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1 Description of the uBro Solution

About This Chapter

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1.1 Background	The application background of Huawei uBro solution.
1.2 Huawei uBro Solution	The networking application of Huawei uBro solution.
1.3 Benefits	The benefits of the uBro solution for telecom operators and users.

1.1 Background

The indoor coverage of the Universal Mobile Telecommunications System (UMTS) signals has always been a difficult point that troubles users and telecom operators. The reasons are as follows:

- The UMTS frequency is high, and its signals are always blocked by the obstacles, which causes that users fail to use the UMTS signals in small and medium enterprises (SMEs), small offices and home offices (SOHOs), and houses

- The coverage of indoor signals has different features from the coverage of outdoor signals. Outdoor signals cover a large area. This is called plane coverage. The indoor UMTS are of small capacity and of micro areas. Therefore, the wireless coverage of indoor signals requires point coverage. The solution of macro network cannot solve the indoor coverage problem. Therefore, a better indoor coverage solution is required.

- With wide use of the UMTS wireless network, indoor users require the wireless data service of high speed, convenience, and low cost. Though (HSDPA) and (HSUPA) are applied gradually, these service bandwidth resources are shared by many users because there are many users in the macro network. Therefore, the service bandwidth allocated to each user is low and cannot satisfy the requirements of high speed services.

- To solve the problem of the coverage of indoor signals, telecom operators have to consider the cost of purchasing equipment, installing and maintaining the equipment. In a word, telecom operators need a solution of low cost but of high bandwidth.

Therefore, Huawei Technologies Co., Ltd. (hereafter referred to as Huawei) provides the uBro solution, which effectively solves the problem of the coverage of UMTS indoor signals.

1.2 Huawei uBro Solution

Figure 1-1shows the networking application of Huawei uBro solution.

Figure 1-1 Networking application of the uBro solution
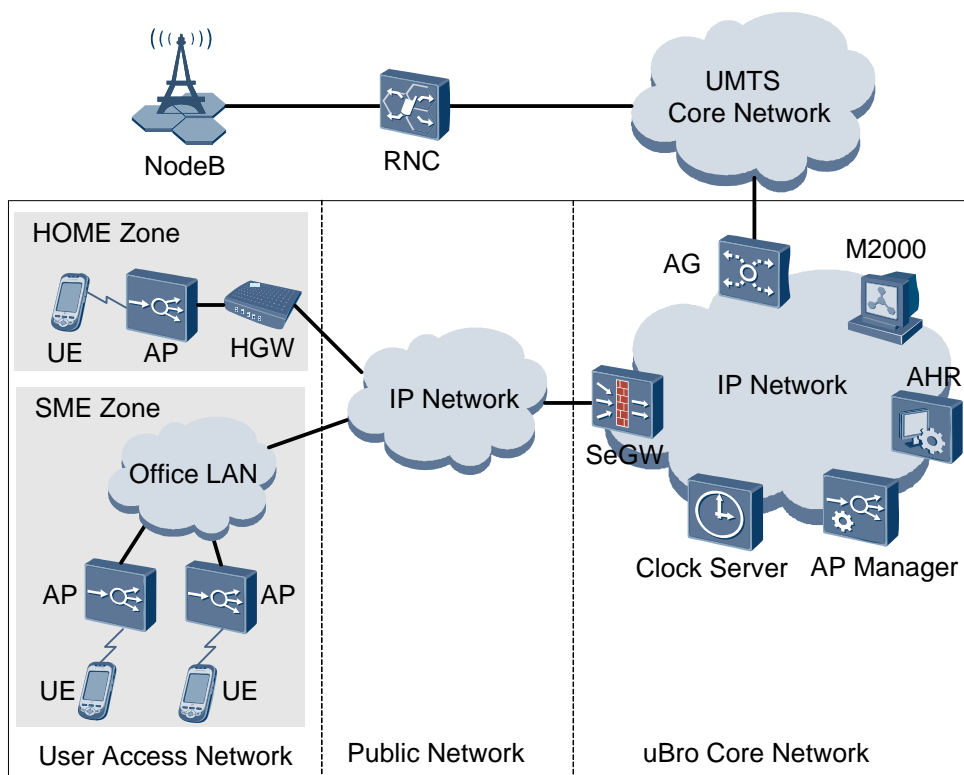
AP	access point	AG	access gateway
AP Manager	AP management maintenance center	AHR	AP home register
SeGW	security gateway	M2000	EMS server
Clock Server	clock server	UE	user equipment
HGW	home gateway	NodeB	UMTS base station
RNC	radio network controller		

According to locations and functions, the uBro network is divided into three parts:

- User access network

  The uBro user access network complete the access function for the uBro network services. The AP, as terminal equipment, is installed in the home, SME or SOHO, and then connected to the public network through the enterprise Ethernet or a home gateway such as ADSL MODEM. By performing the functions of wireless modulation and demodulation, wireless resource management, and power control, the AP can be used to implement the UMTS wireless access service.

- Public network

  The uBro service bearer network completes the convergence, distribution and remote transmission functions for the uBro network services.

- uBro core network

  The uBro core network completes the service routing, forwarding, management and network management (NM) functions for the uBro network services.

  - The AG controls and manages the AP and provides the routing function between the AP and the UMTS core network.

- The AHR provides AP Boot flow pilot information, account-opening information, location information, and UE access control list.
- The AP Manager manages the AP equipment on the network as a whole, including AP configuration and software upgrade, security management, log management, and synchronous AP account-opening information.
- The Clock Server provides accurate clock source for the AP.
- The security gateway (SeGW) provides standard firewall functions and IP Security Protocol (IPSec) VPN tunnel functions to ensure transmission security between AP and various NEs in the uBro core network.
- The M2000 manages the NEs in the uBro core network as a whole.

1.3 Benefits

The uBro solution is complies with the flat architecture of the network and evolution of the fixed network and mobile network integrated. The uBro solution benefits telecom operators and users.

For Telecom operators

Telecom operators can obtain the following benefits from the uBro solution:

- The problem of the coverage of indoor signals in the scenarios such as the SME, SOHO, and home is solved in the uBro solution.
- The High Speed Packet Access (HSPA)capacity of the uBro solution satisfies the requirements of high speed services in the scenarios such as the SME, SOHO, and home. It provides better UMTS service experience for users, which subsequently improves the loyalty of the users. Meanwhile, telecom operators can cultivate the habit of high-end users using high value-added data services.
- The AP equipment is small and light. It can be installed as terminal equipment into the SME, SOHO, or home. It does not require an equipment room. Meanwhile, the AP can be transported easily, and installed, powered by users, which further cut the cost of telecom operators.
- The AP supports automatic network design, automatic software upgrade and automatic data configuration. It does not require much maintenance and interference from telecom operators, which lowers the O&M (operation and maintenance) cost of telecom operators to a great extend.
- The current network form is used. Telecom operators do not need great modifications to the current network, thus able to build a network quickly. The network construction is of low cost and the investment is of short period.

For Users

Users can obtain the following benefits from the uBro solution:

- User investment is protected by preventing the AP from being used by unauthorized UEs, because the AP supports the management and admission control of authorized UEs.

- Users enjoy better indoor UMTS network services, with higher speed data and stable quality of service (QoS) because the air interface of the indoor coverage has large capacity and the indoor air interface is of good quality.

- In the scenarios of home and SOHO, UMTS users in the indoor network covered by the AP enjoy the charge lower than the macro network.

- The AP supports desk installation and wall-mounted installation, and supports Plug and Play for the convenience of user installation and AP using.

2 Solution Architecture

About This Chapter

The following table lists the contents of this chapter.

2.1 Logic Architecture

Figure 2-1 shows the network logic architecture of Huawei uBro solution.

Figure 2-1 Logic architecture of the uBro network

AG	access gateway	AP	access point
AHR	AP home register	AP Manager	AP management maintenance center
UE	user equipment	Clock Server	clock server
SeGW	security gateway		

2.2 Major Equipment

2.2.1 AP

The access point (AP) is a kind of UMTS wireless network access equipment. The AP can be installed in the scenarios such as home, SOHO, or SME. It provides the UMTS wireless network access service for the indoor users in these scenarios.

The AP integrates the functions of NodeB and part of the RNC, provides the UMTS wireless access function, including the functions of wireless modulation and demodulation, wireless resource management, and power control.

According to different scenarios, Huawei provides two AP models, namely, UAP3801 and UAP3801E. The UAP3801 applies to homes and SOHOs with lower specifications requirements, and the UAP3801E applies to the SME scenario with high specifications requirements.

