White Paper

New Technology. New possibilities.

THE FUTURE OF VOICE AND REAL-TIME SERVICES IN MOBILE NETWORKS

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EXECUTIVE SUMMARY

The MNOs and OTT providers are struggling to find services that will attract the end users' attention. MNOs need new tools in order to stay competitive, and one such tool is IMS. IMS provides a standardised framework for service delivery of realtime applications with guaranteed QoS.

The booming mobile data expansion is supported by the Evolved Packet System, introducing the spectralefficient LTE radio interface and the all IP-based EPC core network. The EPS has no connection of its own to the voice domain, but interaction can be handled, for example, through IMS.

Combining IMS and LTE in VoLTE gives new possibilities for services and allows the MNOs to optimise their networks. Interworking with legacy systems is offered through SRVCC.

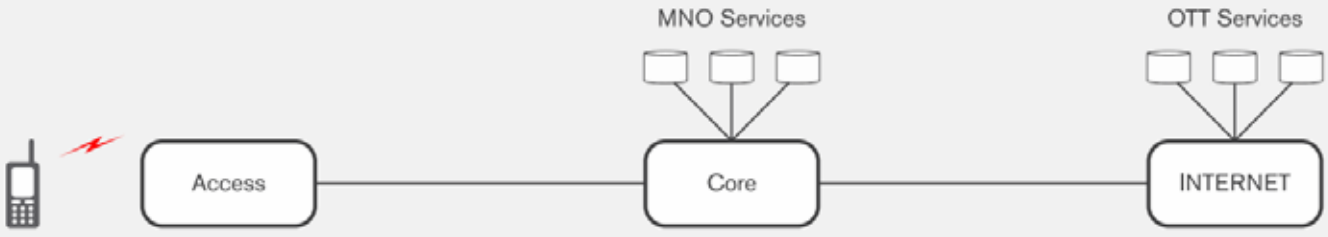
At the end of the day, it will be the end consumer who decides which architecture will be the architecture of the future. However, in order to optimise your network—you need to measure.

NEW TECHNOLOGY. NEW POSSIBILITIES.

Mobile networks and the services those networks provide are evolving. Not long ago, the only reason for subscribers to have a mobile subscription was to get access to the wireless voice service. Then the messaging service boomed, and lately Internet access from the mobile device has become a basic requirement from subscribers for whom it is obvious to be connected anywhere and anytime.

When mobile subscribers access the Internet, they also get access to a multitude of services. Some of these services compete with the cash cows of the mobile network operator (MNO). Both text and voice are now becoming commodity services that can be delivered "over the top" (OTT), and MNOs can already see a decline in revenue from voice and SMS services, as OTT providers and handset manufacturers offer similar services using plain Internet access.

SERVICE PROVIDED BY MNO OR OTT



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The MNOs used to deliver all services, but now the OTTs get more and more of the share. In an extreme scenario, the OTT delivers all services, and the MNO is only a bit-pipe provider. Perhaps this “under the floor” (UTF) approach will become more and more popular with MNOs in the future. Even if the margins will decline, when moving lower down in the valuechain, operators can focus on their area of expertise. The growth will be there, and they will not have to worry about the current trends of the opportunistic end users.

Different MNOs have different approaches to how to handle the interaction with OTT applications. Some operators try to limit the OTT services by blocking them in their networks, some join forces with the OTT providers, while others try to handle the problem by adjusting their data plan offerings.

As the end-user value of vanilla voice and messaging services declines, there is a need for the struggling MNOs to find new ways to attract interest from the end users. The MNOs already have a lot of building blocks to build interesting services. Not only do they have a strong billing relation to the end users, they also know their geographical position, their current state, and what devices they are currently using. As they own the infrastructure, they can allocate the appropriate Quality of Service (QoS) for all services in their network. Also, the “Big Data” that ends up on the Internet passes to a great extent through the MNO networks, and can be measured. All this information can be used to create highly customised services. One platform to deliver these services is the IP Multimedia Subsystem (IMS).

IMS

Internet applications for real-time applications often use proprietary protocols. This is convenient when developing the application, but it limits the usage to users that have compatible devices in both ends. However, the IETF has specified a protocol for realtime, peer-to-peer communication called the Session Initiation Protocol (SIP). It allows SIP devices registered at different domains to establish multimedia sessions with each other, much in the same way as the HTTP protocol allows global interconnection for web browsing.

