WHITEPAPER

Cloud-native VoLTE: an enabler for flexible network evolution

Published by

MOBILE WORLD LIVE

In partnership with

JSC INGENIUM

Mobile networks are in a state of transition. While many communication service providers (CSPs) are rolling out 5G, utilisation of 2G and 3G is declining: usage is shifting to 4G as subscribers progressively upgrade to compatible handsets. As the world becomes increasingly digital, CSPs seek new ways to stay relevant, innovate, and gain a competitive advantage. Despite the ever-increasing availability of high-speed internet and over-the-top messaging services, Voice over LTE (VoLTE) has emerged as an efficient and effective way of delivering voice on next generation networks while improving quality for end users. Deployment of VoLTE can also be a catalyst for CSPs' digital transformation ambitions and their growing desire to transition to cloud-native infrastructure.

Voice is still vital

Although 4G and 5G were primarily developed to meet burgeoning demand for mobile broadband in the internet age, voice remains important: it's the foundational and most intuitive of telecom services. Roaming remains a highly valued, and valuable, service for users and CSPs alike. Most CSPs still have licence obligations to carry voice calls to the emergency services.

The importance of quality voice services was highlighted during the COVID-19 pandemic: connecting with others remains essential to successful collaboration in business and to personal well-being. Noting a substantial increase in voice traffic during the lockdowns, the Cellular Technology Industry Association (CTIA) reported a 24.3% surge in U.S. voice traffic during the pandemic. The trend continued through 2020 and into 2021.

CTIA also estimates that 192 million – approximately 80% - of the 240 million 911 calls made in the United States each year originate from mobiles. Adequate network coverage, reliability, and call quality are vital for these often life-saving calls.

OTT services such as WhatsApp, Skype or Facetime are incapable of satisfying universal service obligations: both calling parties must have the same application installed; the services depend on third parties; quality is not guaranteed and emergency calls are not supported.

VoLTE

2G remained the primary bearer for voice traffic throughout the 3G and early 4G eras. Voice over LTE, based on the IP Multimedia Subsystem (IMS) architecture, was developed to support voice calls natively across 4G networks.

Early in the roll-out of 4G, limited smartphone support for VoLTE held-back its adoption. Now, most 4G smartphones support VoLTE and the functionality has spread to other devices including wearables, and to diverse uses cases in the consumer goods, public services, industry, security and infrastructure sectors.

While voice services do not necessarily drive customer acquisition or increase monthly average revenue per user, they remain an essential network service for CSPs: there is a real risk that subpar services could drive customers away. There are, therefore, valuable efficiency and quality benefits from investing in VoLTE infrastructure. Not least, compared with legacy technologies, VoLTE uses finite radio resources and energy much more efficiently, improving network economics.

VoLTE also offers a higher voice quality than previous circuit-switched bearers. The combination of VoLTE's ability to carry voice in a wider range of frequencies and the Enhanced Voice Services (EVS) codec extends coverage: customers experience a noticeably higher quality of voice service, even in environments suffering from interference, over a wider area. As well as High Definition (HD) voice calls, VoLTE also offers faster call set-up and improved battery life for end-users.

Dropped call rates are also better than OTT services which usually run on shared cloud infrastructures that can be under-provisioned relative to demand, or located in a distant country affecting QoS and latency.

The relaxation of pandemic travel restrictions has led to the return of roamers. As CSPs decommission

their legacy 2G/3G networks, those without VoLTE and VoLTE roaming agreements will be subject to reputational risk if they are unable to offer their customers a native voice roaming service or provide in-bound travellers with access to emergency calls should the need arise. With no circuit-switched voice to fall back on, VoLTE is becoming more than a 'nice to have' and VoLTE roaming needs to become widespread before legacy CS networks are decommissioned. An October 2022 GSMA Intelligence report estimated only 46% of global mobile connections would be able to access VoLTE at the end of that year. The report also anticipated significant regional differences, with North America, Europe and Asia Pacific enjoying VoLTE penetration of 60% or more while Latin America, MENA, CIS and Sub Saharan Africa would be well below the global average.

The cloud and containers

Many sectors of the economy are taking advantage of the cloud to access Software-as-a-Service (SaaS) – from basic office productivity applications to applications that perform sector-specific processes that would previously have been handled by dedicated, and often expensive, hardware. When they started replacing elements of their physical infrastructure elements with virtualised network functions (VNFs) CSPs were following a similar thought process. Now there is growing interest in moving more network functions to the cloud.

