ZTE Accelerates Carriers' Migration to the 5G Core Network

ZTE's Common Core simplifies evolution from EPC to 5G

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Summary

In brief

Network transformation ahead of 5G is the most important driving force in the telecommunications industry today. Leading carriers will leverage 5G for operational efficiencies and new service revenues, and these carriers will need to integrate a flexible, automated 5G core (5GC) to build the agile and programmable network that will be required to monetize the growing 5G opportunity.

Ovum view

5G networks will have more demanding network and service delivery requirements, and these requirements are driving fundamental change to the core architecture. A flexible, automated 5GC will be the foundation of an agile and programmable network; it must be the target of network innovation for successful carriers because common core converges all generations of access technologies, achieves maximum resource usage, and reduces cost. With cloud-native 5GC integration, leading carriers will be able to monetize the multitude of opportunities the Internet of Things (IoT) and 5G will present.

Key messages

- To achieve the necessary scale and performance for 5G, carriers need an agile cloud-native, service-based core architecture that will reduce time to market for both 4G and 5G services and allow them to monetize new services more quickly.
- Service-based architecture, DevOps, and cloud-native virtual network functions technology deliver new opportunities for carriers to quickly build new applications or service offerings. Network slicing and control and user plane separation build on this technology to provide unique services per application with specific latency and service assurance.
- Ovum believes that ZTE's Common Core integrates all the necessary components required to help carriers migrate seamlessly to 5GC while being able to benefit from what will be the first true opportunity in 5G networking, that is, enhanced mobile broadband (eMBB).

5GC market overview

5GC is an important driving force in network transformation

5GC deployment leads to new service creation and delivery

One of the main goals of 5GC integration is for carriers to be able to innovate, create, test, and deliver services more rapidly, while effectively saving costs and delivering a high quality of service (QoS) to enterprise customers. However, upgrading an existing EPC alone will not be enough to support the number of devices that will be connected to the 5G network, nor will it be enough to meet the varied 5G service requirements. To achieve the necessary scale and performance for 5G, carriers need an agile cloud-native, service-based core architecture that will reduce time to market for both 4G and 5G services.

Carriers becoming aggressive in cloud-native 5GC

Global carriers are successfully conducting 5G trials, with some Tier-1 carriers even launching 5G services ahead of 5G commercialization in 2020. Carriers such as Verizon and AT&T in the US, Elisa in Finland, Swisscom in Switzerland, BT/EE in the UK, China Mobile, and others have trialed and launched services ahead of the market, gleaning insights into how to build a proposition for paying 5G customers.

Each carrier is developing a large partner ecosystem to help bring 5G to its customer base as soon as possible and enabling a cloud-native core architecture has been a strategic priority in this race to 5G. Highlighted below are some key 5GC use cases between Chinese telecoms vendor ZTE and its growing carrier customer base.

One of the first notable customer wins for ZTE was French carrier Orange. Over the last year, ZTE and Orange have successfully trialed key 5G technologies including 5GC, end-to-end network slicing, standalone architecture (SA), and 5G overlay architectures.

In 2018, with China Mobile, ZTE was one of the first telecoms vendors to trial certain functionalities of its common core 5GC including a completed 5G call in China based on three-layer decoupling and standalone architecture.

Most recently, ZTE announced the successful completion of Phase 1 of an SA 5G core test for China Telecom. The test was based on the latest 3GPP protocol framework including service-based architecture (SBA), mobility and session management, PCC and QoS policy control, security management, network slicing, 4G and 5G interoperability, VoNR support, and other service functions, as well as manual and automatic scaling, reliability processing, and other virtualization functions.

