

# Inter Operability White Paper

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## *ONE SIZE DOES NOT FIT ALL*

During the last decade a kaleidoscope of wireless technologies has been developed, whether is driven by geographical, cultural or economic differences every market and region across the world has its own characteristics. GSM and CDMA wireless technologies are in the center stage of voice communications, in the data side the combination of Wi-Fi and DSL is a common Internet access service while alternatives keep emerging and getting ready to penetrate the masses. With over 3 billions of GSM users, almost half a billion of CDMA subscribers, with an average around the globe of 6 out of 10 households familiar with WLAN and in some cases up to 2 out of 3 and new technologies such as WiMAX and LTE, convergence is the natural step towards the evolution.

## *BEARER TECHNOLOGY WORLD SCENARIO*

Everything would be very simple if the whole world would follow one unique standard, but that would be like asking that everybody speaks the same language. The following charts will show how diverse and complex the wireless communications landscape is set up across the globe.

### **Connections by Bearer non CDMA Technology (\*1)**

	<b>Number</b>	<b>Percentage</b>
Total	4,310,311,592	
GSM	3,449,010,903	80.02%
WCDMA	255,773,412	5.93%
WCDMA HSPA	132,079,727	3.06%
TD-SCDMA	825,044	0.02%
TDMA	753,411	0.02%
PDC	2,752,436	0.06%
iDEN	21,361,981	0.50%

## Connections by Bearer CDMA Technology (\*2)

	Number	Percentage
CDMAOne	8,000,000	1.67%
CDMA 2000 1X	352,000,000	73.33%
CDMA2000 1xEv-DO	120,000,000	25.00%

## Connections by Bearer Mobile WiMAX Technology (\*3)

	Number	Percentage
Asia-Pacific	761,659	28.35%
Europe	544,504	20.27%
Middle East and Africa	126,530	4.71%
Central and Latin America	395,000	14.7%
North America	859,000	31.97%

## WLAN Devices

Highlights findings examining Wi-Fi chipset sales by category: (\*4)

- Cellular-Wi-Fi Phones: 56 million units shipped (up 52 percent)
- Stationary Consumer Electronic Devices (gaming consoles, digital televisions, set-top boxes, printers): 48 million units shipped (up 51 percent)
- Portable Consumer Electronic Devices (handheld games, cameras, portable music players): 71 million units shipped (up 33 percent)
- Notebook PC's, Mini Notebooks, Ultra Mobile Devices, Mobile Internet Devices: 144 million units shipped (up 23 percent)
- In 2008, approximately 381 million Wi-Fi chipsets shipped, representing a 24% growth rate over 2007
- Total chipset shipments across all major market segments are expected to reach more than 1 billion by 2013
- Smartphone , PDA and browser phones currently there are about 220M 2G/3G WLAN enabled devices sold

	Number
Stationary CE	48,000,000
Notebook/Laptops	144,000,000
PDA/Smartphone	56,000,000
Other Devices	62,000,000

## *AND STILL MORE VARIETY*

Services also should answer to consumers' pockets demands to fit their budgets and still satisfy their needs. The split of subscriber's categories is surprisingly uneven, depending in the region and the Mobile Operator business plan in some markets the difference could be in the magnitude of 90% and 10%, split going either way between post paid and pre paid subscribers. But the trend is that prepaid is in the rise for even traditional postpaid markets where plans such as "Pay as you Go" or the idea of not to tie to lengthy contracts have become very attractive especially as a result of the financial crisis.

Prepaid subscribers are supported using different standards depending in the wireless technology used by the Home network

## *WIN ROUTING SERVICES FOR CDMA NETWORKS*

Many CDMA carriers offer to their subscribers services based on WIN IS-826 (Wireless Intelligent Network) standard. WIN Routing Services supports, routing and processing of WIN-based IS-826 messaging. CDMA prepaid international roaming is basically supported using between a home operator's IS-826 WIN-based prepaid platforms (SCP) and IS-826-compliant markets. The service supports both CDMA voice and SMS text messaging. In addition WIN should also support features to keep inform the subscriber of the current balance using SMS text messages.

