

OmniTWAG □□□□□

□ OmniTouch □

OmniTWAG □□□□□ OmniTWAG □□□



1. □□
 2. □□□ WiFi □□□
 3. □□□□
 4. □□□□
 5. □□□□
 6. □□□□
 7. □□□□□
 8. □□ 2.0 □□
 9. □□□□□
 10. □□□□
 11. □□□□□
-



OmniTWAG □□□ WiFi □□□□□ 3GPP TWAG □□□□□□□□□□□□□□□
□□ WiFi □□□□□□□□□□□ SIM □□□

TWAG □□ EAP-AKA□□□□□ - □□□□□□□□□□□ SIM □□ WiFi □□□□□□□□□□□
□□□□□□□□□□□ WiFi □□□□□ WiFi □□ WiFi □□



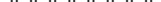
- ဣဣဣဣဣဣဣ SIM ဣဣဣဣ
 - ဣဣဣဣဣဣဣဣဣဣဣ
 - ဣဣဣဣဣဣ WiFi/WPA2
 - ဣဣဣဣ SIM ဣဣ

□ □ □ □ □ □ □ □

100 / 100

- WiFi

WiFi

WiFi  WiFi 

TWAG

TWAG □□□□□□□□

- WiFi 互联互通 RADIUS 互通
 - 互联互通 HSS/HLR互通 Diameter SWx 互通

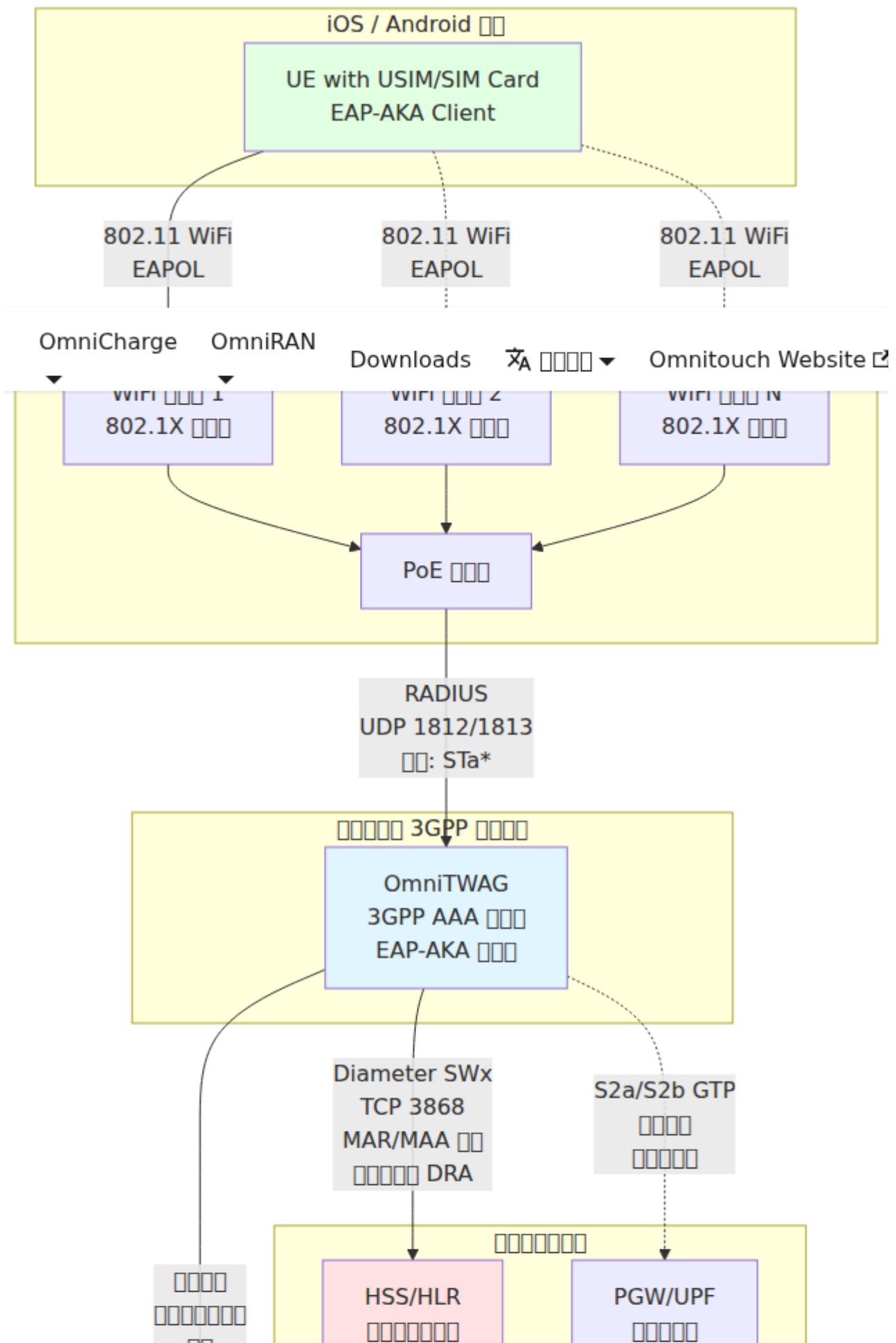
Wi-Fi AP

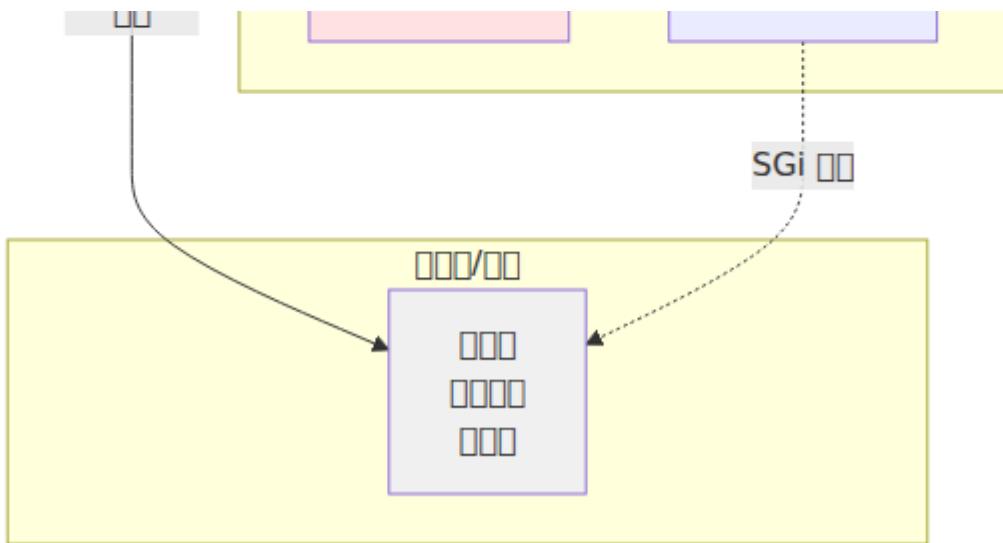
1. SIM卡 IMSI卡 SIM 卡
 2. WiFi AP 及 RADIUS 协议 TWAG

