\[\]\(6b179f3fca7554cbd4b8990bf298e1d2_img.jpg\)](#)
 - [!\[\]\(e163188dc05fc00e300c29eb2036d0c1_img.jpg\)!\[\]\(37105b5fa3e9d624b711ca308333a337_img.jpg\)!\[\]\(d85510ca9574af1adba0c5c1cff5872a_img.jpg\)!\[\]\(943fc690cce51455f4862cb2b5978ff8_img.jpg\)](#)
 - [IMS !\[\]\(cb969b432697846dddaed2a1caa131aa_img.jpg\)!\[\]\(88e1860a56f379bf8b072a001848d1ab_img.jpg\)](#)
 - [EIR !\[\]\(c6d475ee9daa3e5cae26df50eb1db5c9_img.jpg\)!\[\]\(ff6b54c25c32d644d893390fafc303c5_img.jpg\)](#)
 - [API !\[\]\(6e649316599f4a777bd0589c54189eb0_img.jpg\)!\[\]\(18a62437cfd5154d31deeb7a628e1f65_img.jpg\)!\[\]\(95f898558804ea58e16fc379c92a07be_img.jpg\)!\[\]\(f75d07a500e30888c17613bdcf2a615e_img.jpg\)!\[\]\(db3d38fca93f2ed6be83947220ac4012_img.jpg\)!\[\]\(fc0eb7abfd3e3137e2ef4ac188139e32_img.jpg\)!\[\]\(38c90492e02908eec9309b80819b8ac3_img.jpg\)](#)
 - [!\[\]\(e18127b8923e6c417fa46cb8c8db1974_img.jpg\)!\[\]\(2943d59b0a87276022d141b5919d5df8_img.jpg\)!\[\]\(07fa178d217db8568887c4c61e0994be_img.jpg\)!\[\]\(92d65d5b32f9a00df8e33d8fa6688ab5_img.jpg\)!\[\]\(66a3ebbe4bdc805557595bfbe634aa05_img.jpg\)!\[\]\(6fca352d34076b633fcdf9b13faaa5d5_img.jpg\)](#)
-



OmniHSS 

config/config.exs ()



- 
- API 
- 

config/runtime.exs ()



- 
 - Diameter 
 -  PLMN 
 - IMS S-CSCF 
 - 
-

- 10
- 4MB
- SQL

config/runtime.exs -

```
config :hss, Hss.Repo,
  username: System.fetch_env!("DATABASE_USERNAME"), #
  password: System.fetch_env!("DATABASE_PASSWORD"), #
  hostname: System.get_env("DATABASE_HOSTNAME", "db.internal.example.com"),
  database: System.get_env("DATABASE_NAME", "omnihss"),
  port: String.to_integer(System.get_env("DATABASE_PORT", "3306")),
  pool_size: String.to_integer(System.get_env("DATABASE_POOL_SIZE", "30")),
  ssl: true,
  ssl_opts: [
    cacertfile: "/etc/ssl/certs/mysql-ca.pem",
    verify: :verify_peer
  ]
```

Diameter

Diameter

config/runtime.exs

```
diameter_config = %{
  service_name: :omnitouch_hss,

  #
  listen_ip: System.get_env("DIAMETER_LISTEN_IP", "10.7.25.186"),
  listen_port: String.to_integer(System.get_env("DIAMETER_LISTEN_PORT",
"3868")),

  # Diameter
  host: System.get_env("DIAMETER_HOST", "omnihss"),
  realm: System.get_env("DIAMETER_REALM",
"epc.mnc001.mcc001.3gppnetwork.org"),

  #
  product_name: "OmniHSS",
  vendor_id: 10415, # 3GPP
  supported_vendor_ids: [5535, 10415],

  #
  request_timeout: 5000,

  #
  peers: [
```

```
config :hss, :diameter, diameter_config
```

?

- ## ?? Diameter ???

```
# config/runtime.exs
```

1

```
# Diameter
listen_ip: System.get_env("DIAMETER_LISTEN_IP", "0.0.0.0"), #
#
# listen_ip: "10.7.25.186",

# API
```

```

config :hss, HssWeb.Api.Endpoint,
  http: [
    ip: {0, 0, 0, 0}, # ????
    port: 8443
  ]

# ????
config :hss, HssWeb.ControlPanel.Endpoint,
  http: [
    ip: {0, 0, 0, 0}, # ????
    port: 7443
  ]

```

????

IMS ??

S-CSCF ????

```

# config/runtime.exs

config :hss, :ims, %{
  scscf: %{
    # ?????:random_peer :round_robin
    selection_method: :random_peer,

    # ?? S-CSCF ????
    peers: [
      %{
        host: "sip:scscf01.ims.mnc001.mcc001.3gppnetwork.org:5060",
        capabilities: [] # ????
      },
      %{
        host: "sip:scscf02.ims.mnc001.mcc001.3gppnetwork.org:5060",
        capabilities: []
      }
    ]
  }
}

```

S-CSCF ????

????

```

    ??          ??          ??
:random_peer ???? S-CSCF ????
:round_robin ???? S-CSCF    ????

```

IMS

IMS EPC

```
# EPC
"epc.mnc001.mcc001.3gppnetwork.org"

# IMS
"ims.mnc001.mcc001.3gppnetwork.org"
```

EIR

EIR

```
# config/runtime.exs

config :hss, :eir, %{
  #
  unknown_equipment_behaviour: :whitelist
  #
  # :whitelist -
  # :blacklist -
  # :greylist -
  # :reject_unknown_equipment -
}
```

:whitelist
:blacklist
:greylist
:reject_unknown_equipment

:whitelist
:greylist
:blacklist

API

API

```
# config/config.exs

config :hss, HssWeb.Api.Endpoint,
```

```
url: [host: "localhost"],
render_errors: [view: HssWeb.ErrorView, accepts: ~w(json)],
pubsub_server: Hss.PubSub,

# HTTPS
https: [
  port: 8443,
  cipher_suite: :strong,
  certfile: "priv/cert/omnitouch.crt",
  keyfile: "priv/cert/omnitouch.pem"
]
```

?

config/config.exs

```
config :hss, HssWeb.ControlPanel.Endpoint,
  url: [host: "localhost"],
  render_errors: [view: HssWeb.ErrorView, accepts: ~w(html json)],
  pubsub_server: Hss.PubSub,
  live_view: [signing_salt: "some-secret"],

# HTTPS
https: [
  port: 7443,
  cipher_suite: :strong,
  certfile: "priv/cert/omnitouch.crt",
  keyfile: "priv/cert/omnitouch.pem"
]
```

TLS

?

- X.509
-
-
- CN SAN

?

```
https: [
  port: 8443,
  cipher_suite: :strong,
  certfile: System.get_env("TLS_CERT_FILE", "/etc/ssl/certs/omnihss.crt"),
  keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss.key"),
  cacertfile: System.get_env("TLS_CA_FILE", "/etc/ssl/certs/ca-bundle.crt")
]
```

?? ? ? ? ?

?? ? ? ? ?

?? ? ? ? ?

?? ? ?

- ☐ ? ? ? ? ? ? ? ? ? ? ? ?
- ☐ ? ? PLMN ? MCC ? MNC ?
- ☐ Diameter ? ? ? ?
- ☐ Diameter ? ? IP ? ? ?
- ☐ API ? ? ? ? ? ? TLS ? ?

?? ? ? ? ?

- ☐ ? ? Diameter ? ? ? ? ? ? ? ? ? ? ? ?
- ☐ ? ? ? ? ? ? ? Diameter ? ? ? ? ? 3868 ?
- ☐ ? ? ? ? ? ? ? HTTPS ? ? ? ? ? 7443 ? 8443 ?
- ☐ Diameter ? ? ? DNS ? ?

IMS ? ? ? ? ? ? **IMS** ? ? ?

- ☐ ? ? S-CSCF ? ? ? ? ?
- ☐ ? ? S-CSCF ? ? ? ?
- ☐ ? ? ? ? ? IMS ? ?

?? ? ? ?

- ☐ ? ? EIR ? ?
- ☐ ? ? ? ? ? ? ? ?
- ☐ ? ? ? ? ? ? ? ?

?? ? ? ?

?? ? ? ? ?

1. ? ? ? ? ?

? ? ? ? ? ? ? ? ? ? ? ? ? ?

2. ? ? ? ? ? ? ?

? ? https://[hostname]:7443
? ? ? ? ? ? ? ? ? ?

3. **API** ? ? ?

```
curl -k https://[hostname]:8443/api/status
```

4. Diameter

```
##### Diameter ##  
#####
```

5.

```
#####  
##### SQL ##
```

```
#####
```

```
# config/runtime.exs - #####
```

```
import Config
```

```
#
```

```
=====
```

```
# #####
```

```
#
```

```
=====
```

```
config :hss, Hss.Repo,  
  username: System.fetch_env!("DATABASE_USERNAME"),  
  password: System.fetch_env!("DATABASE_PASSWORD"),  
  hostname: System.get_env("DATABASE_HOSTNAME", "db.omnihss.internal"),  
  database: System.get_env("DATABASE_NAME", "omnihss"),  
  port: String.to_integer(System.get_env("DATABASE_PORT", "3306")),  
  pool_size: String.to_integer(System.get_env("DATABASE_POOL_SIZE", "30")),  
  timeout: 15_000,  
  connect_timeout: 15_000,  
  ssl: true,  
  ssl_opts: [  
    cacertfile: "/etc/ssl/certs/mysql-ca.pem",  
    verify: :verify_peer  
  ]  
#
```

```
#
```

```
=====
```

```
# ## PLMN ##
```

```
#
```

```
=====
```

```
config :hss, :home_plmn, %{  
  mcc: System.get_env("HOME_PLMN_MCC", "001"),  
  mnc: System.get_env("HOME_PLMN_MNC", "001")  
}  
#
```

```
#
```

```
=====
```

```
# Diameter ##
```

```

#
=====
diameter_config = %{
  service_name: :omnitouch_hss,
  listen_ip: System.get_env("DIAMETER_LISTEN_IP", "10.7.25.186"),
  listen_port: String.to_integer(System.get_env("DIAMETER_LISTEN_PORT",
"3868")),
  host: System.get_env("DIAMETER_HOST", "omnihss01"),
  realm: System.get_env("DIAMETER_REALM",
"epc.mnc001.mcc001.3gppnetwork.org"),
  product_name: "OmniHSS",
  vendor_id: 10415,
  supported_vendor_ids: [5535, 10415],
  request_timeout: 5000,
  peers: [
    %{
      host: "mme01.epc.mnc001.mcc001.3gppnetwork.org",
      realm: "epc.mnc001.mcc001.3gppnetwork.org",
      ip: "10.7.25.100",
      port: 3868,
      transport: :sctp,
      applications: [:s6a]
    }
  ]
}

config :hss, :diameter, diameter_config

#
=====
# IMS ◇◇
#
=====
config :hss, :ims, %{
  scscf: %{
    selection_method: :random_peer,
    peers: [
      %{host: "sip:scscf01.ims.mnc001.mcc001.3gppnetwork.org:5060"},
      %{host: "sip:scscf02.ims.mnc001.mcc001.3gppnetwork.org:5060"}
    ]
  }
}

#
=====
# EIR ◇◇
#
=====
config :hss, :eir, %{
  unknown_equipment_behaviour: :whitelist
}

#

```

```
=====
# API  ? ? ? ?
#
```

```
=====
config :hss, HssWeb.Api.Endpoint,
  http: [ip: {0, 0, 0, 0}, port: 8443],
  https: [
    port: 8443,
    cipher_suite: :strong,
    certfile: System.get_env("TLS_CERT_FILE", "/etc/ssl/certs/omnihss.crt"),
    keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss.key")
  ],
  url: [host: System.get_env("API_HOST", "api.omnihss.internal"), port:
8443]
```

```
#
```

```
=====
#  ? ? ? ? ? ? ? ?
#
```

```
=====
config :hss, HssWeb.ControlPanel.Endpoint,
  http: [ip: {0, 0, 0, 0}, port: 7443],
  https: [
    port: 7443,
    cipher_suite: :strong,
    certfile: System.get_env("TLS_CERT_FILE", "/etc/ssl/certs/omnihss.crt"),
    keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss.key")
  ],
  url: [host: System.get_env("CP_HOST", "hss.omnihss.internal"), port: 7443]
```

```
← ? ? ? ? ? ? ? ? | ? ? ? ? ? ? ? ? →
```



OmniHSS

[← !\[\]\(b1297194d7c82318a4266d0917bd4e3f_img.jpg\) !\[\]\(6db2a96b0c51b08a934a76a76711ebf5_img.jpg\) !\[\]\(1b00a9103a81da85047a9e1b2a97b2d6_img.jpg\) !\[\]\(90ab4acfd91804f38d1da4033ff956e2_img.jpg\) !\[\]\(002da65212969e7c6c89af77a53c9482_img.jpg\)](#)

