

API 错误

← API 错误

错误

- 错误
 - 错误
-

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

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[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. 创建 EPC 配置
```

```
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\": \"测试配置\",  
  \"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. 创建用户
```

```
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 "创建用户ID: $SUBSCRIBER_ID"
```

配置

配置

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

配置

- 配置 MSISDN 配置
- 配置 IMS 配置
- 配置 配置

- 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” APN 普通 IPv4 普通 IoT 普通

```
# 安装 jq (apt-get install jq || 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\ ": \ "001001999999999\  
  \ "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 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

OmniHSS API

←

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

API

URL

https://[hostname]:8443/api

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

- 例: 例 HTTPS
- 例: 8443 例

例: 例 API 例 "例" JSON 例

例:

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

例:

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

例:

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

例

例 JSON 例

例:

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

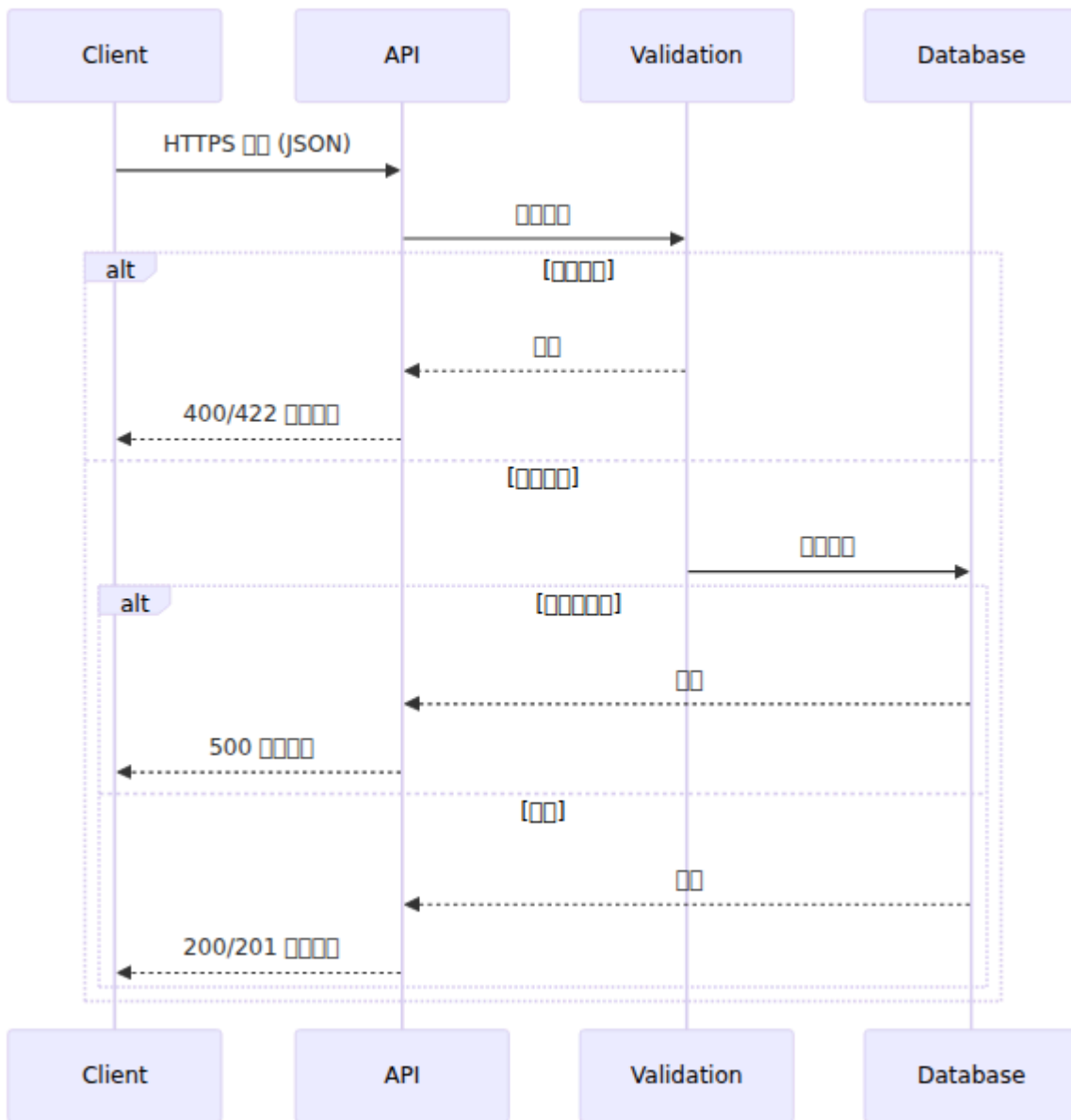
예외:

```
{
  "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	찾을 수 없음	잘못된 URL
422	잘못된 요청	잘못된 요청
500	서버 내부 오류	서버 내부 오류

API 交互



请求

响应

请求/响应

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

リクエスト:

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

レスポンス:

```
{
  "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"
    }
  ]
}
```

リソース ID 一覧

リソース ID 一覧

リクエスト: GET /api/subscriber/:id

レスポンス:

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

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)

curl:

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

レスポンス: 成功時

HTTP

ステータス

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"
    }
  }
}
```

レスポンス:

- imsi - 14-15 桁の IMSI

- `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 00000000 IMS 000000
- `roaming_profile_id` - 00 000000000000000000
- `msisdns` - MSISDN ID 0000000000
- `static_ips` - 00 APN 000 00 IP ID 00
- `custom_attributes` - 00000000

00:

- 0000000000 - 00000000
- 0 MSISDN 00 - 000000000000
- 00 IP 00 - 0000 IP 0000 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` - [] [] [] [] [] []

[] [] [] []:

- `imsi` - [] [] [] IMSI [] [] [] [] [] [] [] [] [] []

[] []:

- [] [] [] [] [] - [] [] [] [] [] [] [] []

[] [] [] []:

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

[] [] [] []:

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

[] [] [] []

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

[] []: DELETE /api/subscriber/:id

[] [] [] []:

[] []	[] []	[] []
<code>id</code>	integer	[] [] [] [] 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 bits

Request:

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

成功 (200 OK):

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

失敗 (404 未見):

```
{
  "error": "未見 MME"
}
```

原因:

- 未見 MME かつ S6a CLR (subscriber_state.last_seen_mme)
- 取消タイプ: subscription_withdrawal
- CLR-Flags: {s6a_indicator: 1, reattach_required: 1} UE 未見
- last_seen_mme が null かつ 404
- IMSI かつ MSISDN/SIM

解決:

- 確認: 設定
- 確認: 設定
- 確認: MME 未見
- 確認: 設定

- 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
- 国际号码
- 国际号码 E.164 国际号码 + 号码

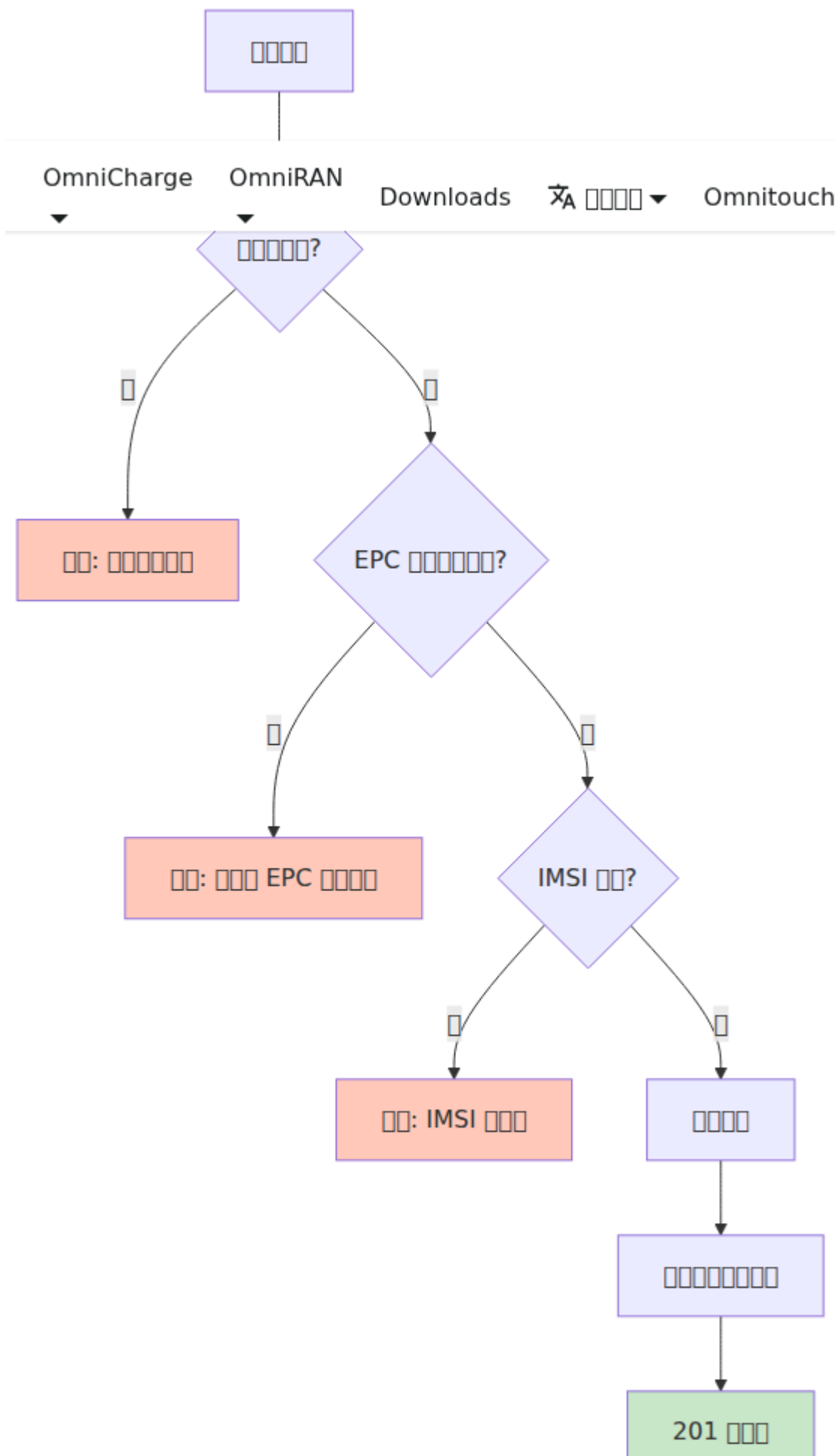
curl:

```
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 + 国际号码

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

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📡📡📡📡

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

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- 📡📡📡📡 - 📡📡📡📡📡📡📡📡

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📡📡: 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		문자열
ue_ambr_dl_kbps	정수	Kbps	10000-1000000
ue_ambr_ul_kbps	정수	Kbps	5000-500000
network_access_mode	문자열		"LTE" 또는 "LTE-CA"
tracking_area_update_interval_seconds	정수		600~
apn_profiles	APN ID 목록		[] 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 内で **Liquid** を Jinja2 を用いて IMS 向けに記述

- 変数: IMS 向けに記述された `{{ imsi }}` は `{% for msisdn in msisdns %}`
- 変数: API 向けに記述された XML 記述
- 変数: IMS 向けに記述された MAA/SAA/HSS
 - IMS 向け
 - XML 記述
 - `{{ imsi }}` → IMSI
 - `{{ msisdns }}` → MSISDN
 - `{{ mcc }}` → MCC
 - `{{ mnc }}` → MNC
 - Cx/Diameter 向け XML 記述 S-CSCF

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 # skip SSL
)
```

(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

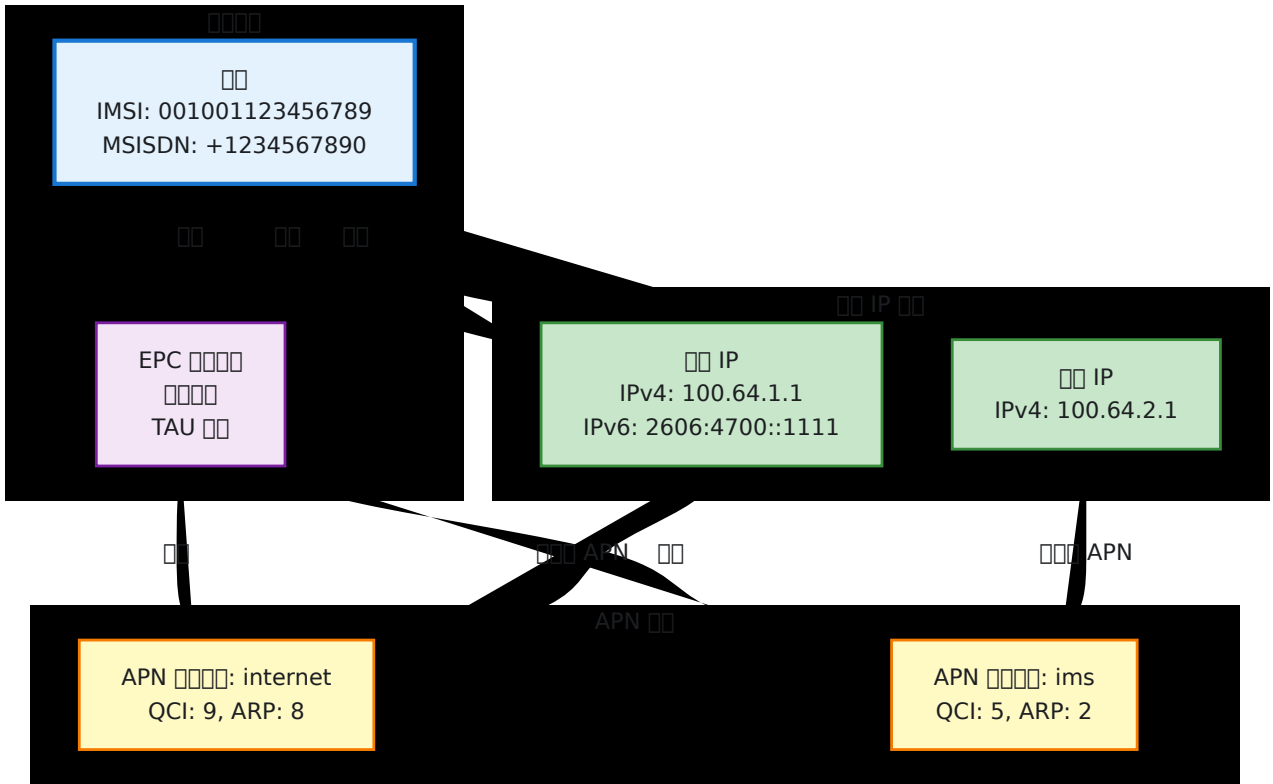
☐☐:

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

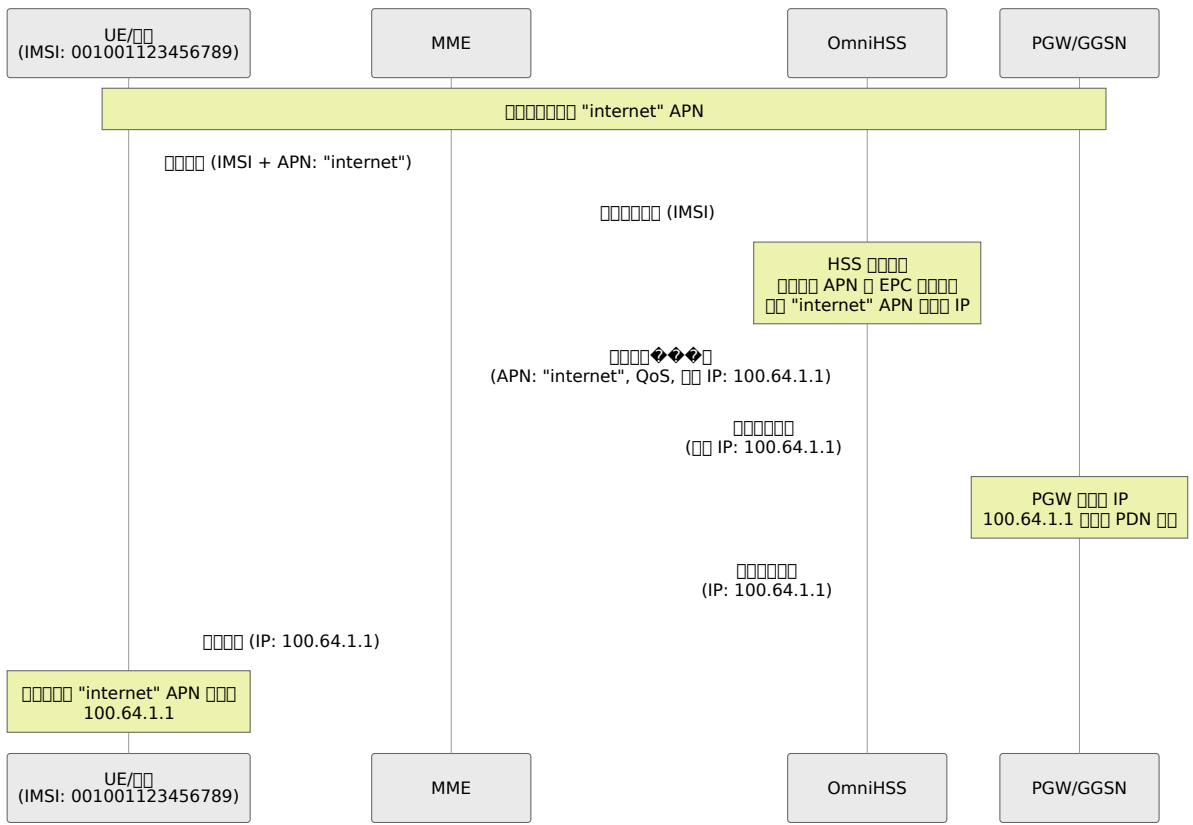
☐☐ IP ☐☐

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

☐☐:

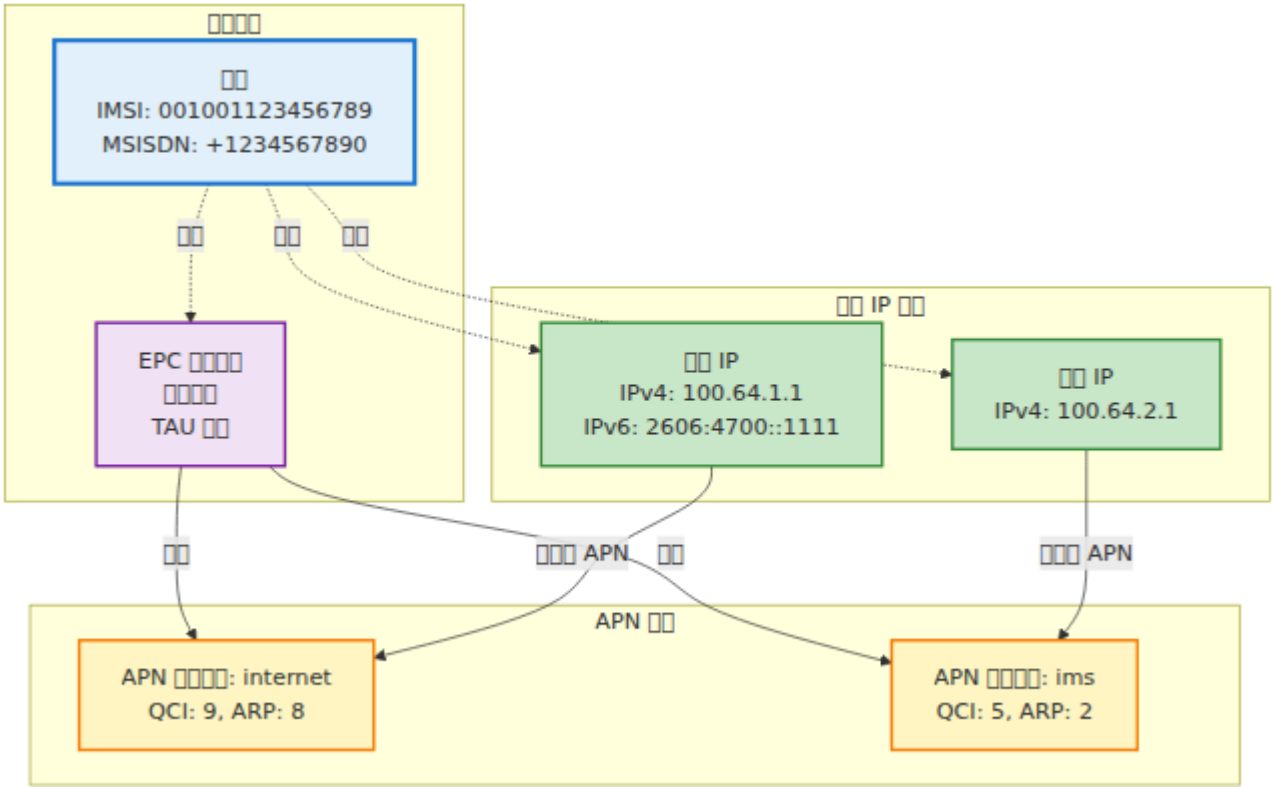


☐☐☐☐☐☐☐☐☐☐:



□□□□□ - **APN** □□□□□□:

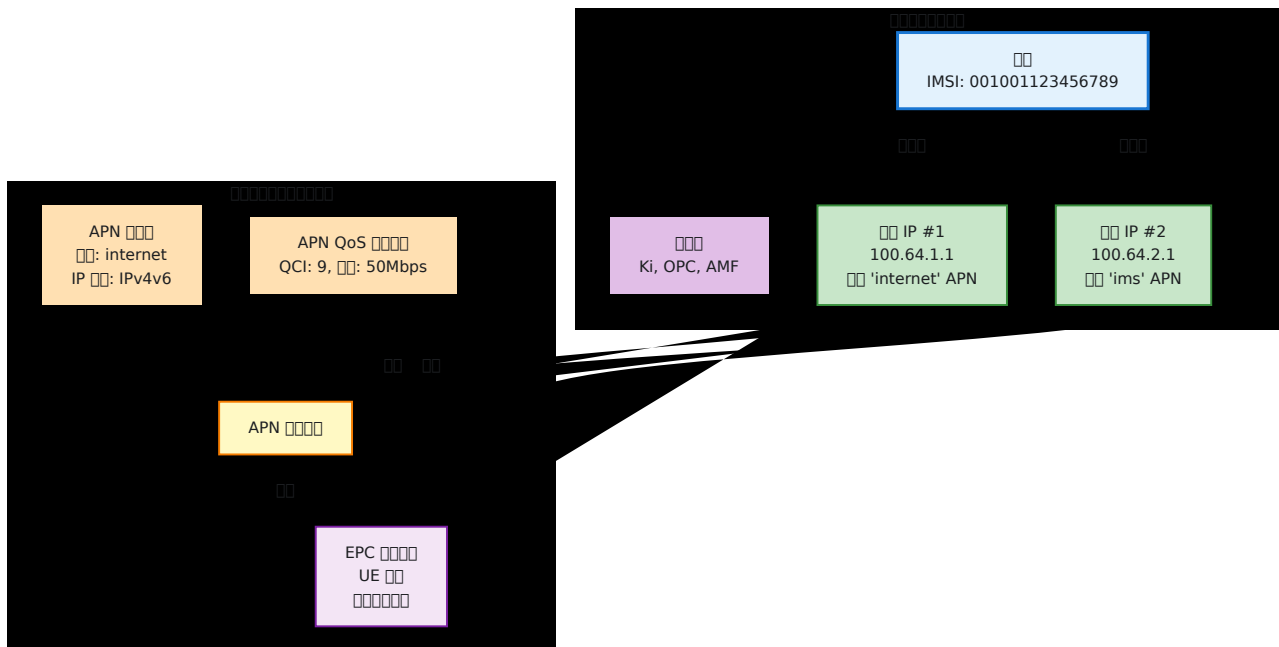
□□□□ S6a □□□□□□ APN-□□ AVP □□□□□□□□□□□□



□□□□:

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 Profile:** `apn_qos_profile`
5. **AMBR:** 1000 kbps → bps
6. **Static IP:** subscriber.static_ips → apn_profile_id → IP
 - `subscriber.static_ips` → `apn_profile_id` → IP
 - IP version `apn_identifier.ip_version`
7. **VPLMN-APN:** 0 - IP

Diagram:



Notes:

- **APN ID:** IP address APN ID
- **APN Name:** APN name IP
- **IPv4 vs IPv6:** IP address IPv4 vs IPv6
- **Static IP:** IP address static IP
 - IPv4 vs IPv6 static IP APN
 - static IP
 - `ipv4_static_ip` `ipv6_static_ip`
- **Notes:** IP address

□□□□:

- IoT □□□□ IP □□
- □□□□□□□□□□□□□□ IP □□□□□□□□
- □□□□ IP □□□□□□□□
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□□□□ 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 - 고정 IP 주소
- APN 프로파일 - APN ID

정적 IP

정적 IP 주소

PUT /api/epc/static_ip/:id

참고:

id	integer	IP ID

Example:

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

Fields:

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

Response:

- `id` - ID

Note: This endpoint is used to create a static IP address for a PDN. The response includes the ID of the static IP address.

Example:

```
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 address
- Static IP address

Response: Static IP address PDN address IP address

Static IP address

Static IP address IP address IP address

Steps:

1. Static IP address IP address
2. `static_ips` address

Static IP address:

```
# 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"
    ]
  }
}
```

エラー:

- 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 に設定する際に MCC/MNC を指定する

静的 IP の取得

リクエスト: GET /api/roaming/profile

静的 IP の設定

リクエスト: POST /api/roaming/profile

{}:

