



IPLOOK EPC PRODUCT DESCRIPTION

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IPLOOK Technologies Co., Limited

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1 Introduction

With the development of network technology, smartphones, laptop computers have been widespread. Unlike traditional wired phones, mobile smartphones allow users to easily access the Internet, download or upload files, and use different applications. Long Term Evolution/Evolved Packet Core (LTE/EPC) is an innovation which depends on GSM/EDGE and UMTS/HSPA technologies, can increase the capacity and speed using a different radio interface together with core network improvements. LTE is a wireless technology for access network; EPC refers to a core network architecture that supports LTE access networks.

EPC Architecture

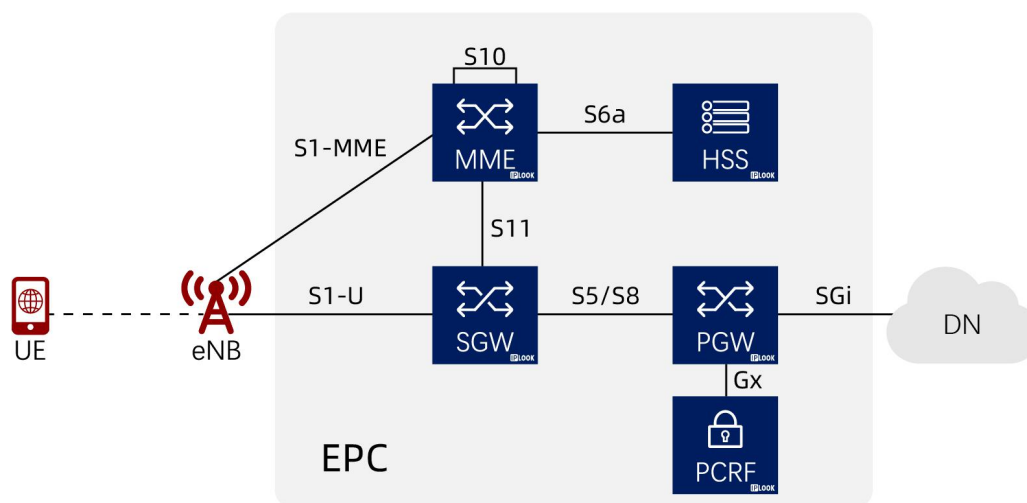


Figure 1: Schematic Diagram:

IPLOOK has developed a series of EPC product, which is designed in accordance with the specifications of telecom operators, using high-performance ATCA hardware architecture platform, COTS servers or private cloud; software using Linux and efficient and reliable middleware to provide the underlying software platform.

1.1 IPLOOK EPC Series Introduction

EPC network includes these entities: MME (Mobility Management Entity), S-GW (Serving Gateway), P-GW (Packet Data Network Gateway) and HSS (Home Subscriber Server).

- Follow 3GPP standards

The EPC products provided by IPLOOK follows the requirements of 3GPP protocol specifications, and each network element supports the main standard interfaces required by telecom operators. Currently supports R14 version.

MME, SGW, PGW, HSS have completed IOT interoperability tests with mainstream core network vendor. They have also undergone SPIRENT's landslide test and completed actual IOT tests with many mainstream eNodeB manufacturers at China or oversea countries.

- Support the needs of telecommunications and private network

IPLOOK has developed a series of EPC product, which is designed in accordance with the specifications of telecom operators, using COTS hardware platform, software using Linux and efficient and reliable middleware to provide the underlying software platform, using C/C++ language to realize the signaling and data processing of MME, SGW, PGW and HSS.

- High reliability design

EPC products have a very important position in the LTE network. At the beginning of the design, IPLOOK considered the high reliability of the system and the need for redundancy. The high reliability design of the system, including the high reliability of the hardware platform High reliability design of the designed software platform.

- Unified software platform

IPLOOK's EPC products using Linux operating system, apply mature software middleware, and are implemented by MME, SGW, PGW and HSS software. The underlying software platform is strictly separated from the high-level applications to maintain high stability and reliability of the system. It also provides the flexibility and convenience of the last application software.

The system uses a complete OAM module to support the management and configuration functions of platform software and application software. Provide users with a variety of management interfaces, including WEB/CLI/RESTful and other necessary network management interfaces and system exception debugging tools for telecom operators, various levels and levels of SYSLOG, and provide users with a full range of error and exception debugging.