3. TWAG ဗုဒ္ဓဓမ္မ HSS ဗုဒ္ဓဓမ္မ
 4. ဗုဒ္ဓ TWAG ဗုဒ္ဓ EAP-AKA ဗုဒ္ဓ-ဗုဒ္ဓ
 5. ဗုဒ္ဓဓမ္မများ WiFi ဗုဒ္ဓ
 6. ဗုဒ္ဓဓမ္မများ ဗုဒ္ဓဓမ္မများ
-

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3GPP AAA

- **STa***: WiFi AP և TWAG մասնակի RADIUS/Diameter պահանջ 3GPP և AAA համապատասխան
- **SWx**: TWAG-3GPP AAA մասնակի HSS մասնակի Diameter համապատասխան
- **S2a/S2b**: բարեկամային GTP պահանջ համապատասխան
- **SGi**: բարեկամային պահանջ համապատասխան
- **802.11**: WiFi պահանջ
- **EAPOL**: EAP over LAN-802.1X պահանջ

3GPP AAA

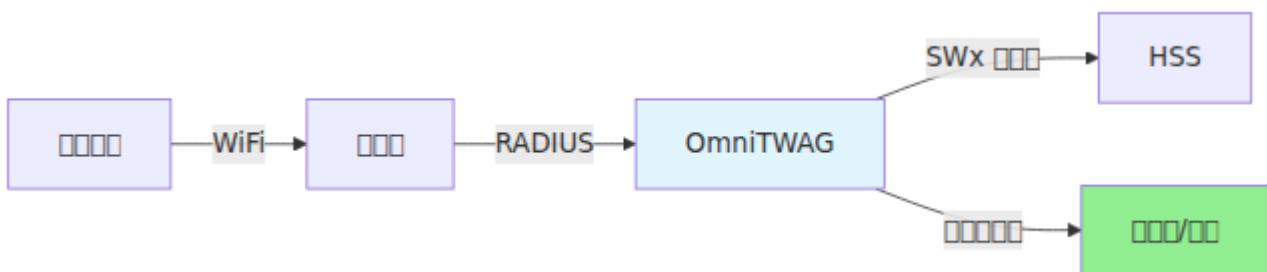
Առ 1 պահանջ համապատասխան



LTE

- 3GPP AAA
- RADIUS
- 3GPP2 AAA
- WiFi

2 3GPP2 AAA GTP ？？？

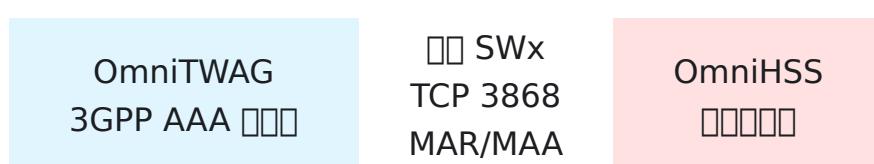


LTE

- 3GPP2 AAA
- LTE/UMTS
- 3G VPN/3GPP2
- WiFi 3GPP2 AAA

SWx چیزی

1 3GPP2 HSS

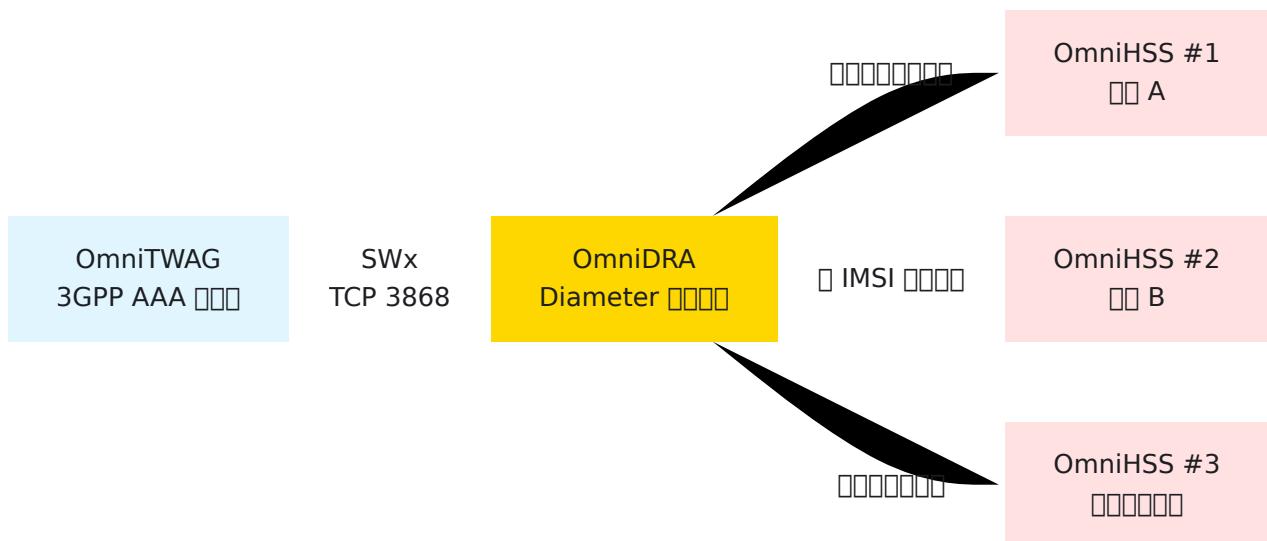


3GPP2 چیزی HSS

三

- 0000000000 DRA0
 - 00000
 - 00000000

2000 DRA/Diameter



□□□ HSS □□□□□□□□□□□□□

三

- ۰۰۰۰۰۰
 - ۰۰۰ HSS ۰۰۰۰۰
 - ۰۰۰۰۰۰۰۰۰ HSS۰
 - ۰۰۰۰۰۰
 - ۰۰۰۰۰

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Wi-Fi AP RADIUS TWAG Gy DRA/OCS