- [!\[\]\(0d6b426bafc7bfd9772bffbf9b38bbf6_img.jpg\) !\[\]\(ce570cb8bfb9e045718ae5c94c71b464_img.jpg\) !\[\]\(09c852dc2e5ebaa0d2cb52fc587bceeb_img.jpg\) !\[\]\(a93d897275c299efdc8c5088b532eb44_img.jpg\) !\[\]\(36766631338bc73bd852e2b9a78483ea_img.jpg\) !\[\]\(f3c0acef6d10561adef6be3b8a24b25c_img.jpg\)](#)
 - [!\[\]\(4cb1e4577612af5c8b3da8e6a184bfce_img.jpg\) !\[\]\(b6a14bcf4e362733737a9563270040a7_img.jpg\) !\[\]\(c74a9c8604edfe34bee50609c73e8299_img.jpg\) !\[\]\(8896e5be396aeeca1f404d9ffa5379f9_img.jpg\) !\[\]\(daf92bc8df9f7ec5e11ddc9e71a4fb2c_img.jpg\) !\[\]\(f0b7d64995808231fb2610c92cdc5bfc_img.jpg\)](#)
 - [!\[\]\(f0d76f80e53fa46ada67163fa477afce_img.jpg\) !\[\]\(ffcb83ea39b6dd1d02adea4d2881a5a1_img.jpg\) !\[\]\(962fb5b93d79d2cac0e1cfd65d1ef587_img.jpg\) !\[\]\(739f838e21d7205ecc89179d194a9630_img.jpg\)](#)
 - [Diameter !\[\]\(5c7285df6bd2591a38bfe2f1a15b8f38_img.jpg\) !\[\]\(a15307eb9fab4bd2b5151c1d81e9e540_img.jpg\)](#)
 - [!\[\]\(f7d47f6c31ba4ff3beb38600a8c5787e_img.jpg\) !\[\]\(1266dbaed2b9d260c1fa68e6fa59088f_img.jpg\) !\[\]\(7940f4a762ff32e0ff9dd985f9346597_img.jpg\) !\[\]\(666eee83dffe37b1329c87bda9ce965f_img.jpg\)](#)
 - [!\[\]\(3a7d6c0c8af995dde922c3f71f855443_img.jpg\) !\[\]\(d90e10b0ac5244f96f0a222229329bed_img.jpg\) !\[\]\(32802a8e0a133ad19d0c034358d5d67d_img.jpg\) !\[\]\(8c2c469004bfd33a8bce5358b2391889_img.jpg\)](#)
 - [!\[\]\(e29c8dbced5b63cdfba8f6b73c068f8d_img.jpg\) !\[\]\(54ddc15b40ab3bad3065bca94efaed12_img.jpg\) !\[\]\(1c95e000b5b0e9ff3e73a229e2ceb086_img.jpg\) !\[\]\(7df5a37bbca6b6e6a64b08a447836e23_img.jpg\) !\[\]\(8850822268b1aa98d03a0de429dafeef_img.jpg\)](#)
-

OmniHSS                                     Diameter            Phoenix LiveView                     

-      -     
-      -         
- **Diameter**   -       
-      -     
-       -     

URL: https://[hostname]:7443
Protocol: HTTPS Only
Port: 7443 (configurable)
Certificate: Configured in config/config.exs

◆ ◆ ◆ ◆

1. 
2.  `https://[hostname]:7443`
3.  TLS 
4. 

TLS

◆ ◆ ◆ ◆

- **7443** 
- **HTTPS**  -  **HTTP**
-   **7443**








LiveView, WebSockets

- Chrome/Chromium
- Firefox
- Safari
- Edge

?? ? ? ? Internet Explorer?

◆ ◆ ◆ ◆

URL: https://[hostname]:7443/overview

◆ ◆ ◆ ◆

?

			 		
ID		    	ID	 	
Enabled		   		 	 ( ) /  ( )

IMSI	?	??	?
	???	???	14-15 ???
ICCID	SIM ? ID	19-20	???? "N/A"
EPC Profile	?????	?????	ID
IMS Profile	?????	?????	ID ? "N/A"
Roaming Profile	?????	?????	ID ? "N/A"

?????

?????

???

???

- **MCC** - ????3 ???
- **MNC** - ????2-3 ???
- **TAC** - ?????
- **Cell ID** - ?????
- **eNodeB ID** - ?????
- **ECI** - E-UTRAN ?????

????

???

- ???? **MME** - ???? MME ???
- ???? - MME ? Diameter ??
- **RAT** ?? - ???? "E-UTRAN" ?? LTE ?
- ???? - ? Diameter ?????

IMS ??

???

- ???? **S-CSCF** - ???? S-CSCF SIP URI
- **IMS** ???? - SIP URI sip:[+14155551234@ims.example.com](sip:+14155551234@ims.example.com)
- ???? **P-CSCF** - ???? HSS ? P-CSCF
- ???? **I-CSCF** - ???? HSS ? I-CSCF

????

???

- **PDN** ?? - ?????
- ???? - ?? VoLTE ?????

□□□□

□□□

	□		□□		□
Hostname	Diameter	□□□□□	FQDN		
Realm	Diameter	□□	□□		
IP:Port	□□□□		IP	□□□□□	
Transport	□□□□		TCP	□	SCTP
Status	□□□□		□□	/	□□

□□□□

□□□□□□□□

□□□□□□□□□□□□□□

□□□□□

- □□□□ - □ HSS □□□□□□
- □□□□ - □□□□□□□□
- □□ **ID** - □□□ Diameter □□

□□ **ID** □□□

- 16777251 - S6a (MME)
- 16777238 - Gx (P-GW)
- 16777216 - Cx (I-CSCF, S-CSCF)
- 16777217 - Sh (□□□□□)
- 16777236 - Rx (P-CSCF)
- 16777252 - S13 (EIR □□□□□□□□)

□□□□□□

□□□□

Diameter □□□ **1** □□□□□□

□□

1. □□□□□

- □□□□□□□□□□□□
- □□□□□□□□□□
- □□□□□□

2. □□□□

- 10.10.10.10.10.10.10.10
- 10.10.10.10.10.10.10.10 TCP 10.10.10.10 SCTP 10
- 10.10.10.10 ID 10.10.10.10.10.10
- 10.10.10.10.10.10.10.10.10.10

3. 10.10.10.10

- 10.10.10.10.10.10.10.10
- 10.10.10.10.10.10.10.10
- 10.10.10.10.10.10.10.10.10.10

10.10.10.10

10.10.10.10.10.10.10.10

10.10.10.10.10.10.10.10

1. 10.10.10.10.10.10.10.10
2. 10.10.10.10.10.10.10.10
3. 10.10.10.10.10.10.10.10
4. Diameter 10.10.10.10.10.10.10.10
5. 10.10.10.10.10.10.10.10.10.10 TLS 10

10.10.10.10.10.10.10.10

1. 10.10.10.10.10.10.10.10 ping [peer-ip]
2. 10.10.10.10.10.10.10.10 telnet [peer-ip] 3868
3. 10.10.10.10.10.10.10.10
4. 10.10 HSS 10.10.10.10.10.10.10.10
5. 10.10.10.10.10.10.10.10.10.10 Diameter 10.10.10 HSS 10.10

10.10.10.10.10.10.10.10.10.10

10.10.10.10.10.10.10.10

1. 10.10.10.10.10.10.10.10
2. 10.10.10.10.10.10.10.10
3. 10.10.10.10.10.10.10.10
4. Diameter 10.10.10.10.10.10.10.10

10.10.10.10.10.10.10.10

1. 10.10.10.10.10.10.10.10
2. 10.10.10.10.10.10.10.10.10.10.10.10.10.10
3. 10.10.10.10.10.10.10.10.10.10.10.10.10.10
4. 10.10.10.10.10.10.10.10 ID 10.10.10.10

- -
- -
- -



OmniHSS

[← !\[\]\(b97c980e060a14f2b840056a1270051b_img.jpg\) !\[\]\(a69dfefaaf0de2def2a4c4fad789590f_img.jpg\) !\[\]\(93430d504728d8da0a354834446100be_img.jpg\) !\[\]\(0fc3059f6f8aa0896e46da8092be468c_img.jpg\) !\[\]\(0af6dc39659a7f5728cbaf8864350606_img.jpg\)](#)

- [!\[\]\(8a2e1268bdd571eb270f5c44ff786cd6_img.jpg\) !\[\]\(501cc2afd9b635265b8ce316d02a07d7_img.jpg\) !\[\]\(cb3ac3657db8445b7768df32231d8e54_img.jpg\) !\[\]\(9684d7fe6295b2635d4ef5d577ab120d_img.jpg\)](#)
- [!\[\]\(8579e7b258f458ca5f23eb2cfe213fc0_img.jpg\) !\[\]\(4ba4fe8ecb9f74e63c026d135fe901e9_img.jpg\) !\[\]\(0e09dfd536d751746d8a38af9dcce6fd_img.jpg\) !\[\]\(b1ef791174fffc259433ecef9d5389c3_img.jpg\)](#)
- [!\[\]\(701b845b10dec7583bb55875f5c1a772_img.jpg\) !\[\]\(4403b9237f76a813f4a7ab8732223dc3_img.jpg\) !\[\]\(18d486a73128d74d366f9cbdf22a1925_img.jpg\) !\[\]\(1400284aecb150a3047c014b5a0bccdf_img.jpg\) !\[\]\(174a5b6deee9890965a5c13728274927_img.jpg\) !\[\]\(8c24f634052d722457ce8ac44e0b13f9_img.jpg\)](#)
- [!\[\]\(91618e081600de83869ee9f9ee3bee93_img.jpg\) !\[\]\(7ab3fd6d0e5f516c93ac38cacac554cb_img.jpg\) !\[\]\(d324b1393039790a33d9cee7d90e367d_img.jpg\) !\[\]\(2371c0545bbd190ddeaf99091b2c466b_img.jpg\)](#)
- [!\[\]\(6ca46197d9602712b1653037bb985876_img.jpg\) !\[\]\(463f6c01e402822371f2b1fa5afa7c17_img.jpg\) !\[\]\(8ce8957c8bdbc8141f54d4ae18421432_img.jpg\) !\[\]\(1e960fcaa1fd2e9282cbf89641679651_img.jpg\) !\[\]\(169250477386797e4ddbe155de0c075d_img.jpg\)](#)
- [!\[\]\(d395b7d89748be33791419aa7df48944_img.jpg\) !\[\]\(a73f860affd8b863a6e1949234da25f8_img.jpg\) !\[\]\(b83aee05e3899c19e3fee2da84814e00_img.jpg\) !\[\]\(ce9d6ae2fa65f8c007c80a38b64cbbe3_img.jpg\) !\[\]\(a8ac4016371bef82e5367da290c6ef5a_img.jpg\) !\[\]\(38dddc91673d7b9228f682194e5614a5_img.jpg\)](#)
- [!\[\]\(9678c988f74f3a40ea4311cb3f5a309f_img.jpg\) !\[\]\(a84d74e039102a9313c906d8d8a80f42_img.jpg\) !\[\]\(3d1559ab49658c2f48788f951fd0496c_img.jpg\) !\[\]\(6312f04c4e31aaaa74d33a48bb119d67_img.jpg\) !\[\]\(3e5e87ac703b6895ae4ac7c631e9abb7_img.jpg\)](#)

OmniHSS                                                 

 	 	 	 
id	bigint	 	 
enabled	boolean	    	  : true
ims_enabled	boolean	IMS   	  : true
imsi	string	      	14-15     
custom_attributes	map	      	 
sim_id	bigint	SIM   	 
key_set_id	bigint	    	 
epc_profile_id	bigint	EPC        	

	??		??		??		??
opc		binary	????????????		128	?	
op		binary	????????????	OPC	128	?	
amf		binary	????????		16	??2	???
sqn		bigint	????????		48	?	
authentication_algorithm	string		????		???	"milenage"	
ota_counter		bigint	OTA	????		??	

????

- ???? ? ? ? ? ? ? ? ?
- Ki ?? SIM ? ? ? ? ?
- ? ? ? ? OPC ? OP ? OPC ? ? ? OP ? ? ?
- SQN ? ? ? ? ? ? ? ? ?
- Milenage ? ? ? ? ? ? ? ? ? ?

??????

MSISDN

MSISDN ? ? ? ? ? ? ? ?

???

	??		??		??		??
msisdnstring	???	ISDN	??	1-15	????	E.164	??

????

- MSISDN ? ? ? ? ? ? ? ?
- ?? MSISDN ? ? ? ? ? ? ? ?
- ?? MSISDN ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? + ? ? ? ? ? ? ? "14155551234" ? ? +1 415-555-1234 ?

MSISDN ? ? ?

?? ? ? ? ? ?

EPC ? ? ? ?

EPC ? ? ? ? ? ? ? ? LTE ? ? ? ? ? ? ? ?

???

	??		??	??	??
name		string	??????		??
ue_ambr_dl_kbps		integer	??????	Kbps	
ue_ambr_ul_kbps		integer	??????	Kbps	
network_access_mode		integer	???		??
tracking_area_update_interval_seconds	integer	TAU	??		?

??????

AMBR ???????

IMS ?????

IMS ??????/??????

???

	??		??		??		??
name		string	?????		??		
ifc_template	text	XML	?????	XML			

IFC ?????

????

- IFC????? IMS ?????
- ??????
- ??????
- ? IMS ????? S-CSCF

APN ?????

APN ?????????????

?????

APN ???

	??		??		??		??
apn		string	APN	??	"internet", "ims", "mms"		
ip_version	integer	IP	?????				

IP ?????