The SIP protocol leaves many options for implementations. The IP Multimedia Subsystem (IMS) uses the SIP protocol, but narrows down the choices to suit the mobile environment. IMS allows subscribers to access the same services wherever they go, and it allows QoS control of real-time multimedia sessions. It also allows the operator to keep control of the network resources and to handle user subscriptions.

IMS has been around for over 10 years, and it is present in well over 100 commercial installations, but has never really taken off. Even if the IMS architecture seems compelling as a future architecture, the short-term benefits for introducing a full-blown IMS network in a mobile network has not been large enough. However, the LTE/EPC networks are constructed to fit the IMS architecture.

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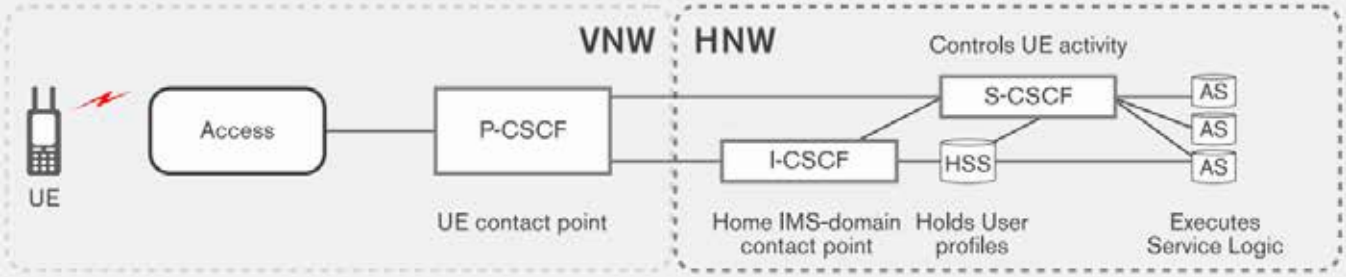
IMS ARCHITECTURE



IMS offers the MNO some nice things. It offers admission control and session management in order to guarantee the end-to-end QoS for real-time multimedia services. It can also help by allocating existing resources in the most optimal way, for example by giving sensitive real-time traffic higher priority than best-effort services.

Note that web browsing and other Internet activities are not “real-time multimedia services”. Internet access takes place outside the IMS system. IMS can be seen as just another tool for the MNO that handles real-time services in a QoS-assured way. In EPS terms, the IMS is just a PDN (Packet Data Network), in the same way that the Internet is just another PDN.

However, IMS gives you more. It allows the MNO to tie services tighter to the subscriptions. It offers a way to always execute services in the home network. Correctly configured, it also offers the MNO a way to orchestrate services for specific users in an individual way. IMS interacts with the operator’s core network, and can deliver a multitude of services to the subscribers. Since IMS has access to, for example, location and device information, the services offered can be tailored for a specific user in a specific situation. As resources can also be allocated with a guarantee, the user experience of the service can also be assured.

IMS is a service platform, enabling services over any IP-based access. It can provide services for example via the traditional ISP network, the cable network, or the mobile network.

LTE

The data traffic volume in the mobile networks almost doubles each year, and very high demands are put on the networks of the future. In order to meet the near to exponential growth in mobile user data, the Evolved Packet System (EPS) was introduced by 3GPP. EPS consists of the Evolved Packet Core (EPC) and the Evolved UTRAN (E-UTRAN) or, more popular, the “Long Term Evolution” (LTE).

With the LTE radio interface, based on Orthogonal Frequency Division Multiple Access (OFDMA), the mobile networks increase their spectral efficiency, allowing for more information to be sent per Hertz available bandwidth. The data transmission and retransmission is also more efficient, minimising the number of bits