EPC system products meet the user's requirements for high reliability and redundant backup. According to SAFRUM specifications, HA has been customized and developed to support the backup switching of the system's business units, so that the it can maintain the system when the hardware unit and software unit fail and the services could be stable.

- High-speed data forwarding processing

The user data processing of the EPC system is handled by SGW and PGW, the coding and decoding of the specific GTP-U data plane, as well as the identification of data packets, the implementation of related QoS strategies, and the extremely high processing speed of the data plane. SGW and PGW GTP data messages are realized by the well-known *cavium* multi-core network processing and Intel's DPDK.

1.2 The applications of EPC

Designed for the evolution from 3G to 4G, the IPLOOK EPC platform is the benchmark for today's and tomorrow's multimedia-enabled core network. The platform uses a simple, flexible distributed architecture that supports multiple access technologies, subscriber mobility management, and call-control capabilities, as well as inline services (Figure 2). With its leading-edge throughput, signaling, and capacity, the IPLOOK EPC can readily support all EPC network functions.

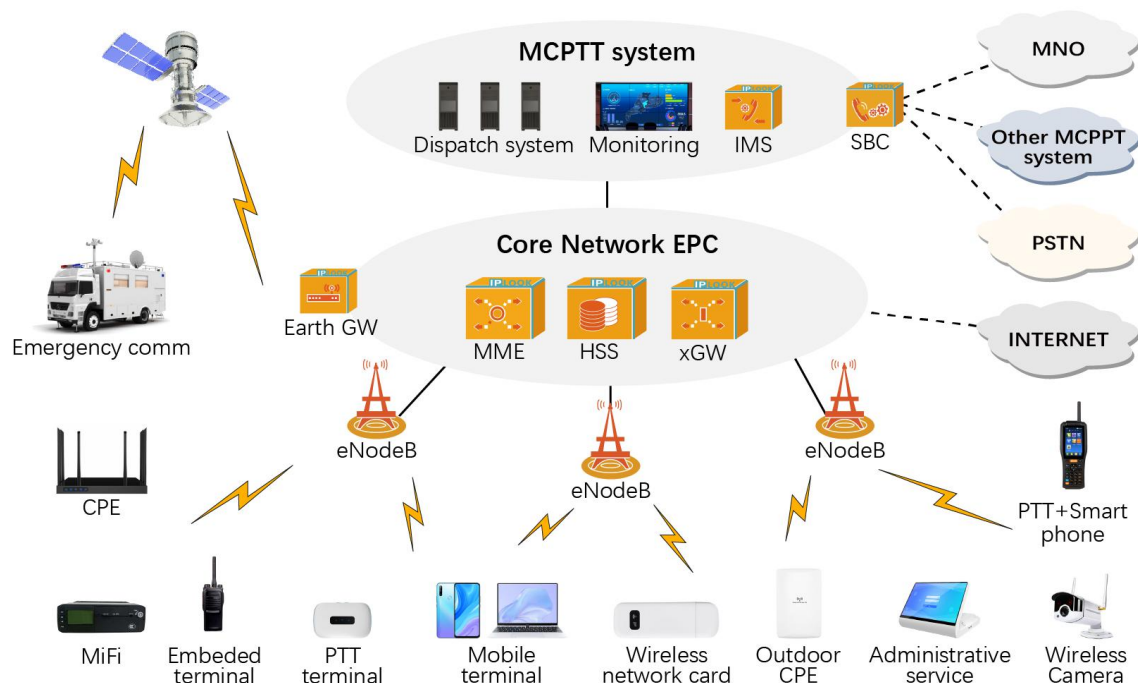


Figure2 Applications of EPC

2 Feature List

2.1 MME

Feature	Type	Details
Access Control	Security	<ul style="list-style-type: none"> • Authentication • GUTI allocation function • User equipment identification function • AS security context distributed function • Confidentiality and integrity protection of the NAS signaling • 3G security parameters and EPC security context mapping function
	Admission Control	<ul style="list-style-type: none"> • on the capacity of system • on the CPU and Memory resource consumption • overload control
Mobility Management Functions	State Model	
	Attach	
	Detach	
	TAU	
	Tracking Area Management	
	Tracking Area Update	
	Paging and Service Request	
	Purge UE	
	Access Restriction Function	
	Multi-PDN Connection	
	ODB Function	
Session Management	EPS Bearer Activation	
	EPS Bearer Modification	
	EPS Bearer Deactivation	
	UE AMBR Management	
Selection function	PDN GW Selection	
	Serving GW Selection	
	MME Selection Function	
	SGSN Selection Function	