```
{
  "roaming_profile": {
    "name": "XXXXXX",
    "data_action_if_no_rules_match": "deny",
    "ims_action_if_no_rules_match": "deny",
    "roaming_rules": []
  }
}
```

{}:

- "allow" - {}
- "deny" - {}

{}:

- data_action_if_no_rules_match - {} {} {} {} {}
- ims_action_if_no_rules_match - IMS {} {} {} {} {}

{} {} {} {} {}

{}: 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

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

← API | API: API →

API 测试指南

[← API 概览](#)

简介

本 API 提供以下功能：

GET /api/status

测试方法

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

返回结果

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

更多详情请参阅 [API 文档](#)

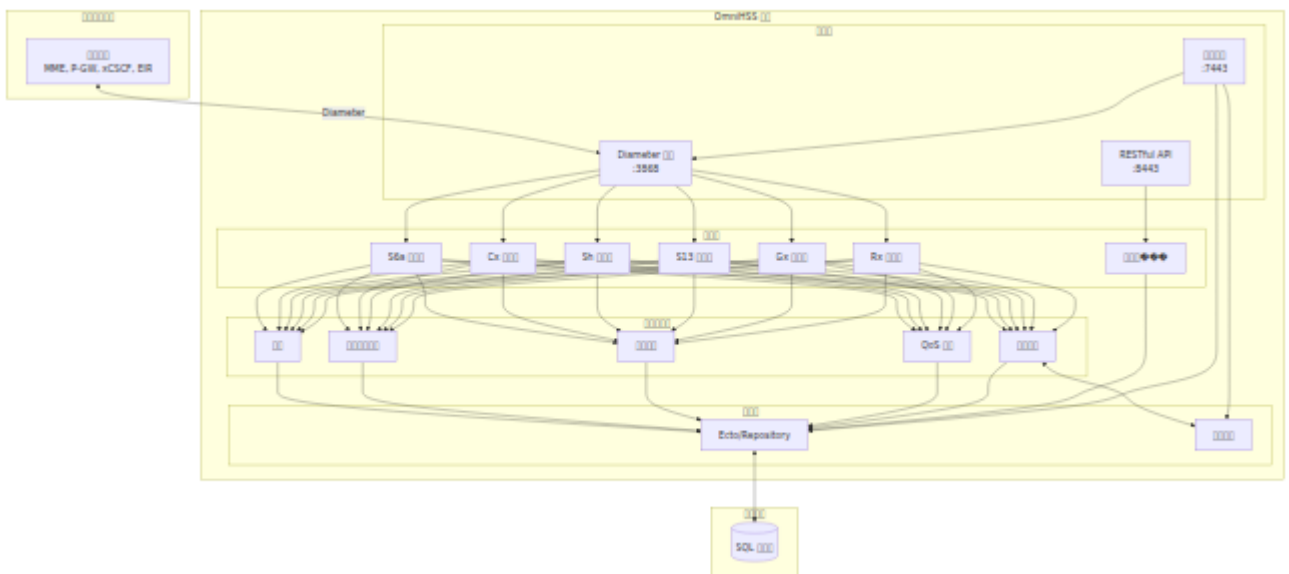
[← API 概览](#)

OmniHSS

←

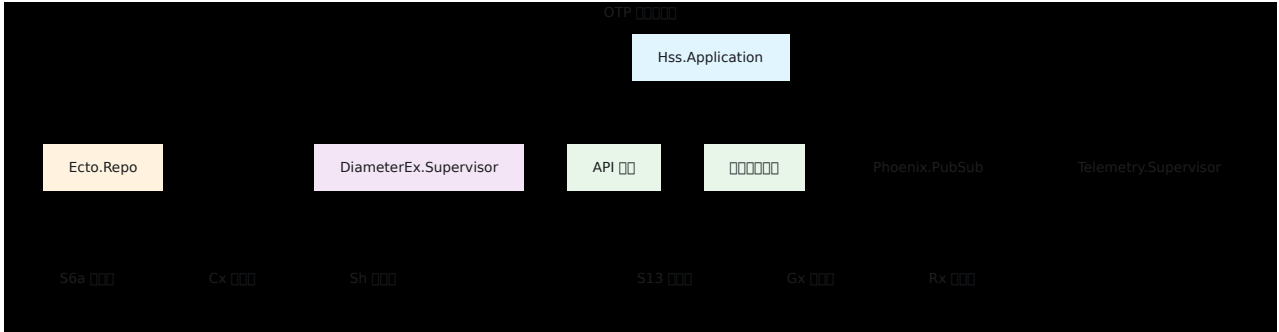
-
-
- Diameter
-
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-

OmniHSS Elixir Erlang/OTP



□□□□

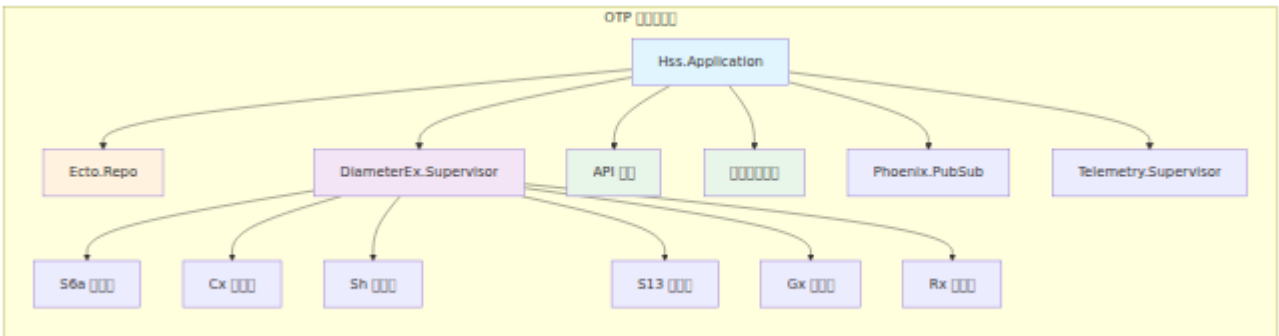
□□□□



Diameter □□□□□

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

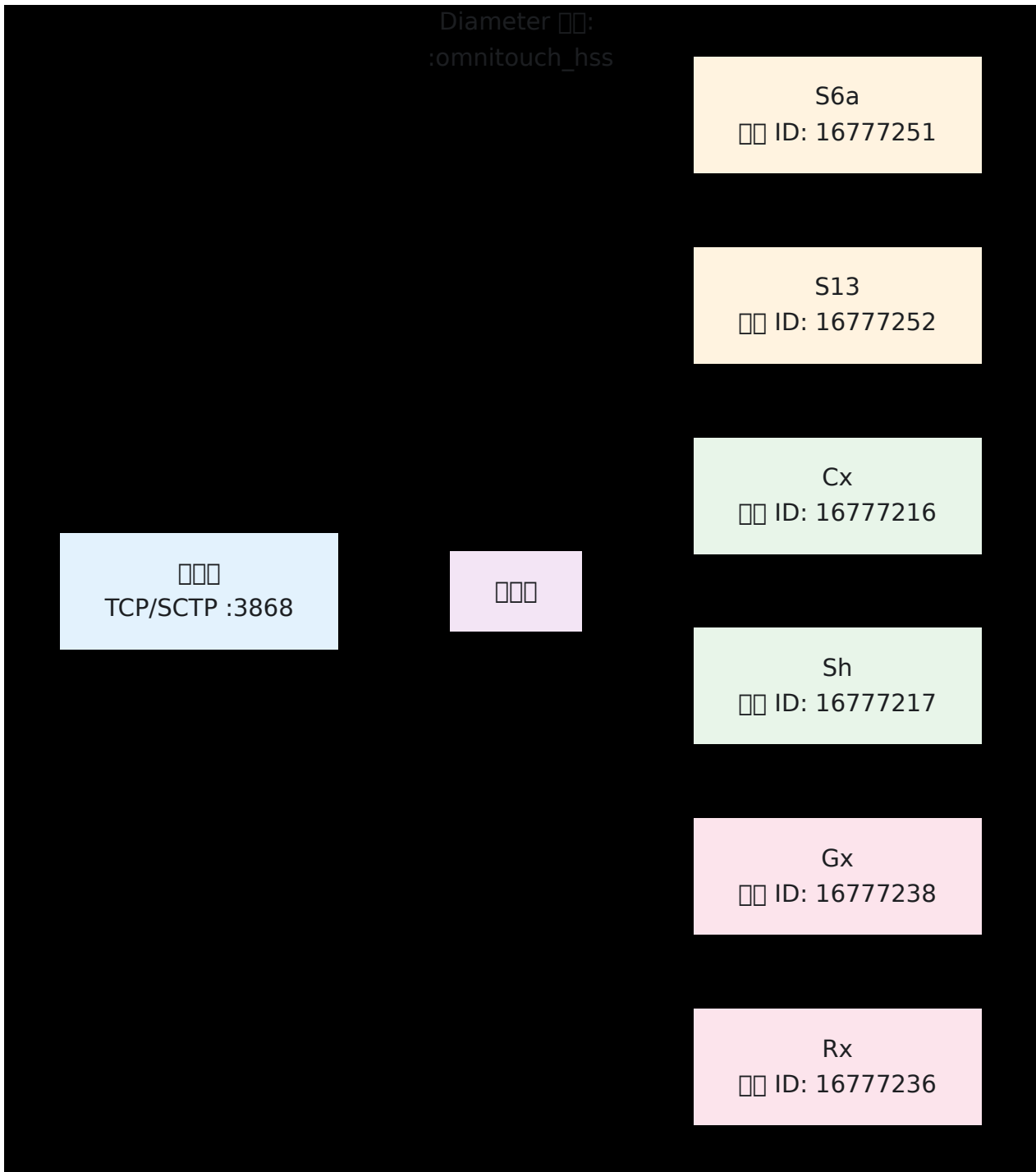
1. □ **DiameterEx** □□ - □□□□□ Diameter □□ ID
2. □□□□ - □□ AVP□□□□□□□□□□
3. □□□□□□ - □□□□□□□□□□□□
4. □□□□ - □□ AVP □□ Diameter □□□□□
5. □□□□ - □□□□□□ Diameter □□□□□



Diameter 00

Diameter 0000

OmniHSS 0000000000000000 Diameter 000



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□□□□□□

Configured

□□□□

Connecting

□□□□

Connected

□□□□

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□□□□□□

□□□□

□□□□ Diameter □□



Down

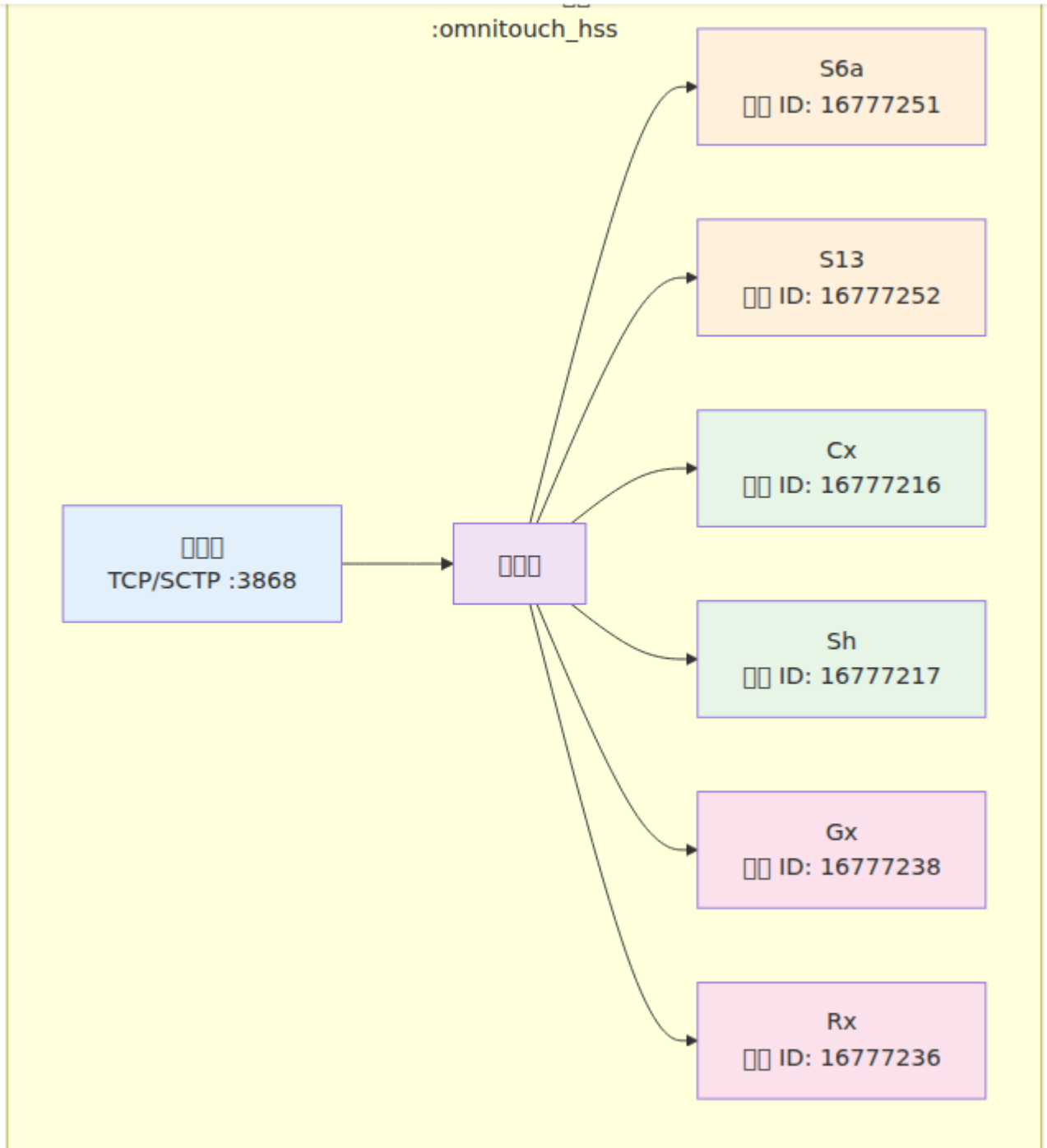
□□□□
□□□□

Diameter [] [] []

Downloads

🔍 [] [] [] []

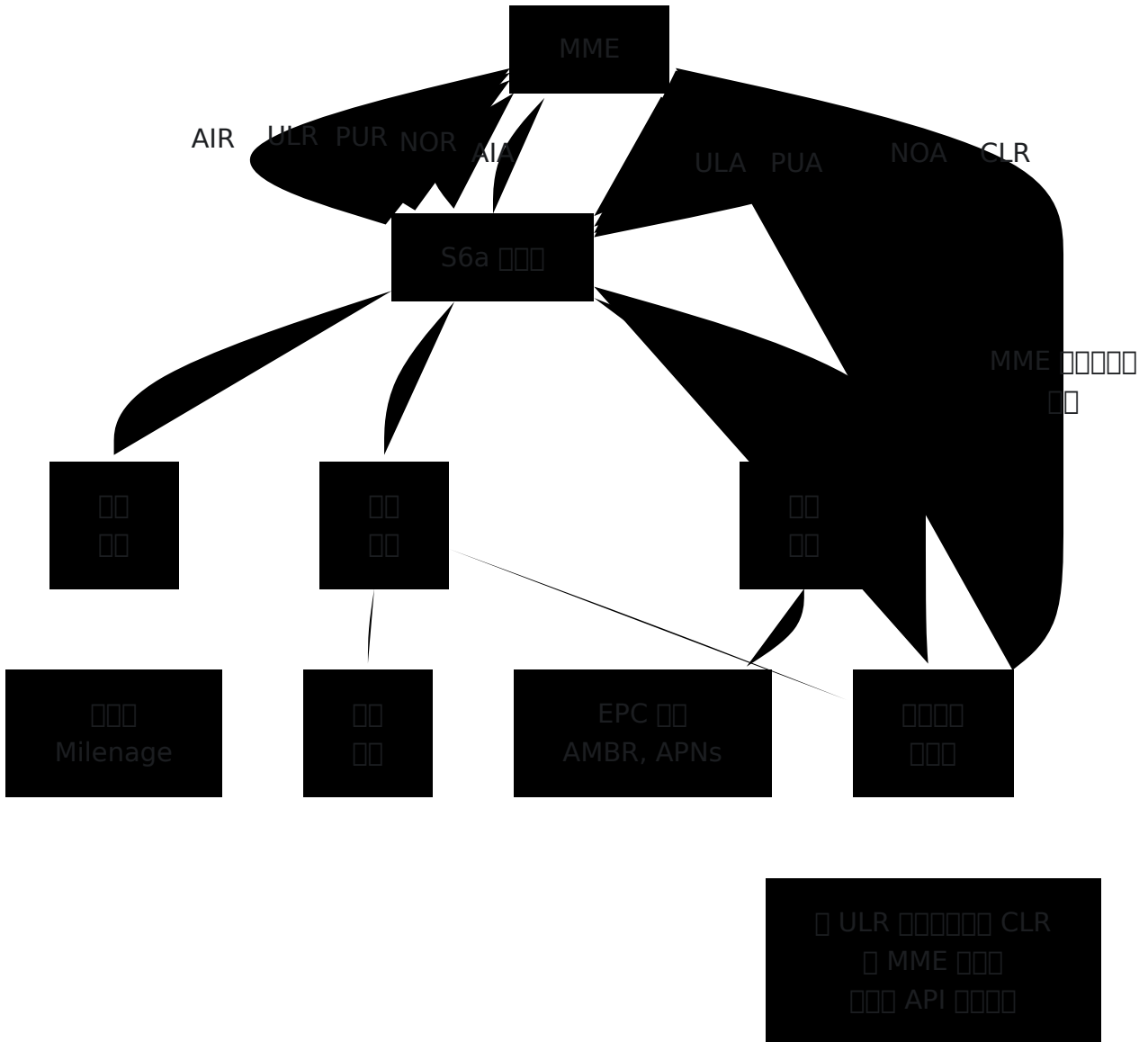
omnitouch website



□□□

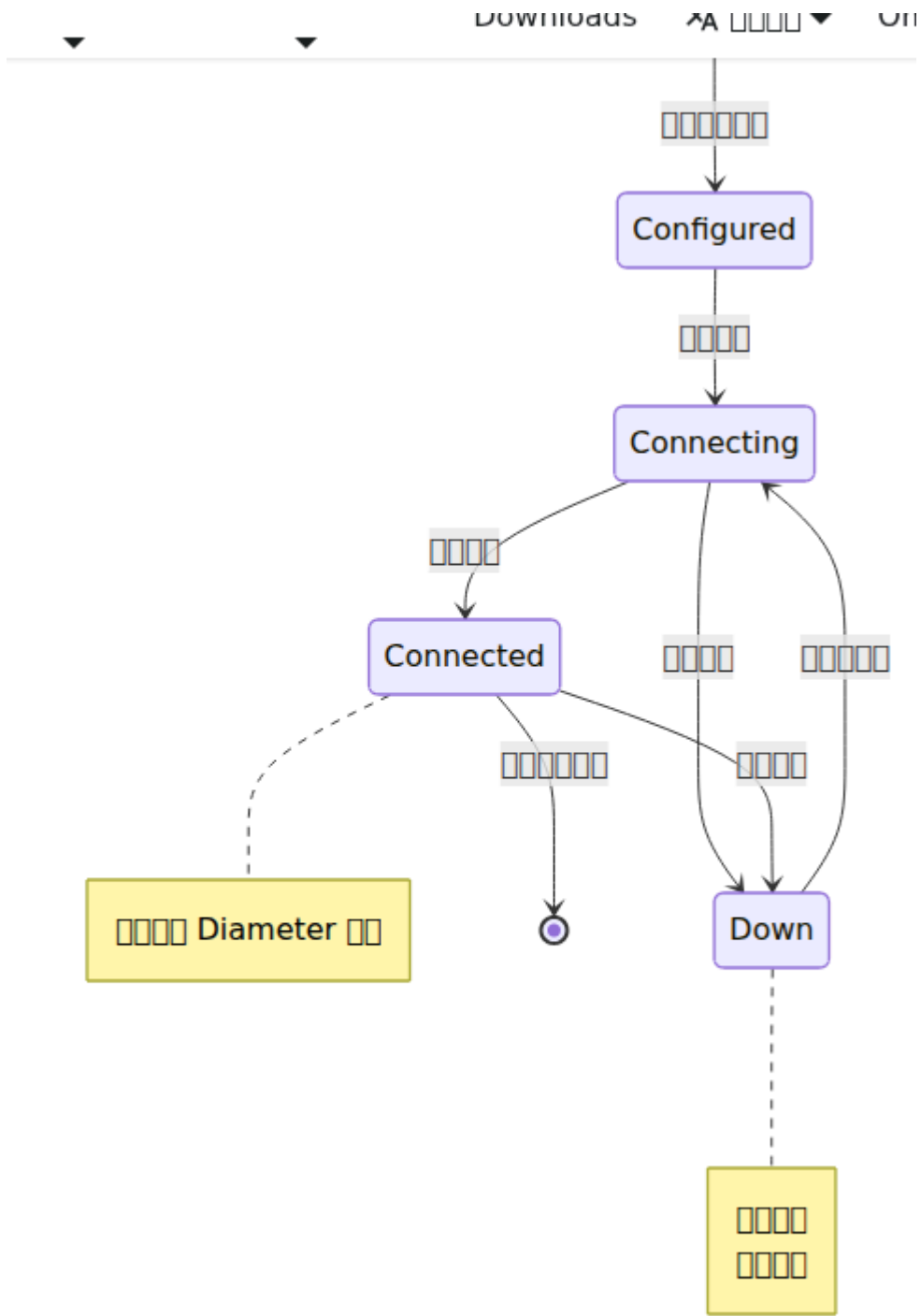
S6a □□ (LTE/EPC)

□□ LTE □□□□□□□□□□



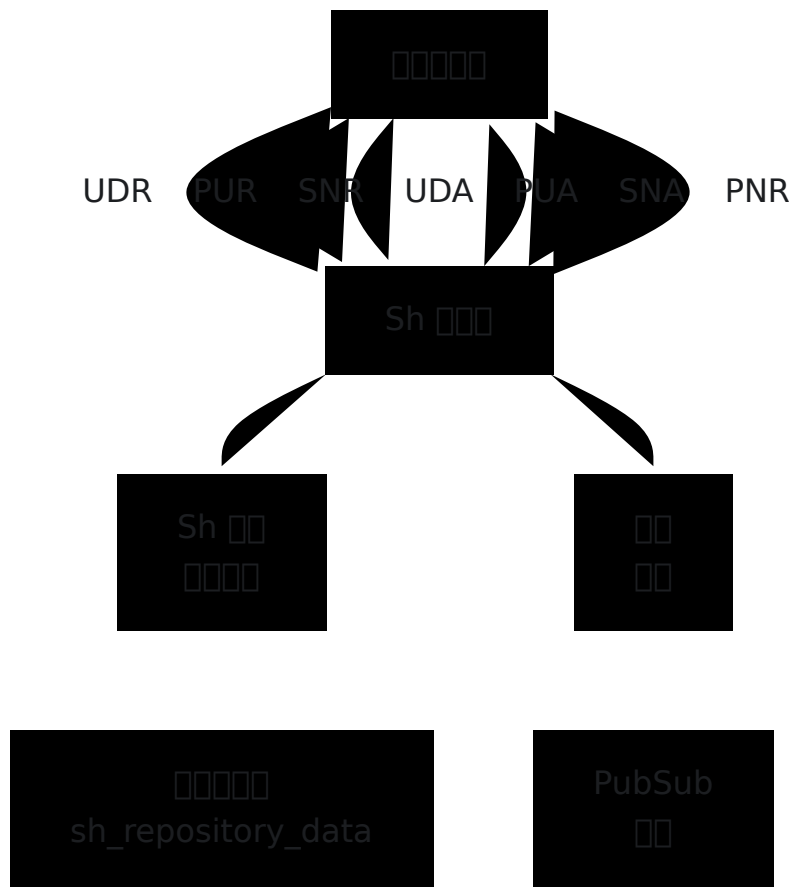
Cx □□ (IMS)

□□ IMS □□□□□□



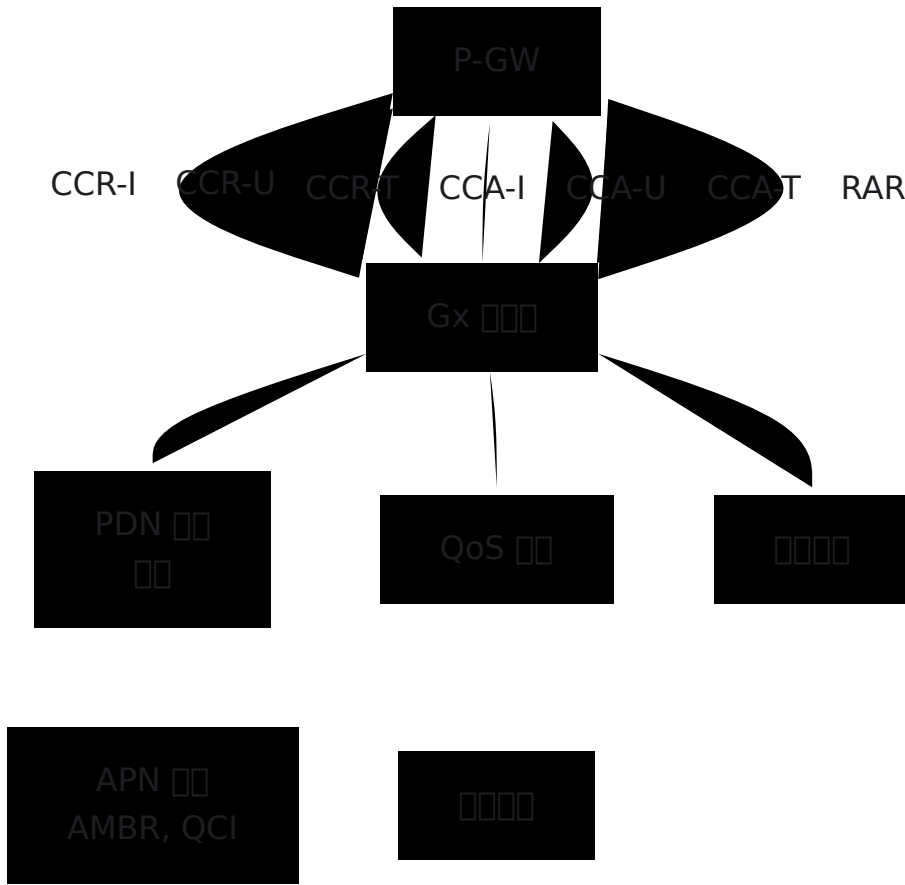
Sh (IMS)

IMS



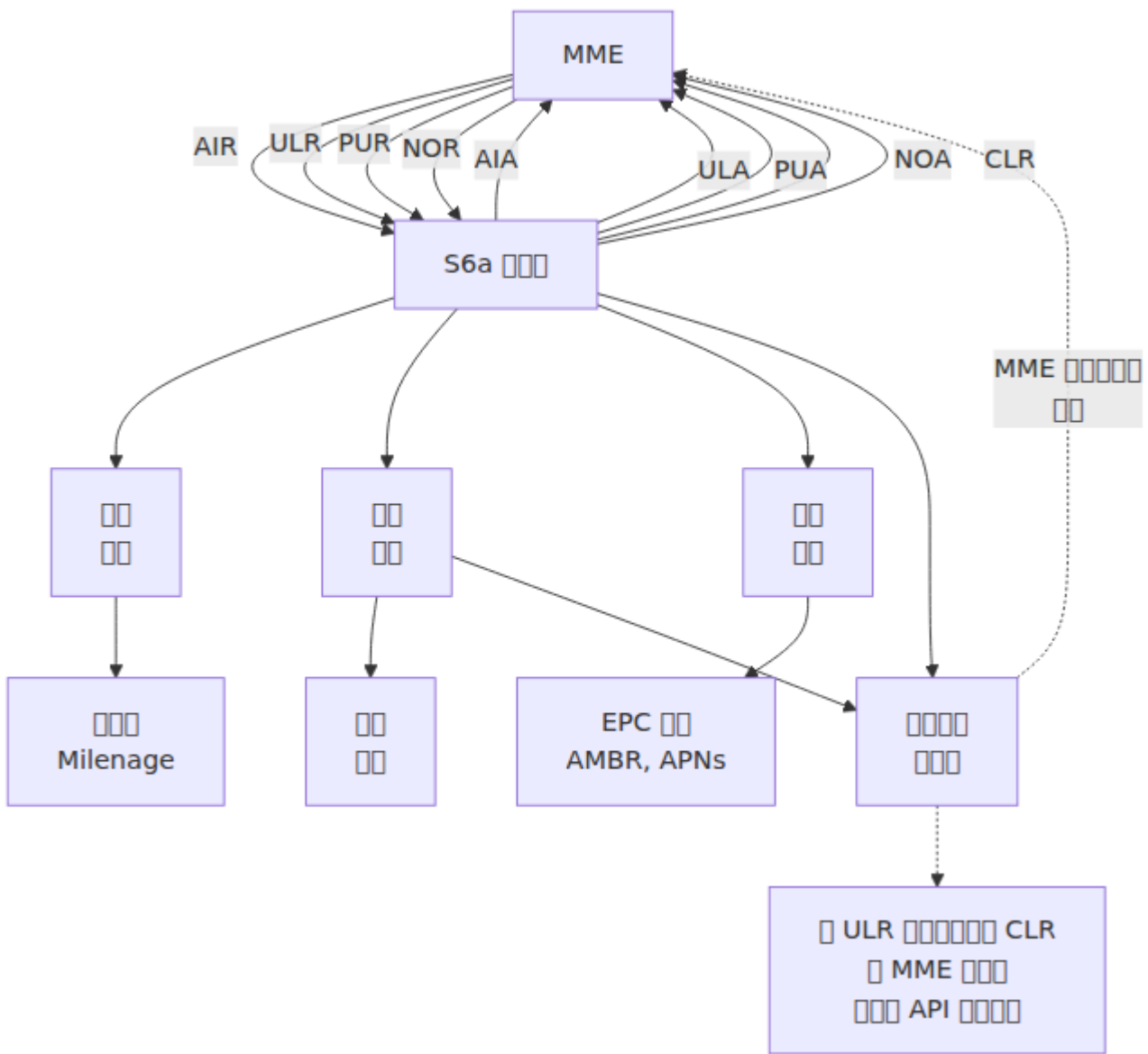
Gx ()

PCRF



Rx (IMS)

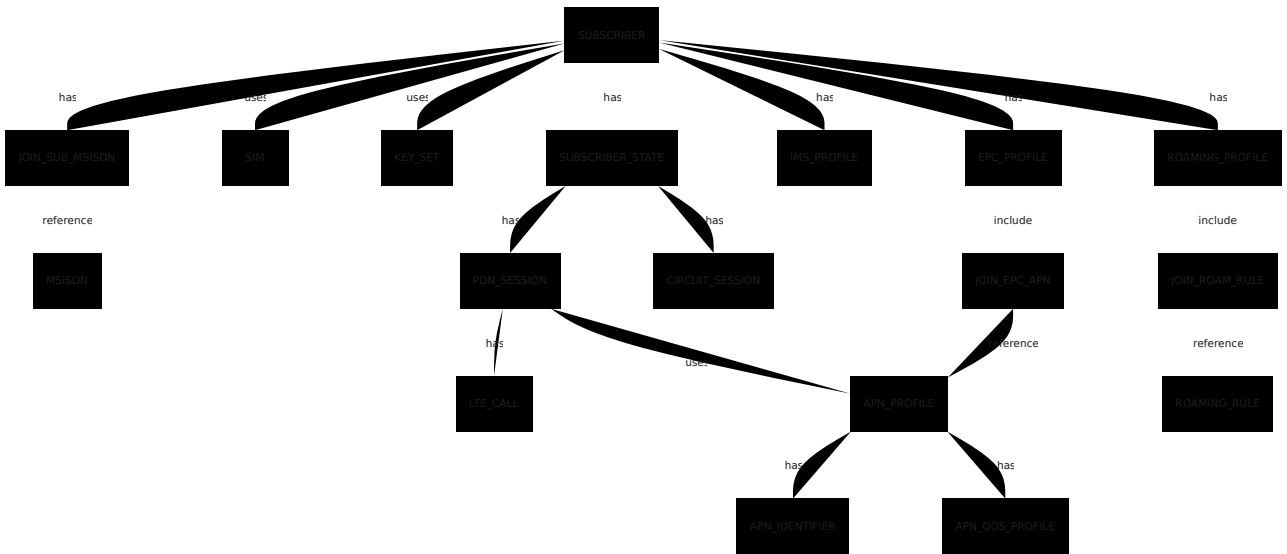
IMS VoLTE PCRF



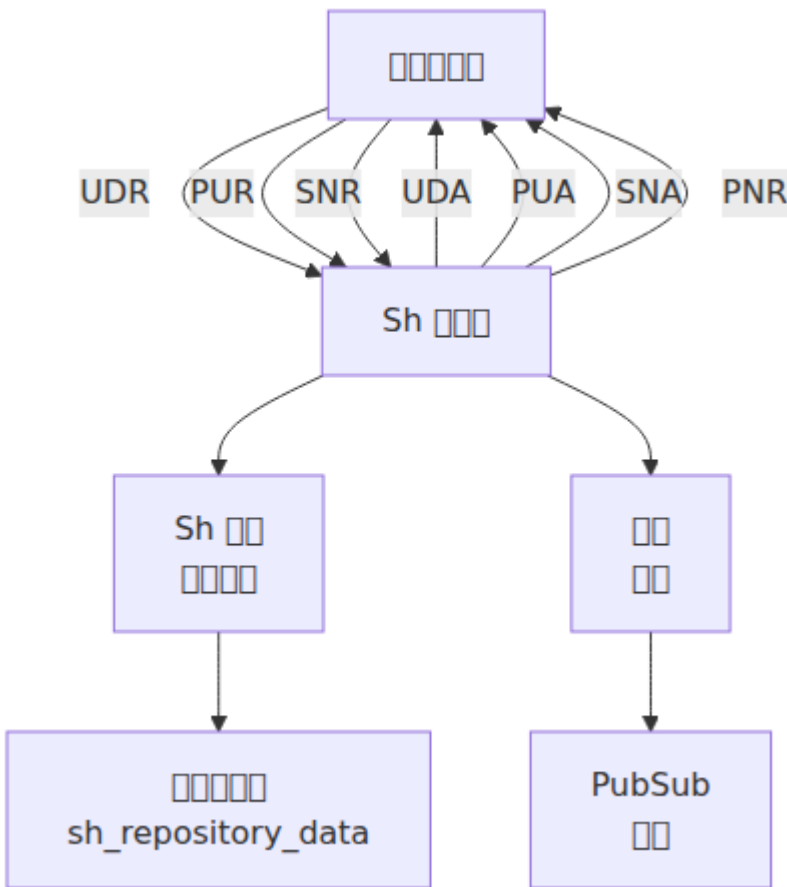
S13 (EIR)

IMEI EIR

□□□□□□□□

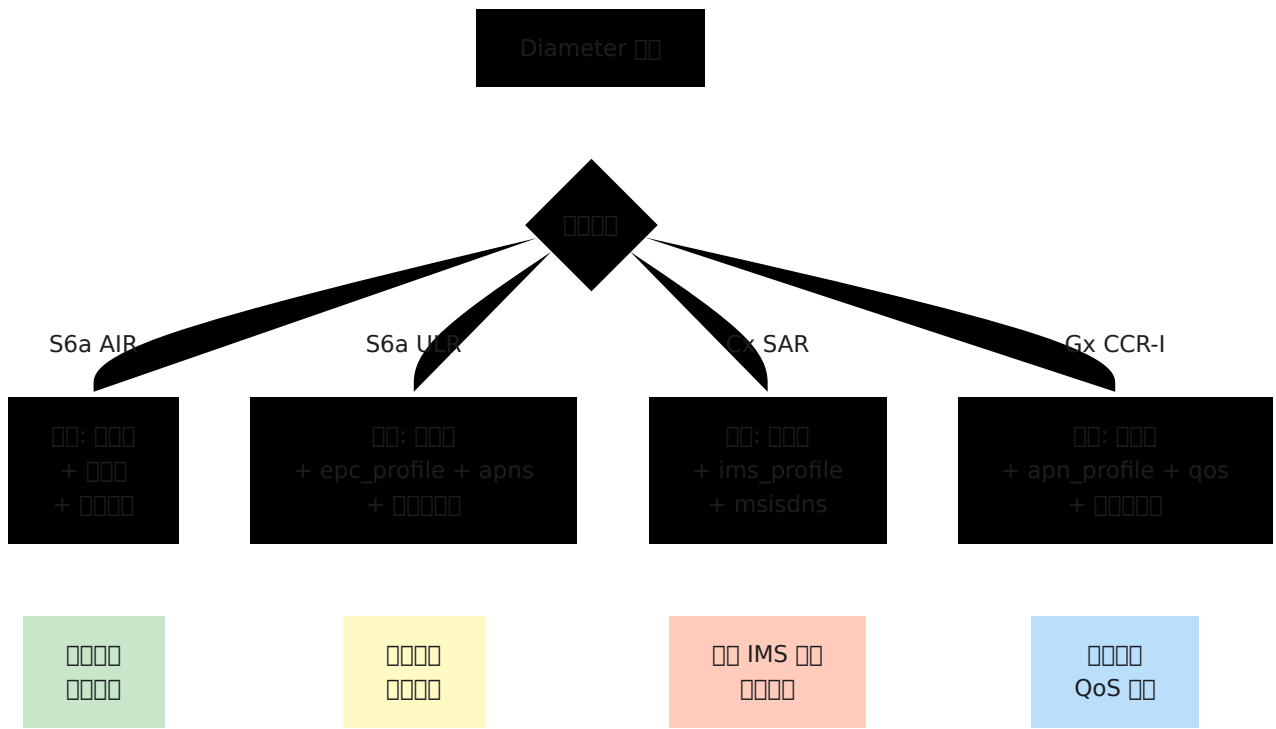


Ecto □□□□



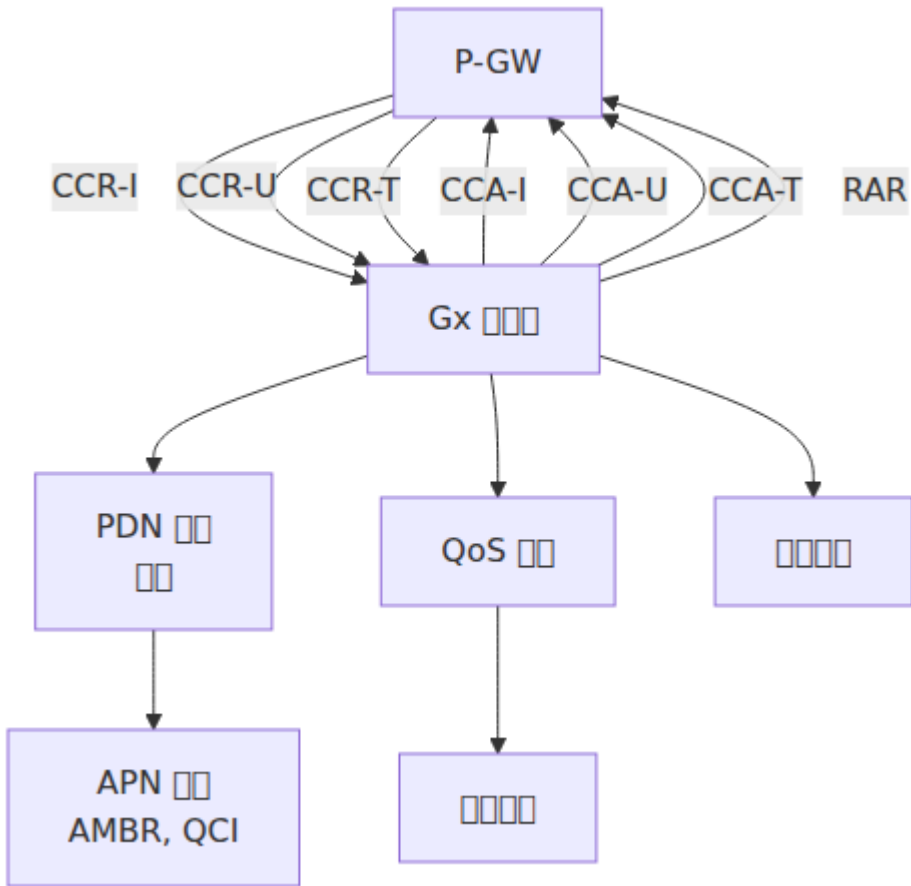
□□□□□□

□□ Diameter □□□□□□□□□□□□□□□□□□

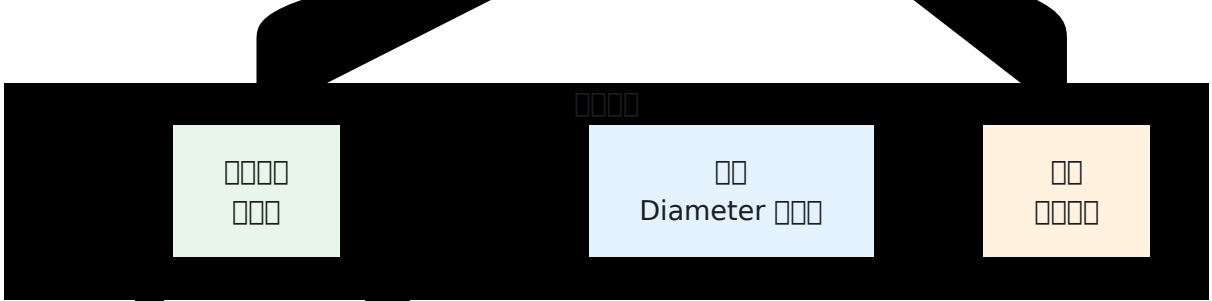
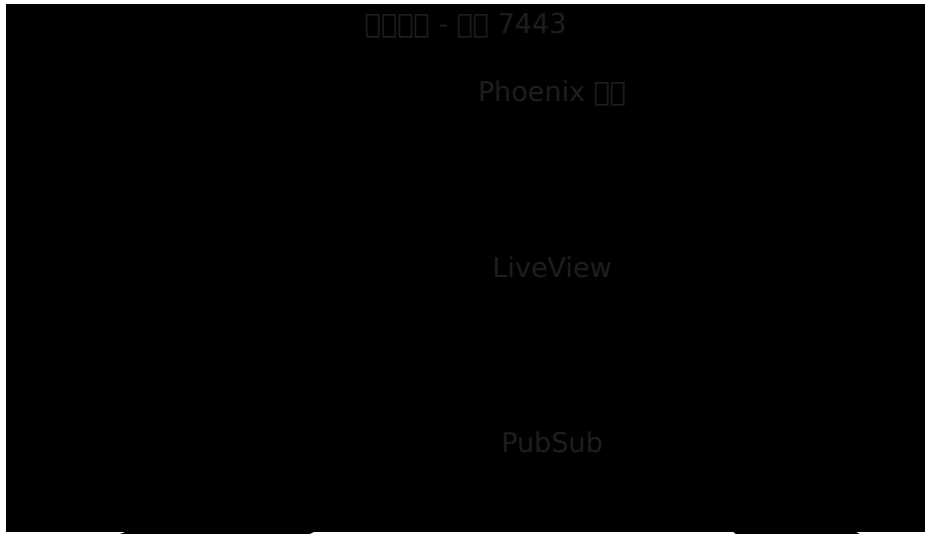


□□□□

API □□

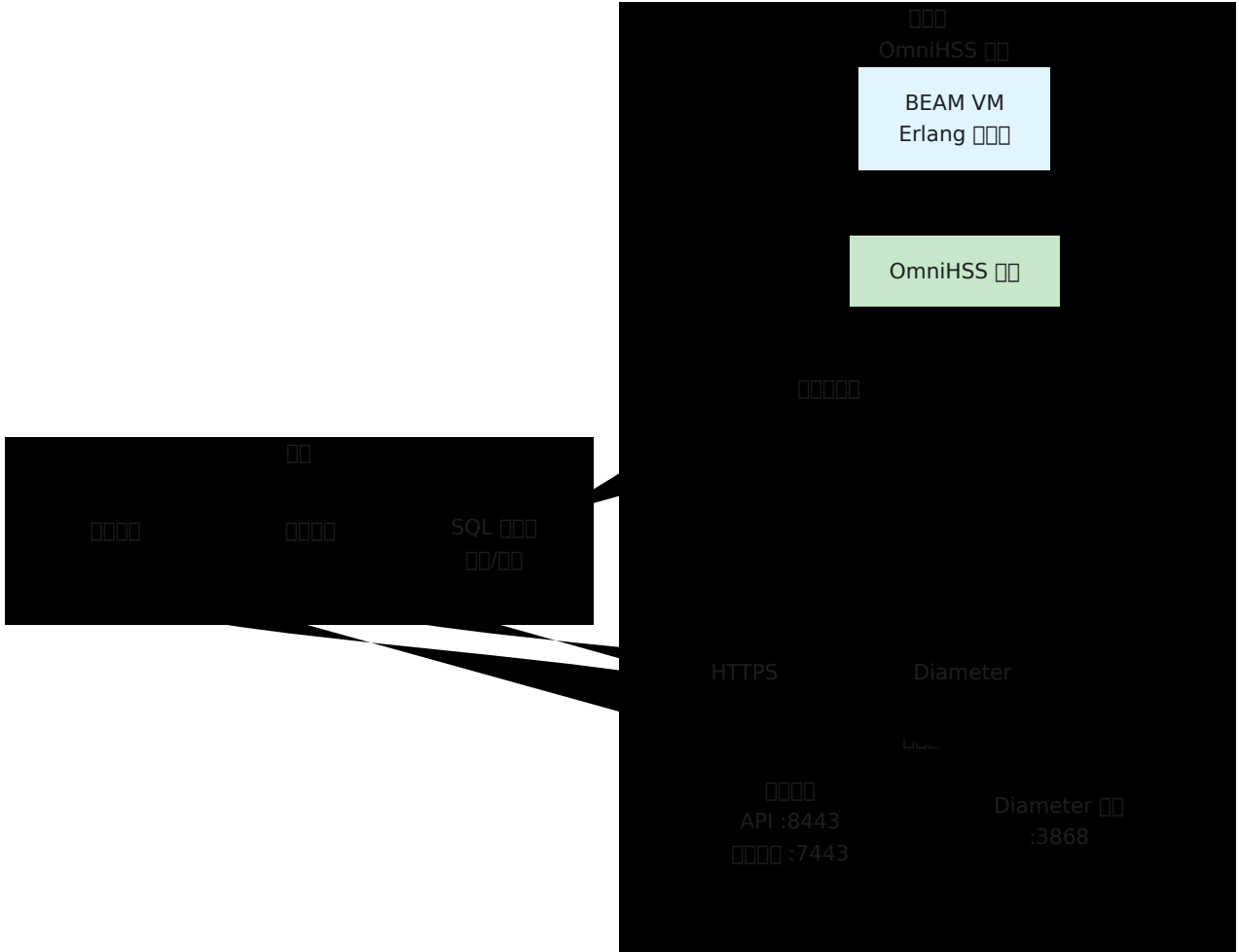


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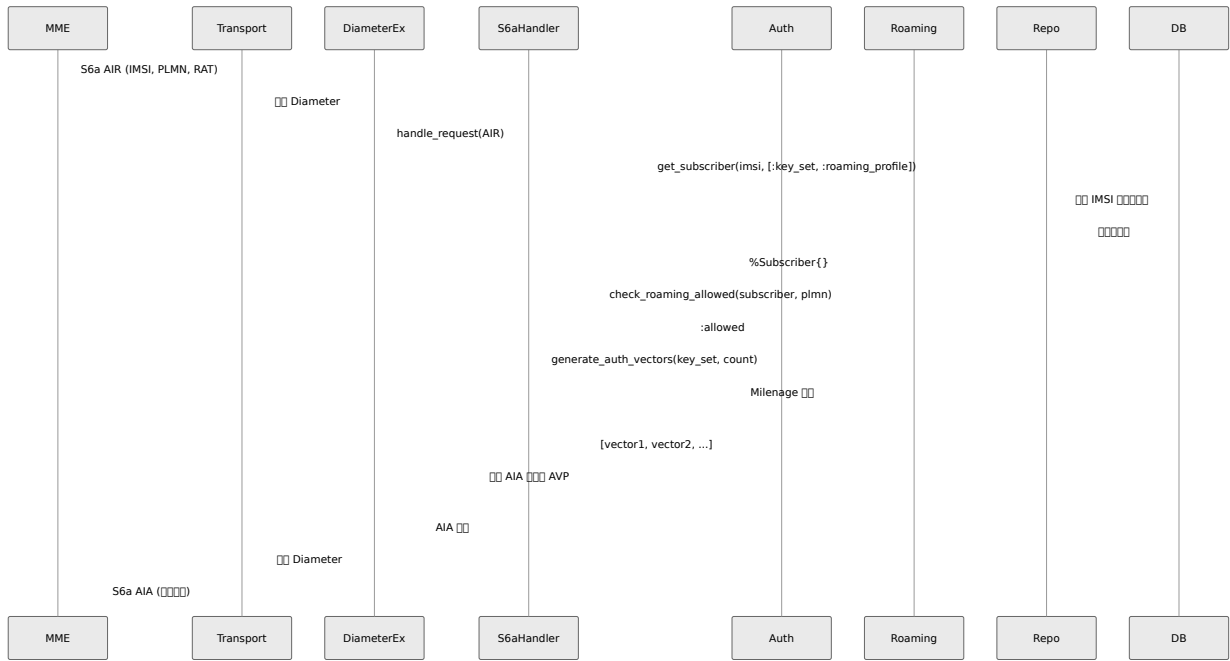
□□□□

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□□□□□□□□ (Galera □□)

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



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1. □□□

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

2. □□□

- □□ Diameter □□□□□□□□□□□□
- □□□□□□□□□□□□□□
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3. □□□

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

4. 00

- 00000000000000000000
- 0000000000000000
- 00000000

5. 0000

- 0000000000000000
- 0000000000000000
- Diameter 00000000
- 00000000000000

OmniHSS 架构图

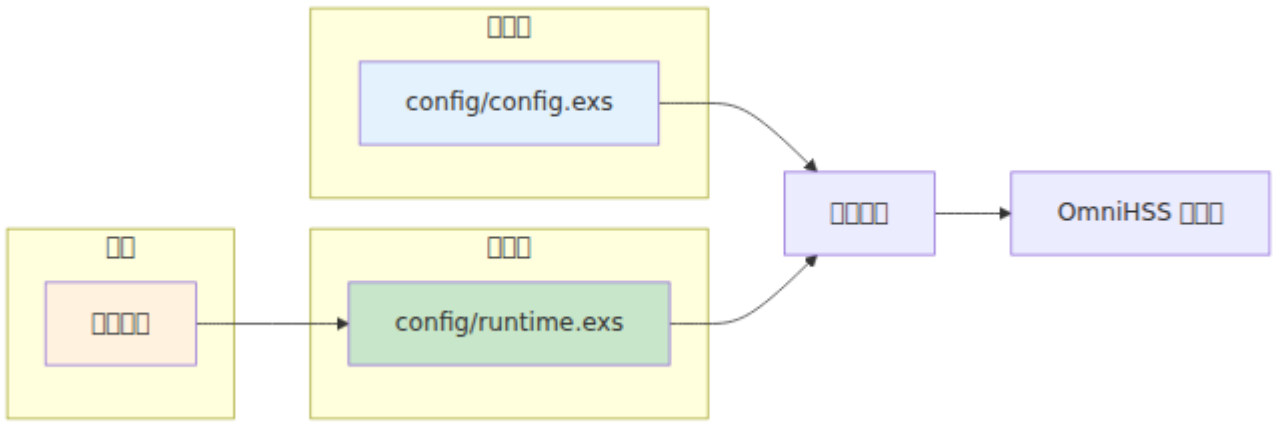
← 架构图

架构

- 核心网
 - 接入网
 - 终端
 - 网络功能
 - Diameter 接口
 - 鉴权
 - 本地 PLMN 鉴权
 - HSS 鉴权
 - IMS 核心网
 - EIR 接口
 - API 接口
 - 网络管理
-

接口

OmniHSS 接口



config/config.exe (config)

config/config.exe

- config/config.exe
- API config
- config

config/runtime.exe (config)

config/runtime.exe

- config/config.exe
- 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"

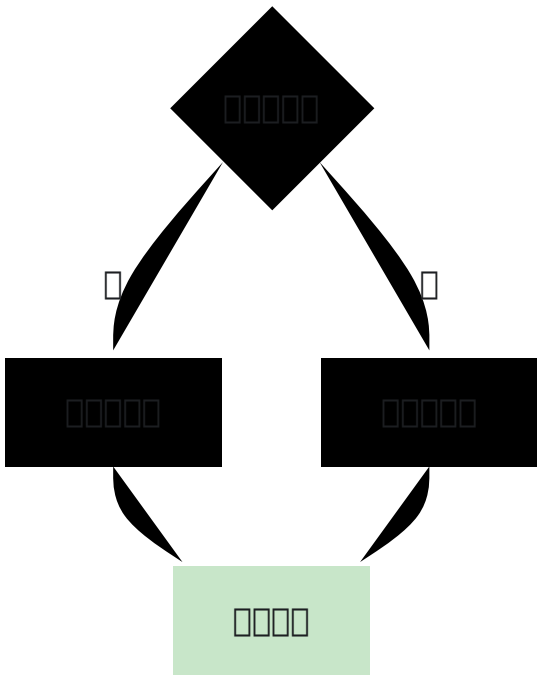
许可证

- 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

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OmniHSS □□□□□□□□

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

環境変数

データベース接続

```
# config/runtime.exs

config :hss, Hss.Repo,
  # データベース接続
  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")),

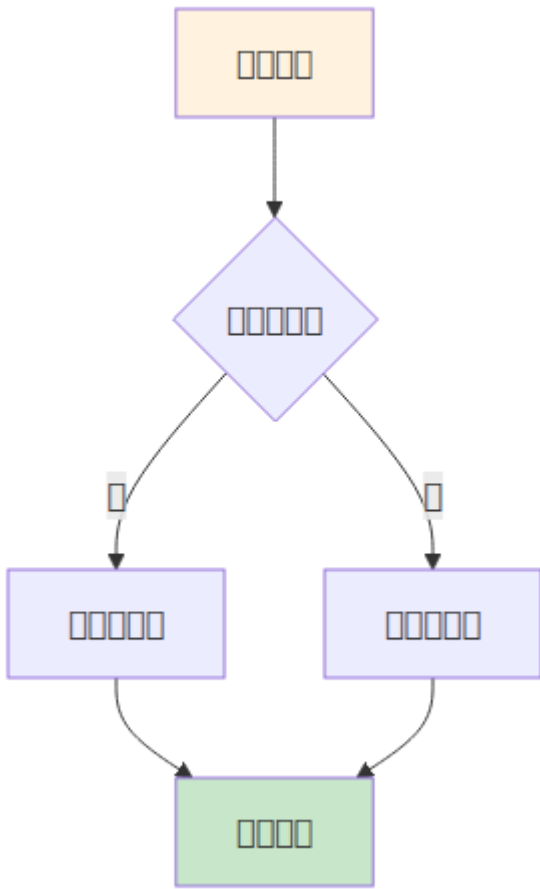
  # タイムアウト
  timeout: 15_000,
  connect_timeout: 15_000,

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

環境変数の設定

変数名	説明	デフォルト値	推奨値
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	データベース接続プールサイズ	20	データベース接続数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"),

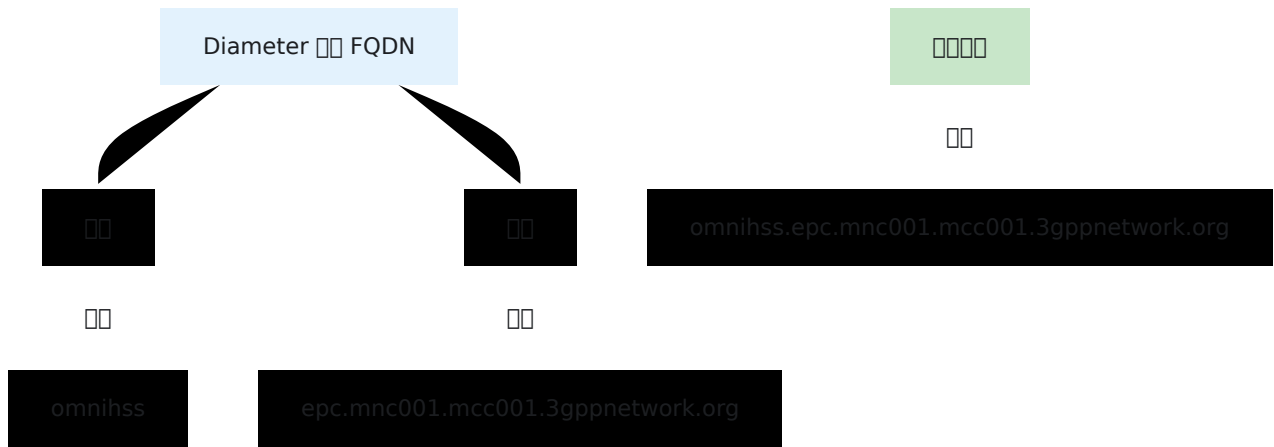
  # ☐☐☐☐
  product_name: "OmniHSS",
  vendor_id: 10415, # 3GPP
  supported_vendor_ids: [5535, 10415],

  # ☐☐☐☐
  request_timeout: 5000,

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

config :hss, :diameter, diameter_config
```

Diameter FQDN



FQDN

- HSS 호스트 이름 "omnihss" "hss01"
- PLMN 이름 Diameter 호스트 이름 "epc.mnc001.mcc001.3gppnetwork.org"
- FQDN 이름 {host}.{realm}

Diameter 호스트

호스트 이름

```

# 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]
  }
]

```

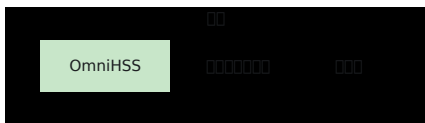
□□□□

□□□□□□◆◆□□□ HSS □□□□

```
# config/runtime.exs

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

Diameter



SCTP			Diameter
TCP			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,

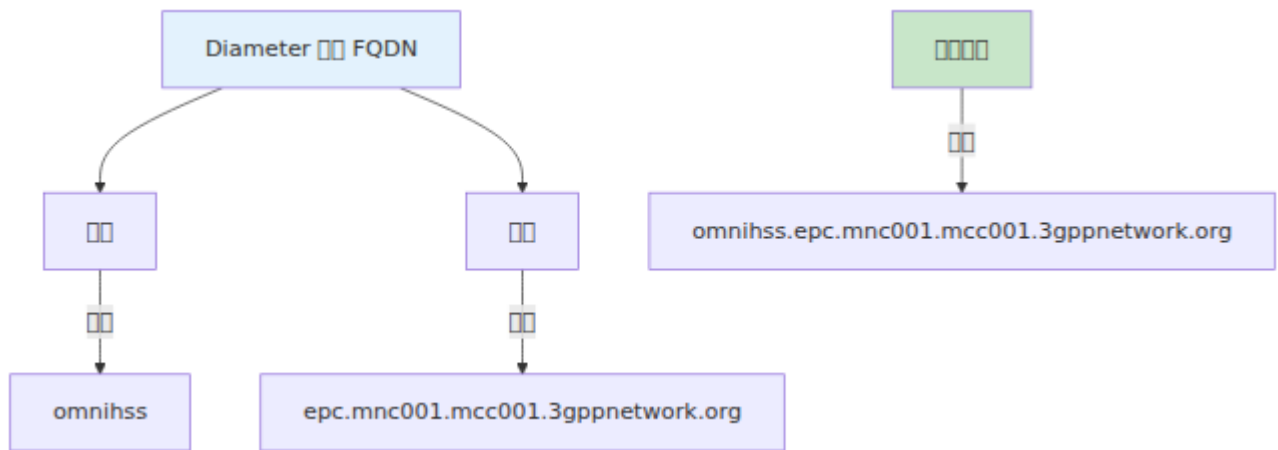
  # 数据库 Diameter 配置
  stop_diameter_on_database_failure: true,

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

HSS 配置

項目	説明	値	単位
ecto_repos	リポジトリ Ecto リポジトリ	[Hss.Repo]	文字列 文字列 文字列 文字列
send_clr_on_mme_change	送信 MME 変更 通知	true	文字列 文字列 文字列 文字列 文字列 文字列
stop_diameter_on_database_failure	停止 Diameter データベース	true	文字列 文字列 文字列 文字列
license_enforced	強制	true	文字列 文字列 文字列
license_module	モジュール クライアント	LicenseClient	文字列 文字列

PLMN



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

□□□□□□

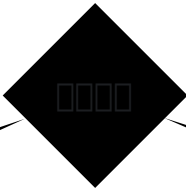
```
# config/runtime.exs

# 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

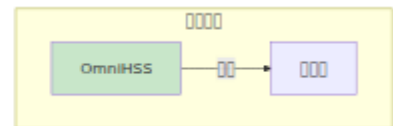
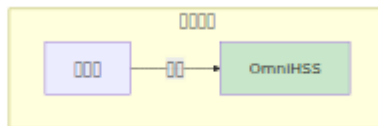
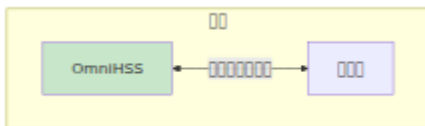
S-CSCF

```
# config/runtime.exs

config :hss, :ims, %{
  scscf: %{
    # 0000:random_peer 0 :round_robin
    selection_method: :random_peer,

    # 00 S-CSCF 00000
    peers: [
      %{
        host:
        "sip:scscf01.ims.mnc001.mcc001.3gppnetwork.org:5060",
        capabilities: [] # 0000000
      },
      %{
        host:
        "sip:scscf02.ims.mnc001.mcc001.3gppnetwork.org:5060",
        capabilities: []
      }
    ]
  }
}
```

S-CSCF



00000

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

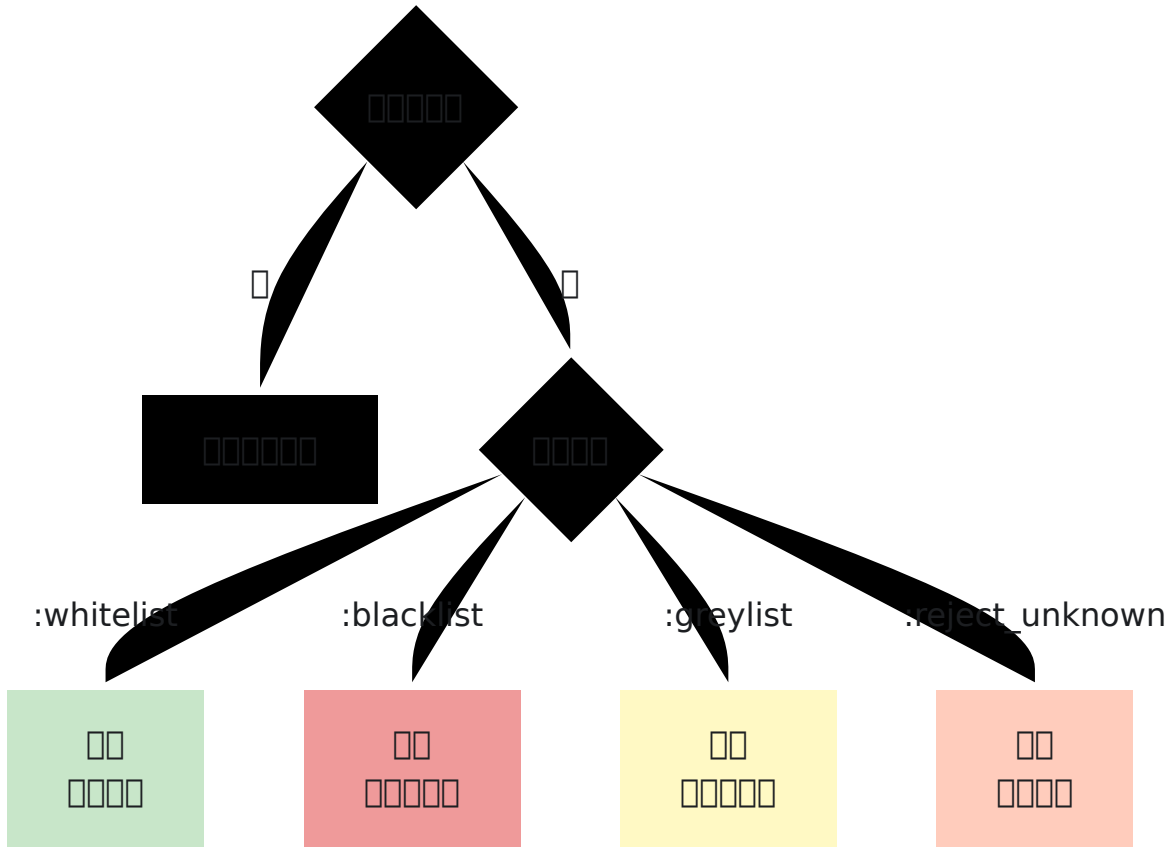
EIR

```
# config/runtime.exs

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

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IMEI □□□□



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□□	□□	□□
: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"
]
```

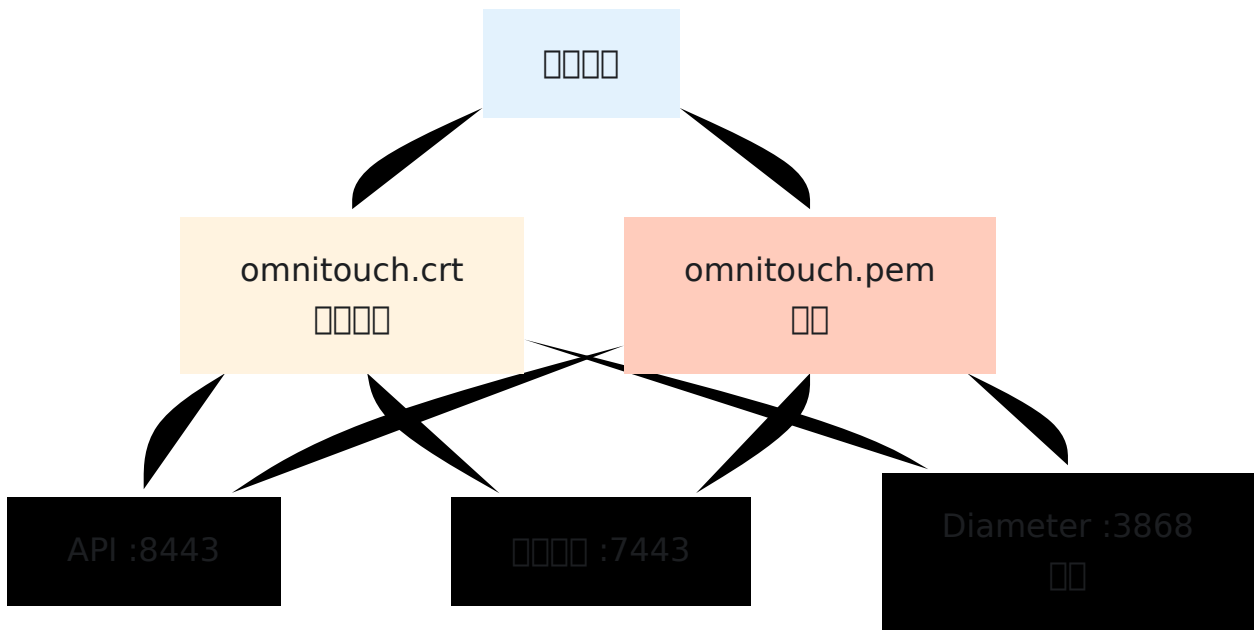
〇〇〇〇〇〇〇

```
# 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

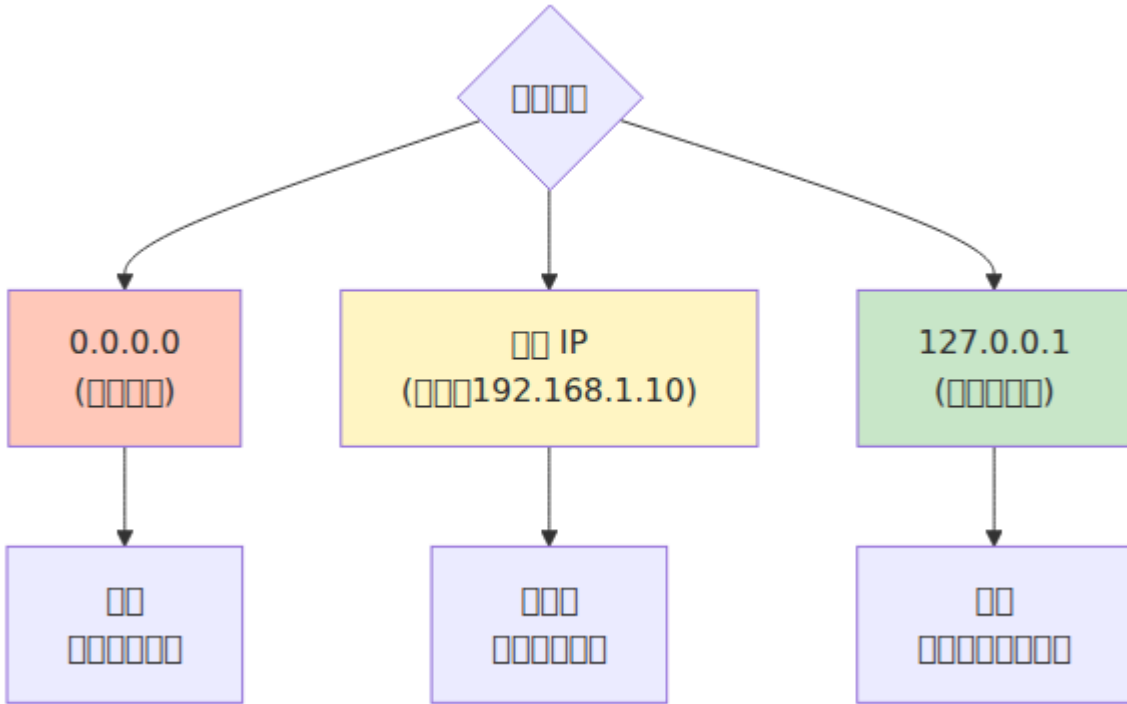
- 証明書 X.509 形式
- 証明書
- 証明書
- CN と SAN 証明書

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")  
]
```

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-
- PLMN□MCC□MNC□
- Diameter □□□□□□
- Diameter □□ IP □□□□
- API □□□□□□□ TLS □□
- URL□□□□□□◆◆□□□□□□□□
- HSS □□□□□□send_clr_on_mme_change□stop_diameter_on_database_failure□

□□□□□□

- Diameter □□□□□□□□□□□□□□
- Diameter □□□□□□ 3868□
- HTTPS □□□□□□ 7443□8443□

Diameter DNS

IMS IMS

S-CSCF

S-CSCF

IMS

EIR

1.

2.

