

Vo5G

Full course at
<https://telcomaglobal.com>

TELCOMA

Voice over 5G

Vo5G :

- Vo5G is set to offer and support ultra HD voice communications.
- Voice become integral to new 5G driven services.

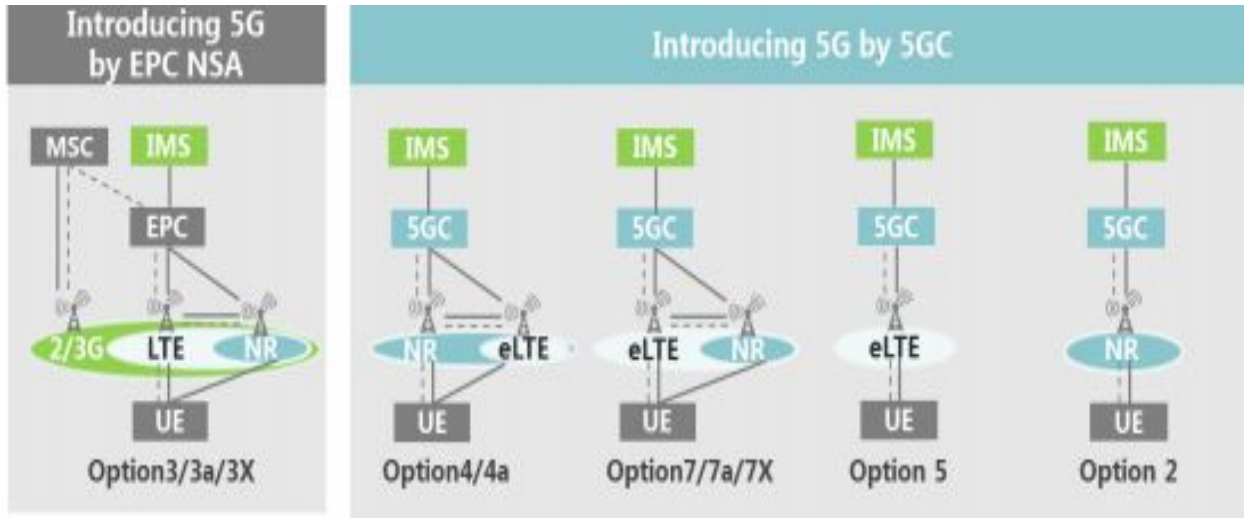
Vo5G :

- In addition to expansion of 5G network coverage and maturity of the terminal ecosystem, carriers need to consider the factors of various 5G network deployment options when deploying 5G networks.
- In addition to VoNR, the voice/video communication solutions EPS fallback,RAT fallback and voice/video over eLTE need to be implemented by using 5GC.

Vo5G :

- Vo5G should include VoNR, VoLTE, EPS FB and RAT FB.

5G voice solution options :

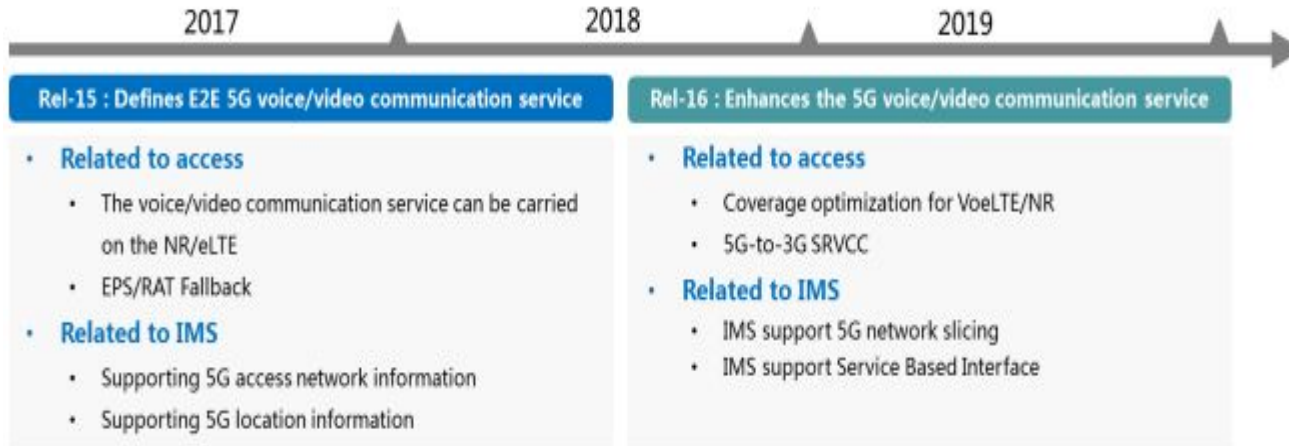


Optional Voice/Video Communication Solution	CSFB->VoLTE->VoNR	EPS FB or RAT FB or VoLTE->VoNR	VoLTE->VoNR	VoLTE	EPS FB or RAT FB or VoLTE->VoNR
---	-------------------	---------------------------------	-------------	-------	---------------------------------

Vo5G standard development :

- By June 2018, 3GPP has completed the definition of basic Vo5G functions in rel-15 meeting the requirements of commercial deployment of 5G networks.
- After the 5G is introduced, the 5G doesn't provide the CSFB solution to simplify the network and accelerate the exit of the CS voice.

