IPLOOK XGW PRODUCT DESCRIPTION

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IPLOOK XGW Product Information

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Revision history

Version	Usage State	Modification Summary	Reviser	Reviewer	Revision date
1.1	Initiation Version		David	Li	28-06-18
1.2	Done	Support Gx and Gy	David	Li	13-09-20
1.3	Done	Add Radius function	Kevin	James	26-03-21
1.4	Done	Add Volte function	Kevin	James	05-11-21

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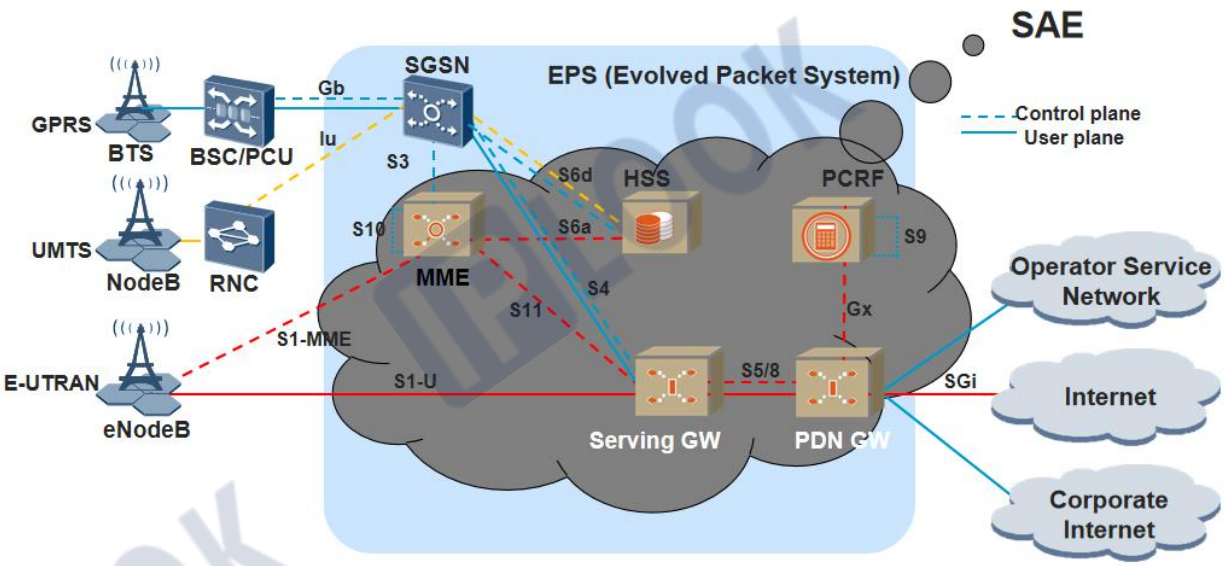
1 Introduction

1.1 xGW overview

EPC refers to a core network architecture that supports LTE access networks. IPLOOK provides Long Term Evolution/Evolved Packet Core (LTC/EPC). The PGW provides connectivity between the UE and external packet data networks. It provides the entry and exit point of traffic for the UE. A UE may have simultaneous connectivity with more than one PGW for accessing multiple Packet Data Networks. The PGW/GGSN performs policy enforcement, packet filtering for each user, charging support, lawful interception and packet screening. S-GW is the gateway that terminates at the E-UTRAN interface. IPLOOK xGW provides flexible network deployment capabilities. xGW can be deployed in EPC networks as individual SGW network elements, individual PGW network elements, and combined xGW network element functions.The location of xGW in the EPC network is shown in Figure 1.

Figure 1 Schematic Diagram



The xGW product is IPLOOK's self-developed core gateway platform that integrates GGSN/SGW/PGW functions.

Table 1 Core network node description

Name	Function

Name	Function
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network.
MME	The Mobility Management Entity (MME) represents the control plane for the User Equipments(UEs) to access the 4G LTE, or EPS network. From a UE's perspective, signaling for access control, location tracking, and bearer set up is performed via the MME.
HLR/HSS	Home Location Register, which stores the subscription data and location information of subscribers and provides route information for calls from the network to subscribers. Home Subscriber Server, which stores the subscription data and location information of subscribers and implements subscriber authentication and authorization.
MSC	Mobile Switching Center, which provides the call conversion service and call control between the telephony and data systems.
CG	Charging Gateway, which lies between the Gn/Gp SGSN/GGSN and the Charging Center to send CDR files to the Charging Center.
SGW	The service gateway that implements user-plane data routing in the EPC network.
PGW/GGSN	Gateway GPRS Support Node, which provides routing and encapsulation of data packets between the 3G core-network and external data network. In EPC network, the GGSN is evolved into a PGW(the packet data network gateway) function node, that implements subscriber access to the PDN in the EPC network.
PCRF	Implements policies and charging rules.

Name	Function
PDN	Provides the data transmission service for subscribers.

1.2 Highlight features

1.2.1 Virtualization

Software and hardware are decoupled through virtualization. The IPLOOK xGW software can be deployed quickly and operate on universal hardware devices of the X86 COTS server or VM/container based virtual platform.