```
 https://[hostname]:7443  

```

3. **API**

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

4. **Diameter**

```
 Diameter   

```

5. 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,

```

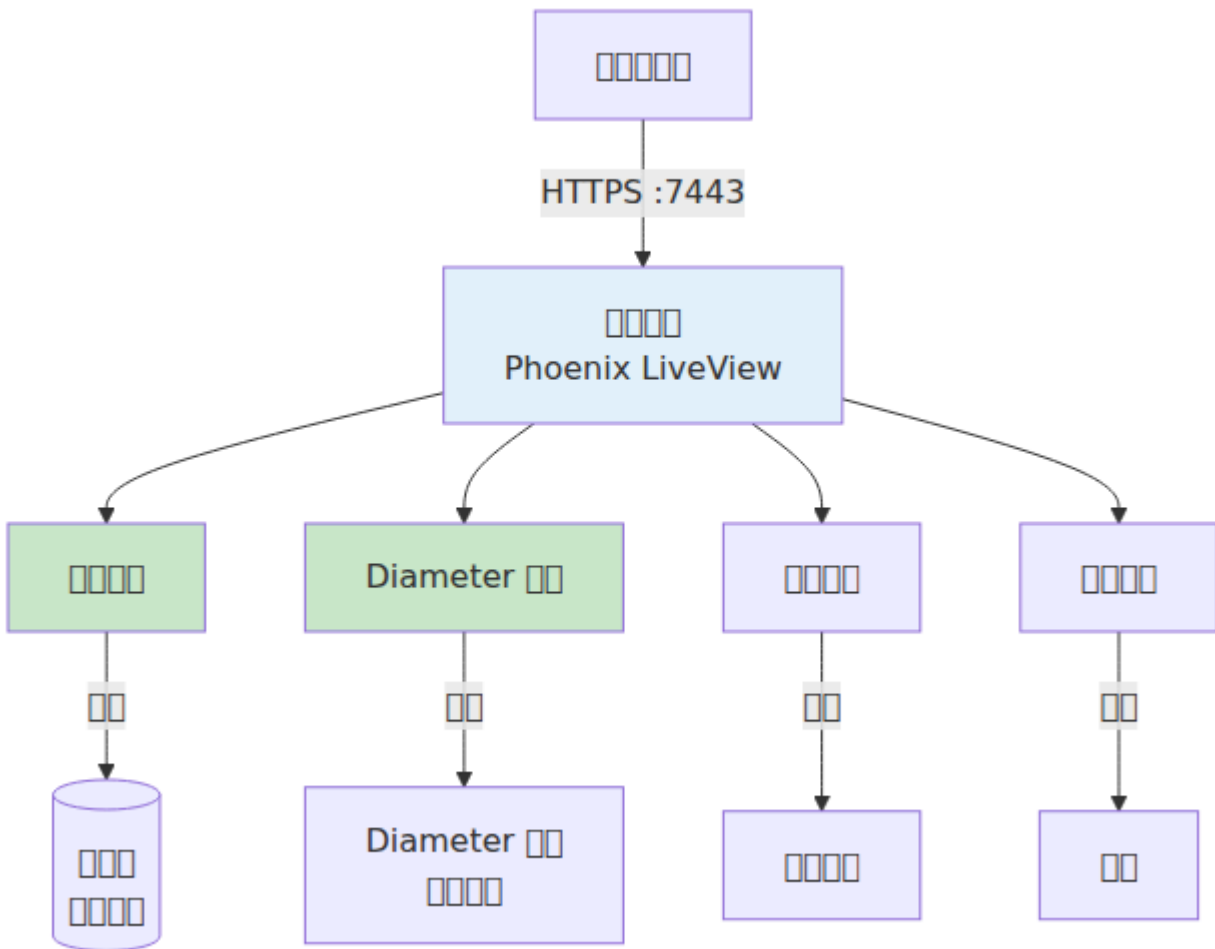
```
http: [ip: {0, 0, 0, 0}, port: 7443],
https: [
  port: 7443,
  cipher_suite: :strong,
  certfile: System.get_env("TLS_CERT_FILE", "/etc/ssl/certs/omnihss"),
  keyfile: System.get_env("TLS_KEY_FILE", "/etc/ssl/private/omnihss"),
],
url: [host: System.get_env("CP_HOST", "hss.omnihss.internal"), port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

← □□□□□□ | □□□□□□□□ →

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

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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

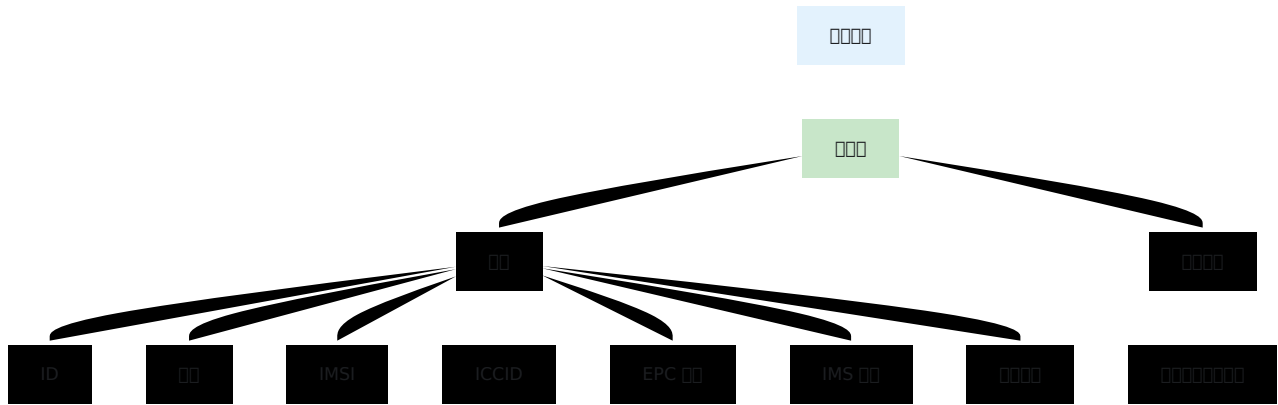
証明書 Internet Explorer

証明書

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

証明書

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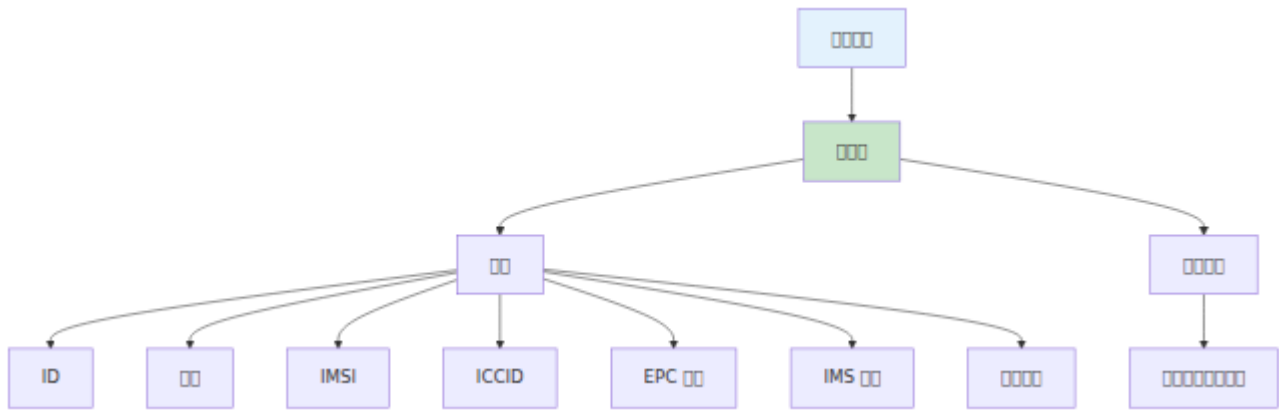
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ID	□□□□□ ID	□□
□□	□□□□	✓□□□□/ X□□□□
IMSI	□□□□□□□□	14-15 □□□
ICCID	SIM □ ID	19-20 □□□□ "N/A"
EPC □□	□□□□□□□□	□□□□□ ID
IMS □□	□□□□□□□□	□□□□□ID □ "N/A"
□□□□	□□□□□□	□□□□□ID □ "N/A"

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0000

- **MCC** - 000000003 0000
- **MNC** - 000000002-3 0000
- **TAC** - 0000000
- **00 ID** - 00000000
- **eNodeB ID** - 000000
- **ECI** - E-UTRAN 000000

00000

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- 000000 **MME** - 000000 MME 0000
- 000000000 - MME 0 Diameter 000
- **RAT** 00 - 000000000000"E-UTRAN"00 LTE0
- 000000000 - 00 Diameter 00000000

IMS 00

0000

- 0000 **S-CSCF** - 000000 S-CSCF SIP URI
- **IMS** 00000 - SIP URI00000sip:+14155551234@ims.example.com0
- 000000 **P-CSCF** - 00000 HSS 0 P-CSCF
- 000000 **I-CSCF** - 00000 HSS 0 I-CSCF

00000

- 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

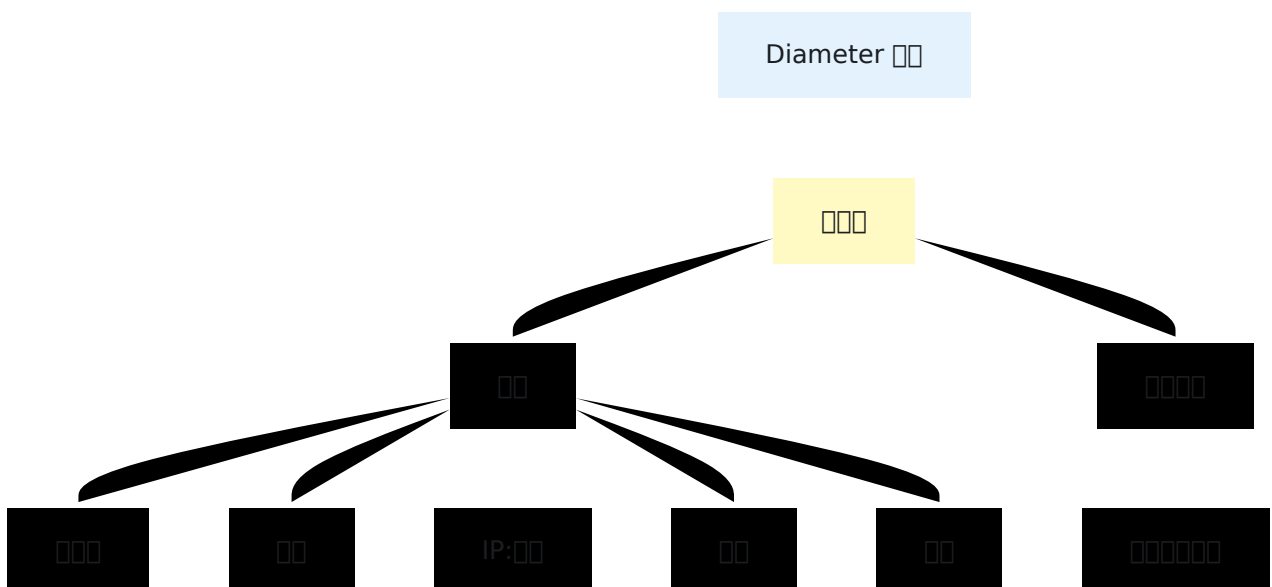
- 网络架构
- PDN 网络
- VoLTE 网络

Diameter 网络

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

Diameter 网络架构

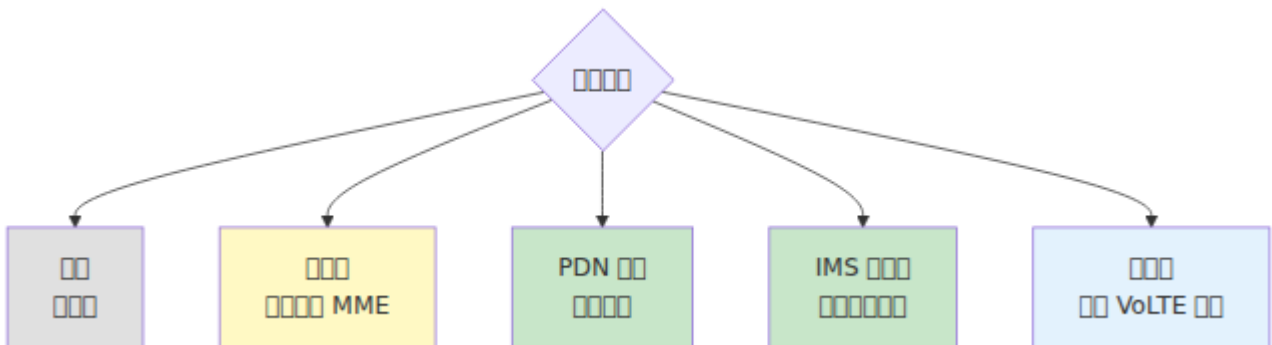
网络架构



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□□□	Diameter □□□□□	FQDN
□□	Diameter □□	□□
IP:□□	□□□□	IP □□□□□
□□	□□□□	TCP □ SCTP
□□	□□□□	□□□ / □□□

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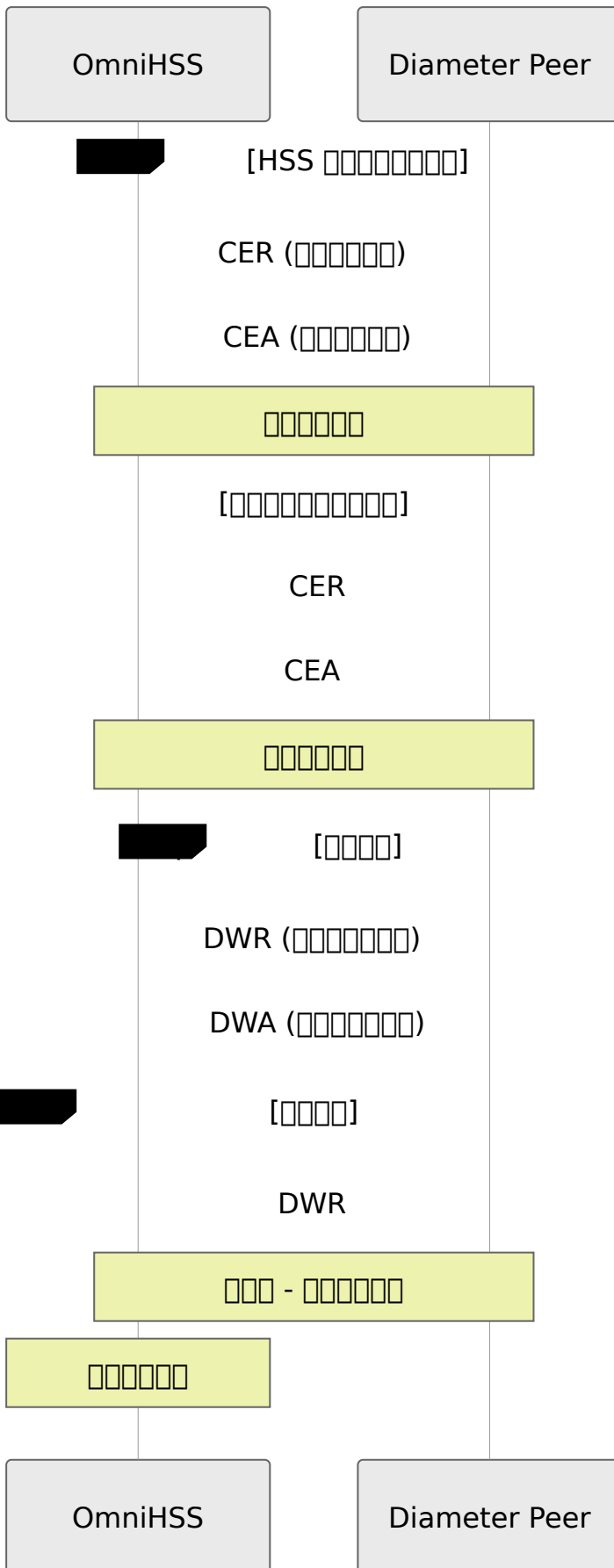
- □□□□ - □ HSS □□□□□□
- □□□□ - □□□□□□□□□□
- □□ **ID** - □□□□ Diameter □□

□□ **ID** □□□

- 16777251 - S6a (MME)

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

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Diameter □□□ **1** □ □□□□□

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- □□□□□□□□ TCP □ SCTP□
- □□□□ ID □□□□□□
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3. □□□□□□□

4. Diameter □□□□□

5. □□□□□□□□□ TLS□

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

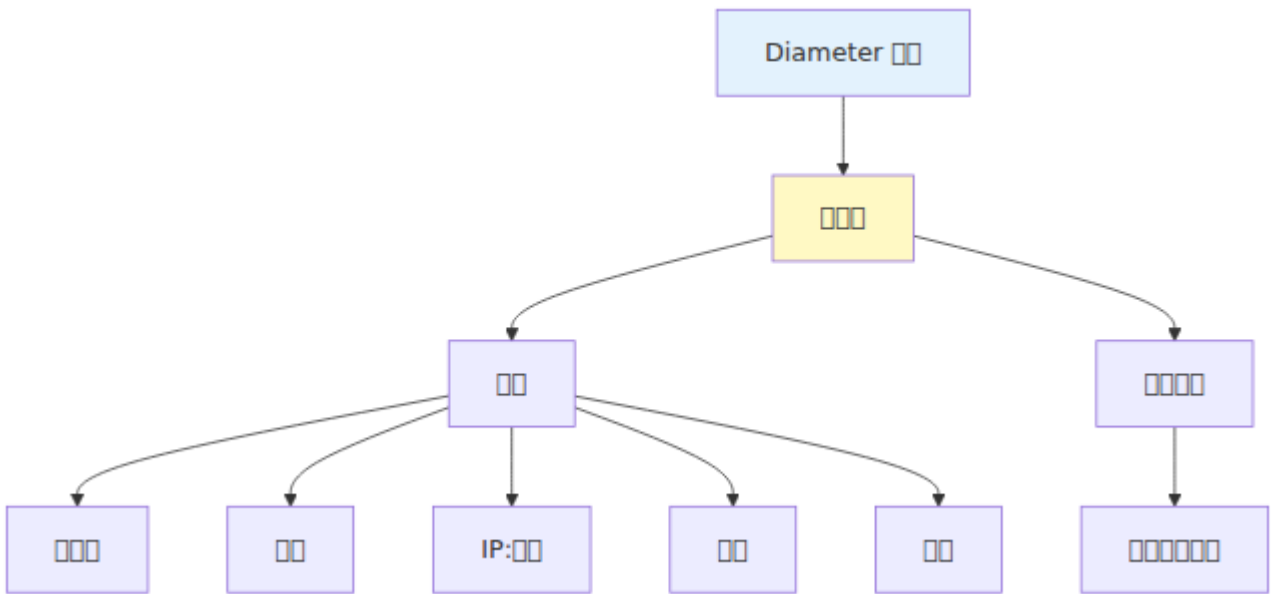
- 1.
- 2.
- 3.
4. Diameter

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

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

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

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 - □□□□□□□□
 - □□ Erlang VM □□
-

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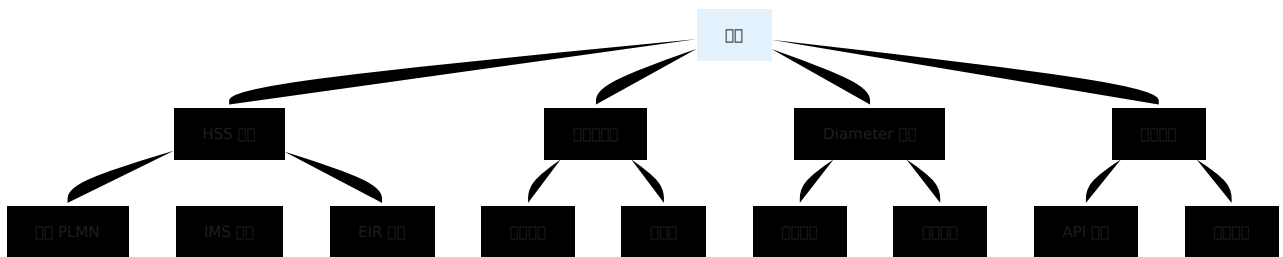
URL: `https://[hostname]:7443/configuration`

□□□□□ OmniHSS □□□□□□□□□□

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- □□ Diameter □□□□

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- □□ 3□□□□□□□□□□

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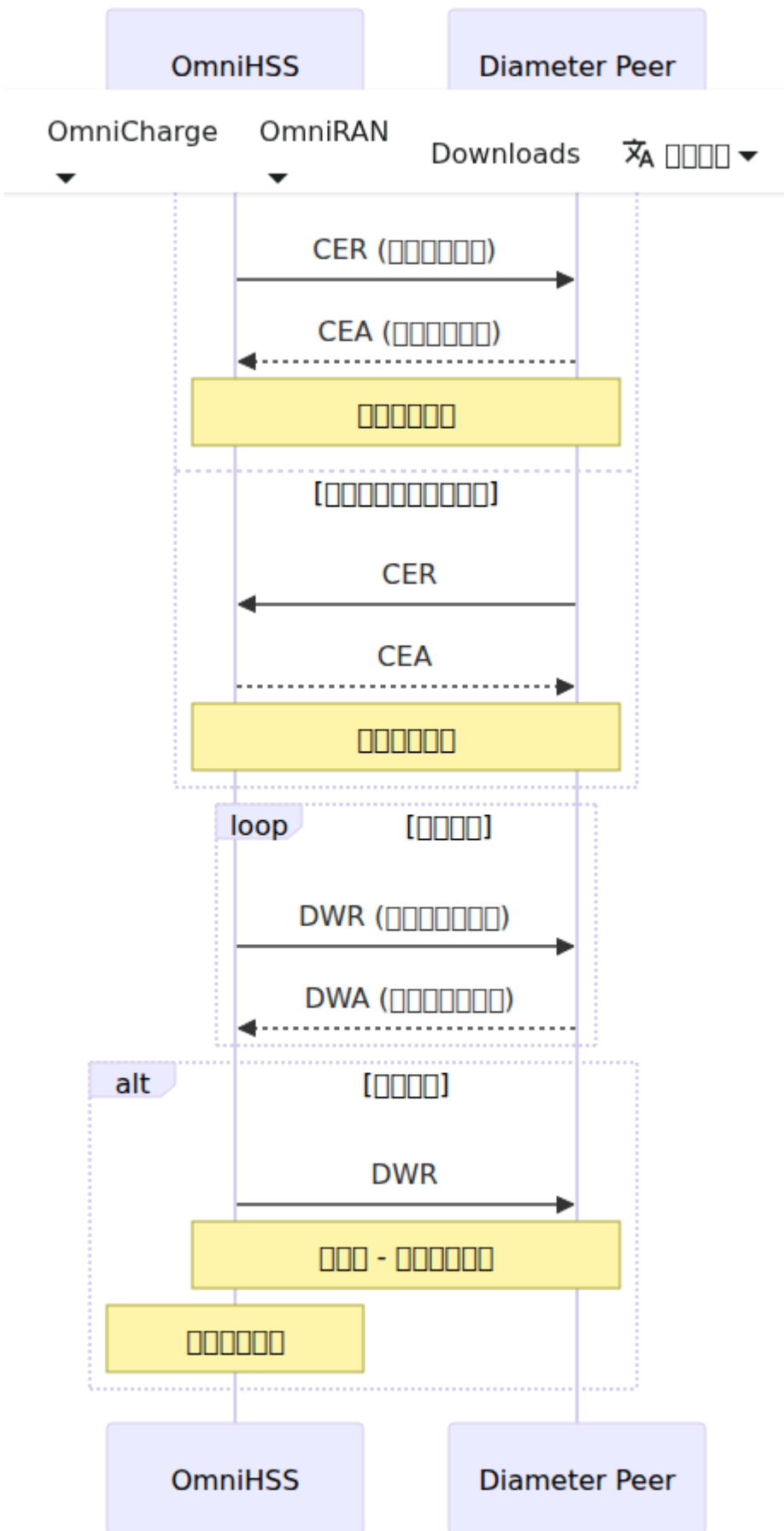
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 - □□ Diameter □□ - □□□□□□□□
2. □□□□
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 - □□□□□□□□
 - □□ Diameter □□□□□□□□
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□□□□ Diameter □□	1 □□	2+ □□□□□□
□□□□	> 80%	> 90%
□□□□□□	> 5%	> 10%
□□□□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

← □□□□□□ | □□□□□□□□□□ →

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

□□□□

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

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□□□	2	□□□□□□	□□□□□

S13 □□

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□□□□□□□□ **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

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EIR □□□□□□□□□□□□□□□□

1. IMEISV□IMEI + Software-Version□
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2. □ IMEI
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4. □□□□□□

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□□ 1□IMEISV □□

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

□□ 2□IMEI □□□□□□

- □□□ IMEI□ "35979139461611"
- □□□□ EIR □□□□□□□□□□
- □□□□□□□□□□□□□□

□□ 3□IMSI □□□□□□□□ IMSI □□□□

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

□□ 4□□□□□□□□□□□□□□

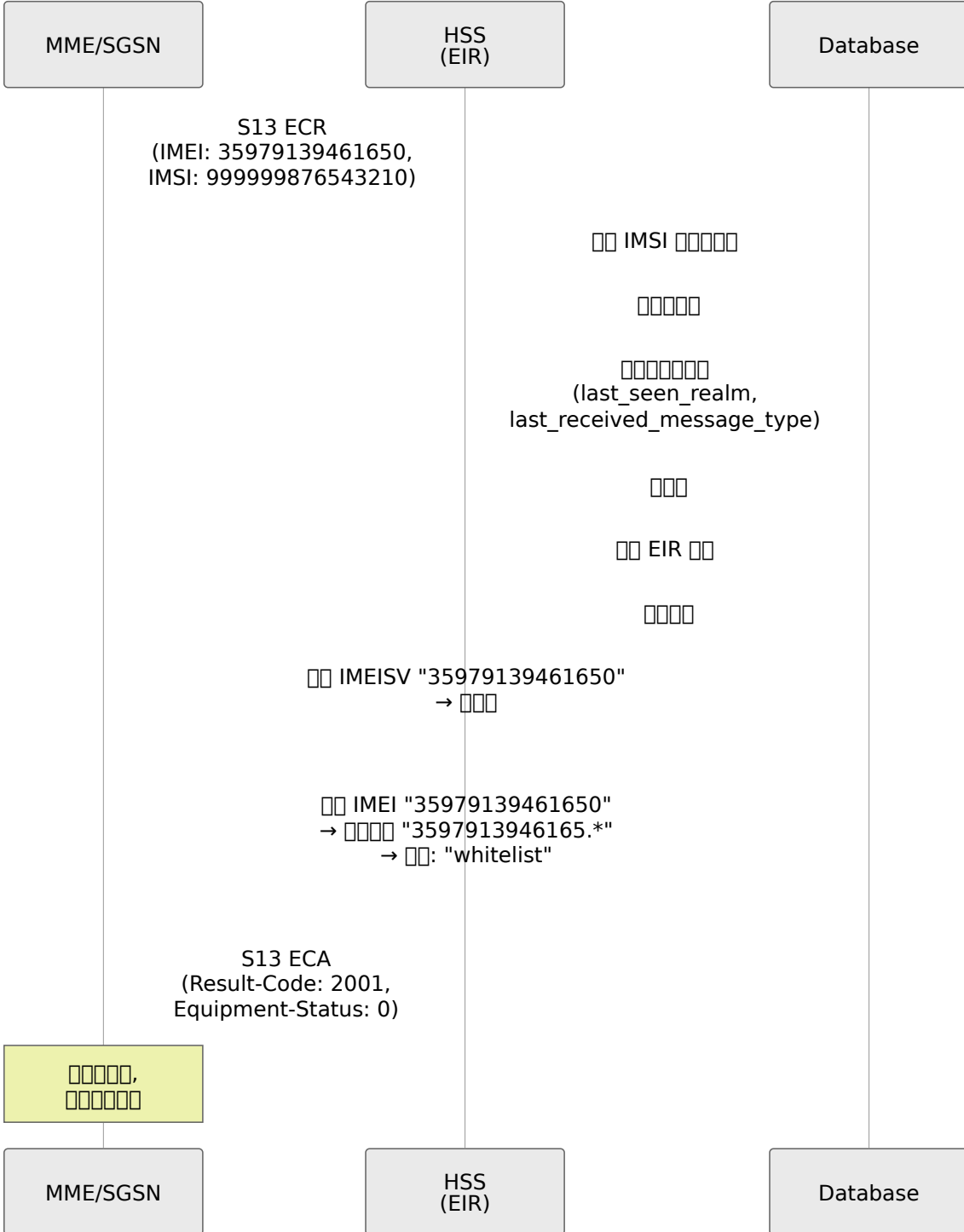
- `eir_unknown_equipment_behaviour`
- `whitelist` - `whitelist`
- `blacklist` - `blacklist`
- `greylist` - `greylist`
- `reject_unknown_equipment` - `reject_unknown_equipment` 5422

`whitelist`

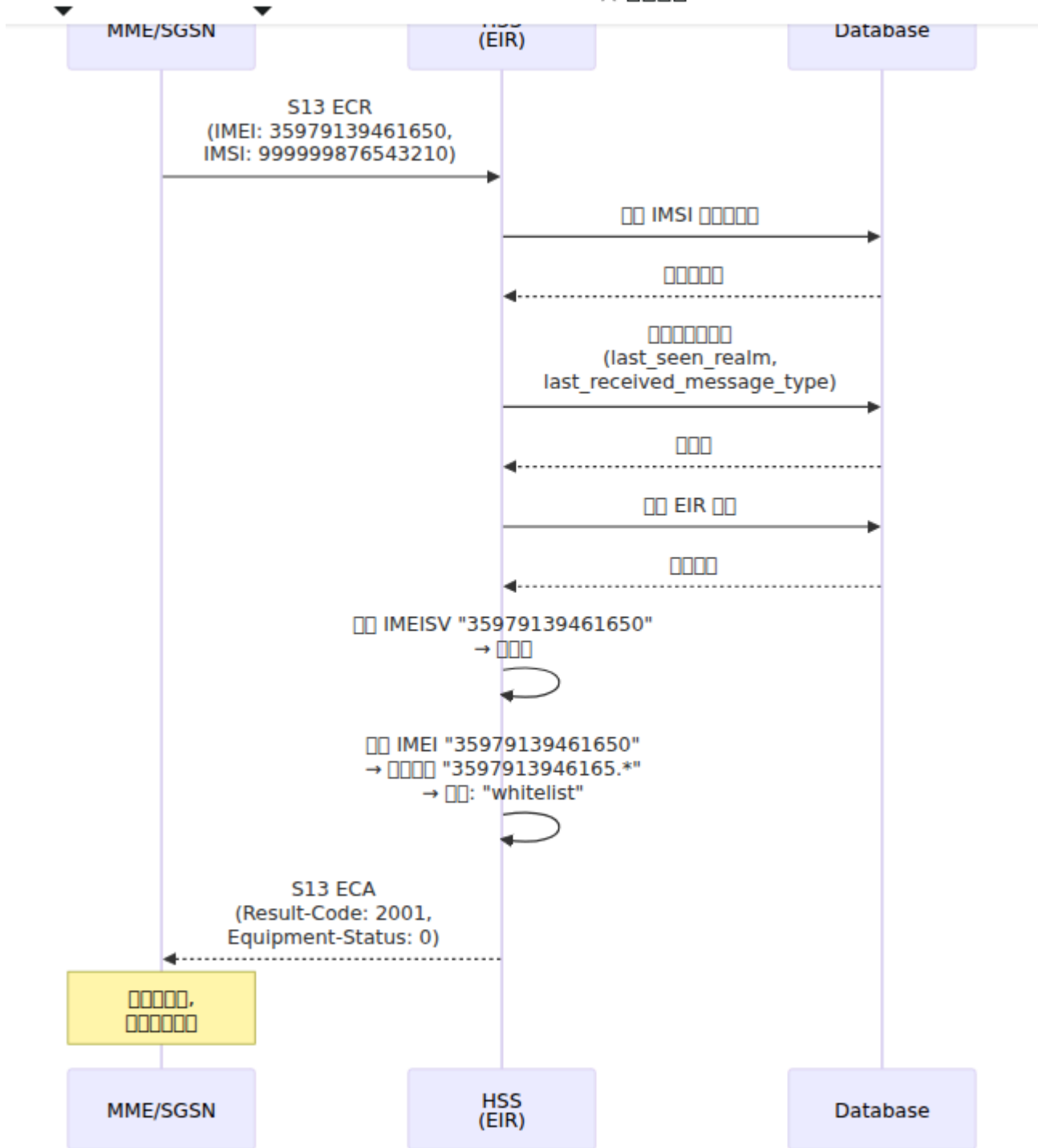
<code>whitelist</code>	IMEI	IMEI SV
<code>"35979139461650"</code>	IMEI	IMEI SV
<code>"3597913946165.*"</code>	IMEI	IMEI SV
<code>"3597913946161108"</code>	IMEI SV	IMEI SV
<code>"999999876543210"</code>	IMSI	IMSI
<code>"359791.*"</code>	TAC	TAC

□□□□□□

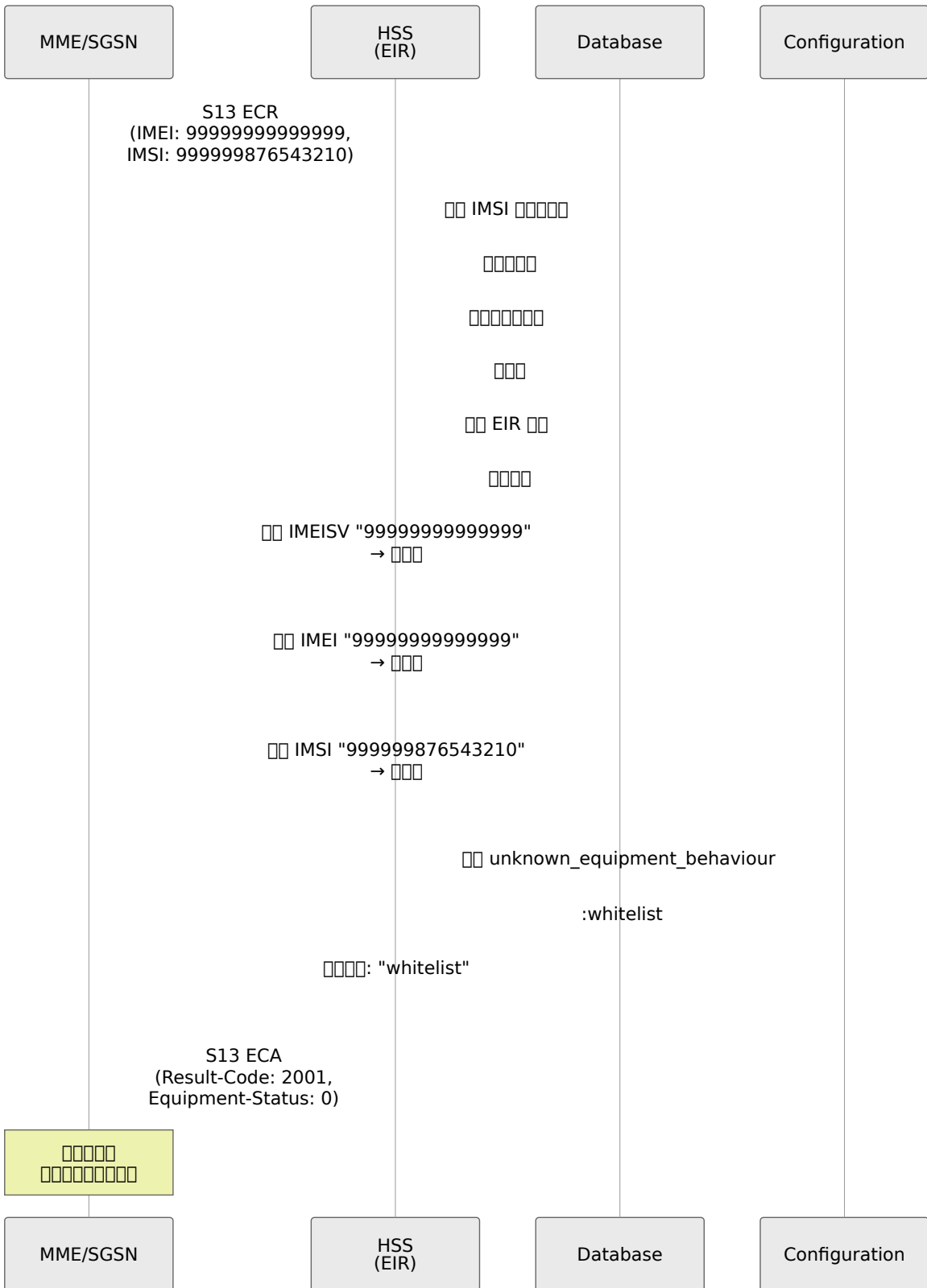
□□ 1□□□□□ - □□□□□ IMEI



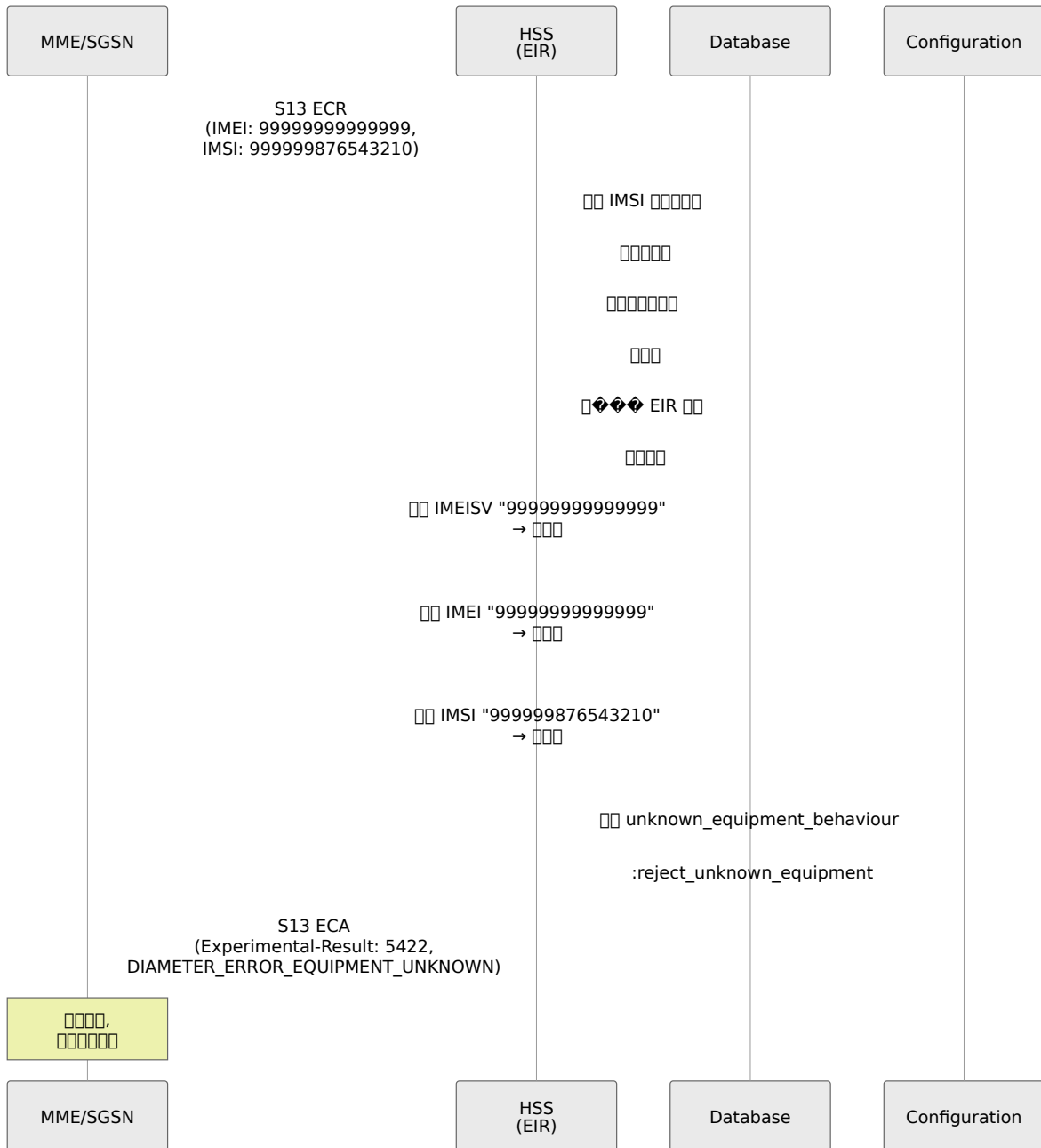
2 - IMEI



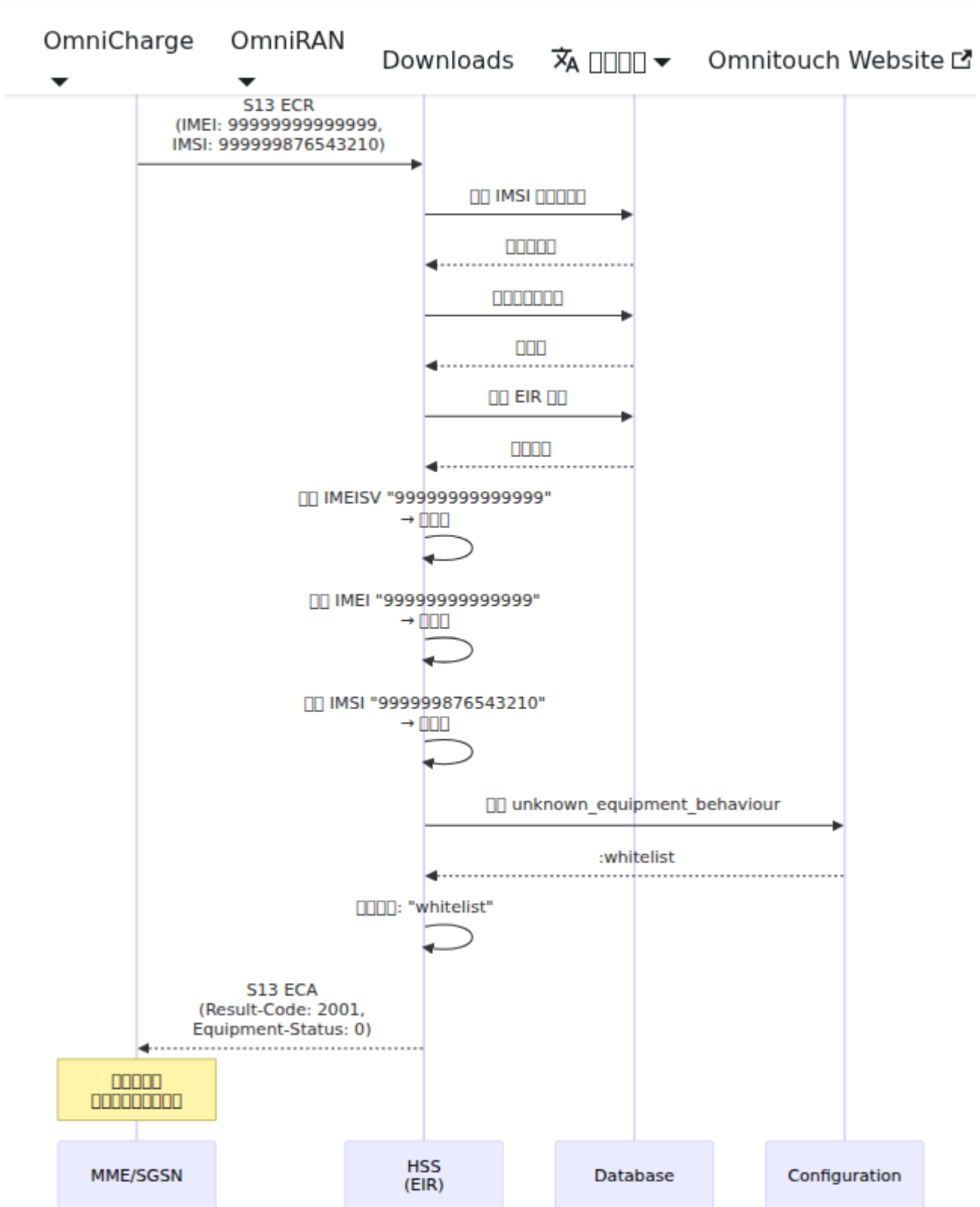
3 -



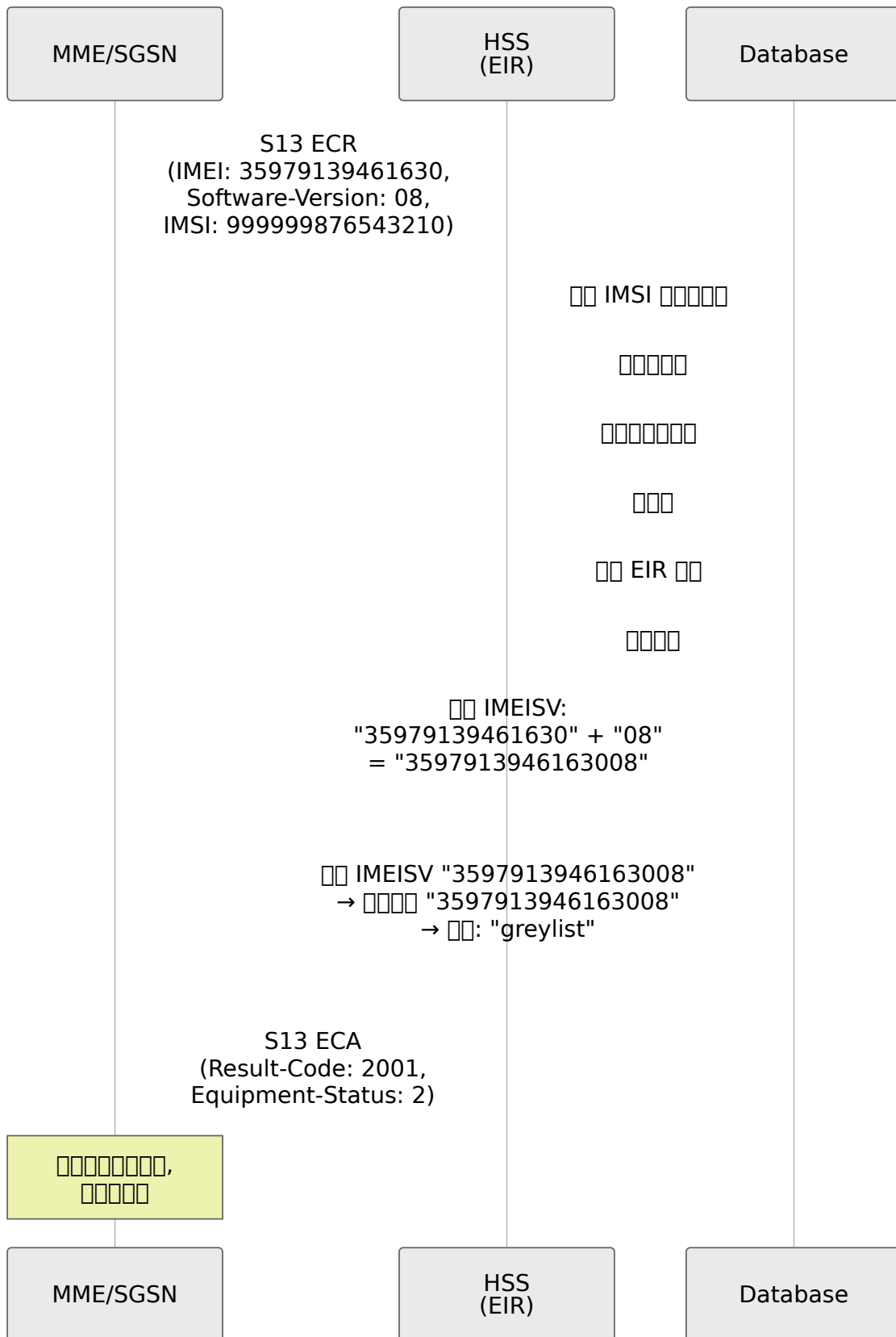
4 -



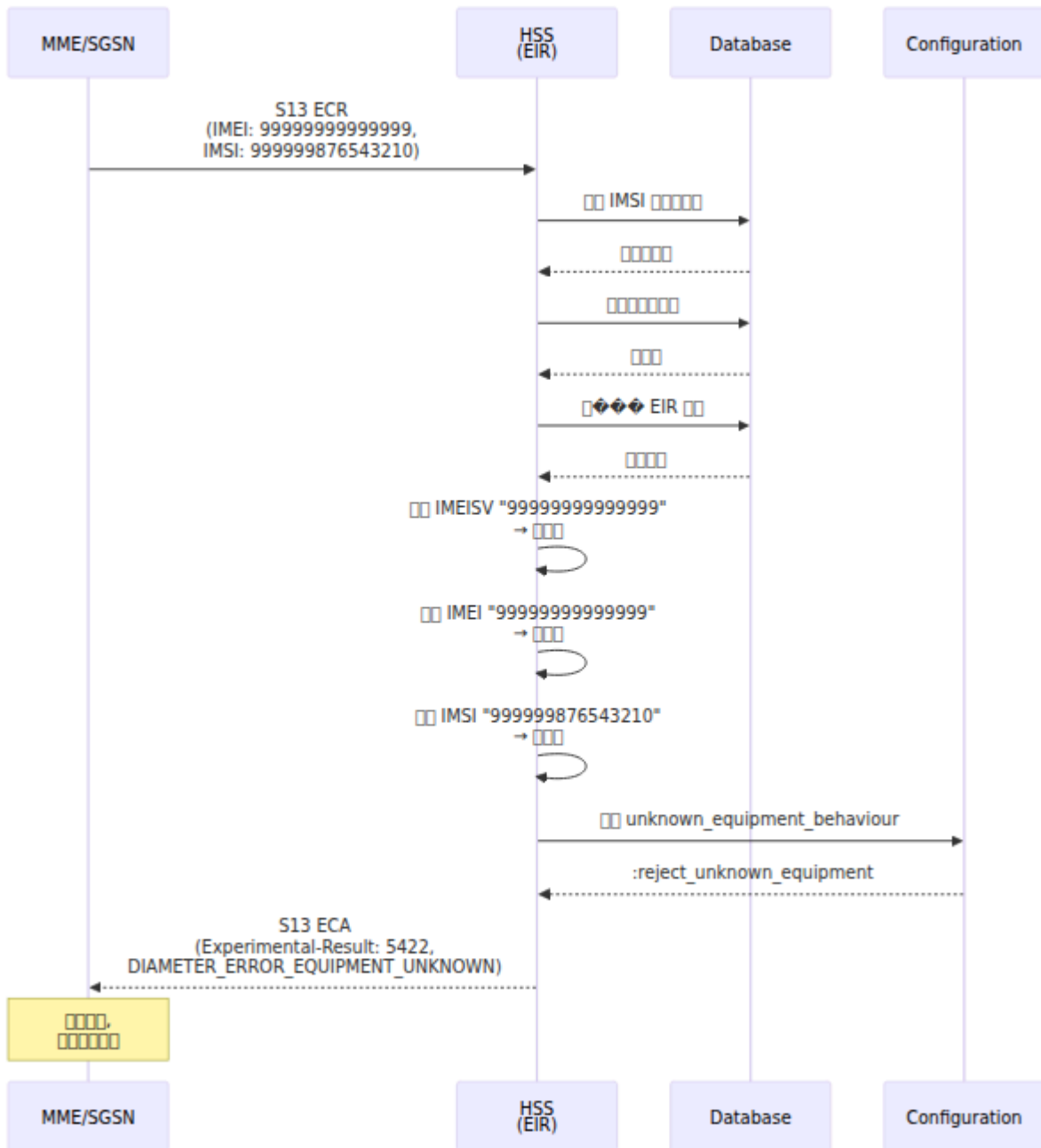
5 -



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

35979139

05

EIR 359791394616 + 05

- **S13** 35979139 - 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

查詢設備的步驟如下：

1. **IMEISV** 查詢設備 IMEI + 查詢
2. **IMEI** 查詢設備 IMEI
3. **IMSI** 查詢設備 IMSI
4. 查詢設備的詳細信息

查詢設備的查詢條件如下：

- `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 查詢設備的步驟如下：

- 查詢設備的 IMEI 查詢
- 查詢設備的詳細信息
- 查詢 API 查詢設備的詳細信息

查詢設備

EIR 查詢設備的 ID 查詢設備的詳細信息

- ```

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

```

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

## □□□□

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

## □□□□

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

## □□□ **IMEI** □□

## **IMEI** □□□ **15** □□□□

