

# API 错误

← API 错误

---

## 错误

- 错误
  - 错误
- 

## 400 错误

### 400 错误

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

## 原因

- JSON 格式
- 错误
- 错误

### 404 错误

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

## 原因

- 000/0000/00000
- URL 00 ID 000

## 422 00000000

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

000

- 0000
- 000000000
- 00000000

## 500 00000000

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

000

- 00000000
  - 0000000000
-



API Request

OmniCharge

OmniRAN

Downloads

🔍 □□□□ ▼

[Omnitouch Website](#) ↗

Invalid JSON

Valid

400 Bad Request

Authorized?

No

Yes

401 Unauthorized

Resource Exists?

No

Yes

404 Not Found

Data Valid?

No

Yes

422 Validation Error

Process Request

Database OK?

Error

Success

500 Server Error

200/201 Success

---

← API →

# API 教程

← API 教程

---

## 简介

- 什么是 API
  - API 的 IP 地址
- 

## 安装 jq

jq 是一个轻量级的 JSON 处理器，可以在 Linux 和 macOS 上使用。

在 Linux 上使用 `apt-get install jq` 或在 macOS 上使用 `brew install jq` 安装。

安装后：

- 验证安装
- APN 配置
- EPC 配置
- 其他配置

```
# 1. 키셋 생성
KEY_SET_ID=$(curl -k -X POST
https://hss.example.com:8443/api/key_set \
-H "Content-Type: application/json" \
-d '{
  "ki": "0123456789ABCDEF0123456789ABCDEF",
  "opc": "FEDCBA9876543210FEDCBA9876543210",
  "authentication_algorithm": "milenage",
  "amf": "8000",
  "sqn": 0
}' | jq -r '.response.id')

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

# 3. APN 식별자 생성
APN_ID=$(curl -k -X POST
https://hss.example.com:8443/api/apn/identifier \
-H "Content-Type: application/json" \
-d '{
  "apn": "internet",
  "ip_version": "ipv4v6"
}' | jq -r '.response.id')

# 4. APN 프로파일 생성
APN_PROFILE_ID=$(curl -k -X POST
https://hss.example.com:8443/api/apn/profile \
-H "Content-Type: application/json" \
-d '{
  "apn_identifier_id": $APN_ID,
  "apn_qos_profile_id": $APN_QOS_ID,
  "name": "인터넷 APN"
}
```

```
}" | jq -r '.response.id')
```

```
# 5. EPC
```

```
EPC_PROFILE_ID=$(curl -k -X POST  
https://hss.example.com:8443/api/epc/profile \  
-H "Content-Type: application/json" \  
-d "{  
  \"apn_profiles\": [\"$APN_PROFILE_ID\"],  
  \"name\": \"\",  
  \"network_access_mode\": \"packet_only\",  
  \"tracking_area_update_interval_seconds\": 600,  
  \"ue_ambr_dl_kbps\": 100000,  
  \"ue_ambr_ul_kbps\": 50000  
}" | jq -r '.response.id')
```

```
# 6.
```

```
SUBSCRIBER_ID=$(curl -k -X POST  
https://hss.example.com:8443/api/subscriber \  
-H "Content-Type: application/json" \  
-d "{  
  \"imsi\": \"001001123456789\",  
  \"key_set_id\": $KEY_SET_ID,  
  \"epc_profile_id\": $EPC_PROFILE_ID  
}" | jq -r '.response.id')
```

```
echo "ID: $SUBSCRIBER_ID"
```

1. ( ) -
2. (EPC ) -
3. **APN** (APN ) - QoS
4. ( ) -

- MSISDN
- IMS
-

- 普通 SIM 普通 SIM

普通

- MSISDN 普通 - 普通
- 普通 - 普通

---

## 普通 IP 普通

普通 IP 普通

普通 普通“普通” APN 普通 IPv4 普通 IoT 普通

```
# 安装 jq (apt-get install jq 或 brew install jq)

# 1. 创建密钥集
KEY_SET_ID=$(curl -k -X POST
https://hss.example.com:8443/api/key_set \
-H "Content-Type: application/json" \
-d '{
  "ki": "0123456789ABCDEF0123456789ABCDEF",
  "opc": "FEDCBA9876543210FEDCBA9876543210",
  "authentication_algorithm": "milenage",
  "amf": "8000",
  "sqn": 0
}' | jq -r '.response.id')

# 2. 创建 APN QoS 配置文件
APN_QOS_ID=$(curl -k -X POST
https://hss.example.com:8443/api/apn/qos_profile \
-H "Content-Type: application/json" \
-d '{
  "name": "IoT 配置文件",
  "allocation_retention_priority": 8,
  "apn_ambr_dl_kbps": 10000,
  "apn_ambr_ul_kbps": 5000,
  "pre_emption_capability": false,
  "pre_emption_vulnerability": false,
  "qci": 9
}' | jq -r '.response.id')

# 3. 创建 APN 标识符
APN_ID=$(curl -k -X POST
https://hss.example.com:8443/api/apn/identifier \
-H "Content-Type: application/json" \
-d '{
  "apn": "internet",
  "ip_version": "ipv4"
}' | jq -r '.response.id')

# 4. 创建 APN 配置文件
APN_PROFILE_ID=$(curl -k -X POST
https://hss.example.com:8443/api/apn/profile \
-H "Content-Type: application/json" \
-d "{
  \"apn_identifier_id\": $APN_ID,
```

```
\ "apn_qos_profile_id\ ": $APN_QOS_ID,  
\ "name\ ": \ "IoT \ \ APN\  
}" | jq -r '.response.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 "{  
  \ "apn_profile_id\ ": $APN_PROFILE_ID,  
  \ "ipv4_static_ip\ ": \ "100.64.1.100\  
}" | jq -r '.response.id')
```

# 6. \ EPC \ \

```
EPC_PROFILE_ID=$(curl -k -X POST  
https://hss.example.com:8443/api/epc/profile \  
-H "Content-Type: application/json" \  
-d "{  
  \ "apn_profiles\ ": [$APN_PROFILE_ID],  
  \ "name\ ": \ "IoT \ \ \  
  \ "network_access_mode\ ": \ "packet_only\  
  \ "tracking_area_update_interval_seconds\ ": 600,  
  \ "ue_ambr_dl_kbps\ ": 10000,  
  \ "ue_ambr_ul_kbps\ ": 5000  
}" | jq -r '.response.id')
```

# 7. \ MSISDN \ \ \ \

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

# 8. \ \ \ \ \ IP \ \

```
SUBSCRIBER_ID=$(curl -k -X POST  
https://hss.example.com:8443/api/subscriber \  
-H "Content-Type: application/json" \  
-d "{  
  \ "imsi\ ": \ "0010019999999999\  
  \ "key_set_id\ ": $KEY_SET_ID,  
  \ "epc_profile_id\ ": $EPC_PROFILE_ID,  
  \ "msisdns\ ": [$MSISDN_ID],  
  \ "static_ips\ ": [$STATIC_IP_ID]
```

```
} | jq -r '.response.id')
```

```
echo "IoT 物联网"  
echo "  ID: $SUBSCRIBER_ID"  
echo "  IMSI: 001001999999999"  
echo "  MSISDN: 14155551000"  
echo "  IPv4: 100.64.1.100  'internet' APN  "
```

物联网

物联网物联网物联网 IoT 物联网

1. 物联网 (物联网) - 物联网
2. **APN** 物联网 (APN 物联网) - “物联网”物联网
3. 物联网 IP 物联网 (物联网 IP) - 物联网 IPv4 物联网 100.64.1.100
4. 物联网物联网 (EPC 物联网) - 物联网 IoT 物联网物联网
5. 物联网 (MSISDN) - 物联网物联网
6. 物联网 (物联网) - 物联网物联网

物联网

物联网物联网物联网“物联网” APN 物联网物联网 IP 物联网 100.64.1.100 物联网 DHCP 物联网

物联网

- 物联网 APN 物联网 IP物联网 APN 物联网 2-5
- 物联网物联网物联网 IMS 物联网
- 物联网物联网物联网 物联网物联网
- 物联网 SIM物联网物联网 SIM

物联网

- 物联网 IP 物联网 - 物联网 IP 物联网
- 物联网物联网 - 物联网 IP 物联网
- 物联网 MSISDN 物联网 - 物联网物联网

---

← 物联网 API 物联网

# OmniHSS API

←

## 

- API
- 
- 
- MSISDN
- SIM
- 
- 
- IP
- 
- EIR
- 
- 
- API

## API

### URL

https://[hostname]:8443/api

### 

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

- 方法: POST HTTPS
- ポート: 8443

API 仕様: API 仕様ドキュメント “JSON” を参照してください

レスポンス:

```
{
  "name": "value",
  "field": "value"
}
```

エラーレスポンス:

```
{
  "subscriber": {
    "name": "value",
    "field": "value"
  }
}
```

コマンド:

```
# 成功
curl -X POST https://hss.example.com:8443/api/ims/profile \
  -H "Content-Type: application/json" \
  -d '{"name": "default", "ifc_template": "...}'

# 失敗
curl -X POST https://hss.example.com:8443/api/ims/profile \
  -H "Content-Type: application/json" \
  -d '{"ims_profile": {"name": "default", "ifc_template": "...}}'
```

参照

JSON 仕様ドキュメント

レスポンス:

```
{
  "status": "success",
  "response": { ... }
}
```

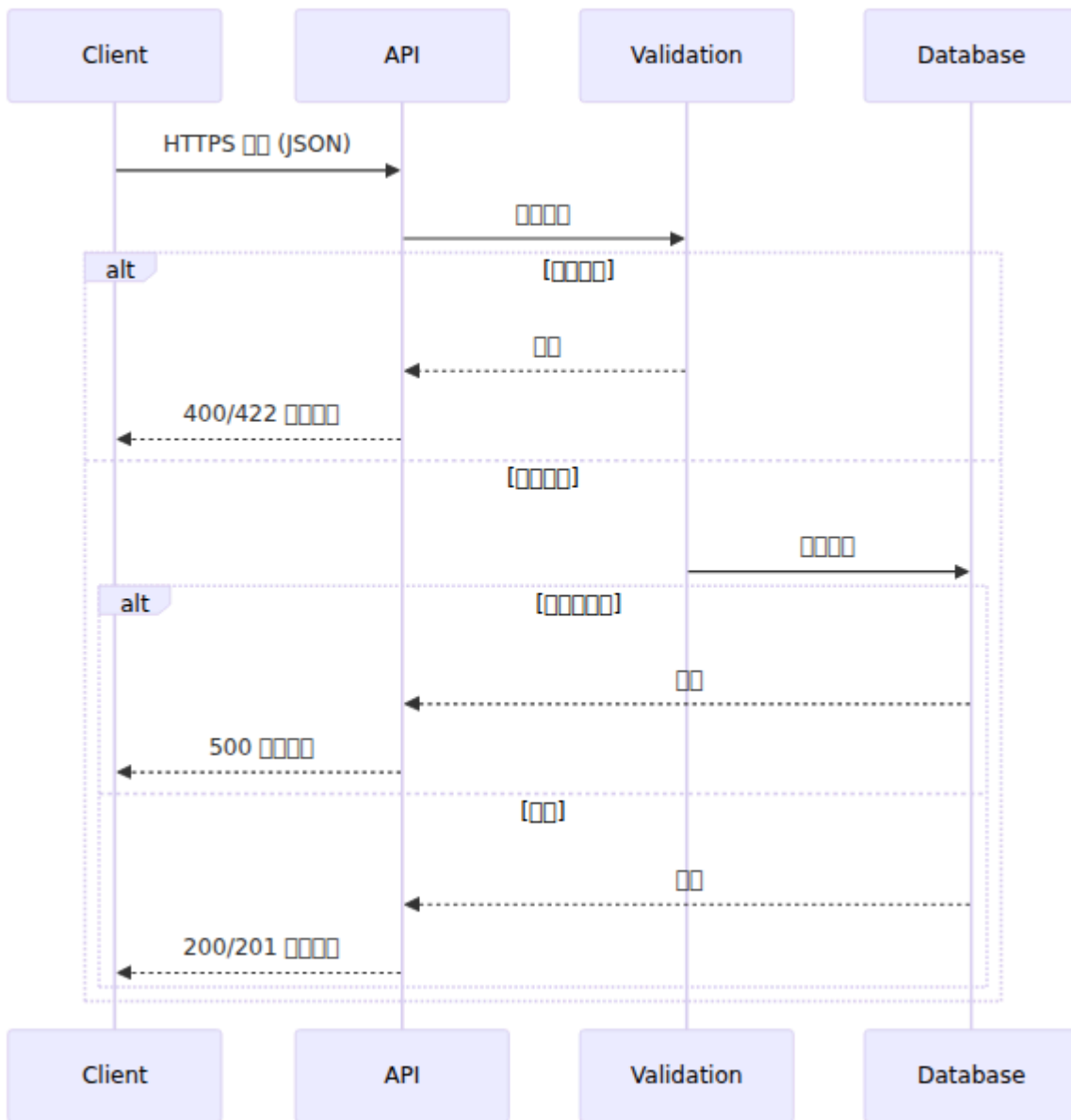
예외:

```
{
  "status": "error",
  "response": {
    "invalid_fields": {
      "field_name": "error message"
    }
  }
}
```

## HTTP 코드

| 코드  | 상태     | 설명               |
|-----|--------|------------------|
| 200 | OK     | GET, PUT, DELETE |
| 201 | 생성됨    | POST             |
| 400 | 잘못된 요청 | 잘못된 요청           |
| 404 | 찾지 못함  | 잘못된 요청           |
| 422 | 잘못된 요청 | 잘못된 요청           |
| 500 | 서버 오류  | 서버 오류            |

# API 交互



请求

响应

数据库交互

请求: GET /api/subscriber

响应:

| 名前          | 型       | 説明        |
|-------------|---------|-----------|
| enabled     | boolean | 有効/無効     |
| ims_enabled | boolean | IMS 有効/無効 |

実行:

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

返答:

```
{
  "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 取得

特定の ID を取得

リクエスト: GET /api/subscriber/:id

返答:

| Field | Type    | Description   |
|-------|---------|---------------|
| id    | integer | Subscriber ID |

Request:

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

## GET IMSI

Request IMSI

Request: `GET /api/subscriber/imsi/:imsi`

Response:

| Field | Type   | Description     | Length       |
|-------|--------|-----------------|--------------|
| imsi  | string | Subscriber IMSI | 14-15 digits |

Request:

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

Response: Subscriber IMSI 001001123456789

## GET MSISDN

Request MSISDN

Request: `GET /api/subscriber/msisdn/:msisdn`

Response:

| 名前     | 型      | 説明      | 制約             |
|--------|--------|---------|----------------|
| msisdn | string | ISDN 番号 | 1-15 桁 (E.164) |

例:

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

レスポンス: 成功

エラー

エラー

メソッド: POST /api/subscriber

ボディ:

```
{
  "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": "テスト"
    }
  }
}
```

注:

- imsi - 14-15 桁

- `key_set_id` - 00000000 0000
- `epc_profile_id` - 00000000 EPC 0000

0000:

- `enabled` - 00: true
- `ims_enabled` - 00: true
- `sim_id` - 00 SIM 0
- `ims_profile_id` - 00 IMS 000000IMS 000000
- `roaming_profile_id` - 00 0000000000000000
- `msisdns` - MSISDN ID 00000000
- `static_ips` - 00 APN 000 00 IP ID 00
- `custom_attributes` - 000000

00:

- 00000000 - 000000
- 0 MSISDN 00 - 0000000000
- 00 IP 00 - 000 IP 000 APN

0000:

```
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
  }
}'
```

0000:

□□□□

□□□□?

□: □□□□□□

EPC □□□□□□?

□□: □□□ EPC □□□□

IMSI □□?

□□: IMSI □□□

□□□□

□□□□□□□□

201 □□□

□□□□

□□□□□□□□

□□: 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 - □□□□□□ APN □ □□ IP

- `custom_attributes` - []

headers:

- `imsi` - IMSI []

body:

- `enabled` - boolean

curl:

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

headers:

- `enabled`: {"enabled": false}
- `ims_enabled`: {"ims\_enabled": false}
- `epc_profile_id`: {"epc\_profile\_id": 2} (EPC ID)
- `roaming_profile_id`: {"roaming\_profile\_id": 3} (ID)

headers:

headers:

method: DELETE /api/subscriber/:id

headers:

| key             | type    | description   |
|-----------------|---------|---------------|
| <code>id</code> | integer | subscriber ID |

Request:

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

Request: PDN IMSI

Request:

- IMSI - IMSI
- SIM - SIM
- MSISDN - MSISDN
- MSISDNs - MSISDNs

Request:

Request: CLR MME

Request: POST /api/subscriber/cancel\_location

Request:

```
{  
  "imsi": "001001123456789"  
}
```

Request:

| Field | Type   | Required | Description       |
|-------|--------|----------|-------------------|
| imsi  | string | Yes      | IMSI 14-15 digits |

Request:

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

200 OK:

```
{
  "data": {
    "message": "Success",
    "imsi": "001001123456789",
    "destination_host": "mme01.operator.com",
    "destination_realm": "epc.operator.com"
  }
}
```

404 Not Found:

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

Notes:

- MME S6a CLR (subscriber\_state.last\_seen\_mme)
- Cancellation-Type: subscription\_withdrawal
- CLR-Flags: {s6a\_indicator: 1, reattach\_required: 1} UE
- last\_seen\_mme is null 404
- IMSI MSISDN/SIM

Details:

- IMSI: 001001123456789
- MSISDN: 1234567890123456
- MME: mme01.operator.com
- UE: 001001123456789

- IMSI: 001001123456789

## IMSI CLR:

CLR MSISDN:

### 1. MSISDN IMSI:

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

// CLR MSISDN
```

### 2. IMSIs:

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

POST /api/subscriber/cancel_location
{"imsi": "001001111111111"}

// A B
```

Flow:

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

Flow:

- IMSI
- IMSI
- S6a

---

# MSISDN

MSISDN [MSISDN](#)

## MSISDN

GET /api/msisdn

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

## MSISDN

GET /api/msisdn/:id

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

## MSISDN

POST /api/msisdn

```
{
  "msisdn": {
    "msisdn": "14155551234"
  }
}
```

注意:

- 号码 1-15 位数
- 国际号码
- 国际号码 E.164 国际号码 + 号码

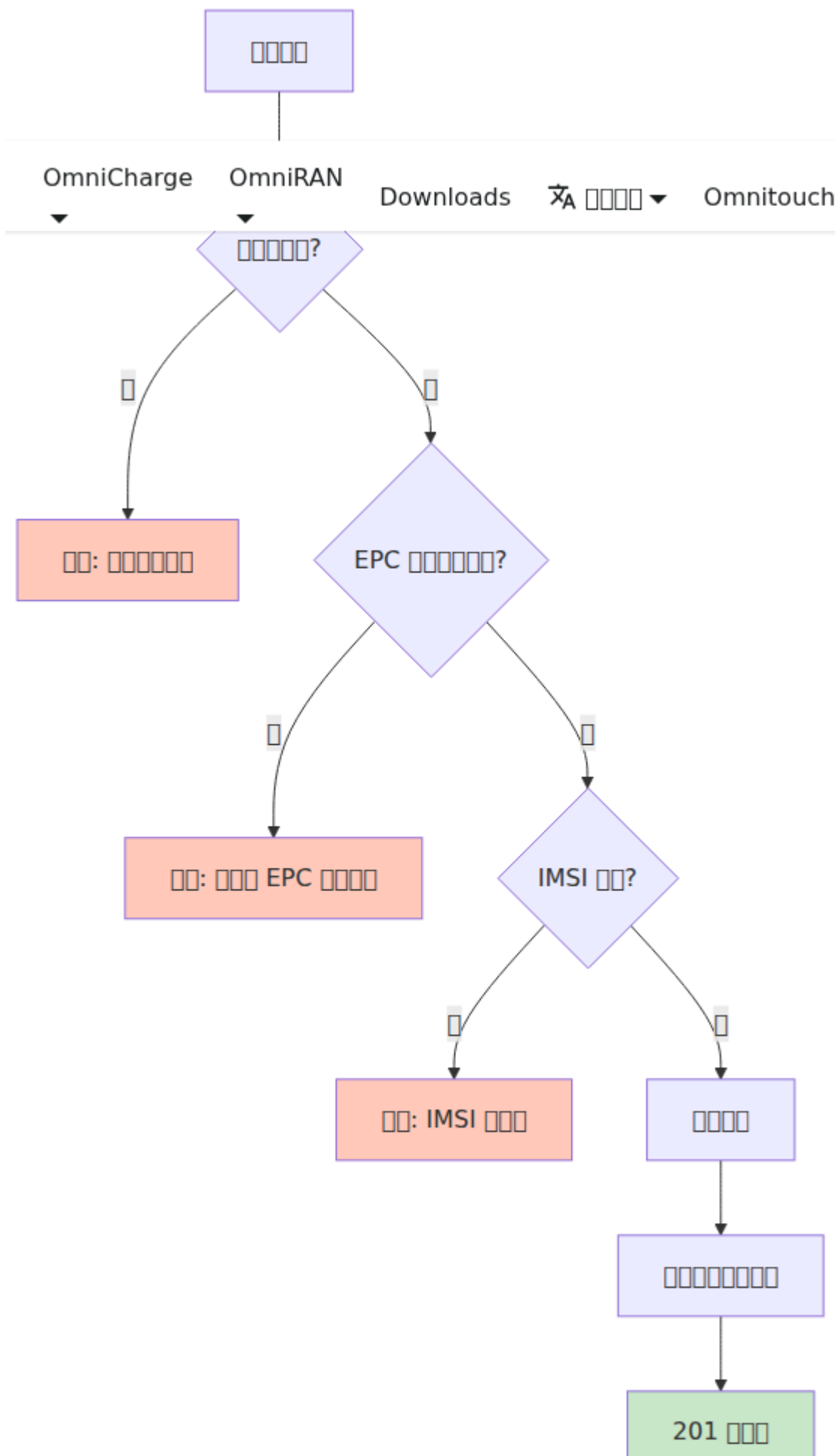
curl:

```
curl -k -X POST https://hss.example.com:8443/api/msisdn \
-H "Content-Type: application/json" \
-d '{
  "msisdn": {
    "msisdn": "14155551234"
  }
}'
```

## MSISDN 号码

国际号码 E.164 国际号码 + 号码

MSISDN 格式:



MSISDN IMSI

## MSISDN

DELETE /api/msisdn/:id

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

## 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

Request: GET /api/sim/:id

Response:

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

## Response SIM

Response body SIM object

Request: POST /api/sim

Response:

```
{
  "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",
    "kic": "0123456789ABCDEF0123456789ABCDEF",
    "kid": "FEDCBA9876543210FEDCBA9876543210"
  }
}
```

Response body:

- `iccid` - 19-20 digit string

Response body:

- `sim_vendor` - string
- `batch_name` - string
- `is_esim` - eSIM flag

- `pin1`, `pin2` - PIN 0000
- `puk1`, `puk2` - PIN 0000
- `adm1-adm10` - 0000
- `kic`, `kid` - OTA 0000000000000000

0000:

```
curl -k -X POST https://hss.example.com:8443/api/sim \
  -H "Content-Type: application/json" \
  -d '{
    "sim": {
      "iccid": "8991101200003204510",
      "sim_vendor": "Gemalto"
    }
  }'
```

## 00 SIM

00 SIM 0000

00: `PUT /api/sim/:id`

0000:

```
curl -k -X PUT https://hss.example.com:8443/api/sim/1 \
  -H "Content-Type: application/json" \
  -d '{
    "sim": {
      "batch_name": "00000000"
    }
  }'
```

## 00 SIM

0000 SIM 0000

00: `DELETE /api/sim/:id`

📡: 📡📡📡📡📡📡📡📡📡 SIM

---

## 📡📡📡📡

📡📡📡📡📡 Milenage 📡📡📡📡📡📡📡📡📡📡Ki📡OPC/OP📡AMF📡SQN📡📡📡 📡📡 📡📡📡📡📡📡

📡📡:

- 📡📡📡📡 - 📡📡📡📡📡📡📡📡

## 📡📡📡📡

📡📡📡📡📡📡

📡📡: GET /api/key\_set

📡📡📡:

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

## 📡📡📡📡

📡📡📡📡📡📡

📡📡: GET /api/key\_set/:id

📡📡📡:

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

📡📡📡:

```
{
  "data": {
    "id": 1,
    "ki": "0123456789ABCDEF0123456789ABCDEF",
    "opc": "FEDCBA9876543210FEDCBA9876543210",
    "op": null,
    "amf": "8000",
    "sqn": 0,
    "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` - 값: "8000"
- `sqn` - 값: 0
- `ota_counter` - 값: 0

요청:

- 키 길이: 128 비트
- Ki/OPC/OP: 32 바이트 (Ki: 128 비트, OPC: 128 비트, OP: 128 비트)
- AMF: 4 바이트 (16 비트)

요청:

```
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": "milena"
  }
}'
```

요청: 키 설정 API 호출

응답:

응답:

요청: `PUT /api/key_set/:id`

요청: 키 설정 업데이트

요청: 키 설정 업데이트

응답:

응답:

요청: `DELETE /api/key_set/:id`

API: 3GPP TS 23.002 3GPP TS 23.002 3GPP TS 23.002

---

3GPP TS 23.002

## EPC Profiles

EPC Profiles API 3GPP TS 23.002 3GPP TS 23.002

API EPC Profiles

API: GET /api/epc/profile

API EPC Profiles

API: GET /api/epc/profile/:id

API EPC Profiles

API: POST /api/epc/profile

API:

```
{
  "apn_profiles": [],
  "name": "3GPP TS 23.002",
  "network_access_mode": "3GPP TS 23.002",
  "tracking_area_update_interval_seconds": 600,
  "ue_ambr_dl_kbps": 100000,
  "ue_ambr_ul_kbps": 50000
}
```

API:

| 필드명                                   | 타입        | 단위   | 범위               |
|---------------------------------------|-----------|------|------------------|
| name                                  | 문자열       | 없음   | 문자열              |
| ue_ambr_dl_kbps                       | 정수        | Kbps | 10000-1000000    |
| ue_ambr_ul_kbps                       | 정수        | Kbps | 5000-500000      |
| network_access_mode                   | 문자열       | 없음   | "LTE" 또는 "LTE-M" |
| tracking_area_update_interval_seconds | 정수        | 없음   | 600~1800         |
| apn_profiles                          | APN ID 목록 | 없음   | [] 또는 [1, 2, 3]  |

예시:

```
curl -k -X POST https://hss.example.com:8443/api/epc/profile \
-H "Content-Type: application/json" \
-d '{
  "apn_profiles": [],
  "name": "LTE 100Mbps",
  "network_access_mode": "LTE",
  "tracking_area_update_interval_seconds": 600,
  "ue_ambr_dl_kbps": 100000,
  "ue_ambr_ul_kbps": 50000
}'
```

참고:

- **ue\_ambr\_dl\_kbps** - 최대 다운로드 속도
- **ue\_ambr\_ul\_kbps** - 최대 업로드 속도 EPC 설정

## API EPC

PUT /api/epc/profile/:id

API EPC

## API EPC

DELETE /api/epc/profile/:id

API

## IMS

IMS IP IFC IMS

## API IMS

GET /api/ims/profile

## API IMS

POST /api/ims/profile

API:

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

API:

- name - IMS
- ifc\_template - IMS Liquid IFC XML

## IFC

IFC Liquid

| 変数                         | 説明        | 値                              |
|----------------------------|-----------|--------------------------------|
| <code>{{ imsi }}</code>    | IMSI      | 001001123456789                |
| <code>{{ msisdns }}</code> | MSISDN 番号 | ["14155551234", "14155555678"] |
| <code>{{ mcc }}</code>     | MCC       | 001                            |
| <code>{{ mnc }}</code>     | MNC       | 001                            |

例:

IFC 経由 **Liquid** テンプレート Jinja2 を用いて IMS サービスを呼び出す

1. 変数: IMS サービスを呼び出す際に `{{ imsi }}` と `{% for msisdn in msisdns %}` を使用する
2. 変数: API 呼び出し時に XML を生成する
3. テンプレート: IMS サービス MAA/SAA/HSS
  - IMS サービス
  - テンプレート変数
    - `{{ imsi }}` → IMSI
    - `{{ msisdns }}` → MSISDN
    - `{{ mcc }}` → MCC
    - `{{ mnc }}` → MNC
  - Cx/Diameter 経由 XML を S-CSCF に送信

例:

```
<!-- 電話番号 -->
{{ imsi }}

<!-- 電話番号 -->
{% for msisdn in msisdns %}
  <MSISDN>{{ msisdn }}</MSISDN>
{% endfor %}

<!-- 電話番号 -->
{{ imsi }}@ims.mnc{{ mnc }}.mcc{{ mcc }}.3gppnetwork.org
```

**IFC 電話番号:**

```

<?xml version="1.0" encoding="UTF-8"?>
<IMSSubscription>
<PrivateID>{{ imsi }}@ims.mnc{{ mnc }}.mcc{{ mcc
}}.3gppnetwork.org</PrivateID>
<ServiceProfile>
{% for msisdn in msisdns %}
<PublicIdentity>
<Identity>sip:{{ msisdn }}@ims.mnc{{ mnc }}.mcc{{ mcc
}}.3gppnetwork.org</Identity>
<Extension>
<IdentityType>0</IdentityType>
</Extension>
</PublicIdentity>
<PublicIdentity>
<Identity>tel:{{ msisdn }}</Identity>
<Extension>
<IdentityType>0</IdentityType>
</Extension>
</PublicIdentity>
{% endfor %}
<InitialFilterCriteria>
<Priority>10</Priority>
<TriggerPoint>
<ConditionTypeCNF>0</ConditionTypeCNF>
<SPT>
<ConditionNegated>0</ConditionNegated>
<Group>0</Group>
<Method>REGISTER</Method>
</SPT>
</TriggerPoint>
<ApplicationServer>
<ServerName>sip:as.ims.mnc{{ mnc }}.mcc{{ mcc
}}.3gppnetwork.org</ServerName>
<DefaultHandling>0</DefaultHandling>
</ApplicationServer>
</InitialFilterCriteria>
</ServiceProfile>
</IMSSubscription>

```

□□□□ (curl):

```
curl -k -X POST https://hss.example.com:8443/api/ims/profile \
-H "Content-Type: application/json" \
-d '{
  "name": "default",
  "ifc_template": "<?xml version=\"1.0\" encoding=\"UTF-8\"?>
<IMSSubscription><ServiceProfile>...</ServiceProfile>
</IMSSubscription>"
}'
```

### Python:

```
import requests

response = requests.post(
    "https://hss.example.com:8443/api/ims/profile",
    json={
        "name": "default",
        "ifc_template": ifc_template_string
    },
    verify=False #
)
```

### (201):

```
{
  "status": "success",
  "response": {
    "id": 1,
    "name": "default",
    "ifc_template": "<?xml version=\"1.0\" encoding=\"UTF-8\"?
>..."
  }
}
```

### :

- API IFC XML
- 
- name



## API APN QoS

Request: GET /api/apn/qos\_profile

## API APN QoS

Request: POST /api/apn/qos\_profile

Response:

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

## API APN

Request: GET /api/apn/profile

## API APN

Request: POST /api/apn/profile

Response:

```
{
  "apn_identifier_id": 1,
  "apn_qos_profile_id": 1,
  "name": "APN"
}
```

Response:

- `apn_identifier_id` - APN ID
- `apn_qos_profile_id` - APN QoS ID

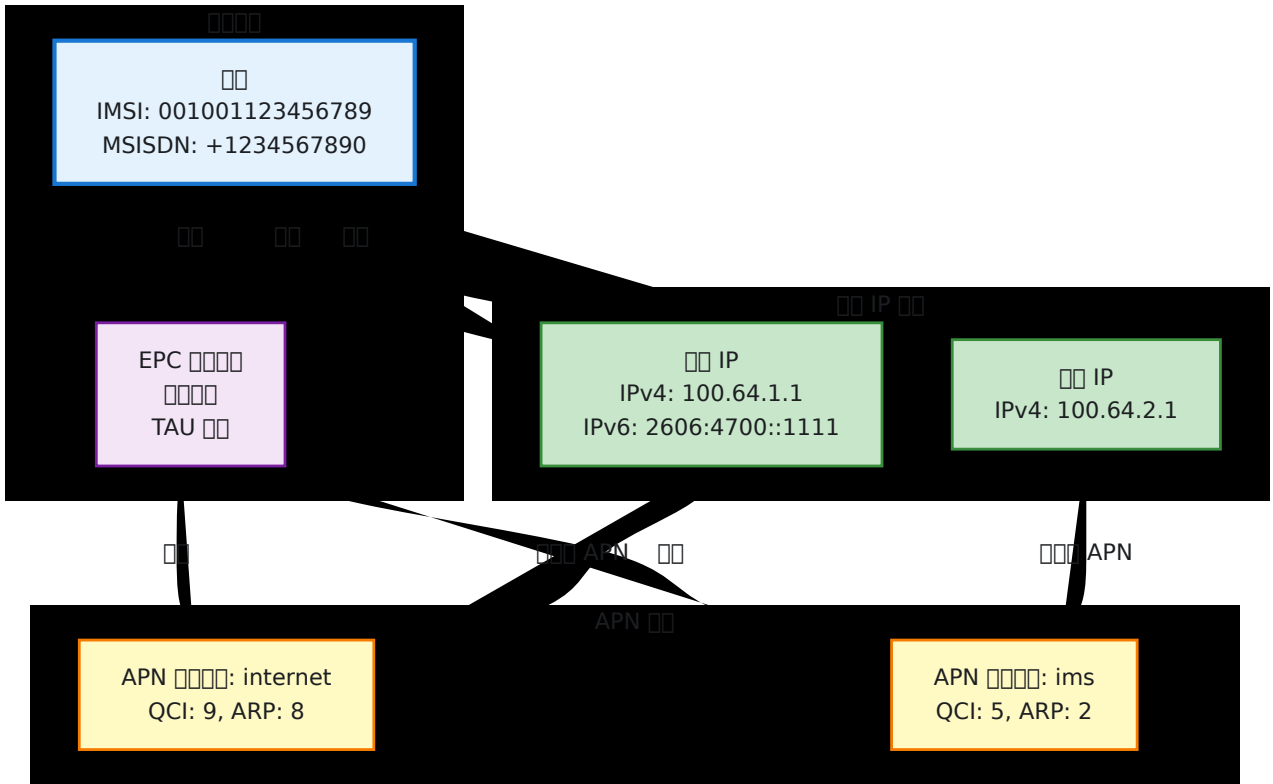
☐☐:

- ☐☐☐☐☐☐ - ☐☐ APN ☐☐☐☐☐☐☐☐
- EPC ☐☐☐☐ - APN ☐☐☐☐☐☐☐☐ EPC ☐☐☐☐

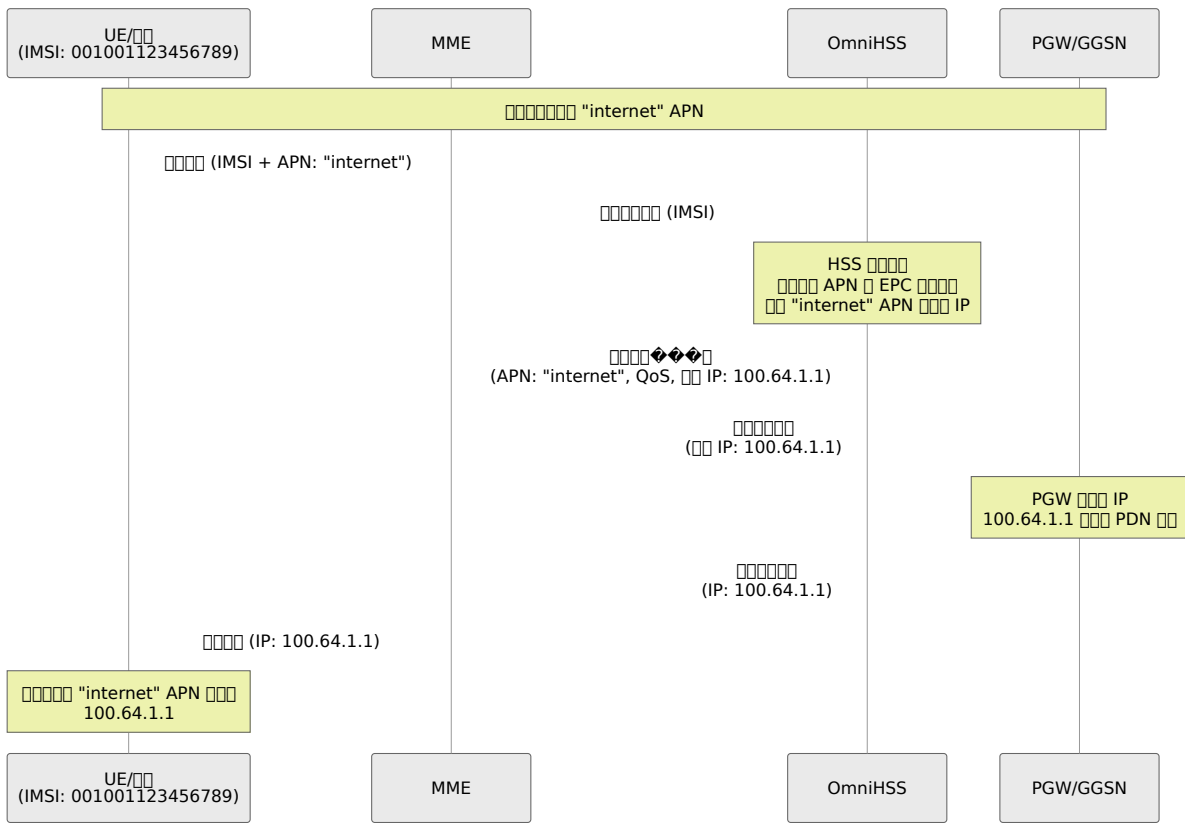
## ☐☐ IP ☐☐

☐☐ IP ☐☐☐☐☐☐☐☐ APN☐☐☐☐☐☐☐☐☐☐☐☐ APN ☐☐☐☐☐☐ IPv4 ☐/☐ IPv6 ☐☐☐☐☐☐☐ DHCP ☐☐☐☐☐☐☐☐☐☐

☐☐:

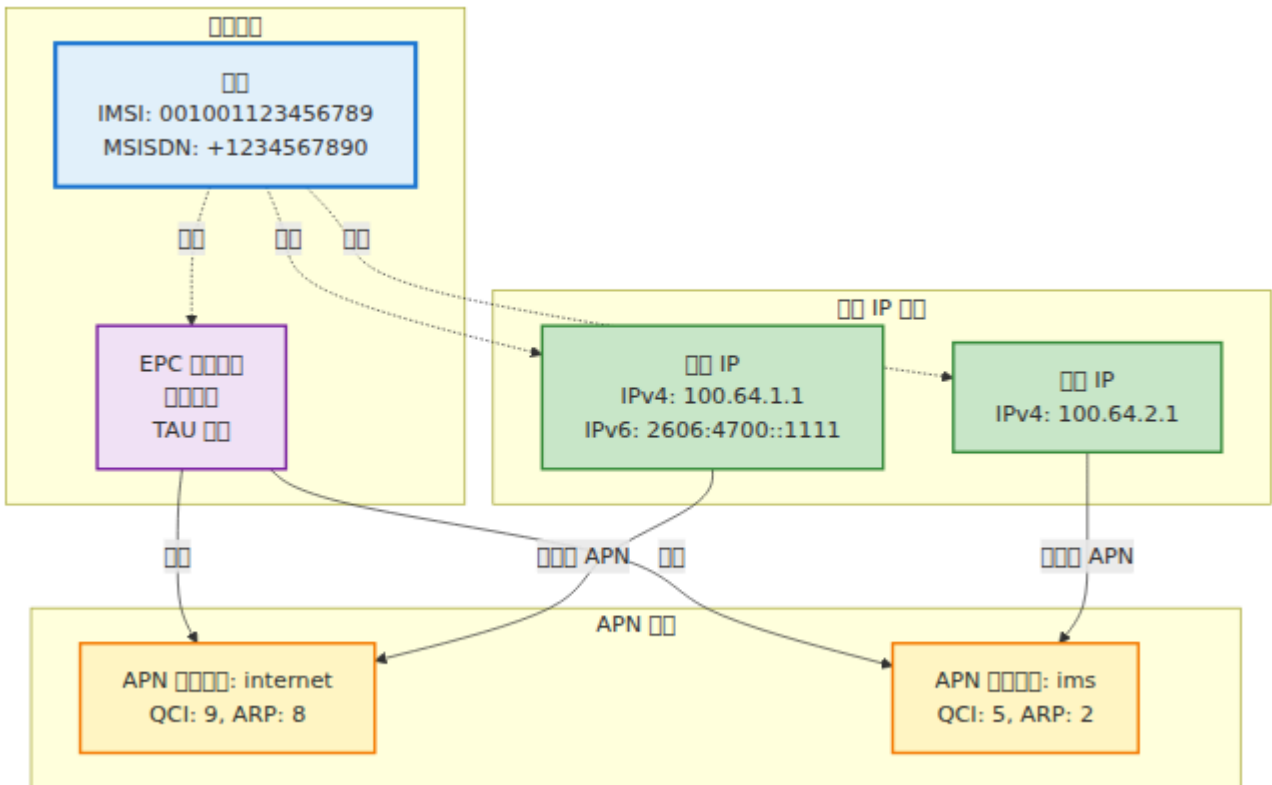


☐☐☐☐☐☐☐☐☐☐:



APN - APN:

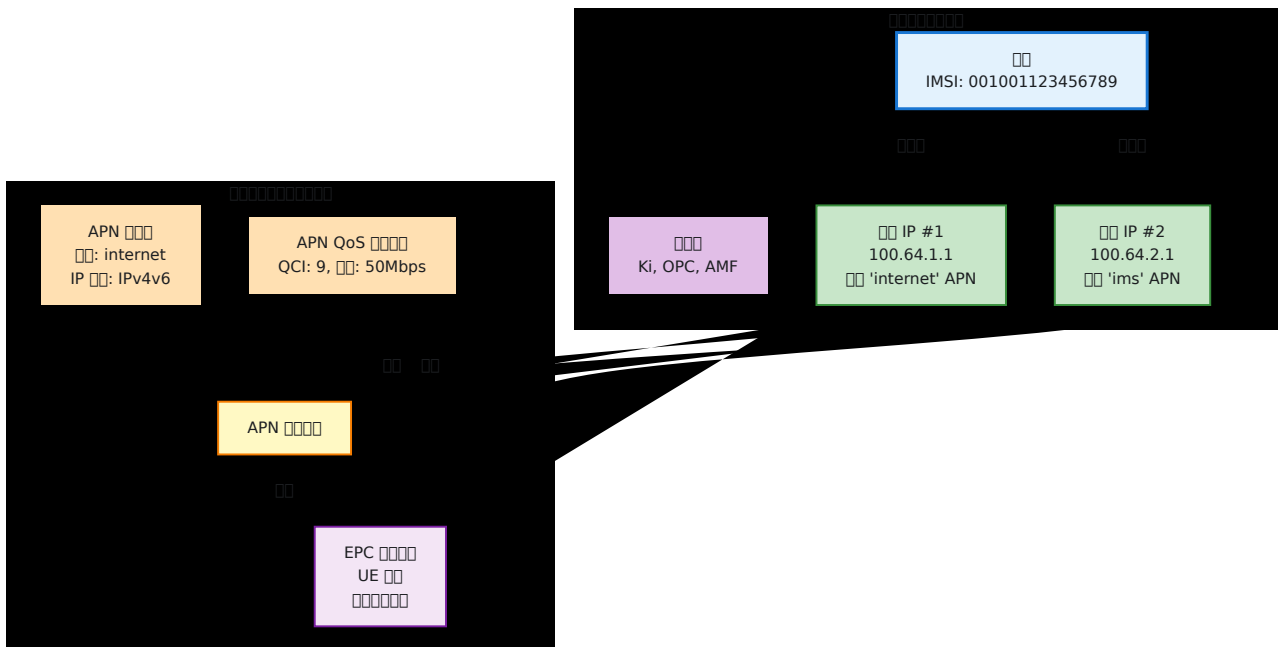
S6a APN- AVP



:

1. **APN ID:** APN ID 0, 1, 2...
2. **APN Name:** `apn_identifier.apn` "internet" "ims"
3. **PDN Type:** `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. **Static IP:** subscriber.static\_ips → `apn_profile_id` → IP  
  - `apn_profile_id` → IP
  - `apn_identifier.ip_version`
7. **VPLMN-APN:** 0 - IP

Diagram:



Notes:

- **APN:** IP APN
- **APN IP:** APN IP
- **IPv4 IPv6:** IP IPv4 IPv6
- **IP:** IP IP IP  
  - IPv4 IPv6 APN
  - IP
  - `ipv4_static_ip` `ipv6_static_ip`
- **IP:** IP

□□□□:

- IoT □□□□ IP □□
- □□□□□□□□□□□□□□ IP □□□□□□□□
- □□□□ IP □□□□□□□□
- □□□ IP □□□□□□□□
- □□ IP □□□□□□□□

## □□□□ IP

□□□□□□ IP □□□

□□: GET /api/epc/static\_ip

□□□□:

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

□□□□:

```

{
  "data": [
    {
      "id": 1,
      "apn_profile_id": 5,
      "ipv4_static_ip": "100.64.1.1",
      "ipv6_static_ip": "2606:4700:4700::1111",
      "apn_profile": {
        "id": 5,
        "name": "☐☐☐ APN",
        "apn_identifier": {
          "apn": "internet",
          "ip_version": "ipv4v6"
        }
      },
      "inserted_at": "2025-11-15T10:30:00Z",
      "updated_at": "2025-11-15T10:30:00Z"
    }
  ]
}

```

## ☐☐☐☐ IP

☐☐☐☐☐☐ IP ☐☐☐

☐☐: GET /api/epc/static\_ip/:id

☐☐☐☐:

| ☐☐ | ☐☐      | ☐☐           |
|----|---------|--------------|
| id | integer | ☐☐ IP ☐☐☐ ID |

☐☐☐☐:

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

# Static IP

APN profile static IP

Request: `POST /api/epc/static_ip`

Request:

```
{
  "static_ip": {
    "apn_profile_id": 5,
    "ipv4_static_ip": "100.64.1.1",
    "ipv6_static_ip": "2606:4700:4700::1111"
  }
}
```

Response:

- `apn_profile_id` - APN profile ID
- `ipv4_static_ip` & `ipv6_static_ip`

Response:

- `ipv4_static_ip` - IPv4 address
- `ipv6_static_ip` - IPv6 address

IP Address:

- IPv4: `100.64.1.1`
- IPv6: `2606:4700:4700::1111`
- IPv4 & IPv6 address IP type
  - Static IP
  - IP address associated with APN
  - Static IP

Response:

| ☐☐     | IPv4 | IPv6 | ☐☐  |
|--------|------|------|---|
| ☐ IPv4 | ✓    | -    | <code>{"ipv4_static_ip": "100.64.1.1"}</code>           |
| ☐ IPv6 | -    | ✓    | <code>{"ipv6_static_ip": "2606:4700:4700::1111"}</code> |
| ☐☐     | ✓    | ✓    | ☐☐☐☐☐☐☐☐  |

☐☐☐☐:

☐ IPv4 ☐☐ 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 ☐☐ 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"
  }
}'
```

☐☐☐☐ 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"
  }
}'
```

응답 (201 OK):

```
{
  "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"
  }
}
```

참고:

- IP 주소 - 100.64.1.1
- APN 이름 - APN ID

## 응답 IP

응답 IP 주소

PUT /api/epc/static\_ip/:id

참고:

| id | integer | IP ID |
|----|---------|-------|
|    |         |       |

id:

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

attributes:

- `ipv4_static_ip` - IPv4 address
- `ipv6_static_ip` - IPv6 address
- `apn_profile_id` - APN profile ID

response:

- `id` - ID

id: ID IP address PDN type PDN type IP address

curl:

```
curl -k -X PUT https://hss.example.com:8443/api/epc/static_ip/1 \
-H "Content-Type: application/json" \
-d '{
  "static_ip": {
    "ipv4_static_ip": "100.64.1.2"
  }
}'
```

## Static IP

Static IP

Request: DELETE /api/epc/static\_ip/:id

Response:

| Field | Type    | Description  |
|-------|---------|--------------|
| id    | integer | Static IP ID |

Example:

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

Notes:

- Static IP ID
- APN (Access Point Name) APN
- Static IP (IPv4 or IPv6) IP
- Static IP (IPv4 or IPv6)

Response: Static IP ID, PDN, Static IP (IPv4 or IPv6)

## Static IP

Static IP (IPv4 or IPv6) IP ID

Steps:

1. Static IP (IPv4 or IPv6)
2. `static_ips` (Static IP)

Static IP ID:

```
# 1: "internet" 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": 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 APN:

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')

# [] 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\": [\$INTERNET_IP, \$IMS_IP]
  }
}"

```

[] []:

- ✓ []: [][] APN [][] IP
- ✗ []: [][] APN [][] IP

[] [] - [] **APN:**

```
# 静的 IP アドレスを APN に設定
curl -k -X POST https://hss.example.com:8443/api/subscriber \
-H "Content-Type: application/json" \
-d '{
  "subscriber": {
    "imsi": "001001123456789",
    "static_ips": [1, 2]
  }
}'

# 応答:
{
  "errors": {
    "static_ips": [
      "静的 IP アドレス 100.64.1.1 は
internet に 100.64.1.2 は internet"
    ]
  }
}
```

注:

- 静的 IP - 静的 IP
- 静的 IP - 静的 IP
- 静的 IP アドレス - 静的 IP

## 静的 IP

静的 IP アドレスを IMS に設定する MNC/MNC を静的 IP

### 静的 IP

注: GET /api/roaming/profile

### 静的 IP

注: POST /api/roaming/profile

{}:

```
{
  "roaming_profile": {
    "name": "漫游规则",
    "data_action_if_no_rules_match": "deny",
    "ims_action_if_no_rules_match": "deny",
    "roaming_rules": []
  }
}
```

{}:

- "allow" - 允许
- "deny" - 拒绝

{}:

- data\_action\_if\_no\_rules\_match - 数据 规则 匹配
- ims\_action\_if\_no\_rules\_match - IMS 规则 匹配

{}:

{}: GET /api/roaming/rule

{}:

{}: POST /api/roaming/rule

{}:

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

□□:

- `mcc` - □□□□□□□3 □□□□
- `mnc` - □□□□□□□2-3 □□□□
- `data_action` - "allow" □ "deny" □□□□
- `ims_action` - "allow" □ "deny" IMS/□□□□

□□:

- □□□□ - □□□□□□□□
- □□□□ - □□□□□ Diameter □□□□□□□□

## EIR □□

OmniHSS □□ S13 Diameter □□□□□□□□□□EIR□□□□EIR □□□□ IMEI □□□□□□□□□□

□□ **EIR** □□ □□□□□□□□□□□□□□**S13** □□□□□ **IMEI** □□□□

### □□ **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 - 设备名称
- imei\_regex - IMEI 正则表达式
- action - 0: 忽略, 1: 报警, 2: 记录

{}:

- 0 - 忽略
- 1 - 报警
- 2 - 记录

{}:

- IMEI
- TAC
- 设备型号

{}:

- S13 EIR
- OmniHSS EIR

{} {}

{} {}

- **API** - API
- **API** - API
- **API** - API

---

← API | API: API →

# API 操作

[← API 操作](#)

---

## 操作

API 操作

GET /api/status

操作

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

操作

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

操作

---

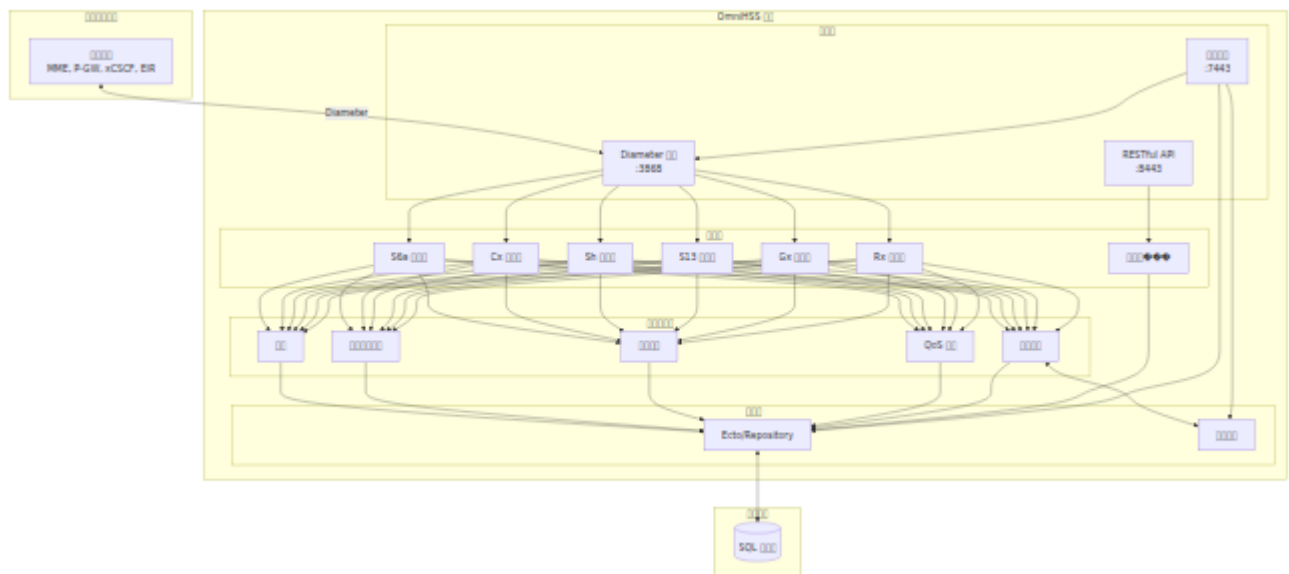
[← API 操作](#)

# OmniHSS

←

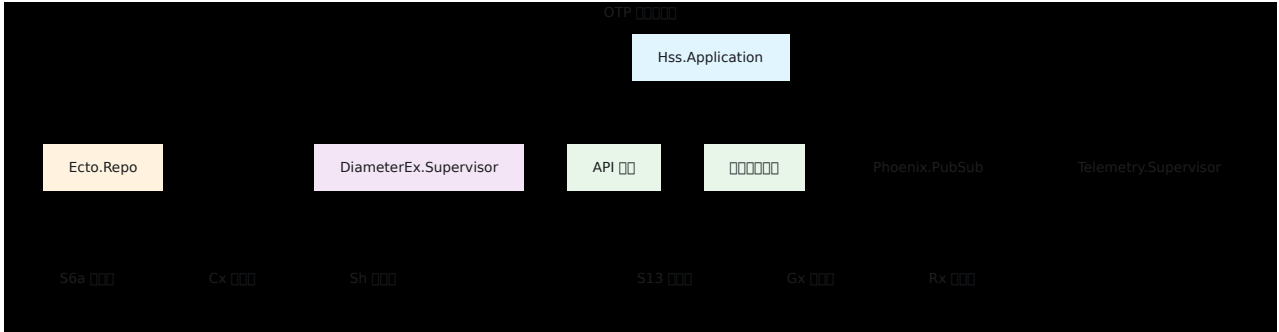
- 
- 
- Diameter
- 
- 
- 
- 

OmniHSS Elixir Erlang/OTP



□□□□

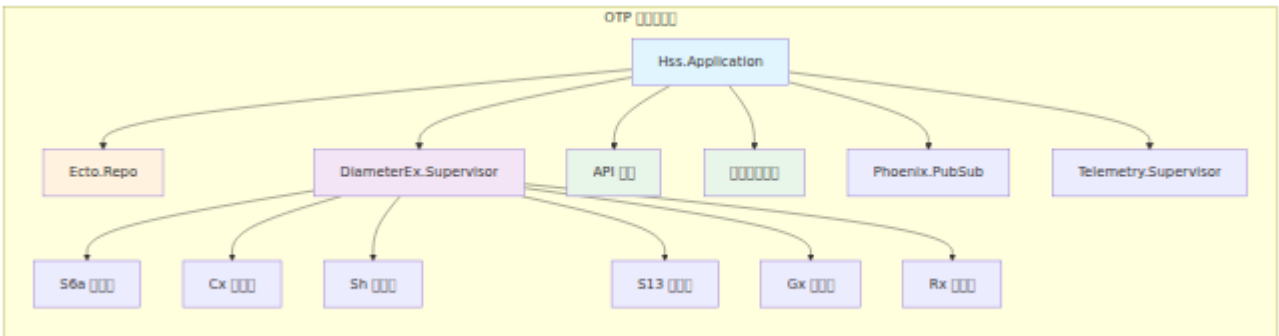
□□□□



## Diameter □□□□□

□□ Diameter □□□S6a□Cx□Sh□S13□Gx□Rx□□□□□□□□ DiameterEx □□□□□□□□□□

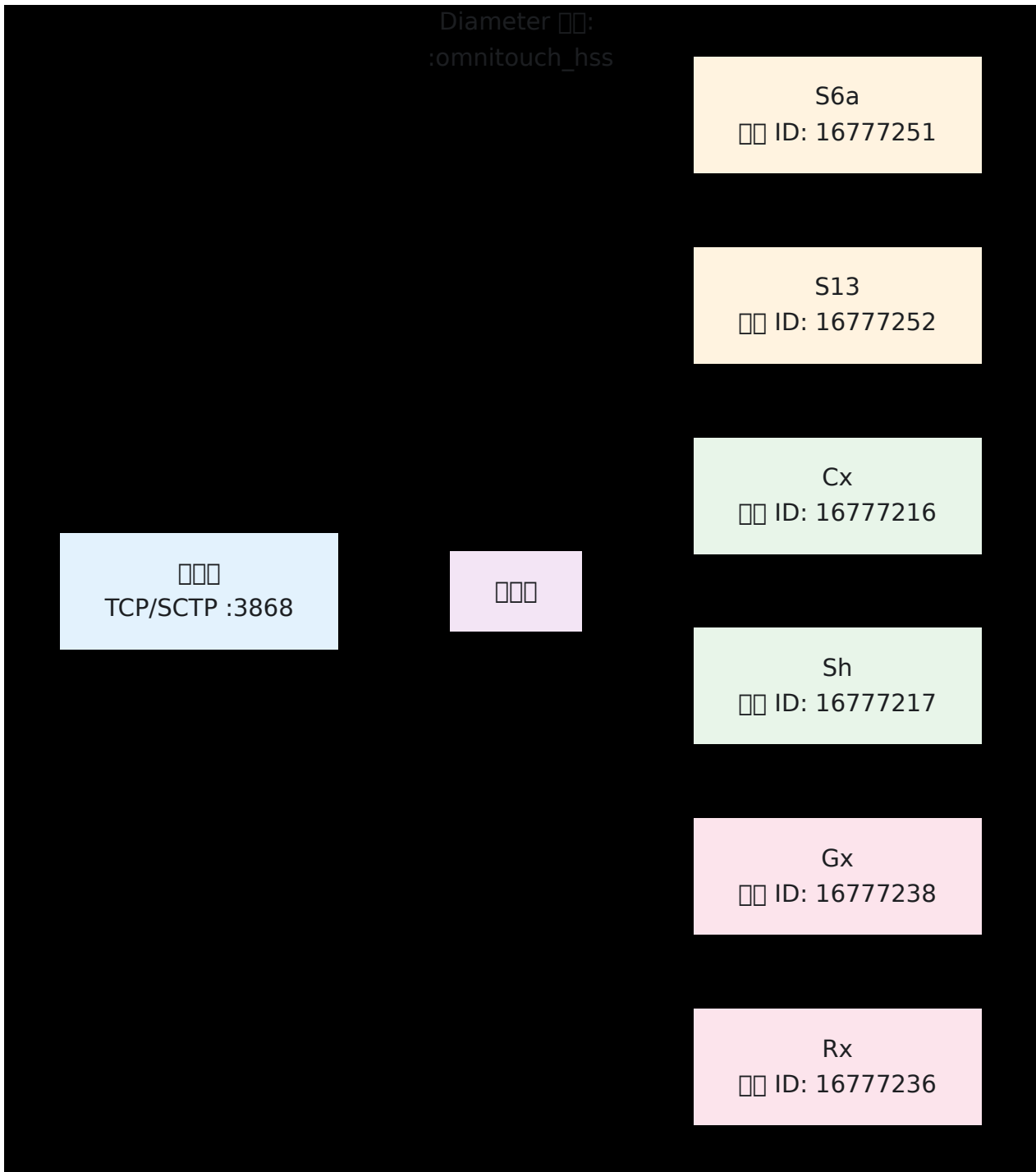
1. □ **DiameterEx** □□ - □□□□□ Diameter □□ ID
2. □□□□ - □□ AVP□□□□□□□□□□
3. □□□□□□ - □□□□□□□□□□□□
4. □□□□ - □□ AVP □□ Diameter □□□□□
5. □□□□ - □□□□□□ Diameter □□□□□



# Diameter 00

## Diameter 0000

OmniHSS 0000000000000000 Diameter 000



□□□□□□



□□□□□□

Configured

□□□□

Connecting

□□□□

Connected

□□□□

□□□□□□

□□□□□□

□□□□

□□□□ Diameter □□

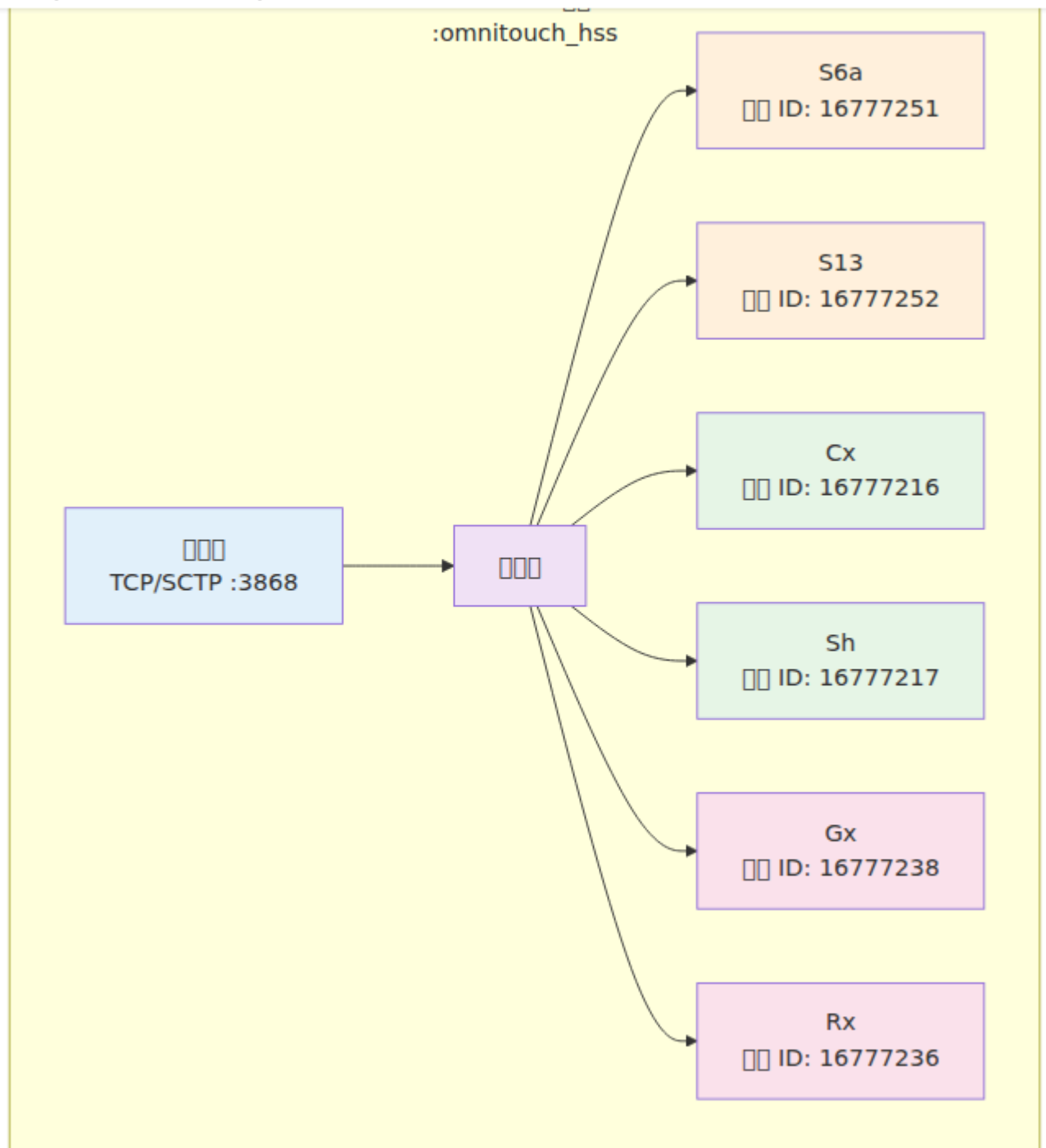


Down

□□□□  
□□□□

# Diameter

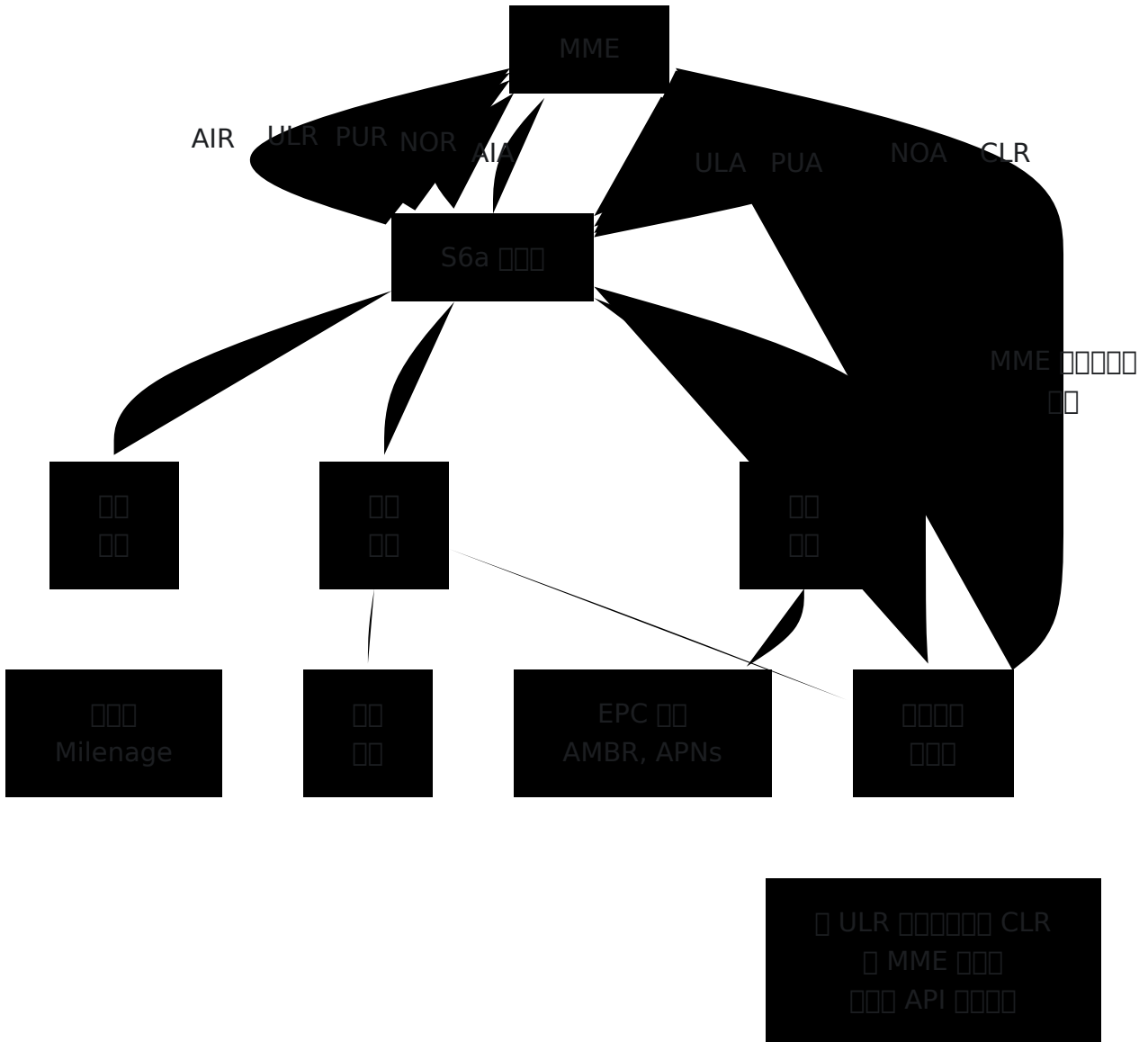
Downloads 🔍 Omnitouch website



□□□

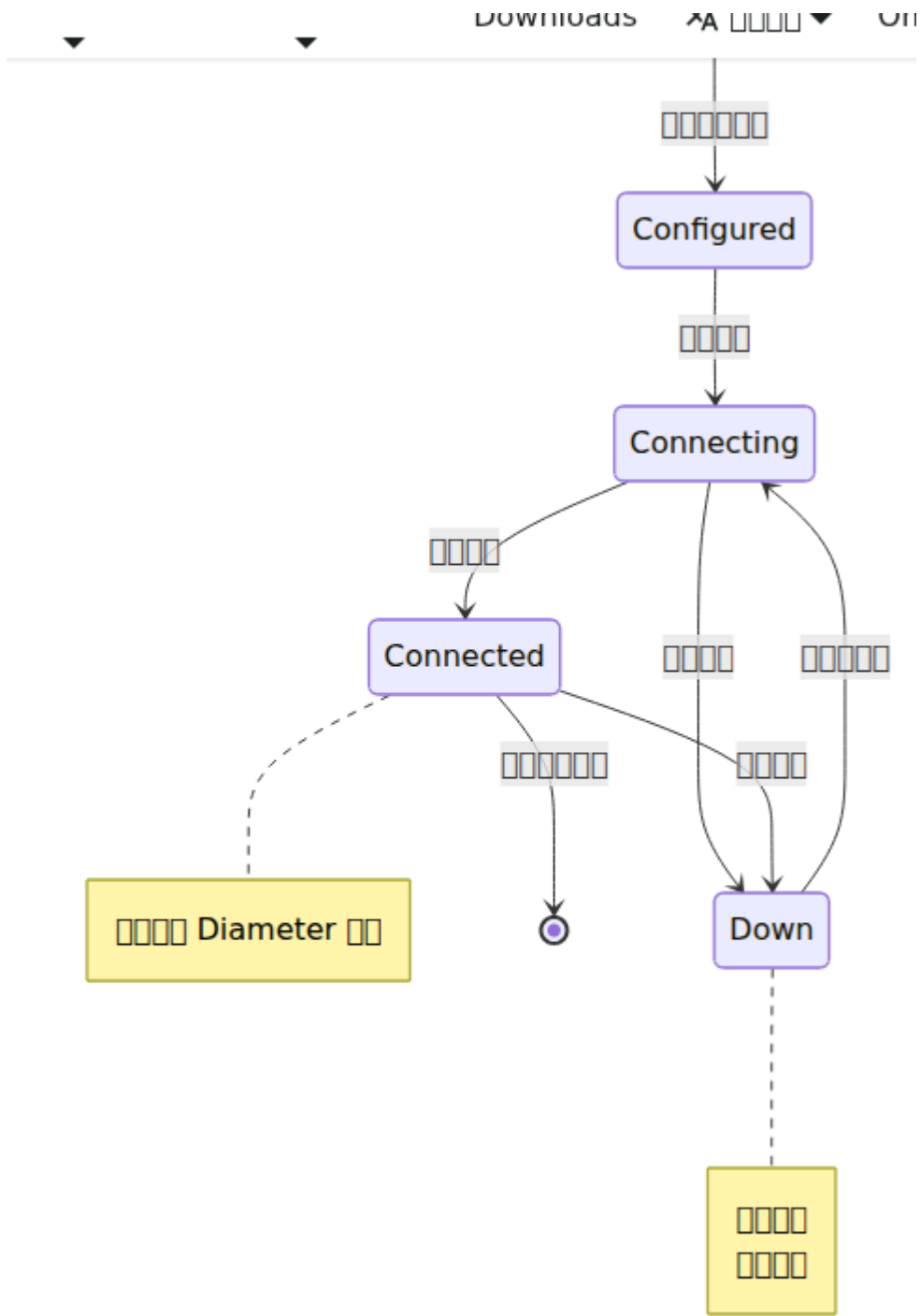
## S6a □□ (LTE/EPC)