## *CAMEL SERVICES FOR GSM NETWORKS*

Customized Applications for Mobile Enhanced Logic – CAMEL (GSM 09.78) - allows roaming subscribers access to their full portfolio of IN services. CAMEL GSM phase 2+ connects the home and visited mobile Networks to various Intelligent Network (IN) platforms used throughout national networks to provide features such as Pre-Paid Calling.

## *THE NEED FOR CONVERGENCY*

Very few users are aware of the technology behind a device that provides the ability to make a phone call or surf the internet. Ubiquity is a state that any user would like to have and most likely pay for it. It also sounds very attractive for an operator the idea of potentially extend the footprint reaching beyond its own network assets offering to clients, worldwide coverage. Following that line of thought somebody might add that worldwide coverage is now achieved using GSM for voice and started with GPRS for data access and it won't be wrong. But why settle for a small hill when we have been in the moon. Whether the goal is to answer to important emails quickly while away from the office, upload to the networking website the latest pictures of ongoing vacations, or watch IP TV, users' demands are simple; more download/upload speed with an affordable price anytime, anywhere.

The good news is that independently most of the wireless technology advocates reached a common ground and at least agreed in a convergence point; the old good Internet Protocol transporting data packets is also suitable to substitute the even older Circuit Switch networks delivering voice services. In the years to come legacy technologies such as CDMA, GSM and its variation will be phased out and services migrated to LTE coexisting with WiMAX and still improved WLAN networks. Business cases and specific region requirements in different markets will dictate the migration path in the race to 4G.

The evolution of the industry is set, leaving an even more heterogeneous landscape. Next generation technologies aiming the 4G promise will not be deployed during an overnight cut off. There are more than 5 billion active devices that do not support these new technologies with this fact, the collapse of some business models is predictable as they were implemented in isolation of a global vision nor considering an open offering. The overlapping of access technologies even within the home network has to be supported since this will be a common scenario in the early stages of migration.

Shared convergence along is not a guarantee for a user to count with ubiquitous services, therefore a robust platform able to interoperate and act as a gateway to bridge the gaps between technologies is the response and solution for the Inter Operability between two or more wireless networks and services providers with different architectures.

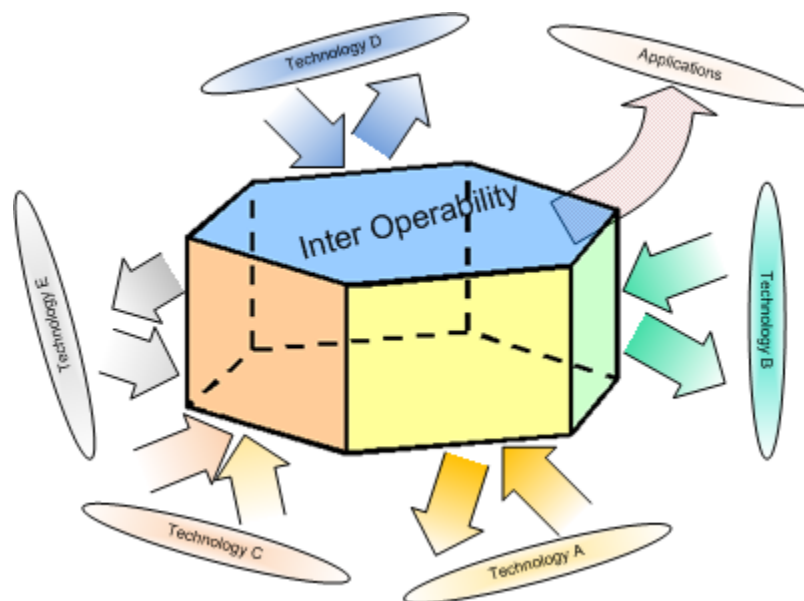
## ***BENEFITS OF INTEROPERABILITY***

Interoperability is the ability of two or more computer systems to provide services mutually and automatically interpret the information exchanged meaningfully and accurately as well as produce understandable output by the end users of both systems regardless of the underlying technology.