```

35 9791 394616 1
└─ TAC□□□□□□□□□□ 8 □□□□□□□□ RBI□
 | └─ RBI□□□□□□□□□□ 2 □□□□
 └─ □□□□/□□□□ 6 □□□□
```

# IMEISV 16

35 9791 394616 1 08

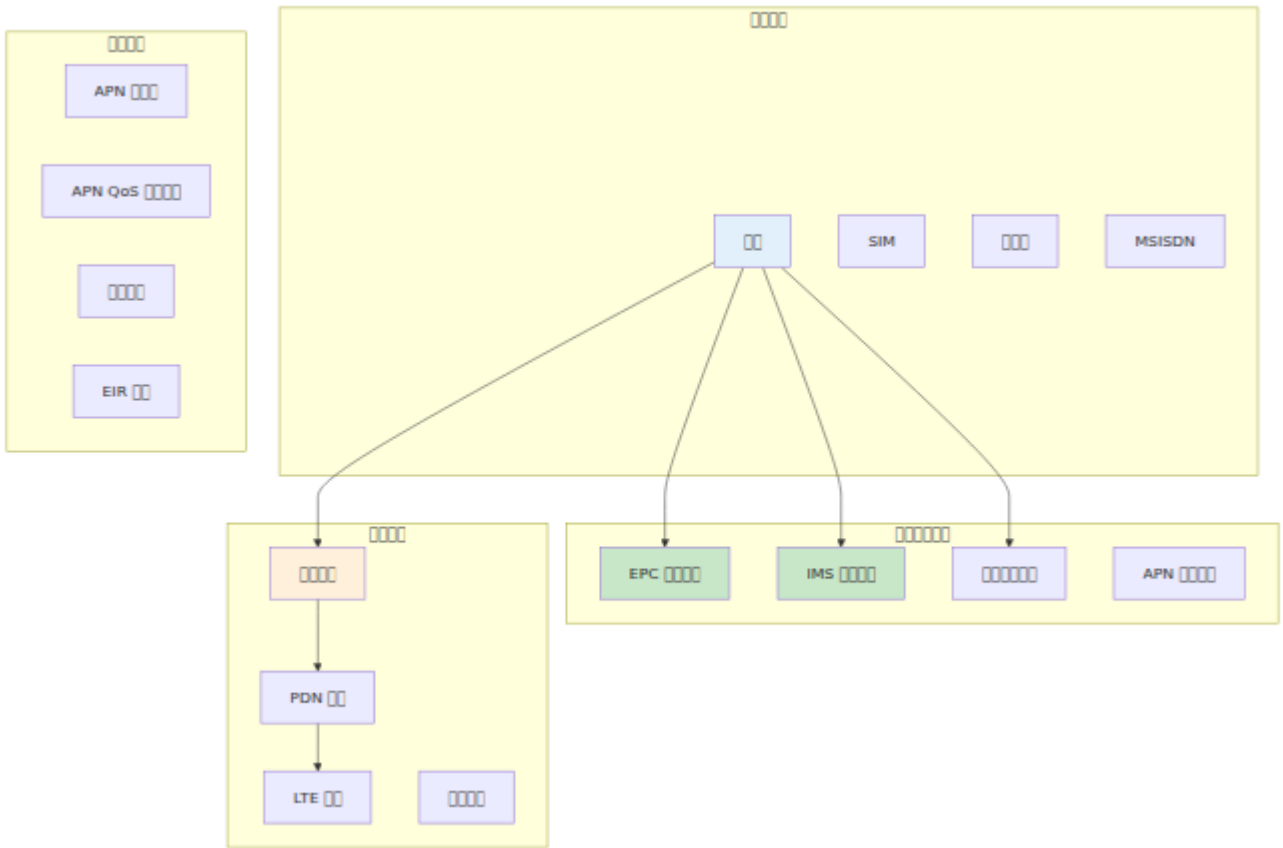
| | | | | 2

IMEI15

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



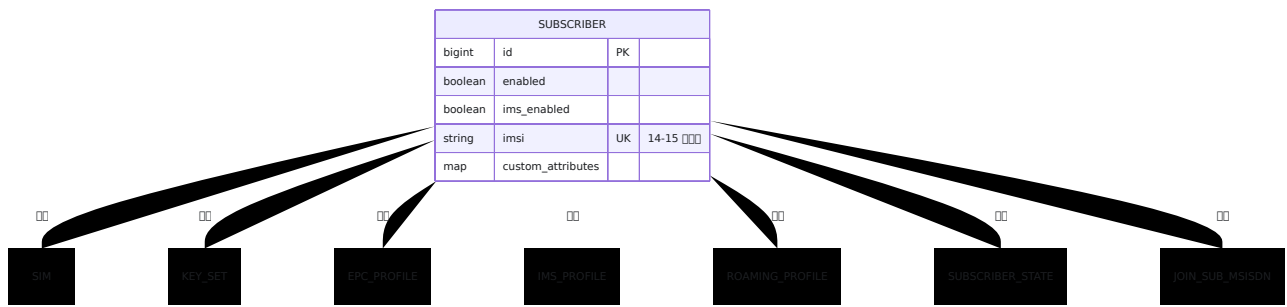
□□□□



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□□:

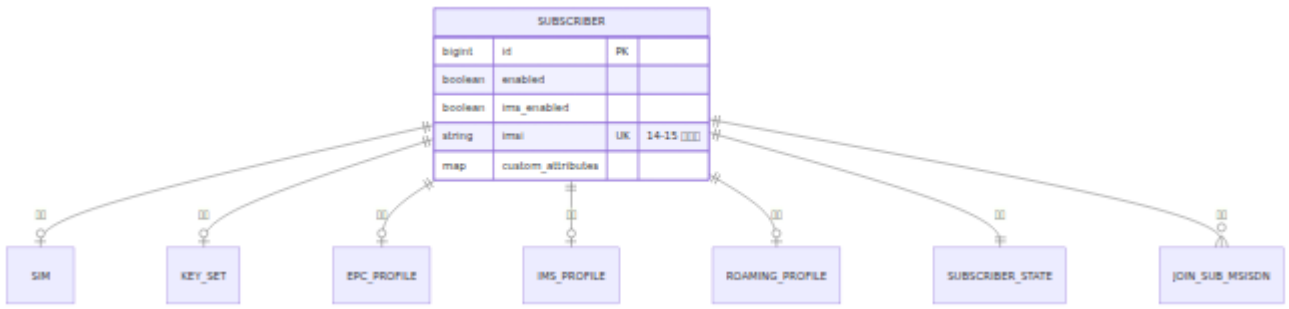
| 欄名                  | 型別      | 説明             | デフォルト値  |
|---------------------|---------|----------------|---------|
| id                  | bigint  | ID             | 自動生成    |
| enabled             | boolean | 有効/無効          | true    |
| ims_enabled         | boolean | IMS 有効/無効      | true    |
| 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 桁は国際移動番号 (MSISDN) と一致する
- 有効/無効
- IMS 有効/無効
- enabled: IMS 有効
- ims\_enabled: IMS 有効

## SIM

SIM は SIM カード



📄:

| 📄            | 📄       | 📄         | 📄📄📄📄 |
|--------------|---------|-----------|------|
| 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 |    |        |

□□□



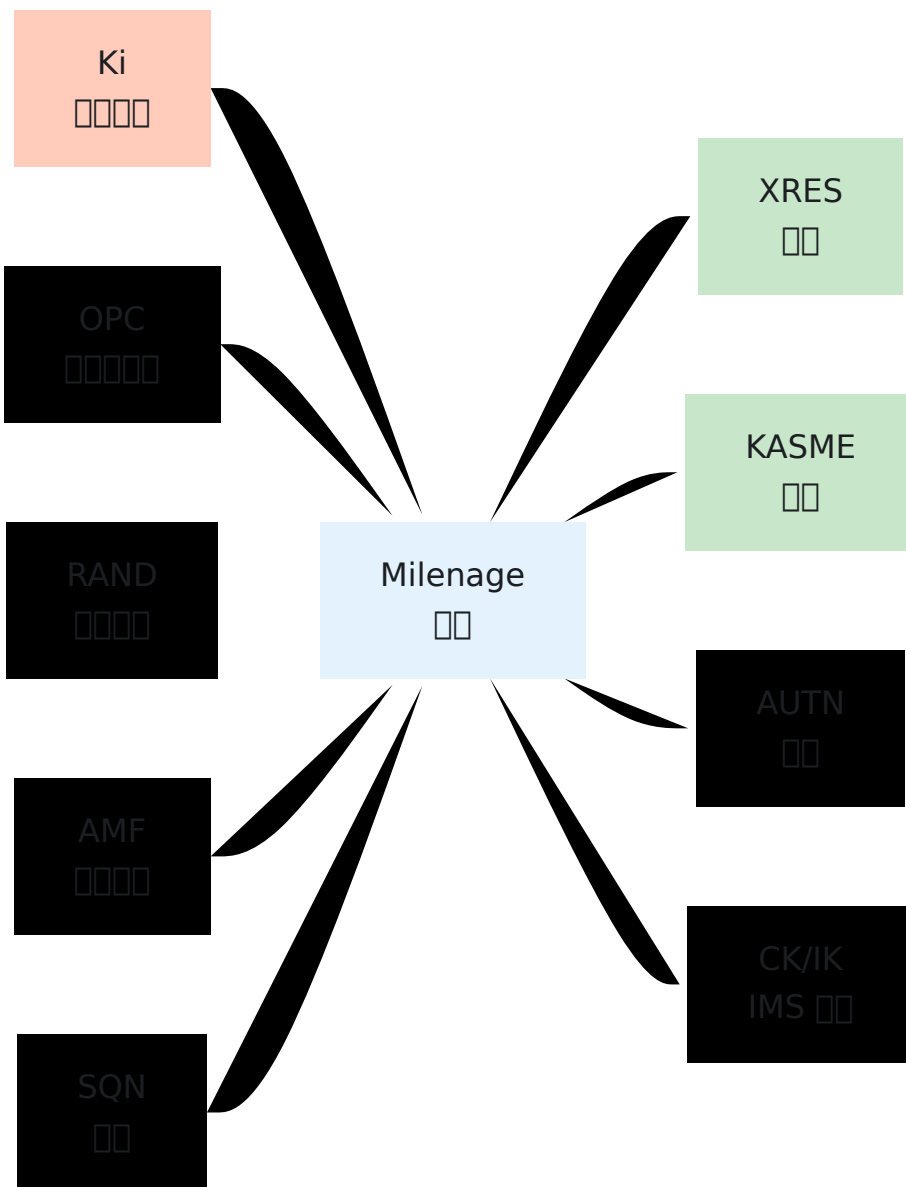
□□:

| 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                  | bits       |

Fields:

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

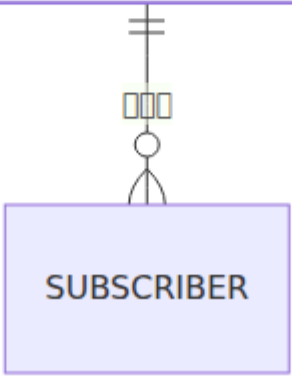
Fields:



## 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  
☐☐☐

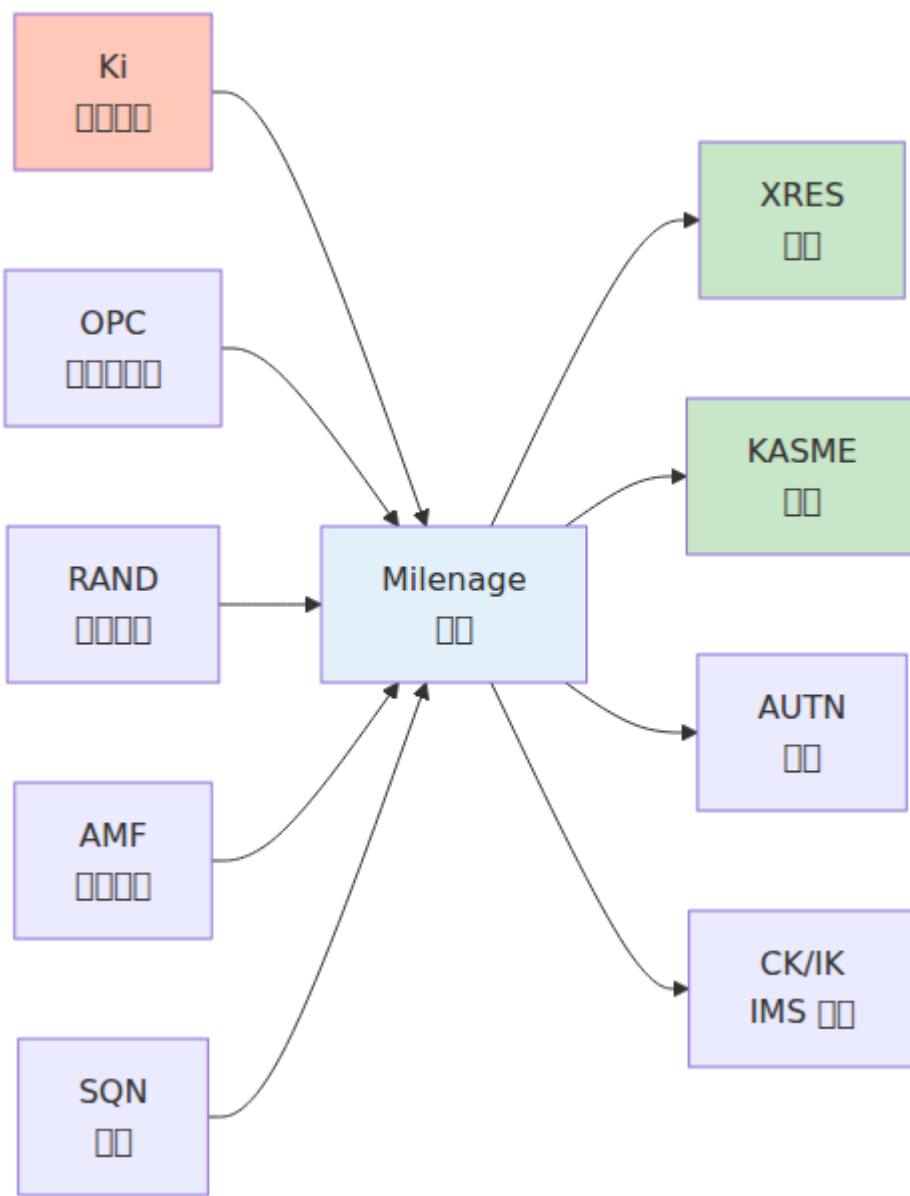
MSISDN: 14155551002  
☐☐☐☐

MSISDN: 14155551003  
☐☐☐☐

☐☐☐☐☐☐☐

**EPC** ☐☐☐☐

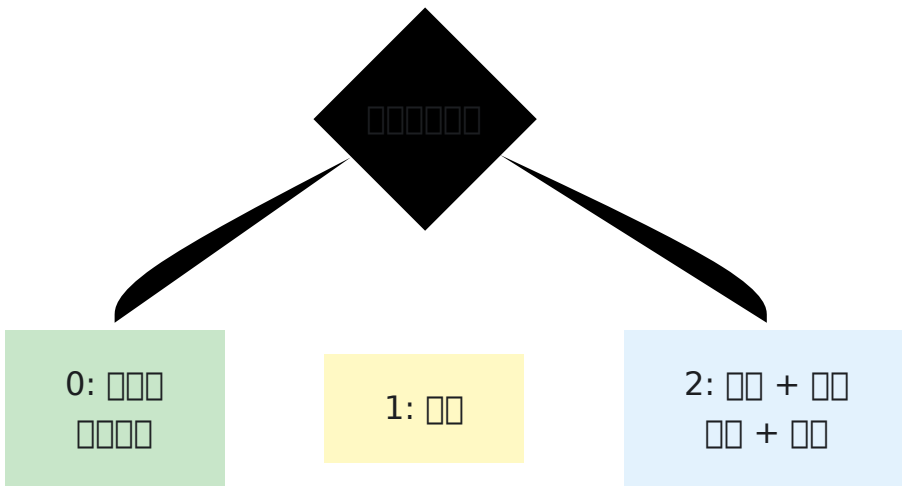
**EPC** ☐☐☐☐☐☐ LTE ☐☐☐☐☐☐☐☐☐



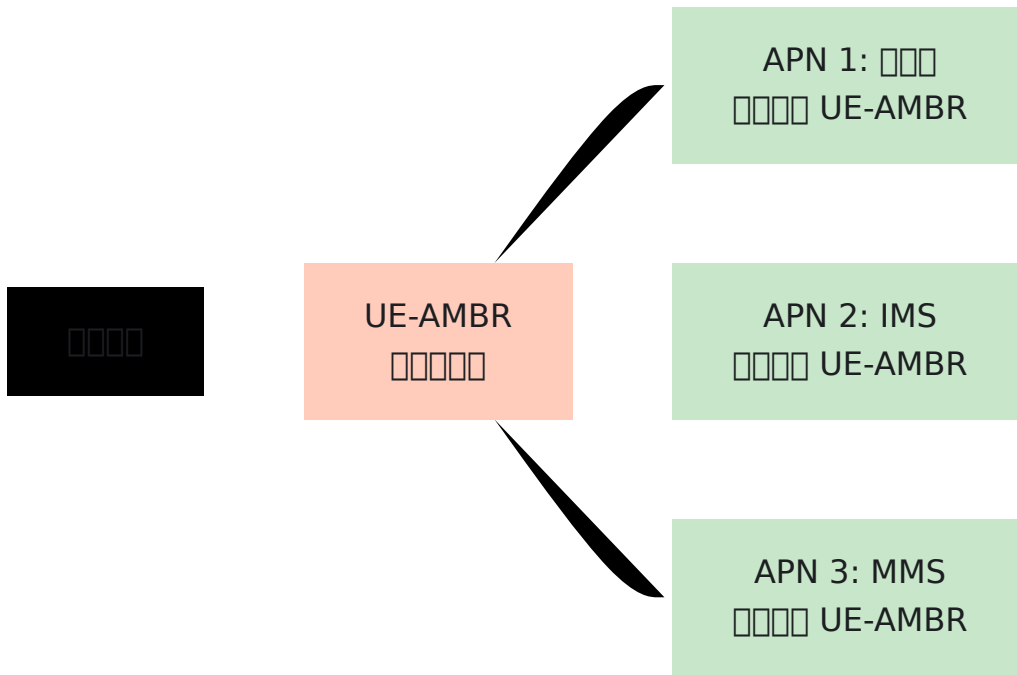
00:

| Field                                 | Type    | Units  | Notes      |
|---------------------------------------|---------|--------|------------|
| name                                  | string  | string |            |
| ue_ambr_dl_kbps                       | integer | Kbps   |            |
| ue_ambr_ul_kbps                       | integer | Kbps   |            |
| network_access_mode                   | string  |        | "0" or "1" |
| tracking_area_update_interval_seconds | integer | TAU    |            |

AMBR:

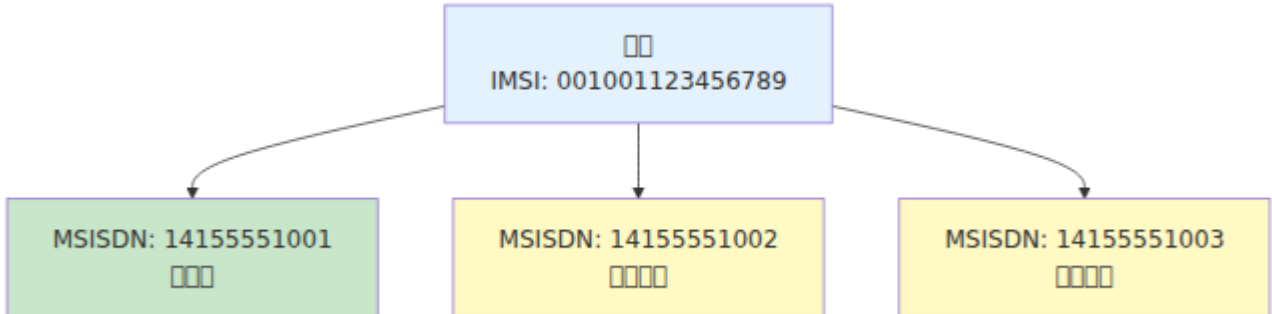


**AMBR:**



## IMS

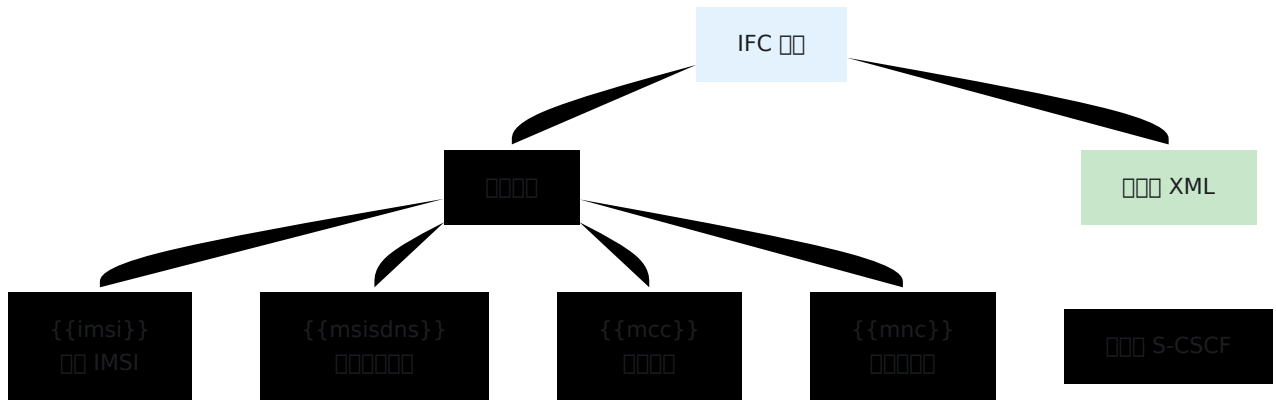
IMS



IMS:

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

IFC

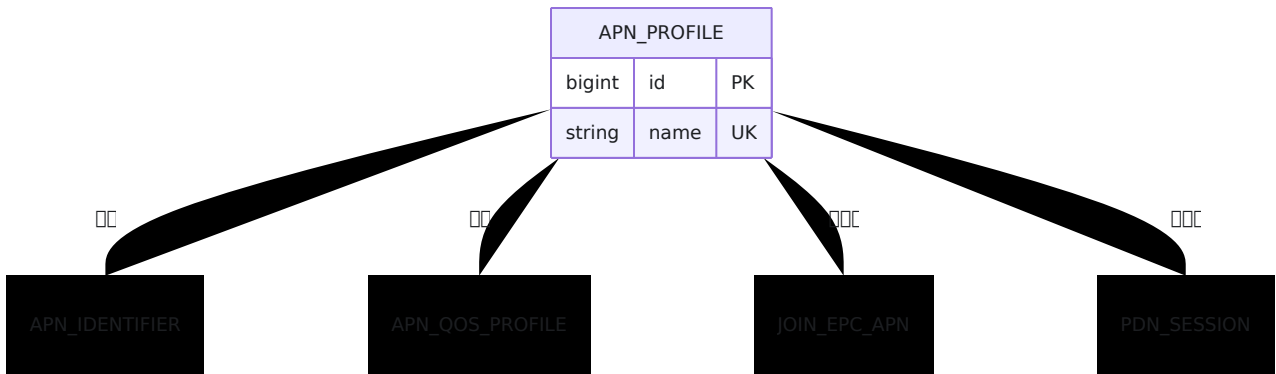


IMS:

- IFC IMS IMSI
- IMSI
- IMSI
- IMS S-CSCF

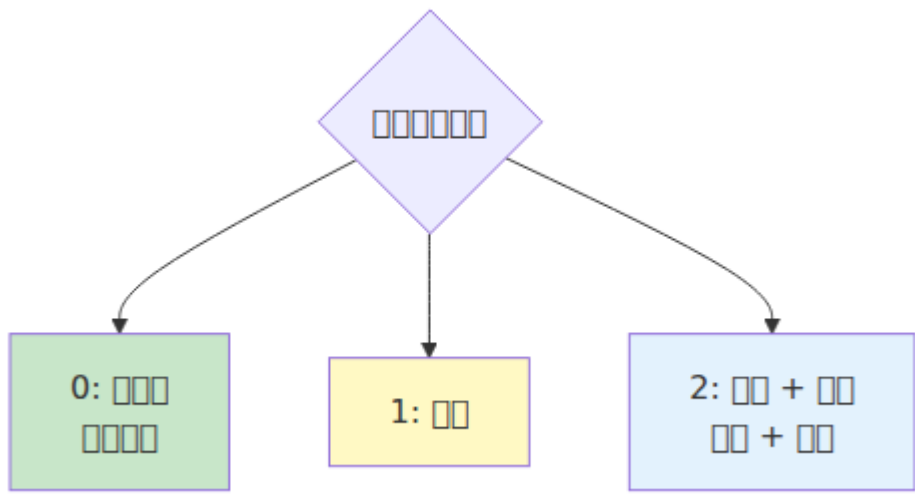
## APN

APN



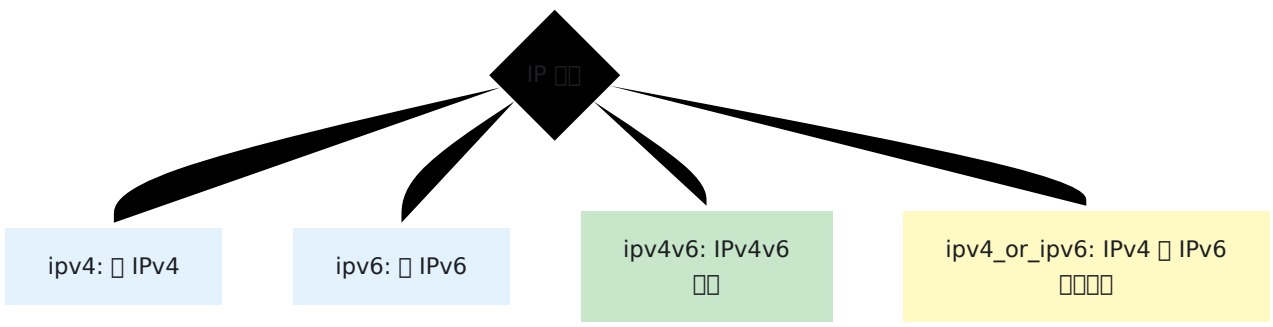
IMS:

APN

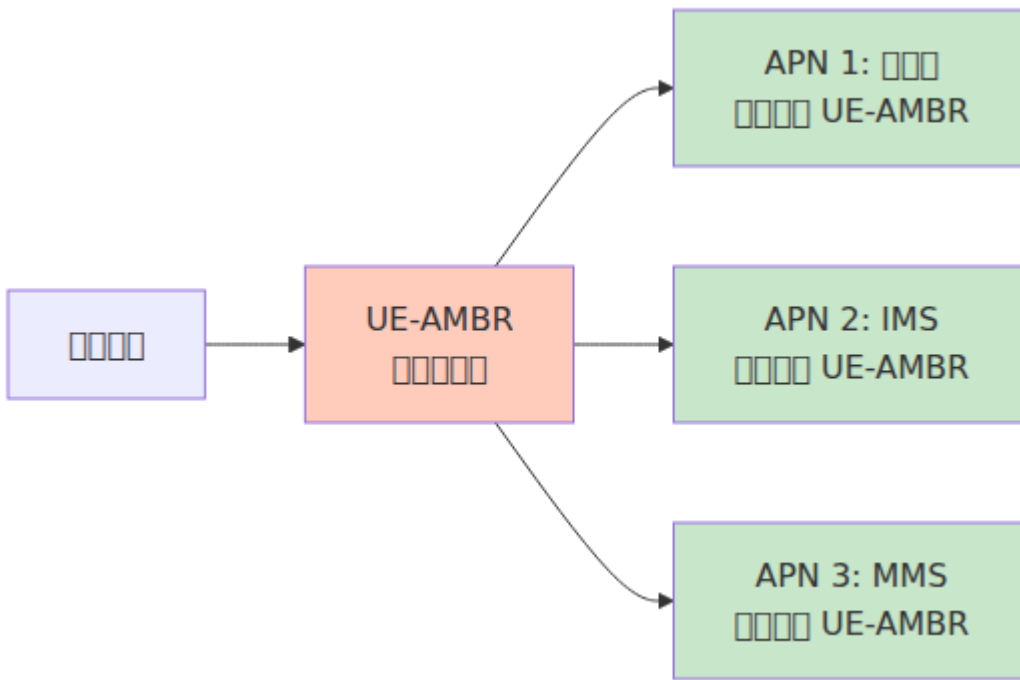


| 00         | 00     | 00      | 00                       |
|------------|--------|---------|--------------------------|
| apn        | string | APN 00  | "internet", "ims", "mms" |
| ip_version | string | IP 0000 | 0000                     |

**IP 0000:**



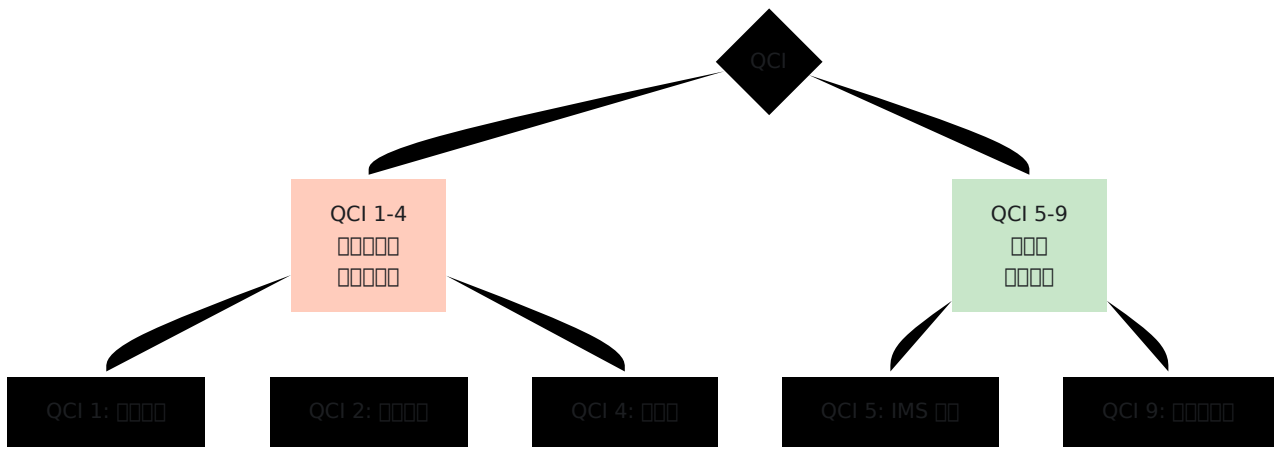
**APN QoS 0000**



**QoS**

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

**QCI**



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000000000000000000000000

| ROAMING_PROFILE |                               |    |       |
|-----------------|-------------------------------|----|-------|
| bigint          | id                            | PK |       |
| string          | name                          | UK |       |
| string          | data_action_if_no_rules_match |    | 00000 |
| string          | ims_action_if_no_rules_match  |    | 00000 |



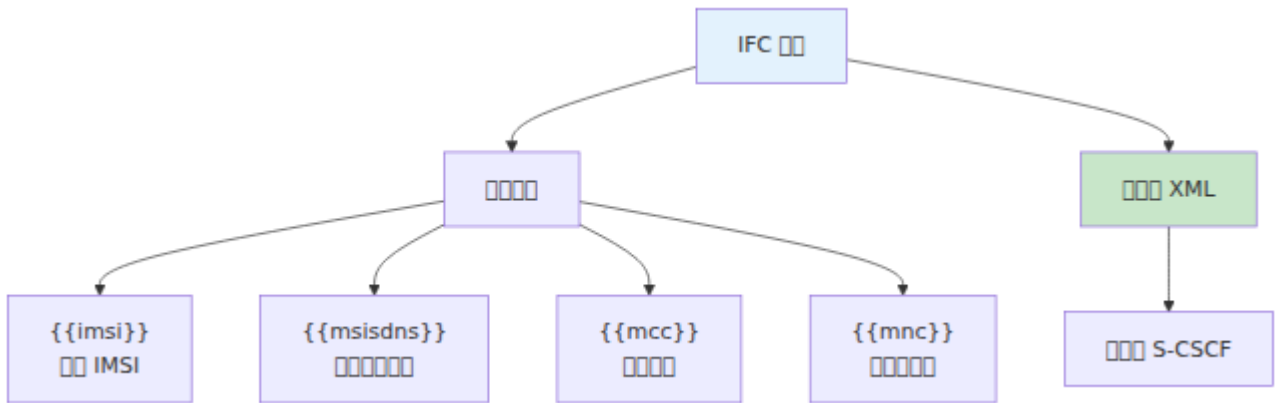
JOIN\_ROAM\_RULE

SUBSCRIBER

00

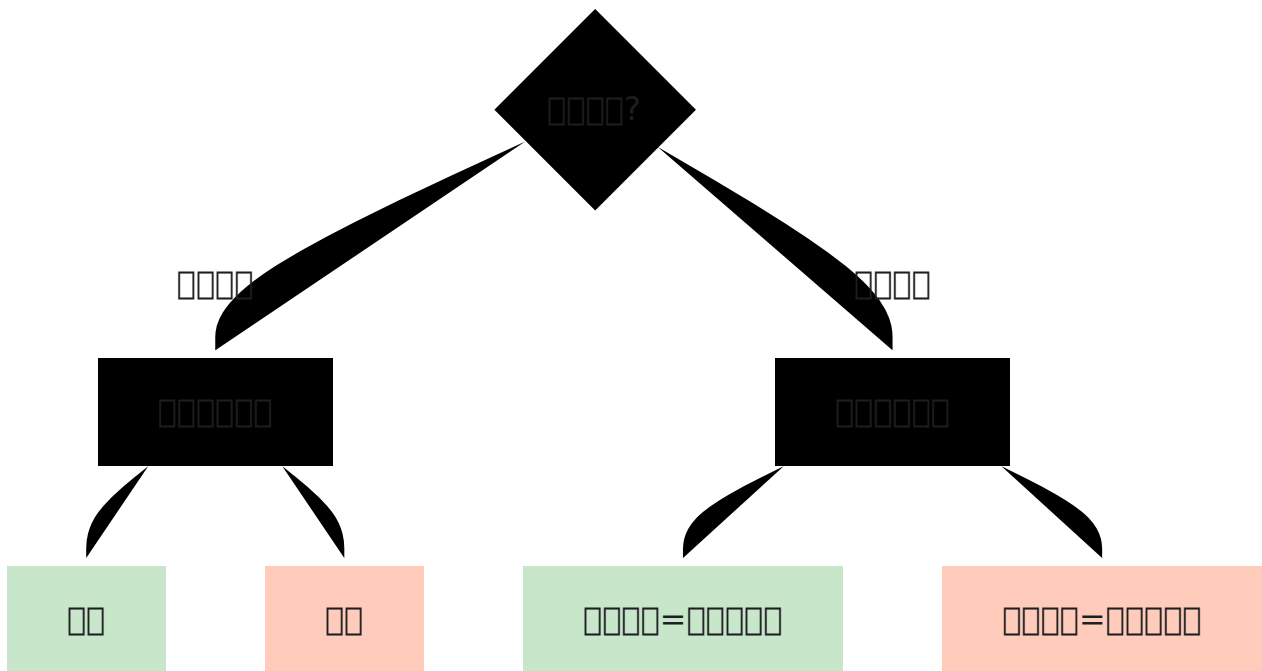
ROAMING\_RULE

□□□□:



□□◀▶□□:

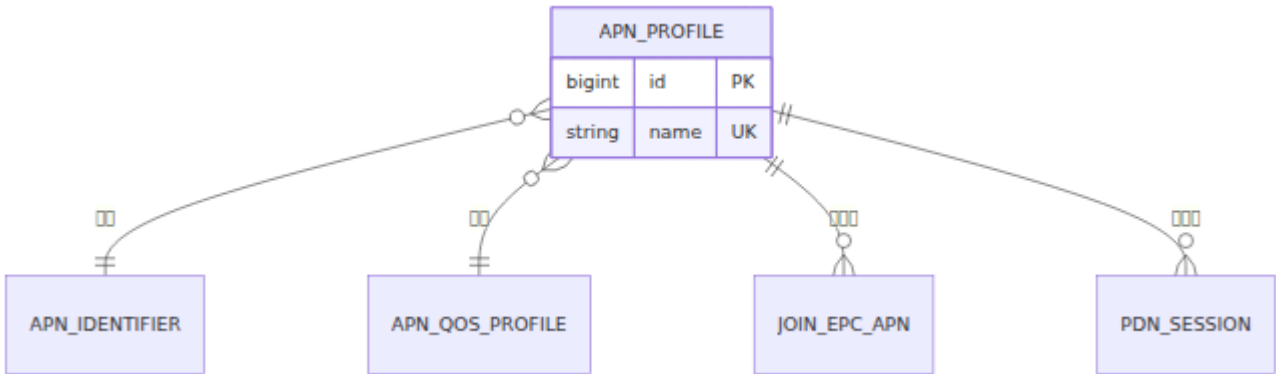
□□□□□□  
MCC: 310, MNC: 410



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- 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

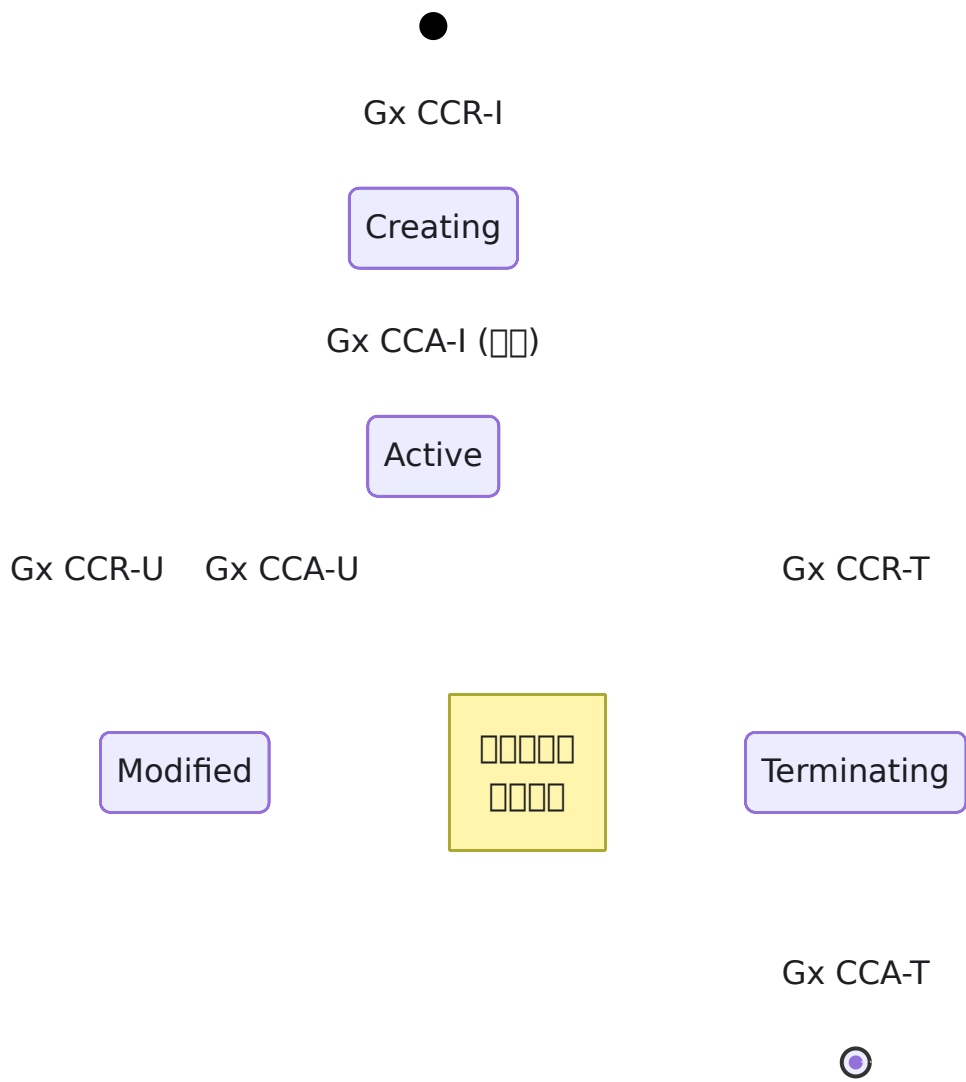
## PDN 00

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        |    |

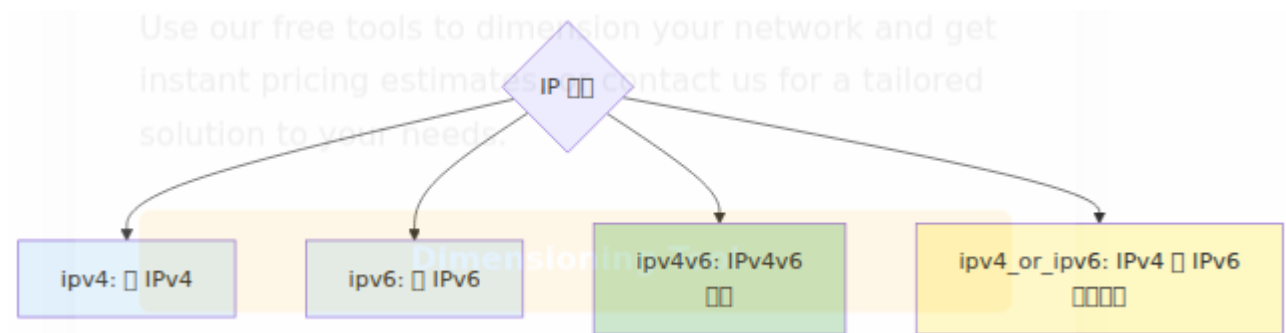


PDN 000000:

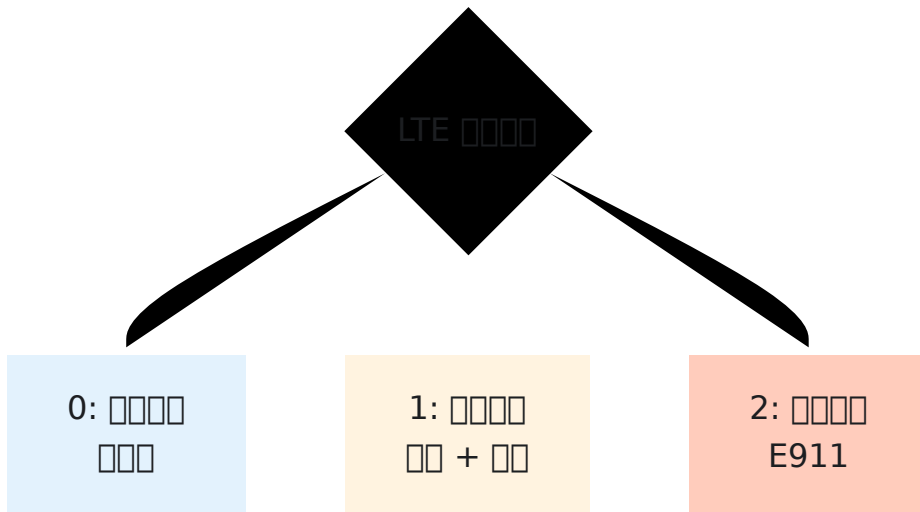


## LTE

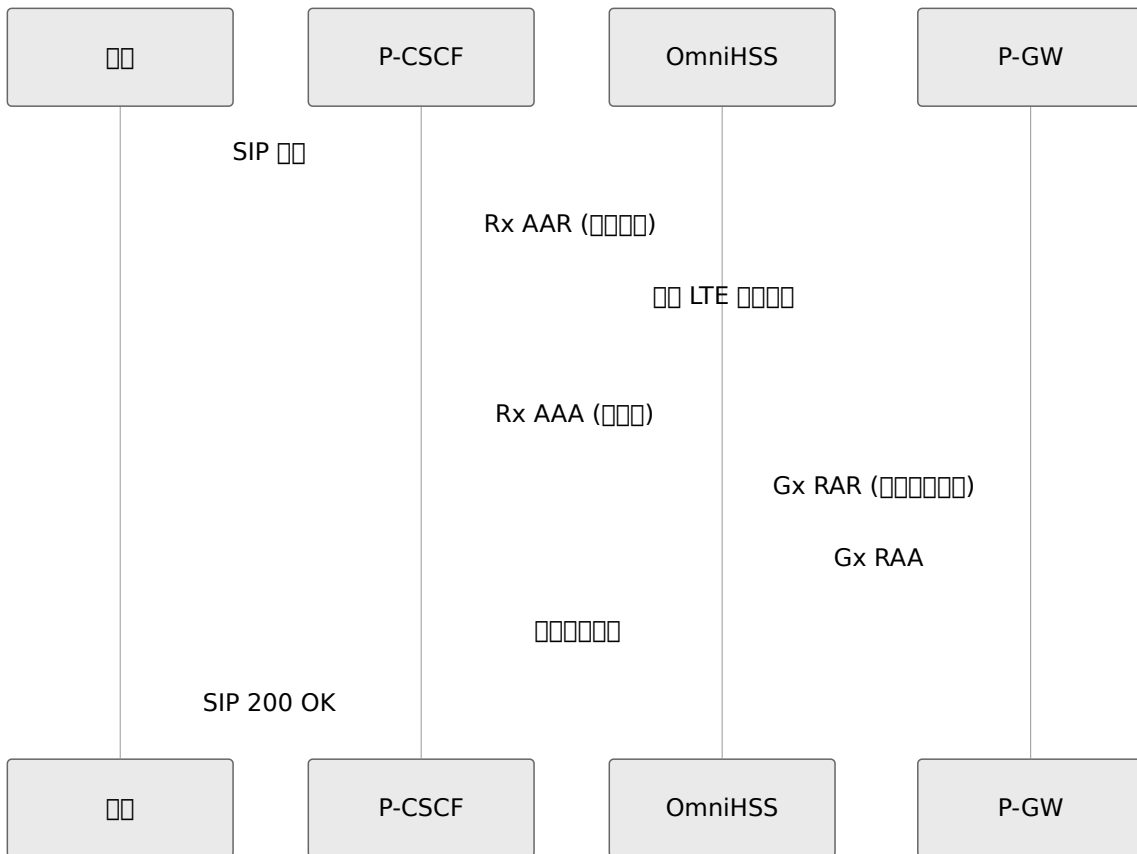
LTE VoLTE



IPv4:



**VoLTE 网络:**



□□□□□

□□□□□

Use our free tools to dimension your network and get instant pricing estimates, or contact us for a tailored solution to your needs.

**Dimensioning Tool**

**Pricing Calculator**

QCI 9: □□□□□

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[Pricing Calculator](#)

[Get in Touch](#)

ROAMING\_RULE

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●  
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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 □□  
□□□□



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[Dimensioning Tool](#)

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□□□□□□

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 □□



S6a AIR - 5G Core Network

5G Core Network

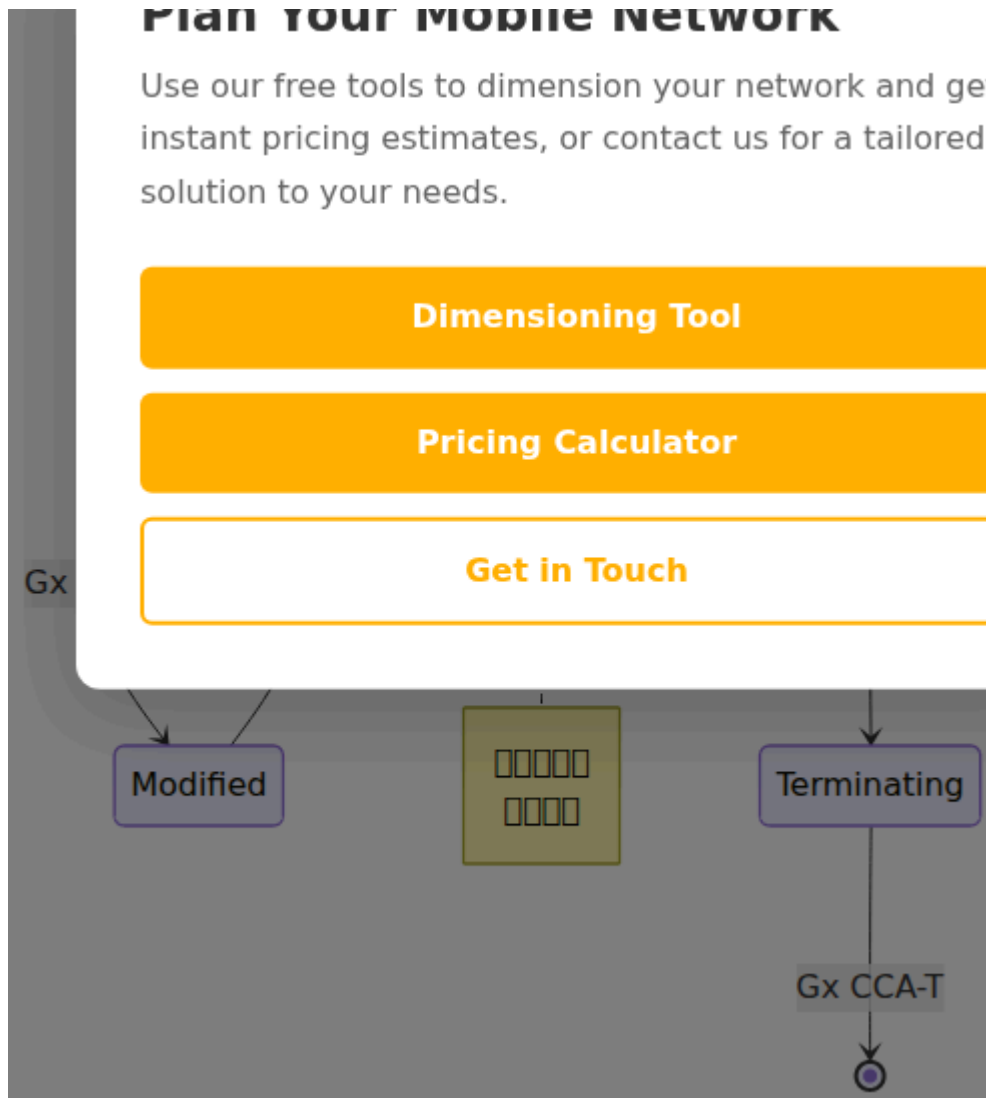
## Plan Your Mobile Network

Use our free tools to dimension your network and get instant pricing estimates, or contact us for a tailored solution to your needs.

[Dimensioning Tool](#)

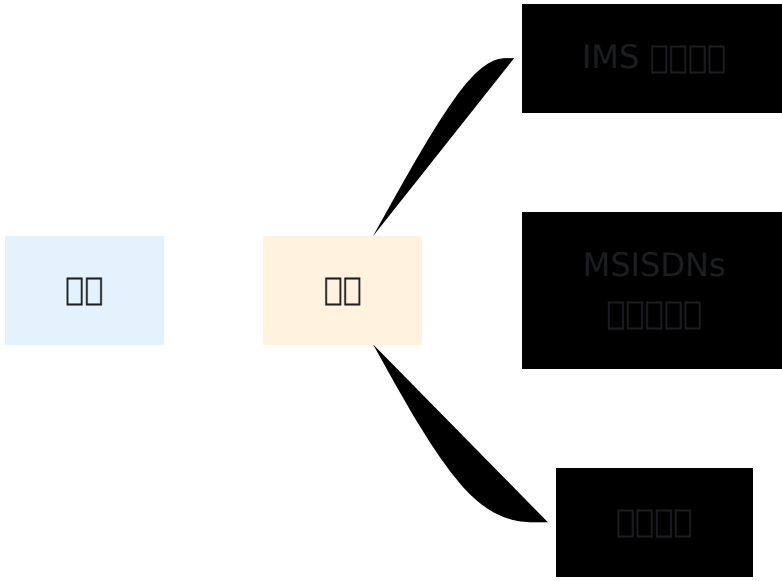
[Pricing Calculator](#)

[Get in Touch](#)



S6a ULR - 5G Core Network 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
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- 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

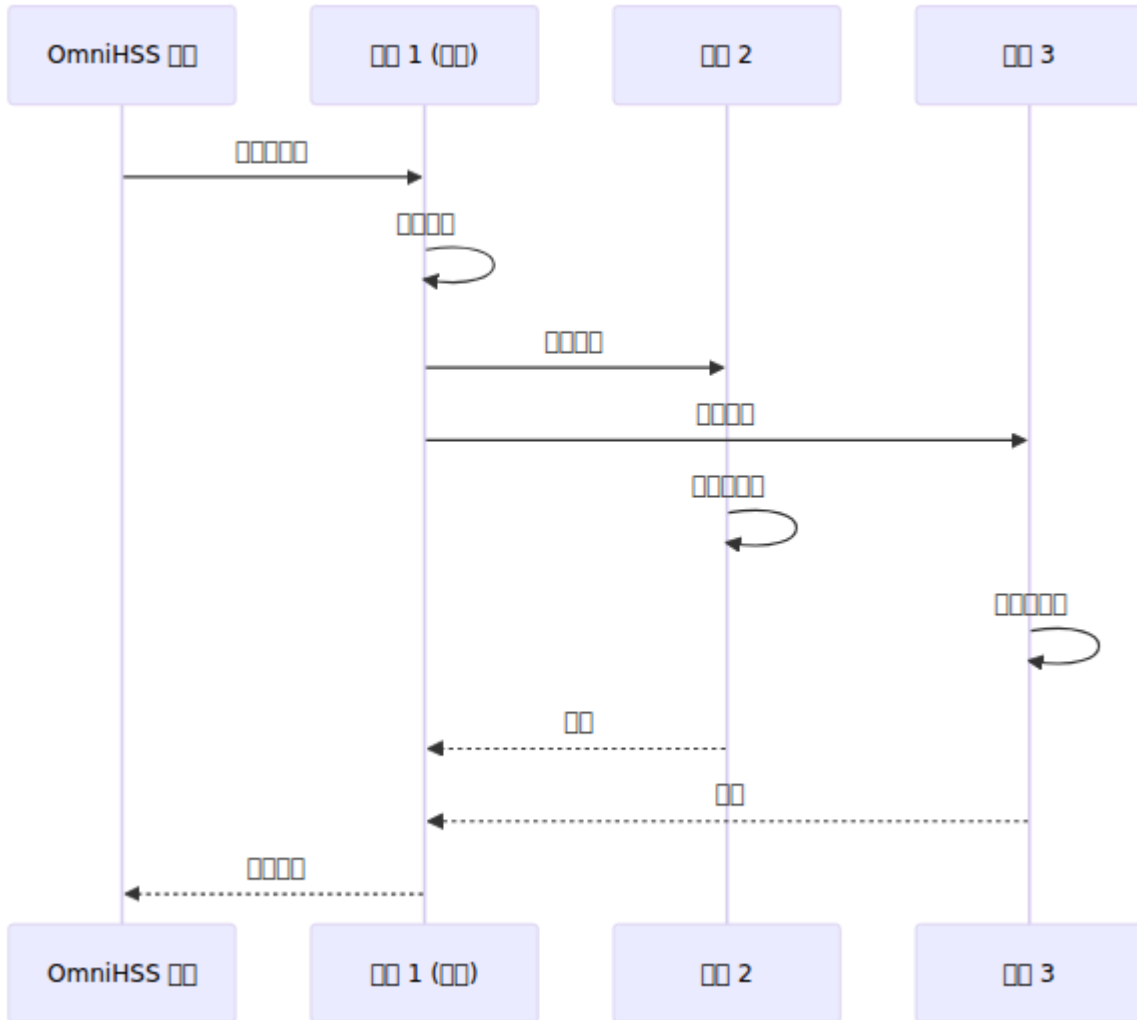
## MariaDB 高可用性 Galera

| 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“111”
3. 1111111111111111
4. 1111111111111111
5. 1111111111111111

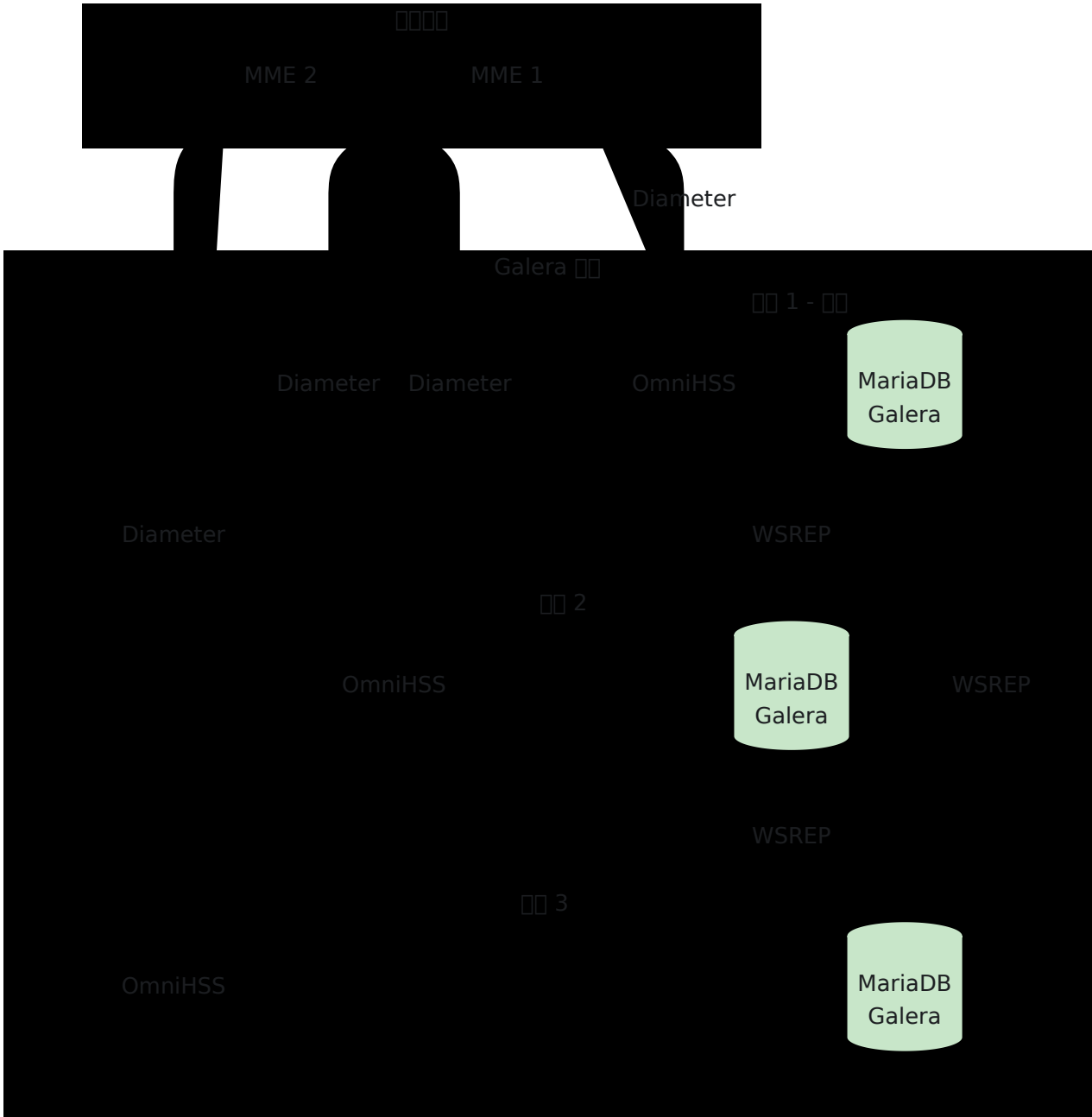
# Oracle

| IST              | Delta sync | rsync |
|------------------|------------|-------|
| <b>IST</b> (IST) | Delta sync | rsync |
| <b>SST</b> (SST) | 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"
```