Vo5G standard development :



Voice & video codec standard development :

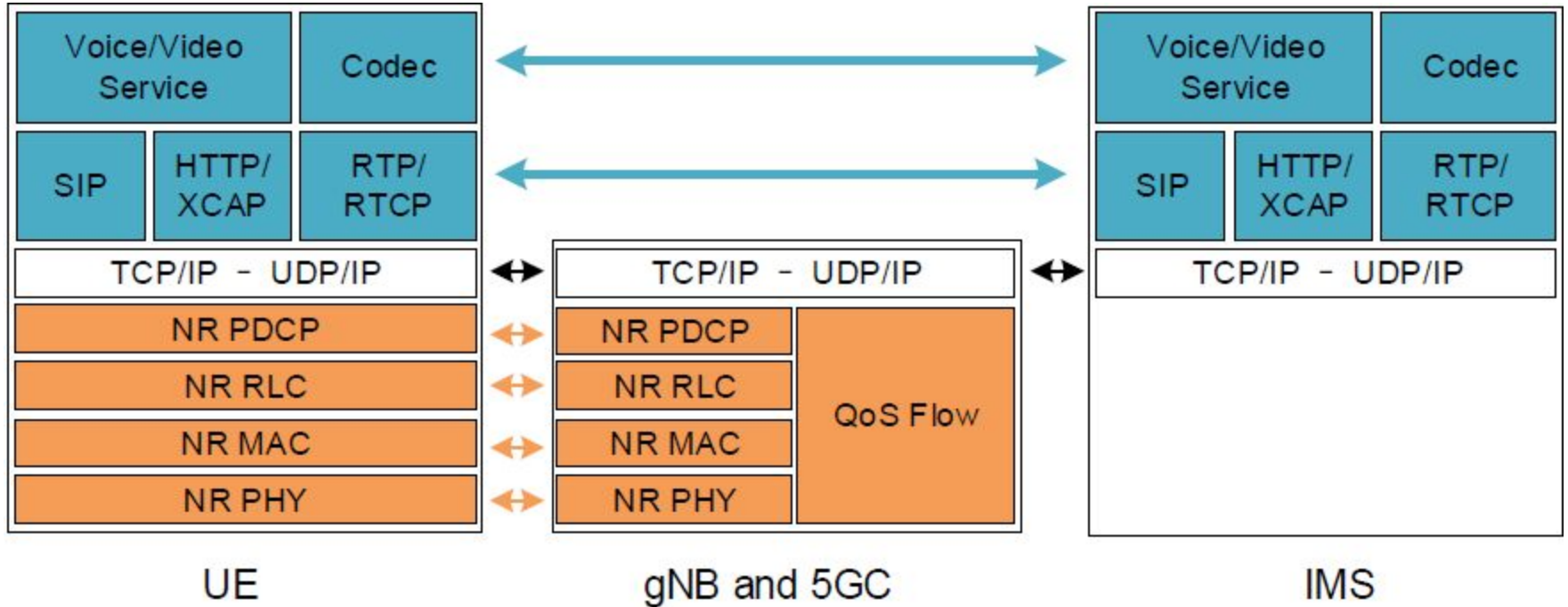
- According to GSMA & 3GPP, EVS and H.265 are mandatory codec for voice and video communication services in Vo5G.
- In future, 3GPP will complete the standardization of Immersive voice and audio services (IVAS) in Rel-16.

Introduction to the Vo5G voice/video communication solution

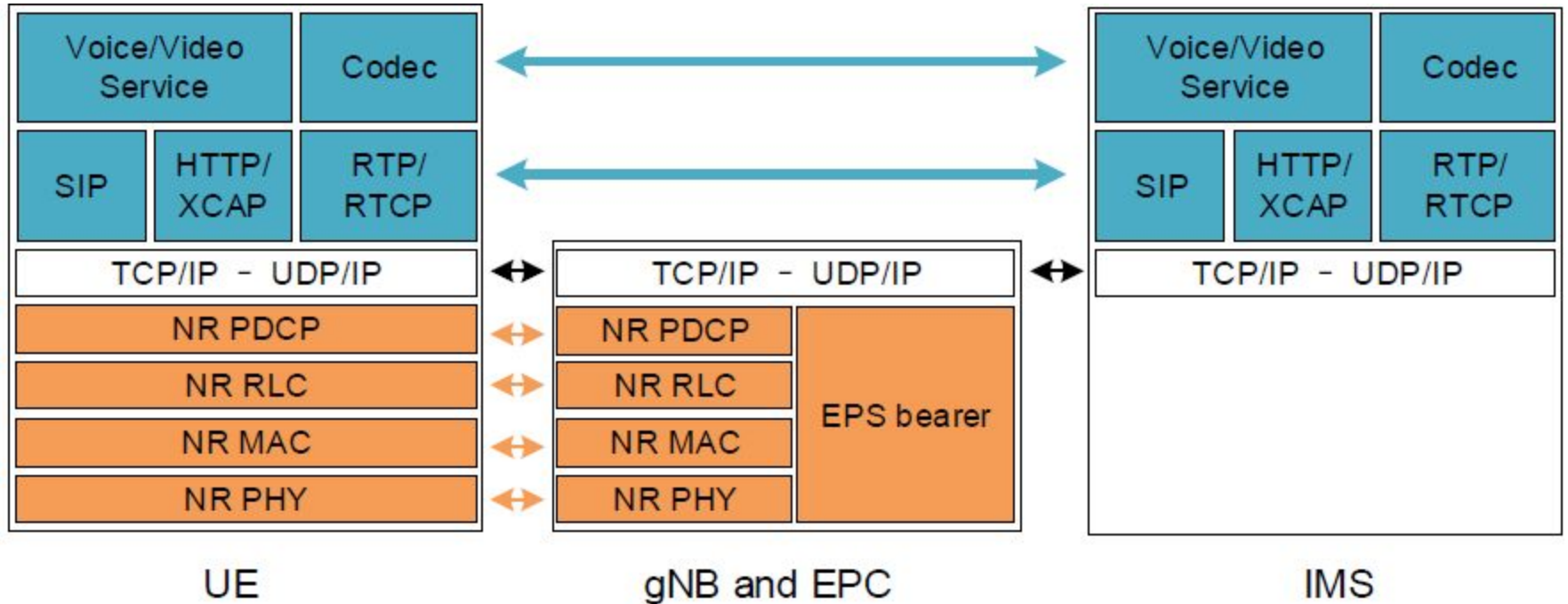
VoNR :

- It indicates that the voice/video communication service is carried on the gNB.
- There are two options based on different 5G networks :
 1. The 5GC and gNB are used to carry VoNR
 2. The EPC and gNB are used to carry VoNR

VoNR protocol stack via 5GC & gNB :



VoNR protocol stack via EPC & gNB :



EPS FB :

- The 5G NR network doesn't provide voice/video communication services at the initial stage.
- The gNB sends a re-direction or inter-RAT handover request to the 5GC to fall back to the LTE network and use the VoLTE service.

