IPLOOK 5GC PRODUCT INFORMATION

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IPLOOK 5GC Product Information

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1 Normative Reference

The terms of the following documents become partial by reference to this section. All subsequent amendments (excluding corrigendum) or revisions to any referenced document dated shall not apply to this section, however, Parties that have reached an agreement under this section are encouraged to explore the availability of the latest version of these documents. The latest version of any undated reference file applies to this section.

Number	Standard Number	Standard Name	Publishing Institution
1	TS23.003	Numbering, addressing and identification v15.4.0	3GPP
2	TS23.401	General Packet Radio Service(GPRS)enhancements for Evolved UniversalTerrestrial Radio Access Network(E-UTRAN)access	3GPP
3	TS 23.501	System Architecture for the 5G System	3GPP
4	TS 24.501	NAS Protocol for 5G-System v15.0.0	3GPP
5	TS 23.502	Procedures for the 5G System	3GPP
6	TS 23.503	Policy and Charging Control Framework fo r the 5G System	3GPP
7	TS 25.104	Base Station(BS)radio transmission and reception(FDD)	3GPP
8	TS 29.244	Interface between the Control Plane and t he User Plane Nodes;Stage 3	3GPP

9	TS 29.281	General Packet Radio System (GPRS) Tunneling Protocol User Plane (GTPv1-U) v15.3.0	3GPP
10	TS 29.502	Session Management Services v15.0.0	3GPP
11	TS 29.518	Access and Mobility Management Services v15.0.0	3GPP
12	TS 36.420	Evolved Universal Terrestrial Radio Access Network(E-UTRAN);X2 generalaspects and principles	3GPP
13	TS 36.421	Evolved Universal Terrestrial Radio Access Network(E-UTRAN);X2 layer	3GPP
14	TS 36.422	Evolved Universal Terrestrial Radio Access Network(E-UTRAN):X2 signaling transport	3GPP
15	TS 36.423	Evolved Universal Terrestrial Radio Access Network(E-UTRAN):X2application protocol(X2AP)	3GPP
16	TS 38.201	NR;Physical layer;General description	3GPP
17	TS 38.300	NR and NG-RAN Overall Description:Stage 2	3GPP
18	TS 38.304	NR;User Equipment(UE)procedures in idle mode	3GPP
19	TS 38.211	NR;Physical channels and modulation	3GPP

20	TS 38.322	NR:Radio Link Control(RLC)protocol specification	3GPP
21	TS 38.331	NR;Radio Resource Control(RRC);Protocol specification	3GPP
22	TS 38.410	NG-RAN;NG general aspects and principles	3GPP
23	TS 38.412	NG-RAN; NG signalling transport v15.0.0	3GPP
24	TS 38.413	NG-RAN;NG Application Protocol(NGAP)	3GPP
25	TS 38.415	PDU Session User Plane protocol v15.0.0	3GPP
26	TS 38.422	NG-RAN:NG data transport NG-RAN;Xn signalling transport	3GPP
27	TS 38.423	NG-RAN:Xn Application Protocol (XnAP)	3GPP
28	TS 38.424	NG-RAN:Xn data transpdrt	3GPP
29	TS 38.425	NG-RAN;NR user plane protocol	3GPP

Figure 1-1

2 IPLOOK 5GC Roadmap

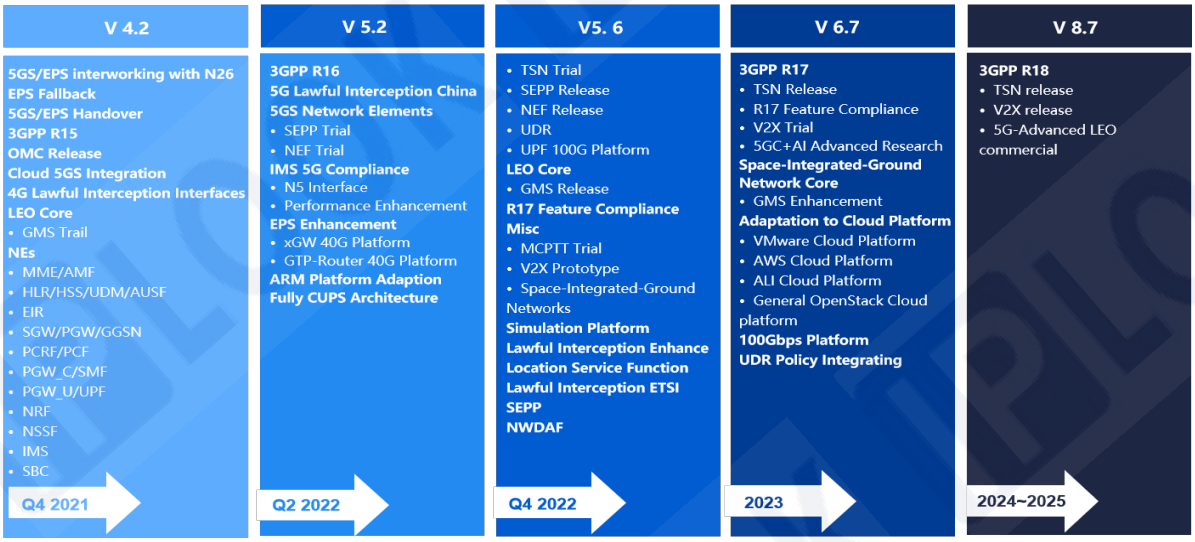

Figure 2-1

Release of implementation：

- **P1:** To achieve UPF, UDM, AUSF, SMF, AMF **Basic Function**
- **P2:** To achieve UPF, UDM, AUSF, SMF, AMF **Full Function**, and PCF, UDR, The IoT with NR, NRF, NEF, NSSF **Basic Function**
- **P3:** To achieve PCF, UDR, NRF, NEF, NSSF **Full Function**, and SMSF, SEPP, MANO **Basic Function**
- **P4:** To achieve:

  (1) SMSF, SEPP **Full Function**

  (2) 3G/4G/5G core network convergence:

  HLR + HSS + UDM

  GGSN + PGW + UPF

  GGSN + PGW + SMF

PCRF + PCF

MME + AMF

STP/DRA + HTTP 2 Gateway

3 5GC Network Architecture

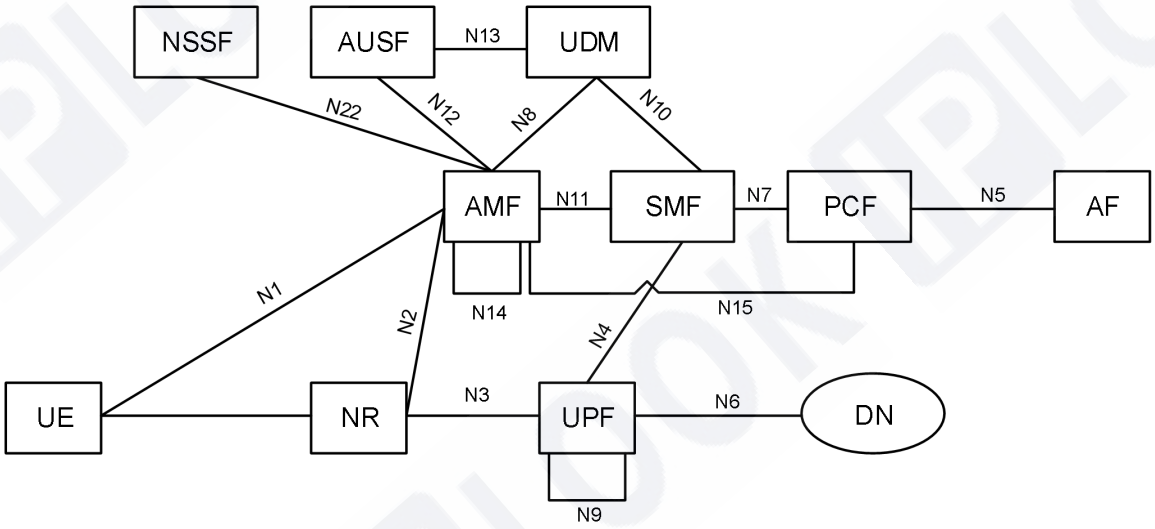

Figure 3-1

IPLOOK 5GC Network includes the elements as shown figure above NSSF, AUSF, UDM, AMF, SMF, UPF, PCF.