1.2.2 Carrier-grade High Availability

The IPLOOK xGW hardware resources are virtualized to many VMs. When the IPLOOK xGW needs to increase its processing capability, more VMs can be installed.
The IPLOOK xGW supports redundancy and disaster recovery of components and NEs. NEs can be deployed in the entire resource pool through distributed deployment of VMs to enhance system reliability.
The IPLOOK xGW supports smooth evolution and system migration through online patches and application updates.

1.2.3 Multi-NE Deployment

The IPLOOK xGW and other VNFs can be deployed on the same hardware platform. Generally IPLOOK xGW and IPLOOK xGW are deployed.

1.2.4 Open Interfaces and Flexible Network Architecture

IPLOOK xGW products provide open and standard interfaces and allow smooth upgrades and expansion.
Support of High speed Ethernet transport allows its integration into any of the existing networks. Safe integration without impact is also ensured by supporting the legacy interfaces and signaling protocols towards the existing network elements.
For implementing authentication and charging (for some enterprise users) function, IPLOOK xGW connects with Radius server.

IPLOOK xGW supports Gy interface (based on diameter protocol) to connect with OCS for online charging and supports Gx interface (also based on Diameter protocol) to connect with PCRF for Policy and Changing control.

1.2.5 Sophisticated Operation and Maintenance System

The IPLOOK xGW performs daily maintenance and management through the EMS/OMM and VNFO.
The IPLOOK xGW functions can be maintained on the local OMM and in the upper-layer EMS.
The features are as follows:
The OMM uses the B/S structure, and the EMS uses the C/S structure, ensuring a desirable networking capability and expansion of the operation and maintenance system.
Provides remote and local access to the system so that both local and remote operation and maintenance can be implemented. Maintenance operations can be performed on the entire system and each specified NE.
Multi-level permission mechanism to ensure system security.

1.2.6 NFV Performance Optimization Techniques

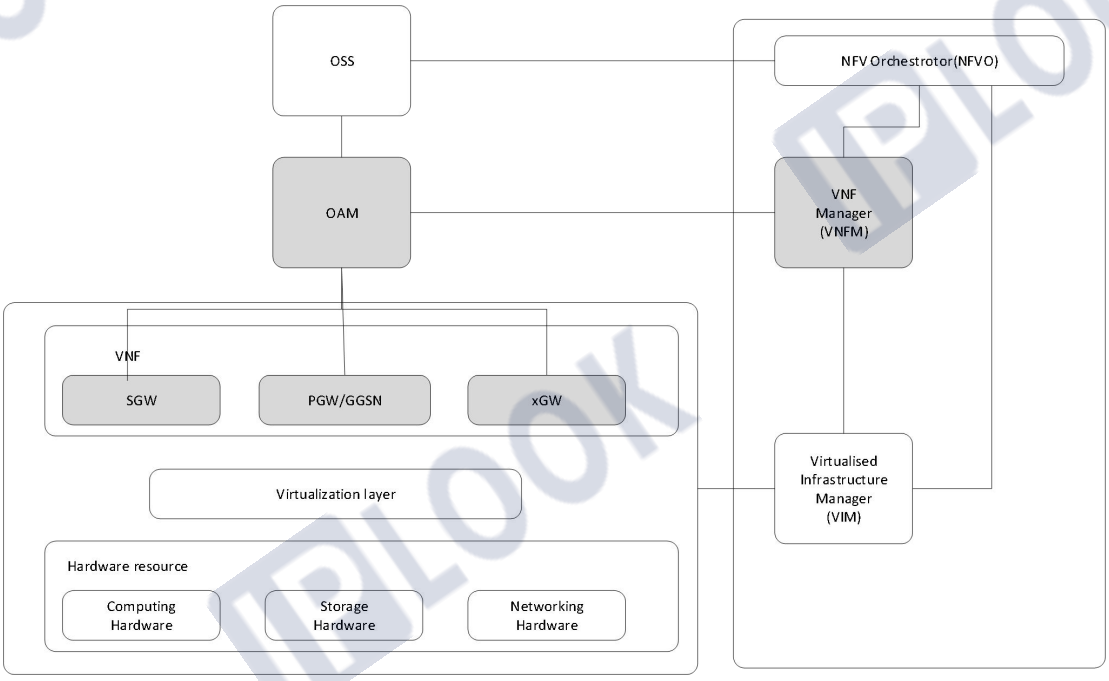
Network Function Virtualization (NFV) is a core structural change in the way telecommunication infrastructure gets deployed. This in turn will bring significant changes in the way that applications are delivered to service providers. NFV will bring cost efficiencies, time-to-market improvements and innovation to the telecommunication industry infrastructure and applications. NFV will achieve this through disaggregation of the traditional roles and technology involved in telecommunications applications.
Performance, especially the user plane performance using COTS has always been a concern for service providers and equipment vendors alike. IPLOOK's vEPC address the issue by applying the following performance optimization techniques to the user plane software processing module.
Combine the Single Root I/O Virtualization (SR-IOV) with Intel's Data Plane Development Kit (DPDK) techniques to enhance the performance.
Apply Open vSwitch (OVS) on enhanced Intel's DPDK (By IPLOOK) to further enhance the data processing performance.
In addition, by using specific 10G, 40G or 100G NIC from Intel, the performance can be further enhanced.