EPS FB :

- If the UE camping on the 5G NR network makes a call, the voice/video communication and data services fall back to the 4G network.
- The connection duration is 1 to 2 seconds longer than that of the VoNR.

EPS FB :

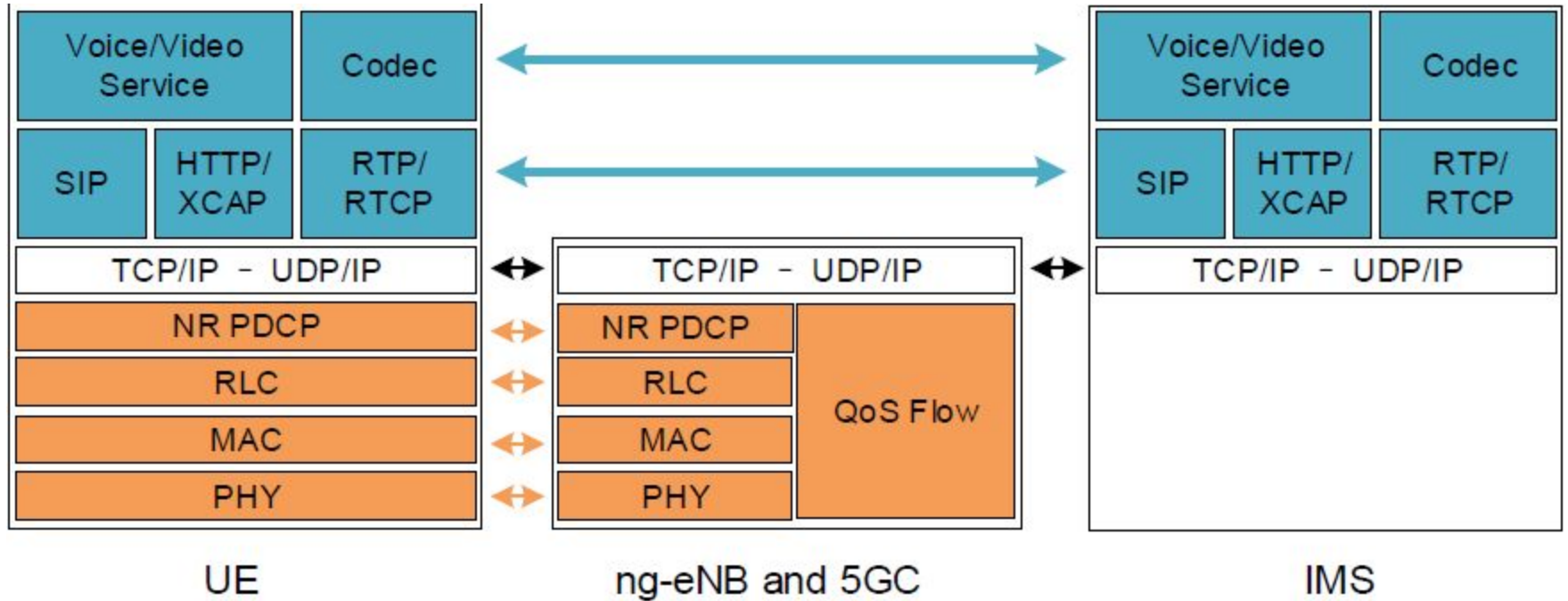
- The deployment of EPS FB requires overlapping coverage of LTE and NR networks.
- The RTP or RTCP over NR requires continuous optimization on the NR network to achieve good voice quality and low power consumption of the UE.

VoeLTE

VoeLTE :

- It refers that the voice/video communication service is carried on the 5GC and ng-eNB.

VoeLTE protocol stack :



VoLTE :

- In VoLTE, UE's camp on the eLTE network, and voice/video communication and data services are carried on the eLTE network.
- When a UE moves to the area where the eLTE signal coverage is poor, a coverage based handover needs to be initiated to implement the interworking with the 4G or NR network. Then , the UE handovers to the LTE or NR network , and the VoLTE or VoNR service is provided.