□□ LTE □□□□□□□□□□



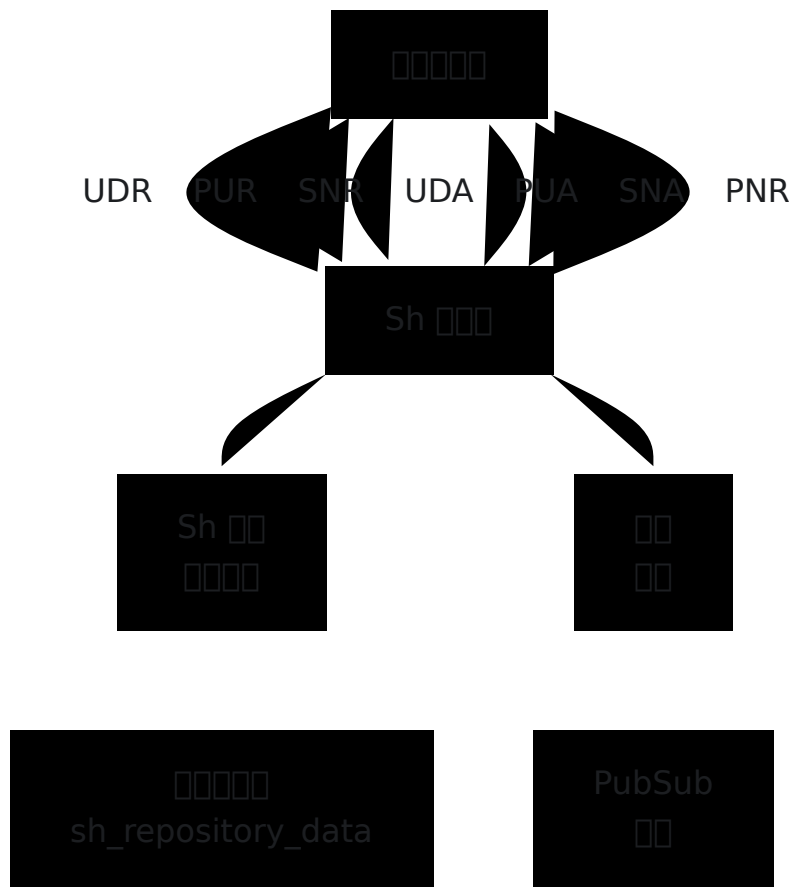
## Cx □□ (IMS)

□□ IMS □□□□□□



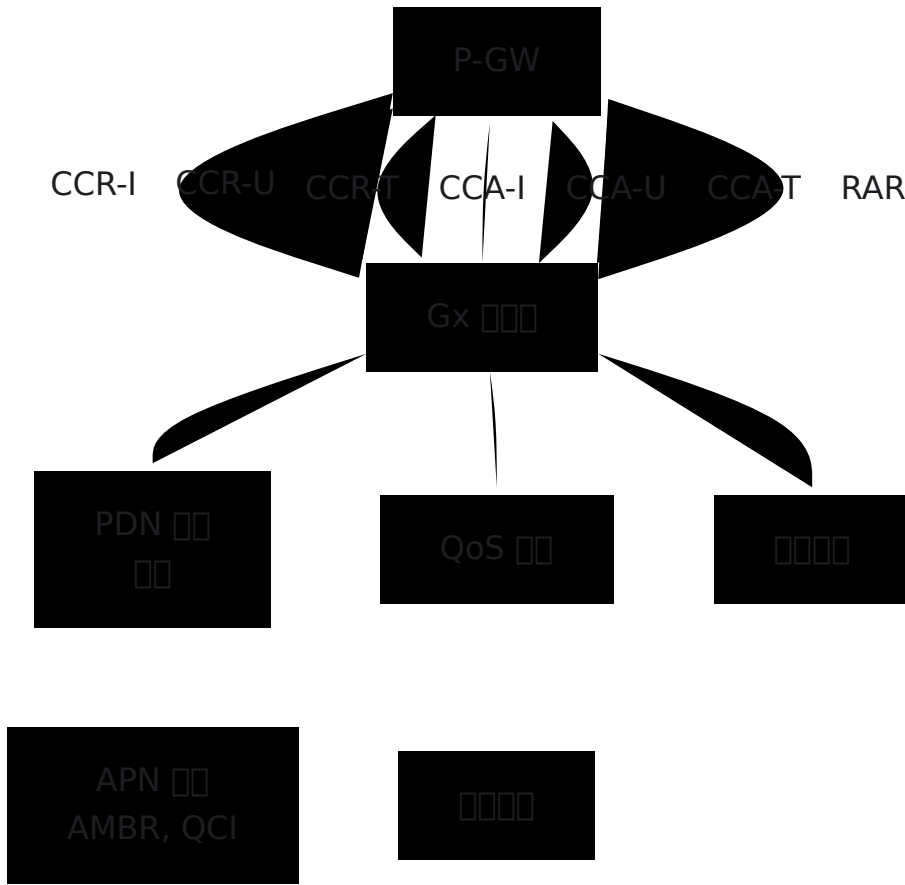
## Sh (IMS )

IMS



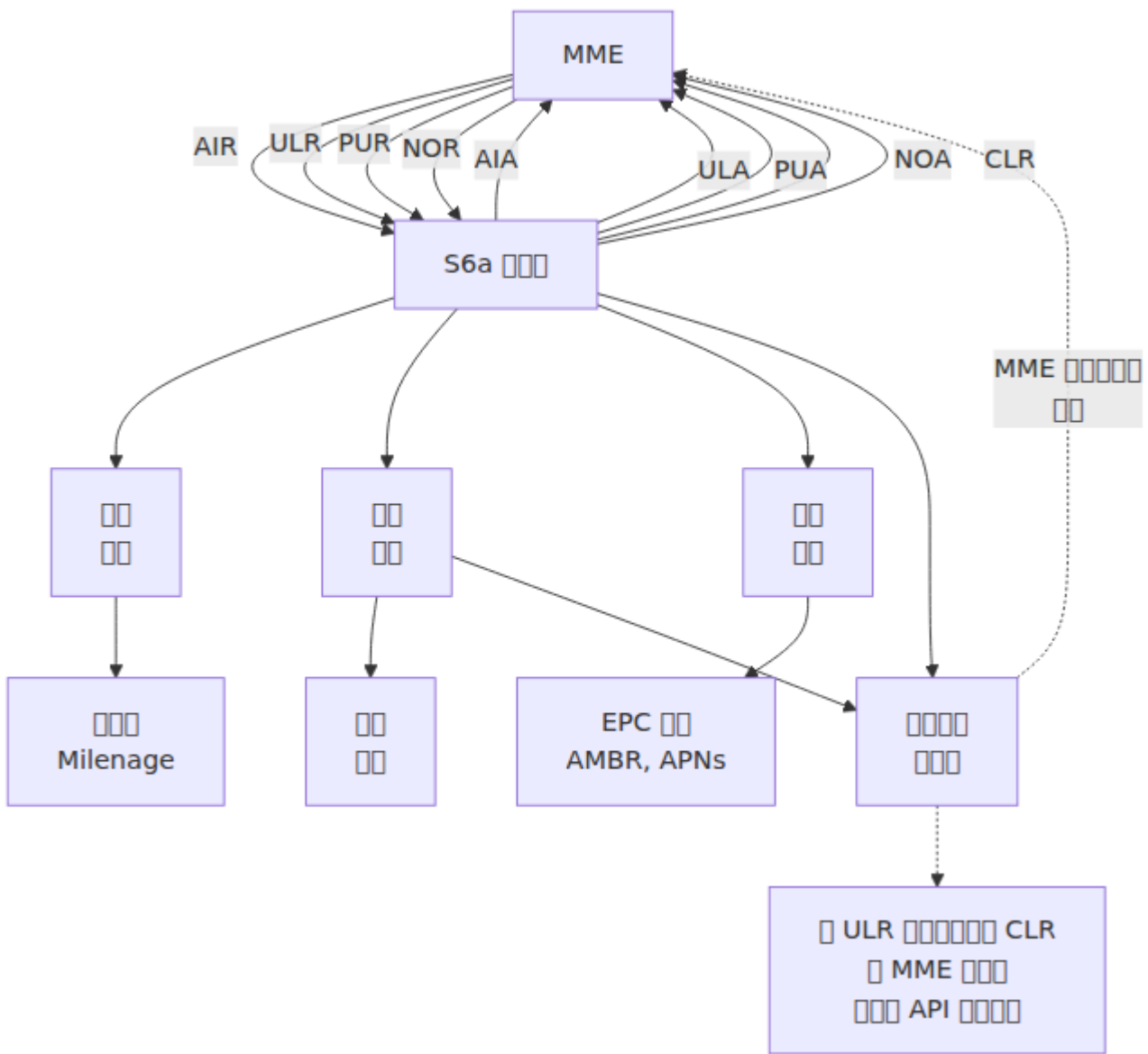
## Gx ( )

PCRF



## Rx (IMS)

IMS VoLTE PCRF

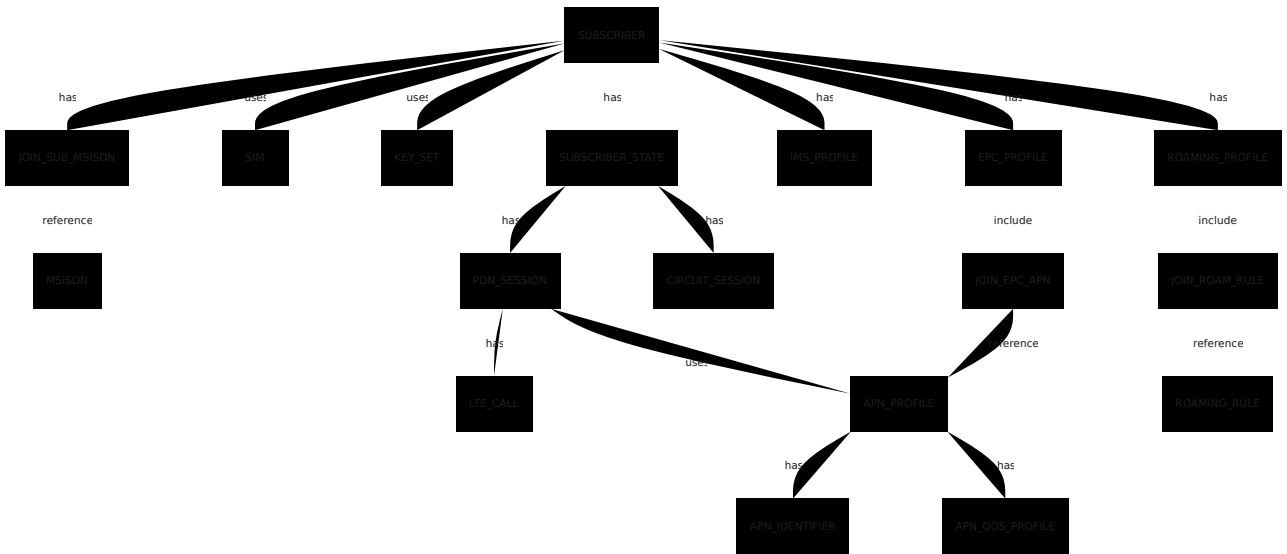


## S13 (EIR)

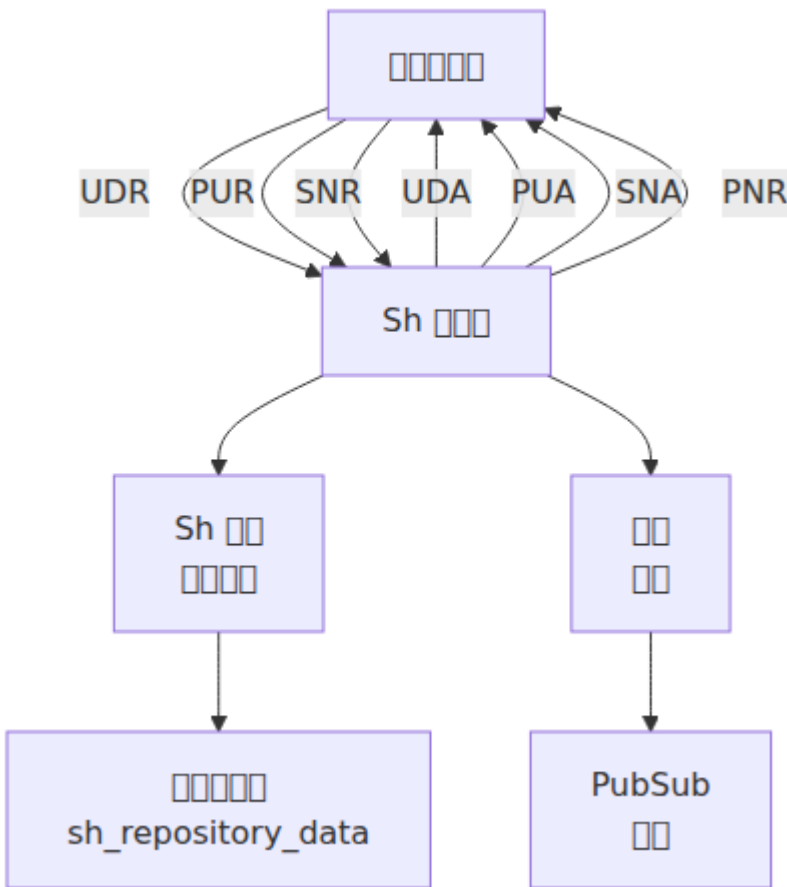
IMEI EIR



□□□□□□□□

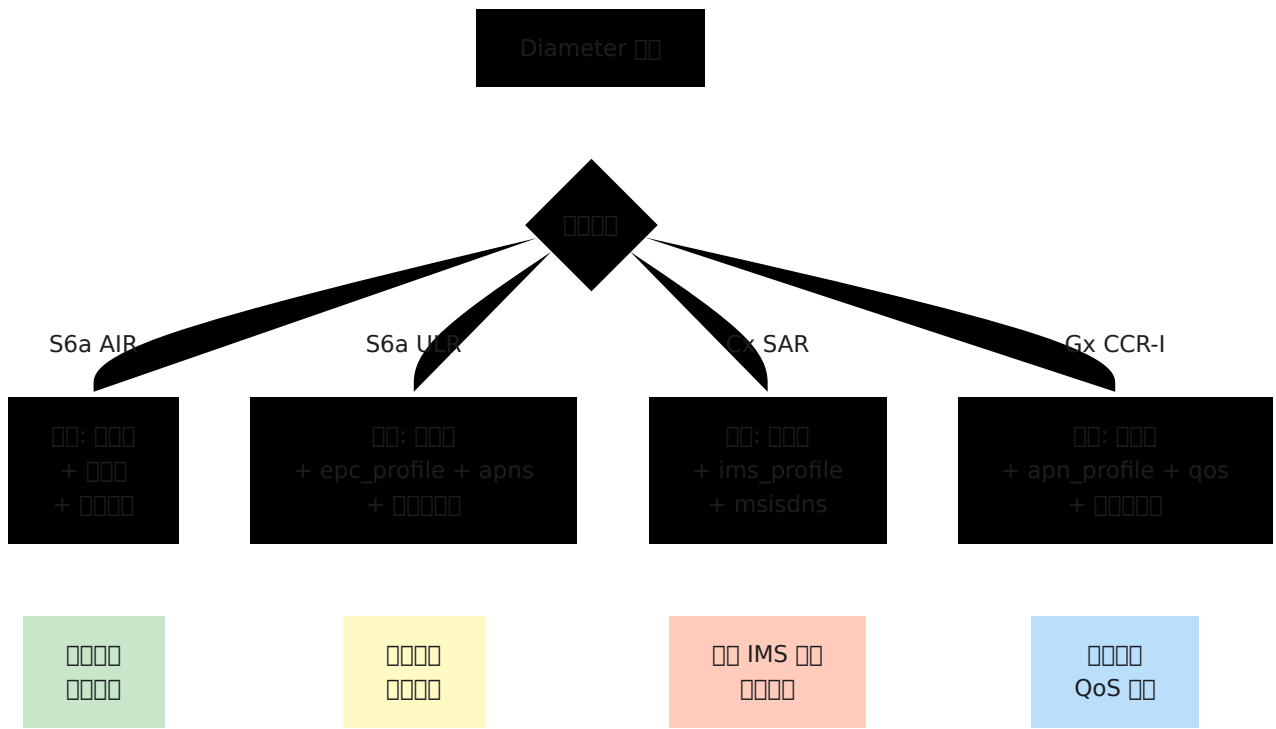


## Ecto □□□□



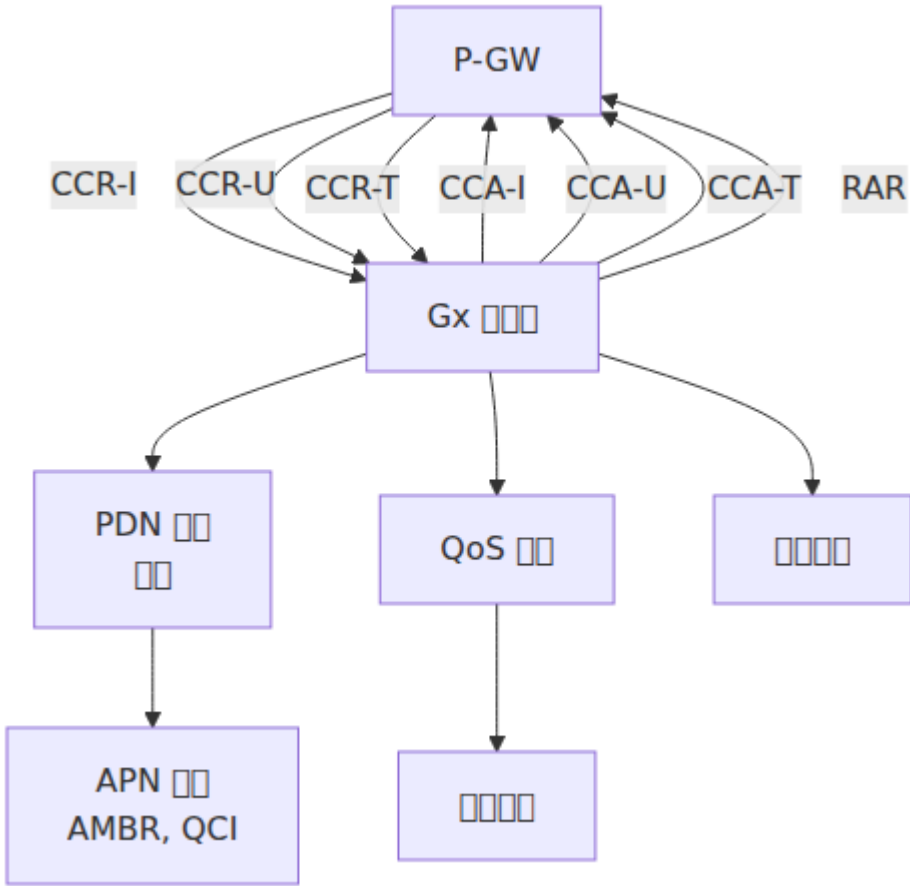
□□□□□□

□□ Diameter □□□□□□□□□□□□□□□□□□

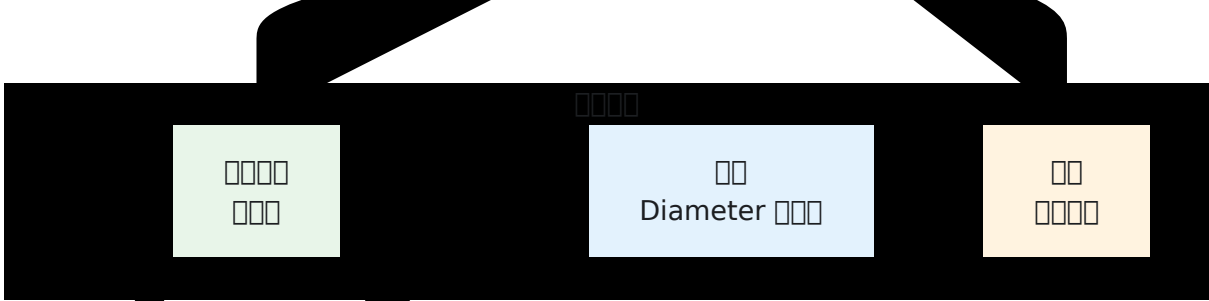
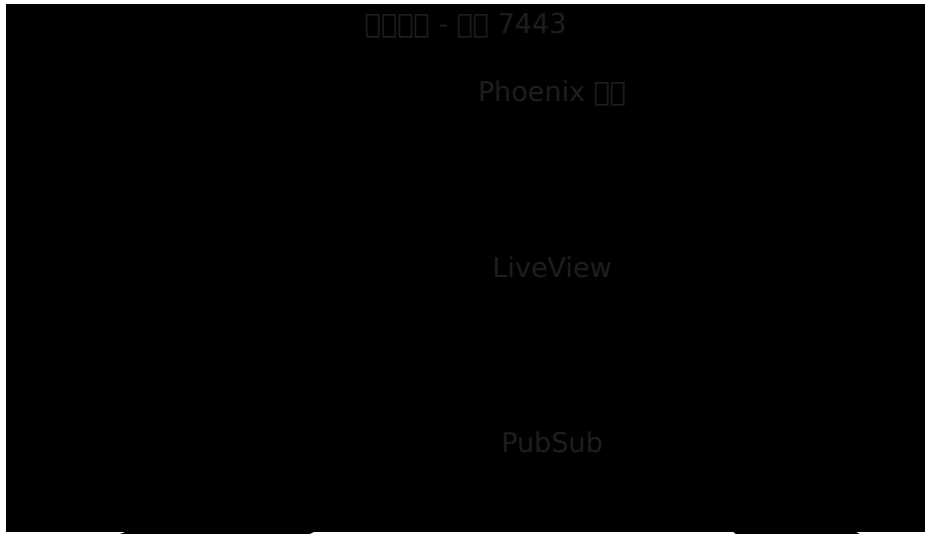


□□□□

## API □□

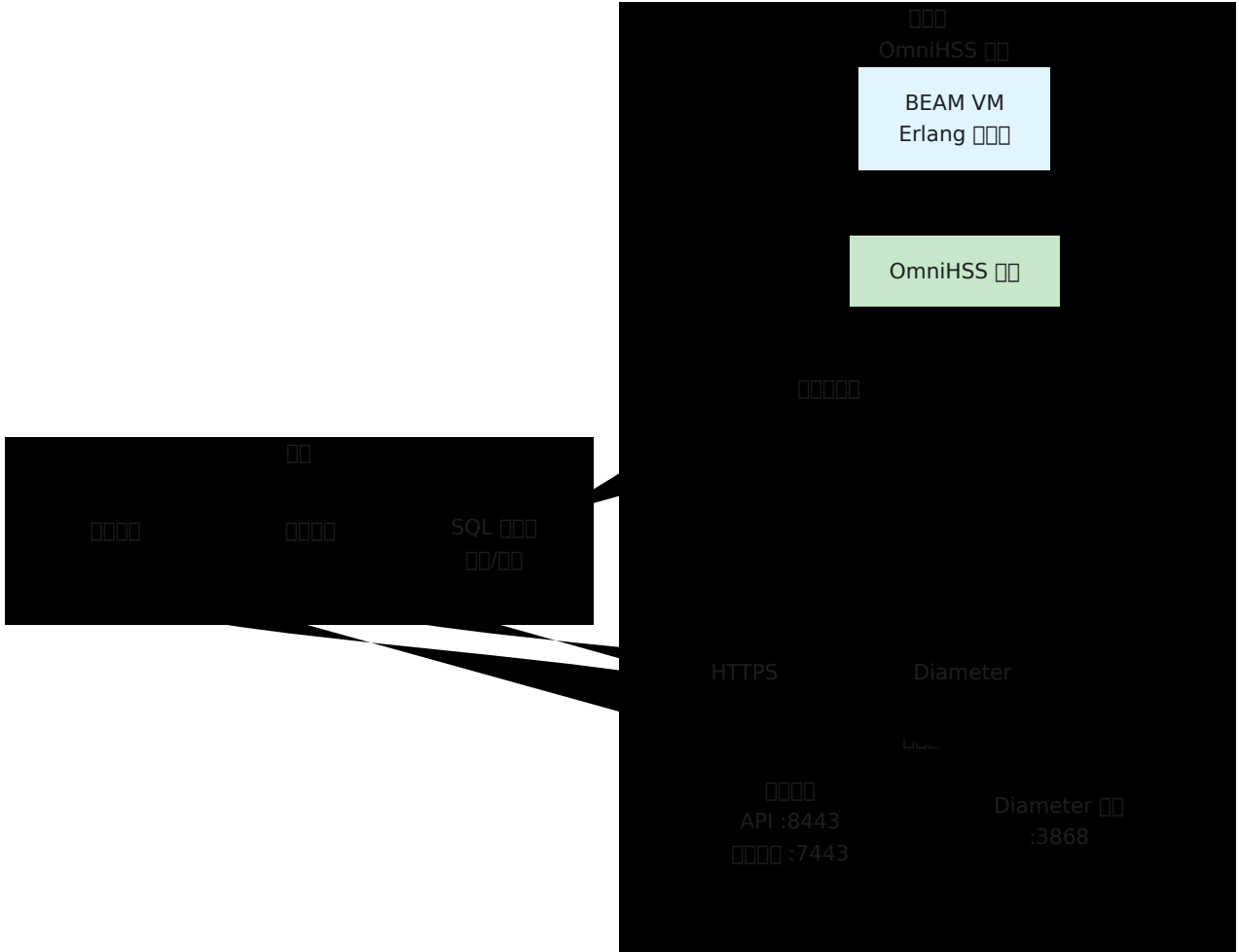


□□□□□□



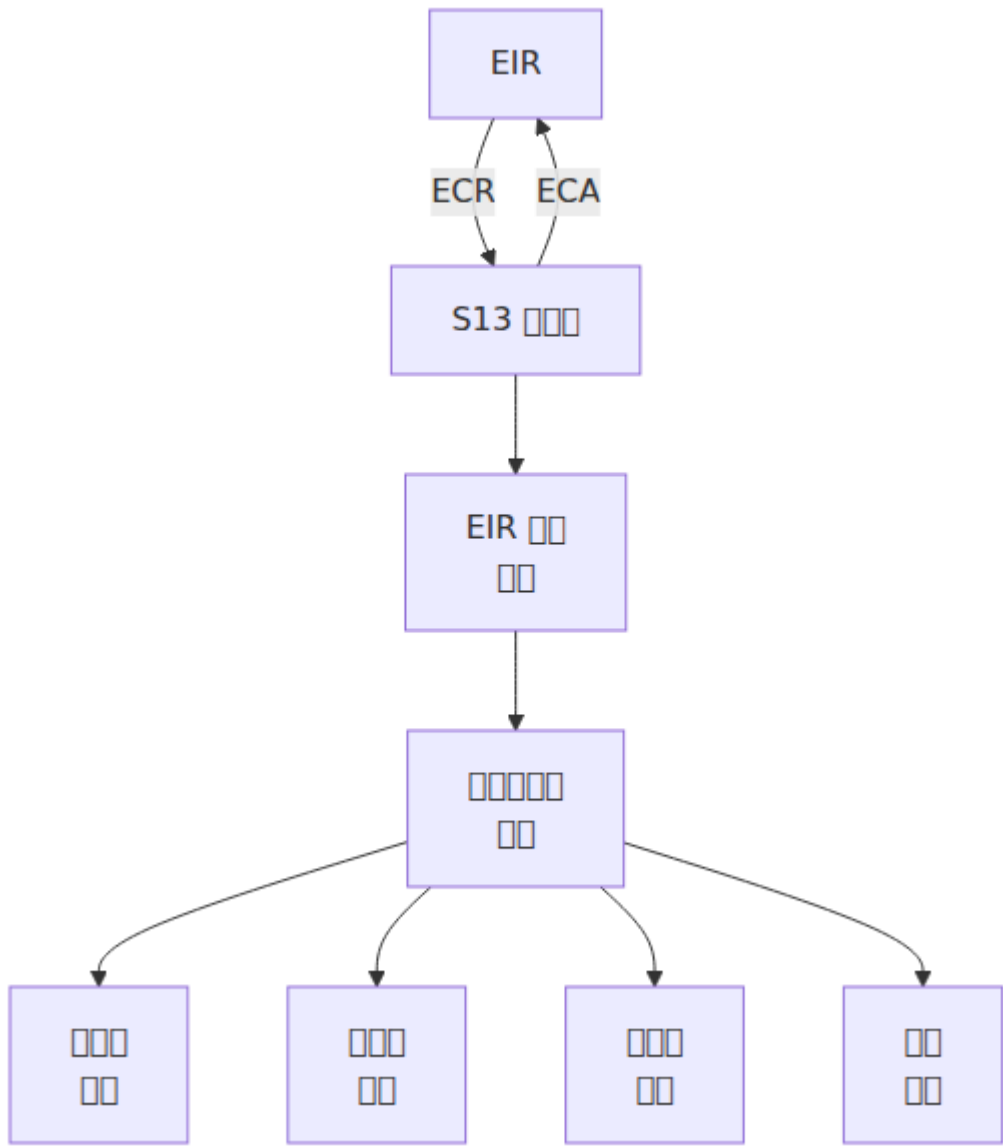
□□□□

□□□□□



## □□□□□□□□ (Galera □□)

□□□□□□□□ OmniHSS □□ MariaDB Galera □□□□□□□□□□□□□□



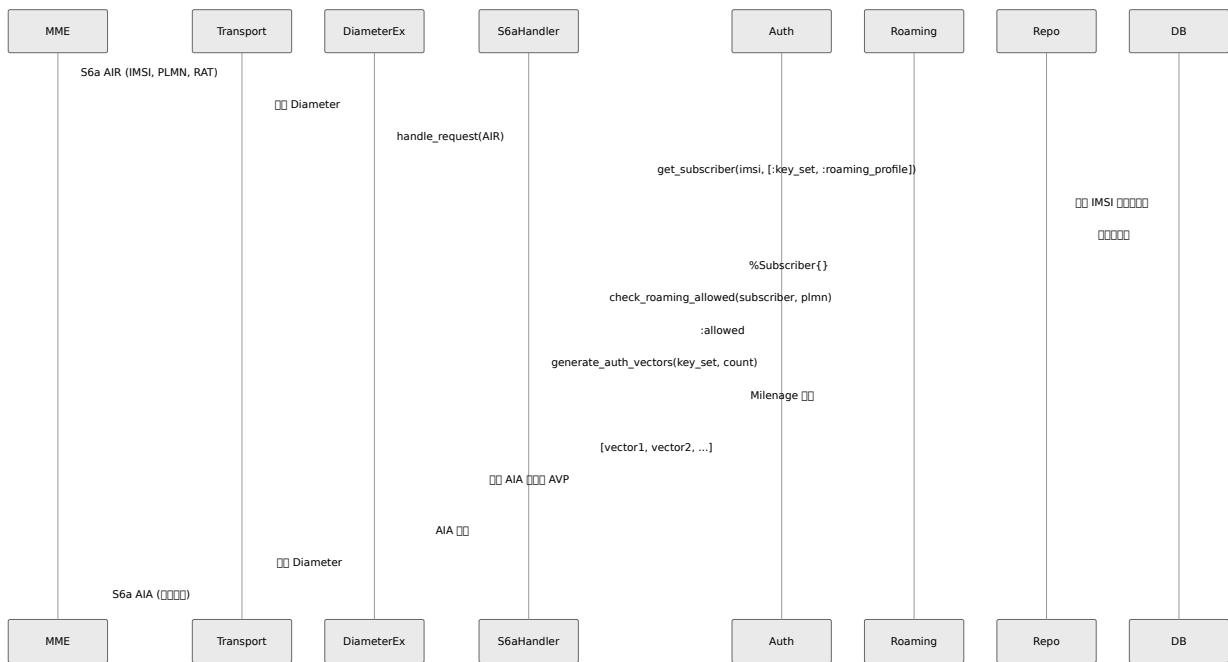
□□□□

- □□□□□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□ **Galera** □□□□□□

□□□□□□□□

□□□□□□□□□□□□□□



□□□□□□

## 1. □□□

- Erlang/OTP □□□□□□□□□□□□
- □□□ Diameter □□□□□□□□□□
- □□□□□□□□□□□□□□

## 2. □□□

- □□ Diameter □□□□□□□□□□□□
- □□□□□□□□□□□□□□
- □□□□□□□□□□□□□□

## 3. □□□

- □□ Diameter □□□□□□□□□□
- □□□□□□□□□□□□□□□□
- □□□□□□□□

## 4. 00

- 00000000000000000000
- 0000000000000000
- 00000000

## 5. 0000

- 0000000000000000
- 0000000000000000
- Diameter 00000000
- 00000000000000

# OmniHSS □□□□

← □□□□□

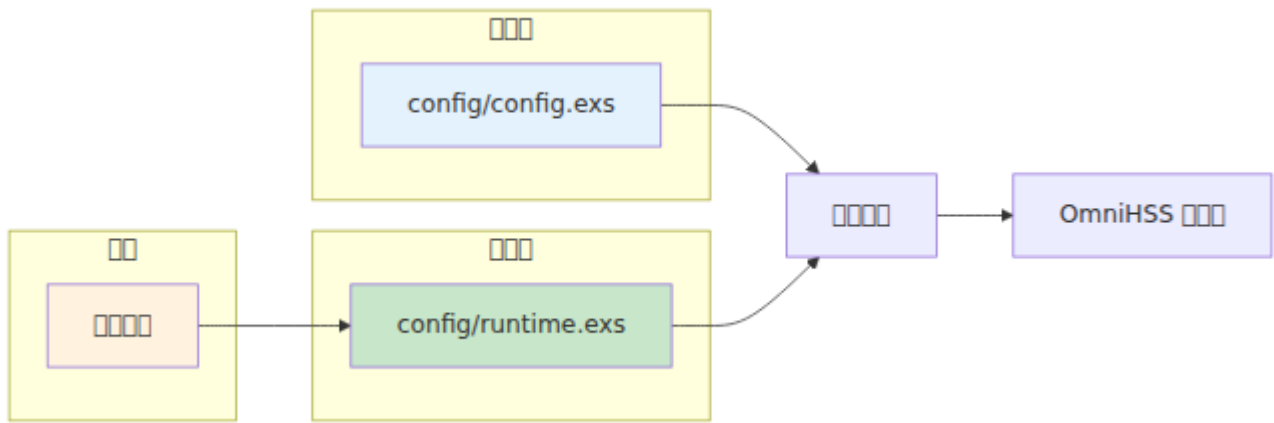
---

## □□

- □□□□□
  - □□□□□□□
  - □□□□
  - □□□□
  - Diameter □□
  - □□□□
    - □□ PLMN □□
    - HSS □□□□
  - IMS □□
  - EIR □□
  - API □□□□□□□
  - □□□□□
- 

## □□□□□□□

OmniHSS □□□□□□□□□□



## config/config.exe (config)

config/config.exe

- config/config.exe
- API config
- config

## config/runtime.exe (config)

config/runtime.exe

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

config/config.exe

config/config.exe HSS config

```
# config/runtime.exs

config :license_client,
  # 许可证 API 端点 URL 列表
  license_server_api_urls:
  ["https://license.example.com:8443/api"],

  # 许可证持有者
  licensee: "许可证持有者",

  # 产品名称
  product_name: "omnihss"
```

### 许可证配置

| 配置项                     | 数据类型              | 是否必填 | 默认值                           |
|-------------------------|-------------------|------|-------------------------------|
| license_server_api_urls | 许可证 API 端点 URL 列表 | 否    | ["https://10.0.0.1:8443/api"] |
| licensee                | 许可证持有者名称          | 否    | "ACME Telecom"                |
| product_name            | 产品名称              | 否    | "omnihss"                     |

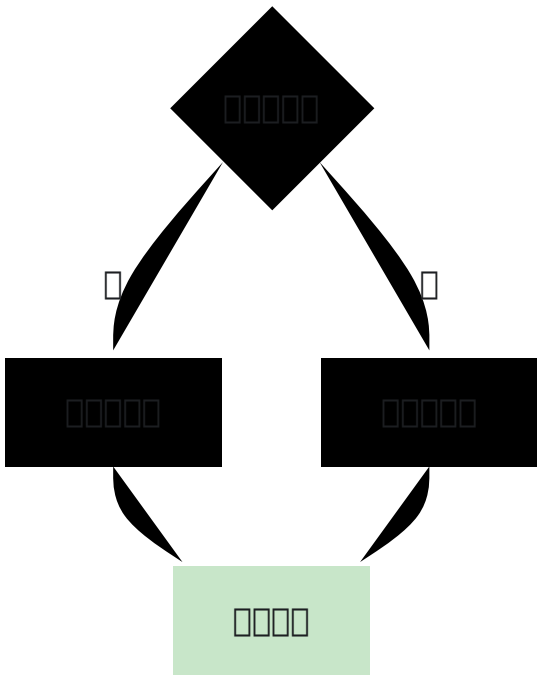
### 许可证

- 许可证持有者 HSS 名称
- 许可证持有者 HTTPS 端点 URL
- 许可证持有者 URL 列表
- 许可证持有者名称

□□□□□

□□□□□

□□□□



□□□□□□

OmniHSS □□□□□□□□

- □□□□□□□□□□□□□□
  - □□□□ runtime.exs □□□
  - □□□□□□□□□□□□□□□□
-

## データベース

## 接続設定

```
# config/runtime.exs

config :hss, Hss.Repo,
  # データベース
  username: System.get_env("DATABASE_USERNAME", "root"),
  password: System.get_env("DATABASE_PASSWORD", "password"),
  hostname: System.get_env("DATABASE_HOSTNAME", "localhost"),
  database: System.get_env("DATABASE_NAME", "omnihss"),

  # プールサイズ
  pool_size:
    String.to_integer(System.get_env("DATABASE_POOL_SIZE", "20")),

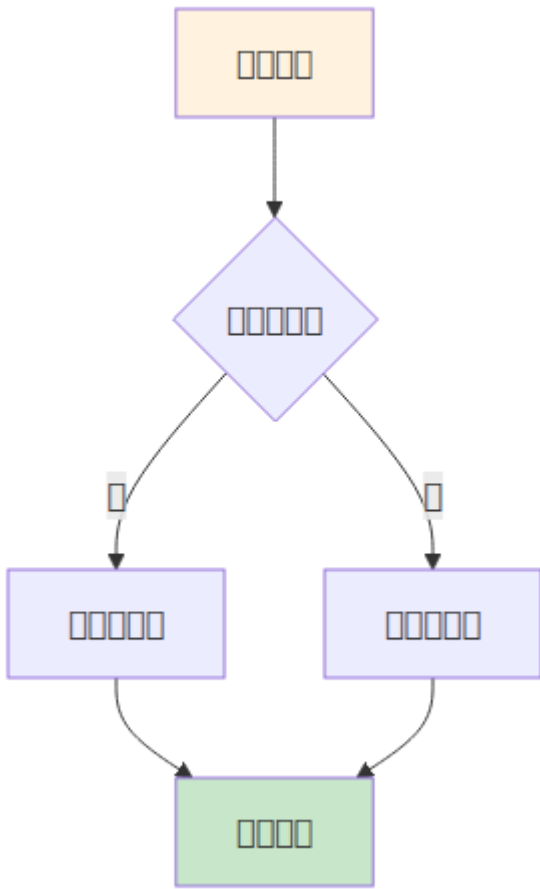
  # タイムアウト
  timeout: 15_000,
  connect_timeout: 15_000,

  # 接続エラー時の挙動
  show_sensitive_data_on_connection_error: false
```

## 設定値

| 項目        | 説明              | 値           | 備考                 |
|-----------|-----------------|-------------|--------------------|
| username  | SQL データベースユーザ名  | "root"      | データベースユーザ名         |
| password  | SQL データベースパスワード | "password"  | データベースパスワード        |
| hostname  | SQL データベースホスト名  | "localhost" | データベース FQDN または IP |
| database  | データベース名         | "omnihss"   | データベース名            |
| pool_size | 接続プールサイズ        | 20          | 推奨値は10-50程度        |

□□□□□



□□□□□

- □ 20 □□□□□
- □□“□□□□□”□□
- □□□□□□□□□□□□□□□□ 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"),

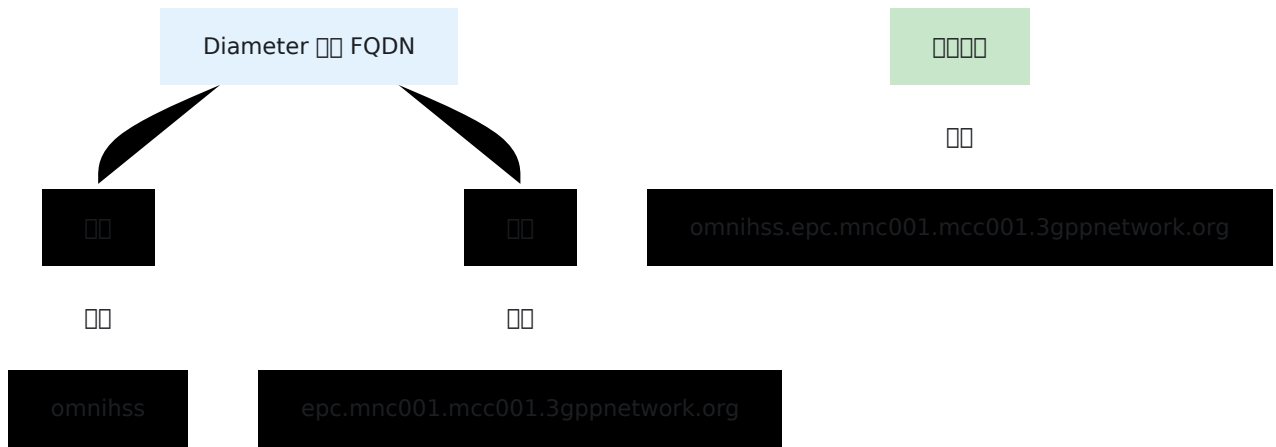
  # ☐☐☐☐
  product_name: "OmniHSS",
  vendor_id: 10415, # 3GPP
  supported_vendor_ids: [5535, 10415],

  # ☐☐☐☐
  request_timeout: 5000,

  # ☐☐☐☐☐
  peers: [
    # ☐☐☐☐☐☐☐☐☐☐
  ]
}

config :hss, :diameter, diameter_config
```

# Diameter FQDN



FQDN

- HSS FQDN "omnihss" "hss01"
- PLMN FQDN "epc.mnc001.mcc001.3gppnetwork.org"
- FQDN format: {host}.{realm}

## FQDN Diameter FQDN

FQDN FQDN

```

# config/runtime.exs

peers: [
  # MME
  %{
    host: "mme01.epc.mnc001.mcc001.3gppnetwork.org",
    realm: "epc.mnc001.mcc001.3gppnetwork.org",
    ip: "10.7.25.100",
    port: 3868,
    transport: :sctp, # :tcp
    applications: [:s6a]
  },

  # P-GW
  %{
    host: "pgw01.epc.mnc001.mcc001.3gppnetwork.org",
    realm: "epc.mnc001.mcc001.3gppnetwork.org",
    ip: "10.7.25.101",
    port: 3868,
    transport: :sctp,
    applications: [:gx]
  },

  # I-CSCF
  %{
    host: "icscf01.ims.mnc001.mcc001.3gppnetwork.org",
    realm: "ims.mnc001.mcc001.3gppnetwork.org",
    ip: "10.7.25.102",
    port: 3868,
    transport: :tcp,
    applications: [:cx]
  }
]

```

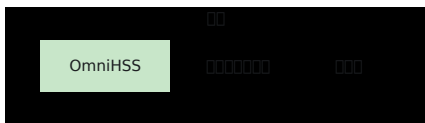
□□□□

□□□□□□◆◆□□□ HSS □□□□

```
# config/runtime.exs

diameter_config = %{
  # ...
  peers: [] # -
}
```

## Diameter



### 

| <b>SCTP</b> |  |  | Diameter |
|-------------|--|--|----------|
| <b>TCP</b>  |  |  | SCTP     |

### 

## PLMN

PLMN

```
# config/runtime.exs

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

## HSS 配置

配置 HSS 数据库

```
# config/runtime.exs

config :hss,
  # 数据库 Ecto 配置
  ecto_repos: [Hss.Repo],

  # MME 配置 CLR 数据库
  send_clr_on_mme_change: true,

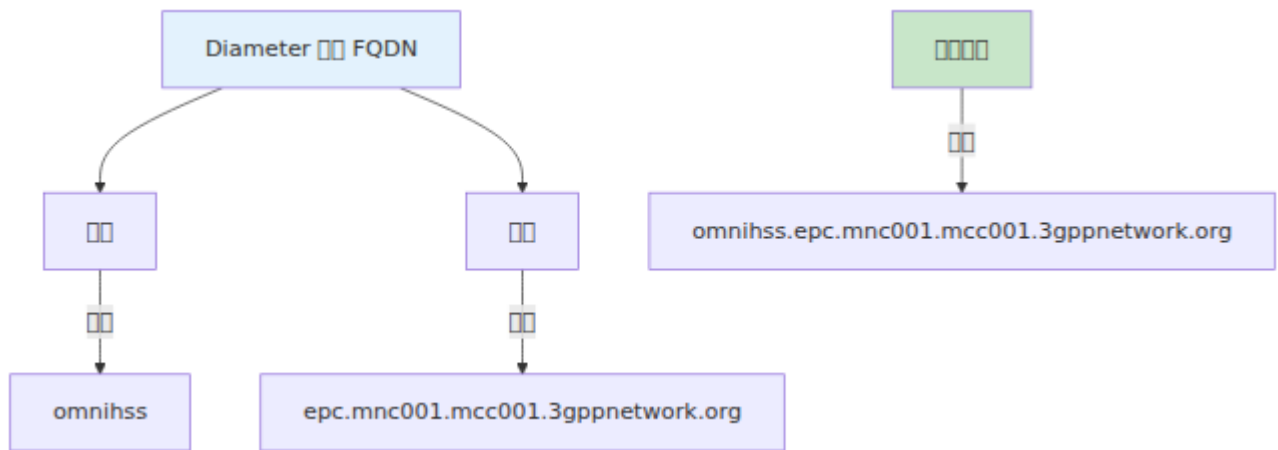
  # 数据库 Diameter 配置
  stop_diameter_on_database_failure: true,

  # 许可证配置
  license_enforced: true,
  license_module: LicenseClient
```

## HSS 配置

| 名前                                | 説明                                  | デフォルト値        | 単位  |
|-----------------------------------|-------------------------------------|---------------|---|
| ecto_repos                        | データベースリポジトリ<br>Ecto リポジトリ           | [Hss.Repo]    | 文字列<br>文字列<br>文字列<br>文字列                      |
| send_clr_on_mme_change            | MME 状態変更<br>通知                      | true          | 文字列<br>文字列<br>文字列<br>文字列<br>文字列<br>文字列<br>文字列 |
| stop_diameter_on_database_failure | データベースエラー発生時<br>Diameter サーバを<br>停止 | true          | 文字列<br>文字列<br>文字列<br>文字列<br>文字列               |
| license_enforced                  | ライセンス強制                             | true          | 文字列<br>文字列<br>文字列                             |
| license_module                    | ライセンスクライアント<br>モジュール                | LicenseClient | 文字列<br>文字列                                    |

# PLMN



- AT&T MCC=310 MNC=410
- Verizon MCC=311 MNC=480
- Vodafone MCC=234 MNC=15
- MCC=001 MNC=01

□□□□□□

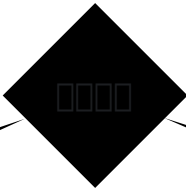
```
# config/runtime.exs

# 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
  ]
```

□□□□□□



0.0.0.0  
(□□□□)

□□ IP  
(□□□192.168.1.10)

127.0.0.1  
(□□□□)



# IMS

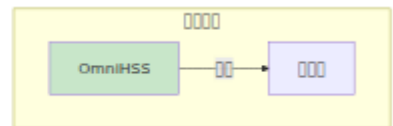
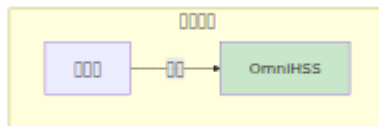
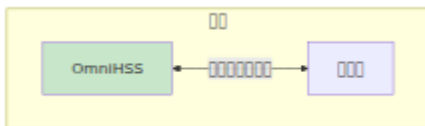
## S-CSCF

```
# 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



S-CSCF

| Peer         | Service | Mode        |
|--------------|---------|-------------|
| :random_peer | S-CSCF  | Random      |
| :round_robin | S-CSCF  | Round Robin |

## IMS

IMS EPC

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

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

## EIR

EIR

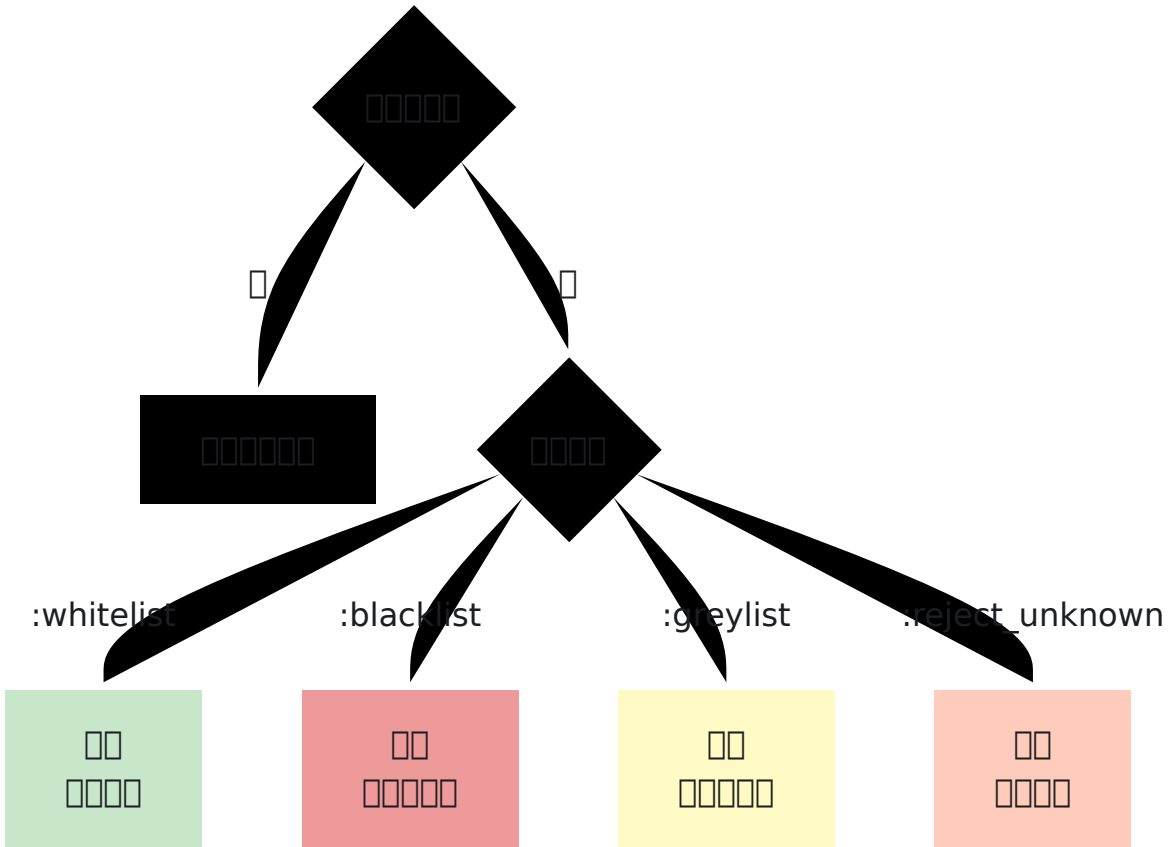
EIR

```
# config/runtime.exs

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

□□□□□□

IMEI □□□□



□□□□□

| □□                        | □□            | □□       |
|---------------------------|---------------|----------|
| :whitelist                | □□□□□□ IMEI   | □□□□□□□□ |
| :blacklist                | □□□□□□ IMEI   | □□□□□□   |
| :greylist                 | □□□□□□□□ IMEI | □□□□□□   |
| :reject_unknown_equipment | □□□□□□□□□□    | □□□□□□   |

□□□ □□□□□□ :whitelist □□□□□□□□□□ :greylist□□□□ :blacklist □□□□□□□□□□

# API 〇〇〇〇〇〇〇〇

## API 〇〇〇〇

```
# config/config.exs

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

# HTTPS 〇〇
https: [
  port: 8443,
  cipher_suite: :strong,
  certfile: "priv/cert/omnitouch.crt",
  keyfile: "priv/cert/omnitouch.pem"
]
```

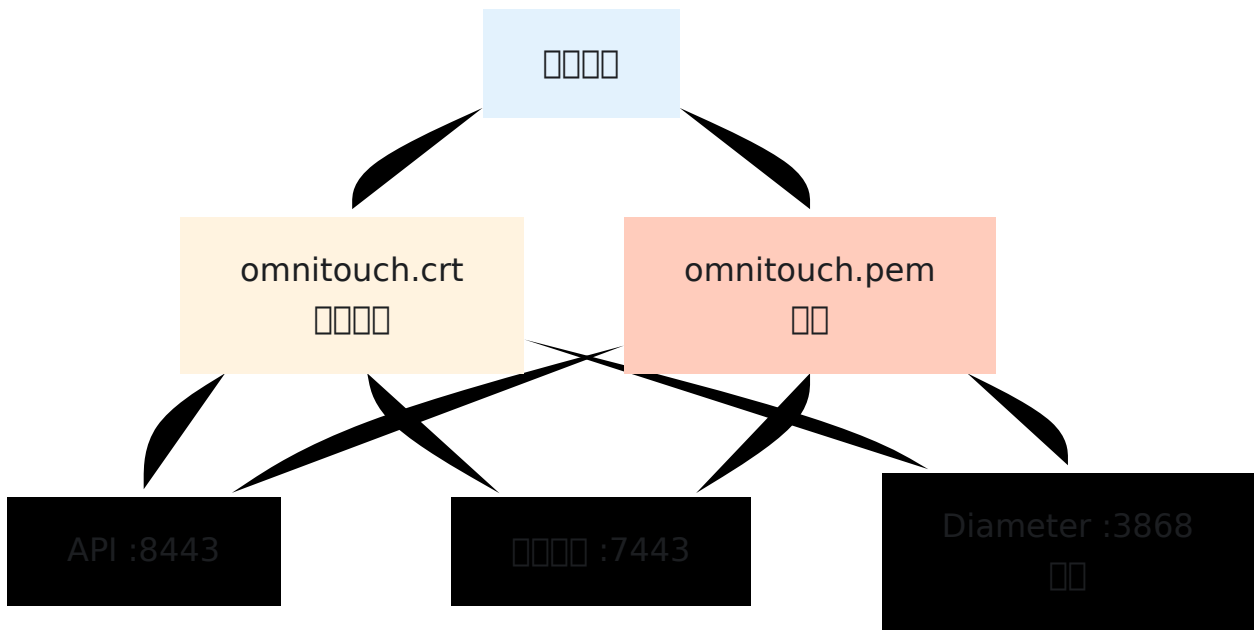
## 〇〇〇〇〇〇〇

```
# 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 〇〇
https: [
  port: 7443,
  cipher_suite: :strong,
  certfile: "priv/cert/omnitouch.crt",
  keyfile: "priv/cert/omnitouch.pem"
]
```

# TLS 証明書



## 証明書

- 証明書 X.509 形式
- 証明書
- 証明書
- CN と SAN 証明書

## 証明書

```
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")  
]
```



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. 数据库

数据库系统概论  
数据库 SQL 语言

---



```
# config/runtime.exs - 配置数据库

import Config

#
=====
# 数据库配置
#
=====
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", "10")),
  timeout: 15_000,
  connect_timeout: 15_000,
  ssl: true,
  ssl_opts: [
    cacertfile: "/etc/ssl/certs/mysql-ca.pem",
    verify: :verify_peer
  ]

#
=====
# 许可证配置
#
=====
config :license_client,
  license_server_api_urls: [System.get_env("LICENSE_SERVER_URL",
"https://license.example.com:8443/api")],
  licensee: System.get_env("LICENSE_ORGANIZATION", "HSS"),
  product_name: "omnihss"

#
=====
# 许可证 PLMN 和 HSS 配置
#
=====
```

```

config :hss,
  ecto_repos: [Hss.Repo],
  home_plmn: %{
    mcc: System.get_env("HOME_PLMN_MCC", "001"),
    mnc: System.get_env("HOME_PLMN_MNC", "001")
  },
  send_clr_on_mme_change: true,
  stop_diameter_on_database_failure: true,
  license_enforced: true,
  license_module: LicenseClient

#
=====
# 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"),
    keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss"),
  ],
  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"),
  keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss"),
],
url: [host: System.get_env("CP_HOST", "hss.omnihss.internal"), port
```

---

← □□□□□□ | □□□□□□□□ →

# OmniHSS 開箱說明書

← 目錄

## 目錄

- 歡迎
- 安裝
- 配置
- Diameter 設定
- 測試
- 故障排除
- 更新

## 歡迎

OmniHSS 是一個基於 Linux 的 HSS 解決方案，支持 Diameter 和 Phoenix LiveView 協議。

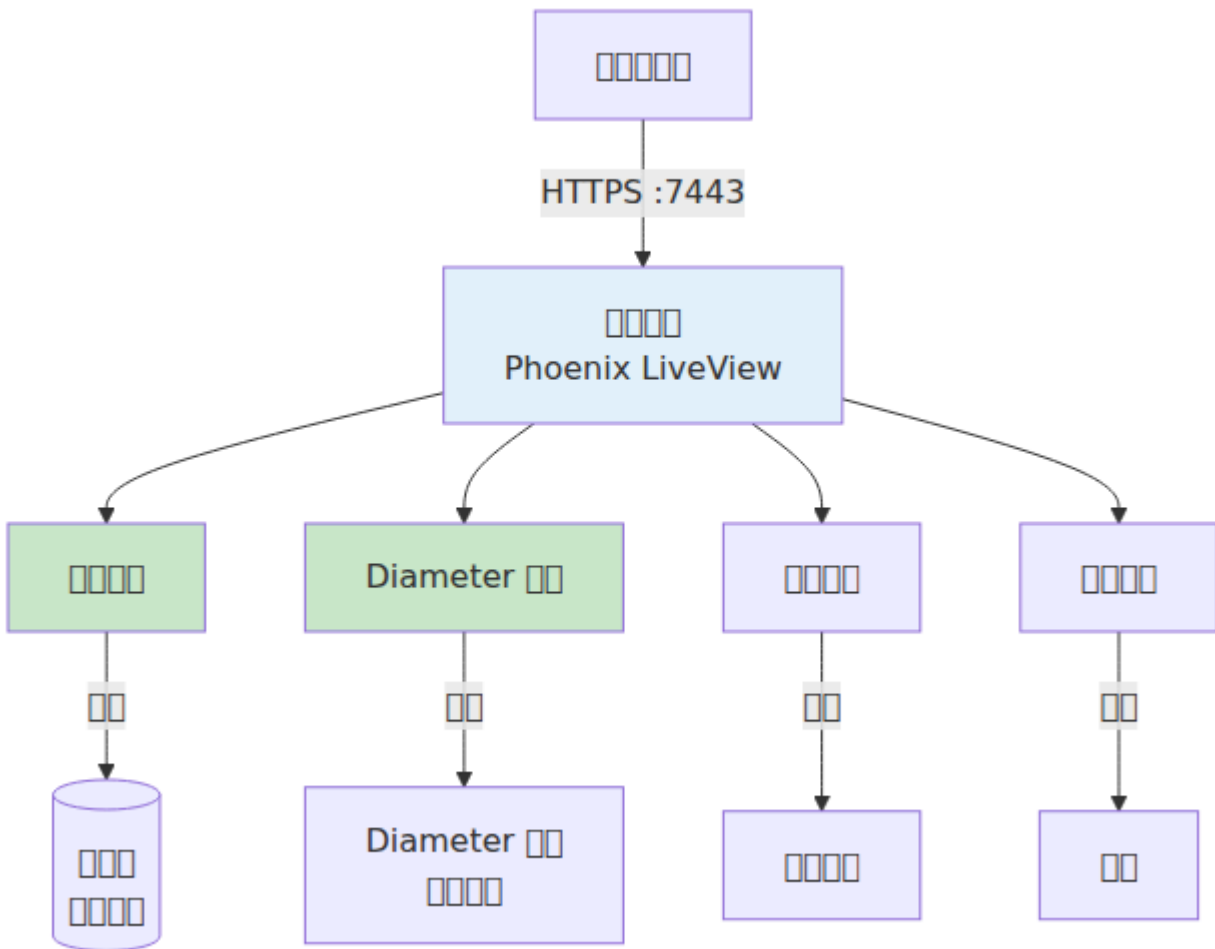
## 安裝

- 系統要求 - 最低配置
- 安裝 - 使用包管理器
- **Diameter 設定** - 配置文件
- 測試 - 驗證安裝
- 服務 - 啟動和停止

□□□□

URL: https://[hostname]:7443  
Protocol: □□ HTTPS  
Port: 7443□□□□□□  
Certificate: □ config/config.exs □□□

□□□□□□



□□□□□□□□

□□□□

1. □□□□□□□□

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

## TLS 証明書

証明書

証明書

証明書

- **7443** 証明書
- **HTTPS** 証明書 - HTTP
- 証明書 7443

証明書

証明書 LiveView, WebSockets

- Chrome/Chromium
- Firefox
- Safari
- Edge

証明書 Internet Explorer

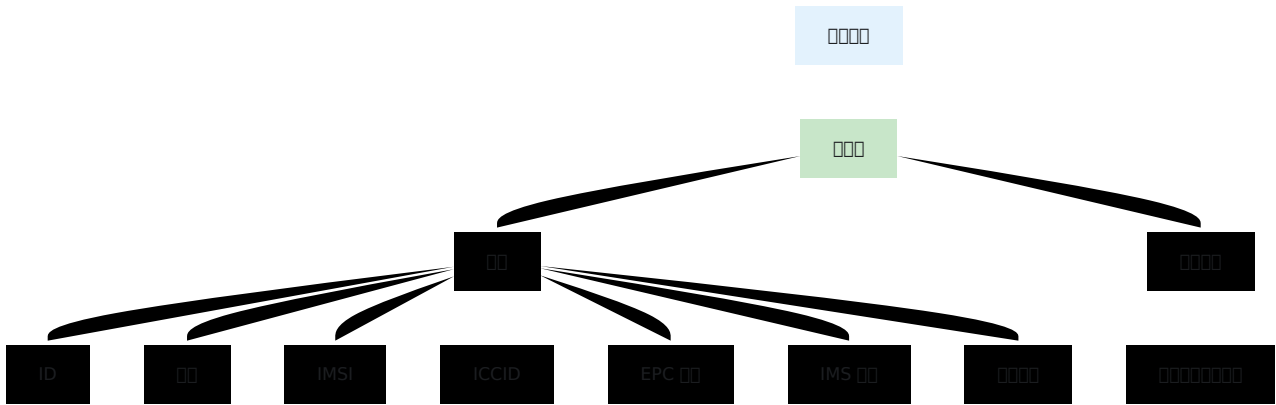
---

証明書

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

証明書

□□□□



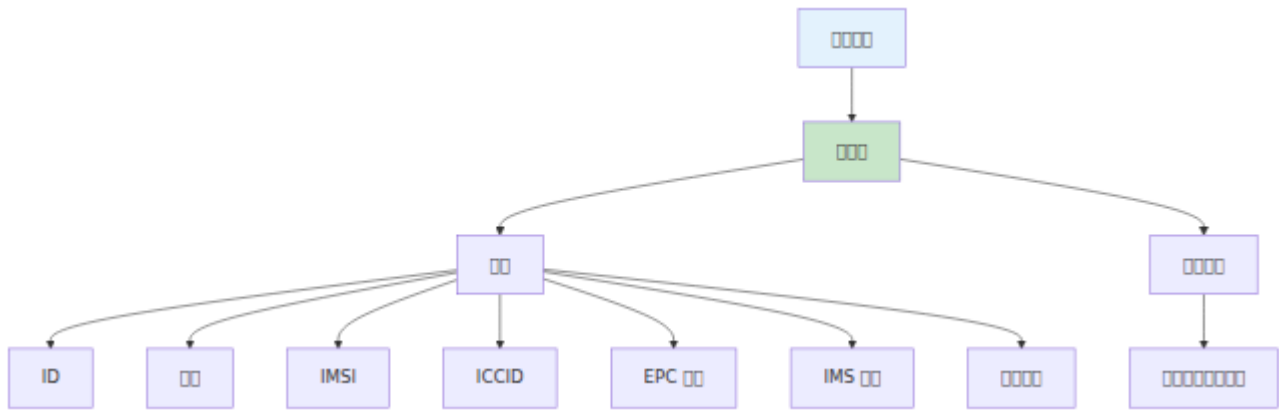
□□

| □             | □□       | □                |
|---------------|----------|------------------|
| <b>ID</b>     | □□□□□ ID | □□               |
| □□            | □□□□     | ✓□□□□/ X□□□□     |
| <b>IMSI</b>   | □□□□□□□□ | 14-15 □□□        |
| <b>ICCID</b>  | SIM □ ID | 19-20 □□□□ "N/A" |
| <b>EPC □□</b> | □□□□□□□□ | □□□□□ ID         |
| <b>IMS □□</b> | □□□□□□□□ | □□□□□ID □ "N/A"  |
| □□□□          | □□□□□□   | □□□□□ID □ "N/A"  |