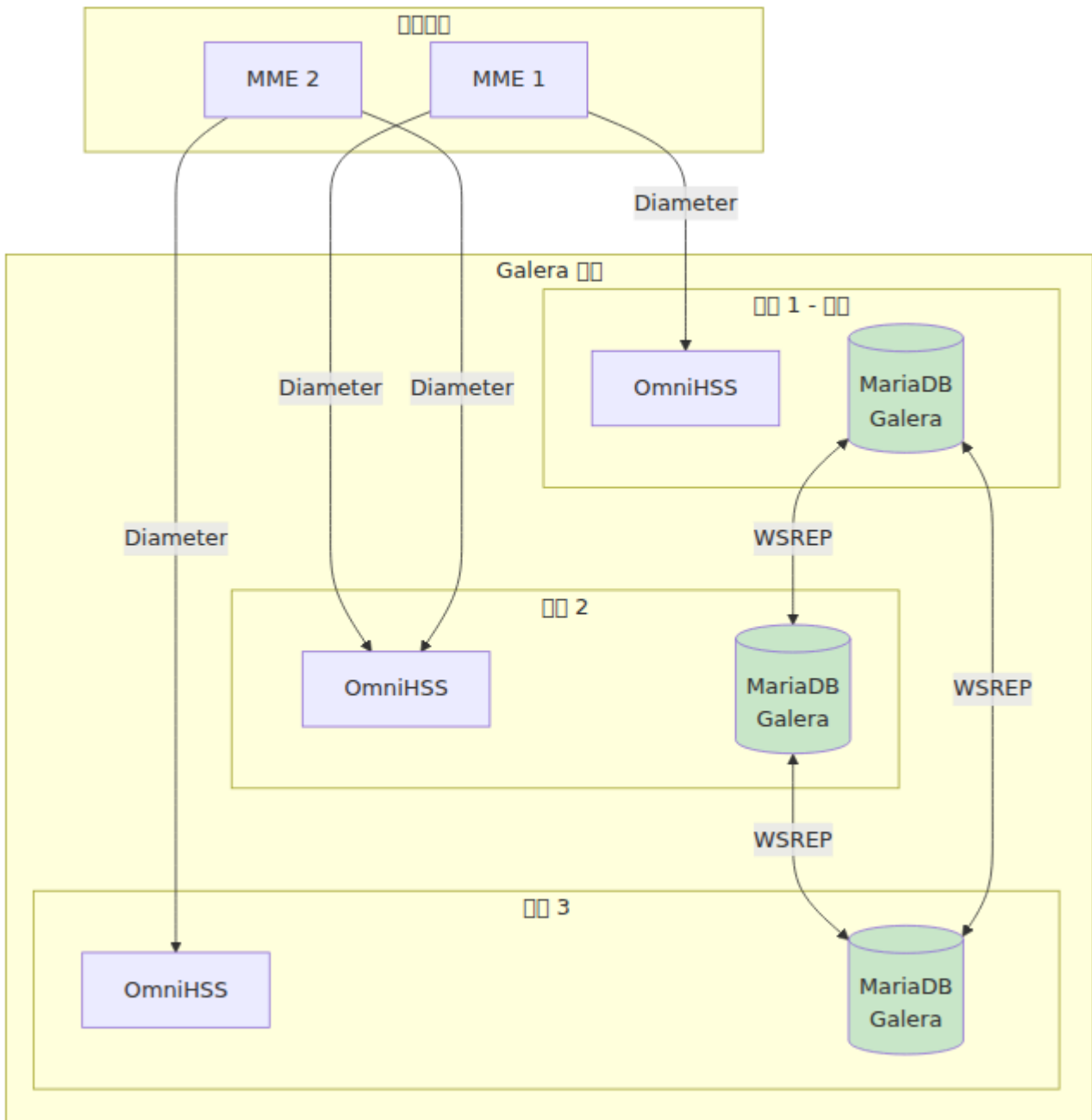
## WSREP

| 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>       | WSREP_IP                         | WSREP_NODE_ADDRESS IP    |
| <code>wsrep_node_name</code>          | WSREP_NAME                       | 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. Galera

```
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

| 状態               | 順序 | 説明           |
|------------------|----|--------------|
| Primary          | 1  | プライマリノード     |
| Secondary/InnoDB | 2  | セカンダリノード SST |
| Primary          | 3  | プライマリノード     |
| Secondary        | 4  | セカンダリノード     |

## Prometheus

Galera MariaDB Galera OmniHSS Galera

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□□□

```
□□ 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 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 を強制実行
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

- wsrep\_local\_send\_queue
- wsrep\_flow\_control\_bytes I/O
- wsrep\_flow\_control\_bytes

確認

- wsrep\_flow\_control\_bytes
- wsrep\_flow\_control\_bytes

- □□□□□□□□
-

# Diameter

←

mermaid Diameter OmniHSS

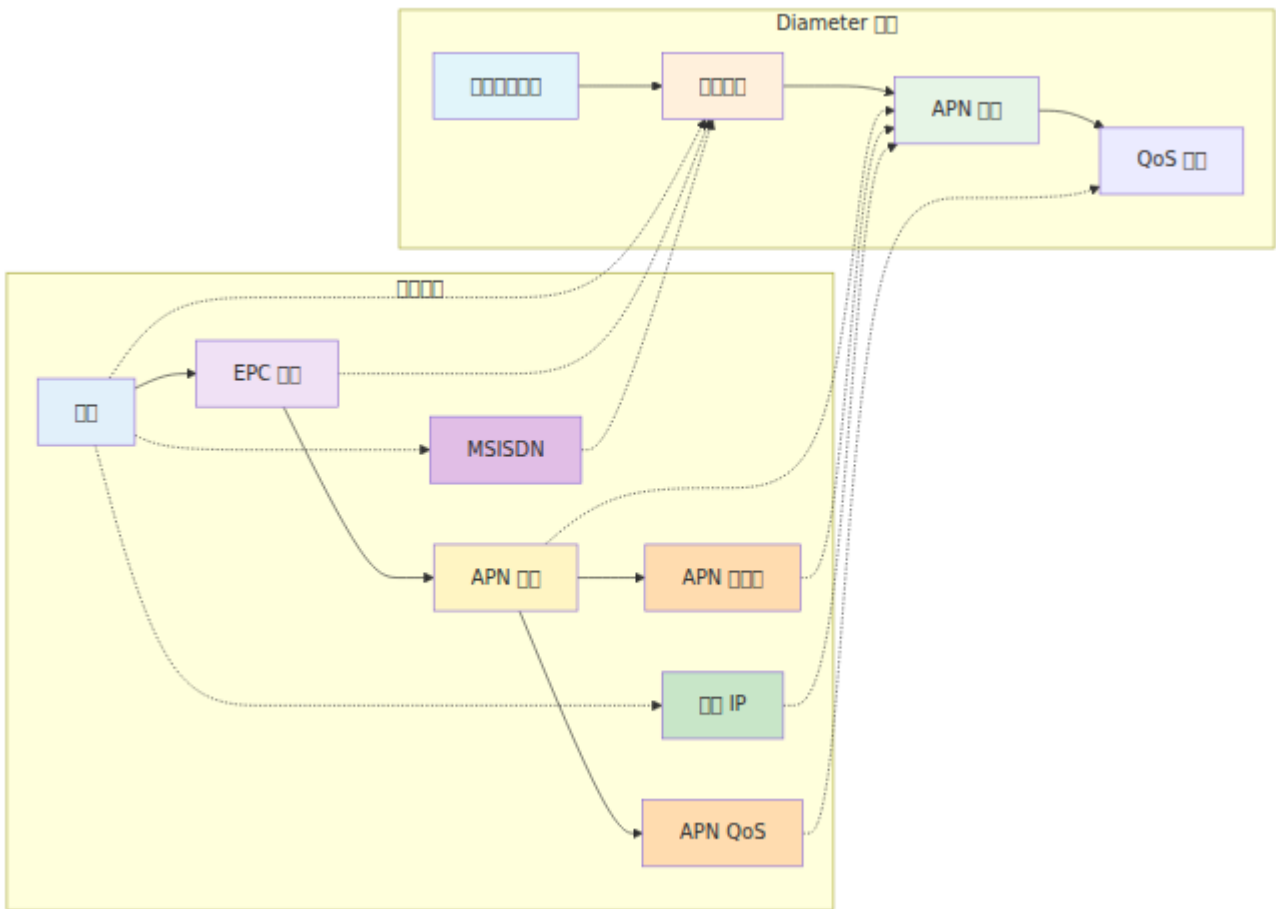
---

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

## (S6a ULA)

HSS LTE MME Diameter AVP

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□□□□□□

| □□□□□                                                | □□            | 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

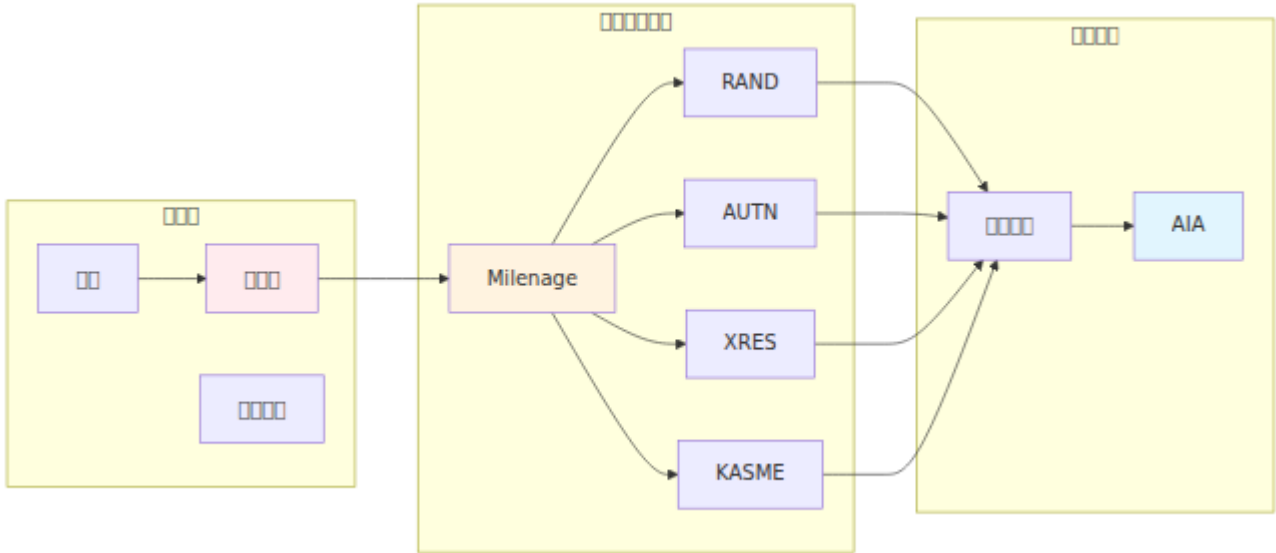
Sequence

- 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)

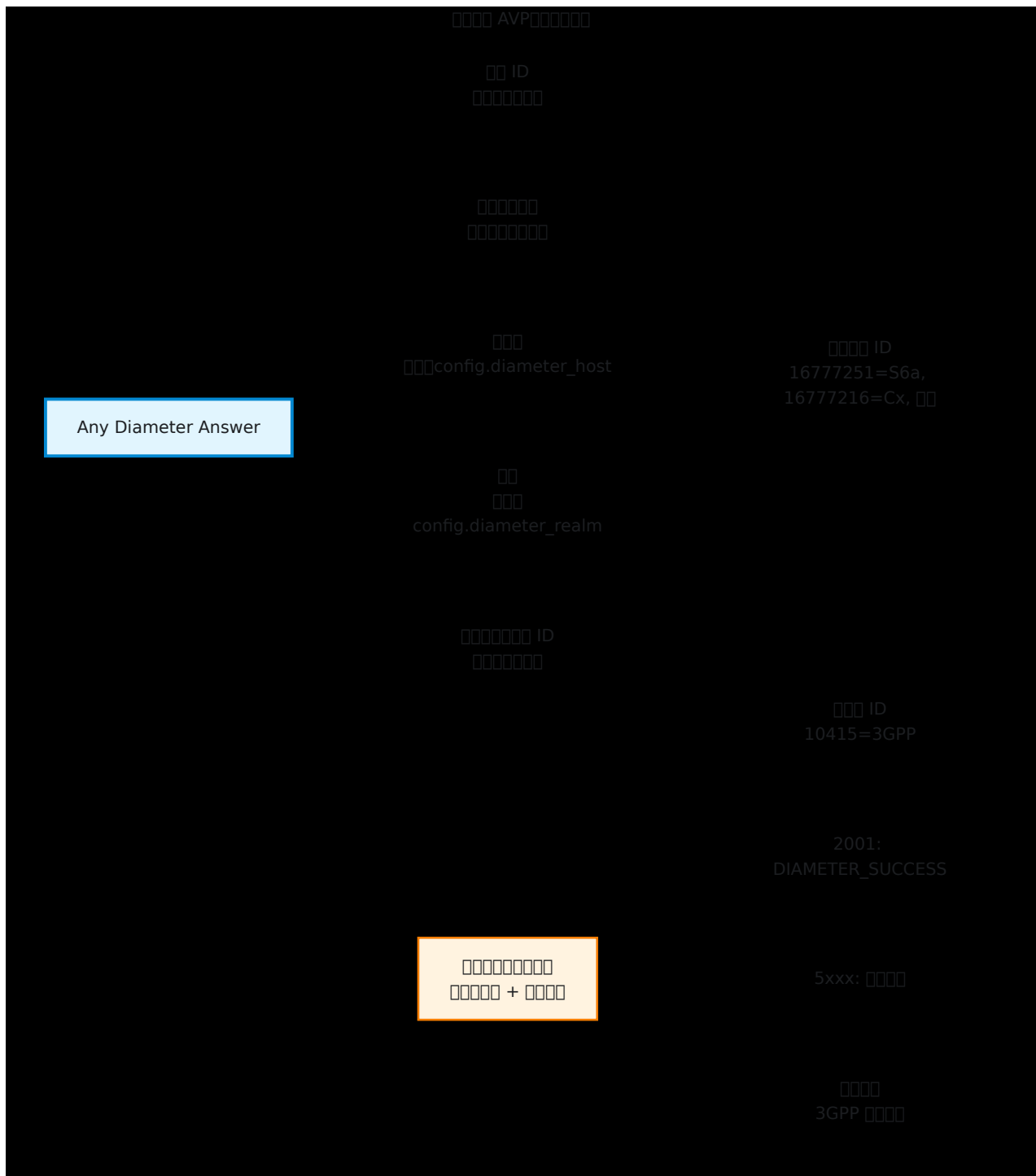
AAA PCRF AAA AAA PGW





- IMEI
  - TAC
  - 
  -
- 

Diameter AVP



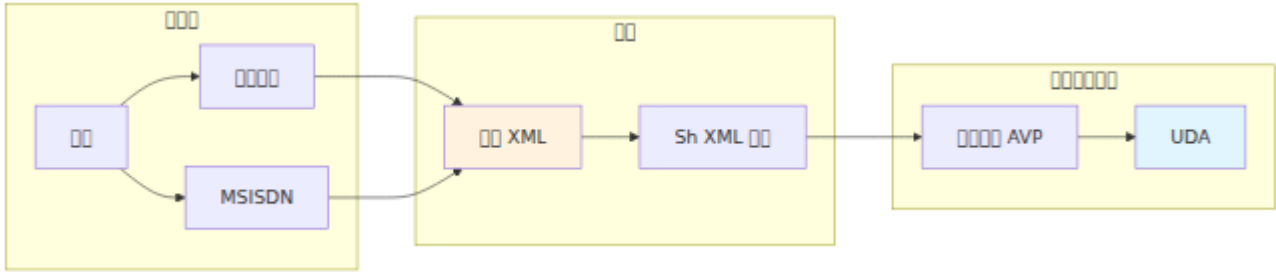
config

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



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□□□□□□ Diameter □□□□□□□□

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

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

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

---

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



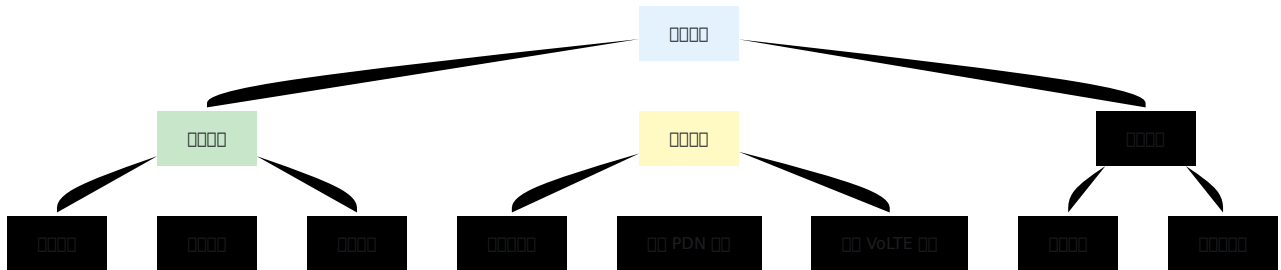
# 概要

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

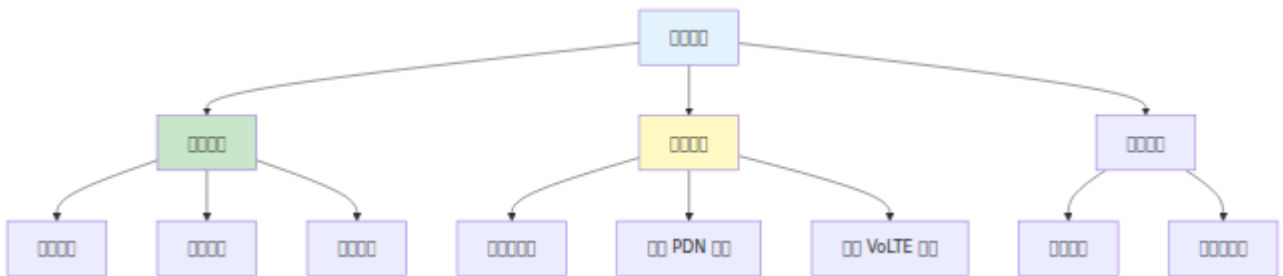
- 概要
- 概要
- 概要

4. Diameter 프로토콜

## Diameter 프로토콜

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

프로토콜



프로토콜

프로토콜

| 프로토콜          | 주소  | 프로토콜     |
|---------------|-----|----------|
| <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   | 単位           | 目標値   | 現状値      |
|------|--------------|-------|----------|
| 通話品質 | 通話 Erlang 時間 | 通話品質  | > 90% 達成 |
| 通話品質 | 通話品質         | < 80% | > 90%    |
| 通話品質 | 通話品質         | N/A   | 通話品質     |

## 通話品質

### 通話品質

通話 SQL 通話品質

通話

通話品質

- 通話品質
- 通話品質
- IMS 通話品質

通話

通話品質

- 通話 PDN 通話品質
- 通話 VoLTE 通話品質
- 通話 APN 通話品質 PDN 通話

通話

通話品質

- 通話品質 MCC-MNC 通話品質
- 通話品質 PLMN 001-001 通話

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- 0000000000000000
- 000 MME 00000000
- 0000000000000000

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- 000000000000
- 000 00000000
- 0000000000
- 000000000000

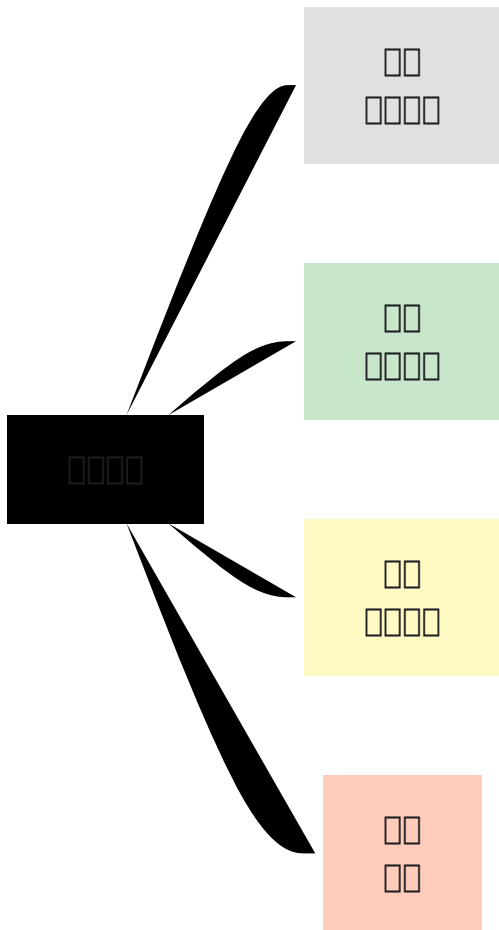
---

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
```

□□□□□:

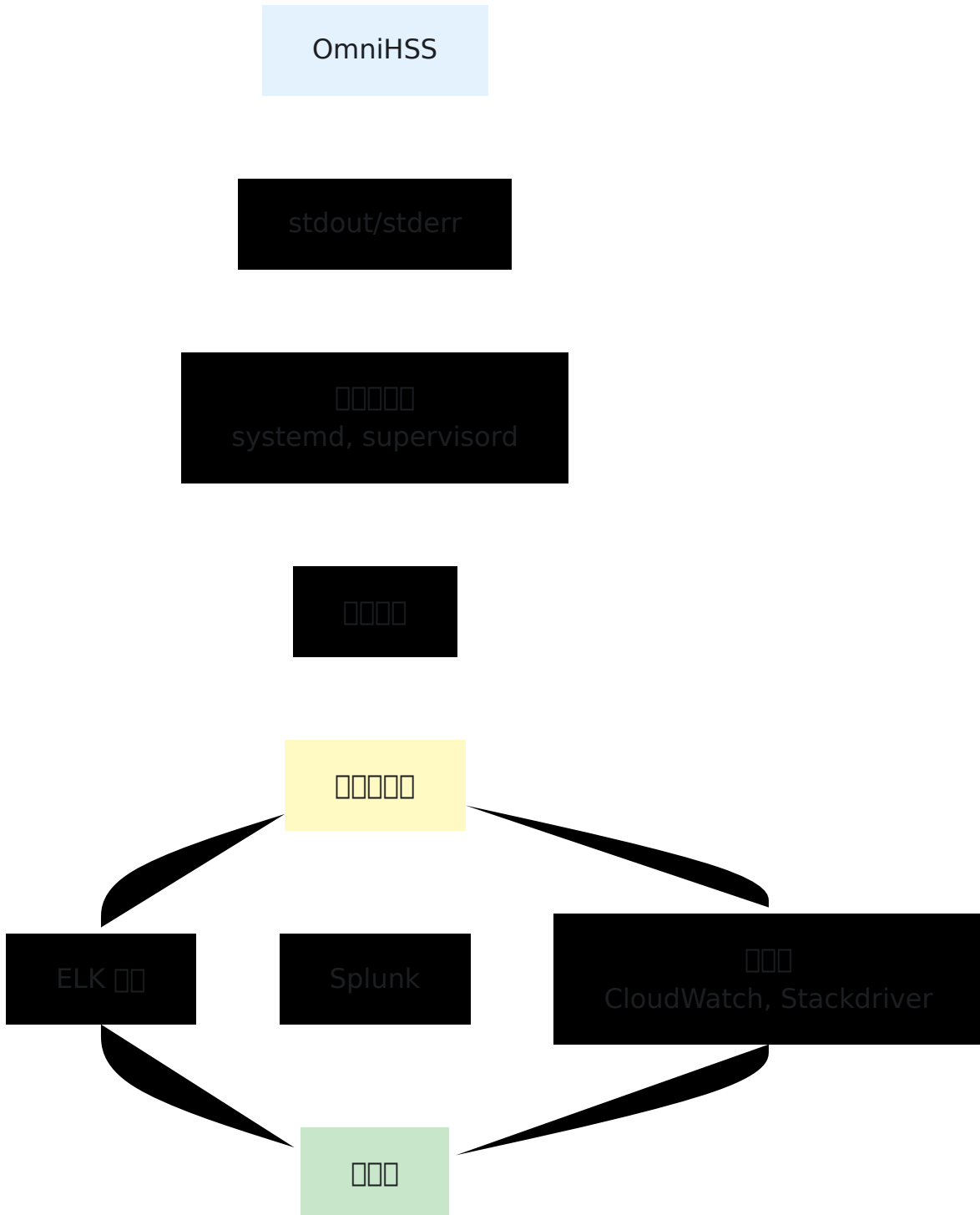
```
[info] Database connection established
[error] Database connection lost: timeout
[error] Database query failed: deadlock detected
```

□□□□:

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

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**API □□□□:** GET /api/status

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

□□□□:

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

**HTTP □□:** 200 OK

□□□□□□

**Nagios/Icinga □□**

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

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

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

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

**Prometheus □□**

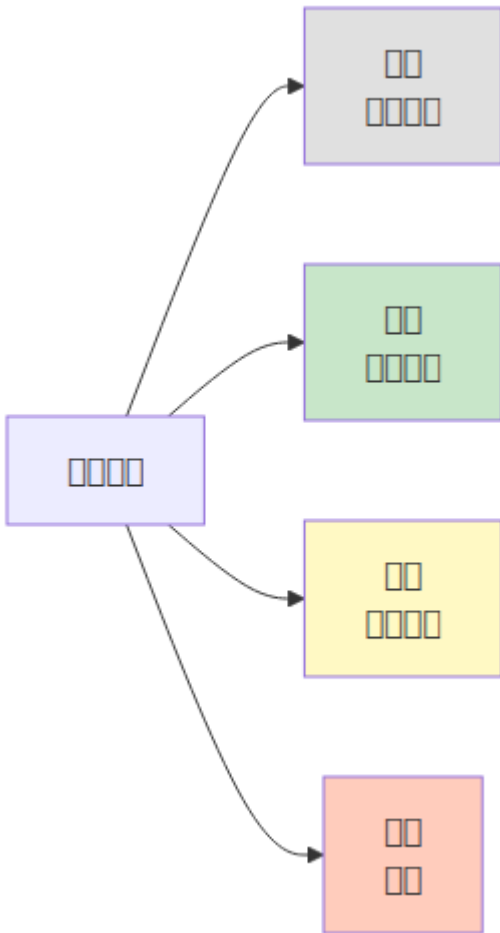
OmniHSS Prometheus API

## SNMP

SNMP SNMP API SNMP OID

---

## KPI



## 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 |

---



- 時間: 10分程度

## 課題 (P2)

### 課題 Diameter 課題:

- MME 時間
- P-GW 時間
- S-CSCF 時間
- 時間: 15分程度

### 課題:

- 時間 > 95%
- 時間: 10分程度

### 課題:

- 10% 時間
- 時間: 10分程度

## 課題 (P3)

### 課題:

- 時間
- 時間
- 時間: 1分程度

### 課題:

- 時間 > 85%
- 時間: 10分程度

### 課題:

- 時間 > 1%
- 時間: 10分程度

## □□□□□ (P4)

□□□□:

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

□□□□:

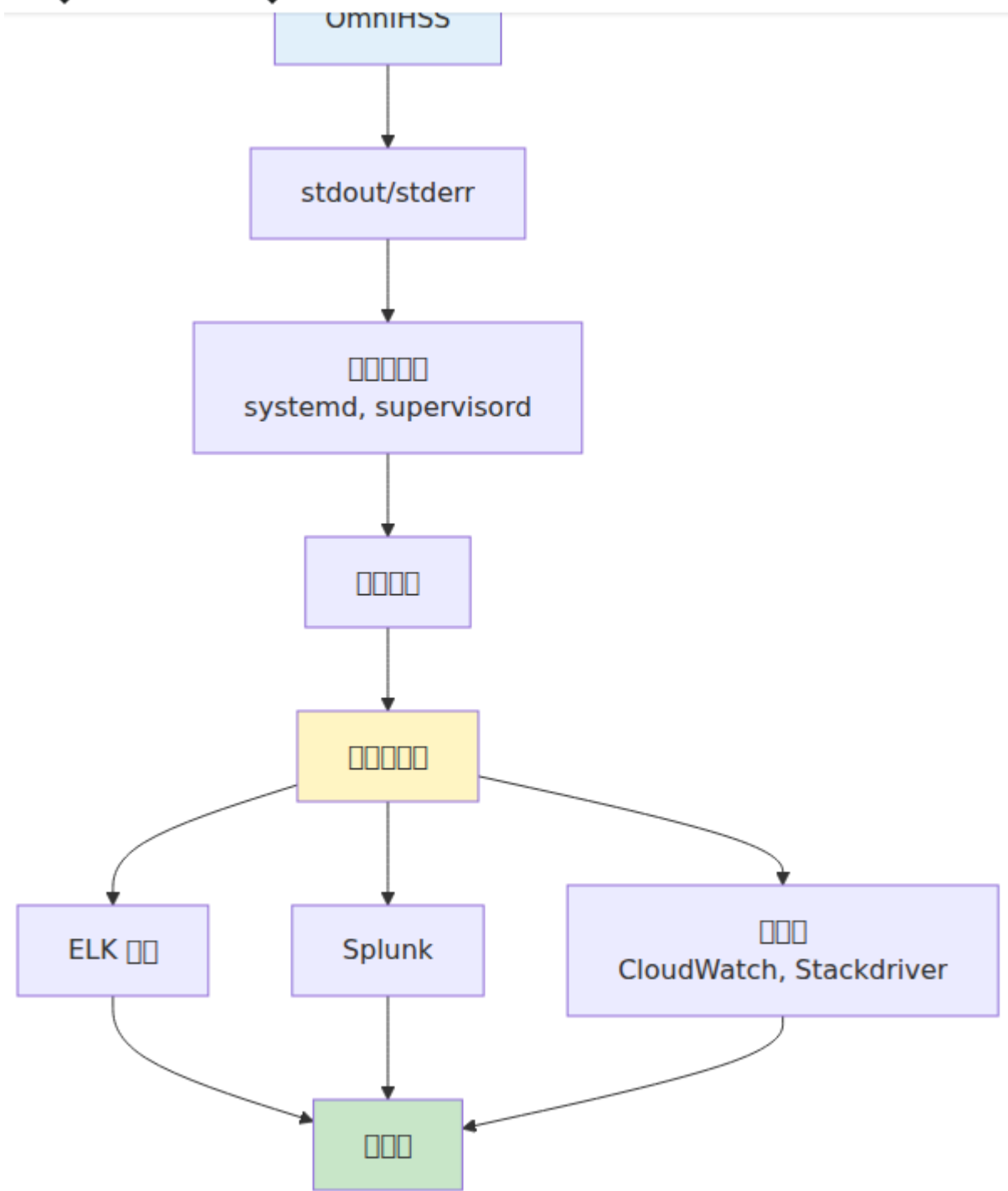
- □□□□□□□□□□
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Downloads

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Omnitouch Webs



# □□□□□□

## □□□□

- - □□□□□□
- Diameter □□ - □□□□◆◆□□□□
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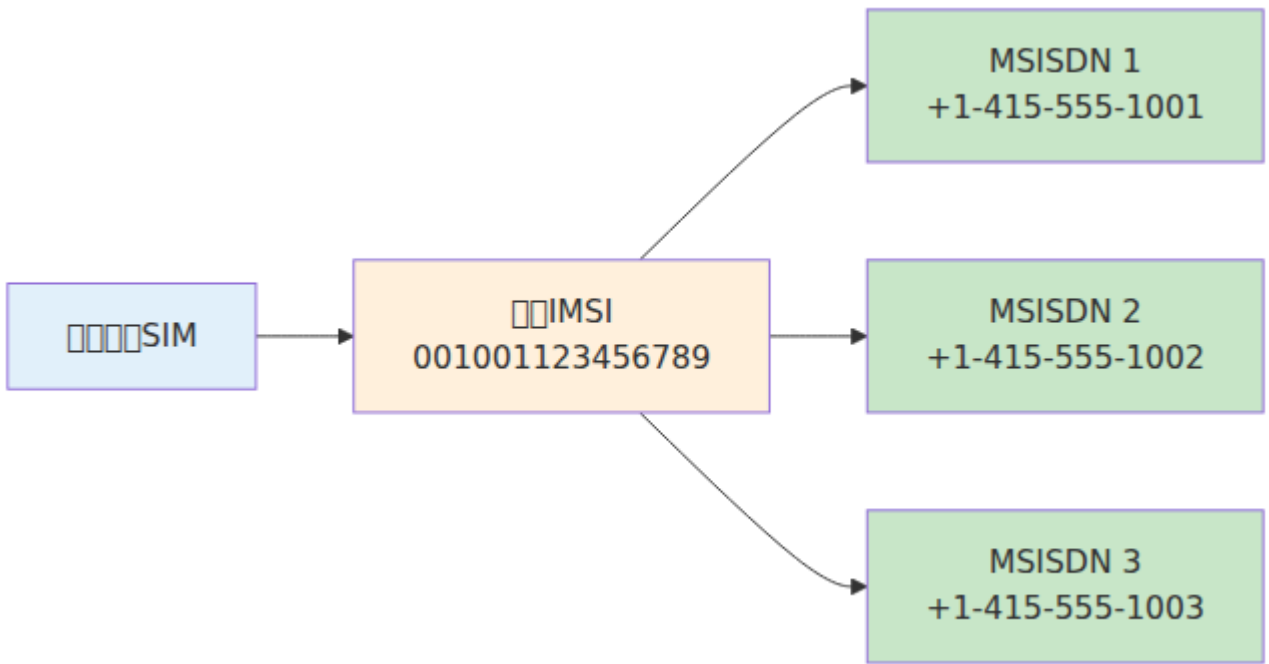
## □□□□

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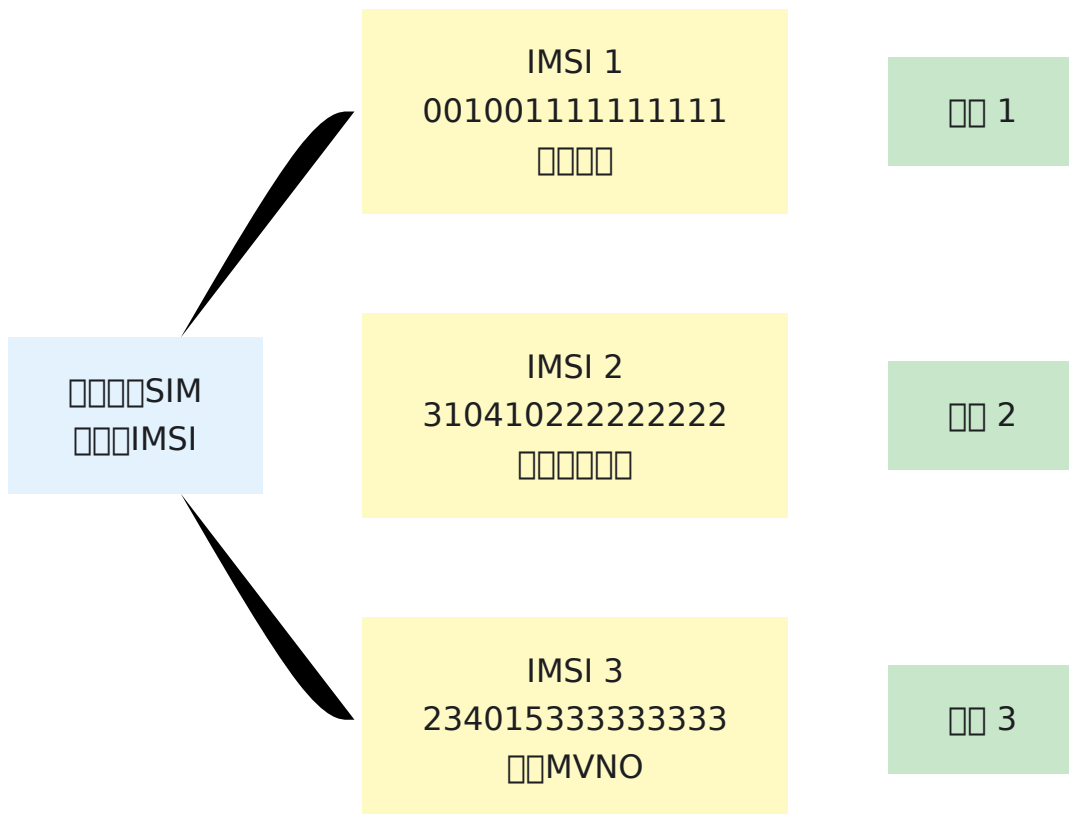




## IMSI SIM

SIM → IMSI

SIM IMSI MVNO



# IMSISDN

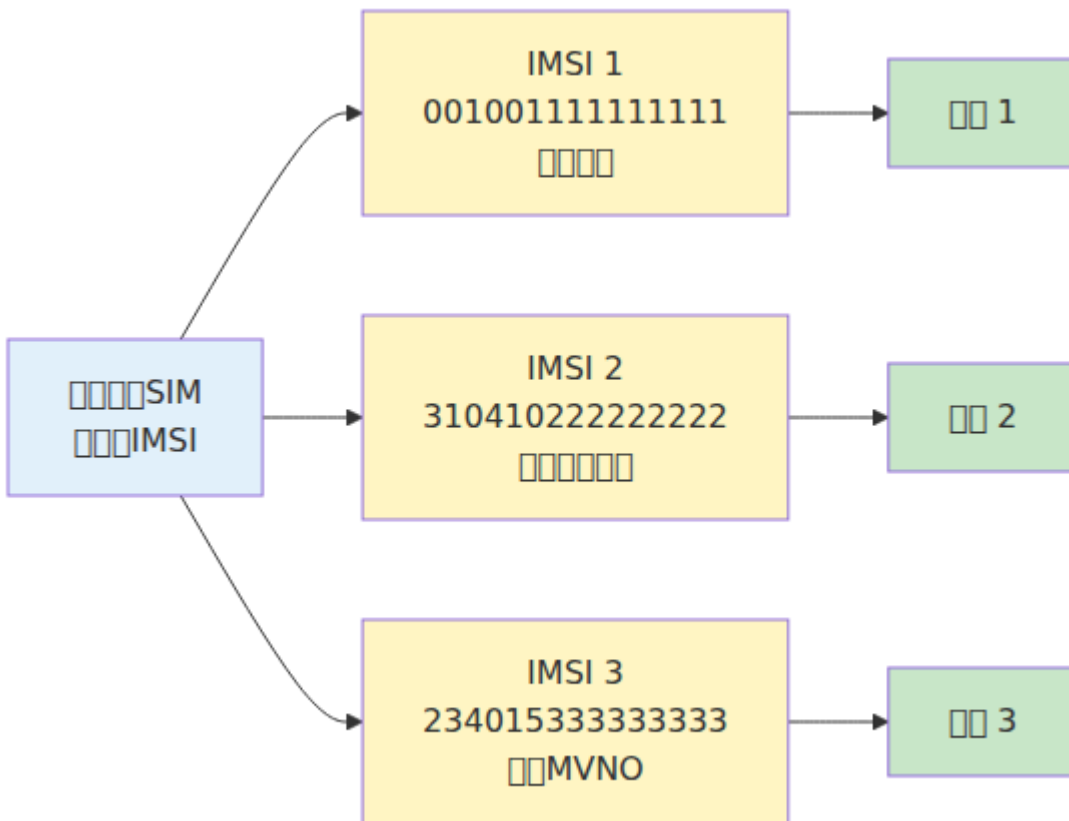
MSISDN

HSS MSISDN IMS MSISDN IMS

MSISDN

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

MSISDN

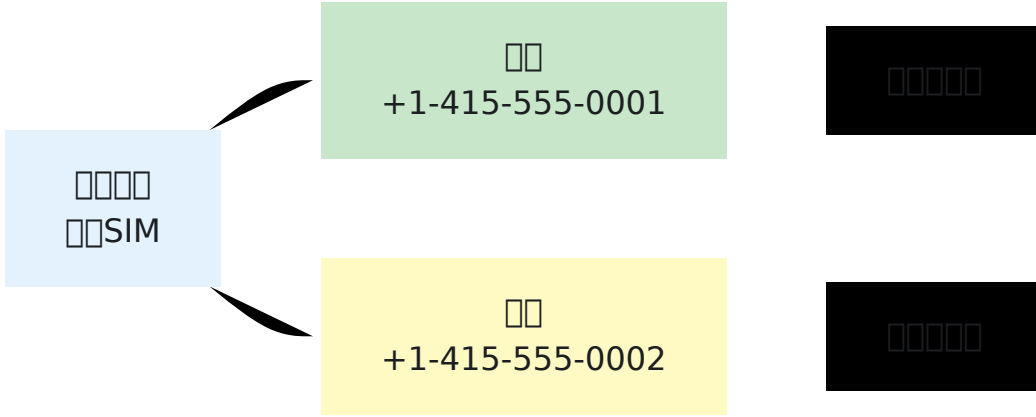


MSISDN MSISDN

□□□□

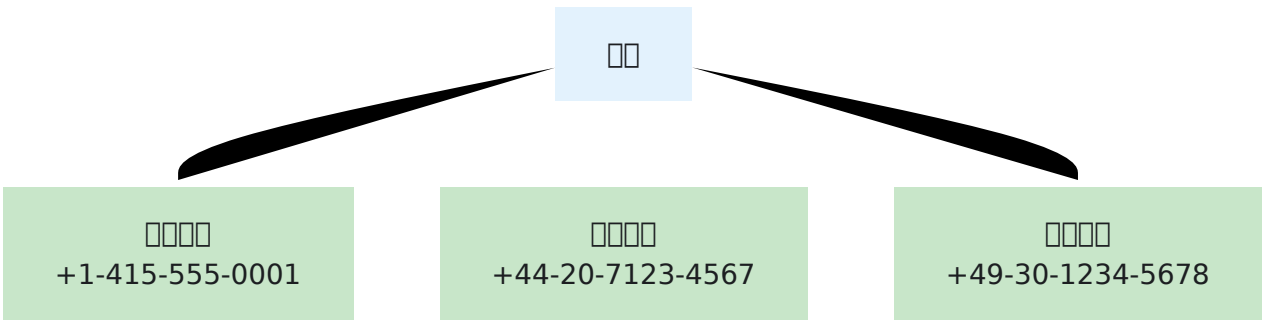
### 1. □□□□□□

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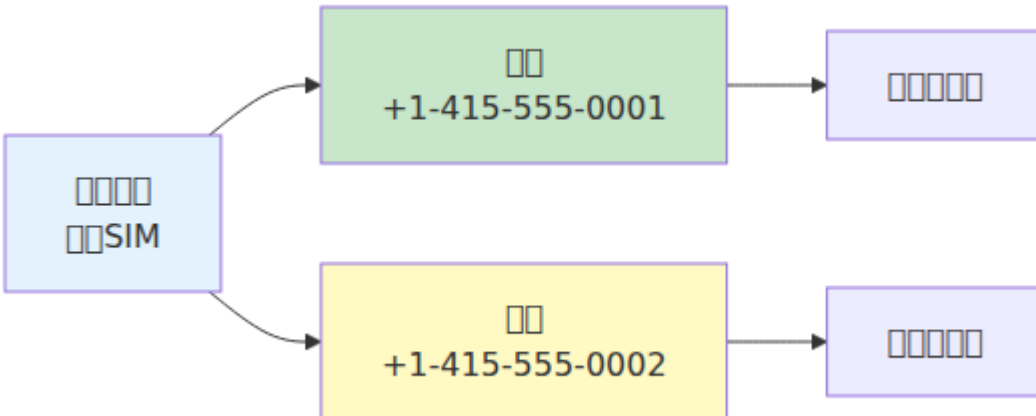
### 2. □□□□

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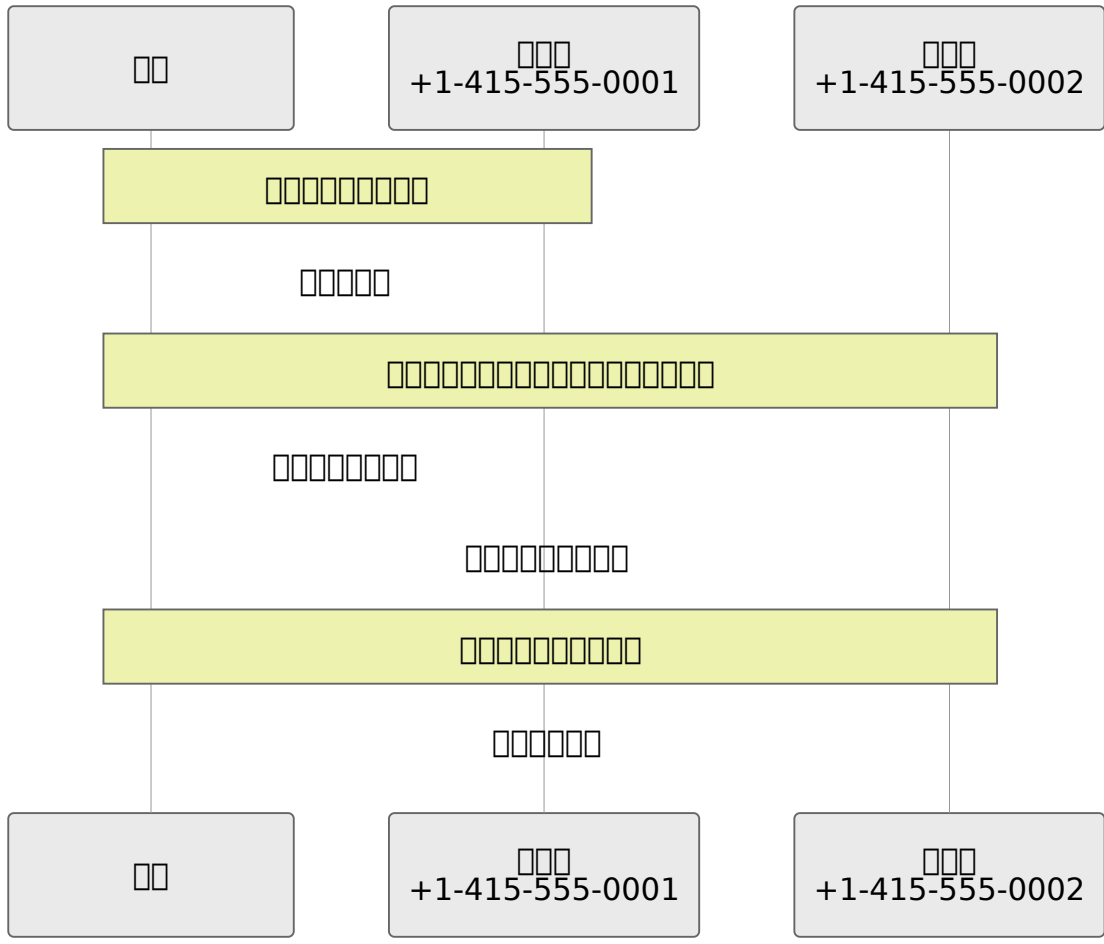
### 3. □□□□

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OmniHSS SIM/IMSI MSISDN

4.



MSISDN

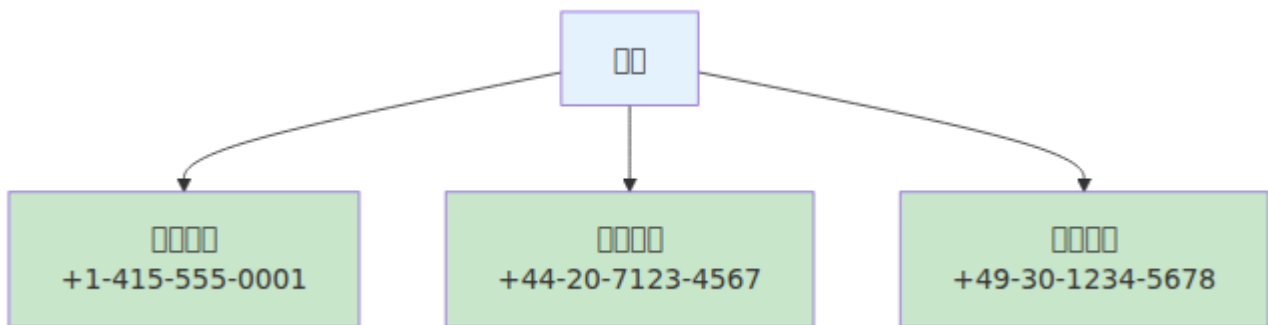
MSISDN

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

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

## MSISDN

1. IMSI ID
2. MSISDN ID
3. subscriber\_id msisdn\_id



MSISDN

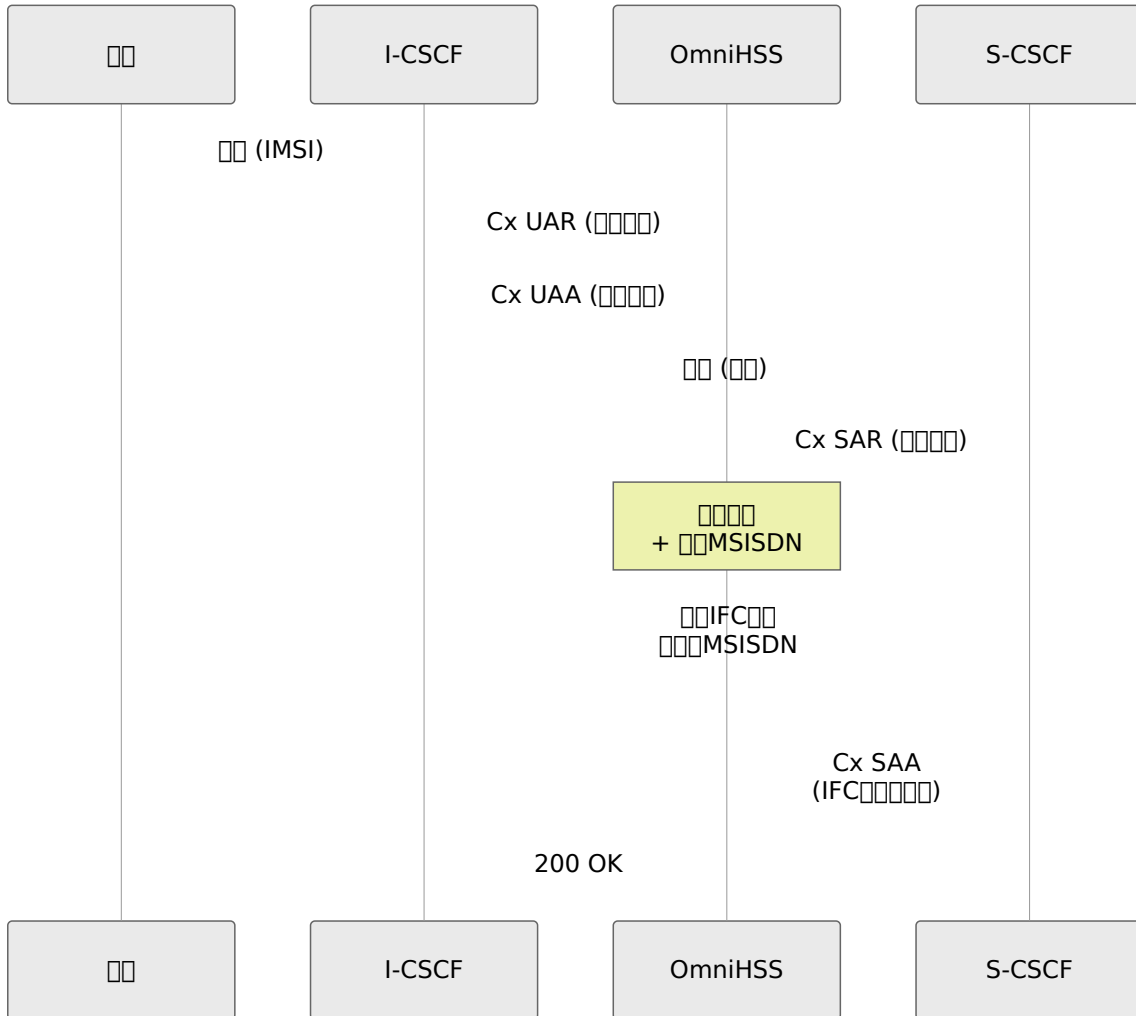
- 
- msisdn
-

□□□□□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>

