REST API □□

← □□□□□

□□□□□□ OmniSS7 **REST API** □ **Swagger UI** □□□□□□

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1. □□
2. HTTP □□□□□
3. Swagger UI
4. API □□
5. □□
6. □□
7. □□□□
8. □□□□
9. □□ (Prometheus)
10. □□□□

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OmniSS7 □ □□ **9090** □□□□□□ REST API□□□□□ SS7 □□□□ MAP□□□□□□□□□ CAP □CAMEL □□□□□□□□□□□□□□□□□ SCCP/M3UA □□□□ API □□□ **47** □ `POST /api/*` □□□ □□□□□□□ Swagger □□□□□□□□

- □□ MAP □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□GPRS□□□□
- □□ CAP/CAMEL □□□□□□
- □□□□ SCCP/M3UA □□□□
- □□ Prometheus □□□□□□

□□□□□□□□□/□□□□□ MAP □□□□□□□□□□□□ **MAP □□□□**□□□□□□□□□□□□□□□

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OmniSS7 □□ □□□□□ **HTTP** □□□□□□□□□□□□□:9090□□□□□□□□ □□□□ □□□□

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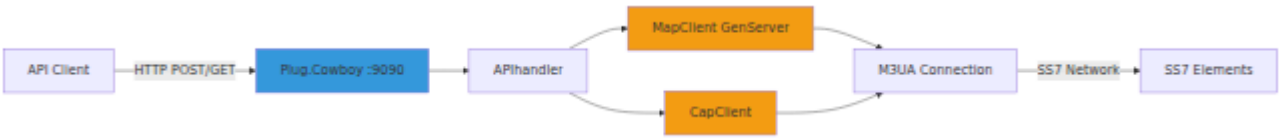
9090	HTTP (`Plug.Cowboy`)	`APIhandler`	□□ MAP/CAP REST `/api/*`□`/metrics`□`/`
8087	HTTPS (`Bandit`, Phoenix)	`ControlPanelWeb.Endpoint`	□□□□□□□□ UI□□□□ We
8445	HTTPS / TLS	`:api_ex` REST □□□	□□□□/□□/□□ REST□□□□

API □□



HTTP □□□□□

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`/api/*`□`/metrics` □ `/swagger` □□□ `Plug.Cowboy` HTTP □□□□□□□□

□□	□	□□□
□□	HTTP	□
IP □□	0.0.0.0□□□□□□	□□□□□
□□	9090	□□`config :omniss7, api_port: <port>`□□□ `9090`□
□□	`Plug.Cowboy`	□

□□ **URL**□`http://[server-ip]:9090`

> □□□□□:8087□Bandit□□ `:api_ex` REST □□□□:8445□□□□□□□□□□□□□□ □□□□□□□

□□/□□ HTTP □□□

□□ :9090 HTTP □□□□□□□□

```
config :omniss7,
  start_http_server: true  # □□□ false □□□
```

□□□`true`□□□□

□□□□:9090 HTTP □□□□□□□□□□REST API / Swagger UI / □□□□□□□□□□□□□□□□:8087□□ `:api_ex`□:8445□□□□□□□□□□□□□□ `start_web_interfaces` □□□□

Swagger UI

□ API □□□□ **Swagger UI** □□□□□ API □□□□□□

□□ Swagger UI

URL□`http://[server-ip]:9090/swagger`

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

Swagger JSON

OpenAPI □□□□□□□□□□□□

URL：`http://[server-ip]:9090/swagger.json`

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- □□□ Postman □□□ API □□□
- □□□□□□
- API □□□□

API □□

□□□□□□□□□□ `POST /api/{operation}` □□□ JSON □□□□□□□ □□ □□□□□□□□□□□□ SS7 □□□□□□□□□□□□ **10** □ □□□□□ MAP □□□□□□ □□□□□□

□□□□□□□□□□ **47** □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ MAP □□□□□□□□□□ **MAP □□□□□**□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

> □□□□□□□□□□□□ `200` = □□□`400` = □□/□□□□□□□□□□□□□□□□□□`504` = □□□□□□□□□□□□□□ SS7 □□□□`500` = □□□□□□□□□□`503` = □□□□□□USSD□□`404` = □□□□□□□□ □□□□□□

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□□	□□	□□
□□□□	`POST /api/updateLocation`	□□□□□□ VLR □□□ HLR□□ HLR □□□□□ □□□ InsertSubscriberData (ISD) □ □□
□□□□	`POST /api/cancelLocation`	□□ VLR □□□□□□□
���□ □□□□	`POST /api/prn`	□□□ MSC □□ MSRN□
□□ MS	`POST /api/purgeMS`	□□□□□□□ HLR □□□□□
□□□□	`POST /api/sendIdentification`	□□□□ VLR □□ IMSI/□□□□□TMSI □□□□ □□□□□
□□	`POST /api/reset`	HLR □□□□□□ VLR□□□□□□□ `{"status":"sent"}`□□
□□□□	`POST /api/restoreData`	VLR □□□ HLR □□□□□□□

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□□ SM □□□□	`POST /api/sri-for-sm`	□□ HLR □□□ SMS □□□□□□□□
MT-□□ SM	`POST /api/MT-forwardSM`	□□□□□□ SM □□□□□ MSC/SGSN □`smsPDU` □□□□□□□□□
MO-□□ SM	`POST /api/forwardSM`	□□□□□□□ SM□`smsPDU` □□□□□□ □□□
□□ SM	`POST /api/sendSM`	□ GSM-7 □□□□□□□ SMS-DELIVER□
□□□□ PDU	`POST /api/deliverPDU`	□□ SMS-DELIVER PDU □□□□□□ □□□□□ SS7□□
□□ SM □□□□	`POST /api/reportSM-DeliveryStatus`	□ HLR □□ SM □□□□□
□□□□ SM	`POST /api/readyForSM`	□□ HLR □□□□□ SMS□
□□□□□□	`POST /api/alertServiceCentre`	□□ SMSC □□□

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□□□□□□	`POST /api/send-auth-info`	□ HLR □□□□□□□
□□ IMSI	`POST /api/sendIMSI`	□ MSISDN □□□ HLR □□ IMSI□

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□□□□□□□	`POST /api/sri`	□□ HLR □□□□□□□□□□□□□□
□□□□□□□	`POST /api/provideSubscriberInfo`	□ VLR □□□□□□□/□□□
□□□□□□□	`POST /api/deleteSubscriberData`	□ VLR □□□□□□□□□□□□□ `withdraw` □□□□
□□□□□□□	`POST /api/anyTimeInterrogation`	gsmSCF □□ HLR □□ □□□□□/□□□
□□□□□□□□□	`POST /api/anyTimeSubscriptionInterrogation`	□□ HLR □□□□□□□□
□□□□□□□	`POST /api/anyTimeModification`	□ HLR □□□□□□□□□
□□□□□□□□□□	`POST /api/noteSubscriberDataModified`	HLR □□ gsmSCF □□ □□□□
□□ MM □□	`POST /api/noteMM-Event`	□ gsmSCF □□□□□□□□ □□

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□□ SS	`POST /api/interrogateSS`	□□□□□□□□□□□□
□□ SS	`POST /api/registerSS`	□□□□□□□□□□□□□□□□ / CFU□□
□□ SS	`POST /api/eraseSS`	□□□□□□□□
□□ SS	`POST /api/activateSS`	□□□□□□□□
□□ SS	`POST /api/deactivateSS`	□□□□□□□□
□□□□	`POST /api/registerPassword`	□□ SS □□□ `ss_code` □□□□
□□□□	`POST /api/getPassword`	□□/□□ SS □□□
□□□□ SS □□	`POST /api/forwardCheckSS-Indication`	□ VLR □□□□□□□□□□□ `{"status":"sent"}` □□

□□□□ SS □□□ `interrogateSS`□ `registerSS`□ `eraseSS`□ `activateSS`□ `deactivateSS` □□□□□□□□□ `ss_code` □□□□□ `hlr_gt` □□□□ `forwarded_to`□ `no_reply_time` □ `basic_service`□

□□□□ (LCS)

□□	□□	□□
□□ LCS □□ □□	`POST /api/sendRoutingInfoForLCS`	GMLC □□ HLR □□□ LCS □□□
□□□□□□	`POST /api/provideSubscriberLocation`	□□□□□□□□□□□□□□
□□□□□□	`POST /api/subscriberLocationReport`	□ GMLC □□□□□□□□

GPRS

□□	□□	□□
□□ GPRS □ □	`POST /api/updateGprsLocation`	□□□□□□ SGSN □□□ HLR□
□□ GPRS □ □□□	`POST /api/sendRoutingInfoForGprs`	□□ HLR □□□ GPRS □□ □GGSN □□□□

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□□	□□	□□
□□ IMEI	`POST /api/checkIMEI`	□□ EIR □□□□□□□

USSD

□□	□□	□□
USSD □□□□□□□	`POST /api/ussd/send`	□□□□□ USSD □□□□□□ `ussd_gateway_enabled: true`□□□□□ `503`□□□□□ USSD □□□□□□

CAP / CAMEL

□□	□□	□□
CAP InitialDP	`POST /api/cap/initialDP`	□ gsmSCF □□ CAMEL □□□□□□□ `otid` □□□□□□□
CAP □□	`POST /api/cap/connect`	□□□□□□□□□ □`destination_number` + `otid`□□
CAP □□	`POST /api/cap/continue`	□□□□□□□`otid`□□
CAP □□□□	`POST /api/cap/releaseCall`	□□□□□□□ `cause`□`otid`□□
CAP □□□□	`POST /api/cap/applyCharging`	□□□□□□□`duration` + `otid`□□

CAP □□□□□□□□ `otid`□□□□□□□ `initialDP` □□□□□□ `{"status":"sent","otid":"<hex>"}`□□□□ CAMEL □□□□□

□□□□□□□/□□□

□□	□□	□□
□□ SCCP	`POST /api/raw/sccp`	□□□□□□□ SCCP □□□□□□□□□□□□□□ SCCP □□□□□/□□□□SSNs□OPC/DPC□□
□□ M3UA	`POST /api/raw/m3ua`	□□□□□□□ M3UA □□□□□□□□□□□□□□ OPC/DPC/□□□□□□□

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□□	□□	□□
`/metrics`	GET	Prometheus □□□□□□□□
`/swagger`	GET	Swagger UI□
`/swagger.json`	GET	OpenAPI □□□

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SendRoutingInfo (SRI)

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□□□`POST /api/sri`

□□□□

```
{
  "msisdn": "1234567890",
  "gmsc": "5551234567"
}
```

□□	□□	□□	□□
`msisdn`	□□□	□	□□□ MSISDN
`gmsc`	□□□	□	□□ MSC □□□□

□□□200 OK□□

```
{
  "result": {
    "imsi": "001001234567890",
    "msrn": "5551234999",
    "vlr_number": "5551234800"
  }
}
```

cURL □□□

```
curl -X POST http://localhost:9090/api/sri \
  -H "Content-Type: application/json" \
  -d '{"msisdn": "1234567890", "gmsc": "5551234567"}'
```

SendRoutingInfoForSM (SRI-for-SM)

□□□ SMS □□□□□□□□□□□□□□□

□□□`POST /api/sri-for-sm`

□□□□

```
{
  "msisdn": "1234567890",
  "service_center": "5551234567"
}
```

□□	□□	□□	□□
`msisdn`	□□□	□	□□□ MSISDN
`service_center`	□□□	□	□□□□□□□□

cURL □□□

```
curl -X POST http://localhost:9090/api/sri-for-sm \
  -H "Content-Type: application/json" \
  -d '{"msisdn": "1234567890", "service_center": "5551234567"}'
```

UpdateLocation

□□ HLR □□□□□□□VLR □□□□□ HLR □□□□□□□□ InsertSubscriberData (ISD) □□□

□□□`POST /api/updateLocation`

□□□□

```
{
  "imsi": "001001234567890",
  "vlr": "5551234800"
}
```

□□	□□	□□	□□
`imsi`	□□□	□	□□ IMSI
`vlr`	□□□	□	VLR □□□□□□

USSD □□□□□□□□

□□□□□ USSD □□□□□ `ussd_gateway_enabled: true`□□□□□□□

□□□503□□□□□□□□

```
{
  "error": "USSD gateway not enabled"
}
```

□□

□□□□□□□ API □□□□□□□

□□□□□□

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

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□□□□□□□ **JSON** □□□

□□□□

HTTP □□□200 OK

□□□

```
{
  "result": {
    // □□□□□□□□□□
  }
}
```

□□□□

HTTP □□□

- 400 Bad Request - □□□□□□□□□□
- 500 Internal Server Error - □□□□□SS7 □□□□□□□□□□
- 503 Service Unavailable - □□□□□□USSD □□□
- 504 Gateway Timeout - □□□□□□□ 10 □□
- 404 Not Found - □□□□

□□□

```
{
  "error": "timeout"
}
```

□

```
{
  "error": "invalid request"
}
```

□□□□

□□□□

□□	**HTTP** □□	□□	□□□□
□□ JSON	400	□□□□□□□□□ JSON	□□ JSON □□
□□/□□ □□	400	□□□□□□□□□□□□□□□□□□□□□□□□ `"required"` □□□	□□□□□□□□□□□□□□□□□□
□□□□	500	SS7 □□□□□□□□□□	□□ `"error"` □□□□□ SS7 □□□□
□□□□	503	USSD □□□□□	□□ `ussd_gateway_enabled: true`
□□	504	□□□□□□□□□□ 10 □□	□□ M3UA □□□HLR/VLR □□□
□□□	404	□□□□	□□□□ URL

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□□□□□□□□□ **10** □□□□

1. □□□□□ MapClient GenServer
2. □□□□□□ 10 □
3. □□□□□□ → □□ 504 Gateway Timeout
4. □□□□□□ → □□ 200 OK □□□

□□□□□□□

- □□ M3UA □□□□□Web UI → M3UA □□□
- □□□□□□□HLR/VLR/MSC□□□□□
- □□□□□□

- □□ SS7 □□□□□□□□□□

□□ (Prometheus)

□ API □□ Prometheus □□□□□□□

□□□□

URL□`http://[server-ip]:9090/metrics`

□□□Prometheus □□□□

□□□□□

```
# HELP map_requests_total Total MAP requests
# TYPE map_requests_total counter
map_requests_total{operation="sri"} 42
map_requests_total{operation="sri_for_sm"} 158
map_requests_total{operation="updateLocation"} 23

# HELP cap_requests_total Total CAP requests
# TYPE cap_requests_total counter
cap_requests_total{operation="initialDP"} 87
cap_requests_total{operation="requestReportBCSMEvent"} 91

# HELP map_request_duration_milliseconds Duration of MAP
request/responses in ms
# TYPE map_request_duration_milliseconds histogram
map_request_duration_milliseconds_bucket{operation="sri",le="10"}
5
map_request_duration_milliseconds_bucket{operation="sri",le="50"}
12
map_request_duration_milliseconds_bucket{operation="sri",le="100"}
35
...

# HELP map_pending_requests Number of pending MAP TID waiters
# TYPE map_pending_requests gauge
map_pending_requests 3

# HELP omniss7_license_status Current license status (1 = valid, 0
= invalid)
# TYPE omniss7_license_status gauge
omniss7_license_status 1
```

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□□□□□□/□□□□□□

□□	□□	□□	□□
`map_requests_total`	□□□	`operation`	□□□□□□□□□□ MAP □□□
`map_request_errors_total`	□□□	`operation`	□□□□□□□□□□ MAP □□□□□
`cap_requests_total`	□□□	`operation`	□□□□□□□□□□ CAP □□□
`cap_request_errors_total`	□□□	`operation`	□□□□□□□□□□ CAP □□□□□
`map_request_duration_milliseconds`	□□□	`operation`	□□□□□□□□□□□
`map_pending_requests`	□□□	-	□□□□ MAP □□□
`ussd_requests_total`	□□□	`direction`	□ USSD □□□□□□/□□□
`ussd_active_sessions`	□□□	-	□□□□□ USSD □□□
`omniss7_license_status`	□□□	-	□□□□□□□□□1 = □□□0 = □□□

SCCP

□□	□□	□□	
`sccp_messages_total`	□ □□□ □	`message_type`, `direction`	□□□ □`udt`/`xudt`/ □□□□`sent`/`r`
`sccp_decode_errors_total`	□□□	-	□□□□□ SCCP
`sccp_segments_received_total`	□□□	-	□□□ XUDT/LU
`sccp_reassembly_completed_total`	□□□	-	□□□□□□□ SC
`sccp_reassembly_timeouts_total`	□□□	-	□□□□□□□□□□□

TCAP

□□	□ □	□□	
`tcap_dialogues_total`	□ □ □	`type`	□□□□□□`begin`/`continue`/`end`/`abo`
`tcap_aborts_total`	□ □ □	`reason`	□□□□□□ TCAP □□□□□P-Abort → `unrecognized_message_type`/`un` □□ `p_abort_other`□□U-Abort → `u`
`tcap_decode_errors_total`	□ □ □	-	□□/□□□□□□□ TCAP □□
`tcap_active_dialogues`	□ □ □	-	□□□□□ MAP □□□□□

SCTP

□□	□□	□□	
`sctp_association_state`	□□□	`remote_ip`, `remote_port`	□□□□□1 = up□
`sctp_association_state_changes_total`	□□□	`event`	□□□□ □`comm_up`/`co`
`sctp_send_errors_total`	□□□	`reason`	□□□ SCTP □□□
`sctp_heartbeat_sent_total`	□□□	`type`	□□□ M3UA □□
`sctp_heartbeat_received_total`	□□□	`type`	□□□ M3UA □□

□□ / SMSc

□□	□□	□□	□□
`sms_messages_total`	□□□	`direction`, `operation`	□□□□`mo`/`mt`□□□□□□`submit`/`deliver`□□□□ SMS
`sms_delivery_failures_total`	□□□	`reason`	□□□□□□ SMS □□□□
`sms_tracked_subscribers`	□□□	-	□□□ SubscriberTracker □□□□□

M2PA□MTP2 □□□□□

□□	□□	□□	□□
`m2pa_messages_sent_total`	□□□	`link_name`, `point_code`, `adjacent_pc`	□□ M2PA □□ MTP3 □□
`m2pa_messages_received_total`	□□□	`link_name`, `point_code`, `adjacent_pc`	□□ M2PA □□ MTP3 □□
`m2pa_bytes_sent_total`	□□□	`link_name`, `point_code`, `adjacent_pc`	□□ M2PA □□□□□
`m2pa_bytes_received_total`	□□□	`link_name`, `point_code`, `adjacent_pc`	□□ M2PA □□□□□
`m2pa_link_state_changes_total`	□□□	`link_name`, `from_state`, `to_state`	M2PA □□□□□□
`m2pa_errors_total`	□□□	`link_name`, `error_type`	□□□□□□□ M2PA □□

M3UA STP

□□	□□	□□	□□
`m3ua_stp_messages_received_total`	□□□	`peer_name`, `point_code`	□□□□□□□ M3UA □□
`m3ua_stp_messages_sent_total`	□□□	`peer_name`, `point_code`	□□□□□□□ M3UA □□
`m3ua_stp_routing_failures_total`	□□□	`reason`	STP □□□□ □`no_route`/`no_gt_`

Prometheus □□

□□□□□ `prometheus.yml`□

```
scrape_configs:
  - job_name: 'omniss7'
    static_configs:
      - targets: ['server-ip:9090']
    metrics_path: '/metrics'
    scrape_interval: 15s
```

□□□□

Python □□

```python
import requests
import json

# SRI-for-SM □□
url = "http://localhost:9090/api/sri-for-sm"
payload = {
    "msisdn": "1234567890",
    "service_center": "5551234567"
}

response = requests.post(url, json=payload, timeout=15)

if response.status_code == 200:
    result = response.json()
    print(f"□□: {result}")
elif response.status_code == 504:
    print("□□ - □□□□□□□")
else:
    print(f"□□: {response.status_code} - {response.text}")
```

JavaScript □□

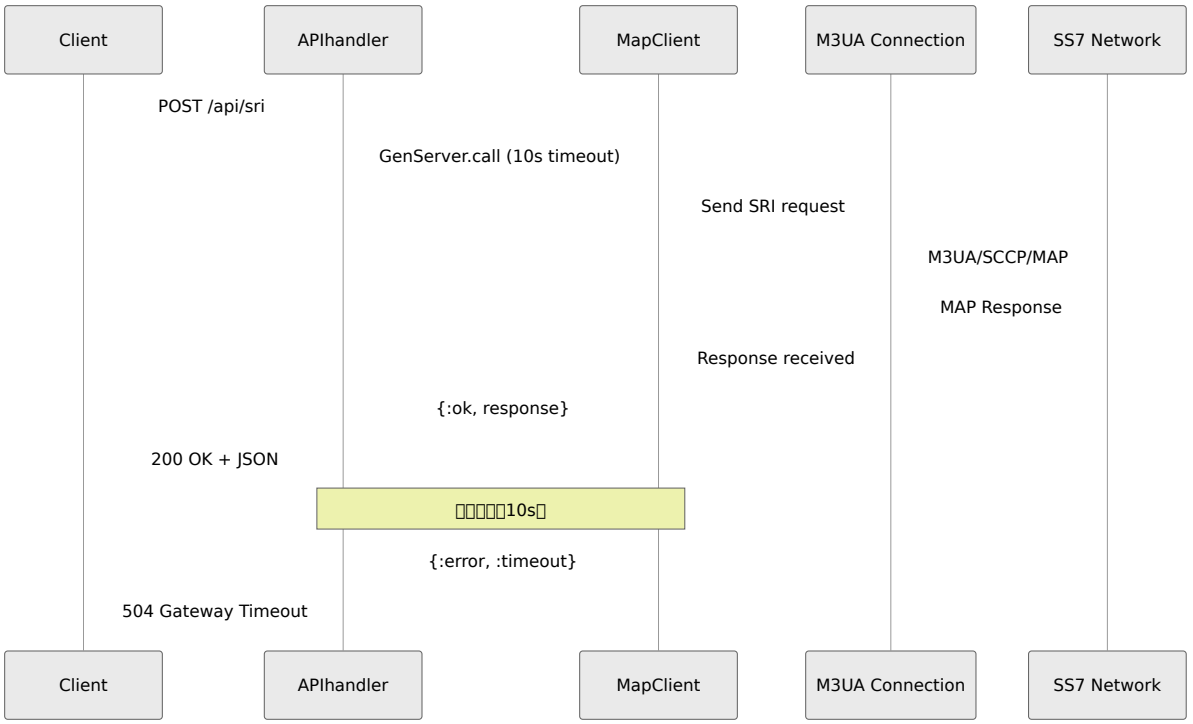
```
const axios = require('axios');

async function sendSRI() {
  try {
    const response = await
axios.post('http://localhost:9090/api/sri', {
      msisdn: '1234567890',
      gmsc: '5551234567'
    }, {
      timeout: 15000
    });

    console.log('□□:', response.data);
  } catch (error) {
    if (error.code === 'ECONNABORTED') {
      console.error('□□ - □□□□□□');
    } else {
      console.error('□□:', error.response?.data || error.message);
    }
  }
}

sendSRI();
```

Bash/cURL □□

```
#!/bin/bash

# UpdateLocation □□
response=$(curl -s -w "\n%{http_code}" -X POST
http://localhost:9090/api/updateLocation \
  -H "Content-Type: application/json" \
  -d '{
    "imsi": "001001234567890",
    "vlr": "5551234800"
  }')

http_code=$(echo "$response" | tail -n 1)
body=$(echo "$response" | sed '$d')

if [ "$http_code" -eq 200 ]; then
  echo "□□: $body"
elif [ "$http_code" -eq 504 ]; then
  echo "□□ - □□□□□□"
else
  echo "□□ $http_code: $body"
fi
```

□□□

API □□□□



□□

OmniSS7 REST API □□□

- **47** □□□□□□

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← □□□□□

SS7□□□OmniSS7□□□□□□□□

SS7□□□



MAP□□□

□□□□□□□□□3GPP TS 29.002□MAP `local` □□□□□□□□□□OmniSS7□□□/□□□□□□□□□

□□	□□□	□□
updateLocation	2	□□□□□□□CS□
cancelLocation	3	□VLR/SGSN□□□□
provideRoamingNumber	4	□□MSRN
noteSubscriberDataModified	5	□□gsmSCF□□□□□□
insertSubscriberData	7	□□□□□□□VLR/SGSN
deleteSubscriberData	8	□VLR/SGSN□□□□□□
registerSS	10	□□□□□□□□□CFU□
eraseSS	11	□□□□□□
activateSS	12	□□□□□□
deactivateSS	13	□□□□□□
interrogateSS	14	□□□□□□□□
registerPassword	17	□□SS□□
getPassword	18	□□□□□SS□□
sendRoutingInfo	22	□□□□□□□SRI□
updateGprsLocation	23	□□□□□□□SGSN□□□
sendRoutingInfoForGprs	24	□□□□GGSN□GPRS□□
reset	37	HLR□□□VLR/SGSN
forwardCheckSS-Indication	38	□□SS□□□□□□□

□□	□□□	□□
checkIMEI	43	□□EIR□□□□□□□
mt-forwardSM	44	□SMS□□□□□□MT□
sendRoutingInfoForSM	45	□□SMS□□□SRI-for-SM□
mo-forwardSM	46	□□□□□SMS□MO□
reportSM-DeliveryStatus	47	□HLR□□SMS□□□□
sendIdentification	55	□□□□VLR□□IMSI/auth
sendAuthenticationInfo	56	□□□□□□
restoreData	57	□VLR□□□□□□□□□
sendIMSI	58	□HLR□□MSISDN□□□IMSI
processUnstructuredSS-Request	59	□□□□□USSD□□□□□□
unstructuredSS-Request	60	□□□□□USSD□□□□□□
unstructuredSS-Notify	61	□□□□□USSD□□
anyTimeSubscriptionInterrogation	62	gsmSCF□□□□□□
alertServiceCentre	64	□□SMSc□□□□□
anyTimeModification	65	gsmSCF□□□□□□
readyForSM	66	□□HLR□□□□□□□SMS
purgeMS	67	□VLR/SGSN□□□□□□□
provideSubscriberInfo	70	□□□□□□/□□

□□	□□□	□□
anyTimeInterrogation	71	gsmSCF□□□□□□/□□
provideSubscriberLocation	83	□□□□□□□□□□□□□LCS□
sendRoutingInfoForLCS	85	GMLC□□□□□□□□□□LCS□
subscriberLocationReport	86	□□□□□GMLC□□□□□LCS□
noteMM-Event	89	□gsmSCF□□□□□□□□

TCAP□□□□

- **BEGIN** - □□□□
- **CONTINUE** - □□□
- **END** - □□□□
- **ABORT** - □□□□

SCCP□□

□□□□□□

- **E.164** - □□□□□□□□□□□447712345678□
- **E.212** - IMSI□□□□□□234509876543210□
- **E.214** - □□□□

□□□□□□SSN□

- **SSN 6**: HLR
- **SSN 7**: VLR

- **SSN 8**: MSC/SMSC
- **SSN 9**: GMLC
- **SSN 10**: SGSN

SMS TPDU

□□□□

- **SMS-DELIVER** (MT) - □□□□□
- **SMS-SUBMIT** (MO) - □□□□□
- **SMS-STATUS-REPORT** - □□□□
- **SMS-COMMAND** - □□□□

□□□□

- **GSM7** - 7□GSM□□□□□□SMS 160□□□□
- **UCS2** - 16□Unicode□□□SMS 70□□□□
- **8-bit** - □□□□□□□□SMS 140□□□

M3UA□□

- **DOWN** - □SCTP□□
- **CONNECTING** - SCTP□□□
- **ASPUP_SENT** - □□ASPUP□□
- **INACTIVE** - ASP□□□□□□□
- **ASPAC_SENT** - □□ASPAC□□
- **ACTIVE** - □□□□□□

□□SS7□□

□□□□□14□□ITU□□24□□ANSI□□□

□□□□□**ITU**□□

- □□□3□
- □□□8□
- □□□3□

SCCP□□□□

- **0** - □□□□□□
- **1** - □□□□□□□□□
- **2** - □□□□□
- **3** - □□□□□
- **4** - □□□□□
- **5** - MTP□□
- **6** - □□□□
- **7** - □□□
- **8** - □□□□□□

MAP□□□□

□□	□□	□□
1	unknownSubscriber	□□□□HLR□
27	absentSubscriber	□□□□□
34	systemFailure	□□□□
35	dataMissing	□□□□□□□
36	unexpectedDataValue	□□□□□

□□□□

- ← □□□□□
- STP□□
- MAP□□□□□
- □□□□□□
- HLR□□
- □□□□

OmniSS7□Omnitouch□□□□□□

CAMEL □□□□□□

□□

CAMEL □□ (CAMELGW) □□□ OmniSS7 □□□□□□□□□□ (IN) □□□□□ CAMEL □□□□ (CAP) □□□□□□□□□□□□□□□□OmniSS7 □□ **gsmSCF** (□□□□□□□)□□□□□ MSC/VLR/GMSC □ **gsmSSF** □□□□□□□□ CGrateS □□□□□□□□

□□□ CAMEL□

CAMEL (□□□□□□□□□□□□□□□) □□□□□□□□□□ GSM □□□□□ UMTS □□□□□□□□□□□□□□□□

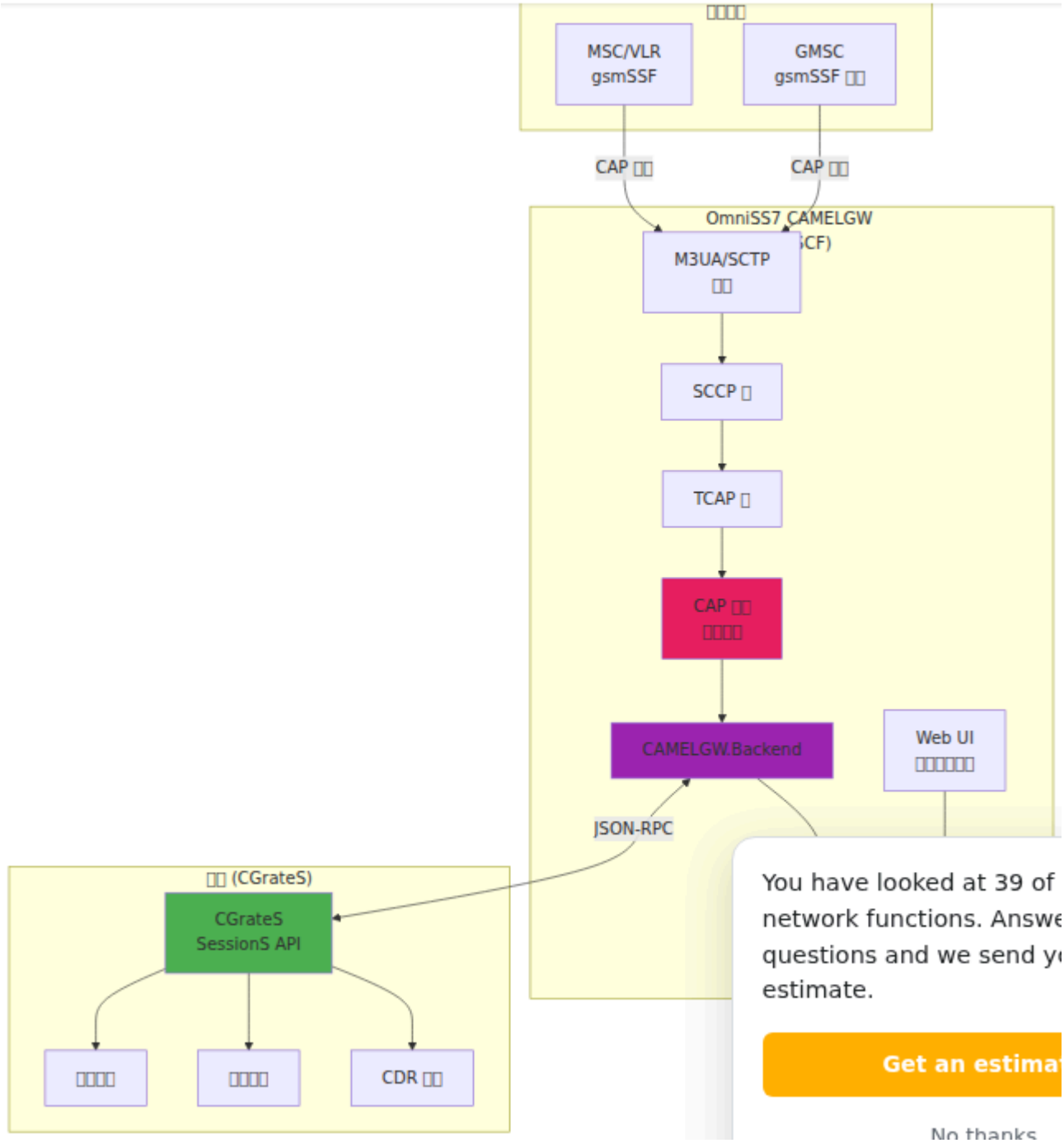
CAP □□□□

OmniSS7 CAMELGW □□□□ CAP □□□□□□□□□ TCAP □□□□□□□□□□□ OID□

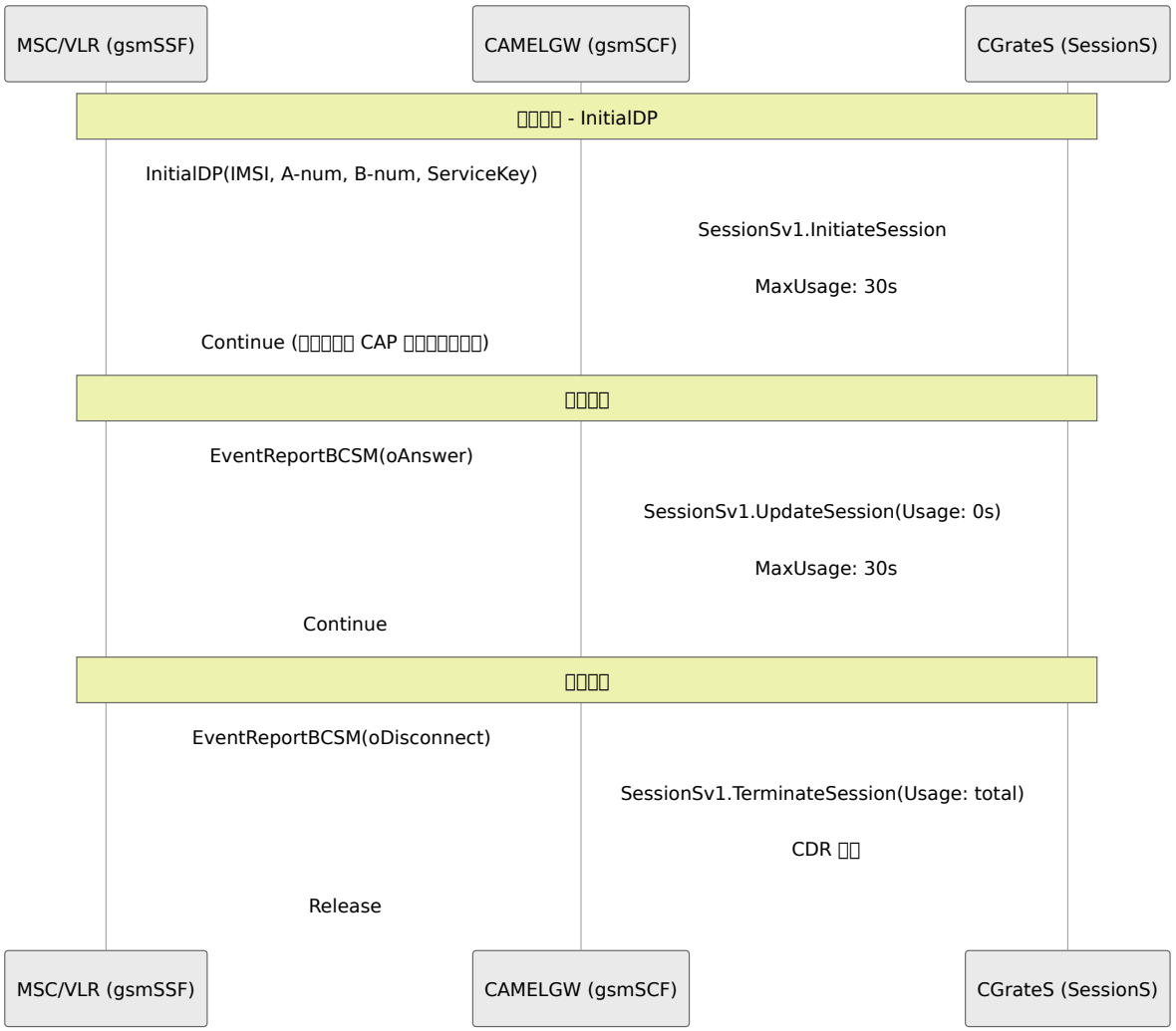
□□	□□	□□□□□ **OID**
CAP v1	CAMEL □□□□	`0.4.0.0.1.0.50.0`
CAP v2	CAMEL □□□□	`0.4.0.0.1.0.50.1`
CAP v3	CAMEL □□□□	`0.4.0.0.1.21.3.4`
CAP v4	CAMEL □□□□	`0.4.0.0.1.23.3.4`

□□**:** CAP v2 (□□□□□)□□□□□□□ InitialDP □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ MSC □ CAP □□□□□

□□


MSC/VLR
gsmSSF
GMSC
gsmSSF □□
CAP □□
CAP □□
OmniSS7 CAMELGW
M3UA/SCTP
□□
SCCP □
TCAP □
CAP □□
□□□□
CAMELGW.Backend
Web UI
□□□□□□□
JSON-RPC
□□ (CGrateS)
CGrateS
SessionS API
□□□□
□□□□
CDR □□
You have looked at 39 of
network functions. Answe
questions and we send y
estimate.
Get an estima
No thanks

□□□□□□



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- □□□□□□ OmniSS7
- □ MSC/GMSC (gsmSSF) □ M3UA □□
- □□□ JSON-RPC □□□ CGrateS □□ (□□□□□□□□□□)

□□ CAMEL □□□□

CAMEL □□□□□□□□□□□□□□`cap_client_enabled` □□ CAP/M3UA □□□□ CAMEL □□□□□`cgrates_enabled` □□□□□ CGrateS □□□□□□ `config/runtime.exs` □□□□□□

```
config :omniss7,
  # □□ CAP/CAMEL □□□ (M3UA ASP, SessionStore, □□□□)
  cap_client_enabled: true,

  # □□□□□□ (□□□□□□□□□□□□)
  map_client_enabled: false,
  smsc_mode_enabled: false,

  # □□□□□/□□□ CAP □□ (:v1 | :v2 | :v3 | :v4)
  cap_version: :v2,

  # CGrateS □□□□
  cgrates_enabled: true,

  # CAP □ M3UA □□ (□□ ASP □□□ MSC/GMSC gsmSSF)
  cap_client_m3ua: %{
    routing_context: 1,
    opc: 5013,
    dpc: 5011
  }
```

> □□ **`cap_client_m3ua`** □□□□ CAMEL □□□□□□□□□□□ `:routing_context`□`:opc` □ `:dpc`□□□□□□□□□□ CAP □□□□□□M3UA ASP □□□□□□□□□□ `:camelgw_client_asp`□

> □□ `camelgw_mode_enabled`□`hlr_mode_enabled` □ `smsc_mode_enabled` - for - CAMEL □□□□□ CAMEL □□□□□□□□ `cap_client_enabled` □ `cgrates_enabled`□

□□□□

□	□□□	□□
`cap_client_enabled`	`false`	□□ CAP/CAMEL □□□ (M3UA ASP, SessionStore, CAP □□□□)
`cgrates_enabled`	`false`	□□ `CAMELGW.Backend` □□ CGrateS □□□□
`cap_version`	`:v2`	□□□□□□□ CAP □□/□□ OID
`map_client_enabled`	`false`	□□□ MAP □□□□□
`smsc_mode_enabled`	`false`	□□□ SMSc □□ (□□ MAP □□□)

CGrateS □□□□

□	□□□	
`cgrates_enabled`	`false`	CGrate
`cgrates_url`	`http://localhost:2080/jsonrpc`	CGrate □
`cgrates_tenant`	`cgrates.org`	□□ Sess
`cgrates_request_type`	`*prepaid`	CGrate `*prepa` `*postp`
`cgrates_timeout`	`5000`	HTTP □
`cgrates_voice_usage_seconds`	*□□*	□□□□□□ InitialD ApplyC □□□□□□ ApplyC □□□ TAS □

□□ Web UI □□

Web UI □□□□□□□□ CAMEL □□□□□□ `config/config.exs` □□□□

```
config :control_panel,
  use_additional_pages: [
    {SS7.Web.EventsLive, "/events", "SS7 □□"},
    {SS7.Web.M3UAStatusLive, "/m3ua", "□□□"},
    {SS7.Web.CAMELSessionsLive, "/camel_sessions", "CAMEL □□"},
    {SS7.Web.CAMELRequestLive, "/camel_request", "CAMEL □□□□□"}
  ],
  page_order: [
    "/events", "/m3ua", "/camel_sessions", "/camel_request",
    "/application", "/configuration"
  ]
```

□□□□	□□	□□
□□□	`/m3ua`	`SS7.Web.M3UAStatusLive`
CAMEL □□	`/camel_sessions`	`SS7.Web.CAMELSessionsLive`
CAMEL □□□□□	`/camel_request`	`SS7.Web.CAMELRequestLive`

□□□ CAP □□

CAP □□□□□□□□□□□□□□□□□□□□□□ CAP □□□□□□□□□□□□□□□□□□□□

□□	□□
InitialDP	□□□□□□□□□□ CGrateS `InitiateSession`□□□□□ 0 □□□□ 60 (□□ InitialDP/InitialDPSMS) □□□□
AssistRequestInstructions	□□□□ TCAP □□□□□□□□ 1 □□
EventReportBCSM	BCSM □□□oAnswer □□□□□□□□□□oDisconnect / oAbandon / tDisconnect / tAbandon / busy / no-answer □□ CGrateS □□□□□□□□
ApplyChargingReport	□□□ 36□□□□□□□□ CGrateS □□□□□□□□□□□□□□□□□ □□□□□□□□□□ CGrateS □□
Continue	□□
ConnectToResource	□□
RequestReportBCSMEvent	□□
ApplyCharging	□□ BER □□□□□
Connect	□□ BER □□□□□
ReleaseCall	□□

□□□□□□□□□□ TCAP □□□□□□□□□□/□□□□□□□□□□□□

□□□□ (gsmSCF → gsmSSF)

□□□ gsmSSF□□□□□□□□ OmniSS7 □□□□□

□□	□□□
InitialDP	0
Connect	20
ReleaseCall	22
RequestReportBCSMEvent	23
Continue	31
ApplyCharging	35
InitialDPSMS	60
NoteMM-Event	89 (MAP)

> **InitialDPSMS** (□□□ 60) □□ MO-SMS CAMEL □□□□ smsSSF □ SMS-CSI / mo-sms-CSI □□□□□□□ gsmSCF□□□□□□□□□ SMSC □□□□□□□□□□ CAP ASN.1 □□□□□□□ □□ `id-ac-cap3-sms-AC` □□□□□□
>
> **NoteMM-Event** □□□ MAP □□ (□□□ 89□□□ CAP)□□□□ VLR □ gsmSCF □ CAMEL M-CSI □□□□□□□□ MAP ASN.1 □□□□ (`:TCAPMessages.encode(:MapSpecificPDUs, …)`) □□□ `mm-EventReporting-v3` □□□□□□

□□ CAP TCAP □□□□□ `:GenericTCAP.encode(:GenericPDUs, …)` □□□□□□□□ MAP □ NoteMM-Event □□ `:TCAPMessages`□

Web UI □□

CAMEL □□□□□

□□**:** CAMEL □□ · □□**:** `/camel_sessions` (HTTPS, □□ 8087)

□□□□□□□□ CAMEL □□□□□□

- □□□□□□□□□□□□□□
- □□□□□□□□ - OTID□□□□ ID□□□□□□□□□□
- **CAP** □□ □ InitialDP □□□□□□□□□□
- □□□□□ - IMSI□A □□□B □□□□□□□□
- □□□□□ - `initiated`□`answered`□`terminated`

□□**:** □□ ID□□□□□□□□IMSI□□□□□□□□□□□□□

□□	□□□	□□
□���□ GT	`99988415011`	□□□□□□
□□□ GT	(□□□)	□□□□□
□□ SSN	`146`	gsmSSF
□□ SSN	`146`	gsmSSF
OPC	`5013`	□□□□
DPC	`5011`	□□□□□

□ CGrateS □□□

OmniSS7 □□ CGrateS **SessionS** JSON-RPC API □□□□□□□□□ `CGrateS.SessionsClient` □□□□□□ `cgrates_url` □□ CAP □□□□□ SessionS □□□

CAP □□	**SessionS** □□
InitialDP	`SessionSv1.InitiateSession` (□□□□□)
ApplyChargingReport□□□□□	`SessionSv1.UpdateSession` (`LastUsed` = □□□□□□□□□)
ApplyChargingReport□□□□□□ EventReportBCSM □□/□□□□□ MSC □ TCAP □□□□□	`SessionSv1.TerminateSession` (□□□□)□□□ `SessionSv1.ProcessCDR`

□□□□□□ TAS Ro □□□□□□□□□ (`cgrates_tenant`)□`ToR *voice`□`RequestType` `cgrates_request_type`□`Category call`□□□□ (`cgrates_voice_usage_seconds`)□ □□□□□□□□□□ `GetAttributes`□□□□□□ AttributeS □□□□□□□□□□□□□□□□□□□`Account` □□□

InitialDP □□□□□□□ **IMSI** (□□ IMSI □ InitialDP □□□□)□`Destination` □□□□□□ `OriginID` □ `CAMEL-<hex OTID>`□`OriginHost` □ `CAMELGW`□

□□□□□□□□□

1. □□□□ (InitialDP)

□ MSC □□ InitialDP □□CAMELGW□

1. □□□□□□□ **CAP** □□
2. □□ **InitialDP** (IMSI□ISUP □□/□□□□□CalledPartyBCDNumber□□□□□□□□□□)
3. □□ **CGrateS** `SessionSv1.InitiateSession` □□□□□□
4. □ **TCAP Continue** □□□ **MSC**□□□ RequestReportBCSMEvent (O-BCSM □ T-BCSM □□□□□□ 1 □□ 2 □□□□□□□□□□□□□□)□ApplyCharging □ Continue

`MaxUsage` □□ ApplyCharging □ `maxCallPeriodDuration`□□□□ `releaseIfDurationExceeded` □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ MSC □□□□□□□□□□□ □□□□□□□□□□ CGrateS □□□□□□□□□□ **ReleaseCall** (□□ 31) □ TCAP □□□□□□□□□

2. □□□□ (EventReportBCSM - oAnswer / tAnswer)

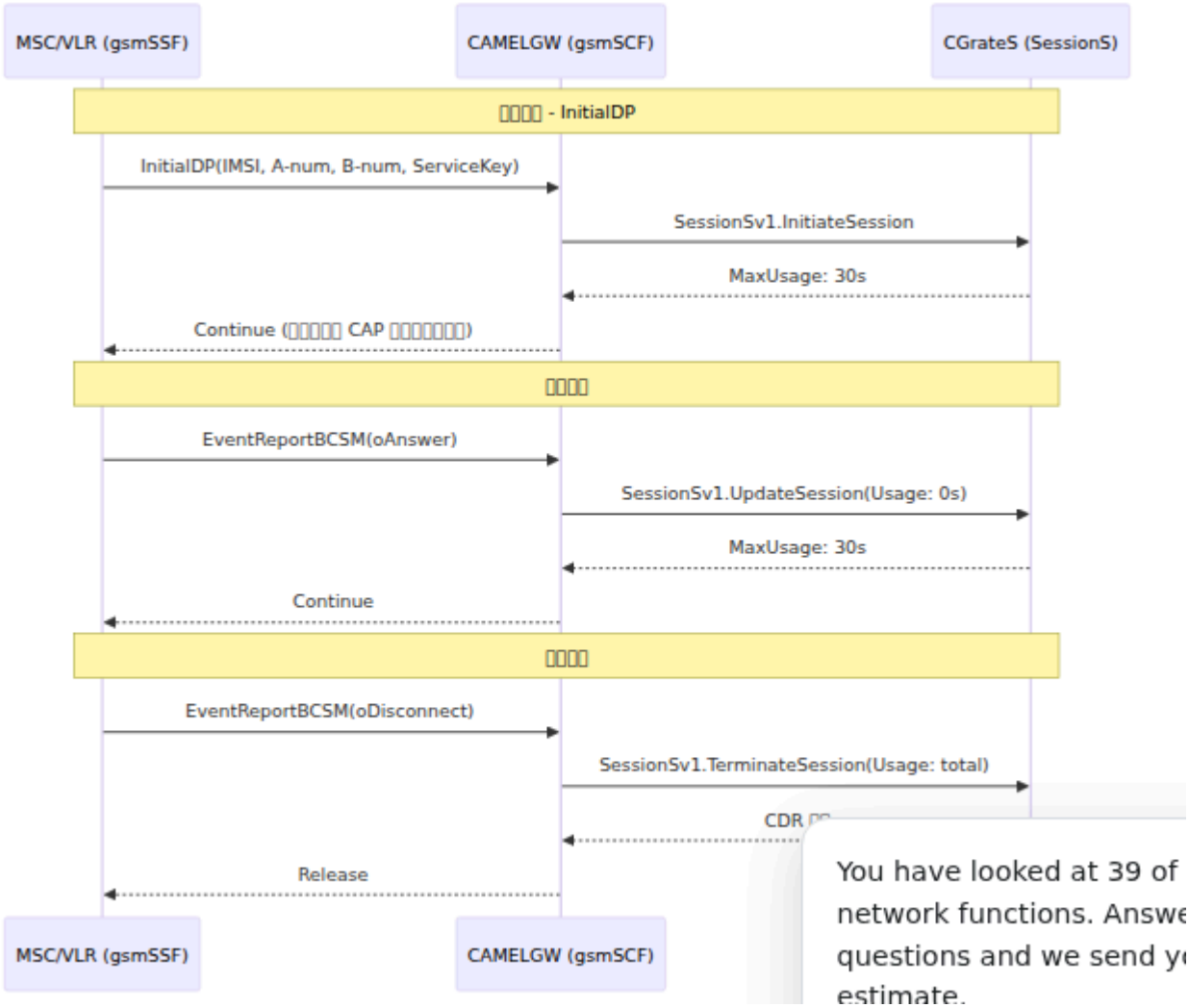
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

3. □□□□ (ApplyChargingReport)

□□□□□□□□□□□□□MSC □□□□□□□□□□□□□□□□□□ CGrateS□□□□□□□□□□□□□□□□□□□□□□□□□□ ReleaseCall□

4. □□□□

□□□ ApplyChargingReport (□□□□□□□)□□□□/□□ EventReportBCSM□□ MSC □□□□□□□ CGrateS □□□□□□□ CDR (`ProcessCDR`) □□□□□□□



CDR □□□□ CAMEL

CDR □ CGrateS □□□□□□□□

- `Account` - IMSI (□□□□□□□)
- `Destination` - □□□□□
- `OriginID` - □□□□□ (`CAMEL-<hex OTID>`)
- `Usage` - □□□□□□□□□□
- `IMSI`□`CallingPartyNumber`□`CalledPartyNumber`
- `MSCAddress` - □□ MSC
- `ServiceKey` - CAMEL □□□□

□□

□□□□□□□□□□□□□□

1. □□ `https://your-server:8087/camel_request`
2. □□ **InitialDP**□□□□□□□□/□□/□□□□□□□□□□ CAP □□□□□□□□□□□□□□□□□□ OTID□
3. □□ `https://your-server:8087/camel_sessions` □□□□□ `initiated` □□□□
4. □□ **EventReportBCSM**□□□ `oAnswer` □□□□□□ `answered`□
5. □□□□ `16` (□□) □□ **ReleaseCall** □□□□

□□□□ MSC □□□□

□□□ MSC/VLR □□□ CAMEL □□ (□□□□□gsmSCF □□□□)□□□□□ InitialDP □□ OmniSS7□□□ MSC □□□□

```
ADD CAMELSERVICE:
  SERVICEID=1,
  SERVICEKEY=100,
  GSMSCFADDR="55512341234",   # CAMELGW □□□□
  DEFAULTCALLHANDLING=CONTINUE;

ADD CAMELSUBSCRIBER:
  IMSI="310150123456789",
  SERVICEID=1,
  TRIGGERTYPE=TERMCALL;
```

□□□□

OmniSS7 □□□□□ JSON □□□□□□□□□□□□□ `OmniLogger.JsonFormatter`□□□□□□□□□□□□□□□□□□□

```
# □□□□□□□□ CAP □□
tail -f /var/log/omniss7/omniss7.log | jq 'select(.map_event |
tostring | startswith("CAP:"))'
```

□□□□□

Prometheus □□

CAMELGW □ `http://localhost:9090/metrics` □□□□□

CAP □□□

- `cap_requests_total{operation}` - □□□□□ CAP □□□□□□□ snake_case□□□ `initial_dp`□`connect`□`release_call`□`continue`□`apply_charging`□
- `cap_request_errors_total{operation}` - □□□□ CAP □□□□/□□□□□

MAP / API □□□

- `map_requests_total{operation}` - □□□□□ MAP □□
- `map_pending_requests` - □□□□ MAP TID □□□□□

M3UA STP □□ (□□□□□ STP □□)□

- `m3ua_stp_routing_failures_total{reason}` - □□□□□□□□

```
# □□ CAP □□□□□
curl http://localhost:9090/metrics | grep cap_requests_total

# □ InitialDP (□□ snake_case □□)
curl http://localhost:9090/metrics | grep
'cap_requests_total{operation="initial_dp"}'
```

□□□□

```
# M3UA □□□□□ (TLS API □□□ 8445)
curl -k https://localhost:8445/m3ua-status

# □□□ CAMEL □□ (□□ session_count + □□□□□□□□)
curl -k https://localhost:8445/camel-sessions
```

□□ `/api/ocs-status`□`/api/events` □ `/api/camel/sessions/count` □□□□□□□□□□ `/camel-sessions`□

□□□□

□ `config/runtime.exs` □□□□□□□□□

```
config :logger, level: :info   # :debug | :info | :warning |
:error
```

□□□□□□□ `config/config.exs` □□□□□□□□ JSON□

```
config :logger, :default_formatter,
  format: {OmniLogger.JsonFormatter, :format},
  metadata: :all,
  truncate: :infinity
```

□□□□

□□□□□□ CAP □□

□□□ □□□□□□□□□□□□□ MSC □□□□ InitialDP□

□□□

1. M3UA □□□□□□ `curl -k https://localhost:8445/m3ua-status`
2. MSC CAMEL □□□□ (□□□□□gsmSCF □□)
3. SCCP □□ (gsmSCF □□□□□□□□□□ CAMELGW)
4. □□□□□ (□□ SCTP □□ 2905)

□□□CGrateS □□

□□□ □□□□□ `not_configured`□`http_error` □ `cgrates_error`□

□□□

1. `cgrates_enabled: true` □ `cgrates_url` □□□□□□ JSON-RPC □□
2. □□ (IMSI □□□□□□) □□□□ CGrateS □□□□
3. `cgrates_tenant` □ `cgrates_request_type` □□□ CGrateS □□□□□□
4. `cgrates_timeout` □□□□ CGrateS □□□□□

□□□□□□□□□□□□□□□CAMELGW □□□□□□□□□□□□□□□□□□□□

□□□□□□□□

□□□ EventReportBCSM □□□□ "□□□□□"□

□□□ OTID □□□□□□□□□□□□

□□□ □□□□□□ OTID□□□□ DTID/OTID □□□□□□□□

□□□□□□□

□□□ □□□□□ "□□□□ InitialDP"□

□□□ CAP □□□□□□□□□□□□□□

□□□ □□ CAP □□□□□ MSC □□□□□□ PCAP □□□□□

```
tcpdump -i eth0 -w cap_trace.pcap sctp port 2905
```

□□

CAMEL □□□□□ OmniSS7 □□□□ gsmSCF□□□□

- **CAP** □□□□ (v1/v2/v3/v4) □□□□□□□□□□□
- □□ **CGrateS SessionS JSON-RPC API** □□□□
- □□□□□□ (Connect□Release□Continue□ApplyCharging)
- **ETS** □□□□□□□□ **OTID** □□

- □□ **Web UI** □□□□□□□□□□□□
- □□□□□□□□□□ (Web UI □ `/camel-sessions` API)
- □ **CGrateS** □□□ **CDR** □□□□□□□

□□□□□□□

- □□□□ - CAP □□

□□□ OmniSS7 CAMEL □□
□□□□□ 1.1

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← □□□□□

□□□□□□□□ OmniSS7 □□□□□□□□□□□

□□

1. Web UI □□
2. API □□
3. □□□□□
4. □□□□
5. □□□□□□□□ SCTP □□□

Web UI □□

Web UI □□ HTTPS □□□ `8087` □□□□□□□□ `force_ssl` □□□□ TLS□□□□ `https://localhost:8087/`□

□□□

□□□ `config/config.exs` □□□□□□□□□□□□ `page_order` □□□□□□□□□□□□□□□□□□□

- □□ (`/application`) - □□□□□□□□□□□
- □□ (`/configuration`) - □□□□□□□□
- **SS7** □□ (`/events`) - □□ SS7 □□□□□□□□□□
- □□□□ (`/logs`) - □□□□□□□□
- **SS7** □□□ (`/client`) - □□□ MAP □□□□□□□□
- □□□ (`/m3ua`) - M3UA/M2PA □□□□
- □□ (`/routing`) - □□□□□□□□□□
- □□□□ (`/routing_test`) - □□□□□□□□□
- **SMSc** □□ (`/smsc_links`) - □□□□□□□ (SMSc)
- **SMSc** □□□ (`/smsc_subscribers`) - □□□□□□□□□ (SMSc)
- **HLR** □□ (`/hlr_links`) - HLR □□□□ (HLR)
- □□□□□ (`/subscribers`) - □□□ UpdateLocation □□□
- **CAMEL** □□ (`/camel_sessions`) - □□ CAMEL □□□□ (CAMEL GW)
- **CAMEL** □□□□□ (`/camel_request`) - □□□ CAP □□□□□ (CAMEL GW)

- **MSISDN/IMSI** □□ (`/msisdn_imsi_test`) - □□□□□□□□□

□□ Web UI

1. □□□□□□□□□□
2. □□□□□□□□□□□ 8087□□□□`https://localhost:8087/`□
3. □□□□□□□□□□

Swagger API □□

□□□ API □□□ MAP □□ API □ HTTP □□ 9090 □□□

```
http://your-server:9090/swagger
```

Web UI □□

Web UI □□□ `config :control_panel, ControlPanelWeb.Endpoint` □□□□□□□□□□ `config :control_panel` □□

```
config :control_panel, ControlPanelWeb.Endpoint,
  force_ssl: [rewrite_on: [:x_forwarded_proto]],
  server: true,
  url: [host: "0.0.0.0", path: "/"],
  https: [
    port: 8087,
    keyfile: "priv/cert/omnitouch.pem",
    certfile: "priv/cert/omnitouch.crt"
  ]

config :control_panel,
  page_order: [
    "/application", "/configuration", "/events", "/logs",
"/client",
    "/m3ua", "/routing", "/routing_test", "/smsc_links",
"/smsc_subscribers",
    "/hlr_links", "/subscribers", "/camel_sessions",
"/camel_request",
    "/msisdn_imsi_test"
  ]
```

□□□□□

□□	□□	□□
`ControlPanelWeb.Endpoint.url.host`	□□□□	`"0.0.0.0"`
`ControlPanelWeb.Endpoint.https.port`	□□□	`8087`
`ControlPanelWeb.Endpoint.https.keyfile`	□□□□□	`"priv/cert/omnitouch.pe`
`ControlPanelWeb.Endpoint.https.certfile`	□□□□□	`"priv/cert/omnitouch.cr`
`ControlPanelWeb.Endpoint.force_ssl`	□□□□□	`[rewrite_on: [:x_forwarded_proto]]`
`page_order`	□□□□□□□□	□□□

> □□□ □□□□ □□□□□□□□□□□□□□

□□□□

□□□ `OmniLogger.JsonFormatter` □□□□ JSON □□□□□□□□□□□□□□□□□□□□□□□□□□□□ `Logger.metadata`□□□□□□□□□□□□□STP □□ OPC/DPC/GTs□□□□□□□/□ MSISDNs□□□ otid/□ □□□□□□□□□□□□ `config/config.exs` □□□□

```
config :logger, :default_formatter,
  format: {OmniLogger.JsonFormatter, :format},
  metadata: :all,
  truncate: :infinity
```

□□□□□□□□□□

```
config :logger,
  level: :debug  # □□: :debug, :info, :warning, :error
```

□□□□□

□□	□□	□□
`:logger.level`	□□	`:debug`
`:logger.default_formatter.format`	□□	`{OmniLogger.JsonFormatter, :format}`
`:logger.default_formatter.metadata`	□□/□□	`:all`
`:logger.default_formatter.truncate`	□□/□□	`:infinity`

API □□

OmniSS7 □□□□ HTTP □□□

□□	□□	□□	□□
MAP □□ API	`9090`	HTTP	MAP `/api/*` □□□`/swagger`□`/swagger.json`□`/met
JSON □□ API (`api_ex`)	`8445`	HTTPS	□□□□ (`/api/status`□`/api/m3ua-status`□`/api/routing`□`/api/subscribers`□`/api sessions`□...)