2.2.2 AG

The access gateway (AG) is Huawei AG equipment with the model as SGSN9810. According to the requirements, Huawei provides two models of AGs, namely, independent AG and eSGSN.

📖 **NOTE**

If the AG does not integrate the SGSN function, the AG is an independent one. If the AG integrates the SGSN function, the AG is the enhanced SGSN (eSGSN). The eSGSN is an available mode of the AG in the uBro solution, telecom operators can select a model as required in practice. If not specified, the AG in this solution refers to the independent AG.

Independent AG Functions

The independent AG performs the following functions:

- Provides the enhanced Iu (eIu) interface to connect to the AP in order to manage and control the AP.
- Provides a standard Iu interface to connect to the core NEs in the UMTS, such as the MSC Server, media gateway (MGW) and serving GPRS support node (SGSN), to forward data and signaling between the AP and the UMTS core network and between the CS domain and the PS domain.

eSGSN Functions

The eSGSN performs the following functions:

- Provides the enhanced Iu (eIu) interface to connect to the AP in order to manage and control the AP.
- Provides a standard Iu-CS interface to connect to the core NEs in the UMTS, such as the MSC Server and MGW, to forward data and signaling between the AP and the CS domain of the UMTS core network.
- To integrate the function of the SGSN, it provides a standard Gn interface to connect to the Gateway GPRS Support Node (GGSN) in the UMTS core network to forward data and signaling between the AP and the GGSN.

2.2.3 Clock Server

The Clock Server locates in the uBro core network, and provides a precise clock source to the AP. The model of Huawei Clock Server is IPCLK1000.

Huawei Clock Server adopts the Clock over IP technology:

- The Clock over IP technology is divided into two parts, namely, Server and Client. The IPCLK1000 acts as the Server and the AP acts as the Client.
- The Server obtains the clock source from the clock equipment, and then provides the synchronous reference clock to the Client (AP) through the IP network in the form of IP packets after local phase-lock and hold-in.

2.2.4 AHR

The AP home register (AHR) locates in the uBro network managed by telecom operators.

Huawei AHR performs the following functions:

- Provides the pilot information when the AP initiates the Boot flow.
- Provides the AP account-opening/account-canceling information and management of subscription data.
- Provides the AP access control list and integrated database management.
- Provides the AP area management.
- Provides the AP authentication.
- Provides the AHR system management.
- Provides the AHR log management.

2.2.5 AP Manager

The AP Manager locates in the uBro core network. It is Huawei-developed AP management platform and manages all the APs on the network in a unified manner.

The AP Manager performs the following functions:

- AP configuration management
- AP fault management
- AP version management
- AP software management
- Task management
- Security Management
- Log Management

2.2.6 SeGW

The SeGW locates in the entrance of the uBro core network. Huawei SeGW is Eudemon500/1000.

The SeGW performs the following functions:

- Provides standard Fire Wall function. The SeGW provides security protection for the NEs in the uBro core network.
- Provides the SeGW function. The SeGW provides security protection for the communications between the AP and NEs in the uBro core network through establishing IPSec VPN tunnel between the AP and SeGW.

2.2.7 M2000

M2000 locates in the uBro core network. Huawei M2000 is the unified management platform of Huawei mobile network. It can manage the NEs in the uBro core network in a unified form through this platform.

2.3 Technical Features of the uBro System

The uBro network is a new network form, and introduces the following features:

Automatic Network Design

The uBro system supports the following features about automatic network design:

- Automatic configuraiton of the frequency point in the cell. The AP automatically selects the frequency point with the lowest interference as the frequency point of the AP cell. The AP selects the frequency point in the list of the AP cell frequency points.

- Automatic configuration of scrambles in the cell. The AP detects scrambles to select the scramble with the lowest interference as the AP scramble.

- Automatic configuration of AP adjacent cells. The AP detects the adjacent macro cells with or without the same frequency and completes the AP adjacent cell configuraiton automatically.

- Automatic pilot power adjustment. The AP adjusts pilot power automatically according to the specific free numbers called by UEs.

Interference Detection

After the logic cells are established, the AP can automatically detect the quality of uplink signals, and show the signal quality at the current position through the signal indicator on the panel, thus instructing users to adjust the AP installation angle to a suitable position.

- The AP detects the interference signals in uplink receiving channels.

- The AP provides the interference indicator to show the signal quality at the current position through the signal indicator on the AP panel.

- The AP supports interference threshold configuration, modification and query for manual detection.

Location Detection

The uBro system supports the following features about location detection:

- The uBro system supports the configuration and query of the parameters of AP location detection policies.

- The uBro system supports detection of location information of the macro network through detecting the public land mobile network (PLMN) and location area identification (LAI) to judge the validity of AP location. The invalid AP will be automatically prohibitted.

Location Indication

When the UE accesses the AP cell and stays successfully, the AP must notify the UE of current network status in a certain way. The user knows the status for the convenience of further operation.

At present, the uBro system supports the following two modes of location indication:

- Short message indication
  - The AP can send a short message. When the UE accesses the AP cell, the AP sends a short message to the UE as notification. Telecom operators can set the contents of the message on the AP.

- – The AP can send a flash short message to the UE for notifying the location. Such messages can be deleted automatically after being read.
  - – The AP has the punish timer function. When the same UE accesses and leaves the AP cell frequently within a short period of time, the AP does not send messages to the UE each time the UE accesses or leaves the cell. This is to prevent interference from user activities.

- • PLMN Identifier indication

  The AP cell uses different PLMN from the macro cell. When a user resides in the AP cell, the UE displays a roaming mark, which indicates that the UE has been in the AP cell. After the user leaves from the AP cell to the macro cell, the roaming mark disappears.

Location Services

After the UE accesses the AP cell, the uBro system can perform the function of location services (LCS).

- • For common LCS in a home scenario, the precise location of a UE can be decided based on the information provided by the AP because the AP is a home device and its signals cover only a small range of area.

- • For emergency LCS, different methods are used to locate the UE based on the validity of the UE.
  - – The emergency call from the valid UE. The AP searches the MSISDN to which the International Mobile Subscriber Identity (IMSI) corresponds and then reports the MSISDN and APIndex to the AHR. The call emergency center searches for the AHR for the registration information of the appropriate AP based on the MSISDN to obtain the precise location of the UE.
  - – The emergency call from the invalid UE. The call emergency center locates the UE based on the MSISDN and the service area identity (SAI) obtained from the CN.

Clock Synchronization

To satisfy the requirements of clock synchronization, the uBro solution supports two synchronization modes:

- • Synchronization through IP networks. The AP receives IP clock packets from the Clock Server for synchronization, and the accuracy of the clock is 0.1 ppm.

- • Synchronization through air interfaces. In the scene with coverage of UMTS macro network, the AP supports synchronization through air interfaces, and its accuracy is not lower than 0.1 ppm.

Access Control

The uBro system supports the access control system to perform access control for UEs.

The uBro system supports the following features of access control:

- • Supports configuration of access control policies to perform access control of UEs.
  - – The access control policies are configured to all-open mode. All UEs can access to the AP.
  - – The access control policies are configured to non-open mode. Only authorized UEs can access, and non-authorized UEs are rejected (the emergency call does not distinguish authorized UEs).
- • Supports configuration of access control list to perform access control of UEs.

– Supports IMSI configuration for the access control list. Users add or delete the IMSI in the access control list to perform access control of UEs.

– Supports MSISDN configuration for the access control list. Users add or delete the MSISDN in the access control list to perform access control of UEs (this mode is supported only when the AG mode is eSGSN).

Cell Reselection

The uBro system supports the following features of cell reselection:

- When the UE is in the idle state, the UE can select between the AP cell and the macro cell or select between two AP cells.
- The AP supports the configuration of the hierarchical cell structure (HCS) parameter. It allows the UE to first reside in the AP cell by surveying the valid HCS parameter.

Handoff

The uBro system supports the unidirectional hard handoff, from the AP cell to the macro cell.

AP Security Authentication

To avoid invalid AP access to the AG, the AG performs authentication to the accessed AP. Only valid AP can access the AG. The uBro system meanwhile supports the connection security between AP and OMC, thus ensuring that non-authorized users cannot monitor or control the AP.

The uBro system supports the following security authentication features of equipment:

- The AP that can access to the AG supports password-based authentication.
- Supports authentication between the AP and operation & maintenance center (OMC).

QoS

The core of QoS is to map the services in the uBro solution onto the various QoS priority levels and the transmission network.