RAT FB

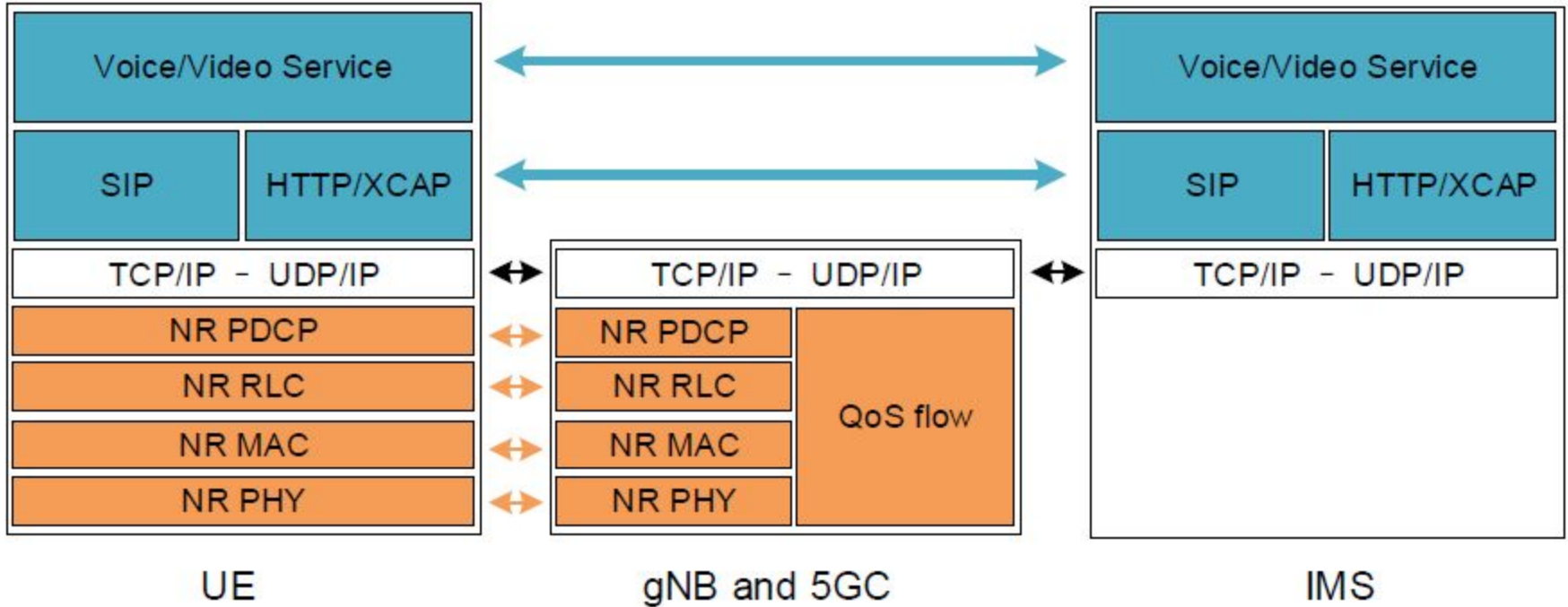
RAT FB :

- Similar to EPS FB, the 5G NR does not provide voice/video communication services at the initial stage.
- When the gNB establishes an IMS voice/video communication channel on the 5G network, a handover is triggered.

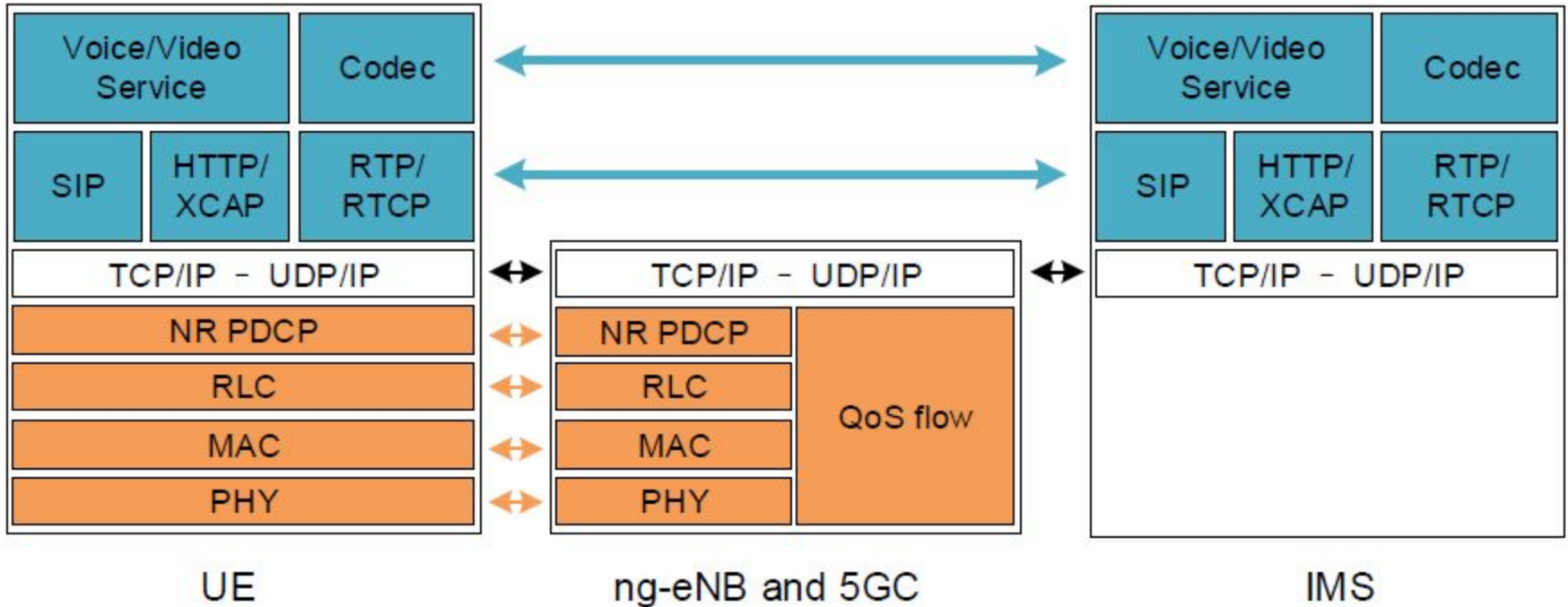
RAT FB :

- In this case, the gNB sends a redirection or inter-RAT handover request to the 5GC to fall back to the eLTE network and use the VoLTE service.

RAT FB :



RAT FB :



Introduction to the Vo5G SMS and USSD solutions

Vo5G SMS & USSD solutions :

- In Vo5G, the short message service and USSD solutions are implemented through the 5GC and IMS regardless of VoNR, EPS FB, VoLTE or RAT FB.
- The SMS solution is implemented through SMS over IMS.