□□□□□□□□

□□□□□□□□□□□□□□□□□□

□□□□



IMSI

- **MCC** - 3 digit
- **MNC** - 2-3 digit
- **TAC** - 3 digit
- **ID** - 5 digit
- **eNodeB ID** - 5 digit
- **ECI** - E-UTRAN 5 digit

IMSI

IMSI

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

IMS ID

IMS ID

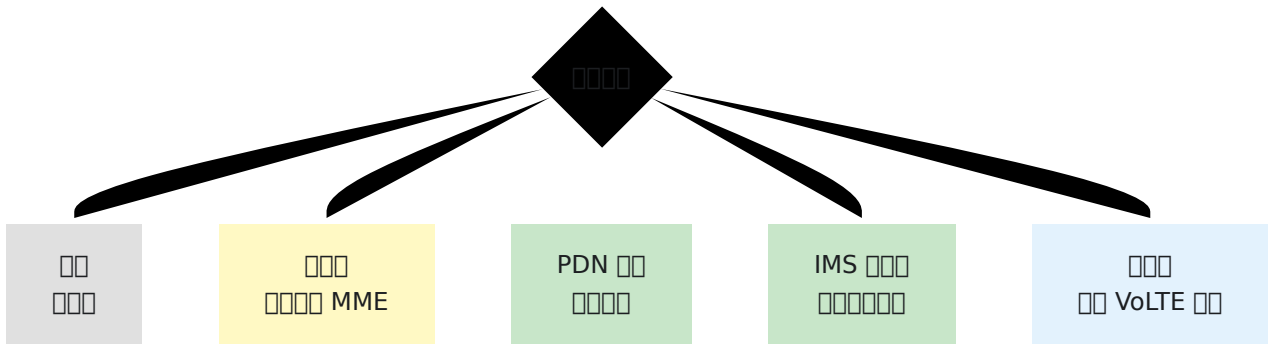
- **S-CSCF** - S-CSCF SIP URI
- **IMS ID** - SIP URI <sip:+14155551234@ims.example.com>
- **P-CSCF** - HSS ID P-CSCF
- **I-CSCF** - HSS ID I-CSCF

IMS ID

□□□

- **PDN** □□ - □□□□□□□□□□
- □□□□ - □□ VoLTE □□□□□□

□□□□□□



□□□□□□□□

- □□□ □□□□□□□□□□□□ MME
- □□□□ □□□□□ MME □□□□□□□□□□
- **PDN** □□□□ PDN □□□□  $> 0$
- **IMS** □□□□ □□□□ S-CSCF □□
- □□□□ □□□□□□□  $> 0$

□□□□□□

□□□□□□ **1** □ □□□□□□□□□□□□□□□□□

□□□□□□

- □□□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□
- □□□□□□□□

□□□□□□

1. □□□□□□
  - □□□□□□□□□□

- 网络架构
- IMS 网络

## 2. 网络

- 网络架构
- 网络架构
- 网络架构
- 网络架构

## 3. 网络

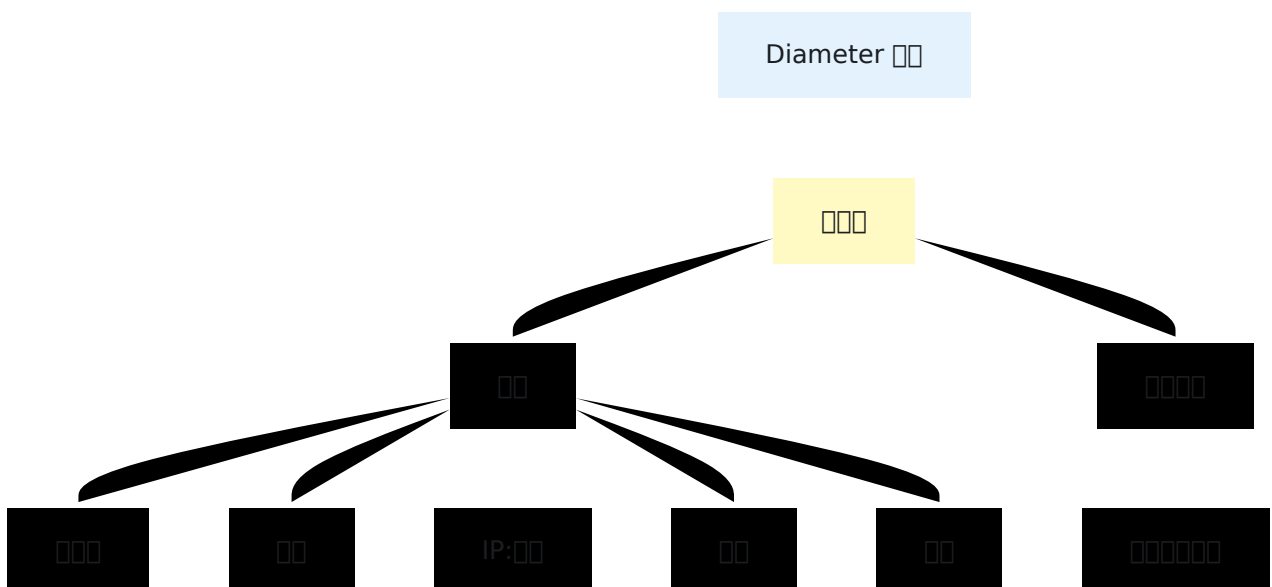
- 网络架构
- PDN 网络
- VoLTE 网络

# Diameter 网络

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

Diameter 网络 Diameter 网络

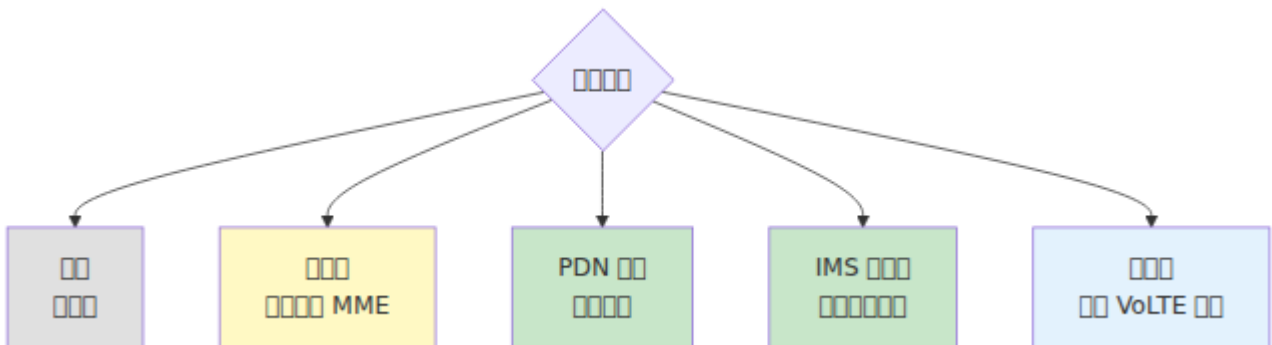
网络



□□

| □            | □□             | □          |
|--------------|----------------|------------|
| □□□          | Diameter □□□□□ | FQDN       |
| □□           | Diameter □□    | □□         |
| <b>IP:□□</b> | □□□□           | IP □□□□□   |
| □□           | □□□□           | TCP □ SCTP |
| □□           | □□□□           | □□□ / □□□  |

□□□□



□□□□□□□□□□

□□□□□□□□□□□□□□□□

□□□□□

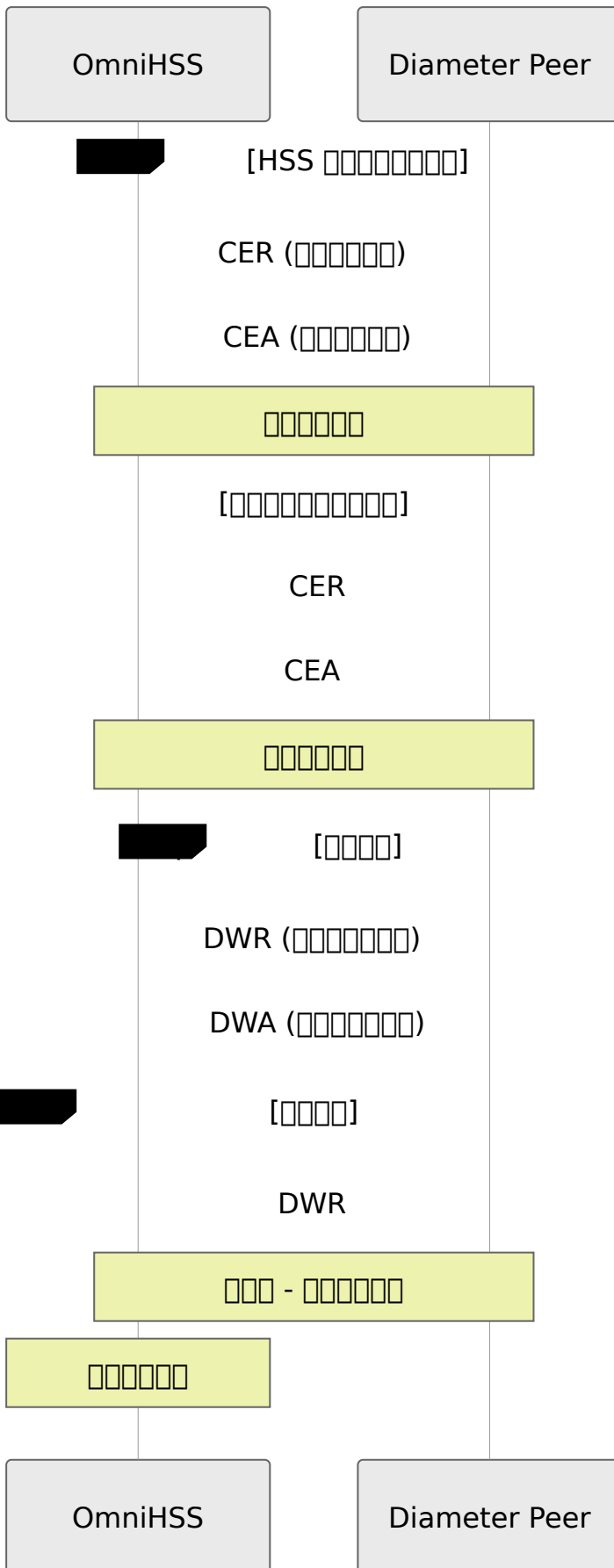
- □□□□ - □ HSS □□□□□□
- □□□□ - □□□□□□□□□□
- □□ **ID** - □□□□ Diameter □□

□□ **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. □□□□

- □□□□□□□□
- □□□□□□□□ TCP □ SCTP□
- □□□□ ID □□□□□□
- □□□□□□□□□□□

3. □□□□

- □□□□□□□□□
- □□□□□□□
- □□□□□□□□□

□□□□

□□□□□□□

□□□□□

1. □□□□□□

2. □□□□□□□□□□□

3. □□□□□□□

4. Diameter □□□□□

5. □□□□□□□□□ TLS□

□□□□□□□

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

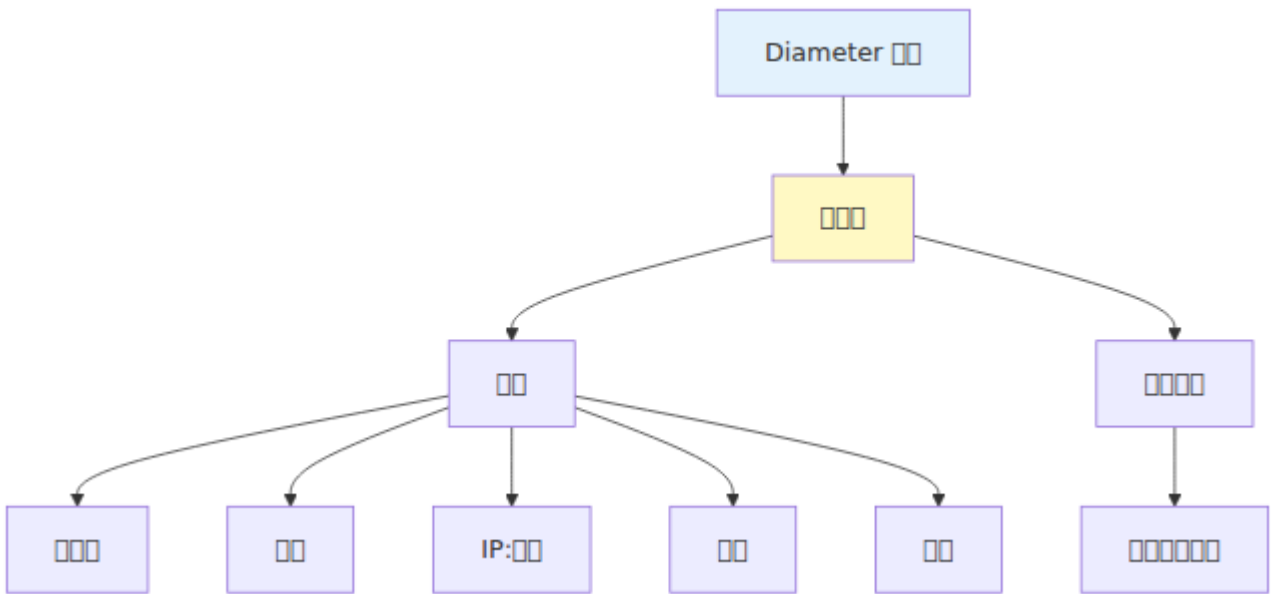
- 1.
- 2.
- 3.
4. Diameter

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

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

- Erlang VM
- 
- OmniHSS
- **Erlang VM**

□□□□



□□□□

1. □□□□

- □□□□□□□□
- □□□□□□□□□□□□□□
- □□□□□□□□

2. □□□□

- □□□□□□□□
- □□□□□□□□□□
- □□□□□□□□□□

3. □□□□

- □□□□□□□
  - □□□□□□□□
  - □□ Erlang VM □□
-

□□□□

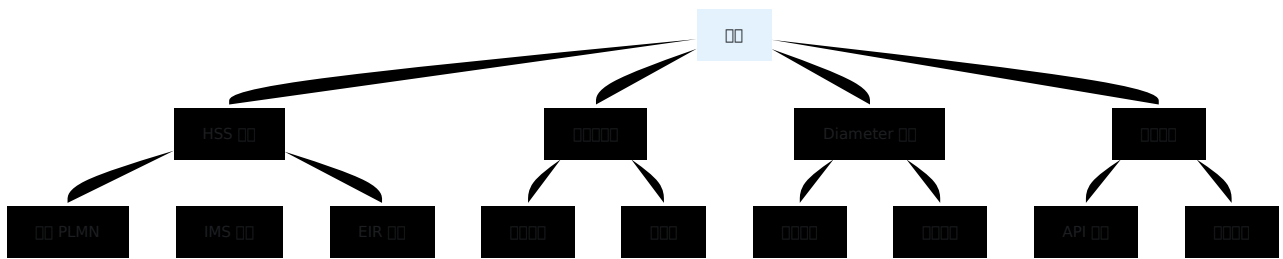
**URL:** `https://[hostname]:7443/configuration`

□□□□□ OmniHSS □□□□□□□□□□

□□

- □□□□ - □□□□□□□□□□
- □□□□ - □□□□□□□□
- □□□□ - □□□□□□□□

□□□□□



□□□□□

### 1. □□□□

- □□ runtime.exs □□□□□□□□
- □□□□□□□□□□
- □□ Diameter □□□□

### 2. □□□□

- □□□□□□□
- □□□□□□□□□□□□□□
- □□□□□□□□□□

### 3. □□

- □□□□□□□□□□□□□□

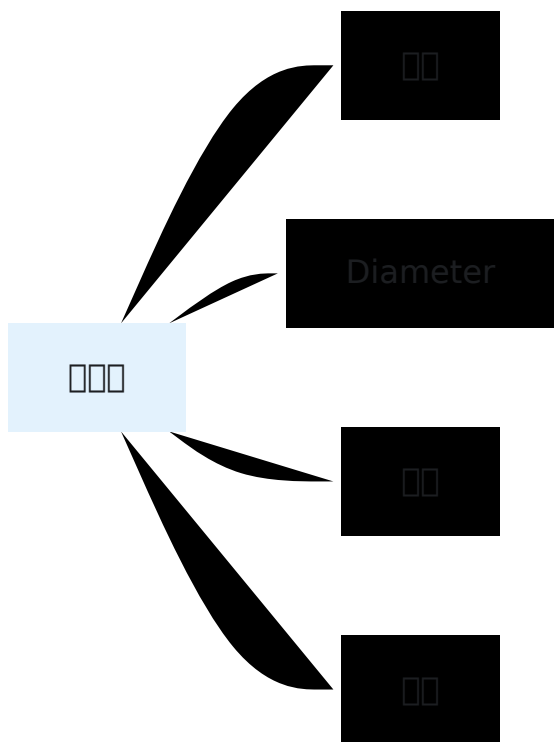
- [Placeholder]

[Placeholder]

---

[Placeholder]

[Placeholder]



[Placeholder]

[Placeholder]

[Placeholder]

- **Ctrl+R / F5** - [Placeholder]
- **Ctrl+F** - [Placeholder]
- **Ctrl+T** - [Placeholder]

## □□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□

- □□ 1□□□□□□□□□□□□□□□□
- □□ 2□Diameter □□□□□□□□□□
- □□ 3□□□□□□□□□□□□□□

□□□□□□□□□□□□

## □□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□ 1920x1080 □□□□□□□□□□□□

## □□□□□□□

□□□□□

### 1. □□□□□

- □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□
- □□ Diameter □□ - □□□□□□□□□□

### 2. □□□□□

- □□□□□□□□□□□□□□□□
- □□□□□□□□□□
- □□ Diameter □□□□□□□□□□

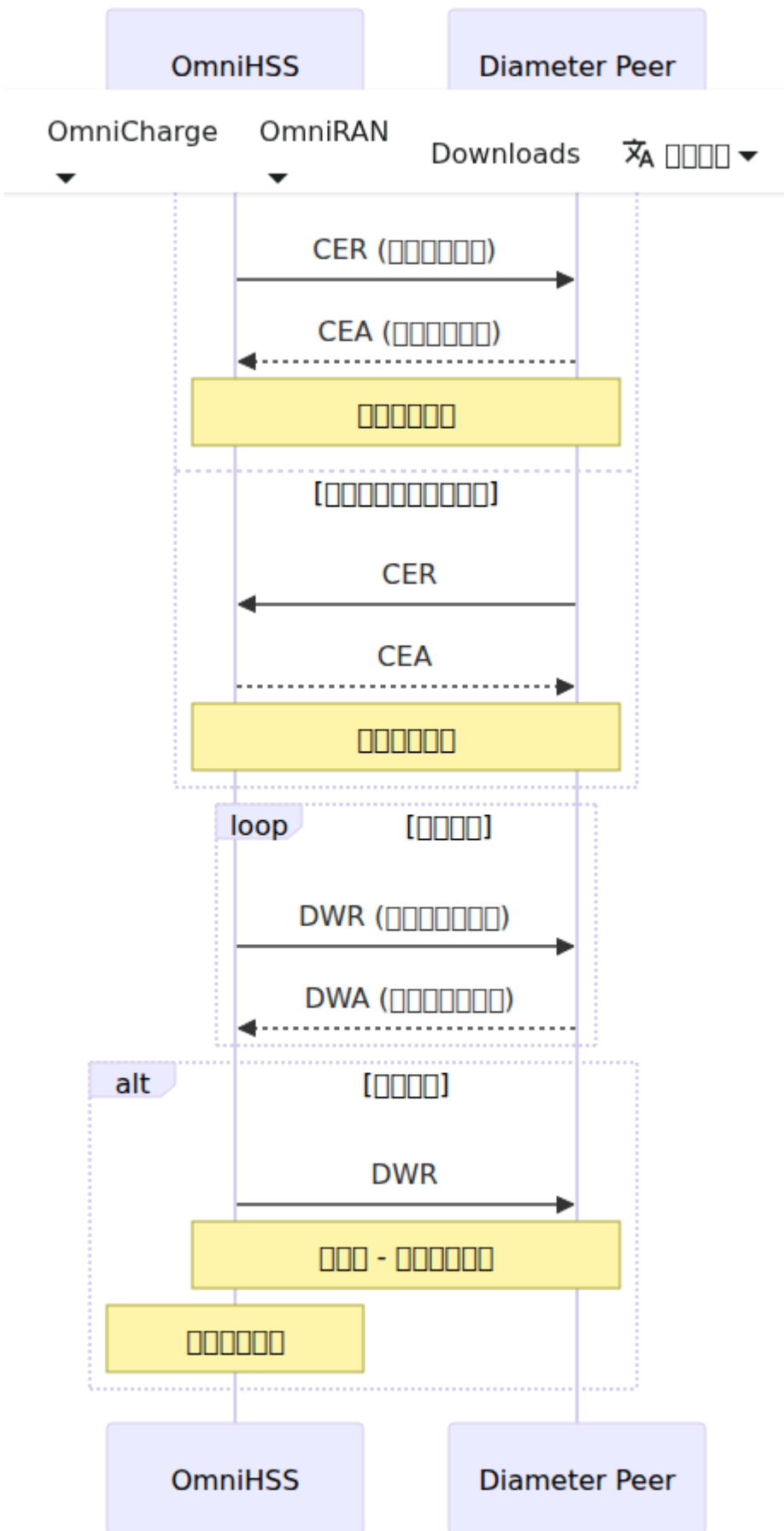
### 3. □□□□□

- □□□□□□□□□□

- □□□□□□□□□□□□

- □□□□□□

□□□□□□□□



# □□□□

□□□□□□□□□□□□□□

| □□               | □□        | □□        |
|------------------|-----------|-----------|
| □□□□ Diameter □□ | 1 □□      | 2+ □□□□□□ |
| □□□□             | > 80%     | > 90%     |
| □□□□□□           | > 5%      | > 10%     |
| □□□□             | > 80% □□□ | > 95% □□□ |

---

← □□□□□□ | □□□□□□□□□□ →

# EIR 简介

## 背景

HSS 存储 EIR 数据，EIR 存储 IMEI 数据

## 需求

- **S13** 通过 Diameter 接口
- **IMEI** 查询 IMEI/IMEISV 数据
- 支持 IMEI/IMEISV 及 IMSI 查询
- 支持 ...
- 支持 ...
- **REST API** 提供 CRUD 接口 EIR 数据

## 配置

### Diameter 配置

| 名称         | 名称 ID      | 接口       | 地址  |
|------------|------------|----------|-----|
| <b>S13</b> | 16,777,252 | MME/SGSN | ... |

## 部署

EIR 部署

| EIR_RULE  |             |    |
|-----------|-------------|----|
| int       | id          | PK |
| string    | action      |    |
| string    | regex       |    |
| timestamp | inserted_at |    |
| timestamp | updated_at  |    |

□□□□

- whitelist - □□□□
- blacklist - □□□□
- greylist - □□□□

□□□□□□□□ IMEI□IMEISV □ IMSI □□

□□□□□

| □□  | □□ | □□       | □□□□   |
|-----|----|----------|--------|
| □□□ | 0  | □□□□□    | □□□□□□ |
| □□□ | 1  | □□□□/□□□ | □□□□□□ |
| □□□ | 2  | □□□□□□   | □□□□□  |

## S13 □□

□□□□□

□□□□□□□□ ECR□/□□□□□□□□ ECA□

□□ MME/SGSN → HSS□EIR□

MMME

### AVPs

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

### EIR

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

### AVPs

- 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 □□□□

- □□□□□□ IMSI□ "999999876543210"
- □□□□ EIR □□❓❓❓□□□□□□□□
- □□□□□□□□□□□□□□
- □□□□□□□□□□□□□□

□□ **4**□□□□□□□□□□□□□□

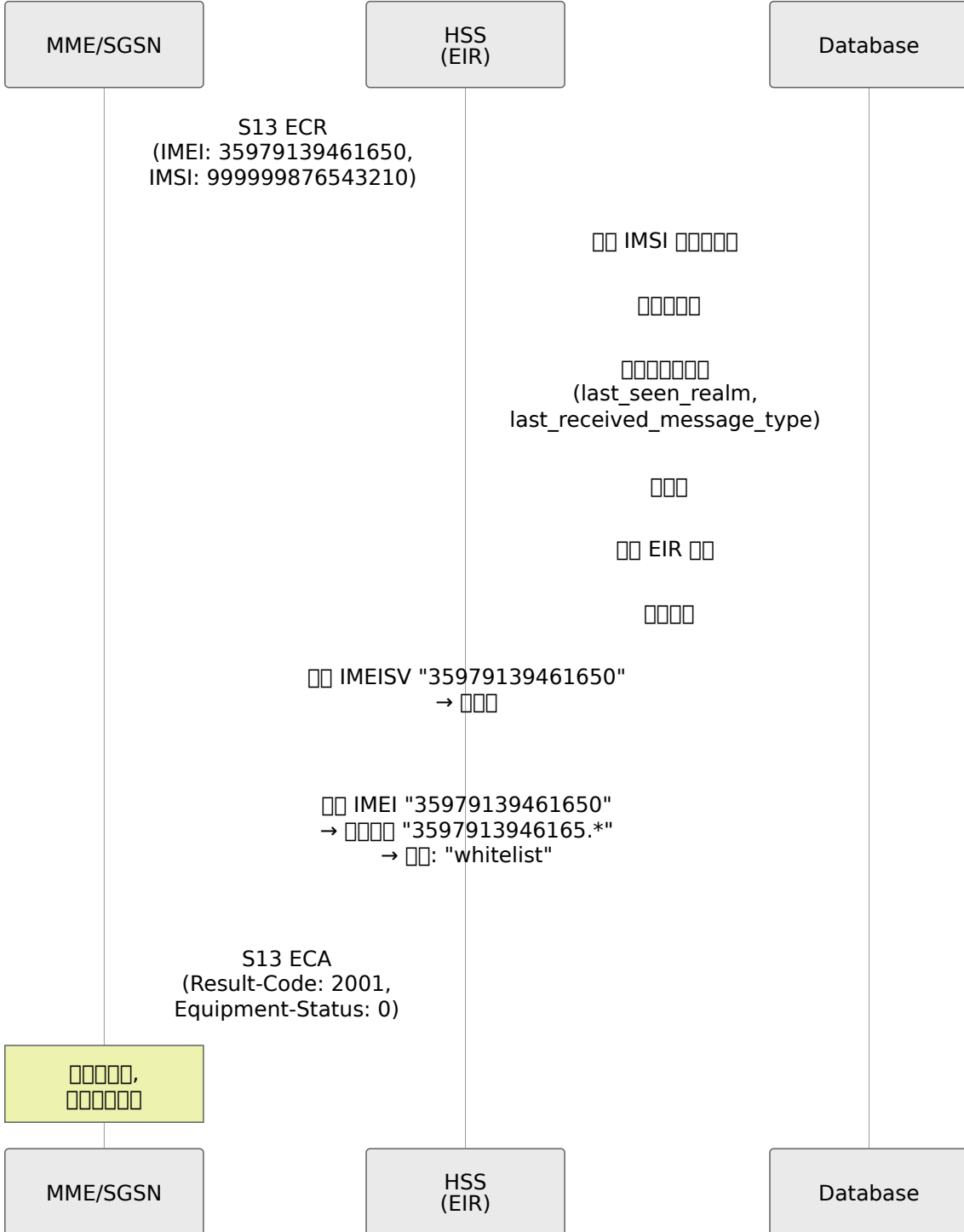
- `eir_unknown_equipment_behaviour`
- `whitelist` - `whitelist`
- `blacklist` - `blacklist`
- `greylist` - `greylist`
- `reject_unknown_equipment` - `reject_unknown_equipment` 5422

`whitelist`

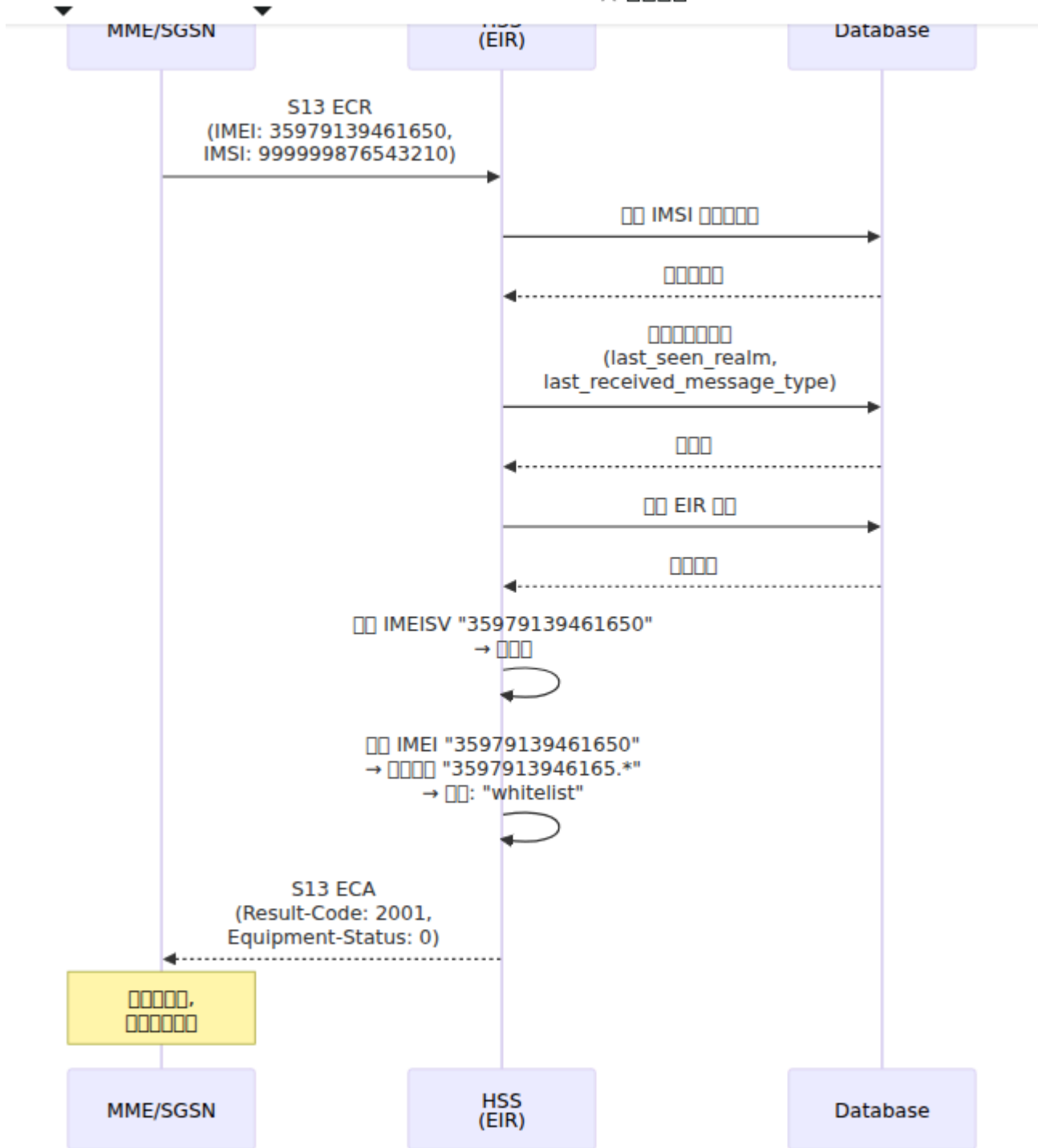
| <code>whitelist</code>          | IMEI    | IMEI SV |
|---------------------------------|---------|---------|
| <code>"35979139461650"</code>   | IMEI    | IMEI SV |
| <code>"3597913946165.*"</code>  | IMEI    | IMEI SV |
| <code>"3597913946161108"</code> | IMEI SV | IMEI SV |
| <code>"999999876543210"</code>  | IMSI    | IMSI    |
| <code>"359791.*"</code>         | TAC     | TAC     |

□□□□□□

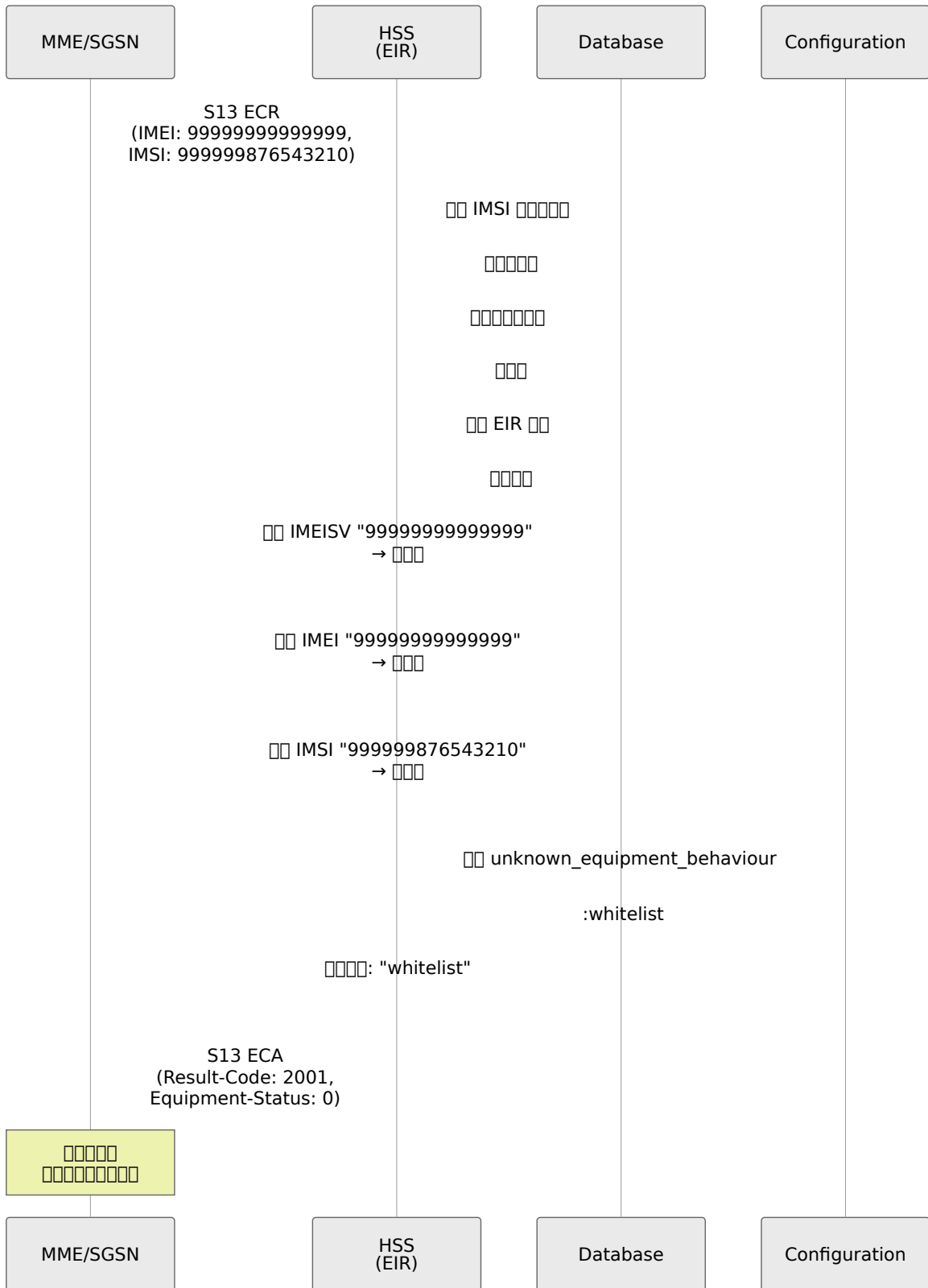
# □□ 1□□□□□ - □□□□□ IMEI



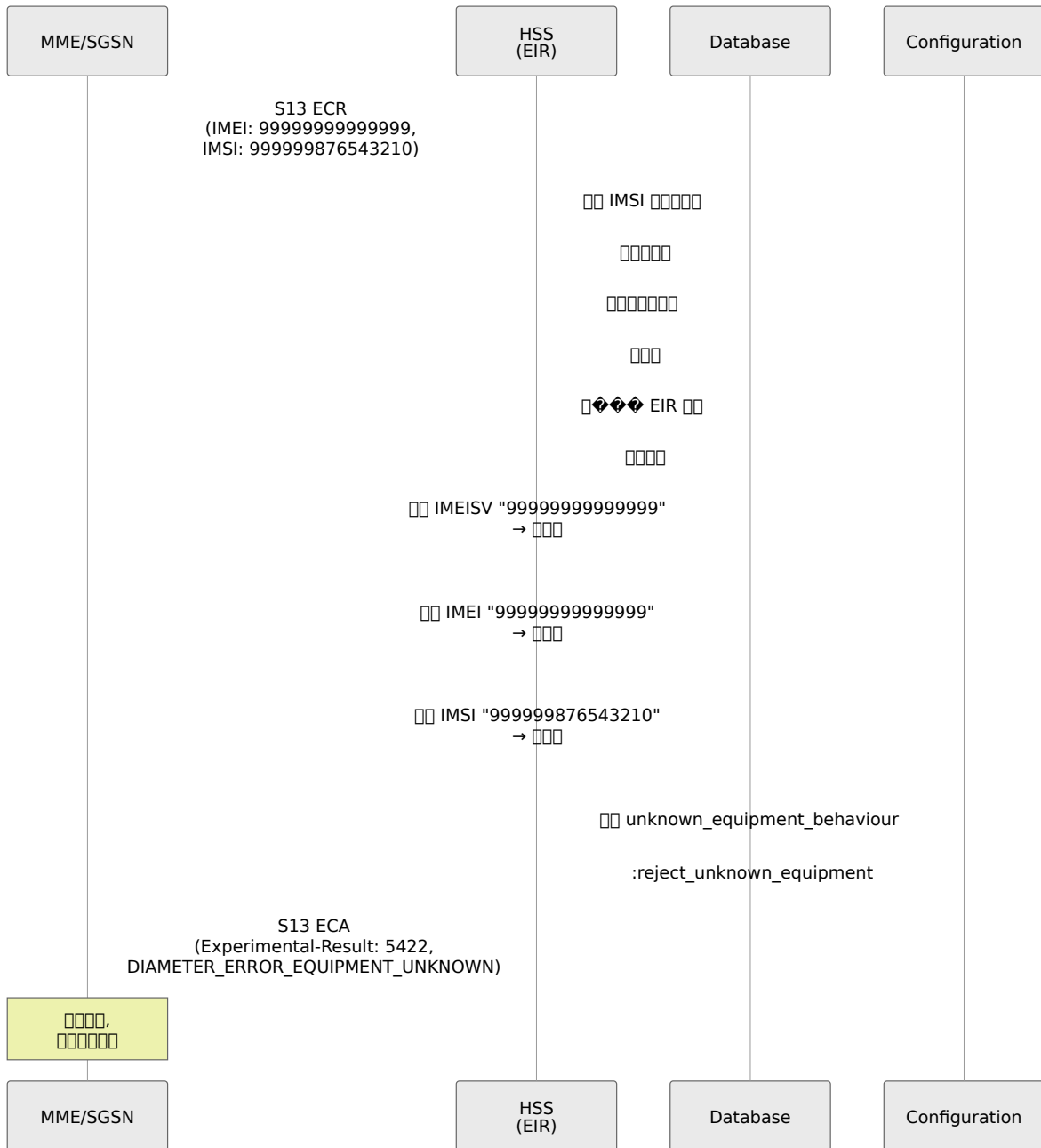
# 2 - IMEI



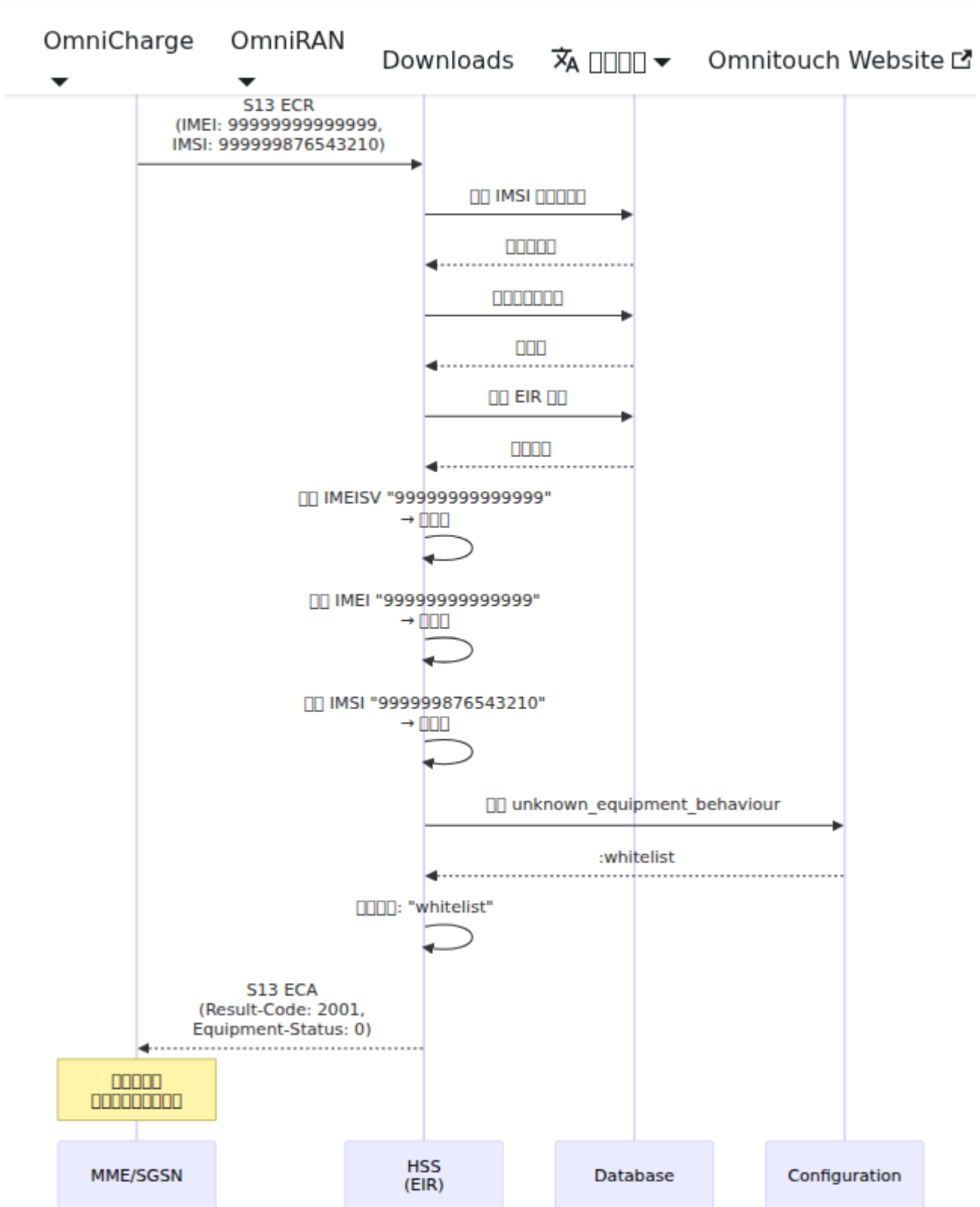
# 3 -



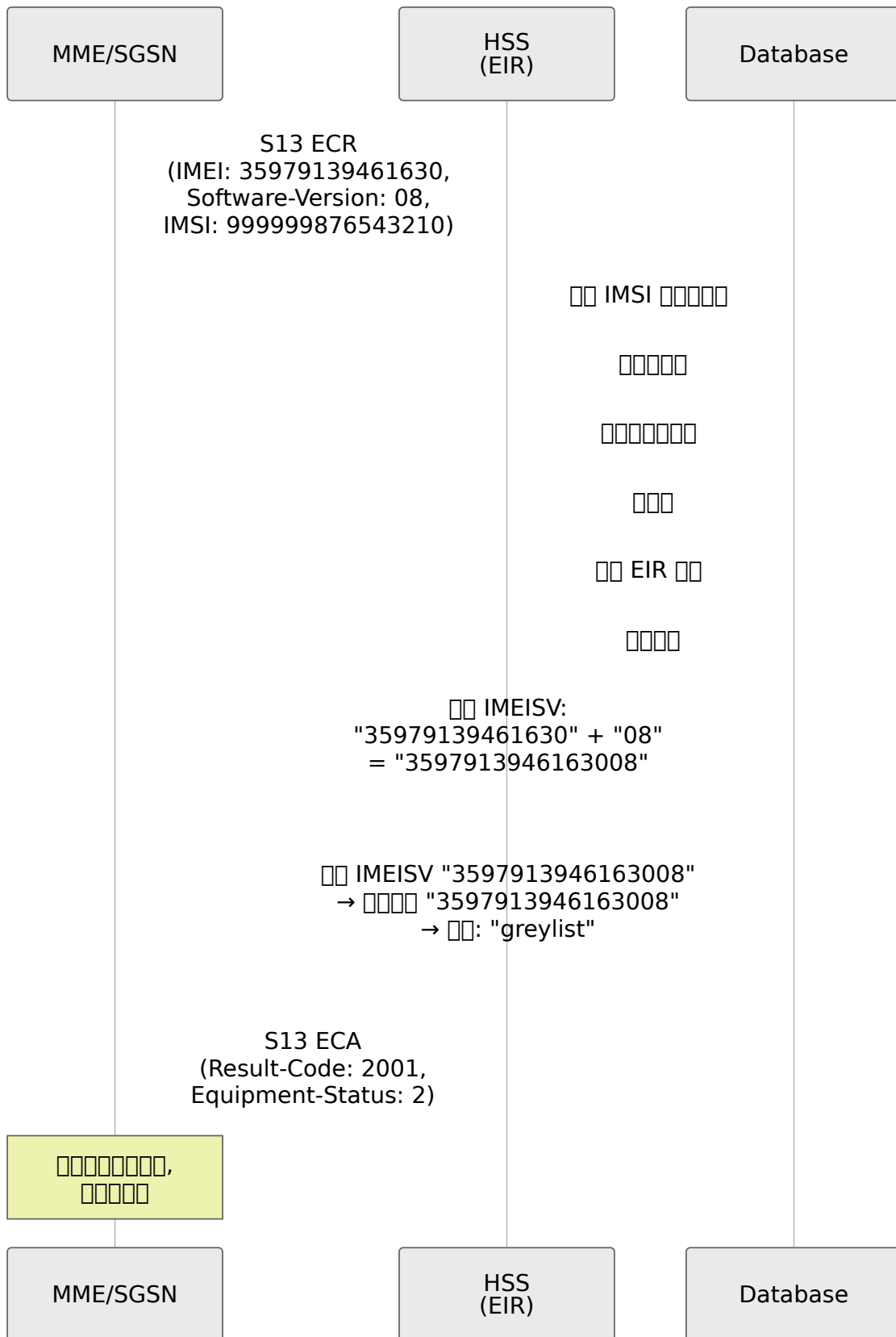
# 4 -



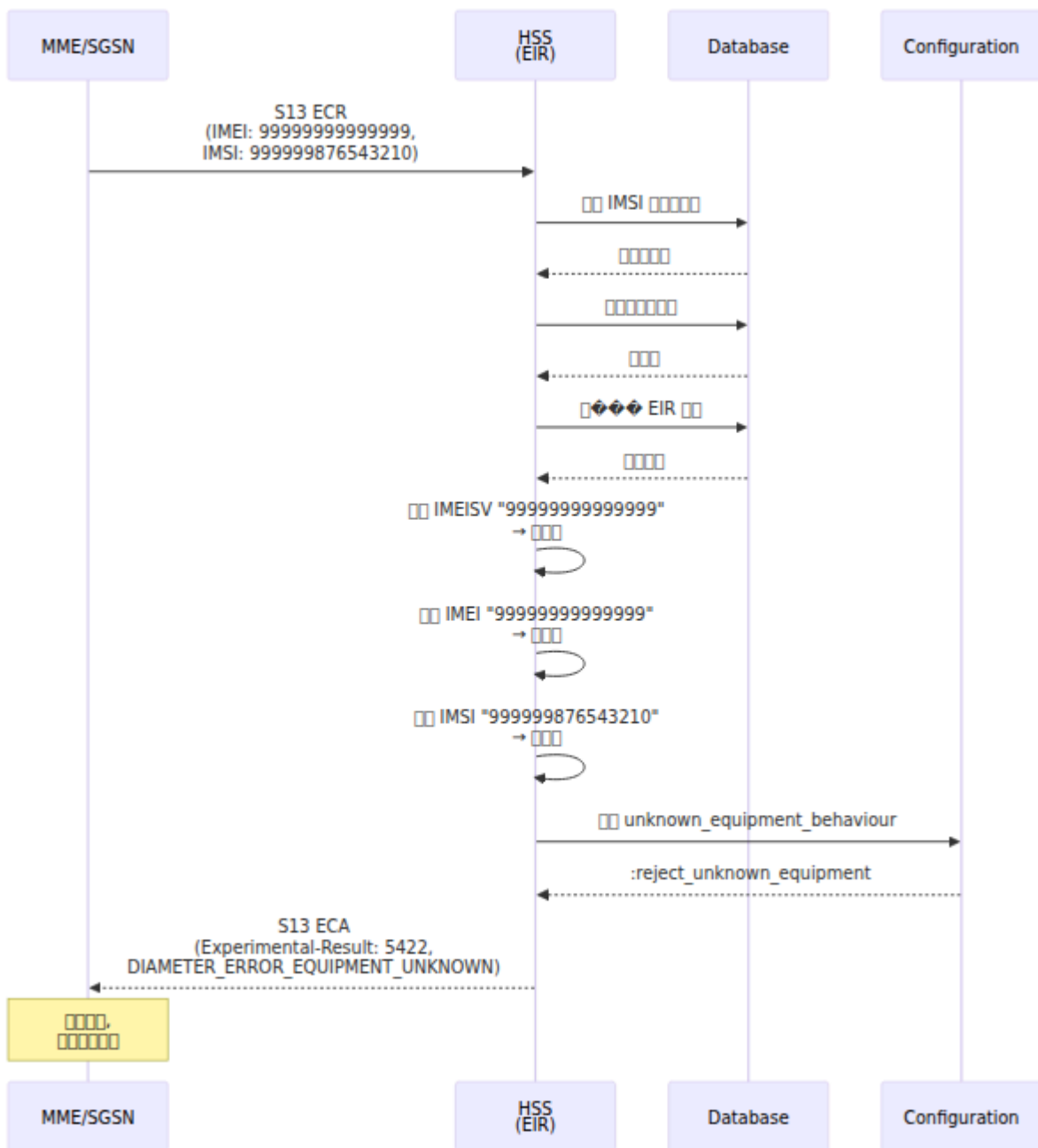
# 5 -



# 6 - IMEISV



# 7 - IMSI



## REST API

### EIR

/api/eir/rule

EIR

□□□

```
GET /api/eir/rule
```

□□□HTTP 200□□

```
{
  "data": [
    {
      "id": 1,
      "action": "whitelist",
      "regex": "3597913946165.*",
      "inserted_at": "2025-01-15T10:30:00Z",
      "updated_at": "2025-01-15T10:30:00Z"
    },
    {
      "id": 2,
      "action": "blacklist",
      "regex": "35979139461640",
      "inserted_at": "2025-01-16T14:20:00Z",
      "updated_at": "2025-01-16T14:20:00Z"
    }
  ]
}
```

□□□□ **EIR** □□

□□□

```
GET /api/eir/rule/{id}
```

□□□HTTP 200□□



```
{
  "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: :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. □□□□□□□

□□□□□□□□□□□□□□□□SIM □□

□□□

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

□□□□□□□□ SIM □□□□□□□□

## 4. 35979139 TAC 05

35979139 TAC 05

05

```
POST /api/eir/rule
{
  "action": "greylist",
  "regex": "35979139.*" # 35979139 TAC 05
}
```

35979139 TAC 05

## 5. IMEI 05

IMEI 05

05

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

IMEI 359791394616 + 05

359791394616

05

EIR 359791394616 + 05

- **S13** 359791394616 - ECR/ECA 05
- 359791394616 - IMEI/IMEISV/IMSI 05

- **EIR** 查詢 - 查詢設備
- **REST API** 查詢 - 查詢設備

## 查詢設備

查詢設備

1. **IMEISV** 查詢設備 IMEI + 查詢
2. **IMEI** 查詢設備 IMEI
3. **IMSI** 查詢設備 IMSI
4. 查詢設備

查詢設備

- `whitelist` - 查詢設備
- `blacklist` - 查詢設備
- `greylist` - 查詢設備
- `reject_unknown_equipment` - 查詢設備

## 查詢設備

### IMEI 查詢

IMEI 查詢設備EIR

- 查詢設備 IMEI
- 查詢設備
- 查詢 API 查詢設備

## 查詢設備

EIR 查詢設備 ID

- ```

查詢 1: 查詢 "359791.*" 查詢 "whitelist" (查詢)
查詢 2: 查詢 "35979139461640" 查詢 "blacklist" (查詢)

```

□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□

□□□□□□□□□□□□□□

- □□□□□□□□□□ S13 ECR □□
- REST API EIR □□□□
- IMEI □□□□□□□□□□□□

□□□□

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

□□□ **IMEI** □□

**IMEI** □□□ **15** □□□□