QoS priority mapping ways are classified as follows:

- The AP, AG and transmission equipment support the IP DiffServ to guarantee the differentiation services of mobile services over IP layer. The MAC layer adopts IEEE802.1P to guarantee differentiation services over the MAC layer.
- The user end equipment such as multi-channel MODEM/ADSL supports the priority of the PVC to ensure QoS of the uBro services.
- The uBro system supports DSLAM and 2-layer transmission network. It allocates independent virtual local area network (VLAN) to guarantee the QoS of the uBro services.
- The uBro system supports the MPLS DiffServ/TE technology of the 3-layer transmission network to guarantee the QoS of the 3-layer transmission network.

2.4 Interfaces

The system interfaces of Huawei uBro solution are different in the cases of independent AG and eSGSN.

Independent AG

When the AG is not integrated with the SGSN function, the interfaces of the uBro system are shown in Figure 2-2.

Figure 2-2 Interfaces in the uBro solution

AG	access gateway	SGSN	serving GPRS support node
MGW	media gateway	MSC Server	mobile switching center server
AHR	AP home register	AP Manager	AP management maintenance center
AP	access point	Clock Server	clock server
UE	user equipment		
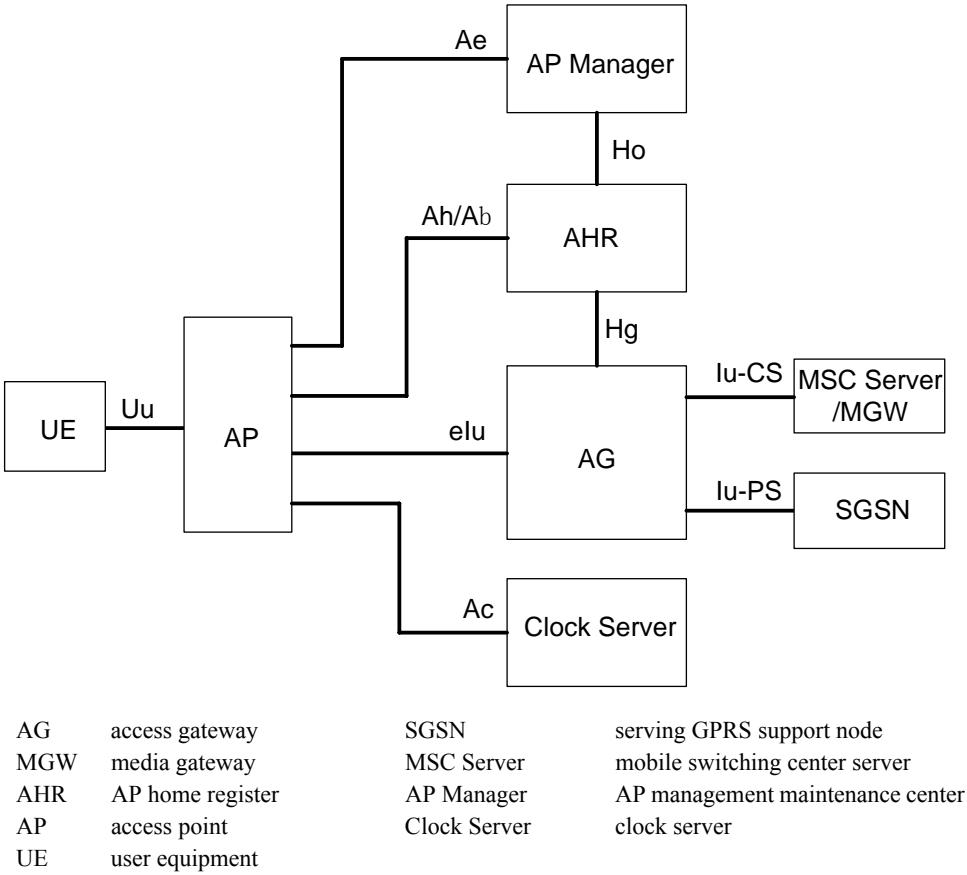
eSGSN

When the AG is integrated with the SGSN function, the interfaces of the uBro system are shown in Figure 2-3.

Figure 2-3 Interfaces in the uBro solution

eSGSN	enhanced SGSN	GGSN	gateway GPRS support node
MGW	media gateway	MSC Server	mobile switching center
AHR	AP home register	AP Manager	AP management maintenance center
AP	access point	Clock Server	clock server
UE	user equipment		
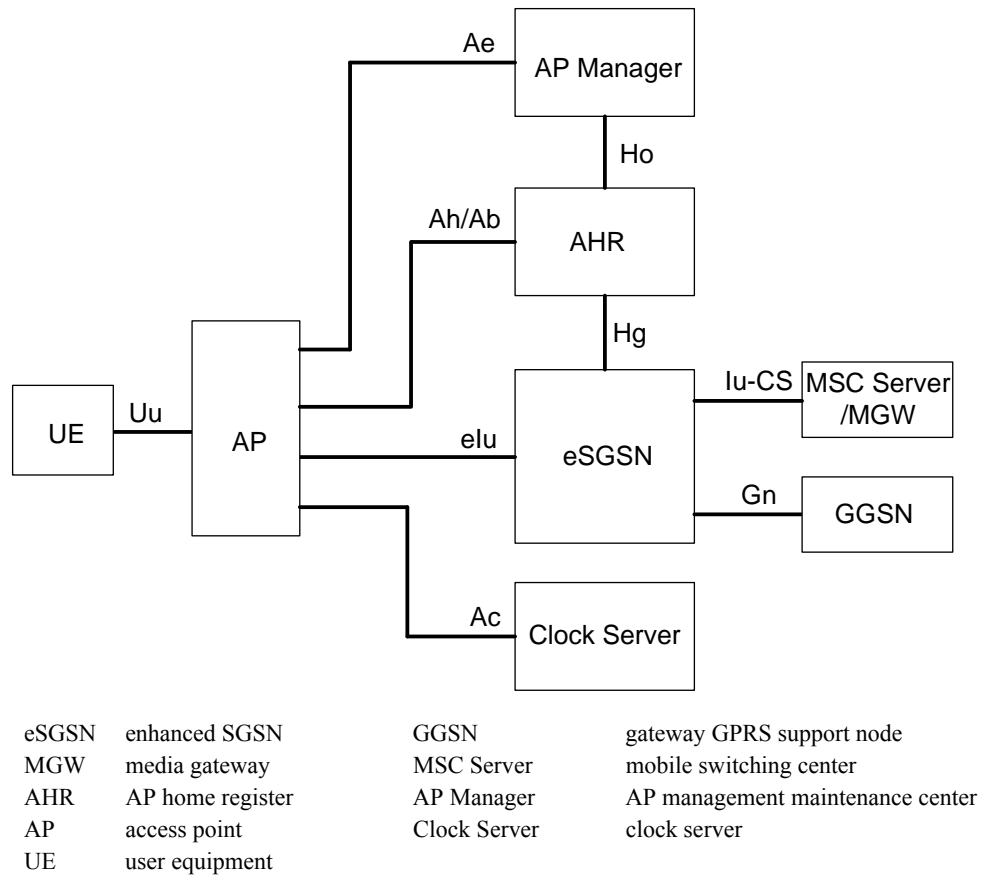
2.4.1 eIu Interface

The eIu interface defined by Huawei are adopted between the AP and AG. The eIu interface exchanges the control plane signaling and user plane data between the AP and AG.

Figure 2-4 shows the protocol stack of the eIu interface.

Figure 2-4 Protocol stack of the eIu interface

Control Plane	
RANAP	APM
SPUA	
SCTP	
IP	
Data Link	

CS User Plane
IuUP
RTP
UDP
IP
Data Link

PS User Plane
DATA
GTP-U
UDP
IP
Data Link

Control Plane

The protocols adopted by the control plane are as follows:

- Radio Access Network Application Part (RANAP) :

  Standard RANAP protocol: to convert the RANAP cells and RANAP non-connection messages.

- AP Management Private Protocol (APM) :APM

  Private protocol defined by Huawei: to provide AP management function such as link management and AP authentication.

- SCTP Private User Adaptation Layer (SPUA) :SPUA

  Private user adaptation layer protocol between the SCTP and RANAP: to replace the functions of MTP3 User Adaptation layer (M3UA) and of Signaling Connection Control Part (SCCP).

- Stream Control Transmission Protocol (SCTP) :SCTP

  Reliable transmission protocol oriented to connection and based on packets: to transport the Signaling System Number 7 (SS7) over the IP network.

CS User Plane

The protocols on the CS user plane are as follows:

- Iu User Plane (IuUP) : IuUP

  The Iu User Plane (IuUP) is the wireless layer protocol at the Iu interface. It is used to transmit the user data relevant to the radio access bearer (RAB).