4 5GC Network elements Function

4.1 AMF

4.1.1 Basic Function

(1) Access Control

Number	Description	Phase
1	Authentication function	P2

Number	Description	Phase
2	User equipment identification function	P2
3	5G-GUTI Allocation function	P2
4	NAS（N1 Interface）Signal and Security	P2
5	AS Security Context Download Function	P2

Figure 4.1-1

(2) Mobility management

Number	Description	Phase
1	Registration area management	P2
2	Connection management function	P2
3	Registration and cancellation	P2
4	Switching within 5G system	P3
5	Cross-system mobility	P3
6	Business request	P2

Figure 4.1-2

(3) User context information management

Number	Description	Phase
1	Store, modify, delete user mobility context and bearer context information	P2

Figure 4.1-3

(4) Networking Function

Number	Description	Phase
1	Support for AMF Pool	P4
2	Support for building pool, UE remains unchanged while moving in the tracking area of the AMF Pool service	P4

3	Support Served GUAMI and the allocation of weights	P4
4	Support the delivery of Served GUAMI and weight information to RAN in the NG setup process	P4
5	Support IPv4, IPv6 and IPv4/IPv6 dual stack networking	P4

Figure 4.1-4

4.1.2 Interface and Protocol

The interfaces supported by AMF are shown in the figure：

Number	Name	NE	Protocol	Phase
1	N1	UE	NAS	P2
2	N2	AN	NGAP	P2
3	NB	UDM	/	P2
4	N12	AUSF	/	P2
5	N14	AMF	/	P4
6	N11	SMF	/	P2
7	N15	PCF	/	P2
8	N20	SMSF	/	P4
9	N26	MME	GTPv2	P3

Figure 4.1-5

The control plane protocol stack between the AMF and the UE, 5G-AN, and the interface protocol stacks of N1, N2, and N26 are as shown in the figure:

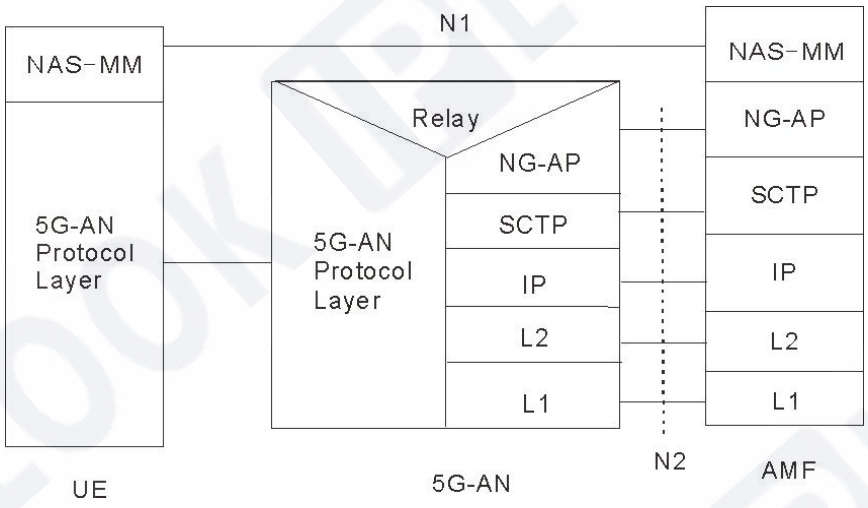

Figure 4.1-6

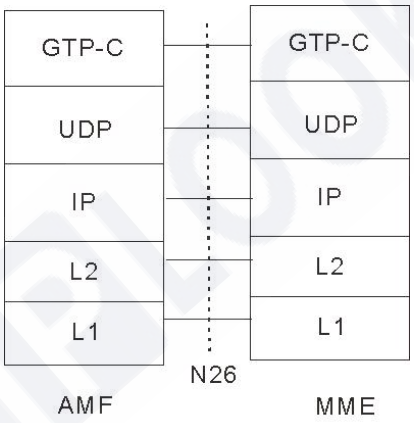

Figure 4.1-7

Among them, the definition of the service interfaces are as follows:

Number	Services	Description
1	Namf_Communication	Enable NF consumers to communicate with UE/AN via AMF； Enable SMF to request EBI allocation to support interworking with EPS

2	Namf_EventExposure	Allow other NF consumer users to get notifications of mobile-related events and statistics
3	Namf_MT	Enable NF consumers to ensure that the UE can access
4	Namf_Location	Enable NF consumers to request location information of the target UE

Figure 4.1-8

4.1.3 Performance

Hardware / platform resources:

2 x 10 cores, 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G NIC

Number	Performance index	Numerical value
1	Maximum number of gNodeBs connections	500 sets
2	Maximum number of accounts opening	400,000 pieces

Figure 4.1-9

4.2 AUSF

4.2.1 Basic Function

(1) Authentication

Number	Description	Phase
1	Support NF service authentication	P1
2	Support 5G AKA authentication mechanism	P1
3	Support EAP-AKA' authentication mechanism	P1

Figure 4.2-1

(2) NF registration and discovery

Number	Description	Phase
1	Support for configuring and storing NRF information, interact with the standby NRF when the active NRF fails or the connection is abnormal	P4
2	Support for AUSF service registration, update and de-registration, status subscription to NRF	P4
3	Support for status subscription to other NF via NRF	P4

Figure 4.2-2

(3) Support IPv6

Number	Description	Phase
1	Support for IPv4/IPv6 dual stack	P4

Figure 4.2-3

4.2.2 Interface and Protocol

The interfaces supported by AUSF are as follows:

Number	Name	NE	Protocol	Phase
1	N12	AMF	Nausf	P2
2	N13	UDM	Nudm	P1

Figure 4.2-4

Among them, the definition of the service interfaces are as follows:

Number	Services	Description	TS 23.502
1	Nausf UEauthentication	UE authentication service	5.2.10.2

Figure 4.2-5

4.2.3 Performance

Hardware / platform resources:

2 x 10 cores, 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G NIC

Number	Performance index	Numerical value
1	Maximum number of accounts opening	1000,000 pieces

Figure 4.2-6

4.3 UDM

4.3.1 Basic Function

Number	Description	Phase
1	Generate 3GPP AKA authentication certificate	P1
2	User ID processing, such as storage and management of user SUPI	P1
3	Privacy protection logo (SUCI) to hide	P1
4	Access rights based on contracted data, such as roaming restrictions	P1
5	Management of UE service NF, such as storage of SMF information corresponding to user service AMF and PDN session	P1

6	Support business/session continuity, such as SMF/DNN relationships corresponding to sessions	P1
7	Legal Monitoring Function	P2
8	User Contract Management	P2
9	Short Message SMS Management	P2
10	Inheritance of all functions of 4G HSS and 3G HLR (HSS/HLR functions can be referred to IPLOOK 3G/4G technical specifications)	P2

Figure 4.3-1

4.3.2 Interface and Protocol

The interfaces supported by UDM are as follows.