MAP API □□ URL

```
http://your-server:9090/api
```

□□□□

- **200** - □□
- **400** - □□□□
- **504** - □□□□

OpenAPI □□

```
http://your-server:9090/swagger.json
```

□□□□□

Prometheus □□□□

```
http://your-server:9090/metrics
```

□□□□□□

M3UA/SCTP □□□

- SCTP □□□□□□
- M3UA ASP □□□□
- □□/□□□□□□□□□

M2PA □□□

- □□□□□□□DOWN → ALIGNMENT → PROVING → READY□
- □□□□□□/□□□□□□□□

- □□□□□□□□□□□□□□□SCTP□

STP □□□

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

MAP □□□□□□

- □□□□□□□ MAP □□
- □□□□□□□□□□
- □□□□□□□□

CAP □□□

- □□□□□□□ CAP □□
- CAMEL □□□□

SMSc □□□

- □□□□
- □□□
- □□□□□

Grafana □□

OmniSS7 □□□ Prometheus □ Grafana □□□

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1. □□□□
    - □□□□□ VLAN □

- □□□□□□□□□□
- □□□□□□□□□□□ SCTP

2. **Web UI** □□

- □□□□□□□ TLS
- □□□□□□□□□□□□□
- □□□□□ IP

3. **API** □□

- □□□□□□
- □□ API □□□ OAuth
- □□□□□□□□□□

□□□

1. **TPS** □□

- □□□□□ TPS
- □□□□□□
- □□ SCTP □□□

2. □□□□□□

- □□ SMS □□ API □□□□□□ 5 □□□□□
- □□ `auto_flush_tps` □ `auto_flush_interval` □□□□□□□
- □□□□□□□□□□

3. **M3UA** □□

- □□ SCTP □□□□
- □□□□□
- □□□□□□□□□□□

□□□□□□□ SCTP □□□

□□□ SCTP □□□□

SCTP □□□□ SCTP □□□□□□□□□□□□ M3UA □□□□□□□□□□□□□□□□□□□□□□□□□□□□ IP □□□□□□□□□□□□□□□□□□□□□□□□□□□□

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- □□□□□□□□□□□□□□□□□□□□□□□□SCTP □□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□ - SCTP □□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□□□□ NIC □□
- □□□□□□SCTP □□□□□□□□□□□□□□□□□□□□□□□□□

□□□□

□□□ M3UA ◆◆□□□□□ IP □□□□SCTP□

1. □□□□□□ **IP**□□□□□□□□□□□□□□□ IP □□
2. □□□□□□SCTP □□□□□□□□□□□□□□□□□□□□□□□□□□□□
3. □□□□□□□□□□□□□□□□□□□□□SCTP □□□□□□□□□
4. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
5. □□□□□□□□□□□□□□□□□□SCTP □□□□□□□□□□□□□□□□

□□

SCTP □□□□□□□□ **IP** □□□□ □□□□□□ IP □□□□□□□□

□□ **IP**□□□□

```
# □□ IP - □□□□
local_ip: {10, 179, 4, 10}
```

□□ **IP**□□□□□□□

```
# □□ IP - □□□□□□
# □□□□ IP □□ IP□□□□ IP □□□□□□
local_ip: [{10, 179, 4, 10}, {10, 179, 4, 11}]
```

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> □□□□□□□□□□□□□□□□□□□□□□
>
> □□□□□□ `role: :server`□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `remote_ip` □□□□ □□□□□ - □□□□□□□□□□□ SCTP □□□SCTP INIT□□ IP □□□□□□□□□□□□
>
> □□□□□ STP □□ SCTP INIT □□□□□□ IP □□□□□□□□SCTP □□□□□□□□□□□□□□□□□□□□

```
# STP □□□□□□□□□□□□□□□□
config :omniss7,
  m3ua_peers: [
    %{
      peer_id: 1,
      name: "Partner_STP_Redundant",
      role: :client,  # □□ - □□□□□□□
      # □□□□□□□□□□□□ IP □□□□□□
      local_ip: [{213, 57, 23, 200}, {213, 57, 23, 201}],
      local_port: 0,
      # □□□□□□□□□□□□□ - □□□□□□□□□□□□□□□
      remote_ip: [{213, 57, 23, 100}, {213, 57, 23, 101}],
      remote_port: 2905,
      routing_context: 1,
      point_code: 100,
      network_indicator: :international
    }
  ]
```

□□ 2□□□□□□□ MAP □□□

```
# □□□□□□□ MAP □□□□□□
config :omniss7,
  map_client_enabled: true,
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :hlr_client_asp,
    # □□□□□□□□□ IP □□□□□□□□
    local_ip: [{10, 0, 0, 100}, {10, 0, 0, 101}],
    local_port: 2905,
    # □□ STP □□□□□□□□
    remote_ip: [{10, 0, 0, 1}, {10, 0, 0, 2}],
    remote_port: 2905,
    routing_context: 1
  }
```

□□ 3□□□□□□□ STP □□□

```
# □□□□□□□□□ STP □□□
config :omniss7,
  sctp_handler: %{
    enabled: true,
    # □□□□ IP □□□□□□□
    local_ip: [{172, 16, 0, 10}, {172, 16, 0, 11}],
    local_port: 2905,
    point_code: 100
  }
```

□□ 4□□□□□□ - □□□□□□□□□□□□□□□□

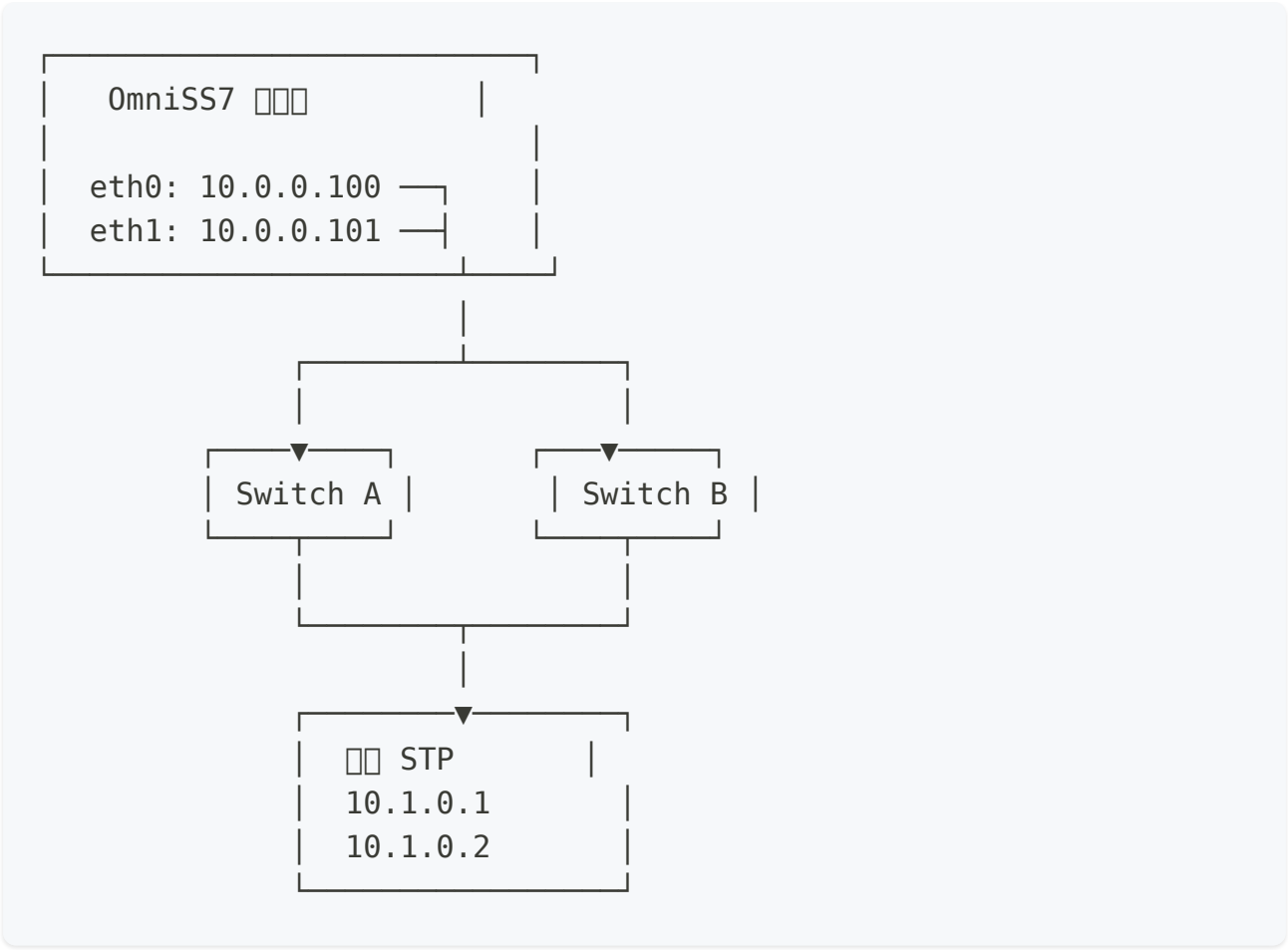
```
# □□□□□□□□ HLR □□□□□
config :omniss7,
  m3ua_peers: [
    %{
      peer_id: 1,
      name: "HLR",
      role: :server,  # □□ - HLR □□□□□
      # □□□□□□□□□ IP□□□□□□□□
      local_ip: [{10, 0, 1, 10}, {10, 0, 1, 11}],
      local_port: 2905,
      # □□□□□□□□ - HLR □□□□ SCTP INIT □ IP
      # SCTP □□□□□□□□□□ HLR □□□ IP
      remote_ip: {10, 0, 2, 100},  # □□ IP□□□□□□□
      remote_port: 0,  # □□□□□□□□□
      routing_context: 1,
      point_code: 100,
      network_indicator: :international
    }
  ]
```

□□ 5□□□□□□□□□□□

```
# □□□□□□□□□□□□□□□
config :omniss7,
  m3ua_peers: [
    # □□□□□□ - □□ IP
    %{
      peer_id: 1,
      name: "Legacy_STP",
      role: :client,
      local_ip: {10, 0, 0, 1},      # □□ IP □□
      local_port: 0,
      remote_ip: {10, 0, 0, 10},
      remote_port: 2905,
      routing_context: 1,
      point_code: 100
    },
    # □□□□□ - □□□
    %{
      peer_id: 2,
      name: "Redundant_STP",
      role: :client,
      local_ip: [{10, 0, 0, 2}, {10, 0, 0, 3}],  # IP □□
      local_port: 0,
      remote_ip: [{10, 0, 0, 20}, {10, 0, 0, 21}],
      remote_port: 2905,
      routing_context: 2,
      point_code: 200
    }
  ]
```

□□□□□□

□□ 1□□ NIC□□□□□□



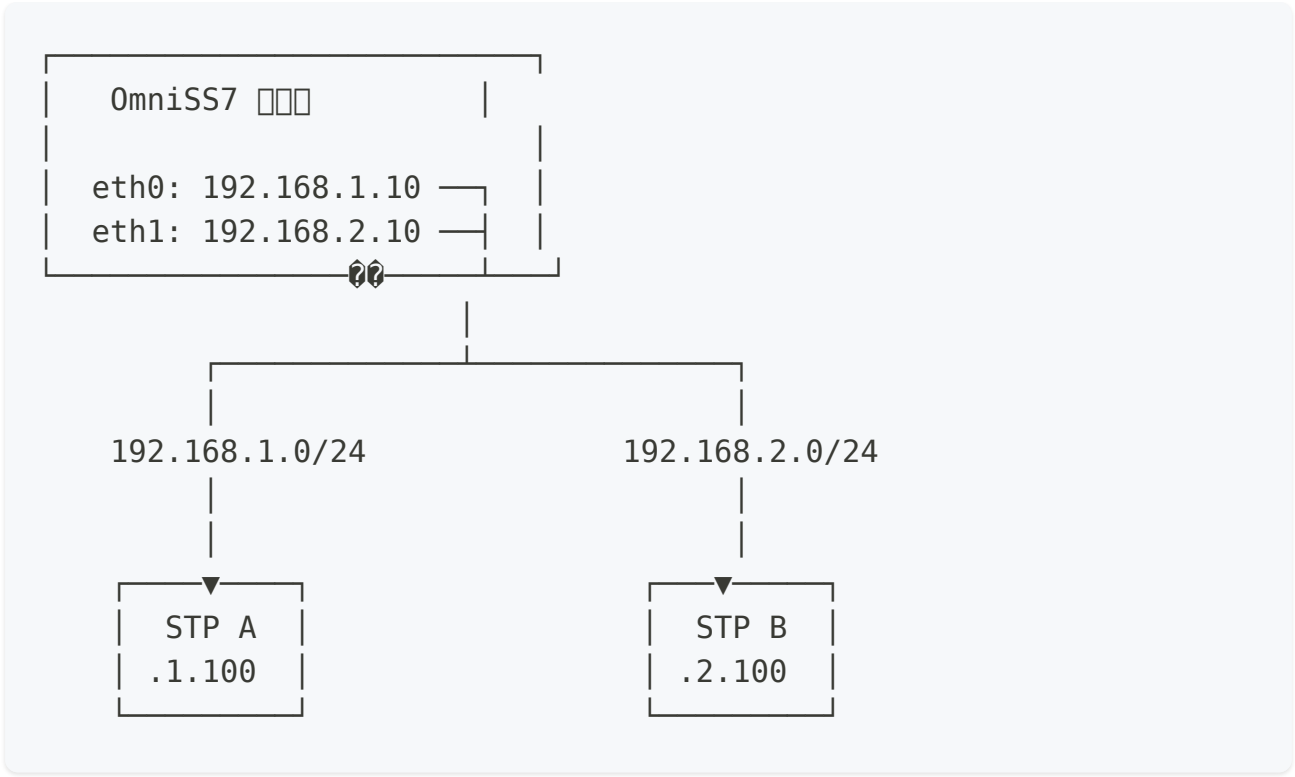
□□□

```
local_ip: [{10, 0, 0, 100}, {10, 0, 0, 101}]   # □□ NIC
remote_ip: [{10, 1, 0, 1}, {10, 1, 0, 2}]      # □□□□□
```

□□□

- □□□□□□□ NIC □□□
- □□□□□□□□□□□□□□□
- □□□□□□□□□□ 1 □

□□ **2**□□□□□



□□□

```
local_ip: [{192, 168, 1, 10}, {192, 168, 2, 10}]
remote_ip: [{192, 168, 1, 100}, {192, 168, 2, 100}]
```

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- □□□□□□□□□
- □□□□□□□□□
- □□□□□□□□

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□□□□□□□

```
[info] SCTP □□□□□□□□□□ 2 □□□ IP
[info] STP □□□□□□□□□□□□ 2 □□□ IP
```

□□□□□□□□□

```
[warning] [MULTIHOMING] □□ 10.0.0.100 □□□□□□ Partner_STP
(assoc_id=1) □□□□□□
[info] [MULTIHOMING] □□ 10.0.0.101 □□□□□□□ Partner_STP (assoc_id=1)
□□□□□
[info] [MULTIHOMING] □□ 10.0.0.100 □□□□□□□ Partner_STP (assoc_id=1)
□□□□□□
```

Web UI □□

Web UI □□□□□□□□□□□□

M3UA □□□□□

- □□ **IP**□□□□ `10.0.0.100`
- □□ **IP**□□□□ `10.0.0.100 (+1)` □ `10.0.0.100 (+2)`
- □□□□□□□□□□ IP □□/□□□

□□□□

1. □□□□

- □□□□□□ **NIC** □□□□□□□□
- □□□□□□□ □□□□□□□□□
- □□□□□□□□□□□ □□□□□□□□□
- □□□□□□□□□□ - □□□□□□□□□□□

2. IP □□□□

- □□□ **IP** □□ **IP** - □□□□□□□□□□□□□□
- □□□□□□ - □□□□□□□□□ IP
- □□□□□□□□ - □□□□□□□□□□□□□□□□□□

3. □□□□□□□

```
# □□□□□□□□□□□□□□□
sudo ip link set eth0 down

# □□□□□□□□□□□□□□□
tail -f /var/log/omniss7.log | grep MULTIHOMING

# □□□□□□□
sudo ip link set eth0 up
```

4. □□□□□□□□□□

- □□□□□□□□□□□□□□□ IP
- □□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□□□

5. □□□□□

```
# □□□□□□□□ IP ▯▯▯ SCTP
iptables -A INPUT -p sctp --dport 2905 -s 10.0.0.0/24 -j ACCEPT
iptables -A INPUT -p sctp --dport 2905 -s 10.1.0.0/24 -j ACCEPT
```

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□□□□□□□□ IP□□□□□□□

□□□

1. □□ Erlang SCTP □□□`erl -eval 'gen_sctp:open(9999, [binary, {ip, {127,0,0,1}}]).'`
2. □□□□ SCTP □□□`lsmod | grep sctp`
3. □□□□□□ SCTP□`sudo modprobe sctp`
4. □□□□□□□□□□ IP□`ip addr show`

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□□□

1. □□ SCTP □□□□
2. □□□□□□□□□□□□□□□□
3. □□□□□□□□□□ IP □□ SCTP
4. □□ SCTP □□□□□□□

□□□□□□□□□□□

□□□□□□ UP □ DOWN □□□□□□

□□□

1. □□□□□ - □□□□□□
2. SCTP □□□□□□ - □□□□□□
3. □□□□□ SCTP □□
4. □□□□□□ MTU □□

□□□

- □□□□□SCTP □□□□□□□
- □□□□□□□□□□□□□□□□□
- □□□□□□□□□□□ 1 □□□□□□□□□
- □□□□□□□□□□□

□□

- □□□□□□□ IP □□□□□□□□□□
- □□□□□□□□□□ IP □□ IP □□□
- □□□□□□□□ STP□HLR□SMSc □ MAP □□□□□□□□□
- **Erlang** □□□□□□□□□ SCTP □ Erlang

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- M3UA □□□

- MAP □□□□□
- API □□□□
- □□□□□□

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- M3UA □□ > 1 □□
- MAP □□□ > 10%
- □□□□ > 1000
- API □□□ > 5%

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□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□ (`:logger`)

```
config :logger, :default_formatter,
  format: {OmniLogger.JsonFormatter, :format},
  metadata: :all,
  truncate: :infinity

config :logger,
  level: :debug  # :debug | :info | :warning | :error
```

□□	□□	□□	□□
`:logger.level`	□□	□	`:debug`
`:logger.default_formatter.format`	□□	□	`{OmniLogger.JsonFormatt` `:format}`
`:logger.default_formatter.metadata`	□□/□□	□	`:all`
`:logger.default_formatter.truncate`	□□/□□	□	`:infinity`

Web UI □□ (`:control_panel`)

```
config :control_panel, ControlPanelWeb.Endpoint,
  force_ssl: [rewrite_on: [:x_forwarded_proto]],
  server: true,
  url: [host: "0.0.0.0", path: "/"],
  https: [
    port: 8087,
    keyfile: "priv/cert/omnitouch.pem",
    certfile: "priv/cert/omnitouch.crt"
  ]

config :control_panel,
  page_order: [
    "/application", "/configuration", "/events", "/logs",
"/client",
    "/m3ua", "/routing", "/routing_test", "/smsc_links",
"/smsc_subscribers",
    "/hlr_links", "/subscribers", "/camel_sessions",
"/camel_request",
    "/msisdn_imsi_test"
  ]
```

□□	□□	□□	□□
`ControlPanelWeb.Endpoint.url.host`	□□□□	□	`"0.0.0.0"`
`ControlPanelWeb.Endpoint.https.port`	□□□	□	`8087`
`ControlPanelWeb.Endpoint.https.keyfile`	□□□□	□	`"priv/cert/omnitouc`
`ControlPanelWeb.Endpoint.https.certfile`	□□□□	□	`"priv/cert/omnitouc`
`ControlPanelWeb.Endpoint.force_ssl`	□□□□	□	`[rewrite_on: [:x_forwarded_proto`
`page_order`	□□□□□□	□	□□□

SCTP SocketHandler □□ (`:omniss7`)

```
config :omniss7,
  sctp_handler: %{
    enabled: false,
    local_ip: {127, 0, 0, 1},
    local_port: 2905
  },
  enable_gt_routing: true,
  m3ua_peers: [...],
  m3ua_routes: [...],
  m3ua_gt_routes: [...]
```

□□	□□	□□	□□	□□
`sctp_handler.enabled`	□□	□	`false`	□□□□□ STP □□
`sctp_handler.local_ip`	□□	□	`{127, 0, 0, 1}`	□□□□ M3UA □ IP
`sctp_handler.local_port`	□□	□	`2905`	M3UA □ SCTP □□
`enable_gt_routing`	□□	□	`false`	□□□□□□□□□

M3UA □□□□□□

□□	□□	□□	□□
`peer_id`	□□	□	□□□□□□□□□□
`name`	□□□	□	□□□□□□□□□
`role`	□□	□	`:client` □ `:server`
`local_ip`	□□□□□	□□□ `:client`	□□ IP□□□□ `{10, 0, 0, 1}` □□□□ `[{10, 0, 0, 1}, {10, 0, 0, 2}]` □
`local_port`	□□	□□□ `:client`	□□□□□0 □□□□□
`remote_ip`	□□□□□	□	□□□□□ IP□□□□ `{10, 0, 0, 10}` □□ □□ `[{10, 0, 0, 10}, {10, 0, 0, 11}]` □
`remote_port`	□□	□□□ `:client`	□□□□□□□
`routing_context`	□□	□	M3UA □□□□□
`point_code`	□□	□	SS7 □□
`network_indicator`	□□	□	`:international` □ `:national`

M3UA □□□□□

□□	□□	□□	□□
`dest_pc`	□□	□	□□□□
`peer_id`	□□	□	□□□□□□□□□□
`priority`	□□	□	□□□□□□□□□□□□□□□□□□□□
`network_indicator`	□□	□	`:international` □ `:national`

M3UA GT □□□□□

□□	□□	□□	□□
`gt_prefix`	□□□	□	□□□□□□□□□□
`peer_id`	□□	□	□□□□□
`priority`	□□	□	□□□□□
`description`	□□□	□	□□□□□□□□□
`source_ssn`	□□	□	□□□ SSN □□□□□
`dest_ssn`	□□	□	□□□ SSN □□□□□

MAP □□□□□ (`:omniss7`)

```
config :omniss7,
  map_client_enabled: false,
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :map_client_asp,
    local_ip: {10, 0, 0, 100},
    local_port: 2905,
    remote_ip: {10, 0, 0, 1},
    remote_port: 2905,
    routing_context: 1
  }
```

□□	□□	□□	□□	□□
`map_client_enabled`	□□	□	`false`	□□ MAP □□□□□
`map_client_m3ua.mode`	□□□	□	`"ASP"`	M3UA □□□□ □`"ASP"` □ `"SGP"`□
`map_client_m3ua.callback`	□□	□	`{MapClient, :handle_payload, []}`	□□□□□□ □□
`map_client_m3ua.process_name`	□□	□	`:map_client_asp`	□□□□□□ □
`map_client_m3ua.local_ip`	□□	□	-	□□ IP □□
`map_client_m3ua.local_port`	□□	□	`2905`	□□ SCTP □□
`map_client_m3ua.remote_ip`	□□	□	-	□□ STP/SGP IP
`map_client_m3ua.remote_port`	□□	□	`2905`	□□ SCTP □□
`map_client_m3ua.routing_context`	□□	□	-	M3UA □ □□□□

□□□□□□ (`:omniss7`)

```
config :omniss7,
  auto_flush_enabled: false,
  auto_flush_interval: 10_000,
  auto_flush_dest_smsc: nil,
  auto_flush_tps: 10
```

□□	□□	□□	□□	□□
`auto_flush_enabled`	□□	□	`false`	□□□□□□□□□□□□
`auto_flush_interval`	□□	□	`10000`	□□□□□□□□□□□□
`auto_flush_dest_smsc`	□□□/nil	□	`nil`	□□□ SMSC □□□nil = □□□
`auto_flush_tps`	□□	□	`10`	□□□□□□□□

HTTP API □□ (`:omniss7`)

□□□□□□□□□ HTTP API □□□□□□□□□□□□□□

```
config :omniss7,
  smsc_api_base_url: "https://omnimessage.example.com:8443",
  smsc_name: "omni-smsc01"  # □□□□□□□□□□□□□□□
```

API □□□

□□	□□□	□□	□□
`smsc_api_base_url`	□□□□	□	`"https://omnimessage.example.com:8443"`
`smsc_name`	□□□□	□	□□□□□

□□□ **API** □□□

- `POST /api/frontends` - □□□□□□□□□□□□
- `POST /api/messages_raw` - □□□□ SMS □□
- `GET /api/messages` - □□□□□□□□ `smsc` □□
- `PATCH /api/messages/{id}` - □□□□□□□□□
- `PUT /api/messages/{id}` - □□□□□□
- `POST /api/events` - □□□□□□
- `GET /api/status` - □□□□□□

□□□□□

□□□□□□□□□□□□□ API □□□□□□□□□ 85 □□□□□□□□□□□□□□□

- □□□□□□□□□□□□ `SS7`□
- □□□
- □□□□□□□□
- □□□□□JSON □□□

□□□□□

- □□□□□□□□□□□□□□□□ SSL □□
- HTTP □□□ 5 □□□□

- □□□□□□□□ ISO 8601 □□
- API □□ JSON □□□□/□□□□

□□□□

- ← □□□□□
- STP □□
- MAP □□□□□
- □□□□□□
- HLR □□

OmniSS7 □ Omnitouch □□□□□□

□□□□

← □□□□□

□□□□□□□□ OmniSS7 □□□□□□□□□□

□□

1. □□
2. □□□□
3. □□□□□□
4. HLR □□□□
5. SMSc □□□□
6. STP □□□□
7. CAMEL □□□□□□
8. □□□□ NAT □□
9. M3UA □□□□
10. SCCP □□□□□
11. □□□□
12. USSD □□□□
13. □□□ / □□□□
14. □□□□□□
15. □□□□□
16. □□□□

□□

OmniSS7 □□□□□□□□□□□□□□□□□□□□□

- **STP** □□ - □□□□□□□□□□
- **HLR** □□ - □□□□□□□□□□□□□□

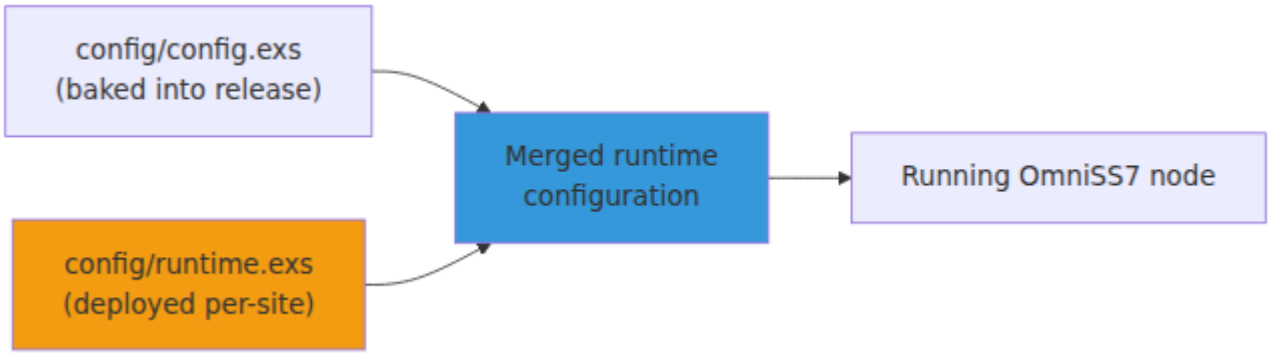
- **SMSc** □□ - □□□□□□□□□□□
- **CAMEL GW** □□ - CAMEL □□□□□□□□□□□

□□□□□□□□□□□□□□ □□□□□□ □□□□□□□□□ HLR + SMSc□□

□□□□

OmniSS7 □□□

□□	□□	□□□□□□ □□
`config/config.exs`	□□ / □□□□□□ □□□□□□□□□□□□□□□□□□□`:api_ex` REST □□□□□□□□□□□□□□□□□□□□□□□	□□□□□□ □□□□□
`config/runtime.exs` (□□□□□)	□□ **4** □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	□□
`config/runtime.exs` (□□□□)	□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ Ansible/Jinja □□□□□□□□□□□□□□□□□□□□□□ GT□□□□M3UA □□□□□ API □□□□□□□	□□□□□□ □□□□□□ □□□□



> □□□□□ □□□□□□□□□□ `config :omniss7, ...`□□□□□□□□□□□□□□□□ □□□□□ `config/runtime.exs`□□□□□□□□ `config/runtime.exs` □□□□□□□□□□□□□□□□□□□□

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`map_client_enabled`	□□□	`false`	□□ MAP □□□□ M3UA □□	□□
`hlr_mode_enabled`	□□□	`false`	□□ HLR □□□□	HLR
`smsc_mode_enabled`	□□□	`false`	□□ SMSc □□□□	SMSc
`cap_client_enabled`	□□□	`false`	□□ CAMEL □□□ CAP □□□	CAMEL GW
`camelgw_mode_enabled`	□□□	`false`	□□ CAMEL □□□□	CAMEL GW
`ussd_gateway_enabled`	□□□	`false`	□□ USSD □□ □HTTP/JSON □□□	USSD GW

□□□

```
config :omniss7,
  map_client_enabled: true,
  hlr_mode_enabled: true,
  smsc_mode_enabled: false
```

HLR □□□□

HLR□□□□□□□□□□□□□□□□□□

HLR API □□

□□	□□	□□□	□□	□□
`hlr_api_base_url`	□□□	-	□	□□ HLR API □□
`hlr_api_key`	□□□	-	□	OmniHSS API OmniSS7 □□□ OmniHSS □□□ □□□□□□□□ `x-omnihss-key` □□□□□□ Omni □□□ `hlr_interwo` □□□□□□□□□□□□□ □ OmniHSS □□ □□□□□□□□ `hlr_api_key`
`hlr_api_status_path`	□□□	`"/api/status"`	□	□□□ `hlr_api_base` □□□□□□ HLR □ □□□□□□ **HLR** □ □ `/hlr-links` REST □□□□□□
`hlr_service_center_gt_address`	□□□	-	□	□ UpdateLoca □□□□□□ HLR □ □
`smsc_service_center_gt_address`	□□□	-	□	□ SRI-for-SM □ □ SMSC GT □□

> **SSL** □□□ □□ `hlr_api_verify_ssl` □□□□□□□□□□□□□□□□ API □□□ TLS □□□□□□□□ `:api` □□□ `verify_ssl` □□□□□□□ API □□ SSL □□□□

□□□

```
config :omniss7,
  hlr_api_base_url: "https://omnihss.example.com:8443",
  hlr_api_key: "<OmniHSS API key with the hlr_interworking role>",
  hlr_api_status_path: "/api/status",
  hlr_service_center_gt_address: "55512341111",
  smsc_service_center_gt_address: "55512341112"
```

AlertServiceCenter □□

□□□□□ UpdateLocation □□HLR □□□□ SMSc GT □□ alertServiceCenter □□□□□□□□□□ □□□□□

□□	□□	□□□	□□	□□
`hlr_smsc_alert_gts`	□□□□□□	`[]`	□	□□ alertServiceCente □□□ SMSc □□□□□□
`hlr_alert_location_expiry_seconds`	□□	`172800`	□	□□□□□□□□□□□□□48 □□□□□□ 0 □□□□□□

□□□

```
config :omniss7,
  hlr_smsc_alert_gts: [
    "15559876543",
    "15559876544"
  ],
  hlr_alert_location_expiry_seconds: 172800  # 48 hours
```

MSISDN ↔ IMSI □□

□ MSISDN □□□□ IMSI □□□□□□□□□□□□□□□□□□□□□□□□ HLR □□□□ MSISDN ↔ IMSI □□□

□□	□□	□□□	□□	□□
`hlr_imsi_plmn_prefix`	□□□	`"50557"`	□	□□□□ IMSI □□□ PLMN □□□MCC+MNC□
`hlr_msisdn_country_code`	□□□	`"61"`	□	IMSI→MSISDN □□□□□□□□□□□
`hlr_msisdn_nsn_offset`	□□	`0`	□	MSISDN □ NSN □□□□□□□□□□□□□□□□□□□□

□□□□ `nsn_offset` □□□□□□□□□□□□□□□□□ NSN□□□□

- □□□□ "9"□1 □□→ `nsn_offset: 1`
- □□□□ "99"□2 □□→ `nsn_offset: 2`
- □□□□ "999"□3 □□→ `nsn_offset: 3`

InsertSubscriberData (ISD) □□

□ UpdateLocation □□□□□ VLR □□□□□□□□□□ ISD □□□□□□□□□□□□□□□ HLR □□□□ InsertSubscriberData □□□

□□	□□	□□□	□□	
`isd_network_access_mode`	□□	`:packetAndCircuit`	□	□□□□□ □□`:packetAndCi` □ `:circuitOnly`
`isd_send_ss_data`	□□□	`true`	□	□□□□□□□□□□ ISD
`isd_send_call_barring`	□□□	`true`	□	□□□□□□□□□□ ISD

□□□

```
config :omniss7,
  isd_network_access_mode: :packetAndCircuit,
  isd_send_ss_data: true,
  isd_send_call_barring: true
```

CAMEL □□

□□□□ CAMEL □□□□□□□□□□□□□ CAMEL □□□□□□□□□□□□□□□□ HLR □□□□ CAMEL □□□

□□	□□	□□□	□□	
`camel_service_key`	□□	`11_110`	□	□□ S
`camel_trigger_detection_point`	□□	`:termAttemptAuthorized`	□	CAM□□ `:t`
`camel_gsmscf_gt_address`	□□□	(□□□□ GT)	□	CAM

| `hlr_camel_subscriptions` | □□ | `[]` | □ | □□□ VLR □□□ IMSI □□ O-CSI / T-CSI □ InsertSubscriberData □□□ ISD □□ CAMEL □□□ |

□□□

```
config :omniss7,
  camel_service_key: 11_110,
  camel_trigger_detection_point: :termAttemptAuthorized,
  hlr_camel_subscriptions: [
    %{
      imsi_prefix: "3133800000009",
      o_csi: %{service_key: 100, gsmscf_address: "14155550300",
default_call_handling: :release_call},
      t_csi: %{service_key: 101, gsmscf_address: "14155550300",
default_call_handling: :continue_call}
    }
  ]
```

□□ VLR □□

□□□□□□□□□□□□□□□□□□□□□□□□□□/□□□□□□ PRN □□□□□□□□□□□□ HLR □□□□□□□□□□□□□

□□	□□	□□□	□□	□□
`home_vlr_prefixes`	□□	`["5551231"]`	□	□□□“□□”□□□ VLR GT □□

□□□

```
config :omniss7,
  home_vlr_prefixes: ["5551231", "5551234"]
```

SMSc □□□□

□□□□□□□□□□□

SMSc API □□

□□	□□	□□□
`smsc_api_base_url`	□□□	`"https://omnimessage.example.com`
`smsc_api_status_path`	□□□	`"/api/status"`
`smsc_name`	□□□	`"{hostname}_SMSc"`
`smsc_service_center_gt_address`	□□□	-

> **SSL** □□□ □□ `smsc_api_verify_ssl` □□□□□□□□□□□□□□□□ API □□□ TLS □□□□□□□□ `:api` □□□ `verify_ssl` □□□□□□□ API □□ SSL □□□□

□□□

```
config :omniss7,
  smsc_api_base_url: "https://omnimessage.example.com:8443",
  smsc_api_status_path: "/api/status",
  smsc_name: "ipsmgw",
  smsc_service_center_gt_address: "55512341112"
```

□□□□□□□□ **5** □□ □□□□□□□□□□□□ `SMS.FrontendRegistry` □□□

□□□□□□

□□	□□	□□□	□□	□□
`auto_flush_enabled`	□□□	`true`	□	□□□□ SMS □□□□
`auto_flush_interval`	□□	`10_000`	□	□□□□□□□□□□
`auto_flush_dest_smsc`	□□□	-	□	□□□□□□□ SMSC □□
`auto_flush_tps`	□□	`10`	□	□□□□□□□□□/□□

□□□

```
config :omniss7,
  auto_flush_enabled: true,
  auto_flush_interval: 10_000,
  auto_flush_dest_smsc: "ipsmgw",
  auto_flush_tps: 10
```

STP □□□□

M3UA □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ STP □□□□□

□□ STP □□□

□□	□□	□□□	□□	□□
`sctp_handler.enabled`	□□□□	`false`	□	□□□□ SCTP SocketHandler □□□
`sctp_handler.local_ip`	□□□□□□	`{127, 0, 0, 1}`	□	□□□□□ IP □□□□□ IP: `{10, 0, 0, 1}` □□□ IP □□ SCTP □□□□ `[{10, 0, 0, 1}, {10, 0, 0, 2}]`
`sctp_handler.local_port`	□□□	`2905`	□	□□□□□
`sctp_handler.point_code`	□□□	-	□□□□□□	□ STP □□□ SS7 □□

□□□□□ IP□□

```
config :omniss7,
  sctp_handler: %{
    enabled: true,
    local_ip: {10, 179, 4, 10},
    local_port: 2905,
    point_code: 100
  }
```

□□□SCTP □□□□□

```
config :omniss7,
  sctp_handler: %{
    enabled: true,
    # □□ IP □□□□
    local_ip: [{10, 179, 4, 10}, {10, 179, 4, 11}],
    local_port: 2905,
    point_code: 100
  }
```

> □□□□□ SCTP □□□□□

□□	□□	□□□	□□	□□
`peer_id`	□□	-	□	□□□□□□□□
`name`	□□□	-	□	□□□□□□□□
`protocol`	□□	`:m3ua`	□	□□□□□`:m3ua` □ `:m2pa`
`role`	□□	`:client`	□	□□□ □□`:client`□`:server`□`:a □ `:sgp`
`local_ip`	□□□□□□	-	□	□□□□□□□ IP □□
`local_port`	□□	-	□	□□ SCTP □□□M3UA: 2905, M2PA: 3565□
`remote_ip`	□□□□□□	-	□	□□ IP □□
`remote_port`	□□	-	□	□□ SCTP □□
`routing_context`	□□	-	□	M3UA □□□□□□□□□□□□ M3UA□

□□	□□	□□□	□□	□□
`point_code`	□□	-	□	□□□□
`network_indicator`	□□	`:international`	□	□□□□□□ `:international` [`:national`
`initiate_connection`	□□□	`true`	□	□□□□ SCTP □□

M2PA □□□□□

□□	□□	□□□	□□	□□
`adjacent_point_code`	□□	-	□□M2PA□	□□□□□□□□□

□□□□□□□

M2PA □□□□ SCTP.SocketHandler □□□□□□□□□□□□□ M2PA □□□□□□□□□□□□□

```
config :omniss7,
  m3ua_peers: [
    %{
      peer_id: 1,
      name: "HLR_East",
      protocol: :m3ua,
      role: :sgp,
      local_ip: {10, 179, 4, 10},
      local_port: 2905,
      remote_ip: {10, 179, 4, 20},
      remote_port: 2905,
      point_code: 100,
      network_indicator: :international
    }
  ]
```

□□□M2PA □□□□□

```
config :omniss7,
  sctp_handler: %{
    enabled: true,
    local_ip: {10, 179, 4, 10},
    local_port: 3565,
    point_code: 100
  },
  m3ua_peers: [
    %{
      peer_id: 2,
      name: "M2PA_Link_STP_West",
      protocol: :m2pa,
      role: :client,
      local_ip: {10, 179, 4, 10},
      local_port: 3565,
      remote_ip: {10, 179, 4, 30},
      remote_port: 3565,
      point_code: 100,
      adjacent_point_code: 200
    }
  ]
```

M3UA □□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□	□□	□□□	□□	□□
`m3ua_routes`	□□□□	`[]`	□	□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□ □□ `m3ua_routes` □□□□□□□□□□□□□□□□□□

- `dest_pc`□□□□□□□□□□
- `peer_id`□□□□□□□□□□□□□□□□
- `priority`□□□□□□□ - □□□□□□□□□□□□□□
- `network_indicator`□□□□□□□□□□□□`:international` □ `:national`

□□□

```
config :omniss7,
  m3ua_routes: [
    # □□□□□□ 1 □□□ PC 100□□□□□□□□
    %{dest_pc: 100, peer_id: 1, priority: 1, network_indicator:
:international},
    # □□□□□□ 2 □□□ PC 200
    %{dest_pc: 200, peer_id: 2, priority: 1, network_indicator:
:international},
    # □□□□□□□□□ dest_pc □□□□□□□□□
    %{dest_pc: 300, peer_id: 3, priority: 1, network_indicator:
:international},
    %{dest_pc: 300, peer_id: 4, priority: 2, network_indicator:
:international}
  ]
```

M3UA □□□□□□

□□□□□□□□□□□□□□□□□ SCCP □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□	□□	□□□	□□	□□
`m3ua_gt_routes`	□□□□	`[]`	□	□□□□□□□□□□□□□□□□□□□□□□

□□□□□ □□ `m3ua_gt_routes` □□□□□□□□□□□□□□□□□

□□□□□

- `gt_prefix`□□□□□□□□□□□□□□□□□ - □□□□□□□□
- `peer_id`□□□□□□□□□□□□□□□ - □□ 0 □□□□□
- `priority`□□□□□□ - □□□□□□□□□□□□
- `description`□□□□□□□□□□□□□

□□□□□□□

- `source_ssn`□□□□□□□□□□□□
- `source_tt`□□□□□□□□□□□□
- `source_npi`□□□□□□□□□□□□□□
- `source_nai`□□□□□□□□□□□□□□

□□□□□□□

- `dest_ssn`□□□□□□□□□ SSN□□□□
- `dest_tt`□□□□□□□□□□□□□□□□
- `dest_npi`□□□□□□□□□□□□□□□□□□
- `dest_nai`□□□□□□□□□□□□□□□□□□
- `route_on_ssn`□□□□□□□□□□□□□□□ SSN □□□□□□□□□ `false`□□□□□□ GT □□□□□□□ `false`□□□□□□□□□ GTT□ITU-T Q.714 §2.4□□□□□ STP □□□□□□□□□□ SSN □□□□□□□□ `true`□□□□ STP □□ → GTT □□ SSN □□□

□□□□

- □□□□ **(TT)**□ 0=□□□1=□□□2=□□□3=□□□
- □□□□ **(NPI)**□ 0=□□□1=ISDN(E.164)□6=□□(E.212)
- □□□□ **(NAI)**□ 0=□□□1=□□□3=□□□4=□□
- □□□□□ **(SSN)**□ 6=HLR□7=VLR□8=MSC□9=EIR□□□

□□□

```
config :omniss7,
  m3ua_gt_routes: [
    # □□□□□□□
    %{gt_prefix: "1234", peer_id: 1, priority: 1, description: "□□
□□"},
    %{gt_prefix: "44", peer_id: 2, priority: 1, description: "□□□
□"},

    # □□□□□□□
    %{
      gt_prefix: "61",
      peer_id: 3,
      priority: 1,
      description: "□□□□□□□□TT 0→1 □□",
      source_tt: 0,  # □□ TT=0 (□□)
      dest_tt: 1     # □□□ TT=1 (□□)
    },

    # NPI □□
    %{
      gt_prefix: "49",
      peer_id: 1,
      priority: 1,
      description: "□□□□□□□□→ISDN NPI □□",
      source_npi: 6,  # □□ NPI=6 (□□/E.212)
      dest_npi: 1     # □□□ NPI=1 (ISDN/E.164)
    },

    # □□ SSN □□□□□
    %{
      gt_prefix: "86",
      source_ssn: 8,   # □□ SSN=8 (MSC)
      peer_id: 3,
      dest_ssn: 6,     # □□□ SSN=6 (HLR)
      priority: 1,
      description: "□□□□□□□□□□□□",
      source_tt: 0,
      dest_tt: 2,
      source_npi: 6,
      dest_npi: 1,
      source_nai: 4,
      dest_nai: 3
    },
```

```
    # □□/□□□□
    %{
      gt_prefix: "",
      peer_id: 1,
      priority: 99,
      description: "□□□□□□□"
    }
  ]
```

CAMEL □□□□□□

CAMEL □□ (CAP □□) □□□□□□

CAMEL □□□□

□□ CAMEL/CAP □□□□ □□□□□□ □□□ `cap_client_enabled: true` □ `camelgw_mode_enabled: true`□□

CAP □□□□

□□	□□	□□	□□	□□
`cap_version`	□□	`:v2`	□	CAP □□□□□ `:v1`□ `:v2`□ `:v3`□□ `:v4`
`camel_gsmscf_gt_address`	□□□	(□□□□ GT)	□	CAMEL □□□□□ gsmSCF □□□□

CAP □□□□□

- `:v1` → □□□□□ OID: 0.4.0.0.1.0.50.0
- `:v2` → □□□□□ OID: 0.4.0.0.1.0.50.1 (□□ - □□□□□)
- `:v3` → □□□□□ OID: 0.4.0.0.1.21.3.4

- `:v4` → □□□□□ OID: 0.4.0.0.1.23.3.4

□□□ □□□□□□□□□ OID □□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□

```
config :omniss7,
  cap_client_enabled: true,
  camelgw_mode_enabled: true,
  cap_version: :v2,
  camel_gsmscf_gt_address: "99988411553"
```

CGrateS □□

□ CGrateS □□��□□□□□□□□□□/□□□□□□

□□	□□	□□	□□	□□
`cgrates_enabled`	□□	`false`	□	□□ CGrateS □□
`cgrates_url`	□□□	-	□□□□	CGrateS JSON-RPC □□ URL
`cgrates_tenant`	□□□	`"cgrates.org"`	□	CGrateS □□□□□
`cgrates_request_type`	□□□	`"*prepaid"`	□	□□□□□ `"*prepaid"`□ `"*postpaid"`□□ `"*pseudoprepaid"`
`cgrates_timeout`	□□	`5000`	□	CGrateS □□□□□□□□

□□□

```
config :omniss7,
  cgrates_enabled: true,
  cgrates_url: "http://localhost:2080/jsonrpc",
  cgrates_tenant: "cgrates.org",
  cgrates_request_type: "*prepaid",
  cgrates_timeout: 5000
```

CAP M3UA □□

CAMEL □□□□□□□ M3UA □□□□ CAP □□□

□□	□□	□□	□□	□□
`cap_client_m3ua`	□□	-	□	CAP M3UA □□□□□□ `map_client_m3ua` □□□ □□□□□□□ `opc` □ `dpc` □□□

□□□

```
config :omniss7,
  cap_client_m3ua: %{
    mode: "ASP",
    callback: {CapClient, :handle_payload, []},
    process_name: :camelgw_client_asp,
    local_ip: {10, 5, 198, 200},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 4,
    opc: 5013,    # □□□
    dpc: 5011     # □□□□
  }
```

□□□□ NAT □□

□□□

```
config :omniss7,
  gt_nat_enabled: true,
  gt_nat_rules: [
    # □□□□□□□□□□ "8772" □□□ AND □□□ "555"
    %{calling_prefix: "8772", called_prefix: "555", weight: 1,
response_gt: "111111"},

    # □□□□□□□□□□□□ "8772" □□□
    %{calling_prefix: "8772", weight: 10, response_gt:
"99988411553"},

    # □□□□□□□□□□□□ "555"
    %{called_prefix: "555", weight: 10, response_gt:
"99988411554"},

    # □□□□□ "8773" □□□
    %{calling_prefix: "8773", weight: 10, response_gt:
"99988411554"},

    # □□□□□□□□□□□□□□□□□□□□
    %{weight: 100, response_gt: "99988411555"}
  ]
```

□□□□□□□□□□□□□□□□□ GT NAT □□□

M3UA □□□□

MAP □□□□□□□ M3UA □□□□□□□□□□□□□□□□□□□ MAP □□□□□□

□□	□□□	□□	□□□	□□
`map_client_m3ua.mode`	□□□□	-	□	□□□□□ `"ASP"` □
`map_client_m3ua.callback`	□□	-	□	□□□□/□□□ `{MapC` `:handle_payloa`
`map_client_m3ua.process_name`	□□	-	□	□□□□□□□
`map_client_m3ua.local_ip`	□□□□□□□	-	□	□□□□□□ IP □□□□□ `0, 0, 1}` □□□□□ □□□ `[{10, 0, 0` `{10, 0, 0, 2}]`
`map_client_m3ua.local_port`	□□□	`2905`	□	□□ SCTP □□
`map_client_m3ua.remote_ip`	□□□□□□□	-	□	□□ STP/SGW IP [`{10, 0, 0, 10}` `[{10, 0, 0, 1` `0, 0, 11}]`
`map_client_m3ua.remote_port`	□□□	`2905`	□	□□ SCTP □□
`map_client_m3ua.routing_context`	□□□	-	□	M3UA □□□□□ ID
`map_client_m3ua.opc`	□□□	`5013`	□	□□□□□ MAP □□□ □□□□□□□□□□ `5013`

□□	□□	□□	□□
`map_client_m3ua.dpc`	□□	`5011`	□	□□□□□ MAP □□□□ □□□□□□□□□□□ `501`
`map_client_m3ua.receive_watchdog`	□□	`true`	□	□□ ASP □□□□□□□□ □□□□□ `receive_watchd` □□□□□□ SCTP □□ □□□□□ `false` □□ □□□ □□□□□□□
`map_client_m3ua.receive_watchdog_idle`	□□	`15`	□	□□□□□□□□□□□□□□ SCTP □□□□□□□□□□ □□□□□□□□□□ `receive_watchd` `true` □□□□

□□□□ **IP□□**

```
config :omniss7,
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :hlr_client_asp,
    local_ip: {10, 179, 4, 11},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1,
    opc: 5013,    # □□□ (2-114-5)
    dpc: 5011     # □□□□ (2-114-3)
  }
```

> □□□□□`X-Y-Z` □□□□□□□□□□□□□`(X * 2048) + (Y * 8) + Z`□□□□ `2-114-5` = `(2 * 2048) + (114 * 8) + 5` = `5013`□

□□□**SCTP** □□□□□

```
config :omniss7,
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :hlr_client_asp,
    # □□□□ IP □□□□□
    local_ip: [{10, 179, 4, 11}, {10, 179, 4, 12}],
    local_port: 2905,
    # □□□□ IP □□□ STP □□
    remote_ip: [{10, 179, 4, 10}, {10, 179, 4, 20}],
    remote_port: 2905,
    routing_context: 1
  }
```

> □□□□□ SCTP □□□□□□□□□□□□□□□□□□ □□□□□□ SCTP □□□□

□□□□□

□□□□□ □□ SCTP □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ ESTABLISHED □□□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  map_client_m3ua: %{
    mode: "ASP",
    local_ip: {10, 179, 4, 11},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1,
    receive_watchdog: false        # □□ - □□ SG □□□□□□□□
  }
```

□□□□□□□□□□□□

```
config :omniss7,
  map_client_m3ua: %{
    mode: "ASP",
    local_ip: {10, 179, 4, 11},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1,
    receive_watchdog: true,
    receive_watchdog_idle: 30      # □ 30 □□□□□□□□□□□15 □□
  }
```

SCCP □□□□□

OmniSS7 □□□□□□□□□□□□□□□□□□□ SCCP □□□□□□□□□□ (SST)□ITU-T Q.714 §5.3.4□□ `local_subsystems` □□□□□□□□□□□□□□□□□□ (SSN)□□□□ SSN □ SST □□□ `Subsystem-Allowed` (SSA)□□□□□ SSN □□□ `Subsystem-Prohibited` (SSP)□

□□	□□	□□	□□	□□
`local_subsystems`	□□□□□□ `:all`	`:all`	□	□□□□ SST □□□□□ SCCP SSN□`:all`□□□□□

```
config :omniss7,
  # □□□□□□□□□□□□□□□□□□□□□□□□
  screening_default_action: :deny
```

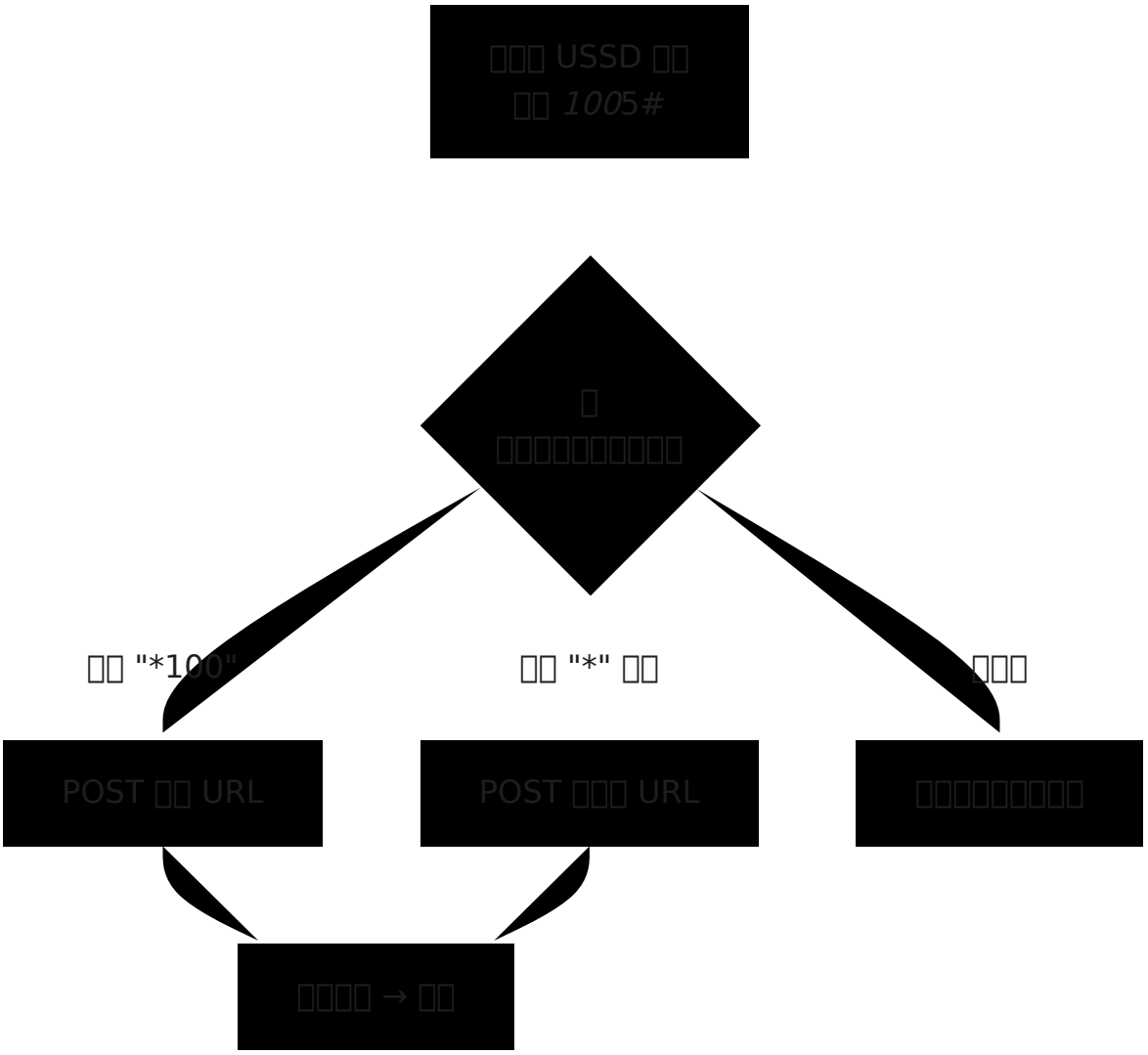
□□□□□□□□ `ss7_screen_rule` Mnesia □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

USSD □□□□

USSD □□□□□□□□□□□□□□□ USSD □□□ HTTP/JSON □□□□□ `ussd_gateway_enabled: true` □□□□□□□□ □□□□□□□□□□□□□ `ussd_gateway` □□□□□□□□□□□□□□□□□□□□□□□□□□□□ USSD □□□□□

□□	□□	□□	□□	□□
`ussd_gateway.routes`	□□□□	`[]`	□□□□	□□□ → □□ URL □□□□□□□□□□ `%{pattern: "<□□>", url: "<□□ URL>"}`□□□□□□□□□□□ `"*"` □□□□□□□□□□□□□□□□
`ussd_gateway.session_timeout_ms`	□□	`180_000`	□	□□□□□□□□□□□□□□□□□□□3 □□□□□□□□□□□□□□□
`ussd_gateway.turn_timeout_ms`	□□	`30_000`	□	□□□□□□□□□□□□□□□□□□□□□□□□□□
`ussd_gateway.http_timeout_ms`	□□	`5_000`	□	□□□□□□□□□□□□ HTTP □□/□□□□□□□□□
`ussd_gateway.max_text_length`	□□	`182`	□	USSD □□□□□□□□□□□□□□□□GSM 7 □□□□□□□□□□□□□□□□□□□□□□□

□□□□ □ USSD □□□□□□□□□□□□□□ `pattern` □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `pattern` □□□□□□□□□□□□□□□□□□□□



□□□

```
config :omniss7,
  ussd_gateway_enabled: true,
  ussd_gateway: %{
    routes: [
      %{pattern: "*100", url: "http://balance-app:9000/ussd"},
      %{pattern: "*200", url: "http://topup-app:9000/ussd"},
      %{pattern: "*",    url: "http://default-app:9000/ussd"}
    ],
    session_timeout_ms: 180_000,
    turn_timeout_ms: 30_000,
    http_timeout_ms: 5_000,
    max_text_length: 182
  }
```

□□□ / □□□□

□□□

□□□□ **Web □□□ REST API□□**

```
config :omniss7,
  start_web_interfaces: false,
  start_http_server: true
```

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□□□□□□□□□□□□□□□□□□□Web □□□API □□□□□□□□□□

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□□	□□	□□	□□	□□
`license_client.license_server_api_urls`	□□□□□	-	□	□□□□□□□ API □□ URL
`license_client.licensee`	□□□	-	□	□□□□□□□□□□□

□□□

```
config :license_client,
  license_server_api_urls: ["https://localhost:10443/api"],
  licensee: "Omnitouch Network Services Pty. Ltd."
```

□□□□ Web □□

□□	□□	□□
`control_panel.parent_application_readable_name`	□□□	`"OmniSS7 Stack"`
`control_panel.use_additional_pages`	□□□□□	`[]`
`control_panel.page_order`	□□□□□□	`[]`
`ControlPanelWeb.Endpoint.url.host`	□□□	`"0.0.0.0"`
`ControlPanelWeb.Endpoint.https.port`	□□	`8087`
`ControlPanelWeb.Endpoint.https.keyfile`	□□□	`"priv/cert/omnit`
`ControlPanelWeb.Endpoint.https.certfile`	□□□	`"priv/cert/omnit`

□□□