OmniTWAG 3GPP AAA TWAG

1. 3GPP AAA

OmniTWAG 3GPP AAA

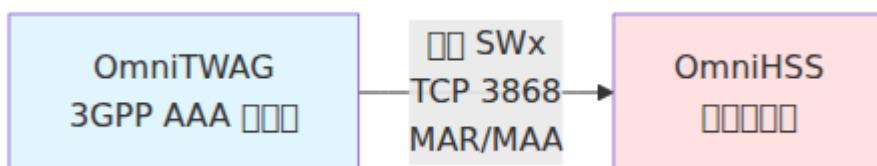
1.1. 3GPP AAA

OmniTWAG 3GPP AAA

AAA

- 3GPP AAA WiFi
- 3GPP AAA RADIUS
- 3GPP AAA RADIUS

AAA



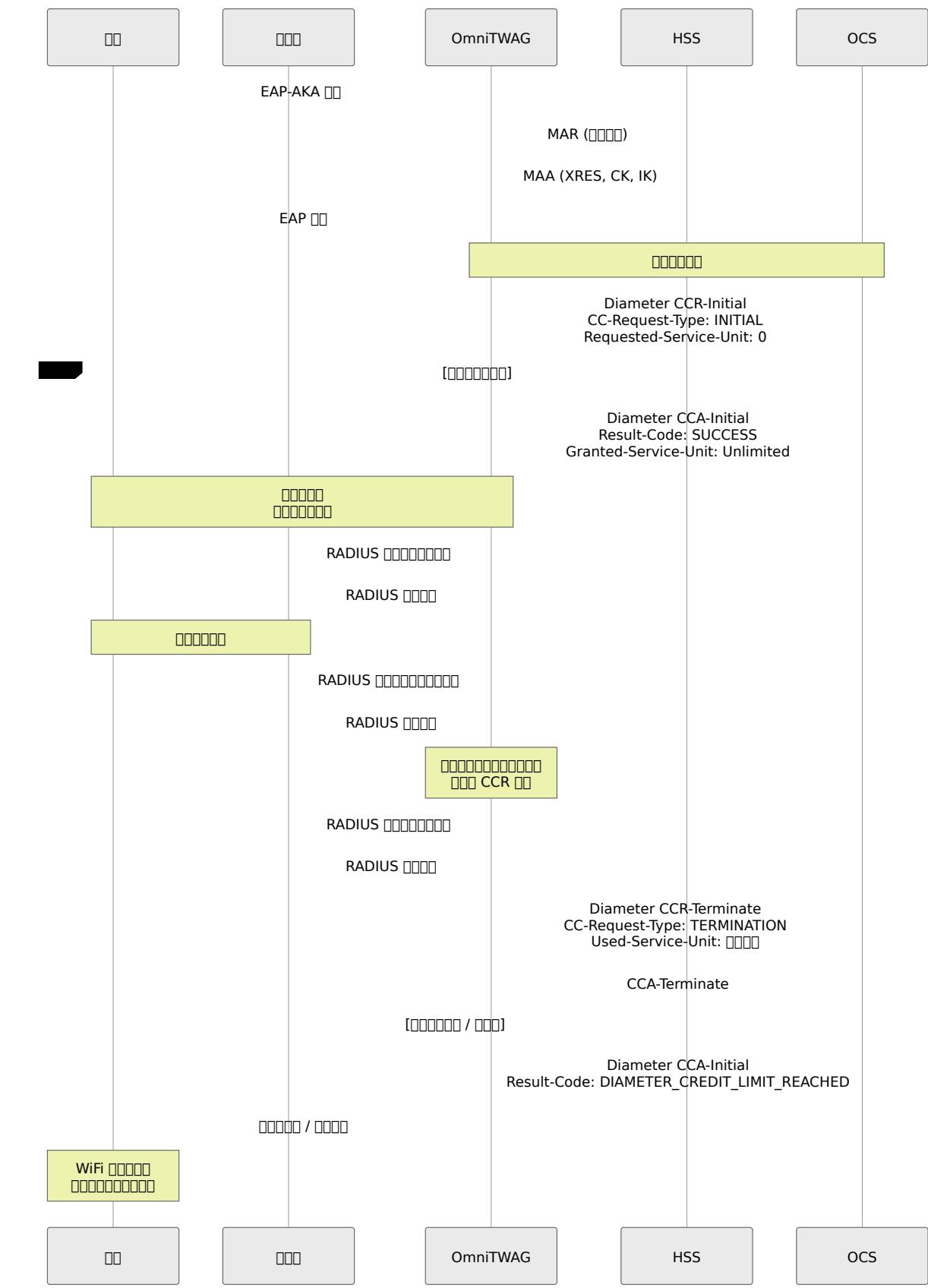
2. WiFi

WiFi 3GPP AAA OCS CCR-Initial

AAA

- ဗိုလ်ချုပ်အောက်လောက်/၁၁
- ဗိုလ်ချုပ် WiFi ၁၁
- ဗိုလ်ချုပ်အောက်လောက်
- ၁၁ WiFi အောက်လောက်/၁၁၁၁၁