Network Management Function	MME Pool Function with Load Balancing Between MMEs	
	Overload Control	
CS Fallback Function		
Standard NB-IoT Function		
APN Correction Function		
Interface Conform to 3GPP standard, Conform to 3GPP R13 Release	S1-MME	
	S6a	
	S11	
	S3/Gn	
	SGs	
	S10	
	N26	

Table 3: MME features

2.2 Serving Gateway

Feature	Details
Session Management	
Mobility Management	
Data Forward and Rout Path Selection	
QoS Control	
Charging Function	
Overload Control	
S-GW Pool Function	
Interface Conform to 3GPP Standard, Conform to 3GPP R13 Release	S1-U
	S11
	S5/S8
	S4/Gn
	Ga

Table 4: SGW features

2.3 PDN Gateway

Feature	Details
Session Management	
Mobility Management	
Data Forward and Route Path Selection	
QoS Control	
Charging Function	
IP address Allocation	
PCEF Function	
Overload Control	
PCRF Function Integrated with PGW	
Interface Conform to 3GPP Standard, Conform to 3GPP R13 Release	S5/8
	S11
	Gx
	Gy
	Ga
	Gn
	SGi
	Rx

Table 5: PGW features

2.4 HSS

Feature	Details
EPS Subscriber Data Management	Create a Subscriber
	Delete a Subscriber
	Define and Manage a subscriber Template
	Modify a Subscriber
Authentication Center	EPS-AKA Function
	KI/OP/OPC Management
Mobility Management	LTE Subscriber Mobility Management
	UE Reachable Management
	Subscriber Area Roaming Restriction
	Local Breakout for Roaming
Admission Control with Access Type	

IMS HSS Subscriber Data Management	
Interface Conform to 3GPP Standard, Conform to 3GPP R13 Release	S6a
	Cx
	Sh
	Zh
	HSS-BOSS(RESTful)

Table 6: HSS features

2.5 NSA feature

Support option 3/3a/3x:

- Option-3 — Traffic is split between 4G and 5G at eNodeB.
- Option-3a — Traffic is split between 4G and 5G at EPC (S-GW).
- Option-3x — Traffic is split between 4G and 5G at 5G cell.

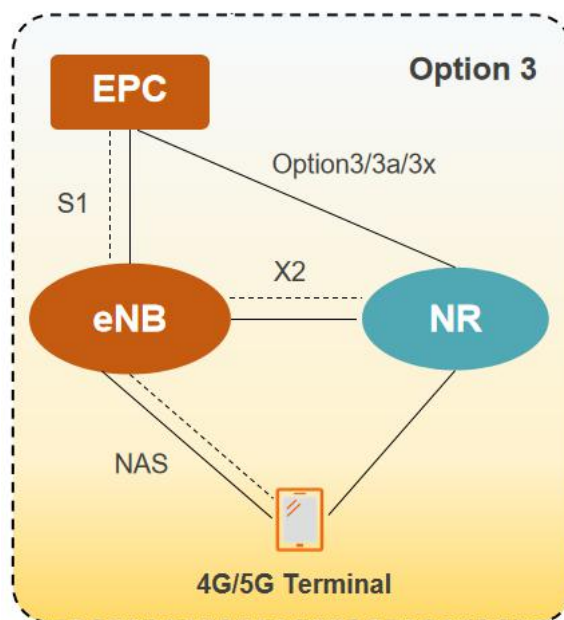


Figure 7 NSA architecture

3 Recommended deployment platform

3.1 Single server

Index	Specification
Product Model	IKEPC100
Description	Compact EPC products, including MME, SGW, PGW, built-in HSS
Hardware type	Dedicated Hardware, or equivalent configuration's Virtual Machine
Hardware parameters	Intel i5 4 cores, 3.0GHz; 8GB RAM; 64GB SSD; 6 x 1GbE NIC
Virtual platform	VMware, KVM or OpenStack
Maximum base station number	20
Maximum UE Number	1000
Maximum Data throughput	640Mbps