Cloud native network functions (CNFs) are software applications that implement or facilitate network functionality and have been designed to run in a cloud environment. CNFs typically consist of one or more microservices deployed in containers.

Containers are a way to package software and are an alternative to the virtual machines on which early virtualised network functions ran. Adoption of an open source management platform such as Kubernetes allows containers to be used across different cloud environments. Containerisation also allows multiple applications to run simultaneously on the same server, realising cost and performance benefits. Adoption of a Kubernetes conformance program enables CSPs to take advantage of the variety of conformant CNFs available from different vendors.

However, CSPs need to decide which cloud option to adopt for their CNFs: bare metal, public or private/telco cloud. A move to the cloud will have technology, business and organizational impacts. Choices will inevitably be shaped by a CSP's overall strategic goals, their desired speed of transformation, available capital and human resources, and ability to access new skills.

Adopting the bare metal approach involves up-front expenditure in physical infrastructure for each virtualised network function. As the technologies are mature and reasonably familiar to existing staff, internal cultural is less disrupted but the scope to transform IT and network capabilities will be constrained in the future. Dependence on manual hardware set-up and provisioning limits agility and, potentially, longer-term improvements to competitiveness.

Working with a hyperscale public cloud demands significant cultural change and reskilling but scores highly in transforming IT and network capabilities and equipping the CSP to compete more effectively and improve time to market for new services. While

Pros and cons of different cloud deployment strategies:

	Criteria	CNF Over Bare Metal	CNF Over Public Cloud (Hyperscalers)	CNF in Telco Cloud
Technology	Transform IT Capabilities	●●○○○	●●●●●	●●●○○
	Transformation Network Capabilities	●●○○○	●●●●○	●●●●○
	Technical Risks	●●●○○	●●●○○	●●●●○
Business	Capital Expenditure (CAPEX)	●○○○○	●●●●●	●●●○○
	Operating Expenditure (OPEX)	●●●○○	●●●●○	●●●○○
	Time to Market	●●○○○	●●●●●	●●●●○
	Business Risks	●●○○○	●●○○○	●●●●○
	Business Model Complexity	●●●●○	●●●○○	●●●●○
	Future Competition	●●○○○	●●●●○	●●●●●
	Future Maturity	●●●●●	●●●●●	●●●●○
Operator	Ease of Use	●●●●○	●●●○○	●●●○○
	Cultural Aspect	●●●●●	●●○○○	●●●○○
	Skills	●●●●●	●●●○○	●●○○○

● positive, ● neutral, ● negative, more bullets – bigger the impact.

up-front CAPEX can be significantly reduced, predicting OPEX can become difficult. However, the lack of interoperability between competing hyperscalers does create a risk of vendor lock-in.

A private or telco cloud is a cloud purpose-built and maintained by the CSP. Up-front CAPEX is higher than for a hyperscaler but can be lower than the bare metal option.

Embracing a new culture, skills and working practices are prerequisites but the CSP gains complete control over their network, their ability to compete and time to market for new services. OPEX is more predictable and business models are simpler without the involvement of a hyperscaler.

Embracing cloud computing design and architectural concepts empowers CSPs to take full advantage of cloud capabilities. The use of microservices enables the adoption of a continuous integration, continuous testing, and continuous delivery (CI/CT/CD) approach to software development. Building, testing, and deploying microservices independently allows for faster development cycles, shortens time to market and reduces the risk and impact of human error.

A cloud-native infrastructure opens the way to enhanced automation and service orchestration: manual procedures can be replaced by automated zero-touch deployments. It can also provide a platform for the creation of partner ecosystems which can stimulate further product innovation.

As illustrated in the table on page 5, cloud adoption has technical, business and organisational implications. On the technical front, each CNF microservice can be scaled independently to respond to fluctuations in demand, enhancing system performance and efficiency of resource use. The failure of a single CNF component doesn't bring down the whole system: compartmentalization improves the robustness and availability of each application.

CNFs improve business as well as technical agility by enabling CSPs to respond more quickly to changing market needs. Rapid prototyping, testing, and deployment allow CSPs to experiment and react swiftly to changing customer demands or market trends. The independent scalability of CNFs mean that the response to traffic load variations can be adjusted depending on the commercial or cost impact of different relevant solutions.