၁၁၁



三

- CCR-I CCR-T OCS
 - CCR CCR

- 
 - 

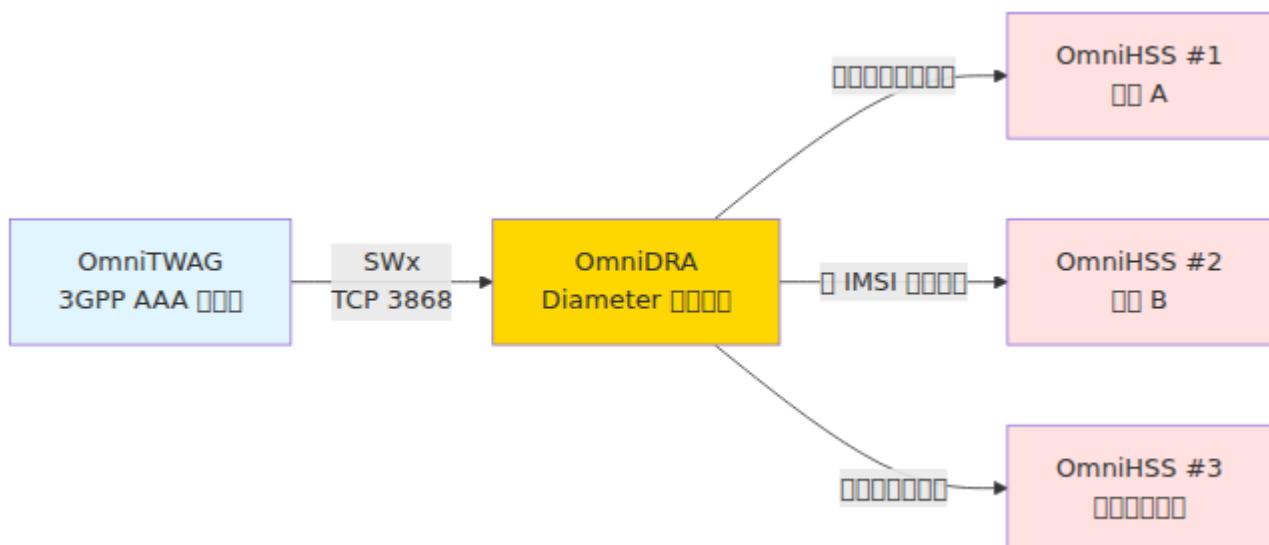
3. **Gy**

3GPP WiFi ? ? ? OCS

三

- 10Gbps Ethernet
 - 10Gbps WiFi
 - 10Gbps Ethernet 10GB 网口
 - 10Gbps Ethernet

三

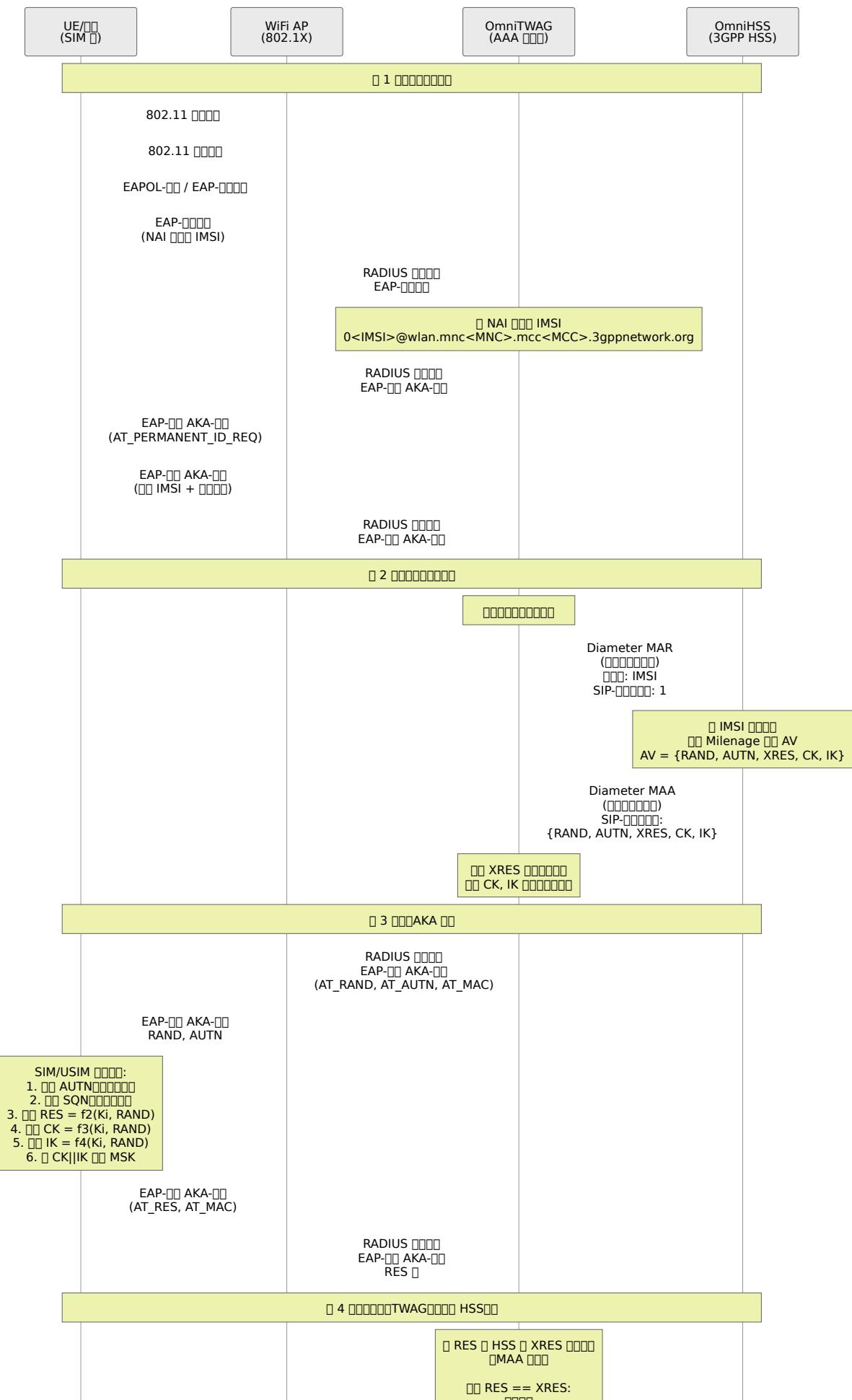


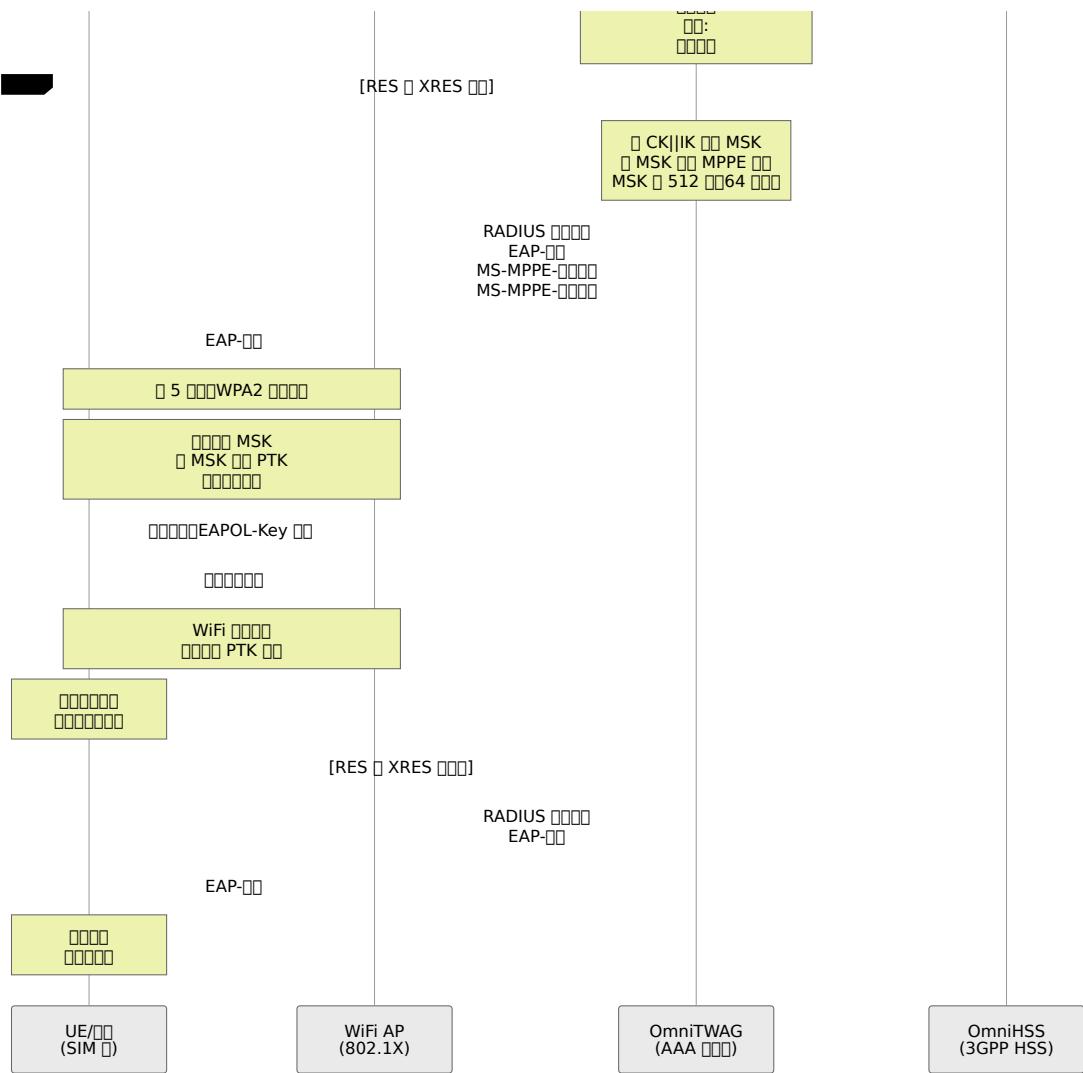
三

- CCR-I CCR-U CCR-T OCS
 - 10MB 50MB 100MB
 - 80% CCR //
 -
 -
 -
 -

□□□

□□□ **EAP-AKA** □□□





A horizontal sequence of twelve rectangular boxes. The first eight boxes are empty. The next three boxes are filled with a large, bold question mark. The final box is empty.

4 of 4

NAI IMSI

50557000000000000001@wlan.mnc057.mcc505.3gppnetwork.org

0<IMSI>@wlan.mnc<MNC>.mcc<MCC>.3gppnetwork.org

□ - IMSI □□□□□□□□□□□□ 0□□□□ IMSI SIM □/□□□□□□□□□□□□

MSK

MSK EAP-AKA 512 64 WiFi

MSK

1. UE → TWAG 亂數串 → MSK
 2. UE → SIM 亂數串 CK/IK →
 3. TWAG → HSS 亂數串 CK/IK →
 4. MSK = PRF'(CK || IK, "Full Authentication", IMSI, ...)

MSK

1. **PMK** \rightarrow PMK = MSK \oplus 256 \oplus 32 \oplus
 2. **WPA2** \rightarrow UE \sqcap AP \oplus PMK \oplus PTK
 3. \rightarrow WiFi \rightarrow $\boxed{?}$ $\boxed{?}$ PTK \rightarrow $\boxed{?}$ TK \rightarrow $\boxed{?}$

MSK

- မြန်မာစာ MSK WiFi မြန်မာစာ
 - မြန်မာစာ WiFi မြန်မာစာ
 - မြန်မာစာ EAP မြန်မာစာ WiFi မြန်မာစာ
 - မြန်မာစာ MSK မြန်မာစာ
 - မြန်မာစာ MSK မြန်မာစာ MSK မြန်မာစာ