Table 8: IKEPC100

3.2 Dual server

Index	Specification	
Product Model	IKEPC150-MME/IKEPC150-HSS	IKEPC150-xGW
Description	Standard MME	Combine GW, Including SGW, PGW
Hardware type	Universal Server, or equivalent configuration's Virtual Machine	Universal Server, or equivalent configuration's Virtual Machine
Hardware parameters	2 x Intel Silver 4114 10 cores, 2.3GHz; 32GB RAM; 2x500GB HDD Raid 1; 4 x 1GbE NIC;	2 x Intel Silver 4114 10 cores, 2.3GHz; 32G RAM; 2x500GB HDD Raid 1; 6 x 1 GbE NIC; 1 x 10GbE NIC(Intel 82599 serials)
Virtual platform	VMware, KVM or OpenStack	
Maximum base station number	250	NA
Maximum UE Number	50,000	50,000
Maximum Data Throughput	NA	8Gbps

Table 9: IKEPC150

Note: an additional server is needed if the backup is needed.

3.3 Triple Server

Index	Specification		
Product Model	IKEPC200-MME	COMPACTHSS100C	IKEPC150-xGW
Hardware type	Universal Server, single server or equivalent configuration's Virtual Machine	Universal Server, single server or equivalent configuration's Virtual Machine	Universal Server, single server or equivalent configuration's Virtual Machine
Hardware parameters	2 x Intel Xeon Silver 4110, 8 cores, 2.1GHz;32GB RAM; 2x500GB HDD Raid 1; 4 x 1GbE NIC;	Intel Xeon Silver 4110 , 8 cores, 2.1GHz;32GB RAM; 2x500G B HDD Raid 1; 4 x 1GbE NIC;	2 x Intel Silver 4114 10 cores, 2.3GHz;32GB RAM; 2x500GB HDD Raid 1; 4 x 1GbE NIC;
Virtual platform	VMware, KVM or OpenStack		
Maximum base station number	500	NA	NA
Maximum UE Number	100,000	100,000	100,000
Maximum Data Throughput			8Gbps

Table 10: IKEPC200

Note: three additional servers are needed if the backup is needed.

3.4 Customized Solution

The IPLOOK EPC solution provides a customizable deployment supporting up to 10 Million subscribers:

- MME Pool

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- S-GW/P-GW Pool
- HSS frontend-backend distributed deployment