Vo5G SMS & USSD solutions :

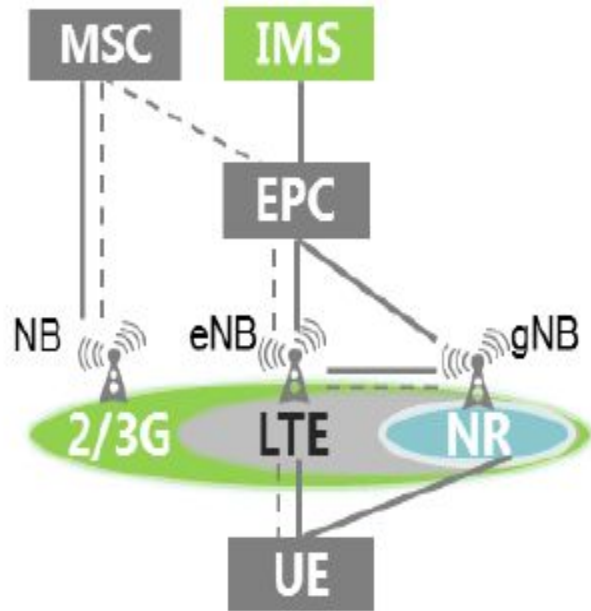
- The modification of supplementary services is implemented over the XCAP/Ut interface.
- The USSD solution is implemented through USSD over IMS.

Vo5G solution on different 5G networks

Introducing 5G by EPC NSA :

- For 5G option 3/3a/3x , the NR is provided by the gNB, and the gNB serves as the secondary node of the master node of eNB to access the EPC network.

Introducing 5G by EPC NSA :



5G Option3/3a/3X

Voice /video communication :

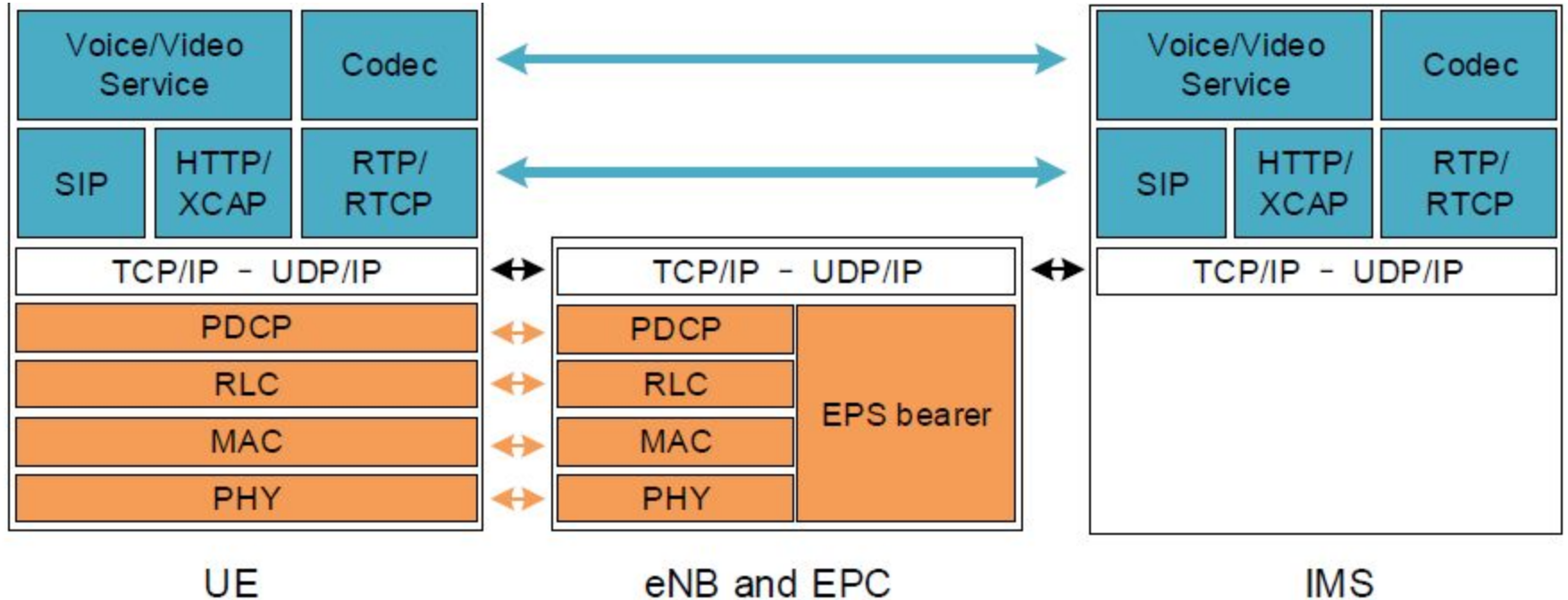
- In the networking, the voice/video communication services can continue using technologies such as CSFB and VoLTE, or using the VoNR technology under the NR coverage.
- Generally, carriers can select evolution from CSFB to VoLTE and then choose to evolve to VoNR.