APN QoS

QoS

	??	??	??	???
qci		QoS	1-9	QCI 9
allocation_retention_priority	ARP	1-15		8
apn_ambr_dl_kbps	APN	0+		
apn_ambr_ul_kbps	APN	0+		
pre_emption_capability		true/false	false	
pre_emption_vulnerability		true/false	true	

QCI








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◆ ◆ ◆ ◆

◆ ◆ ◆ ◆ ◆

◆ ◆ ◆ ◆ ◆

- last_seen_mcc, last_seen_mnc - 2 2 2 2 2
- last_seen_tac - 2 2 2 2 2
- last_seen_cell_id - 2 2 ID
- last_seen_enodeb_id - eNodeB ID
- last_seen_eci - E-UTRAN 2 2 2 2 2

◆ ◆ ◆ ◆ ◆

- last_seen_mme - 222222 MME
- last_seen_realms - MME 2222
- last_seen_rat_type - 22222222 LTE 5G 22

IMS

- assigned_scscf - 1234567 S-CSCF
- ims_public_identity - SIP URI1234
sip:[+14155551234@ims.example.com](tel:+14155551234)
- sh_repository_data - 123 IMS 456789

1234

- last_seen_at - 123456789
- last*_at 123456789

PDN 12

PDN 12345678901234

PDN 1234567

LTE 12

LTE 12345678 VoLTE 12/345678

12345

VoLTE 12345

12345

123456

1234

123456789012345678901234567890

123456

123456

123456789

123456














IMS    

◆ ◆ ◆ ◆ ◆ ◆








OmniHSS 

◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆

◆◆◆ S6a AIR - ◆◆◆◆◆◆◆◆◆◆◆◆

◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆

◆◆◆ S6a ULR - ◆◆◆◆◆ EPC ◆◆◆◆◆

◆◆◆◆◆IMS◆◆◆

[illegible]



Diameter

←

mermaid Diameter OmniHSS

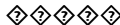


- (S6a ULA)
- (S6a AIA)
- (Cx SAA)
- (Gx CCA)
- (Sh UDA)
- ME (S13 ECA)

(S6a ULA)

HSS LTE MME Diameter AVP

		Diameter AVP	
subscriber.enabled	true/false	Subscriber-Status	true → 0 (active), false → 1 (barred)
msisdn.msisdn	'14155551234'	MSISDN	MSISDN TBCD
epc_profile.ue_ambr_ul_kbps	50000	Max-Requested-Bandwidth-UL	1000 (kbps → bps)
epc_profile.ue_ambr_dl_kbps	100000	Max-Requested-Bandwidth-DL	1000 (kbps → bps)
epc_profile.network_access_mode	0	Network-Access-Mode	
apn_identifier.apn	'internet'	Service-Selection	
apn_identifier.ip_version	2	PDN-Type	0=IPv4, 1=IPv6, 2=IPv4v6, 3=IPv4_or_IPv6
apn_qos_profile.qci	9	QoS-Class-Identifier	

 	Diameter AVP	
apn_qos_profile.allocation_retention_priority 8	Priority-Level	  
apn_qos_profile.pre_emption_capability false	Pre-emption-Capability	false → 0, true → 1
apn_qos_profile.pre_emption_vulnerability true	Pre-emption-Vulnerability	false → 0, true → 1
apn_qos_profile.apn_ambr_ul_kbps 25000	APN AMBR UL	  1000 (kbps → bps)
apn_qos_profile.apn_ambr_dl_kbps 50000	APN AMBR DL	  1000 (kbps → bps)
static_ip.ipv4_static_ip '100.64.1.1'	Served-Party-IP-Address (IPv4)	      
static_ip.ipv6_static_ip '2606:4700::1111'	Served-Party-IP-Address (IPv6)	      

1. **AMBR** [redacted] kbps [redacted] Diameter [redacted] bps [redacted] 1000 [redacted]
2. **IP** [redacted] 0=IPv4, 1=IPv6, 2=IPv4v6, 3=IPv4_or_IPv6
3. [redacted] enabled: true → 0 (SERVICE_GRANTED) [redacted] enabled: false → 1 (OPERATOR_DETERMINED_BARRING)
4. [redacted] APN [redacted] (0, 1, 2...)
5. [redacted] **IP** [redacted] static_ips [redacted]

- `PLMN` `roaming_profile.roaming_rules`
- `subscriber.enabled == true`
- `APN` `IMS` `IMS APN`

[illegible]

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1. **key_set**
2. **SQL**
3. **Milenage** 3GPP TS 35.206 -
4. **KASME** TS 33.401 KDF CK||IK

- SQN
- Ki/OPc HSS
- AUTN (SON) AMF

ME 111111 (S13 ECA)

ME 111111 EIR 111111 MME 11 IMEI 111

11111

11111

1. **IMEI** 11111111111111111111111111111111
2. 11 **TAC** 11111111111111111111111111111111 8 11111
3. 1111111111111111 IMEI 1111111111111111
4. 11111111
 - 0 = 111111111111
 - 1 = 11111111/1111
 - 2 = 1111111111111111
 - 5 = 1111111111111111

111

- 11111 IMEI 11111111
- 11 TAC 1111111111
- 1111111111111111
- 1111111111

11111111

11 Diameter 1111111111 AVP1

111111

```
config :diameter_ex,
  diameter_host: "hss",
  diameter_realm: "example.com",
  diameter_service_name: "OmniHSS"
```

111111

11111111

1111111111

OmniHSS 11 111111111111 1111111111111111

```
# 1111ULR 1111111111111111
def get_subscriber_data(:update_location_request, imsi) do
  from(s in Subscriber, where: s.imsi == ^imsi)
  |> join(:left, [s], epc in assoc(s, :epc_profile))
  |> join(:left, [s, epc], apn in assoc(epc, :apn_profiles))
  |> join(:left, [s, epc, apn], qos in assoc(apn, :apn_qos_profile))
  |> join(:left, [s], msisdn in assoc(s, :msisdns))
  |> join(:left, [s], sip in assoc(s, :static_ips))
  |> preload([s, epc, apn, qos, msisdn, sip], [
    epc_profile: {epc, apn_profiles: {apn, apn_qos_profile: qos}},
```




OmniHSS

[← !\[\]\(fd91d60f77a472676459c4f834093416_img.jpg\) !\[\]\(e93fb394d6e1306cb5b32185a5a3c741_img.jpg\) !\[\]\(7a5592c50bfda06cebc6877eef6c31e4_img.jpg\) !\[\]\(7145cb875f1c9a065dd9d00ffdc8a7c9_img.jpg\) !\[\]\(041f8e763d8bfdb91be8ee07f39f8a3c_img.jpg\) !\[\]\(1b52a53f85f57b35176bf0b0a3b915d6_img.jpg\)](#)

- [!\[\]\(8affb7320c0c77a35524f9184b2c0901_img.jpg\) !\[\]\(a1f6f2770319300371b64837415c5954_img.jpg\) !\[\]\(801c389dbc33b0b077bc399dde4a0a94_img.jpg\) !\[\]\(0c2abc49882b37a8c31667a68b935800_img.jpg\)](#)
- [!\[\]\(bf9bc1690809789aba4e97c2bd2e0e9b_img.jpg\) !\[\]\(3045910921d49645d73ae33a13441cd2_img.jpg\) !\[\]\(c2bd6adc5a471f9ad2d6cbaf404b860e_img.jpg\) !\[\]\(92e00fc5eb1674db258106625d6d996f_img.jpg\) !\[\]\(8a4f6ed72419c38cbbba997277548bd7_img.jpg\) !\[\]\(0eab996694e25c39de0e9f9a08409817_img.jpg\)](#)
- [!\[\]\(8b1877ef3b96d0db02a44208fcf73e6c_img.jpg\) !\[\]\(8104df500df55e47617e3650bf71dfa6_img.jpg\) !\[\]\(d26d7fe07583727bcede7c698c2d1f94_img.jpg\) !\[\]\(fba0298f1b754bf1c7bfef3b3fe4a944_img.jpg\) !\[\]\(6a8073986b34a7c96f3b118de955fcef_img.jpg\)](#)
- [!\[\]\(a0d0eab45134ae6ad537c16e397c685e_img.jpg\) !\[\]\(3e833cb4eb08ac3a418f0535447ae245_img.jpg\) !\[\]\(6b1751af6af30ac418d0a4117e196717_img.jpg\) !\[\]\(5dbe02b78ad61f4e2ffe208cecf84e6a_img.jpg\)](#)
- [!\[\]\(77ca8b527efcc4cede8761667712354c_img.jpg\) !\[\]\(8a50c6e5509e52b93012be13d7675abe_img.jpg\) !\[\]\(bb754620858be4423a46abfe44c29483_img.jpg\) !\[\]\(584107dc69eb533f78db2ad1a1e53431_img.jpg\) !\[\]\(0a884fe1b91a4f880fef1961cb8df03b_img.jpg\) !\[\]\(89e9eb1c03c666c52574aea070c2307f_img.jpg\)](#)
- [!\[\]\(c430450ba05c59620f4ceb3510437935_img.jpg\) !\[\]\(ae7c28853239f55cc4e3603de2863e7f_img.jpg\) !\[\]\(73d3bbc53820e0de54acc520294dd770_img.jpg\) !\[\]\(8c93860dbab20dee0b2e83278639f0d5_img.jpg\) !\[\]\(a8834c1c41c49e1c85acf732d16216ba_img.jpg\) !\[\]\(2ca8f0ed267d959d70d5067ae65fb4db_img.jpg\)](#)
- [!\[\]\(1b4732144e6aff2e099e79cd15d33e04_img.jpg\) !\[\]\(a6eaa9cf84cdd743df5c59119642a2cf_img.jpg\) !\[\]\(f702413c3e37d4dfedc083bb2f51b771_img.jpg\) !\[\]\(b7e79507d987ca2655d543ad5c69f057_img.jpg\)](#)

OmniHSS                                    
   

URL: https://[hostname]:7443/overview

   MME        

PDN   PDN                

IMS   S-CSCF          

??
?? ? ? ? ? ? ? > 0 VoLTE ? ? ? ? ?

?? ? ? ? ? ? ?

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

1. ? ? ? ? ? ? ? ? ? ? ? ?
2. ? ? ? ? ? ? ? ? ? ? ? ? ? ?
3. ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
4. ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

Diameter ? ? ? ?

URL: https://[hostname]:7443/diameter

? ? ? ?

? ? ? ? ? ?

? ? ? ? ? ? ? ? ? ? ? ? ? ?

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

MME ? ? ? ? LTE ? ?

P-GW ? ? ? ? ?

S-CSCF ? ? ? IMS ? ?

P-CSCF ? ? ? VoLTE ? ?

I-CSCF ? ? ? IMS ? ? ? ?

AS ?-? ? ? ? ? ? ? ?

? ? ? ? ? ?

URL: https://[hostname]:7443/application

? ? ? ?

??
?? ? ? ? ? ? ? Erlang ? ? ? ? ? ? ? ? > 90% ? ? ?
? ? ? ? ? ? ? ? ? ? < 80% > 90%
? ? ? ? ? ? ? ? ? ? ? ? ? ? N/A ? ? ? ? ?

?? ??

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?? SQL ???????

????

???????

- ???????
- ???????
- IMS ??????

????

???????

- ?? PDN ?????
- ?? VoLTE ?????
- ? APN ?????? PDN ??

????

???????

- ??????? MCC-MNC ???
- ??????? PLMN 001-001?
- ???????

????

???????

- ???????
- ??? MME ?????
- ???????

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- ???????
- ???????
- ???????
- ???????

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◆◆◆◆

OmniHSS ◆◆◆◆◆ **stdout/stderr**◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

Diameter ◆◆◆◆◆:

```
[info] Diameter peer connected: mme01.epc.example.com
[warn] Diameter peer disconnected: pgw01.epc.example.com
[error] Diameter peer connection failed: timeout
```

◆◆◆◆◆:

```
[info] Database connection established
[error] Database connection lost: timeout
[error] Database query failed: deadlock detected
```

◆◆◆◆◆:

```
[info] Authentication successful: IMSI 001001123456789
[warn] Authentication failed: IMSI 001001123456789, invalid vector
[error] Roaming denied: IMSI 001001123456789, MCC 310 MNC 410
```

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API ◆◆◆◆◆: GET /api/status

```
curl -k https://hss.example.com:8443/api/status
```

◆◆◆◆◆:

```
{"status": "ok"}
```

HTTP 200 OK

Nagios/Icinga

```
#!/bin/bash
# check_omnihss.sh

API_URL="https://hss.example.com:8443/api/status"

response=$(curl -k -s -o /dev/null -w "%{http_code}" "$API_URL" --max-time 5)

if [ "$response" = "200" ]; then
    echo "OK - OmniHSS API responding"
    exit 0
else
    echo "CRITICAL - OmniHSS API not responding (HTTP $response)"
    exit 2
fi
```

Prometheus

OmniHSS Prometheus API

SNMP

SNMP SNMP API
SNMP OID

KPI

KPI

KPI			
	99.99%	< 99.95%	< 99.9%
Diameter	99.9%	< 99.5%	< 99%
	> 99%	< 99%	< 95%
Diameter	< 100ms	> 200ms	> 500ms
	< 50ms	> 100ms	> 500ms
	< 0.1%	> 0.5%	> 1%

◆◆ KPI

◆◆	◆◆	◆◆◆◆
◆◆◆◆	◆◆◆◆	80% ◆◆◆◆◆
◆◆ PDN	◆◆◆◆◆	70% ◆◆◆◆◆◆
◆◆◆◆◆	◆◆◆ MB	80% ◆◆◆◆◆
◆◆◆◆◆	◆◆◆◆◆	80% ◆◆◆◆◆

◆◆◆◆

◆◆◆◆◆

◆◆◆◆

◆◆◆◆ (P1)

◆◆◆◆◆:

- API ◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆

◆◆ Diameter ◆◆◆◆◆:

- ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆:

- ◆◆◆◆◆ SQL ◆◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆ (P2)

◆◆ Diameter ◆◆◆◆◆:

- ◆ MME ◆◆
- ◆ P-GW ◆◆
- ◆ S-CSCF ◆◆
- ◆◆◆◆ 15 ◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆:

- ◆◆ > 95%
- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◇◇◇◇◇◇◇:

- 10% ◇◇◇◇◇◇◇◇

- ◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇

◇◇◇◇◇◇◇ (P3)

◇◇◇◇◇◇◇◇◇:

- ◇◇◇◇◇◇◇◇
- ◇◇◇◇◇◇◇◇◇
- ◇◇◇◇◇◇ 1 ◇◇◇◇◇◇◇

◇◇◇◇◇◇◇:

- ◇◇ > 85%
- ◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇

◇◇◇◇◇◇◇:

- ◇◇◇◇ > 1%
- ◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇

◇◇◇◇◇◇◇ (P4)

◇◇◇◇◇◇:

- ◇◇ > 80% ◇◇◇◇
- ◇◇◇◇ > 80% ◇◇◇◇◇◇◇
- ◇◇◇◇◇◇◇◇◇◇◇◇◇◇

◇◇◇◇◇◇◇:

- ◇◇◇◇◇◇◇◇◇◇◇◇
- ◇◇◇◇◇◇◇◇◇◇◇◇◇

◇◇◇◇◇◇◇◇

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◇◇◇◇◇◇◇◇

- □ ◇◇◇◇◇◇◇◇◇◇ - ◇◇◇◇◇◇◇◇
- □ ◇◇ Diameter ◇◇ - ◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇
- □ ◇◇◇◇◇◇◇◇◇◇ - ◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇◇

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[←](#) | [: →](#)

- **IMS** - MSISDN IMS
- - EPC IMS

MSISDN MSISDN

1.