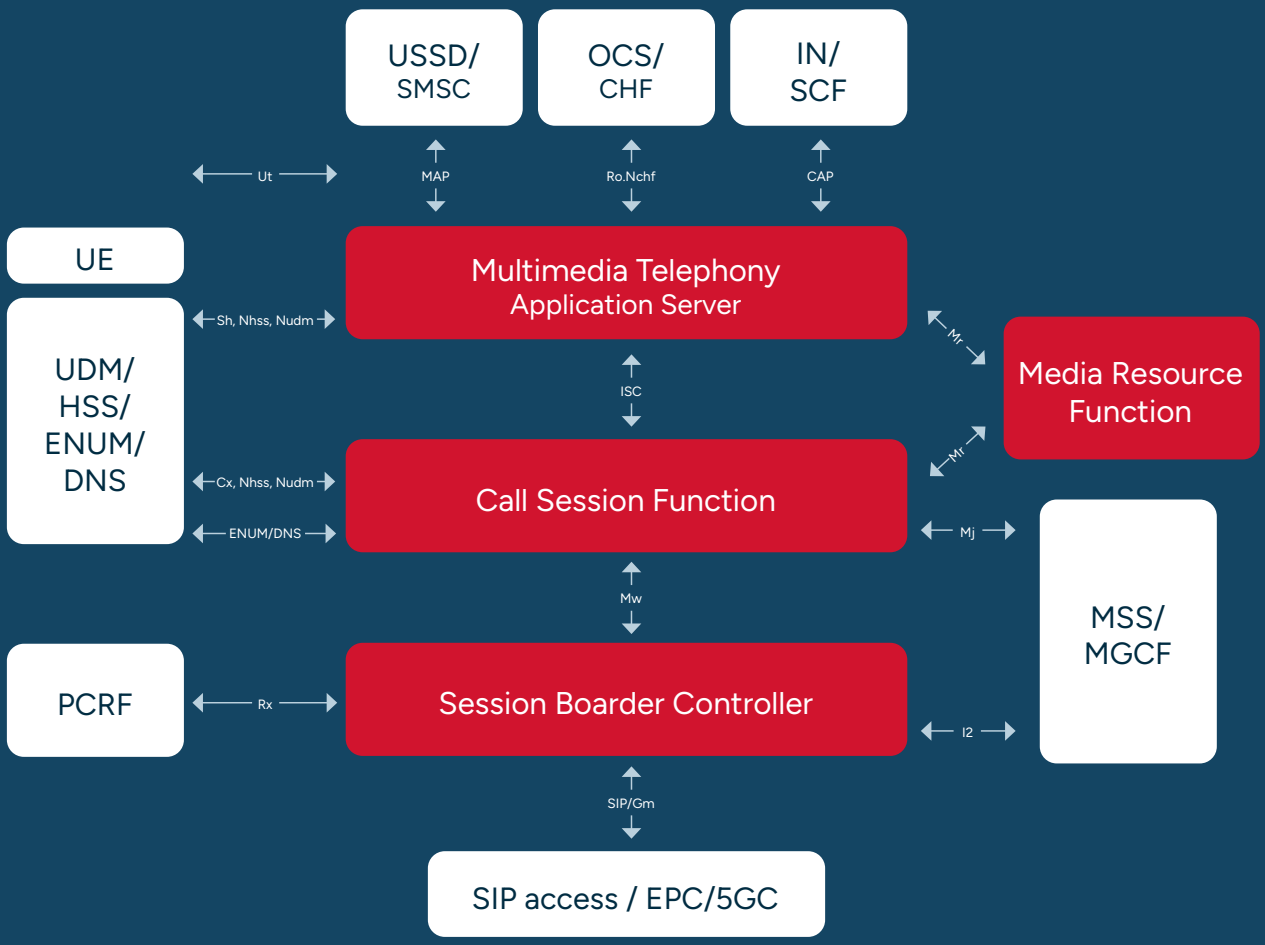
IMS

IMS is the go-to architecture for delivering varied high-quality digital services. As the foundation for 4G VoLTE, HD Voice capabilities, and 5G VoNR, IMS makes it easier for CSPs to continuously update and enhance their offerings with new, innovative customer experiences.

Deploying a cloud-native IMS can drive momentum for VoLTE services. VoLTE can be integrated as an incremental component in a cloud network migration. This approach allows CSPs to scale their capacity more efficiently and benefit from "pay per use" pricing models.

While IMS is well suited to cloud deployments, making IMS services truly "cloud-native" is key to maximising the benefits of enhanced flexibility, agility, scalability and speed of product development. Additionally, a cloud-native IMS can enhance service orchestration and facilitate the creation of partner ecosystems which can further promote product innovation. Cloud-native solutions can replace manual with automated procedures to enable automated zero-touch deployment.