2 System architecture

2.1 IPLOOK xGW in the NFVI

IPLOOK xGW Support virtualization deployment and customization of private and public cloud systems.

Figure 2 IPLOOK xGW System Architecture



For a description of the architecture of the IPLOOK MME, refer to Table 2.

Table 2 IPLOOK MME System Architecture Descriptions

Node	**Description**
OAM	Comprehensive service operation and management platform, which provides various functions such as network management , system management and daily maintenance and management for xGW.
NFVI	Network functions virtualization infrastructure, which refers to physical

Node	Description
	resources. The NFVI is provided and managed by the cloud platform.
Hypervisor	Arranges and manages NFV resources (infrastructure and applications) in the network, and deploys the NFV service on the NFVI.
Hardware	Includes computer hardware, storage hardware, and network hardware.
NFVO	Arranges and manages network services, virtualization resources, and physical resources in the network.
VNFM	Manages the xGW lifecycle.
VIM/CMS	Management module of the NFVI, which is the VIM in the ETSI NFV and the CMS in the CCSA. • The VIM/CMS is a system managing virtual infrastructure, managing and monitoring infrastructure-layer hardware resources and virtualization resources, monitoring and reporting alarms, and providing virtual resource pools for upper-layer applications. • The VIM/CMS are operation interfaces providing virtual resources related to the VNF for the NFVO and VNFM. • The VIM/CMS is a cloud platform management function provided by the cloud platform. General applications include TECS, VmWare, and Openstack.

3 Functionality

3.1 Basic function

3.1.1 Session management

3.1.1.1 Definition

Session management is the basic function of GW500, which enables ue to connect to PDN, manage PDP context / EPS bearer, establish, update and delete it.

3.1.1.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
√	√	√	√	√	-	-

3.1.1.3 Principle description

GPRS session management

▪ PDP context activation: after UE completes the attachment process to GPRS network, it can initiate PDP context activation request. After completing the request, a data path from ue to PDN will be established.In the process, the network side will complete IP address allocation, QoS configuration and other operations according to the request message and signing data.

▪ PDP context deactivation: the operation of releasing PDP context initiated by UE, SGSN or GGSN.After deactivation, the IP address used by the UE is released, and the PDP context in SGSN and GGSN is deleted.

▪ PDP context update: initiated by UE, SGSN or GGSN to modify the activated PDP context parameters, such as QoS or TFT.

EPS session management

▪ UE attachment: an EPS bearer will be established when the UE is connected to the core network and will not be released when connected to the PDN, which is called the default bearer.

▪ Default bearer activation: initiated by the UE and can be performed during or after the attachment is completed. It is used for an attached ue to apply to other PDNs to establish a connection.MME completes the selection of S-GW and P-GW, and P-GW completes IP address allocation and UE access to external PDN.After the default bearer is activated successfully, the UE can communicate with the PDN through the EPC network.

▪ Proprietary bearer activation: initiated by P-GW to establish a bearer context using specific QoS and TFT.After the proprietary bearer is activated successfully, the data service requested by the user will be protected by the specified QoS.

▪ Proprietary bearer deactivation: initiated by MME or PGW, one or more EPS bearers can be deactivated.The IP address of UE is released, and the bearer context in MME and P-GW is deleted.

▪ Proprietary bearer update: it is initiated by UE, HSS or P-GW to update the parameters of EPS bearer context, such as QoS and TFT.

3.1.2 Path management

3.1.2.1Definition

3.1.2.2 Principle overview

The path management function of GW500 mainly detects the communication path failure with the opposite end network element and the working state of the opposite end network element by

sending a path management message.After sending the path management message to the opposite NE, if the GW500 does not receive the response message returned by the opposite NE within the time period configured by the system, it will resend the detection message.In case of GTP interface path failure, GW500 does not resend the detection message and immediately responds to the failure of the opposite end.If no response is received after reaching the maximum number of retransmissions configured by the system, it is considered that the communication path or the opposite network element is faulty.

Message type

agreement	explain
Path management message of GTP protocol	Path management message based on echo message.
	Path management messages based on non echo messages.
Path management message of PMIPv6 protocol	Path management message based on heartbeat message.

3.1.3 Address assignment

3.1.3.1 Definition

GW500 supports three ways to provide users with IP addresses: static address allocation, local address allocation and radius allocation. It can provide users with three types of addresses: IPv4, IPv6 and IPv4v6 (dual stack).

3.1.3.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS	AAA SErver
-	-	-	-	√	-	√	√

3.1.3.3 Principle description

3.1.3.3.1 How to get IP

When the UE establishes the default bearer, it will carry the PDN address allocation cell, which contains the address type and IP address that the UE needs to use when accessing the PDN.In the EPC network, the MUE indicates the desired IPv4 / IPv6 / IPv4v6 address acquisition method of the network, so as to obtain the IP address.