5GC: technology advancement

Progress toward 5GC

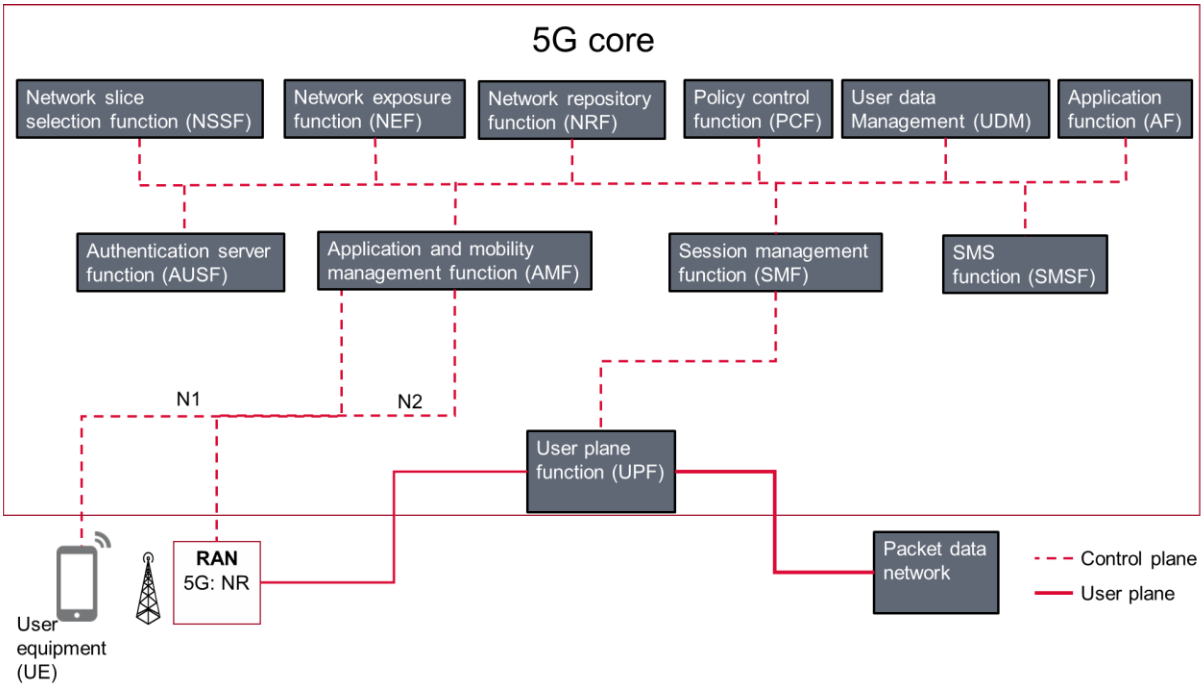
At the heart of network virtualization are software-defined networking (SDN) and network functions virtualization (NFV), which are the technologies driving the shift from legacy hardware infrastructure to software-mediated networking. SDN/NFV will play a pivotal role in getting carriers to 5G, and with commercialization expected after 2020, the 5G network promises to transform the way in which carriers can deliver and monetize services. Through NFV, network functions (NFs) are virtualized and hosted in a cloud environment, blurring the physical boundary between traditional EPC network elements (MME, SGW, and PGW). This requires vendors to integrate key technologies to make 5GC open and flexible enough to support the variety of service requirements in 5G networking.

Key technologies to enable 5GC

Service-based architecture

5G introduces several innovations to support new services. The first is upgrading the legacy mobile core to an SBA 5G core. The new core provides greater capabilities built as elements to provide carriers greater flexibility to allow new use cases. These elements are broken down into network functions that take advantage of virtualization and cloud-ready software. Figure 3 shows the breakdown of the network functions and the split of control plane and user plane. These network functions are flexible to allow carriers to combine them, providing new and unique services for their customers, and also use a 5G core to support legacy 3G or 4G services. These functions can also be upgraded individually, allowing carriers to more quickly apply new software.

Figure 1: 5G core service-based architecture



Source: Ovum

Control and user plane separation

In Release 14 of 3GPP, control and user plane separation (CUPS) was first added to the 4G EPC. CUPS was added to improve latency performance while dealing with bandwidth growth and using software-defined networking tools. CUPs allows user plane functions to be deployed closer to the user to reduce latency but was not required by 4G EPC. By building a 5G core based on the service-based architecture, CUPS comes with the solution. New 5G applications require low-latency support, which requires the user plane functions to be deployed much closer to the RAN. A carrier can deploy a 5G core with control plane network functions in a core data center and data plane network functions at the edge close to the customer. A 5G core can also be used to support 4G LTE deployments with CUPS. Overall, CUPS allows carriers to deliver new low-latency services that were not possible with legacy solutions.