Cloud-native IMS architecture



A cloud-native IMS network function can provide rich real-time communication services over any access network for any device type. The key elements are:

- The Multimedia Telephony Application Server: hosts applications to deliver rich voice and supplementary services for fixed and mobile networks
  - MMTEL AS, SCC-AS, Anchor AS, IM-SSF, IP-SM-GW, Conference AS, XCAP Server
- Call Session Control Function: manages signaling from the end user to services and other networks as a core part of IMS
  - I-CSCF, S-CSCF, BGCF
- Session Border Controller: ensures media and signaling interoperability of the IMS solution and its security
  - A-SBC, I-SBC, ATCF/ATGW, P-CSCF, E-CSCF
- Media Resource Function: offers media services, announcements, tones and conferences for any access network

A well designed cloud native IMS gives CSPs the ability to save on costs and manage OPEX while improving network, IT, and operational efficiencies

High costs combined with complex and non-transparent licencing models have restricted access to IMS for smaller CSPs and MVNOs: incumbent vendors have generally been focused on serving Tier-1 CSPs. Virtualised or cloud deployment options have also been limited. This is now changing.

Cloud agnostic use cases

By adopting the open-source Cloud Native Computing Foundation (CNCF) software foundation, JSC Ingenium has eliminated dependency between its VoLTE application and the underlying cloud platform: The solution has been designed to be cloud agnostic and to prevent lock-in to any one cloud environment. This approach also allows CSPs to work with their own preferred operational environment. The JSC Ingenium solution has been successfully deployed by CSPs on their own bare metal, on a hyperscale public cloud and on a telco cloud.

The use of Kubernetes allows the VoLTE IMS solution to scale from a system capable of supporting as few as 30 calls a second – which can be run on a PC - up to millions of busy-hour calls.

A robust versioning system enables Continuous Integration/Continuous Deployment (Ci/CD) and facilitates automation. It also builds reliability and consistency across different environments, promotes collaboration between the vendor and CSP and improves speed and efficiency of delivery.

The versatility and flexibility of JSC Ingenium's VoLTE solution is illustrated by three distinct use cases.

Mexican shared-network wholesale deployment

Altán Redes won a government tender to improve mobile phone penetration and network coverage across the extensive territory of Mexico and has been building an open-access wholesale 700 MHz 4G network branded Red Compartida. Services are marketed to consumers by partner MNOs, MVNOs and CSPs that retail domestic mobile phone and fixed internet services. Altán Redes has deployed VoLTE on bare metal to carry and guarantee calls across the new agnostic 4G network. The solution also supports the termination of voice calls on the 3G networks of partner MNOs.

European multi-national public cloud deployment

A public cloud deployment allows one operator group to deliver fully automated 4G voice services across its footprint which spans multiple European countries. The flexibility of the solution ensures that, even when deployed on a single hyperscaler, the service continues to satisfy the relevant requirements in each of the regulatory jurisdictions served.

European Tier1 telco cloud deployment

In a proof of concept, a European Tier1 CSP has successfully deployed the JSC Ingenium VoLTE solution in its Container as a Service (CaaS) running on its own private telco cloud. The independence of the microservices contributes to high availability and agile development practices and enabled rapid adaptation to changing business needs. An automated deployment, configuration and update process was successfully demonstrated on the CaaS platform and updates or upgrades to individual containers were shown not to disrupt the VoLTE service, maintaining system reliability. Outside busy hours, resources can be off-loaded to minimise operational costs. All the artifacts necessary for the cloud-native function were housed within the customer's own repository giving them complete control. A fully cloud-native VoNR solution has now been implemented to complement VoLTE.

Strategic flexibility

The deployment of VoLTE can play a catalytic role in helping CSPs fully migrate to IP and take advantage of the flexibility offered by cloud-native functions. The adoption of cloud-native IMS and VoLTE equips a CSP to better manage the sunsetting of 2G and 3G while ensuring they are prepared to offer a full suite of services to existing 4G and future 5G customers.

The momentum behind the sunsetting of legacy 2G & 3G networks is building globally. A GSA report from October 2022 noted that 142 CSPs were actively planning or progressing sunsets. Of these, 51 had already completed the decommissioning of a 2G or 3G network as they consolidated on 4G and/or 5G. GSA forecasts that sunsetting will reach a peak in 2025.