2.

3.

OmniHSS SIM/IMSI MSISDN

4.

MSISDN

MSISDN

```
# MSISDN
curl -k -X POST https://hss.example.com:8443/api/msisdn \
  -H "Content-Type: application/json" \
  -d '{"msisdn": {"msisdn": "14155551001"}}'

# MSISDN
curl -k -X POST https://hss.example.com:8443/api/msisdn \
  -H "Content-Type: application/json" \
  -d '{"msisdn": {"msisdn": "14155551002"}}'
```

MSISDN

1. IMSI ID
2. MSISDN ID

3. subscriber_idmsisdn_id

MSISDN

-
- msisdn
-

IDIMSI MSISDN

IMS

IMS

IMS MSISDN S-CSCF IMS

IFC

IMS IFC {{msisdns}} MSISDN

IFC

```
<ServiceProfile>
  <PublicIdentity>

<Identity>sip:{{imsi}}@ims.mnc{{mnc}}.mcc{{mcc}}.3gppnetwork.org</Identity>
</PublicIdentity>
<!-- MSISDN -->
<PublicIdentity>
  <Identity>sip:+14155551001@ims.example.com</Identity>
</PublicIdentity>
<PublicIdentity>
  <Identity>tel:+14155551001</Identity>
</PublicIdentity>
<PublicIdentity>
  <Identity>sip:+14155551002@ims.example.com</Identity>
</PublicIdentity>
<PublicIdentity>
  <Identity>tel:+14155551002</Identity>
</PublicIdentity>
<!-- ... -->
</ServiceProfile>
```


- 123456789
- 123S-CSCF45678901234567

1234567**MSISDN**8901234

123

- 1234567
- 123“4567”8“9012”

123456

1. **MSISDN**7890

- 123456789**MSISDN**0123456789
- 1234567890123456789012345678901234567890

2. **MSISDN**7890

- 1234567890**MSISDN**01234567
- 12345678901234567**API**0123456789**MSISDN**01

1234567890123456789012345678901234567890

123

- 1234567
- 1234567890123456789012345678901234567890

1234567890

1. 12**IMS**34567890123

- 123S-CSCF45678901
- 123456789 SIP URI012

2. 12**IMS**34567

- 1234567890123456789012345678901234567890
- 1234567890123456789012345678901234567890

3. 123456789

```
# 123456789
sip:+14155551001@ims.example.com # 1234567
sip:+14155551002@ims.example.com # 1234567
```

1234567**API**890**MSISDN**12345678901234

123

- API123 /api/subscriber/msisdn/:msisdn 45678901234

???

?????MSISDN?????
?????

????

????

1. ????MSISDN
2. ???
3. ?MSISDN???
4. ?????

MSISDN??

- ????**custom_attributes**?????
- ??????????
- ??????????

IMS??

- ??IFC?????
- ??????
- ??????

??

????MSISDN???

??IMSI SIM???

????

??IMSI SIM?????IMSI?????IMSI?
?????

?????IMSI????SIM????IMSI??HSS?????
????IMSI?

OmniHSS??

??OmniHSS??IMSI SIM??IMSI?????**SIM??**

??

1. ?????

- ??IMSI: 001-001????

- IMSI: 310-410
- IMSI: 234-015
- IMSI

2. MVNO

- IMSI: MVNO
- IMSI:
- MVNO

3. IoT/M2M

- IMSI 1:
- IMSI 2:
- IMSI 3: /
-

4.

- IMSI
-
-

IMSI

- IMSI Ki OPC
- IMSI
-

- EPC APN
- IMS
- IMSI

- IMSI SIM sim_id
- ICCID
- SIM

- SIM IMSI
-
- HSS IMSI

1. SIM IMSI

??IMSI????????????????

IMSI????

?????

?????

- ????SIM????
- ?????
- ?????

?????

- ????IMSI?????
- IMSI?????
- ???CDR?????

????

- IMSIMME????
- PDP?????
- ?????

IMSI????

??/SIM????IMSI???

1. ?????

- ?IMSI????
- ????IMSI

2. ?????

- ?????
- SIM????IMSI

3. ?????

- SIM????????????IMSI?
- ?MCC/MNC????

4. ?????

- ????IMSI
- ????IMSI?????

IMS??

????????IMSI???

???

?????

1. ???? ?IMSI???IMSI?HSS?“?”????
2. ??**SIM**???? ?IMSI SIM???sim_id?????
?“?”??
3. ???? subscriber_state????IMSI???MME/SGSN?IMSI????
??
4. ???? ?
 - ????IMSI
 - ????IMSI???
 - ????SIM????IMSI?????

????

IMSI + MSISDN

?????SIM???IMSI?IMSI???MSISDN?

????

- ????IMSI 1?
 - ????+1-415-555-1001
 - ????+1-415-555-1002
- ????IMSI 2?
 - ????+1-212-555-2001
 - ????+1-212-555-2002

?????IMSI 1??MSISDN?????IMSI 2???MSISDN?

????

MSISDN?

????MSISDN?

API???GET /api/subscriber/imsi/:imsi

????MSISDN?

??IMSI

??IMSI??

1. ???IMSI???????
2. ???IMSIkey_set?????
3. ??EPC???????
4. ????????

??IMSI?

- ???/SIM????HSS
- HSS????IMSI
- ???IMSI???

??MSISDN

?????

1. ??MSISDN?????
2. ??IMS????{{msisdns}} ??
3. ??IMS?????
4. ??S-CSCF?????

?????

- ??????????
- ?????HSS
- HSS?????

???

MSISDN??

- ✓ ??SIM?????
- ✓ ??????
- ✓ ?????
- ✓ ?????
- ✓ ??????
- ✓ ?IMSI???

IMSI SIM??

- ✓ ?????
- ✓ ?????
- ✓ ??????
- ✓ ?????
- ✓ ???
- ✓ ??????

2 2 2 2

✓ 1 2 2 2 2

✓ 1 2 2 2 2 2 2 2 2 2

✓ 1 2 2 2 2 2 2 2 2 2

✓ 1 2 2 2 2 2 2

✓ 1 2 2 2 2 2 2

← 1 2 2 2 2 2



OmniHSS

[← !\[\]\(48ede73b67a7785777f47d61f346cc47_img.jpg\)!\[\]\(943fdf5836a8a976a1a7dfd5df7a9cd6_img.jpg\)!\[\]\(25ebb77ee623caad1d047834049cd0bb_img.jpg\)!\[\]\(86001b4ff57497a8d6386edecaa8b50a_img.jpg\)!\[\]\(19d4019d89ec245152ba10c70608b1f2_img.jpg\)](#)



OmniHSS 



EPC

EPC LTE 



	 	 	  
ue_ambr_dl_kbps		     	10,000 - 1,000,000 Kbps
ue_ambr_ul_kbps		    	5,000 - 500,000 Kbps
network_access_mode		  	0            +CS 
tracking_area_update_interval_seconds	TAU   	54      	

 **EPC** 

```
curl -k -X POST https://hss.example.com:8443/api/epc/profile \  
-H "Content-Type: application/json" \  
-d '{  
  "epc_profile": {  
    "name": "Premium 100Mbps",  
    "ue_ambr_dl_kbps": 100000,  
    "ue_ambr_ul_kbps": 50000,  
    "network_access_mode": 0  
  }  
}'
```

 **EPC** 



- : 10 Mbps (10,000 Kbps)
- : 5 Mbps (5,000 Kbps)

◆◆:

- ◆◆: 50 Mbps (50,000 Kbps)
- ◆◆: 25 Mbps (25,000 Kbps)

◆◆:

- ◆◆: 100 Mbps (100,000 Kbps)
- ◆◆: 50 Mbps (50,000 Kbps)

◆◆◆:

- ◆◆: 1 Gbps (1,000,000 Kbps)
- ◆◆: 500 Mbps (500,000 Kbps)

IMS ◆◆◆◆

IMS ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ IFC◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

IFC ◆◆

IFC ◆◆◆◆ S-CSCF ◆◆◆◆◆◆◆◆ XML ◆◆◆

◆◆◆◆:

- {{imsi}} - ◆◆◆ IMSI
- {{msisdns}} - ◆◆◆◆◆
- {{mcc}} - ◆◆◆
- {{mnc}} - ◆◆◆◆

◆◆ IMS ◆◆◆◆

```
curl -k -X POST https://hss.example.com:8443/api/ims/profile \
-H "Content-Type: application/json" \
-d '{
  "ims_profile": {
    "name": "Standard VoLTE",
    "ifc_template": "<InitialFilterCriteria>...</InitialFilterCriteria>"
  }
}'
```

IFC ◆◆◆◆

```
<ServiceProfile>
  <PublicIdentity>

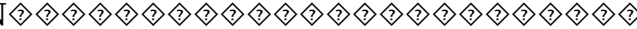
<Identity>sip:{{imsi}}@ims.mnc{{mnc}}.mcc{{mcc}}.3gppnetwork.org</Identity>
  </PublicIdentity>
  <InitialFilterCriteria>
    <Priority>0</Priority>
```

```

<TriggerPoint>
  <ConditionTypeCNF>0</ConditionTypeCNF>
  <SPT>
    <ConditionNegated>0</ConditionNegated>
    <Group>0</Group>
    <Method>INVITE</Method>
  </SPT>
</TriggerPoint>
<ApplicationServer>
  <ServerName>sip:as.ims.example.com</ServerName>
  <DefaultHandling>0</DefaultHandling>
</ApplicationServer>
</InitialFilterCriteria>
</ServiceProfile>

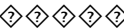
```

APN

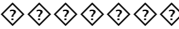
APN 

APN

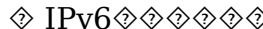
APN

 APN  IP 

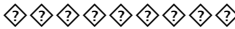
APN:

- internet - 
- ims - IMS/VoLTE 
- mms - 
- vzwadmin - 

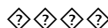
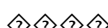
IP

- 0:  IPv4
- 1:  IPv6
- 2: IPv4v6 
- 3: IPv4  IPv6 

APN QoS



QCI

QCI			
1	GBR		
2	GBR		
4	GBR		

QCI 5 GBRIMS 9 GBR

APN

```
# 1. APN
APN_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/identifier \
-H "Content-Type: application/json" \
-d '{"apn_identifier": {"apn": "internet", "ip_version": 2}}' \
| jq -r '.data.id')

# 2. APN QoS
QOS_ID=$(curl -k -X POST https://hss.example.com:8443/api/apn/qos_profile \
-H "Content-Type: application/json" \
-d '{
  "apn_qos_profile": {
    "name": "Best Effort",
    "qci": 9,
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 50000,
    "apn_ambr_ul_kbps": 25000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true
  }
}' | jq -r '.data.id')

# 3. APN
curl -k -X POST https://hss.example.com:8443/api/apn/profile \
-H "Content-Type: application/json" \
-d "{
  \"apn_profile\": {
    \"name\": \"Internet APN\",
    \"apn_identifier_id\": $APN_ID,
    \"apn_qos_profile_id\": $QOS_ID
  }
}"
```

APN EPC

APN join_epc_profile_to_apn_profile EPC

APN ID EPC ID APN EPC

◆◆: ◆◆◆◆◆◆◆◆◆◆

- ◆◆◆◆◆◆◆◆◆◆TAU◆
- ◆◆
- IMS ◆◆◆◆◆◆ IMS ◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆◆◆:

- ◆◆◆◆◆ EPC ◆◆◆◆ AMBR ◆
- ◆◆ APN QoS ◆◆◆◆ AMBR ◆
- ◆◆ MME/P-GW ◆◆◆◆◆ QoS
- ◆◆◆◆◆◆

IMS ◆◆◆◆:

- ◆◆◆◆◆ IMS ◆◆◆◆
- ◆◆ IFC ◆◆ XML ◆◆◆◆
- ◆◆ S-CSCF ◆◆◆◆◆ IFC ◆◆◆◆
- ◆◆ S-CSCF ◆◆◆◆

APN ◆◆◆:

- ◆◆ APN ◆◆◆◆◆◆◆◆◆◆ EPC ◆◆◆◆
- ◆◆ APN ◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- ◆◆ UE ◆ PDN ◆◆◆◆



OmniHSS

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 OmniHSS  Diameter 


S6a (LTE/EPC)

 (AIR/AIA)

MME 

 AVP:

- :  (IMSI), -PLMN-Id, 
- :  (RAND, AUTN, XRES, KASME)

 (ULR/ULA)

MME  HSS 

 AVP:

- :  (IMSI), RAT , ULR , -PLMN-Id, UE-SRVCC 
- :  (AMBR, APN , 

 UE  (PUR/PUA)

MME  HSS 

 (NOR/NOA)

MME  HSS 

 (CLR/CLA)

HSS  MME  OmniHSS  CLR 

CLR

CLR AVP

S6a/S6d 0 1 = S6a
1 1 = UE

CLR:

```
clr_flags: %{\n  s6a_indicator: 1,      # S6a\n  reattach_required: 1   # \n}
```

IMSI

OmniHSS (IMSI) MME MSISDN IMSI
CLR

1: MSISDN IMSI

```
A:\n- IMSI: 999000123456789\n- MSISDNs: ["+1234567890", "+9876543210"]\n- last_seen_mme: "mme01.operator.com"
```

MME

- CLR "mme01.operator.com" IMSI 999000123456789
- MSISDN SIM
- AVP IMSI MSISDNs

2: IMSI MSISDN

OmniHSS MSISDN MSISDN/

```
A:\n- IMSI: 9990001111111111\n- MSISDN: "+1234567890"\n- last_seen_mme: "mme01.operator.com"
```

```
B:\n- IMSI: 9990002222222222\n- MSISDN: "+1234567890" # MSISDN SIM/IMSI\n- last_seen_mme: "mme02.operator.com"
```

?? B ?