```

□□□□

- `{{msisdns}}` - □□□□□□□□MSISDN□□□

□□□□

□□MSISDN□□□□□□□□IMS□□□□□□



□□□□□□

□□□□□□□□□□IMS□□□□□□□□□□SIP URI□



- 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) 格式 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) 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
```

國際行動電話號碼(MSISDN) 格式 API 格式

格式

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

格式

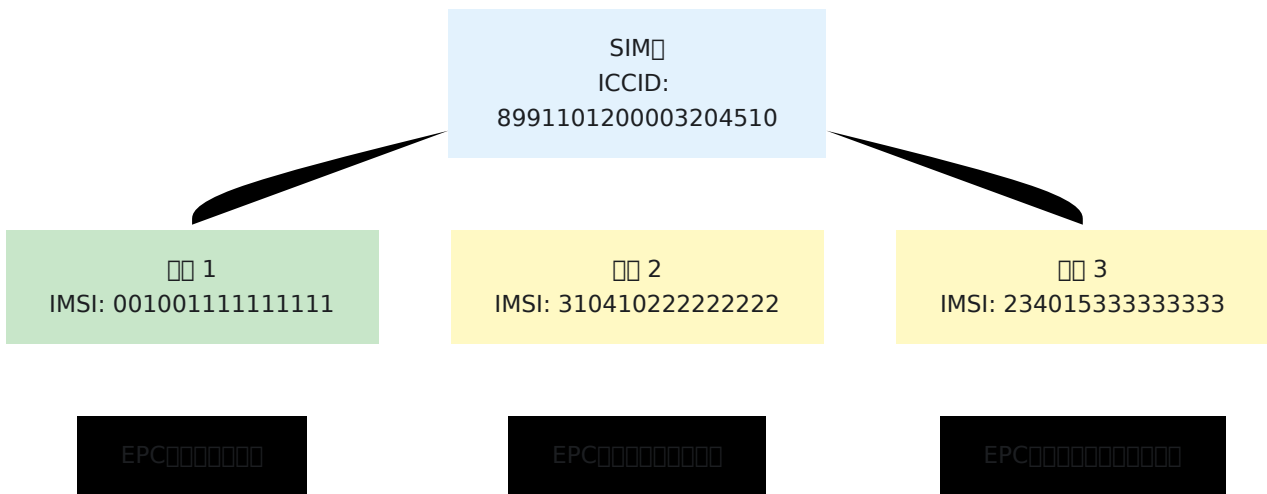
國際行動電話號碼(MSISDN) 格式 API 格式





# OmniHSS

OmniHSS IMSI SIM IMSI SIM



1. 1. 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. 4. 4.

- 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": "001001111111111",
 "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": "111111111111111...", "opc": "2222222222..."}}' \
 | jq -r '.data.id')

5. IMSI 2 subscriber
curl -k -X POST https://hss.example.com:8443/api/subscriber \
 -d '{"subscriber": {
 "imsi": "310410222222222",
 "sim_id": $SIM_ID,
 "key_set_id": $KEYSET2,
 "epc_profile_id": 2
 }}'

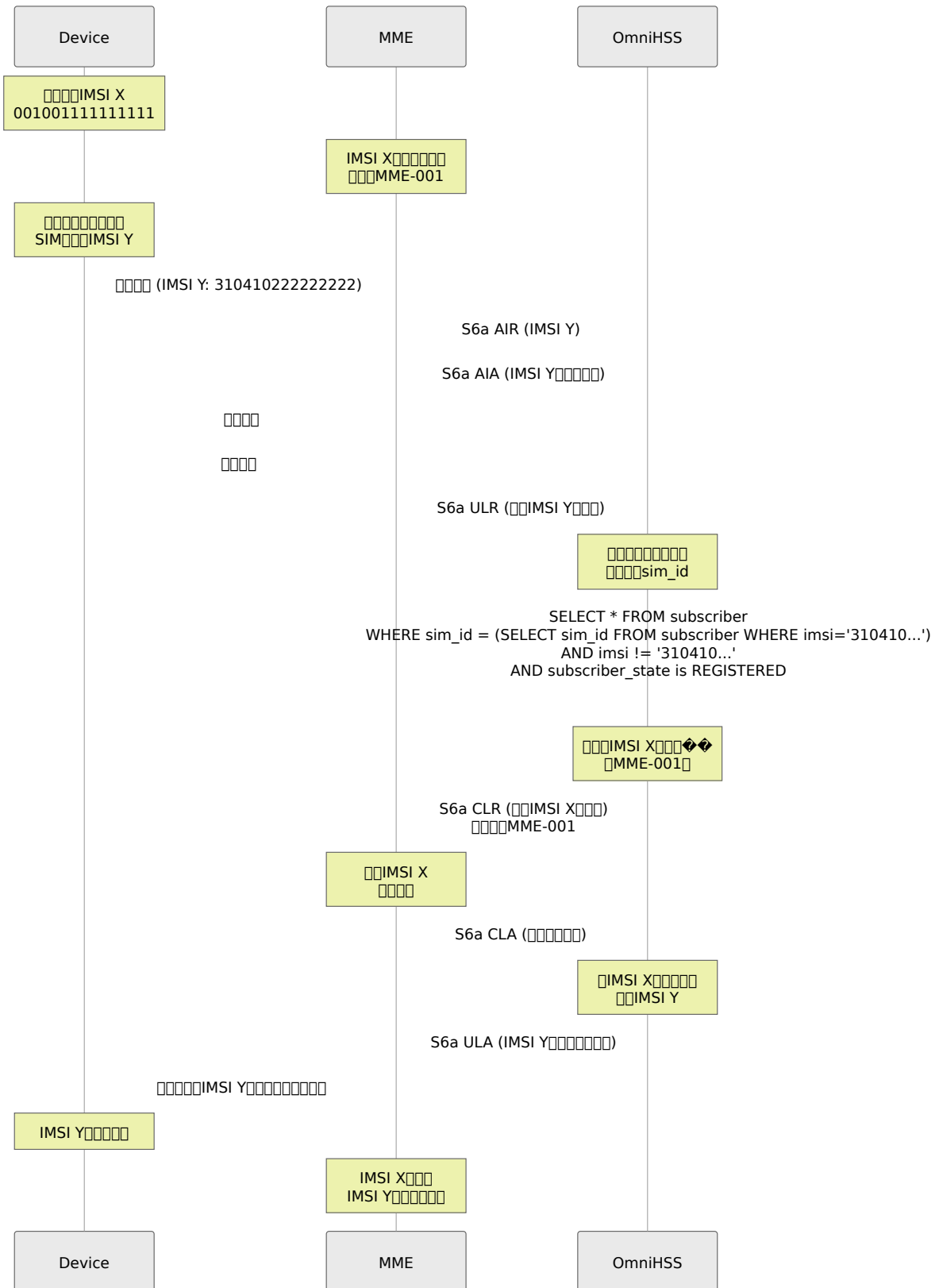
6. SIM ID from IMSI...
```



• HSS IMSI X

IMSI

IMSI



□□□□□□

□□□□□□

- □□□□□□□□SIM□□□□□□
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□□□□□□

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

□□□□□□

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

### **IMSI**□□□□□□

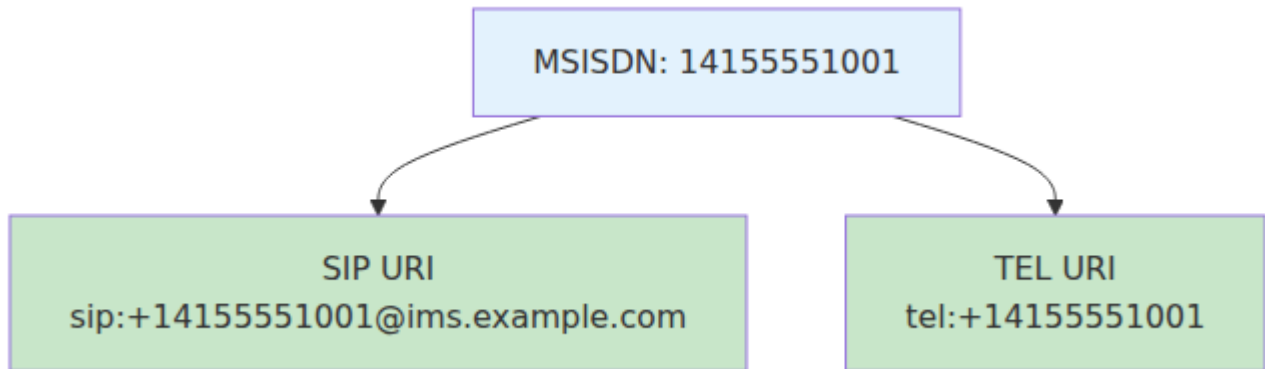
□□/SIM□□□□□□□□IMSI□□□□□□

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

- IMSI
- IMSI

## IMS

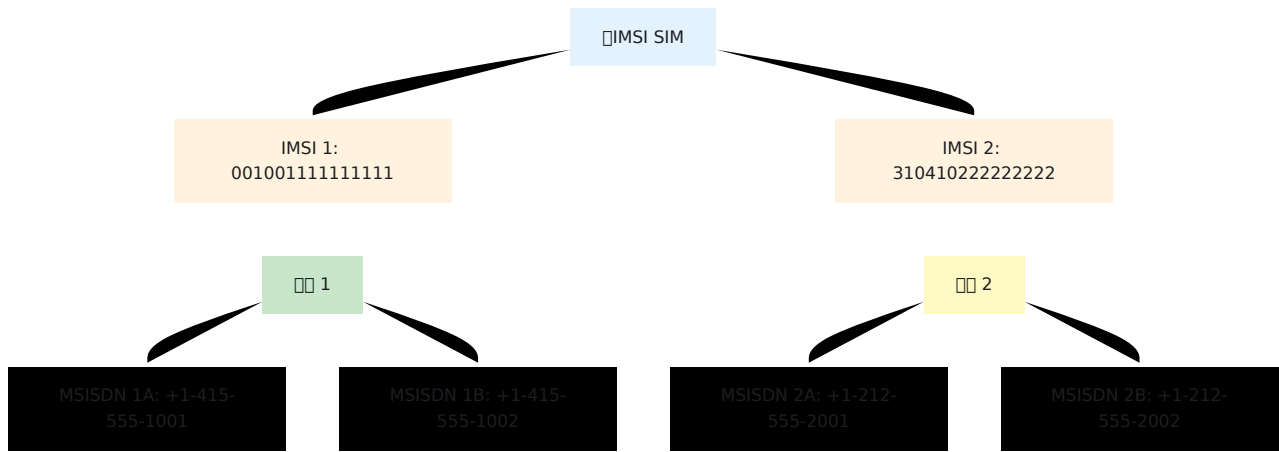
IMS



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

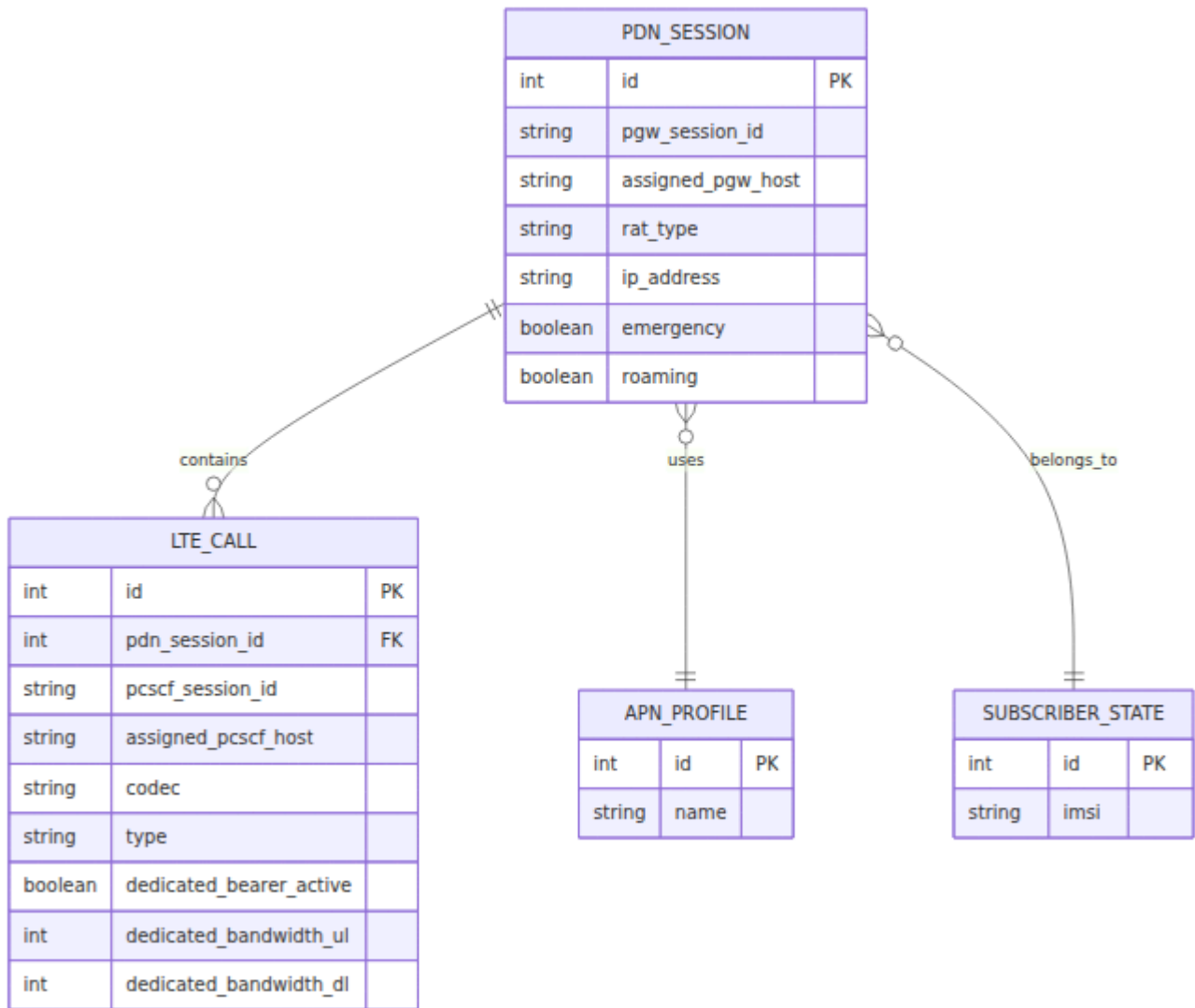
HSS PCRF PCRF LTE QoS

- **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

□□□□□

## 1. □□□□□ - □□□CCR-I□

□□□PGW □□□□□□□□ 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-Identifler": 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-Identifler": 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

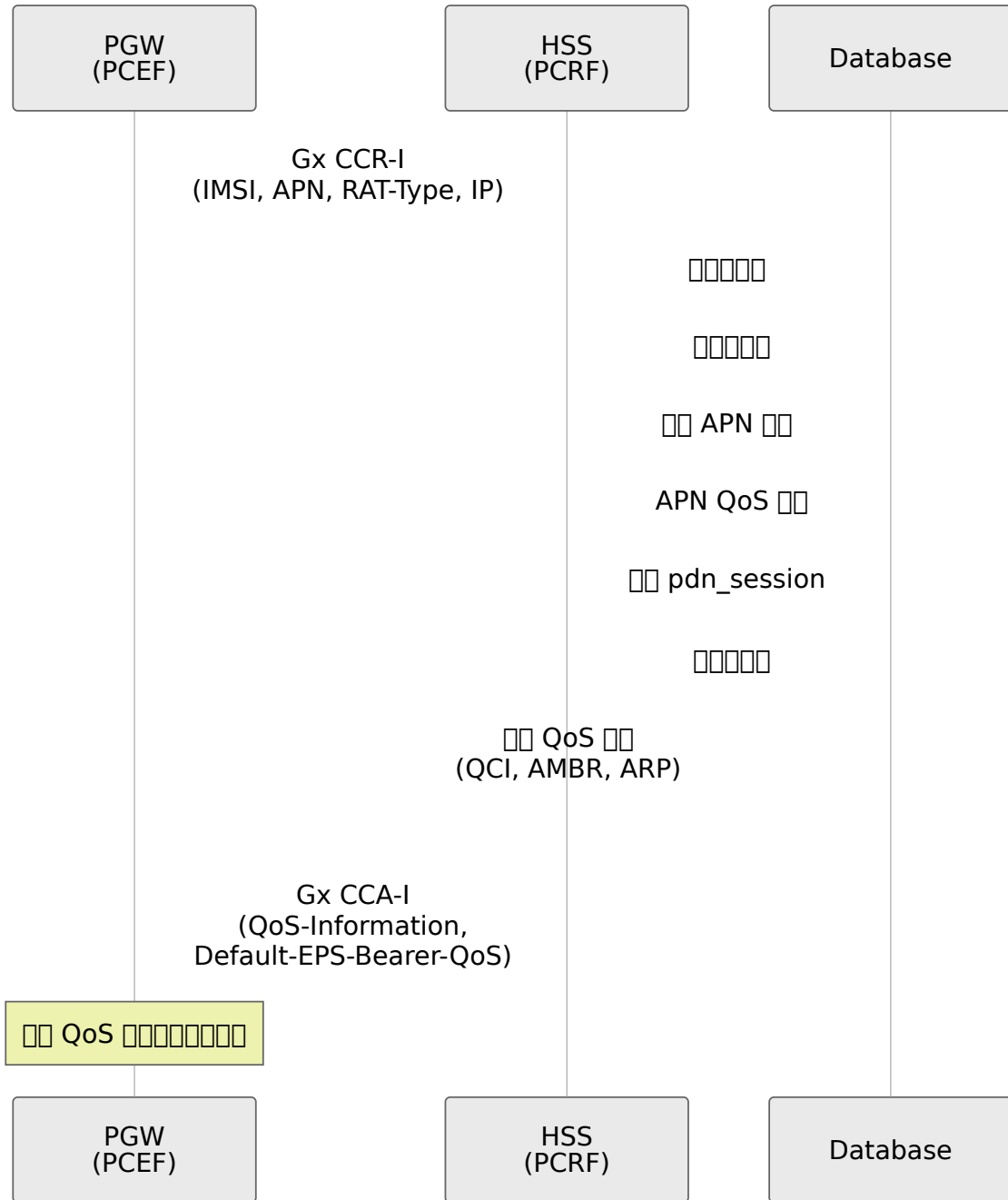
PCRF

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

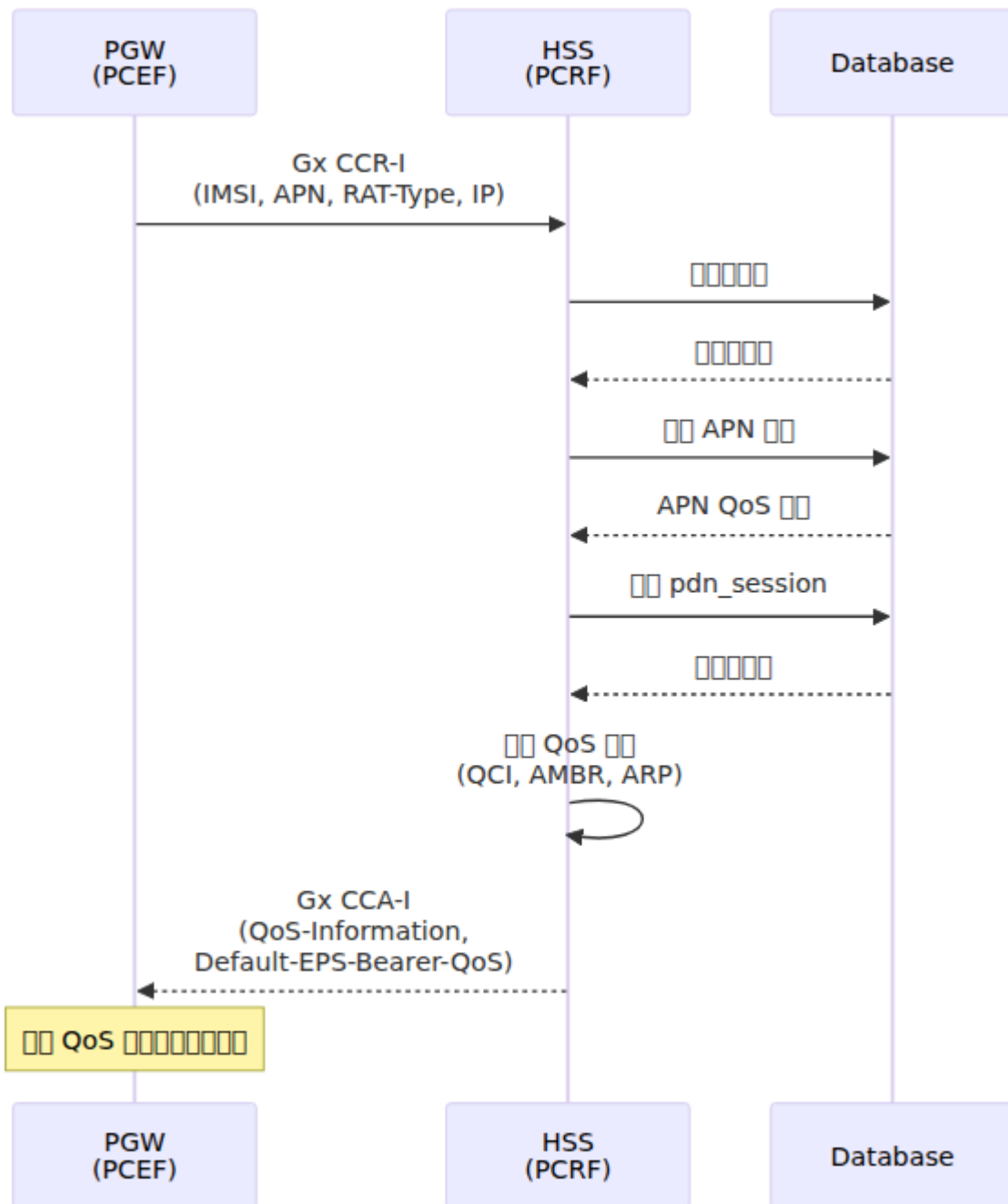
Result-Code 2001

□□□□□

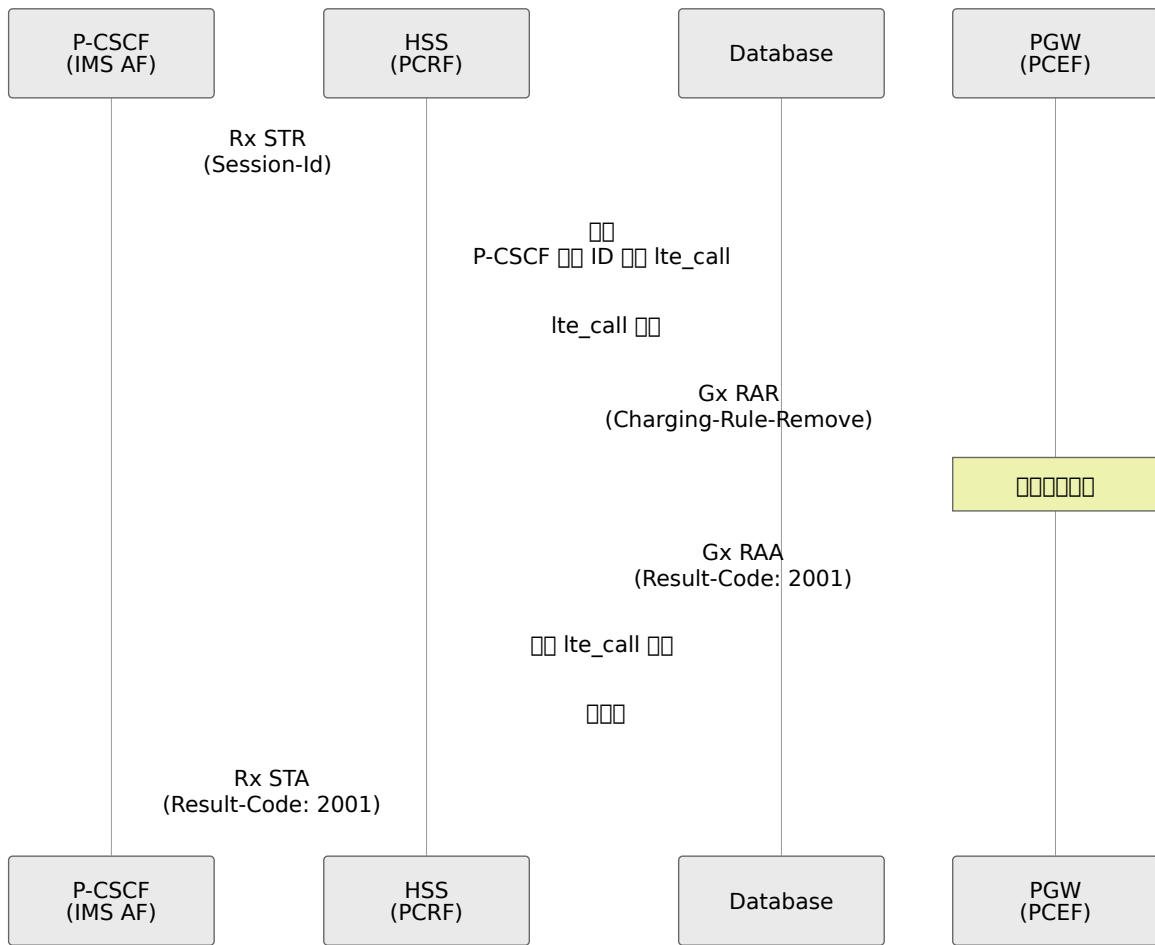
1 PDN □□□□



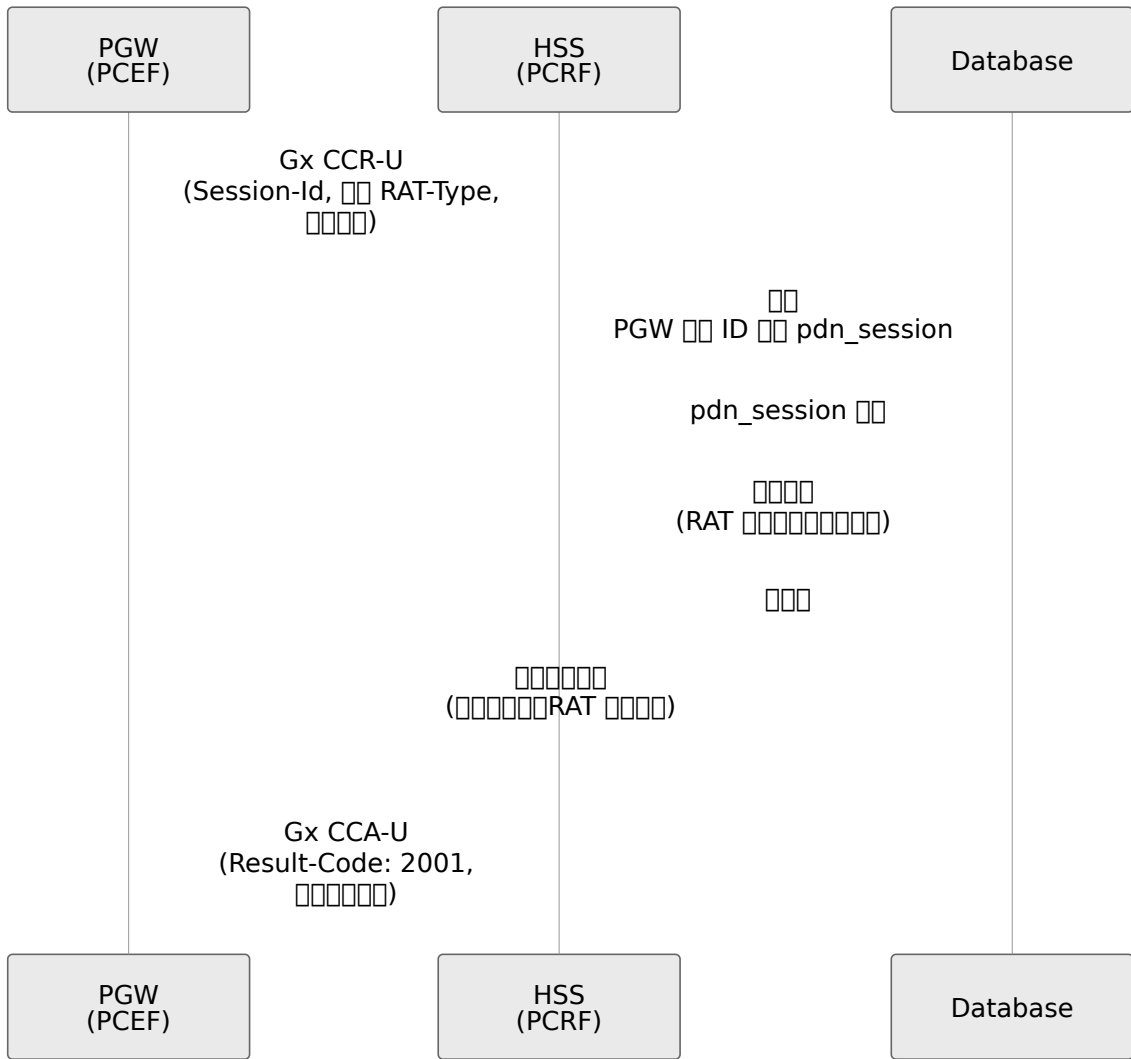
# 2 VoLTE Rx AAR → Gx RAR



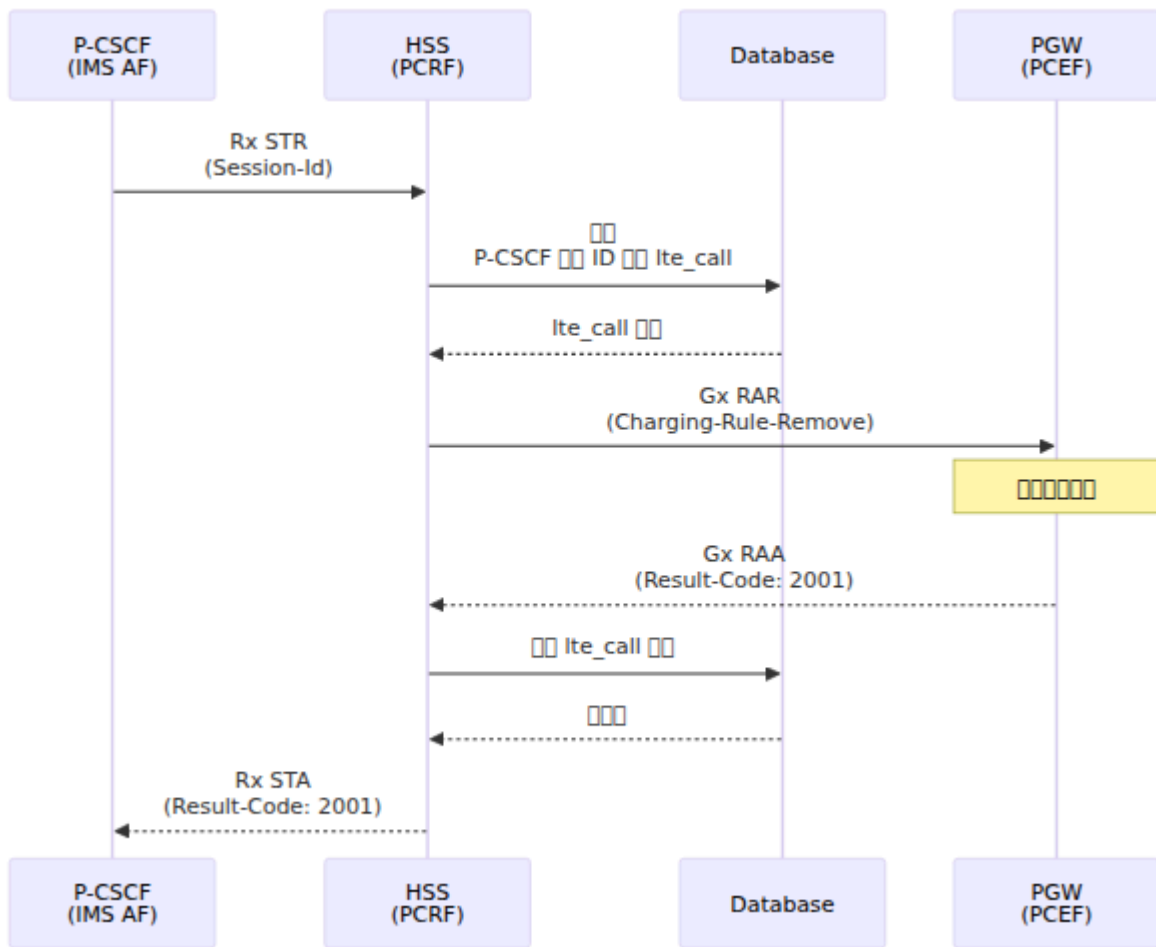
# 3 VoLTE Rx STR → Gx RAR



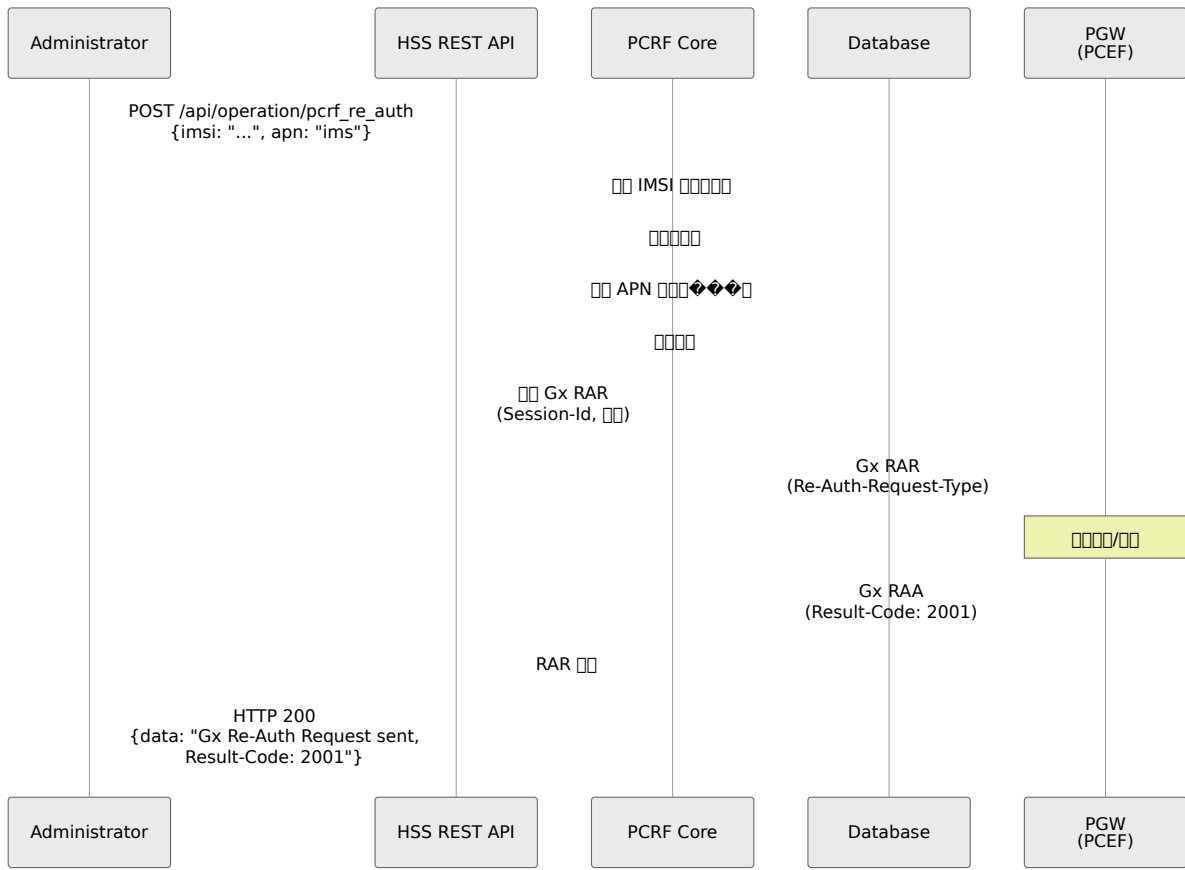
# 4G PDN



# 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 値<br>1-4 = GBR<br>5-9 = Non-GBR |
| allocation_retention_priority | integer | 1-15            | ARP 値<br>1 = 優先度最高                  |
| apn_ambr_dl_kbps              | integer | 1-4,294,967,293 | APN 最大ダウンロード速度 (kbps)               |
| apn_ambr_ul_kbps              | integer | 1-4,294,967,293 | APN 最大アップロード速度 (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 値

- 1 - VoLTE - GBR 100ms レイテンシー
- 2 - GBR 150ms レイテンシー
- 5 - IMS 音声 - Non-GBR 100ms レイテンシー
- 9 - Non-GBR 300ms レイテンシー

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



□□□□□

- □□□□□ APN □□□□□ APN □□□□□ QoS □□
- □□□□□□□□□□□□□□□□ APN □□

□□□□□

□□□□□□□□□ **100 Mbps** / □□ **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
 }
}
```

□□□□□□□□□ **500 Mbps** / □□ **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
 }
}
```

□□□□/□□□□□□□□□□□□□□□□

```
{
 "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



# □□□□

- 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

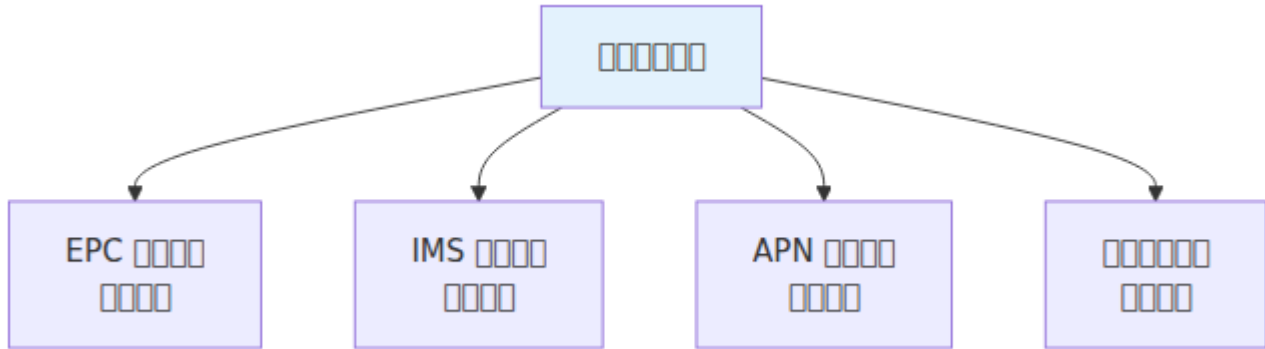
```
<ServiceProfile>
 <PublicIdentity>
 <Identity>sip:
{{imsi}}@ims.mnc{{mnc}}.mcc{{mcc}}.3gppnetwork.org</Identity>
 </PublicIdentity>
 <InitialFilterCriteria>
 <Priority>0</Priority>
 <TriggerPoint>
 <ConditionTypeCNF>0</ConditionTypeCNF>
 <SPT>
 <ConditionNegated>0</ConditionNegated>
 <Group>0</Group>
 <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 📡

---

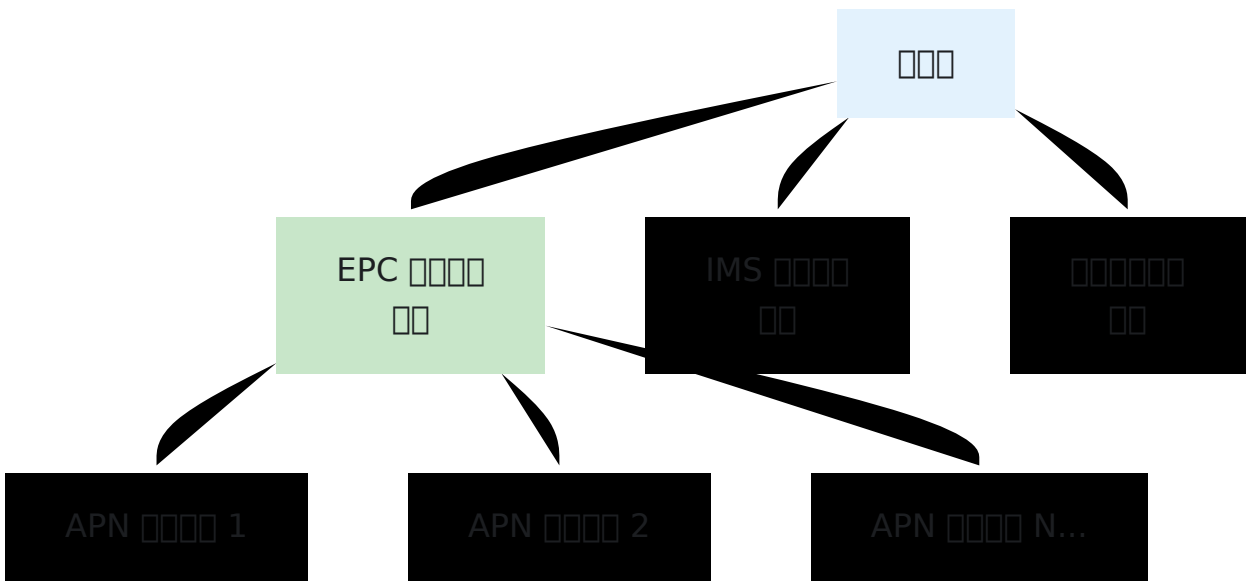
□□□□□□

□□□ □□□□□ □□□□□□

---

□□□□□□

□□□□□□□□



## 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 - IMS profile
2. Create subscriber - EPC profile
3. Update subscriber - EPC profile
4. Create subscriber - IMS profile

# Network Architecture

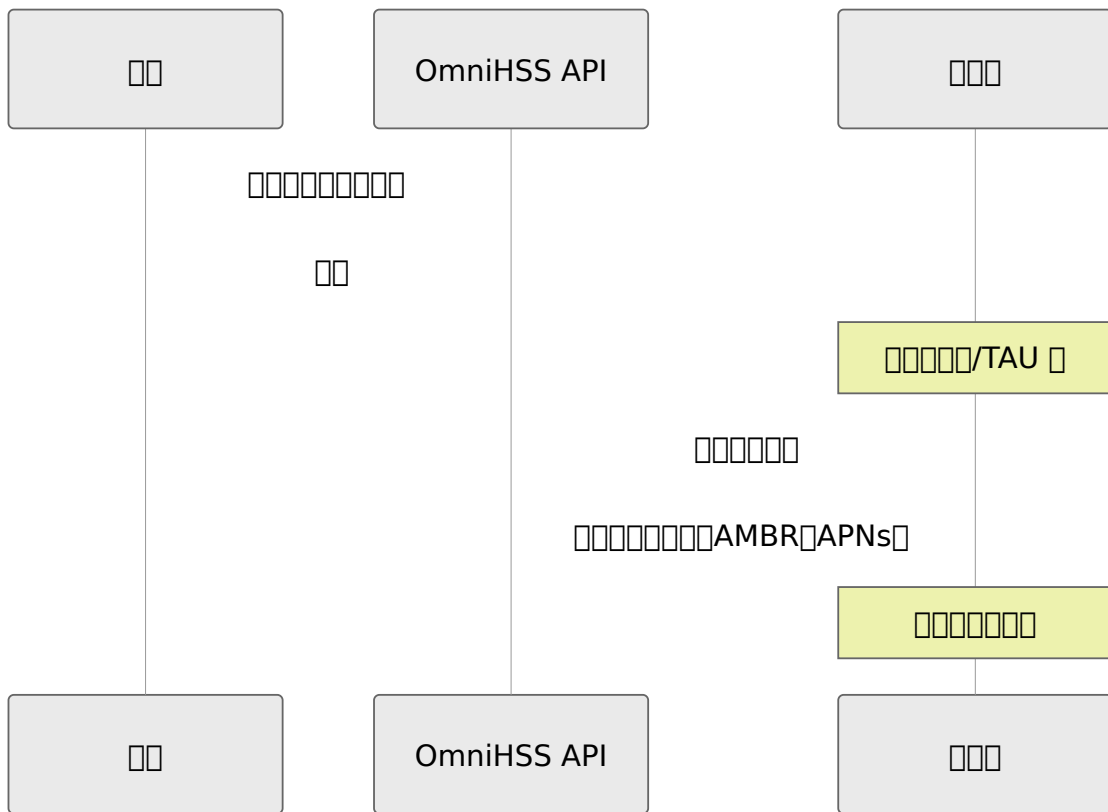
[Network] - [Core] - [Edge]

Network:

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

# Core Network

## Network Architecture



Network: Network Architecture


- Network/TAU
- Network
- IMS Network IMS Network

## □□□□□□□□□□

□□□□□□□□□□:

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

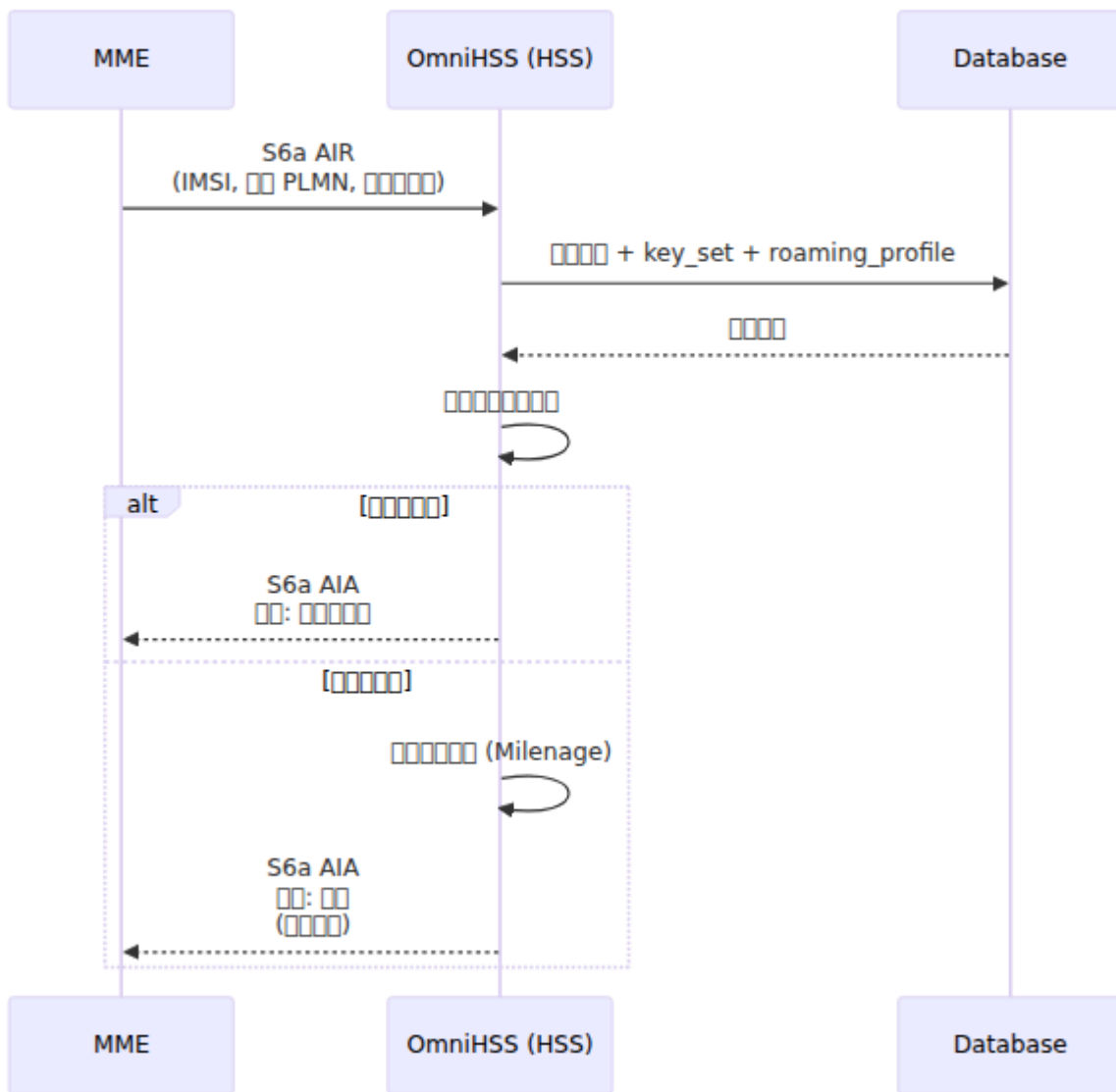
**IMS** □□□□:

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

**APN** □□□:

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



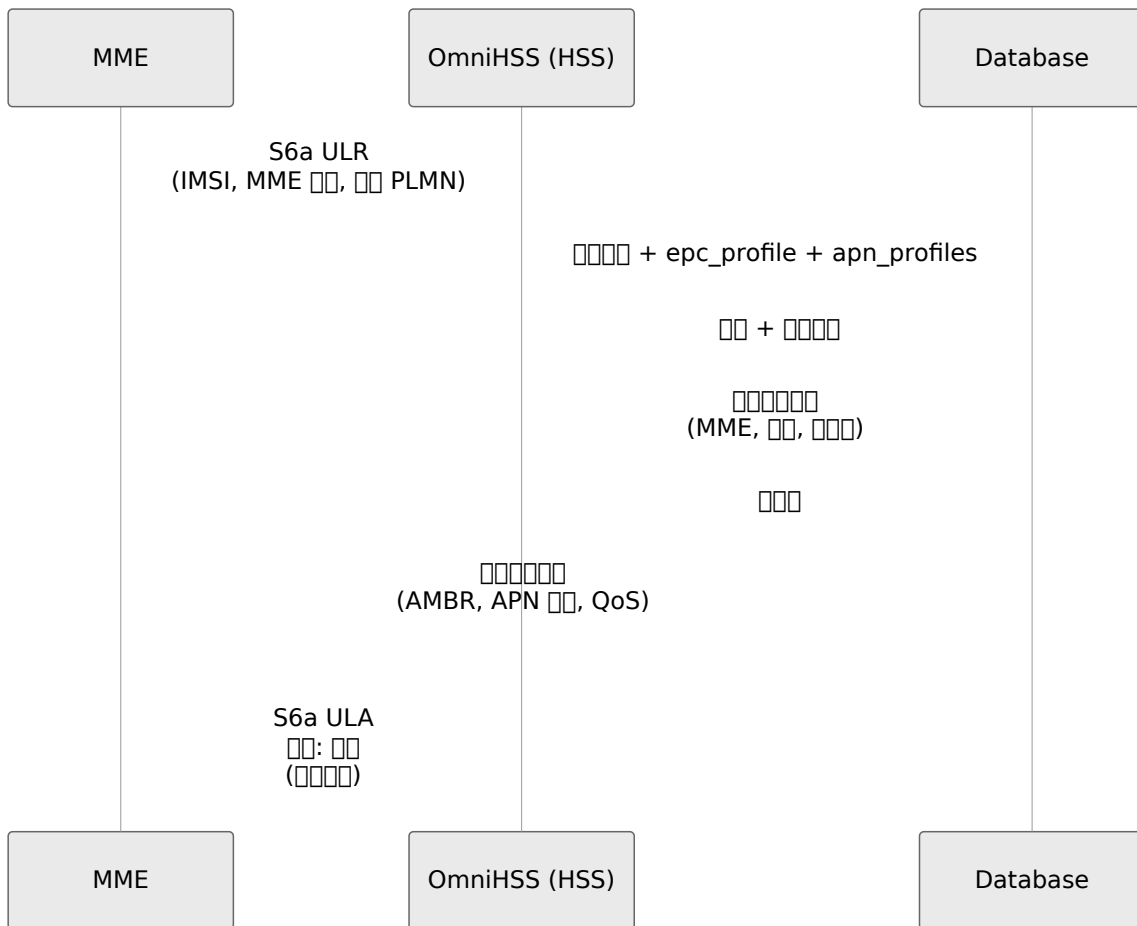


**AVP:**

- **IMSI:** IMSI, PLMN-Id, ...
- **Key Set:** RAND, AUTN, XRES, KASME

**ULR/ULA**

MME ↔ HSS ...