Cloud-native virtual network functions

The 5G core is designed from the start to be cloud native to take advantage of virtualization and cloud computing technology. "Cloud native" describes software built for container-based elastic cloud infrastructure. The power of containers comes from microservices, which are software components that provide for an advanced development framework. By combining software components, new applications can be developed, turbocharging the development process. For a 5G core, these applications provide virtual network functions running on any cloud infrastructure. Carriers can be assured that new services can be created quickly, and the infrastructure can scale to support it.

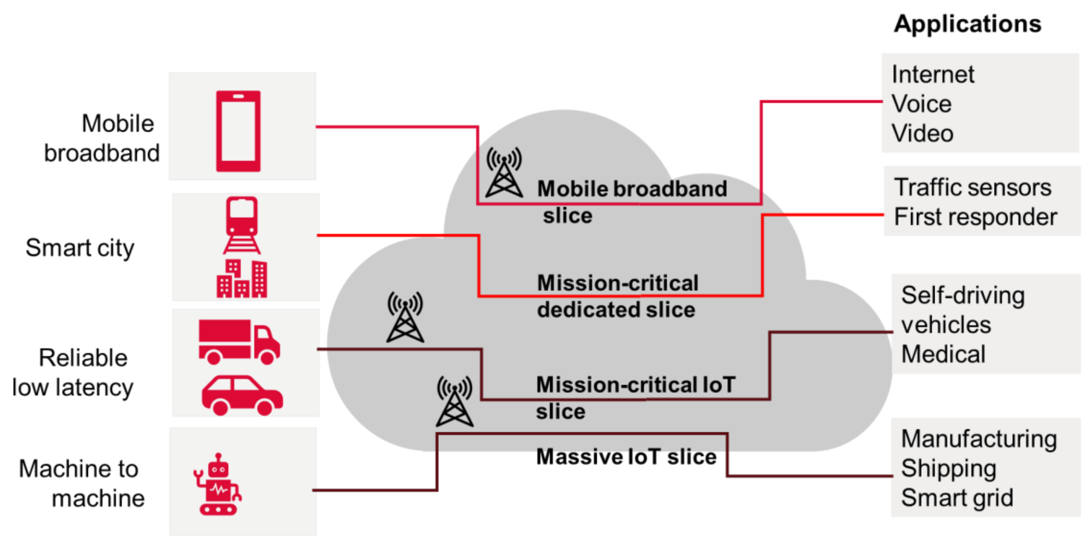
Voice over New Radio

Voice was the initial application for wireless communications. Voice over 5G New Radio (VoNR) and EPS fallback will rely on IMS applications to deliver voice services. However, with network slicing the voice services can be partitioned to assure quality and deliver a more consistent voice performance as well as allowing other applications such as human-to-machine communication to utilize voice.

Network slicing

Network slicing creates a new paradigm for the wireless network where network resources and topology can be partitioned for individual customers or applications. Network slicing is not new but has been greatly expanded in 5G with new slicing features that allow for new service offerings. 4G slicing can be partially implemented by network-sharing technology with limitations, while 5G will allow complete E2E slicing to serve multiple business purposes on a logical network. Figure 4 shows an example of some of the slices a carrier can create from the user equipment through the core. Network slicing will allocate bandwidth, latency and chain NFV, and 5G core network functions to deliver the key functions to tailor high-quality applications.