4 Redundancy

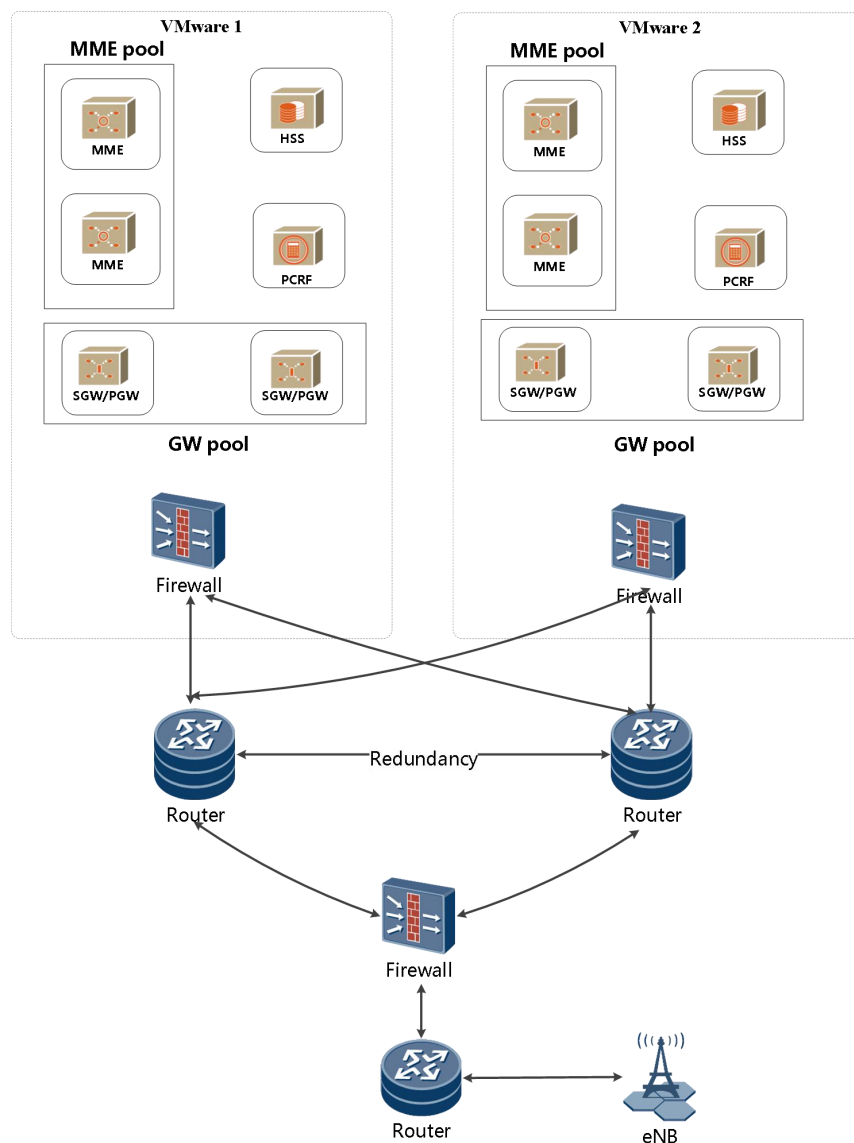


Figure 11: Redundancy

The redundancy of whole system could be deployed in disaster-tolerant way in two DC. The NEs could be 1+1 or N+1 deployed

- MME Pool
- SGW/PGW Pool

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- HSS: One active server and one standby server

5 Roadmap

IPLOOK EPC Roadmap is shown as below:

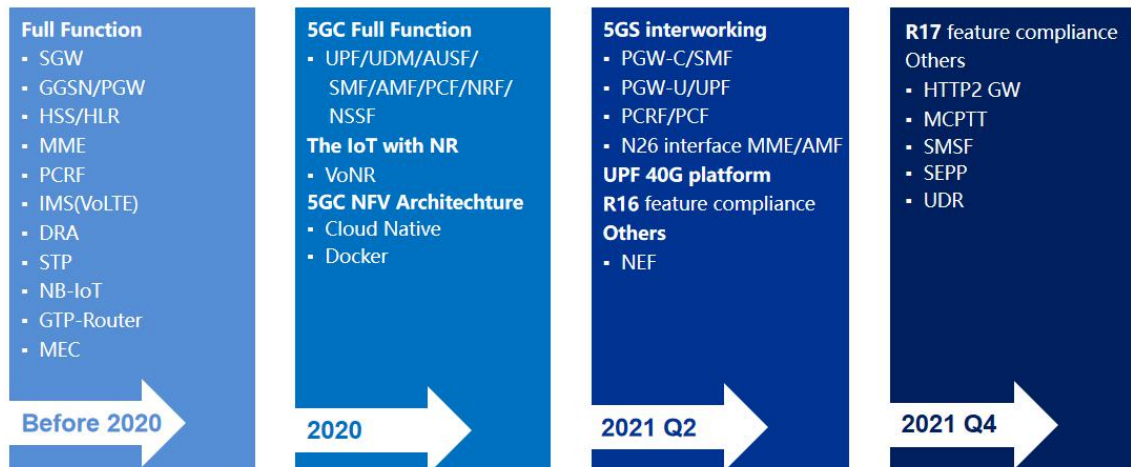


Figure 12: Roadmap

6 Application Scenario

6.1 MVNO

IPLOOK enables MVNOs to become **light MVNO**(with HSS/HLR,BOSS), **full MVNO**(with more like, STP, DRA, GTP- Router, PGW/GGSN, PCRF, SMSC/USSD) and **MOCN operator**(with more like MME, SGW, SGSN, MSC, GMSC) .

- **Application scenario:** International roaming for tourists & M2M
- **Advantages:**
 - Field-proven proposal for MVNO
 - Lower CAPEX & OPEX

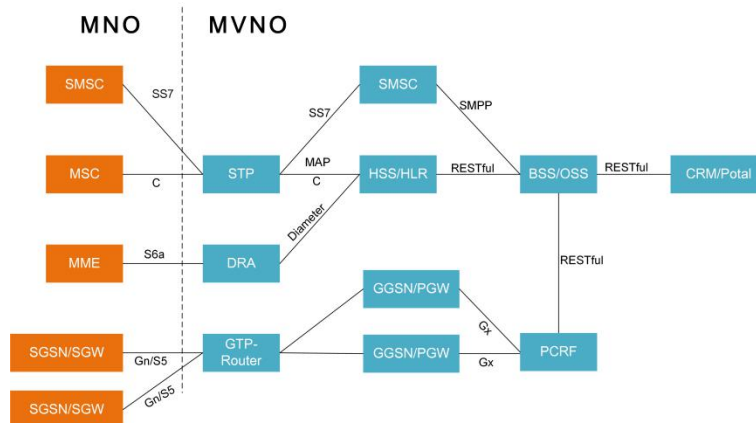


Figure 13: MVNO Solution

6.2 MNO

Solution for MNO:

- Replace existing 2G&3G sites by 4G sites.
- Upgrade the traditional 2G&3G core network to NFV core network.
- Upgrade the OSS/BSS to new system with OCS.
- The new core network is 5G ready platform. It would be upgrade to support 5G NR smoothly.

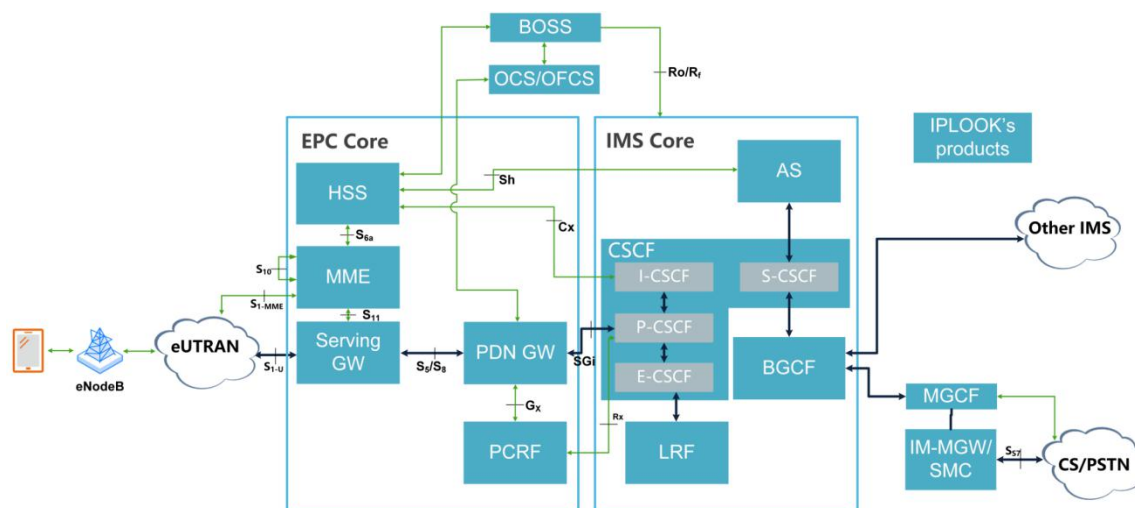


Figure 14: MNO Solution

6.3 WISP

Fixed wireless access over LTE for data service instead of FTTX, LAN or ADSL.

- Application scenario: Remote country; Home internet services.

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- Advantages:
 - Multi-vendor's eNodeBs supported
 - Multi charging mode: RADIUS, OCS, CG

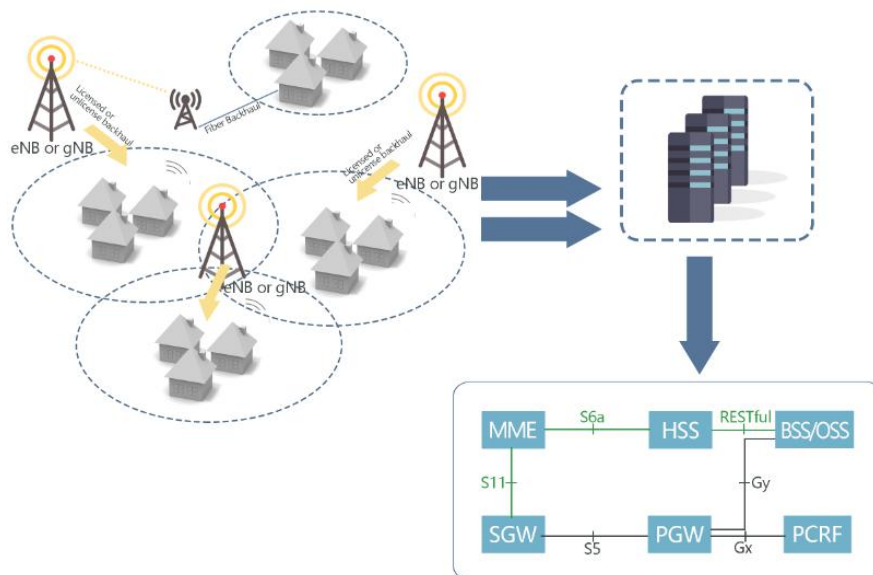


Figure 15: WISP Solution

6.4 Private Network

- **Application scenario:** Private network for mines communication, police communication, power grid etc.
- **Services:** Data, VoLTE, VoNR, MCPTT, SMS
- **Advantages:**
 - Rich industrial network experiences
 - Better customization capability