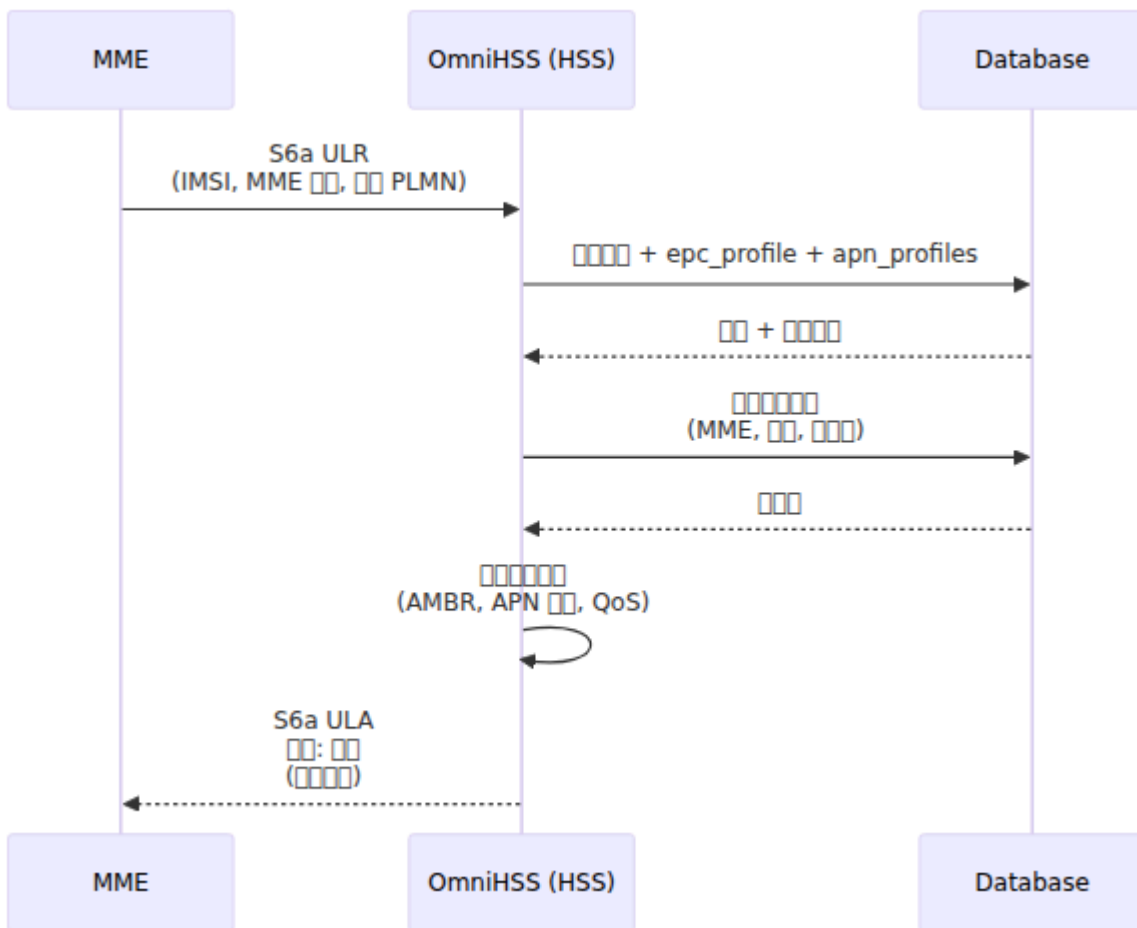


**AVP:**

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

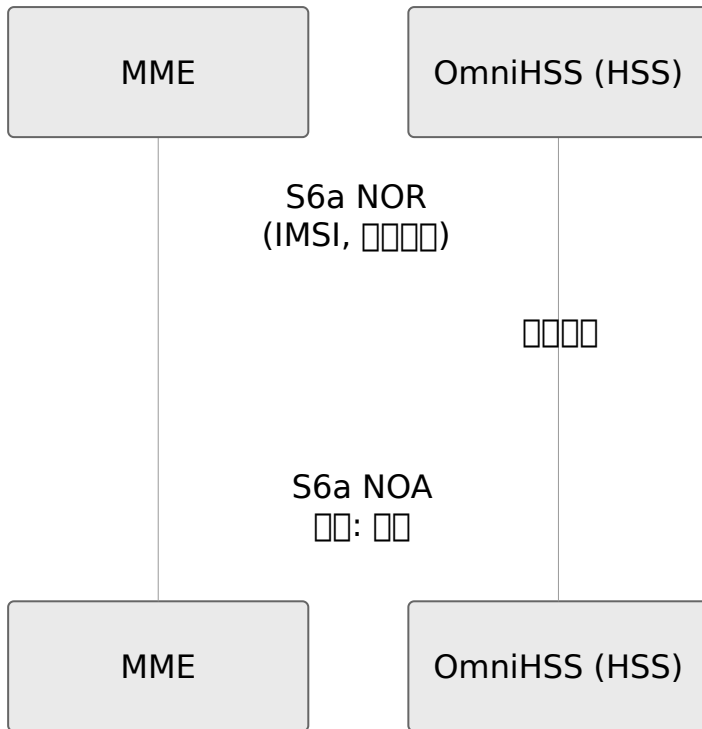
**UE ID (PUR/PUA)**

MME ID HSS ID



## Sequence (NOR/NOA)

MME ID HSS ID

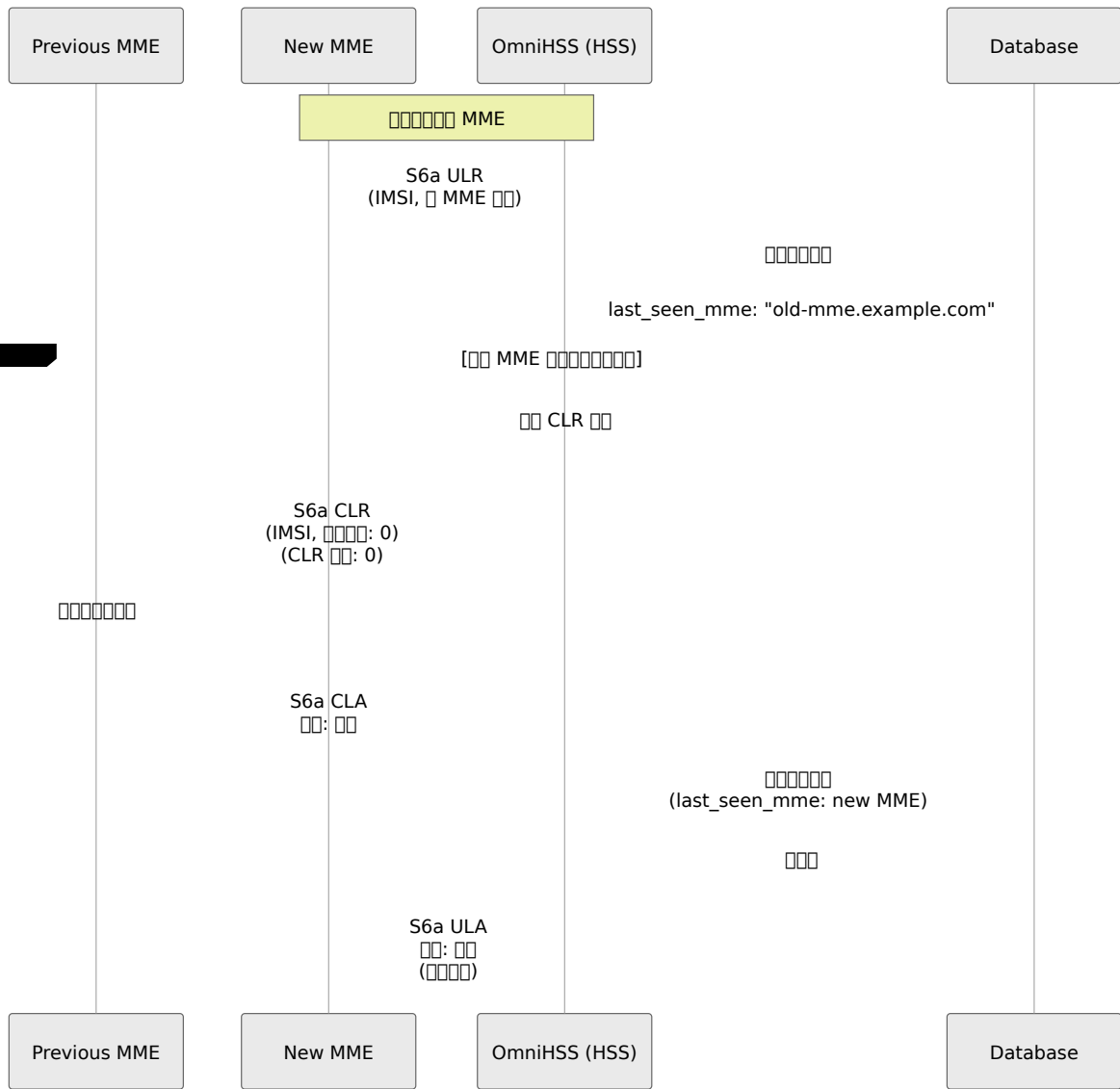


## □□□□□□ (CLR/CLA)

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

### □□ CLR (MME □□)

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

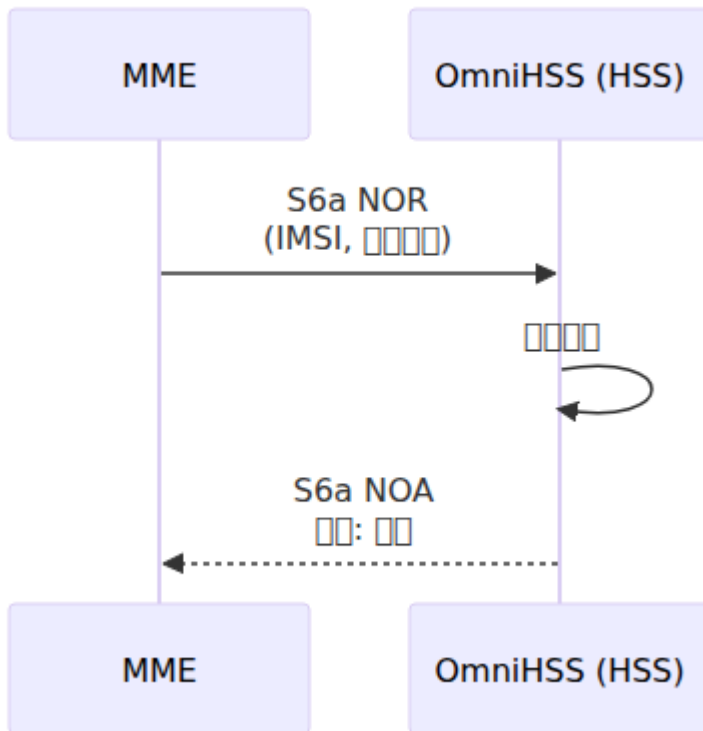


**AVP (CLR):**

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

**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
}
```

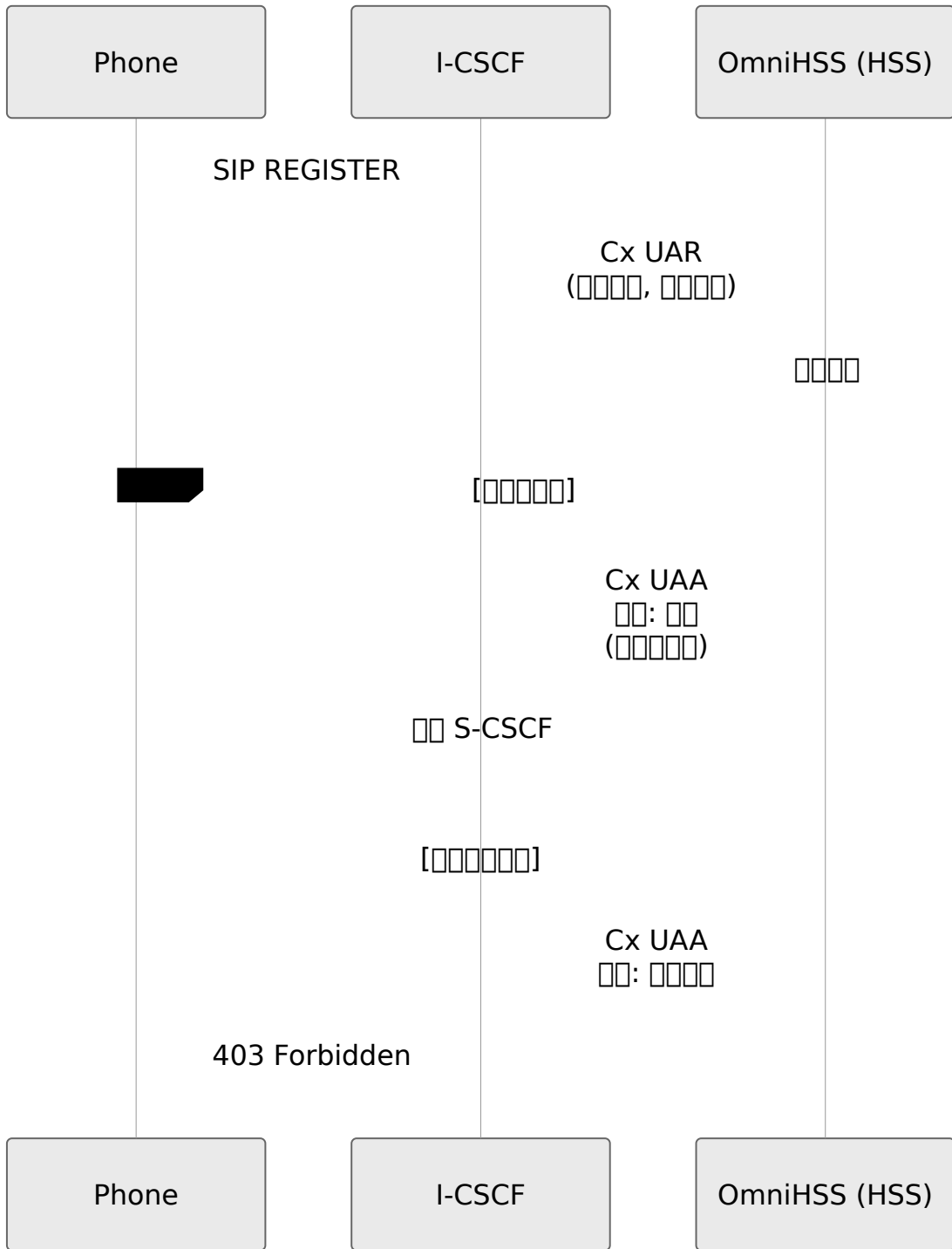
## IMSI Code

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

Code 1: Code MSISDN Code IMSI

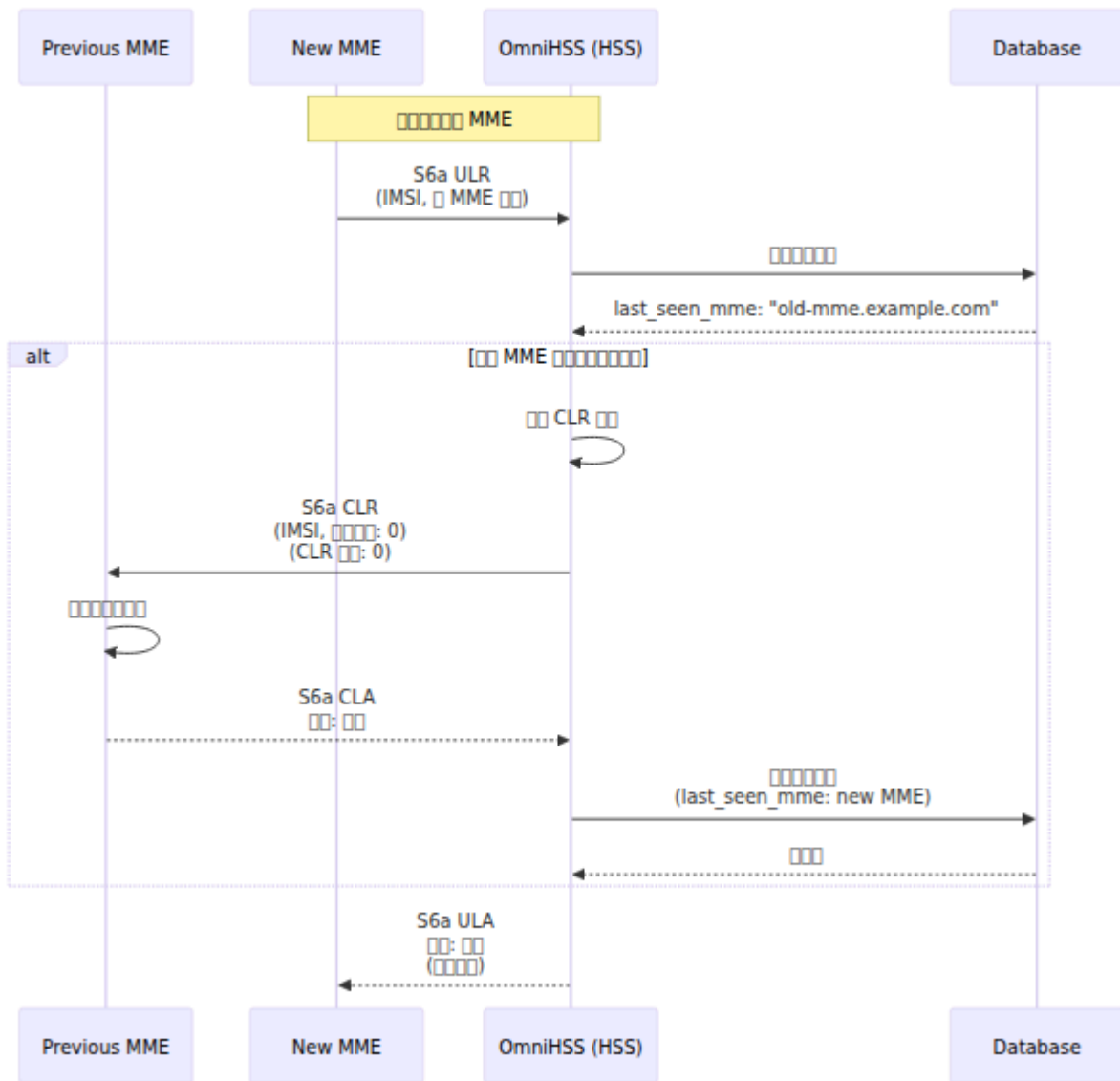






□□□□□□□□ (**SAR/SAA**)

S-CSCF □□/□□□□□□□□ IMS □□□□□□

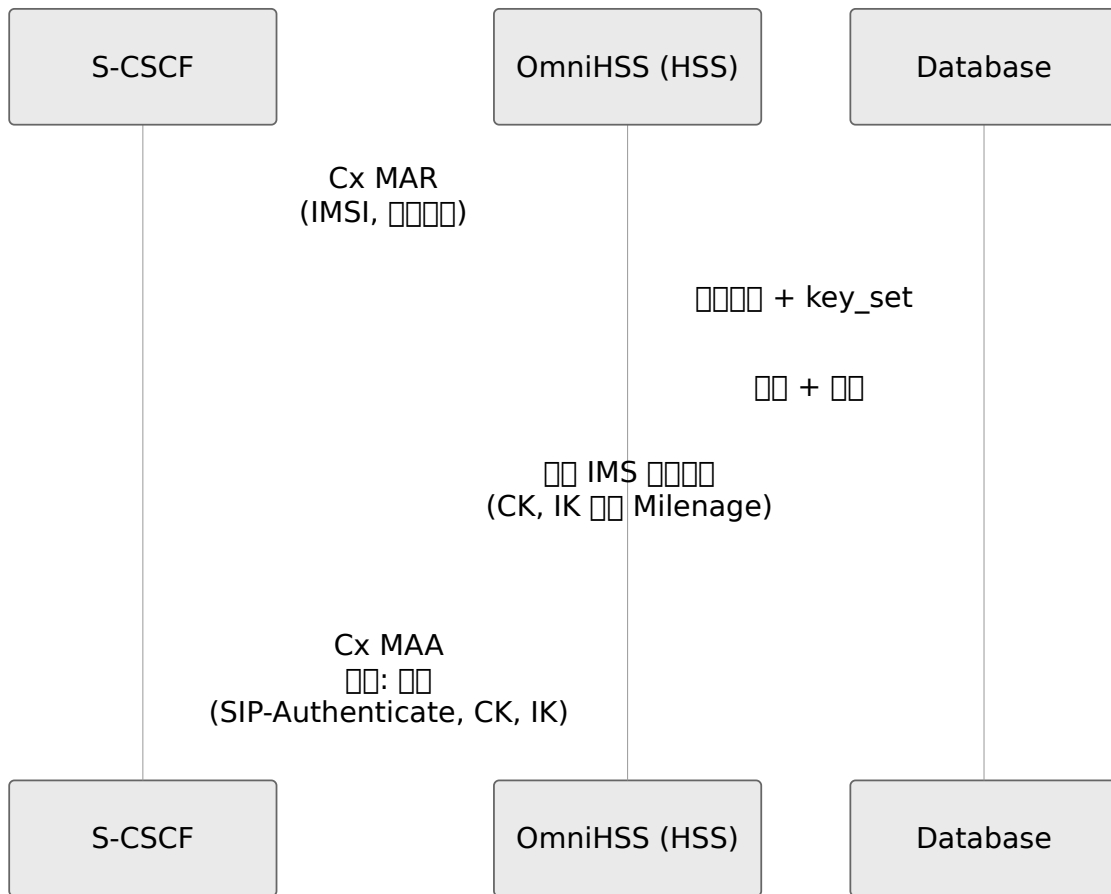


**IFC :**

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

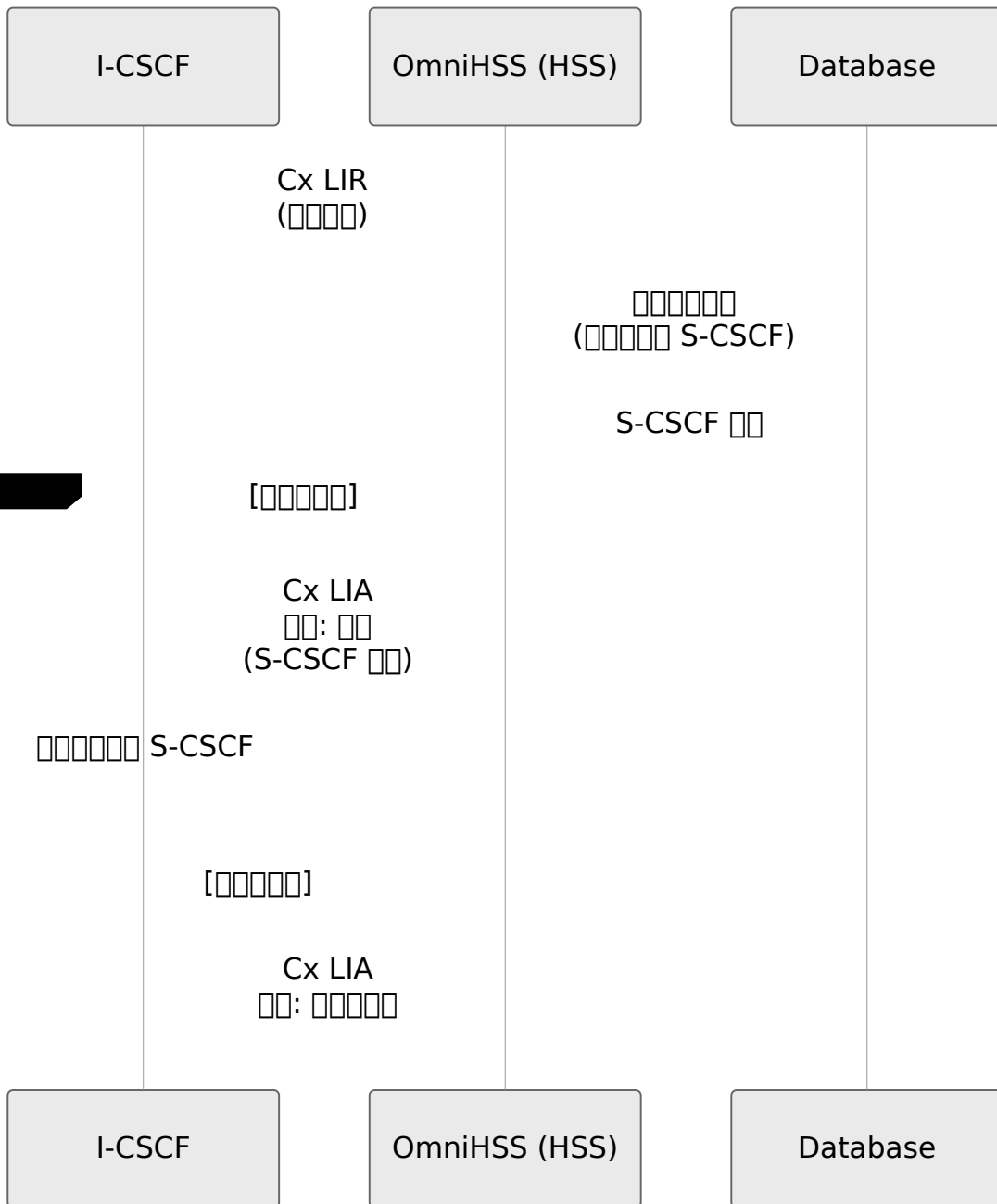
**(MAR/MAA)**

S-CSCF IMS



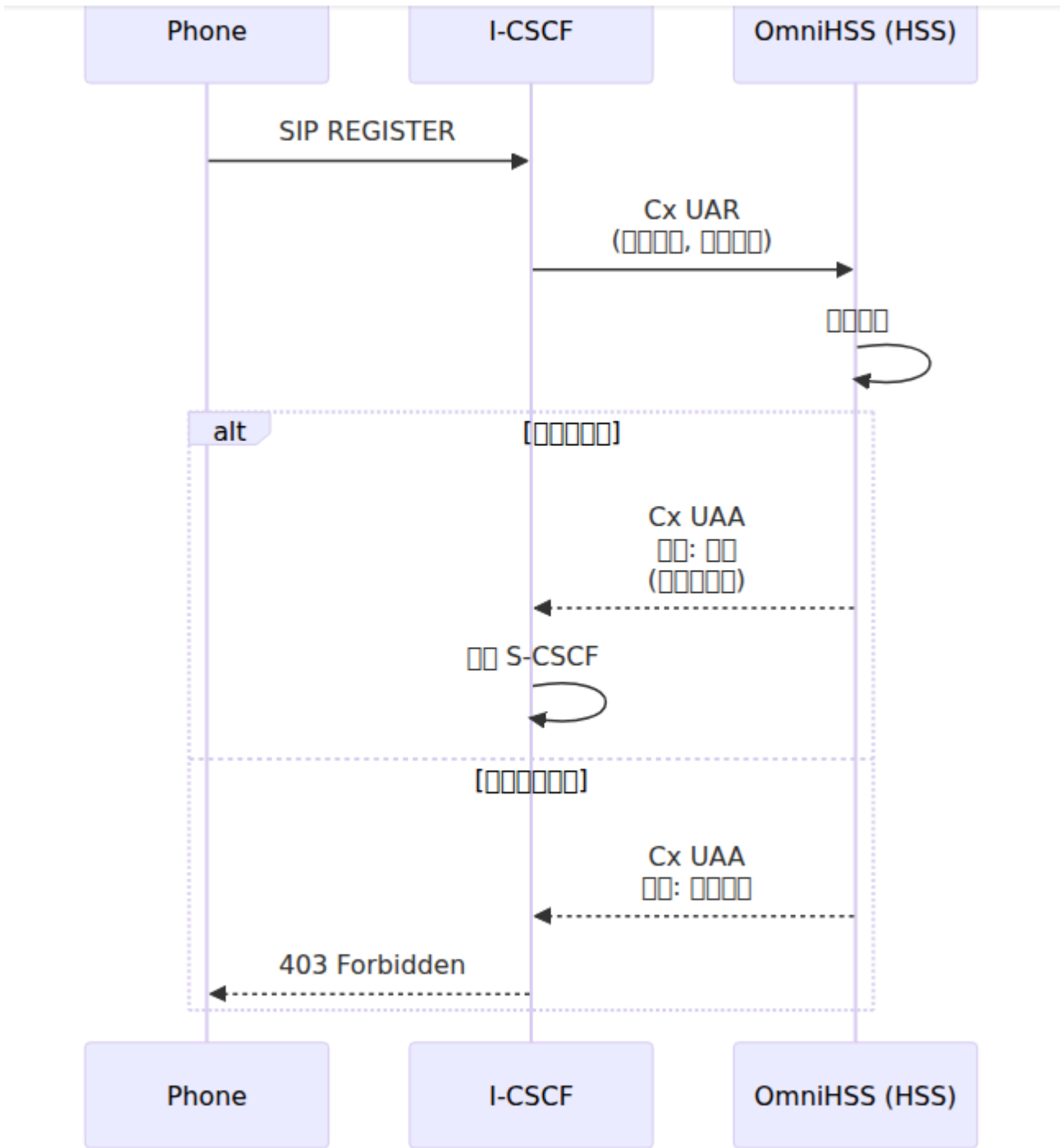
## IMS (LIR/LIA)

I-CSCF sends S-CSCF IMS



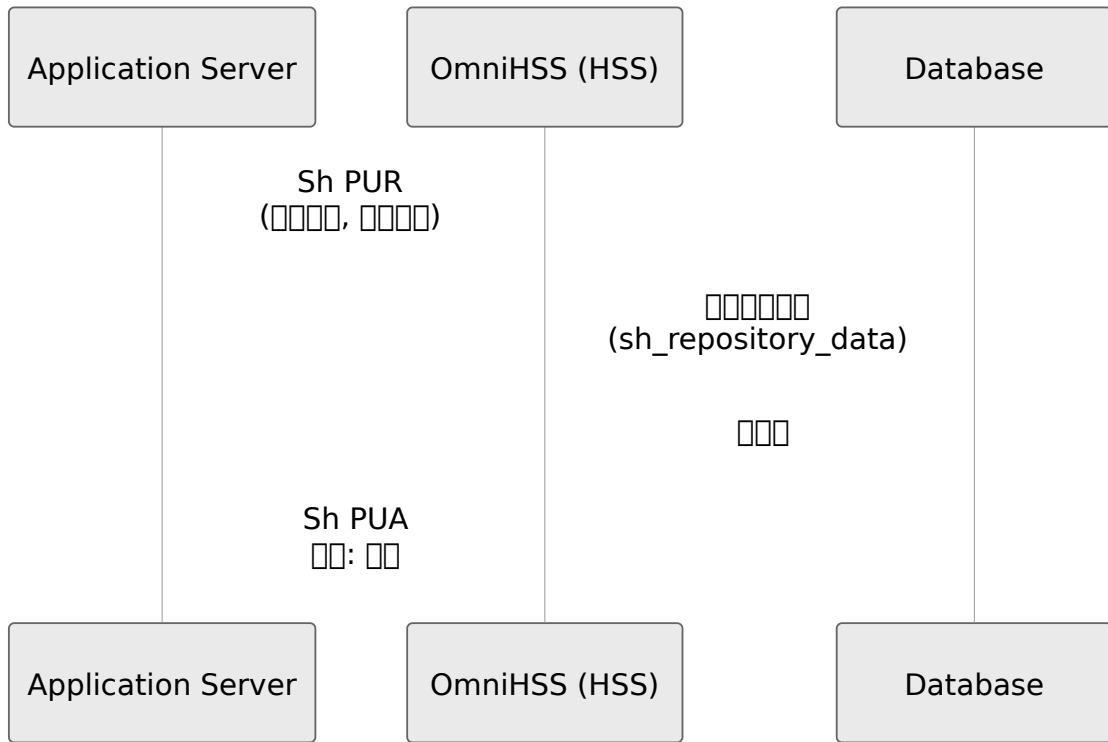
## Sh (IMS )

### (UDR/UDA)

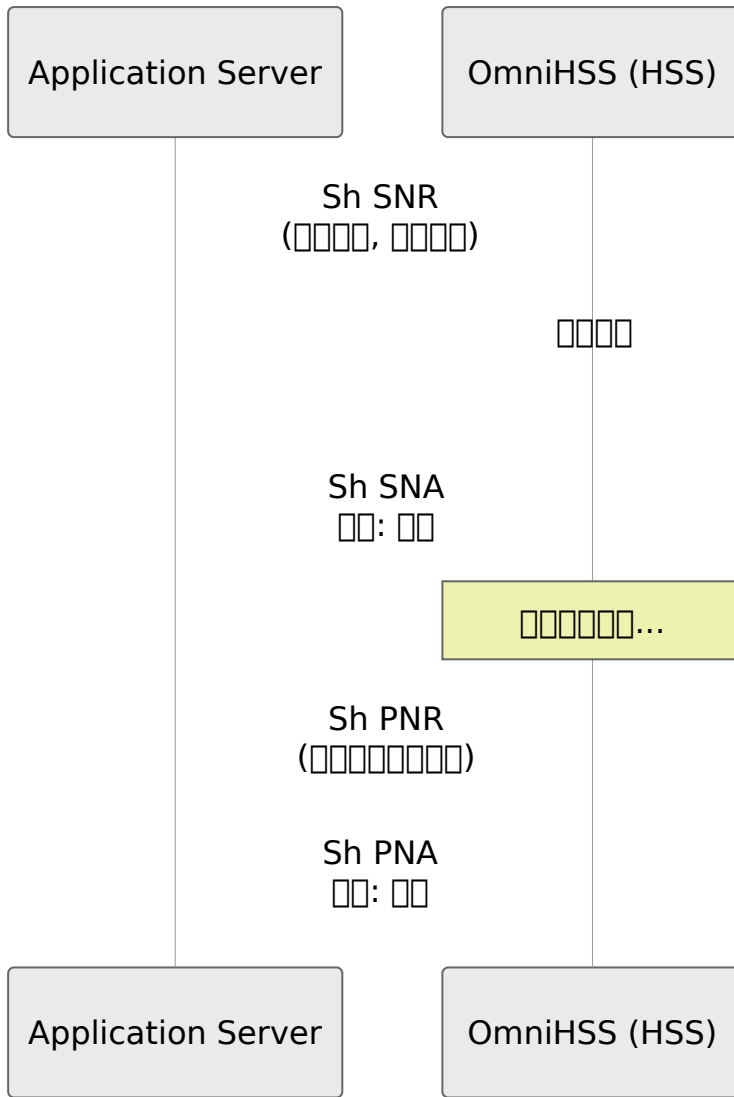


**□□□□□□□□ (PUR/PUA)**

□□□□□□□□□□□□□□□□



## (SNR/SNA)



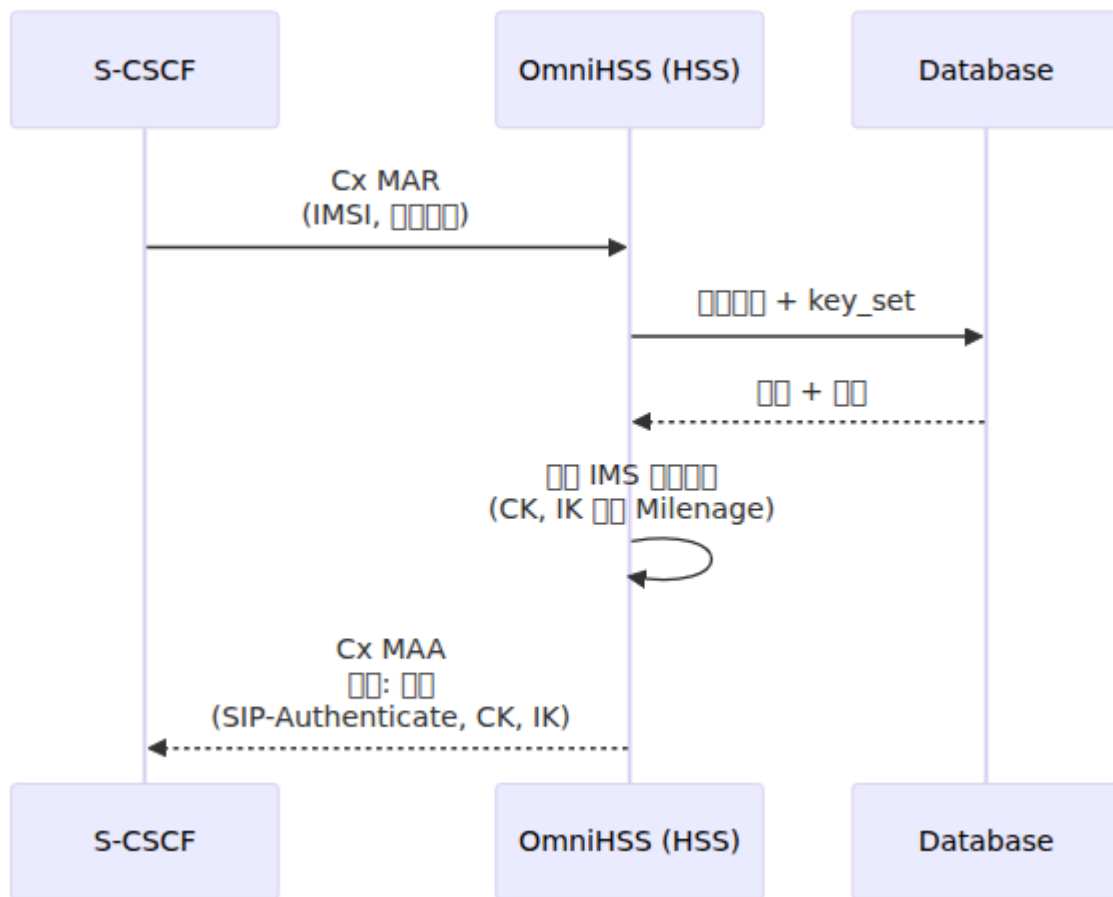
## Gx □□ (□□□□)

OmniHSS □□ Gx □□□□ PCRF□□□□□□□□□□□□

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

## □□□□□□ - □□ (CCR-I/CCA-I)

P-GW □□□ PDN □□□□□□□□□□□□

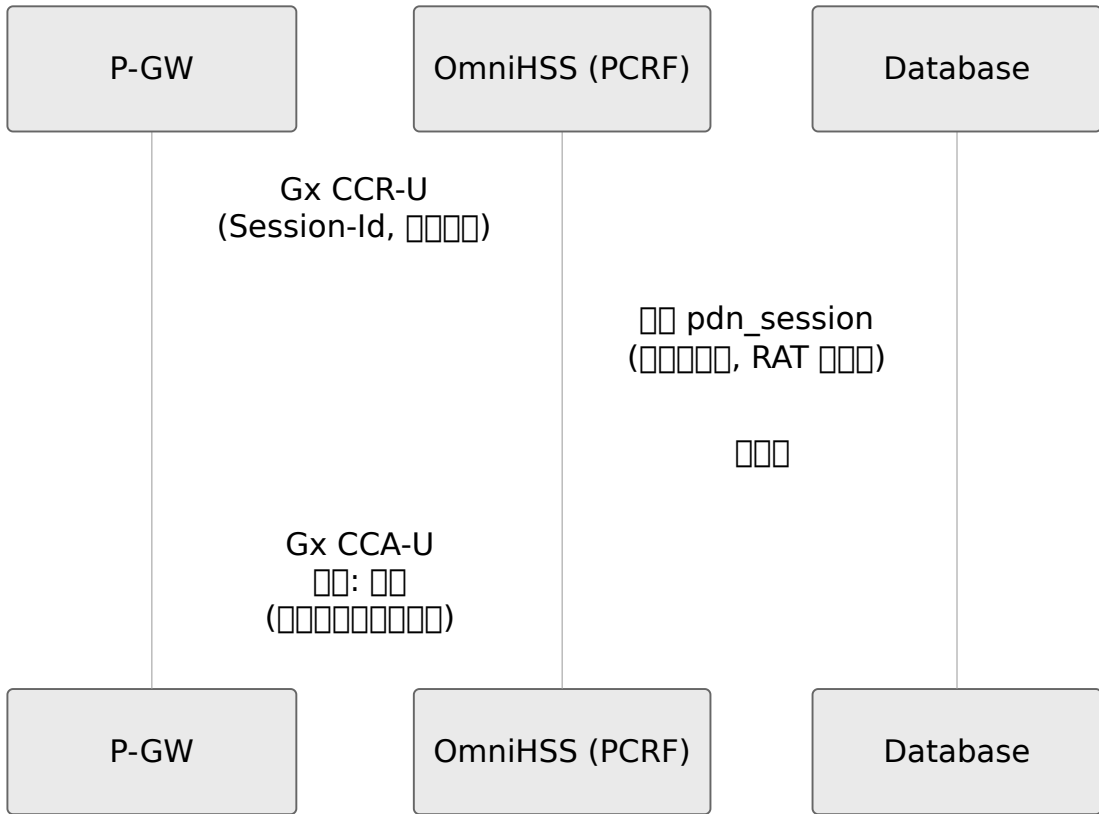


### AVP:

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

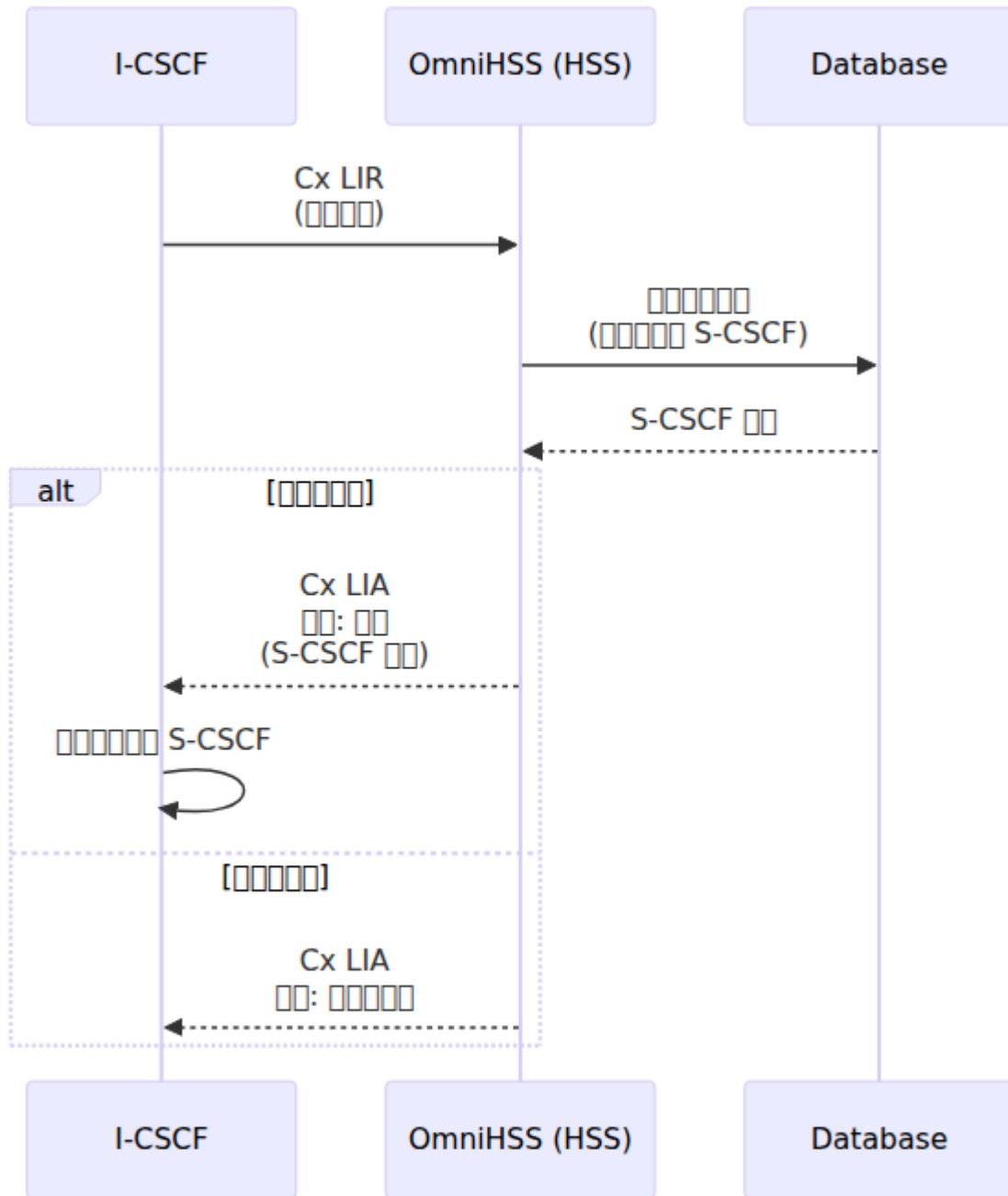
### Authentication - CCR-U/CCA-U

P-GW authentication



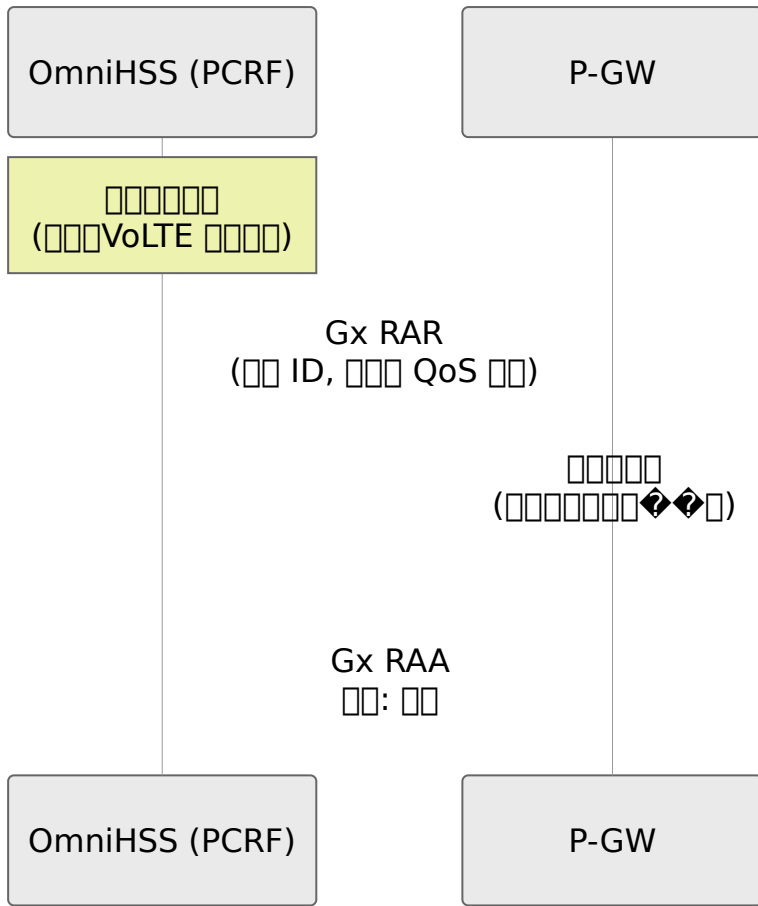
## PDN Selection - P-GW (CCR-T/CCA-T)

P-GW PDN Selection



## □□□□□□ (RAR/RAA)

OmniHSS (PCRF) □ P-GW □□□□□□



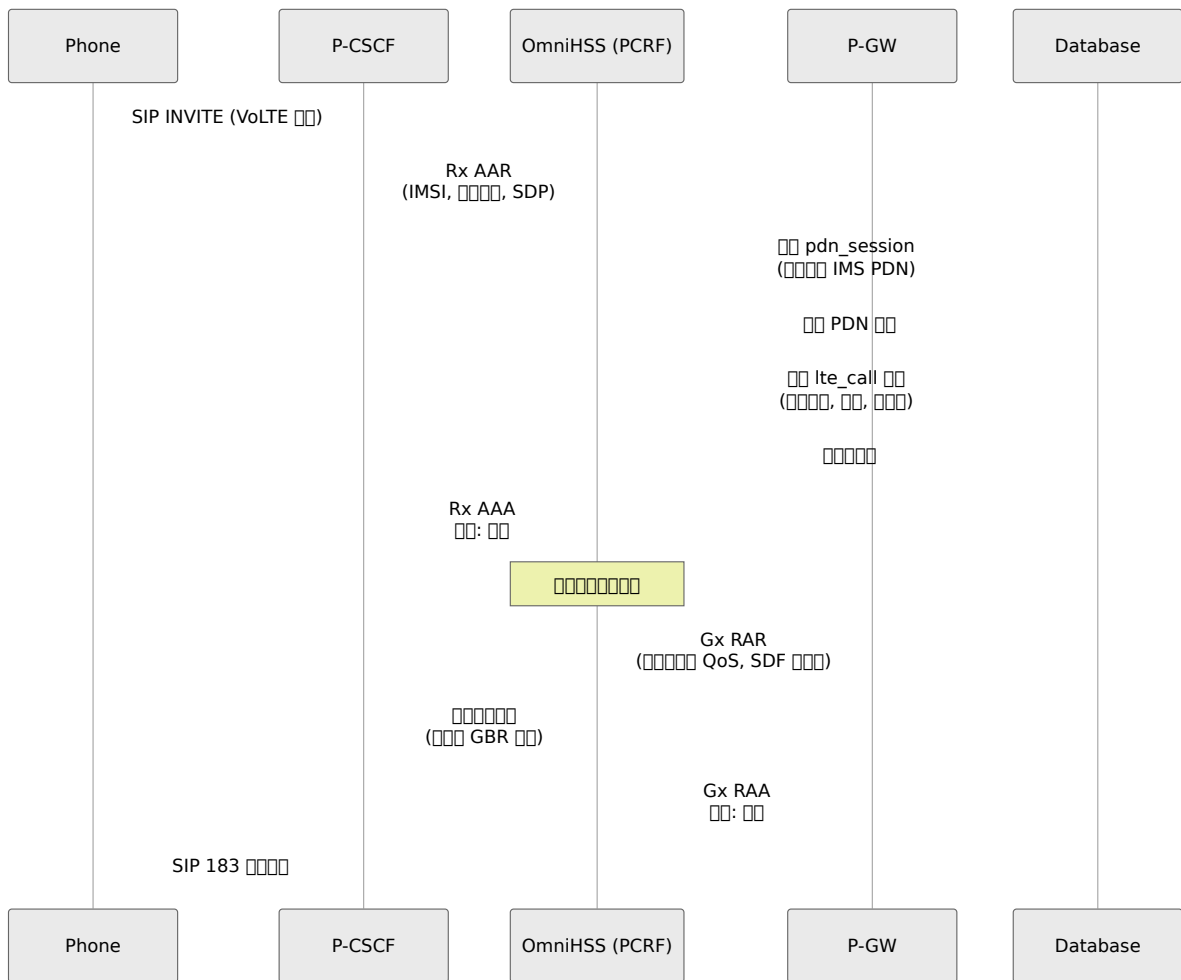
## Rx (IMS)

OmniHSS Rx PCRF IMS

PCRF VoLTE

## AA (AAR/AAA)

P-CSCF IMS

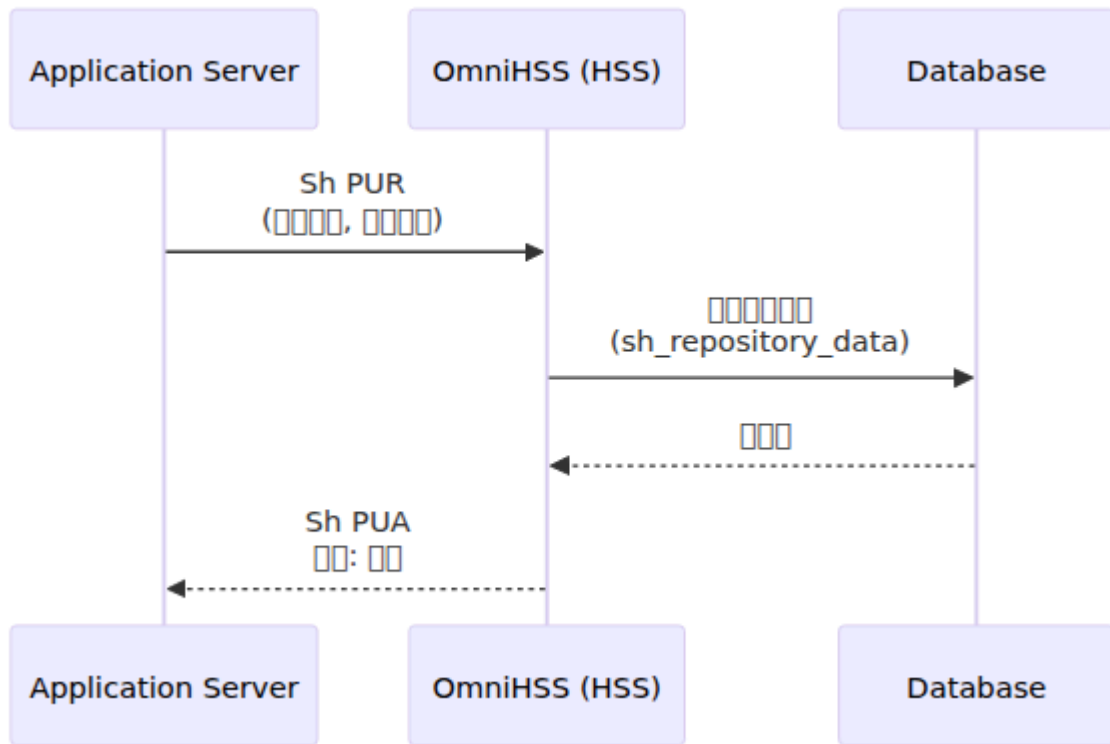


[ ]:

- [ ] SDP [ ]
- [ ] ([ ]/ [ ])
- [ ] SDF [ ]
- [ ] Gx RAR [ ]

## [ ] (STR/STA)

P-CSCF [ ] IMS [ ]



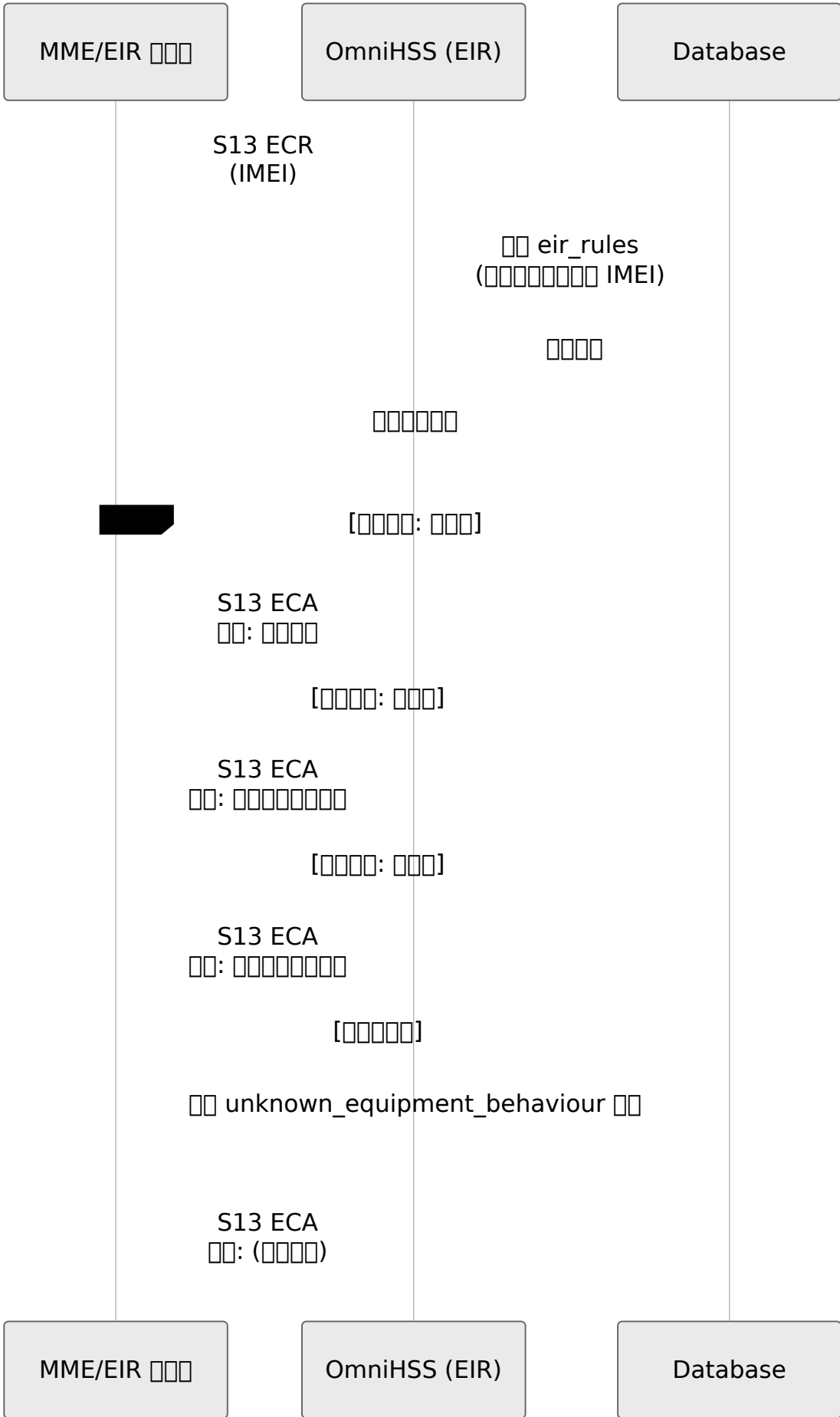
## S13 消息 (EIR)

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

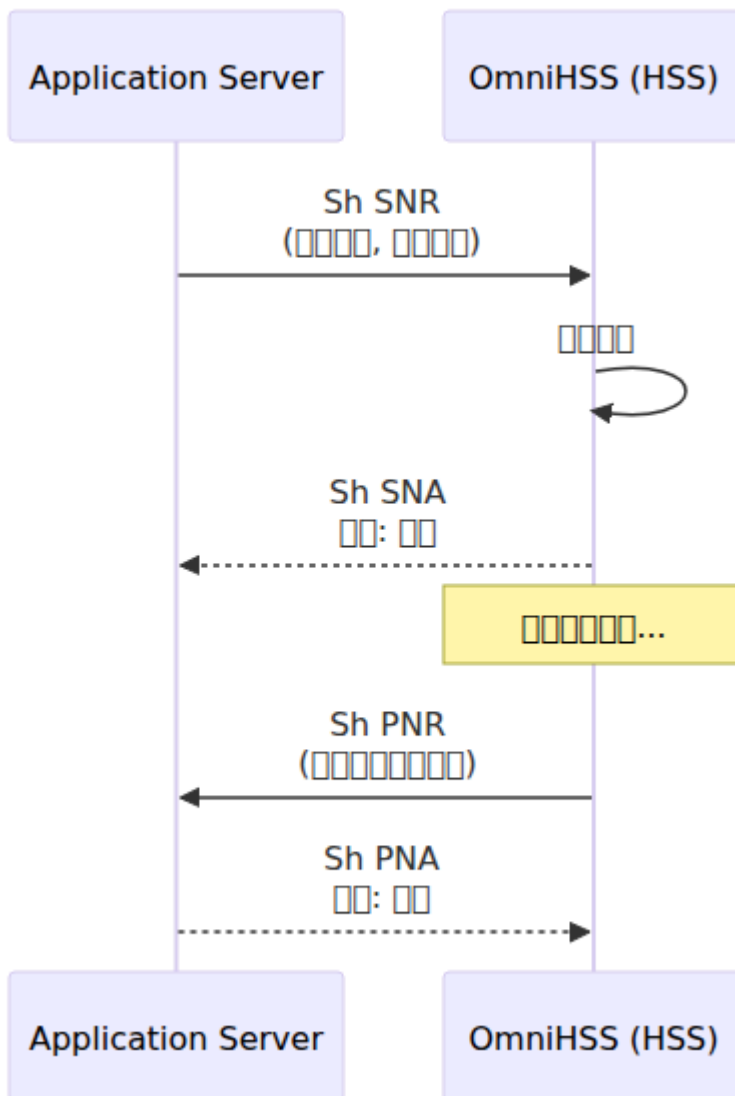


□□□□:

- □□□□ (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)

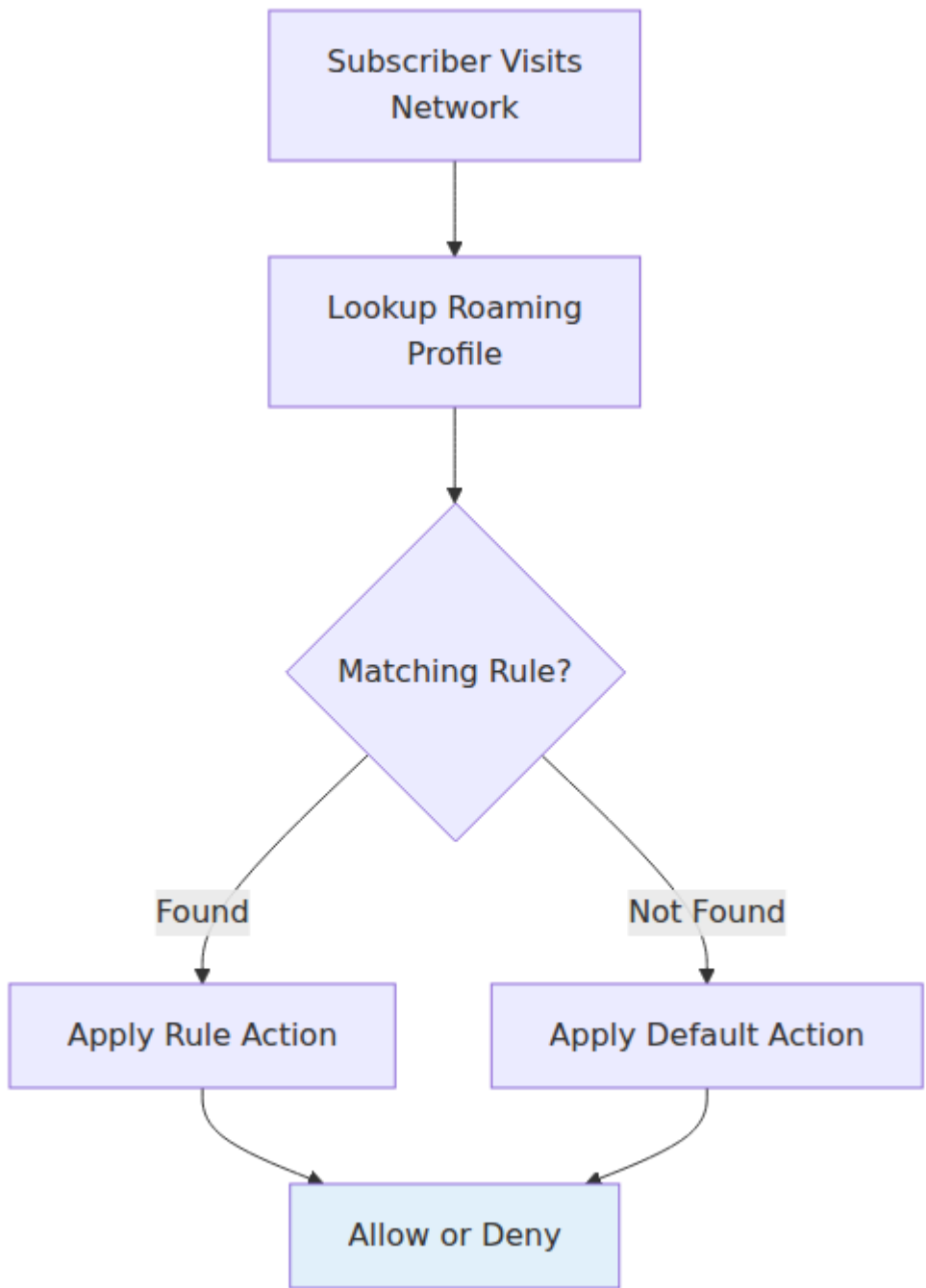
□□:

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

← □□□□□

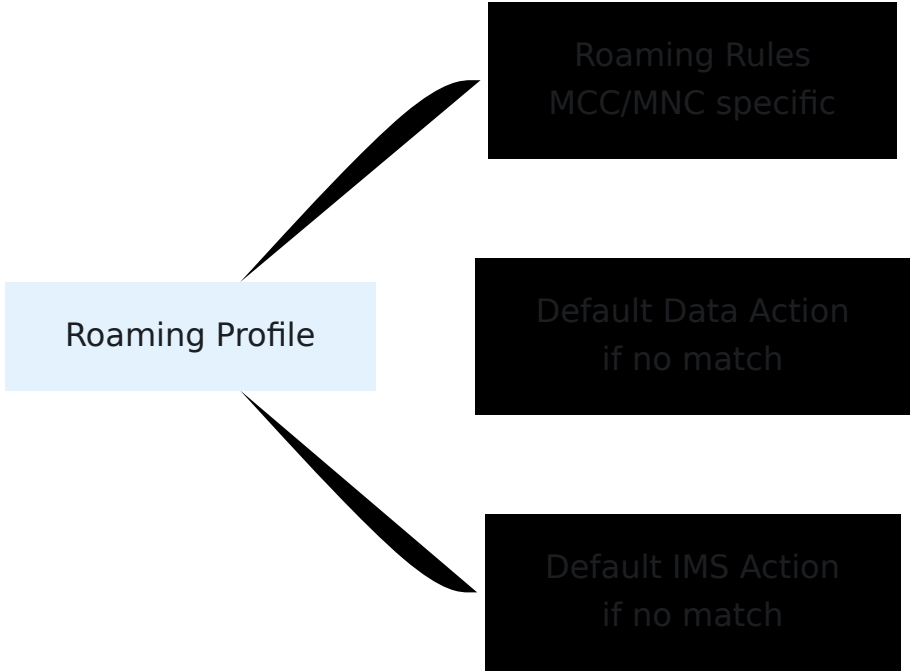


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□□



□□□□

□□□□□□□□□□MCC/MNC □□□□□□□□

□□□

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

□□□□

□□□□□□□□□□□□

□□□

- `name` - 任意
  - `data_action_if_no_rules_match` - "allow" □ "deny"
  - `ims_action_if_no_rules_match` - "allow" □ "deny"
- 

任意

任意