Different technology is not a limitation to do business with a potential roaming partner if seamless roaming is achieved via an Inter Operability Gateway. Another possible limitation when expanding the roaming possibilities outside of an owned wireless technology are the underlying processes applied to settle and reconcile financial positions between partners which are also mitigated by this entity monitoring, routing and keep track of connections, users and usage.

When new business models interacts with the wireless communications DNA (Devices, Networks and Applications), flexibility and quick adoption of new schemas might the difference between success and failure. However some architectures are not versatile enough to support steering changes therefore a mediation allowing to soften those changes is extremely useful and a powerful path to keep the pace of demanding clients within a fast changing industry.

Inter Operability is a multiple sided service able to close the gaps between different wireless technologies , making possible with the right devices to extend two networks providing services to users at the same level with a similar experience experienced in their home market when they are abroad.

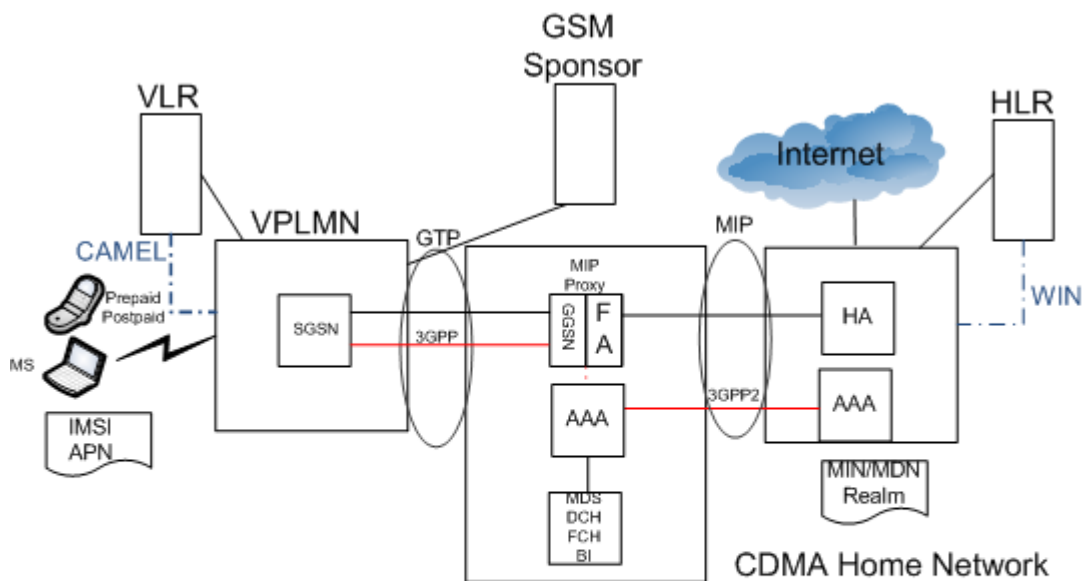


Seeing technologies through a Inter Operability prism

## *Inter Operability across networks with different technologies*

Network operators might have different motivations, strategies or business plans but the general idea is very similar. The goal is to offer a reliable and fast connection to users everywhere anytime. The services should not be limited to the home network footprint, region or country; contrarily a fast global coverage can be achieved by leveraging an intelligent multi sided platform providing Inter Operability.

Following a case study, currently native CDMA subscribers are able to use voice and Data services by using a dual phone supporting GSM as well. This is possible due to the fact that two different standards and interfaces are being treated and translated back and forth by the Inter Operability gateway making look the two distinct networks as another equal roaming partner receiving the same well know and business as usual information. This allows fast, easy and cost effective deployment minimizing CAPEX and OPEX. Also leverage to the maximum extent existent infrastructure, backend, clear, and settlement procedures.



For a better breakdown of the Interoperability framework we have defined three main areas forming the Inter Operability DNA for a better illustration and comprehension, **Devices**, **Network** and **Applications**. We will cover essentially **Network** and **Applications** in this paper.