Voice /video communication :

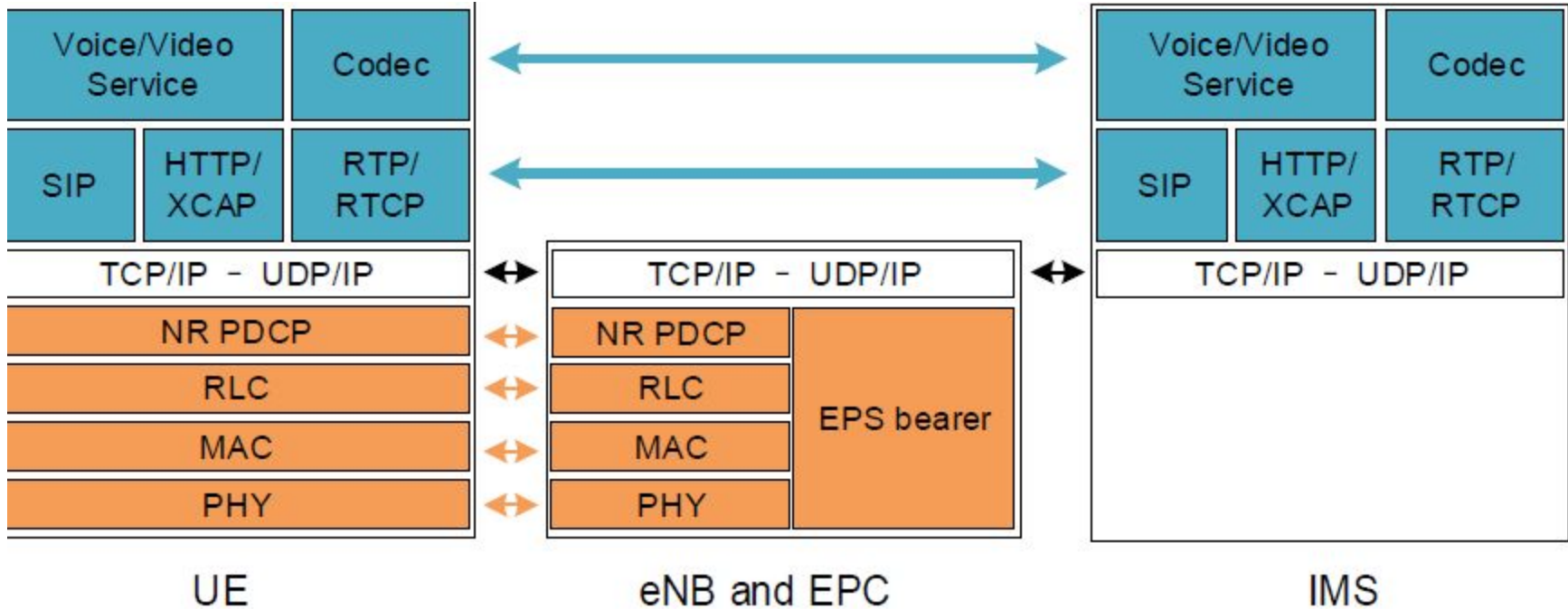
In the networking, there are two options for using the VoLTE technology :

- VoLTE over E-UTRA PDCP defined on the 4G network.

VoLTE over E-UTRA PDCP :



VoLTE over NR PDCP :



Voice /video communication :

- The eNodeB can support NR PDCP or E-UTRAN PDCP.
- If only NR PDCP is supported, the variant VoLTE over NR PDCP is introduced.
- Although no new function is provided for VoLTE, the introduction of new protocol stacks will increase the workload of network optimization and UE power consumption optimization.

SMS & USSD :

- The SMS solution can use the SMS over SGs or SMS over IMS technology.
- The USSD solution can use the CSFB or USSD over IMS technology.

Introducing 5G by 5GC

SMS and USSD :

- The SMS solution can only use the SMS over IMS technology.
- The USSD solution can only use the USSD over IMS technology.

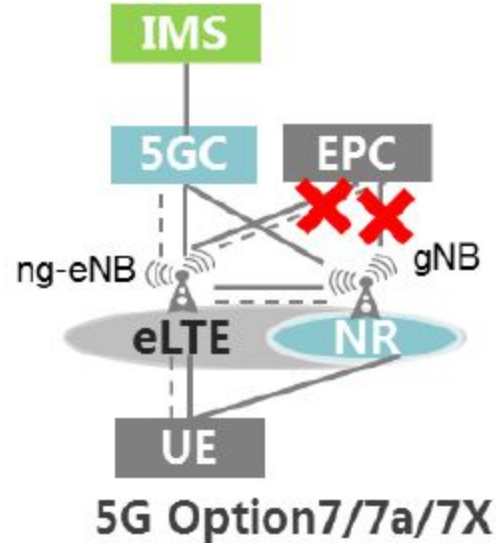
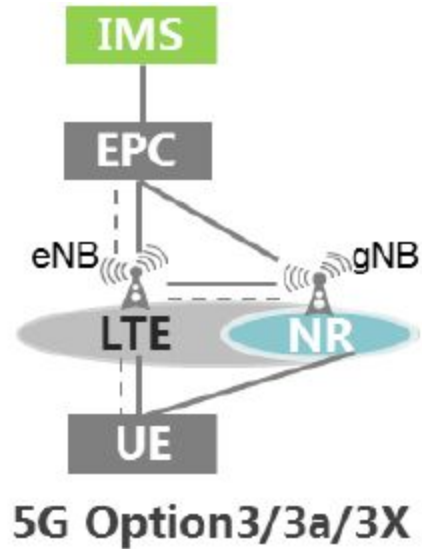
Voice/video communication :

5G option 7/7a/7x :