3.1.3.3.2 Distribution mode

▪ Static address allocation method: the static address allocation method means that the UE uses the IP address determined when signing the packet service with HLR / HSS, carries the IP address in the cell when the bearer context is activated, and sends it to GW500 through the activation request message.

▪ Local address pool allocation method: refers to the IP address (dynamic address) directly obtained by UE from the address pool configured for users in GW500 using the bearer context activation stage.

▪ Radius address allocation method: refers to the IP address obtained from the radius server during user authentication when the bearer context is activated.GW500 supports the allocation

of user IP addresses from the radius server through the radius authentication process, and the addresses will be in the access request message returned by the server.

3.1.3.3.3 Application scenario

▪ Static address allocation method: users can be assigned a fixed IP address.

▪ Local address pool allocation method: operators do not need to separately deploy devices that allocate IP addresses to users, which can save operation costs.

▪ Radius address allocation method: applicable to RADIUS Server managed by enterprise network or ISP.

3.1.4 xGW integration

3.1.4.1 Definition

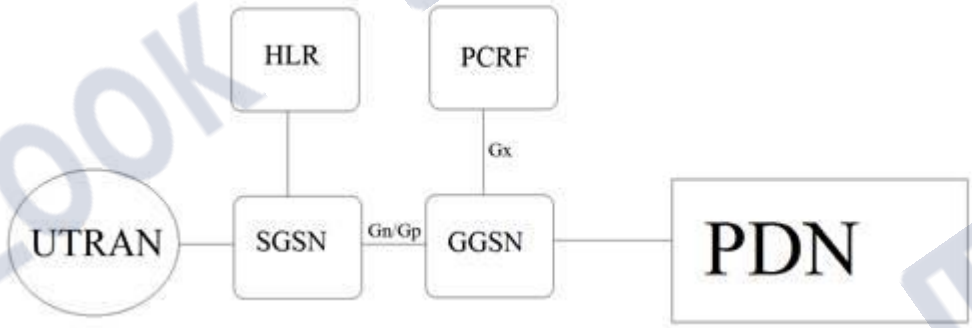
GW500 supports that 3G Users can access PDN and carry out various data services through GPRS and EPC networks.

3.1.4.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
√	√	√	√	√	-	-

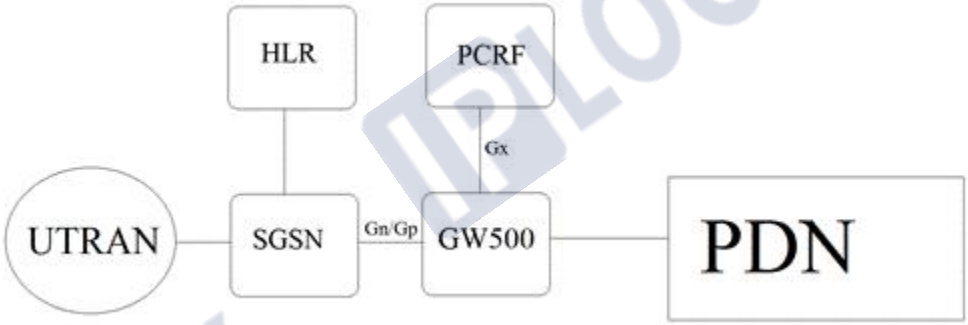
3.1.4.3 Principle description

3.1.4.3 .1



User access networking architecture in GPRS network

3.1.4.4.2



User access networking structure based on GN interface

3.1.5 Billing function

3.1.5.1 Definition

Billing is a cost calculation system established by operators according to certain tariff policies in order to measure users' occupation of network resources.Huawei GW500 supports two billing systems defined by 3GPP and RFC standard protocols: online billing and offline billing.Online billing is realized through the interaction between Gy interface and OCS, and offline billing is realized through the interaction between GA interface and CG.

3.1.5.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
-	-	-	-	√	-	-

3.1.5.3 Principle description

3.1.5.3.1 Billing logic

▪ When the user is activated, GW500 judges the user's billing method according to the charging characteristics, APN and other information carried in the create PDP context request / create session request message, integrating the billing method issued by PCRF and AAA server and the locally configured billing method.

▪ After the service flow arrives, GW500 records the traffic, duration and other information generated during the PDP context / EPS bearer online, and generates billing data and billing bill through interaction with OCS / CG signaling.For content billing users, after the service flow

arrives, GW500 analyzes the characteristics of the service flow, matches the rules of the policy library according to the analysis results, and then records the uplink and downlink traffic according to the billing parameters defined by the rules to generate billing data and billing bills.

3.1.5.3.2 Billing method

The charging methods of GW500 are divided into three categories:

▪ Offline billing: record the user's resource usage, generate a bill, and send the bill to CG through GA interface for billing.

▪ Offline hot charging: it has all the functions of ordinary offline charging, and the bill generation speed is faster than ordinary offline charging.

▪ Online billing: record user resource usage, generate bills, and send bills to OCS through Gy interface for billing.

3.1.5.3.3 Billing method selection

▪ Selection of online / offline billing methods

▪ The online billing methods on GW500 include PCRF distribution, AAA server distribution and local configuration. The offline billing methods include PCRF distribution and local configuration. The local configuration has three granularity: user profile, APN and CC.The priority of these methods is reduced in turn.