Number	Name	NE	Protocol	Phase
1	N8	AMF	Nudm	P2
2	N10	SMF	Nudm	P2
3	N21	SMSF	Nudm	P2
4	N13	AUSF	Nudm	P1
5	NLh	GMLC	Nudm	To be determined
6	N36	UDR	Nudr	P1

Figure 4.3-2

Among them, the definition of the service interfaces are as follows:

Number	Services	Description	TS 23.502
1	Nudm_UECM	1. Provide consumers of NF services with information about UE process, such as the user's service NF identity, UE status, etc. 2. Allow consumers of NF services to register and unregister. 3. Allow consumers of NF services to update UE context information	5.2.3.2
2	Nudm_SDM	1. Allow consumers of NF services to recover user signature data when necessary 2. Provide users with updated subscription data for registered consumers of NF services	5.2.3.3
3	Nudm_UEAuthentication	Provide users with updated user authentication data for	5.2.3.4

		registered consumers of NF services	
4	Nudm_EventExposure	1. Allow consumers of NF services to subscribe to event notifications 2. Provide event monitoring instructions to consumers of NF services registered with users	5.2.3.5
5	Nudm_ParameterProvision	Provide information used in 5GS	5.2.3.6

Figure 4.3-3

4.3.3 Performance

Hardware / platform resources:

2 x 10 cores , 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G NIC

Number	Performance index	Numerical value
1	Maximum number of accounts opening	1000,000 pieces

Figure 4.3-4

4.4 PCF

4.4.1 Basic Function

(1) User subscription data management function

Number	Description	Phase
1	Access user information related to policy	P2

	decisions in database storage (UDR)	

Figure 4.4-1

(2) Session Management

Number	Description	Phase
1	Binding mechanism	P2
2	Traffic monitoring and reporting mechanism	P2
3	QoS control	P2
4	Gate control function	P2
5	Business monitoring and control function	P2
6	Flow oriented control function	P2

Figure 4.4-2

(3) Policy and Charging Function

Number	Description	Phase
1	Specify the charging rule based on the service data flow, and provide it to SMF along with the policy control information, SMF performs charging with UPF according to charging rules	P3

Figure 4.4-3

(4) PCF Discovery and Selection

Number	Description	Phase
1	Initiates registration with BSF and register its binding information, after establishing PDU session and binding PCF	P4
2	AMF and SMF discover the list of available PCFs through NRF and select PCF	P4
3	AF and NEF select the binding PCF according to the UEIP address via BSF	P4

Figure 4.4-4

(5) Requirements for capacity opening and MEC support

Number	Description	Phase
1	Support for creating, updating, deleting, and service subscriptions, notifications to support capacity opening and MEC	P4
2	1. Support creation, modification, and deletion of policies based on service information provided by authorized NF service users 2. Allows NF service users to subscribe to events 3. Allows NF service users to unsubscribe	P4

Figure 4.4-5

4.4.2 Interface and Protocol

The interfaces supported by PCF are as follows.

Number	Name	NE	Phase
1	Rx	VoLTE SBC/P-CSCF	P2
2	N7	SMF	P2
3	N28	CHF	To be determined
4	N15	AMF	P2
5	Boss	PCF/PCRF	P4

Figure 4.4-6

Among them, the definition of the service interfaces are as follows:

Number	Services	Description
1	Npcf_AMPolicyControl	Provide access control, network selection, and mobility management policies to NF consumers; E routing policy
2	Npcf_SMPolicyControl	Provide NF consumers with session-related policies
3	Npcf_Policy Authorization	Authorize AF requests and create policies based on the PDU session to which the AF session is bound; Allow NF consumer users / cancel notifications for user access types and RAT types, PLMN identifiers, access network information, usage reports, etc.
4	Npcf_ BDTPolicy Control	Provide background data transfer policies to NF consumers

Figure 4.4-7

4.4.3 Performance

Hardware / platform resources:

2 x 10 cores, 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G NIC

Number	Performance index	Numerical value
1	IP-CAN	500,000 pieces

Figure 4.4-8

4.5 SMF

4.5.1 Basic Function

(1) Service Management between SMF and NRF

Number	Description	Phase
1	Including service registration, service updates and deregistration	P3

Figure 4.5-1

(2) Slice Function

Number	Description	Phase
1	Support for slice related functions	P3

Figure 4.5-2

(3) Session management process

Number	Description	Phase
1	Establish PDU Session	P2
2	Modify PDU Session	P2
3	Release PDU Session	P2
4	Activate or deactivate the UP connection	P2
5	Business continuity （SSC）	P2

Figure 4.5-3

(4) Routing Selection and Data Forwarding

Number	Description	Phase
1	Network element selection：UPF selection；PCF selection；UDM selection	P2
2	Business diversion：UL CL; Multi-homing；LADN	P2

Figure 4.5-4

(5) Interaction between SMF and UPF

Number	Description	Phase
1	N4 Session management	P3
2	N4 Session report	P3
3	N4 Node management	P3

Figure 4.5-5

(6) Interaction between SMF and AMF

Number	Description	Phase
1	N1 interface interaction	P3
2	N11 interface interaction	P3
3	N2 interface interaction	P3
4	N3 interface interaction	P3
5	N4 interface interaction	P3

Figure 4.5-6

(7) Contract data management

Number	Description	Phase
1	Basic Function	P2

Figure 4.5-7

(8) User surface security

Number	Description	Phase
1	Basic Function	P2

Figure 4.5-8

(9) Switch function

Number	Description	Phase
1	Switching based on Xn Interface	P2
2	Switching based on N2 Interface	P2

Figure 4.5-9

(10) User surface management

Number	Description	Phase
1	UE IP address management	P2
2	CN tunnel management	P2
3	Flow detection	P2
4	User-side forwarding control	P2
5	UP Path management	P2
6	Package cache management	P2

Figure 4.5-10

(11) Policy and charging function

Number	Description	Phase
1	Policy and charging control function	P2
2	Associated flow Strategy for PDU session	P2
3	Trigger policy control request	P2
4	Blind QoS Flow	P2
5	Escalate Policy Control request event function	P2
6	5GS and EPC policy integration control function	P2
7	Reflex QoS function	P2

Figure 4.5-11

(12) Converged billing function

Number	Description	Phase
1	5G convergence billing basic function	P2
2	Collection of billing information	P2
3	Report of billing information	P2
4	PCC rules and billing	P2

Figure 4.5-12

(13) P-CSCF discovery

Number	Description	Phase
1	SMF/SAE GW-C converged network elements support P-CSCF discovery of PCO/ePCO mode; and support the configuration of different P-CSCF (VoLTE SBC) address lists, each of which includes multiple different priorities. According to the requests of different UE, different P-CSCF address lists are dynamically	P4

	selected according to the configured weights, and the weight ratio can be configured.	

Figure 4.5-13

(14) Location management

Number	Description	Phase
1	Basic function	P2

Figure 4.5-14

(15) Support IPv6

Number	Description	Phase
1	Support for IPv4/IPv6 dual stack	P4

Figure 4.5-15

4.5.2 Interface and Protocol

The interfaces supported by UDM are as follows.

Number	Name	NE	Protocol	Phase
1	N1	SMF	NAS	P2
2	N2	AMF	/	P2
3	N4	UPF	PFCP/GTP-U	P2

4	N7	PCF	/	P2
5	N10	UDM	Nudm	P2
6	N40	CHF	/	To be determined

Figure 4.5-16

Among them, the definition of the service interfaces are as follows:

Number	Services	Description
1	Nsmf_PDUSession	Manage PDU sessions and use policies and charging rules received from PCF, which allows the consumer to process PDU sessions
2	Nsmf_EventExposure	Expose events occurring on the PDU session to the consumers of NF

Figure 4.5-17

The control plane protocol stack between SMF and UE is as follows.