The greater spectral efficiency of the two most recent mobile technology generations, and the ability to re-farm 900 MHz and 1800 MHz 2G spectrum or 2100 MHz 3G spectrum to extend the coverage of 4G or 5G, are just two motivations which promise a positive impact on long term business efficiency. Eliminating legacy technologies also reduces network complexity and decreases maintenance costs to deliver further operational efficiencies and help to meet sustainability targets by reducing power consumption.

Pay-per-use models available with cloud-native VoLTE gives CSPs the flexibility to continue to support voice services cost-effectively as circuit switched 2G/3G legacy bearers are progressively withdrawn.

Managing the transition strategically is crucial to maintaining essential voice services and realising the benefits as early as possible. Savings can be reinvested to empower efficiency gains and innovation within next-generation networks.

CSPs with ambitious 5G plans but limited VoLTE footprint are putting their voice service quality at risk. With no provision for circuit-switched fallback (CSFB) in 3GPP's 5G standards, VoLTE is the only fall-back voice solution for initial 5G Non-Stand Alone deployments. In the early phase of 5G roll-outs, built mostly on mid-band spectrum, coverage is not yet universal: making VoLTE available across the more mature and contiguous 4G coverage maintains accessibility to voice services.

Voice over New Radio (VoNR) is the new IMS network function developed within 3GPP for 5G Stand Alone. However, the 5G core which underpins Stand Alone has been specified as a cloud-native architecture. As in the early days of VoLTE, device support for VoNR is unlikely to develop as quickly as networks are rolled-out: this reinforces the need for VoLTE as a fall-back solution for some time to come.

Conclusion

The cloud-native 5G core is on the critical path to many of the revenue enhancing new services - such as network slicing and edge computing - that have been presented as important benefits of 5G. For CSPs, understanding the cloud, cloud-native functions and the principles of microservices is paramount to their ability to seize these new opportunities. They need to embrace the cultural changes required to become more software focussed, cloud-centric organisations and build-up new IT and software skills. This is proving to be a more time-consuming and difficult transition than many anticipated.

For any CSP needing to sunset 2G or 3G, cloud-native IMS and VoLTE network functions provide a cost-effective and practical first step in their transition to a more agile cloud-based business while ensuring they can continue to offer the foundational voice and messaging telecommunications services.

JSC Ingenium is a telecommunications engineering company specializing in core network technologies for mobile CSPs – MNOs and MVNOs. It offers a full range of 3G and 4G core network infrastructure, and a suite of NGN service enablers for smooth coexistence and phased migration from 3G to 4G and 5G technologies. JSC Ingenium also includes BSS solutions in its range in order to offer its customers comprehensive turnkey solutions.

JSC Ingenium's Cloud-native IMS Solution is created using cloud computing design and architectural concepts to fully leverage cloud capabilities on public, private, or hybrid clouds. The single containerised deployment serves new and legacy technologies allowing step-by-step migration through scalable and elastic on-demand capabilities that are microservice-based, scriptable, and decoupled.

Amid the Rapid Growth of 5G and FTTX, JSC Ingenium's Cloud Native IMS helps CSPs build a converged and unified network that provides centralized session control and a multimedia service offering to fully support various types of access methods.

Find out more at https://jscingenium.com/en/

Mobile World Live is the premier destination for news, insight and intelligence for the global mobile industry. Armed with a dedicated team of experienced reporters from around the world, we are the industry's most trusted media outlet for breaking news, special features, investigative reporting, and expert analysis of today's biggest stories.

We are firmly committed to delivering accurate, quality journalism to our readers through news articles, video broadcasts, live and digital events, and more. Our engaged audience of mobile, tech and telecom professionals, including C-suite executives, business decision makers and influencers depend on the unrivalled content and analysis Mobile World Live provides to make informed business decisions every day.

Since 2016, Mobile World Live has also had a team of in-house media and marketing experts who work directly with our brand partners to produce bespoke content and deliver it to our audience in strategic yet innovative ways. Our portfolio of custom work - including whitepapers, webinars, live studio interviews, case studies, industry surveys and more – leverage the same level of industry knowledge and perspective that propels our newsroom.

Mobile World Live is published by, but editorially independent from, the GSMA, producing Show Daily publications for all GSMA events and Mobile World Live TV – the award-winning broadcast service of Mobile World Congress and home to GSMA event keynote presentations.

Find out more at www.mobileworldlive.com