▪ If the PCRF is deployed in the network to control the online / offline billing mode, the PCRF carries the online / offline AVP in the CCA-I message to indicate whether the IP-CAN session enables online / offline billing.

▪ If PCRF is deployed in the network and PCRF supports issuing OCS-ID, PCRF sends OCS-ID defined in GW500 in CCA-I message to instruct the user to enable online billing.

▪ If the PCRF is not deployed in the network and the AAA server supports issuing OCS-ID, the AAA server issues the OCS-ID defined in GW500 in the access accept message to instruct the user to enable online billing.

▪ If PCRF is not deployed in the network and the AAA server does not support issuing OCS-ID, the locally configured online / offline billing method is used

3.1.6 QoS control

3.1.6.1Definition

When the user uses the Internet service, GW500 marks the user message and controls the rate of the user's uplink and downlink data.

3.1.6.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
-	-	-	-	√	-	-

3.1.6.4 Principle description

3.1.6.4.1 QoS function logic

GW500 QoS provides different levels of services for bearer.UE is allowed to obtain different levels of services under different bearers.The uplink and downlink data rates of the bearer can be controlled in different services.

3.1.6.4.2 QoS level service bearer

▪ In GPRS network, each PDP context has a set of independent QoS attributes associated with it.R97 / 98 QoS and R99 QoS have different attribute sets.

▪ R97 / 98 QoS attribute (defined in 02.60, 03.60 and 04.08 specifications of 3GPP):

▪ Priority class: priority class

▪ Delay class

▪ Reliability class

▪ Peak throughput: peak throughput class

▪ Average throughput: mean throughput class

▪ R99 QoS attribute (defined in 23.060, 23.107 and 24.008 specifications of 3GPP, where 23.107 defines the conversion rules between R97 / R98 QoS and R99 QoS):

▪ Business category: traffic class

▪ Maximum bit rate for uplink

▪ Maximum bit rate for downlink

▪ Guaranteed bit rate for uplink

▪ Guaranteed bit rate for downlink

3.1.7 Multi PDN connection

3.1.7.1 Definition

Multi PDN connection means that a UE can connect multiple PDNS at the same time to access different networks.

3.1.7.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
√	√	√	√	√	√	√

3.1.7.3 Principle description

▪ According to 3GPP protocol, EPS (evolved packet system) supports a UE to exchange IP services with multiple PDNS simultaneously through one or more P-GW.

▪ GW500 supports the establishment of PDN connection initiated by UE and the disconnection of PDN connection initiated by UE or MME.

3.1.7.3.1 Establishing PDN connection initiated by UE

▪ UE can use multiple APNs to access different PDN networks at the same time. After UE initiates a PDN connection establishment request, MME determines the S-GW and P-GW that should be used for each PDN connection.During or after the default bearer establishment, the P-GW assigns an independent IP address to the UE for each PDN connection, and the UE uses the IP address to access the corresponding PDN.At the same time, each PDN connection can establish one or more proprietary bearers.

3.1.7.3.2 PDN disconnection initiated by UE or MME

▪ Both UE and MME can initiate a PDN connection disconnection request to disconnect the UE from a PDN.In this process, the S-GW and P-GW will release all bearers from the UE to the PDN, including the default bearer.

▪ The PDN disconnection process cannot be used to disconnect the last PDN of the UE.The last PDN connection can only be realized through the deactivation process initiated by UE or MME.

3.1.8 S5/S8

3.1.8.1 Definition

S5 / S8 interface: signaling interface and user interface between S-GW and P-GW, used for bearer establishment, update and deletion, and user uplink and downlink data transmission.

3.1.8.2 Dependency

S5 / 8 interface

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
-	-	-	√	√	-	-

3.1.8.3 Principle description

3.1.9 SGi

3.1.9.1Definition

SGi interface: as the interface between P-GW and PDN.

3.1.9.2 Dependency

SGI interface

UE	eNodeB	MME	S-GW	PDN-GW	AAA Server
-	-	-	-	√	√

3.1.9.4 Principle descriptio

3.1.10 GN

3.1.10.1Definition

Gn interface: in the indirect tunnel mode, GN interface is the signaling interface and user interface between Gn / Gp SGSN and GGSN / P-GW.In direct tunnel mode, Gn interface is the signaling interface between Gn / Gp SGSN and GGSN / P-GW, and the user interface between RNC and GGSN / P-GW.

3.1.10.2 Dependency

GN interface

UE	eNodeB	MME	S-GW	SGSN	PDN-GW	PCRF	HSS
-	-	-	-	√	√	-	-

3.1.10.3 Principle description

3.1.10.1 Interface message

▪ GN interface message

messages	direction	effect
Forward Relocation Request	Gn/Gp SGSN->MME	Request inter rat handover from UTRAN / GERAN to e-utran for the user.
	MME->Gn/Gp SGSN	Request inter rat switching from e-utran to UTRAN / GERAN for the user.
Forward Relocation Response	MME->Gn/Gp SGSN	Returns the request result of the forward relocation request message.
	Gn/Gp SGSN->MME	
Forward Relocation Complete Notification	MME->Gn/Gp SGSN	Returns the result of successful switching.
	Gn/Gp SGSN->MME	
Forward Relocation Complete Acknowledge	Gn/Gp SGSN->MME	Returns the confirmation result of the forward relocation complete notification message.
	MME->Gn/Gp SGSN	
SGSN Context Request	MME->Gn/Gp SGSN	Request mm and PDP context for user.
SGSN Context Response	Gn/Gp SGSN->MME	Return the request result of SGSN context request message.