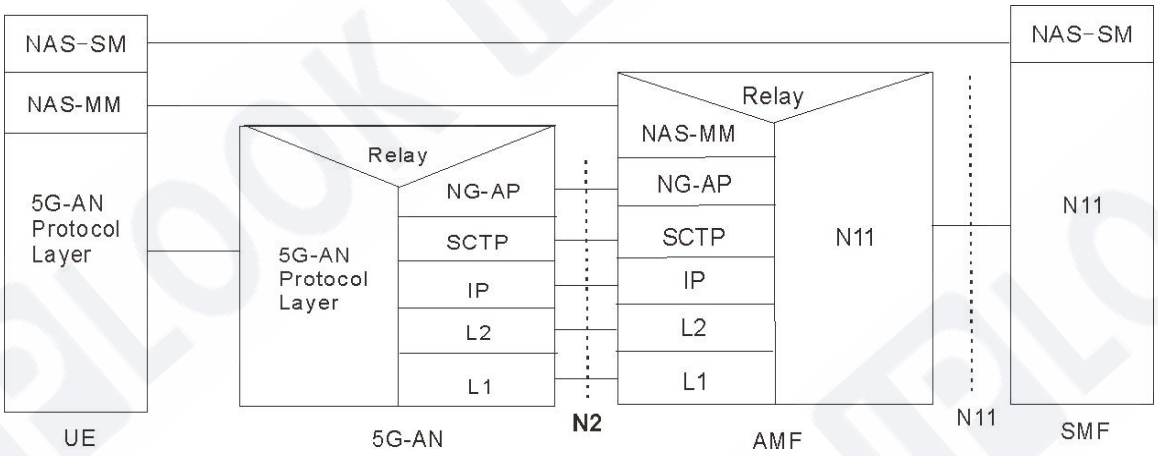

Figure 4.5-18

SMF's service-oriented interface protocol stack, N4 interface control surface and user surface protocol stack are shown as follows:

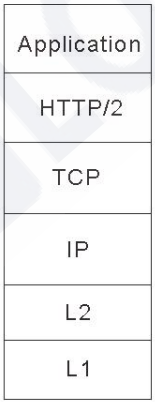

Figure 4.5-19

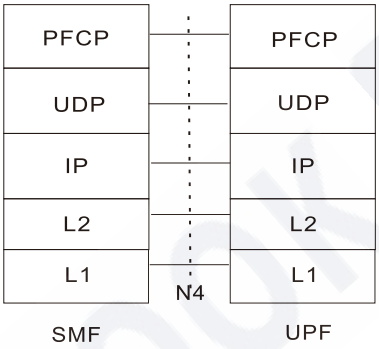

Figure 4.5-20

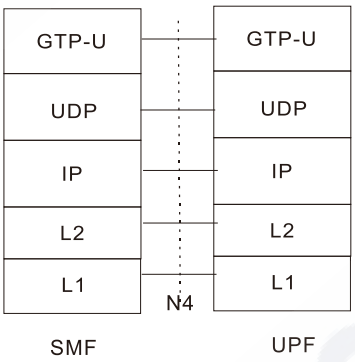

Figure 4.5-21

4.5.3 Performance

Hardware / platform resources:

2 x 10 cores, 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G NIC

Number	Performance index	Numerical value
1	Number of session controls	500,000 pieces

Figure 4.5-22

4.6 UPF

4.6.1 Basic Function

(1) Basic Function

Number	Description	Phase
1	Support PDU Session Management Function	P1
2	Manage PDU session information	P1
3	Support multi-SMF control UPF	P1

Figure 4.6-1

(2) Mobility management

Number	Description	Phase
1	Switching based on Xn Interface	P2
2	Switching based on N2 Interface	P2

Figure 4.6-2

(3) QoS control

Number	Description	Phase
1	Session level (APN-AMBR, TDF session UL and DL bit rates, or PDN connection UL and DL rates);	P2
2	Bearing stage (GBR, MBR of GBR)	P2
3	QoS Flow（for 5GC）	P2
4	Service Data Flow（SDF）or application	P2

Figure 4.6-3

(4) Support ULCL

Number	Description	Phase
1	Support upstream and downstream traffic classifier and merge functions	P2

Figure 4.6-4

4.6.2 Interface and Protocol

The interfaces supported by UDM are as follows.

Number	Name	NEs	Protocol	Phase
1	N3	5G-AN	GTP-U	P1
2	N4	SMF	PFCP	P1
3	N9	UPF	GTP-U	P1
4	N6	/	/	P1
5	Nnrf	NRF	Nudm	P4

Figure 4.6-5

Among them, N3/N9, N4 Interface protocol stack are as follows.

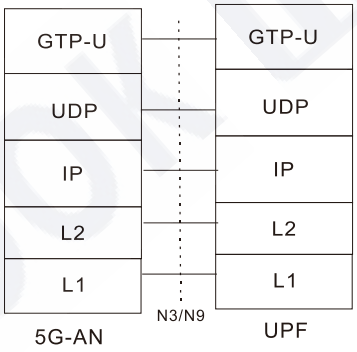

Figure 4.6-6

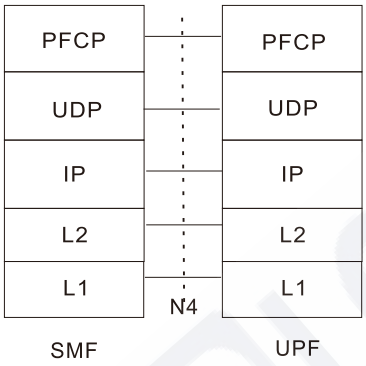

Figure 4.6-7

4.6.3 Performance

Hardware / platform resources:

2 x 10 cores , 2.3GHz CPU; 32G RAM; 2x500G HDD Raid 1; 4 x 1G; 1×10G NIC

Number	Description	Numerical value
1	Number of PDP Sessions	200,000
2	Maximum data plane throughput	9 Gbps

Figure 4.6-8

4.7 NRF

4.7.1 Basic Function

Number	Description	Phase
1	Support service management, service discovery, and service authorization for 5GC serviced network elements such as SMF, AUSF, AMF, PCF, UDM, and UPF defined in 3GPP	P3
2	Provide service management interfaces that implements functions including NF and its service registration, update, deregistration, NF status subscription, NF status notification, and NF status de-subscription	P3
3	Provide service discovery interface to implement service discovery	P3
4	Provides oAuth2-based service authorization for authorization functions when each network element accesses each other.	P3
5	Support IPv4/IPv6 dual stack	P4

Figure 4.7-1

4.7.2 Interface and Protocol

The interfaces supported by NRF are as follows：

Number	Name	NE	Protocol	Phase
1	N27	UDM	Nnrf	P3

Figure 4.7-2

Among them, the definition of the service interfaces are as follows:

Number	Services	Description
1	Nnrf_NFManagement	Manage the registration information of each network element. Each network element exposes the service through the interface, and provides a service change subscription function between the network elements.
2	Nnrf_NFDiscovery	Provide service discovery between network elements

Figure 4.7-3

The NRF service protocol stack is as follows:

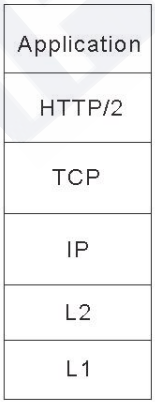

Figure 4.7-1

4.7.3 Performance

Number	Performance index	Numerical value
1	Maximum number of users	To be determined
2	Maximum number of registered elements	To be determined
3	Maximum number of registered elements	To be determined
4	Number of transactions processed per second	To be determined

Figure 4.7-4

4.8 NSSF

4.8.1 Basic Function

(1) Slice selection service

Number	Description	Phase
1	Obtain service information in the UE registration process	P3
2	Obtain service information in the PDU session establishment process	P3

Figure 4.8-1

(2) Slice availability service with other NF

Number	Description	Phase
1	Availability service update	P3
2	Availability service subscription	P3
3	Availability service de-subscription	P3
4	Availability service notification	P3
5	Availability service deletion	P3

Figure 4.8-2

(3) Support for IPv6

Number	Description	Phase
1	Support for IPv4/IPv6 dual stack	P4

Figure 4.8-3

4.8.2 Interface and Protocol

The interfaces supported by NSSF are as follows.