```

35 9791 394616 1
| |   |           \ □□□□Luhn □□□
| |   |   \       \ □□□□6 □□□□
| |   \ FAC□□□□□□□□4 □□□□
\ TAC□□□□□□□□□□ 8 □□□□□□□ RBI□
  |   \ RBI□□□□□□□□□□2 □□□□
  \   □□□□/□□□□6 □□□□

```

# IMEISV 16

35 9791 394616 1 08

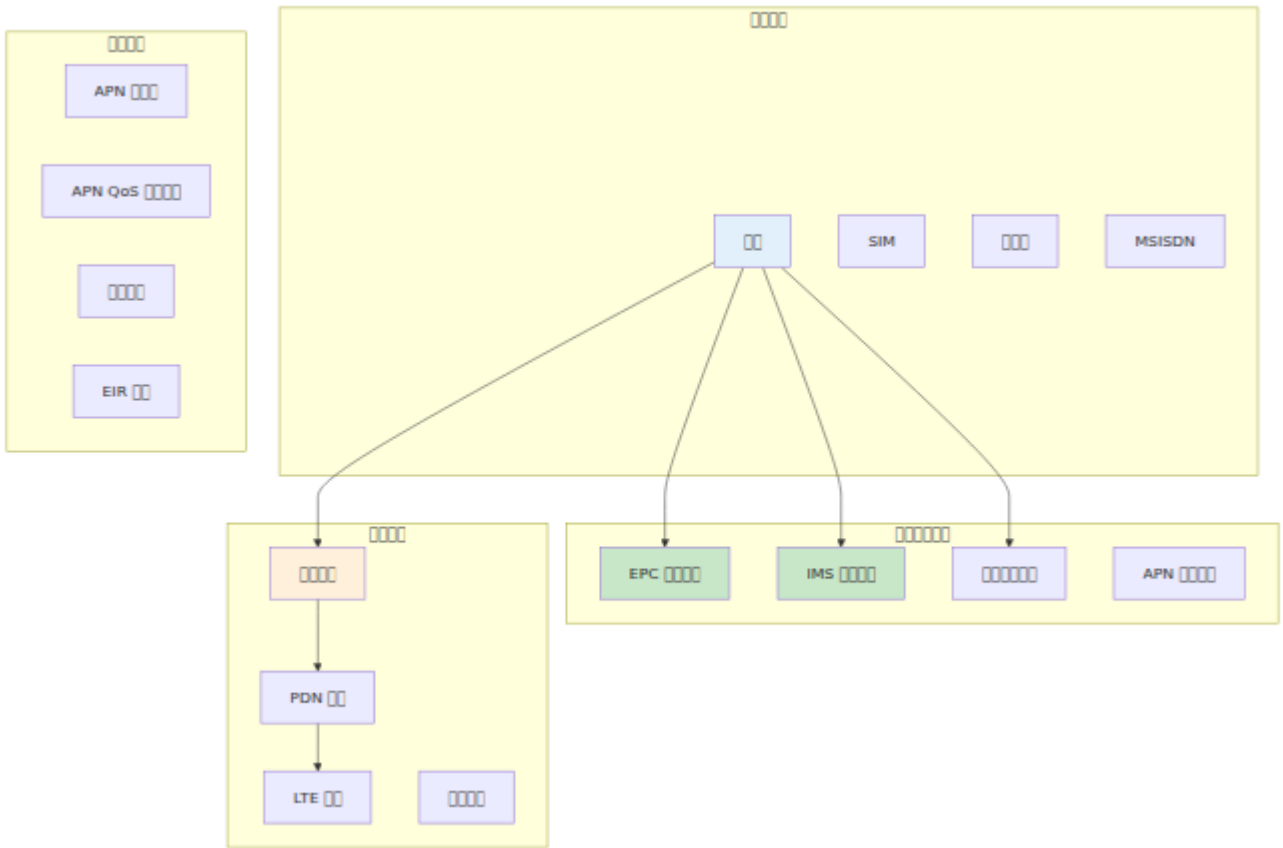
| | | | | 2

IMEI15

| IMEI/IMEISV      |                  |                           |
|------------------|------------------|---------------------------|
| 359791394616108  | 3597913946161.*  | TAC+FAC+<br>359791394616* |
| 359791394616140  | 35979139461614.  | 359791394616141-9<br>□    |
| 35979139461640   | 35979139461640   | IMEI                      |
| 3597913946163008 | 3597913946163008 | IMEISV=IMEI + SV          |



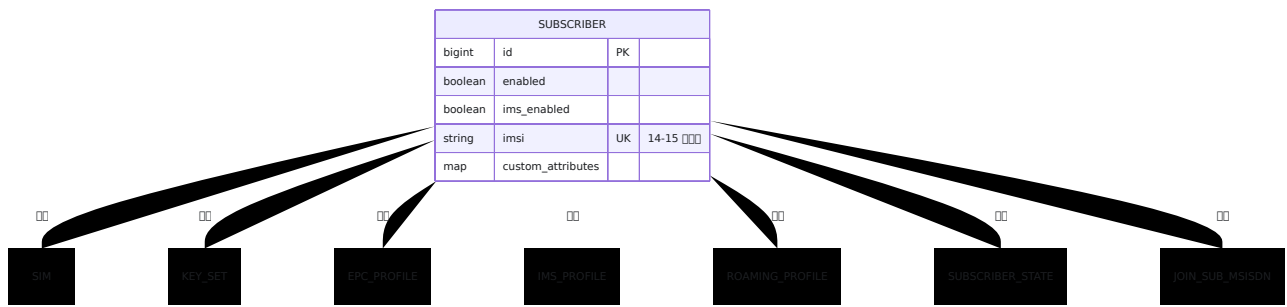
□□□□



□□□□

□□

□□□□□□□□□□□□□□



□□:

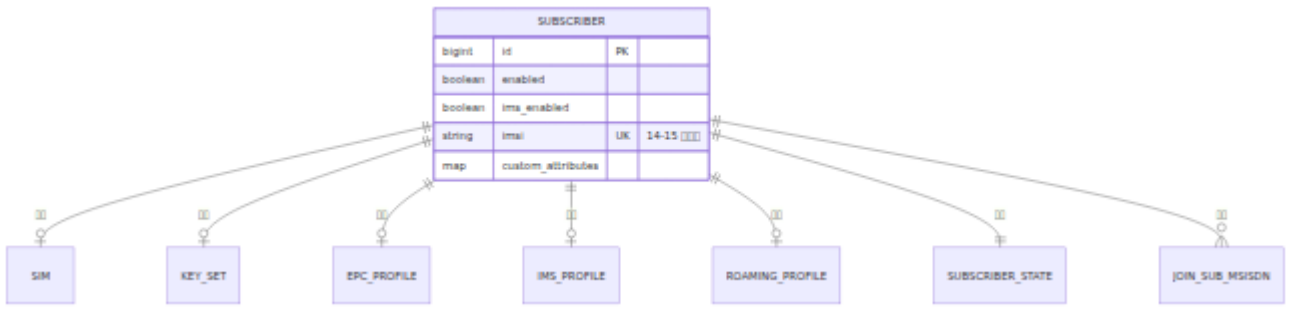
| 欄名                  | 型       | 説明             | デフォルト値  |
|---------------------|---------|----------------|---------|
| id                  | bigint  | ID             | 自動生成    |
| enabled             | boolean | 有効/無効          | true    |
| ims_enabled         | boolean | IMS 有効/無効      | true    |
| imsi                | string  | 国際移動番号         | 14-15 桁 |
| custom_attributes   | map     | カスタム属性         |         |
| sim_id              | bigint  | SIM の ID       |         |
| key_set_id          | bigint  | キーセット ID       |         |
| epc_profile_id      | bigint  | EPC プロファイル ID  |         |
| ims_profile_id      | bigint  | IMS プロファイル ID  |         |
| roaming_profile_id  | bigint  | ローミングプロファイル ID |         |
| subscriber_state_id | bigint  | サブスクリプション状態 ID |         |

注:

- 国際移動番号 (IMSI)
- IMSI の 14-15 桁は MSISDN と一致する
- MSISDN (国際電話番号)
- 有効/無効
- enabled: IMS が有効かどうか
- ims\_enabled: IMS が有効かどうか

## SIM

SIM は SIM カードの ID



📄:

| 📄            | 📄       | 📄         | 📄📄📄📄 |
|--------------|---------|-----------|------|
| iccid        | string  | 📄📄📄📄 ID   | 📄📄   |
| sim_vendor   | string  | SIM 📄📄    | 📄📄   |
| batch_name   | string  | 📄📄📄📄      | 📄📄   |
| is_esim      | boolean | 📄📄 SIM 📄📄 | 📄📄   |
| pin1, pin2   | string  | PIN 📄     | 📄📄   |
| puk1, puk2   | string  | PUK 📄     | 📄📄   |
| adm1 - adm10 | string  | 📄📄📄📄      | 📄📄📄📄 |
| kic, kid     | binary  | OTA 📄📄📄📄  | 📄📄📄📄 |

📄📄📄:

- ICCID 📄📄📄📄 SIM 📄
- 📄📄 SIM 📄📄📄📄📄📄📄📄📄📄
- PIN/PUK 📄📄📄📄📄 SIM 📄📄
- ADM 📄📄📄📄📄 SIM 📄📄
- KIC/KID 📄📄 SIM OTA📄📄📄📄📄📄

□□□

□□□□□□□□□□□□□□□□

| KEY_SET |                          |    |        |
|---------|--------------------------|----|--------|
| bigint  | id                       | PK |        |
| binary  | ki                       |    | 128 □  |
| binary  | opc                      |    | 128 □  |
| binary  | op                       |    | 128 □  |
| binary  | amf                      |    | 16 □   |
| bigint  | sqn                      |    | 48 □□□ |
| string  | authentication_algorithm |    |        |

□□□



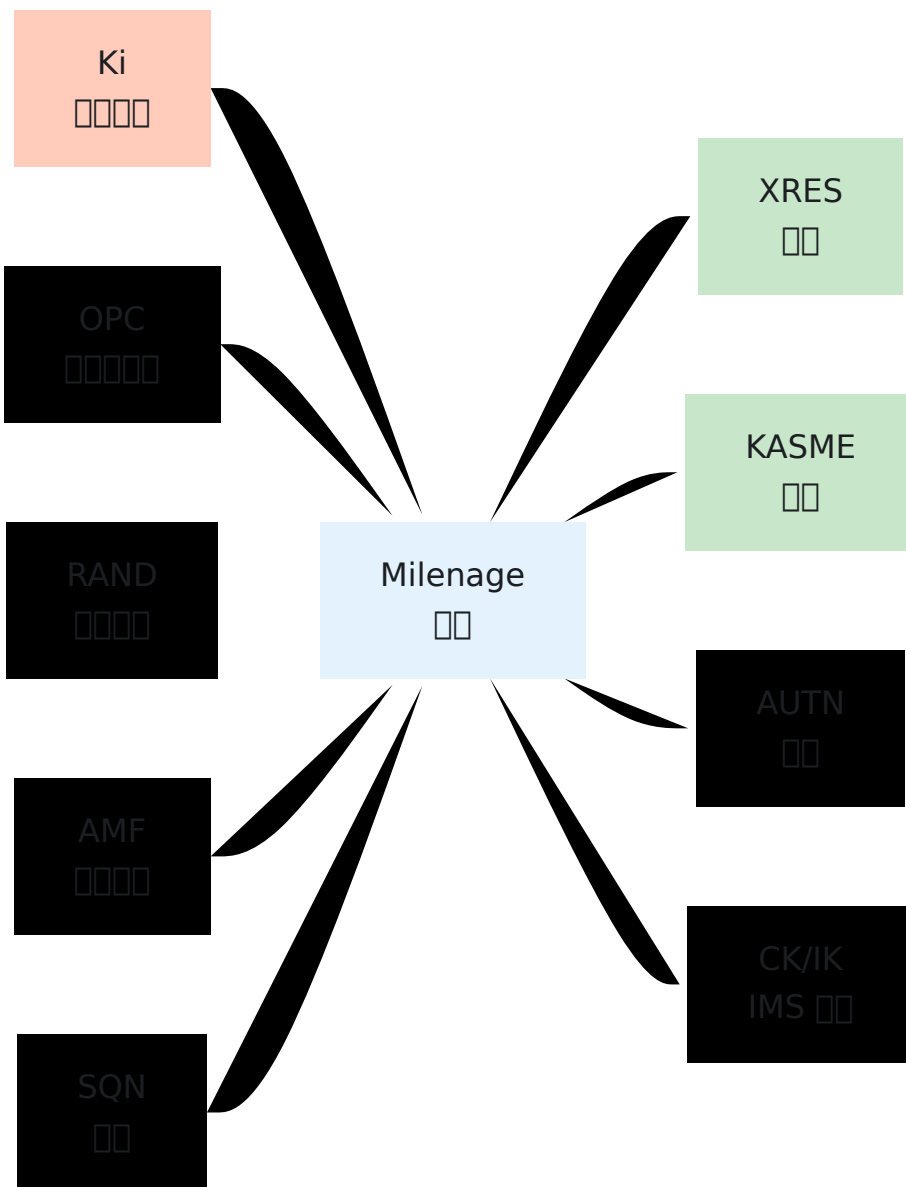
□□:

| Field                    | Type   | Description                  | Length     |
|--------------------------|--------|------------------------------|------------|
| ki                       | binary | Key                          | 128 bits   |
| opc                      | binary | OPC                          | 128 bits   |
| op                       | binary | OPC                          | 128 bits   |
| amf                      | binary | Authentication Method Factor | 16 bits    |
| sqn                      | bigint | Sequence Number              | 48 bits    |
| authentication_algorithm | string | Authentication Algorithm     | "milenage" |
| ota_counter              | bigint | OTA Counter                  | 16 bits    |

Fields:

- Key
- Ki from SIM
- OPC
- SQN
- Milenage

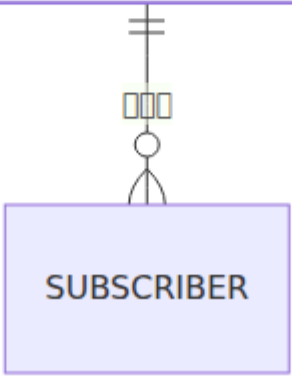
Fields:



## MSISDN

MSISDN □□□□□□□□□□

| KEY_SET |                          |    |          |
|---------|--------------------------|----|----------|
| bigint  | id                       | PK |          |
| binary  | ki                       |    | 128 []   |
| binary  | opc                      |    | 128 []   |
| binary  | op                       |    | 128 []   |
| binary  | amf                      |    | 16 []    |
| bigint  | sqn                      |    | 48 [] [] |
| string  | authentication_algorithm |    |          |



□□:

| □□     | □□     | □□          | □□                |
|--------|--------|-------------|-------------------|
| msisdn | string | □□□ ISDN □□ | 1-15 □□□□E.164 □□ |

□□□:

- MSISDN □□□□□□□□□□
- □□ MSISDN □□□□□□□□□□
- □□ MSISDN □□□□□□□□□□
- □□: □□□□ + □□□□□□□□"+1 415-555-1234" □□□□ "14155551234"□

□ **MSISDN** □□:

☐☐  
IMSI: 001001123456789

MSISDN: 14155551001  
☐☐☐

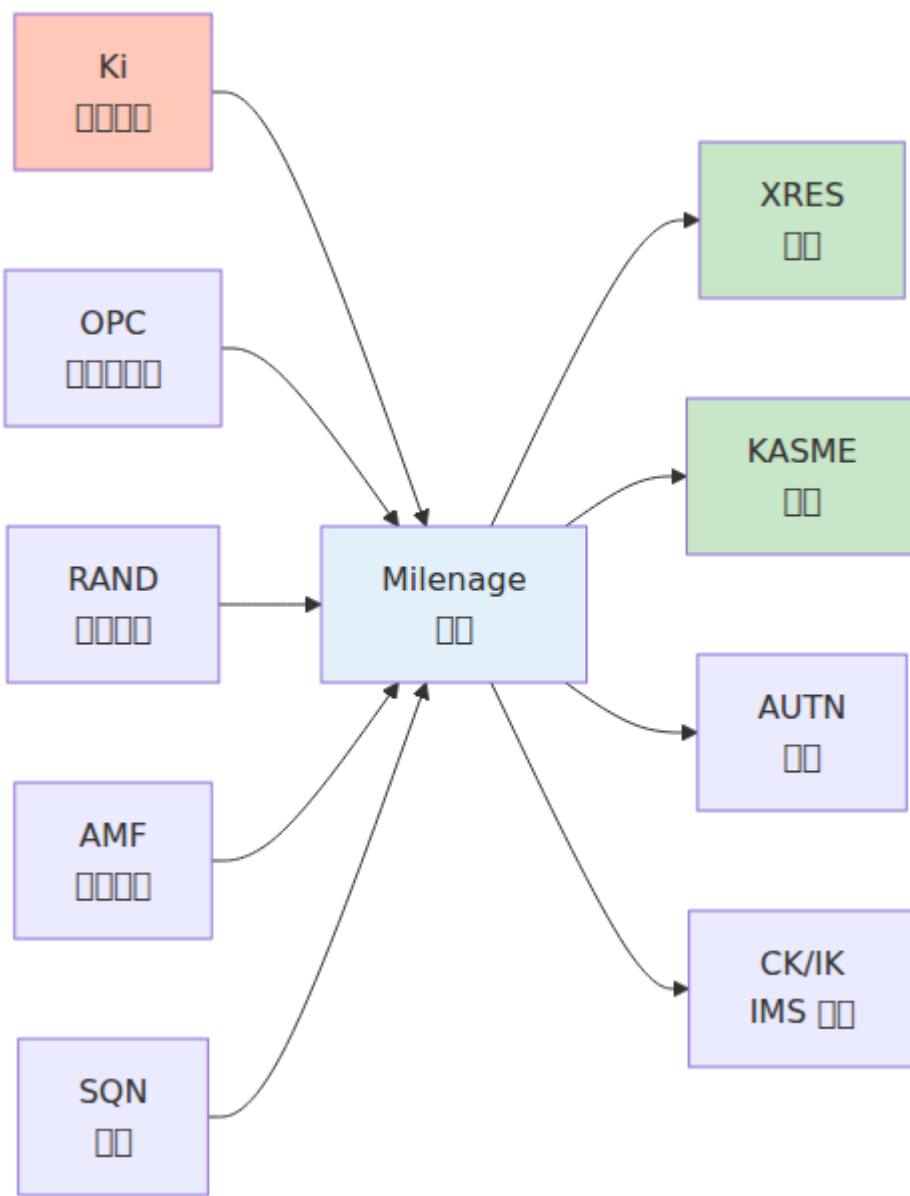
MSISDN: 14155551002  
☐☐☐☐

MSISDN: 14155551003  
☐☐☐☐

☐☐☐☐☐☐☐

**EPC** ☐☐☐☐

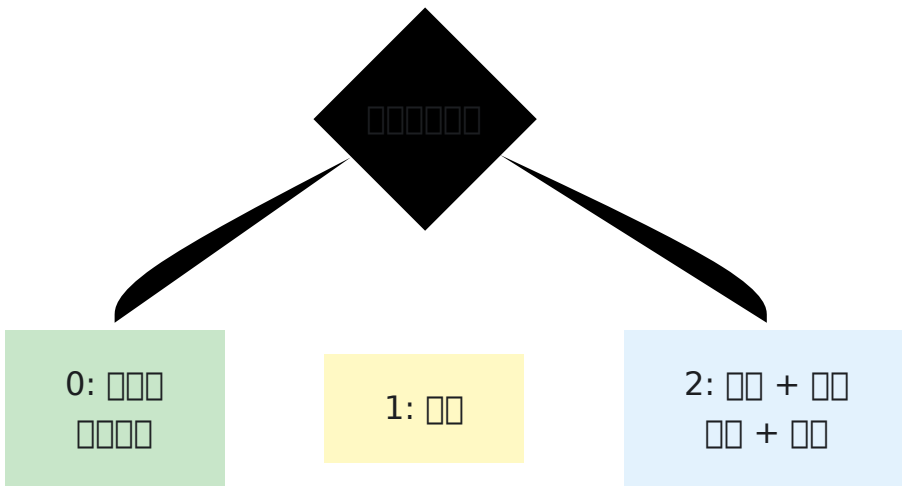
**EPC** ☐☐☐☐☐☐ LTE ☐☐☐☐☐☐☐☐



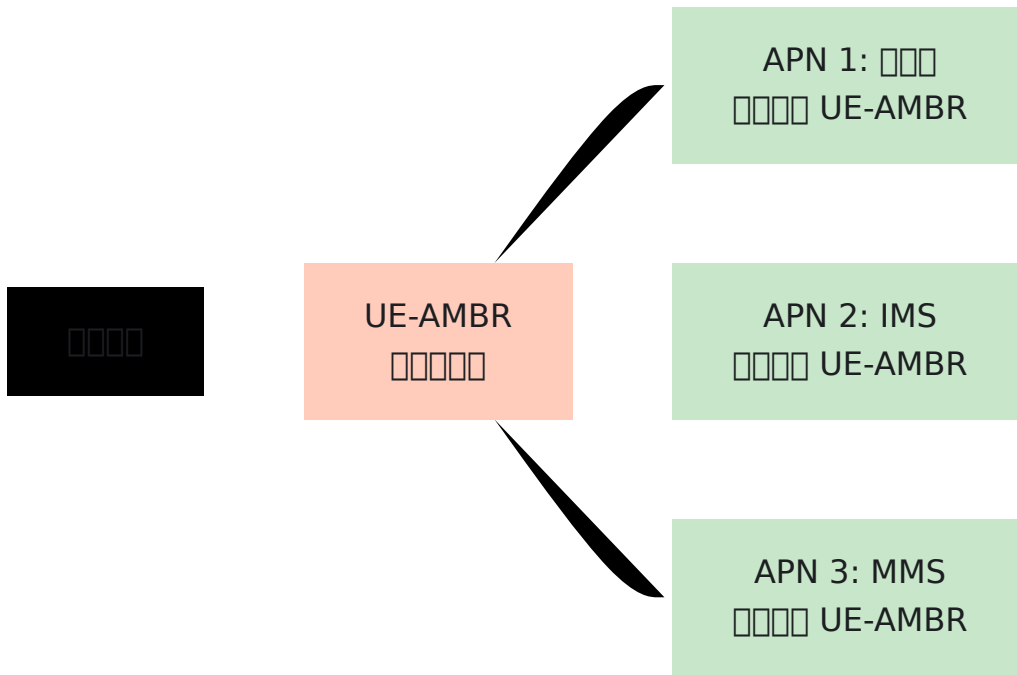
□□:

| 属性名                                   | 属性種別    | 属性値         | 属性単位                  |
|---------------------------------------|---------|-------------|-----------------------|
| name                                  | string  | 文字列<br>文字列  | なし                    |
| ue_ambr_dl_kbps                       | integer | 整数<br>整数    | Kbps                  |
| ue_ambr_ul_kbps                       | integer | 整数<br>整数    | Kbps                  |
| network_access_mode                   | string  | 文字列         | "固定" または "モバイル"<br>固定 |
| tracking_area_update_interval_seconds | integer | TAU 間隔<br>秒 | なし                    |

AMBRの構成:

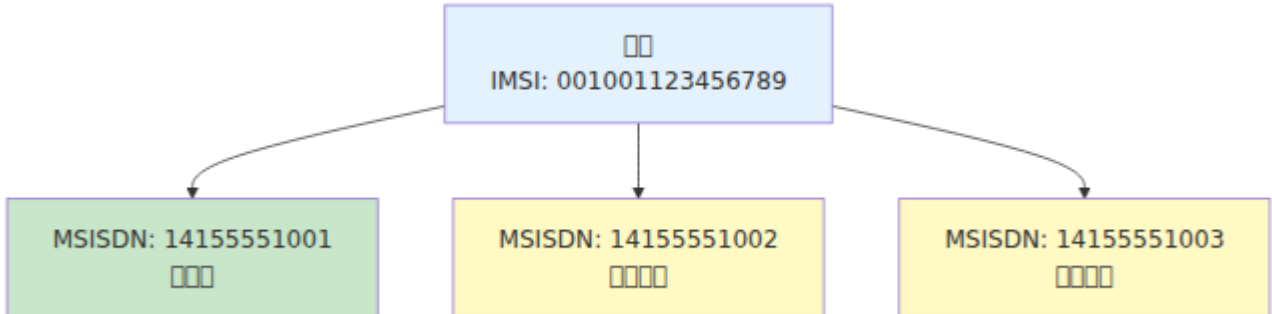


**AMBRの構成:**



## IMS

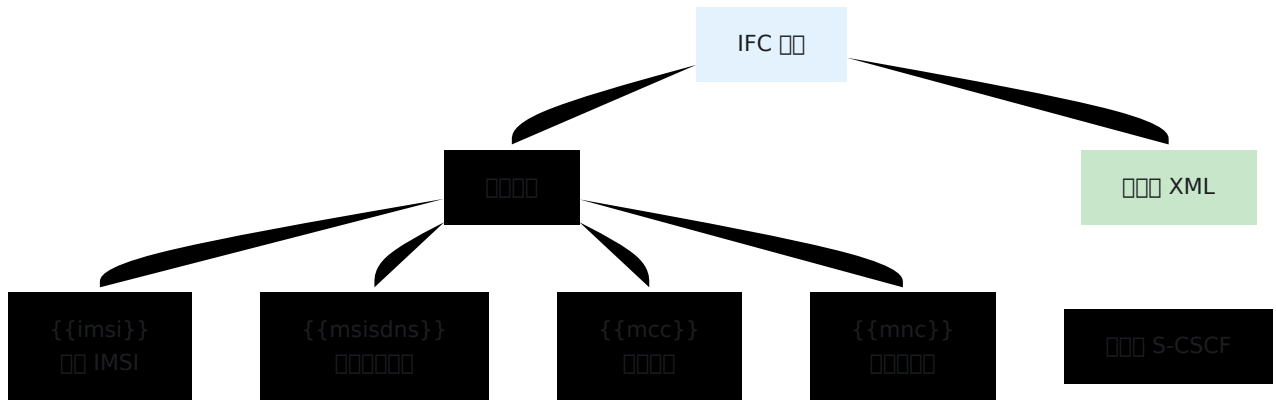
IMS



:

| name         | string |     |     |
|--------------|--------|-----|-----|
| ifc_template | text   | XML | XML |

IFC:

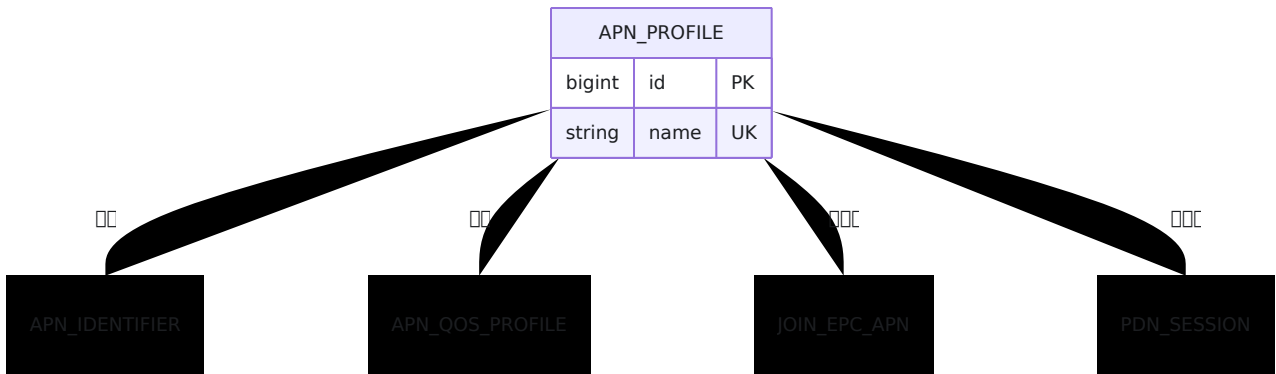


IMS:

- IFC IMS
- 
- 
- IMS S-CSCF

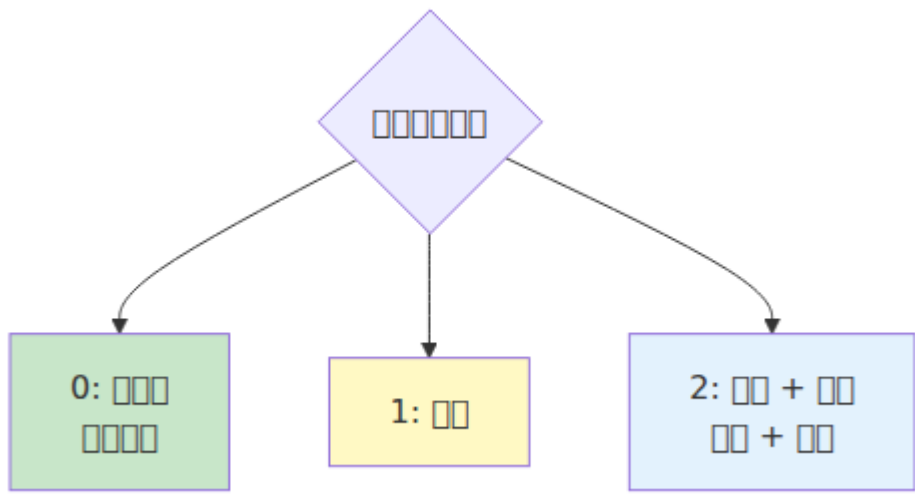
## APN

APN



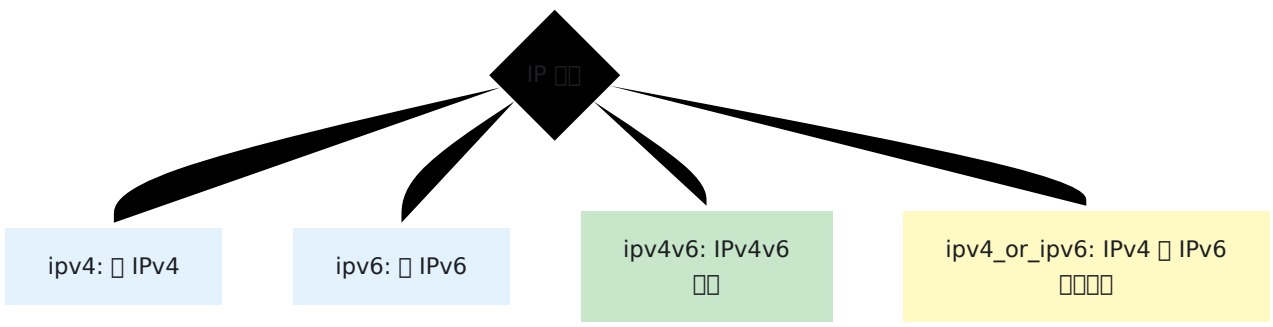
IMS:

APN

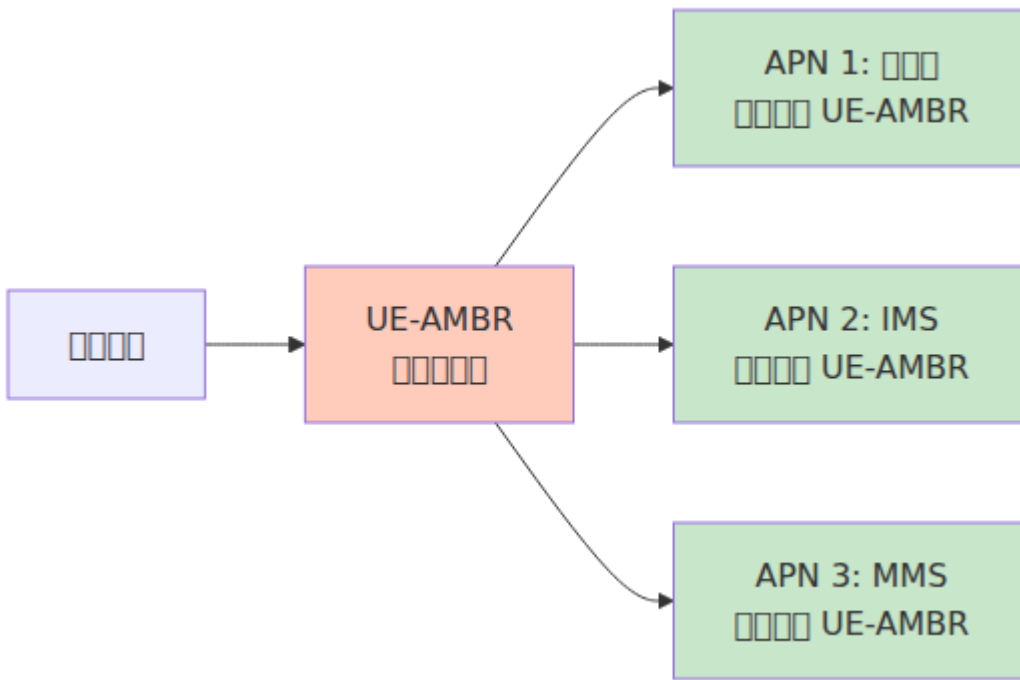


| 00         | 00     | 00      | 00                       |
|------------|--------|---------|--------------------------|
| apn        | string | APN 00  | "internet", "ims", "mms" |
| ip_version | string | IP 0000 | 0000                     |

**IP 0000:**



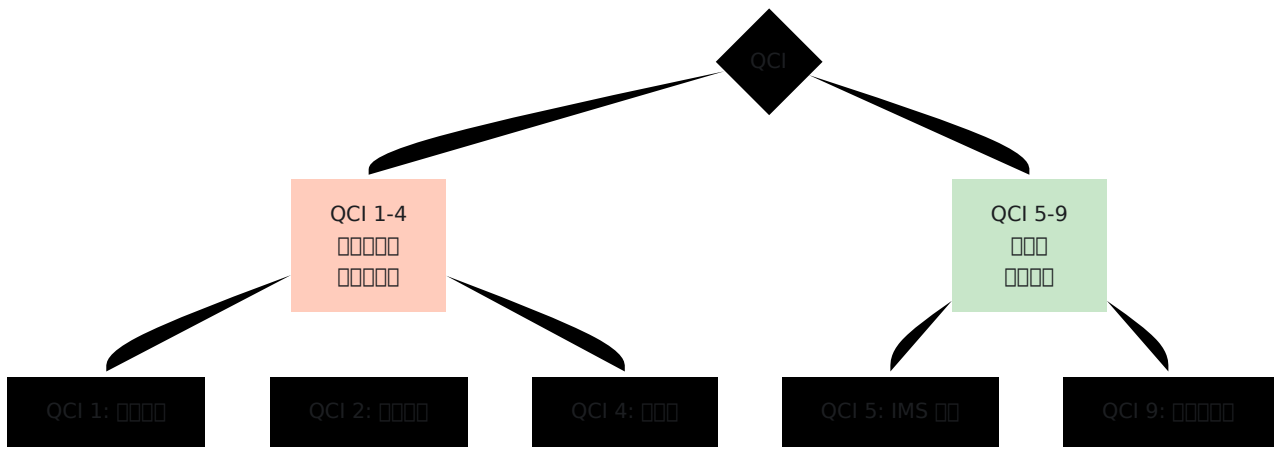
**APN QoS 0000**



**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       |

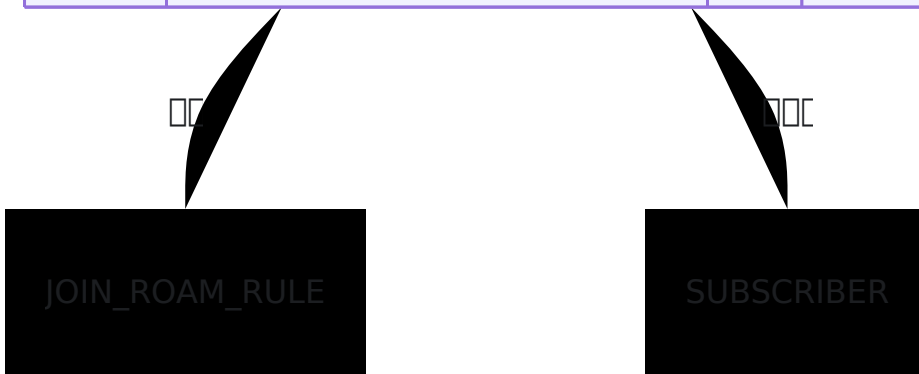
**QCI □:**



[ ] [ ] [ ] [ ] [ ]

[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

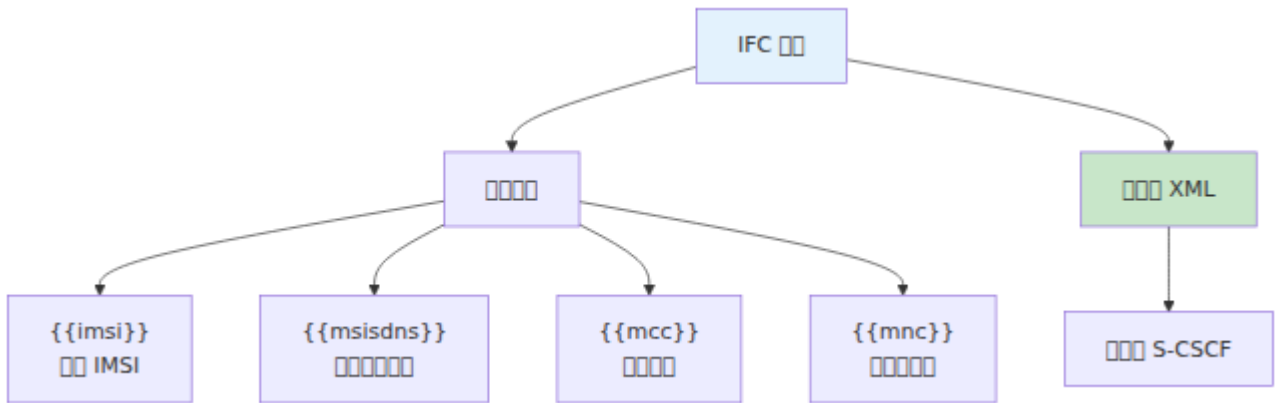
| ROAMING_PROFILE |                               |    |                 |
|-----------------|-------------------------------|----|-----------------|
| bigint          | id                            | PK |                 |
| string          | name                          | UK |                 |
| string          | data_action_if_no_rules_match |    | [ ] [ ] [ ] [ ] |
| string          | ims_action_if_no_rules_match  |    | [ ] [ ] [ ] [ ] |



[ ] [ ]

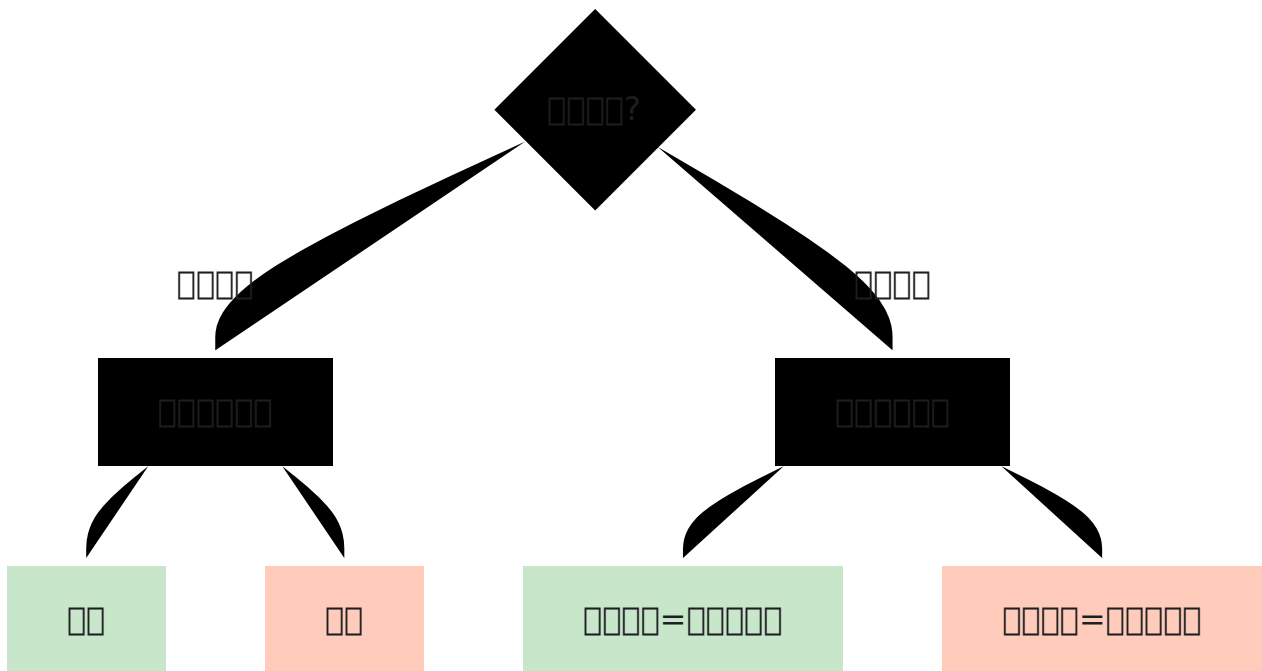
ROAMING\_RULE

□□□□:



□□◀◀□□:

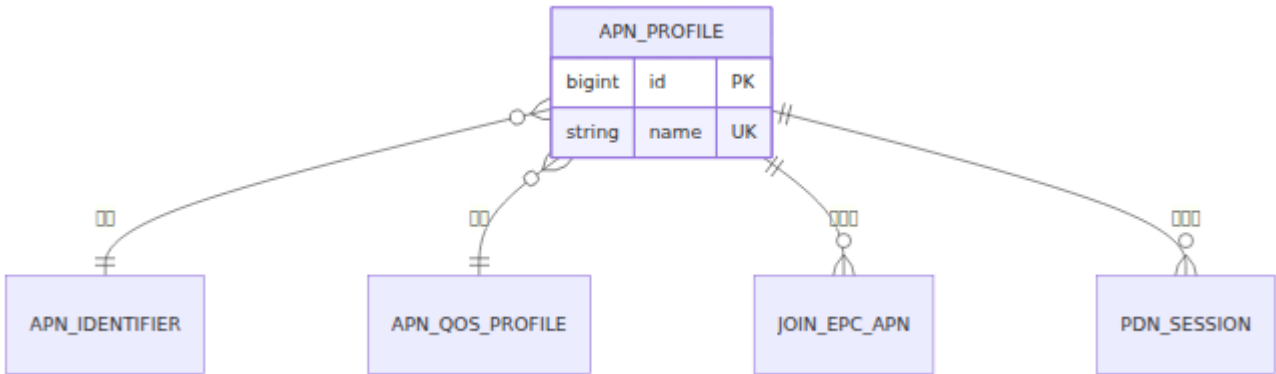
□□□□□□  
MCC: 310, MNC: 410



□□□□

□□□□

□□□□□□□□□□□□



□□□□:

□□□□:

- last\_seen\_mcc, last\_seen\_mnc - □□□□□
- last\_seen\_tac - □□□□□□
- last\_seen\_cell\_id - □□ ID
- last\_seen\_enodeb\_id - eNodeB ID
- last\_seen\_eci - E-UTRAN □□□□□

□□□□:

- last\_seen\_mme - □□□□□□□ MME
- last\_seen\_realm - MME □□□□
- last\_seen\_rat\_type - □□□□□□□□LTE□5G □□

**IMS** □□:

- assigned\_scscf - □□□□□□□ S-CSCF
- ims\_public\_identity - SIP URI□□□□□  
sip:+14155551234@ims.example.com□
- sh\_repository\_data - □□□ IMS □□□□□□

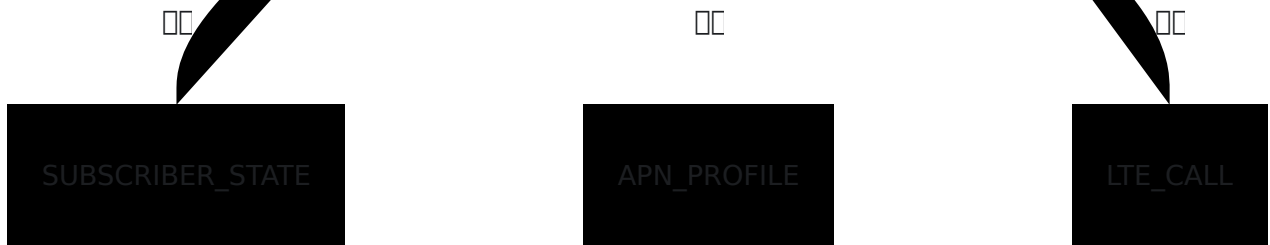
□□□:

- last\_seen\_at - 000000000000
- last\*\_at 000000000000

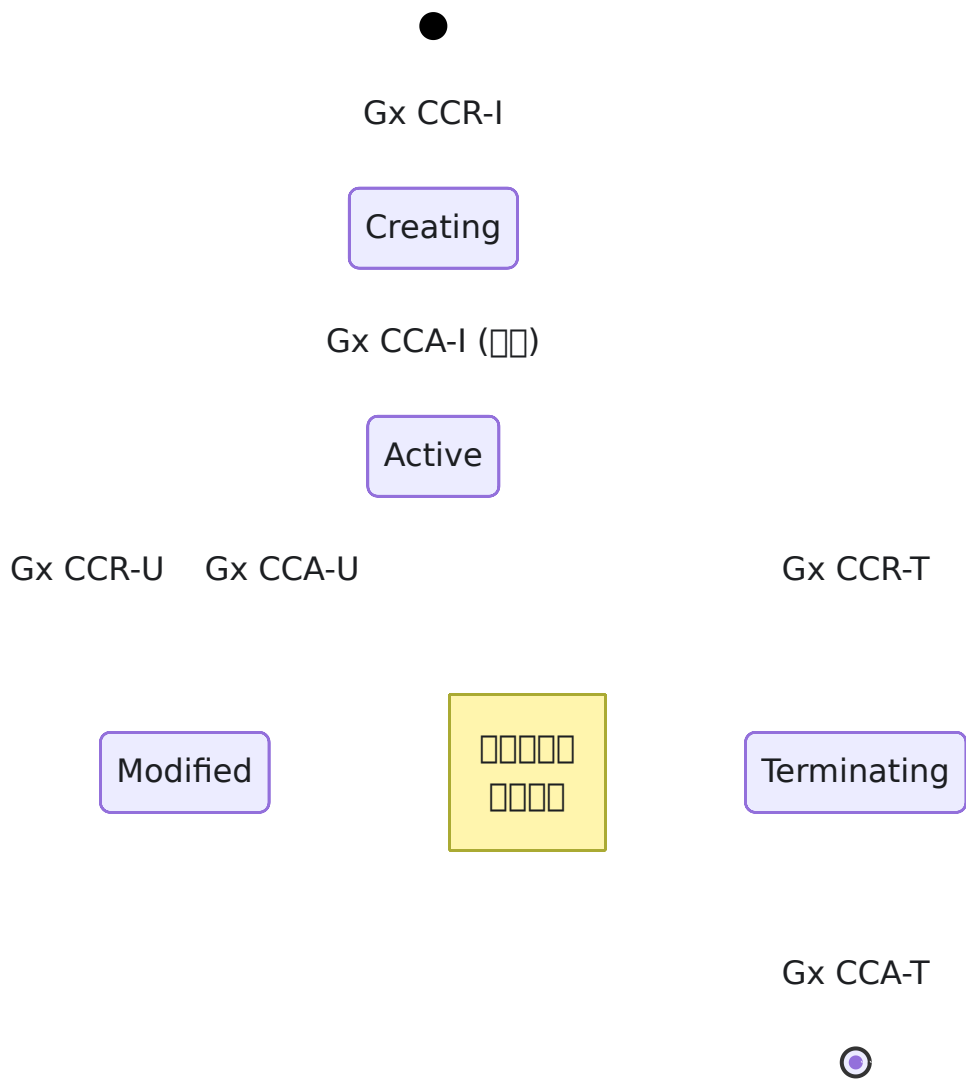
## PDN 00

PDN 0000000000000000

| PDN_SESSION |                   |    |
|-------------|-------------------|----|
| bigint      | id                | PK |
| string      | pgw_session_id    |    |
| integer     | rat_type          |    |
| string      | ip_address        |    |
| string      | assigned_pgw_host |    |
| boolean     | emergency         |    |
| boolean     | roaming           |    |
| datetime    | created_at        |    |

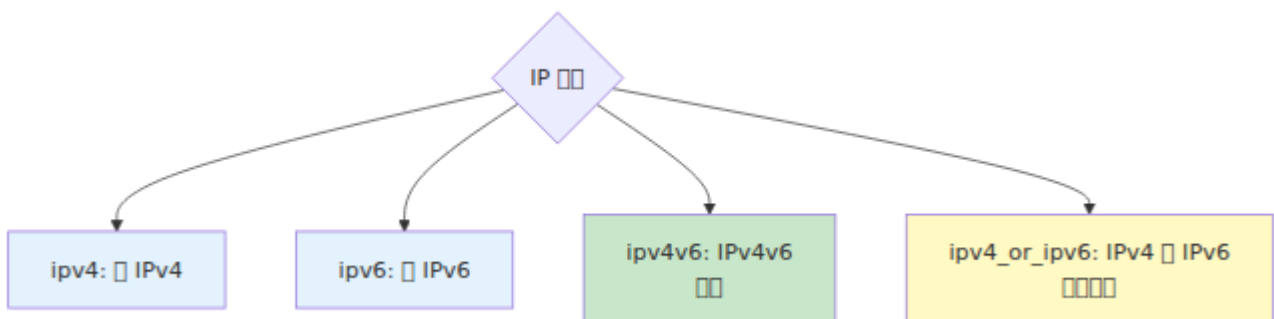


PDN 000000:

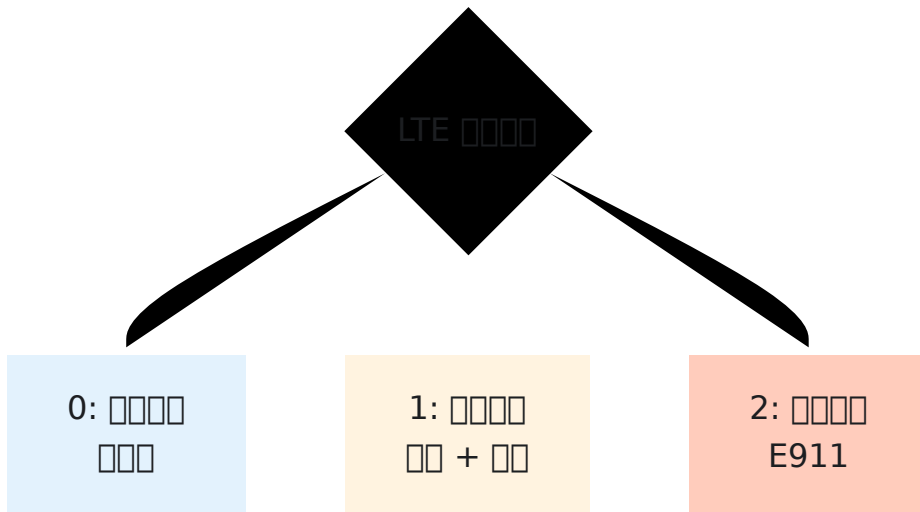


## LTE

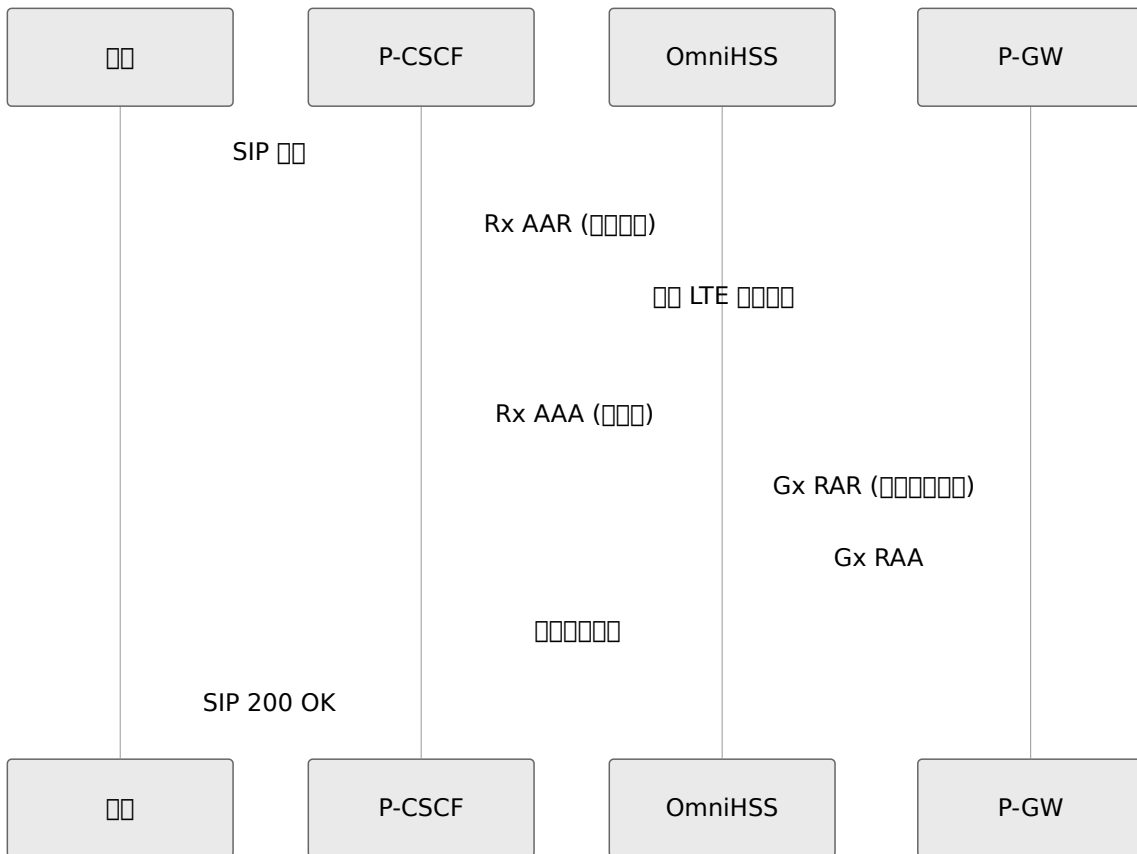
LTE VoLTE



□□□□:

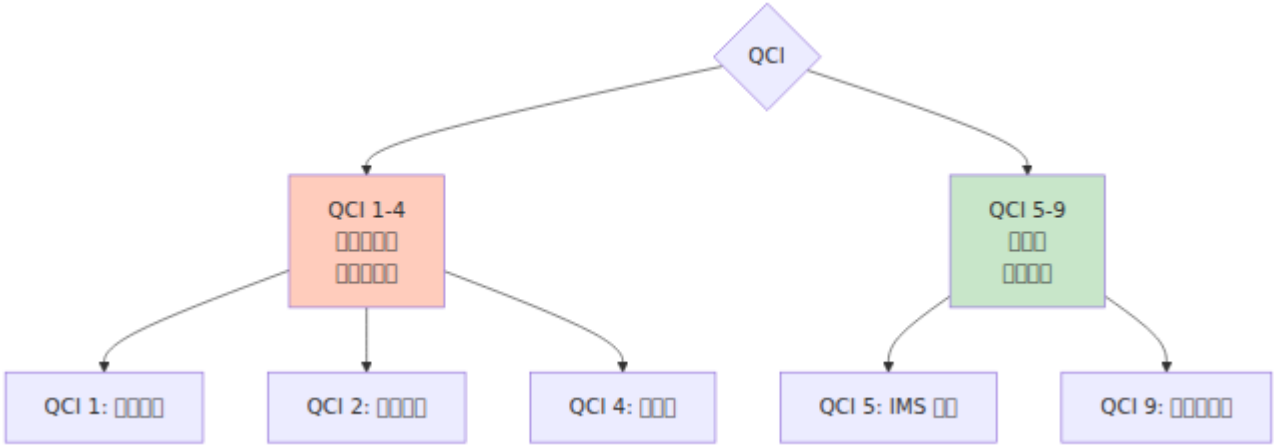


**VoLTE:**



□□□□□

□□□□□□

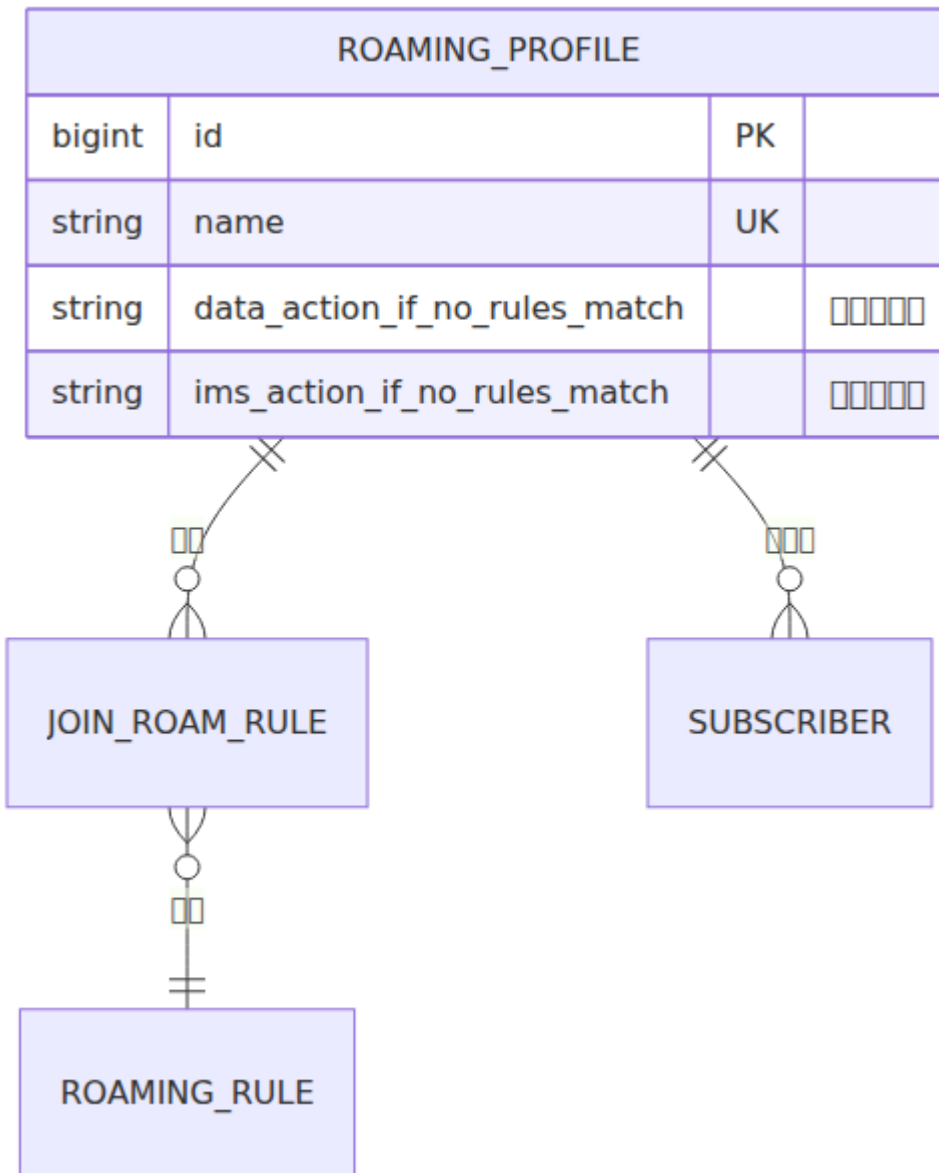


□□□□

□□□□□□□□□□□□□□□□



□□□□□□



---

□□□□□□

□□□□□□□□

●  
□□□□□□

Create\_Prerequisites

□□□□□□□□

□□□□□  
□□ EPC □□□□□□ APN□  
□□ IMS □□□□□□□□  
□□□□□□□□□□□□  
□□ SIM□□□□

Create\_Subscriber

enabled=false

enabled=true

Disabled

□□ enabled=true

□□ enabled=false

Enabled

□□□□

□□□□□□□□

□□□□□□

□□□□

Active

●

IMS □□ IMS □□

IMS\_Registered

VoLTE □□□□ □□□□

In\_Call

□□□□□□



□□□□

No\_Sessions

□□□□□□ □□□□□□

PDN\_Active

VoLTE □□□□

VoLTE □□□□

PDN □□□□□□  
□□□□□

PDN\_And\_Call

□□□□□□ □□□□□□

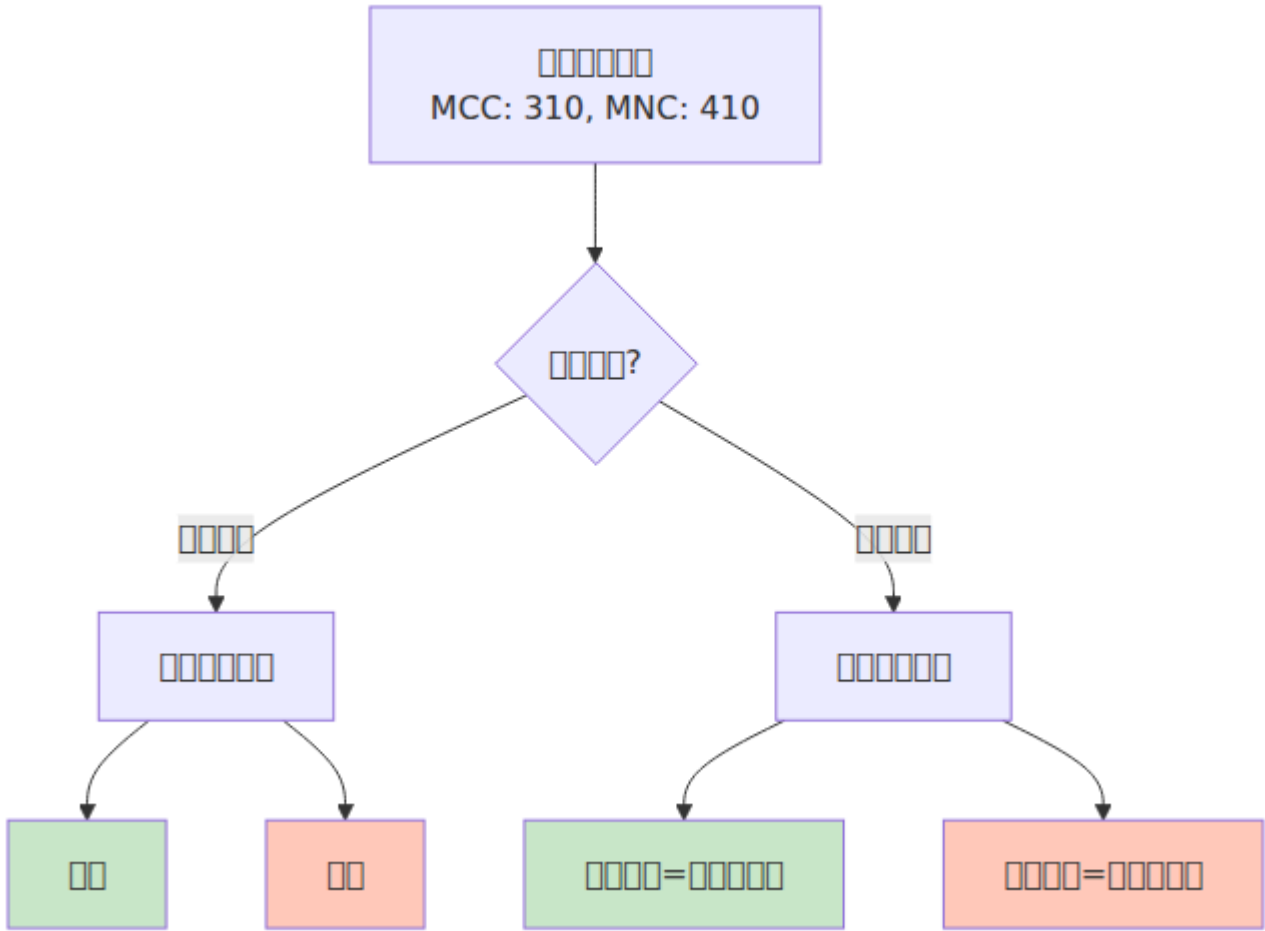
Multiple\_Calls

PDN □□ + LTE □□  
□□□□



□□□□□

□□□□□□



□□□□□□

S6a ULR □□

□□ IMSI □□□□

□□ EPC □□□□  
+ APN □□□□

□□□□□□  
□□□MME □

□□□□□□  
AMBR□APN□QoS

S6a ULA □□

# IMS □□□□

Cx SAR □□

□□ IMSI/MSISDN □□□□

□□ IMS □□□□  
+ MSISDN

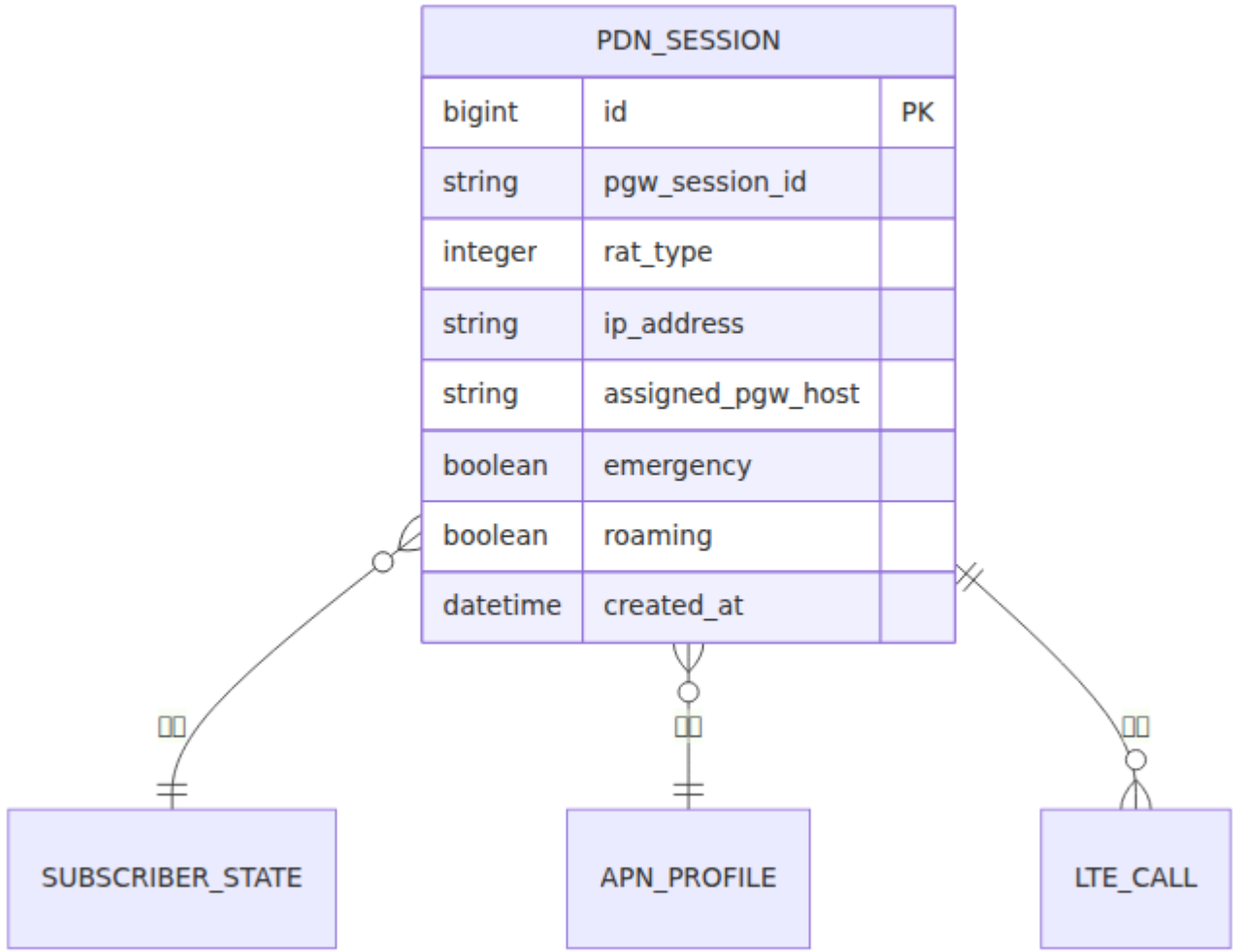
□□ S-CSCF  
□□/□□

□□ IFC □□  
□□□

□□□□□□  
S-CSCF □□

Cx SAA □□

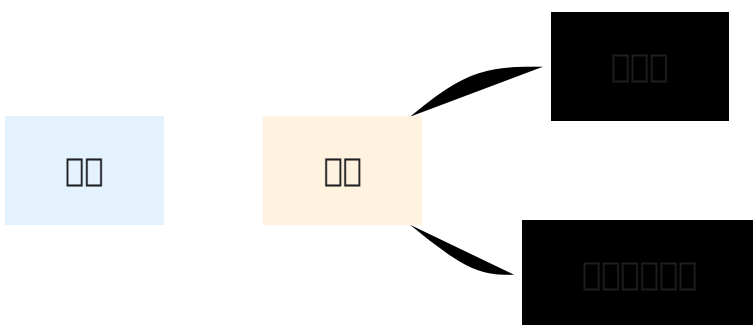
□□□□□□



□□□□□□

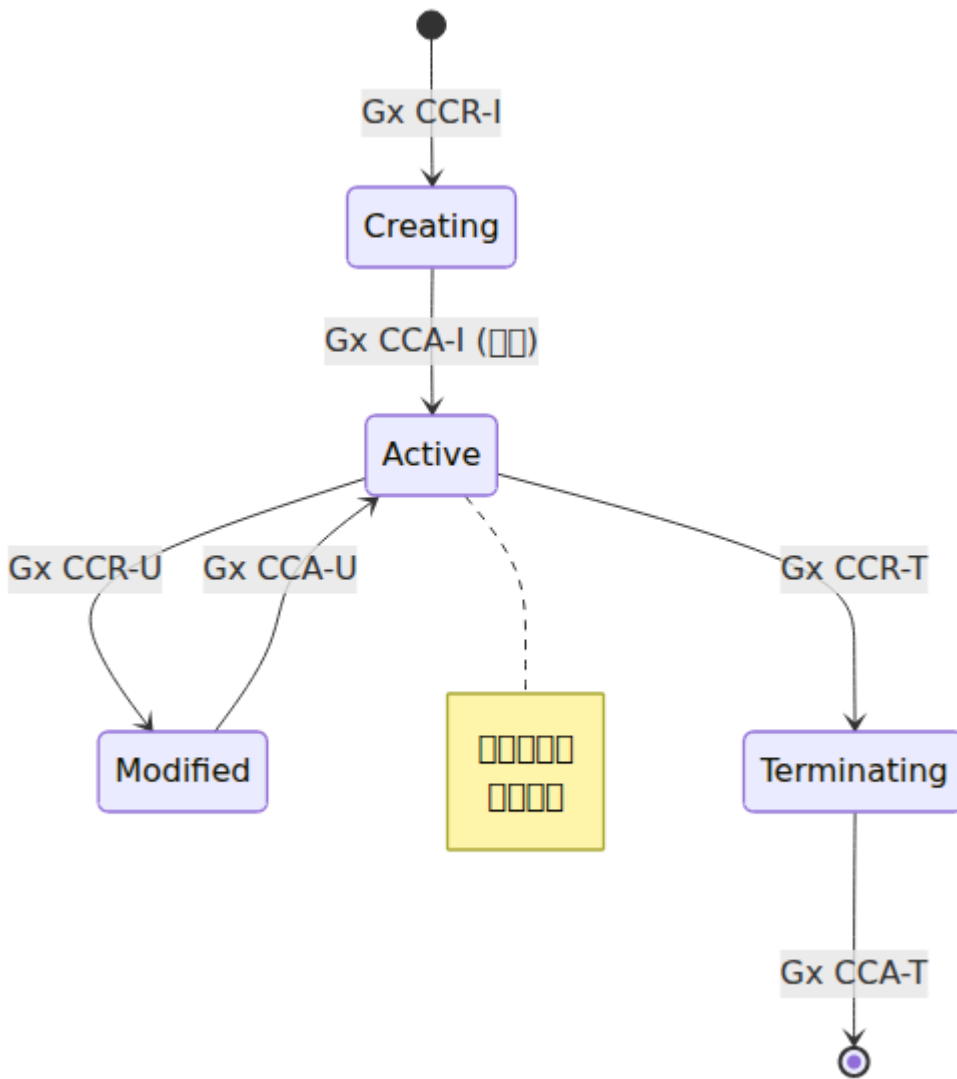
OmniHSS □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□



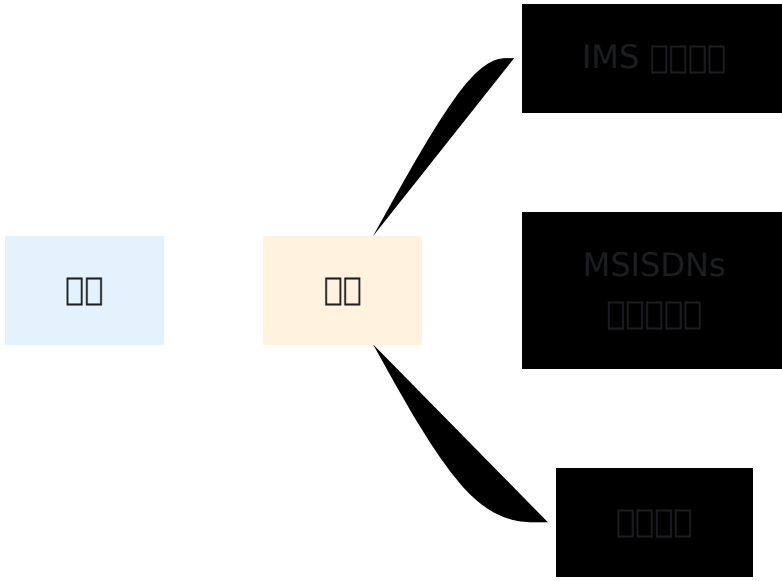
□□: S6a AIR - □□□□□□□□□□

□□□□□□□□□□



□□: S6a ULR - □□□□ EPC □□□□□□

# IMS 数据



数据: Cx SAR - 数据 IMS 数据

---

← 数据 | 数据: API 数据 →

# Galera 高可用性

← 高可用性

## 高可用性

- 高可用性
- 高可用性
- Galera 高可用性
- 高可用性
- 高可用性
- 高可用性
- 高可用性
- 高可用性
- 高可用性

## 高可用性

OmniHSS 高可用性 Elixir 高可用性 **Ecto** 高可用性 Ecto 高可用性 MariaDB 高可用性 Galera 高可用性

高可用性 Omnitouch 高可用性 (ONS) 高可用性

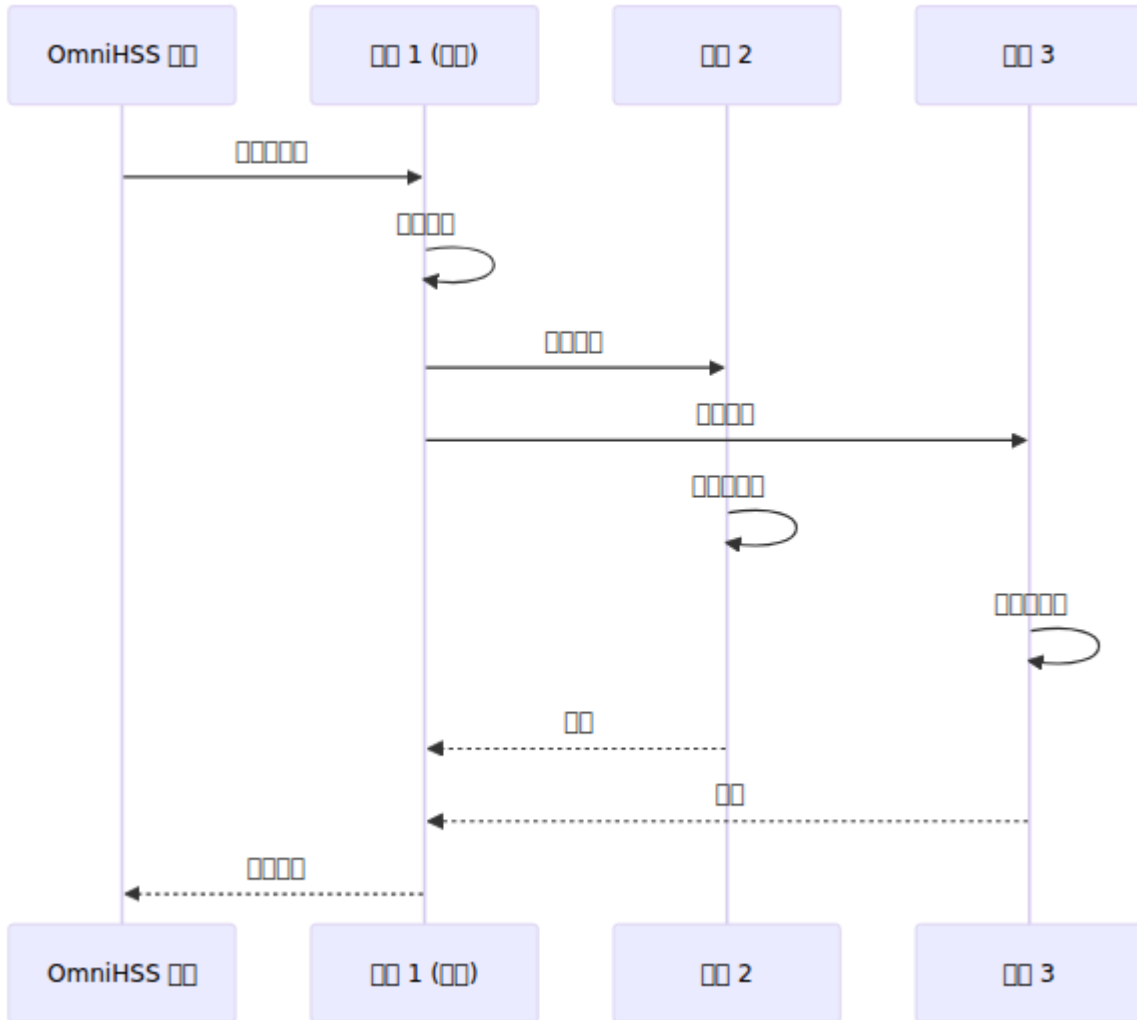
## MariaDB 高可用性 Galera

| 高可用性                 | 高可用性        |
|----------------------|-------------|
| <b>MariaDB 10.6+</b> | Galera 高可用性 |



# Galera 11111

111111



## 1111 (WSREP)

1111111111111111

1. 1111111111111111 SQL
2. 1111111111111111“11”
3. 1111111111111111
4. 1111111111111111
5. 1111111111111111

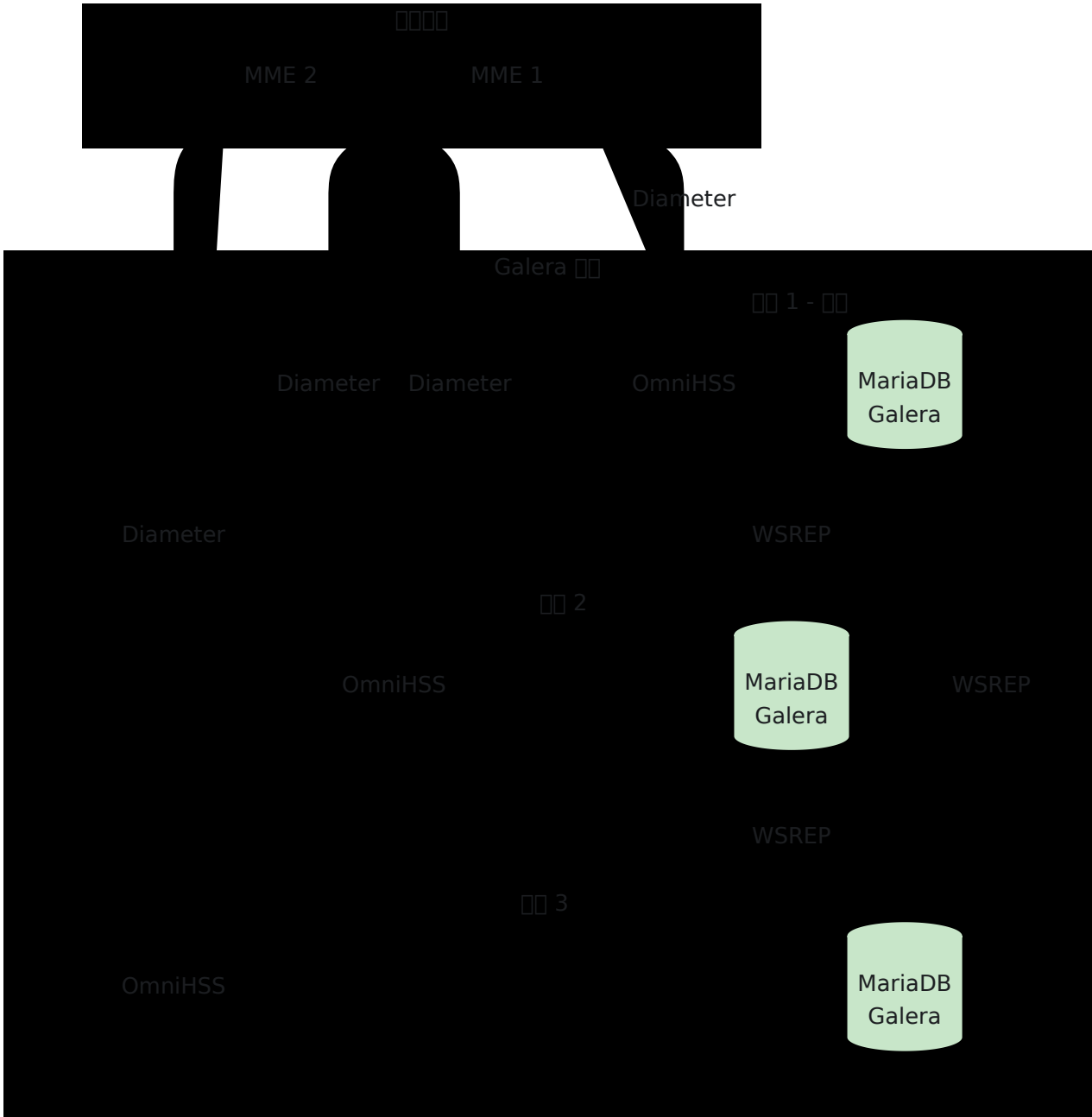
# Oracle

| IST         | Delta sync | rsync |
|-------------|------------|-------|
| IST (rsync) | Delta sync | rsync |
| SST (rsync) | rsync      | rsync |

OmniHSS rsync SST

```
wsrep_sst_method=rsync
```

---



## Ports

| Port | Protocol | Service      |
|------|----------|--------------|
| 3306 | TCP      | MySQL        |
| 4567 | TCP/UDP  | Galera       |
| 4568 | TCP      | Galera (IST) |
| 4444 | TCP      | Galera (SST) |

## Firewall