**Network:** *Traffic signaling, Transport*

**Applications:** *Business processes layers*

*Traffic Signaling:* Control plane protocols such as SS7, SIGTRAN, SIP, AAA , Home prepaid (WIN) visited prepaid platform (CAMEL)

*Transport:* User Plane are the functions that deal with issues of user-to-user, Internet-to-user information transfer.

*Applications:* Backend services related to rating, usage reconciliation, Revenue Assurance, Clearing, Financial settlement, Fraud, Revenue projections, etc... This layer should be intelligent enough to implement service-aware charging.

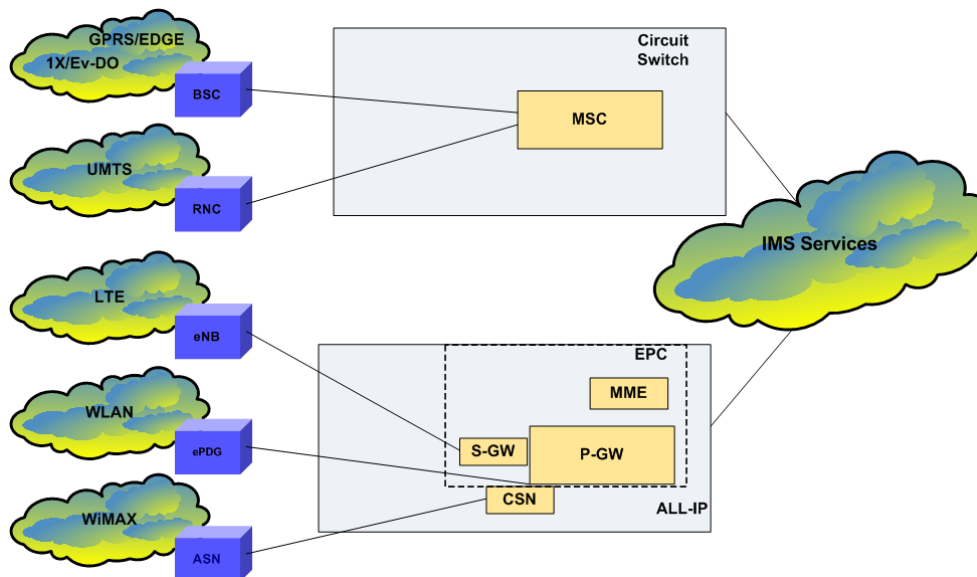
Applying the same principle Inter Operability between other different technologies is also possible

## *Using Inter Operability to mitigate the migration challenges*

As of April 2009 31 Operators have committed to develop to Long Term Evolution (LTE) also referred to as Enhanced-UTRA (E-UTRA). Some Operators will start the migration from either CDMA or GSM (WCDMA) and a least a dozen will be launching commercial services in 2010. Some of the challenges these operators are going to face are the following:

- Transition from a circuit-switched (CS) to an all-IP end-to-end network.
- Spectrum available in order to support wider channel bandwidths.
- Increase Network backhaul capacity.
- Requirement for multi-mode and multi-band subscriber devices to enable seamless internetwork transitions and global roaming.
- Equipment upgrade in the access network

The most important fact we need to highlight is that LTE as opposed to UMTS or CDMA 2000 is not voice centric, devices will need to obtain an IP address to be attached to the network therefore operators will need to solve the dilemma of how to offer voice support when realistically IMS which would be the ultimate solution will not be wide deployed when LTE starts to crop out.

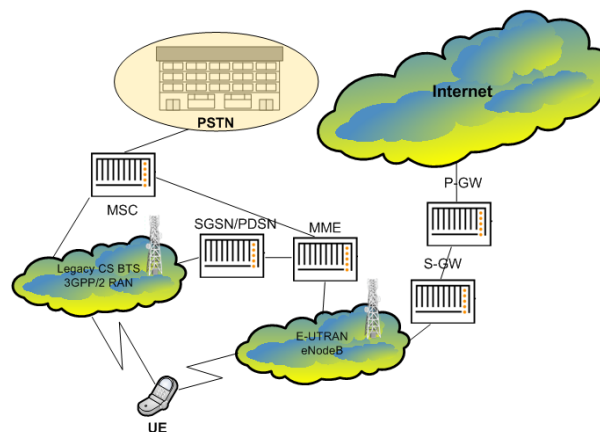


Future voice services support through IMS

Initial LTE deployments most likely would overlap with existent commercial networks, facing some issues when new users with LTE devices are out of the range but still under the legacy technology coverage area leaving two possible scenarios to support voice over a IP centric service (i.e. LTE, WiMAX).