Number	Name	NE	Protocol	Phase
1	N22	AMF	Nnnsf	P3

Figure 4.8-4

N22 is a service interface provided by NSSF network element, which is used by AMF

- Support for HTTP2.0
- Support for JSON format
- Support for IPv4/IPv6 dual stack
- Support for Nnssf_NSSelection Service API
- Support for Nnssf _NSSAIAvailability Service API

Among them, the definition of the service interfaces are as follows:

Number	Services	Description
1	Nnssf_NSSelection	Provide requested network slice information to requestor
2	Nnssf_NSSAIAvailability	Availability of S-NSSAI for NF consumers

Figure 4.8-5

The N22 interface protocol stack provided by NSSF is shown in the following figure:

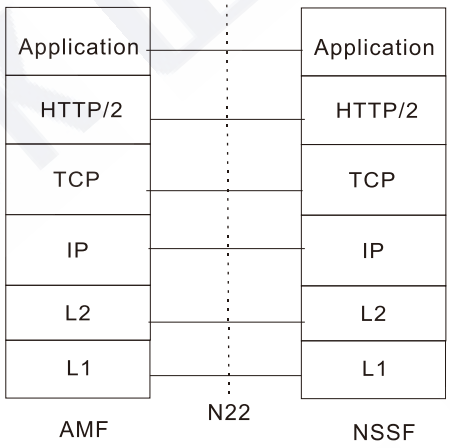

Figure 4.8-6

4.8.3 Performance

*

5 3G/4G/5G core network convergence

5.1 Overall framework

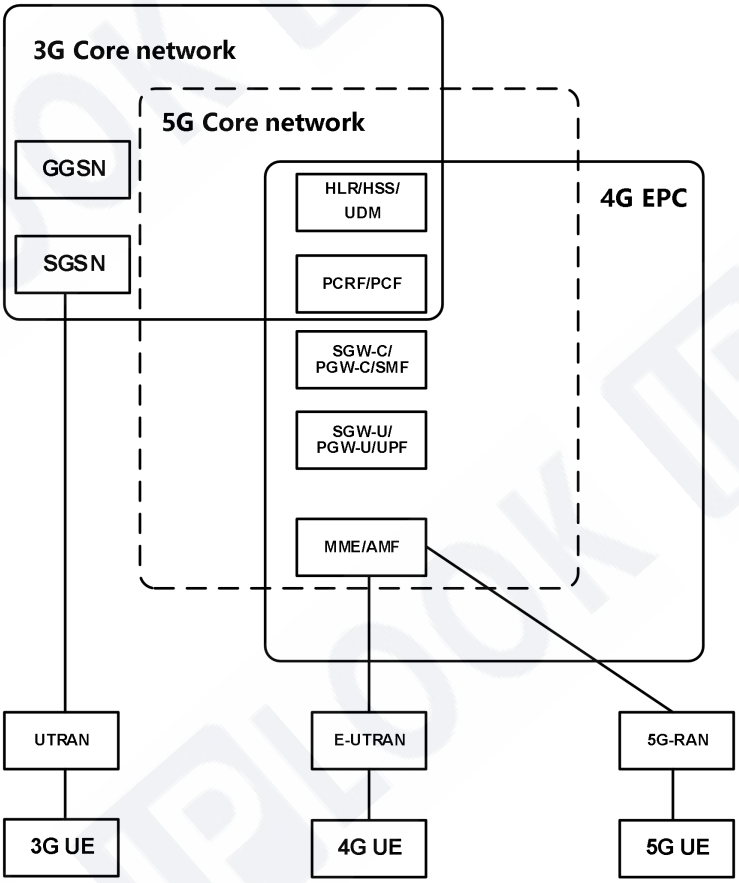

Figure 5.1-1

IPLOOK 5G core network has higher compatibility and will be upgraded to support 3G and 4G user access. Users can register for 3G / 4G / 5G network，so it ensures a smooth upgrade to 5G for existing 3G/4G users.

5.2 Overall framework

5.2.1 MME + AMF

The main functions of AMF and MME are access control, mobility management, network element selection, identification function and so on. After integration, the interoperation between 4G and 5G core network is supported.

UE single registration, users maintain only one active mobility management state at a time, which can be one of the registration management status of 5GC or the EPC mobility management state of EPC. When the user is in the connected state and moves from 5GC to EPC, the seamless business and session continuity of the user can be guaranteed. It is up to SMF based on EPS capabilities and the operator's specific management policies to determine which PDU sessions can be repositioned to the target EPC, and release the part of the PDU session that cannot be migrated to EPC. When the user is in the free state and moves from 5GC to EPC, the UE can perform the tracking area update process or 4G attachment process to complete the mobility processing.

5.2.2 SGW-C + PGW-C + SMF

SGW-C, PGW-C and SMF are combined to support the following functions:

(1) Support for carrying GW-C when registering with NRF during service registration

(2) Session process

- PDU Session related process

  SMF/ SGW-C/PGW-C supports the identification of EPS interoperation instructions sent by AMF and the signing information of session management; for PDU sessions with interoperation requirements, it supports finding interoperable UPF/GW-U through NRF or local configuration.

- PDN Connection related process

SMF/SGW-C/PGW-C supports the selection of PCF+PCRF for 4G sessions and the use of N7 or Gx interfaces to obtain session control policies based on user interoperation decisions.

(3) Interoperation between 5GC and EPC based on N26 Interface

- Switching from 5GC to EPS based on N26 interface
- Reselection from 5GC to EPS based on N26 interface
- Switching from EPS to 5GC based on N26 interface
- Reselection from EPS to 5GC based on N26 interface

(4) SMF supports the establishment of IMS PDU Session

- SMF supports for IMS voice and video calling EPS fallback

5.2.3 SGW-U + PGW-U + UPF

XGW-U and UPF are integrated in EPS, and support EPS and 5GC interoperability, normal switching or reselection

5.2.4 PCRF + PCF

(1) PCRF/PCF Interop in initial attachment

PCRF/PCF supports the user's wireless access mode (4G/5G) as a decision condition for policy decision in the N7 session interface mode.

(2) Interoperation between EPS and 5GC based on N26 Interface

PCRF/PCF supports for switching or reselection processes between EPS and 5GC

5.2.5 HLR + HSS + UDM(AUSF)

This network element is oriented to the goal of user data fusion. 5GC network deploys 3G/4G/5G/IMS convergence devices, which are connected to 3G core networks, EPC, IMS, and

5GC networks respectively. It is used for multiple network data storage, user data management, authentication, mobility and other processes.

6 5GC Network slicing

IPLOOK 5GC network slicing can be differentiated according to the request of each user, enabling operators to manage the slicing types and services that each user is eligible to use according to the Service Level Agreement (SLA). Each network slicing is uniquely identified by S-NSSAI.