```
任意
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": []
 }
 }'
```

任意

```
任意
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": []
 }
 }'
```



□□□□□□□□

```
□□□□□□□□ 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')

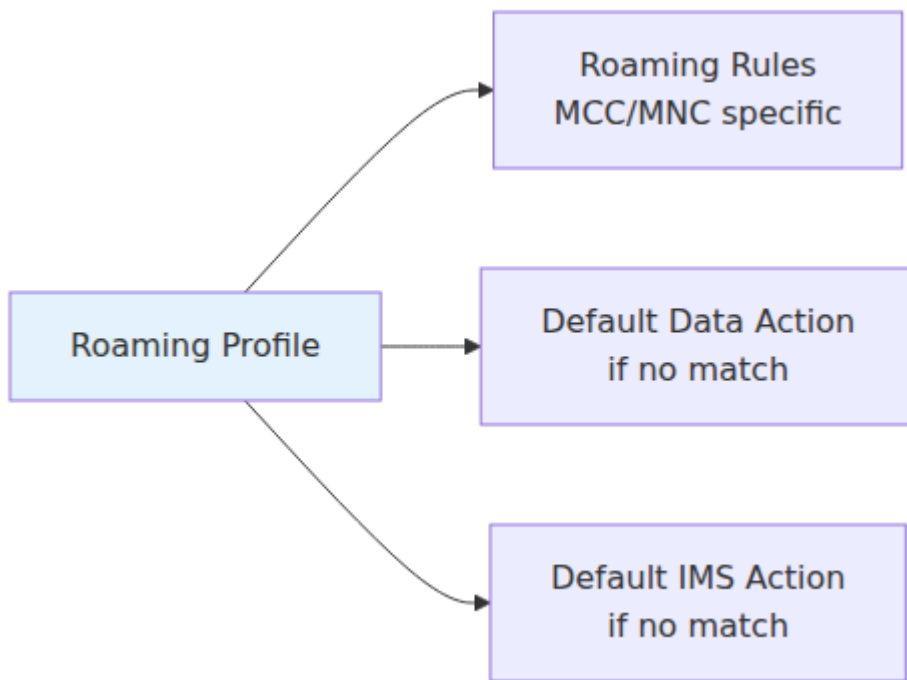
□□□□□□□□□□
curl -k -X POST https://hss.example.com:8443/api/roaming/profile \
-H "Content-Type: application/json" \
-d "{
 \"roaming_profile\": {
 \"name\": \"Block Expensive Networks\",
 \"data_action_if_no_rules_match\": \"allow\",
 \"ims_action_if_no_rules_match\": \"allow\",
 \"roaming_rules\": [$RULE]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

---

□□□□□□□□

□□ **1**□□□□□□□□

□□□□□□□□□□□□□□□□□□□□



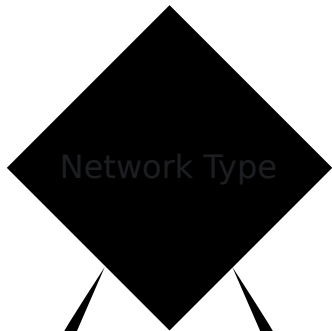
□□□

- □□□□□□□□
- □□□□□□□□ 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	☐☐☐☐☐☐☐☐

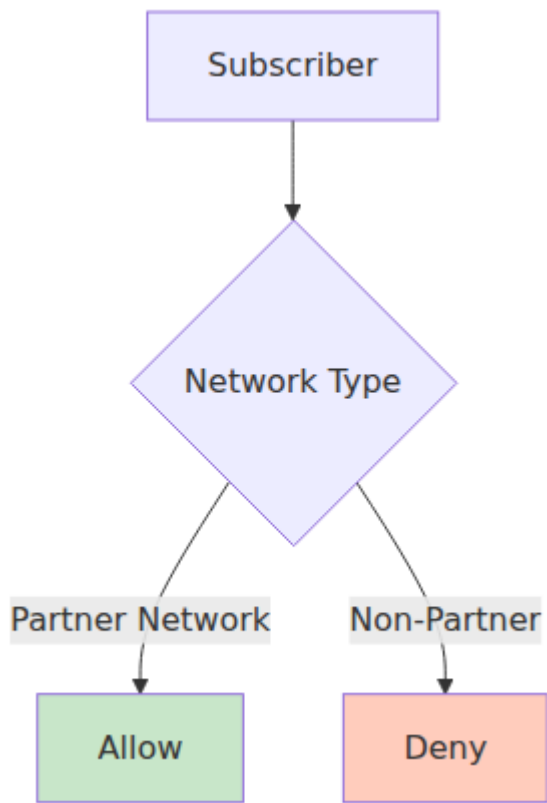
☐☐☐☐☐ ☐☐☐ ITU-T E.212 ☐ MCC/MNC ☐☐☐

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☐☐☐☐☐☐

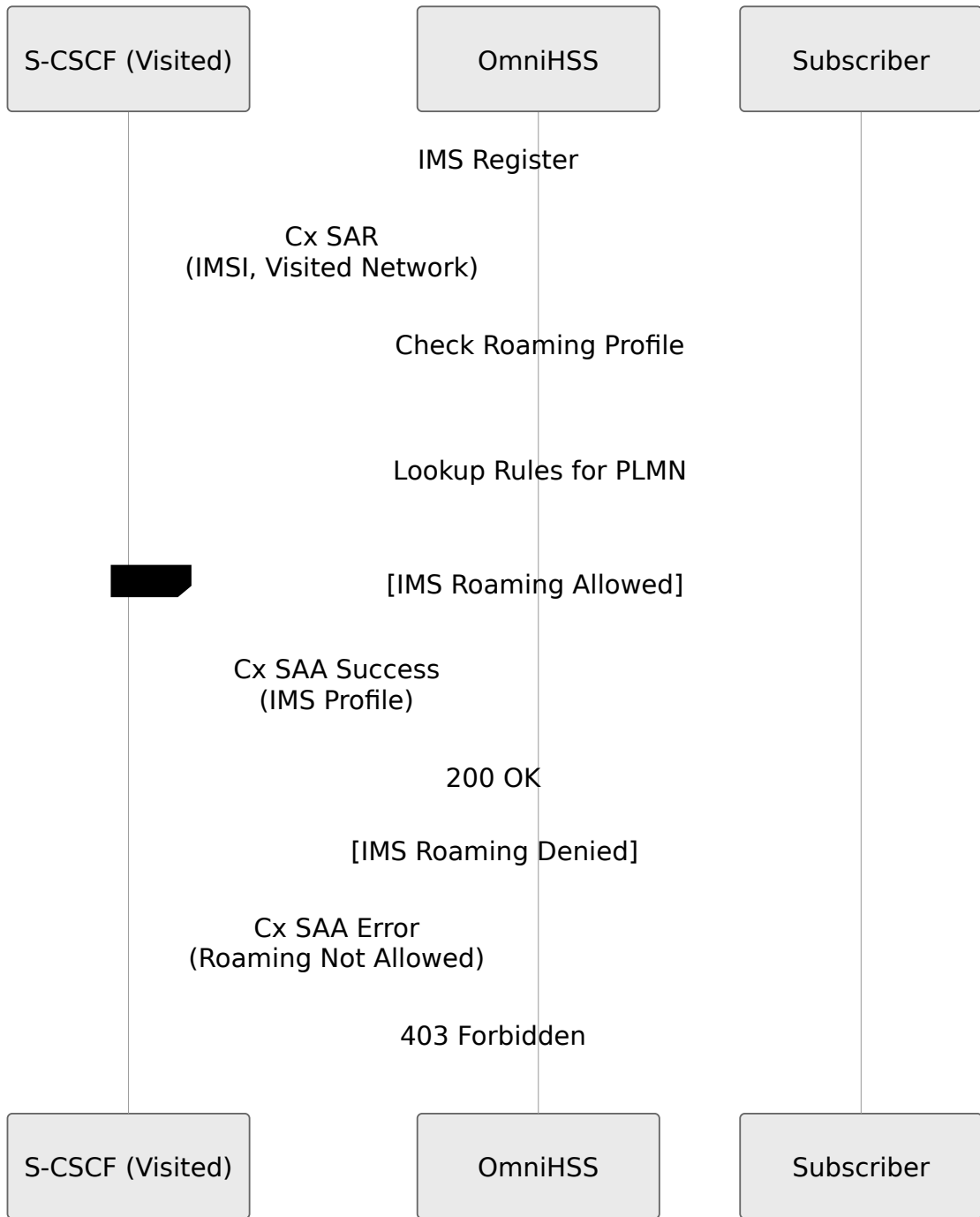
**S6a** ☐☐☐☐☐☐

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐



## Cx IMS

IMS



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□□□□□□□□□□□□□□

□□□□□□□□

- □□□□□□□□□□□□□□□□

- 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 □□□□□□

← □□□□□□

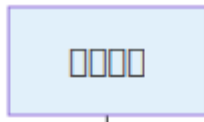
---

## □□

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

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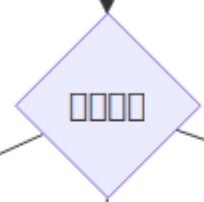
OmniCharge

OmniRAN

Downloads

☒ 开始 ▾

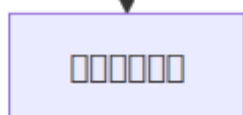
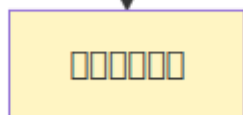
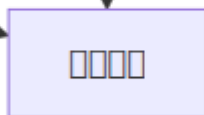
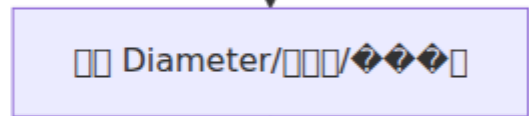
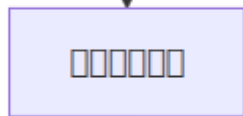
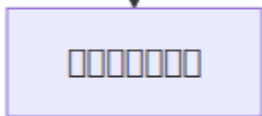
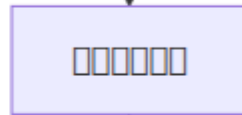
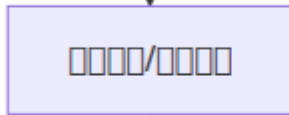
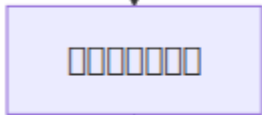
Omnitouch Website

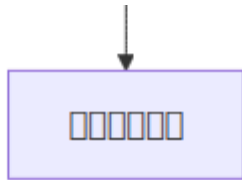


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1. □□□□□□□□□□□□□□□□

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

2. □□□□

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- □□□□□□□□□□
- □□□□□□□□□□

3. □□□□

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- □□□□□□□□/□□□□□□□□

4. □□□□

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

# □□□□□□

## □□

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

# □□□□□□□□□□

## □□ **1**□□□□□□□□

### □□□

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- □□□□□□□□□□□□□□□□

### □□□□□

1. □□□□□□□□ key\_set\_id□

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

2. □□□□□□□□□□□□□□□□

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

3. □ Ki □ OPC □□ SIM □□□□□□□□

### □□□□□

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

## □□ **2**□SQN □□□

### □□□

- 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**00000000

000

- 0000000000
- 0000000000

000000

1. 0000000000

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

2. 00 `enabled` 000 `true`

00 **???**00

- 000000

```
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

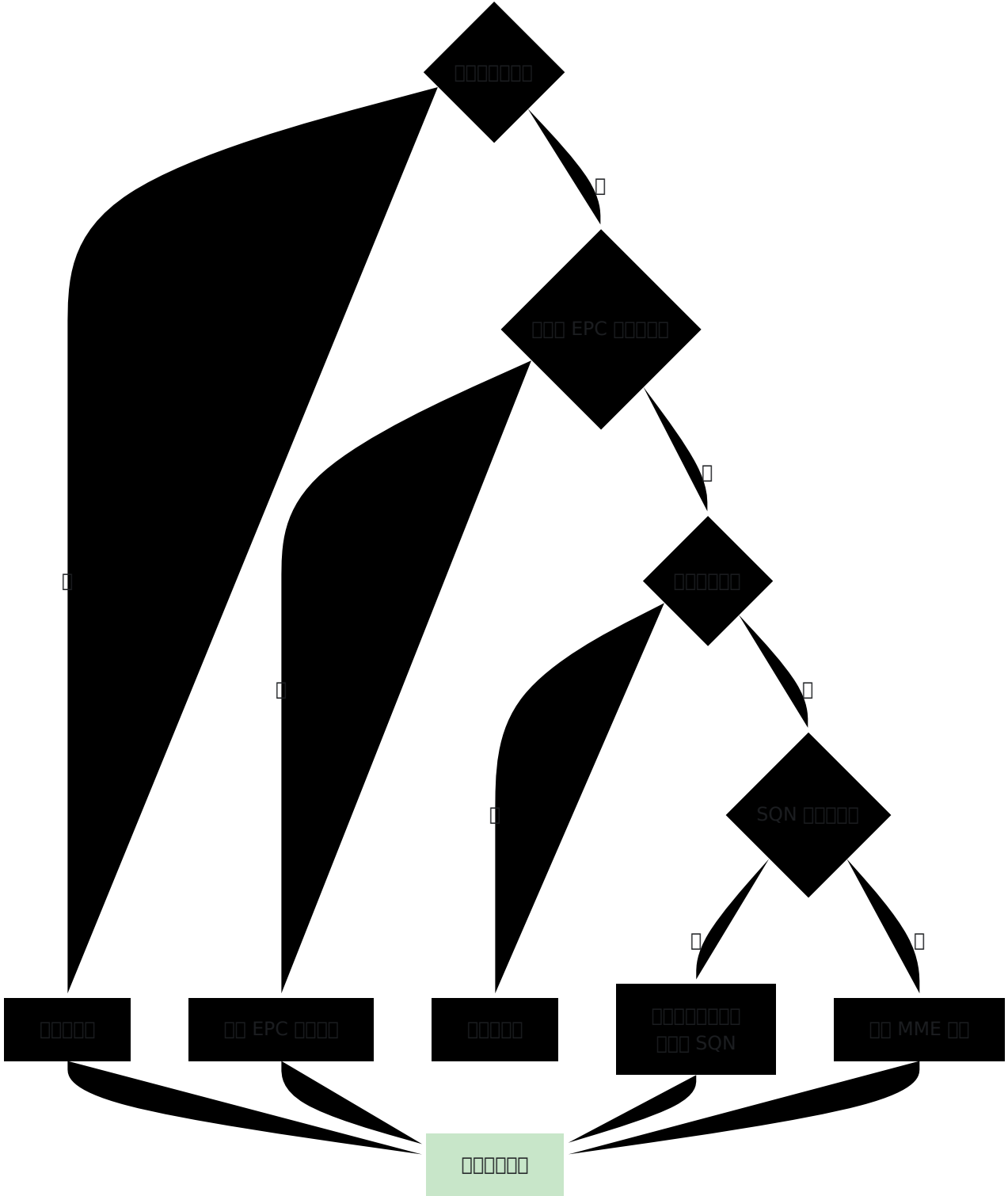
```
curl -k
https://hss.example.com:8443/api/epc/profile/[PROFILE_ID]
```

### 

- EPC

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# 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

- 测试
- 测试
- 测试

## 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
- 配置证书用于 OmniHSS

配置 4 配置证书用于 TLS

配置

- 配置证书
- 配置私钥
- “配置证书”配置

配置

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

配置

- 配置 Diameter 配置
- 配置 S6a/Cx/Sh 配置
  - MME 配置 S6a 16777251
  - S-CSCF 配置 Cx 16777216
  - P-GW 配置 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. □□□□□□□□□□□□□□□□

## □□□□□

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- □□□□□□□□□□

- 0000000000000000

## 00 2000000000

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- “000000”00
- OmniHSS 00000000

00000

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

00000

- 0 runtime.exs 000 00000
- 00000000000000
- 000000000 OmniHSS

## 00 3000000

000

- 000 500 00
- “000000”00
- 0000000000

00000

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

00000

- 0 runtime.exs 0000000000
- 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

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

□□□□□□□□□□

□□ **1**□□□□□□□□

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

□□□□□□

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

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- □□□□□□ MCC/MNC □□ □□□□
- □□□□□□□□□□□□□□□□□□
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□□ **2**□□□ **APN** □□

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- □□□□□□ PDN □□□□□□
- MME □□“□□ APN”□□

- 認證與授權

認證

1. 向 EPC 註冊 APN 認證
2. 向 APN 認證
3. 向 APN 認證

認證

- 向 APN 認證 EPC 認證
- 向 APN 認證
- 向 APN QoS 認證

3 MME 認證

認證

- 認證
- MME 認證
- Diameter 認證

認證

1. 向 Diameter 認證
2. MME 認證“認證”
3. MME 認證 S6a 認證

認證

- Diameter 認證
- MME 認證
- MME 認證

4 認證

認證

- 認證

- 00000000
- 0000000000

00000

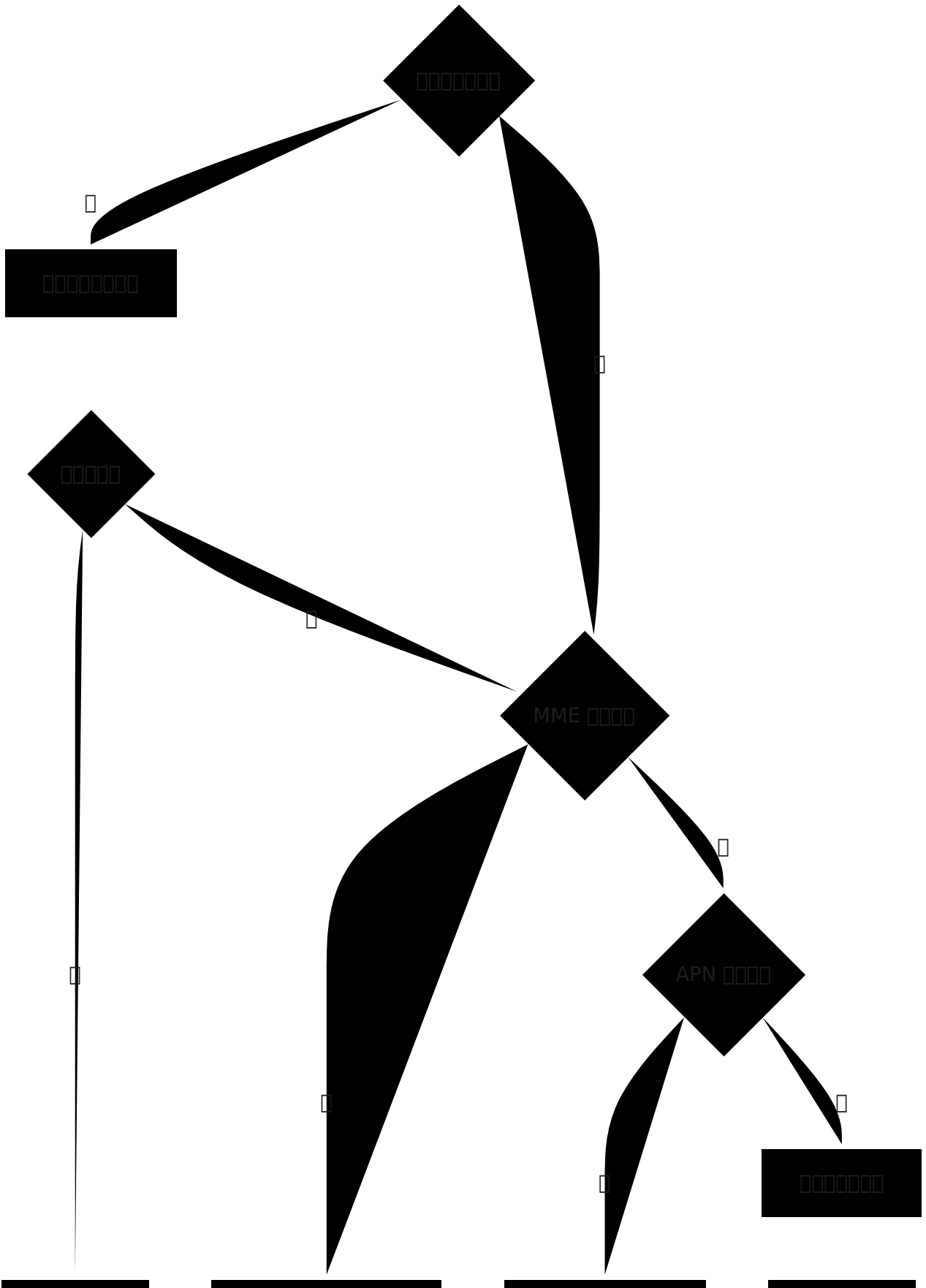
1. 000000000000
2. 00000000 MME 00
3. 0000000000

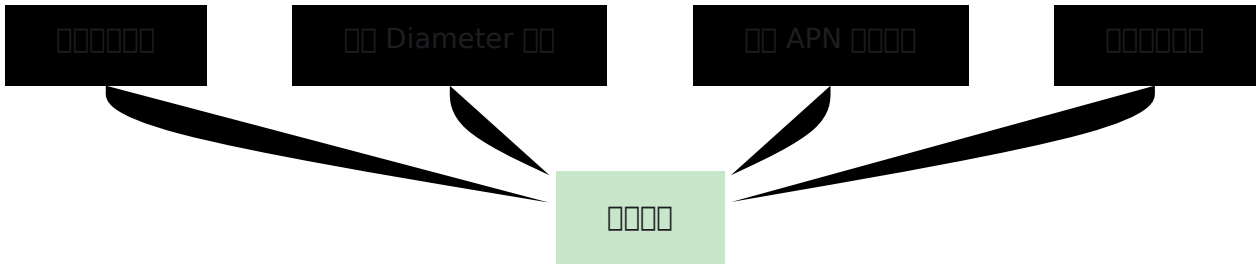
00000

- 00000000000000
- 000000000000 MME
- 000000000000

**EPC** □□□□□□□□

EPC □□□□





# IMS 配置

## 配置

- IMS VoLTE
- IMS “IMS 配置”
- IMS 配置

## 配置

### 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

### 2 S-CSCF

#### 配置

- IMS 網
- IMS 網 Diameter 網

網

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

網

- IMS Diameter 網 S-CSCF
- IMS S-CSCF 網

網 3 網 IFC 網

網

- IMS 網
- IMS IFC 網

網

1. IMS 網
2. IMS IFC 網
3. IMS IFC XML 網

網

- IMS IFC 網 IMS 網
- IMS IFC 網

網 4 IMS 網

網

- IMS 網
- IMS 網
- IMS 網

□□□□

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
2. 設定する AAR/AA-IP
3. IP AAA/AA-IP

設定

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

設定 **3** QoS/設定

設定

- 設定
- 設定
- 設定

設定

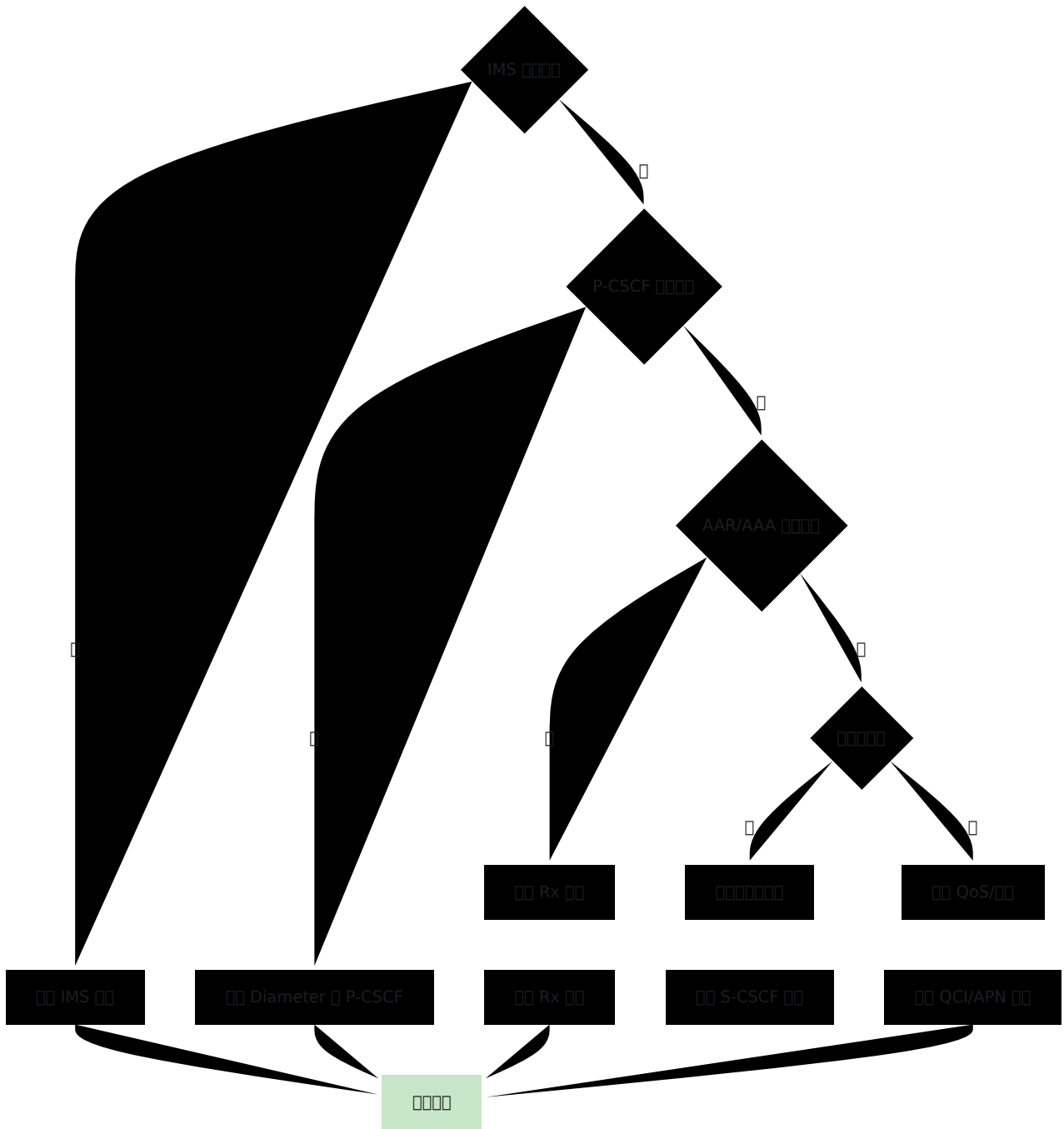
1. 設定する APN IP APN QoS 設定
2. IP QCI 設定する QCI 1
3. IP P-GW 設定する Gx/PCRF 設定

設定

- IP 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



# □□□□

## □□

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## □□□□□□□□□□

### □□ **1**□□□□□□□□□□□□

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#### □□□□□

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

#### □□□□□

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### □□ **2**□□□□□□□□

#### □□□

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#### □□□□□

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

#### 4. 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

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00 **1**00000000

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- 000000
- 000 CPU 0
- 0000

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

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- 00000
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- 00000000
- 000000000000
- 000000000

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1. 000000000

2. 100000
3. 100000000
4. 100000000

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- 100000
- 100000000
- 100000000
- 100000000

### 3 Diameter 100000

1000

- Diameter 10000
- 100000000
- 100000000

100000

1. 10000 Diameter 1000
2. 1000000
3. 100000000
4. 100000000

100000

- 100000000
- 100000000
- 100000000
- 10000000 Diameter 1000

### 4 100000

1000

- OmniHSS 100000

- 000000
- 000000

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1. 0000000000 OmniHSS 000000
2. 000000
3. 0000000000
4. 00 Erlang VM 00

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- 00 OmniHSS 00000000
  - 0000000000000000
  - 0 runtime.exs 000 Erlang VM 0000
  - 00000000000000
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- 000000000000000000
- 00000000
- 00000000
- 00000000

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00 **1MME** 00/00

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

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

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

□□ **2**□□□□□□□□

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- □□□□□□□□□□
- PDN □□□□□□□□□□
- □□□□□

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

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## API □□

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

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□□ **1**□□□□□□□□

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- 400 □ 422 □□
- □□□□□□
- □□□□□□

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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

□□□□

- □□ □□□□
- 

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□□□□□□□□

### 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
```

---

# □□□□

## □□□□

□□□□□□□□□□□□□□□□/□□□□□□

1. □□□□□□□□
2. □□□□□□□□□□□□□□□□
3. □□□□□□□□□□□□
4. □□□□□□□□□□□□□□
5. □□□□□□□□□□□□□□
6. □□□□□□□□□□□□

## □□□□□□

□□□□□□□□□□

1. □□□□ - □□□□□□□□□□
2. □□□□□□ - □□□□□□□□□□
3. □□ - □□□□□□□□□□□□
4. □□ - runtime.exe □□□□□□□□□□□□□□
5. □□ - OmniHSS □□□□□□□□□□□□□□□□
6. □□ - □□□□□□□□□□□□□□
7. □□□□□□ - □□□□□□□□ IMSI

## □□□□□□□□

□□□□□□□□□□□□

- □□□□□□□□
- □□□□□□□□□□□□
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- □□□□□□

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- `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>"imsi"</code>	<code>imsi</code>	IMSI
<code>"TLS"</code>	<code>TLS</code>	TLS

## Table 1

Field	Type	Value
"key_set_id"	String	key_set_id
"imsi"	String	imsi
"phone_number"	String	phone_number
"id"	String	id

## API

Field	Type	Value
"key_set_id"	String	key_set_id
"imsi"	String	imsi
"phone_number"	String	phone_number

# OmniHSS Webhook

←

## 

- 
- Webhook
- Webhook
- Webhook
- 
- 
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- 

## 

OmniHSS **webhooks** IMS  
OmniHSS webhook HTTP POST

## **Webhooks**

Webhooks HTTP OmniHSS HSS  
API





## 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 (PCRF)

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

Webhook

OmniHSS provides webhook URL 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. □□□□□□□□

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```
// 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
 });
 }

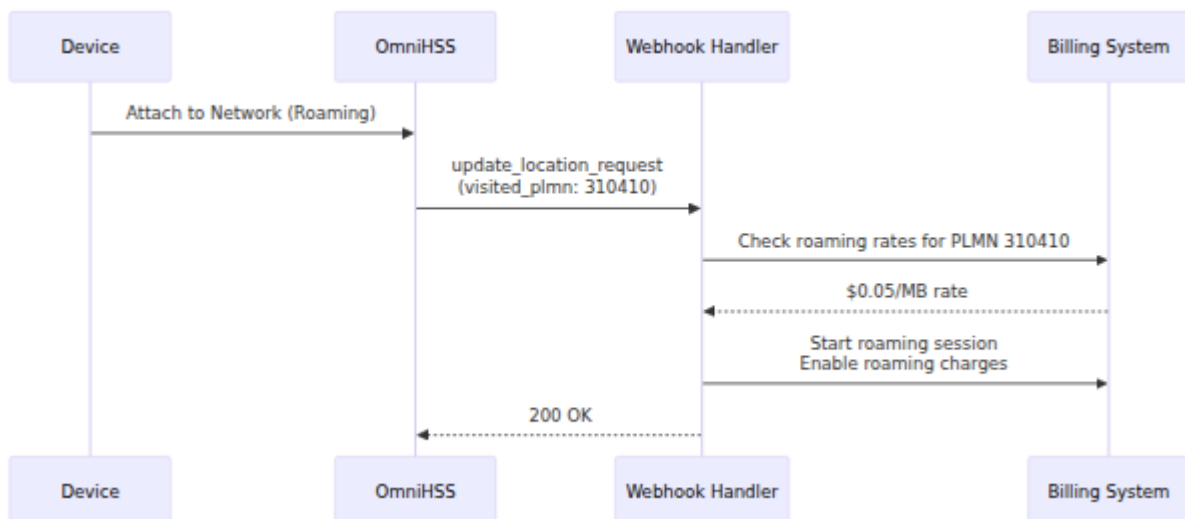
 res.status(200).send();
});
```

□□□□□□

- □□ 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']
 });
 }

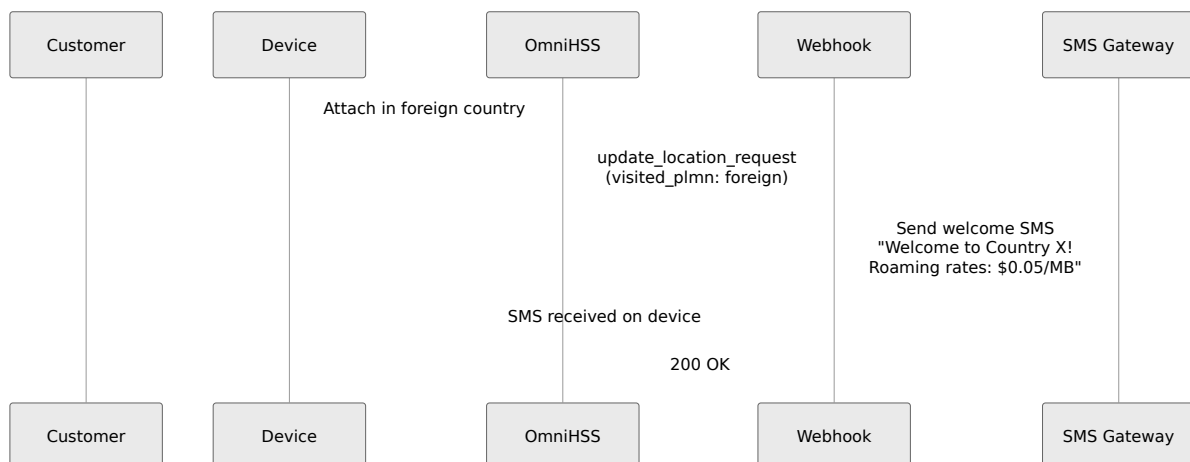
 res.status(200).send();
});

```

## 5. IMS ON

IMS ON

IMS ON



IMS ON

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

## 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.

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

## Webhook

- HSS webhook
- Webhook HSS

#### 1.

- 5 HTTP 200
- 

#### 2.

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

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

## Webhooks

10

- 10초 지연
- event\_id 10초 지연

20

- 20초 지연 OmniHSS 20초 지연
- 20초 지연 webhook

10

10 event\_id 10초 지연



- 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

- 验证 webhook 签名
- 验证 null 值

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 事件数据

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
}
```

---

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# OmniHSS

## Overview

OmniHSS is a 4G LTE (EPC) and IMS (IP Multimedia Subsystem) core network (HSS) solution. It provides a unified core network for 4G LTE and IMS services.

OmniHSS is built on Elixir and Erlang VM, providing a scalable and reliable core network solution.

## Architecture

HSS and LTE/IMS core network architecture.

- Core Network - 4G LTE/IMS
- HSS - Home Subscriber System
- MME - Mobility Management Entity
- S-GW - Serving Gateway
- P-GW - PDN Gateway
- EIR - Equipment Identity Register

## Features

### Key Features

- **S6a** - LTE/EPC interface
- **Cx** - IMS interface
- **Sh** - IMS interface
- **S13** - EIR interface (OmniHSS and EIR)
- **Gx** - PCRF interface (OmniHSS and PCRF)
- **Rx** - IMS interface (OmniHSS and PCRF)
- **PLMN** - IMS interface

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

## API

OmniHSS API

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

## API

API

## API

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

## API

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

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

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- **Galera □□□□□** - □□ HA □□□□□□□□□□

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### □□□□ (Web □□)

URL: https://[hostname]:7443

□□□□□□□□□□□□ Diameter □□□□□□□□□□□□

### API □□

URL: https://[hostname]:8443

RESTful API □□□□□□□□□□□□

## □□□□□□□□

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

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

## □□□□□□□□

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- **Diameter** □□□ - □□ Diameter □□□□□□□□□□
- □□□□□□ - □□ runtime.exs □□□□□□□□
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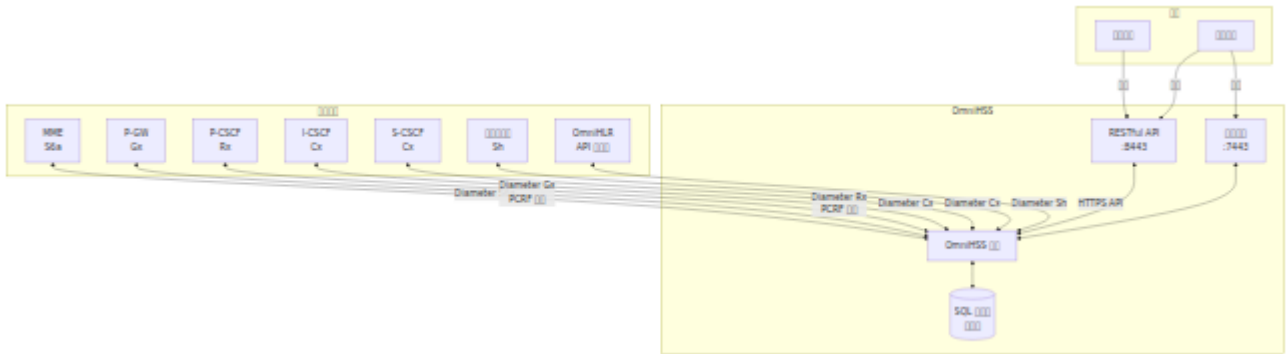
### □□□□

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

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- □□ **TLS** - API □□□□□□□□□□ HTTPS
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- □□□□□□ - □□ runtime.exs □□□□□□□□□□
- □□□□□□ - Diameter □□□□□□□□□□
- **API** □□ - □□□□□□□□□□□□

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