- Real Time Protocol (RTP) : RTP

  The Real-Time Transport Protocol (RTP) supports the end-to-end real-time transmission of media flows such as voice flows and video flows. An example of the transmission is the exchange between voice and image.

PS User Plane

The GPRS Tunneling Protocol for User Plane (GTP-U) : GTP-Utransmits PS domain data packet directly. The GTP-U protocol transmits user data between the AP and AG in tunnel mode.

2.4.2 Ab/Ah Interface

The Ab and Ah interfaces are between the AP and AHR.

After the AP is powered on initially, the AP initiates the BOOT flow, and obtains the AP information and IP address of other NEs in the uBro core network from the AHR through the Ab interface.

When maintaining the AP attribute information, the AP and AHR communicate with each other through the Ah interface. When a user makes a call to change the customized information on the AP, such as the UE admission list and SAI, the AHR updates the AP information on initiative.

2.4.3 Ae Interface

The Ae interface is between the AP and the AP Manager. The AP Manager manages the AP through the Ae interface that complies with the TR069 protocol.

2.4.4 Hg Interface

The Hg interface is between the AG and AHR. In the password based AP authentication solution, the username and password are saved in the AHR. After receiving an authentication request from the AP, the AG must obtain the username and password from the AHR.

The validity of the AP location is detected through the Hg interface.

2.4.5 Ho Interface

The Ho interface is between the AHR and the AP Manager. The AHR issues services and maintains user information of the AP.

When the AHR adds, changes, and deletes the home group data of the AP, the AHR sends the changed home group information to the AP Manager to ensure the consistency in the home groups between the AHR and the AP Manager.

When the AHR adds, changes, and deletes the user data of the AP, the AHR and AP Manager ensure the consistency in the user data of the AP through synchronization. After generating a synchronized data file, the AHR sends a message to notify the AP Manager of the generation. Then the AP Manager obtains the synchronized data file through FTP.

📖 **NOTE**

The AP Manager can only query the account information of the AHR.

2.4.6 Ac Interface

The Ac interface is between the AP and Clock Server. It is for the AP to obtain the clock synchronization.

2.4.7 Uu Interface

The standard Uu interface is between the UE and AP.

2.4.8 Iu-CS Interface

The standard Iu-CS interface is between the AG and MSC Server/MGW.

2.4.9 Iu-PS Interface

The standard Iu-PS interface is between the AG and SGSN.

3 Networking Solution

About This Chapter

The following table lists the contents of this chapter.

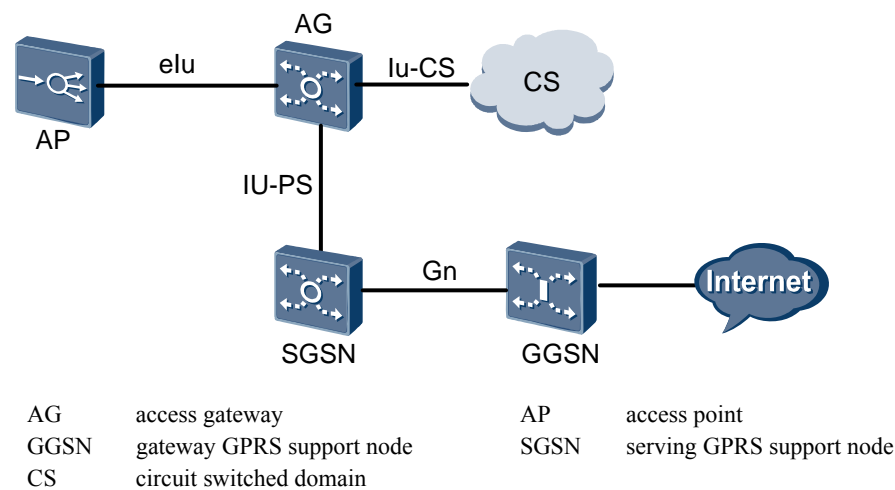| Section	Describes
3.1 Service Networking	Service networking solution of the uBro solution.
3.2 Transmission Networking	Transmission networking solution of the uBro solution.

3.1 Service Networking

Service networking refers to the networking mode of the uBro network oriented to different service strategies.

3.1.1 Independent AG Networking Solution

Networking Diagram

Figure 3-1 shows the independent AG networking solution.

Figure 3-1 Independent AG networking diagram

AG	access gateway	AP	access point
GGSN	gateway GPRS support node	SGSN	serving GPRS support node
CS	circuit switched domain		

In this solution, the AG provides the following functions:

- Provides the eIu interface to connect to the AP, thus controlling and managing the AP.
- Provides the standard Iu interface to connect to the UMTS core network, thus converging, forwarding the service data, and controlling data of the AP.

Networking Principles

In the UMTS, the CN is divided into the CS domain and PS domain. The uBro network services are therefore divided into the CS domain services and PS domain services.

For the traditional CS domain services, such as voice service and voice peripheral (VP) service, the principles are as follows:

1. The AP encapsulates service data into IuUP packets and sends the packets to the AG through the eIu interface in IP bearer mode.

2. If service data is transmitted through the Iu-CS interface in ATM bearer mode, the AG does not process the data. Instead, the AG just converts the mode of bearing the data from IP bearer to ATM bearer. Then the AG sends the service data to the CS domain of the CN through the standard Iu-CS interface.

3. If service data is transmitted through the Iu-CS interface in IP bearer mode, the AG does not have to convert between the IP bearer and the ATM bearer. Instead, the AG directly forwards service data to the CS domain of the CN.

4. After the service data reaches the CS domain of the CN, the CN considers the service data as ordinary data of UMTS CS domain service and processes the service data.

For the PS domain services, the realization principles are the same as that in the traditional UMTS.

Networking Features

The solution is easy to implement. The solution requires only a little change in the current NEs. The AG at the access side can connect to the CN through the standard Iu interface. Telecom operators do not have to test the interconnection of other interfaces.

3.1.2 eSGSN Networking Solution

Networking Diagram

Figure 3-2 shows the eSGSN networking solution.

Figure 3-2 eSGSN networking diagram

| eSGSN | enhanced SGSN | AP | access point |
| GGSN | gateway GPRS support node | CS | circuit Switched domain |
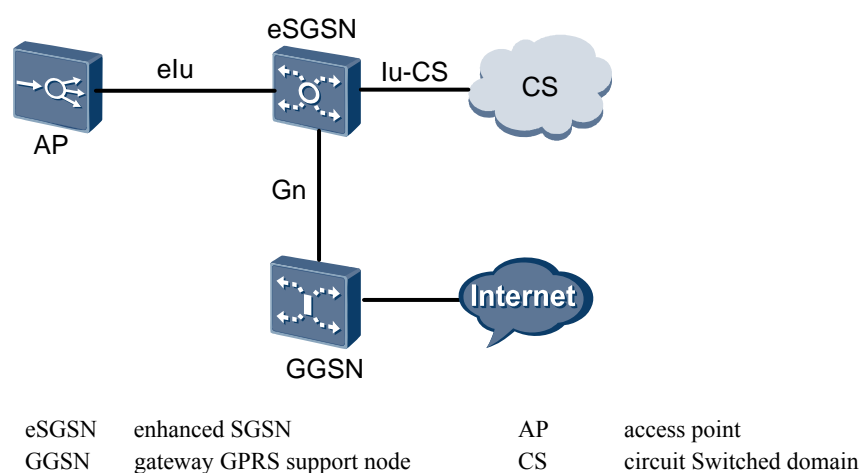
In this solution, the eSGSN, namely, the AG, is integrated with the SGSN. It provides the following functions:

- Provides the eIu interface to connect to the AP, thus controlling and managing the AP.
- Provides the standard Iu-CS interface to connect to the CS domain of the UMTS CN, thus converging and forwarding the AP CS domain services and signaling.
- Integrated with the SGSN function, the eSGSN is connected to the GGSN through the standard Gn interface to converge and forward the AP PS domain services and signaling.

Networking Principles

For the realization principles of the CS domain services, see. 3.1.1 Independent AG Networking Solution

For PS domain services, because the eSGSN is integrated with the SGSN, the eSGSN can process the data on the control plane of PS domain services and forward the PS domain service data to the GGSN.

Networking Features

The eSGSN networking solution possesses the following features:

- This solution decreases the investment in PS domain equipment.

  Because the eSGSN is integrated with the SGSN, this decreases the investment in the SGSN, thus reducing the operation cost of telecom operators.

- This solution decreases the number of times of routing service data.

  Because the eSGSN is integrated with the SGSN, service data can reach the GGSN directly without passing through the SGSN. This decreases the frequency of forwarding service data in the SGSN and reduces the delay time in transmitting service data.