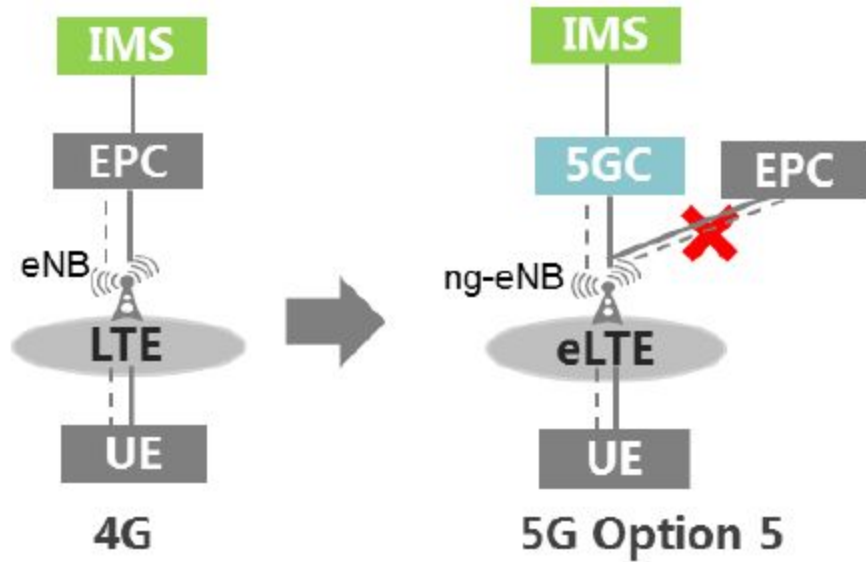
- The networking is evolved from option 3/3a/3x.
- With the deployment of 5GC, option 3/3a/3x originally connected to the EPC can be cut over to the 5GC.

Voice/video communication :

5G option 7/7a/7x :



5G option 5 :



5G option 5 :

- The networking is evolved from the LTE networking.
- With the deployment of 5GC, the eNodeB originally connected to the EPC is upgraded to ng-eNB and can be cut over to the 5GC.

5G option 2 :

- The networking is the target 5G networking.
- VoNR can be selected for the voice/video communication services.

5G option 2 networking :



5G option 2 :

- At the initial stage of 5G deployment, NR and 4G network coverage is overlapped.
- EPS FB can be preferentially selected for voice/video communication services.

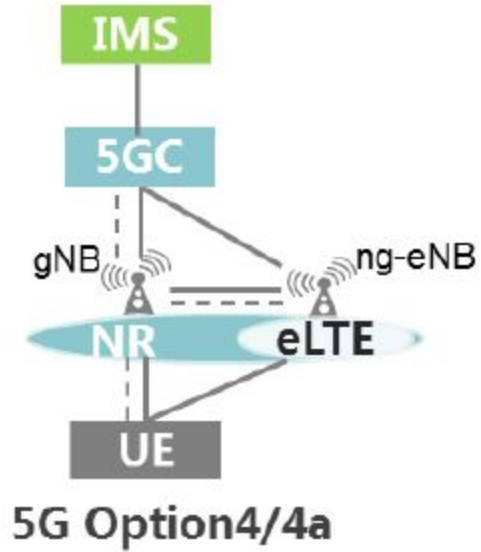
Evolution from EPS fallback to VoNR :



5G Option 4/4a :

- The networking is enhanced on the basis of 5G option 2, and the secondary node of the eLTE is added.

5G option 4/4a :



5G option 4/4a :

- The NR coverage scope of the master node is larger than that of the eLTE secondary node.
- Therefore, the voice/video communication service is optional on the secondary node.

Vo5G for 5G development

Vo5G for 5G development :

- 5G development requires more spectrum resources, especially low-frequency resources with good penetrating capabilities.
- High-quality low-frequency resources are occupied by 2G or 3G networks for voice/video communication and cannot be released.

Vo5G for 5G development :

- With the introduction of 5G, carriers will face the challenge of coexistence of 2G, 3G,4G and 5G networks.
- Too many RATs and network result in high CAPEX and OPEX.

Vo5G for 5G development :

- Vo5G can accelerate the migration of voice/video communication from 2G or 3G networks to 4G or 5G networks, reducing the number of networks and costs as well as refarming low-frequency resources for 5G.

Vo5G for 5G development :

- Vo5G provides the same user experience as VoLTE.
- A voice/video call is connected within a short period, only about 1 to 2 seconds from dialing to hearing the ring back tone.
- While making the call, subscribers can also enjoy high speed 4G or 5G internet access e.g, by accessing a high speed download service.

Vo5G for 5G development

Vo5G for 5G development :

- EVS and H.265 codec is mandatory for Vo5G, which provides better user experience.
- The voice bandwidth is expanded and the high error robustness of voice and video communication services is improved.
- Vo5G will be fundamental to accelerate 5G development because both carriers and subcarriers are willing to use Vo5G.

Road to Vo5G :

- 3GPP has specified that 5G must provide voice/video communication services based on the IMS , i.e IMS must be deployed by VoNR, VoLTE, EPS FB and RAT FB in 3GPP rel-15 or 5G to 3G SRVCC in 3GPP rel-16.

Evolution to VoNR :