```
config :control_panel, ControlPanelWeb.Endpoint,
  url: [host: "0.0.0.0", path: "/"],
  https: [
    port: 8087,
    keyfile: "priv/cert/omnitouch.pem",
    certfile: "priv/cert/omnitouch.crt"
  ],
  parent_application_readable_name: "OmniSS7 Stack STP"

config :control_panel,
  use_additional_pages: [
    {SS7.Web.EventsLive, "/events", "SS7 □□"},
    {SS7.Web.M3UAStatusLive, "/m3ua", "□□□"}
  ],
  page_order: ["/events", "/m3ua", "/application",
"/configuration"]
```

REST API □□□

□□	□□	□□□	□□	□□
`start_http_server`	□□	`true`	□	□□/□□ HTTP □□ (□□ 9090)
`api_ex.api.port`	□□	`8445`	□	API □□□□
`api_ex.api.listen_ip`	□□□	`"0.0.0.0"`	□	API □□□□ IP
`api_ex.api.product_name`	□□□	`"OmniSS7"`	□	API □□□□
`api_ex.api.title`	□□□	`"API - OmniSS7"`	□	Swagger UI □ API □□
`api_ex.api.hostname`	□□□	`"localhost"`	□	API □□□□
`api_ex.api.enable_tls`	□□	`true`	□	□ API □□□□ TLS
`api_ex.api.tls_cert_path`	□□□	`"priv/cert/omnitouch.crt"`	□	API □ TLS □□□

□□	□□	□□□	□□	□□
`api_ex.api.tls_key_path`	□□□	`"priv/cert/omnitouch.pem"`	□	API □ TLS □□□

□□□

```
config :omniss7,
  start_http_server: true

config :api_ex,
  api: %{
    port: 8445,
    listen_ip: "0.0.0.0",
    product_name: "OmniSS7",
    title: "API - OmniSS7",
    hostname: "localhost",
    enable_tls: true,
    tls_cert_path: "priv/cert/omnitouch.crt",
    tls_key_path: "priv/cert/omnitouch.pem"
  }
```

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□□	□□	□□□	□□
9090	HTTP (Plug.Cowboy)	`APIhandler`	MAP/CAP REST `/ap` `/metrics`, `/swagge` `/swagger.json`□□ `start_http_server`
8087	HTTPS (Bandit/Phoenix)	`ControlPanelWeb.Endpoint`	Web □□□□ UI□□□ We (`start_web_interf`
8445	HTTPS / TLS	`:api_ex` REST □□□	□□□□□ CRUD□□□□□□ CAMEL/SCTP/M3UA Web □□

API □□□

- MAP/CAP REST API + Swagger: `http://[server-ip]:9090/...` (□ API □□)
- `:api_ex` REST □□□: `https://[server-ip]:8445/api/*`
- Web □□□□: `https://[server-ip]:8087/`
- Prometheus □□: `http://[server-ip]:9090/metrics`

API □□ SSL □□

□□□ HLR/SMSc API □□□□□□□□□□□□□□ `*_verify_ssl` □□□□□□□□□□ `:api` □□□□□

□□	□□	□□□	□□
`api.base_url`	□□□	□□□ `smsc_api_base_url`	□□ API □□□□□□ URL□
`api.timeout`	□□	`5000`	□□□□□□□□□
`api.verify_ssl`	□□	`false`	□□□□□□ TLS □□□□□□□□ **SSL** □□□□ □□ `hlr_api_verify_ssl` □ `smsc_api_verify_ssl`□

□□□

```
config :omniss7,
  api: %{
    base_url: "https://backend.example.com:8443",
    timeout: 5000,
    verify_ssl: false
  }
```

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□□	□□	□□□	□□	□□
`logger.level`	□□	`:debug`	□	□□□□: `:debug` `:warning`, `:`
`logger.backends`	□□	`[:console]`	□	□□□□□□□ `SS7.Web.Log` □□ Web UI□
`logger.default_formatter.format`	□□□	-	□	□□□□□□□□□
`logger.default_formatter.metadata`	□□	`[]`	□	□□□□□□□□□□□
`logger.default_formatter.truncate`	□□/□□	`:infinity`	□	□□□□□□□□

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```
config :logger,
  level: :debug,
  backends: [:console, SS7.Web.LoggerBackend]

config :logger, :default_formatter,
  format: "[$date] [$time] [$level] $message\n",
  metadata: [:error_code, :file],
  truncate: :infinity
```

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Mnesia □□□□□□□□□□□

□□	□□	□□□	□□	□□
`mnesia_storage_type`	□□	`:disc_copies`	□	Mnesia □□□□: `:disc_copies` □ `:ram_copies`

□□:

```
config :omniss7,
  mnesia_storage_type: :disc_copies  # □□
  # mnesia_storage_type: :ram_copies  # □□□□□
```

□□□□:

- `:disc_copies` - □□□□□□□□□□□□□□□□□□ - □□□□□□□
- `:ram_copies` - □□□□□□□□□□□□□□ - □□□□□□

Mnesia □:

- `m3ua_peer` - M3UA □□□□
- `m3ua_route` - □□□□
- `m3ua_gt_route` - □□□□□□

□□: `Mnesia.{node_name}/` □□

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□	□□	□□□□
MAP □□□□: **10** □	□□ MAP □□□ 10 □□□□	□□□□□
ISD □□: **10** □	□□ ISD □□□ 10 □□□□	□□□□□

HTTP □□□

□	□□	□□□□
HTTP IP: **0.0.0.0**	□□/Swagger □□□□□□□□ □□□□	□□□□□
HTTP □□: **9090**	□□/Swagger □□□ 9090 □□□□	□□ `config :omniss7, api_port: <port>` (□□ `9090`)

□□□□

□	□□	□□□□
□□□□: **5** □□	SMSc □ 5 □□□□□□□□	□□□□□

Web UI □□□□

□□	□□
□□□□	5 □
□□□□□	2 □

□□□□

□□ HLR □□

```
config :omniss7,
  map_client_enabled: true,
  hlr_mode_enabled: true,
  smsc_mode_enabled: false,

  hlr_api_base_url: "https://omnihss.example.com:8443",
  hlr_api_key: "<□□ hlr_interworking □□□ OmniHSS API □□>",
  hlr_service_center_gt_address: "55512341111",
  smsc_service_center_gt_address: "55512341112",

  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :hlr_client_asp,
    local_ip: {10, 179, 4, 11},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1
  }
```

□□ SMSc □□

```
config :omniss7,
  map_client_enabled: true,
  hlr_mode_enabled: false,
  smsc_mode_enabled: true,

  smsc_api_base_url: "https://omnimessage.example.com:8443",
  smsc_name: "ipsmgw",
  smsc_service_center_gt_address: "55512341112",

  auto_flush_enabled: true,
  auto_flush_interval: 10_000,
  auto_flush_dest_smsc: "ipsmgw",
  auto_flush_tps: 10,

  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :stp_client_asp,
    local_ip: {10, 179, 4, 12},
    local_port: 2905,
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1
  }
```

□□□□□□ STP

```
config :omniss7,
  map_client_enabled: true,
  hlr_mode_enabled: false,
  smsc_mode_enabled: false,

  enable_gt_routing: true,
  mnesia_storage_type: :disc_copies,

  sctp_handler: %{
    enabled: true,
    local_ip: {10, 179, 4, 10},
    local_port: 2905,
    point_code: 100
  },

  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :stp_client_asp,
    local_ip: {10, 179, 4, 10},
    local_port: 2906,
    remote_ip: {10, 179, 4, 11},
    remote_port: 2905,
    routing_context: 1
  }
```

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□□□□□: 85+

□□□:

- □□□□: 6 □□□
- HLR □□: 18 □□□
- SMSc □□: 8 □□□

- STP □□: 5+ □□□□□□□ m3ua_peers, m3ua_routes, m3ua_gt_routes □□□
- CAMEL GW □□: 14 □□□
- □□□□ NAT: 2 □□□
- M3UA □□: 8 □□□
- SCCP □□□□□: 1 □□□
- USSD □□: 5 □□□
- □□□ / □□: 4 □□□
- □□□□□□□□□□Web□API□□□□: 23 □□□
- □□□: 1 □□□

□□□□□□□□:

HLR □□:

- `hlr_api_base_url`
- `hlr_api_key`
- `hlr_service_center_gt_address`
- `smsc_service_center_gt_address`
- □□ `map_client_m3ua.*` □□□8□

SMSc □□:

- `smsc_api_base_url`
- `smsc_service_center_gt_address`
- `auto_flush_dest_smsc`□□□□□□□□□□
- □□ `map_client_m3ua.*` □□□8□

STP □□:

- `sctp_handler.point_code`□□□□□ SCTP □□□□□
- `sctp_handler.local_ip`
- `sctp_handler.local_port`

CAMEL GW □□:

- `cgrates_url`□□□□□ CGrateS□
- □□ `cap_client_m3ua.*` □□□8□

□□□□:

- `license_client.license_server_api_urls`
- `license_client.licensee`

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- **HLR □□** - HLR □□□□
- **SMSc □□** - SMSc □□□□
- **STP □□** - STP □□□□
- **API □□** - REST API □□
- **USSD □□□□** - USSD □□□□□ HTTP □□□□
- **Web UI □□** - Web □□□□

□□□□ NAT □□

□□

□□□□□□□□□□□□GT NAT□□□□□□□□□□ OmniSS7 □□□□□□□ GT □□□□□□□□ GT □□□□□□□□□□□□□

□□□

```
gt_nat_rules: [
  # □□□□□□□□□□□□□□□□ - □□□□□□
  %{calling_prefix: "8772", called_prefix: "555", weight: 1,
response_gt: "111111"},

  # □□□□□ - □□□□□□
  %{calling_prefix: "8772", weight: 10, response_gt: "222222"},
  %{called_prefix: "555", weight: 10, response_gt: "333333"},

  # □□□□□□ - □□□□□□
  %{weight: 100, response_gt: "999999"}
]
```

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- □□ **A** □□□□ GT `111111` □□□□ `111111` □□□□
- □□ **B** □□□□ GT `222222` □□□□ `222222` □□□□

□□□□ GT NAT□□□□□□□□□□□□□□□□□□□□□□□□ GT NAT□□□ OmniSS7 □□□□□□□□□□□□□□□

□□□□

□□□ HLR □ SMSc □□□□□□□□□□□

- □□□□ □□□□ GT `555000`
- □□□□□□ **1** □□ GT `555001`
- □□□□□□ **2** □□ GT `555002`

GT NAT □□□□□□□□□□□□□□□□ GT □□□□□

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- □□□□□□□□ GT □□□□□ GT
- □□□□□□□□□□□ GT
- □□□□□□□□□□ GT □□□□□

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1. □□□□□□OmniSS7 □□□□□□ SCCP □□□□□□□
   - □□□ GT□`55512341112`□□□ GT□
   - □□□ GT□`877234567`□□□□ GT□
2. **GT NAT** □□□□□□□□□□□ GT `877234567` □□□□□□□□□□□□□□□
3. □□□□□□□□□□□□□□□□□□□□□□□`8772` □□ `877234567`□
4. □□ **GT** □□□□□□□□□□□□□ `response_gt`□□□□`55512341112`□
5. □□□□□□SCCP □□□□□□
   - □□□ GT□`877234567`□□□ - □□□ GT□
   - □□□ GT□`55512341112`□NAT'd GT□

□□□□□□□□□

GT NAT □□□ SS7 □□□□□□□

SCCP □□□□□□□□

- □□□□□□□□□ SCCP □□/□□ GT □□
- ISD□InsertSubscriberData□□□
- UpdateLocation □□

- □□□□

MAP □□□□□□□

- **SRI-for-SM** □□□`networkNode-Number`□SMSc GT □□□
- **UpdateLocation**□□□□□ `hlr-Number`
- **InsertSubscriberData**□ISD □□□□ HLR GT

□□

□□□□

□□□ `config/runtime.exs`□

```
config :omniss7,
  # □□ GT NAT
  gt_nat_enabled: true,

  # □□ GT NAT □□
  gt_nat_rules: [
    # □□ 1□□□□□ "8772" □□□□ "55512341112" □□□□
    %{calling_prefix: "8772", response_gt: "55512341112"},

    # □□ 2□□□□□ "8773" □□□□ "55512341111" □□□□
    %{calling_prefix: "8773", response_gt: "55512341111"},

    # □□□□□□□□□□□□□□□□□□
    %{calling_prefix: "", response_gt: "55512311555"}
  ]
```

□□□□

□□□□□□□□□□□□□□□ □□□□□□□□□□□ NAT □□□

□□	□□	□□	□□
`gt_nat_enabled`	□□	□	□□/□□ GT NAT □□
`gt_nat_rules`	□□□□	□□□□□□□	□□□□□□□□□

□□□□

□□□□□□□□□□□□□□□□□□

```
%{
  calling_prefix: "8772",      # □□□□□□□ GT □□□□□
  called_prefix: "555",        # □□□□□□□ GT □□□□□
  weight: 10,                  # □□□□□□□□□□□□□□□□□□□□
  response_gt: "55512341112"   # □□□□□□□□□□□ GT
}
```

□□□□□

- **`calling_prefix`**□□□□□□□□□□ GT □□□□□□□□□
  - □□□□□□□□□□□□□□□□
  - □□□□ `""` □ `nil` □□□□□□□□□□□□□ GT□
  - □□□□□□□□□□□ GT
- **`called_prefix`**□□□□□□□□□□ GT □□□□□□□□□
  - □□□□□□□□□□□□□□□□
  - □□□□ `""` □ `nil` □□□□□□□□□□□□□ GT□
  - □□□□□□□□□□□ GT
- **`weight`**□□□□□□□□□□□
  - □□□□□ = □□□□□□□□□□□□
  - □□ >= 0
  - □□□□□□□□□□□□□

- **`response_gt`**□□□□□□□□□□□□□□□□□□□□□□□□

  - □□□□□□□ E.164 □□□□□□
  - □□□□□□□ GT □□□□

□□□□□□ **`calling_prefix`** □ **`called_prefix`** □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□/□□□□□□

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□□□□□□

1. □□□□□□□□□□□□□□□□□
   - □□□□□□ `calling_prefix`□□□□□□□□ GT □□
   - □□□□□□ `called_prefix`□□□□□□□□ GT □□
   - □□□□□□□□□□□□□□□□□□□□□
   - □□□□□□□□□□□□□□□□□□□□□
2. □□□□□□□□□□□□□□□□□□□□
   - □□□□□□□□□□ - □□□□□□□□□
   - □□□□□□□□□□□□□□□□ - □□ = □□□□□
3. □□□□□□□□□□□

□□□

```
# □□□□□
gt_nat_rules: [
  # □□ 1□□□□□□□ - □□□□□□□
  %{calling_prefix: "8772", called_prefix: "555", weight: 1,
response_gt: "111111"},

  # □□ 10□□□□□□□ - □□□□□
  %{calling_prefix: "8772", weight: 10, response_gt: "222222"},  #
□□□
  %{called_prefix: "555", weight: 10, response_gt: "333333"},    #
□□□

  # □□ 100□□□□□□□ - □□□□□□
  %{weight: 100, response_gt: "444444"}  # □□□□□□□
]

# □□□□□□
# □□□"877234567"□□□□"555123" -> "111111"□□□ 1□□□□□□□
# □□□"877234567"□□□□"999999" -> "222222"□□□ 10□□□□□□
# □□□"999999999"□□□□"555123" -> "333333"□□□ 10□□□□□□
# □□□"999999999"□□□□"888888" -> "444444"□□□ 100□□□□□□
```

□□

□□ 1□□□□□□□□□□

□□□□□□□□□ SMSc□□□□□□□□□□

```
config :omniss7,
  gt_nat_enabled: true,

  # □□ SMSc GT□□□□ GT NAT □□□□□□□□□□□□
  smsc_service_center_gt_address: "5551000",

  # □□□□□ GT NAT □□
  gt_nat_rules: [
    # □□□□ A□□□ 4412□□□□ GT 5551001 □□□□
    %{calling_prefix: "4412", weight: 10, response_gt: "5551001"},

    # □□□□ B□□□ 4413□□□□ GT 5551002 □□□□
    %{calling_prefix: "4413", weight: 10, response_gt: "5551002"},

    # □□□□□□□□ SMSc GT□□□□□□□□
    %{weight: 100, response_gt: "5551000"}
  ]
```

□□□□□

```
□□ 44121234567 □□□ SRI-for-SM□
  □□ GT□5551001□□□ GT□□□□□ A □□□
  □□ GT□44121234567□□□□□ A □ GT□

GT NAT □□□
  "44121234567" □□□□ "4412"
  □□□ response_gt□ "5551001"

□□ SRI-for-SM □ 44121234567□
  □□ GT□44121234567□□□□
  □□ GT□5551001□NAT'd□
  networkNode-Number□5551001□□ MAP □□□□
```

□□ 2□□□□□ GT □ HLR

□□□□□ HLR □□□□□□□□ GT□

```
config :omniss7,
  gt_nat_enabled: true,
  hlr_service_center_gt_address: "555000",  # □□ HLR GT

  gt_nat_rules: [
    # □□□□ VLR□□□ 5551□
    %{calling_prefix: "5551", weight: 10, response_gt: "555100"},

    # □□□□ VLR□□□ 5552□
    %{calling_prefix: "5552", weight: 10, response_gt: "555200"},

    # □□□□ VLR□□□ 5553□
    %{calling_prefix: "5553", weight: 10, response_gt: "555300"},

    # □□□□□□□□□□□□□□□
    %{weight: 100, response_gt: "555000"}
  ]
```

□□ 3□□□□□

□□□□□□□□ GT □□□□ GT□

```
config :omniss7,
  gt_nat_enabled: true,
  hlr_service_center_gt_address: "123456789",  # □ GT□□□□

  gt_nat_rules: [
    # □□□□□□□□□□□□□□□□□□□
    %{calling_prefix: "555", weight: 10, response_gt:
"987654321"},  # □ GT
    %{calling_prefix: "666", weight: 10, response_gt:
"987654321"},  # □ GT

    # □□□□□□□□□ GT□□□□□□
    %{weight: 100, response_gt: "123456789"}  # □ GT
  ]
```

□□ 4□□□□□□□□□□□□

□□□□□□□□ GT □□□□□□□□□□□□□□□□□□ GT □□□□□□ GT□

```
config :omniss7,
  gt_nat_enabled: true,

  gt_nat_rules: [
    # □□□□□□□□ SMS GT□5551xxx□□□□□□□ GT
    %{called_prefix: "5551", weight: 10, response_gt: "555100"},

    # □□□□□□□□□□□ GT□5552xxx□□□□□□□ GT
    %{called_prefix: "5552", weight: 10, response_gt: "555200"},

    # □□□□□□□□□□□ GT□5553xxx□□□□□□□ GT
    %{called_prefix: "5553", weight: 10, response_gt: "555300"},

    # □□□□□
    %{weight: 100, response_gt: "555000"}
  ]
```

□□□□□□

```
□□□□□□□□□ GT□555100□□□□ SMS GT□
□□ GT□441234567□□□□□□□□□

GT NAT □□□□
  □□ GT "555100" □□□□□ "5551"
  □□□□ response_gt□ "555100"

□□□□□□□□ GT□555100□□□□□□□□□□□□□□
```

□□ 5□□□□□□ + □□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□ GT□□□□□□□□□□□□□□□□

```
config :omniss7,
  gt_nat_enabled: true,

  gt_nat_rules: [
    # □□□□□ A □□□□□ SMS GT - □□□□□□□□□□ 1□
    %{calling_prefix: "4412", called_prefix: "5551", weight: 1,
response_gt: "555101"},

    # □□□□□ B □□□□□ SMS GT - □□□□□□□□□□ 1□
    %{calling_prefix: "4413", called_prefix: "5551", weight: 1,
response_gt: "555102"},

    # □□□□□□□□□ SMS GT - □□□□□□□□□□ 10□
    %{called_prefix: "5551", weight: 10, response_gt: "555100"},

    # □□□□□ A □□□□□ GT - □□□□□□□□□□ 10□
    %{calling_prefix: "4412", weight: 10, response_gt: "555200"},

    # □□□□□ - □□□□□□□□□ 100□
    %{weight: 100, response_gt: "555000"}
  ]
```

□□□□□□

```
# □□□□□ A □□ SMS GT
□□□"441234567"□□□□"555100"
→ □□□□□ 1 □□□□□□□□□→ "555101"

# □□□□□ A □□□□□ GT
□□□"441234567"□□□□"555200"
→ □□□□□ 10 □□□□□□□□→ "555200"

# □□□□□□□□□ SMS GT
□□□"999999999"□□□□"555100"
→ □□□□□ 10 □□□□□□□□→ "555100"

# □□□□□□□□□□□ GT
□□□"999999999"□□□□"555200"
→ □□□□□ 100 □□□ → "555000"
```

□□□□

GT NAT □□□ OmniSS7 □□□□□□□□

HLR □□

GT NAT □□□

- UpdateLocation □□□□□□□ HLR GT□
- InsertSubscriberData □□□□□□□□□ HLR GT□
- SendAuthenticationInfo □□
- □□□□□□

□□ HLR □□□□□□□□□□□ HLR □□□□□

□□□

```
config :omniss7,
  hlr_mode_enabled: true,
  hlr_service_center_gt_address: "5551234567",  # □□ HLR GT

  gt_nat_enabled: true,
  gt_nat_rules: [
    %{calling_prefix: "331", weight: 10, response_gt:
"5551234568"},  # □□
    %{calling_prefix: "44", weight: 10, response_gt:
"5551234569"},   # □□
    %{weight: 100, response_gt: "5551234567"}  # □□□□□
  ]
```

SMSc □□

GT NAT □□□

- SRI-for-SM □□□`networkNode-Number` □□□ - □□ SRI-for-SM □□□□
- MT-ForwardSM □□

□□ SMSc □□□□□□□□□□□ SMSc □□□□□

□□□

```
config :omniss7,
  smsc_mode_enabled: true,
  smsc_service_center_gt_address: "5559999",  # □□ SMSc GT

  gt_nat_enabled: true,
  gt_nat_rules: [
    %{calling_prefix: "1", weight: 10, response_gt: "5559991"},
# □□
    %{calling_prefix: "44", weight: 10, response_gt: "5559992"},
# □□
    %{calling_prefix: "86", weight: 10, response_gt: "5559993"},
# □□
    %{weight: 100, response_gt: "5559999"}  # □□□□□
  ]
```

CAMEL □□□□

GT NAT □□□

- □□ SCCP □□□□gsmSCF GT □□□□□□
- CAMEL/CAP □□□□□InitialDP□EventReportBCSM □□
- RequestReportBCSMEvent □□
- ApplyCharging □□
- Continue □□

□□□

```
config :omniss7,
  camelgw_mode_enabled: true,
  camel_gsmscf_gt_address: "55512341112",  # □□ gsmSCF GT

  gt_nat_enabled: true,
  gt_nat_rules: [
    %{calling_prefix: "555", weight: 10, response_gt:
"55512341111"},  # □□ A
    %{calling_prefix: "666", weight: 10, response_gt:
"55512311555"},  # □□ B
    %{weight: 100, response_gt: "55512341112"}  # □□□□□
  ]
```

□□□□□□□□□□□ gsmSCF□□□□□□□□□□□□□□□□□□ gsmSSF □□□□□□□□□ gsmSCF GT □□□□□□ GT NAT □□□□□□□ gsmSSF □□□□□□□□□ GT□

□□□□□□□

□□ GT NAT □□□□

GT NAT □□□□□□□□□□□□□□□□

```
# □□□□□□□□□□□□
[info] GT NAT [SRI-for-SM □□]: □□ GT 877234567 -> □□ GT
55512341112
[info] GT NAT [UpdateLocation ISD]: □□ GT 331234567 -> □□ GT
55512341111
[info] GT NAT [MAP BEGIN □□]: □□ GT 441234567 -> □□ GT 55512311555
```

□□□□□□□□□ NAT □□□□□□□

- `"SRI-for-SM □□"` - □ SRI-for-SM □□□□□
- `"UpdateLocation ISD"` - □ InsertSubscriberData □□□
- `"UpdateLocation END"` - □ UpdateLocation END □□□
- `"MAP BEGIN □□"` - □□ MAP BEGIN □□
- `"ISD ACK"` - ISD □□

- `"HLR □□□□"` - HLR □□□□□
- `"CAMEL □□"` - CAMEL/CAP □□□□□gsmSCF□

□□

□□□□□□□□□ GT NAT □□□

```
# □□ GT NAT □□
iex> GtNat.validate_config()
{:ok, [
  %{calling_prefix: "8772", weight: 10, response_gt:
"55512341112"},
  %{calling_prefix: "8773", weight: 10, response_gt:
"55512341111"}
]}

# □□□□□□□
iex> GtNat.enabled?()
true

# □□□□□□□
iex> GtNat.get_rules()
[
  %{calling_prefix: "8772", weight: 10, response_gt:
"55512341112"},
  %{calling_prefix: "8773", weight: 10, response_gt:
"55512341111"}
]
```

□□ GT NAT

□□□□□□□□ GT NAT □□□

```
# □□□□□□ GT □□□□□□called_gt □ nil□
iex> GtNat.translate_response_gt("877234567", nil, "default_gt")
"55512341112"

# □□□□□□□□□ GT □□□□□
iex> GtNat.translate_response_gt("877234567", "555123",
"default_gt")
"55512341112"

# □□□□□□□□□nil □□ GT□
iex> GtNat.translate_response_gt_with_logging("877234567", nil,
"default_gt", "test")
# □□□GT NAT [test]: □□ GT 877234567 -> □□ GT 55512341112
"55512341112"

# □□□□□□□□□□□ GT□
iex> GtNat.translate_response_gt_with_logging("877234567",
"555123", "default_gt", "test")
# □□□GT NAT [test]: □□ GT 877234567, □□ GT 555123 -> □□ GT
55512341112
"55512341112"

# □□□□□□□□□□□□□□□
iex> GtNat.translate_response_gt("999999999", "888888",
"default_gt")
"default_gt"
```

□□□□

□□□GT NAT □□□

□□ 1□□□□□□

```
iex> Application.get_env(:omniss7, :gt_nat_enabled)
true  # □□□ true
```

□□ 2□□□□□□□□

```
iex> Application.get_env(:omniss7, :gt_nat_rules)
[%{calling_prefix: "8772", response_gt: "55512341112"}, ...]  # □□
□□□□
```

□□ **3**□□□□□ □□□□□□□ "GT NAT" □□□□□□□□□□□□

□□□□□□□ GT □□

□□□□□□□□□□ GT □□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□

```
# □□□□□□□□□□□□□□□□□□□□□□□□□□□
gt_nat_rules: [
  %{weight: 1, response_gt: "111111"},               # □□□□□□□□□□□
  %{calling_prefix: "8772", weight: 10, response_gt: "222222"}  #
□□□□
]

# □□□□□□□□□□□□□□□□□□□□□□□□□□□□□
gt_nat_rules: [
  %{calling_prefix: "8772", weight: 10, response_gt: "222222"},  #
□□□□□□□
  %{weight: 100, response_gt: "111111"}  # □□□□□□□□□□□□
]
```

□□□GT NAT □□□□□□□□□□□

□□□□□□□□□□ NAT'd GT□□□□□□□□

□□□□□□□□

- □ SCCP □□ GT□□□□□□
- □ SRI-for-SM □□□networkNode-Number□
- □ UpdateLocation ISD □□□HLR GT□
- □ UpdateLocation END □□

- □ ISD □□
- □ MAP BEGIN □□

□□□□□□□□□□□□ GT NAT□□□□□□□□□□□□□□□□□□□□□□□□

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GT NAT □□□□□□□□□□□□□□□□□ O(n)□□□ n □□□□□□□□

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- □□□□□□□□□ 100 □□□□□□□□□□
- □□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□

□□□□□□□□□□□□

- 10 □□□□□□□□□ < 1μs
- 50 □□□□□□□□□ < 5μs
- 100 □□□□□□□□□ < 10μs

□□□□

□□□□□□□□ 100 □□□□□□□

- 10 □□□ ≈ 1 KB
- 100 □□□ ≈ 10 KB

□□□□

1. □□□□□□□□□□□□□□□□

```
gt_nat_rules: [
  %{calling_prefix: "8772", weight: 10, response_gt: "111111"},
  %{calling_prefix: "8773", weight: 10, response_gt: "222222"},
  %{weight: 100, response_gt: "default_gt"}  # □□□□□□□□□□□□□□□
]
```

2. □□□□□□□□□□□□

```
# □□□□□□□□□□□□□□□□□□□□□□
%{calling_prefix: "331", weight: 10, response_gt: "..."}  # □□
%{calling_prefix: "44", weight: 10, response_gt: "..."}   # □□

# □□□□□□□□□□□□□□□□□□□□□□
%{calling_prefix: "3", weight: 5, response_gt: "..."}     # □□□□
%{calling_prefix: "331", weight: 100, response_gt: "..."}  # □□□□□
□□□□□
```

3. □□□□□□

```
gt_nat_rules: [
  # □□□□□ XYZ - □□□□□□GT □□□4412xxxxxxx□
  # □□ 10□□□□□□□□□□□
  %{calling_prefix: "4412", weight: 10, response_gt: "5551001"},

  # □□□□□ ABC - □□□□□□GT □□□33123xxxxxx□
  # □□ 10□□□□□□□□□□□
  %{calling_prefix: "33123", weight: 10, response_gt: "5551002"}
]
```

4. □□□□□

```
# □□□□□□ iex □□□
iex> GtNat.translate_response_gt("44121234567", nil, "default")
"5551001"  # □□□□

# □□□□ GT □□
iex> GtNat.translate_response_gt("44121234567", "555123",
"default")
"5551001"  # □□□□
```

5. □□□□

□□ INFO □□□□□□□□□□□□□□□□□□ GT NAT □□□

□□□□□□□□

STP □□

GT NAT □□□ STP □□□□□STP □□□□□□□□ GT □□□□□□ GT NAT □□□□□□□

□□ STP □□□□□□□□□□□ STP □□□□□

CAMEL □□

GT NAT □□□□ □ CAMEL/CAP □□□

SCCP □□

- □□ CAMEL □□□□□□□ GT
- □□□□□ gsmSSF GT □□□□

□□□

- `camel_gsmscf_gt_address` - □□ gsmSCF GT□□□□
- □□□□□□□□□□□□□□□□□□ GT
- GT NAT □□□□□□□□□□□□□□□□

□□□

```
# □ gsmSSF 555123456 □□□□ gsmSCF
# □□□□□=55512341112□□□=555123456
# GT NAT □□□"555" -> response_gt="55512341111"
# □□□□□=555123456□□□=55512341111
```

□□□□

GT NAT □□□ M3UA □□□□□□□□□□□□□□□□□□□□□□□□

□□□□

□□□□□□□□□ GT NAT

1. □□□□

```
# □□□ runtime.exs□□□□□□□□
config :omniss7,
  gt_nat_enabled: false,  # □□□□□
  gt_nat_rules: [
    # □□□□□□□□□□□□□□□□
    %{calling_prefix: "877", weight: 10, response_gt:
"111111"},
    %{weight: 100, response_gt: "999999"}  # □□□□□
  ]
```

2. □□□□

```
# □□□□□□□□□
mix compile

# □ iex □□□
iex -S mix
iex> GtNat.validate_config()
```

3. □□□□□□□□□

```
gt_nat_enabled: true  # □□□ true
```

4. □□□□

```
tail -f log/omniss7.log | grep "GT NAT"
```

5. □□□□□

   - □□□□□□□□□□□□
   - □□□□□ 24 □□
   - □□□□□□□□ `gt_nat_enabled` □□□ false□

□□

□□□□□□□□

- □□□□□□ "GT NAT" □□
- □□ `GtNat.validate_config()` □□□□
- □□□□□□□□□□□□□
- □□ OmniSS7 □□□□□□□□□

□□

- HLR □□ - HLR □□□□
- SMSC □□ - SMSc □□□□
- STP □□ - STP □□□□
- □□□□ - □□□□□□

HLR □□□□

← □□□□□

□□□□□□□□ OmniSS7 □□ □□□□□□□□ **(HLR/HSS)** □ **OmniHSS** □□□□□□□□□□□□□□□□□□

OmniHSS □□

OmniSS7 HLR □□□□ **SS7** □□□□□□□ **OmniHSS**□□□□□□□□□□□□□□□□□□ HSS □□□□□□□□□□□ □□□□□□□□□□

- **OmniSS7 (HLR □□)**□□□□□□ SS7/MAP □□□□□SCCP □□□□□□□□
- **OmniHSS (HSS □□)**□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□ OmniHSS□

OmniHSS □□□□□□□□□□□□□□□□□□□□□□

- □ **IMSI** □□□□□□□□□□□□□ MSISDN □□□□ IMSI□□□□□□□□□□□□□□□ eSIM □□
- □□□□□□□□□□ Milenage□3G/4G/5G□□ COMP128□2G□□□□□□□
- □□□□□□□□□□□□□□□□ CS□□□□□□□ PS□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□ CAMEL □□□□
- **API** □□□□□□□□□□□CRM □□□□□□□□ RESTful HTTP API
- □□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□ OmniHSS □□□□□□□OmniSS7 □□ HTTPS API □□□□ OmniHSS□□□□□ UpdateLocation□SendAuthenticationInfo □ SendRoutingInfo □ MAP □□□

□□□OmniSS7 HLR □□□□ □□□□□□□□□□□□□□□□□□□□

□ IMSI □□

OmniHSS □□□□□ **IMSI** □□□□□□□□□□□□ MSISDN □□□□□□□ IMSI□□□□□

- □□□□□□□□□□□□□□□□ IMSI □□□□□□□
- **eSIM** □□□□□□□□□ eSIM □□□□□□□□□□□□
- □□□□□□□□□ MSISDN □□□□□□□□□□
- □ **SIM** □□□□□□□□□□□ SIM □□□□
- □□□□□□□□□□ IMSI □□□□□□

□□□□

- □□ IMSI □□□□□□□□□□□□Ki□OPc□□□□
- □□ IMSI □□□□□□□□□□□□□□□□□
- □□□□□□□□□□ IMSI □□□□□□□□
- OmniSS7 □ IMSI □□ OmniHSS□OmniHSS □□□□□□□□□
- □□□□□□□ IMSI □□□□□□□□□□□ IMSI □□□□□□□

□□□ **IMSI** □□□

```
□□ MSISDN: +1-555-123-4567
├─ IMSI 1: 310260123456789 (□□□□□□ - Milenage □□□□)
├─ IMSI 2: 208011234567890 (□□□□□□ - Milenage □□□□)
└─ IMSI 3: 440201234567891 (□□□□□□ - COMP128 □□□□)
```

□□□□ IMSI □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□OmniHSS □□ IMSI □□□□□□□□□□□□□ IMSI □□□□□□□□□□

□□

1. OmniHSS □□
2. □ IMSI □□
3. □□□ HLR □□□
4. □□ HLR □□
5. □□□□□
6. □□□□□□
7. □□□□
8. CAMEL □□
9. □□□□□□
10. HLR □□

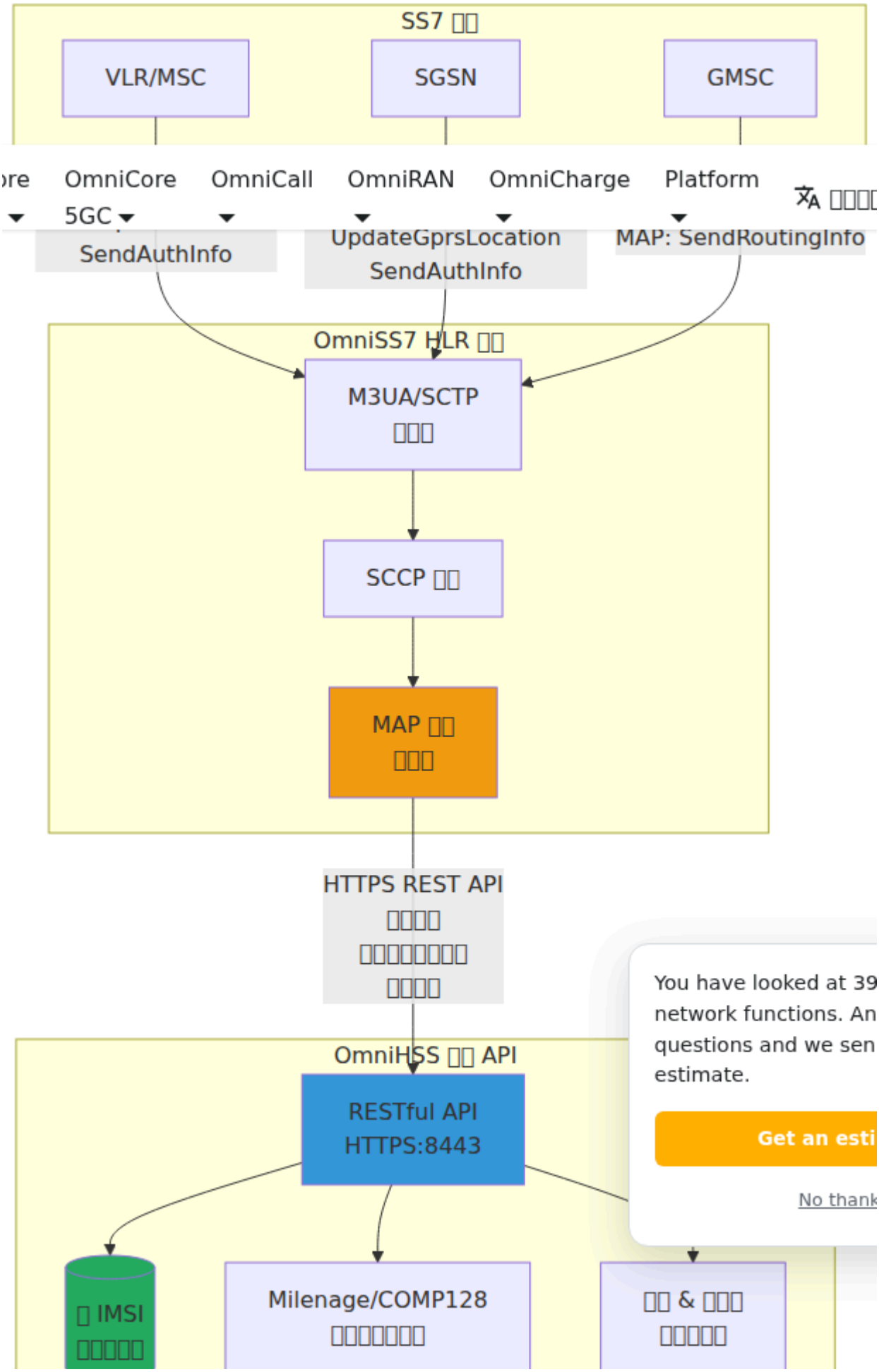
- □□□□□□
  - SendRoutingInfo (SRI)
  - UpdateLocation / ISD
  - SendRoutingInfoForSM
- □□□□□

□□□ HLR □□□

HLR □□□ OmniSS7 □□□□□□□□□□□□□□□□□□□□□□□□

- □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□□ VLR □□□□□
- □□□□□□□□□□□ SMS □□□□□□

HLR □□


SS7 □□
VLR/MSC
SGSN
GMSC
OmniCore
5GC
OmniCall
OmniRAN
OmniCharge
Platform
SendAuthInfo
UpdateGprsLocation
SendAuthInfo
MAP: SendRoutingInfo
OmniSS7 HLR □□
M3UA/SCTP
□□□
SCCP □□
MAP □□
□□□
HTTPS REST API
□□□□
□□□□□□□□
□□□□
OmniHSS □□ API
RESTful API
HTTPS:8443
□ IMSI
□□□□□
Milenage/COMP128
□□□□□□□
□□ & □□□
□□□□□



□□ HLR □□

OmniSS7 □□□□□□□□□□□□STP□HLR□SMSc□□□□□□□□□□□□ **`config/config.exs`** □□□□□□□□□□□□□

```
config :omniss7,
  # □□□□□ - □□□ HLR □□
  map_client_enabled: true,
  hlr_mode_enabled: true,
  smsc_mode_enabled: false,

  # OmniHSS □□ API □□
  hlr_api_base_url: "https://omnihss.example.com:8443",
  hlr_api_key: "<□□ hlr_interworking □□□ OmniHSS API □□>",

  # HLR □□□□□ GT □□□□□□ SMS □□
  hlr_service_center_gt_address: "1234567890",

  # MSISDN ↔ IMSI □□□□
  # □□□□□MSISDN ↔ IMSI □□□□□
  hlr_imsi_plmn_prefix: "50557",
  hlr_msisdn_country_code: "61",
  hlr_msisdn_nsn_offset: 0,
  hlr_msisdn_nsn_length: 9,

  # InsertSubscriberData □□
  # □□□□□□□□:packetAndCircuit□:packetOnly □ :circuitOnly
  isd_network_access_mode: :packetAndCircuit,

  # □□ ISD #2□□□□□□□□□
  isd_send_ss_data: true,

  # □□ ISD #3□□□□□□□□□
  isd_send_call_barring: true,

  # CAMEL □□□□□ SendRoutingInfo □□□
  # CAMEL □□□□□□□□□□
  camel_service_key: 11_110,

  # CAMEL □□□□□
  # □□□:termAttemptAuthorized□:tBusy□:tNoAnswer□:tAnswer
  camel_trigger_detection_point: :termAttemptAuthorized,

  # □□ VLR □□
  # □□□“□□”□□□ VLR □□□□□□□
  # □□□□□□ VLR □□□□□□□□□□□□□□□□□□ SRI □□
  # □□□□□□□□□□□□□□□□□□□□ PRN □□□ MSRN
  # □□□□□□□□□□ []□□□□□□ = □□ VLR □□□□□□
```

```
  home_vlr_prefixes: ["555123"],

  # M3UA □□□□
  # □□ ASP □□□□□ MAP □□□UpdateLocation□SendAuthInfo □□
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :hlr_client_asp,
    # □□□□□HLR □□□
    local_ip: {10, 179, 4, 11},
    local_port: 2905,
    # □□ STP □□
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1
  }
```

□□□□□□□□□

□□□□□□□□□□□□□□□□□□ □□□□□

□□	□□	□□	
`hlr_api_base_url`	□□□	*□□*	**Om**

`hlr_api_key`	□□□	*□□*	Omn
			Omn
			Omn
			`x-o`
			□□ C
			`hlr_`
			□□□□

`hlr_service_center_gt_address`	□□□	*□□*	□ Up □□□□
`smsc_service_center_gt_address`	□□□	*□□*	□ SR SMS
`hlr_smsc_alert_gts`	□□	`[]`	□ Up □ al □ SM
`hlr_alert_location_expiry_seconds`	□□	`172800`	□ SM alert □□□□
`hlr_imsi_plmn_prefix`	□□□	`"50557"`	MSIS PLM □MC MSIS

□□	□□	□□	
`hlr_msisdn_country_code`	□□□	`"61"`	□□ I□□□□ IMSI
`hlr_msisdn_nsn_offset`	□□	`0`	□ MS□□□□ IMSI
`hlr_msisdn_nsn_length`	□□	`9`	□□□□ MSIS
`isd_network_access_mode`	□□	`:packetAndCircuit`	Inse□□□□
`isd_send_ss_data`	□□	`true`	□□□□
`isd_send_call_barring`	□□	`true`	□□□□
`camel_service_key`	□□	`11_110`	Sen□ CAM
`camel_trigger_detection_point`	□□	`:termAttemptAuthorized`	CAM
`hlr_camel_subscriptions`	□□	`[]`	□□ I□ T-CS□ Inse□□□□ □□□
`home_vlr_prefixes`	□□	`[]`	□□□‘□□□□

□□	□□	□□	
			□□
`local_ip`	□□	*□□*	□□ H
`local_port`	□□	`2905`	□□ S
`remote_ip`	□□	*□□*	□□ S
`remote_port`	□□	`2905`	□□ S
`routing_context`	□□	`1`	M3U

□□ HLR □□□□□□□□

□ `hlr_mode_enabled: true` □□Web UI □□□□

- □ **SS7** □□ - □□□□
- □ **SS7** □□□ - MAP □□□□
- □ □□□ - □□□□□M3UA/SCTP □□□□
- □ **HLR** □□ - HLR API □□ + □□□□ ← *HLR □□*
- □ □□ - □□□□
- □ □□ - □□□□□

□□□□□□□□ **SMSc** □□ □□□□□□□□□

□□□□

- □□□□□`hlr_service_center_gt_address` □□□ □□□□□□□□□□□□□□□□□□□□□□□□□□

- **OmniHSS** □□□OmniHSS API □□□□□□□□ `hlr_api_base_url` □□□□
- **OmniHSS API** □□□`hlr_api_key` □□□□□□OmniSS7 □□□ OmniHSS □□□□□□□□ `x-omnihss-key` □□□□□□ HLR □□□□□□□□□□□□□□□□□□□□□□□□□□ OmniHSS □□□□□□ `hlr_api_key` □□□□□□□□OmniSS7 □□□□□□□□□□□□□□□□□□□□□□□□□□□□OmniHSS □□□ HTTP 401□
- **API** □□□□□□□□ OmniHSS API □□□□ □□□□ **5** □□□
- **MAP** □□□□□□□□ MAP □□□SRI□UpdateLocation□SendAuthInfo □□□□ □□□□ **10** □□□
- **ISD** □□□□ UpdateLocation □□□□□□ InsertSubscriberData (ISD) □□□□ □□□□ **10** □□□
- □□□ STP □ M3UA □□□□□ MAP □□
- □□□□□□□□□□□□□□□□□□□□□□□□
- **Web UI**□□□□□ Web □□□□□□□□□ Web UI □□
- **API** □□□□□ REST API □□□ Swagger UI □□□□□□□□□ API □□

□□□□□

OmniHSS □□□□□□□□□□□□□□□□□□□□

□□□□□□

□□□□□□□□

OmniHSS □□ **Milenage** □ **COMP128** □□□□□□□□

□□□□

□□□□□□□

□□□□ **updateLocation** MAP □□□□OmniSS7 □ OmniHSS □□□□□□□□ VLR □□□□□□

1. □ **UpdateLocation** □□□□□□□□□□□IMSI□□ VLR GT□□ MSC GT□
2. □□ **OmniHSS** □□□□□□□□□□□□□□□
3. □ **OmniHSS** □□□□□□□□□□□□□□ VLR/MSC □□
4. □□ **InsertSubscriberData (ISD)** □□□□□□ VLR □□□□□□
5. □□ **UpdateLocation** □□ □ VLR□□□□□□ `hlr_service_center_gt_address` □ HLR GT□
6. □□□□ **SMSc GT** □□ **alertServiceCenter**□□□ `hlr_smsc_alert_gts` □□□□

□□□`hlr_service_center_gt_address` □□□□□□□□ UpdateLocation □□□□□□□ HLR □□□ □□□□□□□ VLR/MSC □□□□□□□□□□□ HLR□

□□□□□□□□□

□□□□ UpdateLocation □□□HLR □□□□□□□ **alertServiceCenter**□MAP □□□ 64□□□□□□□□ SMSc □□□□□□□□□□□□ SMSc □□□□□□□□□□□□□□□□□□ SMSc □□□□□□□□□□□□□□□□□

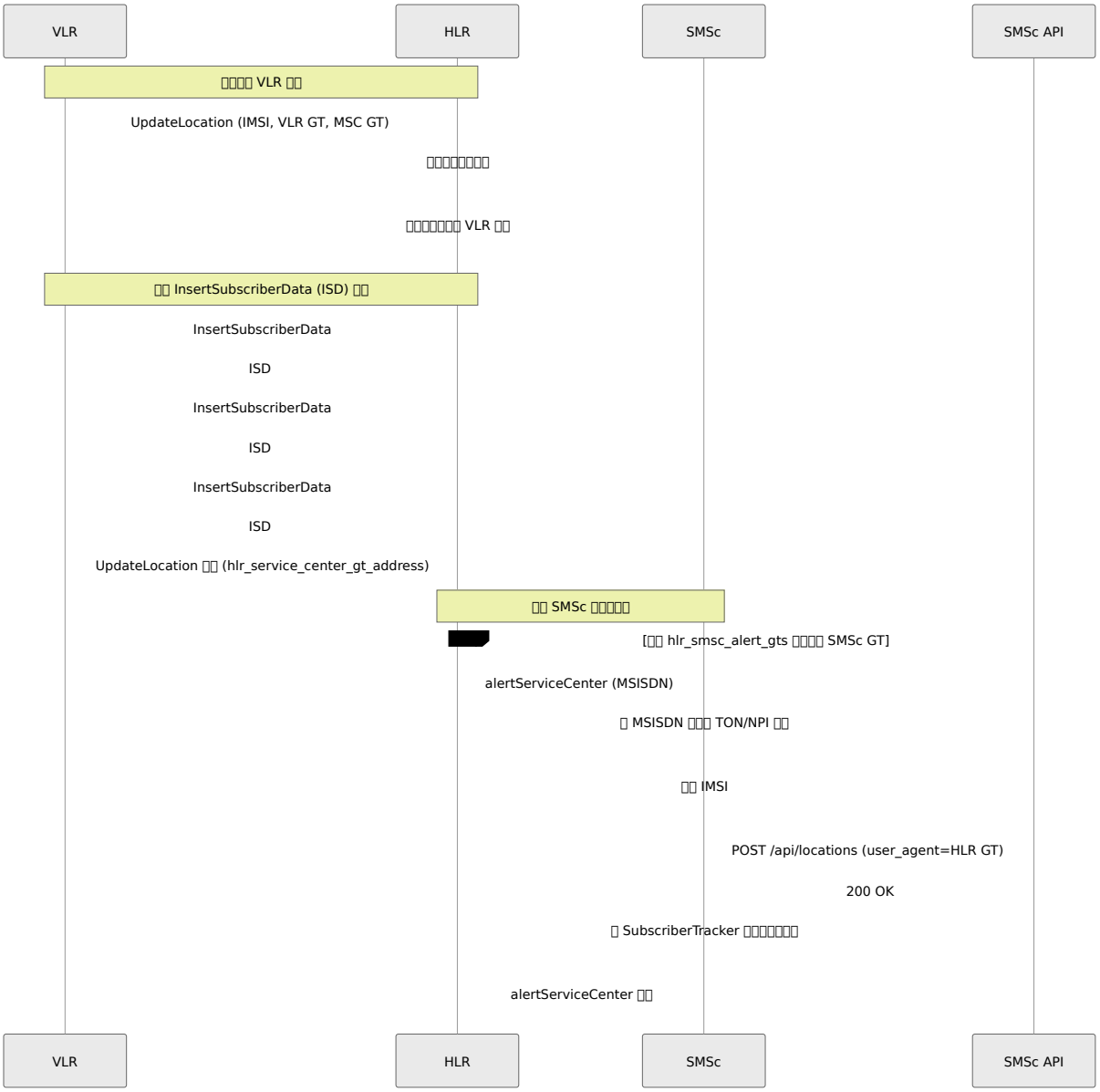
□□

□□□□□□□ SMSc □□□□□□□□

```
config :omniss7,
  # □ UpdateLocation □□□ alertServiceCenter □ SMSc GT □□
  hlr_smsc_alert_gts: [
    "15559876543",
    "15559876544"
  ],

  # □ SMSc □□□ alertServiceCenter □□□□□□□□□□□□□48 □□□
  hlr_alert_location_expiry_seconds: 172800
```

□□□



□□

□□□□□ UpdateLocation □□

1. HLR □ `hlr_smsc_alert_gts` □□□□ □□ SMSc GT □□ alertServiceCenter
2. □□□□□□□ MSISDN
3. HLR □□ `hlr_service_center_gt_address` □□□□□ GT
4. SCCP □□□□□ SSN=6□HLR□□□□ SSN=8□SMSc□

SMSc □□□□□□

- □ **MSISDN** □□□ **TON/NPI** □□□□□□“19123123213” → “123123213”□
- □□□□□□□□□□□□□□□□□□□□□ POST □ /api/locations□

- □□□ **API** □□ `user_agent` □□□□□ **HLR GT**□□□□□□□ HLR □□□□□□
- □□ `hlr_alert_location_expiry_seconds` □□□□□□□□
- □ SMSc □□□□□□□□□□□□□□□□

□□

□□ Web UI □□ □□□□□ □□□□□□ alertServiceCenter □□□□□□□

1. □□□“□□□□□”□□□
2. □□“□□□□□□□□”□□
3. □□ MSISDN□SMSc GT □ HLR GT□□□□□□□□□□□□□
   - SMSc GT □□□□ `hlr_smsc_alert_gts` □□□□□□□
   - HLR GT □□□□ `hlr_service_center_gt_address`
4. □□“□□ alertServiceCenter”

□□□□ SMSc □□□□□□□□□□□□□□□ UpdateLocation □□□□□□□□ `phx-blur` □□□□□□□□□□ □□□□

InsertSubscriberData (ISD) □□

□□□□ UpdateLocation □□□HLR □□ **InsertSubscriberData** (ISD) □□□ VLR □□□□□□ □□□□ISD □□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□ ISD □□□□□□□□□□

ISD □□

HLR □□□□□□ 3 □□□ ISD □□□

1. **ISD #1**□□□□□□ - □□□□□□□□

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

2. **ISD #2**□□□□ - □□□□□SS□□□□

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

3. **ISD #3**□□□□ - □□□□□□□□

   - □□□□□□□□□□□BAOC□
   - □□□□□□□□□□□BOIC□
   - □□□□□□□

□□□□

```
# InsertSubscriberData □□
# □□□□□□□: :packetAndCircuit, :packetOnly, □ :circuitOnly
isd_network_access_mode: :packetAndCircuit,

# □□ ISD #2□□□□□□□□□
isd_send_ss_data: true,

# □□ ISD #3□□□□□□□□□
isd_send_call_barring: true,
```

□□□□□□

`isd_network_access_mode` □□□□□□□□□□□□□□□□□□□□□□

□	□□	□□
`:packetAndCircuit`	□□□□□□□□□□GPRS/LTE□□□□□□□□□□□	□□ - □□□□□□□
`:packetOnly`	□□□□□□□□□□□/LTE□	□□□ SIM □□□□□□□□
`:circuitOnly`	□□□□□□□□□□□/SMS□	□□□□□□□□□□□

□□ **ISD** □□

□□□□□□□□□□□□□□□□□ ISD □□□

□□□□ **ISD**□□□ - □□□□□□□

```
isd_send_ss_data: true,
isd_send_call_barring: true,
```

□□□□□□□□□□□□□□□□□□□

```
isd_send_ss_data: false,
isd_send_call_barring: false,
```

□□□□ **+** □□□□□□□□□□□□□

```
isd_send_ss_data: true,
isd_send_call_barring: false,
```

ISD □□□□

□□□□ UpdateLocation □□

```
VLR → HLR: UpdateLocation (BEGIN)
HLR → VLR: InsertSubscriberData #1 (CONTINUE) - □□□□
VLR → HLR: ISD #1 ACK (CONTINUE)
HLR → VLR: InsertSubscriberData #2 (CONTINUE) - SS □□ [□□□□]
VLR → HLR: ISD #2 ACK (CONTINUE)
HLR → VLR: InsertSubscriberData #3 (CONTINUE) - □□□□ [□□□□]
VLR → HLR: ISD #3 ACK (CONTINUE)
HLR → VLR: UpdateLocation □□ (END)
```

□□ `isd_send_ss_data` □ `isd_send_call_barring` □□□ `false`□□□□□□ ISD □□□□□□ □□ UpdateLocation END□

□□□□

- □□□□□□□□ `:packetAndCircuit` □□□□□ ISD □□□□□□□□□

- □□□/**M2M**□□□ `:packetOnly` □□□ SS □□/□□□□□□□□□□□□□
- □□□□□□□□ VLR □□□□□□□□□□□ - □□□□□□□□□□ `isd_send_ss_data`
- □□□□□□□□□ ISD □□□□□□□□□□□□□□□□□

CAMEL □□

CAMEL □□□□ SendRoutingInfo

□□□□□ GMSC□□□ MSC□□ **SendRoutingInfo** (SRI) □□□□HLR □□□□ GMSC □□ CAMEL □□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□ CAMEL □□□□□□□□□□

□□□ **CAMEL**□

CAMEL□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ GSM/UMTS □□□□□□□□□□□□□□□□□□□□

`camel_service_key` □□□□ gsmSCF□□□□□□□□□□□□□ CAMEL □□□□□□□□□□□□□□□□□□□□□

□��□□	□□□□
`11_110`	□□□□□□□□□□□□□□□
`100`	□□□□□□□□□
`200`	□□□□□□□□□□□□□
`300`	□□□□□□□□VPN□
□□□	□□□□□□□□

□□□□□

```
# □□□□□□□□□□□□□
camel_service_key: 11_110,

# □□ VPN □□
camel_service_key: 300,
```

□□□□□

`camel_trigger_detection_point` □□□□□□□□□□□□□□ CAMEL □□□

□□□	□□	□□□□
`:termAttemptAuthorized`	□□□□□□□□□□□□	□□□□□□□□□□□□
`:tBusy`	□□□□	□□□□□□□□
`:tNoAnswer`	□□□□□	□□□□□□□□
`:tAnswer`	□□□□	□□□□□□□□□

□□□□□

□□□□□□□□□□□□□□□□□□□□

```
camel_trigger_detection_point: :termAttemptAuthorized,
```

□□□□□□□□□□□□□□□□□□□□

```
camel_trigger_detection_point: :tBusy,
```

□□□□□□□□□□□□□□□□□□□□

```
camel_trigger_detection_point: :tAnswer,
```

□ CAMEL □ SRI □□

□□□□SendRoutingInfo □□□□□ CAMEL □□□□□□

```
GMSC → HLR: SendRoutingInfo (BEGIN)
HLR → GMSC: SRI □□ (END) □□□
  - IMSI
  - VLR □□
  - □□□□□□
  - CAMEL □□□□□□
    * □□□□□: 11_110
    * gsmSCF □□: <□□□□□□>
    * □□□□□□: termAttemptAuthorized
    * □□□□□□□: continueCall

GMSC □□□□□□□ gsmSCF □□ CAMEL □□
```

□□□□□

- □□□□□□□□□□□□ gsmSCF □□□□□□□□□□□□□□□□□□□□
- □□□□□□ `:termAttemptAuthorized` □□□□□□□□□□
- □□□□□□□□□□□□ `11_110` □□□□□□□□□□□□□□□□□□□□
- □□□□□□`defaultCallHandling: :continueCall` □□□ gsmSCF □□□□□□□□□□□□□

InsertSubscriberData □□ CAMEL □□

□ UpdateLocation □□□□□□□ IMSI □ `hlr_camel_subscriptions` □□□□□□□□HLR □□□ □ InsertSubscriberData□□□ `vlrCamelSubscriptionInfo`□□□□□□□□□□□□MSC □□ O-CSI □□ MO □□□DP □□□□□□ VT-CSI □□ MT □□□DP termAttemptAuthorized□□□□□ CAP □□□ `gsmscf_address` □□□□□□□ gsmSCF □□ HLR □□□□□□□□ MSC □□□□□□

```
config :omniss7,
  hlr_camel_subscriptions: [
    %{
      imsi_prefix: "3133800000009",
      o_csi: %{service_key: 100, gsmscf_address: "14155550300",
default_call_handling: :release_call},
      t_csi: %{service_key: 101, gsmscf_address: "14155550300",
default_call_handling: :continue_call}
    }
  ]
```

□	□□
`imsi_prefix`	□□□□□ IMSI □□
`o_csi` / `t_csi`	□□□□□ `service_key` □InitialDP serviceKey□□ `gsmscf_address` □gsmSCF E.164 GT□□ `default_call_handling` □ `:release_call` □ `:continue_call` □□ MSC □ gsmSCF □□□□ □□□

CSIs □□ CAMEL □□□□ 2□CAP v2□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□

□□ VLR □□□ VLR □□

□ HLR □□□ **SendRoutingInfo** (SRI) □□□□□□□□□□□□□□□“□□” VLR□□□□□□□□□□□□□□□ VLR□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□ □□ VLR □□□□□□□□□□□