- This solution is flattened.

  – Network layers, maintenance workload, and maintenance cost are decreased.

  – The flattened network is easy to expand.

- This solution is easy to upgrade.

  Telecom operators can upgrade the network only by upgrading appropriate software.
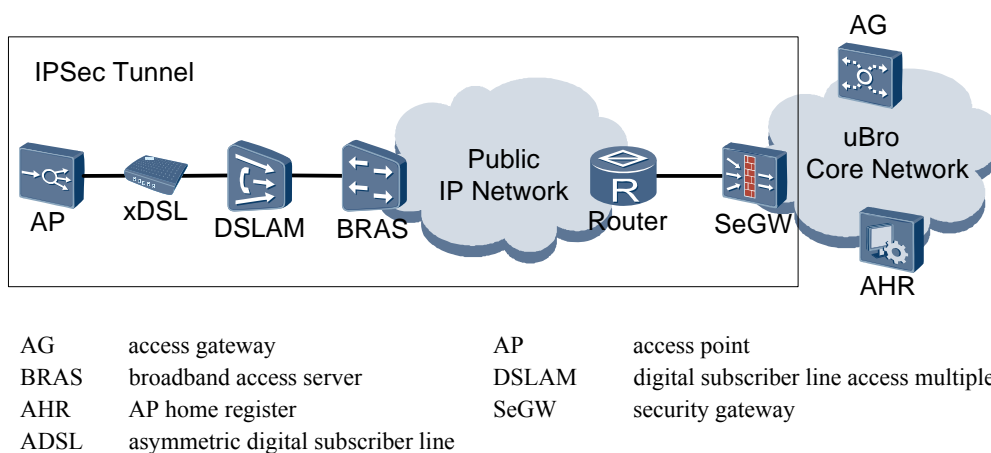
3.2 Transmission Networking

Transmission networking refers to the networking mode for the network from the AP to the uBro CN.

3.2.1 xDSL Access Networking Solution

Because the current families and SOHO scenarios use the wideband access ADSL/ADSL2+ commonly, the transmission networking of Huawei uBro solution supports the xDSL access topology.

Figure 3-3 shows the xDSL access topology.

Figure 3-3 xDSL access topology

AG	access gateway	AP	access point
BRAS	broadband access server	DSLAM	digital subscriber line access multiplexer
AHR	AP home register	SeGW	security gateway
ADSL	asymmetric digital subscriber line		

Networking Principles

In the home and SOHO scenarios, the AP uses multi-channel ADSL/ADSL2+ to access to the public IP network. The DSLAM completes the data convergence and forwarding, and separates from other AP users through private VLAN. The AP service is transmitted to the broadband access server (BRAS) through the point to point protocol over Ethernet (PPPOE) or dynamic host configuration protocol (DHCP) to complete the access authentication and charging of the public IP network. After the BRAS authentication, the AP service accesses to the entrance equipment of the SeGW in the uBro CN. After processed by the SeGW, the service data are forwarded to the AG and AHR to complete the authentication of mobile services.

Networking Features

The xDSL access networking solution possesses the following features:

- Use rich home broadband resources. The AP, as an online user of the xDSL, does not require private transmission network for the solution.

- The ADSL allocates the PVC channel to the AP service to separate it from other services, thus ensuring the QoS of the AP service.

- The IPSec transmission solution is adopted to ensure safe transmission.

  Because the AP data must pass through the IP pubic network with safety hidden trouble, the IPSec transmission solution creates the IPSec security tunnel between the AP and SeGW to ensure communication safety between the AP and NEs of the uBro CN.

☐ **NOTE**
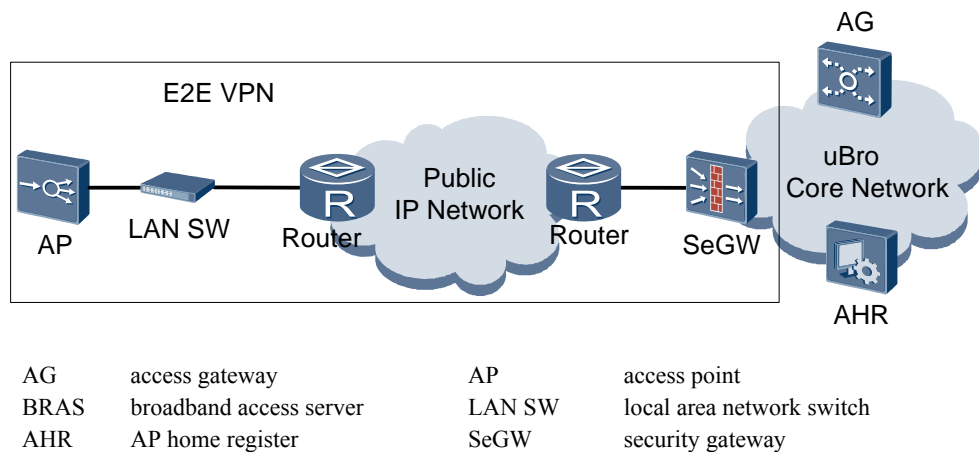
The IPSec technology is to add a new field after the header of the IP data packet to ensure security of data transmission. In tunneling mode, the whole IP packet is used to calculate the ESP header. The whole IP packet is encrypted and encapsulated in a new IP packet with the ESP header. When data is transmitted through Internet, the real original address and destination address are hidden.

3.2.2 Ethernet Access Networking Solution

Because the current SME uses the enterprise LAN to access to the IP network, the transmission networking of Huawei uBro solution adopts the Ethernet access networking mode.

Figure 3-4 shows the Ethernet access topology.

Figure 3-4 Ethernet access topology

AG	access gateway	AP	access point
BRAS	broadband access server	LAN SW	local area network switch
AHR	AP home register	SeGW	security gateway

Networking Principles

In the Ethernet access networking solution, the AP is connected to the public IP network through the enterprise LAN and separated from other users through the private VLAN. The AP service directly accesses to the entrance equipment of the uBro CN, namely, SeGW, through the public IP network, and then the SeGW forwards the data to the AG and AHR to complete the authentication of the mobile services. The AP and AG adopt the PPPoE or DHCP authentication mode to complete the authentication of the mobile service.

Networking Features

The Ethernet access networking solution possesses the following features:

- The Ethernet access networking solution allocates private VLAN and MPLS DiffServ/TE mode to the AP service to ensure the QoS of the uBro services.
- The Ethernet access networking mode uses the E2E VPN to ensure the security of the transmission.

4 Security Solution

About This Chapter

The following table lists the contents of this chapter.

Section	Describes
4.1 Overview of the Authentication Security Solution	Classification of security solutions in the uBro solution.
4.2 Network equipment security	Security policies in the NE security part of the uBro solution.
4.3 Network Security	Security policies in the network security part of the uBro solution.
4.4 Operation and Maintenance Security	Security policies in the OM security part of the uBro solution

4.1 Overview of the Authentication Security Solution

The security system of the uBro solution consists of the following aspects:

- NE security
- Network Security
- Operation and Maintenance Security

4.2 Network equipment security

Network equipment security refers to the following security measures provided by NEs:

- AP equipment security
    - The AP and AG support password-based authentication.
    - The local maintenance AP and remote maintenance AP supports the NE access authentication based on password.
    - The AP supports anti-DOS attack in the operating system and sensitive data encryption.
    - The AP supports the ACL control UE access to prevent the access from non-authorized UE.
- CN equipment security
    - The operating system needs strengthening.
    - Installing firewalls on NEs
    - Installing security patches
    - Detecting the communication between NEs
    - Virus prevention
    - Sensitive data encryption

4.3 Network Security

The features of the uBro solution are to use the public network to expand the mobile network to homes, to provide high quality of UMTS wireless voice and data service. How to ensure the network security as a whole, especially to prevent threaten from the mobile CN, is the most tricky issue in the uBro security solution.

4.3.1 Security Domain Partition

The uBro system prevents the various network security from being threatens by partitioning different security domains.

- Not-trusted domain
    - Home network domain and enterprise LAN domain
    - Public network domain
- Trusted domain

    – uBro CN domain

    – UMTS mobile CN domain

4.3.2 Border Protection

The security equipment like firewall is deployed between different security domains to perform border protection. The keystone is the security border protection between the uBro CN domain and public network domain.