SGSN Context Acknowledge	MME->Gn/Gp SGSN	When the reason value of SGSN context response message is accept, respond to the message.

3.1.11 Ga

3.1.11.1Definition

Ga interface: the interface between GGSN / S-GW / P-GW and charging gateway entity CGF (charging gateway functionality) to run GTP protocol.

3.1.11.2 Dependency

Ga interface

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
-	-	-	-	√	√	-

3.1.12 Gx

3.1.12.1Definition

Gx interface: signaling interface between P-GW and PCRF.

3.1.12.2 Dependency

Gx interface

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
-	-	-	-	√	√	-

3.1.12.3 Principle description

3.1.12.3.1 Interface message

GX interface message

messages	direction	effect
(Credit-Control-Request)CCR	P-GW->OCS	PCEF sends it to OCs to request charging rules for UE bearer.
(Credit-Control-Answer)CCA	OCS->P-GW	Response message from CCR.
(Re-Auth-Request)RAR	OCS->P-GW	OCS actively provides QoS to PCEF through push.
(Re-Auth-Answer)RAA	P-GW->OCS	Returns the request result of the RAR message.

3.1.13 Gy

3.1.13.1 Definition

▪ S5 / S8 interface: signaling interface and user interface between S-GW and P-GW, used for bearer establishment, update and deletion, and user uplink and downlink data transmission

▪ SGi interface: as the interface between P-GW and PDN.

▪ Gn interface: in the indirect tunnel mode, Gn interface is the signaling interface and user interface between Gn / Gp SGSN and GGSN / P-GW.In direct tunnel mode, GN interface is the signaling interface between Gn / Gp SGSN and GGSN / P-GW, and the user interface between RNC and GGSN / P-GW.

▪ Ga interface: the interface between GGSN / S-GW / P-GW and charging gateway entity CGF (charging gateway functionality) to run GTP protocol.

▪ Gx interface: signaling interface between P-GW and PCRF.

▪ Gy interface: Gy interface is the signaling interface between GGSN / P-GW and OCS.

3.1.13.2 Dependency

Gy interface

UE	eNodeB	MME	S-GW	PDN-GW	OCS
-	-	-	-	√	√

3.1.13.3 Principle description

3.1.13.3.1 Interface description

Gy interface message

message	direction	effect
(Credit-Control-	P-GW->OCS	PCEF sends it to OCs to request charging rules for UE bearer.

Request)CCR		
(Credit-Control-Answer)CCA	OCS->P-GW	Response message from CCR.
(Re-Auth-Request)RAR	OCS->P-GW	OCS actively provides QoS to PCEF through push.
(Re-Auth-Answer)RAA	P-GW->OCS	Returns the request result of the RAR message.
(Abort-Session-Request)ASR	OCS->P-GW	OCS notifies P-GW of termination of specific dialogue.
(Abort-Session-Answer)ASA	P-GW->OCS	Returns the request result of the ASR message.
(Disconnect-Peer-Request)DPR	P-GW->OCS	PCEF notifies OCS that the data path will be closed.
(Disconnect-Peer-Answer)DPA	OCS->P-GW	Returns the request result of the DPR message.
(Capabilities-	P-GW-	The P-GW informs the OCS of link

Exchange-Request)CER	>OCS	maintenance.
(Capabilities-Exchange-Answer)CEA	OCS->P-GW	Returns the request result of the CER message.
(Device-Watchdog-Request)DWR	P-GW->OCS	Heartbeat check between P-GW and OCS.
(Device-Watchdog-Answer)DWA	OCS->P-GW	Returns the request result of the DWR message.

3.1.14 Radius function

3.1.14.1 Definition

GW500 realizes radius authentication and radius billing functions by using RADIUS protocol with radius server.

1.14.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	AAA Server

-	-	-	-	√	√

3.1.14.3 Principle description

▪ GW500 realizes the functions of radius authentication and radius billing by using RADIUS protocol communication with radius server.

▪ Radius authentication: refers to UE authenticating through GW500 to AAA server,

▪ Radius billing: refers to that the GW500 sends the user billing information to the AAA server, and the radius server completes the billing related processing.

3.1.14.3.1 Radius authentication

▪ Assign UE IP address in radius mode

▪ The IP address UE assigned by the mobile user is the address (dynamic address) obtained when the radius server completes the authentication request in the PDP context activation stage.

▪ Support PAP (password authentication protocol) and CHAP (Challenge Handshake Authentication Protocol) authentication

▪ When users access the network and carry PAP or chap in PCO, GW500 supports corresponding authentication for users.