```
# Galera
ufw allow from <node2_ip> to any port 3306,4567,4568,4444 proto tcp
ufw allow from <node2_ip> to any port 4567 proto udp
ufw allow from <node3_ip> to any port 3306,4567,4568,4444 proto tcp
ufw allow from <node3_ip> to any port 4567 proto udp
```

## Ansible

### Ansible

group\_vars Galera

```
omnihss:
  database_host: "localhost"
  database_username: "hss"
  database_password: "secure_password"
  mysql:
    replication_mode: "galera"           # Galera
    bootstrap_host: "hss01"            #
    run_bootstrap: false                # true
    reinstall: false                    # true MariaDB
```

## Galera

Galera `/etc/mysql/my.cnf`

```
[mysqld]
#
pid-file           = /var/run/mysqld/mysqld.pid
socket             = /var/run/mysqld/mysqld.sock
datadir            = /var/lib/mysql
log-error          = /var/log/mysql/error.log

# Galera
binlog_format=ROW
default-storage-engine=innodb
innodb_autoinc_lock_mode=2
bind-address=0.0.0.0

# Galera
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so

#
wsrep_cluster_name="omnihss_galera"
wsrep_cluster_address="gcomm://10.4.10.140,10.4.10.141,10.4.10.142"

#
wsrep_sst_method=rsync

#
wsrep_node_address="10.4.10.140"
wsrep_node_name="hss01"
```

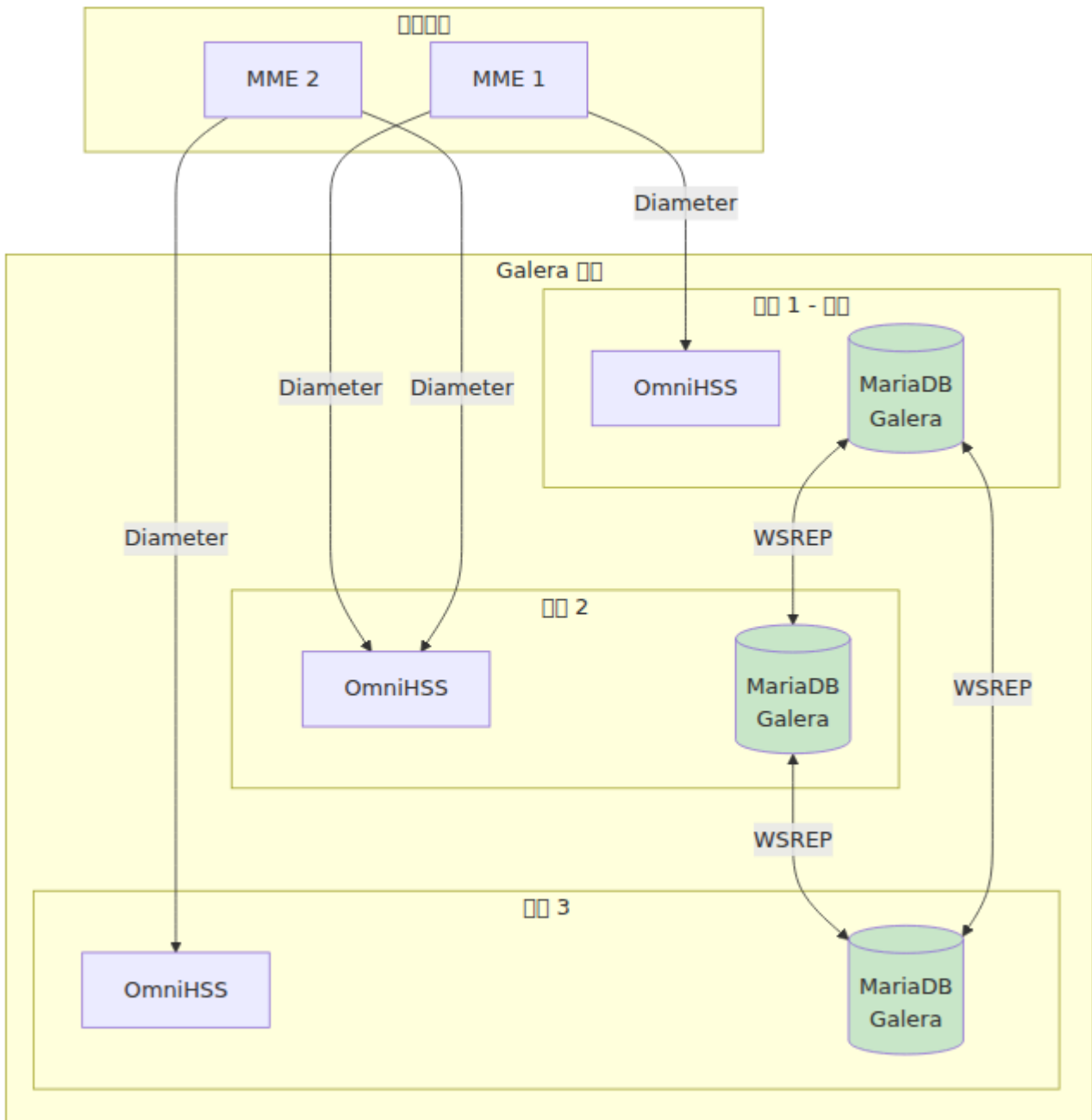
## WSREP

| WSREP                                 | WSREP                            | WSREP                    |
|---------------------------------------|----------------------------------|--------------------------|
| <code>binlog_format</code>            | <code>ROW</code>                 | WSREP - ROW              |
| <code>innodb_autoinc_lock_mode</code> | <code>2</code>                   | WSREP - innodb           |
| <code>wsrep_on</code>                 | <code>ON</code>                  | WSREP ON                 |
| <code>wsrep_provider</code>           | <code>libgalera</code>           | Galera                   |
| <code>wsrep_cluster_name</code>       | <code>"omnihss_galera"</code>    | WSREP_CLUSTER_NAME       |
| <code>wsrep_cluster_address</code>    | <code>gcomm://ip1,ip2,ip3</code> | WSREP_CLUSTER_ADDRESS IP |
| <code>wsrep_sst_method</code>         | <code>rsync</code>               | WSREP_SST_METHOD         |
| <code>wsrep_node_address</code>       | <code>IP</code>                  | WSREP_NODE_ADDRESS IP    |
| <code>wsrep_node_name</code>          | <code>WSREP_NODE_NAME</code>     | WSREP_NODE_NAME          |

## WSREP

### WSREP

WSREP Galera



□□□□

1. □□□□□□

```

omnihss:
  mysql:
    replication_mode: "galera"
    bootstrap_host: "hss01"
    run_bootstrap: true
  
```

## 2. Ansible

```
ansible-playbook -i hosts/your_site/inventory.ini
services/omnihss.yml
```

## 3. Galera

- AppArmor Galera
- Galera
- `/var/lib/mysql/grastate.dat` `safe_to_bootstrap=1`
- `mysqld_bootstrap`
- MariaDB `gcomm://`
- 

## 4. Ansible

```
omnihss:
  mysql:
    run_bootstrap: false #
```

# Grastate

`/var/lib/mysql/grastate.dat`

```
# GALERA
version: 2.1
uuid: abc12345-6789-def0-1234-567890abcdef
seqno: 1234567
safe_to_bootstrap: 0
```

- `uuid`
  - `seqno`
  - `safe_to_bootstrap` 1
-

□□

□□□□□

1. □□□□□□□□□□ hss □
2. □□ wsrep\_cluster\_address □□□□□□□□
3. □□ OmniHSS □□ - □□□□□□
  - □□ Galera □□□
  - □□□□□□□□□□
  - □□ SST □□□□

□□□□

1. □□□□□□□□□□ OmniHSS □ MariaDB
2. □□□□□□□□□□
3. □□□□□□□□□□ wsrep\_cluster\_address
4. □□□□□□□□□□ MariaDB

□□□□

□□❗❗□□□□□□□□□□

```
# □□□□□□□□□□
systemctl stop omnihss
systemctl stop mysql
# □□□□
systemctl start mysql
systemctl start omnihss
```

□□□□□□□□□□□□□□□□□□□□□□□□

□□□□

□□□□□□□□□□□□□□

1. □□□□□□

```
# seqno
cat /var/lib/mysql/grastate.dat
```

## 2. seqno

```
# seqno
sed -i "/safe_to_bootstrap/s/0/1/" /var/lib/mysql/grastate.dat
mysqld_bootstrap
```

## 3. mysql

```
# mysql
systemctl start mysql
```

---

##

###

#####

```
-- #####
SHOW STATUS LIKE 'wsrep_cluster_size';

-- ###
SHOW STATUS LIKE 'wsrep_cluster_status';

-- ###
SHOW STATUS LIKE 'wsrep_local_state_comment';

-- ## WSREP ##
SHOW STATUS LIKE 'wsrep_%';
```

## Galera

| 変数名                                    | 値       | 説明         |
|----------------------------------------|---------|------------|
| <code>wsrep_cluster_size</code>        | 4       | クラスタサイズ    |
| <code>wsrep_cluster_status</code>      | Primary | クラスタステータス  |
| <code>wsrep_local_state</code>         | 4       | ローカル状態     |
| <code>wsrep_local_state_comment</code> | Synced  | ローカル状態コメント |
| <code>wsrep_ready</code>               | ON      | 準備完了       |
| <code>wsrep_connected</code>           | ON      | 接続済み       |

## Galera

| 変数名                                         | 値 | 説明                 |
|---------------------------------------------|---|--------------------|
| <code>wsrep_flow_control_paused</code>      | 1 | フロー制御が一時停止         |
| <code>wsrep_flow_control_paused_idx</code>  | 2 | 一時停止した SST のインデックス |
| <code>wsrep_flow_control_paused_idx2</code> | 3 | 一時停止した SST のインデックス |
| <code>wsrep_flow_control_paused_idx3</code> | 4 | 一時停止した SST のインデックス |

## Prometheus

Galera 監視: MariaDB Galera 監視 OmniHSS 監視 Galera 監視

---

□□□□

□□□□□□□□

□□□□□□□□□□□□

□□□

```
# □□ MariaDB □□□□  
tail -f /var/log/mysql/error.log  
  
# □□ wsrep □□□□□□  
mysql -e "SHOW STATUS LIKE 'wsrep_on';"
```

□□□□□

- □□□□□□□ 4567□4568□4444
- `wsrep_cluster_address` □□ IP □□
- AppArmor □□□□
- □□ UUID □□□

□□□

```
# □□□□ AppArmor  
systemctl status apparmor  
# □□□□□systemctl stop apparmor && systemctl disable apparmor  
  
# □□□□□□□□  
ss -tlnp | grep -E '4567|4568|4444|3306'
```

□□ / □□□□

□□□ `wsrep_cluster_status` □□ `non-Primary`

□□□□□

- □□□□□□□□□□□□□□□□

- 確認する

確認

```
-- 確認する  
SET GLOBAL wsrep_provider_options='pc.bootstrap=YES';
```

## SST 確認

確認する

確認

```
# 確認する  
df -h /var/lib/mysql  
  
# rsync 確認  
ps aux | grep rsync
```

確認

- 確認
- rsync 確認
- 確認 4444

確認

wsrep\_local\_state\_comment Donor/Desynced

SST 確認

確認

```
# 確認 rsync
ps aux | grep rsync
# 強制終了
pkill rsync
systemctl restart mysql
```

## Grastate 確認

MySQL MariaDB の Grastate 確認

確認

```
# Grastate 確認
rm /var/lib/mysql/grastate.dat

# SST 確認
systemctl start mysql
```

確認

MySQL の wsrep\_local\_send\_queue

確認

```
SHOW STATUS LIKE 'wsrep_local_send_queue%';
SHOW STATUS LIKE 'wsrep_flow_control%';
```

確認

- 確認
- 確認 I/O
- 確認

確認

- 確認
- 確認

- □□□□□□□□
-

# Diameter

←

mermaid Diameter OmniHSS

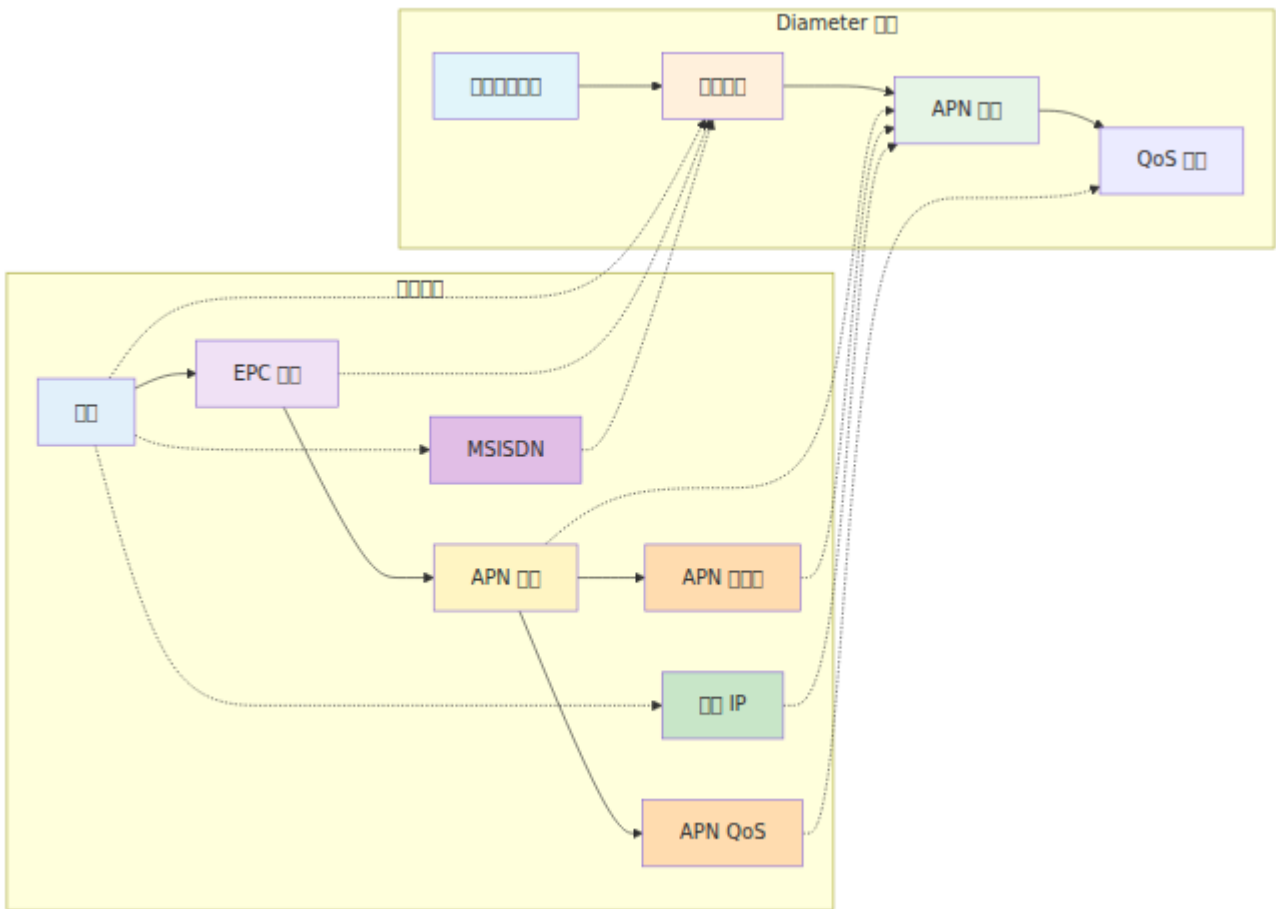
---

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

## (S6a ULA)

HSS LTE MME Diameter AVP

□□□□□



□□□□□□

| □□□□□                                                | □□            | D                    |
|------------------------------------------------------|---------------|----------------------|
| <b>subscriber.enabled</b>                            | true/false    | Su<br>St             |
| <b>msisdn.msisdn</b>                                 | '14155551234' | MS                   |
| <b>epc_profile.ue_ambr_ul_kbps</b>                   | 50000         | Ma<br>Re<br>Ba<br>UL |
| <b>epc_profile.ue_ambr_dl_kbps</b>                   | 100000        | Ma<br>Re<br>Ba<br>DL |
| <b>epc_profile.network_access_mode</b>               | 'packet_only' | Ne<br>Ac<br>Mo       |
| <b>apn_identifier.apn</b>                            | 'internet'    | Se<br>Se             |
| <b>apn_identifier.ip_version</b>                     | 'ipv4v6'      | PE                   |
| <b>apn_qos_profile.qci</b>                           | 9             | Qc<br>Id             |
| <b>apn_qos_profile.allocation_retention_priority</b> | 8             | Pr<br>Le             |

| Property Name                                    | Value             | Description                         |
|--------------------------------------------------|-------------------|-------------------------------------|
| <b>apn_qos_profile.pre_emption_capability</b>    | false             | Pre-emption Capability              |
| <b>apn_qos_profile.pre_emption_vulnerability</b> | true              | Pre-emption Vulnerability           |
| <b>apn_qos_profile.apn_ambr_ul_kbps</b>          | 25000             | APN UL AMBR                         |
| <b>apn_qos_profile.apn_ambr_dl_kbps</b>          | 50000             | APN DL AMBR                         |
| <b>static_ip.ipv4_static_ip</b>                  | '100.64.1.1'      | Static IPv4 IP Address (If enabled) |
| <b>static_ip.ipv6_static_ip</b>                  | '2606:4700::1111' | Static IPv6 IP Address (If enabled) |

### Configuration

- AMBR** (kbps) Diameter (bps) 1000
- IP** (0=IPv4, 1=IPv6, 2=IPv4v6, 3=IPv4\_or\_IPv6)
- enabled**: true → 0 (SERVICE\_GRANTED) | false → 1 (OPERATOR\_DETERMINED\_BARRING)
- APN (0, 1, 2...)
- IP** (static\_ips)

### Configuration

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

## Authentication (S6a AIA)

LTE/EPC Authentication

Sequence



Sequence

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

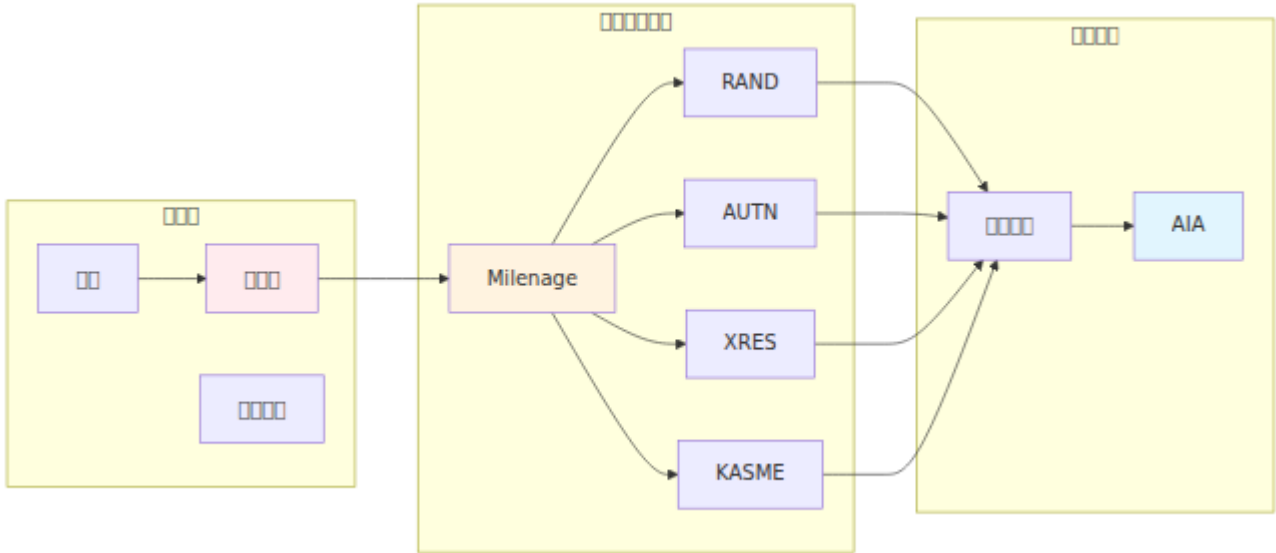
Sequence

- SQL
- Ki/OPc HSS
- AUTN SQL AMF
- UE

# AAA (Cx SAA)

AAA HSS IMS AAA S-CSCF

AAA



AAA

1. **IFC** XML AAA `ims_profile.ifc_template`
2. AAA AAA AAA `{{msisdn}}` `{{imsi}}` `{{impu}}`
3. **S-CSCF** AAA `subscriber_state.assigned_scscf` AAA S-CSCF
4. **IMS** AAA AAA `sip:+{msisdn}@{ims_domain}` `tel:+{msisdn}`

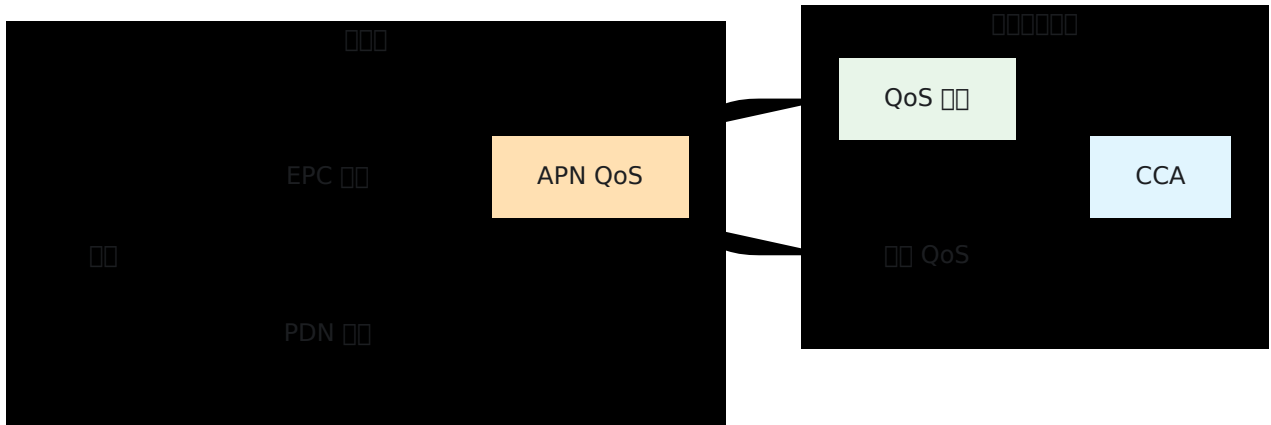
**IFC** AAA

- `{{msisdn}}` - AAA MSISDN
- `{{imsi}}` - IMS IMSI
- `{{impu}}` - IMS AAA AAA `subscriber_state`
- `{{impi}}` - IMS AAA AAA `IMSI@realm`

# AAA (Gx CCA)

AAA PCRF AAA AAA PGW

□□□□□



□□□□□

1. □□□□□□□□□□/□□ `pdn_session` □□
2. **QoS** □□□□□□□□ APN QoS □□□ QCI □□□□□□
3. □□□□□□□□□□□□□□□□□□□□
4. **CC-**□□□□□□□□ INITIAL (1)□UPDATE (2)□TERMINATION (3)

□□□□□□□

- `INITIAL_REQUEST` □□□□□□ PDN □□□□□
- `UPDATE_REQUEST` □□□□□□ PDN □□
- `TERMINATION_REQUEST` □□□□ PDN □□□□□

## □□□□□□ (Sh UDA)

□□□□□□□ HSS □□ Sh □□□□□□ AS□□□□□□□□□□

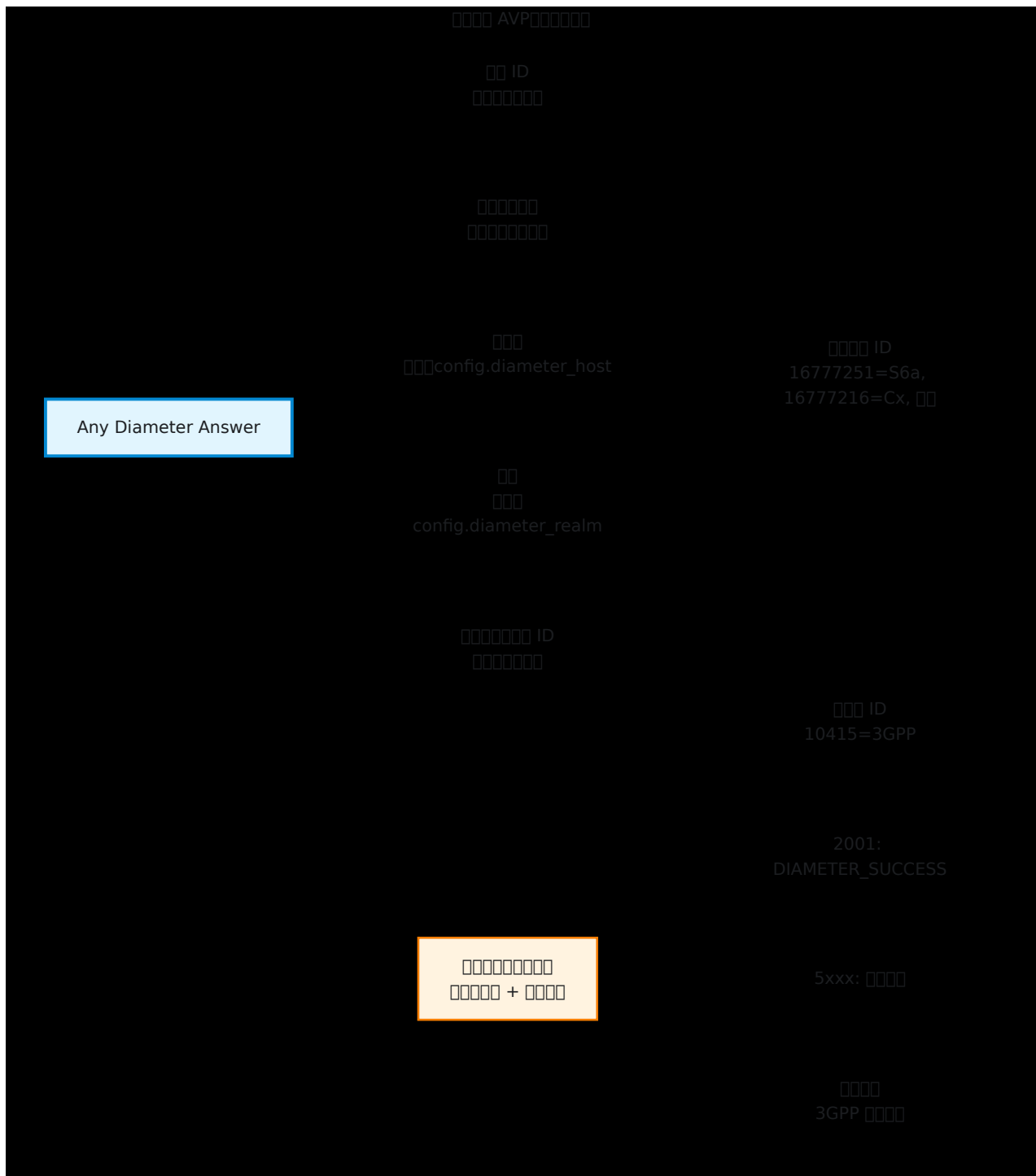
□□□□□□





- IMEI
  - TAC
  - 
  -
- 

Diameter AVP



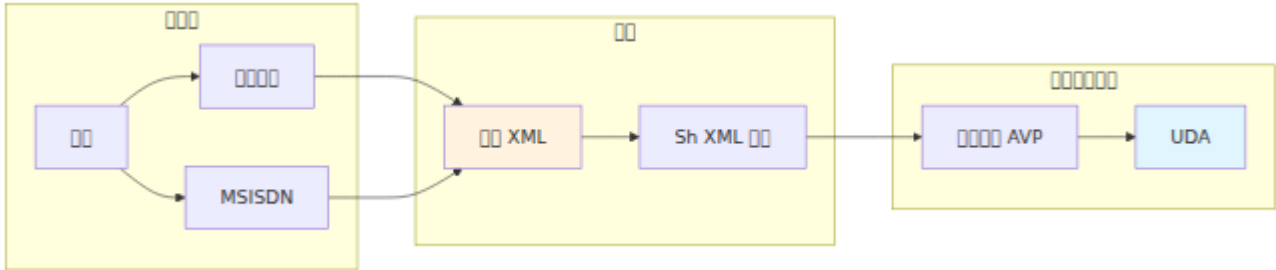
0000

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



□□□□□

□□□□□□



□□□□

□□□□□□

□□□□□□ Diameter □□□□□□□□

- **S6a** - LTE/MME □□□□□□□□□□
- **Cx** - IMS/CSCF □□□□ IMS □□□□□□□□
- **Sh** - IMS/AS □□□□□□□□□□
- **Gx** - PCRF □□□□□□□□□□
- **Rx** - IMS/AF □□□□□□□□
- **S13** - EIR □□□□ IMEI □□
- **SWx** - WiFi/IMS □□□□□ 3GPP □□□□

□□□□

□□□□□□◆◆◆□□□□□□□□

- □□ - □□□□□□□□□□ IMSI
- □□□ - □□□□□□□□□□
- **EPC** □□ - LTE □□□□
- **APN** □□ - □□□□□□
- **IMS** □□ - □□ IFC □□□□ IMS □□□□

- **IMEI** - **IMEI** **IMEI**
- **IMEI** - **IMEI** **IMEI**
- **PDN** **IP** - **PDN** **IP**
- **IP** **IP** - **IP** **IP** **IP**
- **EIR** **IP** - **IMEI** **IMEI**

---

← **IMEI** **IMEI** | **API** **IP** → | **IMEI** →



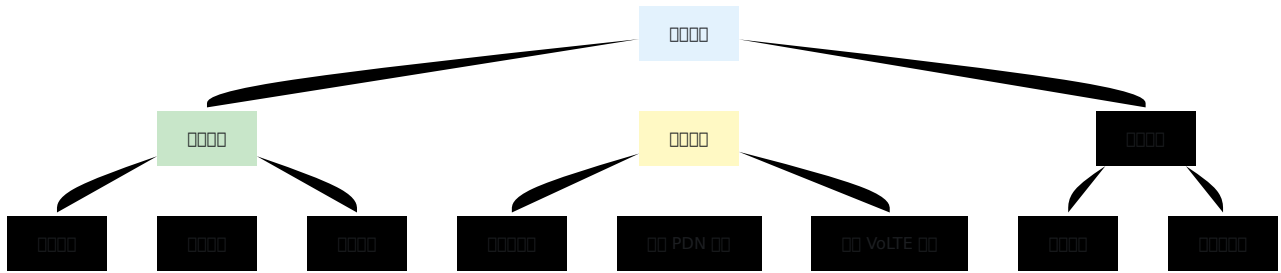
# 概要

概要

概要

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

概要



概要

| 項目            | 概要         | 概要       |
|---------------|------------|----------|
| 概要            | 概要         | 概要       |
| 概要            | MME 概要     | 概要       |
| <b>PDN 概要</b> | PDN 概要 > 0 | 概要       |
| <b>IMS 概要</b> | S-CSCF 概要  | 概要       |
| 概要            | 概要 > 0     | VoLTE 概要 |

概要

概要

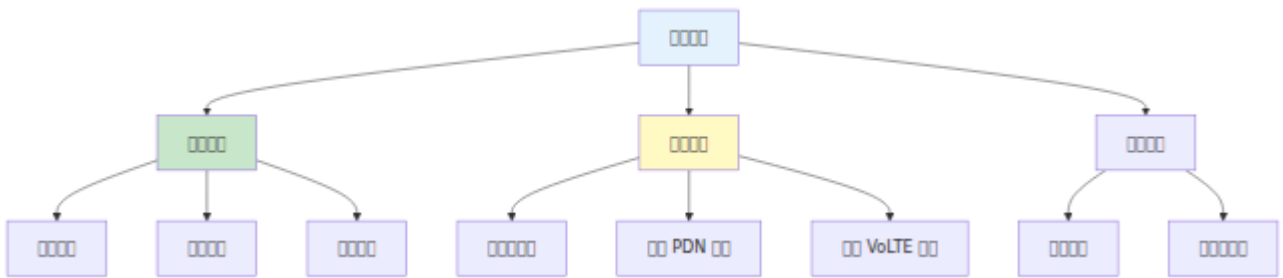
- 概要
- 概要
- 概要

4. Diameter 프로토콜

## Diameter 프로토콜

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

프로토콜



프로토콜

프로토콜

| 프로토콜          | 주소  | 프로토콜 설명  |
|---------------|-----|----------|
| <b>MME</b>    | 1   | 프로토콜 LTE |
| <b>P-GW</b>   | 1   | 프로토콜     |
| <b>S-CSCF</b> | 1   | IMS      |
| <b>P-CSCF</b> | 1   | VoLTE    |
| <b>I-CSCF</b> | 1   | IMS      |
| <b>AS</b>     | 1-1 | 프로토콜     |

프로토콜

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

프로토콜

| 項目 | 項目           | 項目    | 項目       |
|----|--------------|-------|----------|
| 項目 | 項目 Erlang 項目 | 項目    | > 90% 項目 |
| 項目 | 項目           | < 80% | > 90%    |
| 項目 | 項目           | N/A   | 項目       |

---

項目

項目

項目 SQL 項目

項目

項目

- 項目
- 項目
- IMS 項目

項目

項目

- 項目 PDN 項目
- 項目 VoLTE 項目
- 項目 APN 項目 PDN 項目

項目

項目

- 項目 MCC-MNC 項目
- 項目 PLMN 001-001 項目

- 0000000000000000

0000

0000000000

- 0000000000000000
- 000 MME 00000000
- 0000000000000000

00000000

000000000000

- 000000000000
- 000 00000000
- 0000000000
- 000000000000

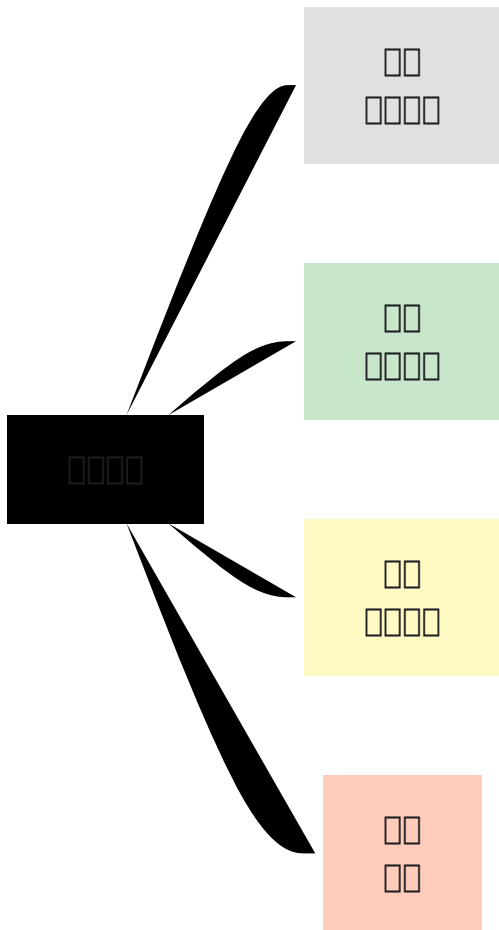
---

0000

0000

OmniHSS 000000 **stdout/stderr**0000000000000000

0000



□□□□□□□□□□

**Diameter** □□□□□:

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

□□□□□:

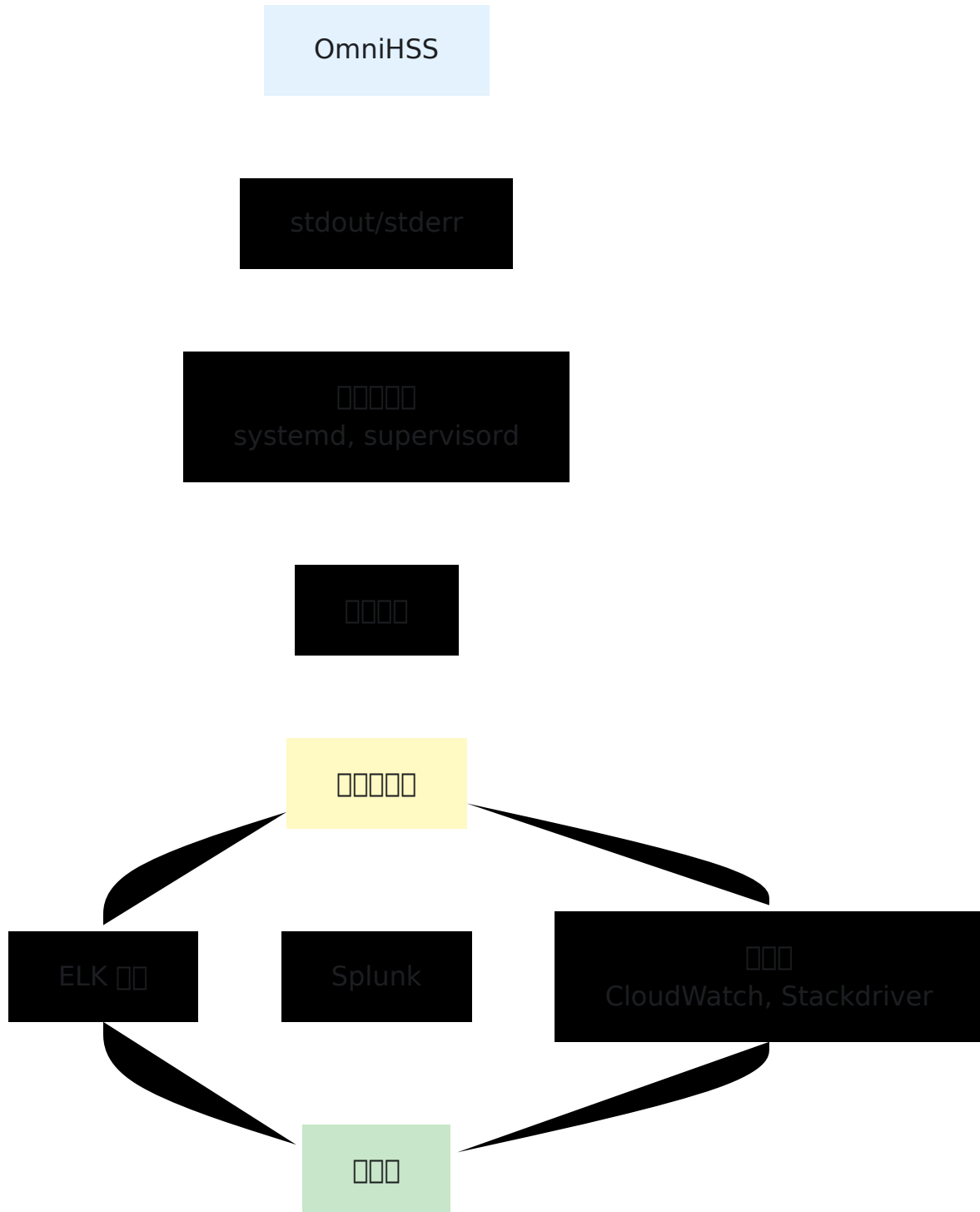
```
[info] Database connection established
[error] Database connection lost: timeout
[error] Database query failed: deadlock detected
```

□□□□:

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

□□□□

□□□□□□□□□□□□□□□□



---

□□□□□□

□□□□□□

**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 □□**

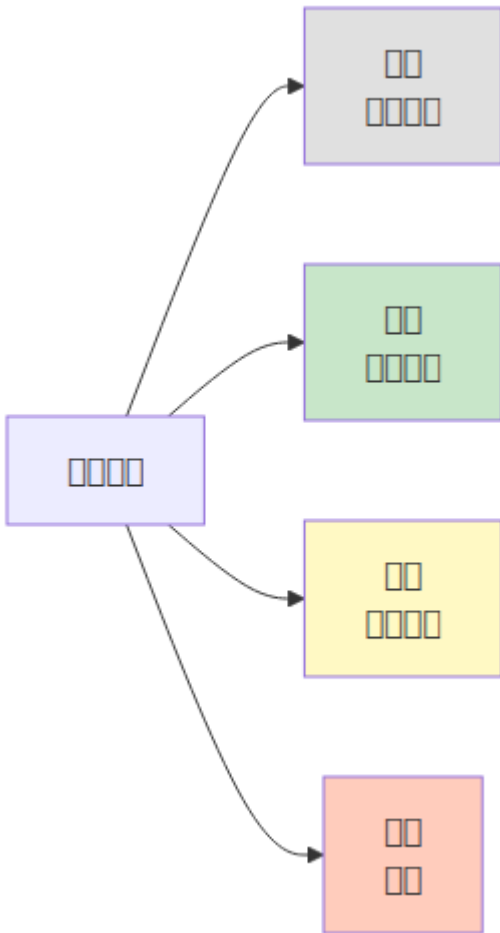
OmniHSS Prometheus API

## SNMP

SNMP SNMP API SNMP OID

---

## KPI



## Table 1: KPI

| KPI                          | Target  | Warning  | Critical |
|------------------------------|---------|----------|----------|
| Availability                 | 99.99%  | < 99.95% | < 99.9%  |
| <b>Diameter</b> Availability | 99.9%   | < 99.5%  | < 99%    |
| Throughput                   | > 99%   | < 99%    | < 95%    |
| <b>Diameter</b> Latency      | < 100ms | > 200ms  | > 500ms  |
| Latency                      | < 50ms  | > 100ms  | > 500ms  |
| Errors                       | < 0.1%  | > 0.5%   | > 1%     |

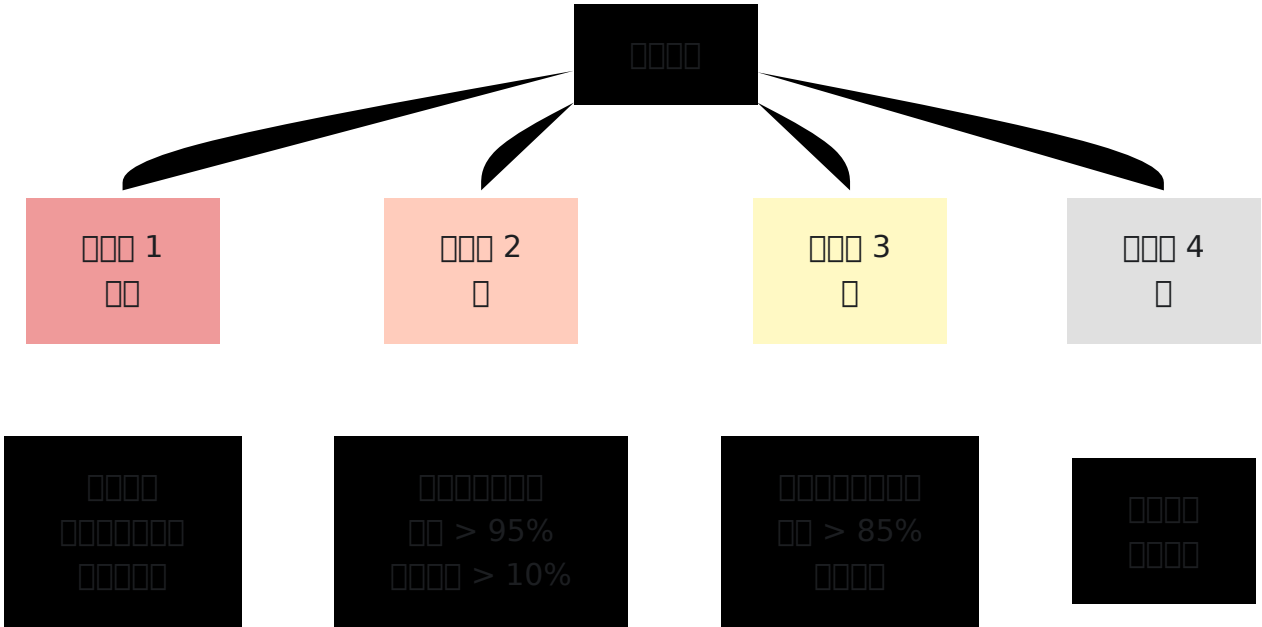
## Table 2: KPI

| Target                | Warning       | Critical       |
|-----------------------|---------------|----------------|
| Throughput            | Throughput    | 80% Throughput |
| <b>PDN</b> Throughput | Throughput    | 70% Throughput |
| Throughput            | Throughput MB | 80% Throughput |
| Throughput            | Throughput    | 80% Throughput |

---

□□□□

□□□□□



□□□□

□□□□ (P1)

□□□□□:

- API □□□□□□
- □□□□□□□□
- □□□□□□□□
- □□: □□□□□□□□

□□ **Diameter** □□□□□:

- □□□□□□
- □□: □□□□□□□□□□

□□□□□:

- □□□□□□ SQL □□□

- 時間: 10分

## 問題 (P2)

### 問題 Diameter 問題:

- MME 時間
- P-GW 時間
- S-CSCF 時間
- 時間: 15分

### 問題:

- 時間 > 95%
- 時間: 10分

### 問題:

- 10% 時間
- 時間: 10分

## 問題 (P3)

### 問題:

- 時間
- 時間
- 時間: 1分

### 問題:

- 時間 > 85%
- 時間: 10分

### 問題:

- 時間 > 1%
- 時間: 10分

## □□□□□ (P4)

□□□□:

- □□ > 80% □□□
- □□□ > 80% □□□□□
- □□: □□□□□□

□□□□:

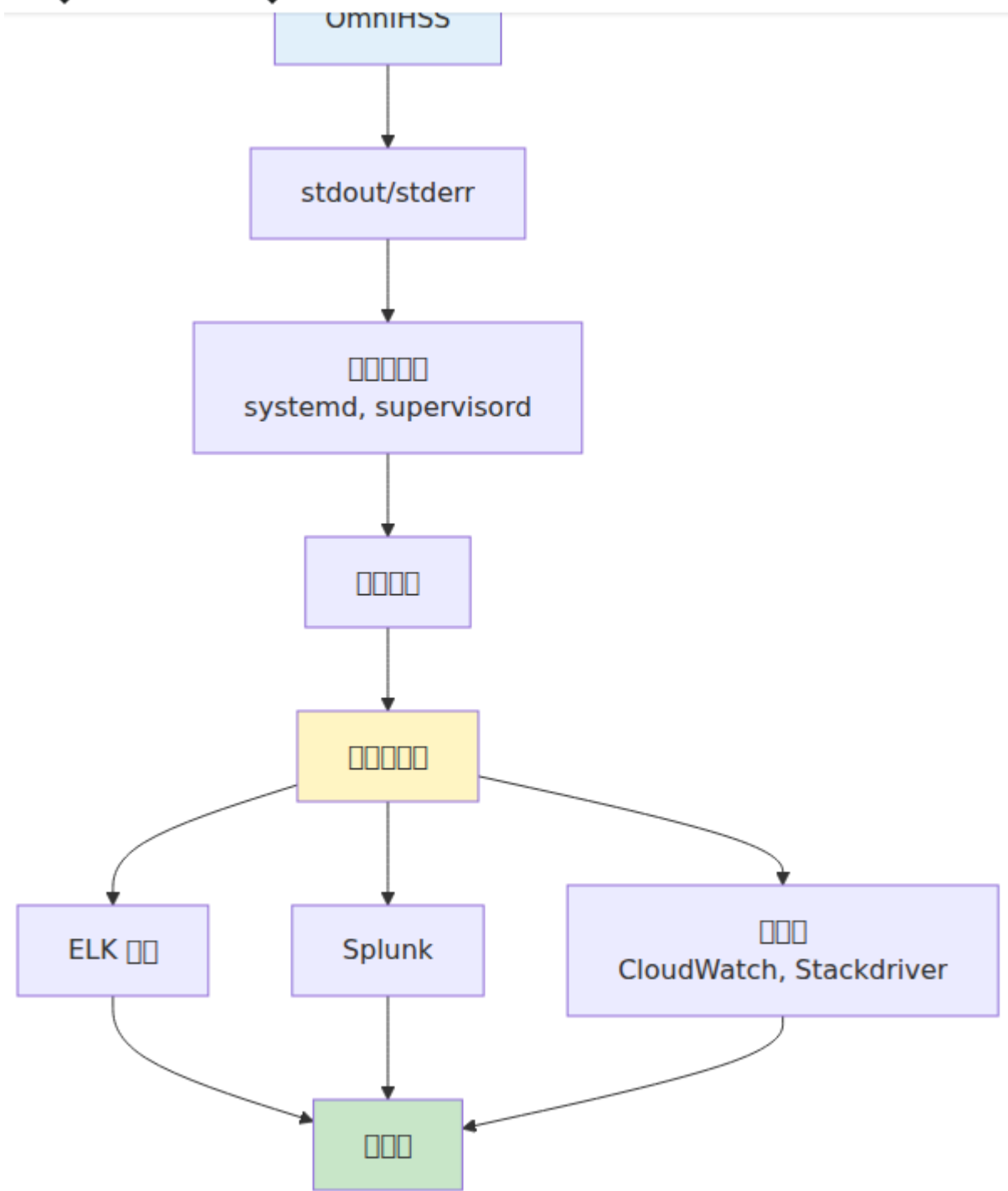
- □□□□□□□□□□
- □□: □□□□□□□

□□□□□□

Downloads

☒ □□□□ ▼

Omnitouch Webs



# □□□□□□

## □□□□

- - □□□□□□
- Diameter □□ - □□□□◆◆□□□□
- - □□□□□□□□□□
- - □□ 24 □□□□□□□□
- 

## □□□□

- - □□□□
- - □□□□
- - □□□□□□
- - □□□□
- - □□□□□□

## □□□□

- - □□ 6 □□□
- - □□□□□□
- - □□□□□□□□
- - □□□□□□
- - □□□□□□□□

# OmniHSS [MSISDN] IMSI

← [ ]

---

[ ]

- [ ]
  - [MSISDN]
  - [IMSI SIM]
  - [ ]
  - [ ]
  - [ ]
- 

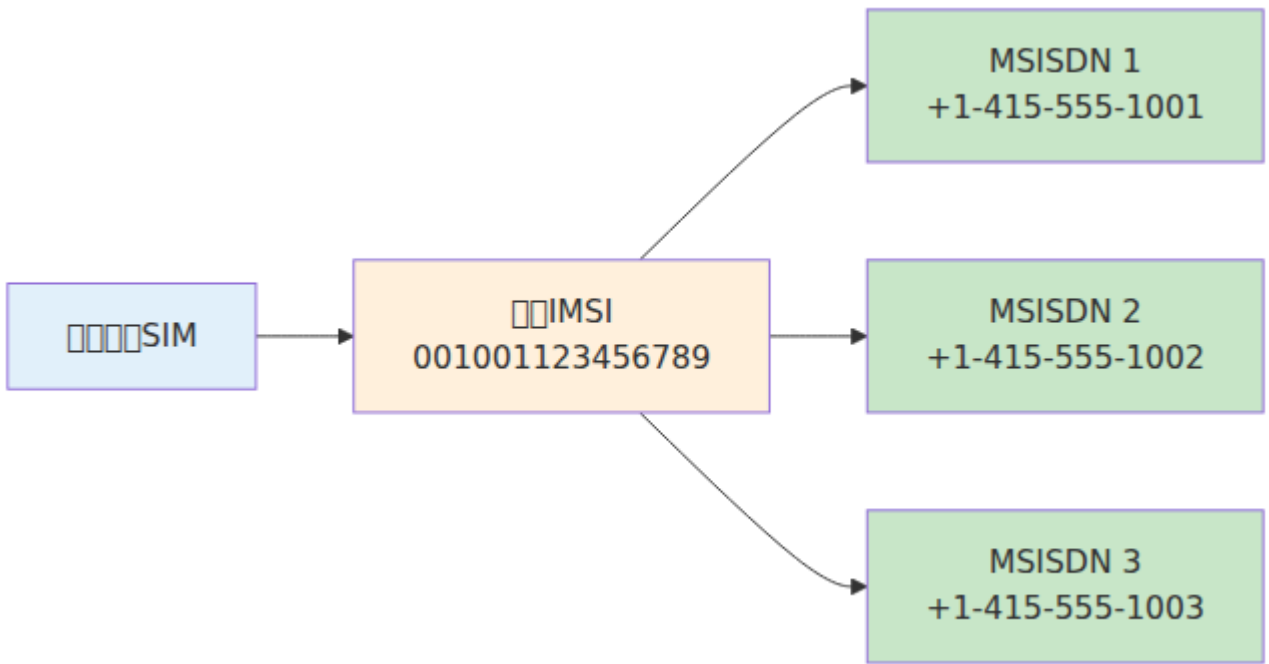
[ ]

OmniHSS [ ]

## [MSISDN]

[IMSI] → [ ]

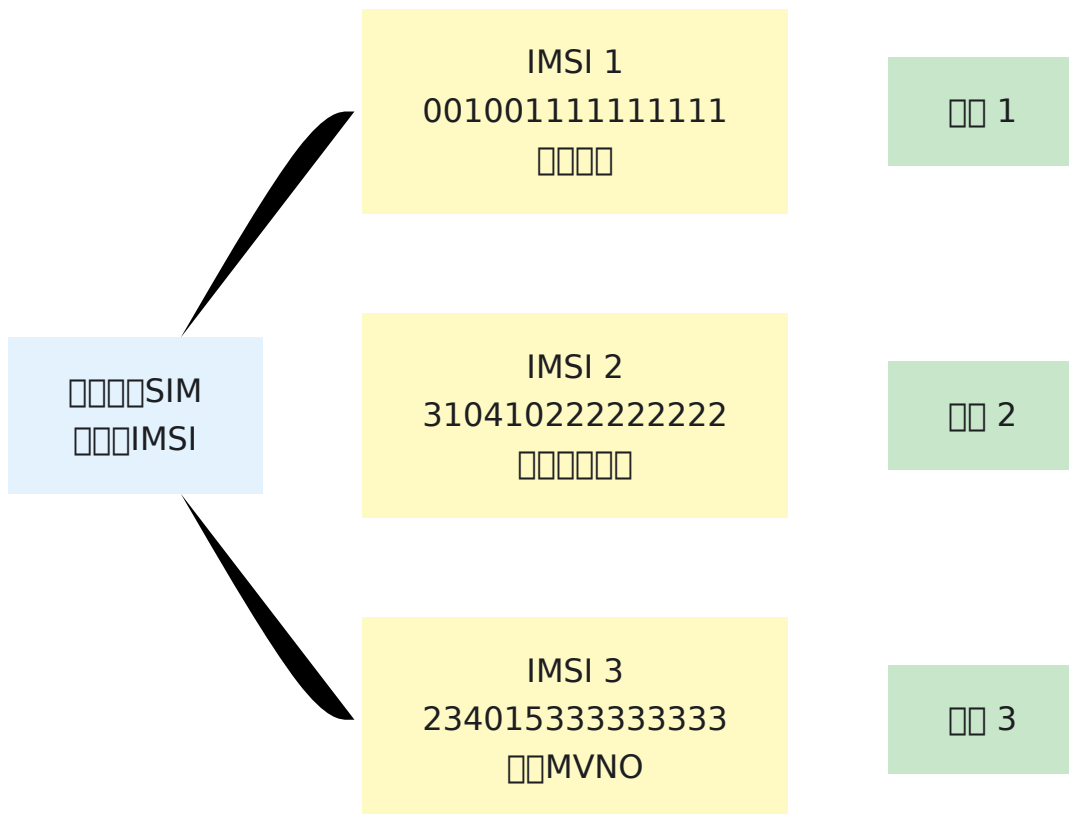
[ ] [IMSI] [ ] [MSISDN] [ ]



## IMSI SIM

SIM → IMSI

SIM IMSI MVNO



# IMSISDN

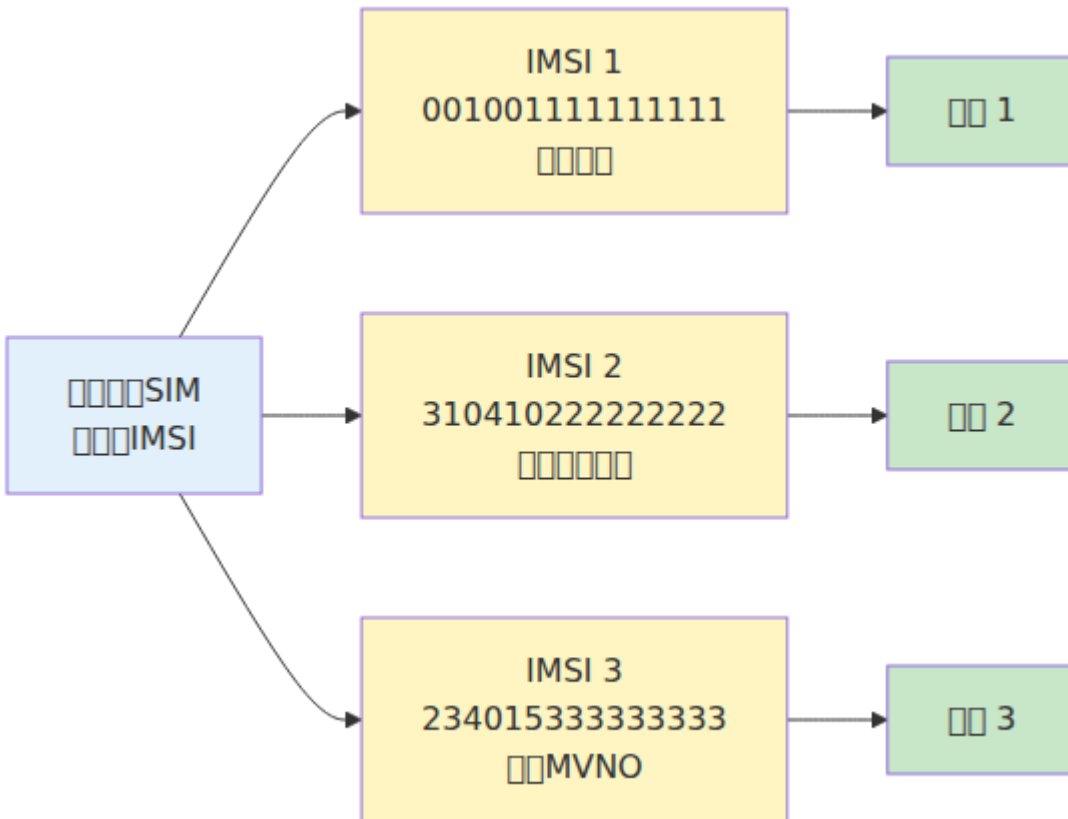
MSISDN

HSS MSISDN IMS MSISDN IMS

MSISDN

- IMSI - SIM IMSI
- MSISDN -
- IMS - MSISDN IMS
- - EPC IMS

MSISDN

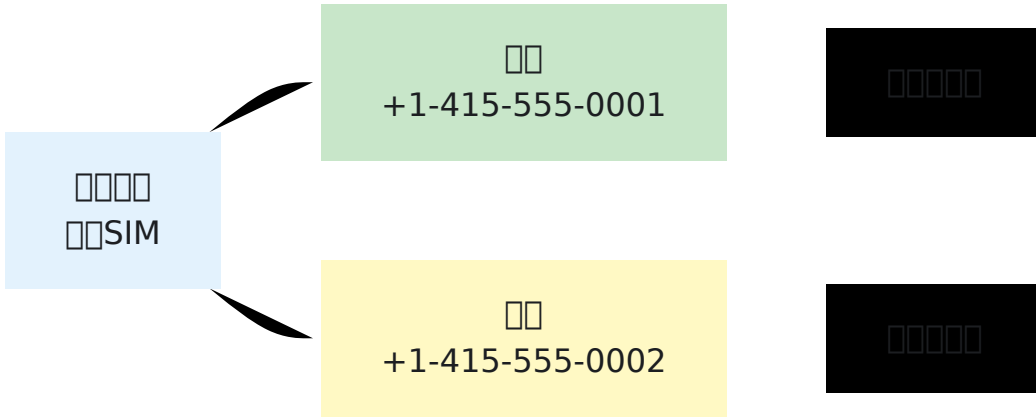


MSISDN MSISDN

□□□□

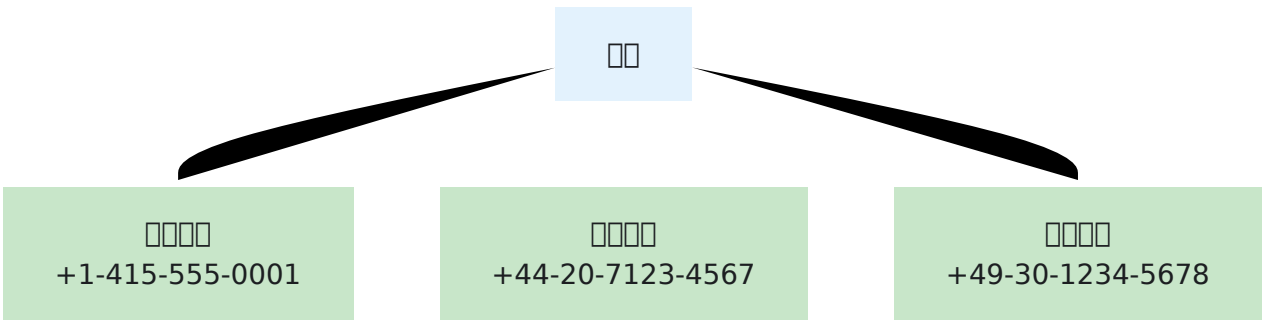
### 1. □□□□□□

□□□□□□□□□□□□□□□□□□



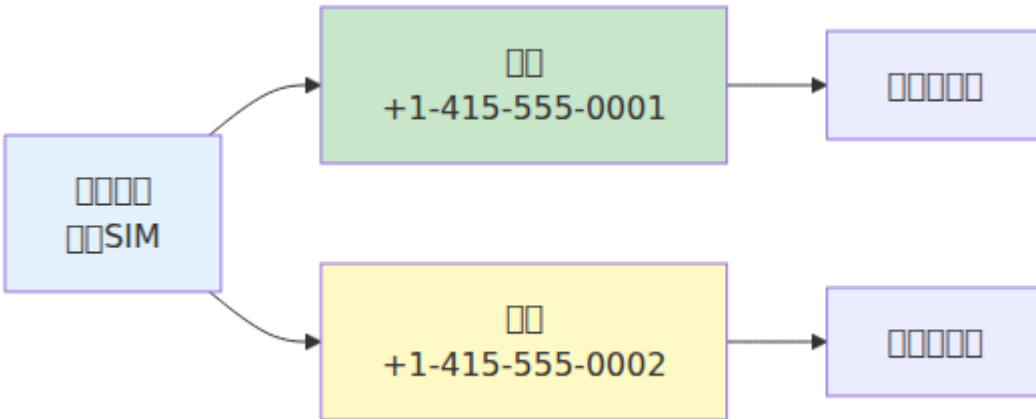
### 2. □□□□

□□□□□□□□□□□□□□□□



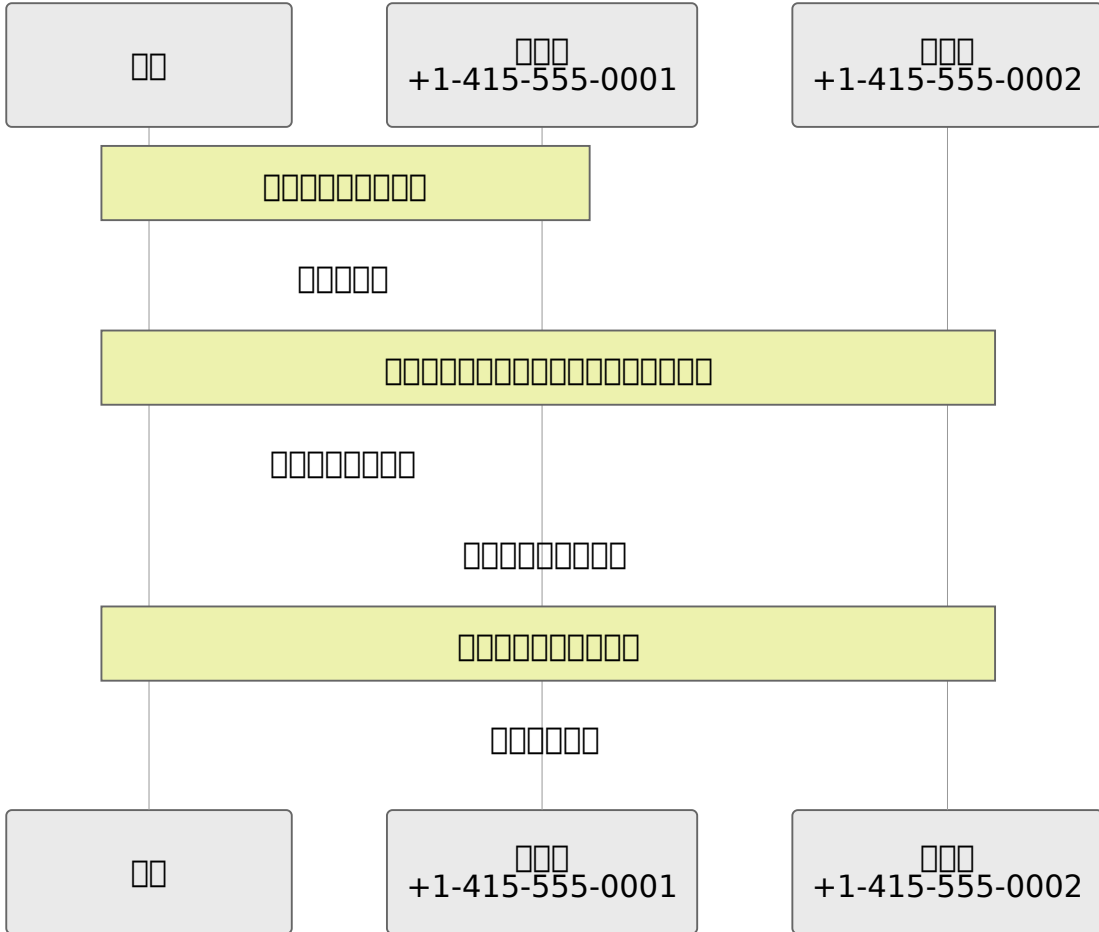
### 3. □□□□

□□□□□□□□□□□□□□□□



OmniHSS SIM/IMSI MSISDN

4.



MSISDN

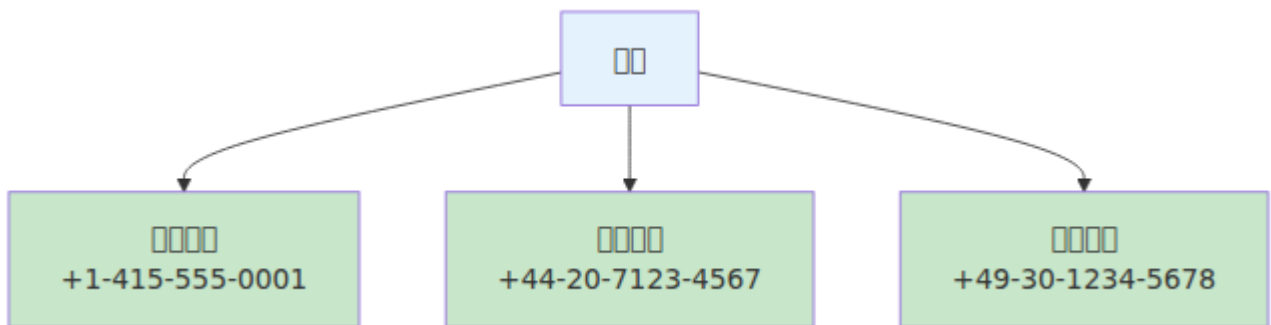
MSISDN

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