Figure 2: 5G network slicing

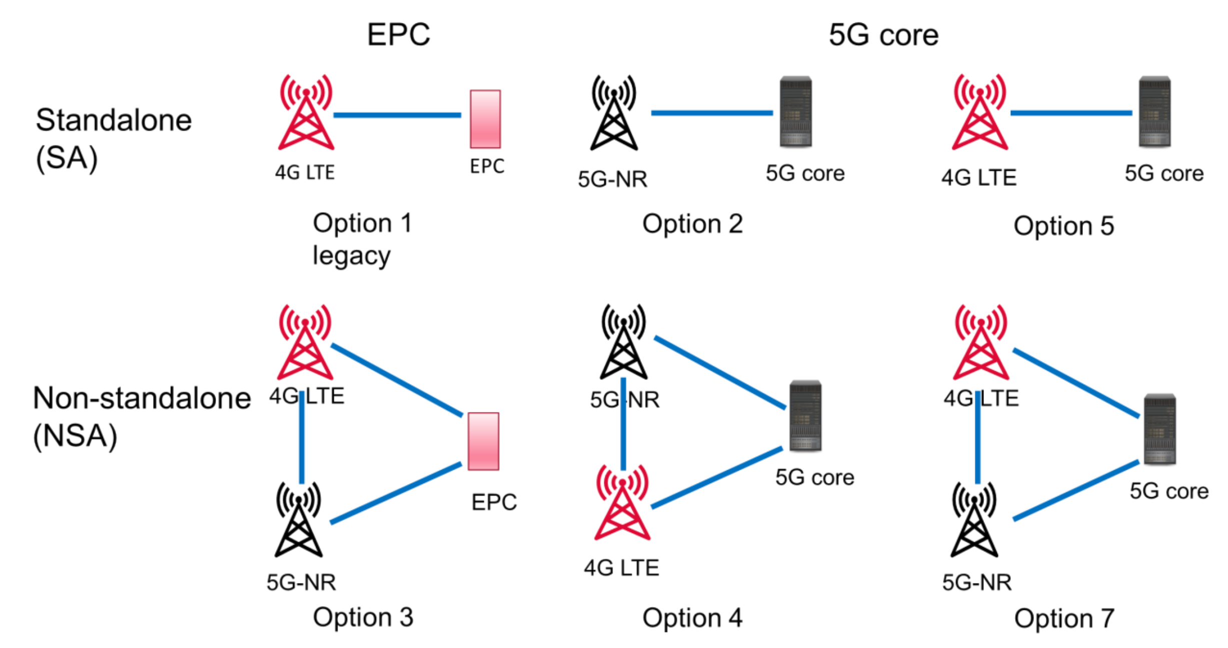


Source: Ovum

Standalone and non-standalone operation

With 5G, the core has multiple operations methods. A 5G core can support 4G LTE and 5G-NR radio-access equipment as shown in Figure 5. Option 2 is the greenfield 5G deployment, where a carrier does not need to worry about migration or is planning to offer new 5G services standalone. Option 3 provides a step using a legacy EPC to support a 5G radio. The other non-standalone (NSA) options provide migration paths from 4G to 5G core. Option 5 provides a path for support of 5G services using 4G radio-access network. These are all new options that were not available in previous generations.

Figure 3: 5G core operation – SA vs. NSA



Source: GSMA

DevOps tools required for successful network slicing

As end-to-end management of the network becomes more essential during 5GC migration, CSPs need to accelerate efforts to move to a DevOps model. This will expand the network architecture knowledge base among employees and help lower the organizational culture barrier inhibiting network transformation ahead of 5G. The vendor that remains agile and can help CSPs move quickly via DevOps tools and processes will be the better-trusted partner for 5GC migration.

In a successful DevOps environment, development processes include defining KPIs and SLAs through slice modeling release, and operational processes will include slice deployment, service activation, and SLA guarantees. Essentially, the DevOps environment should not only speed up new service launching but should also form a closed-loop process for existing services with optimization added. Also, when it is the time to adjust and improve on SLAs of existing services, successful DevOps tools will be triggered to update the slice.

5GC innovation drives new revenue opportunities

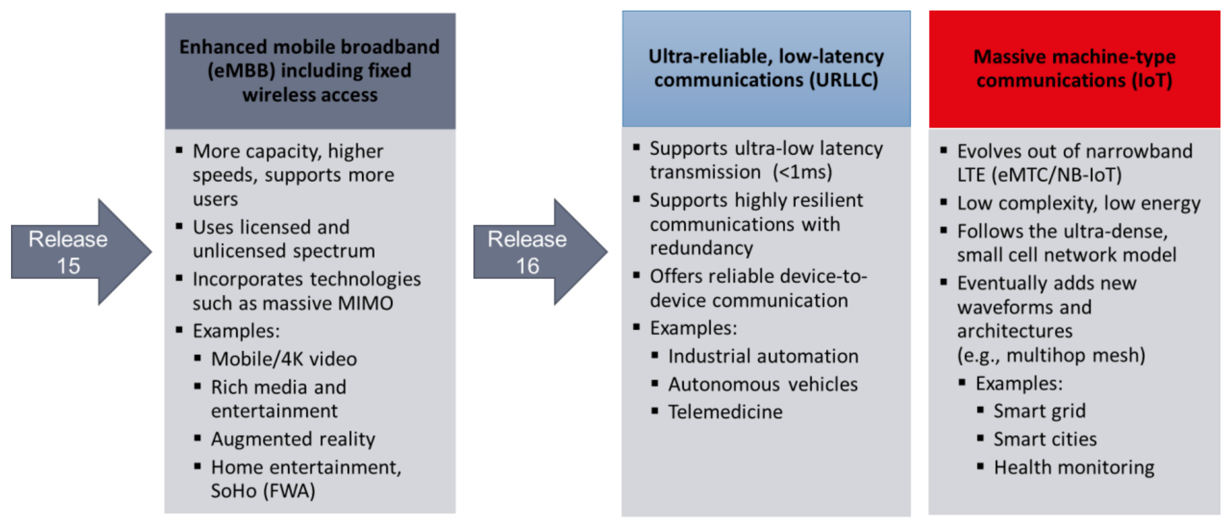
New revenue opportunities through common core