ANSWER

SON

1. 3GPP AUTS - 3GPP
 2. 3GPP EAP-AKA 3GPP AT-AUTS
 3. TWAG 3GPP AUTS 3GPP HSS
 4. HSS 3GPP AUTS
 5. 3GPP AUTS

A horizontal row of 15 empty rectangular boxes, intended for children to write their names in, likely on a worksheet.

10 of 10

TWAG config/ Elixir config/runtime.exs

A decorative horizontal line consisting of a series of small, evenly spaced rectangular blocks, likely a page separator or a decorative element.

Diameter

```
config :diameter ex
```

```
config :diameter_ex,
diameter: %{
  # Diameter 服务
  service_name: :omnitouch_twag,

  # Diameter 服务 IP 地址
  listen_ip: "10.5.198.200",

  # Diameter 服务端口 3868
  listen_port: 3868,

  # Diameter Origin-Host
  host: "omnitwag",

  # Diameter Origin-Realm
  realm: "epc.mnc057.mcc505.3gppnetwork.org",

  # Diameter HSS/DRA/AAA 服务
  peers: [
    %{
      # Diameter Origin-Host
      host: "omni-hss01.epc.mnc057.mcc505.3gppnetwork.org",

      # Diameter Origin-Realm
      realm: "epc.mnc057.mcc505.3gppnetwork.org",

      # IP 地址 HSS/DRA
      ip: "10.179.2.140",

      # 端口 3868
      port: 3868,

      # TLS 服务
      tls: false,
    },
    # diameter_tcp :diameter_sctp
    transport: :diameter_tcp,
    # initiate_connection: true
    initiate_connection: true
  ]
}
```

```
        ]  
    }
```