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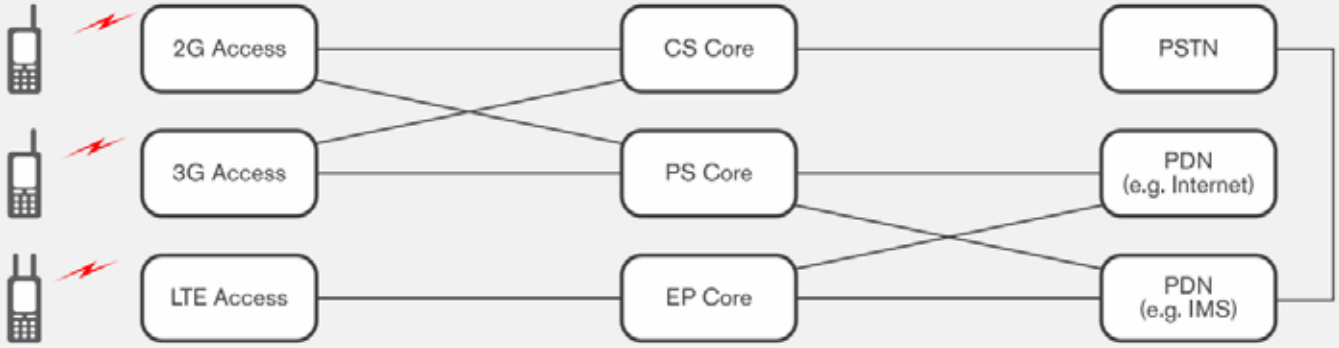
sent over the radio interface. Furthermore, LTE-radio utilises more frequency bands than UMTS, and different bands can be combined. LTE also allows for more dense networks, for example by using beam forming, home eNBs and heterogeneous networks (HetNet). In the evolution path of the (already evolved) LTE networks, the spectral efficiency gets even higher, and the networks even denser, aiming to meet the bandwidth-hungry (video) applications of the future.

3GPP ACCESS NETWORK EVOLUTION



One deliberate limitation of the EPS is that there is no direct connection to any circuitswitched network. The EPS is nothing but a highly efficient access network to Packet Data Networks (PDN), where one PDN can be the Internet, while another can be the IMS. The user can simultaneously connect to a wide range of different networks, with bearers of different Quality of Service, using different IP addresses in each PDN.

EPS NETWORK

If you are attached to the EPS, you will automatically get an IP address from your PDN. In each PDN connection, you will have exactly one so-called Default Bearer. If you want to establish real-time bearers, this requires the establishment of Dedicated Bearers, all with guaranteed QoS.

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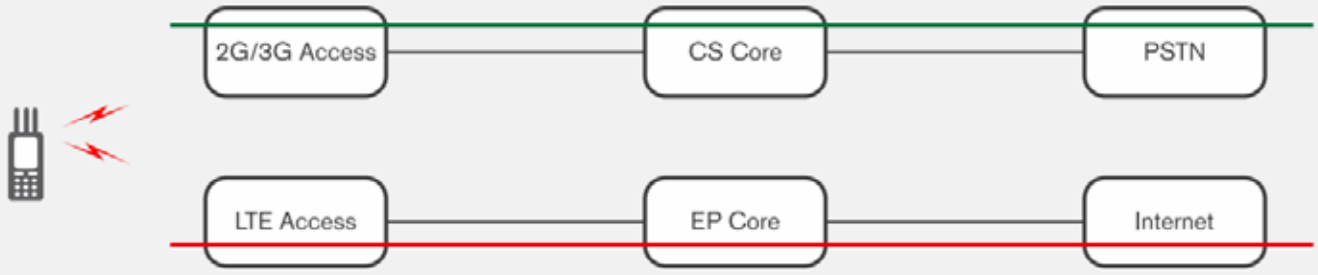
LTE AND VOICE INTERWORKING

In a legacy 3GPP environment, LTE networks are rolled out to off-load the jammed 3G networks. LTE coverage will start as “islands in an ocean of UMTS”. Over time, the 2G networks will close down, in benefit of LTE access. Also, more and more frequencies from the 3G access network will be reallocated to the more spectral-efficient LTE network.

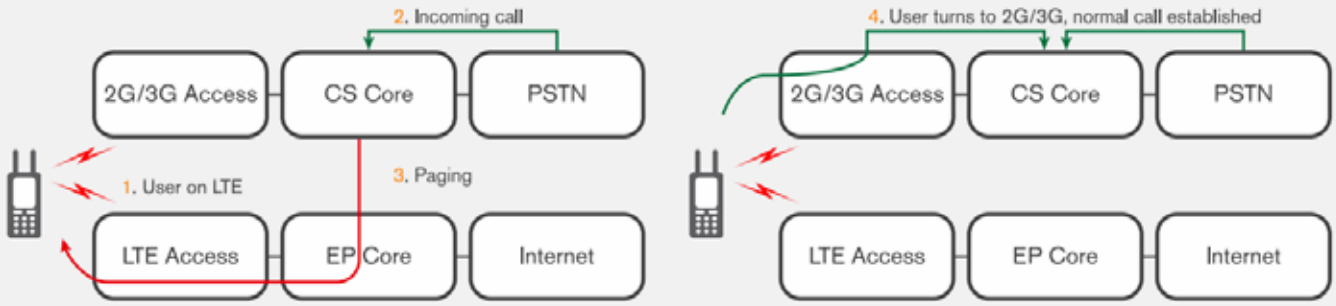
In networks with no 3GPP heritage, no interworking has been implemented, and the LTE operators instead aim for full LTE coverage as soon as possible. In the early deployments in North America, voice is handled by Simultaneous Voice and LTE (SVLTE), that is, by having an additional CDMA antenna in the LTE device.