The 5G promise is well known by now. It is programmability, so carriers can support IoT use cases with different latency and reliability requirements; it is the ability to handle the increase in data traffic from connected devices, cloud computing, video streaming, and AR/VR; and it will hopefully lead to new revenue streams from new 4G and 5G services. A flexible and scalable 5G core will be required to enable carriers to deliver enhanced connectivity and IoT services during migration toward 5GC.

Enhanced mobile broadband

The industry is approximately 18 months away from the introduction of 5G in most mature and some emerging markets. Initial 5G use cases will be traditional connectivity-type services, primarily enhanced mobile broadband (eMBB). Enhanced mobile broadband is an extension of carriers' connectivity value proposition and will deliver gigabit speeds and dense broadband to residential and enterprise customers as a viable alternative to fixed line connectivity. To deliver on the promise of eMBB, the mobile core must support the scalability and density requirements of eMBB, and as new architectures evolve, and carriers migrate to 5GC, they will benefit from expanded 5G and IoT services such as ultra-reliable, low-latency communications (uRLLC) and massive machine-type communications (MTC) (see Figure 6).

Figure 4: Major use cases for 5G networking



Source: Ovum

IoT implemented by network slicing

Across mobile phones, wearables, smart homes and cities, and connected cars, IoT is poised to transform how telecoms vendors, carriers, and enterprises connect, collect, and exchange data across 5G networks. Connected IoT devices will generate billions of connections with varying service requirements, ranging from network support for low-bandwidth sensors to high-bandwidth, mission-critical services such as manufacturing IoT and autonomous driving. Network slicing will enable carriers to allocate the most efficient network resources to support high-quality services for enterprise customers.

Smart cities

Smart cities represent a compelling IoT vertical for carriers, since they see the potential to leverage existing infrastructure relationships with cities to expand commercial engagement with them through IoT. Carriers must focus on a connectivity technology strategy that is conducive to broader IoT deployment. An integrated approach of deploying (or at least supporting) multiple LPWA technologies will be imperative. However, 5G will also be a key element of carriers' smart cities strategy.

Low-latency and high-bandwidth applications (e.g., AR/VR)

One of the most anticipated applications for 5G networks will be immersive augmented reality (AR) and virtual reality (VR) experiences in the workplace and in sports, gaming, music, and other entertainment arenas. The issue in the past was that the AR/VR bandwidth and latency requirements necessary for acceptable QoS could not be supported in a traditional, centralized network. However, migration to 5GC will enable carriers to support these stringent parameters, particularly with CUPS support in the common core. As mentioned earlier, CUPS allows user plane functions to be deployed closer to the user to reduce latency, so it will enable carriers to support 5G applications with low-latency and high-bandwidth requirements.

4G and upcoming 5G services

The move from 4G to 5G will be different from previous network generation migrations. 5G will be a full ecosystem of networking technologies, from low-power wireless to enhanced mobile broadband, to support a variety of current and future revenue-generating services. 4G LTE and 5G will coexist for quite some time, and interworking between the two technologies will need to be seamless. Common core convergence can optimize 4G/5G handover and reduce time delay to improve end users' experiences, allowing new 4G and/or 5G services to be developed and to generate new revenue.

ZTE 5G Common Core overview

ZTE Common Core helps carriers migrate to 5G

With the introduction of 5G and the long-term coexistence of 2G/3G/4G, carriers are facing the challenge of diverse network architectures and rising costs. Common core must become carriers' optimal 5G architecture, because it converges all generations of access technologies and facilitates efficient resource usage to reduce cost. It will be critical for carriers to choose a partner that has not only a strong understanding of networking and software but a proven record of successful 5GC deployments for its carrier customers.