3GPP TS 23.003

```
epc.mnc<MNC>.mcc<MCC>.3gppnetwork.org
```

•

- MNC = 057
- MCC = 505

• **DRA** OmniDRA IP DRA HSS DRA IMSI HSS

RADIUS

```
config :omnitwag
```

```
config :omnitiwag,
  radius_config: %{
    # RADIUS IP 地址
    # 地址 = 192.168.1.1
    allowed_source_subnets: ["10.7.15.0/24", "192.168.1.0/24"],

    # RADIUS 端口号
    # AP 地址
    secret: "YOUR_STRONG_SECRET_HERE"
  }
```

7.1.1.1

- 802.11 RADIUS 802.11 20 802.11
 - 802.11 allowed_source_subnets 802.11 AP 802.11
 - 802.11 802.11 1812/1813 802.11

□ □ □ □ □ □ □

allowed_source_subnets: ["10.7.15.0/24", "192.168.1.0/24"]

□□□□□□□□□□□□□□□□□□/□□□□

Prometheus 配置

config :omnitwag

```
config :omnitwag,  
  prometheus: %{  
    # Prometheus 配置  
    port: 9568  
  }
```

访问地址: <http://<twag-ip>:9568/metrics>

端口映射

端口	协议	服务
1812	UDP	RADIUS 服务
1813	UDP	RADIUS 服务
3868	TCP	Diameter (SWx 与 HSS/DRA)
443	TCP	HTTPS Web 服务
8444	TCP	HTTPS REST API
9568	TCP	Prometheus 服务

端口映射

端口映射

OmniTWAG 端口映射 WiFi AP 服务

- **WPA2-802.1X** ဗို့
- **RADIUS** ဗို့ ဗို့
- **EAP-AKA** ဗို့

ဗို့ Cisco Aironet ဗို့ Aruba ဗို့ Ubiquiti UniFi ဗို့ Ruckus ဗို့ hostapd ဗို့ AP

AP ဗို့

1. **WPA2-802.1X** ဗို့
2. **RADIUS** ဗို့ ဗို့ TWAG IP ဗို့
3. **RADIUS** ဗို့ 1812
4. **RADIUS** ဗို့ 1813 ဗို့
5. **RADIUS** ဗို့ ဗို့ TWAG ဗို့
6. **EAP** ဗို့ EAP-AKA ဗို့ “” ဗို့

Cisco AP ဗို့

CLI ဗို့

```
! ဗို့ RADIUS ဗို့
radius-server host 10.5.198.200 auth-port 1812 acct-port 1813 key
YOUR_SHARED_SECRET

! ဗို့ SSID ဗို့ 802.1X
dot11 ssid OPERATOR-WIFI
  vlan 10
  authentication open eap eap_methods
  authentication network-eap eap_methods
  authentication key-management wpa version 2

! ဗို့ SSID ဗို့
interface Dot11Radio0
  encryption mode ciphers aes-ccm
  ssid OPERATOR-WIFI
```

Web ဗို့

1. ဗို့ ဗို့ → **AAA** → **RADIUS** ဗို့

2. 亂 RADIUS 亂 10.5.198.200:1812 亂
3. 亂 WLAN 亂
4. 亂 WPA2-PSK 亂
5. 亂 EAP 亂 亂 EAP-AKA 亂 亂
6. 亂 RADIUS 亂

hostapd 亂

亂 Linux 亂 AP\OpenWrt 亂

```
# /etc/hostapd/hostapd.conf

interface=wlan0
driver=nl80211
ssid=OPERATOR-WIFI

# WPA2-[]
wpa=2
wpa_key_mgmt=WPA-EAP
wpa_pairwise=CCMP
ieee8021x=1

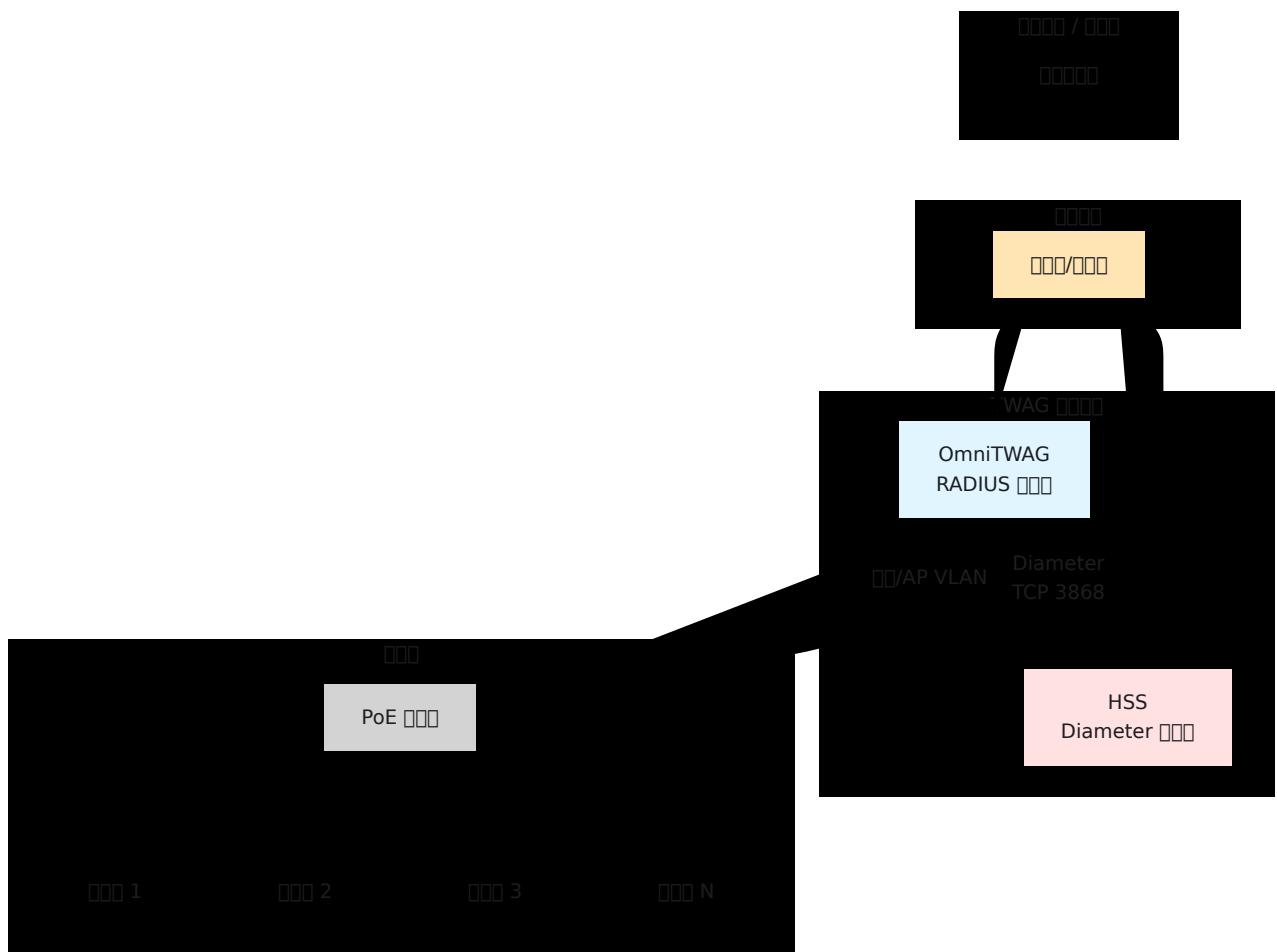
# RADIUS []
auth_server_addr=10.5.198.200
auth_server_port=1812
auth_server_shared_secret=YOUR_SHARED_SECRET

acct_server_addr=10.5.198.200
acct_server_port=1813
acct_server_shared_secret=YOUR_SHARED_SECRET

# EAP []
eap_server=0

# [] 2.0[] - []
interworking=1
internet=1
anqp_3gpp_cell_net=505,057
domain_name=wlan.mnc057.mcc505.3gppnetwork.org
nai Realm=0,wlan.mnc057.mcc505.3gppnetwork.org,0,21[2:1][5:7]
roaming_consortium=505057
hs20=1
```