- ? **CLR** ? IMSI = ?
- ? A ? mme01 ?
- ? B ? mme02 ?
- ?

3: ? **CLR** ? **MSISDN** ?

API ? ? ? ? ? ?

```
Hss.Control.Common.send_cancel_location_request(:imsi,
"999000123456789")
```

??

- ? **CLR** ? last_seen_mme
- ? **MSISDN** ? IMSI ? ? ? ? ? ? ? ? ? ?
- IMSI ? ? MME ? ? ? ?

?? ?

1. **IMSI** ? : CLR ? ? ? ? **IMSI** ? ? ? ? MSISDN ? subscriber_state ? ? ? ? (IMSI) ? last_seen_mme ?
2. ? ? ? : ? ? ? ? ? ? ? ? ? ? MME ? ? ? ? CLR ? ? ? ? ? ? ? ? ? ? ? ?
3. ? ? ? ? ? ? **MME** ? ? ? ? **CLR**: ? ? last_seen_mme ? nil ? CLR ?
4. ? ? ? ? ? : ? ? CLR ? ? ULR ? ? ? ? ? ? ? ? ? ? Subscription-Data AVP ? ? ? ? ? MME ? ? ? ? ? ? ? ?
5. ? : CLR ? ? ? ? ? ? ? ? ? ? ? ? ? ? MME ? ULA ? ? ? ? ? ? MME ? CLA ?
6. **CLA** ? : OmniHSS ? ? CLA ? ? ? ? ? ? ? ? ? ? ? ? ? ? 398 ? ? :discard ? HSS ? ? ?

Cx ? ? (IMS)

?? ? ? ? ? ? (UAR/UAA)

I-CSCF ? ? ? ? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? (SAR/SAA)

S-CSCF ? ? / ? ? ? ? ? ? ? ? ? ? IMS ? ? ? ? ?

IFC :

- {{imsi}} →   IMSI
- {{msisdns}} →      
- {{mcc}}, {{mnc}} →   PLMN  

 (MAR/MAA)

S-CSCF   IMS       

 (LIR/LIA)

I-CSCF     S-CSCF         

Sh **(IMS** **)**

 (UDR/UDA)

 (PUR/PUA)

 (SNR/SNA)

Gx **(** **)**

OmniHSS   Gx     PCRF          

   [!\[\]\(f64dea98c573eb6731318722bde32546_img.jpg\) !\[\]\(edefd3a075cf410b4da0639738350f5a_img.jpg\) !\[\]\(19de015df72f7879a2829b5b92075250_img.jpg\) !\[\]\(e078406f8808b41dcf944ecb0456fa16_img.jpg\) !\[\]\(a12f129889fb91f45a904bec9a275765_img.jpg\) !\[\]\(4a04e1772b44c4efb404bab8ceb19ff7_img.jpg\) !\[\]\(8f8e0cb8d31d772d44b08e1bb3e09249_img.jpg\) !\[\]\(edb8cc1b267409850e533197a0615408_img.jpg\) !\[\]\(5a2a464714ec8c709e3680cd63565608_img.jpg\) !\[\]\(578ffba85fe5732d7498679cd368f779_img.jpg\) !\[\]\(2ce32177fc770a34ecc32ddb67c153d4_img.jpg\) !\[\]\(61638fc71b5bf029c50cb0b5a8e66e34_img.jpg\) !\[\]\(186a753c094106574e6fee716cff8817_img.jpg\) !\[\]\(4fdfeaa7b6dcd74ca90f501b93a2c921_img.jpg\) !\[\]\(7c23aa417297e47798f8d69cfa8dbf68_img.jpg\) !\[\]\(19ac66438a142dfc7ececb7af1907774_img.jpg\) !\[\]\(7a4ae581e9aea1771b180ed07e6cee42_img.jpg\) !\[\]\(930d942d2cc673aa4f9c053c364a344b_img.jpg\) !\[\]\(856620c3d6c373c73bd15655152e9aeb_img.jpg\) !\[\]\(498f3671fb8342e44fddf20978dcc7c4_img.jpg\) !\[\]\(cbea016bf093ed31c47d26169c71a20a_img.jpg\) !\[\]\(b1f739a35c1a63f23cdf8da48a50b990_img.jpg\) !\[\]\(627fb5d34a4c4da0da88398863710a65_img.jpg\) !\[\]\(ff8b2542433d5da074543d19cd0a8e63_img.jpg\) !\[\]\(a44f20f976ea466a2349a8c29260ffe0_img.jpg\) !\[\]\(faf640ea703f5c0a51f27e1e5c7b41b9_img.jpg\) !\[\]\(375cba2168bded8572c791a9fa04a807_img.jpg\) !\[\]\(eede21b886973bd06c10b16d8b0566ea_img.jpg\) **QoS** !\[\]\(d80916dc79d774167291b953ac5cfabe_img.jpg\) !\[\]\(ba67c2c09ed4a0381c90e332a0dda672_img.jpg\) !\[\]\(be2f695fef785afa673a004685b5839b_img.jpg\)](#)

 - **(CCR-I/CCA-I)**

P-GW  PDN             

 AVP:

-  :   ID (IMSI),    ID (APN), RAT  , IP-CAN  
-  : QoS   (QCI, ARP, AMBR),      

◆◆◆◆◆◆ - ◆◆ (CCR-U/CCA-U)

P-GW ◆◆◆◆◆◆

◆◆◆◆◆◆ - ◆◆ (CCR-T/CCA-T)

P-GW ◆◆ PDN ◆◆◆◆◆◆

◆◆◆◆◆◆ (RAR/RAA)

OmniHSS (PCRF) ◆ P-GW ◆◆◆◆◆◆◆◆◆◆◆◆

Rx ◆◆ (IMS ◆◆◆◆◆◆)

OmniHSS ◆◆ Rx ◆◆◆◆◆ PCRF ◆◆◆◆◆ IMS ◆◆◆◆◆

◆◆◆ [PCRF ◆◆](#) ◆◆◆◆◆◆◆ **VoLTE** ◆◆◆◆◆◆◆◆◆◆◆◆

AA ◆◆ (AAR/AAA)

P-CSCF ◆◆ IMS ◆◆◆◆◆◆◆◆

◆◆◆◆:

- ◆◆ SDP ◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆ (◆◆/◆◆)
- ◆◆◆◆◆ SDF ◆◆◆
- ◆◆ Gx RAR ◆◆◆◆◆◆

◆◆◆◆◆◆ (STR/STA)

P-CSCF ◆◆ IMS ◆◆◆◆◆◆

S13 ◆◆ (EIR)

OmniHSS ◆◆ S13 ◆◆◆◆ EIR◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆ [EIR ◆◆](#) ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ **IMEI** ◆◆◆◆◆◆◆◆◆◆◆◆

ME ◆◆◆◆◆◆ (ECR/ECA)

◆◆ EIR ◆◆◆◆◆ MME◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆:

- 0000 (0) - 00000000
- 00000000 (1) - 00000
- 000000000 (2) - 0000000000

00000: VoLTE 00

000 VoLTE 000000000000

00000000

0000 (S6a AIR)

00:

1. 00000000 (Ki, OPC, AMF)
2. SQN 00 (000000)
3. 000000000000

000000 (S6a ULR)

00:

1. EPC 000000000000 APN
2. 000000000
3. MME 0000000

IMS 0000 (Cx SAR)

00:

1. IMS 000000000000
2. IFC 0000 XML
3. S-CSCF 00000
4. 00000000000000 MSISDN

PDN 0000 (Gx CCR-I)

00:

1. APN 0 EPC 000000 APN 000000
 2. APN QoS 0000000
 3. PDN 00000000000000
-





OmniHSS

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OmniHSS                              IMS 

- name -    
- mcc -       3   
- mnc -        2-3    
- data_action - 0      1    
- ims_action - 0      1    

- name -    
- data_action_if_no_rules_match - 0      1    
- ims_action_if_no_rules_match - 0      1    

◆◆◆◆

◆◆◆◆◆◆

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

```
curl -k -X POST https://hss.example.com:8443/api/roaming/profile \
-H "Content-Type: application/json" \
-d '{
  "roaming_profile": {
    "name": "Allow All",
    "data_action_if_no_rules_match": 0,
    "ims_action_if_no_rules_match": 0
  }
}'
```

◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

```
curl -k -X POST https://hss.example.com:8443/api/roaming/profile \
-H "Content-Type: application/json" \
-d '{
  "roaming_profile": {
    "name": "No Roaming",
    "data_action_if_no_rules_match": 1,
    "ims_action_if_no_rules_match": 1
  }
}'
```

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```
PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/
roaming/profile \
-H "Content-Type: application/json" \
-d '{
  "roaming_profile": {
    "name": "US Carriers Only",
    "data_action_if_no_rules_match": 1,
    "ims_action_if_no_rules_match": 1
  }
}' | jq -r '.data.id')
```

◆◆ AT&T

```
RULE1=$(curl -k -X POST https://hss.example.com:8443/api/roaming/rule \
-H "Content-Type: application/json" \
-d '{
```

```
    "roaming_rule": {
      "name": "Allow AT&T",
      "mcc": "310",
      "mnc": "410",
      "data_action": 0,
      "ims_action": 0
    }
  }' | jq -r '.data.id')
```

  Verizon

```
RULE2=$(curl -k -X POST https://hss.example.com:8443/api/roaming/rule \
-H "Content-Type: application/json" \
-d '{
  "roaming_rule": {
    "name": "Allow Verizon",
    "mcc": "311",
    "mnc": "480",
    "data_action": 0,
    "ims_action": 0
  }
}' | jq -r '.data.id')
```

```
#  join_roaming_profile_to_roaming_rule      
#      ID       ID
```

```
curl -k -X POST https://hss.example.com:8443/api/roaming/rule \
-H "Content-Type: application/json" \
-d '{
  "roaming_rule": {
    "name": "Data Only - T-Mobile",
    "mcc": "310",
    "mnc": "260",
    "data_action": 0,
    "ims_action": 1
  }
}'
```

```
PROFILE_ID=$(curl -k -X POST https://hss.example.com:8443/api/
roaming/profile \
-H "Content-Type: application/json" \
```

```

-d '{
  "roaming_profile": {
    "name": "Block Expensive Networks",
    "data_action_if_no_rules_match": 0,
    "ims_action_if_no_rules_match": 0
  }
}' | jq -r '.data.id')

# 1
curl -k -X POST https://hss.example.com:8443/api/roaming/rule \
-H "Content-Type: application/json" \
-d '{
  "roaming_rule": {
    "name": "Block Expensive Network",
    "mcc": "206",
    "mnc": "01",
    "data_action": 1,
    "ims_action": 1
  }
}'

```

1

1

20601

1

- 20601
- 20601 MCC 310311312313314315316

2

20601

2

- 20601
- 20601 MCC/MNC

3

20601 WiFi

2

- data_action: 0ims_action: 1

4

MME/OmniHSS

MCC/MNC

MCC

MCC	
310-316	AT&T, Verizon, T-Mobile
302	Rogers, Bell, Telus
234-235	Vodafone, O2, EE
262	Deutsche Telekom, Vodafone
208	Orange, SFR, Bouygues
222	TIM, Vodafone, Wind
214	Movistar, Vodafone

MCC 310-316

MCCMNC

310	410	AT&T
311	480	Verizon
310	260	T-Mobile
310	120	Sprint
313	380	

[ITU-T E.212](#) [MCC/MNC](#)

S6a

CxIMS

IMS

?? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? ? ? ? ? ?

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- ?? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ?? ? ? ? ? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? ? ? ? ?

- ?? ? ? ? ? ? ? ? ? ? ? ? ? ? MCC/MNC ? ? ? ? ? ?
- ?? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ?? ? ? ? ? ? ? ? data_action ?

?? ? ? ? ? ? ? ? ? ? ? ? ? **IMS**

?? ? ? ? **IMS** ? ? ?

- ?? ? ? ? ? ? ? ? ?
- ?? data_action ? ims_action ?
- ?? ? ? ? ? ? ? ? IMS ? ? ? ? ? ?

?? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? ?