With key partners such as Orange, Telefónica, and China Mobile, ZTE has demonstrated its ability to help its customers transform their core architectures in preparation for 5G. ZTE Common Core is one of the first cloud-native 5G cores for 2G/3G/4G/5G/fixed access and has support for NSA and SA deployments. ZTE's Common Core solution is ready for commercialization, with shipping to begin in 1Q19.

Proven cost savings with ZTE's Common Core

ZTE Common Core is a complete, 5G-oriented cloud-native core solution, which can be introduced to build an independent 5G core or upgrade the existing EPC network. One of the main goals carriers' want to achieve with 5GC is cost saving through operational efficiencies and seamless multi-access technology transitions. Table 1 outlines some of the cost-saving benefits ZTE strives to help carriers achieve through convergence and migration choice.

Table 1: Benefits gained through ZTE's Common Core

Cost savings through convergence	Cost savings through choice (NSA or SA)

It is one unified network that can not only work as EPC/EPC+/5GC or any combination of them to support non-standalone or standalone 5G but can also adapt fixed access to the 5GC. Licenses between 2G/3G/4G/5G/fixed can be shared or converted flexibly, resulting in capex savings.	Many carriers are investigating which migration path to take (SA vs. NSA). This it is not only a technical but a cost issue. ZTE takes the view that SA should be deployed at the start of 5G deployments to avoid the cost of rearchitecting the network a second time, which is the case if NSA is deployed first. It is estimated that the entire cost is reduced by 20% if SA is deployed from the beginning.
As all NFs share the same architecture, common resources can be saved. All NFs do not need a dedicated resource. The HW and SW license costs will be reduced.	Supports both SA and NSA to protect carriers' existing investments; it also provides a one-step migration to 5G networks, which will help mitigate rising costs associated with multiple migrations.
Multi-access technology support allows carriers to shorten the time for network deployment and speed up time to market of new services. Through ZTE DevOps Builder, service deployment time is reduced, driving down operation costs.	Both NSA and SA are supported by one common core for different deployment purposes. It is implemented by functioning as EPC/EPC+/5GC or any combination of them. The common core can adaptively adjust resource allocation and forwarding path between NSA and SA.
Total cost of ownership is estimated to be reduced by 20–30%.	Capex and opex are estimated to be reduced by 50%.

Source: Ovum and ZTE

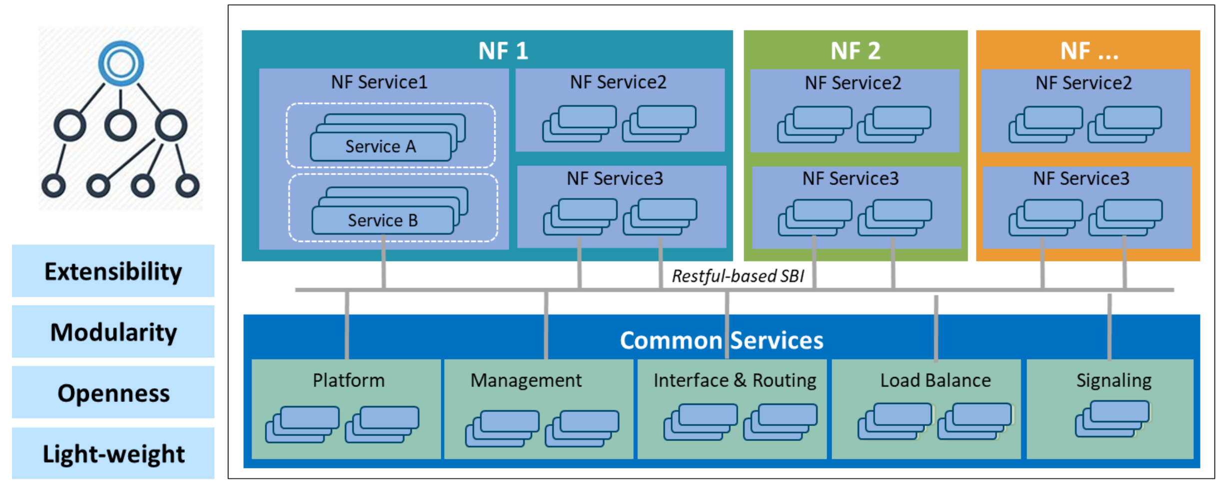
ZTE's service-driven architecture provides value-add services for customers