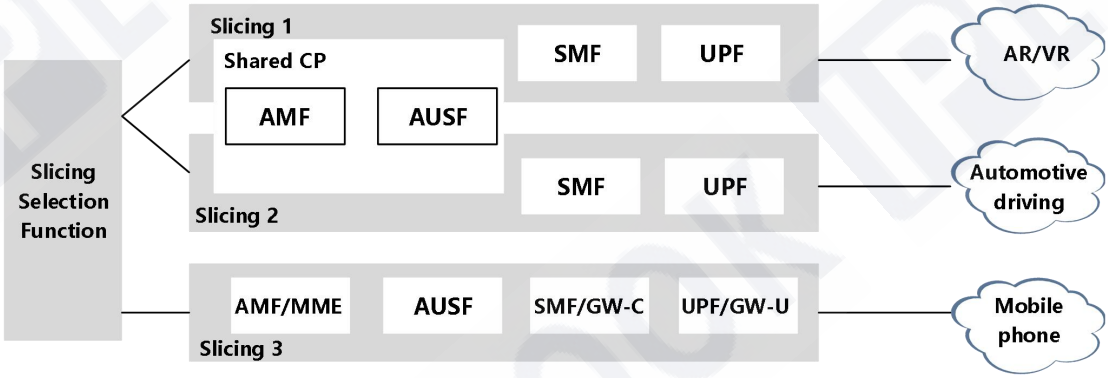

Figure 6-1

The implementation of network slicing:

- **Select the service AMF that supports network slice**

  Register to a set of network slices according to sNSSAI and S-NSSAI; it can also modify the network slice set of UE from the network side, and the network of the modified UE initiates a redirection from its service AMF to the target AMF.。

- **Establish the PDU session in a network slice**

- **Interworking between Network slices and EPS**

  During the establishment of a PDN connection in the EPC build, the UE allocates the PDU session ID and sends it to the PGW-C+SMF via PCO. The S-NSSAI associated with the PDN connection is determined by the PGW-C+SMF based on the operator policy and sent to the UE.

7 VoNR

VoNR is the target voice solution for 5G network. IPLOOK evolves from the voice scheme chosen in the early stage of 5G business to VoNR, which mainly includes the following three solutions:

7.1 VoLTE

IPLOOK LTE EPC supports NSA (Non-standalone) networking in 2018. In this way, the control plane signaling is forwarded by LTE, while the data is distributed by gNB and eNB. EN-DC dual connection is required by user devices.The voice solution is still VoLTE.

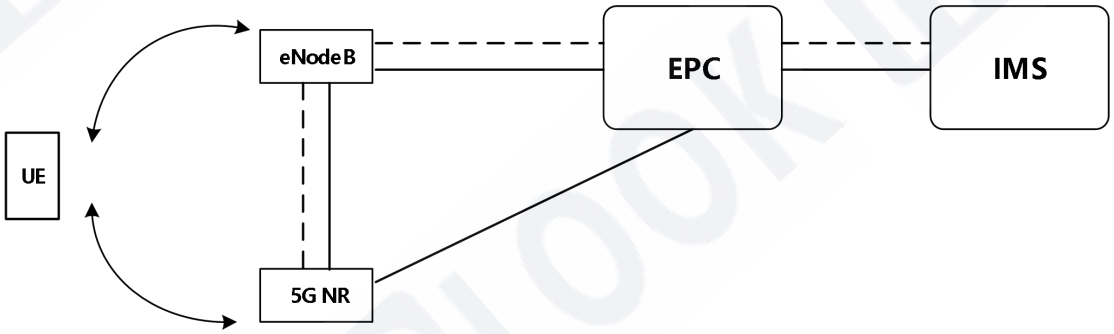

Figure 7.1-1

7.2 EPS FB

When 5GC deployment coexists with 4G existing networks, IPLOOK provides a voice solution for EPC FB. When the mobile phone is resident in the 5G cell and actively dials or receives an incoming call, it receives the paging from the EPC through N26 interface and copies it to the LTE-EPC to realize the VoLTE call.

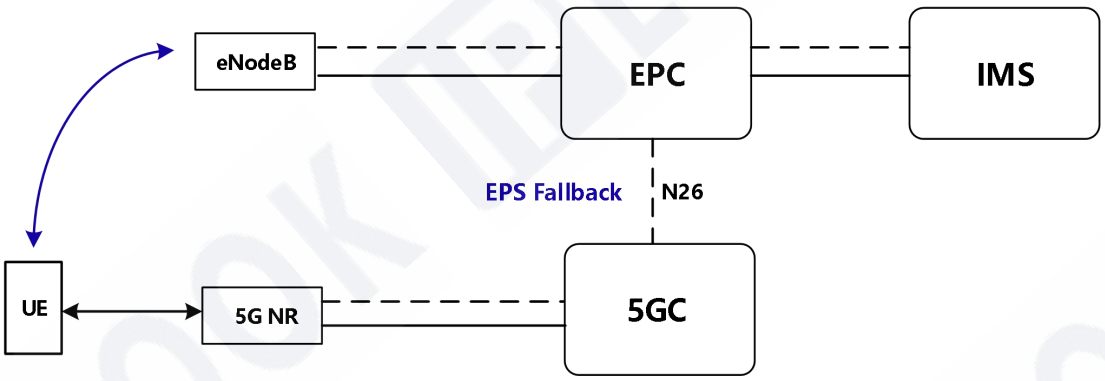

Figure 7.2-1

7.3 VoNR

Above two types are transitional schemes for operators. The final 5GC voice deployment should be Voice over NR, which connects directly to IMS through 5GC.

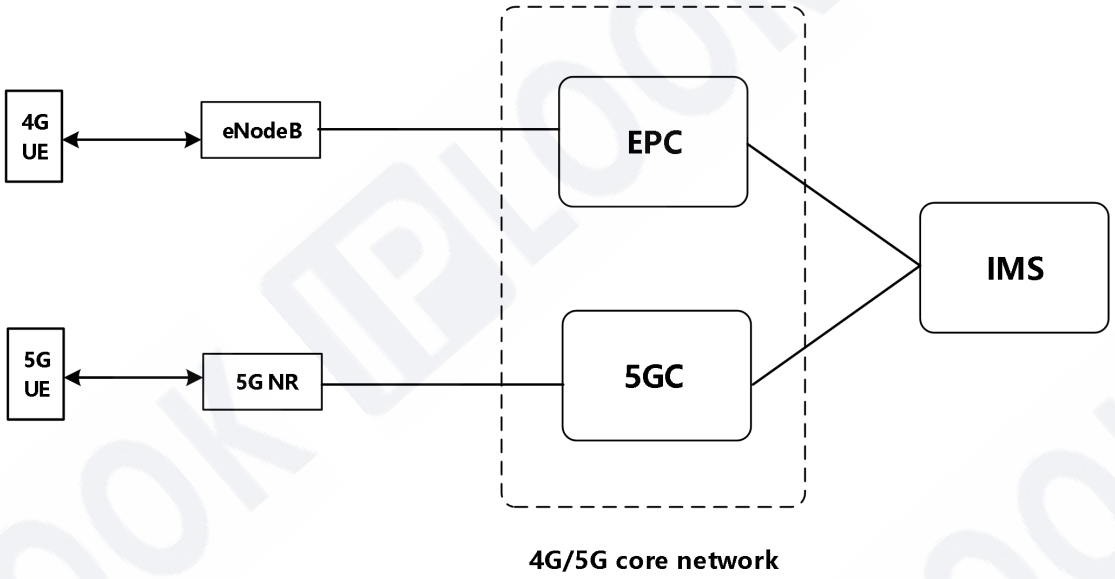

Figure 7.3-1

8 Virtualization Technology

8.1 NFV

IPLOOK 5GC is based on NFV technology to realize the separation of network element functions and hardware resources, and to realize the software-based system functions and the generalization of hardware resources. It can be deployed with IaaS cloud computing service platforms such as AWS and Azure to achieve flexible capacity scaling. New business and new communication versions are on-line fast, and hardware generalization to ensure fast update iteration.