The security prevention policies of the firewall are as follows:

- Attack Prevention Policy
- ACL policy and data packet filtering policy
- NAT Policy
- Dual gateway policies

4.3.3 Network Anti-Attack

Through firewall deployment and security setting, the network security prevents the following attacks:

- Anti-DoS (Denial of Service) network attack
- Anti-scan network attack
- Anti-malformation message attack

4.3.4 Network Access Authentication and Access Control

Network Access Authentication

Network access authentication refers to identifying the equipment that accesses the network to achieve the following aims:

- Preventing the access from the unauthorized AP
- Preventing attackers from accessing the network

The access authentication of the uBro solution consists of the following:

- Broadband access authentication

  After accessing the ADSL broadband network, the AP is authenticated before obtaining an IP address. This authentication can be in the DHCP mode or PPPoE mode.The enterprise AP can access to the IP public network directly through the enterprise LAN, and the broadband authentication is not required.

- Mobile network access authentication

  When accessing the mobile network through IPSec or DHCP mode, the AP and the AG are authenticated through key negotiation sharing and the authentication of the user name and password. The protocols used in this authentication are IKEv1.

  📖 **NOTE**

  Subsequent versions will support IKEv2 and EAP-Authentication and Key Agreement (EAP-AKA).

Access Control

The uBro system supports the access control system to perform access control for UEs. The access control system makes the AP can be accessed by the authorized UE only, and rejects non-authorized UE accessing to the uBro network.

4.3.5 Transmission Security

For the bearer network, the transmission security is to prevent the control plane data and user plane data of the AP from being stolen, counterfeited or damaged, thus ensuring the security and integrality of the data transmission.

The uBro solution supports the following features about transmission security:

- Supports end-to-end VLAN and MPLS VPN technologies to realize separation between AP users. In the fixed access network, different PVC and VLAN are allocated to realize separation between AP services and non-AP services.

- Supports the access control list (ACL) mode to define the protected data flow. The messages allowed by the ACL are protected, and those rejected by the ACL are not protected.

- Supports the IPSec protocol.

  The IPSec security tunnel is established between the AP and SeGW to protect the defined data flow, Thus realizing transmission safety over the bearer network.

  The IPSec tunnel provides the following security features:

  - Data confidentiality.

  - Data integrity

  - Anti-replay

- Supports the Internet Key Exchange protocol (IKE).

  - The IKE provides safety bidirectional authentication.

  - The IKE supports the test and traversing of the Network Address Translation (NAT).

- Supports the Encapsulating Security Payload (ESP) protocol.

  - The ESP can encrypt the IP messages.

  - ESP authenticates the integrity of IP packets to judge whether the packets are corrupted during transmission.

  - The ESP protocol supports the traversing of the NAT.

📖 **NOTE**

The transmission between the AP and AG adopts the IPSec tunneling mode based on the ESP/IKE protocols. The IPSec key negotiation management can be based on the IKEV1 standard, and supports multiple authentication and key management methods such as the pre-shared key and EAP-SIM. Subsequent versions will support IKEv2 and EAP-Authentication and Key Agreement (EAP-AKA).

4.4 Operation and Maintenance Security

The OM security refers to the security of network management, and its security policies are as follows:

- Integrated NE management
  - The AP Manager manages all the AP equipment on the network.
  - M2000 manages the uBro CN NEs as a whole.
- Integrated management of accounts and rights Prevent illegal users from attacking and destroying the system through identity forgery, authority-exceeding access, password-guessing, and password file-stolen, thus improving the security of the system. The following measures are taken to protect the security of OM accounts:
  - All accounts of NE administrators are created and managed by the NM system (NMS) in a centralized manner.
  - All account information is stored in the network management (NM) system.
- Integrated log management
  - The NM can collect / filter the log information of every NE.
  - Provides the functions of checking / summing up/ analyzing the logs.
  - Provides the integrated storage / backup functions of the logs.

5 Service Operation

About This Chapter

The following table lists the contents of this chapter.

Section	Describes
5.1 Service Application	How to apply for the AP.
5.2 Installation of the AP	How to install the AP.
5.3 Interference Processing of the AP	How to make the AP free from interference.
5.4 Movement of the AP	Movement of the AP.
5.5 Deregistration of the AP	Movement of the AP.
5.6 Upgrade of the AP	How to upgrade the AP.
5.7 Maintenance of the AP	How to maintain the AP.

5.1 Service Application

The current AP authentication adopts the authentication mode based on the user name and password. There are two ways to issue the services.

Password Directly Written Into the AP

- The telecom operator writes the password into the AP when delivering the AP.
- The user applies for purchase in the business hall and submits the user information. The telecom operator delivers the AP to the user and opens an account using the user information in the AHR.
- After hardware installation of the AP, the user connects the AP to the internet, and the AP passes the password authentication automatically before normal operation.

Password in an Envelop

- The user applies for purchasing the service and submits the user information, and the telecom operator provides the envelop containing the password.
- After installing the hardware of the AP, the user can log in to the AP local WEB maintenance webpage through a home PC. Then the user enters the password and other information.
- After the AP accesses the Internet, it can start to work after passing the password authentication.

5.2 Installation of the AP

The AP installation supports desk installation and mounted installation. For specific installation methods, see relevant AP installation manuals.

5.3 Interference Processing of the AP

After being interfered, the AP shows the severity of interference through an indicator. If the indicator is yellow, it indicates that the severity of the interference is minor. If the indicator is red, it indicates that the severity of the interference is major.

The interference to the AP can be classified into temporary interference and permanent interference.

Temporary Interference

If there is temporary interference in the AP, the AP can recover through power control.

Permanent Interference

If there is permanent interference in the AP, the AP cannot recover. In this case, users must move the AP to a new location until the indicator becomes green.

If users cannot make the AP free from the interference through moving the AP, they can turn to the customer service call of the telecom operator to report the fault. Then maintenance engineers adjust the wireless parameters of the AP on the AP Manager to decrease the interference severity.

5.4 Movement of the AP

According to the service area of the telecom operator, the movement of the AP consists of valid movement and invalid movement.

Valid Movement

Valid movement refers to moving the AP within the service area of the appropriate telecom operator. If a user moves the AP to a new place within the original service area, the user can still use the AP after installing it correctly.

Invalid Movement

Invalid movement refers to moving the AP out of the service area of the appropriate telecom operator.

The AP performs the LCS function, so it can judge whether it is moved out of the original service area. The AP on the invalid position will be prohibited.

5.5 Deregistration of the AP

The deregistration of the AP refers to the process during which a user deregisters the service of the AP. After a user sends a request for deregistering the AP, the telecom operator needs to deregister the user data from the NEs of the uBro central office.

5.6 Upgrade of the AP

To provide new services or remove faults from software, the telecom operator needs to upgrade AP software. Software upgrade is implemented automatically between the AP and the NMS. It is recommended to upgrade the software once or twice every year. The upgrade does not affect the use of the AP.

The software can be upgraded in the following scenarios:

- Specific customer requirements are to be fulfilled.
- A serious fault in the software must be removed or new functions are to be performed.

5.7 Maintenance of the AP

When the AP becomes faulty (normally indicated by the state indicator), users can restart the AP manually to restore the AP. If the fault still exists, users can take the following measures:

- Remote fault diagnosis mode

  The user makes a customer service call to report the fault. The engineer analyzes the fault identification data of the AP online and removes the fault by changing configuration data or upgrading the software.

- Onsite maintenance mode

  If the AP cannot be restored remotely, the telecom operator sends a maintenance engineer to the site for fault maintenance. If the AP cannot be restored onsite, the maintenance engineer brings the faulty AP back to the telecom operator. During the maintenance period, the telecom operator can lend a AP for temporary use to the user.

6 Operation and Maintenance

About This Chapter

The following table lists the contents of this chapter.

Section	Describes
6.1 O&M System	The O&M architecture of the uBro solution.
6.2 O&M System of the AP	The O&M functions of the AP in the uBro solution.
6.3 O&M System of Central-Office Equipment	The O&M functions the equipment in the uBro central office.

6.1 O&M System

Figure 6-1 shows the architecture of the O&M system of the uBro solution.