## Circuit Switch Fallback:

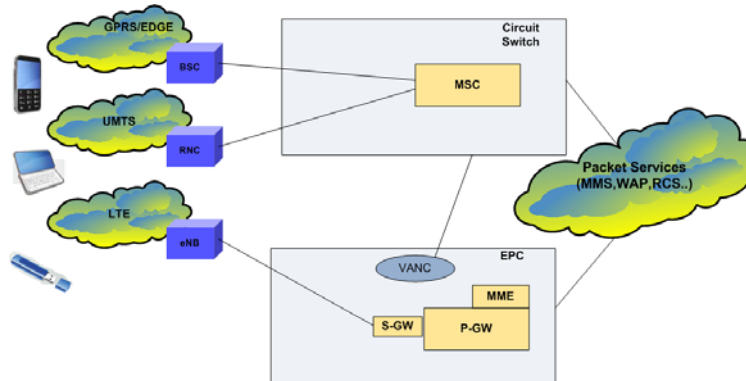
CSFB establishes a signaling channel/path between a circuit switched MSC and the LTE core network. In this way mobile devices currently in the (ALL-IP) LTE network can switch to the legacy circuit switch (2G/3G) network in order to make or receive a voice call.



## Voice over LTE via generic access

The main VoLGA's objective is to make traditional GSM/UMTS circuit switched (CS) services available to UEs accessing the EPS network via LTE, resembling 3GPP Generic Access Network (GAN). GAN provides a controller node - the GAN controller (GANC) - inserted between the IP access network (i.e., the EPS) and the 3GPP core network. The GAN provides an overlay access between the terminal and the CS core without requiring specific enhancements or support in the network it traverses. This provides a terminal with a 'virtual' connection to the core network already deployed by an operator. The terminal and network thus reuse most of the existing mechanisms, deployment and operational aspects.

For VoLGA, all signaling and user plane traffic is fully transparent to the EPS access network on the UNI (User Network Interface). This means that the EPS sees all VoLGA traffic as normal user plane traffic occurring over suitable EPS bearers.



## *Inter Operability to attract more business opportunities*

Since once size does not fit all and there is no reason to only do business with networks that share the same technology, it will make sense to consider driving more revenues expanding the coverage allowing clients to use foreign networks while travelling regardless the technology, or allowing inbound roamers from different based wireless types.

## *CONCLUSIONS*

The Internet revolution and the wide availability of broadband access are creating a tremendous new appetite for mobile data services. Users are demanding the same Internet experience that they have at home, anytime, anywhere. Existing wireless access technologies such as Wi-Fi, HSPA and Ev-DO are part of the way in meeting and everyday life. But spectral efficiency, cell-edge performance and high latency prevent them from providing the bandwidth, capacity and QoS to enable a true broadband service that is reasonably priced for consumers and profitable for Mobile Network Operators. The overall telecommunications market continues to grow at measured pace, mobile data revenue (excluding SMS revenue) is reported to have grown by ~25-40 % average since 2006 and is generally projected to continue on a rapid growth path. While the data revenue is seeing a steady growth the data usage on current 3.5G network is exploding with reports of 6-30x growth year on year, fuelled by flat rate tariffs, better devices and USB dongles providing connection to laptops. In response to these dynamics, the wireless industry is anticipated to shift toward LTE and WiMAX technologies to be able to support cost effectively the capacity required for operators to accommodate mass market adoption of mobile data services. In the meantime while technologies settle down and a new horizon is clear, heterogeneous services where Inter Operability is the glue to keep business profitable and users expectations satisfied will be the transitional wave to ride.



## **Sources**

(\*1) GSMA

(\*2) CDMA Development Group (CDG)

(\*3) WiMAX Forum

(\*4) In-Stat