```
[info] Roaming check: IMSI 001001123456789, Visited PLMN 310-410
[info] Roaming rule matched: "Allow AT&T"
[info] Data action: allow, IMS action: allow
```

?? ? ? ? ? ?

?? ? ? ?

1. ?? ? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ?
2. ?? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
3. ?? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ?
4. ?? ? ? ? - ? ? ? ? ? ? ? ? ? ? ? ? ? ?

?? ? ? ?

1. ?? ? ? ? ? ? - "Allow-ATT-Data-Only" ? ? ? "Rule1"
2. ?? **MCC/MNC** - ? ? ? ? ? ? ? ? ? ? ? ? ? ?
3. ?? ? ? ? ? ? - ? ? ? ? ? ? ? ? IMS

$$4. \begin{array}{cccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array} - \begin{array}{cccccccccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array}$$

$$\begin{array}{cccc} \diamond & \diamond & \diamond & \diamond \end{array}$$

1. $\begin{array}{cccc} \diamond & \diamond & \diamond & \diamond \end{array} - \begin{array}{cccc} \diamond & \diamond & \diamond & \diamond \end{array} / \begin{array}{cccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array}$
2. $\begin{array}{cccc} \diamond & \diamond & \diamond & \diamond \end{array} - \begin{array}{cccccccccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array}$
3. $\begin{array}{cc} \diamond & \diamond \end{array} - \begin{array}{cccccccccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array}$
4. $\begin{array}{cccc} \diamond & \diamond & \diamond & \diamond \end{array} - \begin{array}{cccccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array}$

$$\leftarrow \begin{array}{cccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array} \mid \begin{array}{cccccc} \diamond & \diamond & \diamond & \diamond & \diamond & \diamond \end{array} \rightarrow$$



OmniHSS

[← !\[\]\(b072bf4265d9233e96e6b7ec2dd456ef_img.jpg\) !\[\]\(e87b46bb90d3ba05b63b9264a9c48762_img.jpg\) !\[\]\(ebc33e4a6e6cf185d3b814b46927dba1_img.jpg\) !\[\]\(ec318f311a55935ba6b695c0c52f49fd_img.jpg\) !\[\]\(79eed31b7d361b685868c1c889e12a22_img.jpg\)](#)

- [!\[\]\(709ae90b7c84db7c368d4dbda3455996_img.jpg\) !\[\]\(6c0c6f6e48a9a85f559e811357f7fc23_img.jpg\) !\[\]\(2f3675f50e1c2cdcbcbfbd3313f04f6d_img.jpg\) !\[\]\(6d6f19f39f4b4e1cc07e2437173aafae_img.jpg\) !\[\]\(1e398815d801cad1190cec942ef1cc2a_img.jpg\) !\[\]\(2a1c9103184adfc31539d564a102ef7e_img.jpg\)](#)
 - [!\[\]\(fb4ac05b8bacfb44bb02be4fd56001a3_img.jpg\) !\[\]\(38f0776a2e3fa66c5e644e755bcd5583_img.jpg\) !\[\]\(bf870ef85a0b4264e2830ec462550904_img.jpg\) !\[\]\(62efdb55dcbd9a316ab768f54e8d0ba6_img.jpg\) !\[\]\(4a5ca21351a262a75b30a42890eade6e_img.jpg\) !\[\]\(3262158e0dcec9a7398149f493f26716_img.jpg\)](#)
 - [Diameter !\[\]\(2363d9c27da884d5ff4f6b224c88c6f5_img.jpg\) !\[\]\(4bb4c81d5f32af85f3b56911a0640063_img.jpg\) !\[\]\(7a07d53110e272f4c6dcd67da69c9034_img.jpg\) !\[\]\(7b14ed8c2f1ca10685b30d55efef02f9_img.jpg\)](#)
 - [!\[\]\(21cd7d26c1ac93ed458b7ee30b995d17_img.jpg\) !\[\]\(90df2a70eaa6c0fbb7adaa51f9a55bf7_img.jpg\) !\[\]\(9d38cd8e17d10a952002a2e35c6e3399_img.jpg\) !\[\]\(ddce4250a41b4a5183a1f284fb82e3fe_img.jpg\) !\[\]\(69c5a775138a6f2887d632cb1fb2ea33_img.jpg\)](#)
 - [EPC !\[\]\(ff150ab3be8e9cf36c6036743583be3d_img.jpg\) !\[\]\(5c92feeda0a5c5f2825cb9764d22bae5_img.jpg\) !\[\]\(7c5f5dbd09bfd38a6833cf81c5562d51_img.jpg\) !\[\]\(79162dbe96ca0ead061f0dc9d152e628_img.jpg\)](#)
 - [IMS !\[\]\(c67dd5430e45eda0cf5c0e77695556c2_img.jpg\) !\[\]\(506ebe1954ffad69f17d4d6805150cb0_img.jpg\) !\[\]\(3b3cf8e1e9332dc93b3b77c3f3924c00_img.jpg\) !\[\]\(256b0621429f867feecfee24c2c78573_img.jpg\)](#)
 - [VoLTE !\[\]\(ebcb491271da44e4e1ed408ed974d62b_img.jpg\) !\[\]\(f6eeb00b4f85f2e7ffcee7654cbcfd37_img.jpg\) !\[\]\(e21f3ed0e76aa2488d42ba4adb40dfbd_img.jpg\) !\[\]\(d47249ffa00261cc329b9b0a17266c3d_img.jpg\)](#)
 - [!\[\]\(42bf0551783f2dd65952e611e25317d2_img.jpg\) !\[\]\(70d401752fbac772385340be0045a5d6_img.jpg\) !\[\]\(bc3224d3f637fc943bbfa17d683feee6_img.jpg\) !\[\]\(049beeef1be5e6ded08d7184462e3f33_img.jpg\)](#)
 - [EIR !\[\]\(39155f1dcfe14dd2a4123644f9cabf54_img.jpg\) !\[\]\(9df0332699e2863691736f73b1f605c1_img.jpg\)](#)
 - [!\[\]\(a0961c00682f6b21c01154cbfbf95ad9_img.jpg\) !\[\]\(49030ff58af535a6e2f195db752e71e5_img.jpg\) !\[\]\(f0e6f6c767b4c471d4947162bc4b6bfc_img.jpg\) !\[\]\(880b0324055919218e69c078835be4f7_img.jpg\)](#)
 - [!\[\]\(430b9d91466140d1e4fffec5a06a2043_img.jpg\) !\[\]\(9061bcaf029472fa0910f01ac394c048_img.jpg\) !\[\]\(1e4a42441b263a617f797f9538124c58_img.jpg\) !\[\]\(844953b017df25c476bc95ed59c4173a_img.jpg\) !\[\]\(2c6d6fa73bc80fa763fae450cd37e0e3_img.jpg\) !\[\]\(69c312e722968362b736124b643ac59c_img.jpg\)](#)
 - [API !\[\]\(3cd8a6d52efc1a63d9d3d7616f64dee8_img.jpg\) !\[\]\(39b9d11c65663e87612020574c51566a_img.jpg\)](#)
 - [!\[\]\(5491405a45d77f55cf65455452865cdb_img.jpg\) !\[\]\(ccf4f445da61a0483563a71ec45835ba_img.jpg\) !\[\]\(e0ce193cf5a5ff39e6ad821b4861f8b8_img.jpg\) !\[\]\(b12c1af5e2ec0eb374f83e38a8ea3753_img.jpg\) !\[\]\(cf1126d355ddb96dbd07f53c3777d0a9_img.jpg\) !\[\]\(aa44c16603051d3b1bf5e91504f94529_img.jpg\) !\[\]\(82b3c9ef284a890f79e79fa766c3a588_img.jpg\)](#)
-

1.          

- IMSI
- MSISDN     
-     
-      

2.    

-      
-        
-        

3. ❶❷❸❹

- ❶❷❸❹❺❻❼❽❾❿
- ❶❷❸❹❺❻❼❽❾❿
- ❶❷❸❹❺❻❼❽❾❿/❶❷❸❹❺❻❼❽❾❿

4. ❶❷❸❹

- ❶❷ ❸❹❺❻ ❽❾❿❿
- ❶❷ Diameter ❸❹❺❻
- ❶❷❸❹❺❻❽❾

❶❷❸❹❺❻

❶❷

- ❶❷❸❹❺❻❽❾
- “❶❷❸❹❺❻”❽❾
- ❶❷❸❹❺❻❽❾

❶❷❸❹❺❻❽❾

❶❷ **1**❸❹❺❻❽❾

❶❷❸

- ❶❷❸❹❺❻❽❾❿❿❿❿
- ❶❷❸❹❺❻❽❾❿❿❿❿❿❿

❶❷❸❹❺

1. ❶❷❸❹❺❻ key_set_id❽

```
curl -k https://hss.example.com:8443/api/subscriber/imsi/[IMSI]
```

2. ❶❷❸❹❺❻❽❾❿❿❿❿❿❿❿❿

```
curl -k https://hss.example.com:8443/api/key_set/[KEY_SET_ID]
```

3. ❶ Ki ❷ OPC ❸❹ SIM ❺❻❽❾❿❿

❶❷❸❹❺

- ❶❷❸❹❺ ❻❽❾ ❿❿❿❿
- ❶❷❸❹❺❻❽❾ SIM ❿❿❿❿❿❿

- 12345678901234567890
- 1234 "1234 EPC 12345678"

123456

1. 123456 epc_profile_id 12
2. 12 EPC 1234567890123456

```
curl -k https://hss.example.com:8443/api/epc/
profile/[PROFILE_ID]
```

1234567

- 12345 [EPC 123456](#) 12345678

123456789012345678

Diameter 1234

12

- 1 [123456](#) 1234 Diameter 123456789012
- "123456789012" 12
- 1234567890123456

1234567890123456

12 123456789012

1234

- 123456789012
- 1234567890
- Ping 12345678

12345678

1. 1234 OmniHSS 1234567890123456

```
ping [PEER_IP]
```

2. 12 Diameter 123456789012

```
telnet [PEER_IP] 3868
```

3. 12345678901234 Diameter 12345678 3868

3. 12345678

4. 12345678901234567890 TLS

12345

- 1234567
- 12345678
- 1234567890 OmniHSS

4 1234567890123456

123

- 1234567890123456
- 12345678901234
- "1234567890"12

123456

1. 12 [1234 Diameter 12](#) 1234567890
2. 123456789012345678901234567890 S6a Cx Sh 12
3. 1234567890 CER/CEA 12

123456

- 12345678901234567890 Diameter 12
- 12345678901234567890
 - MME 1234 S6a 16777251
 - S-CSCF 1234567890 Cx 16777216
 - P-GW 1234 Gx 16777238

Diameter 12345678

12345

12

- API 12 500 12
- 1234567890
- "1234567890"12
- 1234567890

????????

1?????

???

- ?? API ???
- ???????
- "?????"??

?????

1. ?????

```
# ??? PostgreSQL
psql -h [DB_HOST] -U [DB_USER] -d [DB_NAME]