```
# 更新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\_id msisdn\_id



MSISDN

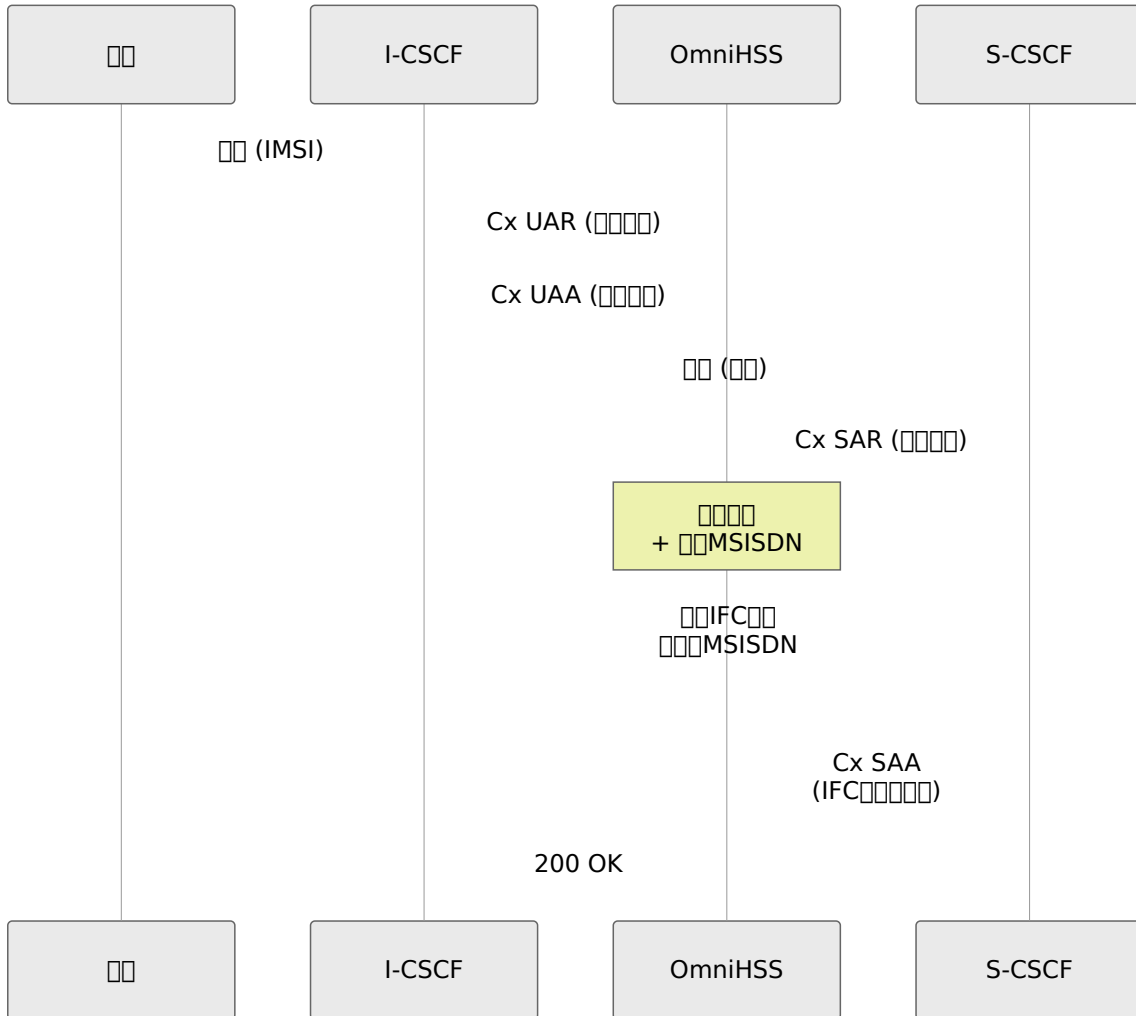
- 
- msisdn
-

□□□□□ID□IMS□□□□□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>

```

MSISDN

- `{{msisdns}}` - MSISDN

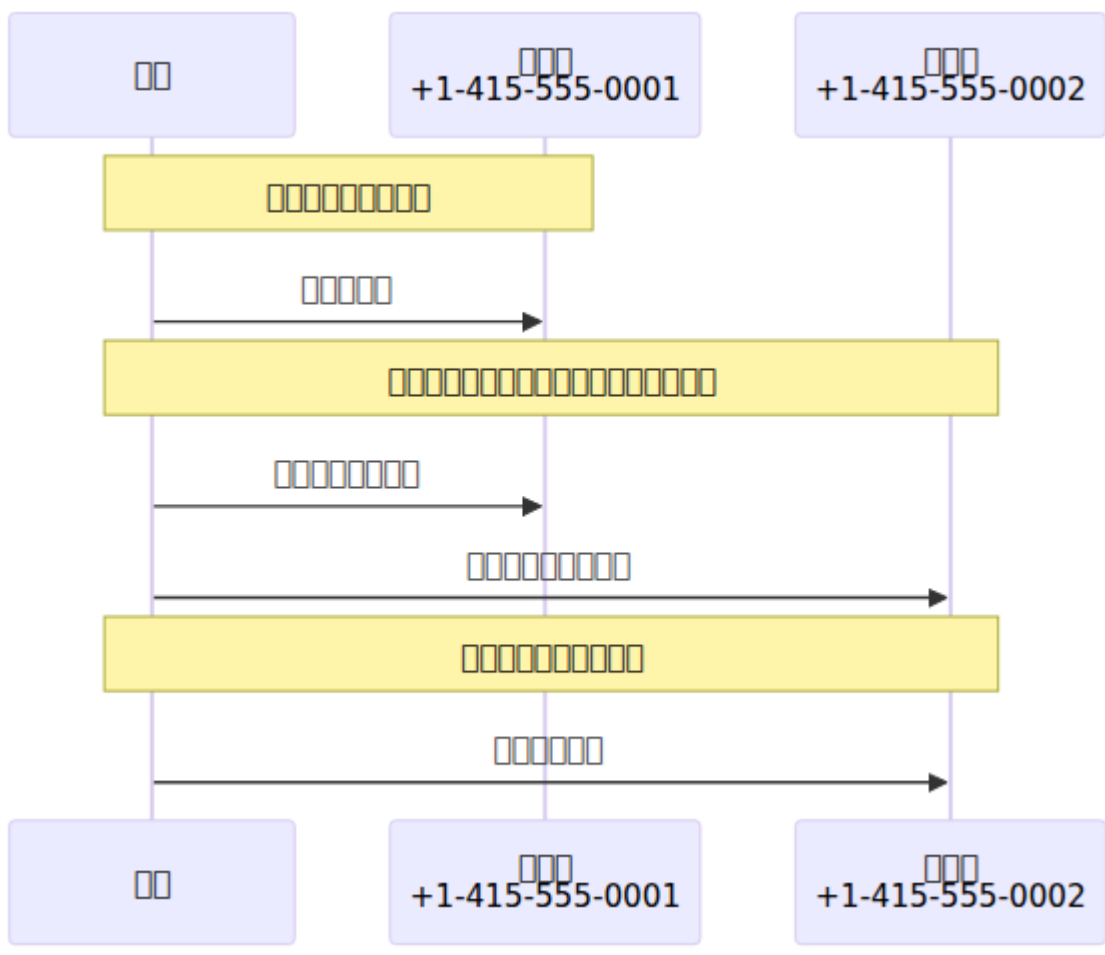
URI

MSISDN IMS



URI

IMS SIP URI



INVITE

INVITE

**SIP INVITE**

```
INVITE sip:+15105551234@ims.example.com SIP/2.0
From: "+14155551002" <sip:+14155551002@ims.example.com>;tag=123
To: <sip:+15105551234@ims.example.com>
P-Asserted-Identity: <sip:+14155551002@ims.example.com>
```

From P-Asserted-Identity

**MSISDN**

MSISDN IMS

- S-CSCF
- 

### 1. MSISDN

- IMSI
- MSISDN

### 2. IMS

- `{{msisdns}}`
- XML

### 3. HSS

- IMS Cx SAR
- MSISDN

### 4. IMS

- 
- S-CSCF

MSISDN

- 
- “” “”

### 1. MSISDN

- MSISDN
- 

### 2. MSISDN

- 國際行動電話號碼(MSISDN) 格式
- 國際行動電話號碼(MSISDN) 與 API 格式

國際行動電話號碼(MSISDN) 格式

格式

- 國際行動電話號碼(MSISDN) 格式
- 國際行動電話號碼(MSISDN) 與 API 格式

國際行動電話號碼(MSISDN) 格式

### 1. IMS 格式

- S-CSCF 格式
- SIP URI 格式

### 2. IMS 格式

- IFC 格式
- 格式

### 3. 格式

```
# SIP 格式  
sip:+14155551001@ims.example.com # 格式  
sip:+14155551002@ims.example.com # 格式
```

API 與 MSISDN 格式

格式

- API 格式 `/api/subscriber/msisdn/:msisdn` 格式

格式

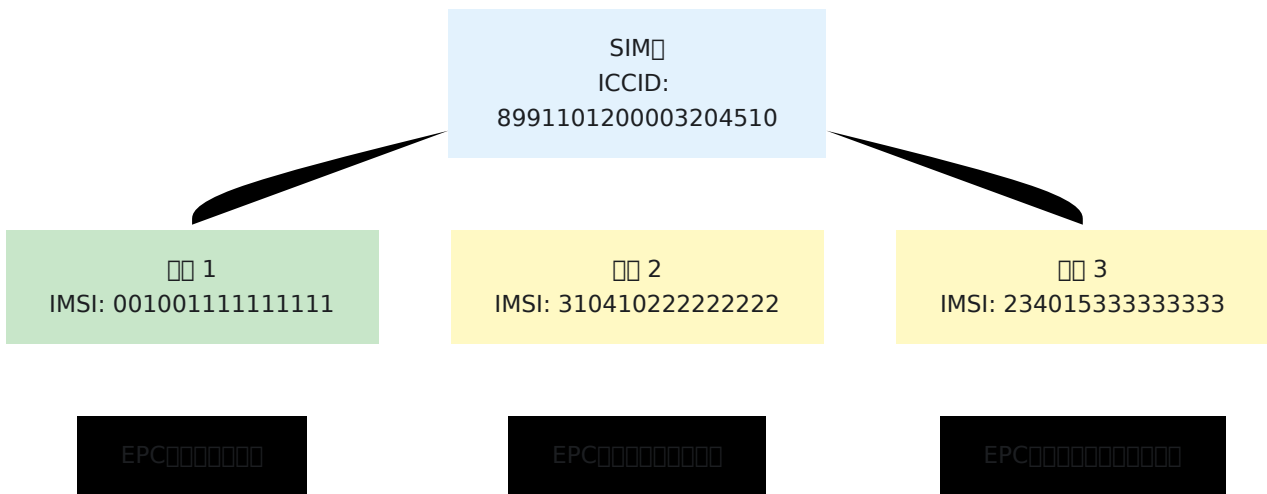
國際行動電話號碼(MSISDN) 格式





# OmniHSS

OmniHSS IMSI SIM IMSI SIM



1. 1.1

## 1. 1.1

- 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. 4.1

- IMSI
- 
- 

## IMSI

### 

- IMSI Ki OPC
- IMSI
- 

### 

- EPC APN
- IMS
- IMS

### 

- IMSI SIM sim\_id
- ICCID
- SIM

### 

- SIM IMSI
- 
- HSS IMSI



```
# 1. SIM ID from IMSI
SIM_ID=$(curl -k -X POST https://hss.example.com:8443/api/sim \
  -d '{"sim": {"iccid": "8991101200003204510", "is_esim": false}}' \
  | jq -r '.data.id')

# 2. IMSI 1 key set
KEYSET1=$(curl -k -X POST https://hss.example.com:8443/api/key_set \
  -d '{"key_set": {"ki": "0123456789ABCDEF...", "opc": \
  "FEDCBA9876..."}}' \
  | jq -r '.data.id')

# 3. IMSI 1 subscriber
curl -k -X POST https://hss.example.com:8443/api/subscriber \
  -d '{"subscriber": {
    "imsi": "0010011111111111",
    "sim_id": $SIM_ID,
    "key_set_id": $KEYSET1,
    "epc_profile_id": 1
  }}'

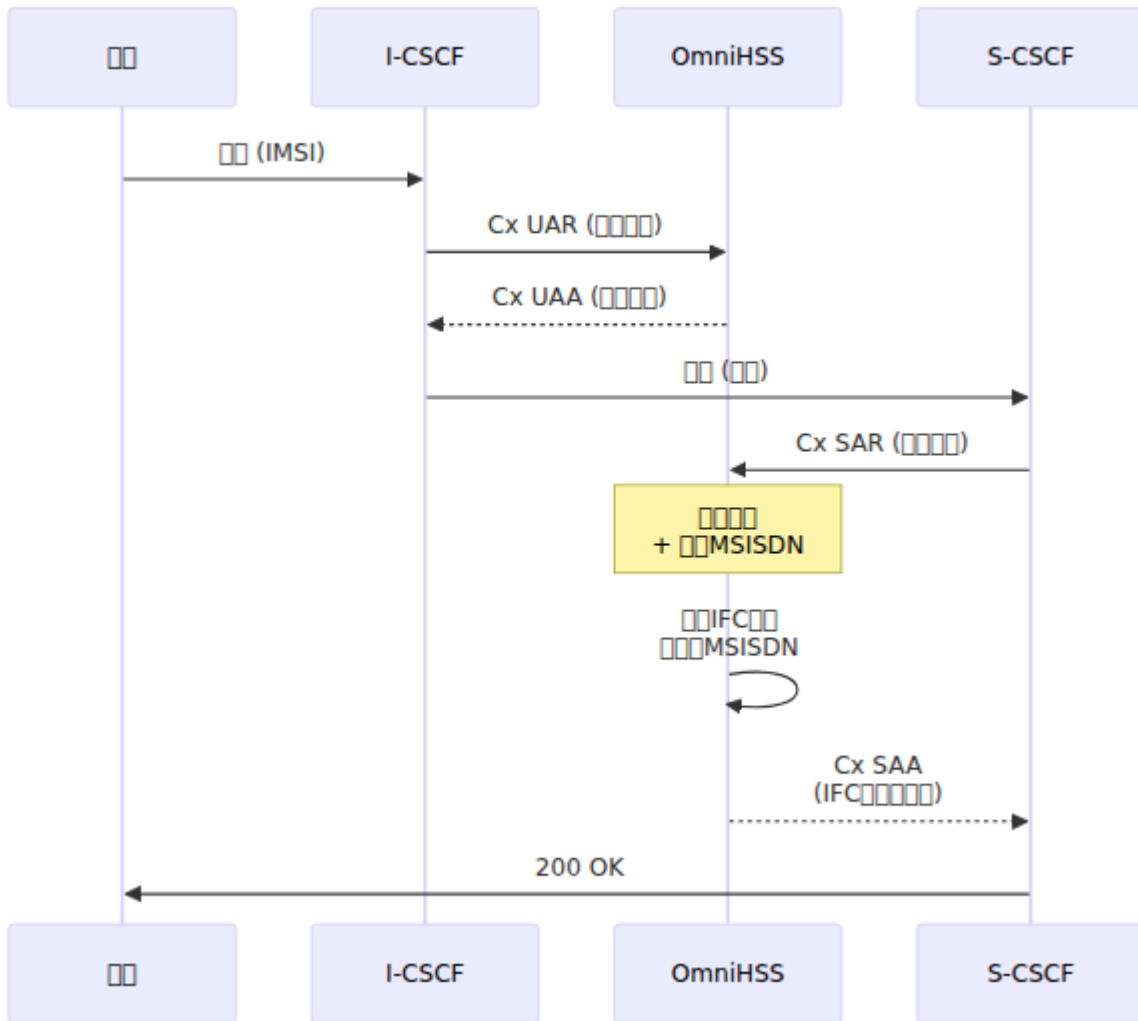
# 4. IMSI 2 key set
KEYSET2=$(curl -k -X POST https://hss.example.com:8443/api/key_set \
  -d '{"key_set": {"ki": "1111111111111111...", "opc": \
  "2222222222..."}}' \
  | jq -r '.data.id')

# 5. IMSI 2 subscriber
curl -k -X POST https://hss.example.com:8443/api/subscriber \
  -d '{"subscriber": {
    "imsi": "3104102222222222",
    "sim_id": $SIM_ID,
    "key_set_id": $KEYSET2,
    "epc_profile_id": 2
  }}'

# 6. SIM ID from IMSI...
```

□□□□□□

□□IMS□□□□□□



HSS□□□□□□□□IMS□ SIM—□□□□□□□□□□IMS□

### IMS□□□□□□

□□IMS□ SIM□□□IMS□□□□□IMS□□□□□□□□□IMS□□OmniHSS□□□HSS□□\*\*□□□□□□  
□CLR□\*\*□□□□□□□□□□□□□□□□□□□□IMS□

□□□□IMS□□

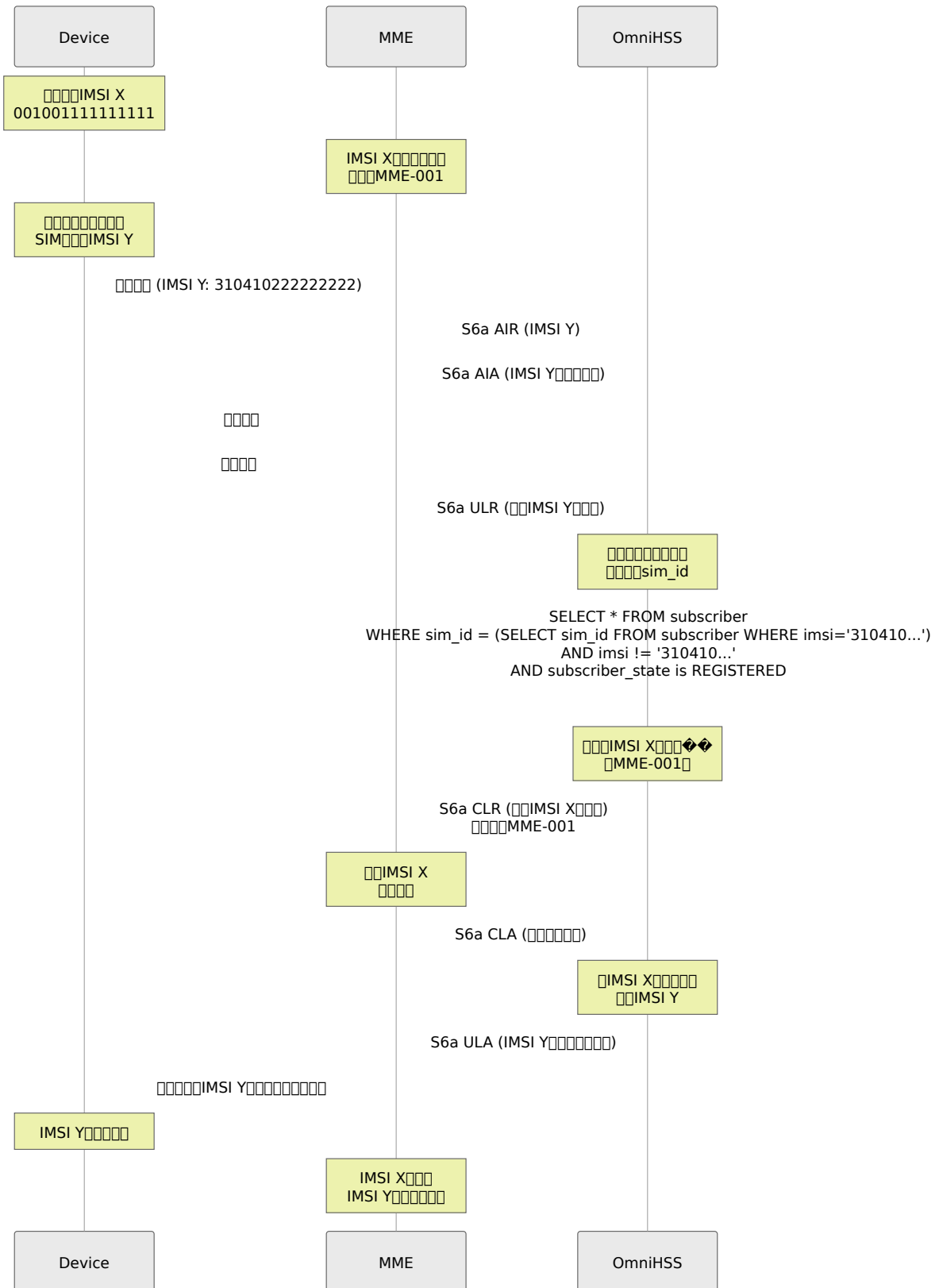
□□□□□ □□SIM□□□□□□□□IMS□□□□□□□□□□□□□□

- □□□□□MME□□□□IMS X
- □□HSS□□□□IMS Y□□IMS X□□□SIM□□□□□□□□□□□□□□

• HSS IMSI X

IMSI

IMSI



□□□□□□

□□□□□□

- □□□□□□□□SIM□□□□□□
- □□□□□□□□□□□□
- □□□□□□□□□□□□

□□□□□□

- □□□□□□□□IMSI□□□□□□□□□□
- IMSI□□□□□□□□□□□□
- □□□□CDR□□□□□□□□□□□□

□□□□□□

- □IMSI□MME□□□□□□
- PDP□□□□□□□□□□□□
- □□□□□□□□□□

## IMSI□□□□□□

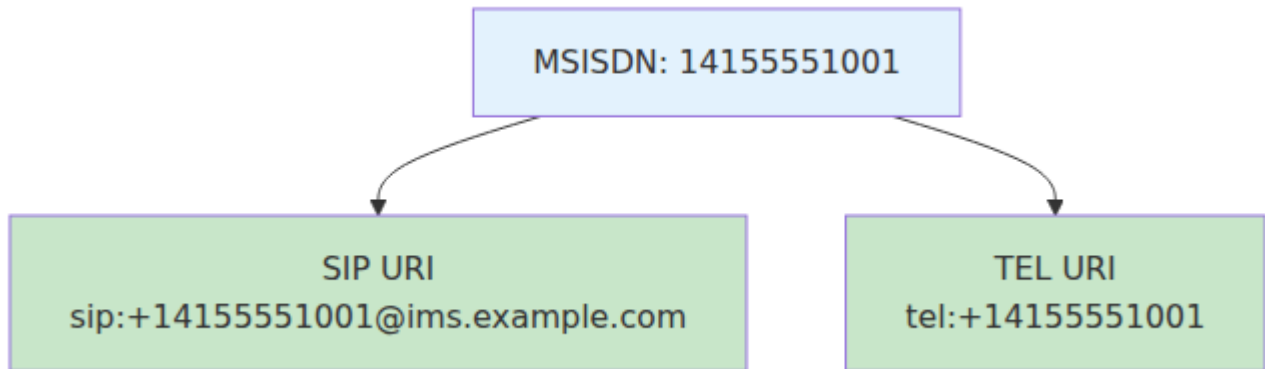
□□/SIM□□□□□□□□IMSI□□□□□□

1. □□□□□□
  - □□IMSI□□□□□□
  - □□□□□□□□□□IMSI
2. □□□□□□
  - □□□□□□□□□□
  - SIM□□□□□□□□IMSI
3. □□□□□□
  - SIM□□□□□□□□□□□□□□□□□□□□□□IMSI□
  - □□MCC/MNC□□□□□□
4. □□□□□□

- IMSI
- IMSI

## IMS

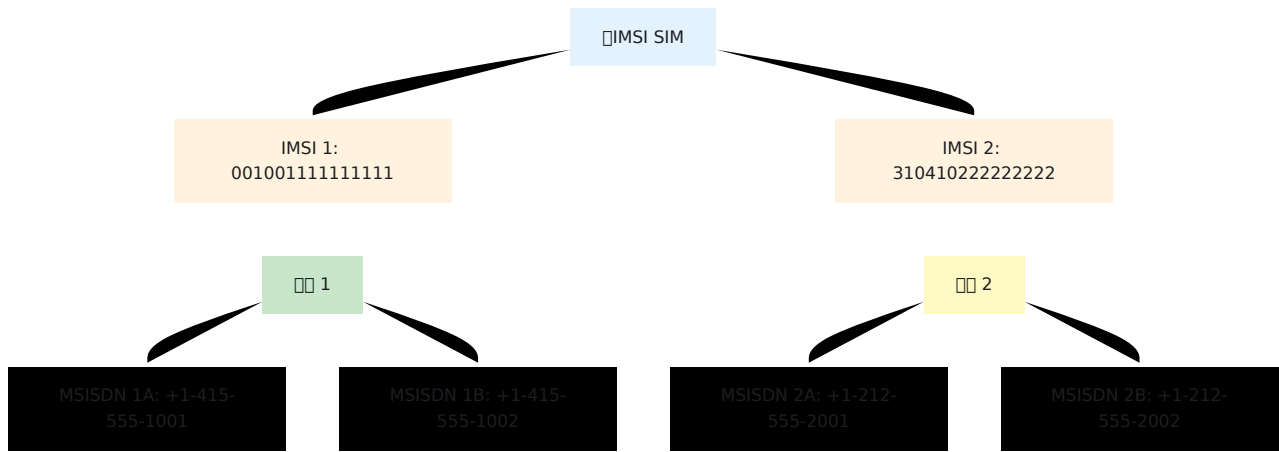
IMS



1. 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. □□□IMSI□key\_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

✓ 000000 ✓ 000000 ✓ 00000000 ✓ 000000 ✓ 0000 ✓ 0000000000

0000

✓ 00000 ✓ 00000? ? ? 0000 ✓ 00000000000 ✓ 00000000 ✓ 00000000

---

← 000000

# PCRF

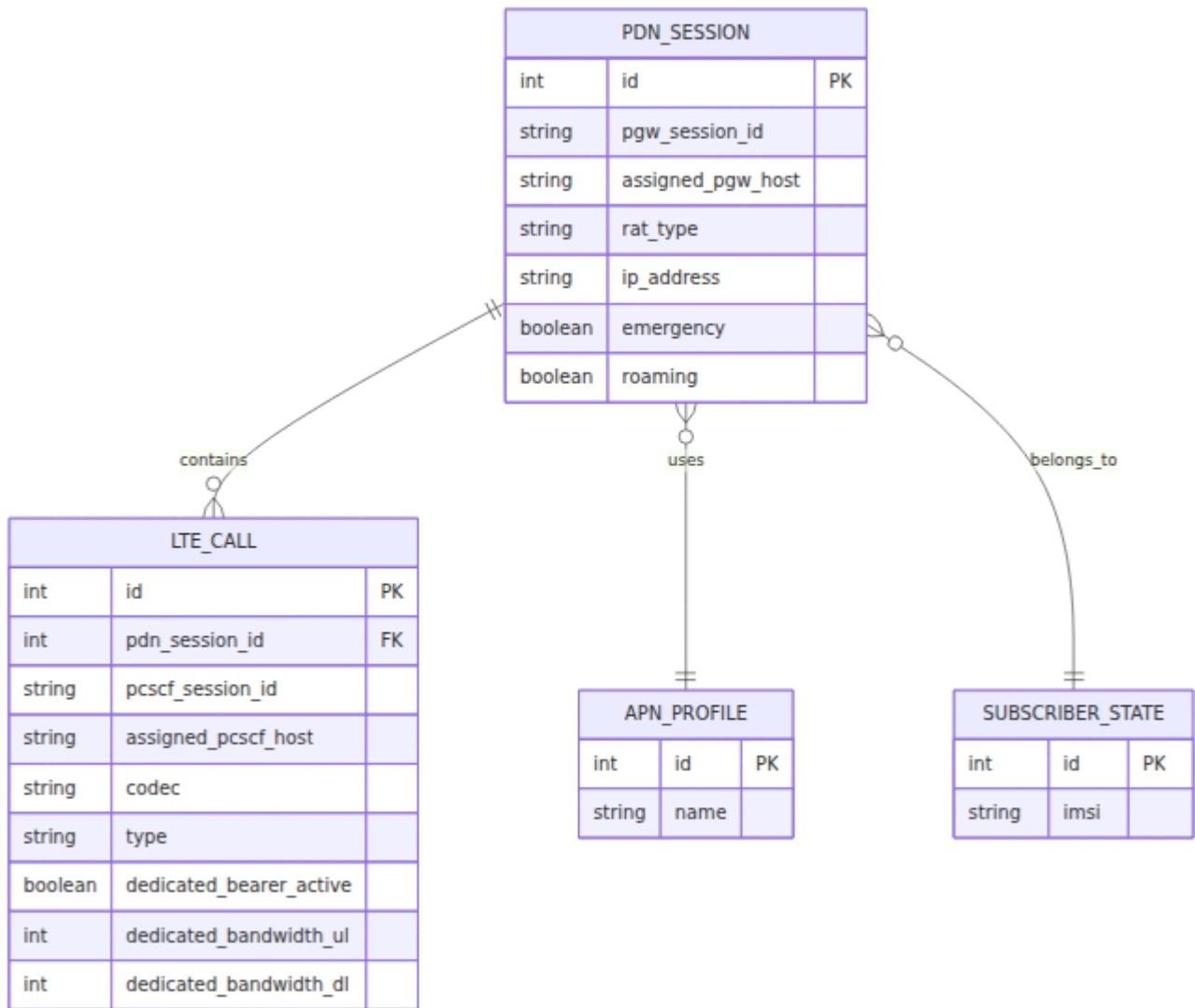
HSS PCRF PCRF LTE QoS

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

## Diameter

|           | ID         |             |         |
|-----------|------------|-------------|---------|
| <b>Gx</b> | 16,777,238 | PGW (PCEF)  | PDN QoS |
| <b>Rx</b> | 16,777,236 | P-CSCF (AF) | IMS     |

PCRF PDN VoLTE



# Gx

PGW

## 1. PGW - CCR-I

PGW sends PDN

AVP

- Session-Id
- Origin-Host, Origin-Realm
- Subscription-Id IMSI
- Called-Station-Id APN

- IP-CAN-Type IP
- RAT-Type
- Framed-IP-Address UE IP

**PCRF**

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

**AVP**

- Result-Code: 2001 DIAMETER\_SUCCESS
- QoS-Information APN
- Default-EPS-Bearer-QoS QCI ARP
- Bearer-Control-Mode

**2. CCR-U**

PGW RAT

**PCRF**

1. ID
2. RAT
- 3.

Result-Code 2001

**3. CCR-T**

PGW PDN

**PCRF**

1. ID
- 2.
- 3.

Result-Code 2001

#### 4. RAR

PCRF → PGW HSS

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

#### RAR AVP

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

#### PGW / /

PCRF TFT

- -
- -
- - QoS

- Gx RAR
- 
- 5 / IP / TFT

- - Spotify WhatsApp Facebook

- **QoS** - **Quality of Service**
- **QoS** - **Quality of Service**
- **QoS** - **Quality of Service**
- **QoS** - **Quality of Service**
- **SLA** - **Service Level Agreement** QoS

## QoS **QoS**

**QoS** APN **QoS**

```
{
  "QoS-Class-Identifider": 9,           // QCI9 = QoS
  "APN-Aggregate-Max-Bitrate-UL": 50000, // kbps
  "APN-Aggregate-Max-Bitrate-DL": 100000, // kbps
  "Allocation-Retention-Priority": {
    "Priority-Level": 8,
    "Pre-emption-Capability": 1,       // QoS
    "Pre-emption-Vulnerability": 1    // QoS
  }
}
```

**QoS** VoLTE

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

## Rx **Rx**

**Rx**

**1. AA** **AAR**/ **AA** **AAA**

IP-CSCF IMS VoLTE

AVP

- Session-Id IP-CSCF
- Subscription-Id IMS SIP URI
- Media-Component-Description
  - Media-Type
  - Max-Requested-Bandwidth-UL/DL
  - Codec-Data
  - Flow-Description 5
- AF-Application-Identifier

PCRF

1. IMSI SIP URI
2. IMS
- 3.
- 4.
5. Gx RAR PGW
6. Gx RAA
7. Rx AAA

AVP

- Result-Code: 2001 5063

2. STR/ STA

IP-CSCF IMS

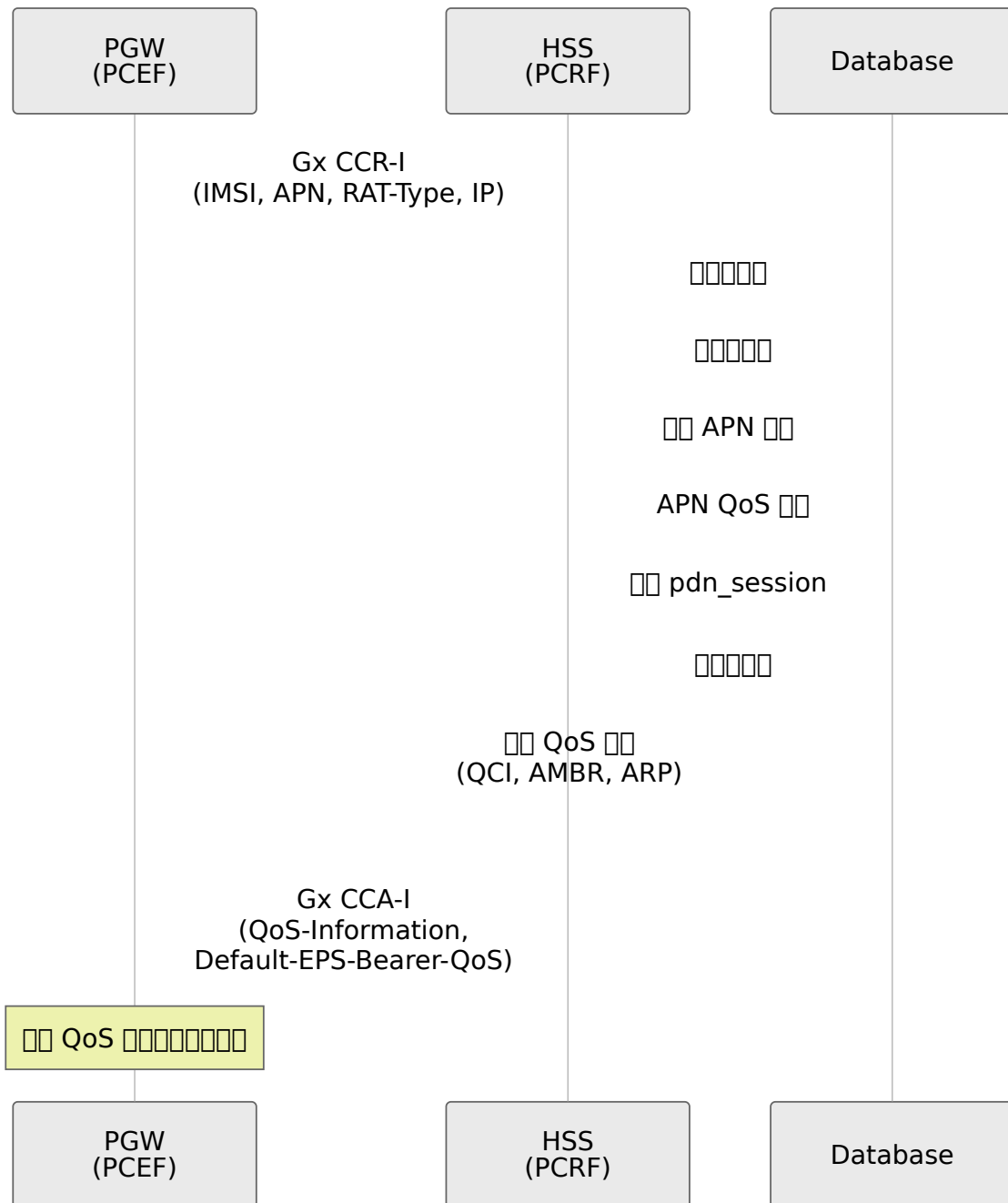
PCRF

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

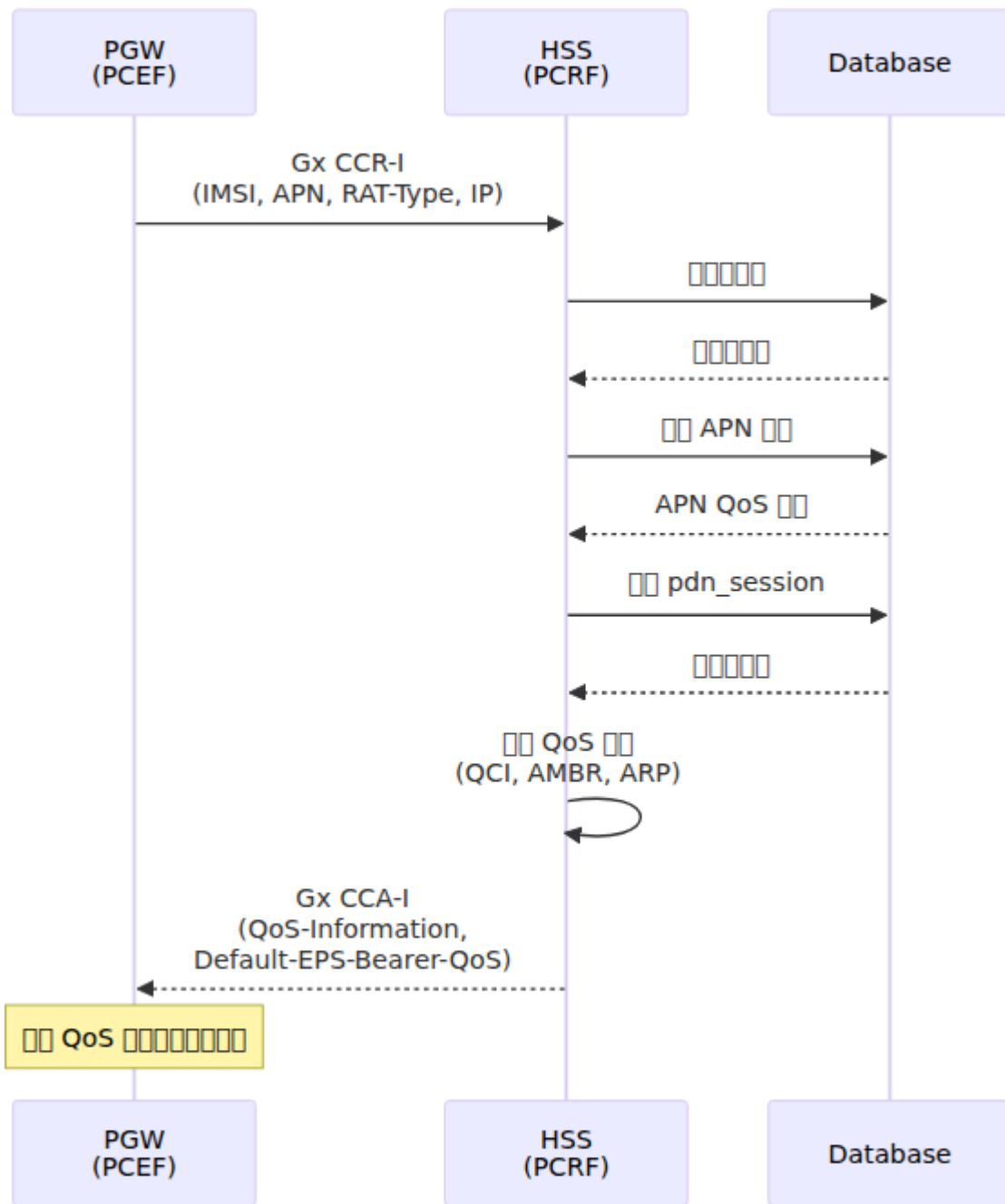
Result-Code 2001

□□□□□

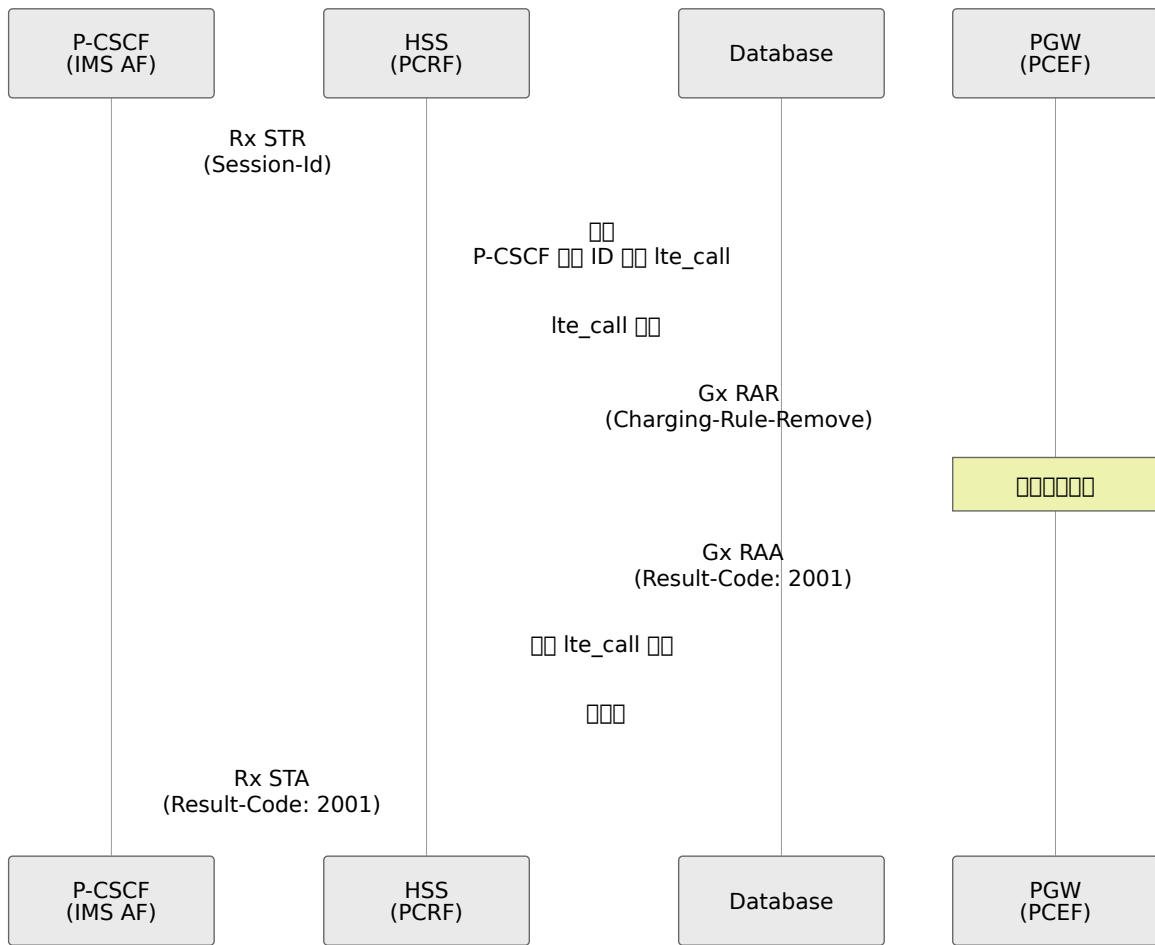
1 PDN □□□□



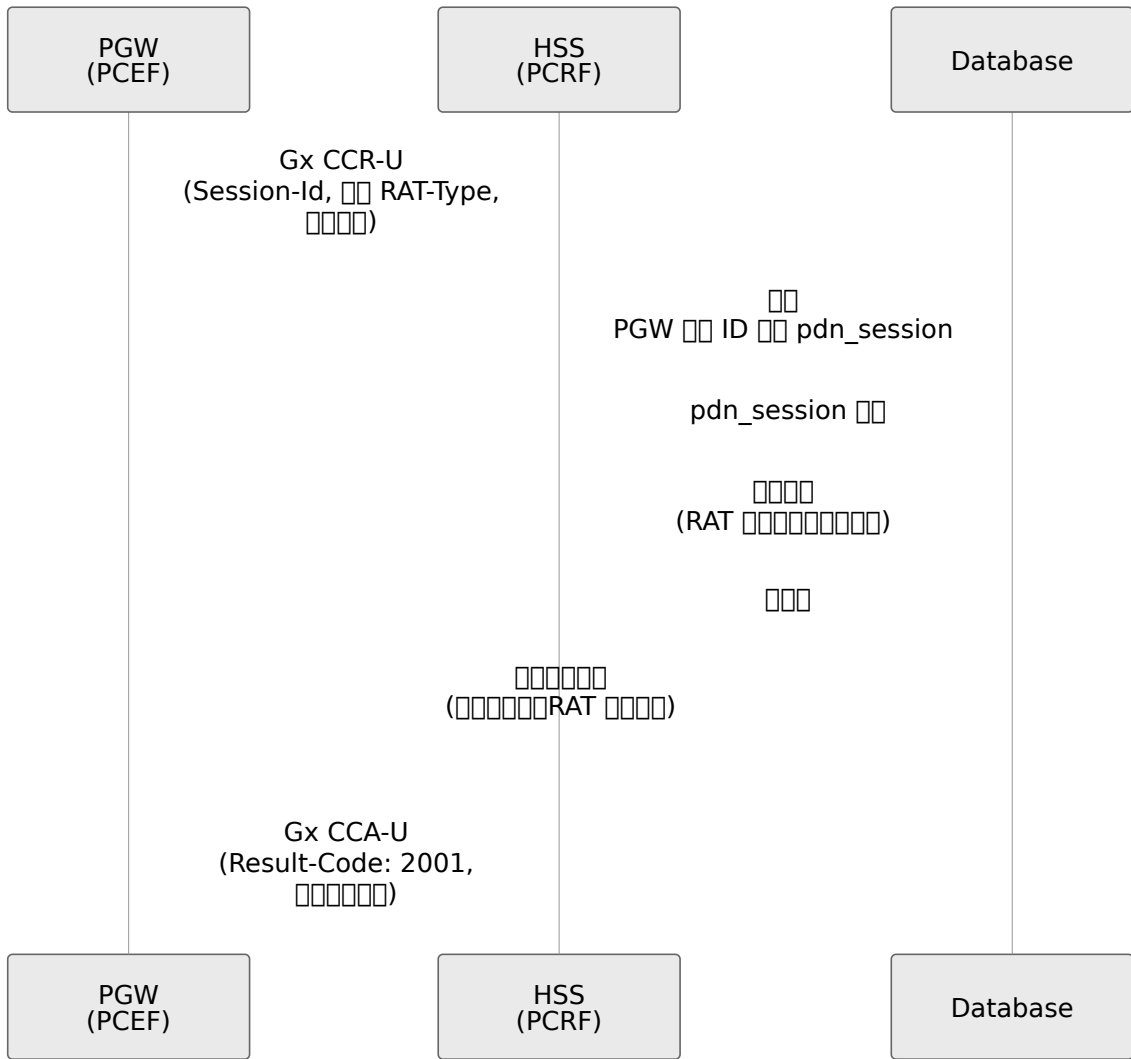
# 2 VoLTE Rx AAR → Gx RAR



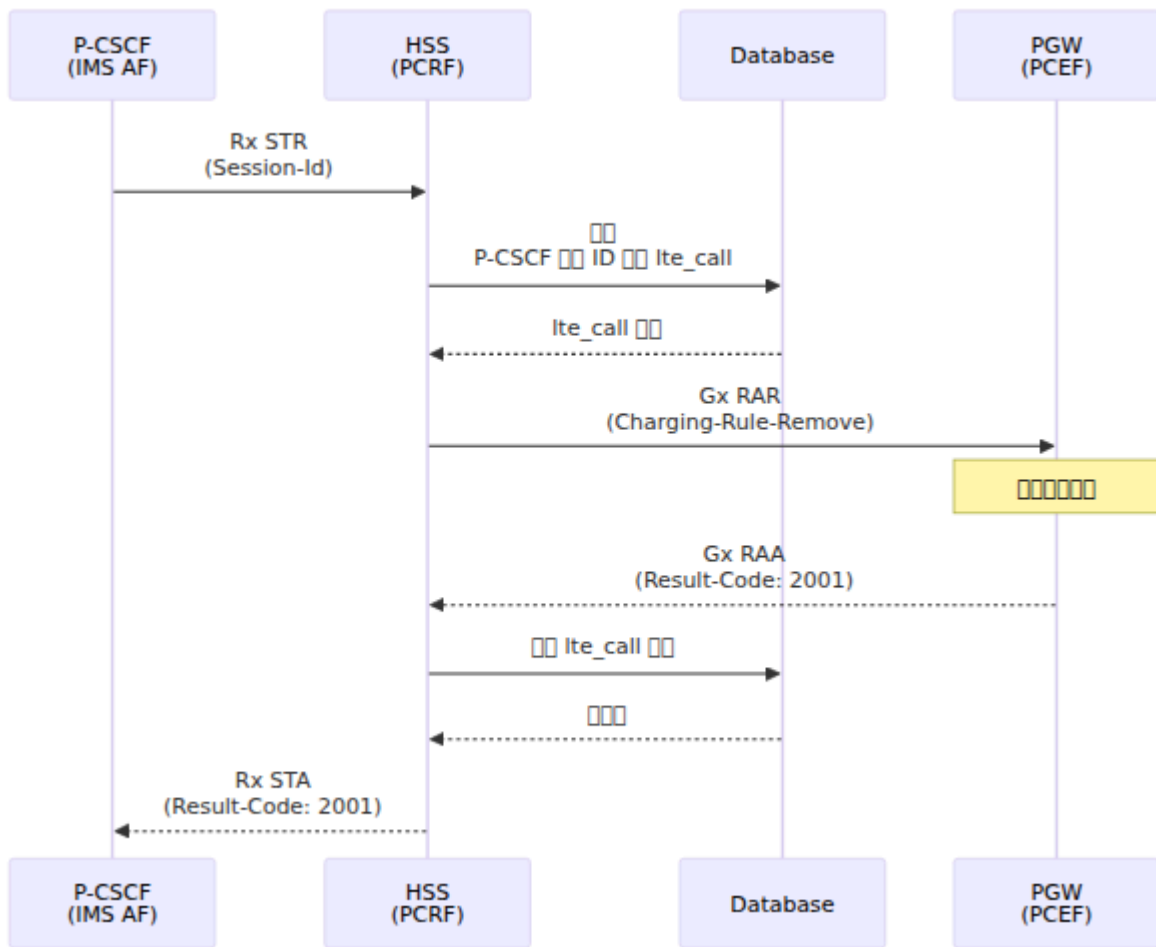
# 3 VoLTE Rx STR → Gx RAR



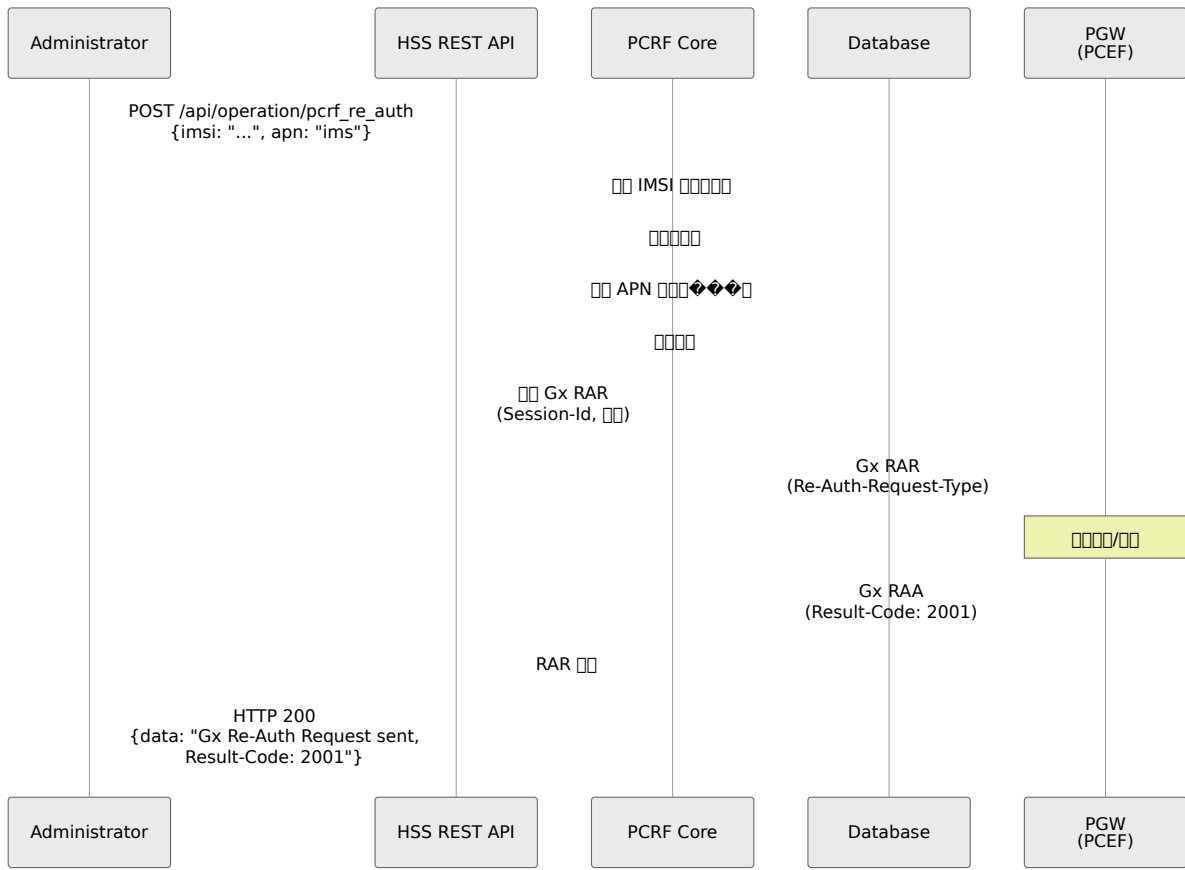
# 4G PDN



# 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 APN PDN PGW Gx RAR

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

### 1. APN

APN IP

POST /api/apn/identifier

Request

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

## IP Version

- "ipv4" - IPv4
- "ipv6" - IPv6
- "ipv4v6" - IPv4 or IPv6
- "ipv4\_or\_ipv6" - IPv4 or IPv6

Response HTTP 201

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

Notes

- apn 1-254
- ip\_version

APN GET /api/apn/identifier

## 2. APN QoS

QoS QCI

POST /api/apn/qos\_profile

{}

```
{
  "apn_qos_profile": {
    "name": "Best Effort Internet",
    "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** {}

| 名前                            | 型       | 範囲              | 説明                                    |
|-------------------------------|---------|-----------------|---------------------------------------|
| name                          | string  | 1-254 文字        | 名前                                    |
| qci                           | integer | 1-254           | QoS 優先度<br>1-4 = GBR<br>5-9 = Non-GBR |
| allocation_retention_priority | integer | 1-15            | ARP 優先度<br>1 = 最高                     |
| apn_ambr_dl_kbps              | integer | 1-4,294,967,293 | APN 最大ダウンロード速度<br>[kbps]              |
| apn_ambr_ul_kbps              | integer | 1-4,294,967,293 | APN 最大アップロード速度<br>[kbps]              |
| pre_emption_capability        | boolean | true/false      | 優先度低いサービスが優先度高いサービスにリソースを奪われる能力       |
| pre_emption_vulnerability     | boolean | true/false      | 優先度低いサービスが優先度高いサービスにリソースを奪われる脆弱性      |

### QCI 一覧

- 1 - VoLTE - GBR 100ms 遅延
- 2 - GBR 150ms 遅延
- 5 - IMS 音声 - Non-GBR 100ms 遅延
- 9 - 標準データサービス - Non-GBR 300ms 遅延

HTTP 201 OK

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

GET /api/apn/qos\_profile

### 3. APN

APN QoS

POST /api/apn/profile

```
{
  "apn_profile": {
    "name": "Internet APN",
    "apn_identifier_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": "Internet 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 Signaling QoS",
    "qci": 5,
    "allocation_retention_priority": 2,
    "apn_ambr_dl_kbps": 5000,
    "apn_ambr_ul_kbps": 5000,
    "pre_emption_capability": true,
    "pre_emption_vulnerability": false
  }
}'
# [{"data": {"id": 2, ...}}]

# 3. APN
curl -X POST https://hss.example.com:8443/api/apn/profile \
-H "Content-Type: application/json" \
-d '{
  "apn_profile": {
    "name": "IMS APN",
    "apn_identifier_id": 2,
    "apn_qos_profile_id": 2
  }
}'
# [{"data": {"id": 2, ...}}]

```

2

APN EPC API APN



## QoS Profiles

- Default APN QoS Profile
- Premium APN QoS Profile

## Default

Download Speed **100 Mbps** / Upload Speed **50 Mbps**

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

Download Speed **500 Mbps** / Upload Speed **100 Mbps**

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

## 5G / M2M QoS Profile

```
{
  "apn_qos_profile": {
    "name": "IoT 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
  }
}
```

□□□□□□□□□□□□

```
{
  "apn_qos_profile": {
    "name": "Emergency 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: :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: :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 AVP
  - Flow-Description AVP

## □□□□

| □□□□ | □□  | □□               | □□                |
|------|-----|------------------|-------------------|
| 2001 | □□  | DIAMETER_SUCCESS | □□□□□□            |
| 5001 | □□□ | □□□□□□           | IMSI □□□□□□□□□□   |
| 5002 | □□□ | □□□□□□           | PDN □□□□□□□□□□/□□ |
| 5063 | □□□ | □□□□□□           | IMS □□□□□□□□      |

## □□□□

### □□□□

PCRF □□□

- □□ **PDN** □□ - □□ APN□□□□□□□□□□
- **VoLTE** □□ - □□ IMS □□□□□□□□□□□□□□□□
- **QoS** □□ - □□ APN □□□□□□□□
- □□□□ - □□□□□□□□□□□□□□□□

### □□□□□□

PCRF □□□□□□□□□□□□□□

- □□ Gx □□□□□□□□□□/□□
- □□□□□□**TFT**□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□ TFT □□□□□□□□

# □□□□

- Diameter □□ - □□□□□□
- API □□ - □□□ API □□
- □□ - □□ HSS □□
- □□□□ - □□□□ Diameter AVP □□□



## 속성

| 속성명                                   | 유형        | 범위                                       |
|---------------------------------------|-----------|------------------------------------------|
| ue_ambr_dl_kbps                       | 정수<br>정수  | 10,000 - 1,000,000 Kbps                  |
| ue_ambr_ul_kbps                       | 정수<br>정수  | 5,000 - 500,000 Kbps                     |
| network_access_mode                   | 정수<br>문자열 | "packet_only" 또는<br>"packet_and_circuit" |
| tracking_area_update_interval_seconds | TAU<br>정수 | 54 초                                     |

## 예시 EPC 생성

```
curl -k -X POST https://hss.example.com:8443/api/epc/profile \
-H "Content-Type: application/json" \
-d '{
  "apn_profiles": [],
  "name": "Premium 100Mbps",
  "network_access_mode": "packet_only",
  "tracking_area_update_interval_seconds": 600,
  "ue_ambr_dl_kbps": 100000,
  "ue_ambr_ul_kbps": 50000
}'
```

## 예시 EPC 속성

속성:

- ue\_ambr\_dl\_kbps: 10 Mbps (10,000 Kbps)
- ue\_ambr\_ul\_kbps: 5 Mbps (5,000 Kbps)

타이머:

- 4G: 50 Mbps (50,000 Kbps)
- 4G: 25 Mbps (25,000 Kbps)

5G:

- 5G: 100 Mbps (100,000 Kbps)
- 5G: 50 Mbps (50,000 Kbps)

6G:

- 6G: 1 Gbps (1,000,000 Kbps)
- 6G: 500 Mbps (500,000 Kbps)

---

## IMS 架构

IMS 架构由 IFC 和 S-CSCF 组成

### IFC 参数

IFC 参数由 S-CSCF 通过 XML 消息

参数:

- `{{imsi}}` - IMSI
- `{{msisdns}}` - 域名
- `{{mcc}}` - MCC
- `{{mnc}}` - 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

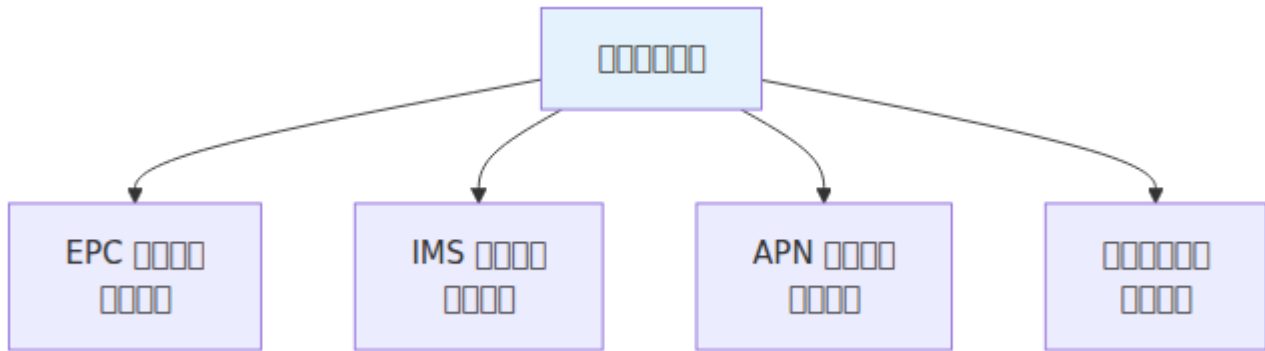
```
<ServiceProfile>  
  <PublicIdentity>  
    <Identity>sip:  
{{imsi}}@ims.mnc{{mnc}}.mcc{{mcc}}.3gppnetwork.org</Identity>  
  </PublicIdentity>  
  <InitialFilterCriteria>  
    <Priority>0</Priority>  
    <TriggerPoint>  
      <ConditionTypeCNF>0</ConditionTypeCNF>  
      <SPT>  
        <ConditionNegated>0</ConditionNegated>  
        <Group>0</Group>  
        <Method>INVITE</Method>  
      </SPT>  
    </TriggerPoint>  
    <ApplicationServer>  
      <ServerName>sip:as.ims.example.com</ServerName>  
      <DefaultHandling>0</DefaultHandling>  
    </ApplicationServer>  
  </InitialFilterCriteria>  
</ServiceProfile>
```

---

# APN 网络

APN网络结构图

## APN 网络



## APN 网络

APN 网络 IP 地址

### APN:

- internet - 互联网
- ims - IMS/VoLTE
- mms - 彩信
- vzwadmin - 运营商

### IP 地址:

- "ipv4": IPv4
- "ipv6": IPv6
- "ipv4v6": IPv4v6
- "ipv4\_or\_ipv6": IPv4 或 IPv6

## APN QoS 网络

网络 QoS

**QCI QoS :**

| QCI | QoS | QoS | QoS |
|-----|-----|-----|-----|
| 1   | GBR | GBR | GBR |
| 2   | GBR | GBR | GBR |
| 4   | GBR | GBR | GBR |
| 5   | GBR | IMS | GBR |
| 9   | GBR | GBR | 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": "internet", "ip_version": "ipv4v6"}' \
  | jq -r '.response.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 '{
    "name": "Best Effort",
    "allocation_retention_priority": 8,
    "apn_ambr_dl_kbps": 50000,
    "apn_ambr_ul_kbps": 25000,
    "pre_emption_capability": false,
    "pre_emption_vulnerability": true,
    "qci": 9
  }' | jq -r '.response.id')

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

## 📡 APN 📡 EPC 📡

APN 📡 `join_epc_profile_to_apn_profile` 📡 EPC 📡

📡 APN 📡 ID 📡 EPC 📡 ID 📡 APN 📡 EPC 📡

---

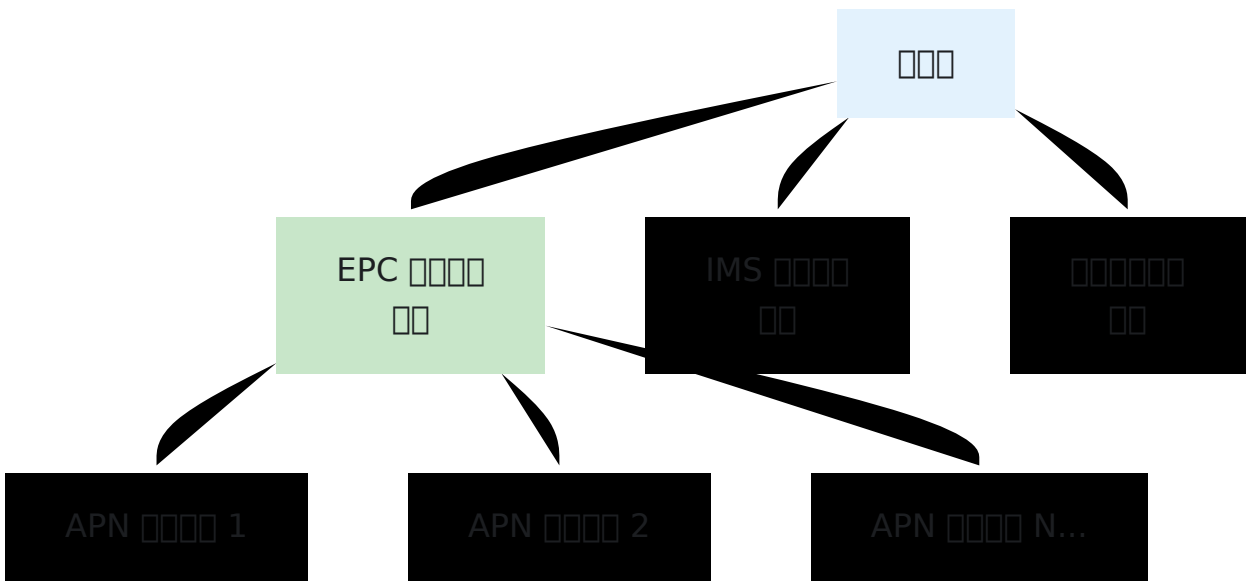
□□□□□□

□□□ □□□□□□ □□□□□□

---

□□□□□□

□□□□□□□□□□



## POST /api/subscriber

```
# Create subscriber EPC & IMS profile
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,
      "ims_profile_id": 1,
      "roaming_profile_id": 1
    }
  }'
```