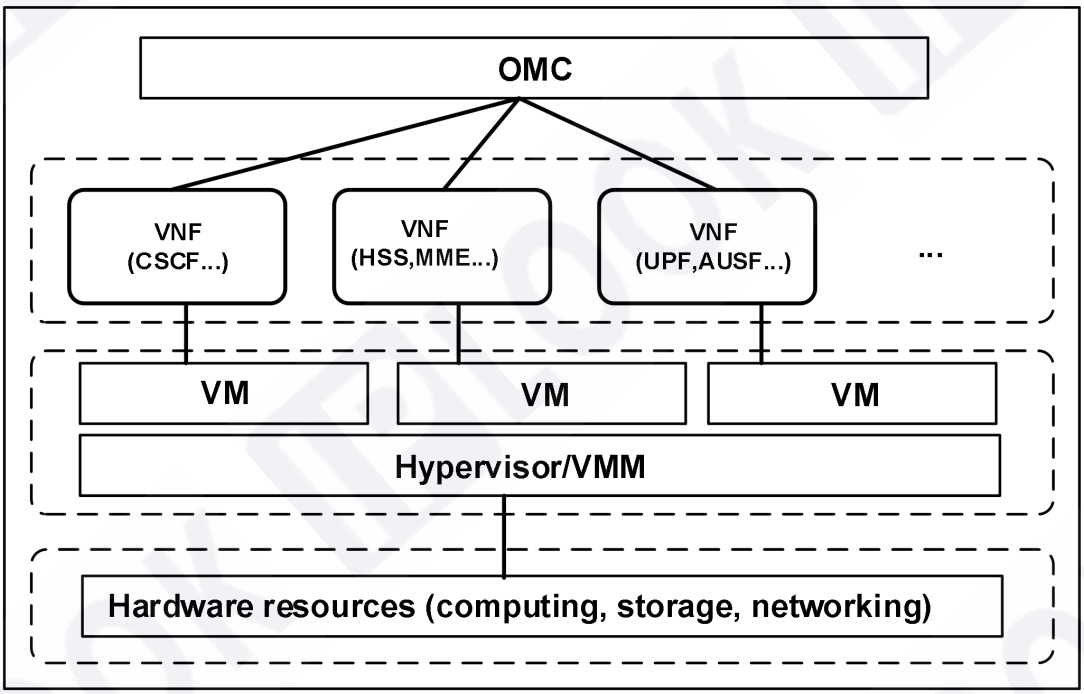

Figure 8.1-1

8.2 MANO

8.2.1 MANO Core network Cloud Management Architecture

IPLOOK 5GC virtual network element management adopts MANO mode, including NFVO (Network Function Virtualization Orchestration), VNFM (Virtualized Network Function Management), VIM (Virtual Infrastructure Management) to achieve top-down hierarchical management of virtualization architecture.

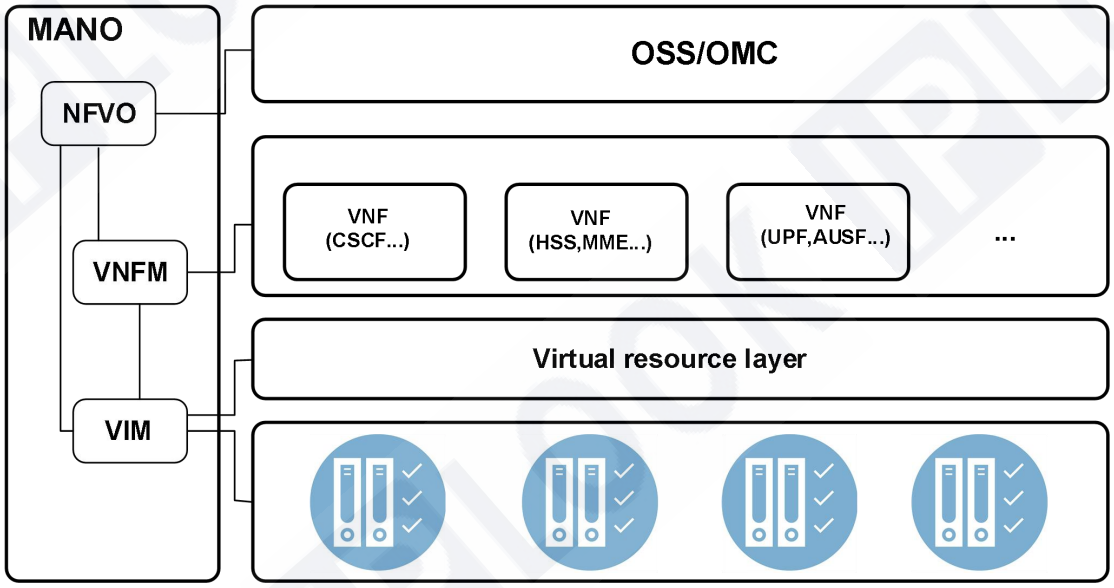

Figure 8.2-1

8.2.2 Core network cloud management function

NFVO: Network Function Virtualization Orchestration

VNFM: Virtualized Network Function Management

VIM：Virtual Infrastructure Management

9 Applications

9.1 MVNO

As shown in the following figure, the existing network built by IPLOOK for MVNO mainly includes PGW/GGSN, HSS/HLR, PCRF, STP, DRA, that can be upgraded to 5G, so that 3G, 4G, 5G users can access at the same time.