# ??? MySQL
mysql -h [DB_HOST] -u [DB_USER] -p [DB_NAME]
```

2. ??????

3. ?????

????

- ??????
- ??????
- ??????

2?????

???

- "?????"??
- OmniHSS ?????

????

1. ?? runtime.exs ???

2. ??????

3. ?????

????

- ?? [?????](#) runtime.exs ?
- ??????
- ?????? OmniHSS

3

- 500
- “ ”
-

- 1.
2. runtime.exs
- 3.

- runtime.exs
-
-

4

- API
-
- CPU

- 1.
- 2.
- 3.
- 4.

-
-
-
-

EPC

-        LTE  
- MME    
-    PDN  

  **1**      

-                            
- “      ”  
-                            

1.      roaming_profile_id
2.          
3.       MCC/MNC
4.                            

-      MCC/MNC   [!\[\]\(5b9eeb5f0fae4f06be8eeb4a04f029d5_img.jpg\) !\[\]\(639670f016d71c781de2f3a9b7171292_img.jpg\) !\[\]\(4871af83e86dd7a282f09dc4a70427a9_img.jpg\) !\[\]\(4b03fb48f190188d26f3de16569db4d9_img.jpg\)](#)
-                            
-   [!\[\]\(f05f420ae5131ec190d6f91e8cf691ff_img.jpg\) !\[\]\(c13d1a631553f814aef10f0f35972022_img.jpg\) !\[\]\(d02f143085c5e78078c7bdc6e90b47ab_img.jpg\) !\[\]\(153cbafc8ea978c061200f810dc53d1a_img.jpg\)](#)    

  **2**    **APN**  

-      PDN    
- MME   “  APN”  
-                            

1.   EPC                         
2.   APN                         
3.   APN                         

- [APN](#) [EPC](#)
- APN
- APN QoS

3 MME

-
- MME
- Diameter

1. [Diameter](#)
2. MME “”
3. MME S6a

- [Diameter](#)
- MME
- MME

4

-
-
-

- 1.
2. MME
- 3.

-
- MME
-

EPC

IMS ❶❷❸❹

❶❷

- ❶❷❸❹❺❻ VoLTE
- ❶❷❸❹❺❻ “IMS ❶❷❸❹❺❻”
- ❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

❶❷ 1❶❷❸❹❺❻ IMS

❶❷❸

- ❶❷❸❹❺❻❷❸❹❺❻ IMS
- ❶❷❸❹❺❻❷❸❹❺❻

❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

1. ❶❷❸❹❺❻❷❸❹❺❻ ims_enabled ❶❷
2. ❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻ ims_profile_id

❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

- [❶❷❸❹❺❻ IMS](#)
- ❶❷ [IMS ❶❷❸❹❺❻](#)

❶❷ 2❶S-CSCF ❶❷❸❹

❶❷❸

- ❶❷ IMS ❶❷❸❹❺❻
- ❶❷ IMS ❶❷❸❹❺❻ Diameter ❶❷

❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

1. ❶❷ [❶❷❸❹❺❻ Diameter ❶❷](#)
2. ❶❷ S-CSCF ❶❷❸❹❺❻❷❸❹❺❻
3. ❶❷ S-CSCF ❶❷❸❹❺❻ Cx ❶❷

❶❷❸❹❺❻❷❸❹❺❻❷❸❹❺❻

- ❶❷ [Diameter ❶❷❸❹❺❻](#) ❶ S-CSCF
- ❶❷ S-CSCF ❶❷

3 IFC

-
- IFC

1. IMS
2. IFC
3. IFC XML

- IFC [IMS](#)
- [IMS](#) IFC

4 IMS

- IMS
-
- IMS

1. IMS
2. ims_action

- [IMS](#)
- IMS

IMS

VoLTE

- IMS
-
-
- “ ”

□□□□□□□□

□□ 1□P-CSCF □□□

□□□

- □□□□□□□□
- □□□□□□

□□□□□

1. □□ [□□□□□ Diameter □□](#)
2. □□ P-CSCF □□□□□□
3. □□ P-CSCF □□□□ Rx □□□ OmniHSS PCRF □□□

□□□□□

- □□ [Diameter □□□□□](#) □ P-CSCF
- □□ P-CSCF □□□□□ OmniHSS □ Rx

□□ 2□□□□□□□

□□□

- □□□□□□□□
- AAR/AAA □□□□
- Rx □□□□

□□□□□

1. □□□□□□ Rx Diameter □□
2. □□□□□□ AAR□AA-□□□
3. □□ AAA□AA-□□□□□

□□□□□

- □□ P-CSCF □□□□ AAR □□□□□□
- □□ OmniHSS Rx □□□□
- □□□□□□□□□□ IMS □□

□□ 3□QoS/□□□□

□□□

- □□□□□□□□
- □□□□
- □□□□

□□□□□

1. □□□□□ APN □ APN QoS □□□□
2. □□ QCI □□□□□□□□□□□□□ QCI 1 □
3. □□ P-GW □□□□ Gx□PCRF □□□

□□□□□

- □□ [APN QoS](#) □□□□□ □□□□□ IMS APN
- □□□□□□□□□□ QCI 1
- □□□□□□□□ [Diameter](#) □□□□□ □ P-GW

VoLTE □□□□□□□□□

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1. □□□□□□ roaming_profile_id
2. □□□□□□□□ null

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□□ **2** □□□□□□□□

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1. ◆◆◆◆◆ MME ◆◆◆◆◆ MCC/MNC
2. ◆◆◆◆◆
3. ◆◆◆◆◆ MCC/MNC
4. ◆◆◆◆◆

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- ◆◆ [◆◆◆◆◆](#) ◆◆◆◆◆

```
curl -k -X POST https://hss.example.com:8443/api/roaming/rule \
-H "Content-Type: application/json" \
-d '{
  "roaming_rule": {
    "name": "◆◆◆◆◆",
    "mcc": "310",
    "mnc": "410",
    "data_action": 0,
    "ims_action": 0
  }
}'
```

◆◆ 3◆◆◆◆ IMS ◆◆◆

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- ◆◆◆◆◆
- ◆◆/IMS ◆◆◆◆◆
- ◆◆◆◆◆

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3. ◆◆◆◆◆

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- ◆◆◆◆◆ IMS◆
 - ◆◆ ims_action: 0 ◆◆◆
- ◆◆◆◆◆ ims_action_if_no_rules_match

◆◆ [◆◆◆◆◆](#) ◆◆◆◆◆

EIR

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- EIR

1IMEI

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1. EIR
- 2.
3. IMEI
4. /

- [EIR](#)
-
-

2MME S13

- EIR
-

1. MME S13
2. MME Diameter
3. S13
4. MME

- MME S13 EIR

- Diameter S13 16777252
- MME

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- API 
- Diameter 
- CPU 
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◇◇ **3** **Diameter** ◇◇◇◇◇

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- Diameter ◇◇◇◇
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4. ◇◇◇◇◇◇◇◇◇◇

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- 3333333333
- 33333333
- 33333333 Diameter 33

33 **4**33333

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- OmniHSS 333333
- 333333
- 3333333

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1. 3333333333 OmniHSS 333333
2. 333333
3. 333333333333
4. 33 Erlang VM 33

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- 33 OmniHSS 33333333
- 33333333333333333333
- 3 runtime.exs 333 Erlang VM 3333
- 333333333333333333

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33 **1**3MME 33/33

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1. $\diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond$ MME
2. $\diamond \diamond$ MME $\diamond \diamond \diamond \diamond \diamond$
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- MME 

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- PDN 
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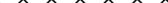


1.  last_seen 
2. 
3. 







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API



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- API 
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- 400 $\diamond$ 422 $\diamond \diamond$
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-  API 
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-  ID 

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-  "key_set_id 
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2. 

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- $\diamond \quad ? \quad ? \quad \underline{\color{blue} ? \quad ? \quad ? \quad ? \quad ? \quad ? \quad ? \quad ? \quad ?}$

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-   API    
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1. $\diamondsuit ? \diamondsuit ? \diamondsuit ? \diamondsuit ?$

- URL: https://[hostname]:7443/overview
- 

2. Diameter $\diamond\diamond$

- URL: https://[hostname]:7443/diameter
- 

3. $\diamondsuit \diamondsuit \diamondsuit \diamondsuit$

- URL: https://[hostname]:7443/application
- 

API    









```
curl -k https://hss.example.com:8443/api/status
```

❖❖❖❖❖

❖ IMSI

```
curl -k https://hss.example.com:8443/api/subscriber/imsi/001001123456789
```

❖ MSISDN

```
curl -k https://hss.example.com:8443/api/subscriber/msisdn/14155551234
```

❖ ID

```
curl -k https://hss.example.com:8443/api/subscriber/1
```

❖❖❖❖❖❖❖

```
curl -k https://hss.example.com:8443/api/subscriber
```

❖❖❖❖❖❖❖❖❖

EPC ❖❖❖❖

```
curl -k https://hss.example.com:8443/api/epc/profile/1
```

IMS ❖❖❖❖

```
curl -k https://hss.example.com:8443/api/ims/profile/1
```

❖❖❖❖❖❖

```
curl -k https://hss.example.com:8443/api/roaming/profile/1
```

❖❖❖❖❖❖

❖❖ **Diameter** ❖❖❖❖❖❖

```
telnet [PEER_IP] 3868
```

❖❖ **TLS** ❖❖❖

```
openssl s_client -connect [hostname]:8443 -showcerts
```

❖❖❖❖❖❖❖❖❖

PostgreSQL

```
psql -h [DB_HOST] -U [DB_USER] -d [DB_NAME] -c "SELECT COUNT(*) FROM subscriber;"
```

MySQL

```
mysql -h [DB_HOST] -u [DB_USER] -p -e "SELECT COUNT(*) FROM subscriber;" [DB_NAME]
```

????

????? IMSI?

```
grep "001001123456789" /var/log/omnihss/omnihss.log
```

??????

```
grep "authentication.*fail" /var/log/omnihss/omnihss.log
```

?? **Diameter** ?????

```
grep "Diameter peer" /var/log/omnihss/omnihss.log
```

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```
grep -i "database.*error" /var/log/omnihss/omnihss.log
```

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1. ??????
2. ?????
3. ?????
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5. ?????
6. ?????

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1. ? - ?
2. ? - ?
3. ? - ?
4. ? - runtime.exs ?
5. ? - OmniHSS ?
6. ? - ?
7. ? - ? IMSI

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- ? ? ? ?

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" ? ? ? ? ? ? ? ? ? ? "		? ? ? ? ? ? ? ? ? ? ? ?		<u>? ? ? ? ?</u>	
"SQN ? ? ? ?"		SQN ? ? ?		<u>? ? ? ? ? ?</u>	
" ? ? ? ? ? "		? ? IMSI		? ? IMSI ? ? ? ? ?	
" ? ? ? ? ? "		enabled=false		<u>? ? ? ?</u>	

Diameter ? ?

	? ? ? ?		? ?		? ? ? ?
"Diameter ? ? ? ? ? ? ? ?"		? ? ? ? ?		<u>? ? ? ? ? ?</u>	
"CER/CEA ? ? ? ?"		? ? ? ? ?		<u>? ? Diameter ? ?</u>	
" ? ? ? ? ? ? "		? ? ? ? ? ? ? ? ? ? ?		<u>? ? ? ? ? ? ? ?</u>	
"TLS ? ? ? ?"		? ? ? ? ?		<u>? ? ? ?</u>	

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" ? ? ? ? ? "		? ? ? ? ? ?		<u>? ? ? ? ? ?</u>	
" ? ? ? ? ? ? ? "		? ? ? ? ?		<u>? ? ? ?</u>	
" ? ? ? ? ? ? ? "		? ? ? ?		<u>? ? ? ? ? ? ?</u>	
" ? ? ? ? ? "		? ? ? ?		<u>? ? ? ? ?</u>	

API ? ?

	? ? ? ?		? ?		? ? ? ?
"key_set_id ? ? ? ?"		? ? ? ? ?		? ? ? ? ? ? ? ?	
"IMSI ? ? ? ? ?"		? ? IMSI		? ? ? ? ? ? ? ? IMSI	
" ? ? ? ? ? "		? ? ? ? ?		? ? ? ? ? ? ? ? ? ? ?	



OmniHSS Webhook

[!\[\]\(56f5aaf38f85a1eafdb3a9291c49e15e_img.jpg\) !\[\]\(7ff92f9fde1ec289e12e7c7623b1e611_img.jpg\) !\[\]\(38ea85a3430584eb4d5d7cc7537c74c1_img.jpg\) !\[\]\(9b96700d0891d25ca8e2b445a06827a6_img.jpg\) !\[\]\(4591351f12e08292dfbfbcbd3c6cfbb6_img.jpg\) !\[\]\(941ba0cc197f90579b80c57fa248ac8b_img.jpg\)](#)

- [!\[\]\(bc04f7b0b5f0c15f1eb80091302f9752_img.jpg\) !\[\]\(a7cbbd58fe54f55c32863a92c0eb431e_img.jpg\)](#)
- [Webhook !\[\]\(7b55a75e1554de4b963e3da7104a8368_img.jpg\) !\[\]\(7183452c11d26a07b5450e803fe137c9_img.jpg\) !\[\]\(34c93957b026974a56cfb428e650a7d3_img.jpg\) !\[\]\(0abc1362a8b76268789fbe83acf70159_img.jpg\)](#)
- [Webhook !\[\]\(cfe79c52d659015668786a1ad5915157_img.jpg\) !\[\]\(38f149d200d05a57c77011ec18cc0d80_img.jpg\)](#)
- [Webhook !\[\]\(3510e36d84e0599b34153e5c5bb1ea8f_img.jpg\) !\[\]\(c761c2308c129facceff1530625dff6c_img.jpg\) !\[\]\(6fbe47f3323787977ce92b0749daecc9_img.jpg\) !\[\]\(84ff1585112337289cd8cd9f8ffa9607_img.jpg\)](#)
- [!\[\]\(1a727ff466ecc0502328a55b7099abe0_img.jpg\) !\[\]\(ccf96814c6c5028133764802d0076c7f_img.jpg\)](#)
- [!\[\]\(31b5d9d7da17a58963bb69dd5c28e9ec_img.jpg\) !\[\]\(0ea0cf82dd3e6b428a92575e311404e7_img.jpg\)](#)
- [!\[\]\(863f84ce5aac324ccd9c36d9fdd63240_img.jpg\) !\[\]\(5dd7672d530437d3b4d4c4abe3bf9a8c_img.jpg\) !\[\]\(1d966852c2403605915538606515031c_img.jpg\) !\[\]\(9a667243281b51b053e609ada6894080_img.jpg\)](#)
- [!\[\]\(017e46fd773bc5612c8cf308f34e6417_img.jpg\) !\[\]\(701c06491cb5c2b76ebd39f16df51d71_img.jpg\) !\[\]\(07b80b954fabd11eae5a9df3f8efa550_img.jpg\) !\[\]\(686868e68f5332a920eb0b4ed7e82d4d_img.jpg\)](#)

OmniHSS  **webhooks**                                       

Webhook

1. - IMS
2. **HSS** - OmniHSS Diameter /
3. **Webhook** - webhook HSS HTTP POST
4. - Webhook JSON
5. - HTTP 200-299

- - Webhooks
- - Webhook 5
- - webhook
- -

: webhook webhook

Webhook

OmniHSS webhooks

EPC/LTE

update_location_request	S6a ULR	
authentication_information_request	S6a AIR	
purge_request	S6a PUR	MME
cancel_location_answer	S6a CLA	MME

IMS

ims_registration	Cx SAR	IMS/VoLTE
ims_deregistration	Cx SAR (de-reg)	IMS
ims_profile_request	Sh UDR	IMS

◆◆◆◆ (PCRF)

policy_request ◆◆ Gx CCRP-GW ◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
media_authorizationRx AAR P-CSCF ◆◆ IMS ◆◆◆◆◆◆◆◆◆◆◆◆

◆ IMSI ◆◆

imsi_switch ◆◆ ULR for different IMSI on same ◆◆ ◆◆◆◆ IMSI SIM ◆◆◆◆◆◆◆◆◆◆
SIM IMSI