```
# Update subscriber EPC profile
curl -k -X PUT https://hss.example.com:8443/api/subscriber/1 \
  -H "Content-Type: application/json" \
  -d '{
    "subscriber": {
      "epc_profile_id": 2
    }
  }'
```

## POST /api/subscriber

### Steps

1. Create subscriber - Create IMS profile & EPC profile
2. Update subscriber - Update EPC profile
3. Create subscriber - Create EPC profile
4. Update subscriber - Update IMS profile

# Network Architecture

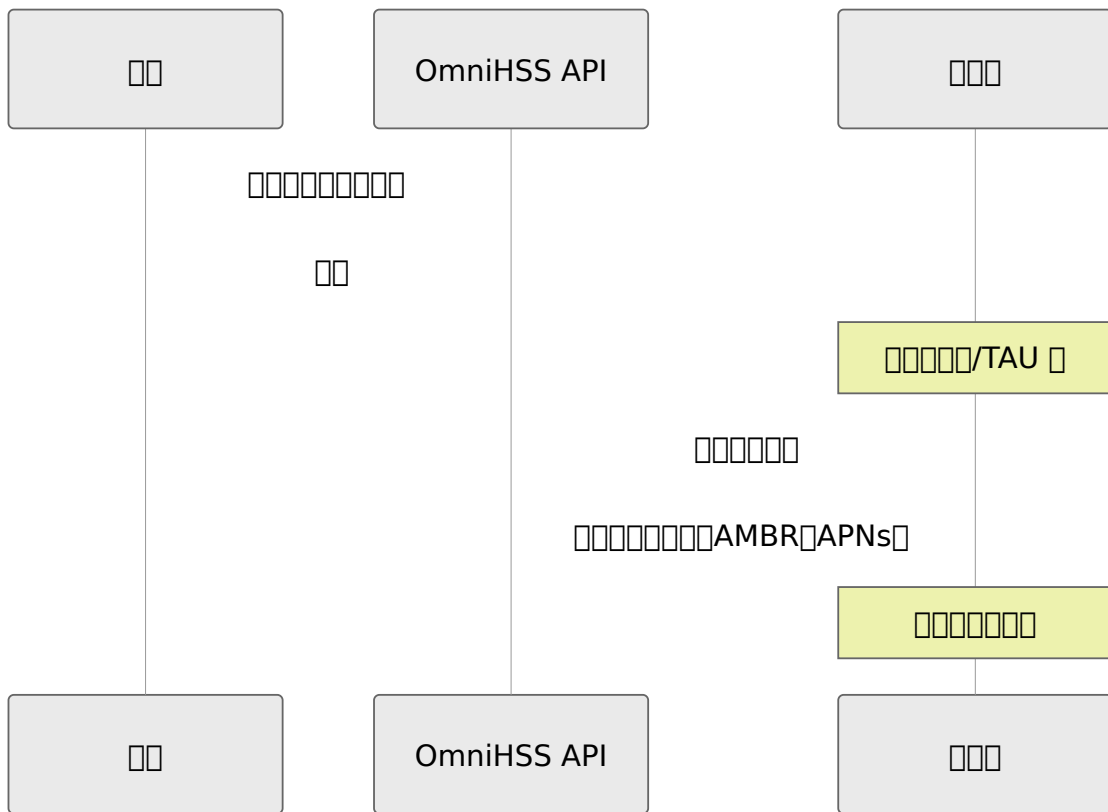
[Network] - [Core] - [Edge]

Network:

- "Basic-10Mbps-Internet"
- "Premium-100Mbps-VoLTE"
- "Enterprise-1Gbps-MultiAPN"

# Core Network

## Network Architecture



Network: Network/TAU


- Network/TAU
- Network
- IMS Network IMS Network

## □□□□□□□□□□

□□□□□□□□□□:

1. □□□□□ EPC □□□□ AMBR □
2. □□ APN QoS □□□□ AMBR □
3. □□ MME/P-GW □□□□□□□ QoS
4. □□□□□□

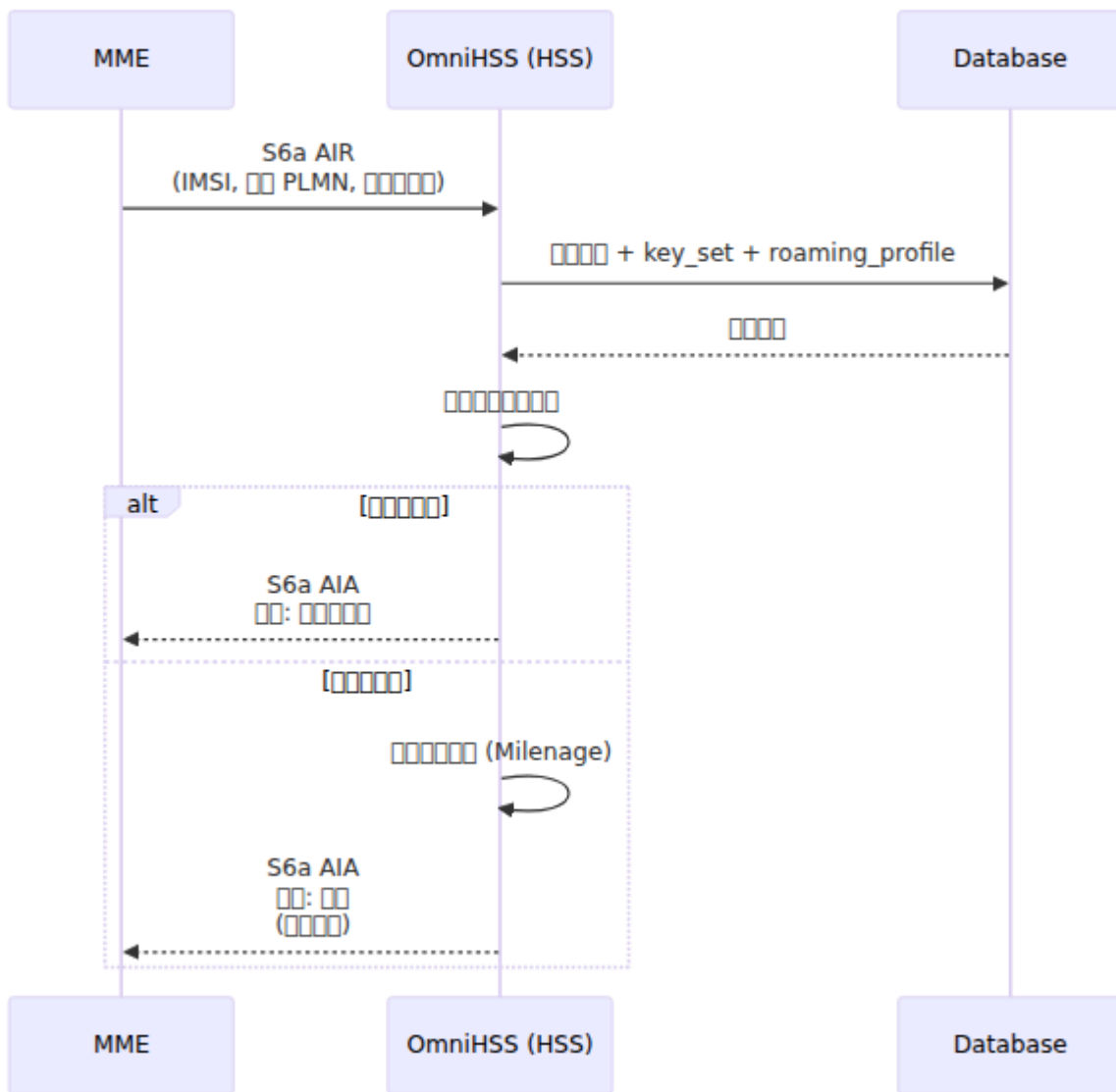
**IMS** □□□□:

1. □□□□□□□ IMS □□□□
2. □□ IFC □□ XML □□□□
3. □□ S-CSCF □□□ IFC □□□□
4. □□ S-CSCF □□□□

**APN** □□□:

1. □□ APN □□□□□□□□□□ EPC □□□□
2. □□ APN □□□□□□□□□□□□
3. □□ UE □ PDN □□□□



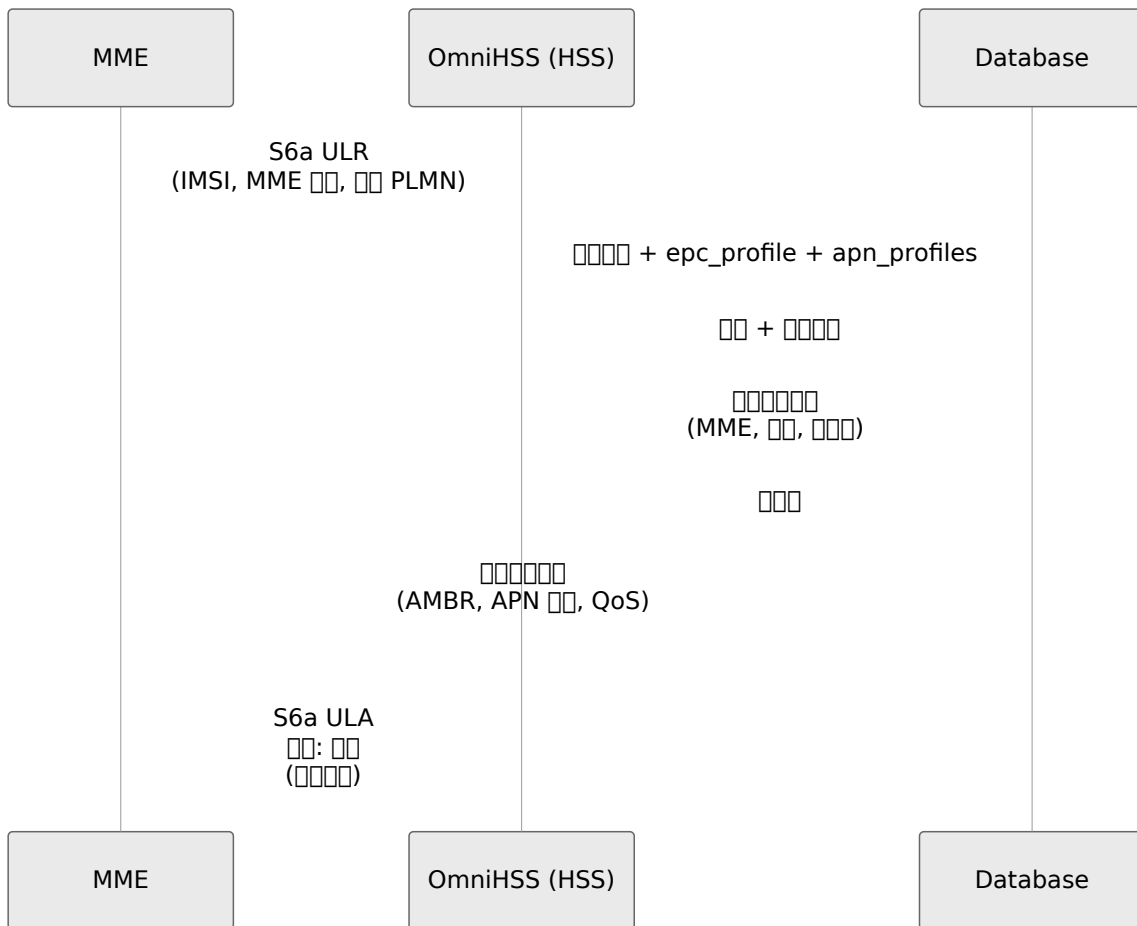


**AVP:**

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

**(ULR/ULA)**

MME HSS

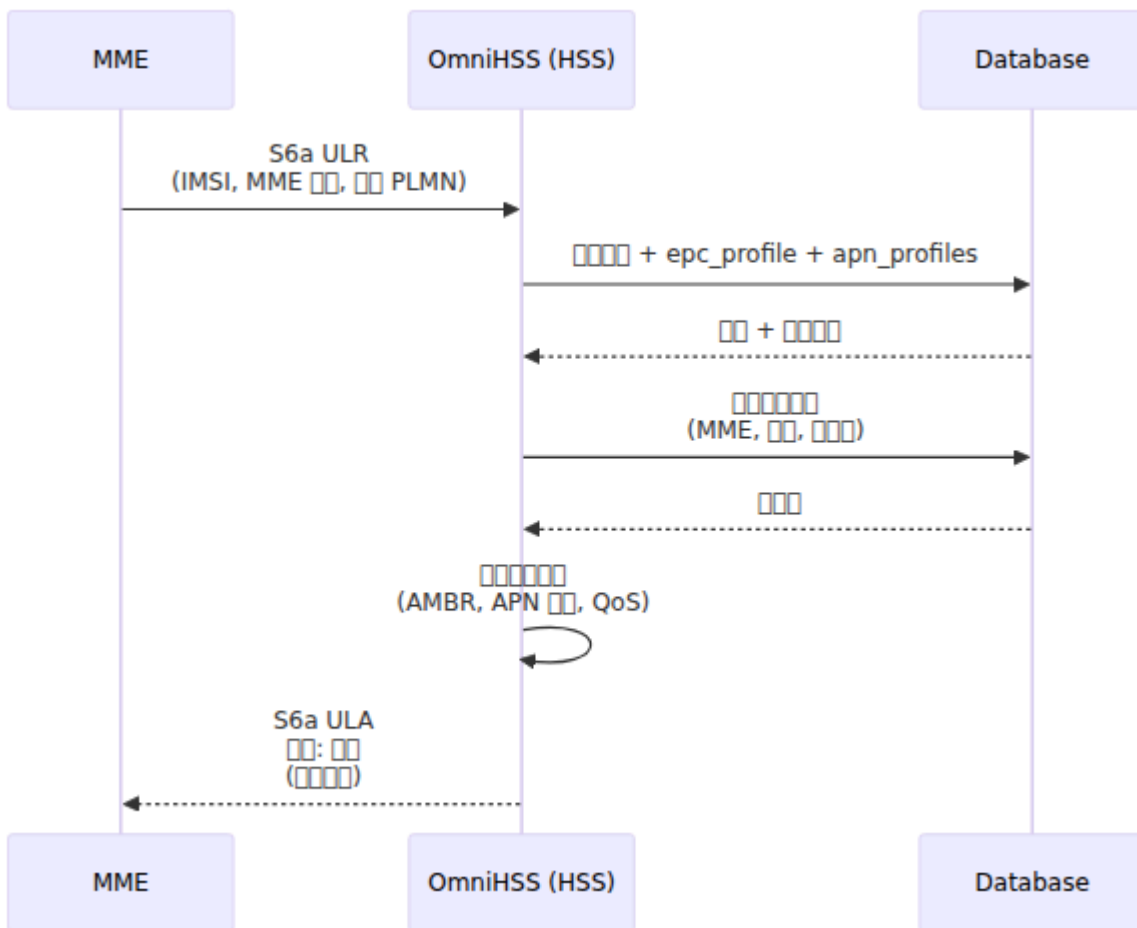


**AVP:**

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

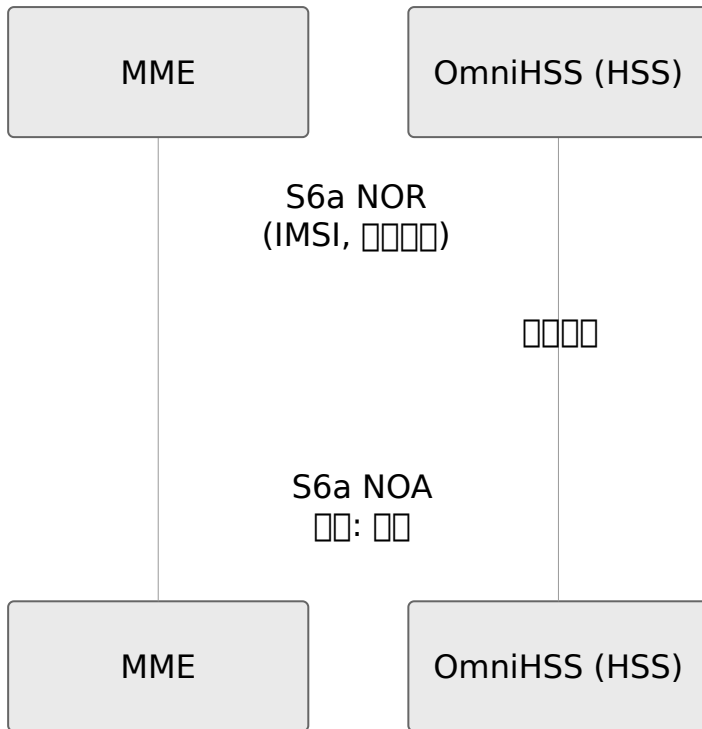
**UE ID (PUR/PUA)**

MME ID HSS ID ID ID ID ID ID ID ID



## Sequence Diagram (NOR/NOA)

MME ID HSS ID

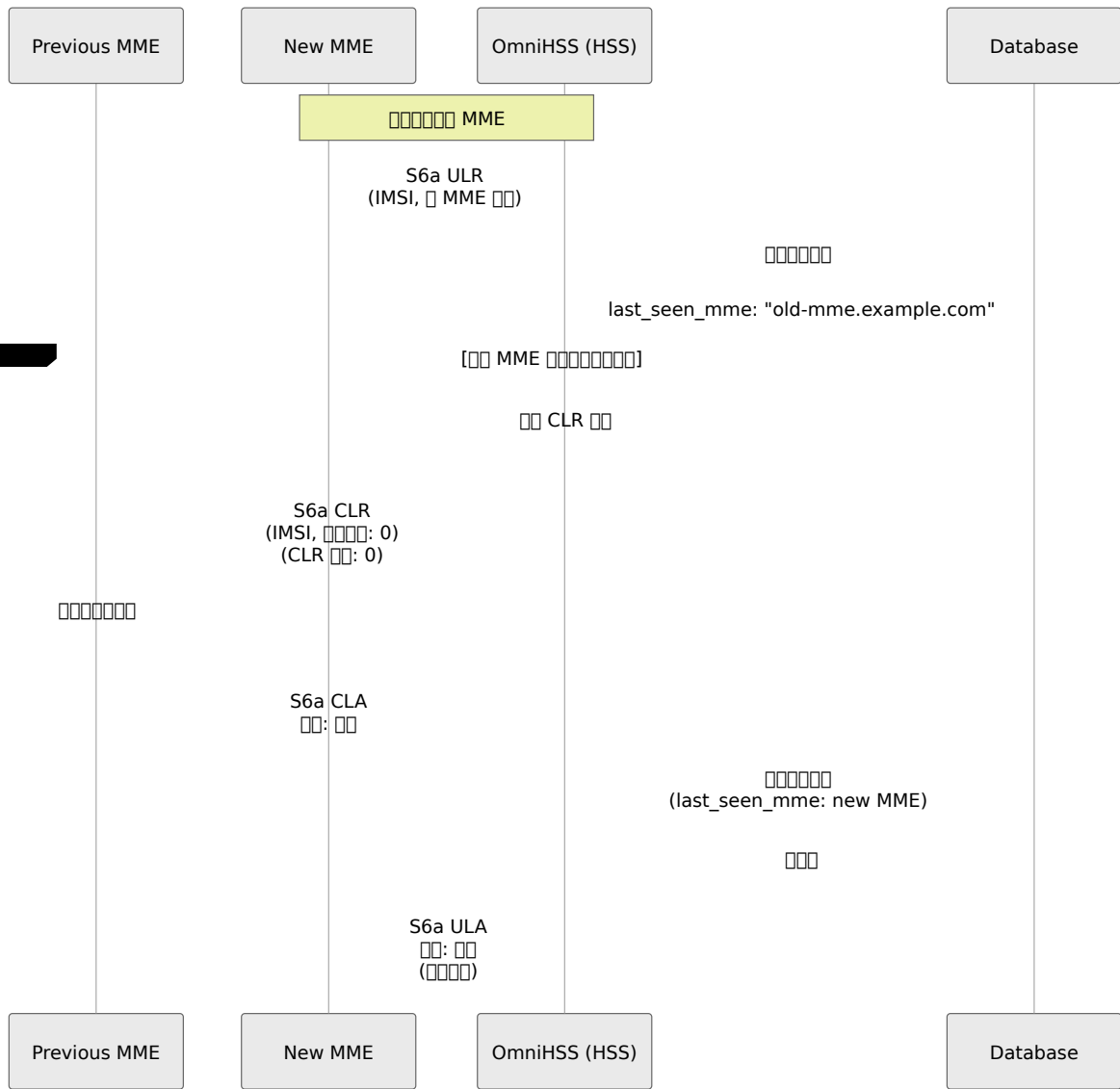


## □□□□□□ (CLR/CLA)

HSS □□□□□□□□ MME □□□□□□□□ OmniHSS □□□□□□□□ CLR □□□

### □□ CLR (MME □□)

□□□□□□ MME □□□□□□□□□□ OmniHSS □□□□□□ MME □□ CLR □□□□□□□□

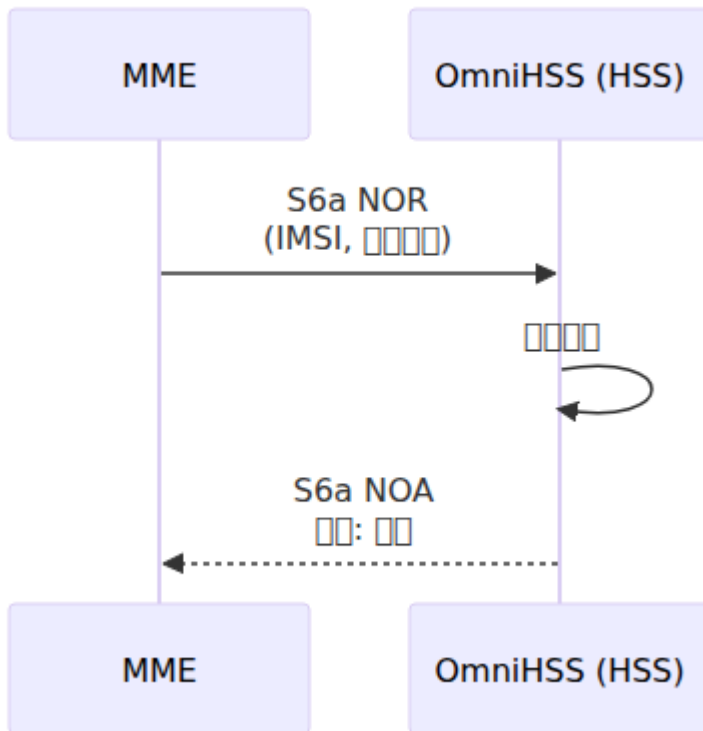


**AVP (CLR):**

- IMSI: IMSI
- MME: MME
- MME: MME
- MME: 0 (MME)
- CLR MME: 0
- MME: MME

**CLR (API)**

API CLR



□□ AVP (□□□ CLR):

- □□□: □□□ IMSI
- □□□□: □□□□□ MME □□□
- □□□□: □□□□□ MME □
- □□□□: `:subscription_withdrawal` (□ 3GPP TS 29.272 □□□□□)
- CLR □□:
  - s6a\_indicator: 1 (□□□□ S6a □□)
  - reattach\_required: 1 (UE □□□□□□□□□□)

□□□□

OmniHSS □□□□□□□□□□ 3GPP TS 29.272□

| Code      | Value | Label     | Description  |
|-----------|-------|-----------|--------------|
| MME Code  | 0     | MME Code  | MME Code ULR |
| SGSN Code | 1     | SGSN Code | 3G/2G Code   |
| Code      | 2     | Code      | API Code     |
| Code IWF  | 3     | Code      | Code         |
| Code      | 4     | Code      | Code         |

## CLR Code

CLR-Flags AVP Code

| Code         | Value | Description  |
|--------------|-------|--------------|
| S6a/S6d Code | 0     | 1 = S6a Code |
| Code         | 1     | 1 = UE Code  |

## CLR-Flags Code:

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

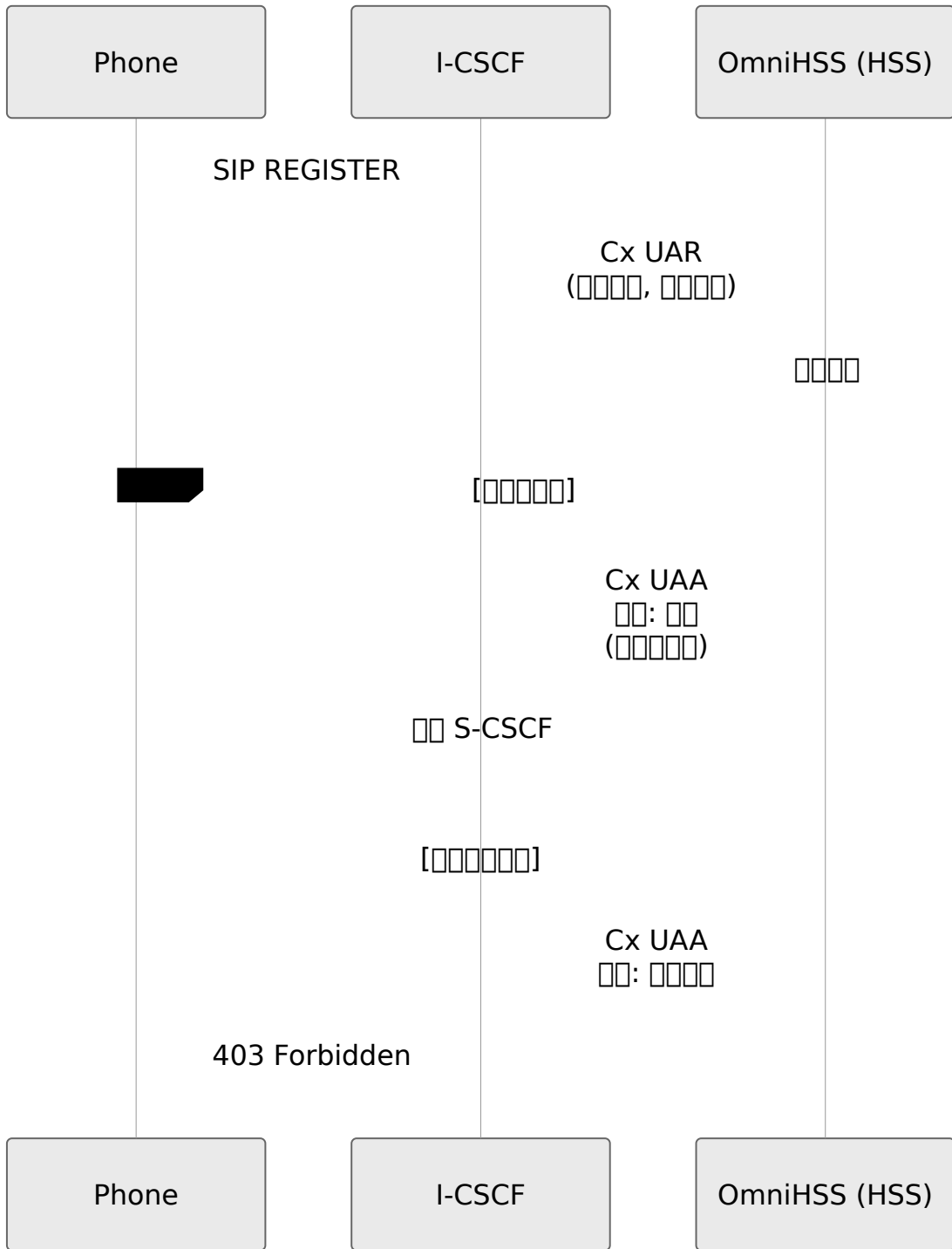
## IMSI Code

OmniHSS Code (IMSI) Code MSISDN Code IMSI Code CLR Code

Code 1: Code MSISDN Code IMSI

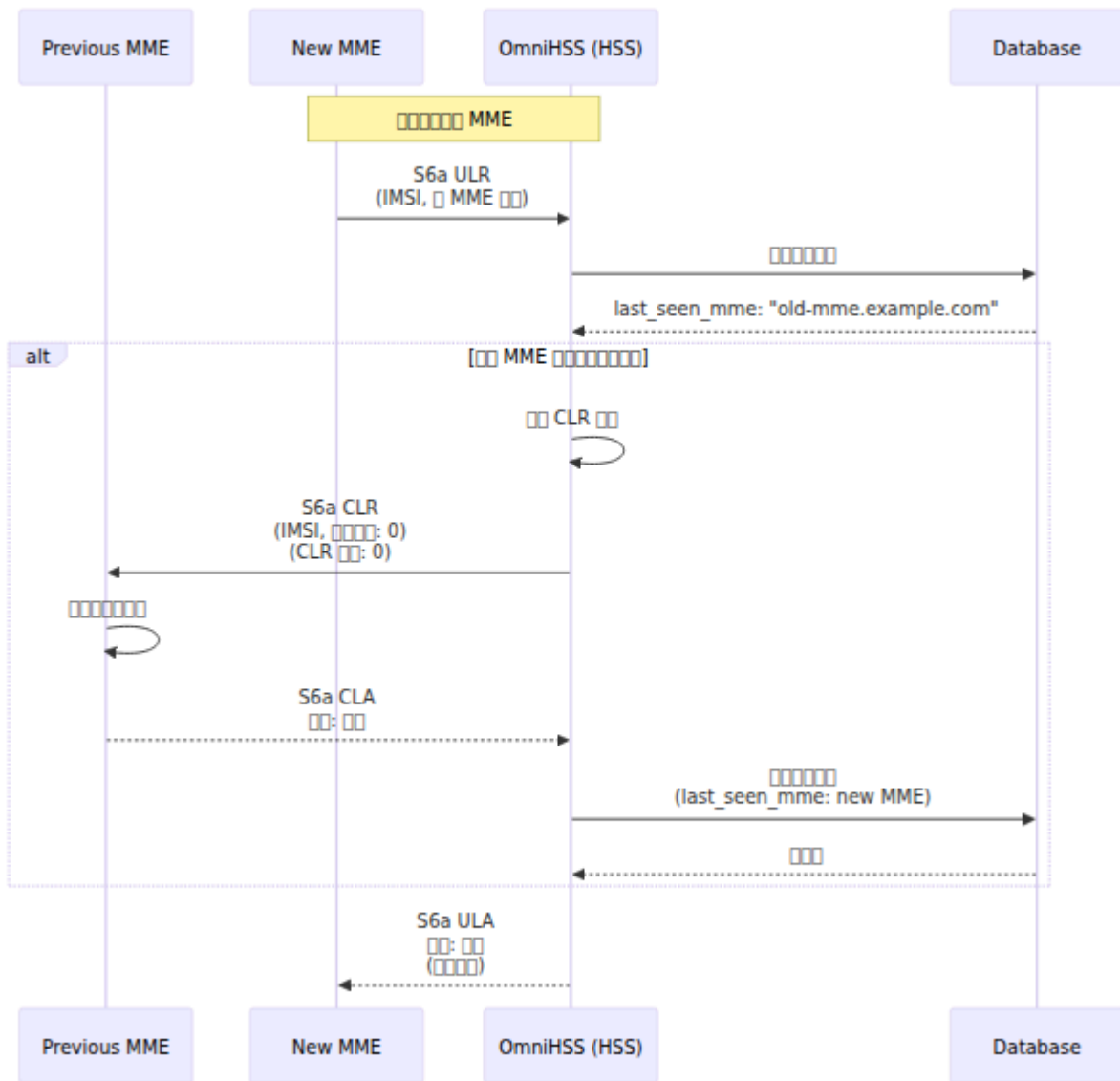






**[ ] (SAR/SAA)**

S-CSCF [ ]/ [ ] IMS [ ]

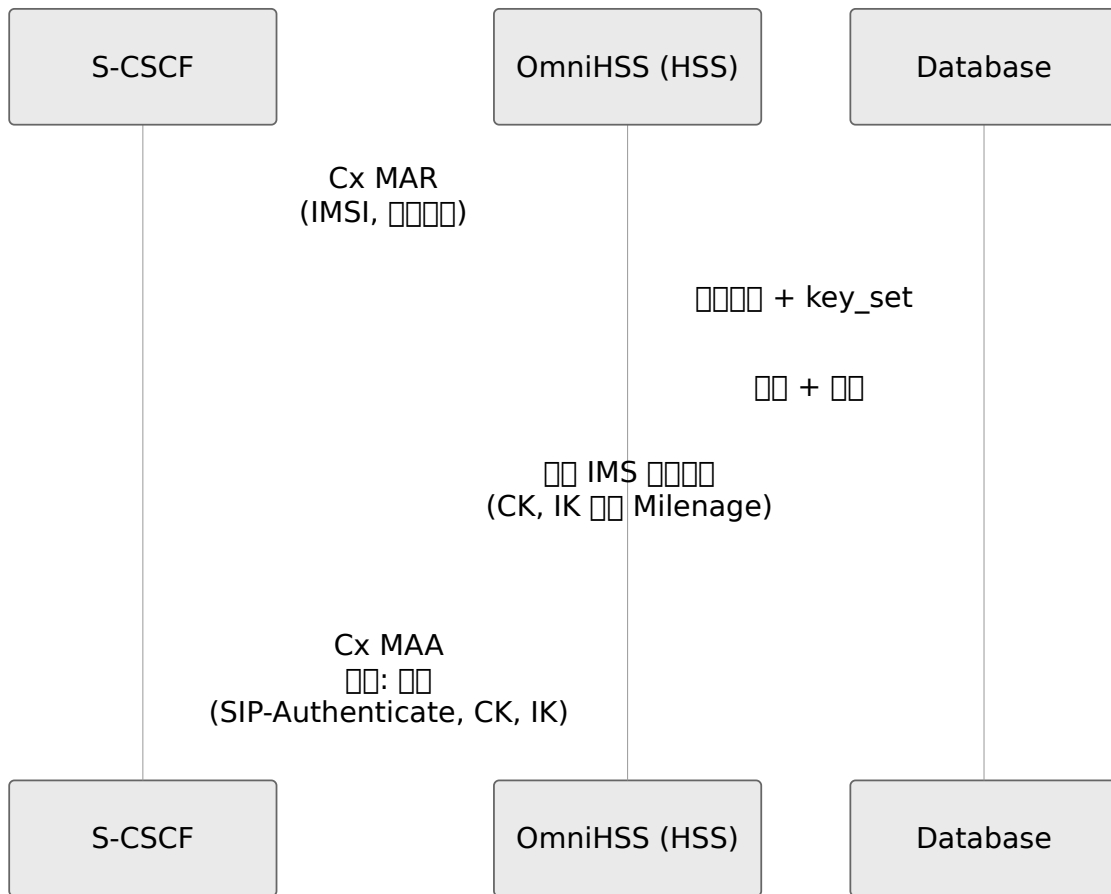


**IFC :**

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

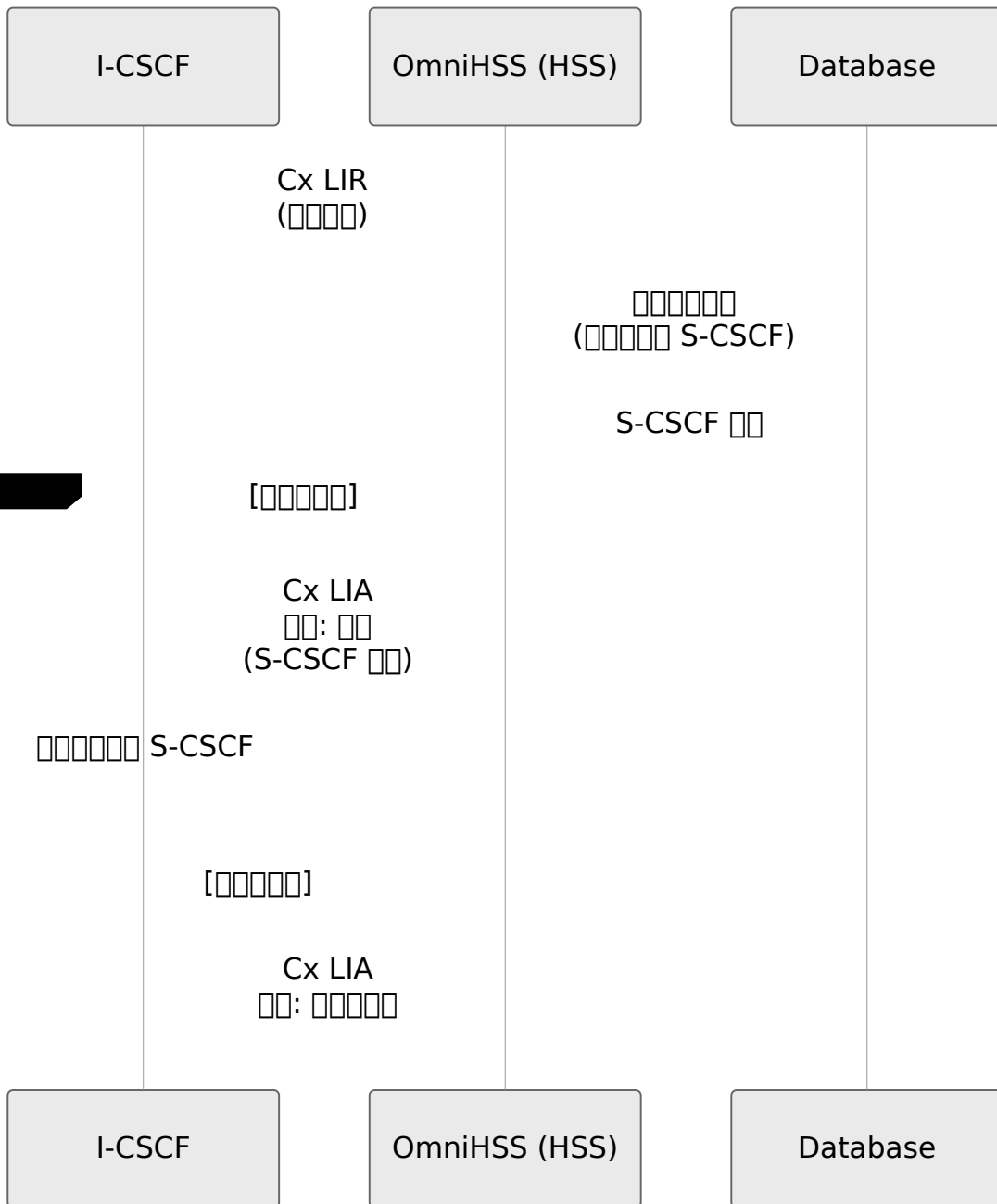
**(MAR/MAA)**

S-CSCF IMS



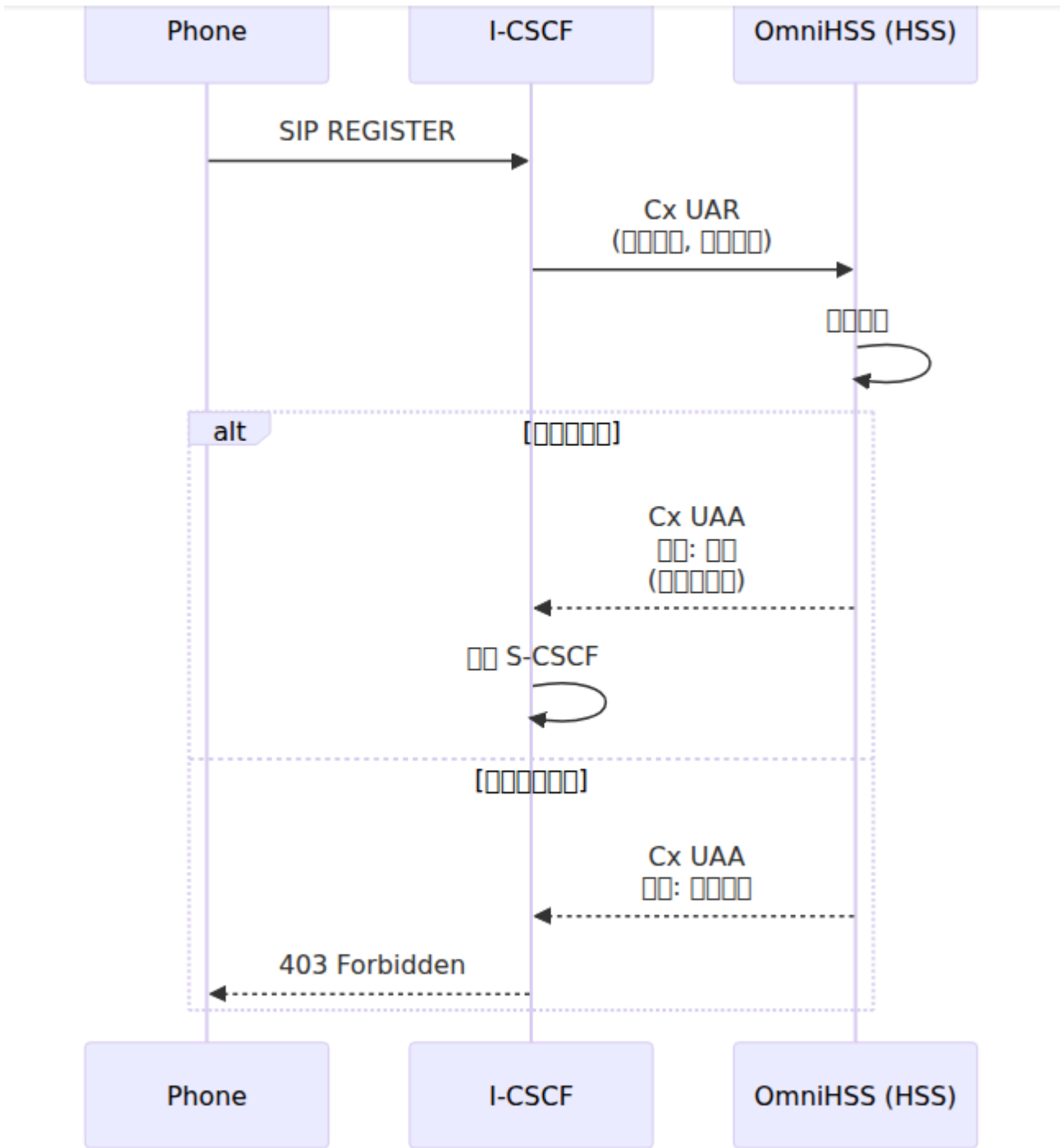
## IMS Authentication (LIR/LIA)

I-CSCF requests S-CSCF authentication



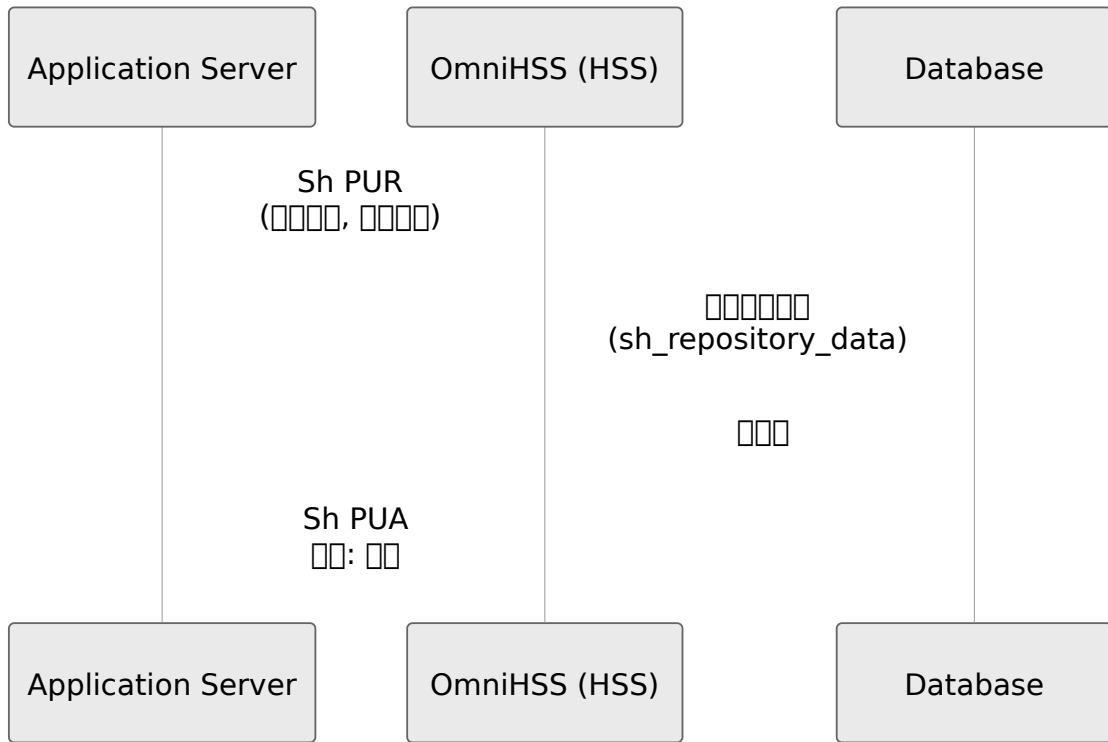
## Sh (IMS )

### (UDR/UDA)

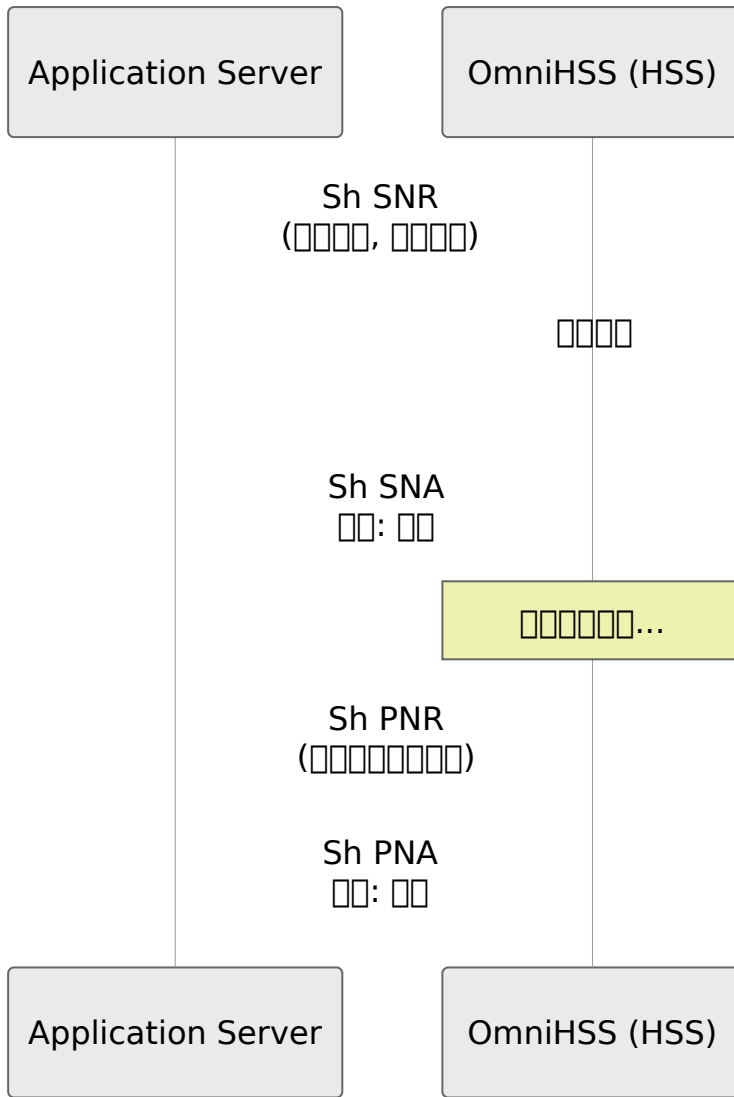


XXXXXXXXXX (PUR/PUA)

XXXXXXXXXXXXXXXXXXXX



## (SNR/SNA)



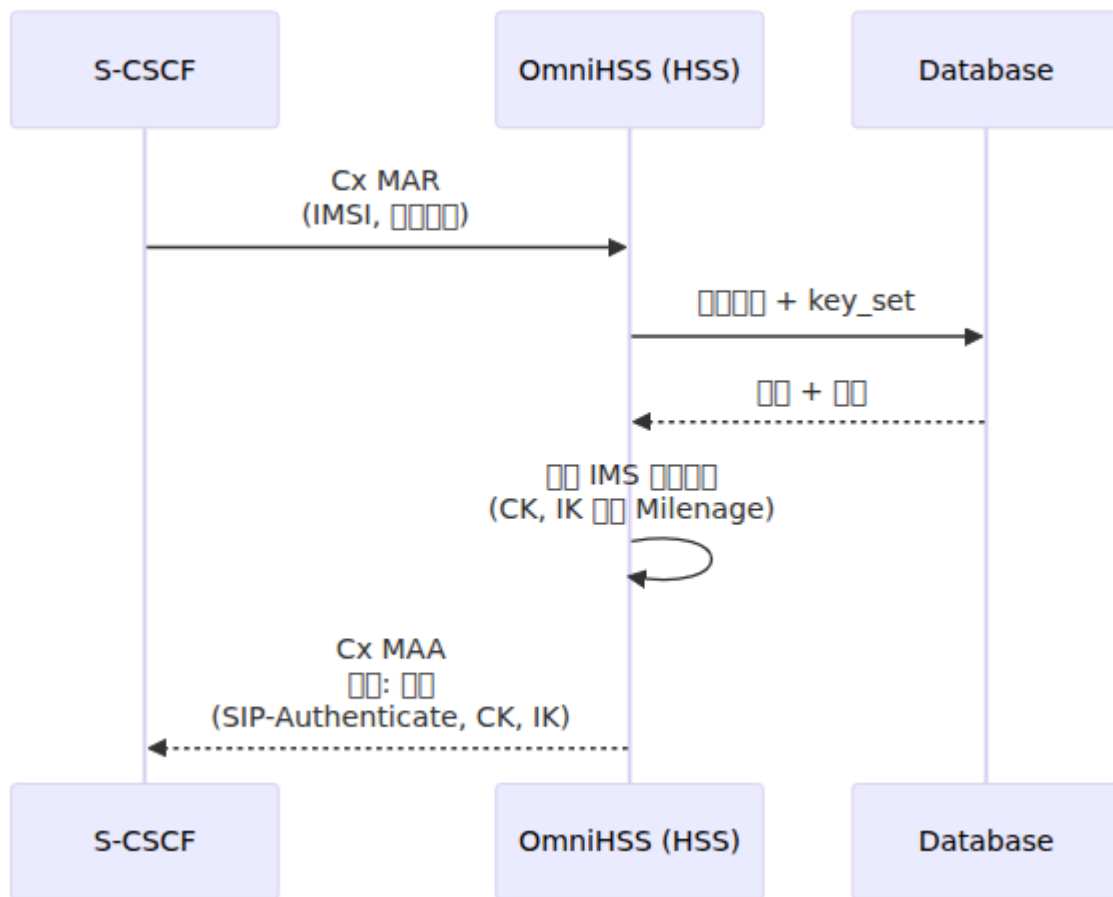
## Gx □□ (□□□□)

OmniHSS □□ Gx □□□□ PCRF□□□□□□□□□□□□

□□□ □□ **PCRF** □□ □□□□□□□□□□□□ □□□ **QoS** □□□

## □□□□□□ - □□ (CCR-I/CCA-I)

P-GW □□□ PDN □□□□□□□□□□□□

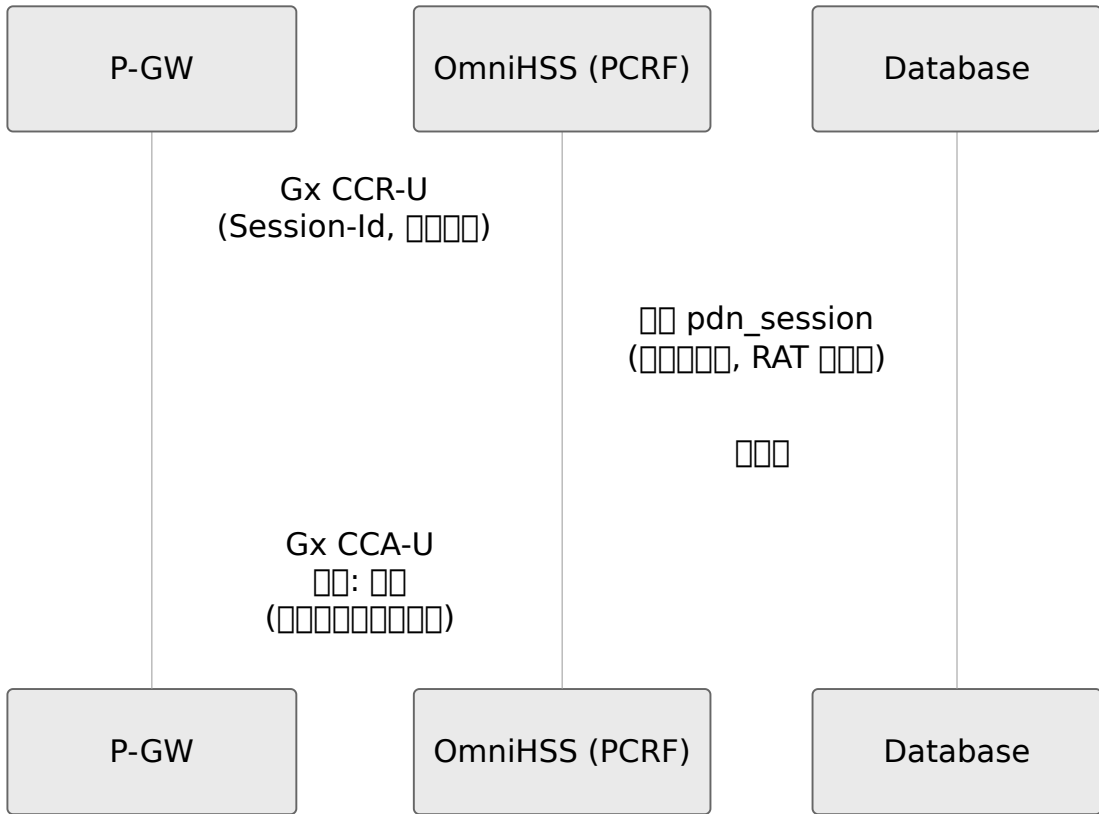


**AVP:**

- IMSI: IMSI ID (IMSI), APN ID (APN), RAT type, IP-CAN type
- QoS: QoS type (QCI, ARP, AMBR), key\_set

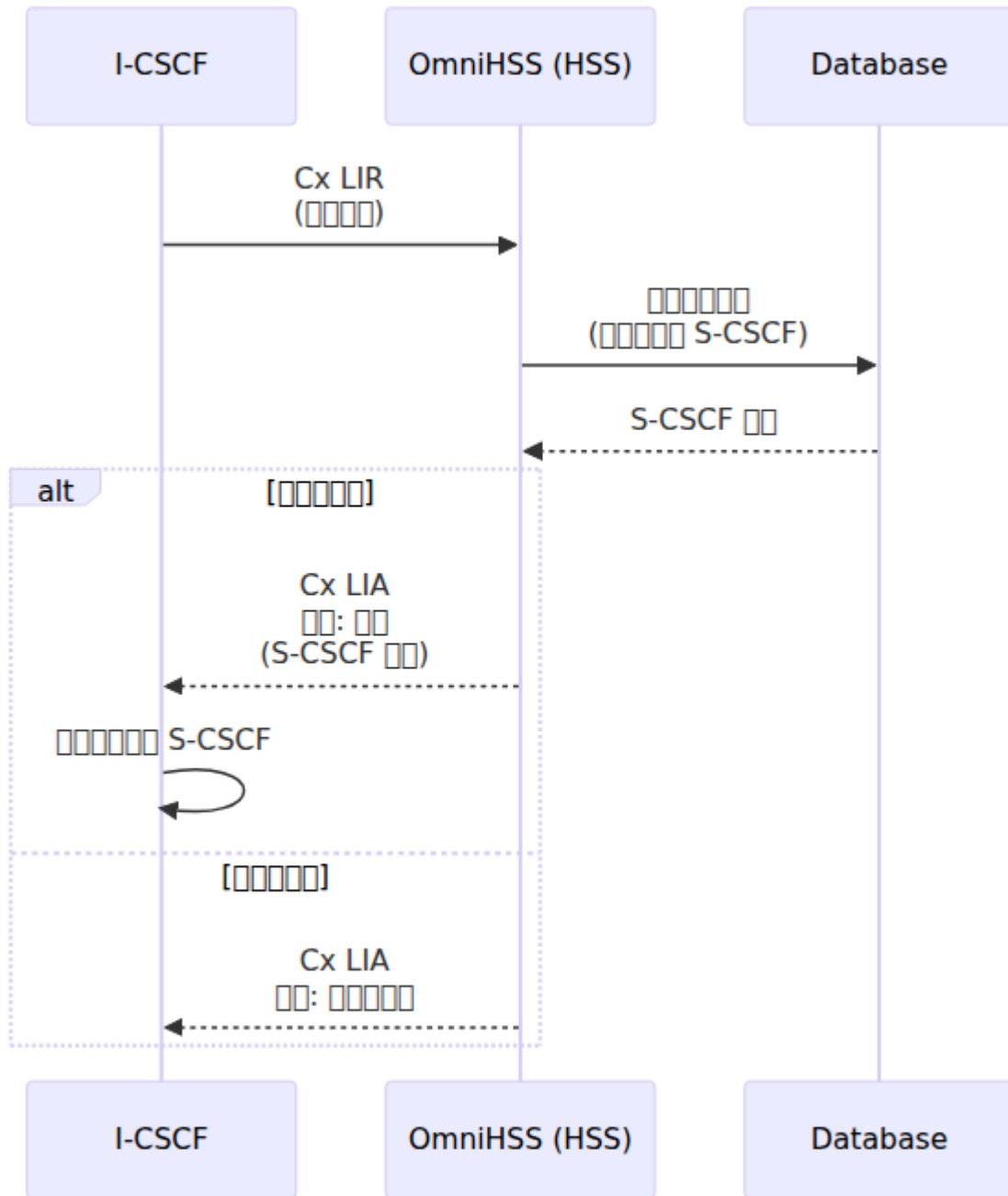
**Authentication - (CCR-U/CCA-U)**

P-GW authentication



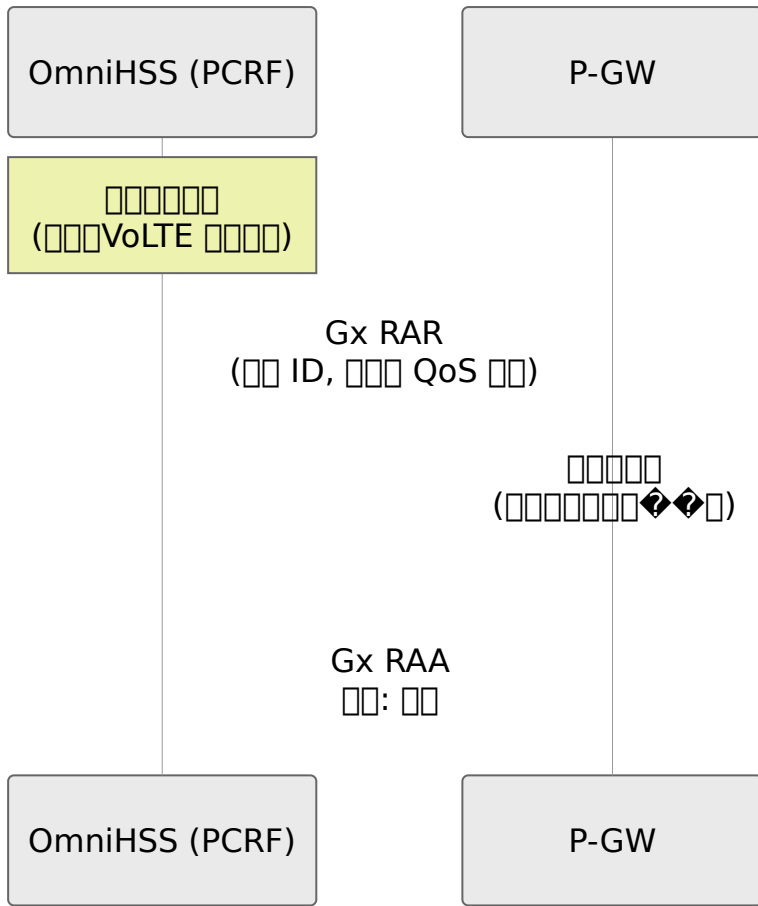
## PDN Selection - PCRF (CCR-T/CCA-T)

P-GW [hex] PDN [hex]



## □□□□□□ (RAR/RAA)

OmniHSS (PCRF) □ P-GW □□□□□□



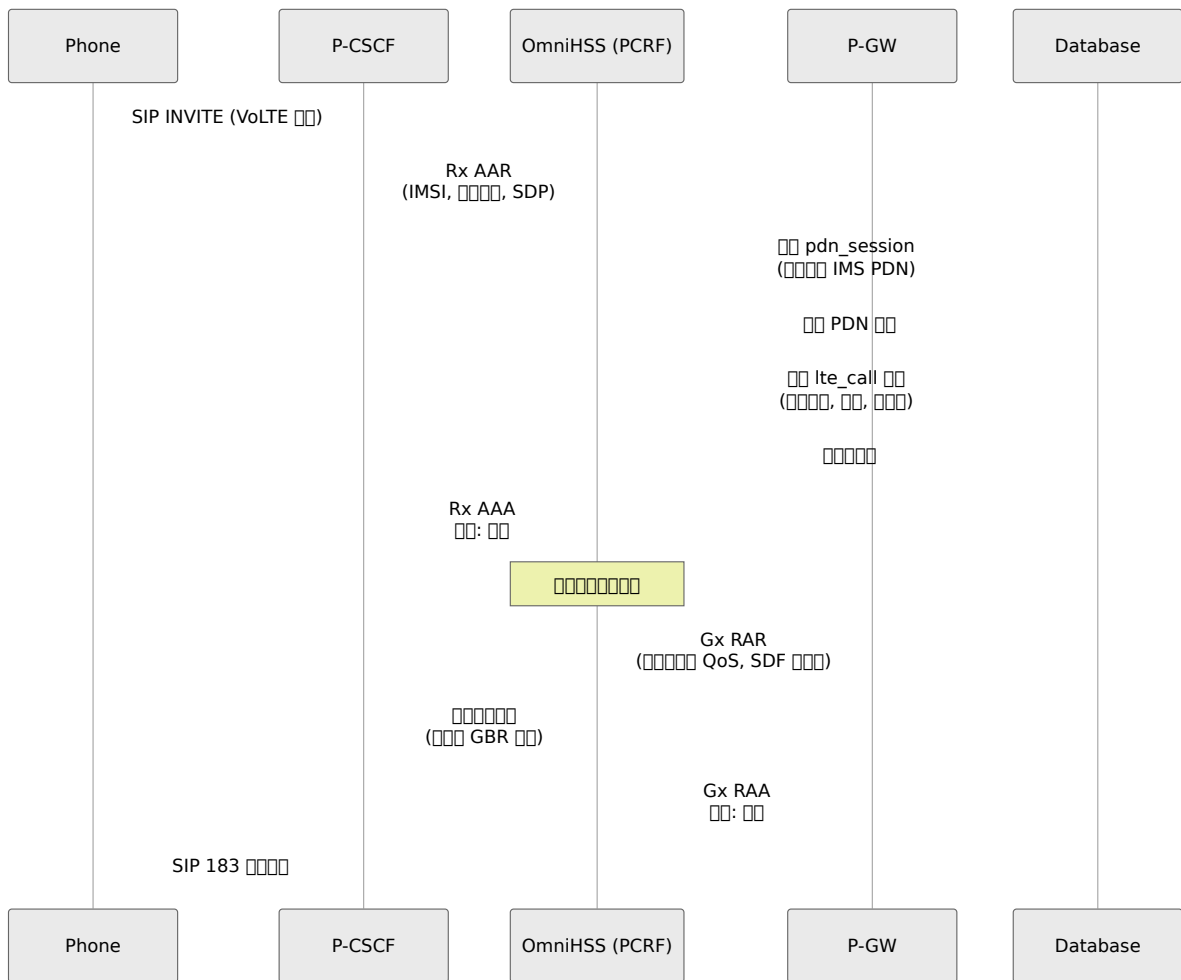
## Rx (IMS)

OmniHSS Rx PCRF IMS

PCRF VoLTE

## AA (AAR/AAA)

P-CSCF IMS

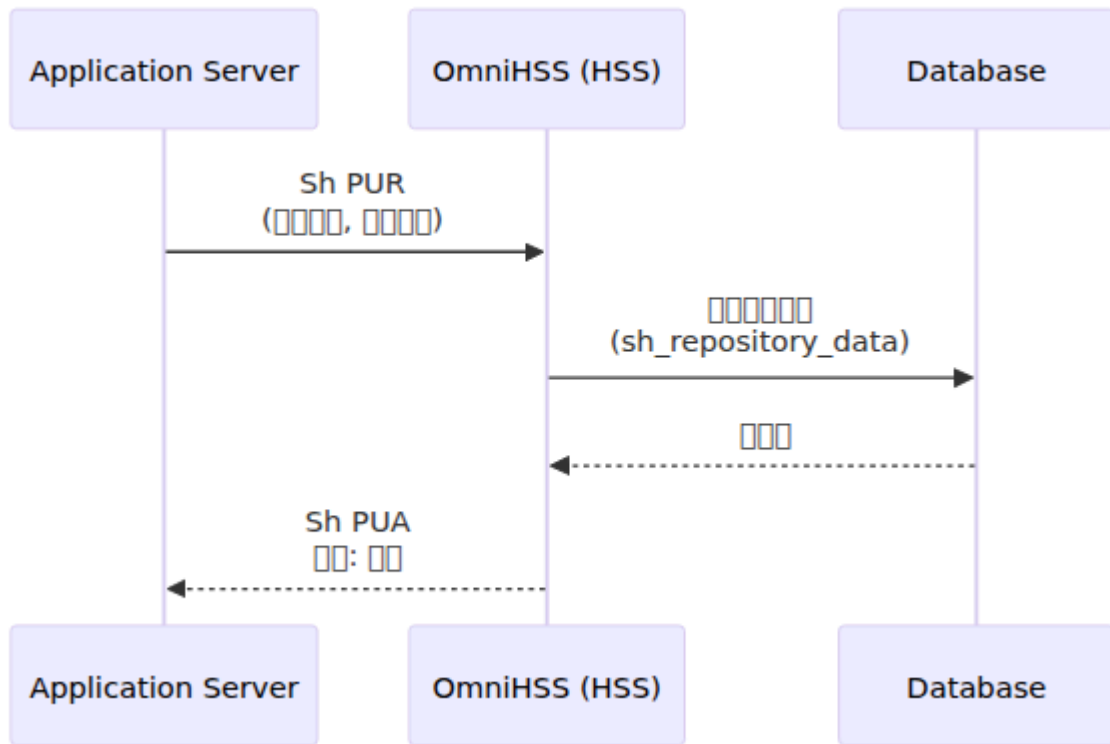


□□□□:

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

## □□□□□□ (STR/STA)

P-CSCF ◀◀ IMS □□□□□□



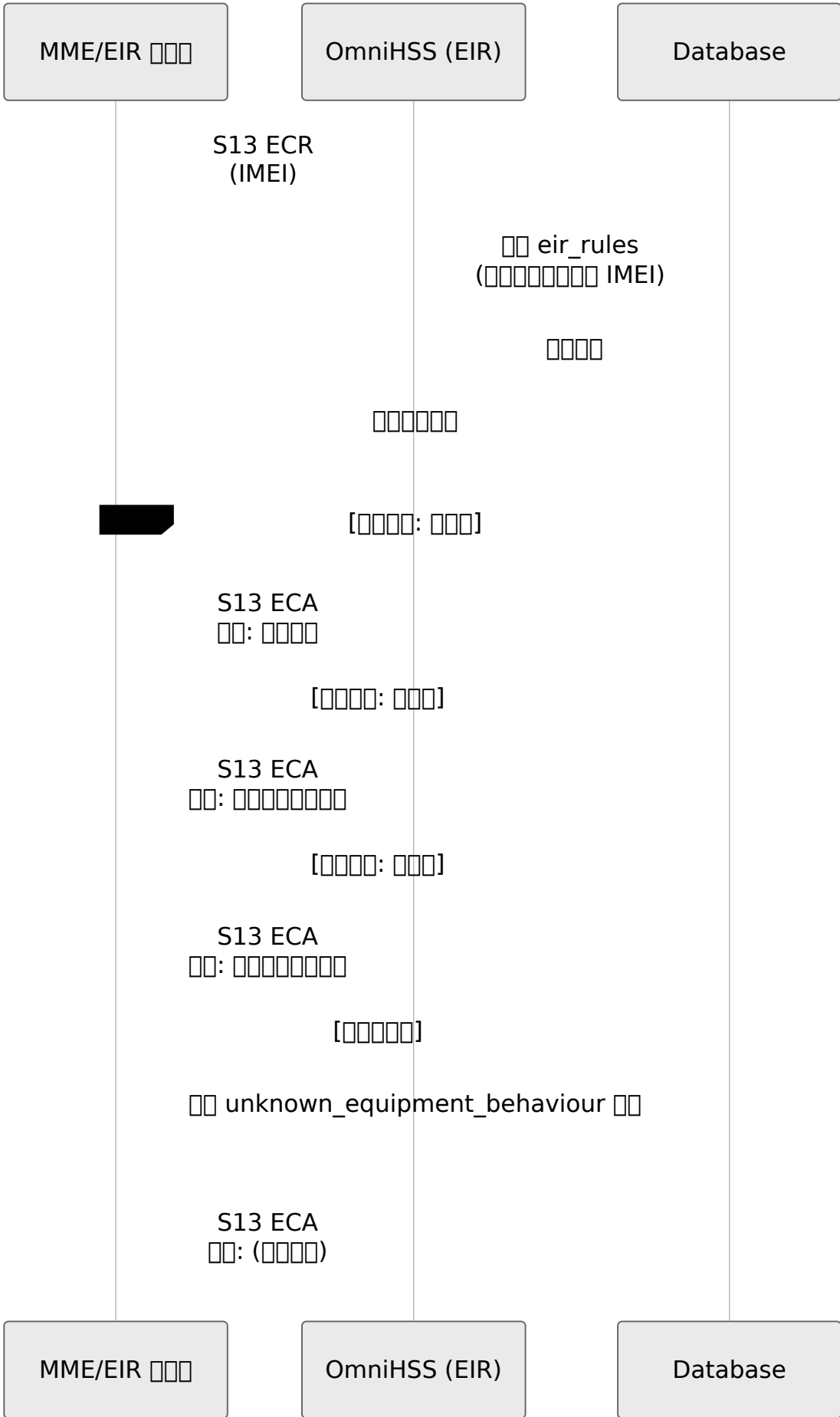
## S13 消息 (EIR)

OmniHSS 通过 S13 消息 EIR 接收来自 MME 的消息

消息 EIR 包含来自 MME 的 IMEI 消息

## ME 消息 (ECR/ECA)

消息 EIR 包含来自 MME 的消息

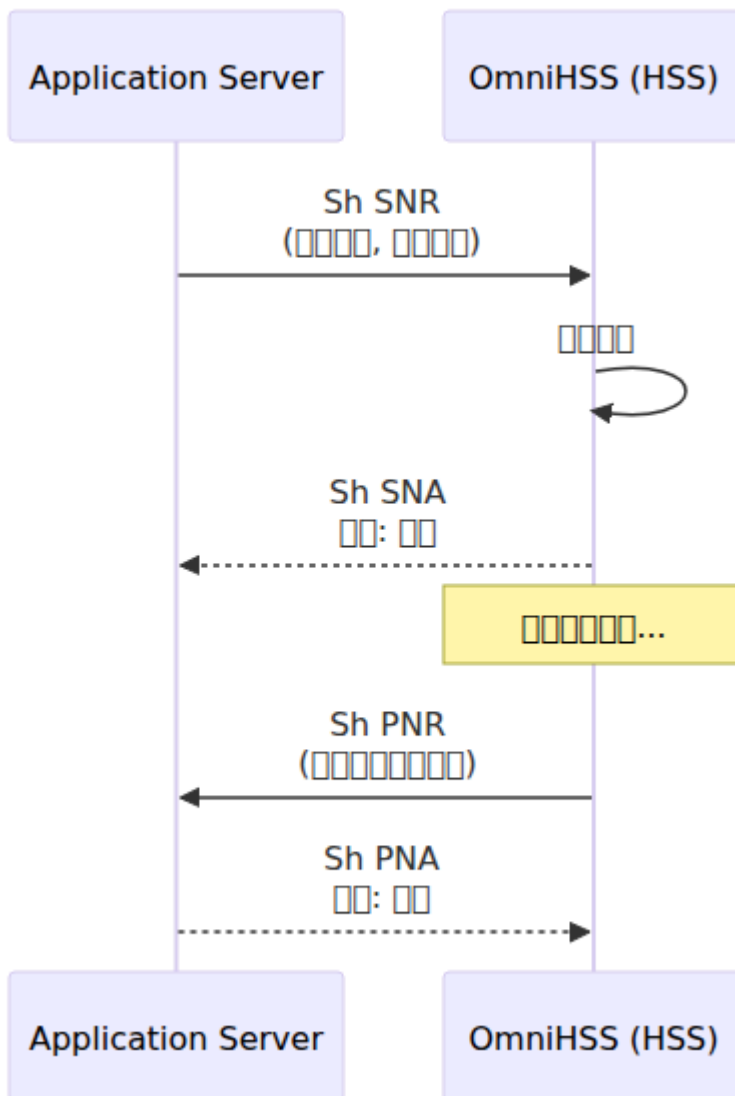


□□□□:

- □□□□ (0) - □□□□□□□□
  - □□□□□□□□ (1) - □□□□□
  - □□□□□□□□ (2) - □□□□□□□□
- 

## □□□□□□: VoLTE □□

□□□ VoLTE □□□□□□□□□□□□



□□□□□□□□

## □□□□ (S6a AIR)

□□:

- (Ki, OPC, AMF)
- SQN □□ (□□□□□□)
- 

## □□□□□□ (S6a ULR)

□□:

- EPC □□□□□□□□ APN
- 
- MME □□□□□□

## IMS □□□□ (Cx SAR)

□□:

- IMS □□□□□□□□
- IFC □□□□ XML
- S-CSCF □□□□□□
- MSISDN

## PDN □□□□ (Gx CCR-I)

□□:

- APN □ EPC □□□□□ APN □□□□□
  - APN QoS □□□□□□□□
  - PDN □□□□□□□□□□□□
-

← □□□□□

# OmniHSS

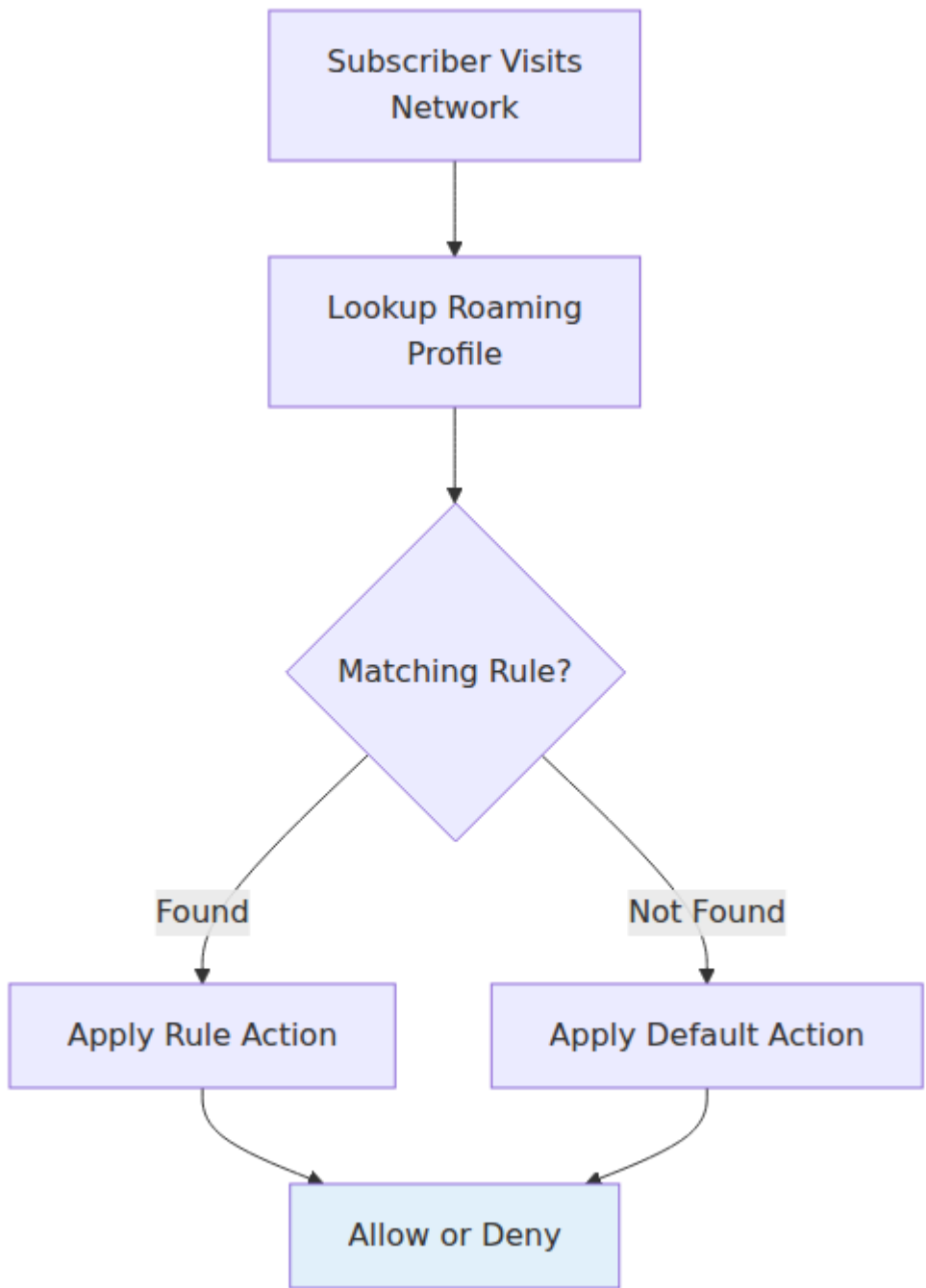


←



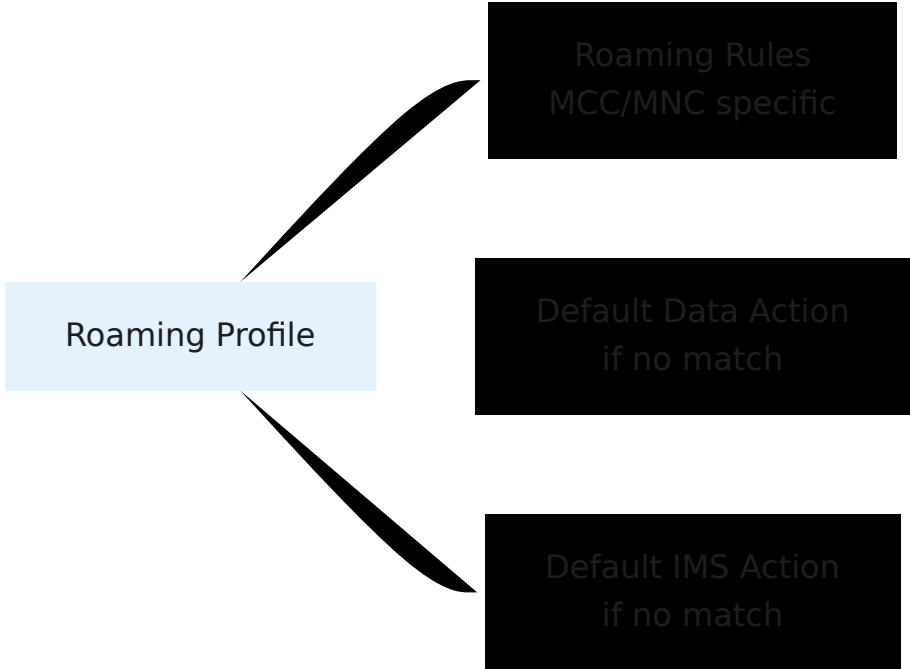
OmniHSS IMS

□□□□□□



□□□□□□

□□



□□□□

□□□□□□□□□□MCC/MNC □□□□□□□□

□□□

- name - □□□□□
- mcc - □□□□□□□3 □□□□
- mnc - □□□□□□◆◆◆2-3 □□□□
- data\_action - "allow" □ "deny"
- ims\_action - "allow" □ "deny"

□□□□

□□□□□□□□□□□□□□

□□□

- name - 允许
  - data\_action\_if\_no\_rules\_match - "allow" 或 "deny"
  - ims\_action\_if\_no\_rules\_match - "allow" 或 "deny"
- 

允许

不允许