SVLTE ARCHITECTURE



In LTE networks with 3GPP inheritance, we now see interworking for the voice service handled by the Circuit Switched Fall Back (CSFB) service, allowing users to be paged in the LTE network and made to revert to the legacy system to complete the call setup.

CSFB ARCHITECTURE



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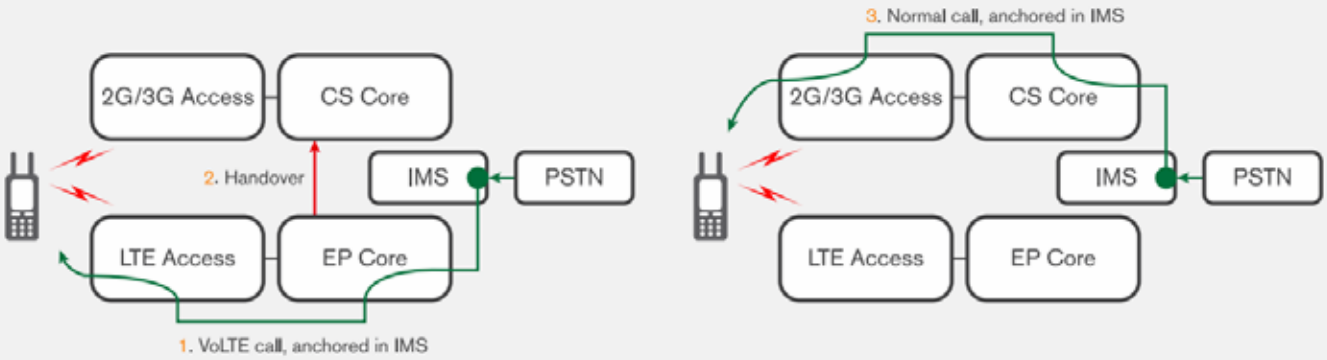
As LTE networks get higher penetration, Voice over LTE (VoLTE) becomes an option. The interaction will then be handled by the IMS, introducing the Single Radio Voice Call Continuity (SRVCC), to allow handovers from LTE to UMTS/GSM.

SRVCC ARCHITECTURE



The technically interesting initiative of combining voice and LTE via a Generic Access Network Controller (GANC), in the Voice over LTE via Generic Access (VoLGA) architecture, is currently out of the scope for the majority of MNOs.

VoLTE

One criticism towards IMS has been that it introduces an unnecessary level of complexity. In combination with few short-term benefits, this has hampered the introduction of IMS in mobile networks. However, the Voice over LTE (VoLTE) initiative from GSMA put a lot of focus on simplicity, and only the basic features to deliver basic service are required.

Since VoLTE can be seen as a community project, it will lower the threshold to implement IMS. Once IMS is there, and roaming works, more complexity can be added. The future end users will not be that keen on spending money on simple voice services, but IMS can potentially offer services that are not possible to offer in current networks.