- □□ **VLR**□□□□□□ SRI □□□□□□ CAMEL □□□□□
- □□ **VLR**□□□□□□□□□□□□□PRN□□□□□□□ MSRN□□□□□ SRI □□□□□□□

□□

```
# □□ VLR □□
# □□□□“□□”□□□□ VLR □□□□□□□□
# □□□□□□□□□ VLR □□□□□□□□□□□□□□□□□□□□□□□ SRI □□
# □□□□□□□□□□□□□□□□□□□□□□ PRN □□□□ MSRN
home_vlr_prefixes: ["555123"],
```

□□□□□□

```
# □□□□□□□□
home_vlr_prefixes: ["555123"],

# □□□□□□□□□□□□□□□□□□□□□□□□□□□□
home_vlr_prefixes: ["555123", "555124", "555125"],
```

□□□□

1. □□□□□□□□□□□□

□□□□□□ VLR □□□□□□□□□□□□□□□□□□

```
GMSC → HLR: SendRoutingInfo (MSISDN: "1234567890")
HLR □□□□□ API □□□□□□□□
HLR □□ VLR □□: "5551234567"
HLR □□: VLR □ "555123" □□ → □□□□□
HLR → GMSC: SRI □□□□□□ CAMEL □□□□□□
  - IMSI
  - VLR □□: "5551234567"
  - gsmSCF □□□MSC□: "5551234501"
  - CAMEL □□□□: 11_110
  - □□□□□□: termAttemptAuthorized
```

2. □□□□□□□□□□ PRN□

□□□□□□ VLR □□□□□□□□□□□□□□□□□□

```
GMSC → HLR: SendRoutingInfo (MSISDN: "1234567890")
HLR □□□□□ API □□□□□□□□
HLR □□ VLR □□: "49170123456"
HLR □□: VLR □□ "555123" □□ → □□
HLR → MSC: ProvideRoamingNumber (PRN):
  - MSISDN: "1234567890"
  - IMSI: "999999876543210"
  - MSC □□: "49170123456"
  - GMSC □□: "5551234501"
MSC → HLR: PRN □□□□□ MSRN: "49170999888777"
HLR → GMSC: SRI □□□□□□□□□□□
  - IMSI
  - VLR □□: "49170123456"
  - □□□□□MSRN□: "49170999888777"
```

□□□□□□

□□□□□ **SRI** □□

```
%{
  imsi: "999999876543210",
  extendedRoutingInfo: {
    :camelRoutingInfo, %{
      gmscCamelSubscriptionInfo: %{
        "t-CSI": %{
          serviceKey: 11_110,
          "gsmSCF-Address": "5551234501",
          defaultCallHandling: :continueCall,
          "t-BcsmTriggerDetectionPoint": :termAttemptAuthorized
        }
      }
    }
  },
  subscriberInfo: %{
    locationInformation: %{"vlr-number": "5551234567"},
    subscriberState: {:notProvidedFromVLR, :NULL}
  }
}
```

□□□□□ **SRI** □□

```
%{
  imsi: "999999876543210",
  extendedRoutingInfo: {
    :routingInfo, %{
      roamingNumber: "49170999888777"  # □ PRN □□□ MSRN
    }
  },
  subscriberInfo: %{
    locationInformation: %{"vlr-number": "49170123456"},
    subscriberState: {:notProvidedFromVLR, :NULL}
  }
}
```

□□□□□□□□PRN□□□

PRN □□□□

□□□ MSC/VLR □ PRN □□□□□

□□	□□	□□
MSISDN	SRI □□	□□□□□□□□□
IMSI	HLR API	□□□□ IMSI
MSC □□	HLR API	□□□□□□□□□□□□ MSC (`serving_msc`)
GMSC □□	SRI □□	□□□□ SRI □□□ GMSC
□□□□□□	□□	□□□□□□□□
□□□ **CAMEL □□**	□□	GMSC □□□ CAMEL □□

PRN □□□□

HLR □□ PRN □□□□□

- **MSRN**□□□□□□□□□□□

□□□□□□□

```
# □□□□□□□□□□□□□□□
home_vlr_prefixes: ["555123", "555124", "555125"],
```

- VLR `5551234567` → ���□□□□ 1□
- VLR `5552341234` → □□□□□ 2□
- VLR `5553411111` → □□□□□ 3□
- VLR `44201234567` → □□□□□□

□□□□

□□□□ PRN □□□□□□□□□□□□□□ VLR □□□□□

```
# □□ VLR □□□□□□□□□□□ PRN □□□
home_vlr_prefixes: [],
```

□□□□

- □□□□□□□□□□□□□ VLR □□□□□□□□□□□□□□□□ + □□□□□
- □□□□□□□□□□□□□□ VLR □□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□ PRN
- □□□□□□□□□□□□□□□□□□□□□
- □□□□□ PRN □□□□□□□□□□□□□□□□□□□□

□□□□

□□□□□□□□□□□□□□

- □□□`home_vlr_prefixes` □□□□□□□ VLR □□□□□
- □□□□□□□□□□□□□ VLR □□□□□□□□□

□□□PRN □□□□

- □□□□□□□□ MSC/VLR □□□□□□□
- □□□□□□□ M3UA/SCCP □□□□□ MSC □□

□□□SRI □□□□ MSRN □□

- □□□□□□□□□□ PRN □□□□□□□□□□□□
- □□□□□□□□ PRN □□□□□□□□□□□□□ `extract_msrn_from_prn/1`

HLR □□

□□□ MAP □□

OmniSS7 □□□□□□□□ TCAP □□□□□□□□ MAP □□□□□□□□□□□□□□

□□□	□□	□□
2	`updateLocation`	□□ VLR □□□□□ ISD □□ + □□□ alertServiceCenter□
23	`updateGprsLocation`	□□ SGSN□□□□□□□□
3	`cancelLocation`	□□ VLR □□
7	`insertSubscriberData`	□□□□□□□□□□□□□□□ VLR □□□
22	`sendRoutingInfo` (SRI)	□□ MSRN/CAMEL □□□□□□□□□□□□□□□
45	`sendRoutingInfoForSM` (SRI-for-SM)	□□ IMSI + SMSC GT □□□ SMS □□
44	`MT-Forward-SM`	□□□□ SMS □□
46	`MO-Forward-SM`	□□□□ SMS □□
47	`reportSM-DeliveryStatus`	SMS-GMSC □□□□□□
64	`alertServiceCenter`	□ SMSc □□□□□□□□□
66	`readyForSM`	MSC/SGSN □□□□□□□□□□ SMS
56	`sendAuthenticationInfo`	□□□□□□
57	`restoreData`	VLR □□□□□□□
67	`purgeMS`	□ HLR □□□□□□□□
59	`processUnstructuredSS-Request`	USSD□□□□□□□ USSD □□□□□
71	`anyTimeInterrogation` (ATI)	□□□□□/□□□□

□□□	□□	□□
10	`registerSS`	□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□ `facilityNotSupported`□21□□□□□□

□□□□□□

□□□□□□ HLR □□□□□□□□□□□□

SendRoutingInfo (SRI) □□

□□□□□□□□□□□□□□□□□□□□

HLR □□□□□□□□□□ VLR □□□□□□□□□□□□□□□□□□

□□□□□□□□□**CAMEL** □□□

□□□□□□ VLR □□□□□□□ `home_vlr_prefixes` □□□□□□□□

□□□□□

□□	□□	□□	
IMSI	OmniHSS API	□□ OmniHSS □□□□□□□□ IMSI	
VLR □□	OmniHSS API	□□□□□□□□□□□□ VLR (`circuit_session.assigned_vlr`)	
□□□□□	□□	□□□ `notProvidedFromVLR`	
extendedRoutingInfo	-	□□: `camelRoutingInfo`	
gsmSCF □□	OmniHSS API	□□□□□□□□□□ MSC (`circuit_session.assigned_msc`)	
□□□□	config.exs	CAMEL □□□□□ (`camel_service_key`)	
□□□□□	config.exs	□□□□ CAMEL (`camel_trigger_detection_point`)	
CAMEL □□□□	◆◆◆□	CAMEL □□□□□□	
□□□□□□	□□	□□ gsmSCF □□□□□□□	

□□□□□□□□**MSRN □□**

□□□□□ VLR □□□□□□□□ `home_vlr_prefixes` □□□□□□□□

□□□□□

□□	□□	□□	
IMSI	OmniHSS API	□□ OmniHSS □□□□□□□□ IMSI	"9
VLR □□	OmniHSS API	□□□□□□□□□□□□ VLR (`circuit_session.assigned_vlr`)	"4
□□□□□	□□	□□□ `notProvidedFromVLR`	:r
extendedRoutingInfo	-	□□: `routingInfo`	-
□□□□□**MSRN**□	PRN □□	□□□□□□□□□□□□□□□ MSRN	"4

□□□□□□□□

```
1. OmniSS7 □□ SendRoutingInfo □□
2. OmniSS7 □ OmniHSS API □□□□□□□
3. OmniSS7 □□ VLR □□□ home_vlr_prefixes□

   □□ VLR □□□□□□□□□
     → □□ CAMEL □□□□□□□□□□□□□

   □□ VLR □□□□□□□□□□□
     → □ MSC □□□□□□□□□□PRN□
     → □ PRN □□□□□ MSRN
     → □□□□ MSRN □□□□□□□□□□□□□
```

□□□□

- OmniSS7 □□ OmniHSS □□□□□□□
- OmniHSS □□ IMSI□□□ VLR/MSC □□□□□□□□
- OmniSS7 □□□□□□□□ MAP □□

□□□□□

```
# □ config/config.exs □
home_vlr_prefixes: ["555123"],  # □□ VLR □□□□
```

□□□□□

- □□ `serving_vlr` □ `serving_msc` □ `null`□□□□□ 27□□□□□□□□□
- □□□□□□□□□□□□□□ 1□□□□□□□□
- □□ PRN □□□□□□□□□□□□□□□□□ 27□□□□□□□□□
- □□ PRN □□□□□□□□□□□□□□□□□ 27□□□□□□□□□

UpdateLocation □□□ InsertSubscriberData

□□□□□□ VLR □□□□□□□□□□□□□

UpdateLocation END □□

□□	□□	□□	□□
HLR □□	config.exs	□ HLR □□□□□□ (`hlr_service_center_gt_address`)	`"5551234568"`
TCAP □□□□	□□	□□ ISD □□□□□□□	`END`

InsertSubscriberData #1□□□□□□□□

□□	□□	□□	□□
IMSI	□□	□□ UpdateLocation □□	`"999999876543210"`
MSISDN	OmniHSS API	□□ OmniHSS □□□□□□□	`"555123456"`
□□	□□	□□□□	`"\n"` (0x0A)
□□□□	□□	□□□□	`:serviceGranted`
□□□□□□	□□	□□□□□□□	`[<<31>>]`
□□□□□□	□□	□□□□□□□	`[<<17>>, "!", "\""]`
□□□□□□	config.exs	□□□/□□□□ (`isd_network_access_mode`)	`:packetAndCircuit`

InsertSubscriberData #2□□□□□□ - □□

□□	□□	□□	□□□
□□□ **SS**	□□	□□□□□□	`isd_send_ss_data: true`
□□□□	□□	□□□□□□□□□□□□□□□□□□□□□□□□	□□□□
□□□□	□□	□□□□□□□□	□□□□
□□□□	□□	□□□□□□□	□□□□

ISD #2 □□□

- □□□□□□□□SS □□ 21□
- □□□□□□□□SS □□ 41□
- □□□□□□□□SS □□ 42□

- □□□□□□□□□SS □□ 62□
- □□□□□SS □□ 43□
- □□□□□SS □□ 51□
- CLIP/CLIR □□

InsertSubscriberData #3□□□□□□ - □□

□□	□□	□□	□□□
□□□□□□	□□	□□□□□□	`isd_send_call_barring: true`
BAOC	□□	□□□□□□□□□SS □□ 146□	□□□□
BOIC	□□	□□□□□□□□□SS □□ 147□	□□□□
□□□□□□	□□	□□□□□□	□□□□

ISD □□□□□

- ISD #1: □□□□ - □□□□□□□□
- ISD #2: □□ config/config.exs □ `isd_send_ss_data: true` □□□
- ISD #3: □□ config/config.exs □ `isd_send_call_barring: true` □□□

SendRoutingInfoForSM (SRI-for-SM) □□

□□□□□ MSC/SMSC □□□□□□□ SMS □□□□ SMSc □□□ SMS □□□□□□□□□□ HLR □□ SRI-for-SM □□□□□□□□□□□□□□□

HLR □□□□□□□□□□□□□□□□□□□□ **SCCP** □□□ **GT**□

1. □□□□□□□□□□□□□□□□□□ □□□□□□□ IMSI □□ IP-SM-GW □□□ GT □□□□□□□□□HLR □□□□□ □□□□□□□□ IMSI □□□□□□MT-ForwardSM □□□ IP-SM-GW□□□□□□□□□□□□□□□□□□□□□□□□□□

□□	□□	□□	□□□□	
IMSI	□□	□ MSISDN □□□□□ IMSI	`PLMN_PREFIX + zero_padded_MSISDN`	`"001001`
□□□□ □□	config.exs	□□ SMS □□□ SMSC GT □□	`smsc_service_center_gt_address`	`"555123`

2. □□□□□□□□□□□□□□□□□□□□□□ **SMSc / IP-SM-GW** □□□□□ □□□ GT □□□□□ `home_smsc_gts` □□□□HLR □□□□□□□□□□□ □□ **IMSI** □ □□□ **MSC** □□□□□□□□□□□□□□□ □ SMSc □□□□□ MT-ForwardSM □□□ MSC□□□□□□□□□□□□□□ MSC□□□□□□□□□□□

□□	□□	□□	□□
IMSI	HLR □ □	□□□□ IMSI	`"505570123456789"`
□□□□□ □	HLR □ □	□□□□□□ UpdateLocation □□□ `serving_msc`	`"5559876543"`

□□□□□□□ `config/config.exs`□□

```
# □□□□□ GT □□□□□□□□□□ SRI-for-SM □□□□□□□
# □□□□□□□ SMSc □ MT-ForwardSM □□□□□□□□
smsc_service_center_gt_address: "5551234567",  # □□

# □□□□□□□□□□□□□□□ SMSc / IP-SM-GW □□□ SCCP □□ GT□
# □□□□□□□□ SRI-for-SM □□□□□□□□□ MSC□□□□□□□□□□
# □□□□□□□□□□□□□□□□□□□ ([]) □□□□□□□□□□□□
home_smsc_gts: ["5551234567"],                # □□□□□ []□

# MSISDN ↔ IMSI □□□□
# PLMN □□□MCC (001 = □□□□) + MNC (01 = □□□□□)
hlr_imsi_plmn_prefix: "001001",                  # □□□□□□□□□□
```

> □□□ □□□□□□□□□□ HLR □□□□□□□□ `serving_msc` □□□□□□□□□□□□ MSC □□ MAP `updateLocation` □□ HLR □□□□□□□□□ MSC □□□□□□□□□□□□□□GSUP □□□□ HLR□□□□ □□□□□□□□□□□□□□□□□□□□

MSISDN ↔ IMSI □□

□□□□□

□□□□□□ OmniSS7 □□□ MSISDN □□□□ IMSI □□□ SRI-for-SM □□□

- **`hlr_imsi_plmn_prefix`**□□□□□ IMSI □□□□ MCC+MNC □□□□□□"50557" □□ MCC=505□MNC=57□
- **`hlr_msisdn_country_code`**□□□□□ IMSI→MSISDN □□□□□□□□□□□□□□□□"61" □□□□ □□□"1" □□□□/□□□□
- **`hlr_msisdn_nsn_offset`**□MSISDN □□□□□□□□NSN□□□□□□□□□□□□ 0□□□ MSISDN □□□□□□□□□□□□□□□□□□□□□□□□□□□□□
- **`hlr_msisdn_nsn_length`**□□ MSISDN □□□□ NSN □□□□□

□□□□□□□□□□□□□□ □□□□□□ MSISDN ↔ IMSI □□□

□□□□□ **MSISDN □ IMSI** □□□□

SendRoutingInfoForSM□SRI-for-SM□□ MAP □□□□ HLR □□□□□□□ **IMSI**□□□□□□□□ □□□□□□□□□ SMSc □□□□□□ **MSISDN**□□□□□□□

□□□□□□□□

- SMSc □□ SRI-for-SM□□□ MSISDN□□□□"5551234567"□
- HLR □□□□□□□□□□□□□□□□□□□□ IMSI
- HLR □ SRI-for-SM □□□□□ IMSI
- SMSc □□□□ MT-ForwardSM □□□ MSC/VLR □□□□ IMSI

OmniSS7 □□□ - □□ IMSI□

OmniSS7 □□□□□□□□□□□□□ MSISDN □□ □□ IMSI□□□□□□□□□□□□□□□□□□□□□ MSISDN □ IMSI □□□□□□□□□□□□□□□□□□□□

1. □□□□□□□ HLR □□□□□□□□□□ IMSI □□□□□ SS7 □□□□□ SRI-for-SM □□□□□
2. □□□□□ SRI-for-SM □□□□□□□□□ HLR □□□□□ IMSI □□ - IMSI □□□ MSISDN □□□□□

□□□□□

MSISDN □□□□□ IMSI □□□□□□MCC+MNC □□□□□□

```
IMSI = PLMN_PREFIX + zero_padded_MSISDN
```

□□□

- **PLMN_PREFIX**□MCC + MNC□□□□"001001" □□□□□□□
- **MSISDN**□□□□□□□□□□□
- □□□□□□□□□□□ IMSI □□□ 15 □

□□□□□

```
# □□
plmn_prefix = "001001"  # MCC 001 + MNC 01

# □□□□□ SRI-for-SM □□□ MSISDN□TBCD □□□
msisdn = "555123456"    # 9 □□□

# □ 1 □□□□□□□□□□□□□□□□
subscriber_digits = 15 - String.length("001001")  # = 9 □□□

# □ 2 □□□□□□□ MSISDN □□□□□□□□
padded_msisdn = String.pad_leading("555123456", 9, "0")  # =
"555123456"□□□□□□□

# □ 3 □□□□□ PLMN □□ + □□□ MSISDN
imsi = "001001" <> "555123456"  # = "001001555123456"□□□ 15 □□
```

□□□□□

□□ **MSISDN**	**PLMN □□**	□□□□□□□	□□□ **MSISDN**	□□ **IMSI**	□□
`"555123456"`	`"001001"` (6)	9	`"555123456"`	`"001001555123456"`	□□□□□□□□
`"99"`	`"001001"` (6)	9	`"000000099"`	`"001001000000099"`	□□□□□
`"999999999"`	`"001001"` (6)	9	`"999999999"`	`"001001999999999"`	□□□□
`"91123456789"`	`"001001"` (6)	9	`"555123456"`	`"001001555123456"`	□□□□□□□□

```
# □□□□□□ SRI-for-SM □□□ IMSI
imsi = "001001555123456"

# □ 1 □□□□ PLMN □□
plmn_prefix = "001001"
subscriber_portion = String.slice(imsi, 6, 9)  # = "555123456"

# □ 2 □□□□□□□□□□□□□□ MSISDN
msisdn = String.replace_leading(subscriber_portion, "0", "")  # =
"555123456"
```

□□□□□□□□

□□ IMSI	PLMN □□	□□□□	□□□□□	□□ MSISD
`"001001555123456"`	`"001001"`	`"555123456"`	`"555123456"`	`"5551234`
`"001001000000099"`	`"001001"`	`"000000099"`	`"99"`	`"99"`
`"001001999999999"`	`"001001"`	`"999999999"`	`"999999999"`	`"9999999`

□□□□□□□□

- □ □□□□□□□□ MSISDN □□□□□□□□ IMSI
- □ □□□□□□□□ IMSI □□□ MSISDN
- □ □□□□□□□□□ `hlr_imsi_plmn_prefix`
- □ □□□□□□□□ IMSI □□□□
- □ □□□□□□□□□□□□□□□□□□ API □□
- □ □□ **15** □□IMSI □□□□ 15 □

MSISDN □□□□□

□ HLR □□□ SRI-for-SM □□□□MSISDN □□ TBCD □□□

1. **TBCD** □□□□□□□□ TBCD □□□□□□□□□□□□ TON/NPI □□□□ "91"□
2. □□□□□□□□□□□□□□□□□□□□□□□□□□□□
3. □□

4. □□□□□□ PLMN □□ + □□□□ MSISDN

□□□□□□

□ SRI-for-SM □□□□□□□□□ IMSI □□□□□□□□□□□□□□□□□ HLR □□□□□□□□□□ IMSI□□□□□□□□□□□□□□ □□□□□□□□□□ IMSI □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ UpdateLocation □ SendAuthenticationInfo □□□□□□

□□□□□□

```
1. SMSc → HLR: SRI-for-SM □□
   - MSISDN (TBCD): "91123456789"□□□ TON/NPI□

2. HLR □□□
   - TBCD □□: "91123456789"
   - □□□□□: "91123456789"□11 □□□□
   - □□ 9 □□□: "555123456"□□□ 9 □□
   - □□ PLMN: "001001" + "555123456" = "001001555123456"
   - □□□□□□□ SMSC GT: "5551234567"

3. HLR → SMSc: SRI-for-SM □□
   - IMSI: "001001555123456"□□□□□□□ 15 □□
   - □□□□□□□: "5551234567"□□□ MT-ForwardSM □□□□

4. SMSc □ MT-ForwardSM □□□ "5551234567"□IMS "001001555123456"
```

□□□

□□□□□ `config/config.exs` □□□□

```
# PLMN □□□MCC (001 = □□□□) + MNC (01 = □□□□□)
hlr_imsi_plmn_prefix: "001001",

# NSN □□□□□ MSISDN □□□□□□□
hlr_msisdn_country_code: "1",      # □□□□□□□IMSI→MSISDN□
hlr_msisdn_nsn_offset: 1,          # □□ 1 □□□□□
hlr_msisdn_nsn_length: 10          # □□ 10 □ NSN
```

NSN □□□□□

□□□□ MSISDN □□□□□□□□□□"99988000088" □□□□ "88000088"□□□□□□□ NSN □□□

- **hlr_msisdn_nsn_offset**□NSN □□□□□□□□□□□□□□□□□□□□
- **hlr_msisdn_nsn_length**□NSN □□□□□□

□□□

□□	□□□□	**MSISDN □□**	**nsn_offset**	**nsn_length**	□□□ **NSN**
1 □ CC	"9"	"95551234567"	1	10	"5551234567"
2 □ CC	"99"	"99412345678"	2	9	"412345678"
3 □ CC	"999"	"99988000088"	3	8	"88000088"

□□□□□

1. **MSISDN → IMSI**□□ MSISDN □□□ NSN□□□□□□□□□ PLMN □□

```
MSISDN: "99988000088"
NSN: String.slice("99988000088", 3, 8) = "88000088"
□□□ NSN: "088000088"□9 □□□□
IMSI: "547050" + "088000088" = "547050088000088"
```

2. **IMSI → MSISDN**□□□ PLMN □□□□□□□□□□□□□□□□

```
IMSI: "547050088000088"
□□□□□: "088000088"
□□□: "88000088"
MSISDN: "+999" + "88000088" = "+99988000088"
```

API □□□□ - SRI-for-SM □□□□□□□□□□□□□□□ API □□□

□□□□□□□

□□□□□	□□	□□
OmniHSS API	□□ OmniHSS □□□□□□□□□□□□	IMSI□MSISDN□□□ circuit_session □□□ VLR/MSC
config.exs	OmniSS7 □□ □□	`smsc_service_center_gt_address`□ `camel_service_key`□ `isd_network_access_mode`
□□	□□□□□□□□□□□□ □	□□□□□□□□□□□SS □□
□□	□□□ MAP □□ □□□□□□	□□ UpdateLocation □ IMSI□□□ SRI □ MSISDN
□□	□□□□□□□□□	SRI-for-SM □□□□ IMSI□hlr_imsi_prefix + NSN□

□□□□□□

□ config/config.exs □□□□

- `hlr_service_center_gt_address` - □□ UpdateLocation □□
- `smsc_service_center_gt_address` - □□ SRI-for-SM □□□MT-ForwardSM □□□□□ □□□

□ config/config.exs □□□□□□□□□

- `camel_service_key` - □□: `11_110`
- `camel_trigger_detection_point` - □□: `:termAttemptAuthorized`
- `isd_network_access_mode` - □□: `:packetAndCircuit`

- `isd_send_ss_data` - □□: `true`
- `isd_send_call_barring` - □□: `true`
- `hlr_imsi_plmn_prefix` - □□: `"001001"`□□□ MSISDN↔IMSI □□□ PLMN □□□

□□ **OmniHSS** □□□□

OmniHSS □□□□ REST API □□□□

- □□ IMSI □ MSISDN □□□□
- □□□□□□□□□VLR/MSC □□□
- □□□□□□□
- □□□□□□□□□□□□

□□□

OmniSS7 □□□

- ← □□□□□
- □□□□□□□
- MAP □□□□□
- □□□□
- □□□□

OmniHSS □□□ □□□□□□□□□□□□□□□□□□□□□□□□□□ **OmniHSS** □□□□□□OmniHSS □□□□□□□□□□ □□□□□□□□□□□□□□□□□□□□ IMSI □□□□□

OmniSS7 □ Omnitouch □□□□□□□

MAP□□□□□□□

← □□□□□

□□□□□□□□OmniSS7□□**MAP**□□□□□□□□□□□□□□□OmniSS7□□□□□□□□□□ASP□□□□SS7□□□□□HLR□MSC/VLR□SGSN□GMLC□□□□□□□□□□□□MAP□□□□□□□□□□□□□□□□□□□□□□3GPP TS 29.002□

□□

1. □□□MAP□□□□□□
2. □□MAP□□□□□
3. MAP□□□□
4. □□□□□□
5. □□API□□□□
6. □□□□□
7. □□□□

□□□MAP□□□□□□

MAP□□□□□□□□OmniSS7□□□□□□□□□□□**ASP**□□□**SCTP**□□□**M3UA**□□□□**STP**□**SGP**□□□□**MAP**□□□□□□□□□□□HTTP□□□□□API□□□□□TCAP/MAP□□□□□□SCCP□M3UA□□□SS7□□□□□□OmniSS7□□□□□□□□□□□□□□□□□□□□

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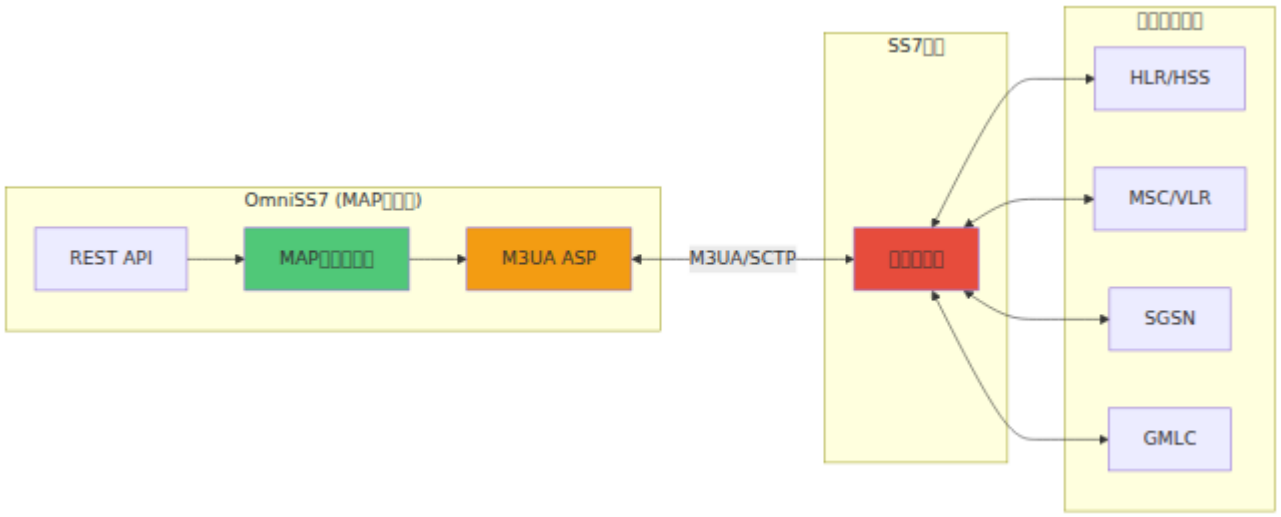
- □□□□□□□□□□□□□□□□□□□□□MS□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□
- □□□SRI-for-SM□MO/MT-ForwardSM□□□□□□□
- □□□□□□□□□□□□□□□
- □□□□□□□□□/□□□□□□□□□□□□
- □□□□□□□□□/□□/□□/□□SS□□□□□
- □□□□□□**LCS**□□**GPRS**□□

□□□□



□□MAP□□□□□

MAP□□□□□□□`config/runtime.exs`□□□□□□□□□□M3UA□□□□□□□□□ M3UA□□□□□

```
config :omniss7,
  # □□MAP□□□□□
  map_client_enabled: true,

  # MAP□□□□M3UA□□□□□ASP□□□□□STP/SGP□
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :map_client_asp,
    local_ip: {10, 0, 0, 100},
    local_port: 2905,
    remote_ip: {10, 0, 0, 1},
    remote_port: 2905,
    routing_context: 1
  }
```

`map_client_m3ua`□□

□□	□□	□□	□□□	□□
`mode`	□□□	□	-	M3UA□□□`"ASP"`□□□

MAP□□□□

□□□□□□□□□□□□□□`POST /api/<endpoint>`□□□□□□□□□□3GPP TS 29.002□MAP□□□□□□□□□□□□API□□□□□□□SS7□□□□□□□□□□□□□□□□□□□□□□

□□□□

□□	□□	□□□	□□
□□□□	`/api/updateLocation`	2	□□□□□□□□VLR□HLR□
□□□□	`/api/cancelLocation`	3	□□VLR□□□□□□□
□□□□□□	`/api/prn`	4	□□□MSC□□MSRN□
□□MS	`/api/purgeMS`	67	□□□□□HLR□□□□□□
□□□□□□	`/api/sendIdentification`	55	□□□□VLR□□IMSI/□□□□□□□
□□	`/api/reset`	37	HLR□□□□□□□□VLR□
□□□□	`/api/restoreData`	57	VLR□□□HLR□□□□□□□

□□□□□□□□□

□□	□□	□□□	□□
□□□□□□□	`/api/sri`	22	□□HLR□□□□□□□□□□□□□
□□□□□□□	`/api/provideSubscriberInfo`	70	□VLR□□□□□□□/□□□
□□□□□□□	`/api/deleteSubscriberData`	8	□□VLR□□□□□□□□
□□□□□	`/api/anyTimeInterrogation`	71	gsmSCF□HLR□□□□□□□/□□□□
□□□□□□□	`/api/anyTimeSubscriptionInterrogation`	62	□□HLR□□□□□□□□
□□□□□	`/api/anyTimeModification`	65	□□HLR□□□□□□□□
□□□□□□□□□□	`/api/noteSubscriberDataModified`	5	HLR□□gsmSCF□□□□□□□
□□MM□□	`/api/noteMM-Event`	89	□gsmSCF□□□□□□□□□□

□□

□□	□□	□□□	□□
□□□□□□□□□□	`/api/sri-for-sm`	45	□□HLR□□□□□□□□□□□□□□□□□□
MT-□□□□	`/api/MT-forwardSM`	44	□□□□□□□□□□□□□□□□ MSC/SGSN□
MO-□□□□	`/api/forwardSM`	46	□SMSC□□□□□□□□□□□□
□□□□ □PDU□	`/api/sendSM`, `/api/deliverPDU`	44	□□□□□SMS-DELIVER PDU□
□□□□□□□□□□	`/api/reportSM-DeliveryStatus`	47	□HLR□□□□□□□□□□
□□□□□□□	`/api/readyForSM`	66	□□HLR□□MS□□□□□□□□
□□□□□□□	`/api/alertServiceCentre`	64	□□SMSC□□□□□□□□□□□

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□□	□□	□□□	□□
□□□□□□□□□□	`/api/send-auth-info`	56	□HLR□□□□□□□□□□
□□IMSI	`/api/sendIMSI`	58	□MSISDN□□□HLR□□IMSI□
□□IMEI	`/api/checkIMEI`	43	□□□□□□□□

□□□□

□□	□□	□□□	□□
□□SS	`/api/registerSS`	10	□□□□□□□□□□□□□□□□/CFU□□
□□SS	`/api/eraseSS`	11	□□□□□□□□
□□SS	`/api/activateSS`	12	□□□□□□□□
□□SS	`/api/deactivateSS`	13	□□□□□□□□
□□SS	`/api/interrogateSS`	14	□□□□□□□□□□□□
□□□□	`/api/registerPassword`	17	□□SS□□□□
□□□□	`/api/getPassword`	18	□□/□□SS□□□□
□□□□SS□□	`/api/forwardCheckSS-Indication`	38	□VLR□□□□□□□□□

□□□□□LCS□□GPRS

□□	□□	□□□	□□
□□LCS□□□□	`/api/sendRoutingInfoForLCS`	85	GMLC□□HLR□□□LCS□□□
□□□□□□	`/api/provideSubscriberLocation`	83	□□□□□□□□□□□□□□
□□□□□□	`/api/subscriberLocationReport`	86	□GMLC□□□□□□□□
□□GPRS□□□□	`/api/sendRoutingInfoForGprs`	24	□□HLR□□□GPRS□□□GGSN□□□□
□□GPRS□□	`/api/updateGprsLocation`	23	□□□□□□□SGSN□HLR□

> **LCS**□□□□□□□□□□□□□□□□□□□□□□□□MAP□□□□□□□□□□HLR□□□□□□□GMLC□□□□□□□□LCS *□□□□□□□□□□□□□*ProvideSubscriberLocation□□□□□□SubscriberLocationReport□□□□□□□□□□□□□□□□□□□

CAP / CAMEL□□□□□

□□	□□	□□
CAP InitialDP	`/api/cap/initialDP`	□gsmSCF□□ CAMEL□□□
CAP Connect / Continue / ReleaseCall / ApplyCharging	`/api/cap/connect`, `/api/cap/continue`, `/api/cap/releaseCall`, `/api/cap/applyCharging`	CAMEL□□□□ □□□□□□ CAMEL□□□ □□
□□SCCP	`/api/raw/sccp`	□□□□□□□ SCCP□□□□ □□□/□□□□
□□M3UA	`/api/raw/m3ua`	□□□□□□□ M3UA□□□□ □□□/□□□□

□□□□□□

□□□□□□□□□SRI-for-SM□

□□HLR□□□□□□□□□□□□□□□□□□□□HLR□□□□□□□□□□□□□HLR□□□□SRI-for-SM□

SCCP□□□SMSc□□□□□□□□ □□□□□□SRI-for-SM□□□**GT**□□□□□**MSISDN**□□□□□□SSN 6/HLR□□□□□STP□□□□□□□□□GTT□□□□□□□□□□□SMSc□□□□□□□**HLR GT**□□□SRI□□□□□□ HLR□□GTT□□□HLR□□□□□□□MSC□□□□□□□□□□□□

□□□ `:omniss7` □	□□	□□
`hlr_gt_address`	□□□□SRI□□□□HLR□GT	`"61455501111"`
`home_msisdn_prefixes`	□□MSISDN□□□□□□□□HLR GT	`["6777"]`

□`home_msisdn_prefixes`□□□□□□□□□□□`hlr_gt_address`□□□□□□HLR GT□□□SSN 6□□□□□□□□□□□MSISDN□□□GT□□□SRI-for-SM□□□□`sccp_opts`□`:called_party`, `:called_ssn`□□□□□□□□□□SCCP□□□□

□□□ `POST /api/sri-for-sm`

□□□

```
{
  "msisdn": "447712345678",
  "serviceCenter": "447999123456"
}
```

□□□

```
{
  "result": {
    "imsi": "234509876543210",
    "locationInfoWithLMSI": {
      "networkNode-Number": "447999555111"
    }
  }
}
```

cURL□

```
curl -X POST http://localhost/api/sri-for-sm \
  -H "Content-Type: application/json" \
  -d '{"msisdn": "447712345678", "serviceCenter": "447999123456"}'
```

□□□□□□□SRI□

□□□ `POST /api/sri`

□□□

```
{
  "msisdn": "447712345678",
  "gmsc": "447999123456"
}
```

□□□□□□□PRN□

□□□ `POST /api/prn`

□□□

```
{
  "msisdn": "447712345678",
  "gmsc": "447999123456",
  "msc_number": "447999555111",
  "imsi": "234509876543210"
}
```

□□□□□□□□

□□□ `POST /api/send-auth-info`

□□□

```
{
  "imsi": "234509876543210",
  "vectors": 5
}
```

□□□

```
{
  "result": {
    "authenticationSetList": [
      {
        "rand": "0123456789ABCDEF0123456789ABCDEF",
        "xres": "ABCDEF0123456789",
        "ck": "0123456789ABCDEF0123456789ABCDEF",
        "ik": "FEDCBA9876543210FEDCBA9876543210",
        "autn": "0123456789ABCDEF0123456789ABCDEF"
      }
    ]
  }
}
```


□□□□

□□□□□□VLR□□□HLR□HLR□□□□□□□□□□□□□□□□□□□□HLR□□□□□□□□□□

□□□ `POST /api/updateLocation`

□□□


```
{
  "imsi": "234509876543210",
  "vlr": "447999555111"
}
```


□□□□□ATI□

□□□ `POST /api/anyTimeInterrogation`

□□□


```
{
  "hlr_gt": "447999123456",
  "msisdn": "447712345678"
}
```

□□□□



□□API□□□□

□□Swagger UI

Swagger UI□□□□□□□□□□□□□□□□

1. □□□`http://your-server/swagger`□
2. □□□□□□□□□`/api/sri-for-sm`□□□□□□□
3. □□□□□□□□□□□
4. □□□SS7□□□□□□□□

□□OpenAPI□□□□`http://your-server/swagger.json`□□□

API□□□□

□□	□□
200	□□□□□□□□□□□□□□
400	□□□□□□□□□□□□□□
504	□□□□□□□□□□□□□□SS7□□□□□10□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

MAP□□□□□

□□□□□□Prometheus□□□`/metrics`□□□□□

□□□ `map_requests_total` □□□ □□□ □□□ □□□□MAP□□□ □□□ `operation`□□□`sri`□ `sri_for_sm`□`prn`□`authentication_info`□`update_location`□

□□□ `map_request_errors_total` □□□ □□□ □□□ □□□□□□□□□□MAP□□□ □□□ `operation`□

□□□ `map_request_duration_milliseconds` □□□ □□□ □□□ MAP□□□□□□□□□□ □□□ `operation`□

□□□ `map_pending_requests` □□□ □□□ □□□ □□□□□□□□MAP□□□

□□Prometheus□□

```
# □□□□□□□SRI-for-SM□□
increase(map_requests_total{operation="sri_for_sm"}[1h])

# □□SRI□□□□
rate(map_request_duration_milliseconds_sum{operation="sri"}[5m])
  / rate(map_request_duration_milliseconds_count{operation="sri"}
[5m])

# □□□□□□□□□
sum(rate(map_request_errors_total[5m])) by (operation)

# □□□□□□□□
map_pending_requests
```

□□□□MAP□□□

□□□□□504□

□□□ API□□504□□□□□HLR/MSC□□□□

□□□□□□□

- M3UA□STP/SGP□□□□□□□□□□□□
- STP□□□□□□□□□□□□□
- SCCP□□□□□□□□□/□□□GT□SSN□□□□□□□□

□□□□□□

1. □□□□□□□□M3UA□□□□□□□□STP□□□□□□□□□
2. □□□STP□□□□□□□SCTP□□
3. □□□□□□□□□□□□□□□□□□□□□□□□□□□□HLR SSN 6□���□□□□□□
4. □□□□□□□□SCCP□□□□□□□□□□□

SCCP□□/□□□□

□□□ □□□□SCCP□□□□□□□□UDTS□□□□□□

□□□□□□□□

- □□□□□□□□□□□□□□□STP□□□□□
- □□□□□□□□□□□□□□□□HLR SSN 6□□□□□
- □□□□/□□□□□□□□□□

□□□□□□

- □□□□GT□STP□□/□□□□□
- □□□□□□□□□□□□□□□
- □□□□□□□□□□

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- □□□□□□□□□□□□□□□
- □□□□□□□□Web UI□API□□□
- STP□□□□□□□□□□□□□□
- HLR□□□HLR□□□□□
- □□□□□□□□□□□□□
- CAMEL□□□□□□CAP/CAMEL□□

OmniSS7□Omnitouch□□□□□□

□□□□ (SMSc) □□□□

← □□□□□

□□□□□□□□ OmniSS7 □□ □□□□ **(SMSc)** □□□ **OmniMessage** □□□□□□□□□□□□□□□□□□□□□□□

OmniMessage □□

OmniSS7 SMSc □□□□ **SS7** □□□□□□ **OmniMessage** □□□□□□□□□□□□□□□□□□□□

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1. OmniMessage □□
2. □□□□□□□□□□□
3. □□ SMSc □□
4. HTTP API □□
5. □□□□□
6. □□□□□□□□□
7. □□□□
8. SMSc □□□□□
9. VLR □□□□
10. □□□□□□□
11. □□□□□
12. □□□□

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□□□□□□□□ OmniSS7 □ SS7 □□□□□□□□□□□

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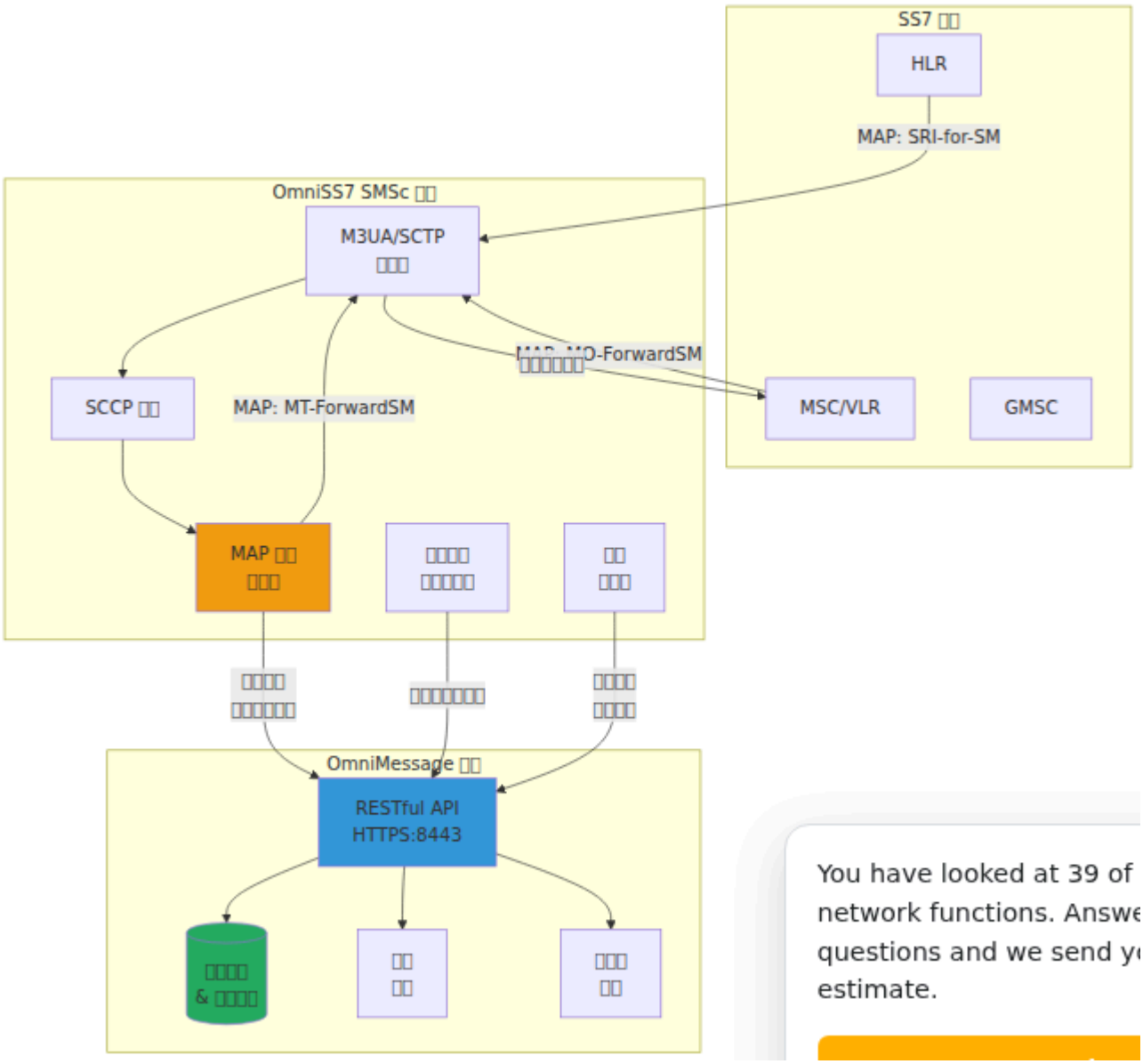

□□ SMSc □□

OmniSS7 □□□□□□□□□□□□□STP□HLR□SMSc□□□□□□□□□□□□□ `config/config.exs` □□□□□□□□□□□□□□

1. □□ `config/config.exs`
2. □□ `config :omniss7` □□□□□□□
   - `map_client_enabled: true`□□□/MAP □□□□
   - `smsc_mode_enabled: true`□□□ SMSc □□□□
   - `hlr_mode_enabled: false`□□□ HLR □□
3. □□ SMSc □□□□□API □□□SMSc □□□GT □□□□□□□□□□M3UA □□□□□□□
4. □□□ □□□□□□
5. □□ □□□□□□□□□□

> □□□`config/runtime.exs` □□□ SMSc □□□□□ `config/config.exs` □□□□□□□□□□ `config/test.exs` □□□□□□□□□□□□□□□□□□□□ `config/config.exs`□

SMSc □□□□

□□□ SMSc □□□□ `config/config.exs` □□□□□□□□

```
config :omniss7,
  # □□□□ - □□ STP + SMSc □□
  # □□□map_client_enabled □ true□□□ SMSc □□□□□□□
  map_client_enabled: true,
  hlr_mode_enabled: false,
  smsc_mode_enabled: true,

  # OmniMessage □□ API □□
  smsc_api_base_url: "https://omnimessage.example.com:8443",
  # □□□□□□□□□ SMSc □□
  smsc_name: "ipsmgw",
  # □□□□□□□□□□ GT □□
  smsc_service_center_gt_address: "5551234567",

  # □□□□□□□□□□ SMS □□□□□□
  auto_flush_enabled: true,
  auto_flush_interval: 10_000,
  auto_flush_dest_smsc: "ipsmgw",
  auto_flush_tps: 10,

  # M3UA □□□□
  # □□ ASP □□□□□/□□ MAP SMS □□
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :stp_client_asp,
    # □□□□□SMSc □□□
    local_ip: {10, 179, 4, 12},
    local_port: 2905,
    # □□ STP □□
    remote_ip: {10, 179, 4, 10},
    remote_port: 2905,
    routing_context: 1
  }
```

Web UI □□□ `config :control_panel` □□□□□□ `config/config.exs` □□□□□ `use_additional_pages` □□□□□□ OmniSS7 □□□□ 16 □□□ **"Peers"**□

```
config :control_panel,
  use_additional_pages: [
    {SS7.Web.EventsLive, "/events", "SS7 □□"},
    {SS7.Web.TestClientLive, "/client", "SS7 □□□"},
    {SS7.Web.M3UAStatusLive, "/m3ua", "Peers"},
    {SS7.Web.SCTPConnectionsLive, "/sctp", "SCTP □□"},
    {SS7.Web.RoutingLive, "/routing", "□□"},
    {SS7.Web.RoutingTestLive, "/routing_test", "□□□□"},
    {SS7.Web.SmscLinksLive, "/smsc_links", "SMSc □□"},
    {SS7.Web.SmscSubscribersLive, "/smsc_subscribers", "SMSc □□
□"},
    {SS7.Web.HlrLinksLive, "/hlr_links", "HLR □□"},
    # ... □□□□□□□□□□□□CAMEL□□□□MSISDN/IMSI □□□□
  ],
  page_order: [
    "/application", "/configuration", "/events", "/logs",
"/client", "/m3ua",
    "/routing", "/routing_test", "/smsc_links",
"/smsc_subscribers", "/hlr_links",
    # ... □□□□□□
  ]
```

□□□□□□□□□

□□□□□□□□□□□□□□□□□□ □□□□□

□□	□□	□□	□□
`smsc_api_base_url`	□□□□	*□□*	**OmniMessag** □□ API □□
`smsc_name`	□□□□	`"{hostname}_SMSc"`	□□ SMSc □□□□□□□□□
`smsc_service_center_gt_address`	□□□□	*□□*	□□□□□□□□□
`auto_flush_enabled`	□□	`true`	□□□□□□□□□
`auto_flush_interval`	□□	`10_000`	□□□□□□□□□□□
`auto_flush_dest_smsc`	□□□□	`nil`	□□□□□□□ SMSC □□□□□□ `nil` = □□□□□□□□□□
`auto_flush_tps`	□□	`10`	□□□□□□□□□/□□
`local_ip`	□□	*□□*	□□ SMSc □□□ IP □□
`local_port`	□□	`2905`	□□ SCTP □□
`remote_ip`	□□	*□□*	SS7 □□□ STP IP □□

□□	□□	□□	□□
`remote_port`	□□	`2905`	□□ SCTP □□
`routing_context`	□□	`1`	M3UA □□□□□ ID

□□ SMSc □□□□□□□□

□ `smsc_mode_enabled: true` □ `map_client_enabled: true` □□Web UI □□□□

- □ **SS7** □□ - □□□□
- □ **SS7** □□□ - MAP □□□□
- □ **Peers** - □□□□□M3UA/SCTP □□□□
- □ □□ - □□□□□□□□ STP□
- □ □□□□ - □□□□□□□□ STP□
- □ **SMSc** □□ - SMSc API □□ + □□□□□□ ← *SMSc □□*
- □ □□ - □□□□
- □ □□ - □□□□□

HLR □□ □□□□□□□□

□□□□□□

- SMSc □□□□ `map_client_enabled: true` □□□□□□□
- **OmniMessage** □□□OmniMessage API □□□□□□□□ `smsc_api_base_url` □□□
- □□□□□□□□ **~85** □ □□□□□ OmniMessage (`@registration_interval` = 85,000 ms)□□□ `SMS.FrontendRegistry` □□
- **API** □□□□□□□ OmniMessage API □□□□ □□□□ **5** □□□
- **MAP** □□□□□SRI-for-SM □ 10 □□□□□□□MT-ForwardSM □ **30** □□□□□□□□□□ 2G/CS □□□□□□ VLR □□
- □□□□□□□□□□□ SMS □□
- □□□ STP □ M3UA □□□□/□□ MAP SMS □□

- □□□□□□□□□□□□□□□□□□□□□□□□
- **Web UI**□□□□□□ Web □□□□□□□□□□ Web UI □□
- **API** □□□□□□ REST API □□□ Swagger UI □□□□□□□□□□ API □□

HTTP API □□

OmniMessage □□□□

OmniSS7 □□ HTTPS REST API □ OmniMessage □□□□□□□□□□□□□□□□□□□□

□□	□□	□□	□□	
`smsc_api_base_url`	□□□□	□	`"https://localhost:8443"`	C A
`smsc_name`	□□□□	□	`""`□□□ `"{hostname}_SMSc"`□	□ S
`smsc_service_center_gt_address`	□□□□	□	`"5551234567"`	□ □ C □ F □ □ S

□□□□

□□□□□□□□□□□□□ OmniMessage□□□ **~85** □ □□□□□□□□ `SMS.FrontendRegistry` □□□□□□ OmniMessage □□□

- □□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□
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- □□□□□□~85 □□`@registration_interval 85_000`□□□□□□
- □□□□□ `smsc_mode_enabled: true` □□□□□□

□□□□□□□□

```
{
  "frontend_name": "omni-smsc01",
  "configuration": "{...}",
  "frontend_type": "SS7",
  "hostname": "smsc-server01",
  "uptime_seconds": 12345
}
```

□□□□□□□□□□ `smsc_name` □□□□□□□□□□□□□□□□□ `"{hostname}_SMSc"`□

OmniMessage API □□

□ OmniSS7 □ SS7 □□□□ MAP □□□□□□□□□□□□□□ OmniMessage □□□□

- □□□□□□□□ □□□□□□□□
- □□□□□□□□□□□□□□□ **(MO)** □□
- □□□□□□□□□□□ **(MT)** □□ □□□□
- □□□□□□□ □□□□□□/□□□□
- □□□□□□□ □□□□□□□□

□□	□□	□□	□□□
`/api/frontends`	POST	□□□□□□	`{"frontend_name"` `"configuration":` `"frontend_type":` `"hostname": "...` `"uptime_seconds"`
`/api/messages_raw`	POST	□□□ SMS □□□□□ TPDU□	`{"rp_originator_` `"...",` `"rp_destination_` `"...", "directio` `"message_body":` `"send_time": ".."` `"smsc_node_name"` `"source_smsc": "` `"source_type": "`
`/api/messages`	GET	□□□□□□	□□: `smsc: <smsc_r`
`/api/messages/{id}`	PATCH	□□□□□□□□	`{"deliver_time":` `"dest_smsc": "..`
`/api/messages/{id}`	PUT	□□□□□□	`{"dest_smsc": nu`
`/api/locations`	POST	□□/□□□□□□□	`{"msisdn": "..."` `"...", "location` `"ims_capable": t` `"csfb": false, "` `"...", "user_age` `"...", "ran_loca` `"...", "imei": "` `"registered": ".`
`/api/events`	POST	□□□□□□	`{"message_id": .` `"name": "...",` `"description": "`

□□	□□	□□	□□□
`/api/status`	GET	□□□□□□□□□□□□ `smsc_api_status_path` □□□□□ `/api/status`□□ SMSc □□□□□□□□□□□□ `SMSc.APIClient`□	-

API □□□□

□□ API □□□□ JSON □□□□□□□□□□

- □□□□□HTTP 200-201□JSON □□□□□□□□
- □□□□□HTTP 4xx/5xx□□□□□□□□□□□□□□□
- □□□□ISO 8601 □□□□□□ `"2025-10-21T12:34:56Z"`□
- □□ **ID**□□□□□□□□□□□□

API □□□□□

□□□□□□□□□□□□□□□□

1. SMSc.APIClient

□□ API □□□□□□□□□ OmniMessage □□□ HTTP API □□□

- `frontend_register/4` - □ OmniMessage □□□□
- `insert_message/1` - □□□□ SMS □□□□□□□□□□□□□□□□ `/api/messages_raw`□
- `insert_location/9` - □□/□□□□□□□□□
- `get_message_queue/2` - □□□□□□□□□□□□
- `mark_dest_smsc/3` - □□□□□□□□□□□□
- `add_event/3` - □□□□□□□□□
- `flush_queue/2` - □□□□□□□□□SRI-for-SM + MT-forwardSM□
- `auto_flush/2` - □□□□□□□□□

2. SMS.FrontendRegistry

□□□□□□□□□□□□□□□

- □□□□□□□□
- □ ~85 □□□□□
- □□□□□□□ `smsc_name`□□□□□□□□□
- □□□□□□□□□□□□□□□□□

3. SMS.Utils

□□ SMS □□□□□□□□□

- `generate_tp_scts/0` - □□ TPDU □□□ SMS □□□

□□□□□

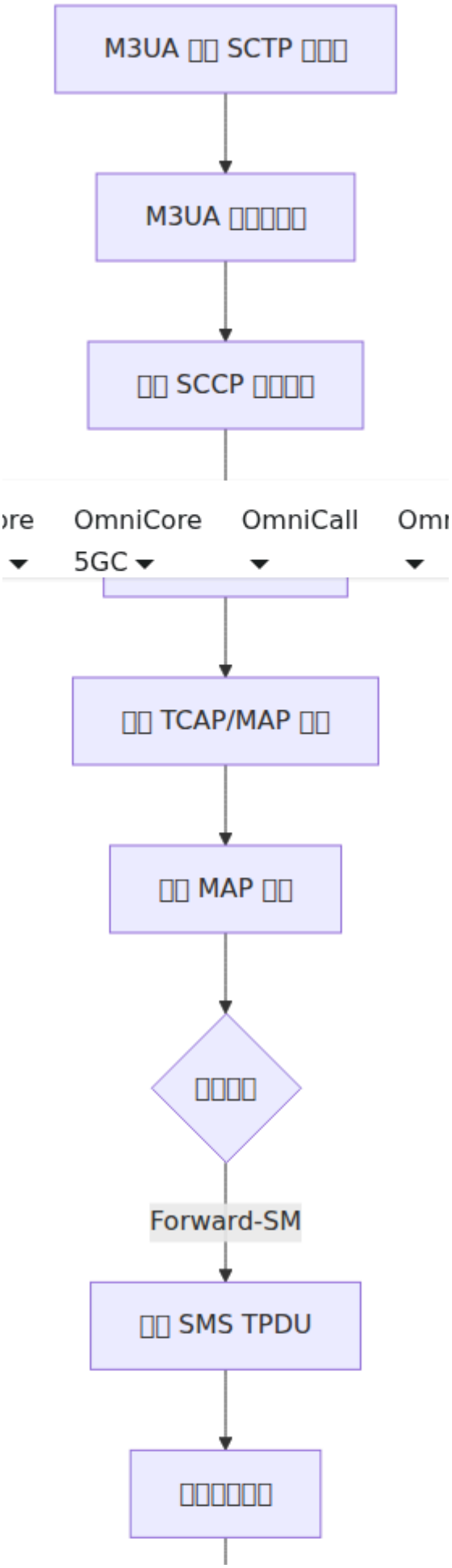
□□ SMS □□□□□□□

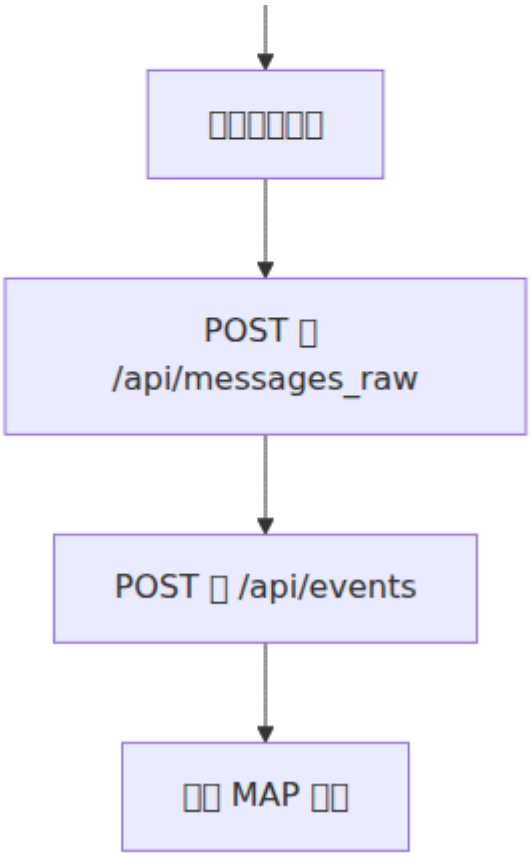

M3UA □□ SCTP □□□
M3UA □□□□□
□□ SCCP □□□□
□□ SCCP □□
□□ TCAP/MAP □□
□□ MAP □□
□□□□
Forward-SM
□□ SMS TPDU
□□□□□□□



□□ SMS □□□□□□□□

□□□□ HSS/HLR API (`hlr_api_base_url`) □□IP-SM-GW □□□□□□□□□ HSS API □□□□□□□□ □ IMSI □□□ VLR□□ □□□□□ □□ MT-SMS□□□□□□ SRI-for-SM □□□**VLR** □□ □□□□□□□□□□□□□□ □□□□□□□□ HSS □□□