A row of eight empty rectangular boxes for writing.



□□□□ AP □ TWAG □□□□□□□□□□□□□□□□□□□□

- AP TWAG 1812/1813
 - TWAG HSS 3868
 - TWAG 443

2.0

2.0 Passpoint

□ 2.0□□□ Passpoint □ 802.11u□ WiFi □□□□□□□□□ WiFi □□□□□□□□□□□□
□□ WiFi □□□□□□□

ANSWER

- 802.11i
- 802.11u SIM 802.11EAP-AKA
- 802.11u OSEN 802.11OSU
- 802.11u 802.11R
- 802.11u 802.11u

2.0 AP

AP 802.11u

1. **802.11u** 802.11ANQP 802.11u/802.11u
2. **WPA2-PSK** 802.1X 802.11u
3. **EAP-AKA** 802.11u EAP-AKA 802.11u
4. **ANQP** 802.11u 802.11u

802.11u hostapd 802.11u AP 802.11u

```
# 2.0 / Passpoint
interworking=1
internet=1
asra=0
esr=0
uesa=0

# ANQP
anqp_3gpp_cell_net=505,057
domain_name=omnitouchns.com,wlan.mnc057.mcc505.3gppnetwork.org

# NAI
nai_realm=0,wlan.mnc057.mcc505.3gppnetwork.org,0,21[2:1][5:7]
# <0><0>,<0>,<eap-0>[auth-id:auth-val]
# 21 = EAP-AKA
# 2:1 = SIM
# 5:7 = EAP EAP-AKA EAP-AKA

# roaming
roaming_consortium=505057
# MCC=505057MNC=057000000

# venue
venue_group=1
venue_type=8
venue_name=eng:Omni WiFi

# WPA2-PSK
wpa=2
wpa_key_mgmt=WPA-EAP
rsn_pairwise=CCMP
ieee8021x=1

# RADIUS OmniTWAG
auth_server_addr=10.5.198.200
auth_server_port=1812
auth_server_shared_secret=YOUR_SHARED_SECRET

acct_server_addr=10.5.198.200
acct_server_port=1813
acct_server_shared_secret=YOUR_SHARED_SECRET

# SSID
```

```
ssid=OperatorWiFi
utf8_ssId=1

# 2.0
hs20=1
hs20_oper_friendly_name=eng:运营商 WiFi
```

运营商 WiFi

运营商 WiFi 逻辑

1. Passpoint 逻辑（运营商 WiFi）
2. 通用 AP 逻辑 ANQP
3. ANQP 逻辑（运营商 MCC/MNC）
 - MCC/MNC 逻辑
4. MCC/MNC ≥ 256 > 16
 - EAP-AKA
5. MCC/MNC > 16
 - WiFi 逻辑
6. 通用逻辑

逻辑

1. MCC/MNC 逻辑
2. 通用逻辑
3. WPA2-PSK/TKIP/WPA2-PSK
4. 通用逻辑
5. WiFi 逻辑

Web 管理

管理界面 URL <https://<twag-ip>/>

三

- **RADIUS** რეიტელისტის მოწყვეტილებები
 - მოწყვეტილი AP-ის გვერდის SSID და
 - მოწყვეტილი მობილური მოწყვეტილებები
 - **Diameter** რეიტელისტის HSS/DRA მოწყვეტილებები

Prometheus

Prometheus TWAG

```
# prometheus.yml
scrape_configs:
  - job_name: 'omnitwag'
    static_configs:
      - targets: ['10.5.198.200:9568']
    metrics_path: '/metrics'
    scrape_interval: 15s
```

5 of 5

RADIUS

- `radius_access_request_count` - რადიუს RADIUS მიმღები
 - `radius_access_accept_count` - რადიუს მიმღები
 - `radius_access_reject_count` - რადიუს მიმღები
 - `radius_access_challenge_count` - რადიუს მიმღები
 - `radius_accounting_request_count{status_type}` - რადიუს მიმღები მიმღები
 - `radius_active_clients_count` - რადიუს 5 მიმღები
 - `radius_access_points_count` - რადიუს 5 მიმღები

EAP-AKA

- `eap_aka_identity_count` - EAP-AKA ۰۰۰۰
 - `eap_aka_challenge_count` - EAP-AKA ۰۰۰۰
 - `eap_aka_sync_failure_count` - ۰۰۰۰SQN ۰۰۰۰۰۰۰

- `eap_aka_auth_success_count` - ፩፻፻፻
- `eap_aka_auth_reject_count` - ፩፻፻፻፻

Diameter ፩፻፻፻

- `diameter_message_count{application, command, direction}` - Diameter ፩፻፻፻፻፻፻፻፻፻፻፻