Another key component of the ZTE Common Core is its service-driven architecture. Thanks to ZTE's multi-access technology support, all services are anchored on the common core to enable a simplified and consistent networking experience as well as network resources optimization. There are several key features around ease of integration and service enablement:

- **Service-based architecture.** ZTE Common Core solution is based on cloud-native and on-demand architecture with service/microservice technologies; this allows the customer to evolve to 3GPP R16 eSBA easily. Also, all network functions are modular in design and can be tailored flexibly to the needs of the customer. The customer can launch new services as quickly as possible.
- **Ease of integration.** The leading 5GC technologies such as SBA, cloud native, CUPS, and UDR/UDSF can be applied to the EPC network. This will extend EPC functionalities and improve EPC network capability significantly.
- **DevOps.** ZTE DevOps Builder provides self-developed tools from ZTE and integrates with third-party tools or open source tools. ZTE also provides a plug-in method to finish integration with those tools. A customer example of the effectiveness of the DevOps builder is that it took five minutes to deploy a cloud VPN service and 30 minutes to deploy vEPC network, with eight VNFs included, to 2 million subscribers.
- **Openness.** ZTE Common Core is compatible with IETF NFV standards and open source communities. The architecture is open enough to be integrated easily with third-party components. Third-party vendor common COTS hardware based on x86 can be used with ZTE Common Core, for example, HP, Dell, Cisco, etc.
- **Intelligent and automatic orchestration and O&M.** When integrating with DevOps and big data, the time for network deployment and integration can be reduced to the minute level. The O&M cost will be reduced.
- **Value-add for customer.** Convergent core-as-a-service can be achieved by combining multi-access technology support with SBA, cloud native, network slicing, and openness to deliver microservices for building and extending EPC and 5GC-enabled cloud applications. Such

value-add services and microservices can be delivered to customers or partners to deploy various networks on demand.

Figure 5: ZTE's hierarchical service-based architecture and platform



Source: ZTE

Summary of ZTE Common Core features

Table 2: ZTE Common Core feature set and technical innovations

Key technical features	Other technical innovations
Network slicing	Convergence for 2G/3G/4G/5G/fixed network
CUPS	Functioning as EPC/EPC+/5GC
Stateless design	Support for SA and NSA
DevOps	Ready for commercial deployment
Service assurance	
SBA/eSBA	
3GPP R15/R16 standards based	
Networking backward compatibility	