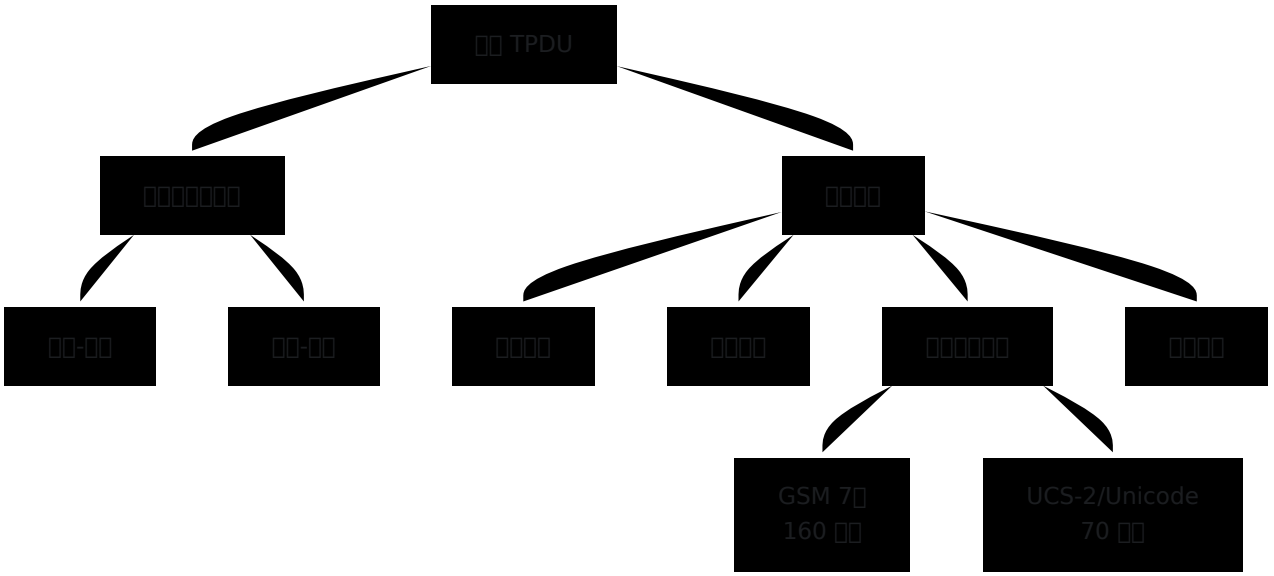

M3UA □□ SCTP □□□
M3UA □□□□□
□□ SCCP □□□□
ore
OmniCore
5GC
OmniCall
Omı
□□ TCAP/MAP □□
□□ MAP □□
□□□□
Forward-SM
□□ SMS TPDU
□□□□□□



□□□□□□□□

- **VLR** □□□□□□□□□ HSS API □□□□□□□□□□□□□□□ VLR □□□□□□□□□□□IMSI + VLR □□□ TTL □□□□□□□□□□□□□ HSS API□□□□□□□□□□□□□ VLR □□□□□
- **HSS API** □□□□□□□□□□□□□□ `hlr_api_base_url` □□IP-SM-GW □□□□ MSISDN □□ HSS API□□□□□□□□□ □□ **IMSI** □ □□ **VLR** □□□□□□□□□□□□IP-SM-GW □□□□ VLR □□ MT-ForwardSM□□□□□□□ SRI-for-SM□
- □□□□□□□□□□□□□ HSS API □□□□□□□□□□□ VLR□□□□□□□□□□□□□□

□□ TPDU □□



□□□□□□□□

SMSc □□□□□□ HLR □ **alertServiceCenter** □□□□□□□□□□□□□□□□

□□ HLR □□□□ alertServiceCenter □□□□□□□□□ HLR □□□□□□□□□□□□□□□□

□□□ alertServiceCenter□

□□□□ HLR □□ UpdateLocation□□□□□□ VLR/MSC□□□HLR □□□□□□□ **alertServiceCenter**□MAP □□□ 64□□□□□□ SMSc □□□□□□□□□

□□

□□□□□□□ HLR □□□□

```
config :omniss7,
  # SMSc □□□ alertServiceCenter □□□□□□□□□□□□48 □□□
  hlr_alert_location_expiry_seconds: 172800
```

□□

□ SMSc □□□ alertServiceCenter □□□□

1. □□ **MSISDN**□□□□□□□□□□ MSISDN□TBCD □□□
2. □□ **TON/NPI** □□□□□□□□□□□ "19"□"11"□"91"□□□□"19123123213" → "123123213"□
3. □□ **IMSI**□□□□□□□ `hlr_api_base_url`□□□□ HSS API □□□□□□□ □□ **IMSI**□□□ HSS □□ □□□□□□□ API□□□□□□□□□ SRI-for-SM □□□□□□□□□□ IMSI□□□ IMSI □□ 2G/CS □□□□□□ MT □□□□□□□□MSC/VLR □□□ MT-ForwardSM □□□□□□□ IMSI□
4. **POST** □ **/api/locations**□□□□□□□□□□□□□□□□□□
   - `msisdn`□□□□□□□□□□□□□□□
   - `imsi`□□□ IMSI
   - `location`□SMSc □□□□□□"ipsmgw"□
   - `expires`□□□□□ + `hlr_alert_location_expiry_seconds`
   - `csfb`□true□□□□□□□□□□□□□□□
   - `ims_capable`□false□□□ 2G/3G CS □□□□□□ IMS/VoLTE□
   - `user_agent`□□□□□□ HLR GT□□□□□□
   - `ran_location`□ "SS7"
5. □ **SMSc** □□□□□□□□□□□□□□□ HLR GT□□□=□□□□□□□□□ 0
6. □□ **ACK**□□ HLR □□ alertServiceCenter □□

□□□□□□

□ SMSc □□□□□□□□ SRI-for-SM □□□□“□□□□”□□□□□□ SRI-for-SM □□□□□□□□□□ HLR □□□□ SRI-for-SM□□

1. □□□□□SRI-for-SM □□ `absentSubscriberDiagnosticSM` □□
2. □□□□□POST □ /api/locations□`expires=0`□□□□□□□□□□
3. □□□□□□□□ "SS7_AbsentSubscriber" □□□□□
4. □□□□□□□□ SMSc □□□□□□□□□□□□□ `failed`

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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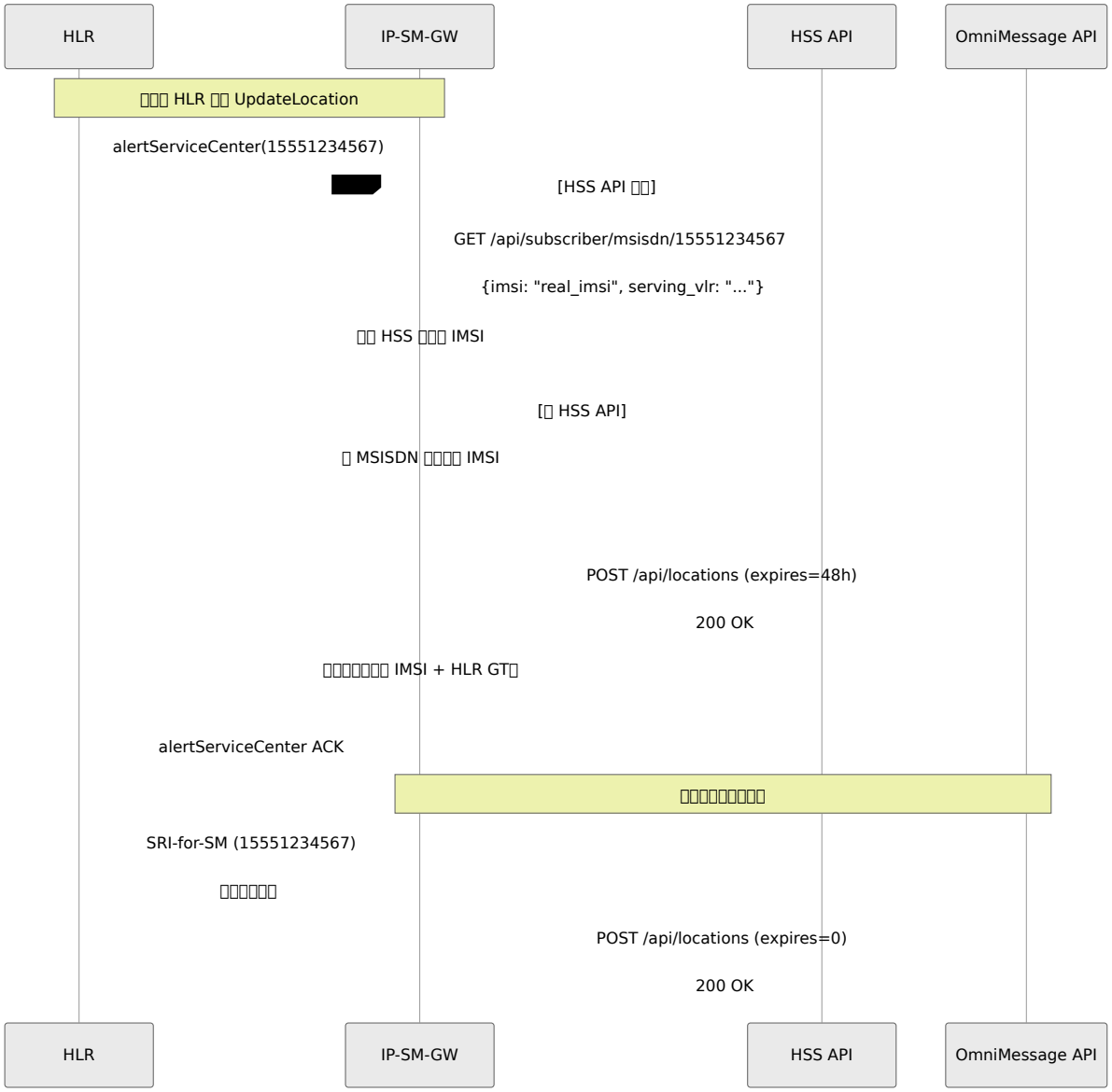

API □□

POST /api/locations

```
{
  "msisdn": "15551234567",
  "imsi": "001010123456789",
  "location": "ipsmgw",
  "ims_capable": false,
  "csfb": true,
  "expires": "2025-11-01T12:00:00Z",
  "user_agent": "15551111111",
  "ran_location": "SS7",
  "imei": "",
  "registered": "2025-10-30T12:00:00Z"
}
```

□□□`user_agent` □□□□□□ alertServiceCenter □ HLR GT□□□ SMSc □□□□□□□□□ HLR□

□□□□□□□`expires` □□□□□□□□□□□□□□□

□□□□

SMSc □□ □□□□□□□□□□□□ SS7 □□□□□□□□□□□□□□□□□□□□□□□□□□□□ MO→MT □□□□□□□□□□□□□□

□□□□□□□□□□

□ SMSc □ SS7 □□□□□□□□□□MO□□□□□□□□□□□□□□□□□□□□□□□□□□□ `source_smsc` □□□□□□□□□□□□□□`"SS7_MO_15551234567"`□□□□□□□□□□□□□□□□□□□□□□□□

1. □ SS7 □□□□ → □□ `source_smsc` □□□ "SS7" □□□□□
2. □□□□□□□ → □□□□□□□□
3. □□□ SS7 □□ → □□□□

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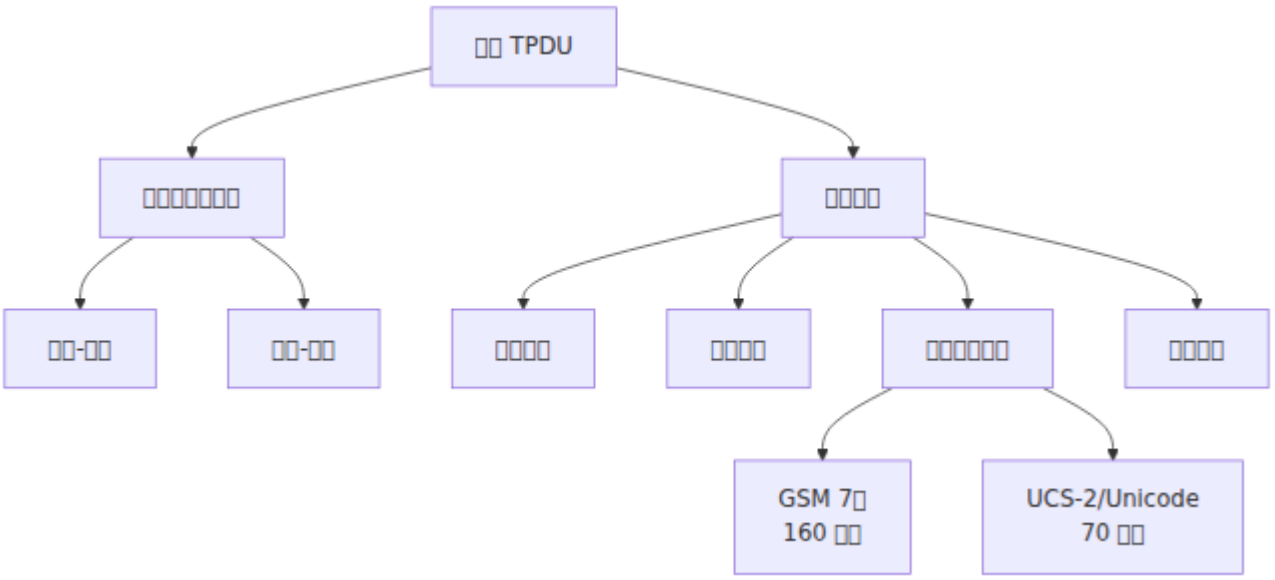
□□□□□□□□□ □□ □ □□□ □□□□□SMSc □□□□□□□□ □□□ □□□□□ SS7 □□□□□□□□□□□□□□□□□□□□



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□□□□□ SS7 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1. **VLR** □□□□□□□□□□□□□□□□□□□□□□□□□□□□ IMSI □□□ VLR □□
2. **HSS API**□□□□□□□□□□□ `hlr_api_base_url`□□□□□□□□□□□□□ MSISDN □□ HSS API□□□□□□□□□ HSS □□□□□□□□□

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□□□□□□□□□□□□□□□SMSc □□ `source_smsc` □□□

- □□ `source_smsc` □□ **"SS7"** □□□□□□□□□
  - □□□□
  - □□□□□□"□□□□"□□□□□□□□□□□□
  - □□ PUT □□□□□□□□□□□□
  - □□□□□□□□
- □□ `source_smsc` □□ **"SS7"** □□□□□□□□
  - □□□□□□□□□□□□□□□ MO→MT □□
  - □□□□ HSS API / VLR □□□□□□

- □□ `source_smsc` □□□ **"SS7"**□
  - □□□□□□□□□□□□□□ Web API□SMPP □□□□ SS7 □□□□□□□

□ SMSC □

□□□□□□□□□ `source_smsc` □□

□□	□□□	□□
SS7 □□□MO-FSM□□□□□□□□□	`"SS7_MO_15551234567"`	□□ - □□□□
SS7 □□□MO-FSM□□□□□□□□	`"SS7_MO_15551234567"`	□□ - □□ MO→MT □□
□□ API/SMPP	`"ipsmgw"` □ `"api_gateway"`	□□□□
□□ SMSc	`"smsc-node-01"`	□□□□□

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□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```
{
  "message_id": 12345,
  "name": "□□□□□",
  "description": "□□□□□ - source_smsc 'SS7_MO_15551234567' □□ 'SS7' □□□□□□□□□□□□□□□□□□□□"
}
```

□□□□□□□□□□□□□

- **Web UI**□SS7 □□□□□ (`/events`)
- □□□□□□□ API □ `events` □
- □□□□□□□□□□□□□

□□

□□□□□□□ □□□ `smsc_mode_enabled: true` □ VLR □□□ `hlr_api_base_url`□

□□□□

□□ **1**□□ SS7 □□□□□□□□ MO-SMS□□□□□□

```
1. □□ → MSC/VLR → IP-SM-GW□□□ MO-ForwardSM□
2. IP-SM-GW □□□ MO-FSM□□□□□□□source_smsc = "SS7_MO_9991900"
3. □□□□□□□□□□□□□□□
4. □□□□□□ VLR □□□ HSS □ → □□□
5. IP-SM-GW □□□ source_smsc □□ "SS7" + □□□□□□□ → □□
6. □□□□□□ "□□□□"
7. □□□□□ SRI-for-SM □ MT-ForwardSM□□□□□□□
```

□□ **2**□□ SS7 □□□□□□□ MO-SMS□□□□□

```
1. □□ → MSC/VLR → IP-SM-GW□□□ MO-ForwardSM□
2. IP-SM-GW □□□ MO-FSM□□□□□□□source_smsc = "SS7_MO_9991900"
3. □□□□□□□□□□□□□□□
4. □□□□□ HSS API □□□ → □□□□□
5. IP-SM-GW □□□□□□□□□□□□ SS7
6. HSS □□□□□ IMSI + VLR → MT-ForwardSM □□□□□□ VLR
```

SMSc □□□□

SMSc □□□□□ □□□□□□ GenServer□□□ alertServiceCenter □□□□□□□□□□□□□□□□□□□□□□□□□□

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- **HLR** □□□□□□□□□ alertServiceCenter □ HLR
- □□□□□□□□□□□/□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□
- **Web UI** □□□□□□□□□□□□□□□□□□□□

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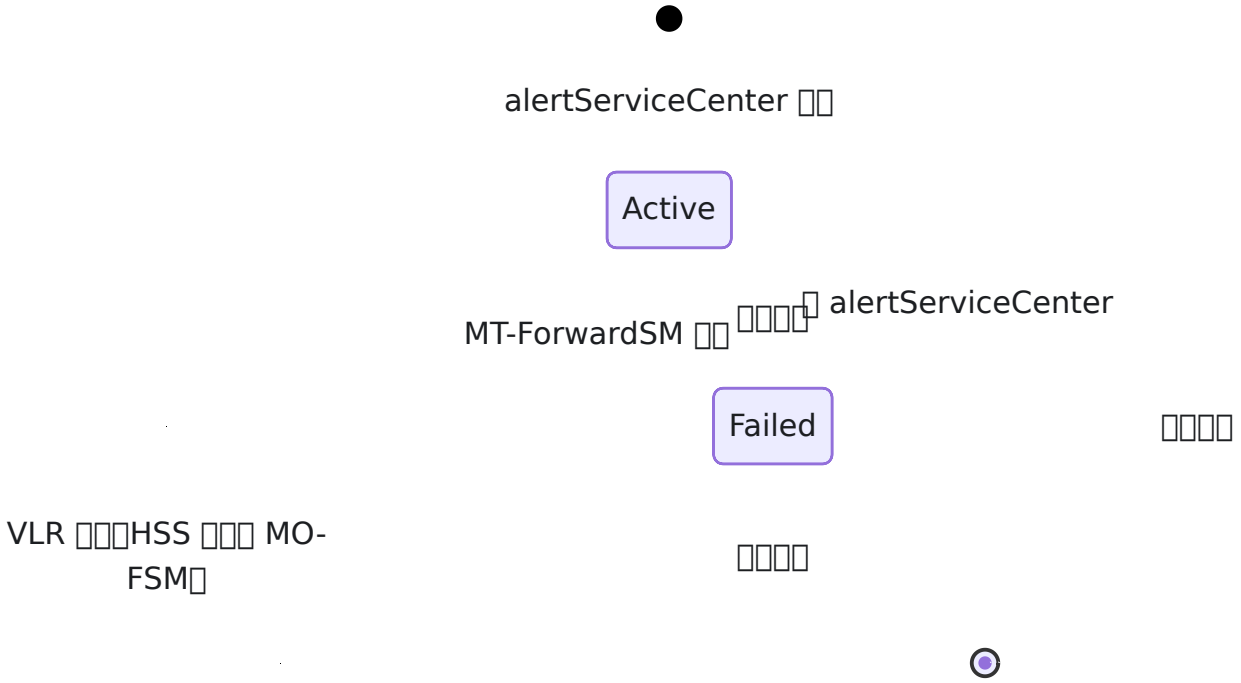
□□□□□□□□□□□□□□

□□	□□	□□
`msisdn`	□□□□□□□□□□	"15551234567"
`imsi`	□□□ IMSI□□□□□□□□□ HSS □□□ IMSI□	"001010123456789"
`hlr_gt`	□□ alertServiceCenter □ HLR GT	"15551111111"
`messages_sent`	□□□ MT-FSM □□□□	5
`messages_received`	□□□ MO-FSM □□□□	2
`status`	`:active` □ `:failed`	`:active`
`updated_at`	□□□□ Unix □□□	1730246400
`vlr_address`	□□□□ VLR GT □□	"14155550100"
`vlr_cached_at`	VLR □□□□ Unix □□□	1730246400

□□□□



□□

□□□□ **alertServiceCenter** □□

- □□□□□□□□□□
- □□ `status = :active`
- □□ HLR GT
- □ HSS API □□□□ IMSI□□□□□□□□□□□□□□ IMSI
- □□□□ VLR □□□□□□□□

□ **HSS API** □□□□ **VLR** □□□□□

- □□□□□□□ VLR □□□□□ IMSI
- □□□□□□□□□ VLR□□□□□□□□ HSS

□□□□ **MO-ForwardSM** □□

- □ SCCP □□ GT □□□□□□ VLR □□□MO-ForwardSM □□□□ GT □□□□□□ VLR□
- □□□□□□□□□□□□□□□

□ **MT-ForwardSM** □□□□□□

- □□□□□ VLR □□□□□□□□□□□□□□□□ HSS API

□ **SRI-for-SM** □□□□

- □□ `messages_sent` □□□
- □□ `updated_at` □□□

□ **SRI-for-SM** □□□□

- □□ `status = :failed`
- □□□□□□□□□□□□□

□□□□□□□□

- □ ETS □□□□
- □□□□□ Web UI □

Web UI - SMSc □□□

□□□`/smsc_subscribers` □□□□□□ 2 □

□□□□□□□□□ SMSc □□□□□□□□□ `config/config.exs` □□□ SMSc □□□□□□□□□□□□□□□□□□□□□□

SMSc □□□□□□□□□□□□□□□□□□□□

□□

1. □□□
    - MSISDN□IMSI□HLR GT□VLR GT□□□□□ VLR □□□
    - □□□□/□□□□□
    - □□□□□□□□/□□□□□□□□
    - □□□□□□□□□□□□
    - □□□□□□□□□
2. □□□□
    - □□□□□□

- □□□□□□□
- □□□□□□□
- □□ HLR □□

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

□□□□

```
┌──────────────────────────────────────────────────────────────────────────────
│ SMSc □□□□□                                          □□: 3
├──────────────────────────────────────────────────────────────────────────────
│ MSISDN          IMSI              HLR GT         VLR GT         □□
│                                                                   □□
├──────────────────────────────────────────────────────────────────────────────
│ 15551234567     001010123456789   15551111111    14155550100    5/2
│ 15559876543     001010987654321   15551111111    -              0/0
│ 15551112222     001010111222233   15552222222    14155550200    3/1
└──────────────────────────────────────────────────────────────────────────────

□□□  □□: 3  |  □□: 2  |  □□: 1  |  □□ HLR: 2
```

API □□

□□□□□□□□□□□□□□□□□□□□

```
# □□□□ alertServiceCenter □□□
SMSc.SubscriberTracker.alert_received(msisdn, imsi, hlr_gt)

# □□□□□□□
SMSc.SubscriberTracker.message_sent(msisdn)
SMSc.SubscriberTracker.message_received(msisdn)

# □□□□□□□SRI-for-SM □□□
SMSc.SubscriberTracker.mark_failed(msisdn)

# □□□□□□□
SMSc.SubscriberTracker.remove_subscriber(msisdn)

# □□□□
SMSc.SubscriberTracker.get_active_subscribers()
SMSc.SubscriberTracker.get_subscriber(msisdn)
SMSc.SubscriberTracker.count_subscribers()
SMSc.SubscriberTracker.clear_all()
```

□□

□□□□□□□□□

- **alertServiceCenter** □□□□□□□□□□□□□□□□ `alert_received/3`
- **SRI-for-SM** □□□□□□□□□□□□□□ `messages_sent`
- □□□□□□□□□□□□□□□□□□ `mark_failed/1`
- □□□□□□□□ SRI-for-SM □□□□□ `mark_failed/1`

VLR □□□□

□□□□□□ HSS API □ IP-SM-GW □□□□□□□□□□□ VLR □□□□□□□□□□ MT □□□□□□□ HSS□

□□□□

VLR □□□□□□□□□□□□

1. **HSS API** □□□□□□□□□□ HSS API □□□□□□□ VLR □□□□□IMSI □ VLR □□□□□□□□□□□□□□□□□□
2. **MO-ForwardSM**□□□□□□□□ MO-ForwardSM □□□□SCCP □□□ GT□□□□□□□□ VLR/MSC□□□□□□□□□ VLR □□□

□□□□ MT □□□□□□□□□□□□□□□□□□□□□□□□□□□□IMSI □ VLR □□□□□□ TTL □□□□□□□□□ HSS API□

□□□□

□□□□□□□□□□VLR □□□□□□□

- **MT-ForwardSM** □□□□□□□□□SCCP □□□VLR □□□□□□□□ VLR □□□□
- **TTL** □□□TTL □□ `vlr_cache_ttl_seconds` □□□□□□□ TTL □□□□□□□□□□□□□□□

□□ □ □ alertServiceCenter □□□□□□□□□ VLR □□□□□□□□□□□□□□□□□□□ VLR □□□

□□

```
config :omniss7,
  # HSS/HLR API □□□VLR □□□□□□□□□□□
  hlr_api_base_url: "https://omnihss.example.com:8443",
  # OmniHSS API □□□□ hlr_api_base_url □□□□□□□
  hlr_api_key: "<□□ hlr_interworking □□□ OmniHSS API □□>",

  # VLR □□ TTL□□□□3600 = 1 □□□
  vlr_cache_ttl_seconds: 3600
```

□□	□□	□□	□□	□□
`hlr_api_base_url`	□□□	□	`nil`	HSS/HLR API □□ URL□□□□□□□□□□□ □□□VLR □□□□□ M □□□□□ `nil` □□□□ ���□ SRI-for-S □□
`hlr_api_key`	□□□	□ `hlr_api_base_url` □□□□	`nil`	OmniHSS API □□ OmniSS7 □□□ HS API □□□□□□□ `x-omnihss-key` □□□ □□□ OmniHSS □□ `hlr_interworki` □□□□□□□□□□□ `hlr_api_base_u` □□□□□□□□□□□□□ HSS API □□□□□□□□ □□□□ `hlr_api_k` □□□□
`vlr_cache_ttl_seconds`	□□	□	`3600`	□□ VLR □□□□□□□□ □□□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□ HSS API□□□□□□□□ HSS API □□□□□□□□ □□□□□□□□

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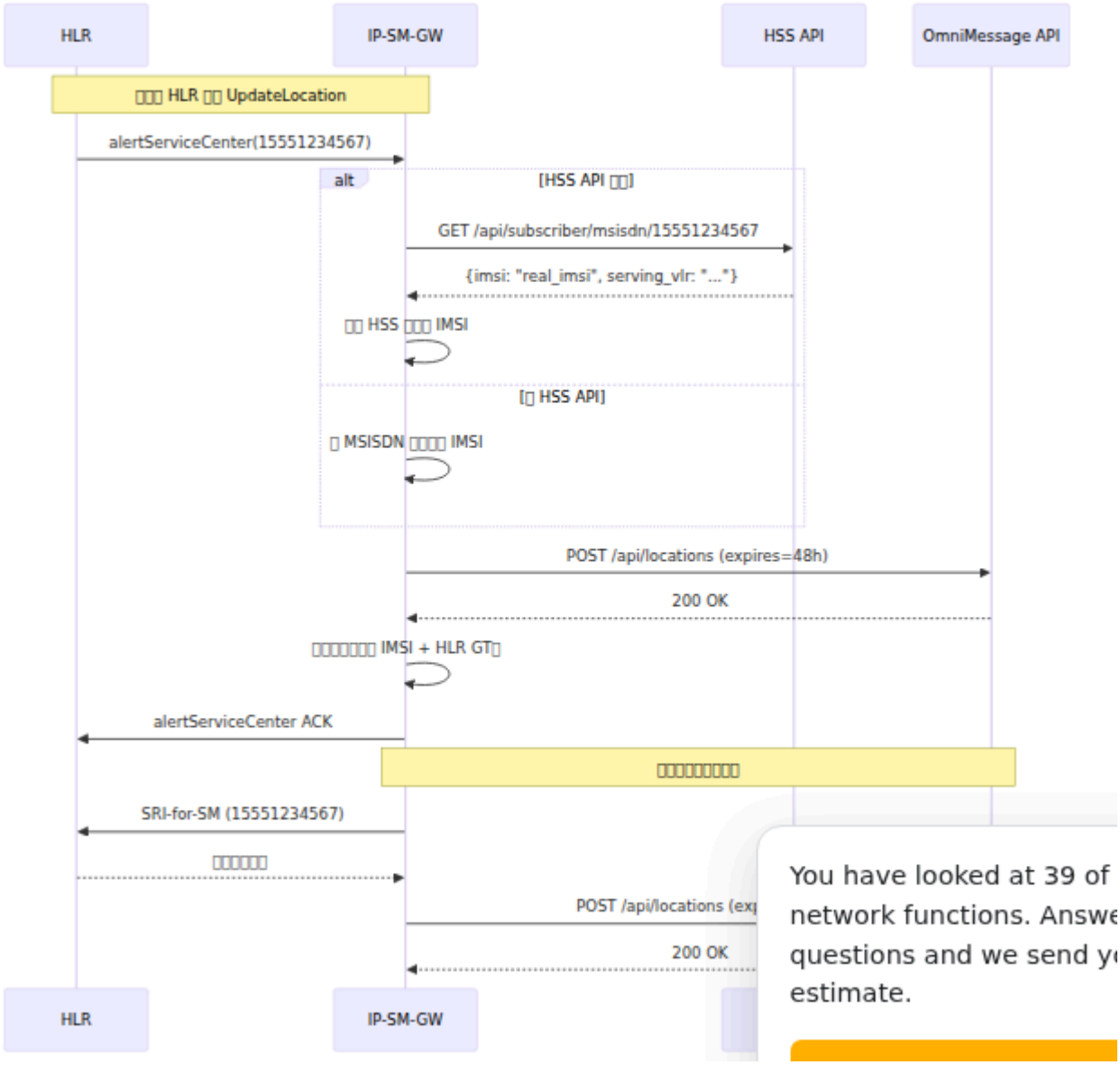
HLR
IP-SM-GW
HSS API
OmniMessage API
□□□ HLR □□ UpdateLocation
alertServiceCenter(15551234567)
alt
[HSS API □□]
GET /api/subscriber/msisdn/15551234567
{imsi: "real_imsi", serving_vlr: "..."}
□□ HSS □□□ IMSI
[□ HSS API]
□ MSISDN □□□□ IMSI
POST /api/locations (expires=48h)
200 OK
□□□□□□□ IMSI + HLR GT□
alertServiceCenter ACK
□□□□□□□□□□
SRI-for-SM (15551234567)
□□□□□□□
POST /api/locations (exp
200 OK
HLR
IP-SM-GW
You have looked at 39 of
network functions. Answe
questions and we send y
estimate.

□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□

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□□

```
config :omniss7,
  auto_flush_enabled: true,           # □□/□□□□□□
  auto_flush_interval: 10_000,        # □□□□□□□□□□□□□
  auto_flush_dest_smsc: nil,          # □□□□nil = □□
  auto_flush_tps: 10                  # □□□□□□□
```

□□□□

1. □□□□ `auto_flush_interval` □□□□ API □□□□□□□□
2. □□□□□□□ `auto_flush_dest_smsc` □□□□
3. □□□□□□□□□□□□□ `auto_flush_tps` □□
4. □□□□□□□□□□
   - □ HLR □□ **SRI-for-SM**□□□□□□□□□□□□□□□□□□□□
     - HLR □□□□ MSISDN □□□□□ IMSI
     - HLR □□ MT-ForwardSM □□□□ SMSC GT □□
     - □□□□□□□□□□ HLR □□□□ SRI-for-SM □□□□
   - □□□□□ MSC/VLR □□ **MT-ForwardSM**
   - □□ API □□□□□□□□□□/□□□
   - □□ API □□□□□□

> □ □□□□□□□□□ SRI-for-SM □□□□□□□□□□□□ MSISDN □ IMSI □□□□□□□ GT □□□□□□□ □□□□□□ IMSI □□□□□□ HLR □□□□□□ SRI-for-SM □□□

SMSc □□

OmniSS7 □□ Prometheus □□□□□□ MAP □□□□ SMS □□□□□ SMSc □□□□□/□□□□□□□ SMS □□□□□□□□□□

□□	□□	□□	□ **SMS** □□□□
`map_requests_total`	□□□	`operation`	□□ MAP □□□□ SMS □□□□□□□ `sri_for_sm`□ `forward_sm`□ `MTforward_sm` □ `prn`□
`map_request_duration_milliseconds`	□□□	`operation`	MAP □□/□□□□□□□ □□□□ SRI-for-SM □ MT-ForwardSM□

□□□□□□□□□□□□□□□ SMS □□□□□`map_requests_total`□`cap_requests_total`□ `ussd_requests_total`□`ussd_active_sessions`□`map_pending_requests`□ `omniss7_license_status` □ `map_request_duration_milliseconds`□

□□□□□

```
# □□ 5 □□ MT-ForwardSM □□□□□
rate(map_requests_total{operation="MTforward_sm"}[5m])

# □□ 5 □□ SRI-for-SM □□□□□
rate(map_requests_total{operation="sri_for_sm"}[5m])

# □□ MT-ForwardSM □□□□□□□ 5 □□□
rate(map_request_duration_milliseconds_sum{operation="MTforward_sm"}
[5m]) /
rate(map_request_duration_milliseconds_count{operation="MTforward_sm"
[5m])
```

□□□□ SMSc

□□□□□□□□□

□□□

1. □□□□□□□□□□
2. □□□□□□□□
3. □□□□□□□□□□
4. □□ M3UA □□□□□□□□□
5. □□ TPS □□

□□□□□□□□□

□□□□□

- TPS □□□□
- HLR □□□□
- □□□□□□□
- □□□□□□□□

□□□□□

- □□ `auto_flush_tps`
- □□ HLR □□□
- □□□□□□□□□□

MT-forwardSM API

□□ API □□ SMS

API □□□ `POST /api/MT-forwardSM`

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `destination_service_centre` □□□□□□□□□ `smsPDU` □□□□□□□□□ SMS TPDU□

□□□

```
{
  "imsi": "234509876543210",
  "destination_service_centre": "447999555111",
  "originating_service_center": "447999123456",
  "smsPDU":
"040B917477218345F60000157030185714 0C0BD4F29C0E9281C4E1F11A"
}
```

□□□

□□□□HTTP 200□□□□□□□□□□□□ `result` □□□□□□□ MT-ForwardSM □□□□□□□ TCAP □□□□□□ `message_id`□□□□□□□□□□ `"success"`□□

```
{
  "result": "<formatted TCAP result>"
}
```

□□ MAP □□□□□□□□□□ HTTP 504 □ `{"error": "timeout"}`□□□□□□□□□□□□□□□□□ HTTP 400 □ `{"error": "invalid request"}`□

□□□□

OmniSS7 □□□

- ← □□□□□□
- HLR □□□□□ - HLR □□□□□□□□
  - **SRI-for-SM □□□□□** - □□ MSISDN □ IMSI □□□□□□□□□□□□□□□□□
- □□□□□□□ - Web UI□API□□□
- MAP □□□□□□ - MAP □□
- □□□□□ - □□□□□

OmniMessage □□□ □□□ **OmniMessage** □□ □□□OmniMessage □□

OmniSS7 □ Omnitouch □□□□□□□

M3UA & M2PA STP □□□□

← □□□□□

□□□□□□□□□ OmniSS7 □□ □□□□□ **(STP)** □□□□□□□

□□

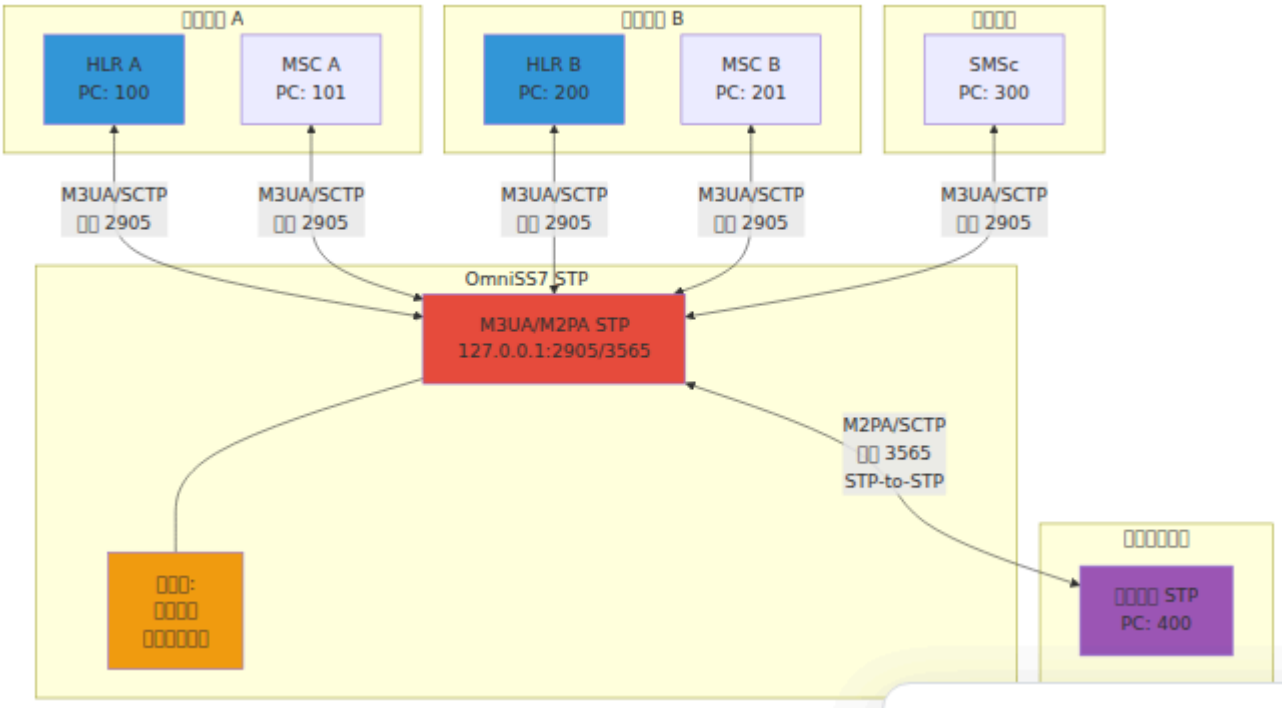
1. □□□ STP□
2. STP □□□□
3. □□□□□□□□ TDM □□□□
4. □□ STP □□
5. □□□□□
6. M2PA □□□□
   - M3UA □ M2PA □□□□□
   - □□ M2PA □□□
   - SLTM □□
   - □□ Web UI □□ M2PA
   - M2PA □□
7. □□□□
8. □□□□□□
9. SCCP □□□□
   - GTT □□ SSN □□
   - □□□□□□□□□□
   - □□□□□□
10. □□□□□ (□□□□□□□)
11. □□□□ (SCCP □□□)
12. □□□□□□
    - □□□□
    - DROP □□ - □□□□□□
13. □□□□
14. □□□□

15. □□□□□
16. M3UA □□□□□
    - M3UA □□□□□□□
    - □ IP □□□□□□□

□□□□□□□□ (STP)□

□□□□□ **(STP)** □ SS7 □□□ IP □□□□□□□□

STP □□□



STP □□□□□□□

ASP (□□□□□□□□)

- □□□□□□□□□ SGP/STP □□□□
- □□□□□□□□
- □□□□□□ STP □□□□□□□□□□□ STP

SGP (□□□□□□□)

- □□□□□□□□ ASP □□□□□□□□
- □□□□□□□□
- □□□□□□□□□□□□□□□□ STP

AS (□□□□□□)

- □□□□□□□□□ ASP □□□□□□

- □□□□□□□□□□□□□□
- □□□□□□ ASP □□□□□□□□□

□□□□□□□□ TDM □□□□

OmniSS7 □□□□□□ IP □□□□□□□□□ SIGTRAN □□ (M3UA/M2PA □□ SCTP)□□□□□□□ □□ **TDM** □ **SS7** □□ □□□□□□□□□□□ □□□□□ **(SGW)** □□□□□□□□□□

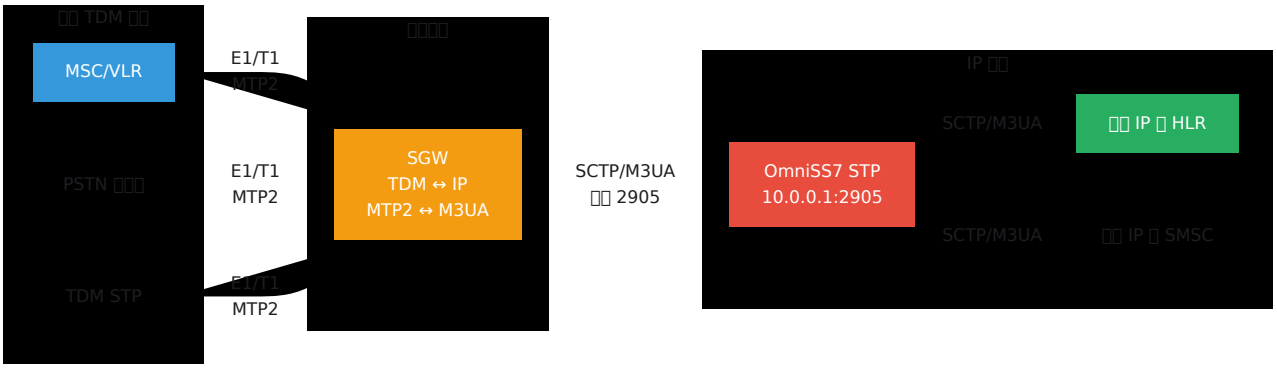
□□□□□□□□□

□□□□ **(SGW)** □□□□□□□□□□□□□□□□□□□□□□□□ SS7 □□□

- **TDM** □□□□ E1/T1 □□□□□□ SS7□□□ MTP1/MTP2/MTP3
- **IP** □□□□ SCTP/IP □ SIGTRAN□□□ M3UA □ M2PA

SGW □□□□□□□□□□□□□□ IP □□□□□□□□ OmniSS7□□□□□□□□ IP □□□□□□ TDM □□□□□□□□STP□ HLR□□□□□□□

TDM □ IP □□



□□□□□

□□	**TDM SS7**	□□□□	**IP (SIGTRAN)**
□□□□	SCCP/TCAP/MAP	← □□ →	SCCP/TCAP/MAP
□□	MTP3	□□	M3UA/M2PA
□□	MTP2	□□	SCTP
□□	MTP1 (E1/T1)	□□	IP/Ethernet

SGW □ TDM □□□ MTP1/MTP2□□□ IP □□□ M3UA □ M2PA □□ MTP3 □□□□□□□□SCCP□TCAP□MAP□CAP□□□□□□

□ OmniSS7 □□□□□□□

OmniSS7 □□ **ASP (□□□□□□□)** □□□□□□□□□ SGW □□ **SGP (□□□□□□)**□

□□□□

```
config :omniss7,
  # □□ ASP □□□□□□□□
  map_client_m3ua: %{
    mode: "ASP",
    callback: {MapClient, :handle_payload, []},
    process_name: :sgw_connection,
    # □□□□□ (OmniSS7)
    local_ip: {10, 0, 0, 1},
    local_port: 0,                    # □□□□□□□
    # □□□□□□□
    remote_ip: {10, 0, 0, 100},       # SGW IP □□
    remote_port: 2905,                # SGW M3UA □□
    routing_context: 1                # SGW □□□□□□□
  },

  # □□□□□ STP □□□□□□□
  peers: [
    %{
      peer_id: 1,
      name: "TDM_Gateway",
      role: :client,                  # OmniSS7 □□□□□
      local_ip: {10, 0, 0, 1},
      local_port: 0,
      remote_ip: {10, 0, 0, 100},     # SGW IP □□
      remote_port: 2905,
      routing_context: 1,
      point_code: 100,                # SGW □□□□□□□□
      network_indicator: :international
    }
  ],

  # □□□□□□□ TDM □□□□□
  m3ua_routes: [
    %{
      dest_pc: 100,                   # TDM MSC □□
      peer_id: 1,                     # □□ SGW □□□□□□
      priority: 1,
      network_indicator: :international
    },
    %{
      dest_pc: 200,                   # TDM HLR □□
      peer_id: 1,
      priority: 1,
```

```
      network_indicator: :international
    }
  ]
```

SGW □□□□□□

□□□□□□□□□ OmniSS7 □□□□□□□

□□	□□	□□□
□□ **IP**	OmniSS7 □ IP □□	□□□□□ IP
□□□□	OmniSS7 □ SCTP □□	2905
□□□□□	SGW □ AS □□□	SGW □□□□□
□□	□□ SGW □□□□ TDM □□□□	□□□□
□□□□	ASP □□□□□□	□□□□□□□

□□□□

□□ 1□IP □□□□ **TDM** □□

OmniSS7 □□ SGW □□□ TDM □ HLR □□ MAP □□ (SRI-SM, PRN)□

```
OmniSS7 (ASP) → SGW (SGP) → TDM □□ → HLR
     M3UA          MTP2           MTP3
```

□□ 2□**OmniSS7** □□ **IP** □ **TDM** □□□ **STP**

OmniSS7 □□□ IP □□□□□□ TDM □□□□□□□□□

```
IP SMSC → OmniSS7 STP → SGW → TDM HLR
              ↓
         □□ IP □ HLR
```

□□ **3□□ SGW □□□□□**

□□□□□□□□□□□□□□□□□□□□

```
peers: [
  %{
    peer_id: 1,
    name: "SGW_Primary",
    role: :client,
    remote_ip: {10, 0, 0, 100},
    remote_port: 2905,
    point_code: 100,
    # ... □□□□
  },
  %{
    peer_id: 2,
    name: "SGW_Backup",
    role: :client,
    remote_ip: {10, 0, 0, 101},
    remote_port: 2905,
    point_code: 100,
    # ... □□□□
  }
],

m3ua_routes: [
  # □□ SGW_Primary □□□□□
  %{dest_pc: 100, peer_id: 1, priority: 1, network_indicator:
:international},
  # □□ SGW_Backup □□□□□
  %{dest_pc: 100, peer_id: 2, priority: 2, network_indicator:
:international}
]
```

□□ M3UA STP □□

OmniSS7 □□□□□□□□□□□□□□□□□□ STP□□□□□ `:omniss7` □□□□□□□□ STP □□□□□

□□□□□□

□□	□□
`config/config.exs`	□□□□□□□□□□□□□Web UI□□□ 8445 □ API □ □□□□□□□□
`config/stp_example_runtime.exs`	□□□□□□□□ **STP** □□□`sctp_handler`□□□ □□PC □□□GT □□□
`config/runtime.exs`	□□

> □□□□□□□□ `config/runtime.exs` □□□□□□□□□□□□□□□□□□□□□□□□□□□□STP □□□□□□□□□□□□□□□ `config/stp_example_runtime.exs` □□

□□□ STP □□

□□□ STP□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1. □□ `config/stp_example_runtime.exs` □□□ STP □□□SCTP □□□□□□□□□□PC □□□ GT □□□□
2. □□ `config :omniss7, ...` □□□□□□□ `config/runtime.exs`□□□□□□□□□□
3. □□□□ □□□□ IP □□□□□□□□□□□□□□□□□□□□
4. □□ □□□□□□`iex -S mix`

STP □□□□

`config/stp_example_runtime.exs` □□ STP □□□□□□□□□□ STP □□□□`sctp_handler`□□ □□□ GT □□□□□□□□□□□□□ PC □ GT □□□

```
config :omniss7,
  # SCTP □□□□□□□ STP □□□□□ - □□□□□□□□□□ STP □□
  sctp_handler: %{
    enabled: true,
    local_ip: {127, 0, 0, 1},
    local_port: 2905,
    point_code: 101            # □ STP □□□
  },

  # □□□□□□□□□□□□□ PC □□□□□
  enable_gt_routing: true,

  # M3UA □□□□□PC □□□□ GT □□□□□
  m3ua_peers: [ %{peer_id: 1, name: "STP_West", role: :client,
...} ],
  m3ua_routes: [ %{dest_pc: 100, peer_id: 1, priority: 1,
network_indicator: :international} ],
  m3ua_gt_routes: [ %{gt_prefix: "44", peer_id: 2, priority: 1,
description: "□□□□□"} ]
```

□□□□ □□ M3UA □□□□□□□□□ □ □□□□□□□ □□□□□□□□□□□□

□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□ □□□□□□

□□□□ `config :omniss7` □□□□□ STP □□

□□	□□	□□□	□□	□□
`sctp_handler`	Map	*□□*	□□ STP □□ □□□□□□□ □ □ STP □□□	`%{enabled: true, local_port: 2905, point_code: 101}`
`enable_gt_routing`	Boolean	`false`	□□□□□□□□ □□□ PC □□ □□	`true`
`m3ua_peers`	List	`[]`	M3UA / M2PA □□□ □□□□□□ □□ M3UA □□ □□	□
`m3ua_routes`	List	`[]`	□□□□□□□ □□□□□□	□
`m3ua_gt_routes`	List	`[]`	□□□□□□□ □□ □□□□□ □□	□

> □□□□□□ `local_ip` □/□ `remote_ip` □□ IP □□□□□□□ SCTP □□□□□□□□□□□□□□□□□□□□ SCTP □□□□□□□

□□ STP □□□□□□□□

□□□□□□□□□□□□□□□Web UI □□□

- □ **SS7** □□ - □□□□□
- □ **M3UA** - □□□□□
- □ □□ - □□□□□□ ← *STP □□*
- □ □□□□□ - □□□□□ ← *STP □□*
- □ □□ - □□□□□
- □ □□ - □□□□□□

□□□□□□

- □□□□ SCTP □□ (IP □□ 132) □□□□□
- □□ M3UA □□□ 2905□□□□□
- □□□□□□□□□□□□□□□□□□
- □□□□□□□□ Web UI □ API □□□□□□□□□□ **Mnesia** □□□ □□□□ □□□□□□□□
- □□□□□ `runtime.exs` □□□□□□□□□□□□ Mnesia □□□□
- □□□□□□□□□□□□□□□□□□□□□
- **Web UI**□□□□ Web UI □□ □□□ Web □□□□□□
- **API** □□□□□□ API □□ □□□ REST API □□□ Swagger UI □□

□□ STP □□

□□□□□□□ □□□ **M3UA STP** □□□□□□□□□□□□□□ `config/stp_example_runtime.exs` □ □□□□□□□□

□□□□ STP

□□□□□□□ `config :omniss7` □□□□□□□□

```
config :omniss7,
  sctp_handler: %{
    enabled: true,
    local_ip: {127, 0, 0, 1},    # □□□ IP □□
    local_port: 2905,             # □□□□□
    point_code: 100               # □ STP □□□
  }
```

STP □□□□

□□	□□	□□□	□□	□□
`enabled`	Boolean	`false`	□□□□ STP □□□	`true`
`local_ip`	Tuple	`{127, 0, 0, 1}`	□□□□□ IP □□	`{0, 0, 0, 0}`
`local_port`	Integer	`2905`	□□□□□	`2905`
`point_code`	Integer	*□□*	□ STP □ SS7 □ □	`100`

□□□□□□ STP

- □□□□□□□□□ M3UA □□□□□□ MAP □□□□□□
- □□ **STP**□□□□□□□□□□□□□□□□□□□□□□□□□□
- □□□□□□□□□ STP □□□□ HLR□MSC □ SMSC

□□□□□□□□□□□□□□□□□ STP □□□□□□□□□ `map_client_m3ua` □ `sctp_handler`□

□□□□□ (Mnesia)

□□□□□□□□□□□□□□□□□□□□□□□□□□□□ **Mnesia** □□□ □□□□□□□□

□□□□□□

1. **Runtime.exs** □□□□□□□□□□□□□□ `config/runtime.exs` □□□□□□□□□ `peers`□□□ □□ `m3ua_peers`□□`m3ua_routes` □ `m3ua_gt_routes`
2. **Web UI** □□□□□ Web UI □□□□ □□□□□□□□ Mnesia □
3. □□□□□□□□□□runtime.exs □□□□□□ Mnesia □□□□□□□□□
4. □□□□□□ Web UI □□□□□□□ □□□□□□□□□□□□

Mnesia □□□□

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

```
config :omniss7,
  mnesia_storage_type: :disc_copies  # □ :ram_copies □□□□
```

□□□□□	□□	□□□	□□
`:disc_copies`	□□□□□□□□□□□□□	□□□□□□□□□	□□□□□
`:ram_copies`	□□□□□□	□□□□□□	□□□□□□

□□□`:disc_copies`

Mnesia □□□□□□

Mnesia □□□□□□□□□□□□□□ Mnesia □□□□□

- □□□`Mnesia.{node_name}/`□□□□`Mnesia.nonode@nohost/`□
- □□□□□□ `M3UARouting.init_database` □□□□□□

□	□□
`m3ua_peer`	M3UA / M2PA □□□□
`m3ua_route`	□□□□ (DPC → □□□□□□□□□)
`m3ua_gt_route`	□□□□□□□ (□□ → □□□□□□□ SSN/TT/NPI/NAI □□□□□□)
`m3ua_dest_state`	□ MTP3 □□□□□□□□□□□□□□□□□□□□□□□□ (TFP/TFA/TFR, Q.704 §13)
`ss7_screen_rule`	□□□□ (SCCP □□□) □□/□□□□

□□□□

□□□□□□□□□□□□□□

1. **Runtime.exs** - □□□□□□□□□□□
2. **Web UI** - □□□□□□□□□□□□ Web UI □□□
3. **REST API** - □□□□□□□□□□□□ API □□□

□□□□□□□□ `runtime.exs` □□□□□□□□□□□ Web UI □□□□□□□□□□□□□□□□□□

□□ M3UA □□□

□□□□□ M3UA □□□□□□□□ STP□HLR□MSC□SMSC□□□□□□□□□□ `config/runtime.exs`□

□□□□□□□□

> □□□□□□□ `peers` □□□□□□□□□□ `m3ua_peers` □□□□□□□□□□□□□□□

```
config :omniss7,
  peers: [
    # □□□□□□□□ STP □□□□□□□□□□□:client□
    %{
      peer_id: 1,                              # □□□□□□
      name: "Partner_STP_West",                # □□□□□□
      role: :client,                           # :client □□□□□□:server
□□□□□
      local_ip: {10, 0, 0, 1},                # □□ IP □□
      local_port: 0,                           # 0 = □□□□□□□
      remote_ip: {10, 0, 0, 10},              # □□□□□□ IP
      remote_port: 2905,                       # □□□□□□□□
      routing_context: 1,                      # M3UA □□□□□□
      point_code: 100,                         # □□□□□□□□
      network_indicator: :international     # :international □
:national
    },

    # □□□□□□ HLR□□□□□:client□
    %{
      peer_id: 2,
      name: "Local_HLR",
      role: :client,
      local_ip: {10, 0, 0, 1},
      local_port: 0,
      remote_ip: {10, 0, 0, 20},
      remote_port: 2905,
      routing_context: 2,
      point_code: 200,
      network_indicator: :international
    },

    # □□□□□ MSC □□□□□□□□□□□:server□
    # □□ :server □□□STP □□□□□□□
    %{
      peer_id: 3,
      name: "Remote_MSC",
      role: :server,                           # □□□□□□□
      remote_ip: {10, 0, 0, 30},              # □□□ IP
      remote_port: 2905,                       # □□□□□□□0 = □□□□□□□□□□
      routing_context: 3,
      point_code: 300,
      network_indicator: :international
```

```
    },

    # □□□□□□□□□□□□□□□□□□□□□□□□
    %{
      peer_id: 4,
      name: "Dynamic_Client",
      role: :server,
      remote_ip: {10, 0, 0, 40},           # □□□ IP
      remote_port: 0,                       # 0 = □□□□□□□□□□□□□□□□
      routing_context: 4,
      point_code: 400,
      network_indicator: :international
    }
  ]
```

□□□□□□

□□	□□	□□	□□
`peer_id`	□□	□	□□□□□□□□□□□
`name`	□□□	□	□□□□□□□□□□□□□□□□
`role`	□□	□	`:client`□□□□□ `:server`□□□□
`local_ip`	□□□□□□	□□□□□□	□□ IP □□□□□□□□□ `{10, 0, 0, 1}` □□□□□ SCTP □□□□ `[{10, 0, 0, 1}, {10, 0, 0, 2}]`
`local_port`	□□	□□□□□□	□□□□□0 □□□□□
`remote_ip`	□□□□□□	□	□□□□□□□□□□□□□□□□

□□□□□□□□□□

□□ □□□□□□□□□:server□□remote_port □□□□□□□□□□

- □□□□□□□□□remote_port: 2905□□□□□□□□□□□□□□□□□□□□
  - □□□□□□□□□□□□□□□□□□
  - □□□□□□□□□□□□□□□□□□
- □□□□□□remote_port: 0□□□□□□□□□□□□□□□□□
  - □□□□□□□□□□/□□□□□□□□□□
  - □□□□□ IP □□
  - □□□□□□□□□□

□□□

```
# □□□□□□ 192.0.2.10:2905□□□□□□□
%{
  peer_id: 1,
  name: "Strict_Peer",
  role: :server,
  remote_ip: {10, 5, 198, 200},
  remote_port: 2905,
  # ... □□□□□
}

# □□□□□ 192.0.2.10 □□□□□□□
%{
  peer_id: 2,
  name: "Flexible_Peer",
  role: :server,
  remote_ip: {10, 5, 198, 200},
  remote_port: 0,  # □□□□□□□□□□
  # ... □□□□□
}
```

M2PA □□□□

OmniSS7 □□ **M3UA** □ **M2PA** □□□□ SS7 □□□□□

□□□ M2PA□

M2PA□MTP2 □□□□□□□□□□□□ IETF □□□□□□□RFC 4165□□□□□□□ IP □□□□ SCTP □□ SS7 MTP3 □□□

M3UA □ M2PA□□□□□

□□	M3UA	M2PA
□□	□□□/□□□□ASP/SGW□	□□
□□	SS7 □ IP □□□□□	□□□□□□□
□□□□□□	□□□□ASPUP/ASPAC□	MTP2 □□□□□□□□□□□□□
□□□	□□□□□	24 □ BSN/FSN □□□□□□
□□□□	SS7 □ IP □□□STP	□□□□□□□□□□□
RFC	RFC 4666	RFC 4165

□□□□□□

□□□□□□□ **M3UA**□□□□□□□□□□ **M2PA**□

□□□□ M3UA□□□

M3UA □□□□□□□□□□□□□

- **STP** □□□□□□□□□□□□
- □□□□□□ SS7 □□□□□ IP □□□□□
- □□□□□□□□ HLR□MSC□SMSC □□□□□□□□□□□□ STP

- □□□□□□**SGW**□□□□□

□□	□	□□
`protocol`	`:m2pa`	□□ M2PA □□□□□□□□□□□□ `:m3ua`□
`role`	`:client` □ `:server`	□□□□
`local_port`	□□	□□ SCTP □□□□□ M2PA □□□ **3565**□
`remote_port`	□□	□□ SCTP □□□□□ M2PA □□□ **3565**□
`point_code`	□□	□□□□
`adjacent_point_code`	□□	□□□□□□□□M2PA □□□
`send_sltm`	□□	□□ SLTM □□□□□□ SLTA □□□
`network_indicator`	□□	`:international` □ `:national` - □□□□□□□□□□

□□□M2PA □□ **3565** □□ □□□□□□□□ M3UA □ 2905 □□□□□□

SLTM □□

SLTM□□□□□□□□□□ □ **SLTA**□□□□□□□□□□ □ MTP3 □□□□□□□□ M2PA □□□□ READY □□□□ □□□□□□□□□ ITU-T Q.707□□□□□ SLTM□□□□□□ SLTA □□□□□□□□□□□□□

SLTM □□

`send_sltm` □□□□□□□□□ SLTM □□□

`send_sltm` □	□□
`true`	□□□□ READY □□□ SLTM□□□ SLTA
`false`	□□□□□□ SLTM□□□ SLTA
□□□□□□□□	□□ Q.707□SCTP □□□□□ SLTM□SCTP □□□□□

□□□□□□□ **Q.707**□□

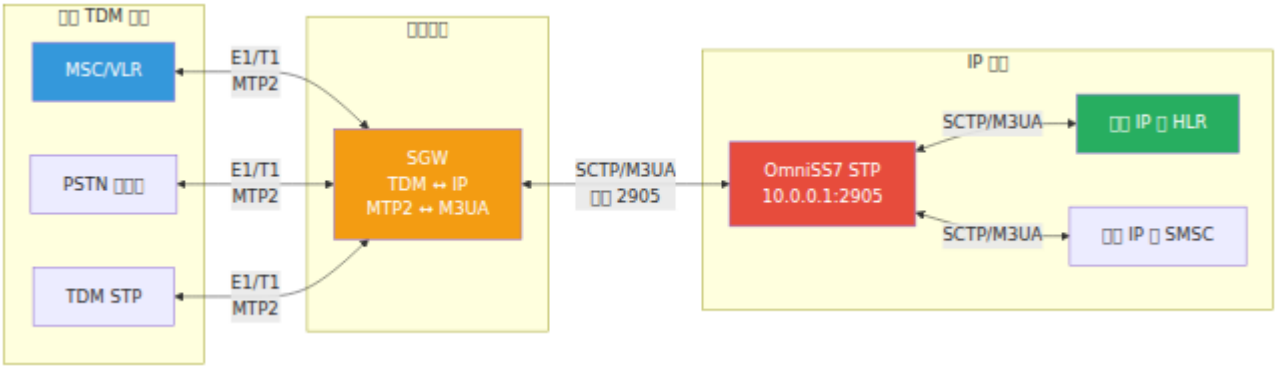
- □□ `initiate_connection: true`□SCTP □□□/□□□□→ □□□□□□□□ SLTM
- □□ `initiate_connection: false`□SCTP □□□/□□□□→ □□□□ SLTM

□□□ **SLTM** □□□

□□□□□□□ Q.707 □□□□□□□□□□□□□□