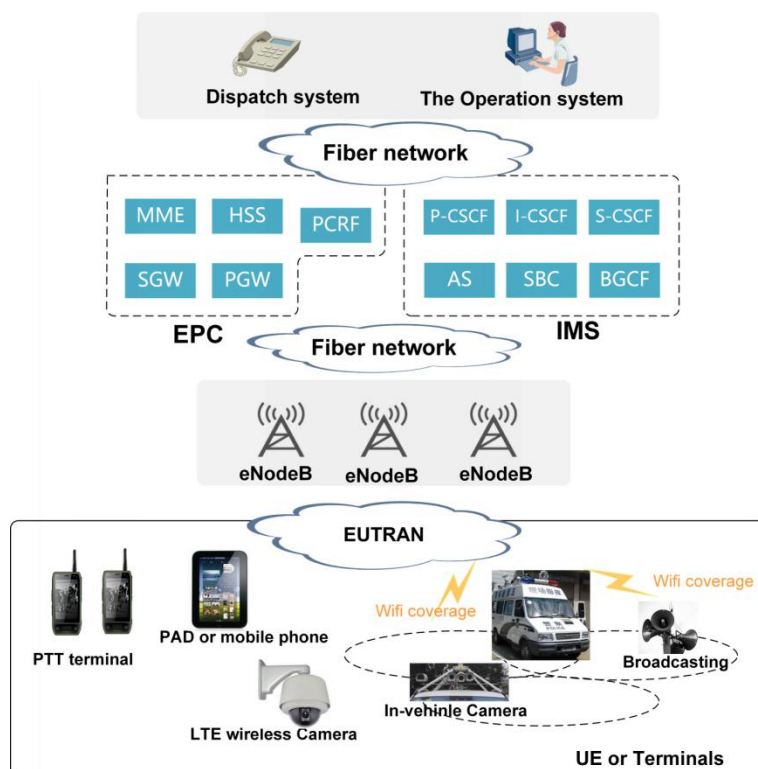


Figure 16: Private Network Solution

7 Technical Support

IPLOOK Product Support Services offers CT foundation service that perform continuous and reliable maintenance services based on the Service Level Agreements (SLAs) you choose.

IPLOOK CT Foundation Service provide flexible service offering portfolio, which include **Onsite service** to help you maintain a more efficient and stable network environment and improve network productivity, and the **Basic Service** is provided as collaborative solution for your maintenance team or certified IPLOOK partners, to support them maintain a more efficient and stable network environment and improve network productivity.

The Following table shows IPLOOK CT Foundation service coverage:

Service offerings	IPLOOK CT Foundation Service			
	Basic Service		Onsite Service	
	9x5xNBD	24x7x4	9x5xNBD	24x7x4
Technical Support Center (TSC) support (E-mail & Hotline)	24x7	24x7	24x7	24x7
Onsite Support	/	/	9x5xNBD	24x7x4 Hour - Arrive
Software Support	YES	YES	YES	YES

Figure 17: SLA

Notes:

1. The SLA in this document is for reference only. Service contents and response time may vary by country. For detailed information, please contact an IPLOOK authorized partner or your local IPLOOK sales and service representative.
2. Service delivery is based on commercially reasonable efforts. IPLOOK will select a proper service mode based on the actual situation and the committed SLA to resolve your problems in a timely and effective manner.
3. 24x7x4: Priority 1 calls, four-hour response available 24x7; Priority 2 Next Day, Priority 3 calls, Next Business Day.
4. The service start date and end date should be specified in the respective Purchase Order or contract between you and IPLOOK. If no service start date is listed on the PO/contract, it is defined as below:
 - 1) For a new service order sold together with IPLOOK product, the service starts on the 90th day after the product shipment date from IPLOOK;
 - 2) For a renewal service order, the service start date is the day after the end date of warranty or the previous Service.