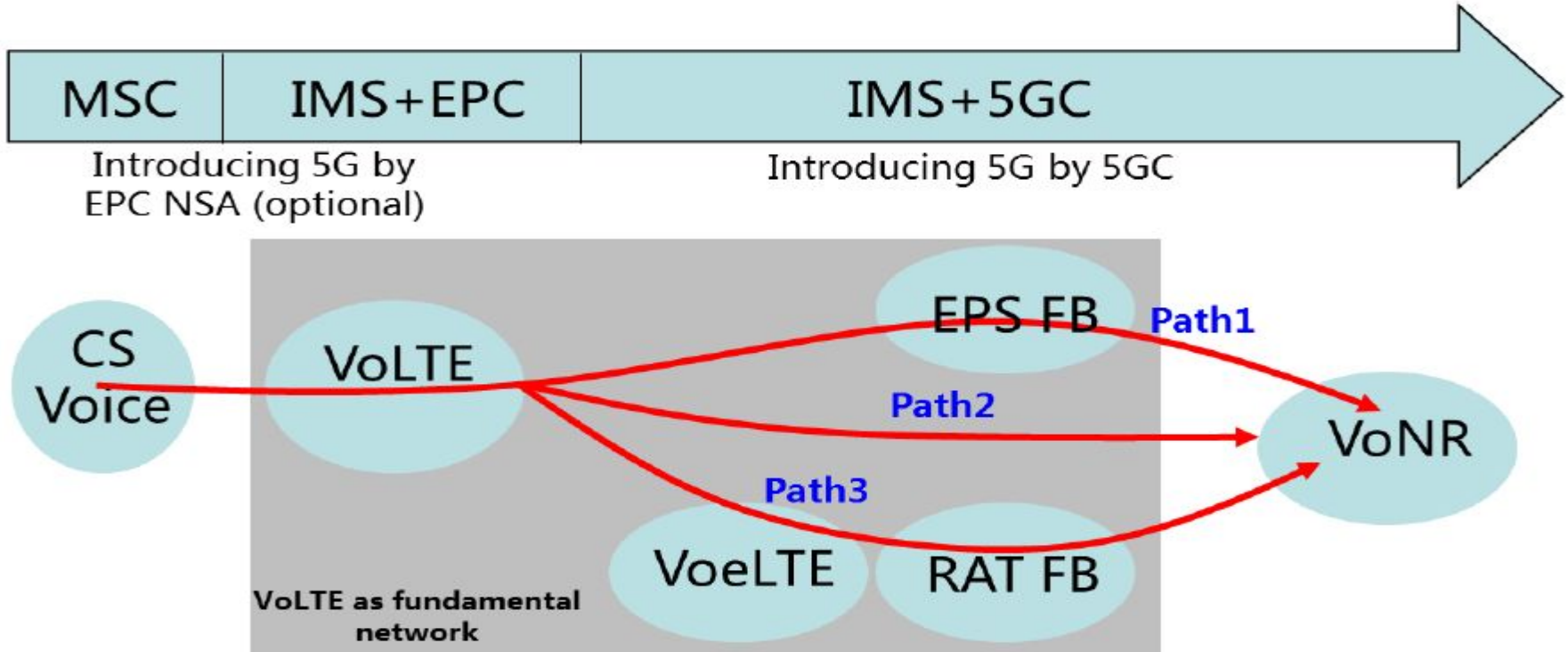
- VoNR is the target voice/video communication solution for 5G networks.
- There are multiple methods to transform the voice/video communication solution selected at the initial 5G stage to VoNR.

Evolution paths

Evolution to VoNR :

- VoNR is the target voice/video communication solution for 5G networks.
- There are multiple methods to transform the voice/video communication solution selected at the initial 5G stage to VoNR.

Evolution to VoNR :



Path 1 : VoLTE->EPS FB->VoNR :

- At the initial stage of 5G, voice/video communication and data networks are separated.
- Voice/video communication services are provided by the EPC and LTE, and VoLTE is used as the voice/video communication solution.

Path 1 : VoLTE->EPS FB->VoNR :

- With the introduction of 5GC, voice/video communication services are still provided by the EPC and LTE and EPS FB is used as the voice/video communication solution.
- After the 5G network is further optimized, VoNR is gradually provided either using either of the following 5G evolution methods :

4G->5G option 3/3a/3x->5G option 2

4G->5G option 2

Path 2 : VoLTE->VoNR :

- voice/video communication and data services are provided on the 5G network using the method
- 4G->5G option 2

Path 3 : VoLTE -> VoNR -> RAT

FB->VoNR:

- At the initial stage of 5G, voice/video communication and data networks are separated, and the NR+LTE networking is adopted.
- voice/video communication services are provided by the EPC and LTE, and VoLTE is used as the voice/video communication solution.

Path 3 : VoLTE -> VoeLTE -> RAT

FB->VoNR:

- With the introduction of the 5GC, the NR+LTE networking is still adopted, voice/video communication services are provided by the 5GC and LTE, and VoeLTE is used as the voice/video communication solution.
- 5G evolution method as
4G-> 5G option 3/3a/3x-> 5G option 7/7a/7x -> 5G option 2

Accelerating VoLTE as the fundamental network of Vo5G

Accelerating VoLTE for Vo5G :

- For 5G, the networking is complex.
- The key to success requires the assurance of service continuity and economic and effective network deployment.
- OPEX and CAPEX can be effectively reduced by providing the voice/video communication services only on the 4G or 5G networks with the 2G or 3G voice networks shut down based on site conditions.
- VoLTE will become the basic voice/video communication network in the 5G era and work with Vo5G to ensure the continuity of voice/video communication services.

Accelerating VoLTE for Vo5G :

- VoLTE will become the basic voice/video communication network in the 5G era and work with Vo5G to ensure the continuity of voice/video communication services.

Three stages for voice solutions

Stages :

- 5G NSA phase
- 5G SA initial phase
- 5G SA mature phase

5G NSA phase :

- When 5G services are launched, operators should, by default enable VoLTE services for 5G NSA subscribers.

5G SA initial phase :

- As defined in 3GPP R-15, CS fallback from 5G to 2G/3G is not supported. During the voice call establishment phase, 5G SA networks should use EPS FB technology for voice fallback to the LTE network, completing the connection through VoLTE.

5G SA mature phase :

- Terminal support for 5G SA will need to become mainstream, and their default configuration will need to be for VoNR .
- When the user moves outside of 5G coverage during a call, packet switched handover technology can be used to seamlessly switch the session from the NR to the LTE , leaving VoLTE to take over the voice sessions.

VoNR call

VoNR call :

5GC core network provides support for IMS based voice solution. In order to fulfill the feature and requirement of IMS service, 5GC introduces the following features :

- QoS guarantee for voice flow
- EPS fallback

VoNR call :

- Paging policy optimized for IMS service
- Network informs UE with IMS capability and information
- Domain selection for UE originating sessions/calls , and terminating domain selection for IMS voice.
- Domain selection for UE originating SMS