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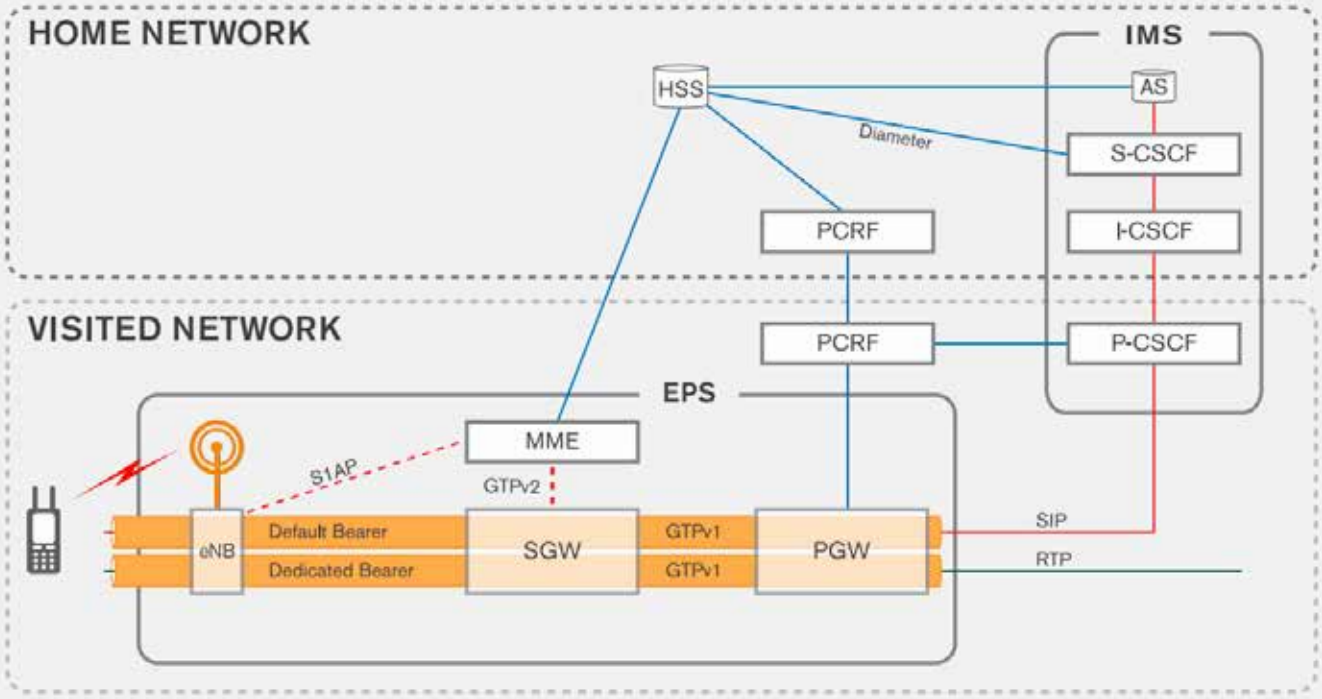
VoLTE ARCHITECTURE



Note that the actual bandwidth used by voice services is quite limited. When we talk about an "explosion" of data traffic, it will not be an explosion of voice. Rather, the proportion of data spent on voice will decline heavily over time as the driver for the bandwidth growth will be other services, for example video and other streaming applications.

VoLTE TODAY

Already in 2012, we have seen a handful of operators launch the VoLTE service. All of them have a legacy of CDMA, and all are aiming for full LTE coverage, to avoid the need for handover to legacy systems.

During 2013 we can also expect legacy 3GPP networks to roll out VoLTE. There will then be a need of handovers to the legacy network, and we will see SRVCC implemented in those networks.

Introducing VoLTE will reduce network complexity by preparing for the shutdown of the CS domain. Since LTE is much more spectral-efficient than 2G/3G networks, the cost for each voice call will decline. As an example, compare GSM (with 200 kHz channel separation for eight timeslots) with VoLTE (using a 12.2kbps AMR codec over a system that can send 16 bits/Hz), and you actually can fit over 30 times more voice calls on the same spectrum.

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OTT vs STANDARDISATION ASPECTS

Another GSMA initiative using IMS is the Rich Communication Services (RCS). Again, this introduces simplifications over the IMS standard, specifying a minimum set of functions to provide certain services. Services standardised by RCS are, for example, Enhanced Phonebook, Enhanced Messaging and Enriched Call. The RCS-e ("enhanced") simplifies the customer proposition of RCS and can accelerate the time to market for RCS. RCS-e is already available in standards as well as in networks, and is marketed under the name "joyn".

Even if RCS will provide a standardised way for the MNOs to offer services traditionally provided by OTTs, it still requires an IMS platform. In the future we might see an even broader standardisation initiative, e.g. the Web Real-Time Communication (webRTC), where the real-time services become a part of the web browser. Such a development can potentially make OTTs services less attractive, and drive the MNOs towards an "under the floor" approach.

NEED FOR MONITORING

Simplifications are nice, but EPS and IMS are still quite complex architectures. An operator applying VoLTE in the network needs to assure that the end users get a similar or better experience of the voice service than before.

Regardless of whether an operator chooses to evolve the network in small steps or giant leaps, the need for monitoring is always higher for new equipment than for old. As a guide, 3GPP defines a number of Key Performance Indicators (KPI) for IMS, EPC and LTE. The KPIs relate to, for example, Accessibility, Availability, Retainability, Mobility and Utilisation.

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Jonas has been following the standardisation in 3GPP, IETF, ETSI and ITU and other standardisation organisations closely for the last 15 years.

He is also a current world champion in Bridge.

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