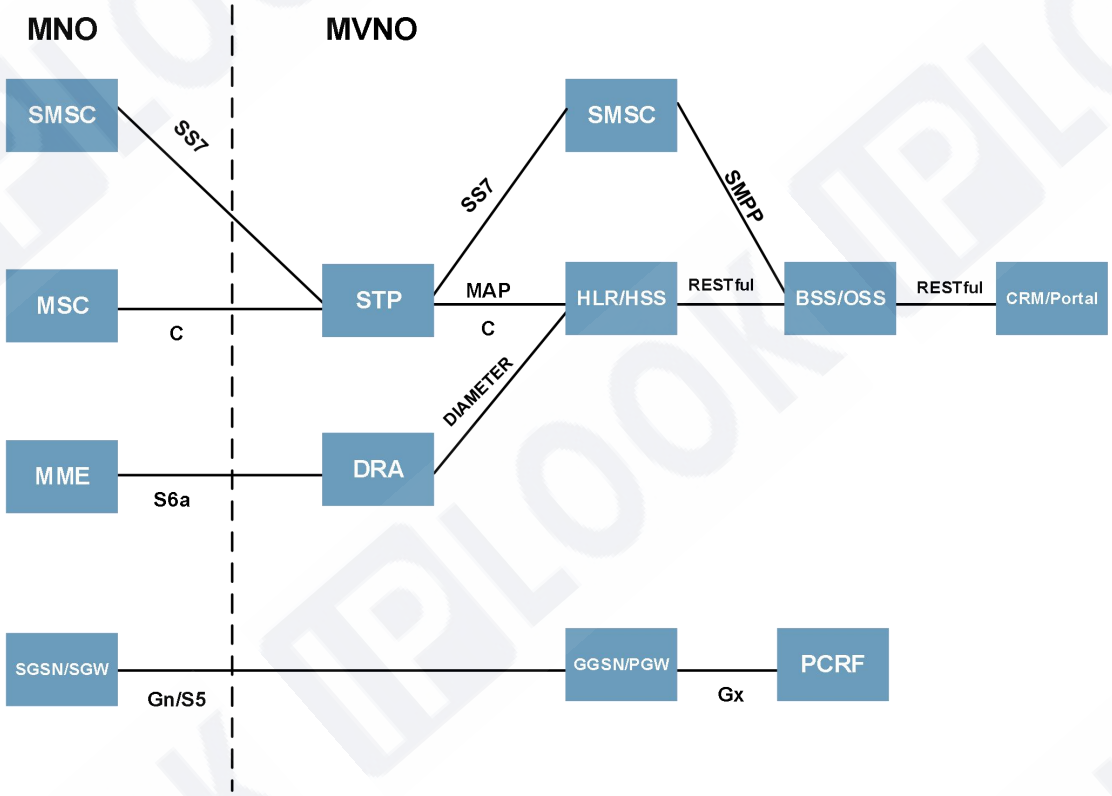

Figure 9.1-1 3G/4G MVNO Network topology

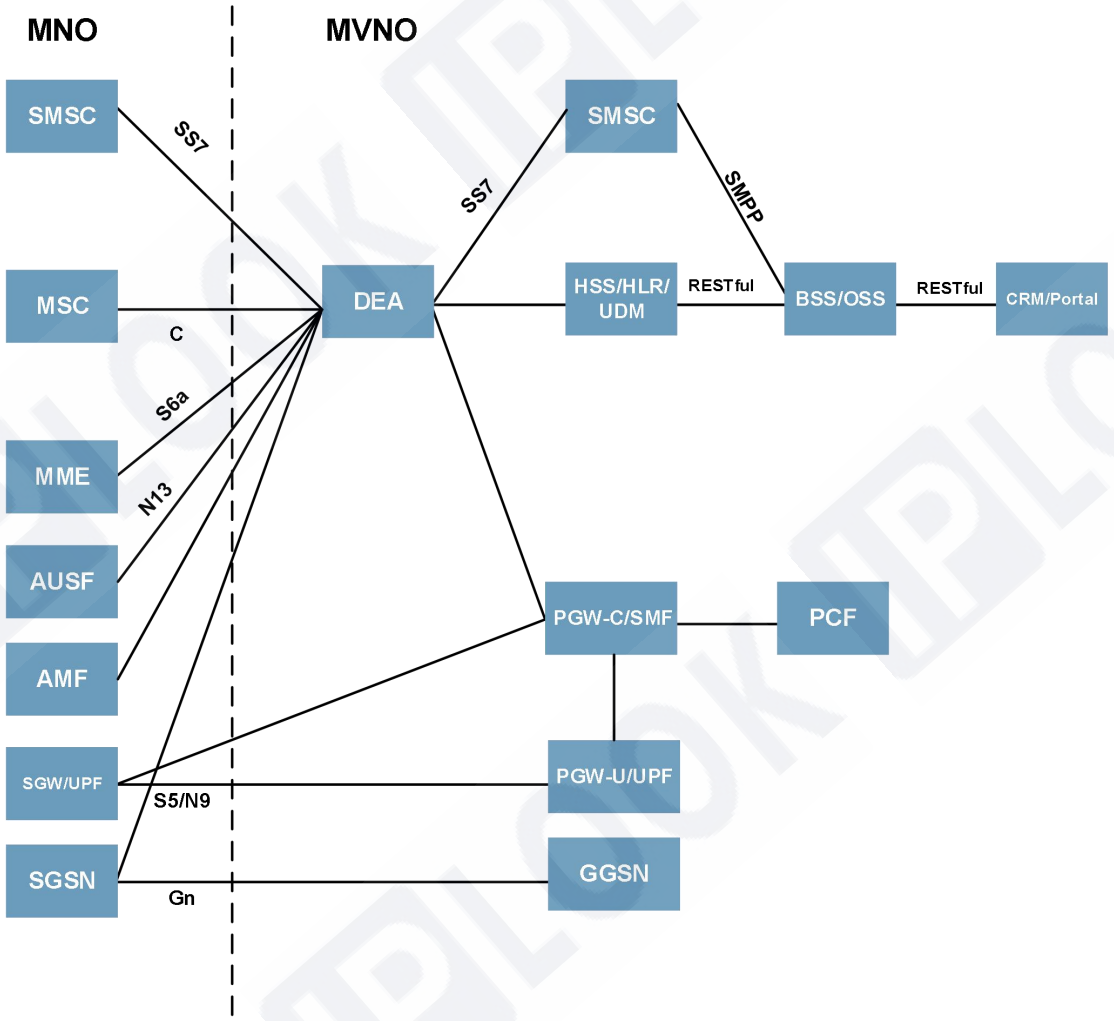

Figure 9.1-2 3G/4G/5G MVNO Network topology

9.2 Network Construction of General 4G/5G operators

As shown in the following figure, the 5G upgrade scheme provided by IPLOOK for 4G operator customers of the existing network can be upgraded on the original platform to support 3G/4G/5G subscriber service at the same time. The replacement degree of existing network equipment is small.

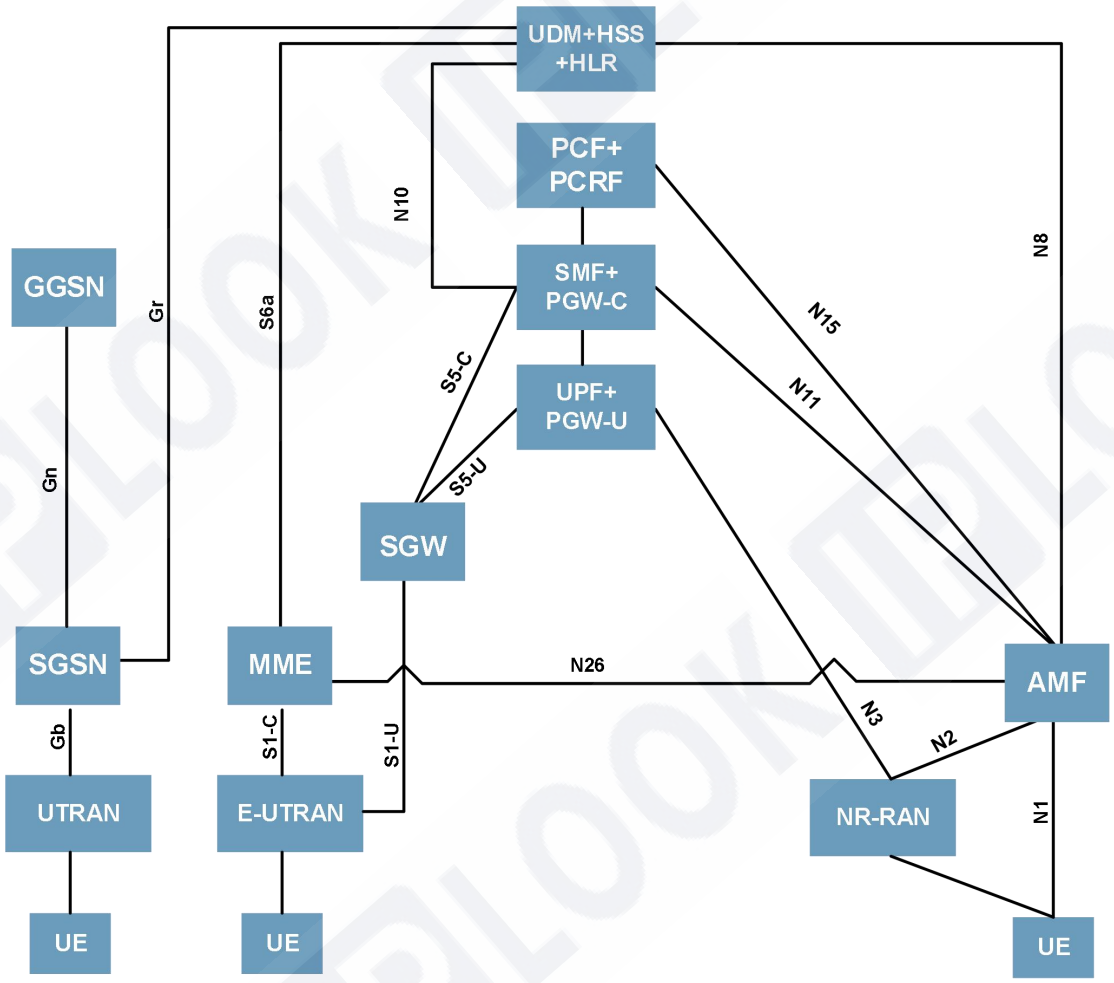
UDM+HSS
+HLR
PCF+
PCRF
SMF+
PGW-C
UPF+
PGW-U
SGW
GGSN
SGSN
MME
AMF
UTRAN
E-UTRAN
NR-RAN
UE
UE
UE
N10
N8
N15
N11
S5-C
S5-U
Gr
S6a
Gn
Gb
S1-C
S1-U
N26
N3
N2
N1

Figure 9.2-1