```
# □□□□□□□□□□□□□□ SLTM□□□ SCTP □□□□
%{
  peer_id: 100,
  name: "Partner_STP",
  protocol: :m2pa,
  role: :client,
  local_ip: {10, 0, 0, 1},
  local_port: 3565,
  remote_ip: {10, 0, 0, 2},
  remote_port: 3565,
  point_code: 7415,
  adjacent_point_code: 15528,
  network_indicator: :international,
  send_sltm: true  # □□□□□□□□ SCTP □□□□□□□□ SLTM
}
```

SLTM □□□



□□ **SLTM** □□

□□□□□□□□ **READY** □□□□□□□□

□□□□□□□□□□□□ SLTM□□□□□□□□□□

```
"waiting for peer to send SLTM"
```

□□□□□ □□□□□ `send_sltm: true` □□□□□□

□□□□□ **SLTM** □□□□ **SLTA**

□□□□□□□

1. `adjacent_point_code` □□□□SLTM □□□□□□□□□ DPC□
2. □□□□□□□□□□`international` □ `national`□
3. □□□□□□□□□□□□□□□□

□□□□□ □□ `adjacent_point_code` □ STP □□□□□□□□□ `sctp_handler.point_code` □□□□□

M2PA □□□□

M2PA □□□□□□□□□□□□□□□□

1. **Down** - □□□□□
2. **Alignment** - □□□□□□□□ 1 □□
3. **Proving** - □□□□□□□□ 2 □□
4. **Ready** - □□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□ Web UI □□ M2PA □□

Web UI □□ □□ □□□□□□ M2PA □□□□□□□□□□□□

1. □□ □□□□□□
2. □□ “□□” □□
3. □□ “□□□□□□”
4. □□□□□□□□□□□ “M2PA (RFC 4165)”
5. □□ □□□□□□
   - □□□□□□□□□□□□□□□
   - □□□M2PA
   - □□□□□□□□□□□□
   - □□□□□□ PC□
   - □□/□□ IP □□
   - □□/□□□□□□□□ M2PA □ 3565□
   - □□□□□□□□□□□□□□□
6. □□ “□□□□”

□□□□□□□□□□□□□□□□□□□□□□□□

- □□ - M3UA □□
- □□ - M2PA □□

M2PA □□□□

M2PA □□□ OmniSS7 □□□□□□□□□□□□

- □□□□□□M2PA □ M3UA □□□□□□□□
- □□□□□□□□□□ M2PA □□□□□□□□
- □□□□□□□M2PA □ M3UA □□□□□□□□□□□□□□□
- □□□□□□□□□□□□ M2PA □□□□□□□□ M3UA□□□□□□

M2PA □□

M2PA □□□□□ Prometheus □□□□□□□□□□□□□□□

□□□□□

- `m2pa_messages_sent_total` - □□□□□□□ MTP3 □□□□
- `m2pa_messages_received_total` - □□□□□□□ MTP3 □□□□
- `m2pa_bytes_sent_total` - □□ M2PA □□□□□□□
- `m2pa_bytes_received_total` - □□ M2PA □□□□□□□

□□□□□□□□`link_name`□`point_code`□`adjacent_pc` □□

□□□□□□□

- `m2pa_link_state_changes_total` - □□□□□□□DOWN → ALIGNMENT → PROVING → READY□
  - □□□`link_name`□`from_state`□`to_state`

□□□□□

- `m2pa_errors_total` - □□□□□□□□□
  - `decode_error` - M2PA □□□□□
  - `encode_error` - M2PA □□□□□
  - `sctp_send_error` - SCTP □□□
  - □□□`link_name`□`error_type`

□□□□□

- Prometheus □□□`http://your-server:9090/metrics`
- □□□□□□□□□□□□

M2PA □□□

1. □□□□□□□ 3565 □□□□ M2PA□□□□□□
2. □□□□□□□□□□□□□□□□□□□
3. □□□□□□□□□□ SCTP□IP □□ 132□
4. □□□□□□□□□□□□□□□□□□

5. □□□□□□□□□□□□□□□□□□□□□□□□□□□□
6. □□□□□□□□□□□□□□□□□□□□□□□□□

M2PA □□□□□

M2PA □□ **SCTP.SocketHandler** □□□□□□□ □□ M2PA □□□□□□□ SCTP.SocketHandler □ □□□□□□□□□□□□□□□□□□□□□□□□□□□□ SCTP □□□

□□□

- SCTP.SocketHandler □□□□□□□□
- □□□□□□□□□ M2PA □□□□□□□□□

□□□

```
# □□ SCTP.SocketHandler
sctp_handler: %{
  enabled: true,
  local_ip: {10, 179, 4, 10},
  local_port: 3565,
  point_code: 100
}

# M2PA □□□□□□□□□□□□
peers: [
  %{
    peer_id: 1,
    name: "M2PA_Link_1",
    protocol: :m2pa,
    role: :client,
    local_ip: {10, 179, 4, 10},
    local_port: 3565,
    remote_ip: {10, 179, 4, 20},
    remote_port: 3565,
    point_code: 100,
    adjacent_point_code: 200
  },
  %{
    peer_id: 2,
    name: "M2PA_Link_2",
    protocol: :m2pa,
    role: :client,
    local_ip: {10, 179, 4, 10},
    local_port: 3565,           # □□□□□□□□□□□□□
    remote_ip: {10, 179, 4, 30},
    remote_port: 3565,
    point_code: 100,
    adjacent_point_code: 300
  }
]
```

SCTP □□□

- □□□□□□ `unordered` □□□
- PPID 5□□□ RFC 4165 □ M2PA □□□□

□□□□□□

□□□□□□□ MTP3 □□□ □□□□ **(DPC)** □□□□□

□□ SS7 □□□□□□□

□□□□□ SS7 □□□□□□□□□□□□□□□□□□□□□□

□□□□□

```
┌─────────────────────────────────────────┐
│  □□□ (SCCP/TCAP/MAP)                    │
├─────────────────────────────────────────┤
│  MTP3 □                                 │ ← □□□□□□□
│  - □□□□: DPC, OPC, SLS                  │ ← □□ STP □□
│  - □□□□□□□ (SIO)                        │
├─────────────────────────────────────────┤
│  M3UA □ M2PA (□□□)                      │ ← □□□□
│  - □□□□ (□□ MTP3)                       │
│  - □□□□ (DUNA/DAVA)                     │ ← □□□□
├─────────────────────────────────────────┤
│  SCTP (□□)                              │
└─────────────────────────────────────────┘
```

□□□□□□□□

1. **MTP3** □□□□□□□□□□
   - □□ MTP3 □□□□□□□DPC□OPC□
   - □□□ M3UA □□□□□□□□□□ 528□□
   - □□□ M2PA □□□□□□□□
   - **STP** □□□□ **DPC** □□□□□□□
   - □□□□□□□□□□□□□□□
2. **M3UA** □□□□□□□□□□□□□
   - □□□ M3UA □□□□□□□DUNA□DAVA□SCON□DUPU□
   - □□□□□□□□□□□□□□□□□

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

STP □□□□□□□□

- □□ **M3UA DATA** □□□STP □□□□□□□□□□□□ 528□□□□ MTP3 □□□□□□□□ MTP3 □□□□□□DPC□OPC□SLS□□□□□ MTP3 □□ DPC □□□□□□
- □□ **M2PA** □□□□□□□□STP □ M2PA □□□□□□□□□□□ MTP3 □□□□□□□□ MTP3 □□□□□□□DPC□
- **M3UA** □□□□□□□□□□□□□□□DUNA□DAVA□SCON□□ M3UA □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□

□□□□□□□ `config/runtime.exs`□

```
config :omniss7,
  m3ua_routes: [
    # □□□□□□□□□ PC 100 □□□ 1□□□ STP□
    %{
      dest_pc: 100,                    # □□□□
      peer_id: 1,                      # □□□□□
      priority: 1,                     # □□□□□□□□□□□□□□□□
      network_indicator: :international
      # mask: 14                       # □□□□□□□ 14□□□□□□
    },

    # □□□□□□□□□ PC 200 □□□ 2□□□ HLR□
    %{
      dest_pc: 200,
      peer_id: 2,
      priority: 1,
      network_indicator: :international
    },

    # □□□□□□□□PC 300 □□□□□□□□□□□
    %{
      dest_pc: 300,
      peer_id: 3,                      # □□□
      priority: 1,
      network_indicator: :international
    },
    %{
      dest_pc: 300,
      peer_id: 4,                      # □□□□□□□□□□□□□□□
      priority: 2,
      network_indicator: :international
    }
  ]
```

□□□`mask` □□□□□□□□□□ `14`□□□□□□□□□□□□□□□□□□□□□□□□□□□ `mask`□□□□□□□□□□□□□

□□□□

1. STP □□ M3UA DATA □ M2PA □□□□□□
2. STP □□□□□□M3UA□□□□□□□M2PA□□□□□ **MTP3** □□
3. STP □ MTP3 □□□□□□ □□□□ **(DPC)**

4. □□□□□□□□□ DPC□□□□□□□
5. □□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□□□ □□□□□□□□ □□□
6. □ MTP3 □□□□□ M3UA DATA □ M2PA □□□□□□□□□□□□□□□
7. □□□□□□□□□□□□
8. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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□□□ 14 □□□□□ 0-16383□□□□□□□□□□□□□□□□□□□□□□□ `/14`□□□□□□□□□□ □□□□ □□□□ □□□□ □ □□□□

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□□□□□□□□□ PC □□□□□□□ DPC □□□□□□□ □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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□□	□□□□□□	□□
`/14`	1 PC□□□□□□	□□□□□□□□□
`/13`	2 PCs	□□□
`/12`	4 PCs	□□□
`/11`	8 PCs	□□□
`/10`	16 PCs	□□□□
`/9`	32 PCs	□□□□
`/8`	64 PCs	□□□□
`/7`	128 PCs	□□□□
`/6`	256 PCs	□□□
`/5`	512 PCs	□□□
`/4`	1,024 PCs	□□□□□
`/3`	2,048 PCs	□□□□□
`/2`	4,096 PCs	□□□□□
`/1`	8,192 PCs	□□□□□ PCs
`/0`	16,384 PCs	□□ PCs□□□/□□□□□

□□□□□□

□□□□□□□□□□□`mask` □□□ □□□□□□□□□□□□□ `14`□□□□□□□

□□ **1**□□□□□□□□□□□

```
# □□□□□□□□□□□□□□□□ PC□
%{
  dest_pc: 1000,
  peer_id: 1,
  priority: 1,
  network_indicator: :international
}
# □□□□□□ 14 - □□□□□ PC 1000

# □□□□□□□□□□□□
%{
  dest_pc: 1000,
  peer_id: 1,
  priority: 1,
  mask: 14,                                # □□□□□□□
  network_indicator: :international
}
# □□□□□ PC 1000
```

□□ 2□□□□

```
%{
  dest_pc: 1000,
  peer_id: 2,
  priority: 1,
  mask: 12,                                # □□ 4 PCs
  network_indicator: :international
}
# □□□PC 1000□1001□1002□1003
```

□□ 3□□□□□

```
%{
  dest_pc: 1000,
  peer_id: 3,
  priority: 1,
  mask: 8,                                  # □□ 64 PCs
  network_indicator: :international
}
# □□□PC 1000-1063□64 □□□□□□
```

□□ **4**□□□/□□□□

```
%{
  dest_pc: 0,
  peer_id: 4,
  priority: 10,                             # □□□□□□□□□
  mask: 0,                                  # □□□□ PCs
  network_indicator: :international
}
# □□□□□□□□□0-16383□
# □□□□□□□□□□/□□□□
```

□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  m3ua_routes: [
    # □□□□□□□ PC 1000□□□□□□□□
    %{
      dest_pc: 1000,
      peer_id: 1,
      priority: 1,
      network_indicator: :international
      # mask □□□ 14□□□□□□□
    },

    # □□□□□□□ PCs 1000-1063
    %{
      dest_pc: 1000,
      peer_id: 2,
      priority: 1,
      mask: 8,                          # □□ 64 □ PC
      network_indicator: :international
    },

    # □□/□□□□□□□□□□□ PC
    %{
      dest_pc: 0,
      peer_id: 3,
      priority: 10,                     # □□□□
      mask: 0,                          # □□□□ PC
      network_indicator: :international
    }
  ]
```

DPC 1000 □□□□□□

1. □□ mask `/14` □□□PC 1000 □□□□□ - □□□□□□□
2. □□□ mask `/8` □□□PC 1000-1063 □□□ - □□□□□□□□□
3. □□□ mask `/0` □□□□□ PC□ - □□□□□□□□□

DPC 1015 □□□□□□

1. □□□ mask `/14` □□□□ PC 1000□
2. □□ mask `/8` □□□PC 1000-1063 □□□ - □□□□□□□□□
3. □□□ mask `/0` □□□□□ PC□ - □□□□□□□□□

DPC 5000 □□□□□□

1. □□□ mask `/14` □□
2. □□□ mask `/8` □□
3. □□ mask `/0` □□□□□ PC□ - □□□□□□□□□□□□□□

□□□□

1. □□□□□□□ **`mask`**□□□□□□□□□□□□□□□□ `mask` □□□□□□ `/14`□
2. □□□□□□□□□ **`/14`**□□□□□□□□□□□□□□□□□□□□□□□□□□ `mask: 14`
3. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `/0` □ `/13`
4. □□ **`/0`** □□□□□□□□□□□□□□□□□□□□□□□□□□□□□
5. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
6. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□GT□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□ IMSI □□□□□□□□□□□□□□□□/□□□□□□□□□□□□□□□□□□□□ □□□□ NAT □□□

□□□□

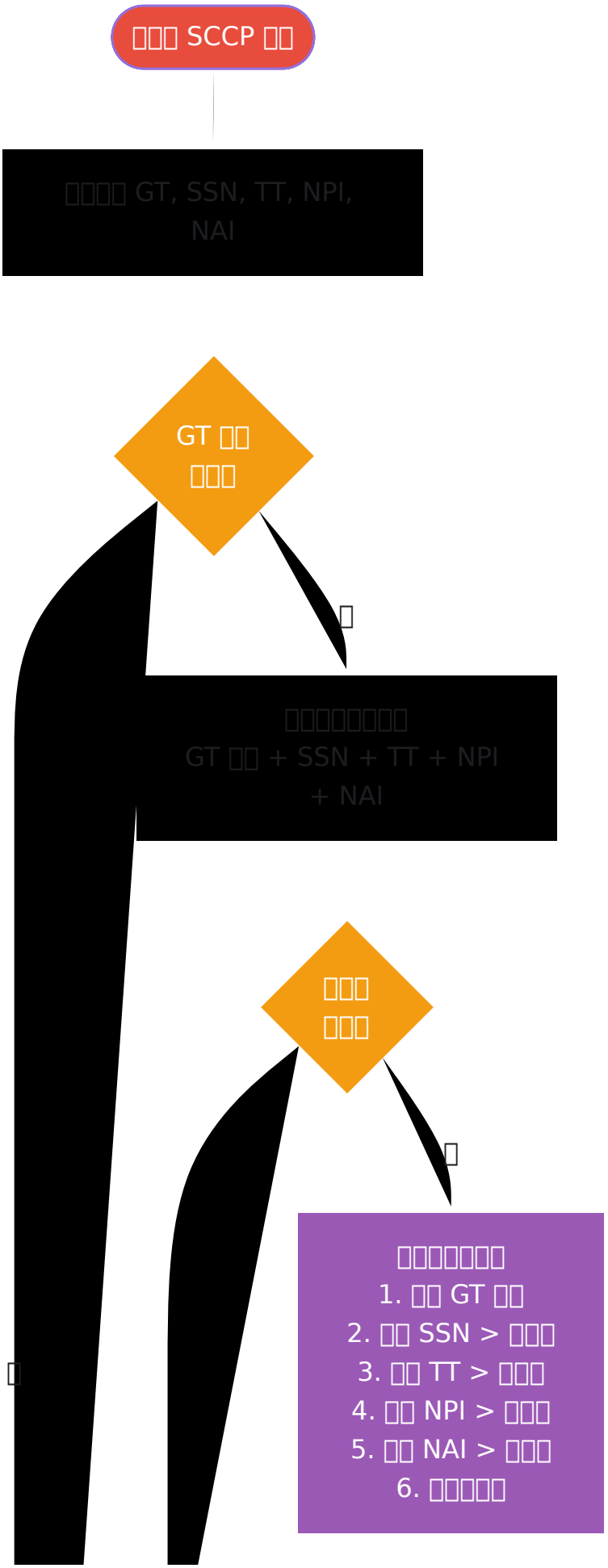
- □□ GT □□□□ `config/runtime.exs` □□□ `enable_gt_routing: true`

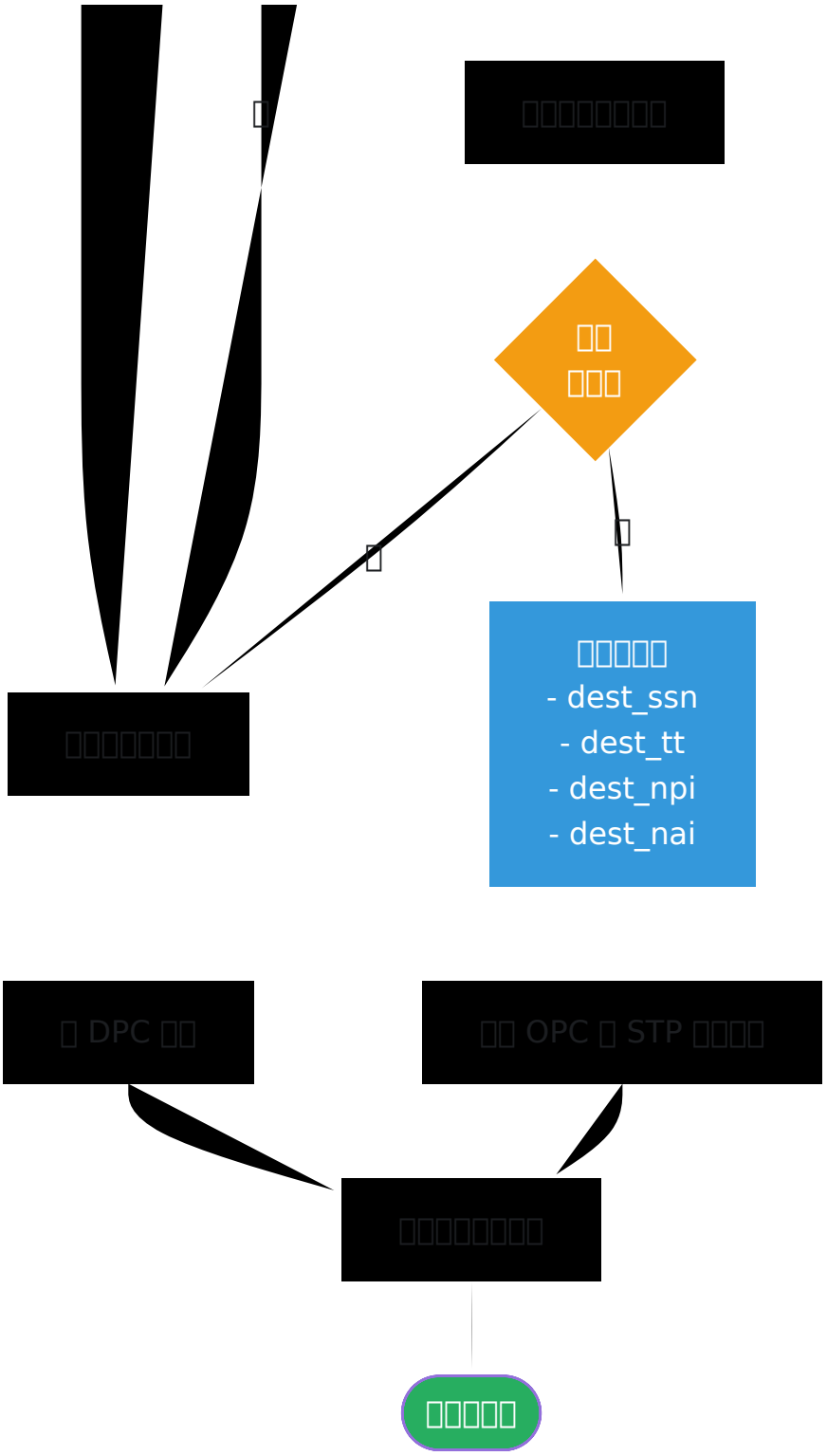
GT □□□□

```
config :omniss7,
  # □□ GT □□
  enable_gt_routing: true,

  m3ua_gt_routes: [
    # □□□□□□□□□□□ 44□□□□□□□ 1
    %{
      gt_prefix: "44",                # □□□□□□□□□□
      peer_id: 1,                     # □□□□□
      priority: 1,                    # □□□□□□□□□□□□□□□□
      description: "□□□□"          # □□□□□□□
    },

    # □□□□□□□□□ 1□□□□□□□ 2
    %{
      gt_prefix: "1",
      peer_id: 2,
      priority: 1,
      description: "□□□□"
    },

    # □□□□□□□□□ 447 □□□□□□□□□
    %{
      gt_prefix: "447",               # □□□□□□□□□
      peer_id: 3,
      priority: 1,
      description: "□□□□□□"
    },

    # SSN □□□□□□□□
    %{
      gt_prefix: "555",
      source_ssn: 8,                  # □□□ SSN = 8□SMSC□□□□
      peer_id: 4,
      dest_ssn: 6,                    # □□□ SSN □□□ 6□HLR□
      priority: 1,
      description: "61 □□□ SMS □□"
    }
  ]
```

GT □□□□

GT □□□□□□□□□□□□□□


□□□ SCCP □□
□□□□ GT, SSN, TT, NPI, NAI
GT □□ □□□
□
□□□□□□□□□
GT □□ + SSN + TT + NPI + NAI
□□□ □□□
□
□□□□□□□□
1. □□ GT □□
2. □□ SSN > □□□
3. □□ TT > □□□
4. □□ NPI > □□□
5. □□ NAI > □□□
6. □□□□□
□



□□□□□□

1. □□□□□□□□□STP □□□□□ GT □□□□□□□□□□□□□□□□□□□□□□□□□□□□
    - □□□GT "447712345678" □□ "44" □ "447"□□ "447" □□□□□□□□□□
2. **SSN** □□□□□□□□□

- □□□□□ `source_ssn`□□□□ SCCP □□□ SSN □□□□□□□□□
- □□ `source_ssn` □ `nil`□□□□□□□□ SSN□□□□□

3. **TT/NPI/NAI** □□□□□□□

- □□□□□ `source_tt`□`source_npi` □ `source_nai`□□□□□□□□□□□□□□
- `nil` □□□□□□□□□□□□□□

4. □□□□□□□□□

- □□□□□□□□□□□□□□□□□□□
- □□□□□□GT □□□□ → SSN → TT → NPI → NAI → □□□□

5. □□□□□□□□□□

- □□□□□ `dest_ssn`□`dest_tt`□`dest_npi` □ `dest_nai`□STP □□□□□□□□

    - □□□□□□□□□□□□□□□□
6. □□□□□□□□
    - □□□□ GT □□□□□□STP □□□□□□□ DPC □□□□□□□

□□ GT □□□□□□□□□□NPI □ NAI

□□ GT □□□ SSN □□□□STP □□□□□□ SCCP □□□□□□□□□□□□□□□□□

- □□□□□□**TT**□□□□□□□□□□□□□□□□
- □□□□□□□□□□**NPI**□□□□□□□□□□□□□□□ISDN□□□□□□□□
- □□□□□□□□□□**NAI**□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□

- `source_tt`□□□□□□□□□□□□□□□□□
- `source_npi`□□□□□□□□□□□□□□□□□□□□
- `source_nai`□□□□□□□□□□□□□□□□□□□□
- `nil` □ = □□□□□□□□□□□□

□□□□□□□□□□

□□□□□□□□□□□□□□□□□

- `dest_tt`□□□□□□□□□□□□
- `dest_npi`□□□□□□□□□□□□□□□
- `dest_nai`□□□□□□□□□□□□□□□
- `nil` □ = □□□□□□□□□□□□□

□□□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1. □□ GT □□□□
2. □□□ SSN □□□□□ SSN
3. □□□ TT □□□□□ TT
4. □□□ NPI □□□□□ NPI
5. □□□ NAI □□□□□ NAI
6. □□□□□□□

□□□

```
config :omniss7,
  enable_gt_routing: true,

  m3ua_gt_routes: [
    # □□ 1□□□□□□□□□□□
    %{
      gt_prefix: "44",
      peer_id: 1,
      source_tt: 0,      # □□ TT=0□□□□
      dest_tt: 3,        # □□□ TT=3□□□□
      priority: 1,
      description: "□□□□□TT 0→3 □□"
    },

    # □□ 2□□□□□ NPI □□□ NAI
    %{
      gt_prefix: "1",
      peer_id: 2,
      source_npi: 1,     # □□ NPI=1□ISDN/□□□
      source_nai: 4,     # □□ NAI=4□□□□
      dest_nai: 3,       # □□□ NAI=3□□□□
      priority: 1,
      description: "□□□□□□□□→□□ NAI"
    },

    # □□ 3□□□ SSN □□□□□□
    %{
      gt_prefix: "33",
      source_ssn: 8,     # □□ SMSC □□
      source_tt: 0,      # □□ TT=0
      dest_ssn: 6,       # □ SSN □□□ HLR
      dest_tt: 2,        # □□□ TT=2
      dest_npi: 1,       # □□ NPI=1□ISDN□
      dest_nai: 4,       # □□ NAI=4□□□□
      peer_id: 3,
      priority: 1,
      description: "□□ SMS□□□□□□"
    },

    # □□ 4□□□□ TT□□□ NPI
    %{
      gt_prefix: "49",
      source_tt: nil,    # □□□□ TT□□□□□
```

```
      source_npi: 6,     # □□ NPI=6□□□□
      dest_npi: 1,       # □□□ NPI=1□ISDN□
      peer_id: 4,
      priority: 1,
      description: "□□□□□□□□□□□"
    }
  ]
```

□□ TT/NPI/NAI □

□□□□□**TT**□□

- `0` = □□
- `1` = □□
- `2` = □□
- `3` = □□□□

□□□□□□□□□**NPI**□□

- `0` = □□
- `1` = ISDN/□□□E.164□
- `3` = □□□X.121□
- `4` = □□□F.69□
- `6` = □□□□□E.212□

□□□□□□□□□**NAI**□□

- `0` = □□
- `1` = □□□□
- `2` = □□□□□□□□□
- `3` = □□□□□□
- `4` = □□□□

□□□□□□

□□□□□□□

- GT: "447712345678"

- SSN: 8
- TT: 0
- NPI: 1
- NAI: 4

□□□□□□□□□

```
# □□ A□□□□ TT
%{gt_prefix: "447", peer_id: 1, priority: 1}

# □□ B□□□ TT
%{gt_prefix: "447", source_tt: 0, peer_id: 2, priority: 1}

# □□ C□□□ TT + NPI
%{gt_prefix: "447", source_tt: 0, source_npi: 1, peer_id: 3,
priority: 1}
```

□□□□□□□ C□□□□□□□ GT + TT + NPI□

□□□□□□ C □ `dest_tt`□`dest_npi`□`dest_nai` □□□□□□□□□□□□□□□

GT □□□□

□□ GT	□ SSN	TT	NPI	NAI	□□□□	□□
447712345678	6	-	-	-	"447" → □□□ 3	□□□□□□□
441234567890	6	-	-	-	"44" → □□□ 1	□□□□□□□□□□□□□□□□
12125551234	6	-	-	-	"1" → □□□ 2	□□□□□□□□□□
555881234567	8	-	-	-	"555"□SSN 8□→ □□□ 4	GT + SSN □□□□□ SSN □□□ 6
555881234567	6	-	-	-	"555"□SSN □□□□→ □□□ X	GT □□□□□ SSN □□
441234567890	6	0	1	4	"44"□TT=0□ → □□□ 1	GT + TT □□□□ TT □□□ 3
12125551234	8	0	1	4	"1"□TT=0□ NPI=1□ NAI=4□	□□□□ GT+TT+NPI+NAI □□

TT/NPI/NAI □□□□□□□□

1. □□□□□□□□
   - □□□□□□□□□□□□□□□□□□□□
   - □□□□□□□□□□□□□□□□□□
   - □□□□□□□□□□ TT=0 □□□□□□□□□□□□ TT=1
2. □□□□
   - □□□□□□□□□□□□□□□□□□□□□□□□□□□□

- □□□□□□□□□□NPI=6□□□□ PSTN□NPI=1□

3. □□□□□□□

   - □□□□□□□□□□□□□□□□ NAI □
   - □□□□□□□□□□□□NAI=4□□□□□□□□□□NAI=3□□□□□□□□

4. □□□□□□□

   - □□□□□□□□□□□□□□□□□□
   - □□□TT=0 □□□□□□ A□□TT=2 □□□□□□ B

5. □□□□□□

   - □□□□□□□□□□□□□□□□□□□□□□
   - □ STP □□□□□□□□□□□□□

SCCP □□□□

□□□□□□□□□□STP □□□ SCCP □□□ □□ STP □□□□□□□□□□□**UDT**□0x09□□**XUDT** □0x11□□ **LUDT**□0x13□□

□□□□□□□□ SSN □□

□□□□□□□STP □□□□□□□□□□□□□□□□□ **GT** □□□□□ GT □□□□□□□□□□□□□□□□□ GT □□□□□□□□□□□*GT □□*□□□□□□□□□ *□□ GT □□*□ □□ ITU-T Q.714 §2.4□□□□□□□□□□□□□□□□□□ □□□ GT□□□□□□□□□□□□□□□ □□□ SSN □□□□□□□□□□□□□□□□□□□□□□□□□□ GT□□□□ SSN □□□□□□□□□□□□□□□□□□□□□□□□ □□□ □□□□□□□□ GTT □ MSS□□□□□□□ `providerAbort(abnormalDialogue)`□

□□ *□* STP □□□ □□□□□□□□□□□□□□□□□ □□□ GTT □ SSN □□□□□□□□□□□□□□□□□□□ SSN□□□□□ GT □□□□ `route_on_ssn: true` □□□□□□□□□□□□□□□

```
m3ua_gt_routes: [
  # □□□□□ - □□□□□□ GT□□□□□□□□□□ GTT
  %{gt_prefix: "44", peer_id: 2, priority: 1, description: "□□□
□"},

  # □□□□□□ SSN □□□□ - □□□□□□□ SSN
  %{
    gt_prefix: "1234",
    peer_id: 1,
    priority: 1,
    dest_ssn: 8,
    route_on_ssn: true,
    description: "□□□□□□ SSN □ MSC"
  }
]
```

□□□□□□□□□□□ API □□□`route_on_ssn` □ `POST /api/routing/gt-routes` □□□□□□□ `false`□□□□□□□□□□□□□□□□□□□□ GT □□□□□□□□□□□□□□ SSN□ITU-T Q.714 §2.4□□

□□□□□□□□□□□XUDT / LUDT□

XUDT □ LUDT □□□□□□□ **SCCP** □□□□□□□□□□□ SCCP □□□□□□□□□□□□□□□□□□□□

□□□□	□□□
UDT (0x09)	UDTS (0x0A)
XUDT (0x11)	XUDTS (0x12)
LUDT (0x13)	LUDTS (0x14)

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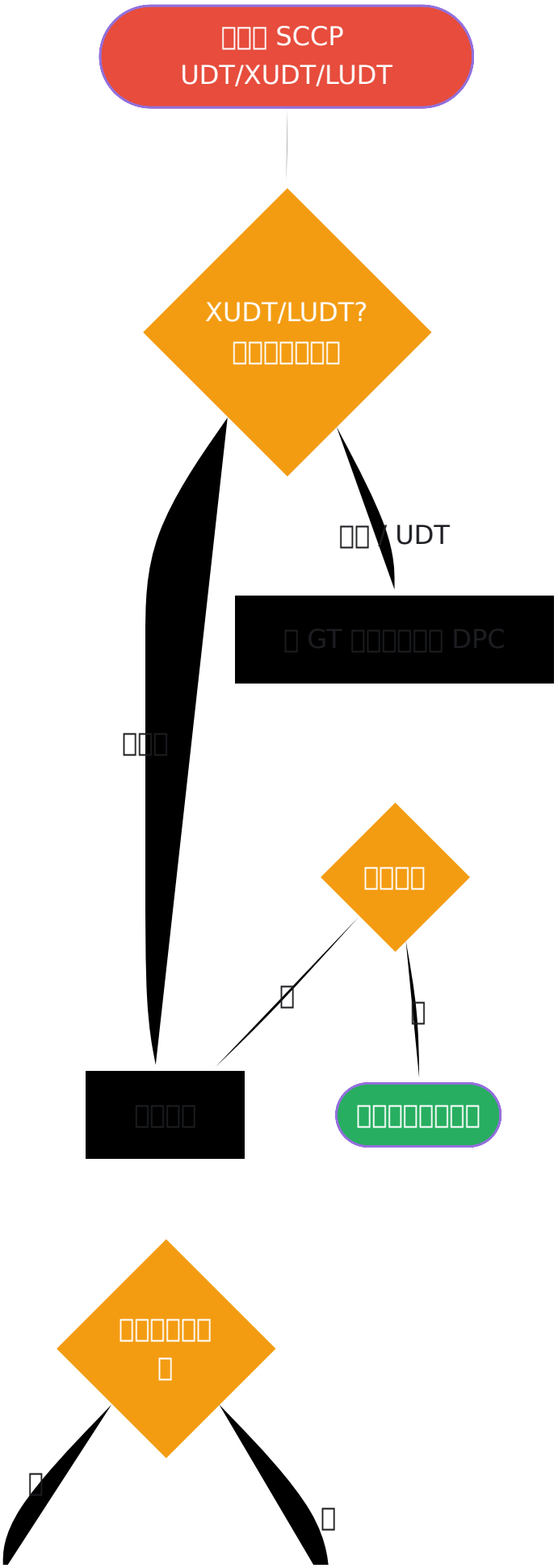
□□□ SCCP
UDT/XUDT/LUDT
XUDT/LUDT?
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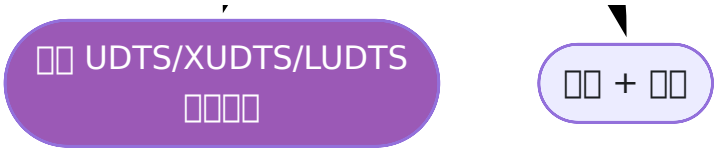

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STP □□ MTP3 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ ITU-T Q.704 §13□□□□□□□ `m3ua_dest_state` Mnesia □□□□□□□□□□□□□□□ □□□□□□□□□□

TFP / TFA / TFR □□

□□	□□	□ **STP** □□□□□
TFP□□□□□□□	□□□□□□□□□□□□□□□	□□□□□□□ `:prohibited`
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TFR□□□□□□□	□□□□□□□□□□□□□□□□	□□□□□□□ `:restricted`

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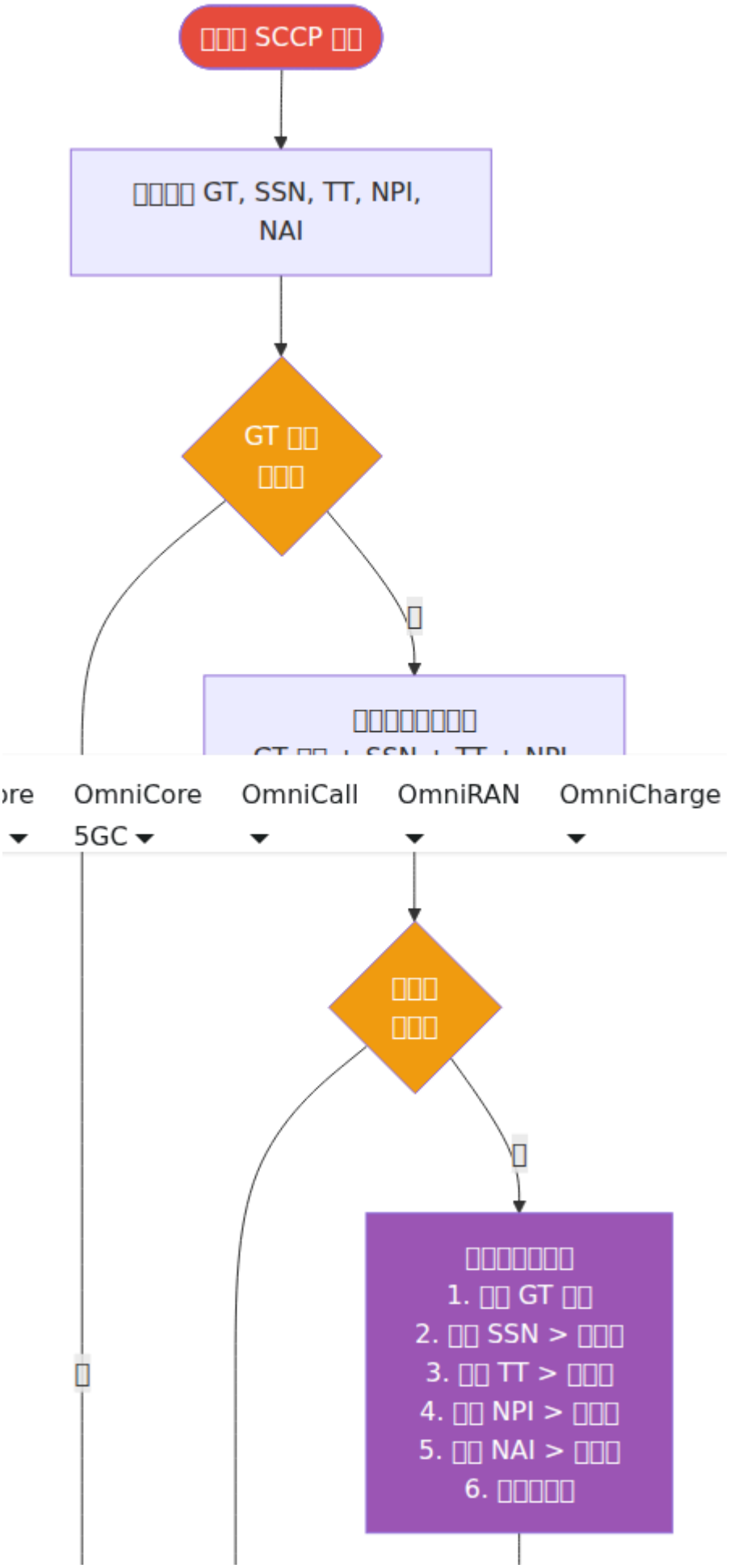
- □□□□□□□□□□STP □□□□□□□□□□□□□□ □□□□ □□□□□□□□□□□□□□ `{:error, :prohibited}`□□□□□□□□□□□□Q.704 §13.2.3□□ □□□□ `m3ua_stp_routing_failures_total{reason="prohibited"}`□
- **DAUD**□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□“□□”□□ blanket□□□□□□□□□□ **DAVA** □□□□□□ □□□□□□□□□□□□□□ **DUNA** □RFC 4666 §3.4.3□□


□□□ SCCP □□
□□□□ GT, SSN, TT, NPI,
NAI
GT □□
□□□
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□□□□□□□□□
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OmniCore
5GC
OmniCall
OmniRAN
OmniCharge
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1. □□ GT □□
2. □□ SSN > □□□
3. □□ TT > □□□
4. □□ NPI > □□□
5. □□ NAI > □□□
6. □□□□□
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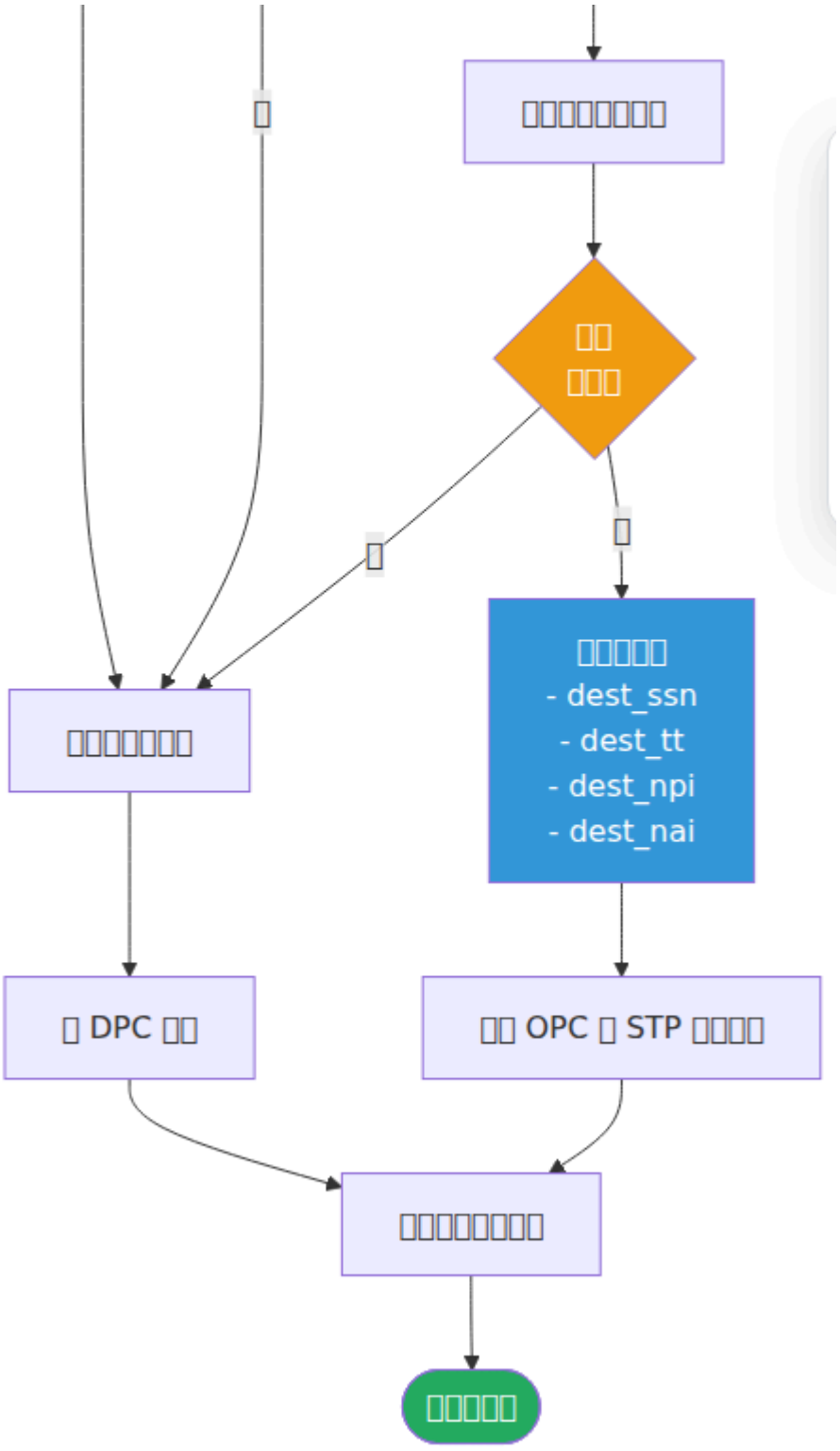

□□□□□SCCP □□□□

□□□□□□□ STP □□□□□□□□□□□□□□□□□□□□□□□□□□□□STP □□□□□□□□□□□□□□□□□□□□

□□□□ M3UA □□□□□

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□□□□	□□□□□□□□□
OPC	□□□□
DPC	□□□□□
□□□□□	MTP3 SI
□□□ GTA □□	SCCP □□□□□□□□□□□□□□
□□□ GTA □□	SCCP □□□□□□□□□□□□□□
SSN	SCCP □□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□`allow` □ `deny`□□□□□□□□□□□□□□□□□□□□ □□□□□□`config :omniss7, :screening_default_action`□□□□□ `:allow`□□

□□□□□□□□ □□□□□□□□□□ `m3ua_stp_routing_failures_total{reason="screened"}`□□ □□□ UDTS/□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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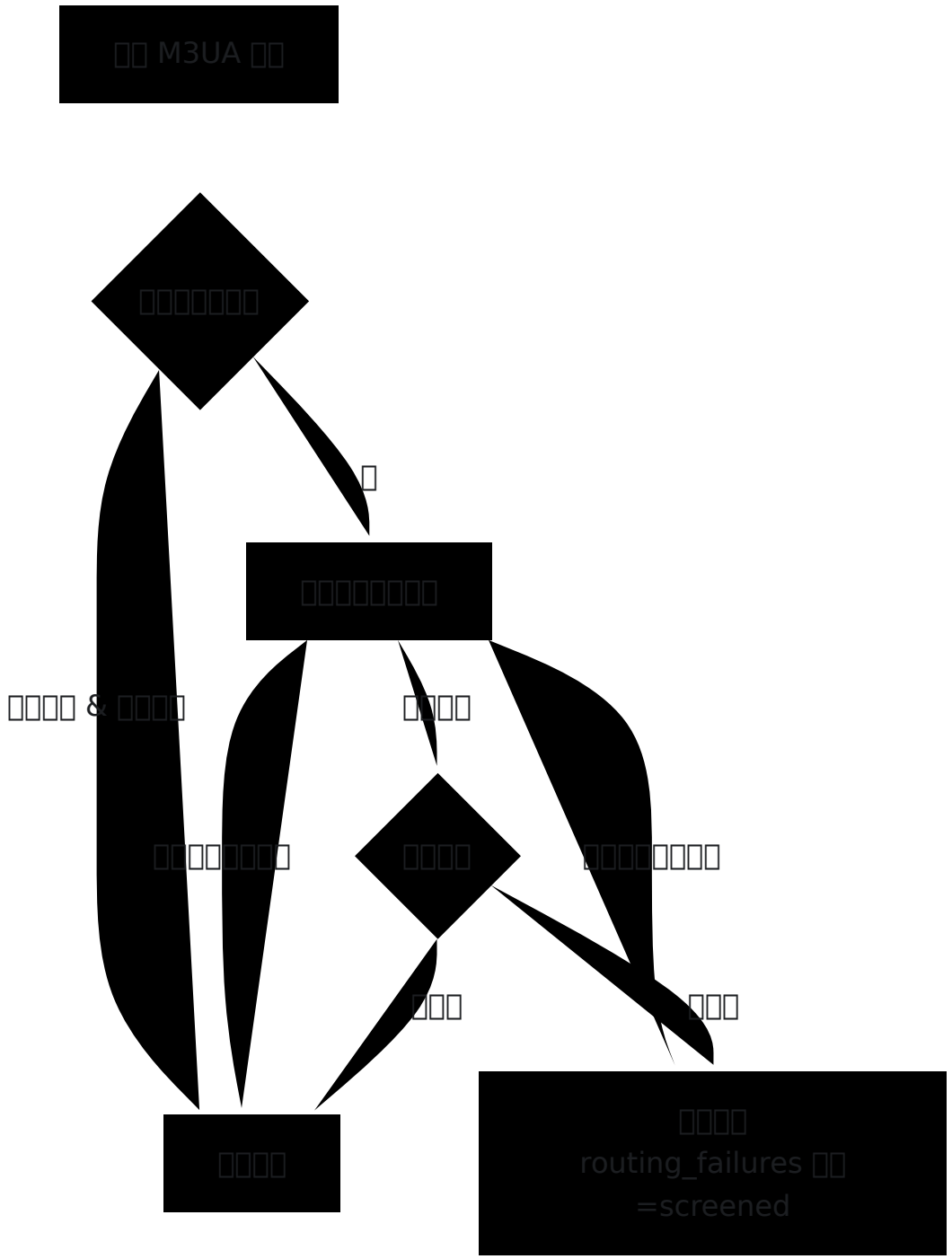

□□ `:allow`□□□□□□□□□□□□□□□□□□□□□□ `:deny`□□□□□□□□□□□□□□
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□□	□□	□□□	□□
`screening_default_action`	`:allow` | `:deny`	`:allow`	□□□□□□□□□□□□□□□□□□□□ `:deny` □□□□□□□□□□□□ □□□□□

```
config :omniss7,
  # □□□□□□□□□□□□□□□□□□
  screening_default_action: :deny
```

□□□□□ `ss7_screen_rule` Mnesia □□□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  m3ua_routes: [
    # □□□□□
    %{
      dest_pc: 100,
      peer_id: 1,
      priority: 1,
      network_indicator: :international,
      enabled: true  # □□□□□□□□□□□□□□□□□□□□□□□□
    },

    # □□□□□□□□□□□□□□□□□□□□
    %{
      dest_pc: 200,
      peer_id: 2,
      priority: 1,
      network_indicator: :international,
      enabled: false  # □□□□□□
    }
  ],

  m3ua_gt_routes: [
    # □□ GT □□
    %{
      gt_prefix: "44",
      peer_id: 1,
      priority: 1,
      description: "□□□□ - □□□□",
      enabled: false
    }
  ]
```

□□□□□

- □□□□□ `enabled`□□□□□□□□□ `enabled: true`
- □□□□□□□□□□□□□□□□□□□□
- □□ Web UI □□□□□□□□/□□□□□□□□□□□

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- □□□□□□□□□

- □□□□□□□
- A/B □□□□□□□□□□
- □□□□□□□□□

DROP □□□□□□□□□

DROP □□□`peer_id: 0`□□□□□□□□□

3. □□ **INFO** □□□`"DROP route matched for DPC 999"` □ `"DROP route matched for GT 999"`
4. □□□□□□ `{:error, :dropped}`

□□□□□ □□□□□□□ INFO □□□□□□□□□□□□□□□□□□

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DROP □□□□□□□□□□□ □□□□□ - □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□

1. □□□□□□□□□□□□□ □□ **DROP** □□□□□□□99□
2. □□□□□□□□□□□□□□□□□□□ □□□□□1□
3. □□□□□□□□□□□□□□□□□□□□□□□□□□□ DROP □□□□□□
4. □□□□□□□□□□□□□ DROP □□□□

□□□□□

□□□□ GT □□ `1234`□□□ 10,000 □□□□□□□□1234000000 - 1234999999□□□□□□□□ 3 □□ □□□□`1234567890`□`1234555000` □ `1234111222`□

```
config :omniss7,
  m3ua_gt_routes: [
    # □□□□□□ DROP □□□□□□□□□□
    %{
      gt_prefix: "1234",
      peer_id: 0,              # DROP
      priority: 99,            # □□□ = □□□□ = □□□□
      description: "□□□□ 1234* □□□□□□□□□"
    },

    # □□□□□□□□□□□□□□□□□□□□□
    %{
      gt_prefix: "1234567890",
      peer_id: 1,              # □□□□□□ 1
      priority: 1,             # □□□ = □□□□ = □□□□
      description: "□□□□□ 1"
    },
    %{
      gt_prefix: "1234555000",
      peer_id: 1,
      priority: 1,
      description: "□□□□□ 2"
    },
    %{
      gt_prefix: "1234111222",
      peer_id: 1,
      priority: 1,
      description: "□□□□□ 3"
    }
  ]
```

□□□□□

□□ GT	□□□□	□□□□□	□□
1234567890	□ "1234567890"□□□□□ 1□ □ "1234" DROP□□□□ 99□	"1234567890"□□□□□□□□□□□□	□□□□□□□ **1**
1234555000	□ "1234555000"□□□□□ 1□ □ "1234" DROP□□□□ 99□	"1234555000"□□□□□□□□□□□□	□□□□□□□ **1**
1234111222	□ "1234111222"□□□□□ 1□ □ "1234" DROP□□□□ 99□	"1234111222"□□□□□□□□□□□□	□□□□□□□ **1**
1234999999	□ "1234" DROP□□□□ 99□	"1234" DROP□□□□□□	□□ + □ □
1234000000	□ "1234" DROP□□□□ 99□	"1234" DROP□□□□□□	□□ + □ □

□□□

- □ □ 3 □□□□□□□□□□□□□□□ 1
- □ □□□□ `1234*` □□□□□□□□
- □ □□□□□□□□□□□□□□□□□□

□□□□□□

```
[INFO] DROP route matched for GT 1234999999
[INFO] DROP route matched for GT 1234000000
```

□□□□□□ **DROP** □□

□□□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  m3ua_routes: [
    # DROP □□□□ /8□64 □□□□□1000-1063□
    %{
      dest_pc: 1000,
      peer_id: 0,
      priority: 99,
      mask: 8,
      network_indicator: :international
    },

    # □□□□□ PC
    %{dest_pc: 1010, peer_id: 1, priority: 1, network_indicator:
:international},
    %{dest_pc: 1020, peer_id: 1, priority: 1, network_indicator:
:international},
    %{dest_pc: 1030, peer_id: 1, priority: 1, network_indicator:
:international}
  ]
```

□□□ □ PC 1010□1020 □ 1030 □□□□1000-1063 □□□□□□□□□ PC □□□□□

□□ DROP □□

□□□□□

```
# □□□□□□□□
tail -f logs/app.log | grep "DROP route matched"

# □□□□□
[INFO] DROP route matched for GT 1234999999
[INFO] DROP route matched for DPC 1050
```

□□ Web UI□

- □□□ □□□□ □□□
- □ `INFO` □□□□
- □□ "DROP route matched"

□□□□□

1. ⚠ □□□□□□□□□□□ DROP □□□□□□□□□□□
2. □ □□□□□□ `description` □□□□□□□□□□□□□
3. □ □□□□□□□□□□90-99□□ DROP □□□□□□□□□□□□□□□□□
4. □ □□□□□□□□□□□ DROP □□□□
5. □ □□□□□□□□□□□□□□□□□□

□□□□□□□ SSN □□□□□□

□□□□□□SSN□

□□□□□□□□□□□□

- **SSN 6**□HLR□□□□□□□□□
- **SSN 7**□VLR□□□□□□□□□
- **SSN 8**□MSC□□□□□□□□/ SMSC□□□□□□
- **SSN 9**□GMLC□□□□□□□□□□

□□ SSN □□□□□

□□□□□□□ SMS □□□□□□ HLR□

```
m3ua_gt_routes: [
  # □□□□□□□ SMS □□□□□□ HLR□□ SSN □ 8□SMSC□□□□ 6□HLR□
  %{
    gt_prefix: "44",
    source_ssn: 8,                    # □□□□ SSN 8□SMSC□
    peer_id: 1,
    dest_ssn: 6,                      # □□□ SSN 6□HLR□
    priority: 1,
    description: "□□ SMS □ HLR"
  },

  # □□□□□□□□□□□□SSN 6□□□□□□□□
  %{
    gt_prefix: "44",
    source_ssn: 6,                    # □□□□ SSN 6□HLR□
    peer_id: 1,
    dest_ssn: nil,                    # □ SSN □□
    priority: 1,
    description: "□□□□□□□"
  }
]
```

□□ STP □□□□

□□□□□□□□□□□□□□□□□□□□□□

1. □□□□□□□□

□□ Web UI□

- □□□ http://localhost
- □□ M3UA □□□□
- □□□□□□□□ □□□**ACTIVE**

□□ IEx □□□□

```
# □□□□□□□□□□□
SCTP.SocketHandler.get_peers_status()

# □□□□□□
# [
#   %{peer_id: 1, name: "Partner_STP_West", status: :active,
point_code: 100, ...},
#   %{peer_id: 2, name: "Local_HLR", status: :active, point_code:
200, ...}
# ]
```

2. □□□□□□□□

```
# □ DPC 100 □□□□□ M3UA □□
test_payload = <<1, 2, 3, 4>>  # □□□□
SCTP.SocketHandler.route_by_pc(100, test_payload, 0)

# □□□□□□□□□□□□□□
# □□□□□□"Routing message: OPC=... -> DPC=100 via peer 1"
```

3. □□□□□□□□□

```
# □□□□□ GT □□
M3UARouting.lookup_peer_by_gt("447712345678")

# □□ {:ok, peer, rewrites}□`peer` □ 13 □□□ m3ua_peer □□□
# `rewrites` □□□□□□□ MAP□nil = □□□□□□□
# {:ok, {:m3ua_peer, 3, "UK_Mobile_Peer", ...},
#       %{dest_ssn: nil, dest_tt: nil, dest_npi: nil, dest_nai:
nil}}

# □□□ SSN □ GT □□□□□□ SSN 8 → 6 □□□□
M3UARouting.lookup_peer_by_gt("555881234567", 8)

# SSN □□□□□□□□□□□□□□□□□□□□□□□□□□□□
# {:ok, {:m3ua_peer, 4, "SMS_HLR_Peer", ...},
#       %{dest_ssn: 6, dest_tt: nil, dest_npi: nil, dest_nai:
nil}}
```

4. □□□□□□

□□ `/metrics` □ Prometheus □□

□□□□□

```
# □□□□□□□□□□□□
m3ua_stp_messages_received_total{peer_name="Partner_STP_West",point_c
1523

# □□□□□□□□□□□□
m3ua_stp_messages_sent_total{peer_name="Local_HLR",point_code="200"}

# □□□□□□□□□□
m3ua_stp_routing_failures_total{reason="no_route"} 5
m3ua_stp_routing_failures_total{reason="no_gt_route"} 2
m3ua_stp_routing_failures_total{reason="no_active_peer"} 1
m3ua_stp_routing_failures_total{reason="prohibited"} 3
m3ua_stp_routing_failures_total{reason="hcounter_violation"} 4
m3ua_stp_routing_failures_total{reason="screened"} 7
```

STP □□□□□

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□□□□□□□□□□□□

- `m3ua_stp_messages_received_total` - □□□□□□□□□□□□□□□
  - □□□ `peer_name`、`point_code`
- `m3ua_stp_messages_sent_total` - □□□□□□□□□□□□□□□
  - □□□ `peer_name`、`point_code`

□□□□□□□□

- `m3ua_stp_routing_failures_total` - □□□□□□□□□□□□□□□
  - □□□ `reason`

`reason`	□□
`no_route`	□□□□□□□□□□□□□
`no_gt_route`	□□□□□□□□□□□□□□ PC □□□□□
`no_active_peer`	□□□□□□□□□□□□□□□/□□□
`prohibited`	□□□□□□□□□□□□□□□□ TFP（Q.704 §13）
`hcounter_violation`	SCCP □□□□□□ XUDT/LUDT □□□□□（Q.714 §2.8.6）