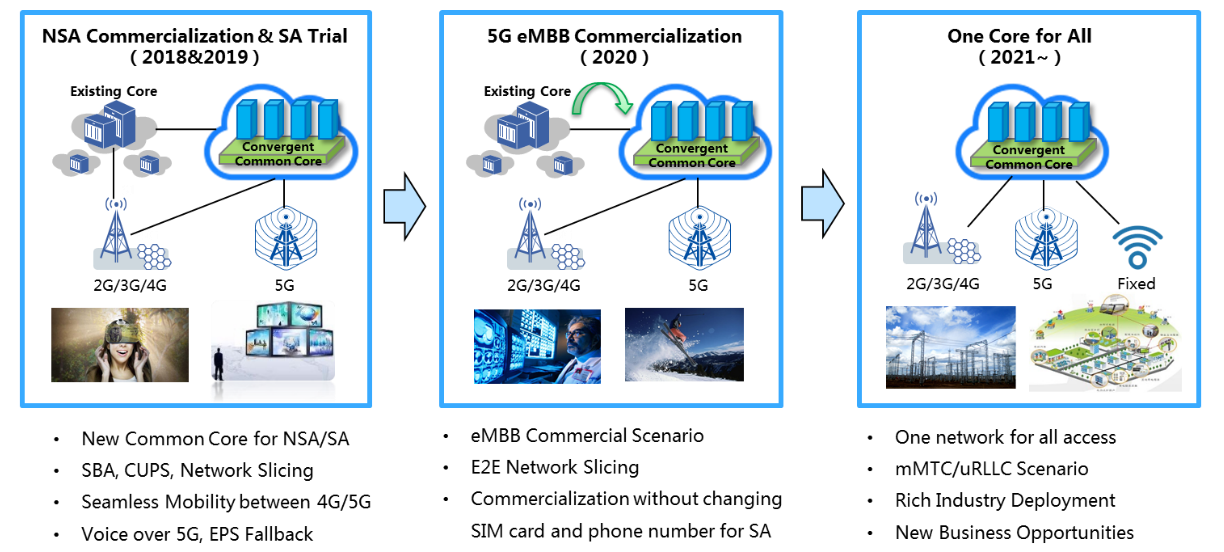
Source: Ovum

ZTE's recommendation for a seamless evolution to 5GC

With Common Core solution, ZTE believes it can help carriers migrate to the 5G network in three phases. In the first phase, which will occur throughout 2019, ZTE's Common Core will launch so carriers can carry out NSA commercialization and 5G trials. Concurrently, vEPC in the converged core can be used to expand existing EPC and protect past carrier investments.

In the second phase, which will occur throughout 2020, 5GC commercialization will expand along with increased eMBB deployments. There will be stronger demand for 4G/5G interworking as 5G commercial deployments increase but 4G services are still relevant. Finally, in the final phase (2021 and beyond), slice-based O&M management will be leveraged to provide multisystem end-to-end network slicing, meeting the needs of different service scenarios such as eMBB, mMTC, and uRLLC. See Figure 8.

Figure 6: ZTE Common Core evolution



Source: ZTE

Conclusions

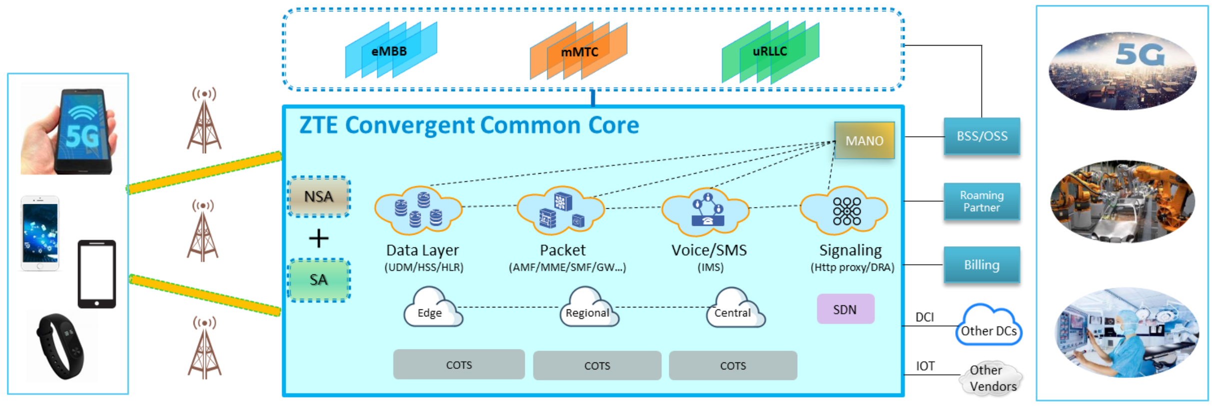
Recommendations for carriers

In the evolution to 5GC, carriers need to turn to trusted partners that can provide operators with guidance in moving from 4G LTE to 5G. This guidance needs to cover how to develop 5G use cases, communicate realistic 5GC migration timelines, and create technology roadmaps for both 4G and 5G services. Above all, operators need partners that have a deep understanding of their network assets and service strategies and are able to map them to new, cloud-native 5GC architectures.

ZTE's position

Ovum considers ZTE to be one of the leading 5GC core vendors today. Commercially ready, and with recent successful SA trials with China Mobile, China Telecom, Orange, Telefónica, etc., ZTE's Common Core integrates all the necessary components required to help carriers migrate seamlessly to 5GC while being able to benefit from what will be the first true opportunities in 5G networking, i.e., eMBB.

Figure 7: ZTE's E2E 5GC landscape for 2020 commercial deployment



Operation & Slicing	NSA/SA Selection	Service Deployment	Infrastructure	IOT
Core network slicing first, then E2E slicing	NSA or SA or both	eMBB prior to mMTC/uRLLC	SW/HW decoupling for rapid deployment	Focus on major IOT interfaces

Source: ZTE

Appendix

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Ovum Consulting

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