3.1.14.3.2 Radius billing

▪ Charging with radius server

▪ When the GW500 triggers the sending of the billing message due to user activation, update, deactivation and other reasons, the GW500 sends the billing message to the user's authentication server according to the record to complete the user's authentication server allocation and address recovery.

3.1.15 Volte function

3.1.15.1 Definition

▪ Connect the user terminal to the IMS network to provide voice and video services

▪ Voice over LTE (voice over LTE) is an LTE voice solution defined by 3GPP standard and based on IMS (IP multimedia subsystem) network.GW500 can provide voice call and video services to IMS network.

3.1.15.2 Dependency

UE	eNodeB	MME	S-GW	PDN-GW	PCRF	HSS
√	√	√	√	√	√	√

3.1.15.3 Principle description

The UE supports IMS services, the PCRF issues corresponding QoS policies, and the GW500 supports the creation of corresponding IMS signaling context or bearer to complete IMS business processes.

4 Operation and Maintenance

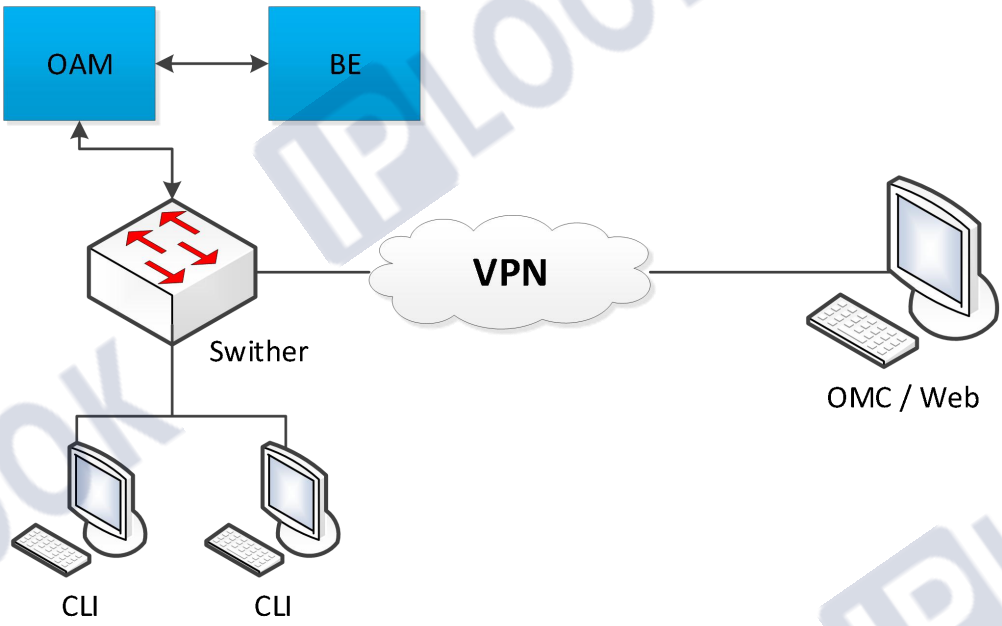
The IPLOOK provides a perfect operation and maintenance function and supports the unified EMS to implement daily maintenance and management.

Based on the Client/Server architecture, the operation and maintenance subsystem provides a GUI operation and maintenance subsystem and a Web UI performance measurement system to support customized human-machine interfaces.

The operation and maintenance subsystem supports three modes of operation:

- You can log in to the OAM server through a Web browser for management and operations
- Accessing to the OMC maintenance center for centralized management by the OMC.
- Remote operation and maintenance, accessing to the internal network through the dial-up server, and remote maintenance based on the Web.

Figure 3 shows the network architecture



5 Reliability design

5.1 Software Reliability

Most IPLOOK solutions or products are 100% software solution, they are cloud based NFV solution and infrastructure agnostic, so IPLOOK recommends our customer purchasing the hardware/servers themselves, and it is benefit to maintain those hardware/servers by a local service company. IPLOOK could provide the turnkey solution, hardware with pre-installed software that will be shipped from mainland China to the customer premise, and IPLOOK will provide a local hardware maintenance service with our partners.

IPLOOK software business model is SnS (Subscription and Support) model. SnS provides customers with the latest software patches, software versions (including new features), and basic software technical support services. Software patches, software versions (including new features), and basic software technical support services are packed and charged by year.

IPLOOK will provide first-year free of cost licenses for software maintenance including patches, new version upgrade etc.

5.1.2 Software License Design

Software features are included in different software packages to meet requirements of different sales scenarios. Software packages can be divided into a basic package and several value-added packages. Customers can purchase the **basic package** and **value-added packages** based on their network development.

The pricing and quotation are made for a software package instead of specific features in the package. The **basic package** is mandatory for each purchase.

6 Interfaces and Protocols

The related interfaces, protocols and functions of the IPLOOK xGW are listed in following table.