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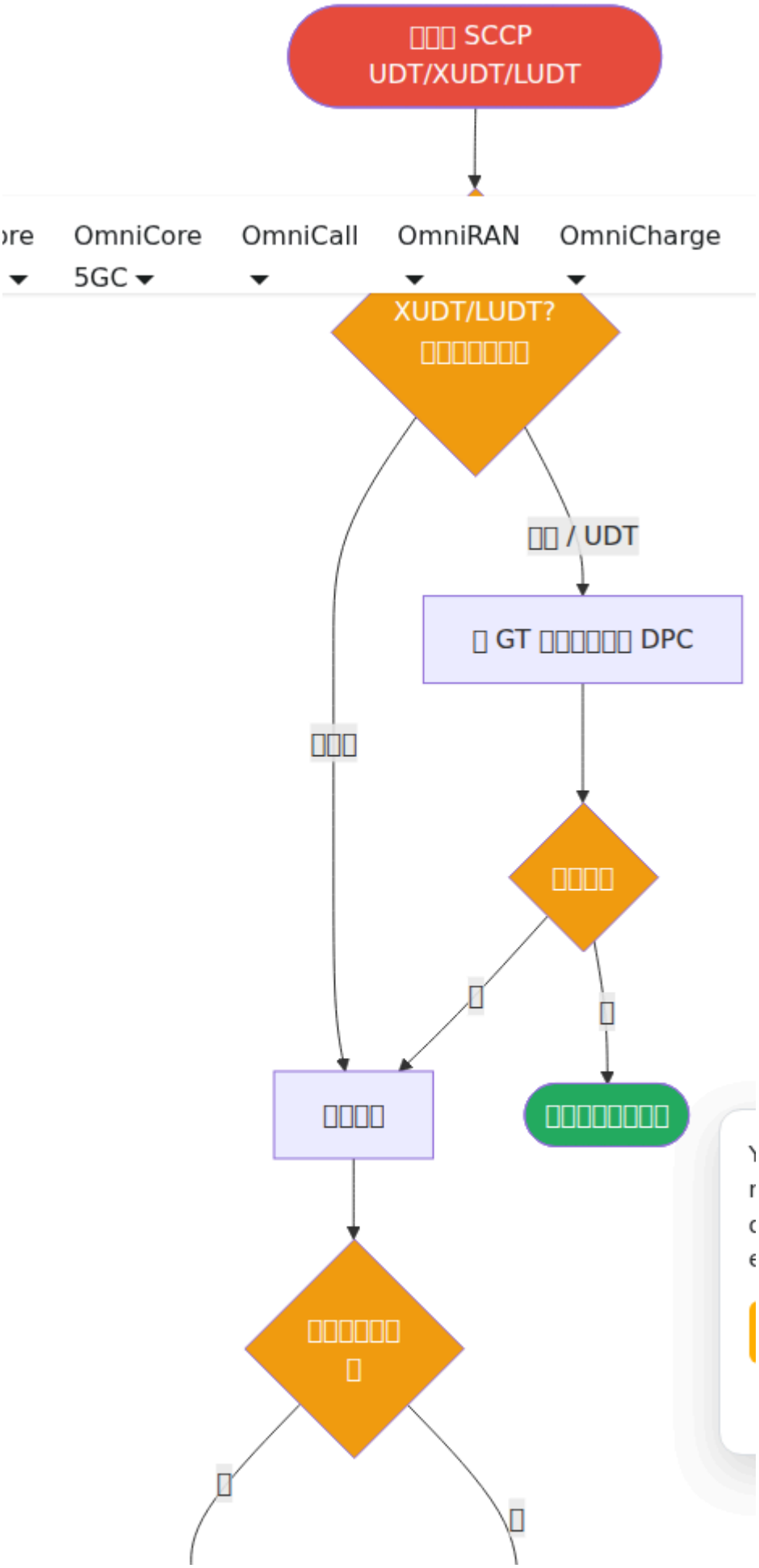
- □□□□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
  - `no_route`□□□□□□□□□□□□□□
  - `no_gt_route`□□□□□□□□□□□□□□□ PC □□□□□
  - `no_active_peer`□□□□□□□□□□□□□□□□□/□□
  - `prohibited`□□□□□□□□□□□□□□□□□□□□

- `hcounter_violation`□□□


□□□ SCCP
UDT/XUDT/LUDT
ore
OmniCore
5GC
OmniCall
OmniRAN
OmniCharge
XUDT/LUDT?
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□□ / UDT
□ GT □□□□□□ DPC
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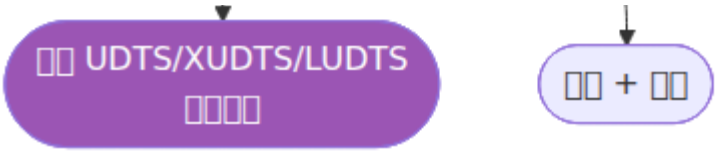

□□□□□

- **DOWN** - □□ SCTP □□
- **CONNECTING** - SCTP □□□□□□
- **ASPUP_SENT** - □□ ASPUP □□
- **INACTIVE** - ASP □□□□□□□□□□□□□□□□□□ ASPAC □□□ ACTIVE□
- **ASPAC_SENT** - □□ ASPAC □□
- **ACTIVE** - □□□□□□□□□□□□
- **ASPDOWN_SENT** - □□□□□□□□

□□ Web UI □□ M3UA □□□

Web UI □□ M3UA □□□□□□□□□□□□

□□ **M3UA** □□□□□

1. □□□ Web UI □□
2. □□□□□□□□ "M3UA □□"
3. □□□□□□□□

M3UA □□□□

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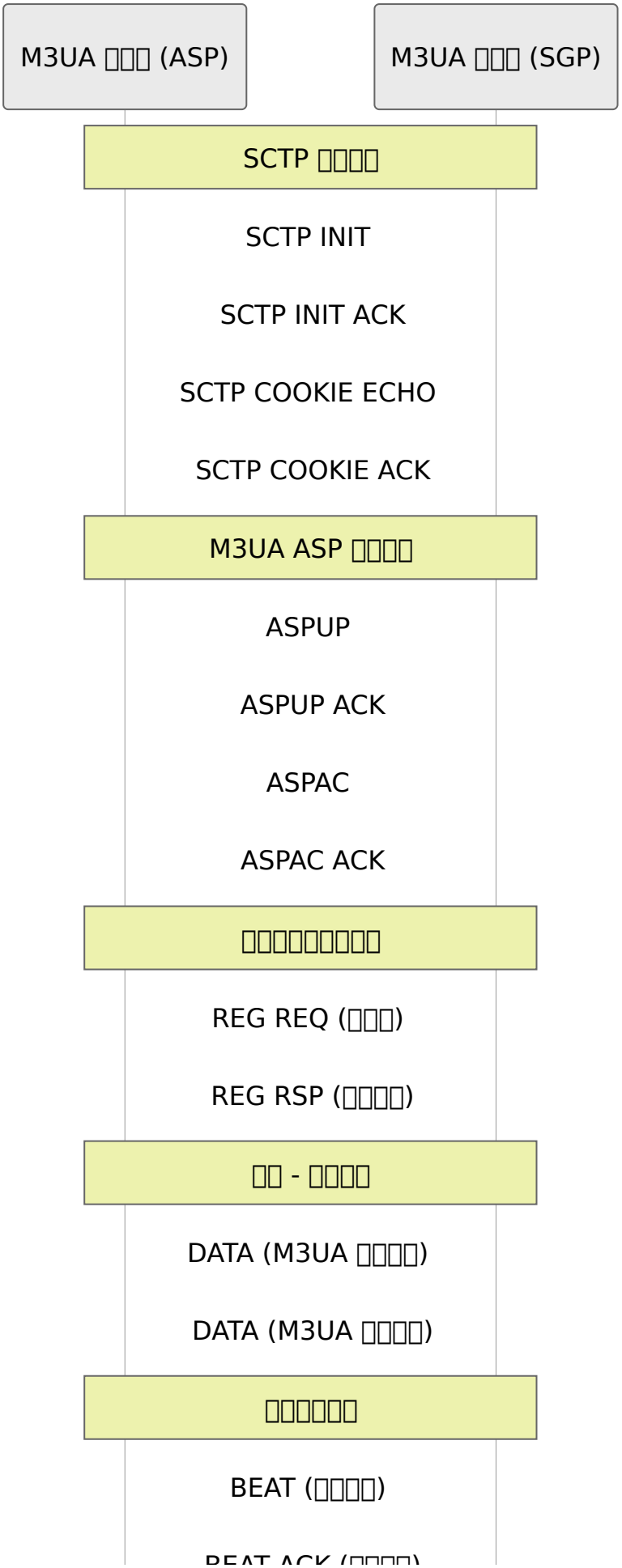
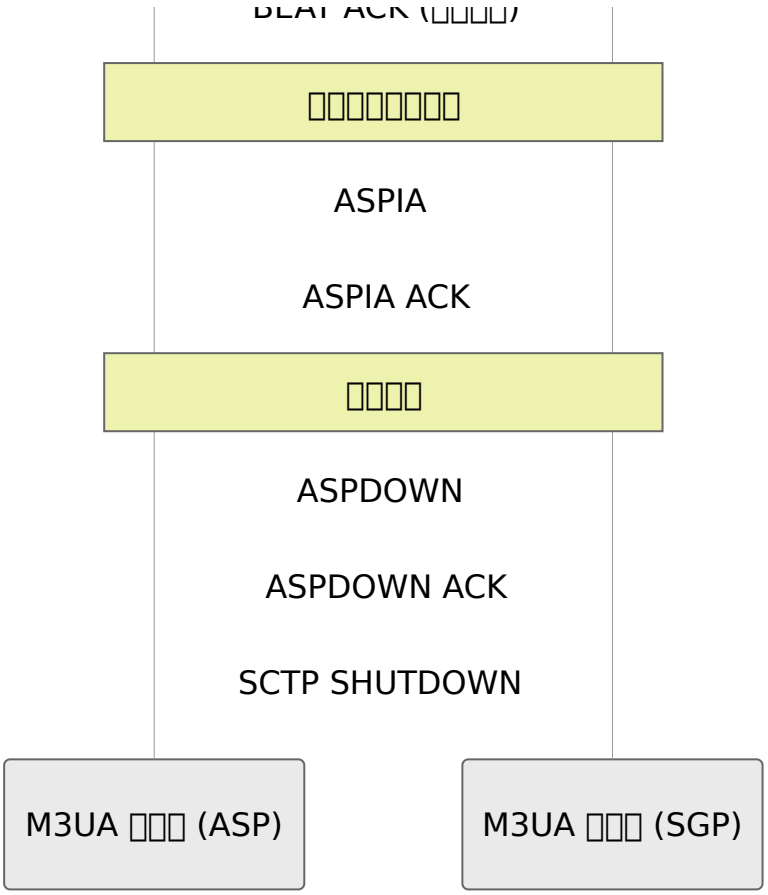
□□	□□□□□□□□□□ `testASP` □
PID	□□□□□
□□	UP□□□□□ DOWN□□□□
ASP □□	□□ M3UA □□□□□□□ACTIVE□INACTIVE□
Assoc/SCTP	SCTP □□□□
□□	□□ IP:□□
□□	□□ IP:□□
RC	□□□□□ ID

□□□□□□□

- □□□**UP**□ - □□□□□□□□□□□□□
- □□□**DOWN**□ - □□□□□□□□□□□
- **ASP □□** - □□□□ M3UA □□□□
- **Assoc/SCTP** - □□ SCTP □□□□

M3UA □□□


M3UA □□□ (ASP)
M3UA □□□ (SGP)
SCTP □□□□
SCTP INIT
SCTP INIT ACK
SCTP COOKIE ECHO
SCTP COOKIE ACK
M3UA ASP □□□□
ASPUP
ASPUP ACK
ASPAC
ASPAC ACK
□□□□□□□□□□
REG REQ (□□□)
REG RSP (□□□□)
□□ - □□□□
DATA (M3UA □□□□)
DATA (M3UA □□□□)
□□□□□□
BEAT (□□□□)



RFC 4666 M3UA □□□□

OmniSS7 □□□ RFC 4666 □□□□□□ M3UA □□□□□

□□	□□	□□	□□	□□
0 (MGMT)	0	ERR	□□	□□□□□□□□□□□□
0 (MGMT)	1	NTFY	□□	□□□□
1 (XFER)	1	DATA	□□	□□ PC □ GT □□□□
2 (SSNM)	1	DUNA	□□	□□□□□□□
2 (SSNM)	2	DAVA	□□	□□□□□□
2 (SSNM)	3	DAUD	□□	□□□□□□□□□□□ PC □□ DAVA□□□□/□□□ PC □□ DUNA
2 (SSNM)	4	SCON	□□	□□□□
2 (SSNM)	5	DUPU	□□	□□□□□□□□□
2 (SSNM)	6	DRST	□□	□□□□□□
3 (ASPSM)	1	ASPUP	□□	□□/□□ ASPUP ACK
3 (ASPSM)	2	ASPDN	□□	□□ ASPDN ACK□□□□□□□□
3 (ASPSM)	3	BEAT	□□	□ BEAT ACK □□□□□□□
3 (ASPSM)	4	ASPUP ACK	□□	□□□□□□□ UP
3 (ASPSM)	5	ASPDN ACK	□□	□□□□□□□ DOWN

□□	□□	□□	□□	□□
3 (ASPSM)	6	BEAT ACK	□□	□□□□
4 (ASPTM)	1	ASPAC	□□	□□/□□ ASPAC ACK□□□□□
4 (ASPTM)	2	ASPIA	□□	□□ ASPIA ACK□□□□□□□□ INACTIVE
4 (ASPTM)	3	ASPAC ACK	□□	□□□□□□□ ACTIVE
4 (ASPTM)	4	ASPIA ACK	□□	□□□□□□□ INACTIVE
9 (RKM)	1	REG REQ	SGP □□	□□□□□□□□ REG RSP
9 (RKM)	2	REG RSP	ASP □□	□□□□□□
9 (RKM)	3	DEREG REQ	SGP □□	□□ DEREG RSP
9 (RKM)	4	DEREG RSP	ASP □□	□□□□□□

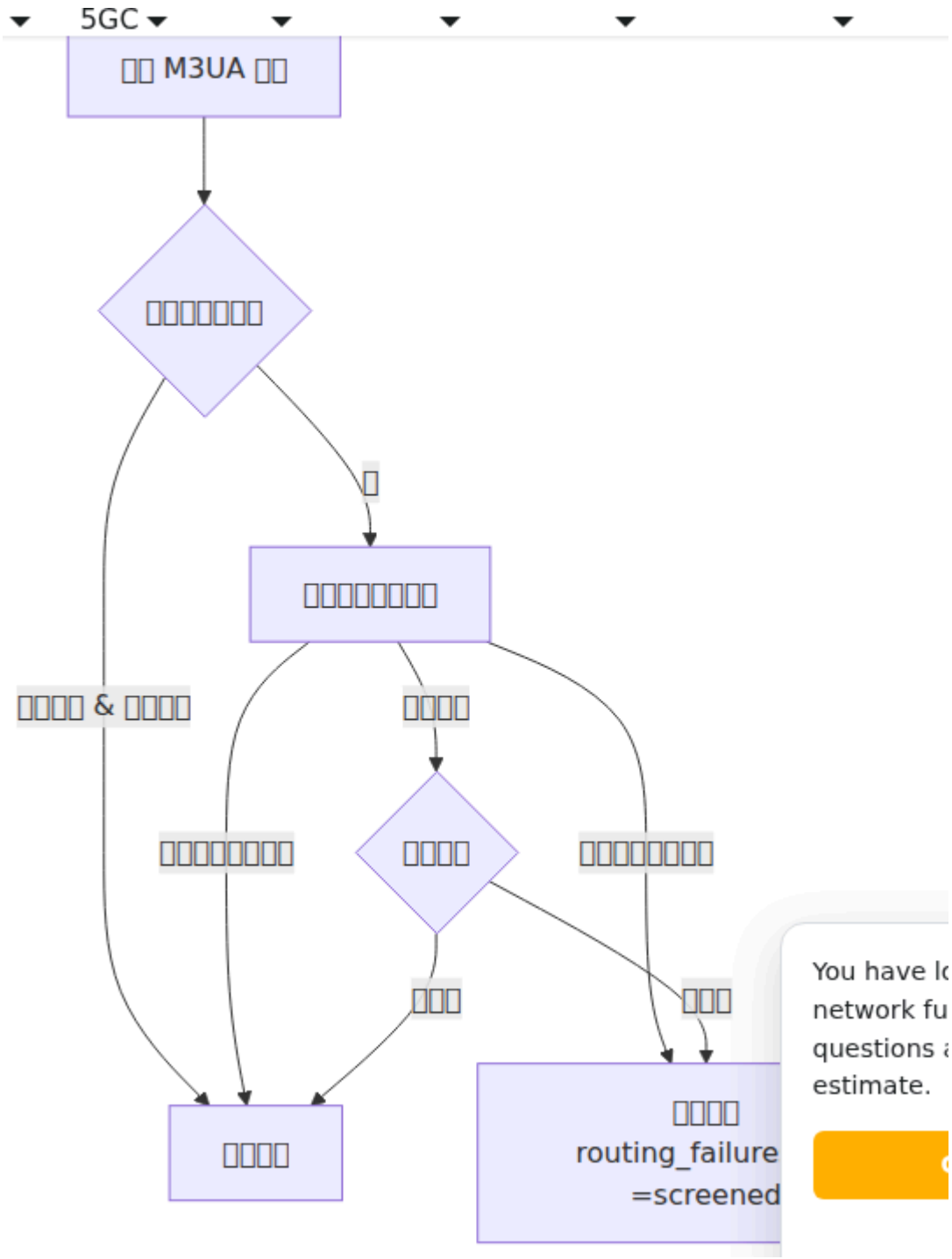
□□□**BEAT/BEAT ACK**□□ □ STP □□□ BEAT □□□□□□□ BEAT ACK □□□□□□□□□□□□□□□□□□□□□□□ SCTP □□□□□□□□□□□□□□□□□

□□□□□□**RKM**□□ □ ASP □□ REG REQ □□SGP □□□□□□□□ RK □□□□□□□□□□□□□□□□□DPC□□□□ REG RSP□□□□□□□□□□□□□□□□□□□

ASP □□□□**ASPIA**□□ □ SGP □□□ ASPIA □□□□□□ ASPIA ACK□□□□□□□□□ INACTIVE□□□ □□□□□□□□□

M3UA □□□□□□□

□□□□□□**RC**□ □ M3UA □□□□ 32 □□□□□□□□□□□□□□□□□□□□□AS□□□□□□□□□□□□□□□□□□□



MAP □□□□ CAP □□□

□□□□□□□□□□MAP □ CAP□□□□□□□□□□□□□□□

□□	**RC □□**	□□
□□□□□□□	□□□□□□□□□□ □ RC	□□ - □□□□
□□□□□□□□ (SRI, PRN, IDP, □)	□□□□□□□□□□ □□ RC	□ `map_client_m3ua` □ `cap_client_m3ua` □□ □ `routing_context`
□□□□□□□□ **RC**	□□□□□□□ RC	□□□□□□□□
□□□□□□□□□□ **RC**	□□□□□□□□□ RC	□□□□□□□□

□□□□□

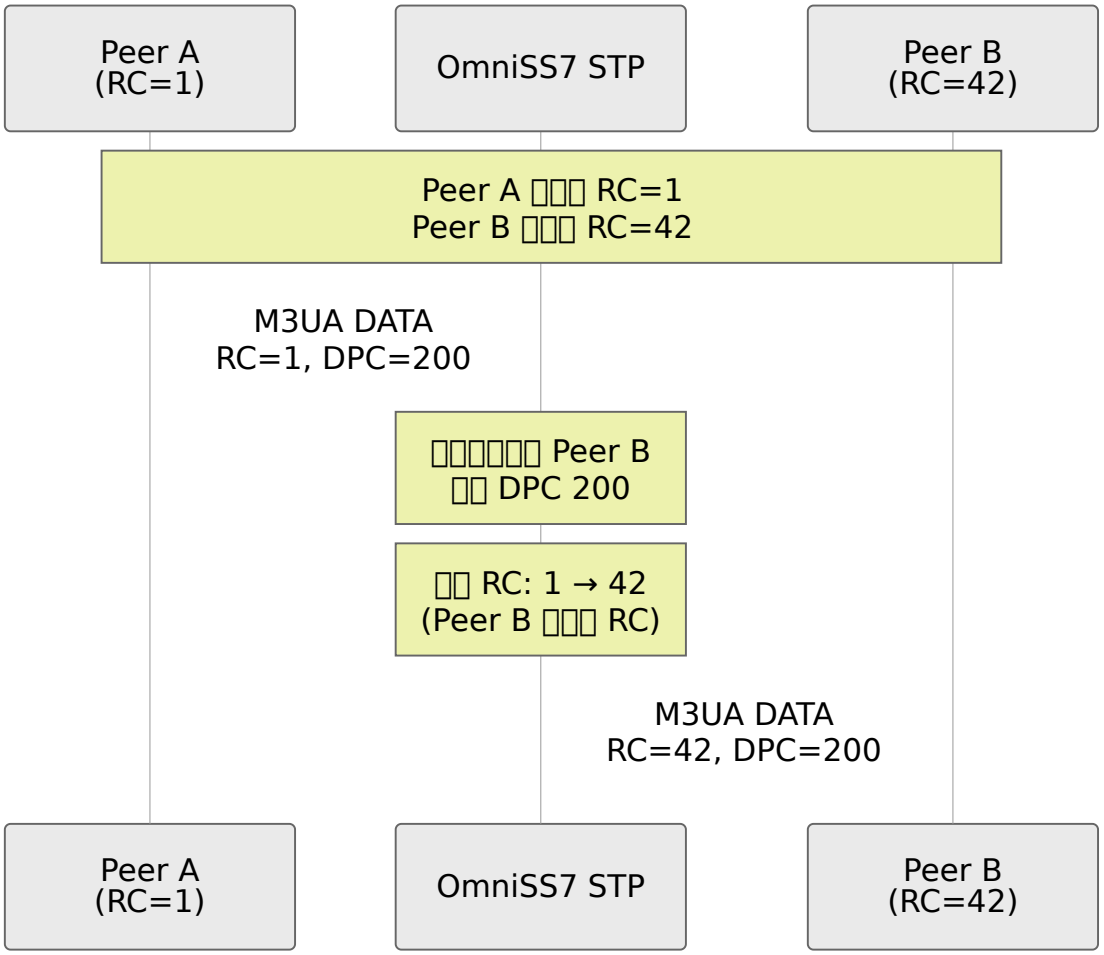
```
config :omniss7,
  # MAP □□□ RC □□
  map_client_m3ua: %{
    mode: "ASP",
    local_ip: {10, 0, 0, 1},
    local_port: 2905,
    remote_ip: {10, 0, 0, 10},
    remote_port: 2905,
    routing_context: 1    # □□□□□□□□□ MAP □□ (SRI, PRN, □)
  },

  # CAP □□□ RC □□
  cap_client_m3ua: %{
    mode: "ASP",
    local_ip: {10, 0, 0, 1},
    local_port: 2906,
    remote_ip: {10, 0, 0, 20},
    remote_port: 2906,
    routing_context: 2    # □□□□□□□□□ CAP □□ (InitialDP, □)
  }
```

STP □□□□□□□

□ STP □□□□□□□□□□□□□□□□ □□ □□□□□□□□□□□□□□□□ RC□□□□□□ RFC 4666 □□□□□□□□□□□

1. RC □□□□□□□□ AS □□□□
2. □□□□□□□□□□□□□□□□ AS □□□□□□□□
3. STP □□□□ AS □□□□□□□□□□ RC □

STP RC □□□□□□



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```
config :omniss7,
  m3ua_peers: [
    %{
      peer_id: 1,
      name: "Network_A_STP",
      role: :server,
      remote_ip: {10, 0, 0, 100},
      remote_port: 2905,
      routing_context: 1,        # □□□□□□□□ RC
      point_code: 100,
      network_indicator: :international
    },
    %{
      peer_id: 2,
      name: "Network_B_HLR",
      role: :client,
      local_ip: {10, 0, 0, 1},
      local_port: 0,
      remote_ip: {10, 0, 0, 200},
      remote_port: 2905,
      routing_context: 42,       # □□□□□□□□ RC
      point_code: 200,
      network_indicator: :international
    }
  ]
```

□□□□□□□ 1□RC=1□□□□□□□□□□□□□□□ 2 □□STP□

1. □□ DPC □□□□□□200 → □□□ 2□
2. □ RC □ 1 □□□ 42□□□□ 2 □□□ RC□
3. □□□□□□□□□□ 2

RC □□□□

□□	□□□□	□□□□	□□□□□
MAP □□□	□□ RC	□□□□□ RC	□□□□□ RC
CAP □□□	□□ RC	□□□□□ RC	□□□□□ RC
STP	□□ RC	N/A	□□□□□□□□□ RC

□ **RC** □□□□

□□□□□□□□□□□ `routing_context`□□□□□ `nil`□□

- **MAP/CAP** □□□□□□□□□□□ RC □□
- **MAP/CAP** □□□□□□□□□□□ RC □□
- **STP** □□□RC □□□□□□□ RC □□□□□□

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□ IP □□□□□□□

□□□□□□□□□□□□□□□□ IP □□□□□□□□ MSC □□□□□□□□□□□□□□□□□□□□ SCTP □□□□□□ □□OmniSS7 □□□□□ IP □□□□□□□□□□□□□□ `remote_port: 0`□□□□□□□□□□□□□□□ IP □□□ □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

OmniSS7 □□ **M3UA ASPAC** □□□□□ □□ `ASPAC` □□□□□□□□ RC □□□□□□□□□ `routing_context` □□□□□□ □ RC □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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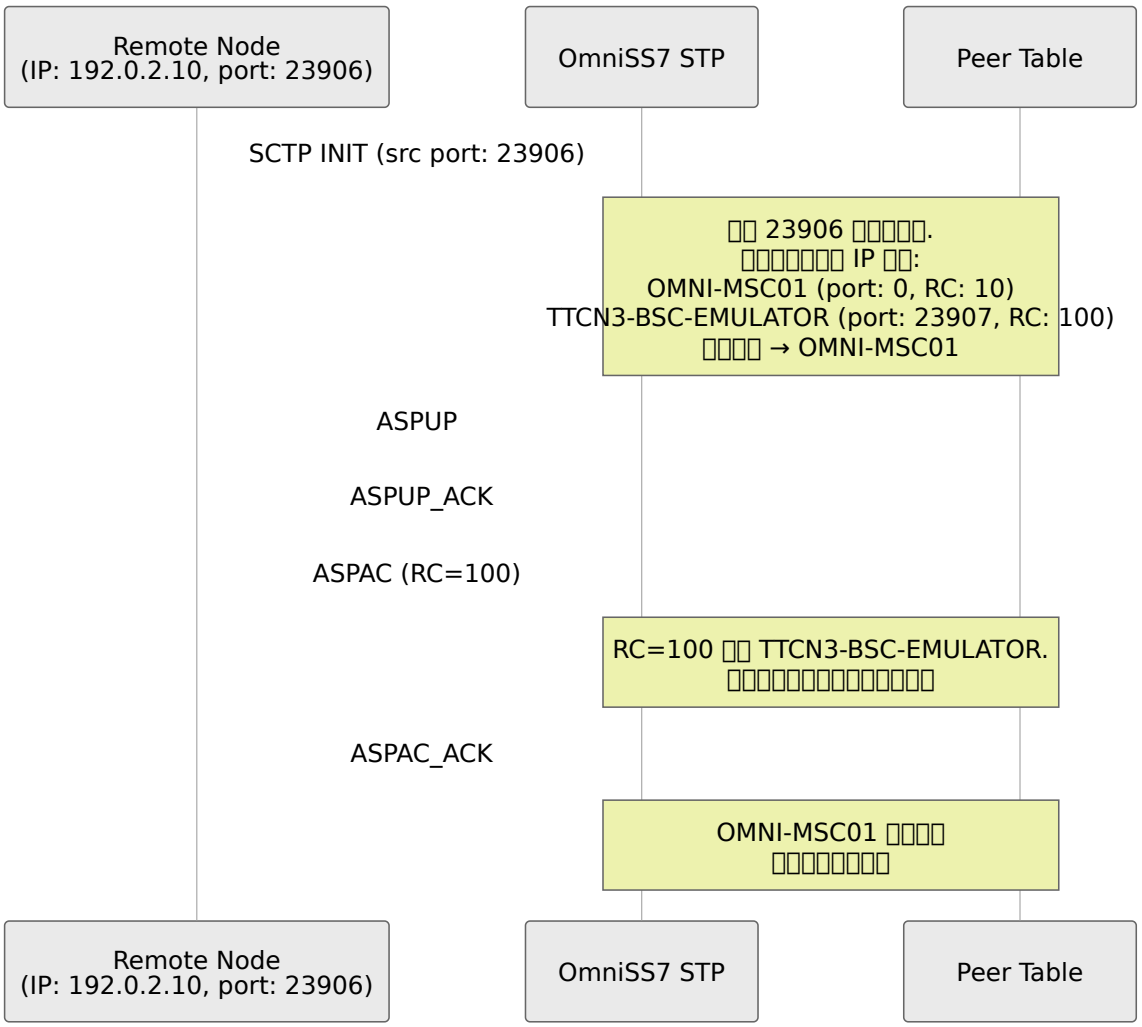

Remote Node
(IP: 192.0.2.10, port: 23906)
OmniSS7 STP
Peer Table
SCTP INIT (src port: 23906)
□□ 23906 □□□□□.
□□□□□□□□ IP □□:
OMNI-MSC01 (port: 0, RC: 10)
TTCN3-BSC-EMULATOR (port: 23907, RC: 100)
□□□□ → OMNI-MSC01
ASPUP
ASPUP_ACK
ASPAC (RC=100)
RC=100 □□ TTCN3-BSC-EMULATOR.
□□□□□□□□□□□□□□□□
ASPAC_ACK
OMNI-MSC01 □□□□
□□□□□□□□□
Remote Node
(IP: 192.0.2.10, port: 23906)
OmniSS7 STP
Peer Table

□□□□

□□□□□□□□□□□□□□□□□OmniSS7 □□□□□□□□□□□□□□□□□□

□□□□ IP □□□□□□□□□□□□□□□□□□□□□□□□□□□□ **`routing_context`**□□□□□ IP □□□□□□□□□□□□□□ RC□□□□□□□ `nil`□□□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  m3ua_peers: [
    %{
      peer_id: 8,
      name: "OMNI-MSC01",
      role: :server,
      remote_ip: {10, 5, 198, 200},
      remote_port: 0,              # □□□ - □□□□□□□□
      routing_context: 10,         # □□□□ IP □□□□□□□□□□
      point_code: 500,
      network_indicator: :national
    },
    %{
      peer_id: 9,
      name: "TTCN3-BSC-EMULATOR",
      role: :server,
      remote_ip: {10, 5, 198, 200},
      remote_port: 23907,          # □□□□□□□□□□□□□□□□□□□□
      routing_context: 100,        # □□□ RC - □□□ ASPAC □□□□□□□□
      point_code: 193,
      network_indicator: :national
    }
  ]
```

> □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `remote_port: 23907` □□□□ 23906 □□□□□□□□□□□□□□□□□□□□

- □□ SCTP □□

□□□

1. □□□□□□□□`ping remote_ip`
2. □□□□□□□□□□ SCTP□□□ 132□
3. □□□□ STP/SGP □□□□□□□□□□□
4. □□□□□□ `remote_ip` □ `remote_port`
5. □□□□□□□□□ SCTP □□

□□□□□□□□□ **ASP** □□□

□□□

- SCTP □□□□
- ASP □□□□□ INACTIVE □ ASPUP_SENT

□□□

1. □□□□□□□□□□□□□□□□
2. □□□□ STP □□□□□□□□□
3. □□□□□□□ ASPUP/ASPAC □□□
4. □□□□□□□□/□□□

□□□□□

□□□

- ASP □□□□□ ACTIVE
- □□□□□□□

□□□

1. □□□□□□□□□□□
2. □□ SCCP □□□GT □□□SSN □□
3. □□□□□□□□□
4. □□ `/events` □□□□□ SCCP □□
5. □□ STP □□□□□□□□

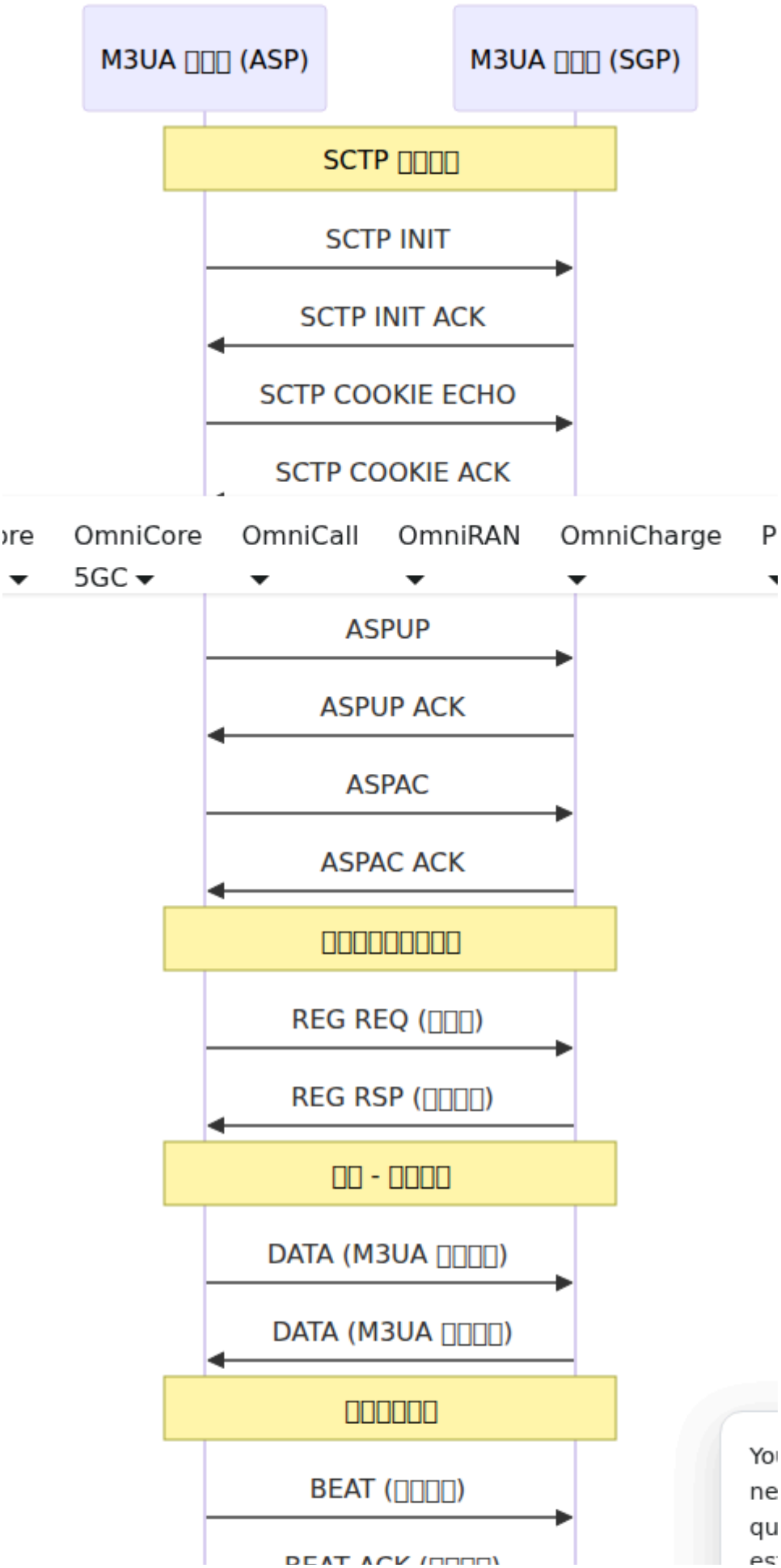
M2PA □□□□□□□

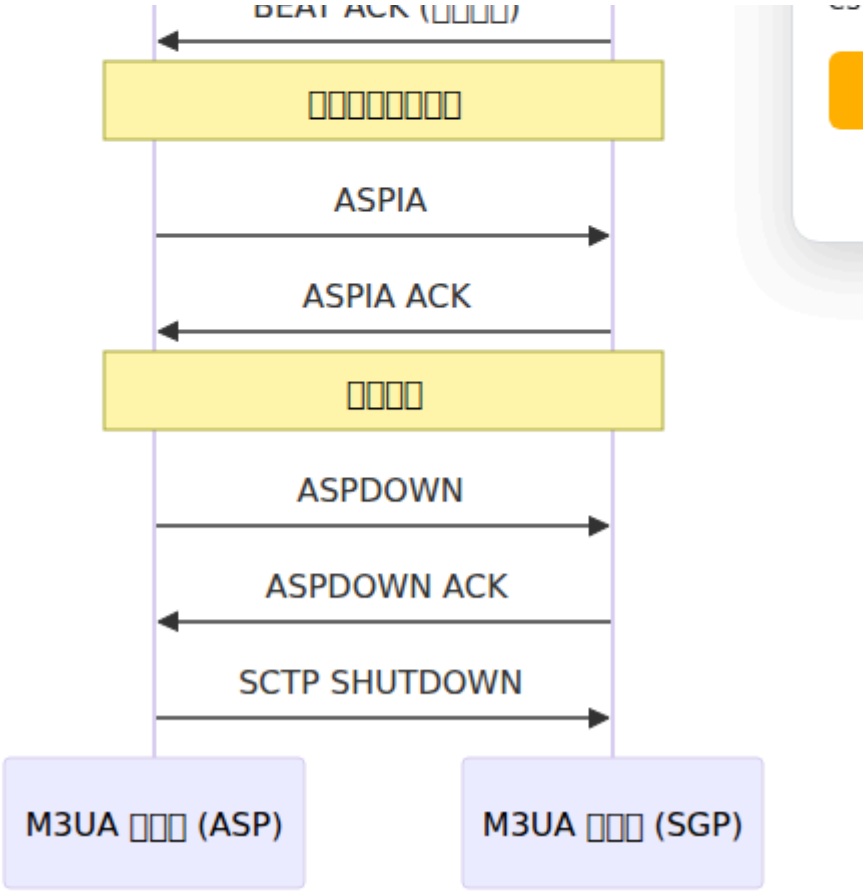
□□ M2PA

M2PA□MTP2 □□□□□□□□□□□□□□□ RFC 4165 □□□□□□□□□□□ SCTP □□□□ MTP3 □□□□□□□□□ ASP/SGP □□□ M3UA □□□M2PA □□□□□□□ TDM SS7 □□□□□□□□□

M2PA □□□□

M2PA □□□□□□□□□□□□□□□□


M3UA □□□ (ASP)
M3UA □□□ (SGP)
SCTP □□□□
SCTP INIT
SCTP INIT ACK
SCTP COOKIE ECHO
SCTP COOKIE ACK
ore
OmniCore
5GC
OmniCall
OmniRAN
OmniCharge
P
ASPUP
ASPUP ACK
ASPAC
ASPAC ACK
□□□□□□□□□□
REG REQ (□□□)
REG RSP (□□□□)
□□ - □□□□
DATA (M3UA □□□□)
DATA (M3UA □□□□)
□□□□□□
BEAT (□□□□)



□□□□□

- **DOWN** - □□ SCTP □□□□□□□□
- **CONNECTING** - SCTP □□□□□□
- **ALIGNMENT** - □□□□□□□□ (~1 □)
- **PROVING** - □□□□□□□□□□□□□ (~2 □)
- **READY** - □□□□□□□□□□□ MTP3 □□□□□□
- **ALIGNMENT**□□□□□□ - □□□□□□□□□□□□

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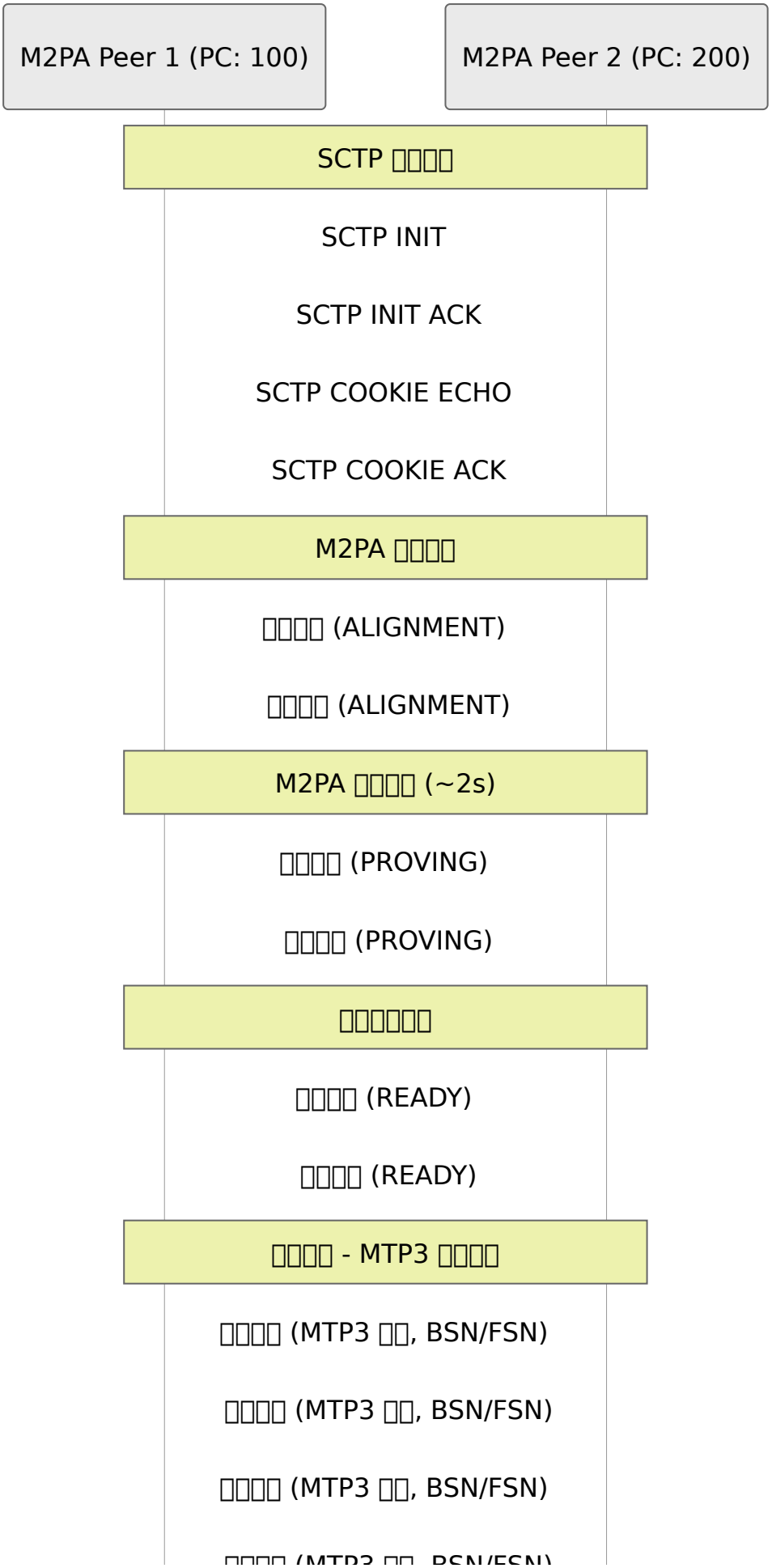
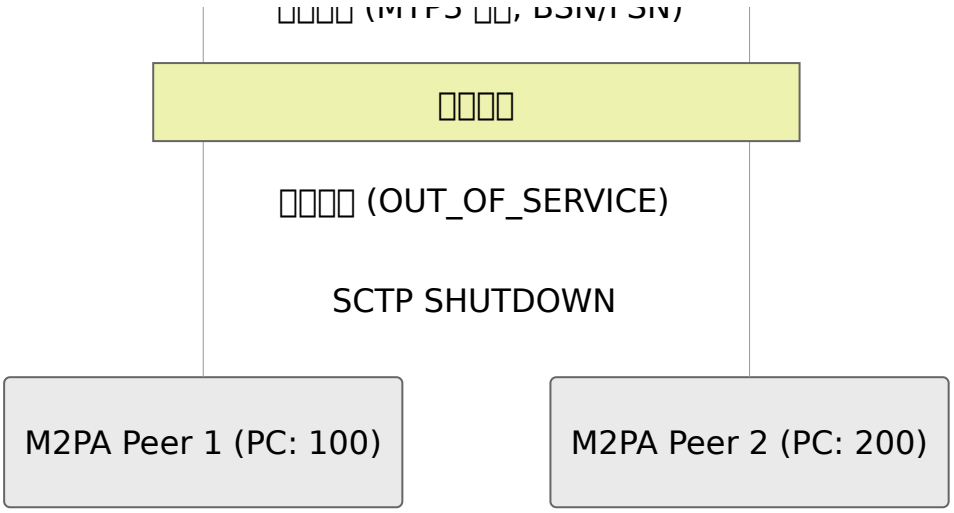
1. **SCTP** □□□□ SCTP □□□DOWN → CONNECTING□
2. □□□□□□□□□□□□□□□CONNECTING → ALIGNMENT□
3. □□□□□□□□□□□□□□□□ALIGNMENT → PROVING□
4. □□□□□□□□□□□□□□□□□□□□PROVING → READY□

M2PA □□□


M2PA Peer 1 (PC: 100)
M2PA Peer 2 (PC: 200)
SCTP □□□□
SCTP INIT
SCTP INIT ACK
SCTP COOKIE ECHO
SCTP COOKIE ACK
M2PA □□□□
□□□□ (ALIGNMENT)
□□□□ (ALIGNMENT)
M2PA □□□□ (~2s)
□□□□ (PROVING)
□□□□ (PROVING)
□□□□□□
□□□□ (READY)
□□□□ (READY)
□□□□ - MTP3 □□□□
□□□□ (MTP3 □□, BSN/FSN)
□□□□ (MTP3 □□, BSN/FSN)
□□□□ (MTP3 □□, BSN/FSN)



□□ Web UI □□ M2PA □□□

Web UI □□ M2PA □□□□□□□□□□□□□

□□□□□□□□□□

1. □□□ Web UI □□
2. □□□□□□□□□ "Routing Management"
3. □□ "M3UA/M2PA Peers" □

M2PA □□□□□

□	□□
□□□ **ID**	□□□□□□□□□
□□	□□□□□□ (□□□`M2PA_Link_STP_A`)
□□	□□ "M2PA"□□□□
□□□	□□□□□
□□ **PC**	□□□□□□□□□
□□	□□ IP:□□□□□□□□ 3565□
□□	□□ IP:□□
□□	□□□□□□□□□READY, ALIGNMENT, DOWN□

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- **READY**□□□□ - □□□□□□□□□□□□
- **ALIGNMENT**□□□□ - □□□□□□□□□□□□
- **PROVING**□□□□ - □□□□□□□□
- **DOWN**□□□□ - □□□□□□□□□

□□□ M2PA □□

□□□□□□□□ **ALIGNMENT**

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- □□□□□□□ ALIGNMENT □□□□□□
- □□□□□ PROVING □ READY

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1. □□□□□□□□□□□□□□□□

2. □□ SCTP □□□□□□□□□□ 132
3. □□ `point_code` □ `adjacent_point_code` □□□□□□
4. □□□□□□□□□□□□□□□□□□□□
5. □□□□□□□□□□ ALIGNMENT □□

□□□□□□□□ **PROVING**

□□□

- □□□□ PROVING □□□□□ READY
- □□□□□ 2-3 □

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1. □□□□□□□□□□□□□
2. □□ SCTP □□□□
3. □□□□□□□□□□□□□□□□□
4. □□□□□□□□□□ PROVING □□
5. □□ SCTP □□□□□□□□□□□

□□□□□□□□**DOWN ↔ READY**□

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- □□□ READY □ DOWN □□□□□□
- □□□□□□

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1. □□□□□□□□□
2. □□ SCTP □□□□
3. □□□□□□□□□□□
4. □□ MTU/□□□□
5. □□□□□□□ IP □□

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- □□□□□□□□ READY
- □□ MTP3 □□□□□□

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1. □□□□□□□□□□□□□□□□□□□□
2. □□ MTP3 □□□□□□□□□□□
3. □□□□□□□ DPC □□□□□□□□□□
4. □□ `/events` □□□□□□□□□□
5. □□□□□□□BSN/FSN□□□□□□□

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- ← □□□□□□
- □□□□□□□ - Web UI, API, □□
- MAP □□□□□ - □□ MAP □□
- □□□□□□□ - □□□□
- □□□□ - □□□□

OmniSS7 □ Omnitouch □□□□□□□

USSD □□□□

← □□□□□□

□□□□□□ OmniSS7 **USSD** □□□□□□□□ SS7/MAP USSD □□□□□□ HTTP/JSON □□□□□□□□□□□□□□□ □□□□□□ HTTP □□□□ USSD □□□□□□

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1. □□
2. □□
3. □□ USSD □□
4. □□
5. HTTP □□□□
6. □□□□□□ USSD (□□ API)
7. □□□□□□□
8. □□□□
9. □□□□□
10. □□□□□□□□
11. □□□□

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USSD □□□□□□□□□□ USSD □□□

- □□□□□□□□□□□□□□□□□□□□□□□□ `*100#`□□□□□□□ MAP `processUnstructuredSS-Request` □□□□ 59□□□□□□□□□□□□ HTTP □□□□□□□□□□ SS7 □□□□□□□□
- □□□□□□□□□□□□□□□□□□□□ REST API □□□□□□□ USSD □□□□□□□□ SS7 □□ MAP `unstructuredSS-Request`□□□□ 60□□□□□□□□□□□□□□□□□□□□□□□□□□□

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□□	□
□□	□□□□ HTTP POST
□□	GSM 7 □□□□□□□□DCS 0x0F□□□□ 3GPP TS 23.038
□□□□□□	182 □□□□□□□□□
□□□□	□□□□□□□□□□□ UUID
□□□□	□□□□ SS7 □□□
□□	□□□□□□□□ URL

3GPP □□

□□	□□□
3GPP TS 23.090	USSD □□□□□□□□□□
3GPP TS 24.090	USSD □□□□□□□□□
3GPP TS 29.002	MAP □□□USSD-Arg□USSD-Res□□□□ 59/60/61
3GPP TS 23.038	GSM 7 □□□□□□□□□□□□□

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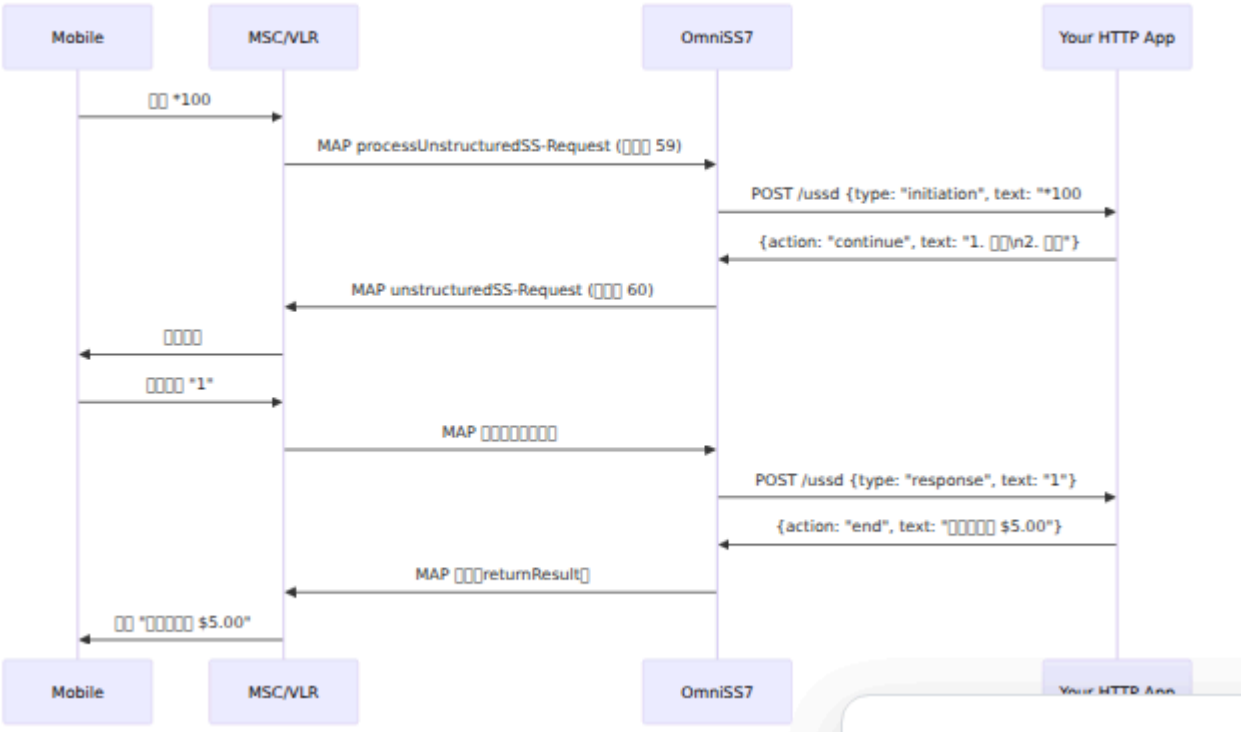
Mobile
MSC/VLR
OmniSS7
Your HTTP App
□□ *100
MAP processUnstructuredSS-Request (□□□ 59)
POST /ussd {type: "initiation", text: "*100
{action: "continue", text: "1. □□\n2. □□"}
MAP unstructuredSS-Request (□□□ 60)
□□□□
□□□□ "1"
MAP □□□□□□□□□
POST /ussd {type: "response", text: "1"}
{action: "end", text: "□□□□□ $5.00"}
MAP □□□returnResult□
□□ "□□□□□ $5.00"
Mobile
MSC/VLR
OmniSS7

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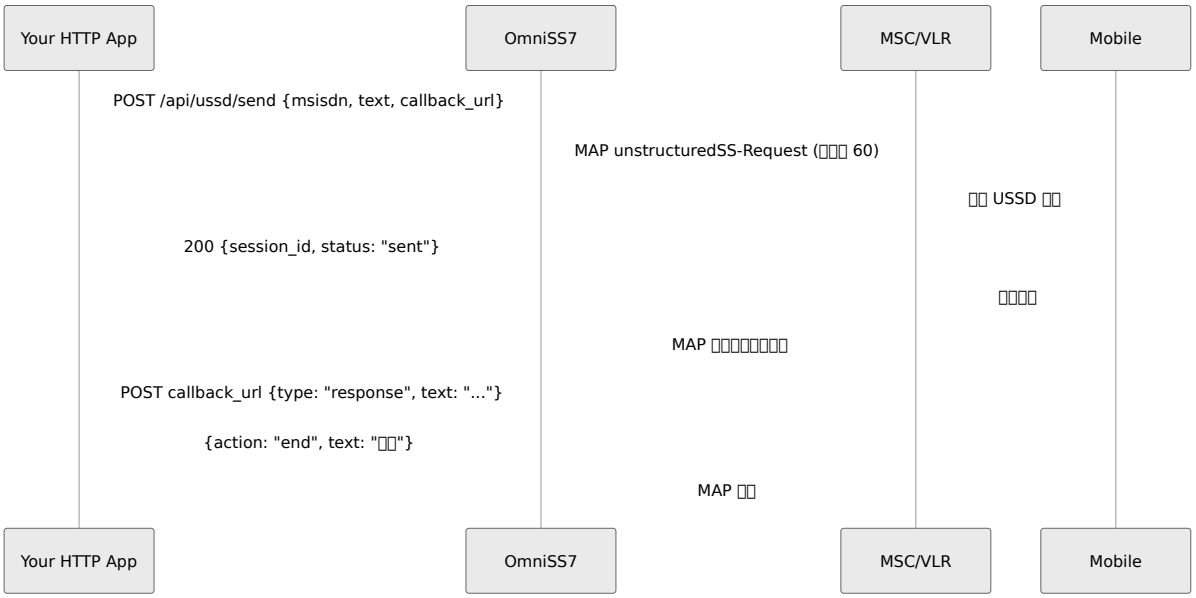
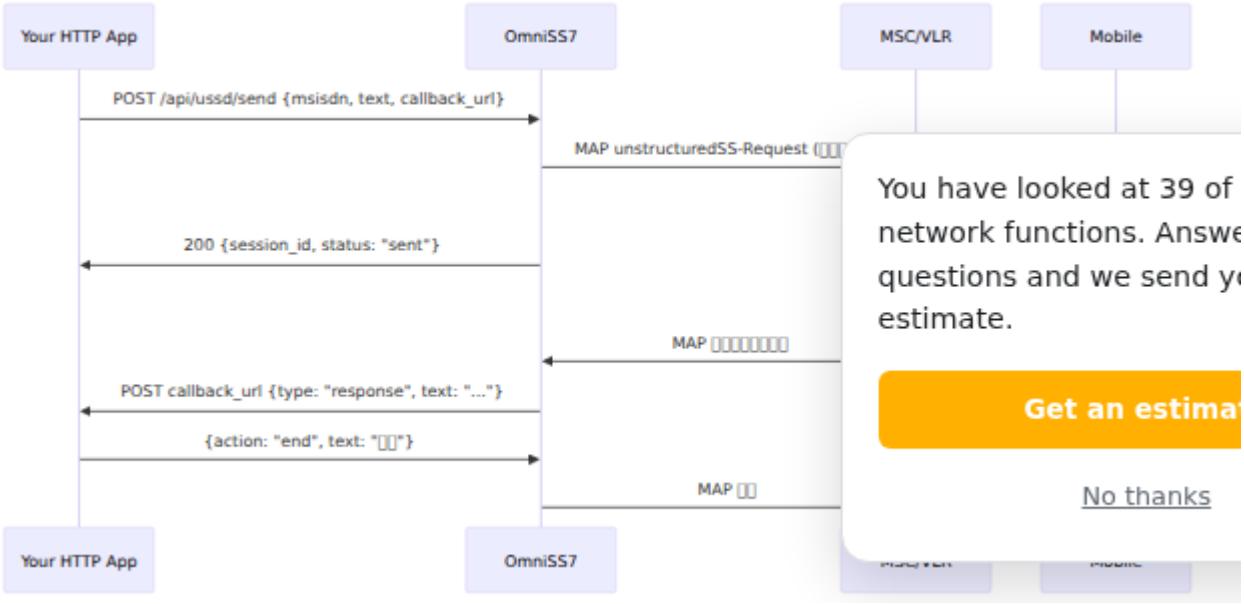

Your HTTP App
OmniSS7
MSC/VLR
Mobile
POST /api/ussd/send {msisdn, text, callback_url}
MAP unstructuredSS-Request (□□□ 60)
□□ USSD □□
200 {session_id, status: "sent"}
□□□□
MAP □□□□□□□□□
POST callback_url {type: "response", text: "..."}
{action: "end", text: "□□"}
MAP □□
Your HTTP App
OmniSS7
MSC/VLR
Mobile

□□□□



□□ USSD □□

USSD □□□□□□□ **MAP** □□□□□□□□□□□□□□□□□□□

```
config :omniss7,
  map_client_enabled: true,
  ussd_gateway_enabled: true
```

□□□□□□□□□□□ M3UA □□□□□□□ MAP □□□□□ □□□ M3UA □□□□

□□

USSD □□□□

```
config :omniss7,
  ussd_gateway_enabled: true,
  ussd_gateway: %{
    # □□□□ - □□□□□□
    routes: [
      %{pattern: "*100", url: "http://balance-app:9000/ussd"},
      %{pattern: "*200", url: "http://topup-app:9000/ussd"},
      %{pattern: "*",    url: "http://default-app:9000/ussd"}
    ],

    # □□□□
    session_timeout_ms: 180_000,    # □□□□□□□□3 □□□
    turn_timeout_ms: 30_000,        # □□□□□□□□□□□□□□□30 □□

    # HTTP □□□□
    http_timeout_ms: 5_000,         # □□□□□□□ HTTP POST □□□□5 □□

    # □□□□
    max_text_length: 182            # GSM 7 □□□□□□□□□□□□□□□□□
  }
```