Figure 6-1 Architecture of the O&M system
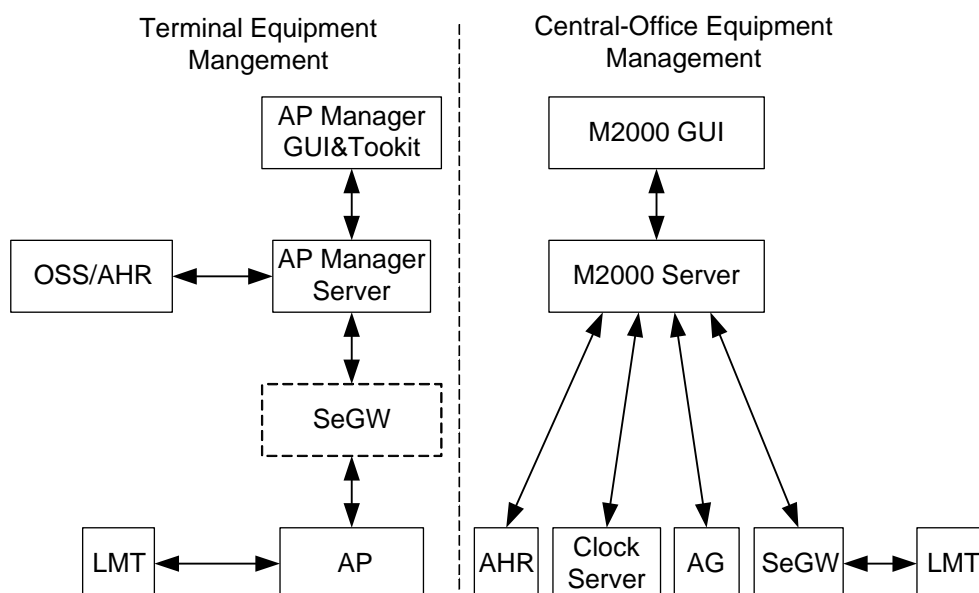
The O&M system of the uBro solution as shown in Figure 6-1 consists of two parts in the vertical direction:

- Terminal equipment management
- Central-office equipment management

In the horizontal direction, the O&M system of the solution consists of three parts, namely, graphical user interface (GUI), AP Manager, and NE and local maintenance terminal (LMT).

📖 **NOTE**

The line between the AP Manager and the AHR shows that the AP Manager interacts with the AHR to obtain the basic information of the managed AP.

6.1.1 Solution of Terminal Equipment Management

Terminal equipment management refers to maintaining the terminal equipment remotely. It possesses the following features:

- Remote maintenance

  The OMC identifies and removes the fault of the terminal equipment remotely, so that maintenance engineers can decrease the number of times of onsite support or do not have to provide onsite support.

- Passive maintenance

  The user reports a fault to the telecom operator. Then the telecom operator takes measures to remove the fault. Normally maintenance engineers do not collect O&M data from the AP on initiative.

6.1.2 Solution of Central-Office Equipment Management

The central-office equipment is managed by the M2000 remotely and managed by the LMT locally. For details about maintenance, see 6.3 "O&M System of Central-Office Equipment"

6.2 O&M System of the AP

The system of the AP consists of three parts:

- AP Manager
- AP Manager Toolkit
- AP LMT

6.2.1 AP Manager

The AP Manager, as the centralized NMS of the AP, is a Web-based maintenance system.

The AP Manager considers the requirements of users for equipment operation and maintenance and performs the powerful O&M functions for users. The AP performs the following O&M functions:

- Configuration management
- Software Management
- Fault Management
- Performance Management
- Test Management

Configuration Management

Configuration management involves the following functions:

- The AP checks the consistency of the added data, deleted data, and changed data.
- The AP supports static data configuration and dynamic data configuration.
  - If data is configured dynamically, the data takes effect immediately after it is changed.
  - If data is configured statically, the changed data takes effect only after the AP is reset. In remote maintenance mode, the AP configures data automatically when it is powered on or configures data online.

Software Management

Software management involves the following functions:

- The AP supports upgrade of versions in batches in remote maintenance mode.
- The AP supports upgrade of the version of a single NE.

Fault Management

Fault management involves the following functions:

- Supports the query of equipment status. It allows querying equipment states in batches in remote maintenance mode.
- Provides the measures for identifying faults. The measures include interface tracing, signaling tracing, and log uploading.

Performance Management

The AP provides the performance data that reflects system operation. By analyzing this data, maintenance personnel can know the operation of the network and find the reasons for the decrease in quality to provide basic data for network optimization.

Test Management

Test management involves the following functions:

- Equipment performance statistic

  Utilization of the central processing unit (CPU).
- Service performance test

  RF performance 141 test and statistics data of the occupation of service resources.

6.2.2 AP Manager Toolkit

You can obtain the AP Manager toolkit from the website and install it on your PC. The AP Manager toolkit consists of the following tools:

- Equipment Diagnosis
- Alarmlog Browser Tool
- Performance Browser Tool
- Trace Viewer
- Monitor Viewer

Equipment Diagnosis

Users need to install the equipment diagnosis software on the client first and then run the program. After that, they need to enter the IP addresses of the agent server and of the AP. They can use the tool after authentication succeeds.

This tool performs the following functions:

- Tracing messages

  This tool can trace the messages at the Iu, Uu, Stream Control Transmission Protocol (SCTP), RNC Signaling Processing Unit (SPUA), CDT, and eIu interfaces of the AP, and save the messages in a file.
- Monitoring CPU usage

  This tool can monitor the changes in the CPU usage of the AP and save the changes in a file.
- Performing 141 test

This tool can test radio frequency indexes.

- Monitoring performance in real time

This tool can monitor temperature and cell performance in real time.

Alarmlog Browser Tool

The maintenance personnel can upload the alarm files generated by the NEs to the M2000 server through the AP Manager. This alarmlog browser tool is used to view the alarm files.

📖 NOTE

The AP provides users with the alarms only related to users.

Performance Browser Tool

The maintenance personnel can upload the performance files generated by the NEs to the M2000 Server through the AP Manager. The performance browser tool is used to view the performance files.

Trace Viewer

The equipment diagnosis saves the traced interface messages of the AP in a file.The maintenance personnel can use the Trace Viewer to view these files.

Monitor Viewer

The equipment diagnosis saves the CPU usage of the AP as a file. The maintenance personnel can use the Monitor Viewer to view these files.

6.2.3 AP LMT

The AP LMT is the PC used by the onsite maintenance personnel. The onsite maintenance personnel can access to the AP built-in maintenance application through the IE browser.

The AP LMT allows users to perform the following operations:

- Viewing AP status
- Viewing and changing AP configuration parameters
- Uploading the logs generated on the AP
- Loading software

📖 NOTE

Users are not recommended to change configuration parameters, uploading the logs generated on the AP, or load software, because these functions are provided for maintenance engineers.

6.3 O&M System of Central-Office Equipment

6.3.1 AG

As central-office equipment, the AG is maintained through the M2000 and LMT. Its maintenance operations are similar to those of other central-office equipment.The O&M system of the AG performs the following functions:

- Configuration management
- Performance management
- Alarm management
- Software management
- Tracing management
- Security management

Configuration Management

Configuration management refers to adding, deleting, changing, and querying system data. The AG supports dynamic data configuration and static data configuration.

- Dynamic data configuration refers to changing data without stopping the system operation.
- Static data configuration refers to a process during which administrators edit **MML.txt** offline first and load it, and then restart the system to validate the changed data.

Performance Management

Performance management refers to collecting the data that reflects network operation from the AG and the network around it.

The AG automatically reports the result of each index in every measurement period to the M2000 server.

Administrators can query, sort, and draw the results of performance measurement on the M2000 client.

Alarm Management

Alarm management refers to monitoring NEs. It is applied in routine maintenance.

The AG generates alarms and sends them to the M2000 or LMT through the human-machine language (MML) interface in real time. The AG can connect to an alarm box, which generates audible and visible alarms to prompt maintenance personnel.

The alarms reported by the AG are classified into fault alarms and event alarms. Based on alarm severity, fault alarms are classified into critical alarms, major alarms, minor alarms, and warning alarms. Maintenance personnel browse, query, configure, maintain, and filter alarms on the alarm console or maintenance console.

Software Management

Software management refers to upgrading the software or expanding the network to add new features or remove faults. Software upgrade refers to managing version files and patch files. Version files and patch files are downloaded from the version server to the AG through FTP, and then the software and patch are loaded and activated locally.

The AG allows installing patches to remove faults online without stopping services.

Tracing Management

Tracing management is a powerful tool in NE maintenance.

The AG can trace the eIu interface, the Iu interface. It can also trace the protocols such as Message Transfer Part-Broadband (MTP3B), SCCP, Signaling ATM Adaptation Layer (SAAL), ATM Adaptation Layer 2 (AAL2), and SCTP.

Maintenance personnel can save tracing results as required and query the results through the tracing reviewing tool when necessary.

Security Management

Security management refers to controlling operators and their rights to ensure that they perform operations within the authorization range. The AG performs security management by managing operators and command groups.

6.3.2 eSGSN

For the O&M functions of the eSGSN, see 6.3.1 "AG."