Interface	Description	Protocol
Interface	**Description**	**Protocol**
Gn/Gp	Transmitting signaling/data between SGSN/GGSN	GTP
Gx	Transfer of (QoS) policy and charging rules	Diameter

Interface	Description	Protocol
Gy	Online Charging	Diameter
Ga	Offline Charging	GTP’
Gi	Forwarding data to the external network	IP
Gi	Authentication, Authorization, and Accounting	Radius
S11	Transmitting GTP signaling	GTPv2
S1-U	Transmitting GTP data	GTP-U
S5/S8	Implementing mobility management and transmitting package between SGW and PGW.	GTPv2
SGi-PDN	Forwarding data to the external network	IP
SGi-AAA	Authentication, Authorization, and Accounting	Radius

7 Dimension

7.1 Dimension sheet

NE	128 200Mbps	1000 1Gbps	2000 5Gbps	5000 10Gbps	10000 20Gbps	20000 40Gbps
GGSN	2 cores 4G mem	4 cores 8G mem	8 cores 16G mem	16 cores 32G mem	32 cores 64G mem	48 cores 128G mem
SGW	2 cores 4G mem	4 cores 8G mem	8 cores 16G mem	16 cores 32G mem	32 cores 64G mem	48 cores 128G mem
PGW	2 cores 4G mem	4 cores 8G mem	8 cores 16G mem	16 cores 32G mem	32 cores 64G mem	48 cores 128G mem
PGW/GGSN	2 cores 4G mem	4 cores 8G mem	8 cores 16G mem	16 cores 32G mem	32 cores 64G mem	48 cores 128G mem
xGW	4 cores 4G mem	6 cores 8G mem	16 cores 32G mem	24 cores 64G mem	48 cores 128G mem	-
xGW/GGSN	2 cores 4G mem	6 cores 8G mem	16 cores 32G mem	24 cores 64G mem	48 cores 128G mem	-

8 Roadmap


V400P11R04B04C00S03
Evolution
Session management
APN Service
Secondary authentication
Ue address allocation
Qos
Charging(GTP/RADIUS/OCS)
Anti-Spoofing
Traffic Shaping
Content Based Billing
DiffServ Marking
NB-IOT
Gn/S1u/S5/S8/S11/SGI/Ga/Gx/Gy
O&M support
Reliability & Capacity
Private cloud adaption
Stateless framework
Session recovery
N-Active redundancy
10Gbps platform
~Q4 2021
V400P11R05B03C00S03
Evolution
Lawful interception
Reliability & Capacity
Health Check
40Gbps platform
Q2 2022
V400P11R05B08C00S04
Evolution
R16 Compliance
DPI enhance
Security
Firewall
DDOS attack protection
Reliability & Capacity
Private container adaption
Q4 2022
V400P11R06B09C00S05
Evolution
R17 compliance
GTP Router intergration
Security
VPN
NAT
Reliability & Capacity
100Gbps platform
2023
V400P11R08B09C00S07
Evolution
R18 compliance
2024~2025

9 Acronyms and Abbreviations

Table 6 Acronyms and Abbreviations

Name	Explanation
2G	Second Generation
3G	the third Generation mobile communications
3GPP	Third Generation Partnership Project
3GPP2	Third Generation Partnership Project 2
ATM	Asynchronous Transfer Mode
AUC	Authentication Center
AVP	Attribute Value Pair
BOSS	Business Operator and Supporting System
BSC	Base Station Controller
CAMEL	Customized Application for Mobile network Enhanced Logic
CAP	CAMEL Application Part
CAPEX	Capital Expenditure
CBC	Content Based Charging
CCG	Content based Charging Gateway
CG	Charge Gateway
CN	Core Network
COTS	Commercial Off The Shelf
CS	Circuit Service
CSCF	Call Session Control Function
EIR	Equipment Identity Register

EMS	Element Management System
EPS	Evolved Packet System
EUTRAN	Evolved Universal Terrestrial Radio Access Network
FCAPS	Fault, Configuration, Accounting , Performance, Security
FTP	File Transfer Protocol
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HLR	Home Location Register
HSS	Home Subscriber Server
IM-SSF	IMS – Service Switch Function
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IOT	Inter-Operation Test
ITU	International Telecom Union
LAI	Location Area Identity
MAP	Mobile Application Part
MME	Mobility Management Entity
MMS	Multimedia Message Services
MS	Mobile Station
MSC	Mobile Switching Center
MSISDN	MS ISDN
MTBF	Mean Time Between Failures

MTTR	Mean Time To Repair
NAT	Network Address Translation
NE	Network element
NFV	Network Function Virtualization
NM	Network Management
NRI	Network Resource Identifier
OMC	Operation and Maintenance Center
OCS	Online Charging System
OPEX	Operating Expense
PDP	Packet Data Protoco1
PLMN	Public Land Mobile Network
POS	Packet Over SONET/SDH
PS	Packet Service
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
RAN	Radio Access Network
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RRU	Remote Radio Unit
SCTP	Stream Control Transmission Protocol
SGW	Serving Gateway
SGSN	Serving GPRS Support Node

SIGTRAN	Signaling Transport
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transfer Protocol
SS7	Signaling System Number 7
TCP/IP	Transmission Control Protocol/Internet Protocol
TECS	Tulip Elastic Computing System
UMTS	Universal mobile telecommunication system