□□□□

□□	□□	□□	□□	□□
`ussd_gateway_enabled`	□□□□	□	`false`	USSD □□□□□□□□□
`ussd_gateway.routes`	□□□□	□	`[]`	□□□□□□□□□□□□□□□□□□ `pattern`□□□□□□□□□ `url`□□□ URL□□□□□□□□□□□□□
`ussd_gateway.session_timeout_ms`	□□	□	`180_000`	□□□□□□□□□□□□□□□□□□

□□	□□	□□	□□
`pattern`	□□□	□	□□□□□□□□□□□□ `"*"` □□□□□□□□□□□□□□□□□□□□
`url`	□□□	□	□□□□□□□□□□□□ POST □ HTTP □□ URL□

□□□□

□□□□ □□□□□□□ □□□□□□□□□□□□□ `*100#`□

1. `"*100"` □□□□□ 4□□□□□
2. `"*10"` □□□□□ 3□□□□□□□□
3. `"*"` □□□□□ 1□□□□

□□□□□□□□□□□□□□ MAP □□□□□□□□□□□□□

HTTP □□□□

□□□□□□□□□□□ HTTP POST □□□□□ JSON □□□□□□□

□□□□□□□□□□□□□

Content-Type: `application/json`

□□□□□□□□□□□

```
{
  "session_id": "a1b2c3d4-e5f6-7890-abcd-ef1234567890",
  "msisdn": "+254712345678",
  "type": "initiation",
  "text": "*100#",
  "turn": 1
}
```

□□□□□□□□□□□□

```
{
  "session_id": "a1b2c3d4-e5f6-7890-abcd-ef1234567890",
  "msisdn": "+254712345678",
  "type": "response",
  "text": "1",
  "turn": 2
}
```

□□□□

□□	□□	□□
`session_id`	□□□	□□□□□ UUID□□□ USSD □□□□□□□□□□□□□□□□
`msisdn`	□□□	□□□□ MSISDN□□□□ MAP □□□□□□□□□□□□□□□□
`type`	□□□	□□□□□□ `"initiation"`□□□□□□□□ `"response"`□
`text`	□□□	□□□□□□□□□□□□□ `*100#`□□□□□□□□□□□□□□□ `1`□□
`turn`	□□	□ 1 □□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□

□□□□□□□□ JSON □□□□□ `action` □ `text`□

□□□□□□□□□□□□□□□□□□

```
{
  "action": "continue",
  "text": "1. □□\n2. □□\n3. □□"
}
```

□□□□□□□□□□□□□□□□□

```
{
  "action": "end",
  "text": "□□□□□□ $5.00"
}
```

□□□□

□□	□□	□□	□□
`action`	□□□	□	`"continue"` □□□□□□□□□□□□□□□□□□□□ `"end"` □□□□□□□□□□□□□□□□
`text`	□□□	□	□□□□□□□□□□□□□□□□□□□□□□ `max_text_length` □□□ 182□□□□□□□ `\n` □□□□□□

□□□□□ USSD (□□ API)

□□□□□□□□□□□□□□ USSD □□□

□□

`POST /api/ussd/send`

□□

```
{
  "msisdn": "+254712345678",
  "text": "□□□□□□□□□□□□□ 1 □□□□□",
  "callback_url": "http://billing-app:9000/ussd"
}
```

□□□□

□□	□□	□□	□□
`msisdn`	□□□	□	□□□□□□ MSISDN□□□□□□□□
`text`	□□□	□	□□□□□□ USSD □□□□□□ GSM 7 □□
`callback_url`	□□□	□	□□□□□□□□□□□□□□□□□□□ URL□

□□

□□□200 OK□□

```
{
  "session_id": "xyz-789-abc-123",
  "status": "sent"
}
```

□□□□□

HTTP □□	□□	□□
400	`{"error": "invalid request", "required": ["msisdn", "text", "callback_url"]}`	□□□□□□□□□□□□□□□□□□□□□□□□ JSON
500	`{"error": "{:gsm7_encode_failed, ...}"}`	□□□□□□□ GSM 7 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ **500**□□□□ 400□
500	`{"error": "..."}`	□□□□□□□□□□□□ M3UA □□□□□ `error` □□□□□□□□□□□□□□
503	`{"error": "USSD gateway not enabled"}`	`ussd_gateway_enabled` □ `false`

> □□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□□□□□□ JSON□□□ **400** **`invalid request`**□□□□□□□ □□□□□□□□□□□□□□□□□□□□ GSM 7 □□□□□□□□□□□□ **500**□□□ `error` □□□□□□□□□□□□

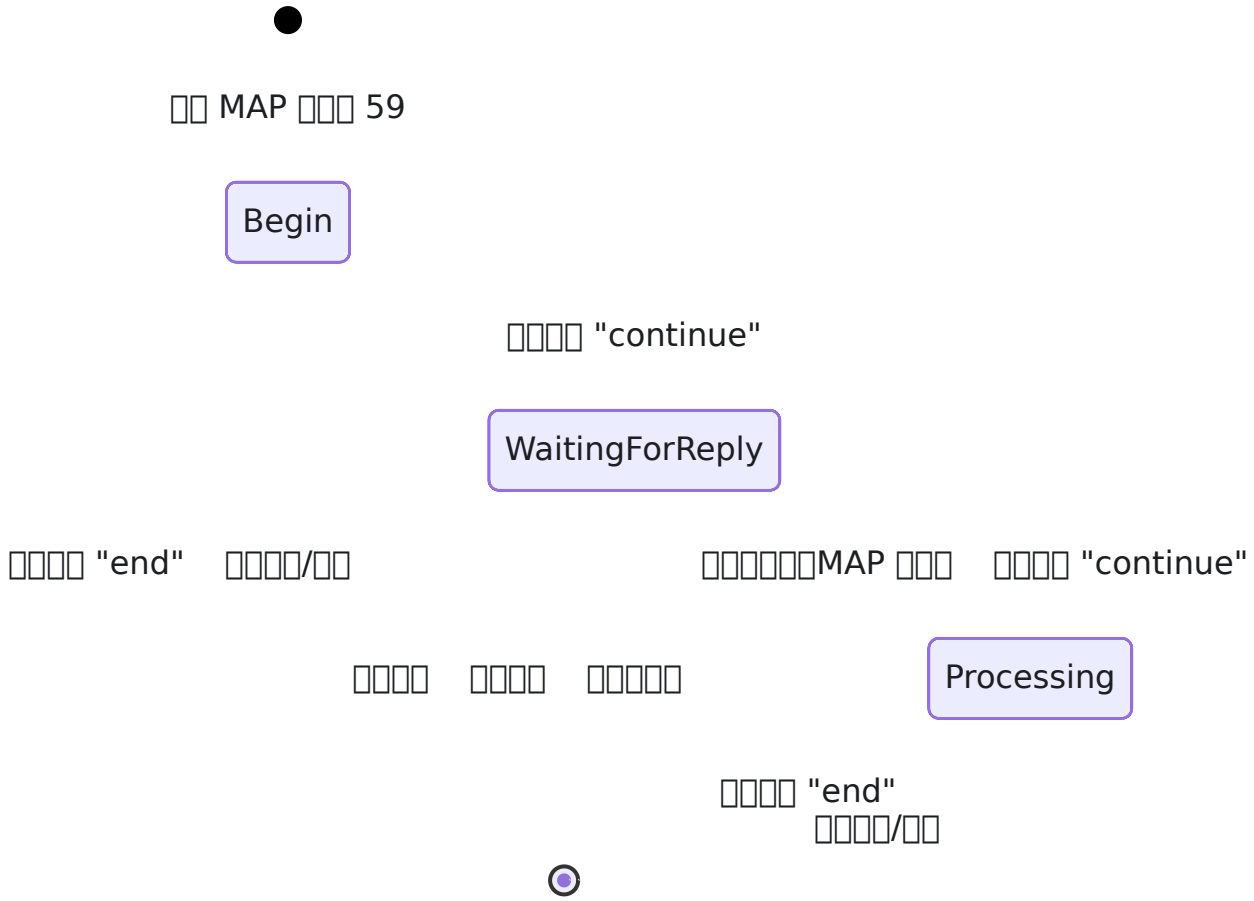
cURL □□

```
curl -X POST http://localhost:9090/api/ussd/send \
  -H "Content-Type: application/json" \
  -d '{
    "msisdn": "+254712345678",
    "text": "□□□□□□□□□□□□□ 1 □□□□□",
    "callback_url": "http://billing-app:9000/ussd"
  }'
```

□□□□□□

□□ USSD □□□□□□□□□□□□□ `session_id` □ □□□

□□□□



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□□□□□□□□□□□□□ `"end"`□□□□□□□□□□□□□□□□□□□□□□□□ MAP □□□□□□□□□

□□□□

□□□□□□□□ `"continue"`□□□□

1. □□□□□ `UssdGateway.Registry` □□□□ □□ **GenServer**
2. □□□□□□□□ 60□unstructuredSS-Request□□ MAP □□□□□□□□
3. □□□□□□□□□□□□ `turn_timeout_ms`□
4. □□□□□□□□□□□
5. □□□□□□□□□□□ `"end"` □□□□□

□□□□

□□	□□	□□
□□□□	30 □	□□□□

□□	□□□□	**MAP** □□□□
HTTP □□□□□ 5xx	□□□□□□□□□□□ MAP □□	34 (systemFailure)
□□□□□□ JSON	□□□□□□□□□□□ MAP □□	34 (systemFailure)
USSD □□□□ `max_text_length`	□□□□□□□□□□□□□□	N/A (□□□□□□□)
□□□□□□□□□□	□□□□□□□□□□□ MAP □□	34 (systemFailure)
□□□□□□□□	□□□□□□ MAP □□□□ □□□	34 (systemFailure)
□□ GenServer □□	□□□□□□□□□□□□□□	N/A (□□□)
USSD □□□□□	□□□□□□□□	21 (facilityNotSupported)

□□□□

USSD □□□□□□ `/metrics` □□□□□ 9090□□□□ Prometheus □□□

USSD □□

□□: `ussd_requests_total` □□: □□□ □□: □□□□ USSD □□ □□:

- `direction`: `"inbound"`□□□□□□□ `"outbound"`□□□□□□□□

□□: `ussd_active_sessions` □□: □□□ □□: □□□□□ USSD □□□□□□□

> □□: □□□□□□□□□□ □□□□□□□□□□□□□□□ `0`□□□□□□□□□□□□□□

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Python (Flask)

```python
from flask import Flask, request, jsonify

app = Flask(__name__)
sessions = {}

@app.route('/ussd', methods=['POST'])
def ussd():
    data = request.json
    session_id = data['session_id']
    text = data['text']
    turn = data['turn']

    if data['type'] == 'initiation':
        sessions[session_id] = {'state': 'main_menu'}
        return jsonify({
            'action': 'continue',
            'text': '□□□\n1. □□□□\n2. □□□□\n3. □□'
        })

    state = sessions.get(session_id, {}).get('state')

    if state == 'main_menu':
        if text == '1':
            del sessions[session_id]
            return jsonify({
                'action': 'end',
                'text': '□□□□□ $5.00'
            })
        elif text == '2':
            sessions[session_id]['state'] = 'buy_airtime'
            return jsonify({
                'action': 'continue',
                'text': '□□□□□'
            })
        else:
            del sessions[session_id]
            return jsonify({
                'action': 'end',
```

```
                'text': '□□□□□□□□□□'
            })

    elif state == 'buy_airtime':
        del sessions[session_id]
        return jsonify({
            'action': 'end',
            'text': f'□□□□□ ${text} □□□□□□□□'
        })

    return jsonify({'action': 'end', 'text': '□□□□□□□'})

if __name__ == '__main__':
    app.run(host='0.0.0.0', port=9000)
```

Node.js (Express)

```
const express = require('express');
const app = express();
app.use(express.json());

const sessions = new Map();

app.post('/ussd', (req, res) => {
  const { session_id, text, type } = req.body;

  if (type === 'initiation') {
    sessions.set(session_id, { state: 'main_menu' });
    return res.json({
      action: 'continue',
      text: '□□□\n1. □□□□\n2. □□□□'
    });
  }

  const session = sessions.get(session_id);
  if (!session) {
    return res.json({ action: 'end', text: '□□□□□□□' });
  }

  if (session.state === 'main_menu' && text === '1') {
    sessions.delete(session_id);
    return res.json({ action: 'end', text: '□□□□□ $5.00' });
  }

  sessions.delete(session_id);
  return res.json({ action: 'end', text: '□□□' });
});

app.listen(9000, () => console.log('USSD □□□□□ 9000 □□□'));
```

□□□□

USSD □□□□ "□□□□□□"

□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□

- `ussd_gateway_enabled` □ `false`
- □□□□□□□□□□□□□
- M3UA □□□□

□□□□□□

1. □□□□□□□ `ussd_gateway_enabled: true`
2. □□□□□□□□□□□□□□□□□□□□□ `*` □□□□□□
3. □ Web UI□□□□□□□□□□□ M3UA □□□□□□

□□□□□□□

□□□□□□□□□ USSD □□□□□□□□□□□□□□□□□□□□ HTTP POST□

□□□□□□□

- □□ URL □ OmniSS7 □□□□□□□
- □□□□□□ OmniSS7 □□□ HTTP
- □□□□□□□□□□□

□□□□□□

1. □□□□□□□□ OmniSS7 □□□□□ `curl -v http://your-app:9000/ussd`
2. □□□□□ HTTP □□□□□□□
3. □□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□

□□□□□□□□□ "systemFailure" □□□□□□□□□□□□□

□□□□□□□

- `turn_timeout_ms` □□□□□□□□□□□□□
- `http_timeout_ms` □□□□□□□□□□□□□□□□□□
- OmniSS7 □□□□□□□□□□□□□□□□□

□□□□□□

1. □□ `turn_timeout_ms`□□□ 30 □□□□□□□□□□□□□
2. □□□□□□□□□□□□□□□□□□□□□□□ `http_timeout_ms`
3. □□□□□□□□□□□□ OmniSS7 □□□□□□□□□

GSM 7 □□□□□

□□□□□□□□□ `gsm7_encode_failed` □□□□□□ `/api/ussd/send` □□ **500** □□□□ `error` □□□□ `{:gsm7_encode_failed, ...}`□

□□□□□□□

- □□□□□□□ GSM 7 □□□□□□□□□□□□□□□□□□□□□CJK □□□

□□□□□□

- □ USSD □□□□□□ GSM □□□□□□□ASCII □□□□□□□□□□□□□□□□□□□□□/□□□□□
- □□□ 3GPP TS 23.038 □ 6.2.1 □ □□□□□□□□

□□□□

- **API □□**□□□□ REST API □□□□□□□□□□ `/api/ussd/send`□
- **MAP □□□□□□**□USSD □□□ M3UA □□□□
- □□□□□□□□□□□
- □□□□□□□□Web UI□□□□ Prometheus □□

Web UI □□

← □□□□□

□□□□□□□□ OmniSS7 **Web UI**□Phoenix LiveView □□□□□□□□□

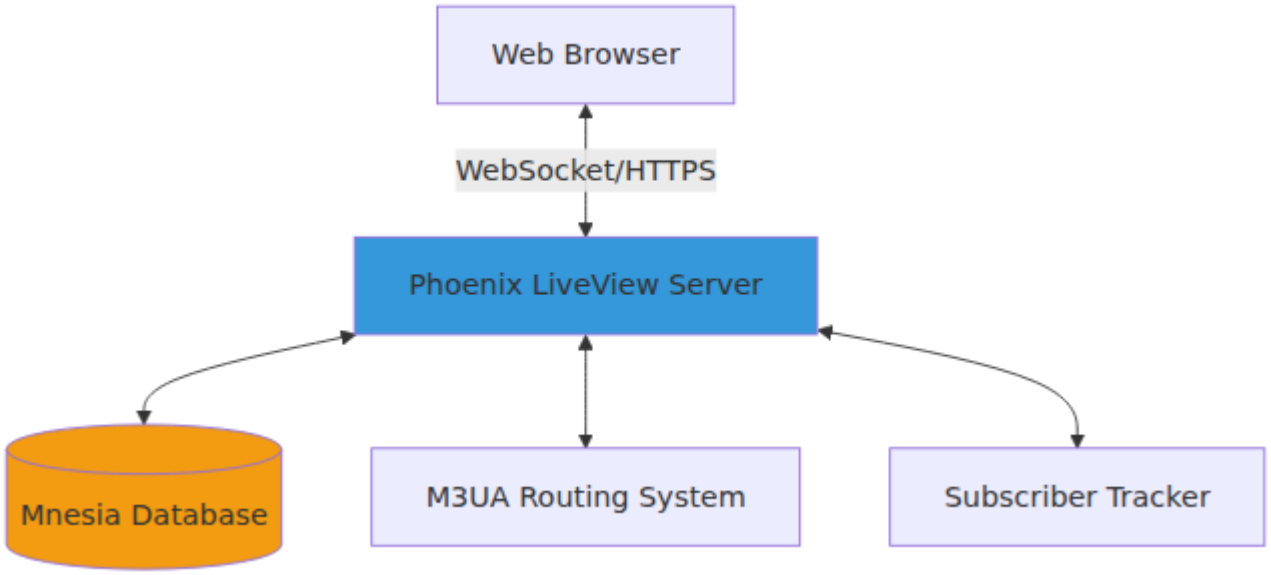
□□

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

□□

OmniSS7 Web UI □□□ **Phoenix LiveView** □□□□□□□□□

Web UI □□



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□□	□
□□	HTTPS (`force_ssl` □□)
□□	`8087`□□ `config :control_panel, ControlPanelWeb.Endpoint` □□□ → `https: [port: 8087]`□
□□ **IP**	`0.0.0.0`□□□□□□□□
□□	`priv/cert/omnitouch.crt`
□□	`priv/cert/omnitouch.pem`
□□□	Bandit (Phoenix)

□□ **URL**: `https://[server-ip]:8087`

□□ Web UI

□□□□

1. **SSL** □□: □□ `priv/cert/` □□□□□□□ SSL □□□
   - `omnitouch.crt` - □□□□
   - `omnitouch.pem` - □□□□
2. □□□□□□□: □□ `iex -S mix` □□□□□□□
3. □□□: □□□□ `8087` □ HTTPS □□□□

□□□□□□□□□

□□□□□□□□□□□ `config/config.exs` □□□□□□□□□□□□`use_builtin_pages` / `use_additional_pages`□□□□□□□□□□□□□□□□□□□□□□□□□□□□□STP/HLR/SMSc□□□□□□□□□□□□□□□□□□□

□□ (□□)	□□	**STP** □□	**HLR** □□	**SMSc** □□	□□
`/application`	□□	□	□	□	□□□□□□□
`/configuration`	□□	□	□	□	□□□□□
`/license`	□□□	□	□	□	□□□□□
`/events`	**SS7** □□	□	□	□	□□□□□ SCCP □□□□
`/logs`	□□□□	□	□	□	□□□□□□□□□ □□
`/client`	**SS7** □□□	□	□	□	□□ MAP □□□ □
`/m3ua`	□□□	□	□	□	M3UA □□□ / ASP □□□□
`/sctp`	**SCTP** □□	□	□	□	□□ SCTP □□ □□
`/routing`	□□	□	□	□	M3UA □□□□ □
`/routing_test`	□□□□	□	□	□	□□□□□□□
`/hlr_links`	**HLR** □□	□	□	□	HLR API □□ □□□□□□
`/subscribers`	□□□□□	□	□	□	□□□□□□□□□ (HLR)
`/smsc_links`	**SMSc** □□	□	□	□	SMSc API □ □□□□□□

□□ (□□)	□□	**STP** □□	**HLR** □□	**SMSc** □□	□□
`/smsc_subscribers`	**SMSc** □□□	□	□	□	□□□□□□□□ (SMSc)
`/camel_sessions`	**CAMEL** □□	□	□	□	□□ CAMEL/CAP □□□□
`/camel_request`	**CAMEL** □□□□□	□	□	□	□□□ CAP □□ □□□
`/msisdn_imsi_test`	**MSISDN/IMSI** □□	□	□	□	MSISDN ↔ IMSI □□ / □□ □□

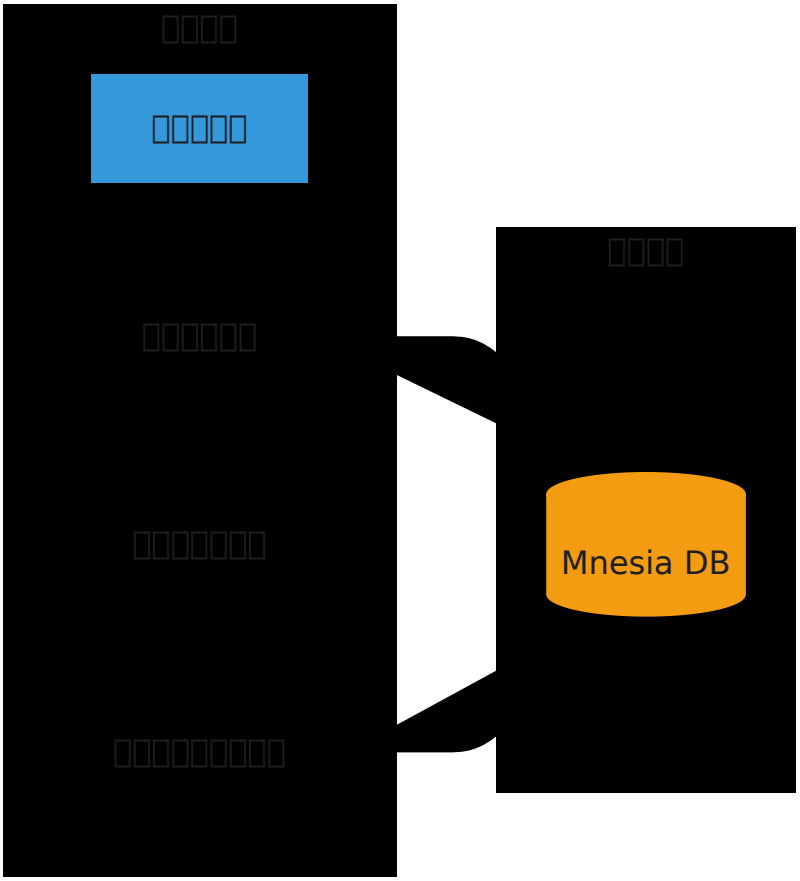
> M3UA □□□□□□□□□ "□□□"□□□ `/m3ua`□□

□□□□

□□: `/routing`
□□: STP, SMSc
□□□□: □ 5 □

□□□□□□□□□□□□□□□□□□□□□□□□ M3UA □□□□

□□□□



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□□ M3UA □□□□□□□□□ STP□HLR□MSC□SMSC□□

□□□□□

□	□□	□□
ID	□□□□□□□□□	`1`
□□	□□□□□□□□□	`"STP_West"`
□□	□□□□	`client`, `server`, `stp`
□□	□□□□ SS7 □□	`100`
□□	□□ IP:□□	`10.0.0.10:2905`
□□	□□□□	`active`, `aspup`, `down`
□□	□□/□□□□	-

□□□□□

1. □□ □□□□□□
2. □□ □□□□□
   - □□□ **ID**: □□□□□□□□□□
   - □□□□□: □□□□□□□□□□
   - □□: □□ `client`□`server` □ `stp`
   - □□: SS7 □□□□□□
   - □□ **IP**: □□□ IP □□
   - □□□□: 0 □□□□□□□□
   - □□ **IP**: □□□ IP □□
   - □□□□: □□□□□□□□□□ 2905□
   - □□□□□: M3UA □□□□□ ID
   - □□□□□: `international` □ `national`
3. □□ "□□□□□"

□□□: □□□□□□□□ Mnesia□□□□□□□□

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1. □□ □□□□□□□ "□□" □□
2. □□□□□□□ □□□□
3. □□ "□□□□□□"

□□: □□□□□□□□□ ID□□□□□□□□□□□□□□□□□□□□

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1. □□ □□□□□□□ "□□" □□
2. □□ □□□□□□□□□□□□□□□□□□□□□□□□□

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□□	□□	□□
`active`	□ □□	□□□□□□□□□□□□□□□
`aspup`	□ □□	ASP □□□□□□□□
`down`	□ □□	□□□□□□□□

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□	□□	□□
□□ **PC**	□□□□□zone.area.id □□□□□	`1.2.3` (100)
□□	□□ PC □□□□□□□□	`/14` (□□)□`/8` (□□)
□□□ **ID**	□□□□□□□□□□	`1`
□□□□□	□□□□□□□□□	`"STP_West"`
□□□	□□□□□□□1 = □□□	`1`
□□	□□□□□	`international`
□□	□□/□□□□	-

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1. □□ "□□□□" □□□
2. □□ □□□□□
   - □□□□: □□□ `zone.area.id`□□□□`1.2.3`□□□□□0-16383□
   - □□: □□□□ `/14` □□□□□□□□□□□□□□□□
   - □□□ **ID**: □□□□□□□□□□□□□□□
   - □□□: □□□□□□□1 = □□□□□□
   - □□□□□: □□ `international` □ `national`
3. □□ "□□□□"

□□□□: □□□□□□□□□□□□□□□

- **3-8-3** □□: `zone.area.id`□□□□`1.2.3`□
- □□□□: `0-16383`□□□□`1100`□

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□□□ 14 □□□0-16383□□□□□□□□□□□□□□□□□□□□□

□□	□□□ **PC**	□□
`/14`	1 (□□□□)	���□□□□□□
`/13`	2 PCs	□□□
`/8`	64 PCs	□□□□
`/0`	□□ 16,384 PCs	□□/□□□□

□□:

- `PC 1000 /14` → □□□ PC 1000
- `PC 1000 /8` → □□ PC 1000-1063□64 □□□ PCs□
- `PC 0 /0` → □□□□□□□□□□□□□□

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□□ SCCP □□□□□□□□□□□□□□□□

□□: □□□□□□□□□□□□□□□□□□

```
config :omniss7,
  enable_gt_routing: true
```

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□	□□	□□
GT □□	□□□ GT □□□□□ = □□□	`"1234"` □ `""`
□ **SSN**	□□□□□ SSN□□□□	`6` (HLR)□ `any`
□□□ **ID**	□□□□□	`1`
□□□	□□□□□	`"HLR_West (1)"`
□□ **SSN**	□□□□□ SSN□□□□	`6`□ `preserve`
□□□	□□□□□	`1`
□□	□□□□	`"US numbers"`
□□	□□/□□□□	-

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1. □□ "□□□□□□□" □□□
2. □□ □□□□□
   - **GT □□**: □□□□□□□□□□□□□□□□□□□□□□□□□ `"1234"` □
   - □ **SSN**: □□ - □□□□ SSN □□
   - □□□ **ID**: □□□□□□□□
   - □□ **SSN**: □□ - □□□□□ SSN
   - □□□: □□□□□□□1 = □□□
   - □□: □□□□
3. □□ "□□□□"

□□□□: □□ GT □□□□□□□□□□□□□□□□□□□□□□□□□□ GT □□□□

□□ **SSN** □

□□□□□□□□□□□□□□□□□ SSN □□

SSN	□□□□
6	HLR (□□□□□□□□)
7	VLR (□□□□□□□□)
8	MSC (□□□□□□□)
9	EIR (□□□□□□□□)
10	AUC (□□□□)
142	RANAP
145	gsmSCF (□□□□□□)
146	SGSN

SSN □□

- □ **SSN**: □□□□□□□□□□□□ SSN
- □□ **SSN**: □□□□□□□□□□□□□□□□ SSN
  - □ = □□□□ SSN
  - □ = □□□□ SSN

□□: □ SSN=6 (HLR) □□□□□□□□□□□□□□□□□□□□ SSN=7 (VLR)□

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□□□□□□□□ **Mnesia** □□□□□□□□□□□□□□□

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1. **Web UI** □□: □□□□/□□/□□□□□□□□□ Mnesia
2. □□□□□□□: □□□□□□□□ Mnesia □□
3. **Runtime.exs** □□: □□ `config/runtime.exs` □□□□□□□ Mnesia □□□□□□□□□

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2. □□□□□□: □□□□□□□□□□□□□□1 = □□□□□□□
3. □□□□□□: □□□□□□□□□ `active` □□□□□□□□

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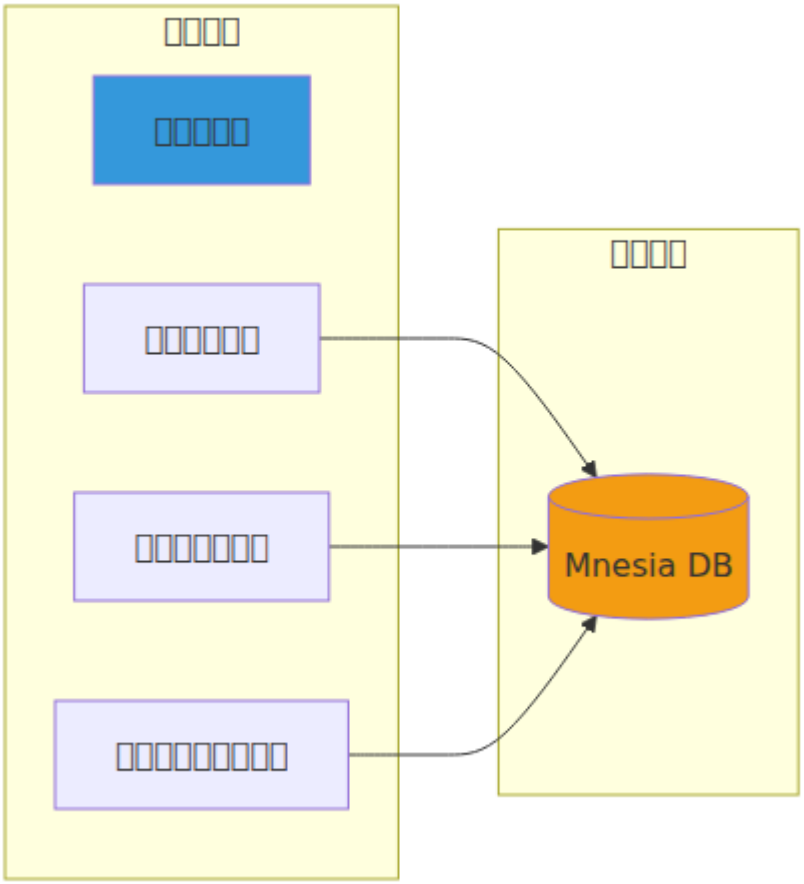
□□: `/subscribers`
□□: □ HLR
□□□□: □ 2 □

□□□□ UpdateLocation □□□□□□□□□□□□□

□□□□



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□	□□	□□
IMSI	□□□ IMSI	`"50557123456789"`
VLR □□	□□ VLR GT □□	`"555123155"`
MSC □□	□□ MSC GT □□	`"555123155"`
□□□□	□□ UpdateLocation □□□	`"2025-10-25 14:23:45 UTC"`
□□□□	□□□□□□□□□	`"2h 15m 34s"`

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- □□□: □□□□□□□□□
- □□ **VLRs**: □□ VLR □□□□□
- □□ **MSCs**: □□ MSC □□□□□

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□□□ **2** □ □□□□□□□□□□□□□□□□□□□

SMSc □□□

□□: `/smsc_subscribers`
□□: □ SMSc
□□□□: □ 2 □

□□□□□ HLR □□□□ alertServiceCenter □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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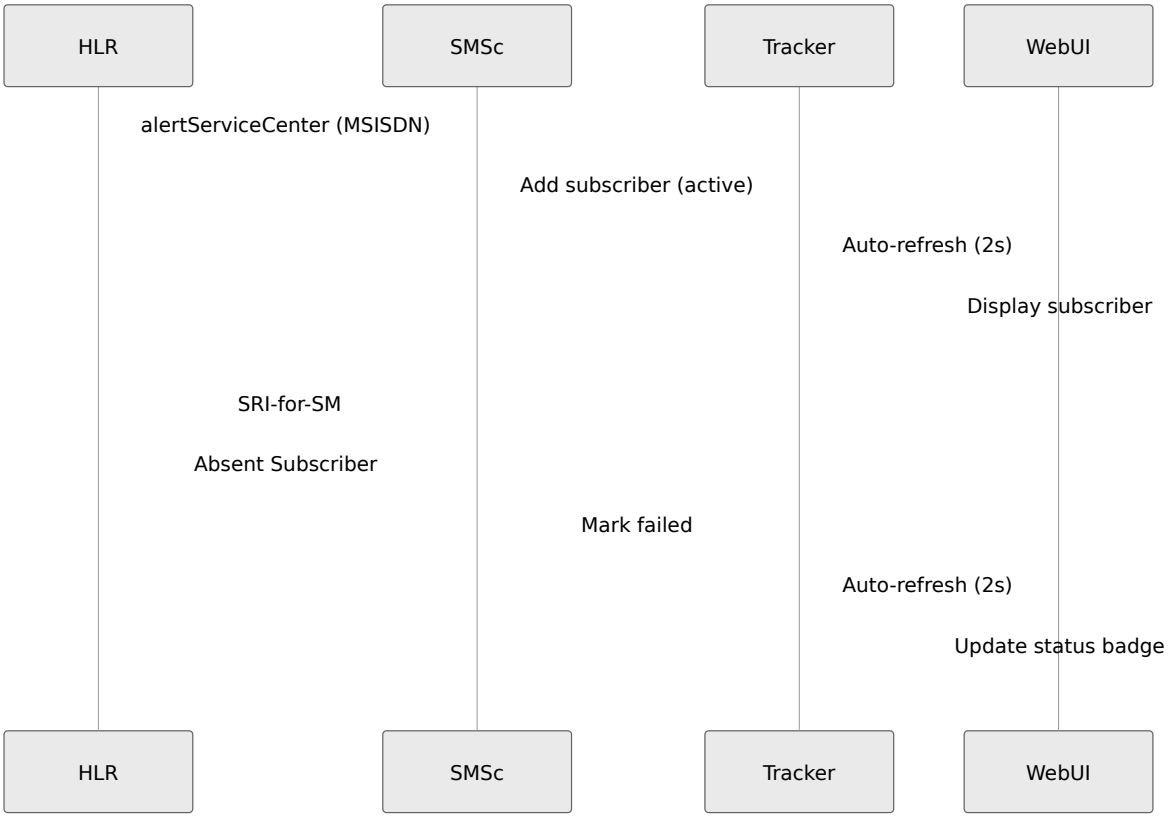

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MSISDN	□□□□□□□□□	`"15551234567"`
IMSI	□□□ IMSI	`"001010123456789"`
HLR GT	□□ alertServiceCenter □ HLR GT	`"15551111111"`
□□□□□	□□□ MT-FSM □□□□	`5`
□□□□□	□□□□□□□ MO-FSM □□□□	`2`
□□	`□□` □ `□□`□□□□□□	`● □□`
□□□□	□□□□□□□□	`"2025-10-30 14:23:45 UTC"`
□□□□	□□□□□□□□□□	`"15m 34s"`

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- ● □□ (□□): □□□□□□□□□□□□□□□□ alertServiceCenter
- ○ □□ (□□): □□□□□□□□□□□□SRI-for-SM □□□□□□□□□

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- □□: □□□□□□□□□□□□
- □□ **HLRs**: □□□□□□□ HLR □□

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1. □□ **1**: □□ REST API □□□□□□□
2. □□ **2**: □□ `config/runtime.exs` □□□□□□□□
3. □□ **3**: □□ Web UI □□□□□□□□□

□□/□□

□□: Web UI □□□□□□□□□□□□□□□□□□□□□

- □□□ Mnesia □□□□□□□
- □ `config/runtime.exs` □□□

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1. **Mnesia**: □□ `Mnesia.{node_name}/` □□
2. □□: □□□□ `config/runtime.exs`

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□□□□	5 □	□□□□□□□□
□□□□□	2 □	□□□□□□□□□□
M3UA □□	□□□□□	□□□□□□□

WebSocket □□: □□□□□□ Phoenix LiveView WebSocket □□□□□□□□□

□□□□: □□ WebSocket □□□□□□□□□□□□□□□□□□

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1. □□ **HTTPS** □□: □□ `priv/cert/omnitouch.crt` □ `priv/cert/omnitouch.pem` □□
2. □□□□ **8087**: □□□□□□□□□□□□ `8087` □ HTTPS □□
3. □□□□□□□: □□□□□□□□□□□□□□ `iex -S mix`
4. □□□□□□□: □□ SSL □□□□□□□□□□□□□□

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1. □□ **Mnesia** □□: □□□□□□ `mnesia_storage_type: :disc_copies`
2. **Mnesia** □□: □□ Mnesia □□□□
3. □□□□: □□□□□□□□□□ Mnesia □□

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1. **WebSocket** □□: □□□□□□□□□□ WebSocket □□
2. □□: □□□□□□□□
3. □□□□□□: □□□□□□ (F5)

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- **STP □□** - □□□□□□□
- **HLR □□** - □□□□□
- **API □□** - □□□□□□□ REST API
- □□□□ - □□□□□□

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OmniSS7 Web UI □□□□□□□□□□□□□□□□□□□□□□□□

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□ □□□□ - Mnesia □□□□□□□□□□□
□ □□□□□ **UI** - □□□□□□□□□ (STP/HLR/SMSc) □□□□
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□□□□□□□□□□□□□□□ API □□□

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← □□□□□

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1. □□□□
2. □□□□□TT□□□
3. □□□□□□□□NPI□□□
4. □□□□□NAI□□□
5. □□□□
6. □□□□□□

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□□□□□**TT**□□

- `0` = □□
- `1` = □□
- `2` = □□
- `3` = □□□□

□□□□□□□□**NPI**□□

- `0` = □□
- `1` = ISDN/□□□E.164□
- `3` = □□□X.121□
- `4` = □□□F.69□

- `6` = □□□□□E.212□

□□□□□□□□□**NAI**□□

- `0` = □□
- `1` = □□□□
- `2` = □□□□□□□□□
- `3` = □□□□□□□
- `4` = □□□□

□□□□□

- □□□□□source_tt, source_npi, source_nai□□□□□□□□□□
- □□□□□□□dest_tt, dest_npi, dest_nai□□□□□□□□□□□
- □□□□□□`nil`□□□□□□□□□□□□□□□□

□□□□□TT□□□

□□ 1□□□□□□□TT□□

□□□ □□□□□□□□□□□□GT□TT=0□□□□□□□□□HLR□□TT=1□□□□□

```
%{
  gt_prefix: "44",
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□TT□□□□□",
  source_tt: 0,      # □□□□TT=0
  dest_tt: 1         # □□□TT=1
}
```

□□□□□

- □□□GT=441234567890□TT=0
- □□□□□□gt_prefix="44"□source_tt=0

- □□□GT=441234567890□TT=1□□□□□

□□ 2□□□□□□□□□□

□□□ □□□TT□□□□□□□□□

```
# □TT=0□□□□□A
%{
  gt_prefix: "33",
  peer_id: 1,
  priority: 1,
  description: "□□□□TT=0□□□□□A",
  source_tt: 0
},

# □TT=2□□□□□B
%{
  gt_prefix: "33",
  peer_id: 2,
  priority: 1,
  description: "□□□□TT=2□□□□□B",
  source_tt: 2
}
```

□□□□□

- GT="33123456789"□TT=0 → □□□□□1
- GT="33123456789"□TT=2 → □□□□□2

□□□□□□□□NPI□□

□□ 1□□□□ISDN NPI□□

□□□ □□□□□□NPI=6□E.212□□PSTN□□NPI=1□E.164□□

```
%{
  gt_prefix: "49",
  peer_id: 1,
  priority: 1,
  description: "□□□□→ISDN□□",
  source_npi: 6,     # □□NPI=6□□□/E.212□
  dest_npi: 1        # □□□NPI=1□ISDN/E.164□
}
```

□□□ □□□□□□□□□□□□□□□□□□□□□□□□

□□ 2□□□□□□□□□□

□□□ □□□□□□□□□□□□□□□□□□

```
# □□□□□□□□□□NPI=3□
%{
  gt_prefix: "1",
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□",
  source_npi: 3      # □□NPI=3□□□/X.121□
},

# □□□□□□□□□□NPI=1□
%{
  gt_prefix: "1",
  peer_id: 2,
  priority: 1,
  description: "□□□□□□□",
  source_npi: 1      # □□NPI=1□ISDN□
}
```

□□□□□NAI□□□

□□ 1□□□□□□□NAI□□

□□□ □□□□□□□□NAI=4□□□□□□□□□□□NAI=3□□□□□□□□□

```
%{
  gt_prefix: "1",
  peer_id: 1,
  priority: 1,
  description: "□□□□□→□□□□",
  source_nai: 4,     # □□NAI=4□□□□□
  dest_nai: 3        # □□□NAI=3□□□□
}
```

□□□□□

- □□□GT=12125551234□NAI=4□□□□□
- □□□GT=12125551234□NAI=3□□□□□

□□ 2□□□□□□NAI□□

□□□ □□□□□□□□□□□□□□□□□□□□□

```
# □□□□□□□□□HLR
%{
  gt_prefix: "44",
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□□□□HLR",
  source_nai: 1      # □□NAI=1□□□□□□
},

# □□□□□□□□□MSC
%{
  gt_prefix: "44",
  peer_id: 2,
  priority: 1,
  description: "□□□□□□□□□□MSC",
  source_nai: 3      # □□NAI=3□□□□□□□□
}
```

□□□

□□ 1□SMS□□□□

□□□ □□□□HLR□□□□□□□□□□□□□□□□SMS□□□

```
%{
  gt_prefix: "86",
  source_ssn: 8,           # □□SSN=8□SMSC□
  peer_id: 1,
  dest_ssn: 6,             # □□□SSN=6□HLR□
  priority: 1,
  description: "□□SMS□□□",
  source_tt: 0,            # □□TT=0□□□□
  dest_tt: 2,              # □□□TT=2□□□□
  source_npi: 6,           # □□NPI=6□□□□
  dest_npi: 1,             # □□□NPI=1□ISDN□
  source_nai: 4,           # □□NAI=4□□□□
  dest_nai: 3              # □□□NAI=3□□□□
}
```

□□□□□□□□

- □□SMS□□□SSN=8□□□□□□□□□GT□□"86"□
- □□□□□□□□□□□□□□□□
- □□□SSN□SMSC□8□□□□HLR□6□
- □□□□□□□□□□□□□□□□□□□□□□□

□□ 2□□□□□□□□□□□□□

□□□ □□TT□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

```
# □□□A□□□□□TT□ISDN NPI
%{
  gt_prefix: "44",
  peer_id: 1,
  priority: 1,
  description: "□□□□□A□□□□□□□/ISDN",
  source_tt: 0,            # □□□□TT=0
  dest_tt: 2,              # □□□TT=2□□□□
  source_npi: 6,           # □□□□NPI
  dest_npi: 1              # □□□ISDN NPI
},

# □□□B□□□□□TT□□□NPI
%{
  gt_prefix: "44",
  peer_id: 2,
  priority: 2,             # □□□□□□□□□□□□
  description: "□□□□□B□□□□□□TT",
  source_tt: 2,            # □□□□TT
  dest_tt: 1               # □□□□□TT
  # NPI□□ = □□□□□
}
```

□□□□□□

□□ 1□□□□□□□

□□□ □□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□ □□□□□□□□□□□□□□□□□□□□

```
%{
  gt_prefix: "555",
  peer_id: 1,
  priority: 1,
  description: "□□HLR□□□",
  # □□□□□□□□□
  source_tt: 1,           # □□□□□
  dest_tt: 0,             # □□□□□
  source_npi: 1,          # □□□ISDN
  dest_npi: 0,            # □□□□□
  source_nai: 4,          # □□□□□
  dest_nai: 0             # □□□□□
}
```

□□ 2□□□□□□□□

□□□ □□□□□□□□□□□□□□□□□□□□□□□□

□□□□□ □□□□□□□□□□□□□□□□□□□□

```
# □□□□A□□TT=0□□□□□□□TT=1
%{
  gt_prefix: "1",
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□A□□□",
  source_tt: 0,
  dest_tt: 1,
  dest_npi: 1,             # □□ISDN NPI
  dest_nai: 4              # □□□□NAI
},

# □□□□B□□TT=3□□□□□□□□□□□TT=1
%{
  gt_prefix: "44",
  peer_id: 2,
  priority: 1,
  description: "□□□□□□□B□□□",
  source_tt: 3,
  dest_tt: 1,
  dest_npi: 1,
  dest_nai: 4
}
```

□□ 3□□□□□□□

□□□ □□□□□□□□□□□□□□□□□□□□□□□

□□□□□ □□□□□□□□□□□□□□□

```
# ???□□□□□□□□□□□□□□
%{
  gt_prefix: "12025",      # □□□□□□□□
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□□",
  source_nai: 4,           # □□□□□□□□□□□□
  dest_nai: 3,             # □□□□□
  source_npi: 6,           # □□□□
  dest_npi: 1              # □HLR□ISDN
}
```

□□ 4□□□□□

□□□ □□□□□□□□□□□□□□□□□

□□□□□ □□□□□□□□□□□□□□□□□□□

```
# □□□□□□□□□□□□□□□
%{
  gt_prefix: "999",
  peer_id: 1,
  priority: 1,
  description: "□□□□□□□□□□",
  source_tt: 0,            # □□□□
  dest_tt: 2,              # □□□□
  source_npi: 0,           # □□□□
  dest_npi: 1,             # □□ISDN
  source_nai: 0,           # □□□□
  dest_nai: 3              # □□□□
},

# □□□□□□□□□□□□
%{
  gt_prefix: "999",
  peer_id: 1,
  priority: 2,
  description: "□□□□□□",
  source_tt: 2,            # □□□□□□
  # □dest_*□□ = □□□□□
}
```

□□□□□□

□□Web UI

1. □□□ □□ → □□□□□□□
2. □□ **“□□□□□□□□TT/NPI/NAI□”**
3. □□□□□□□□□□□□
4. □□ □□□□
5. □□ □□□□ □□□□□□□

□□API

GT□□□□□□□□API□□□□□`/routing/gt-routes`□□□□ **8445**□□□TLS□□JSON□□□□□□□`prefix`□□□□`gt_prefix`□□`prefix`□`peer_id`□□□□□□TT/NPI/NAI□□□□□□□□□□□□□

```
curl -k -X POST https://localhost:8445/routing/gt-routes \
  -H "Content-Type: application/json" \
  -d '{
    "prefix": "44",
    "peer_id": 1,
    "priority": 1,
    "description": "□□TT□□",
    "source_tt": 0,
    "dest_tt": 1
  }'
```

□□	□□	□□	□□
`prefix`	□□□	□	□□□□GT□□
`peer_id`	□□	□	□□□□□ID□`0` = □□□
`priority`	□□	□	□□□□□□□□`1`□□□□□□□□□□□
`description`	□□□	□	□□□□□□□
`source_ssn` / `dest_ssn`	□□	□	□□/□□□□□SSN
`source_tt` / `dest_tt`	□□	□	□□/□□□□□□
`source_npi` / `dest_npi`	□□	□	□□/□□□□□□□□□
`source_nai` / `dest_nai`	□□	□	□□/□□□□□□□□□

□□□□□□□□□`/routing/gt-routes/{prefix}:{peer_id}`□□`DELETE`□□□□□`/routing/gt-routes/44:1`□□

□□□□□□

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

1. □□GT□□□□□□□“441234567890”□
2. □□TT□NPI□NAI□
3. □□“□□□□”
4. □□□□□□□□□□□□□□□□□□□□□□

□□□□

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□□□□□□□□□

1. □□GT□□□□
2. □□□□□□source_ssn□□□□□□
3. □□□□□□source_tt□□□□□□
4. □□□□□□source_npi□□□□□□
5. □□□□□□source_nai□□□□□□
6. □□□□□□□□□□□□□□

□□□□□

□□**dest_**□□□□□□□□

- □□dest_tt/dest_npi/dest_nai□□□“□□□□□”
- □□□□□□dest_*□□□□□

□□□□□□

:bag□□□□□□

- GT□□□□□□□□`:bag`□□□□□□□□□□□□□□□□□□

- □□`{gt_prefix, source_ssn}`
- □□TT/NPI/NAI□□□□□□□□+SSN□□□
- □□□□□□□□□□

□□□□

1. □□□□□□□ □□□□□□□□□□
2. □□□□□ □□□□□□□□□□□□□
3. □□□□□ □□INFO□□□□□□□□□□
4. □□□□□□ □□□□□□□□□□□□□□□□□□□□□
5. □□□□□□□□□ □□source_*□□□□□□□
6. □□□□□□ □□□□□□□□□□
7. □□□□□□ □□□□□□□□□□□□□□□

□□□□□□□□□□□

- ← □□□□□
- STP□□ - □□□□□□
- □□□□ - □□□□□□
- API□□ - REST API□□

OmniSS7 □Omnitouch□□□□□□

M3UA STP □□□□□□

← □□□□□

□□

M3UA STP □□□□ (PC) □□□□□□□□ □□□□ **(GT)** □□□GT □□□□ SCCP □□□□□□□□□□□□□ SS7 □ □□□□□□□□ PC □□□

□□□□

□□□□□

1. **GT** □□□□□□□□□□ SCCP □□□□□ GT → □ GT □□□□□□
2. **PC** □□□□□□□□□ MTP3 □□□ DPC → □ PC □□□□□□

GT □□□□

- □□ □□□□□□ □□
- □□□GT "447123456789"
  - □□ "447"□□□ 3□□□□ "44"□□□ 2□
  - □□□□□□ "447" □□□□□□

□□

□□ GT □□

□ `config/runtime.exs` □□

```
config :omniss7,
  enable_gt_routing: true,  # □□□ false □□□ PC □□
```

□□ GT □□

```
config :omniss7,
  m3ua_gt_routes: [
    # □□□□□□□□ 1234 □□□□□□□□□□ 1
    %{gt_prefix: "1234", peer_id: 1, priority: 1, description: "□□
□□"},

    # □□□□□□□□ 44 □□□□□□□□□□ 2
    %{gt_prefix: "44", peer_id: 2, priority: 1, description: "□□□
□"},

    # □□□□□□□□□□□□□□□447xxx□
    %{gt_prefix: "447", peer_id: 2, priority: 1, description: "□□□
□"},

    # □□□□□□□□□□ 61 □□□□□□□□□□ 3
    %{gt_prefix: "61", peer_id: 3, priority: 1, description: "□□□□
□□"}
  ]
```

> □□□□□□□□□ STP □□□□□ `config/stp_example_runtime.exs` □□□□□□□□□□□□□□□□ STP □□□

□□□□

□□ 1□□□ GT □□

□□□SCCP UDT□Called GT = "447700123456"

□□□□□

- □□□ GT□ "447700123456"
- □□□□□ "447"□□□□□□→ □□□ 2
- □□□□□□□□□ 2

□□ 2□□□□ GT□□□□ PC

□□□SCCP UDT□Called GT = "331234567890"□DPC = 100

□□□□□

- □□□ GT□ "331234567890"
- □□□ "33" □ GT □□
- □□□ PC □□
- DPC 100 → □□□ 1□□□ PC □□□□
- □□□□□□□□□ 1

□□ 3□□□ GT

□□□□□ SCCP □ M3UA DATA□□ MTP3□DPC = 200

□□□□□

- □□ SCCP □□□□ GT
- □□□ PC □□
- DPC 200 → □□□ 2
- □□□□□□□□□ 2

□□□□□

□□□□□ `M3UARouting` □□□□□□ `iex -S mix` □□□□□□

□□ GT □□

```
# □□□□□ GT □□
{:ok, routes} = M3UARouting.get_all_gt_routes()

# □□□□□□□□ 14 □□□□□□□□
# {:m3ua_gt_route, gt_prefix, source_ssn, peer_id, dest_ssn,
priority,
#  description, enabled, source_tt, dest_tt, source_npi, dest_npi,
#  source_nai, dest_nai}
#
# □□□□□□source_ssn □□□□/□□□□□□□□ nil□□
[
  {:m3ua_gt_route, "1234", nil, 1, nil, 1, "□□□□", true, nil, nil,
nil, nil, nil, nil},
  {:m3ua_gt_route, "44", nil, 2, nil, 1, "□□□□", true, nil, nil,
nil, nil, nil, nil},
  {:m3ua_gt_route, "447", nil, 2, nil, 1, "□□□□", true, nil, nil,
nil, nil, nil, nil},
  {:m3ua_gt_route, "61", nil, 3, nil, 1, "□□□□□□", true, nil, nil,
nil, nil, nil, nil}
]
```

□□□□ GT □□

`add_gt_route/3` □□□□□□□□□□□□□□□□□ ID□□□□□□□□□`priority`□`description`□`source_ssn`□`dest_ssn`□TT/NPI/NAI □□□□□□□□□□ `enabled`□□□□□□□□□

```
# □□□add_gt_route(gt_prefix, peer_id, opts \ [])

# □□□□□□□□□□
M3UARouting.add_gt_route("49", 4, priority: 1, description: "□□□
□")

# □□□□ SMS □□□□□□ SSN 8□SMSC□□□ SSN □□□ 6□HLR□
M3UARouting.add_gt_route("55", 4,
  source_ssn: 8,
  dest_ssn: 6,
  priority: 1,
  description: "□□□ HLR □ SMS □□"
)
```

□□ GT □□

```
# □□□□□gt_prefix, peer_id, □□□ source_ssn□
M3UARouting.remove_gt_route("49", 4)
```

□□ GT □□

```
# □□□□□□□□□□□□ GT
# □□□lookup_peer_by_gt(global_title, source_ssn \ nil, opts \ [])
{:ok, peer, rewrites} =
M3UARouting.lookup_peer_by_gt("447700123456")

# `peer` □ 13 □□□ m3ua_peer □□□
# {:m3ua_peer, peer_id, peer_name, protocol, role, local_ip,
local_port,
#  remote_ip, remote_port, routing_context, point_code,
network_indicator, status}
#
# `rewrites` □□□□□□□□□□□□□□ MAP□
# nil □□□“□□□□”□
#   %{dest_ssn: nil, dest_tt: nil, dest_npi: nil, dest_nai: nil}
```

□□□□□□□□□□□□□□□□□□□□□□□□□□□□ `"55"` □□□ `dest_ssn: 6`□

```
{:ok, peer, rewrites} =
M3UARouting.lookup_peer_by_gt("5512345678", 8)
# rewrites => %{dest_ssn: 6, dest_tt: nil, dest_npi: nil,
dest_nai: nil}
```

`peer_id: 0`□DROP□□□□□ `{:error, :dropped}`□□□□□ GT □□ `{:error, :no_gt_route}`□

□□□□

STP □□ GT □□□□□

```
[info] □□ M3UA DATA: OPC=1000, DPC=200, Called GT="447700123456"□□
□□□□ 1□
[info] □ GT □□□447700123456
[info] □□□□□□□ 1 □□□□□□□ 2
```

□□ GT □□□□□

```
[info] □□ M3UA DATA: OPC=1000, DPC=200, Called GT="331234567"□□□□□
□ 1□
[info] □□□ GT □□ 331234567
[info] □□□□□□□ 1 □□□□□□□ 2□□□ PC □□□
```

SCCP □□

□□□ SCCP □□

□□	□□	□□
UDT (□□□□)	0x09	□□□□□GT □□□□□□□□□□
UDTS (□□□□□□)	0x0A	□□□□□□□□□□□□□□□□□□□□
XUDT (□□□□□□)	0x11	□□□□□GT □□□□□□□□□□□□□□□□□□
XUDTS (□□□□□□□□)	0x12	□□□□□□□□□□□□□□□□□□□□
LUDT (□□□□□)	0x13	□□□□□GT □□□□□□□□□□□□□□□□□□
LUDTS (□□□□□□□)	0x14	□□□□□□□□□□□□□□□□□□□□

XUDT □ LUDT □□ SCCP □□□□□□STP □□□□□□□□□□□□□□□□□□□□

□□□□

GT □□□□

□□□□□□□□ `Called GT=nil`

□□□□□□

1. □□ SCCP □□□□□□□□ UDT/XUDT/LUDT
2. □□□□□□□□□□□□□□□□□□
3. □□□□□□□□□□ SCCP □□□□□□

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□□□□□□

1. □□ GT □□□□□□□□□□□□□□
2. □□ `peer_id` □□□□□□□□□□□□
3. □□□□□□□□□□ = □□□□□□□

□□□ PC □□□

□□□□□□□ GT □□□□□□□

□□□□□□

1. □□ `enable_gt_routing` □□□ `true`
2. □□ PC □□□□□□□□ DPC □□□
3. □□ PC □□□□□□□□□□□

□□□□

1. □□□□□□□□□□□□□□□□□□□□□□□□□□□□

- □□ "447"□"448"□"449" □□□□□□□□□□□□
- □□□□□□ "44" □□□□□□□

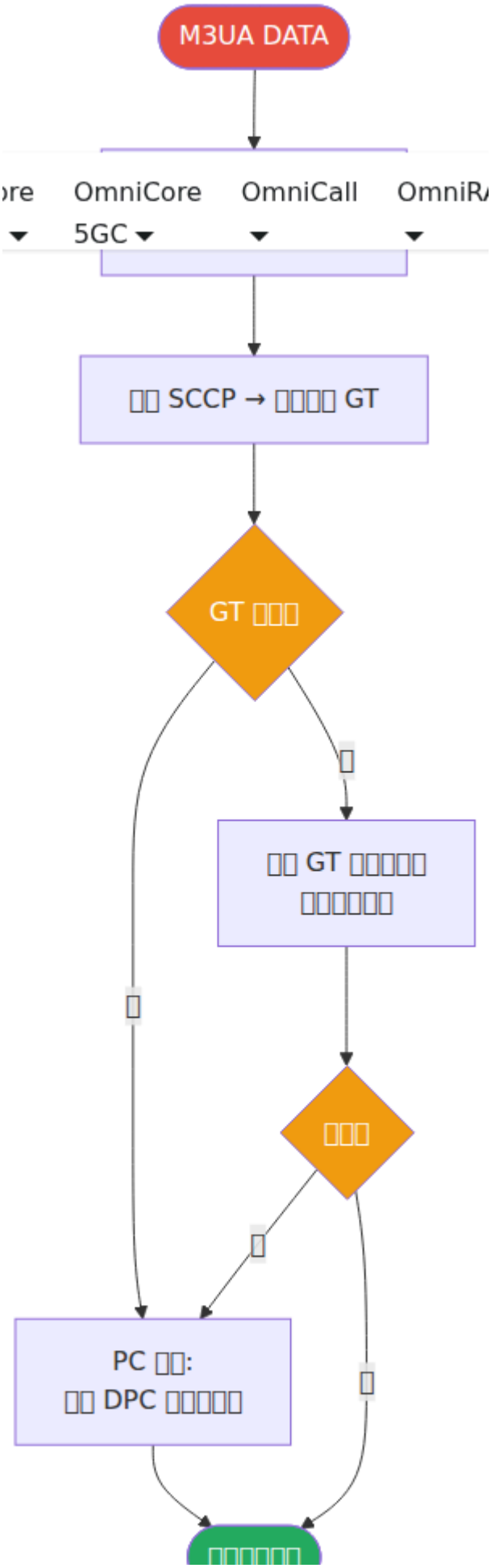
2. □□□□□□□□□□□□□

```
M3UARouting.add_gt_route("1234", 1, priority: 1,
  description: "ACME Corp - □□□□□")
```

3. □□□□□□□□ `lookup_peer_by_gt/1` □□□□

4. □□□□□□□□□□□□□□□□□□□

5. □□□□□□□□ PC □□□□□□□


M3UA DATA
ore
OmniCore
5GC
OmniCall
OmniR
□□ SCCP → □□□□ GT
GT □□□
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□□ GT □□□□□
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PC □□:
□□ DPC □□□□□
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OmniSS7 □ Omnitouch □□□□□□