6.3.3 Clock Server

The Clock Server can meet the requirements of users for equipment operation and maintenance. It performs the following powerful O&M functions for users:

- Security management
- Configuration management
- Software management
- Alarm management
- Log management

Security Management

Security management of the Clock Server involves the following functions:

- The clock server sets multiple levels of operator rights. The clock server controls the hierarchical operation right system to protect the security of NE operation.
- The clock server protects the operator's information. If an operator does not operate an NE for a long time, the O&M interface is locked automatically.

Configuration Management

Configuration management is mainly applied in NE maintenance and data configuration. Configuration management supports the check of the consistency of configuration data. Data can be configured dynamically or statically.

- If data is configured dynamically, the data takes effect immediately after it is changed.
- If data is configured statically, the changed data takes effect only after the clock server is restarted.

Software Management

Software management refers to managing and upgrading software versions.

Alarm Management

The alarm management system of the Clock Server detects and reports the faults of NEs in real time. It also displays alarms and the suggestions for clearing the alarms on the M2000 and LMT.

The alarm management system of the LMT or M2000 can connect to an alarm box through a serial port. The alarm box generates audible and visible alarms, and sends the alarms that are subscribed by users to the mobile phones or pagers of the maintenance personnel. This helps the maintenance personnel to obtain the information of faulty NEs in time.

Log Management

The clock server records the operations of NEs in real time and saves the records as operation logs. This helps to identify and solve problems.

6.3.4 AHR

The AHR is a server. Seen from NM, the AHR performs the alarm management function. The AHR connects to the NMS through the Simple Network Management Protocol (SNMP) and performs routine maintenance through the Telnet.

6.3.5 SeGW

The SeGW is connected to the M2000 for management. The M2000 supports alarm management. Data configuration and upgrade are implemented through the Telnet function of the SeGW.

7 Reference Information

About This Chapter

The following table lists the contents of this chapter.

Section	Describes
7.1 System Performance	Performance parameters of the major NEs in the uBro system.
7.2 Data Homing	Data homing on the NEs in the uBro solution.
7.3 Referenced Standards and Protocols	Standards and protocols that the uBro solution adopts.

7.1 System Performance

7.1.1 AP

Table 7-1 lists the system performance parameters of Huawei AP.

Table 7-1 AP system performance parameters

Item	UAP3801	UAP3801E
Frequency band	• Uplink: 1920 MHz – 1980 MHz • Downlink: 2110 MHz - 2170 MHz	• Uplink: 1920 MHz – 1980 MHz • Downlink: 2110 MHz - 2170 MHz
Maximum transmit power	15 dBm (30 mW)	18 dBm (63 mW)
Number of telecom operators	A single telecom operator; a single cell	A single telecom operator; a single cell
Transceiver diversity	Not supported	Not supported
Receiver sensitivity	$< -107 \text{dBm}$	$< -112 \text{dBm}$
Service capability	• Voice: 12.2 kbit/s (4) • Data: 7.2 Mbit/s (DL)/1.44 Mbit/s (UL)	• Voice: 12.2 kbit/s (16) • Data: 7.2 Mbit/s (DL)/1.44 Mbit/s (UL)
Clock precision	±0.1 ppm	± 0.1 ppm

7.1.2 AG

Table 7-2 lists the system performance parameters of Huawei AG.

Table 7-2 AG system performance parameters

Item	Parameter
Data forwarding capability in the PS domain	10 Gbit/s
Voice forwarding capability in the CS domain	7500 Erl
Number of managed APs	50000

7.1.3 AP Manager

Table 7-3 lists the system performance parameters of Huawei AP Manager.

Table 7-3 System performance parameters of AP Manager

Item	Parameter
Number of managed APs	250,000
Number of concurrent upgraded APs	100
Number of concurrent managed versions	20
Number of concurrent managed tasks	200
Number of concurrent changed configurations	100

7.1.4 AHR

Table 7-4 lists the system performance parameters of Huawei AHR.

Table 7-4 System performance parameters of AHR

Item	Parameter
Number of managed APs	5,000,000
Number of AP power-on concurrent connection requests	200

7.1.5 Clock Server

Table 7-5 lists the system performance parameters of Huawei Clock Server.

Table 7-5 System performance parameters of Clock Server

Item	Parameter
Maximum number of supported clients	512 NodeBs or 10,000 APs
Maximum packet-transmitting rate	50 pps (packet per second)
Maximum occupied bandwidth of each channel of signals	50 kbit/s
Output clock precision	5 ppb (parts per billion)
Clock holding time	7 days

7.1.6 SeGW

Table 7-6 lists the system performance parameters of Huawei SeGW.

Table 7-6 System performance parameters of Huawei SeGW

Item	Eudemon500 performance	Eudemon1000 performance
Maximum throughput of the whole equipment	2 Gbit/s	3 Gbit/s
Number of ACL regulations	20,000	20,000
Number of concurrent connections	500,000	800,000
Number of created connections every second	100,000	100,000
Average faultless interval	37.54 years	37.54 years

7.2 Data Homing

In the uBro solution, the AP, AHR, and AP Manager can store data.

To improve system robustness, some data is stored in multiple NEs, but only one NE is the home of the data. This NE is called the master data node, and other NEs storing the data are called slave data nodes.

If the data on the master node is inconsistent with the data on the slave node, the data on the slave node must be synchronized with the data on the master node. If the data on the slave node changes, then the slave node notifies the master node of the change. If the master node rejects the change, the data on the slave node cannot be changed. If the data on the master node changes, the master node requests the slave node to update the data. If the timer expires or the slave node rejects the change, the master node sends the request to the slave node periodically.

AP

Table 7-7 lists the data stored on the AP and the data homing.

Table 7-7 Data stored on the AP

Data	Description	Management	Master Node
APEI	Serial number of the AP. It uniquely identifies an AP.	This parameter cannot be changed.	AP

Data	Description	Management	Master Node
Admission list	Identifies that the UE is a valid user of the AP	The list is generated during program initialization and exists permanently. • The list can be viewed on the operation interface. The change of the list must be reported to the home server. • The list can be changed on the operation interface. The change takes effect only after being reported to the home server.	AHR
Function control parameters	Define the functions and specifications of the AP. Such parameters include admission policies, maximum resident users, and the types of Aps.	These parameters are generated during program initialization and exist permanently with the default values. • These parameters can be viewed on the operation interfaces of the AP Manager and AP. • These parameters are sent by the home server and cannot be updated by the AP.	AHR
Wireless configuration parameters	Used to configure the network, cell, and algorithm.	• If these parameters are not configured on the AP, the default parameters on the AP are used. • After downloading these parameters from the AP Manager, the AP stores and uses the parameter configuration.	AHR
Transmission configuration parameters	Transmission security parameter configuration of the AP. Used to record the security parameter configuration of each AP.	• These parameters are obtained from the AHR and exist forever. • These parameters can be viewed on the operation interfaces of the AP Manager and AP. • The AP can request updated parameters from the AHR and the AHR can also send updated parameters to the AP on initiative.	AHR

AHR

Table 7-8 lists the data stored on the AHR and the data homing.

Table 7-8 Data stored on the AHR

Data	Description	Management	Master Node
Admission list	Identifies that the UE is a valid user of the AP	• The admission list can be changed on the AHR maintenance terminal. • The AP can request to change the admission list. • The admission list can be read from the AHR maintenance terminal and AP.	AP
Function control parameters	Define the functions and specification of the AP. Such parameters include admission policies and maximum resident users.	• These parameters can be changed on the AHR maintenance terminal. • These parameters can be read from the AP.	AP
AP user information	Specifies the information of the owner of the AP. Such information includes the name, ID number, and address of the owner of the AP.	None.	AP
Transmission configuration parameters	Includes the internal-layer IP address of the AP, security gateway address, and the IP addresses of NEs.	• These parameters can be changed on the AHR maintenance terminal. • These parameters can be obtained from the guide server. The changed transmission configuration parameters can be sent from the guide server to the AP.	AP
Environment information of the AP	Defines the area of the house in which the AP is located, acreage of the house, and residential density of the community.	The environment information can be viewed on the AHR maintenance terminal.	AP

AP Manager

Table 7-9 lists the data stored on the AP Manager and the data homing.

Table 7-9 Data stored on the AP Manager

Data	Description	Management	Master Node
Wireless configuration parameters	Used to configure the network, cell, and algorithm.	The AP Manager generates data configuration sets, each set having an index. When sending wireless configuration parameters, the AHR selects a data configuration set for the AP.	AP

7.3 Referenced Standards and Protocols

This solution complies with the following standards and protocols:

- 3GPP: 3GPP R6 2006-03 version, compatible with the 3GPP R99/R4/R5 protocols, including the Uu and Iu interface protocols.
- Protocols of IETF standards, including IP, TCP, UDP, SCTP, RTP, and PPP.