```
# 允许
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": "allow",
    "ims_action_if_no_rules_match": "allow",
    "roaming_rules": []
  }
}'
```

不允许

```
# 不允许
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": "deny",
    "ims_action_if_no_rules_match": "deny",
    "roaming_rules": []
  }
}'
```

# API Examples

# 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": "allow",
    "ims_action": "allow"
  }
}' | jq -r '.response.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": "allow",
    "ims_action": "allow"
  }
}' | jq -r '.response.id')
```

# Profile

```
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\": \"deny\",
    \"ims_action_if_no_rules_match\": \"deny\",
    \"roaming_rules\": [ $RULE1, $RULE2 ]
  }
}"
```

□□□□□□□□

```
# □□□□□□□□ IMS □□□
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": "allow",
    "ims_action": "deny"
  }
}'
```

□□□□□□□□□□

```
# □□□□□□□□□□
RULE=$(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": "deny",
    "ims_action": "deny"
  }
}' | jq -r '.response.id')

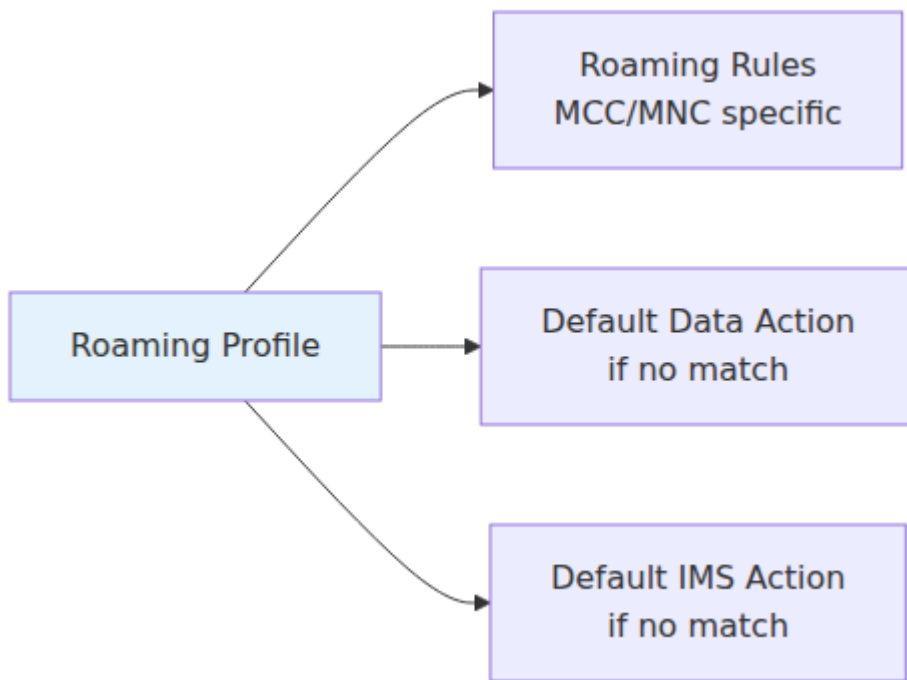
# □□□□□□□□□□
curl -k -X POST https://hss.example.com:8443/api/roaming/profile \
-H "Content-Type: application/json" \
-d "{
  \"roaming_profile\": {
    \"name\": \"Block Expensive Networks\",
    \"data_action_if_no_rules_match\": \"allow\",
    \"ims_action_if_no_rules_match\": \"allow\",
    \"roaming_rules\": [$RULE]
  }
}"
```

---

□□□□□□□□

□□ **1**□□□□□□□□

□□□□□□□□□□□□□□□□□□



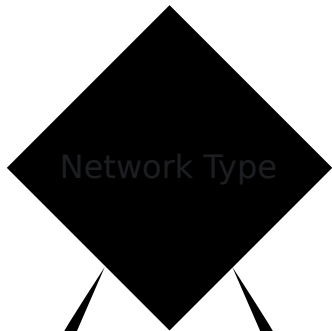
□□□

- □□□□□□□□
- □□□□□□□□ MCC □□□310□311□312□313□314□315□316□

□□ **2**□□□□□□□□□□

□□□□□□□□□□□□□□□□□□

Subscriber



Partner Network

Non-Partner

Allow

Deny

□□□

- □□□□□□□□
- □□□□□□□□□□□□□□□□ MCC/MNC□

□□ **3**□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□ WiFi □□□□□□□□

Subscriber Abroad

Data Request

Voice Request

Allow Data

Deny IMS

□□□

- `data_action: "allow"` `ims_action: "deny"`

## 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☐

| MCC | MNC | ☐☐☐      |
|-----|-----|----------|
| 310 | 410 | AT&T     |
| 311 | 480 | Verizon  |
| 310 | 260 | T-Mobile |
| 310 | 120 | Sprint   |
| 313 | 380 | ☐☐☐☐☐☐☐☐ |

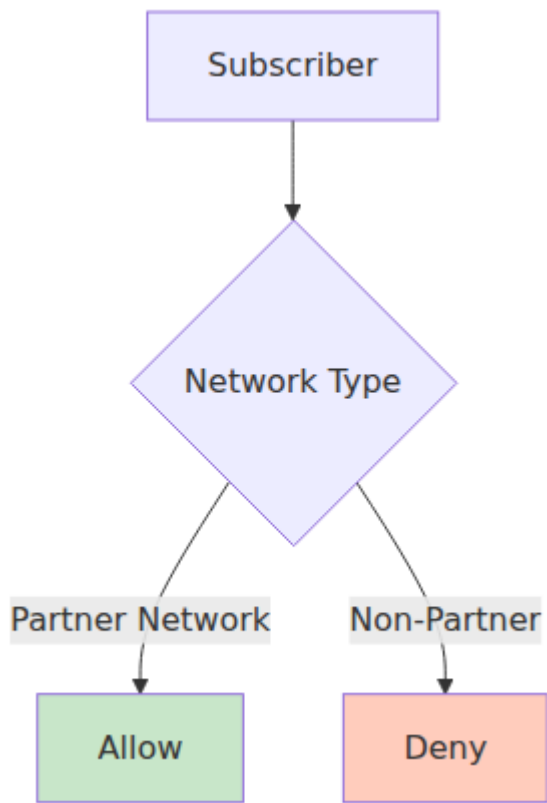
☐☐☐☐☐ ☐☐☐ ITU-T E.212 ☐ MCC/MNC ☐☐☐

---

☐☐☐☐☐☐

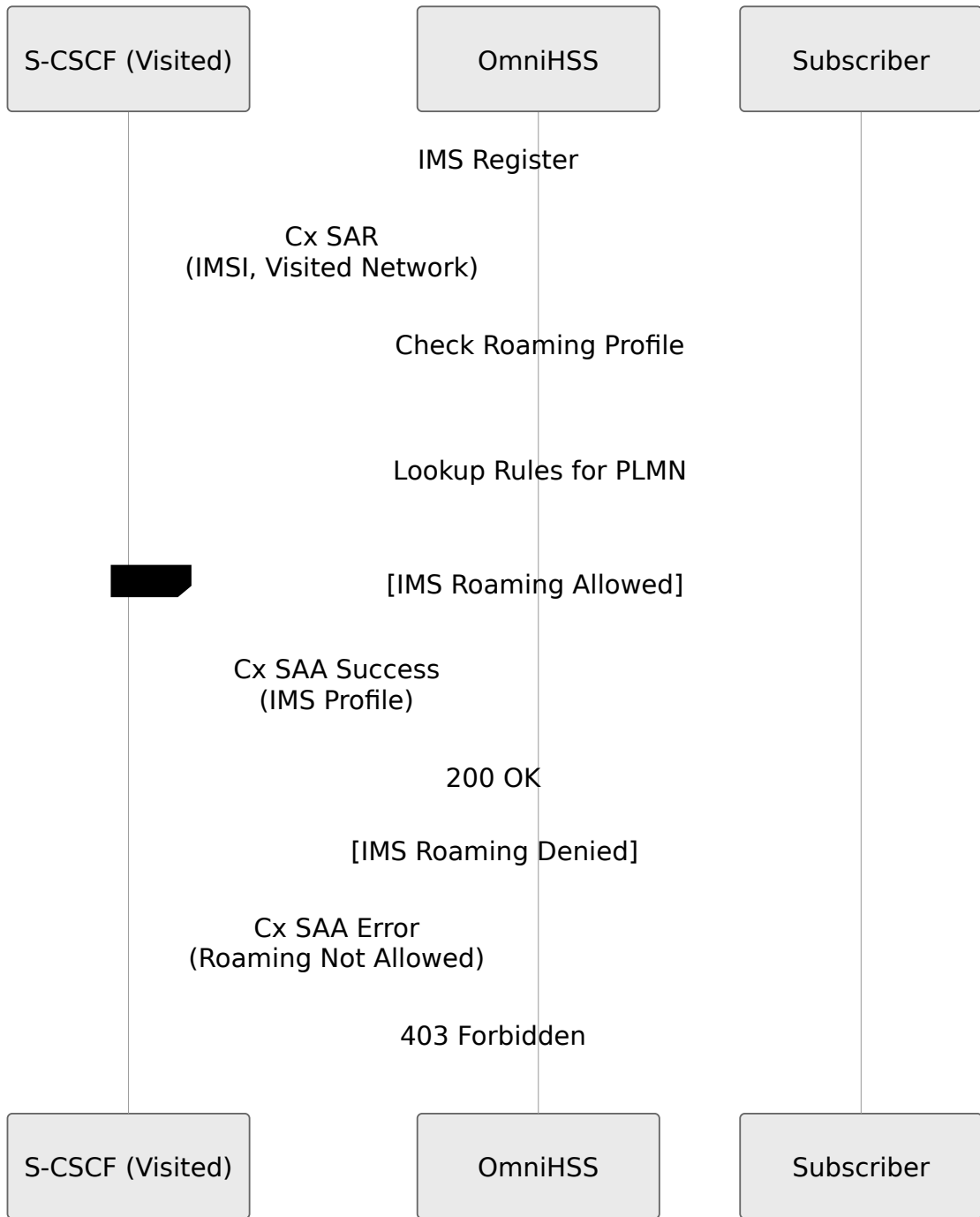
**S6a** ☐☐☐☐☐☐

☐☐☐☐☐☐☐☐☐☐☐☐



## Cx IMS

IMS



□□□□□□

□□□□□□□□□□□□□□

□□□□□□□□

- □□□□□□□□□□□□□□□□

- IMSI 001001123456789

Roaming check

- MCC/MNC 310-410
- data\_action allow
- IMS action allow

## IMS

IMS

- IMSI 001001123456789
- data\_action allow, ims\_action allow
- IMS

Roaming check

Roaming rule

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

Roaming check

Roaming rule

1. IMSI - 001001123456789
2. MCC/MNC - 310-410
3. data\_action - allow
4. IMS action - allow

## □□□□

1. □□□□□□ - "Allow-ATT-Data-Only" □□□ "Rule1"
2. □□ **MCC/MNC** - □□□□□□□□□□□□
3. □□□□□□ - □□□□□□□ IMS
4. □□□□□□ - □□□□□□□□□□□□

## □□□□

1. □□□□ - □□□□□□/□□□□□□□□
2. □□□□ - □□□□□□□□□□□□□□
3. □□ - □□□□□□□□□□□□□□
4. □□□□ - □□□□□□□□□□

# OmniHSS



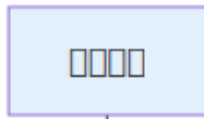
←



- 
- 
- Diameter
- 
- EPC
- IMS
- VoLTE
- 
- EIR
- 
- 
- API
-

□□□□□□

□□□□□□□□



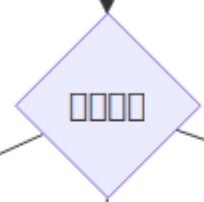
OmniCharge

OmniRAN

Downloads

☒ ☐☐☐☐ ▼

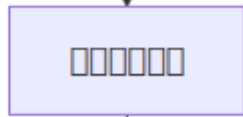
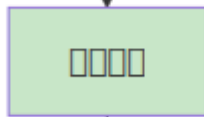
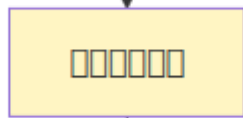
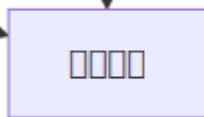
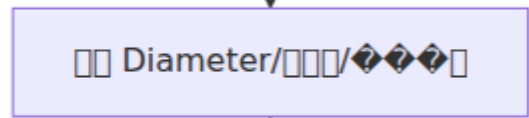
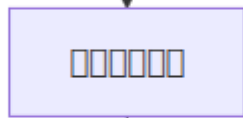
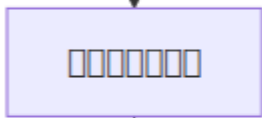
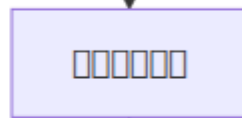
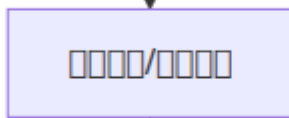
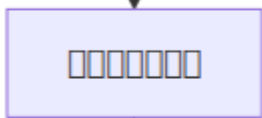
Omnitouch Website ☐

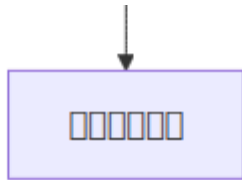


☐☐☐☐☐

☐☐☐☐☐

☐☐☐☐☐





□□□□□

□□□□□□□□□□□□□□□□

1. □□□□□□□□□□□□□□□□

- IMSI
- MSISDN□□□□□□
- □□□□□□
- □□□□□□□□

2. □□□□

- □□□□□□□□
- □□□□□□□□□□
- □□□□□□□□□□

3. □□□□

- □□□□□□□□□□
- □□□□□□□□□□
- □□□□□□□□/□□□□□□□□

4. □□□□

- □□ □□□□ □□□□□□
  - □□ Diameter □□□□□□
  - □□□□□□□□
-

# API 调用

## GET

- 获取设备信息
- “设备信息”
- 获取设备信息

## POST

### POST 1

#### 请求

- 请求头
- 请求体

#### 响应

1. 返回 key\_set\_id

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

2. 返回

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

3. Ki OPC SIM

#### 响应

- 返回
- SIM

### POST 2

#### 请求

- 0000000000000000
- 000“SQN 0000”
- 000000

000000

1. 0000000000000000 SQN 0
2. 00000000 SQN 000000
3. 000000000000 SQN 0

000000

- 00000000 AUTS 00SQN 00000000
- 0000000000000000 SQN 0 0000000000000000

000 00 SQN 000000000000000000000000

00 **3**0000000000

0000

- 000000000000
- 000000000000

000000

1. 000000000000

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

2. 00 `enabled` 0000 `true`

00 **???**00

- 00000000

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

## 4 EPC

### 

- 
- “ EPC ”

### 

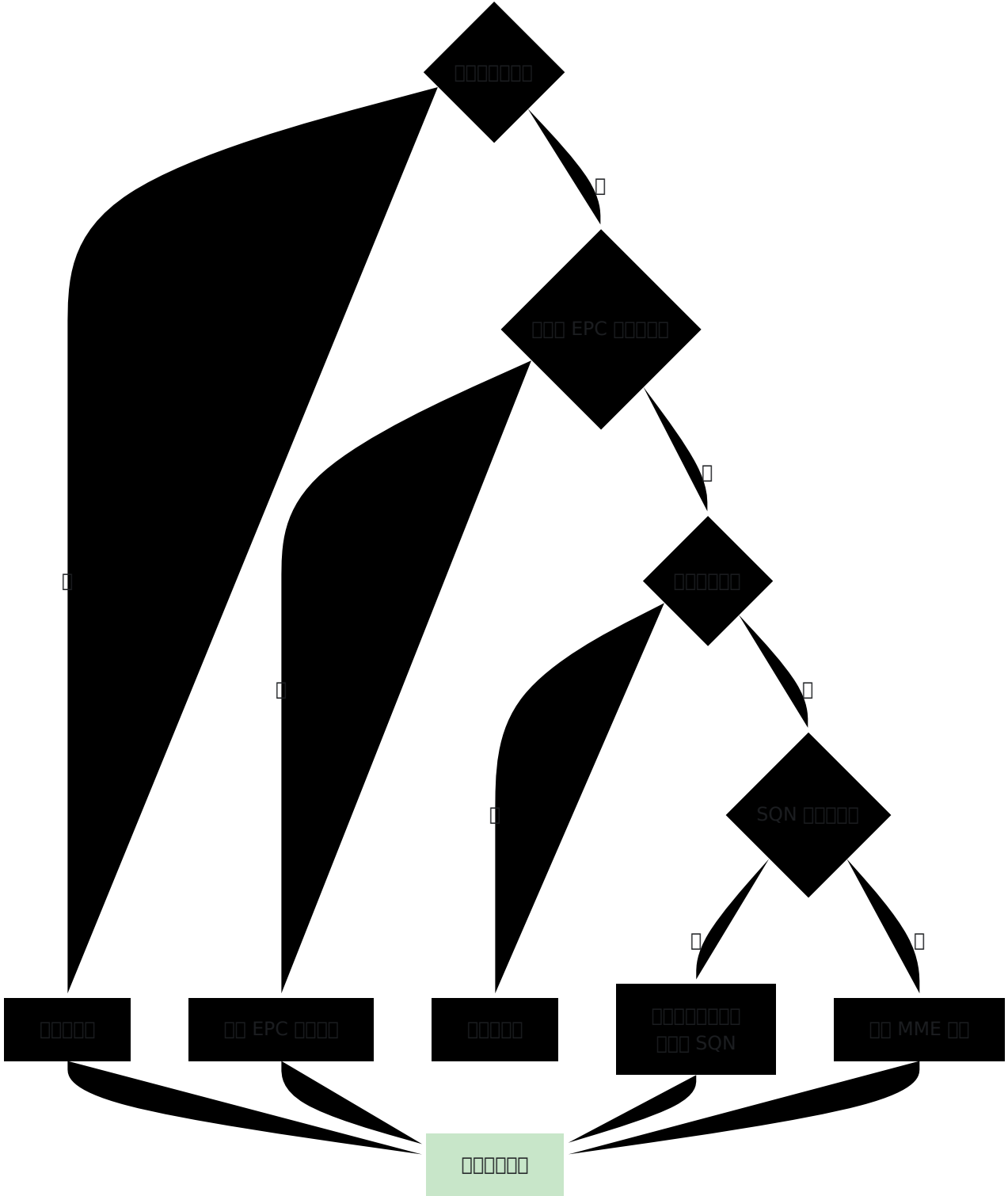
1. `epc_profile_id`
2. EPC

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

### 

- EPC

□□□□□□



# Diameter 测试

## 简介

- 什么是 Diameter 协议
- “Diameter 协议”
- Diameter 协议

## 测试工具

### 工具 1

#### 工具

- 工具
- 工具
- Ping 工具

#### 测试

1. 测试 OmniHSS 工具

```
ping [PEER_IP]
```

2. 测试 Diameter 工具

```
telnet [PEER_IP] 3868
```

3. 测试 Diameter 工具 3868

#### 测试

- 工具
- 工具
- 工具

## 2 Diameter

- 
- CER/CEA
- 

1. runtime.exs Diameter
  - origin\_host
  - origin\_realm
  - IP
2. CER/CEA
3. OmniHSS origin\_host

- Diameter runtime.exs
- OmniHSS
- 

## 3 TLS Diameter

- TLS
- 
- “”

1. priv/cert/
- 2.

```
openssl x509 -in priv/cert/diameter.crt -noout -dates
```

3. 配置证书

4. 配置证书用于 TLS

配置

- 配置证书
- 配置私钥
- 配置证书链 OmniHSS

配置 4 个接口

配置

- 配置 S6a 接口
- 配置 Cx 接口
- “配置 Cx 接口”

配置

1. 配置 Diameter 接口
2. 配置 S6a/Cx/Sh 接口
3. 配置 CER/CEA 接口

配置

- 配置 Diameter 接口
- 配置接口
  - MME 接口 S6a 16777251
  - S-CSCF 接口 Cx 16777216
  - P-GW 接口 Gx 16777238



# □□□□□

## □□

- API □□ 500 □□
- □□□□□□□□
- “□□□□□□□□”□□
- □□□□□□

## □□□□□□□□□□

□□ **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. □□□□□□□□□□□□□□□□

## □□□□□

- □□□□□□□□
- □□□□□□□□□□

- 0000000000000000

## 00 2000000000

000

- “000000”00
- OmniHSS 00000000

00000

1. 00 runtime.exs 00000000
2. 0000000000000000
3. 0000000000

00000

- 0 runtime.exs 000 00000
- 00000000000000
- 0000000000 OmniHSS

## 00 3000000

000

- 000 500 00
- “000000”00
- 0000000000

00000

1. 0000000000000000
2. 00 runtime.exs 00000000
3. 0000000000000000

00000

- 0 runtime.exs 00000000
- 0000000000000000

- 0000000000000000

00 **4**0000

000

- API 00000
- 00000000
- 000 CPU 0

00000

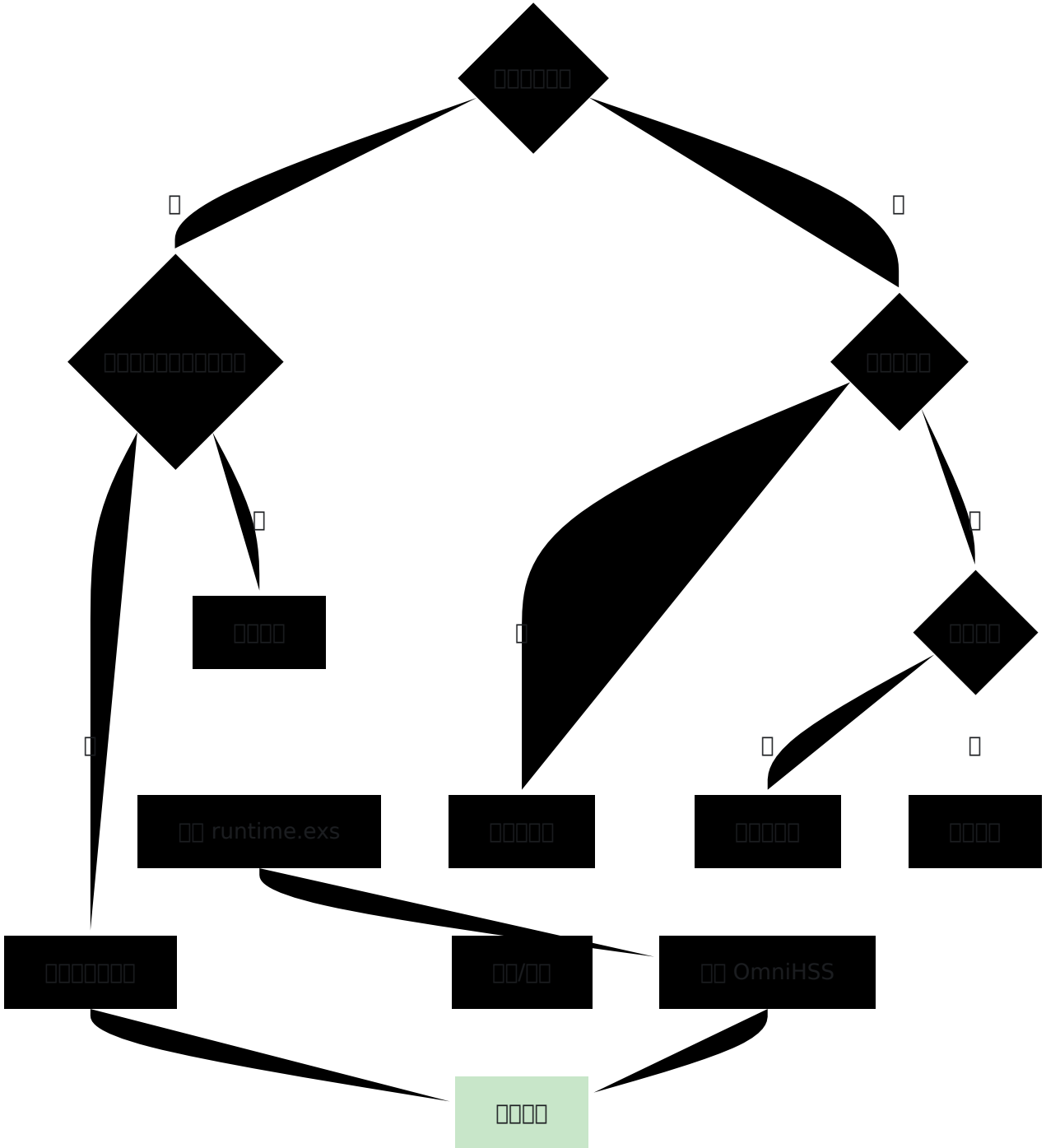
1. 0000000000000000
2. 000000000
3. 00000000
4. 00000000000000

00000

- 00000
- 00000000
- 0000000000
- 00000000000000

□□□□□□□□□□

□□□□□



# EPC

□□

- □□□□□□□□ LTE □□
- MME □□□□
- □□□ PDN □□

□□□□□□□□□□

□□ **1**□□□□□□



□□□

- □□□□□□□□□□□□□□□□□□
- “□□□□□□”□□
- □□□□□□□□□□□□□□□□

□□□□□

1. □□□□□□□□ roaming\_profile\_id
2. □□□□□□□□□□□□
3. □□□□□□□□ MCC/MNC
4. □□□□□□□□□□□□□□

□□□□□

- □□□□□□ MCC/MNC □□  □□□□
- □□□□□□□□□□□□□□□□□□
- □□□□□□□□□□  □□□□

□□ **2**□□□ **APN** □□

□□□

- □□□□□□ PDN □□□□□
- MME □□“□□ APN”□□

- 網路選擇策略

網路選擇

1. 網路 EPC 網路選擇策略 APN 網路
2. 網路 APN 網路選擇策略
3. 網路 APN 網路選擇

網路選擇

- 網路 APN 網路選擇 網路 EPC 網路
- 網路 APN 網路選擇策略
- 網路 APN QoS 網路選擇策略

網路 3 MME 網路

網路

- 網路選擇策略
- 網路 MME 網路
- Diameter 網路

網路

1. 網路 網路 Diameter 網路
2. 網路 MME 網路選擇“網路”
3. 網路 MME 網路 S6a 網路

網路

- 網路 Diameter 網路
- 網路 MME 網路
- 網路 MME 網路

網路 4 網路

網路

- 網路選擇策略

- 00000000
- 0000000000

00000

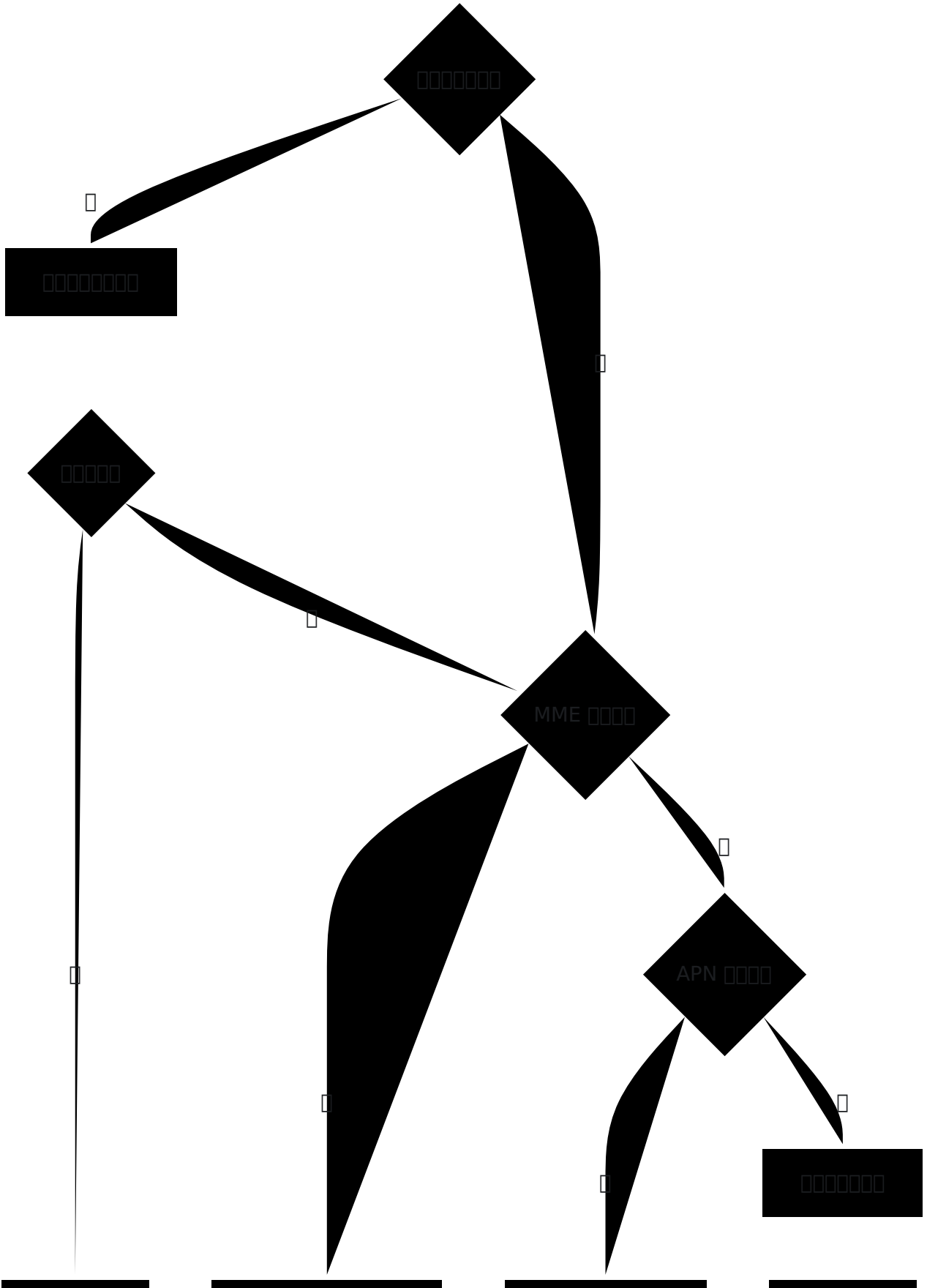
1. 000000000000
2. 00000000 MME 00
3. 0000000000

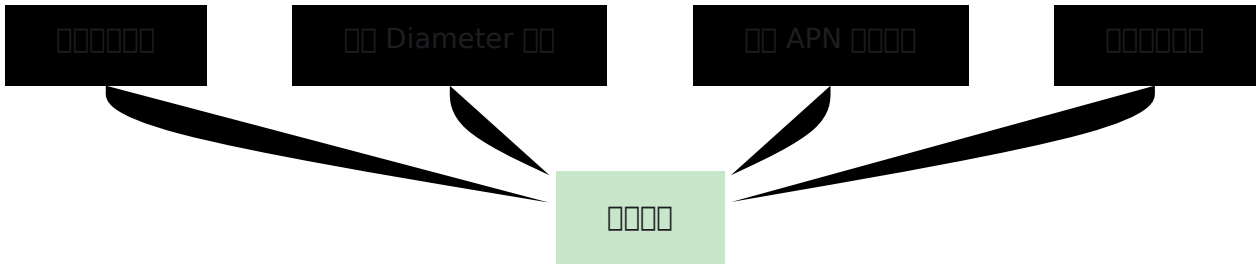
00000

- 00000000000000
- 000000000000 MME
- 000000000000

**EPC** □□□□□□□□

EPC □□□□





# IMS 配置

## 配置

- IMS VoLTE
- IMS “IMS 配置”
- IMS 配置

## 配置

### 配置 1 IMS

#### 配置

- IMS
- IMS

#### 配置

1. IMS `ims_enabled` 配置
2. IMS `ims_profile_id` 配置

#### 配置

- IMS
- IMS 配置

### 配置 2 S-CSCF 配置

#### 配置

- IMS 網路
- IMS 網路 Diameter 網路

網路

1. IMS 網路 Diameter 網路
2. IMS S-CSCF 網路
3. IMS S-CSCF 網路 Cx 網路

網路

- IMS Diameter 網路 S-CSCF
- IMS S-CSCF 網路

IMS 3 網路 IFC 網路

網路

- IMS 網路 網路
- IMS 網路 IFC 網路

網路

1. IMS 網路
2. IMS IFC 網路
3. IMS IFC XML 網路

網路

- IMS 網路 IFC 網路 IMS 網路
- IMS IFC 網路 網路

IMS 4 IMS 網路

網路

- IMS 網路
- 網路
- IMS 網路

□□□□

1. □□□□□□□□ IMS □□
2. □□□□□□□□□□□□□□ `ims_action`

□□□□

- □□ □□□□ □□□ IMS
- □□□□□□□□□□□□ IMS □□



# VoLTE 网络

## 网络

- IMS 网络
- 网络
- 网络
- 网络“网络”

## 网络

### 1 P-CSCF 网络

#### 网络

- 网络
- 网络

#### 网络

1. 网络 Diameter 网络
2. 网络 P-CSCF 网络
3. 网络 P-CSCF 网络 Rx 网络 OmniHSS PCRF 网络

#### 网络

- 网络 Diameter 网络 P-CSCF
- 网络 P-CSCF 网络 OmniHSS 网络 Rx

### 2 网络

#### 网络

- 网络
- AAR/AAA 网络
- Rx 网络

#### 网络

1. 設定する Rx Diameter 設定
2. 設定する AAR/AA-設定
3. 設定する AAA/AA-設定

設定

- 設定する P-CSCF 設定する AAR 設定
- 設定する OmniHSS Rx 設定
- 設定する IMS 設定

設定する 3QoS/設定

設定

- 設定
- 設定
- 設定

設定

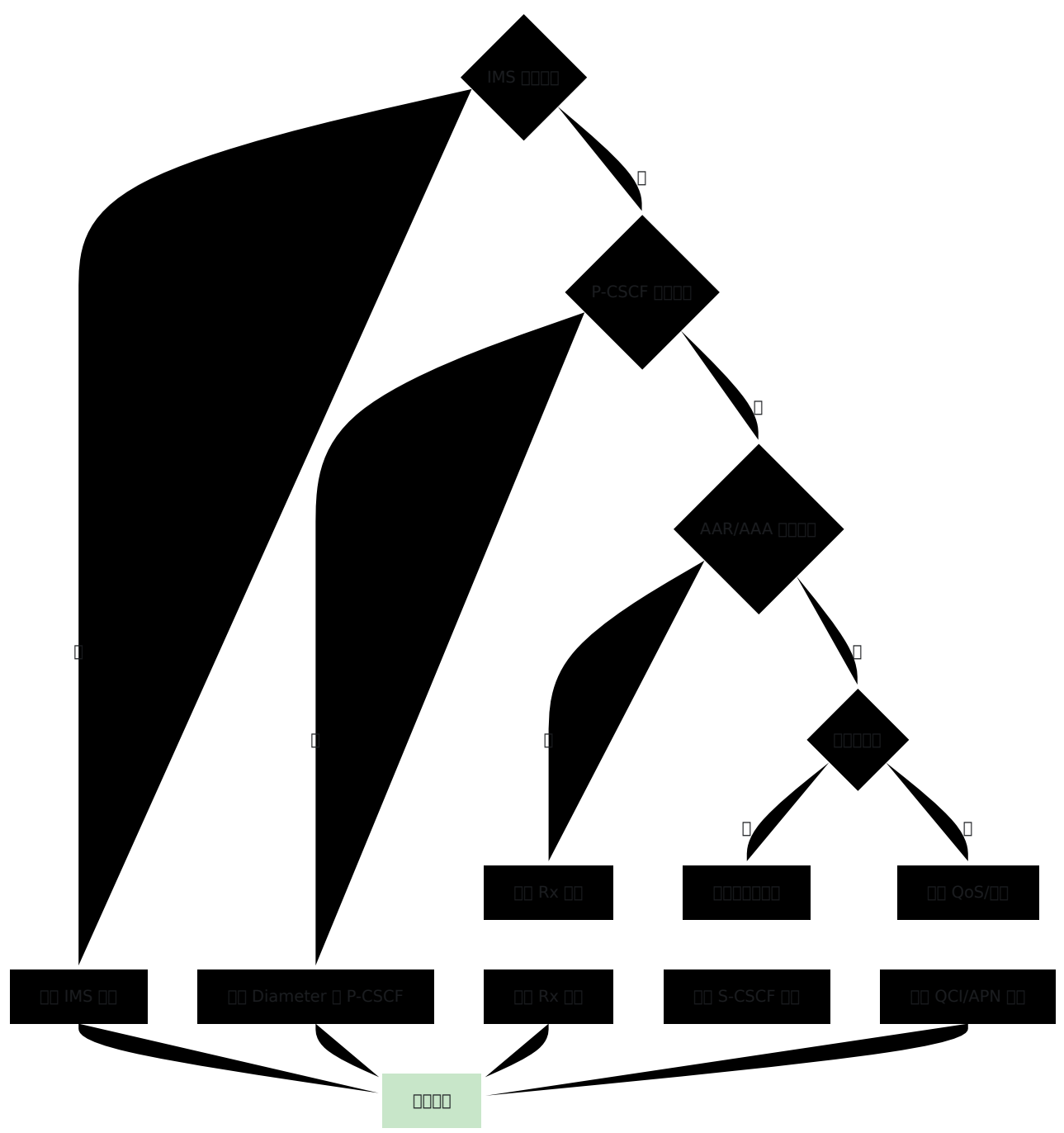
1. 設定する APN 設定する APN QoS 設定
2. 設定する QCI 設定する QCI 1
3. 設定する P-GW 設定する Gx/PCRF 設定

設定

- 設定する APN QoS 設定する IMS APN
- 設定する QCI 1
- 設定する Diameter 設定する P-GW

# VoLTE 网络架构

VoLTE 网络



# □□□□

## □□

- □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□

## □□□□□□□□□□

### □□ **1**□□□□□□□□□□□□

#### □□□

- □□□□□□□□
- □□□□□□□□□□

#### □□□□□

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

#### □□□□□

- □ □□□□□□□ □□□□□□

### □□ **2**□□□□□□□□

#### □□□

- □□□□□□□□□□□□□□
- □□□□□□□□□□

#### □□□□□

1. □□□□□□□□ MME □□□□□□□□ MCC/MNC
2. □□□□□□□□□□□□□□
3. □□□□□□□□□□ MCC/MNC

#### 4. 設定する

設定

- [設定](#) [設定](#)

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

**3 IMS**

設定

- 設定
- IMS 設定
- 設定

設定

1. 設定
2. `data_action` `ims_action`
3. 設定

設定

- 設定 IMS
  - `ims_action: "allow"`
- 設定 `ims_action_if_no_rules_match` `"allow"`

設定 [設定](#)

---

# EIR

## 

- 
- 
- EIR

## 

### 1 IMEI

#### 

- /
- 

#### 

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

#### 

- EIR
- 
- 

### 2 MME S13

#### 

- EIR
- 

####

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

- MME S13 EIR
- Diameter S13 16777252
- MME

3

- 

1. EIR
- 2.
- 3.

- .\* IMEI
- 
- 

- API
- Diameter
- CPU

- 00000000

0000000000

00 **1**00000000

000

- 000000
- 000 CPU 0
- 0000

00000

1. 0000000000000000
2. 00000
3. 00000000
4. 0000000

00000

- 00000
- 00000000
- 00000000
- 00000000
- 00 00 00 00

00 **2**00000000

000

- 00000000
- 000000000000
- 000000000

00000

1. 000000000

2. 000000
3. 0000000000
4. 0000000000

000000

- 00000000
- 000000000000
- 0000000000
- 000000000000

### 00 3 Diameter 000000

000

- Diameter 00000
- 000000000000
- 000000000000

000000

1. 00 0000 Diameter 00
2. 00000000
3. 000000000000
4. 000000000000

000000

- 000000000000
- 000000000000
- 000000000000
- 00000000 Diameter 00

### 00 4 000000

000

- OmniHSS 000000

- 000000
- 00000000

00000

1. 0000000000 OmniHSS 0000000
2. 0000000
3. 000000000000
4. 00 Erlang VM 00

00000

- 00 OmniHSS 00000000
  - 000000000000000000
  - 0 runtime.exs 000 Erlang VM 0000
  - 00000000000000
- 

0000000000

00

- 00000000000000000000
- 00000000
- 00000000
- 00000000

000000000000

00 **1MME** 00/00

000

- 00000000 MME 00 MME 0000
- 0000 MME 00000000
- 0000

□□□□

1. □□□□□□□□ MME
2. □□ MME □□□□
3. □□ MME □□□□□□

□□□□

- □□□□□□□□□□□□□□
- □□□□□□□□
- MME □□□□□□ Cancel-Location

□□ **2**□□□□□□□□

□□□

- □□□□□□□□□□
- PDN □□□□□□□□□□
- □□□□□

□□□□

1. □□□□□□ last\_seen □□□
2. □□□□□□□□□□□□□□
3. □□□□□□□□□□

□□□□

- □□□□□□□□□□□□
- □□□□□□□□□□□□
- □□□□□□□□□□□□□□

□□ **3**□□□□□□

□□□

- □□□□□□□□
- □□□□
- □□□□□

□□□□❓❓

1. □□□□□□□□□□□□
2. □□□□□□
3. □□□□□□□

□□□□□

- □□□□□□□□□□
- □□□□□□□□□□
- □□□□□□□□□□

---

## API □□

□□

- API □□□□
- API □□□□
- □□□□/□□□□
- 500 □□

□□□□□□□□□□

□□ **1**□□□□□□□□

□□□

- 400 □ 422 □□
- □□□□□□
- □□□□□□

□□□□□

1. □□□□□□□□□□□□□□
2. □□ API □□□□

3. 000000000000

4. 00000000

000000

- 0000000000 API 00
- 000000000000
- 0000000000000000 ID 00

00 20000000

0000

- 0000000000
- 0000“key\_set\_id 0000”
- 0000000000

000000

1. 0000000000
2. 00000000000000
  - key\_set\_id → 0000
  - epc\_profile\_id → EPC 00000
  - ims\_profile\_id → IMS 00000

000000

- 000000000000
- 0000000000 ID
- 00 0000000000

00 30000000

0000

- 500 00
- 00 API 00000
- 0000000000

□□□□

- □□ □□□□
- 

□□□□□□□□

□□□□□□□□

### 1. □□□□

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

### 2. **Diameter** □□

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

### 3. □□□□□□

- 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
```

□□□□□□□□

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

---



- `enable`
- `enable`
- `enable`
- `enable`

## Configuration

### Configuration

| Property                     | Value                      | Description         |
|------------------------------|----------------------------|---------------------|
| <code>"enable"</code>        | <code>enable</code>        | Enable the service  |
| <code>"SQN"</code>           | <code>SQN</code>           | Sequence Number     |
| <code>"imsi"</code>          | <code>imsi</code>          | IMSI                |
| <code>"enabled=false"</code> | <code>enabled=false</code> | Disable the service |

## Diameter

| Property                | Value                 | Description        |
|-------------------------|-----------------------|--------------------|
| <code>"Diameter"</code> | <code>Diameter</code> | Diameter           |
| <code>"CER/CEA"</code>  | <code>CER/CEA</code>  | CER/CEA            |
| <code>"enable"</code>   | <code>enable</code>   | Enable the service |
| <code>"TLS"</code>      | <code>TLS</code>      | TLS                |

## Table 1

| Field          | Type   | Example             |
|----------------|--------|---------------------|
| "key_set_id"   | String | 123456789           |
| "imsi"         | String | 123456789012345     |
| "phone_number" | String | 1234567890123456789 |
| "country_code" | String | 12345               |

## API Parameters

| Field          | Type   | Example             |
|----------------|--------|---------------------|
| "key_set_id"   | String | 123456789           |
| "imsi"         | String | 123456789012345     |
| "phone_number" | String | 1234567890123456789 |

# OmniHSS Webhook

←

## 

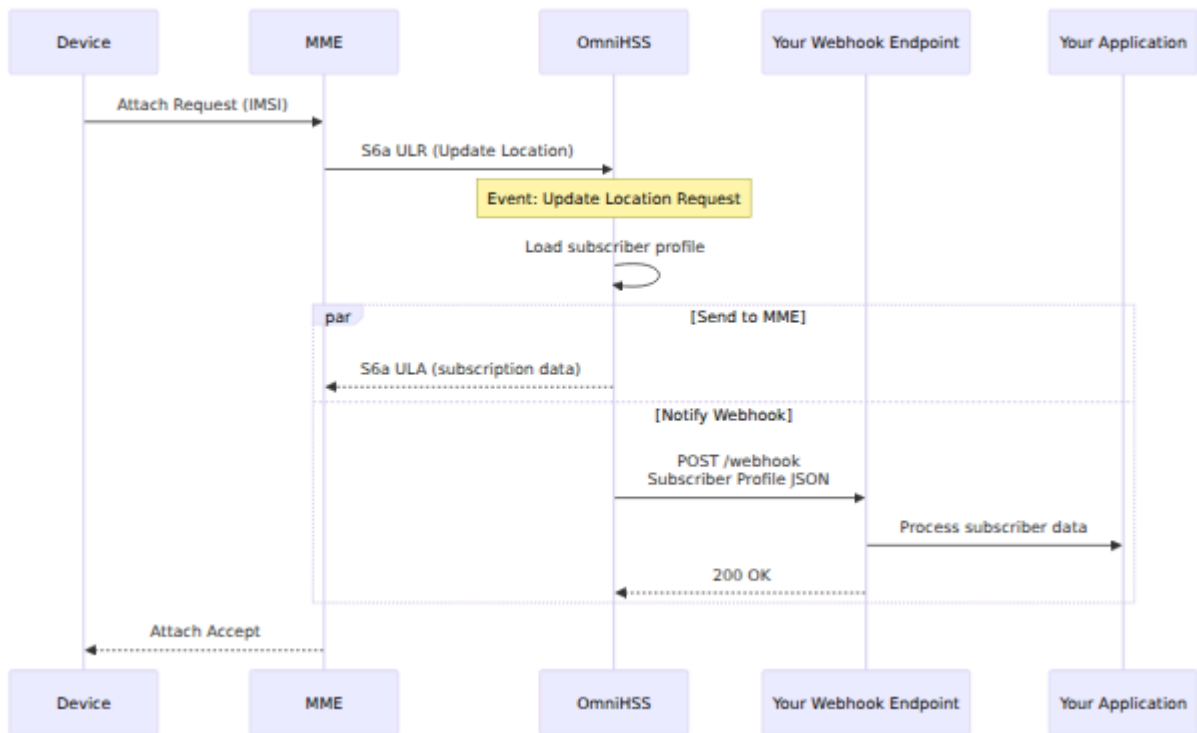
- 
- Webhook
- Webhook
- Webhook
- 
- 
- 
- 

## 

OmniHSS **webhooks** IMS  
OmniHSS webhook HTTP POST

## **Webhooks**

Webhooks HTTP OmniHSS HSS  
API



## 목차

- 목차 - 목차
- 목차 - 목차 webhook 목차 GET /api/subscriber 목차
- 목차 - 목차
- 목차 - 목차 API 목차
- 목차 - 목차 OmniHSS 목차

# Webhook 목차

## 목차

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



## IMS

| Event               | Interface       | Description            |
|---------------------|-----------------|------------------------|
| ims_registration    | Cx SAR          | IMS/VoLTE registration |
| ims_deregistration  | Cx SAR (de-reg) | IMS deregistration     |
| ims_profile_request | Sh UDR          | IMS profile request    |

## PCRF (Policy and Charging Rules Function)

| Event               | Interface | Description                    |
|---------------------|-----------|--------------------------------|
| policy_request      | Gx CCR    | P-GW policy request            |
| media_authorization | Rx AAR    | P-CSCF IMS media authorization |

## IMSI

| Event       | Description                        | Details         |
|-------------|------------------------------------|-----------------|
| imsi_switch | ULR for different IMSI on same SIM | IMSI SIM switch |

## Webhook

Configuration

OmniHSS webhooks are configured via 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"
    },
    "epc_profile": {
      "id": 1,
      "name": "Premium 100Mbps",
      "ue_ambr_dl_kbps": 100000,
      "ue_ambr_ul_kbps": 50000
    },
    "ims_profile": {
      "id": 1,
      "name": "Standard VoLTE"
    },
    "roaming_profile": {
      "id": 1,
      "name": "International Roaming Allowed"
    }
  }
}
```

```

"subscriber_state": {
  "mme_host": "mme-01.example.com",
  "mme_realm": "epc.mnc001.mcc001.3gppnetwork.org",
  "visited_plmn": "001001",
  "last_update": "2025-01-15T14:30:00Z"
},
"custom_attributes": {
  "account_type": "premium",
  "billing_plan": "unlimited"
}
},
"event_context": {
  "visited_plmn": "310410",
  "mme_host": "mme-roaming.example.com",
  "location_update_type": "initial_attach"
}
}

```

□□□□

| □□            | □□     | □□                                       |
|---------------|--------|------------------------------------------|
| event         | string | □□□□□□□□ update_location_request □       |
| event_id      | string | □ webhook □□□□□ UUID                     |
| timestamp     | string | □□□□□□ ISO 8601 □□□                      |
| subscriber    | object | □□□□□□□□□□□□ GET /api/subscriber/:id □□□ |
| event_context | object | □□□□□□□□□□□□                             |

□□□□□□□□

event\_context □□□□□□◆◆□□□□□□

□□ update\_location\_request □

```
{
  "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

| Header              | Value            | Value                   |
|---------------------|------------------|-------------------------|
| 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": "omnihss webhook"
  }
}'
```

□□□

```
{
  "data": {
    "id": 1,
    "url": "https://your-server.com/omnihss-webhook",
    "events": [
      "update_location_request",
      "ims_registration",
      "imsi_switch"
    ],
    "enabled": true,
    "description": "omnihss 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}`);

  // TODO
  // ... TODO ...

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

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

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

app.listen(3000);
```

---

□□

## 1. □□□□□□□□

□□□□□□□□□□□□□□□□□□□□



```
// 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
    });
  }

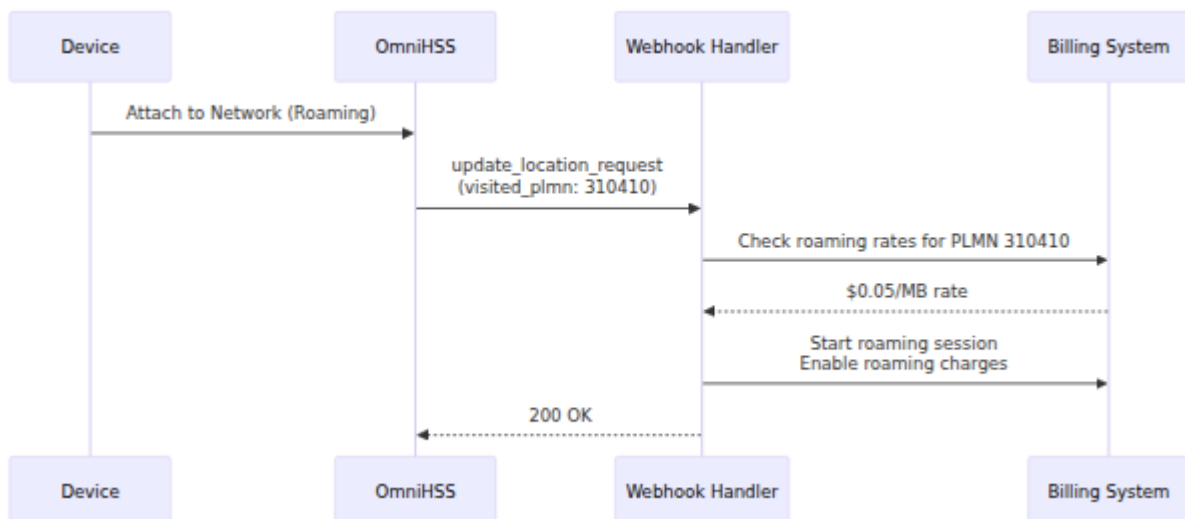
  res.status(200).send();
});
```

□□□□□□

- □□ MME □□□□□□
- □□□□□□□□□□
- □□□□□□
- IMS □□□□□□

### 3. □□□□□□□□

□□□□□□□□□□□□□□□□□□□□



□□□□□□

1. □□□□□□

- □□□□ A □□□
- 30 □□□□ B □□□□□□□□□□
- □□□□□□□□□□□□□□□□

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')

        # 检查是否被阻塞
        if visited_plmn in BLOCKED_PLMNS:
            disable_subscriber(subscriber['imsi'])
            alert_security_team(subscriber, 'Roaming to blocked
PLMN')

        # 检查是否不可能旅行
        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. 网络策略

网络策略配置

网络策略配置 VoLTE 策略 IMS

```

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

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

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

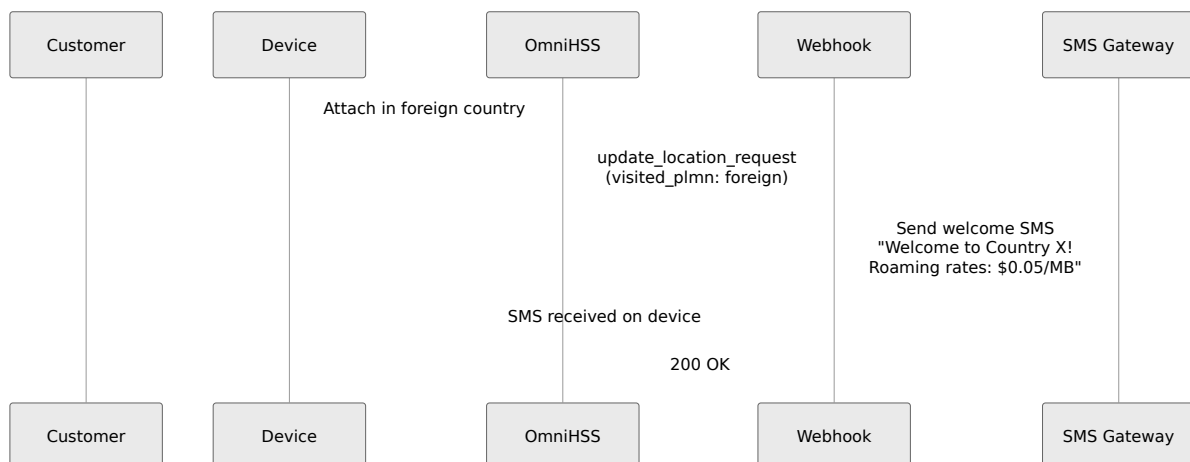
  res.status(200).send();
});

```

## 5. IMS ON

IMS ON

IMS ON



IMS ON

- "IMEI [IMEI] SIM [SIM ID]"
- "IMEI 80% [IMEI]"
- "IMEI [IMEI] VoLTE [VoLTE]"
- "IMEI [IMEI]"

## 6. IMSI SIM

IMSI SIM IMSI

```

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;

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

    //
    await billing.endSession(previous_imsi);
    await billing.startSession(new_imsi);

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

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

```

## 7. 設定

OmniHSS 設定

設定

- **CRM** 設定 - 設定
- 設定 - 設定
- 設定 - 設定
- 設定 - 設定
- 設定 - 設定

設定

### Webhook 設定

設定 webhooks 設定 OmniHSS設定

```
# 設定 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"],
      "secret": "your-secret-key-here"
    }
  }'
```

OmniHSS 設定 `X-OmniHSS-Signature` 設定

```
X-OmniHSS-Signature:
sha256=5d7a8f9b2c1e3a4d6f7e8b9c0a1b2c3d4e5f6a7b8c9d0e1f2a3b4c5d6e7f8a
```

設定



## □□□□

### 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** □□□□□□

- 設定する webhook の events
- 設定する ims\_registration

### 3. HSS

- webhook
- 
- DNS

### 4. テスト

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

## Webhook

- HSS webhook
- Webhook HSS

#### 1. 設定

- 5 HTTP 200
- 

#### 2. テスト

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

// 20 - processData
app.post('/webhook', (req, res) => {
  res.status(200).send(); // 20
  processData(req.body); // 20
});
```

## Webhooks

10

- 10
- `event_id` 10

20

- 20 OmniHSS 10
- 20 webhook

10

10 `event_id` 10



- 验证签名

验证

验证签名

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

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

    // 处理 webhook
    await processWebhook(req.body);

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

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

验证

验证

- 处理 webhook 数据
- 返回 null 数据

验证

1. 验证签名 - 验证签名

## 2. 接收器 - 接收器 webhook 接收器

接收器

接收器

```
const { subscriber } = req.body;  
  
// 接收器  
const imsProfile = subscriber.ims_profile || { name: 'No IMS' };  
const roamingProfile = subscriber.roaming_profile || { name: 'No  
Roaming' };  
  
// 接收器 MSISDN  
const msisdns = subscriber.msisdns || [];
```

接收器

## Webhook 接收器

接收器 webhook 接收器

接收器

- Webhook 接收器
- Webhook 接收器
- 接收器
- 接收器
- 接收器

接收器 **Prometheus/Grafana** 接收器

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

# Webhook 延迟
histogram_quantile(0.95, omnihss_webhook_duration_seconds)
```

## Webhook 事件

Webhook 事件是系统记录的事件。

示例：

```
{
  "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
}
```

---

[← 事件](#) | [API 事件](#) →

# OmniHSS

## 概要

OmniHSS は 4G LTE (EPC) と IMS (IP 電話) の統合 (HSS) を提供します。

OmniHSS は Elixir と Erlang VM を利用しています。

## 機能

HSS と LTE と IMS の統合

- 統合 - 統合
- 統合 - 統合
- 統合 - 統合
- 統合 - 統合
- 統合 - 統合
- 統合 - 統合 (EIR) 統合

## 接続

### 接続

- **S6a** 接続 - LTE/EPC 統合
- **Cx** 接続 - IMS 統合
- **Sh** 接続 - IMS 統合
- **S13** 接続 - 統合 (OmniHSS と EIR)
- **Gx** 接続 - 統合 (OmniHSS と PCRF)
- **Rx** 接続 - IMS 統合 (OmniHSS と PCRF)
- 接続 - PLMN 統合 IMS 統合

- **MSISDN** - 電話番号
- **RESTful API** - REST API (OmniHLR API)
- **Web** - Web

## OmniHSS

OmniHSS 構成

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

## API

API 一覧

## API

- **API** - Diameter
- **API** - Diameter
- **API** - Diameter

## API

- **API** - Diameter
- **API** - Diameter
- **API** - Diameter
- **API** - REST API
- **Webhooks** - Webhooks

## □□□□

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

## □□□□

- **Galera □□□□□** - □□ HA □□□□□□□□□□

## □□□□□□□□

## □□□□□

### □□□□ (Web □□)

URL: https://[hostname]:7443

□□□□□□□□□□□□ Diameter □□□□□□□□□□□□

### API □□

URL: https://[hostname]:8443

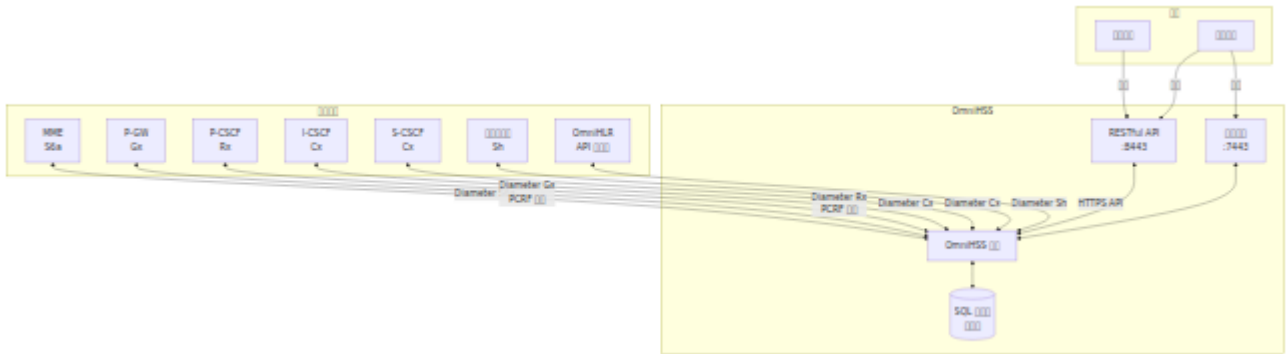
RESTful API □□□□□□□□□□□□

## □□□□□□□□

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



□□□□



□□□

□□□□□□□□□□□□□□□□□□□□

- □ □□□□ □□□□□□□□□□
- □□ □□□□ □□□□□□□□
- □□ □□□□ □□□□□□□□
- □□ **API** □□ □□□□□□□□

□□□□□ 1.0

□□□□ Omnitouch □□□□