Erlang VM ፩፻፻፻

- `vm_memory_total` - ፩፻፻፻፻፻፻፻፻፻፻
- `vm_memory_processes` - Erlang ፩፻፻፻፻፻፻፻፻
- `vm_memory_processes_used` - Erlang ፩፻፻፻፻፻፻፻፻፻፻፻፻፻
- `vm_memory_system` - Erlang ፩፻፻፻፻፻፻፻፻
- `vm_memory_atom` - ፩፻፻፻፻፻፻፻
- `vm_memory_atom_used` - ፩፻፻፻፻፻፻፻፻፻፻፻፻፻
- `vm_memory_binary` - ፩፻፻፻፻፻፻
- `vm_memory_code` - ፩፻፻፻፻፻፻
- `vm_memory_ets` - ETS ፩፻፻፻፻፻

Erlang VM ፩፻፻፻

- `vm_system_info_process_count` - ፩ Erlang ፩፻፻
- `vm_system_info_port_count` - ፩፻፻፻
- `vm_system_info_atom_count` - ፩፻፻፻
- `vm_system_infoSchedulers` - ፩፻፻፻
- `vm_system_infoSchedulers_online` - ፩፻፻፻፻፻

Erlang VM ፩፻፻፻

- `vm_statistics_run_queue` - ፩፻፻፻፻፻፻
- `vm_total_run_queue_lengths_total` - ፩፻፻፻፻፻፻፻፻፻፻
- `vm_total_run_queue_lengths_cpu` - CPU ፩፻፻፻፻፻፻
- `vm_total_run_queue_lengths_io` - IO ፩፻፻፻፻፻፻

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- RADIUS և EAP-AKA աշխատանքներ
 - Աշխատանքներ 5 մաս
 - VM առ 5 մ Erlang աշխատանք
 - Աշխատանք Prometheus առ <http://<twag-ip>:9568/metrics> մաս

4 of 4

TWAG ☕ Elixir ☕ Logger ☕

systemd

```
# 重启twag
journalctl -u twag -f

# 读取100条日志
journalctl -u twag -n 100

# 读取twag的所有日志
journalctl -u twag -b

# 读取twag在2025-10-12 10:00:00 - 2025-10-12 11:00:00的日志
journalctl -u twag --since "2025-10-12 10:00:00" --until "2025-10-12 11:00:00"
```

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- RADIUS 1812 -
 - {IP} - AP RADIUS
 - 1 - EAP
 - 2 AKA -
 - -
 - -
 - AP: {IP} - AP

TWAG

Protocol

TWAG ဆို WiFi

Protocol

1. TWAG ဆို `journalctl -u twag -f`
2. AP မှ TWAG ဆို RADIUS ဆိုတော်းဆို
3. RADIUS ဆိုတော်းဆို TWAG `tcpdump -i eth0 port 1812`
4. HSS/ဆိုတော်းဆို

Protocol

- RADIUS ဆိုတော်းဆို
- ဆိုတော်းဆို UDP 1812/1813
- RES/XRES ဆိုတော်းဆို SIM Ki မှ HSS ဆို
- ဆိုတော်းဆို SQN ဆိုတော်းဆိုတော်းဆို
- AP မှ TWAG ဆိုတော်းဆို

Diameter ဆိုတော်းဆို

Diameter ဆိုတော်းဆို HSS/DRA

Protocol

1. ဆိုတော်းဆို `telnet <hss-ip> 3868`
2. Diameter ဆိုတော်းဆို Origin-Host/Origin-Realm ဆိုတော်းဆို IP
3. HSS/DRA ဆိုတော်းဆို
4. ဆိုတော်းဆို TCP 3868

Protocol

- ဆိုတော်းဆို IP/ဆိုတော်းဆို
- ဆိုတော်းဆို TCP 3868
- Origin-Host/Realm ဆို

- HSS/DRA 5 TWAG 3

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□□□□□□□>5 □□

5.5.5.5.5

1. █ HSS ████
 2. ████ ping <hss-ip> █ mtr <hss-ip>
 3. █ TWAG ████ top █ htop
 4. █ Diameter ████

- HSS համակարգ
 - ՀԱՎԱՐ
 - TWAG համակարգ CPU/ՀԱՎԱՐ
 - ՀԱՎԱՐ համակարգ

4 of 4

5 of 5

```
# ②② RADIUS ②②
tcpdump -i eth0 -n port 1812 or port 1813 -w radius.pcap

# ②② Diameter ②②
tcpdump -i eth0 -n port 3868 -w diameter.pcap

# ③③ AP ③③
tcpdump -i eth0 -n host 10.7.15.72 and port 1812 -w radius-
ap1.pcap
```

Wireshark RADIUS Diameter

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TWAG

```
# iex shell TWAG
iex --sname debug --remsh twag@hostname --cookie <cookie>
```

□ IEx □□□

```
# ፩፩፩፩፩፩፩፩፩፩
CryptoState.keys()

# ፩፩፩፩፩፩፩፩
CryptoState.get("0505338057900001867@wlan.mnc057.mcc505.3gppnetwork.c

# ፩፩፩  AP
APState.list()

# ፩፩፩፩
ClientUsage.list()
```

OmniTWAG

Protocol	Standard	Function
RES	3GPP TS 24.302	AP TWAG RADIUS
RES	3GPP TS 24.302	SIM Ki HSS
Diameter	3GPP TS 29.273	HSS
EAP	3GPP TS 33.402	EAP
EAP-AKA	3GPP TS 35.206	EAP-AKA
802.11	802.11	SQN

OmniTWAG

OmniTWAG 3GPP IETF

- **3GPP TS 23.402** 3GPP
- **3GPP TS 24.302** 3GPP EPC
- **3GPP TS 29.273** Diameter SWx/SWm
- **3GPP TS 33.402** 3GPP
- **3GPP TS 35.206** Milenage
- **RFC 2865** RADIUS
- **RFC 2866** RADIUS
- **RFC 3579** RADIUS EAP
- **RFC 4187** EAP-AKA
- **RFC 5448** EAP-AKA'



OmniTWAG™ **Omnitouch** 3GPP WiFi 5G NR

1. 3GPP WiFi 5G NR
 2. 3GPP SWx/EAP-AKA/RADIUS
 3. SIM 3GPP WiFi 5G NR
 4. MSK 3GPP WiFi 5G NR
 5. **2.0** 3GPP WiFi 5G NR
 6. 3GPP WiFi 5G NR
 7. HSS OmniDRA 3GPP WiFi 5G NR
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