Webhook ◆◆◆◆

◆◆◆◆

◆◆◆◆◆◆◆◆◆◆OmniHSS ◆◆◆◆◆◆◆◆◆◆ webhook URL ◆◆ HTTP POST ◆◆◆◆

```
POST /your-webhook-endpoint HTTP/1.1
Host: your-server.com
Content-Type: application/json
X-OmniHSS-Event: update_location_request
X-OmniHSS-Event-ID: 550e8400-e29b-41d4-a716-446655440000
X-OmniHSS-Timestamp: 2025-01-15T14:30:00Z
```

```
{
  "event": "update_location_request",
  "event_id": "550e8400-e29b-41d4-a716-446655440000",
  "timestamp": "2025-01-15T14:30:00Z",
  "subscriber": {
    "id": 1234,
    "imsi": "001001123456789",
    "enabled": true,
    "ims_enabled": true,
    "msisdns": [
      {"id": 1, "msisdn": "14155551001"},
      {"id": 2, "msisdn": "14155551002"}
    ],
    "sim": {
      "id": 5678,
      "iccid": "8991101200003204510",
      "is_esim": false
    },
    "key_set": {
      "id": 100,
      "amf": "8000"
    }
  },
}
```



```

"visited_plmn": "310410",
"mme_host": "mme-roaming.example.com",
"mme_realm": "epc.mnc410.mcc310.3gppnetwork.org",
"location_update_type": "initial_attach"
}

```

❖❖ imsi_switch:

```

{
  "previous_imsi": "001001111111111",
  "new_imsi": "310410222222222",
  "sim_id": 5678,
  "previous_mme_host": "mme-home.example.com",
  "new_mme_host": "mme-roaming.example.com"
}

```

❖❖ ims_registration:

```

{
  "scscf_host": "scscf-01.ims.example.com",
  "public_identities": [
    "sip:001001123456789@ims.mnc001.mcc001.3gppnetwork.org",
    "sip:+14155551001@ims.example.com",
    "tel:+14155551001"
  ]
}

```

HTTP ❖

Content-Type	❖❖❖ application/json	❖❖ application/json
X-OmniHSS-Event	❖❖❖❖	update_location_request
X-OmniHSS-Event-ID	❖❖❖❖❖❖❖	UUID
X-OmniHSS-Timestamp	❖❖❖❖❖	ISO 8601 ❖❖
User-Agent	OmniHSS ❖❖	OmniHSS/1.0

❖❖

❖❖ Webhooks

Webhooks ❖❖ OmniHSS API ❖❖❖

❖❖❖❖ Webhook

```

curl -k -X POST https://hss.example.com:8443/api/webhook \
-H "Content-Type: application/json" \
-d '{

```

```

"webhook": {
  "url": "https://your-server.com/omnihss-webhook",
  "events": [
    "update_location_request",
    "ims_registration",
    "imsi_switch"
  ],
  "enabled": true,
  "description": "Production billing system webhook"
}
}'

```

❖❖:

```

{
  "data": {
    "id": 1,
    "url": "https://your-server.com/omnihss-webhook",
    "events": [
      "update_location_request",
      "ims_registration",
      "imsi_switch"
    ],
    "enabled": true,
    "description": "Production billing system webhook",
    "created_at": "2025-01-15T14:00:00Z"
  }
}

```

❖❖ Webhooks

```
curl -k https://hss.example.com:8443/api/webhook
```

❖❖ Webhook

```

curl -k -X PUT https://hss.example.com:8443/api/webhook/1 \
-H "Content-Type: application/json" \
-d '{
  "webhook": {
    "enabled": false
  }
}'

```

❖❖ Webhook

```
curl -k -X DELETE https://hss.example.com:8443/api/webhook/1
```

Webhook

webhook

1. **POST** Content-Type: application/json
2. - 5 HTTP 200-299
3. -
4. **HTTPS** - TLS/SSL
5. - OmniHSS

Webhook Node.js/Express

```
const express = require('express');
const app = express();

app.post('/omnihss-webhook', express.json(), (req, res) => {
  const { event, subscriber, event_context } = req.body;

  console.log(`Received event: ${event}`);
  console.log(`Subscriber IMSI: ${subscriber.imsi}`);

  // 
  // ... 

  // 
  res.status(200).json({ received: true });

  // 
  processWebhook(req.body).catch(console.error);
});

async function processWebhook(payload) {
  // 
  // 
}

app.listen(3000);
```

1.

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2. $\diamondsuit ? \diamondsuit ? \diamondsuit ? \diamondsuit ? \diamondsuit ?$

```
// Webhook
app.post('/omnihss-webhook', async (req, res) => {
  const { event, subscriber, event_context } = req.body;

  if (event === 'update_location_request') {
    await analytics.track({
      event: 'subscriber_location_update',
      imsi: subscriber.imsi,
      visited_plmn: event_context.visited_plmn,
      timestamp: req.body.timestamp,
      profile: subscriber.epc_profile.name
    });
  }

  res.status(200).send();
});
```

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- $\diamond \diamond$ MME $\diamond \diamond \diamond \diamond \diamond \diamond$
- $\diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond \diamond$
- $\diamond \diamond \diamond \diamond \diamond \diamond$
- IMS $\diamond \diamond \diamond \diamond \diamond$

3.

$\diamond ? \diamond ? \diamond ? \diamond ? \diamond ? \diamond ? :$

1.

- [illegible]

2. IMSI

-    SIM      IMSI  

- `???` SIM `??????????` IMSI `??`
- `?:??` SIM `????` IMSI`????????`

3. `??????`

- `????????????????????`
- `?:????????????`

`????:`

```
@app.route('/omnihss-webhook', methods=['POST'])
def webhook_handler():
    data = request.json
    subscriber = data['subscriber']
    event_context = data.get('event_context', {})

    if data['event'] == 'update_location_request':
        visited_plmn = event_context.get('visited_plmn')

        # ????
        if visited_plmn in BLOCKED_PLMNS:
            disable_subscriber(subscriber['imsi'])
            alert_security_team(subscriber, 'Roaming to blocked PLMN')

        # ????
        if is_impossible_travel(subscriber['imsi'], visited_plmn):
            flag_for_review(subscriber['imsi'])
            alert_fraud_team(subscriber, 'Impossible travel detected')

    return jsonify({'status': 'ok'}), 200
```

4. `?????`

`????????????????`

`?:????` VoLTE `????` IMS

```
app.post('/omnihss-webhook', async (req, res) => {
    const { event, subscriber } = req.body;

    if (event === 'ims_registration' && !subscriber.ims_enabled) {
        // ?? IMS ?? - ???? IMS
        await omnihss.updateSubscriber(subscriber.id, {
            ims_enabled: true,
            custom_attributes: {
                ...subscriber.custom_attributes,
                volte_activated_at: new Date().toISOString()
            }
        });
    }
});
```

```

// 更新 CRM
await crm.updateCustomer(subscriber.imsi, {
  features: ['volte']
});
}

res.status(200).send();
});

```

5. 短信通知

短信通知模板

短信内容: 尊敬的客户, 您的手机号码为: 1234567890123456

短信标题:

- "尊敬的客户 [姓名]! 您的手机号码为: 1234567890123456"
- "尊敬的客户 80% 您的手机号码为: 1234567890123456"
- "VoLTE 您的手机号码为: 1234567890123456"
- "尊敬的客户 您的手机号码为: 1234567890123456"

6. IMSI SIM 切换

IMSI SIM 切换通知模板

```

app.post('/omnihss-webhook', async (req, res) => {
  const { event, subscriber, event_context } = req.body;

  if (event === 'imsi_switch') {
    const { previous_imsi, new_imsi, sim_id } = event_context;

    // 记录 IMSI 切换
    await db.logImsiSwitch({
      sim_id,
      from_imsi: previous_imsi,
      to_imsi: new_imsi,
      timestamp: req.body.timestamp
    });

    // 结束旧会话, 开始新会话
    await billing.endSession(previous_imsi);
    await billing.startSession(new_imsi);

    // 检查切换次数
    const switchCount = await db.getSwitchCount(sim_id, '24h');
    if (switchCount > 10) {
      await alertFraudTeam(`Excessive IMSI switching: SIM ${sim_id}`);
    }
  }
});

```

}

```
const crypto = require('crypto');

function verifyWebhook(req) {
  const signature = req.headers['x-omnihss-signature'];
  const secret = process.env.WEBHOOK_SECRET;
```

```

const payload = JSON.stringify(req.body);

const expectedSignature = 'sha256=' +
  crypto.createHmac('sha256', secret)
    .update(payload)
    .digest('hex');

return crypto.timingSafeEqual(
  Buffer.from(signature),
  Buffer.from(expectedSignature)
);
}

app.post('/omnihss-webhook', (req, res) => {
  if (!verifyWebhook(req)) {
    return res.status(401).json({ error: 'Invalid signature' });
  }

  // ?? webhook...
  res.status(200).send();
});

```

????

1. ?? **HTTPS** - ??? webhook ??? TLS
2. ??? - ?? webhook ?????
3. ??? - ? webhook ?????
4. **IP** ??? - ?? webhook ?? OmniHSS IP ??
5. ??? - ?? webhook ?????
6. ??? - ?????? webhook ???
7. ??? - ?????? webhook ??????

????

Webhook ?????? ?????

- IMSI?????
- MSISDN????
- ?????? PLMN?MME?
- ??????

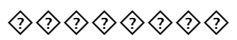
????:

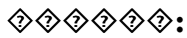
- **GDPR** - ?? webhook ????? GDPR
 - ??? - ??????
 - ??? - ?? webhook ???
 - ?? - ?? TLS ?? webhook ??
 - ??? - ??? webhook ?????
-



Webhook

:

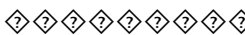
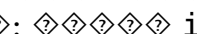
-  webhook 
- Webhook 

:

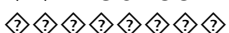
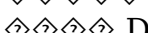
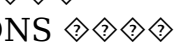
1. **webhook** :

```
curl -k https://hss.example.com:8443/api/webhook  
#  "enabled": true
```

2. **webhook** :

-  webhook  events 
- :  ims_registration 

3. **HSS** :

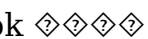
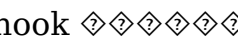
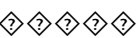
-  webhook 
- 
-  DNS 

4. :

```
curl -X POST https://your-server.com/omnihss-webhook \  
-H "Content-Type: application/json" \  
-d '{"test": true}'
```

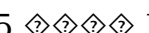
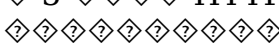
Webhook

:

- HSS  webhook 
- Webhook  HSS 

:

1. :

-  5  HTTP 200
- 

2. :

```
// 22 - 2222222
app.post('/webhook', (req, res) => {
  processData(req.body); // 22 10 2
  res.status(200).send();
});

// 2 - 222222222
app.post('/webhook', (req, res) => {
  res.status(200).send(); // 2222
  processData(req.body); // 2222
});
```

22 Webhooks

22:

- 22222222
- event_id 2222222222

22:

- 2222222 OmniHSS 2222222222222222
- 22222222222222 webhook

2222:

22 event_id 2222222

```
const processedEvents = new Set();

app.post('/omnihss-webhook', (req, res) => {
  const eventId = req.body.event_id;

  if (processedEvents.has(eventId)) {
    // 2222222
    return res.status(200).json({ status: 'duplicate' });
  }

  processedEvents.add(eventId);

  // 22 webhook...
  processWebhook(req.body);

  res.status(200).json({ status: 'processed' });
});
```

Webhook 2222

22:

- HTTP 4xx 5xx
- HSS webhook

:

1. 401 Unauthorized -

- webhook
-

2. 400 Bad Request -

- webhook
- Content-Type

3. 500 Internal Server Error -

-
-

:

```
app.post('/omnihss-webhook', async (req, res) => {
  try {
    // 
    if (!verifyWebhook(req)) {
      return res.status(401).json({ error: 'Invalid signature' });
    }

    // 
    if (!req.body.event || !req.body.subscriber) {
      return res.status(400).json({ error: 'Invalid payload' });
    }

    //  webhook
    await processWebhook(req.body);

    res.status(200).json({ status: 'ok' });

  } catch (error) {
    console.error('Webhook processing error:', error);
    //  200 
    res.status(200).json({ status: 'error', message: error.message });
  }
});
```

??????

?:

- webhook ???????
- null ???

?:

1. ????? - ??????IMS???
2. ????? - ???? webhook ???????

?:

???????

```
const { subscriber } = req.body;

// 
const imsProfile = subscriber.ims_profile || { name: 'No IMS' };
const roamingProfile = subscriber.roaming_profile || { name: 'No Roaming' };

// MSISDN
const msisdns = subscriber.msisdns || [];
```

??????

Webhook ?

webhook ??????

?:

- Webhook ??????
- Webhook ??????
- ?????
- ??????
- ?????

?????Prometheus/Grafana?

```
# Webhook 
rate(omnihss_webhook_success_total[5m]) /
rate(omnihss_webhook_attempts_total[5m])

# Webhook 
histogram_quantile(0.95, omnihss_webhook_duration_seconds)
```

Webhook

webhook

:

```
{
  "timestamp": "2025-01-15T14:30:00Z",
  "level": "info",
  "component": "webhook",
  "event_id": "550e8400-e29b-41d4-a716-446655440000",
  "webhook_id": 1,
  "event_type": "update_location_request",
  "subscriber_imsi": "001001123456789",
  "endpoint": "https://your-server.com/omnihss-webhook",
  "http_status": 200,
  "duration_ms": 145,
  "error": null
}
```