



Voice in an LTE Network

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LTE Introduction

- *“Long Term Evolution”* (LTE)
 - Latest iteration of the standard family defined by 3GPP.
2G GSM => 3G UMTS => 4G LTE
 - High-speed, IP only radio interface
 - Multiple Megabit/s performance
 - Can use “digital dividend” spectrum (800MHz, 2.6GHz)
 - “Single Radio” operation with GSM and UMTS
- LTE packet performance is adequate for voice
- In-service dates starting around 2010
 - Lead by operators migrating from CDMA
 - Initial coverage will be in isolated hot-spots



LTE driven by data

LTE – voice problem



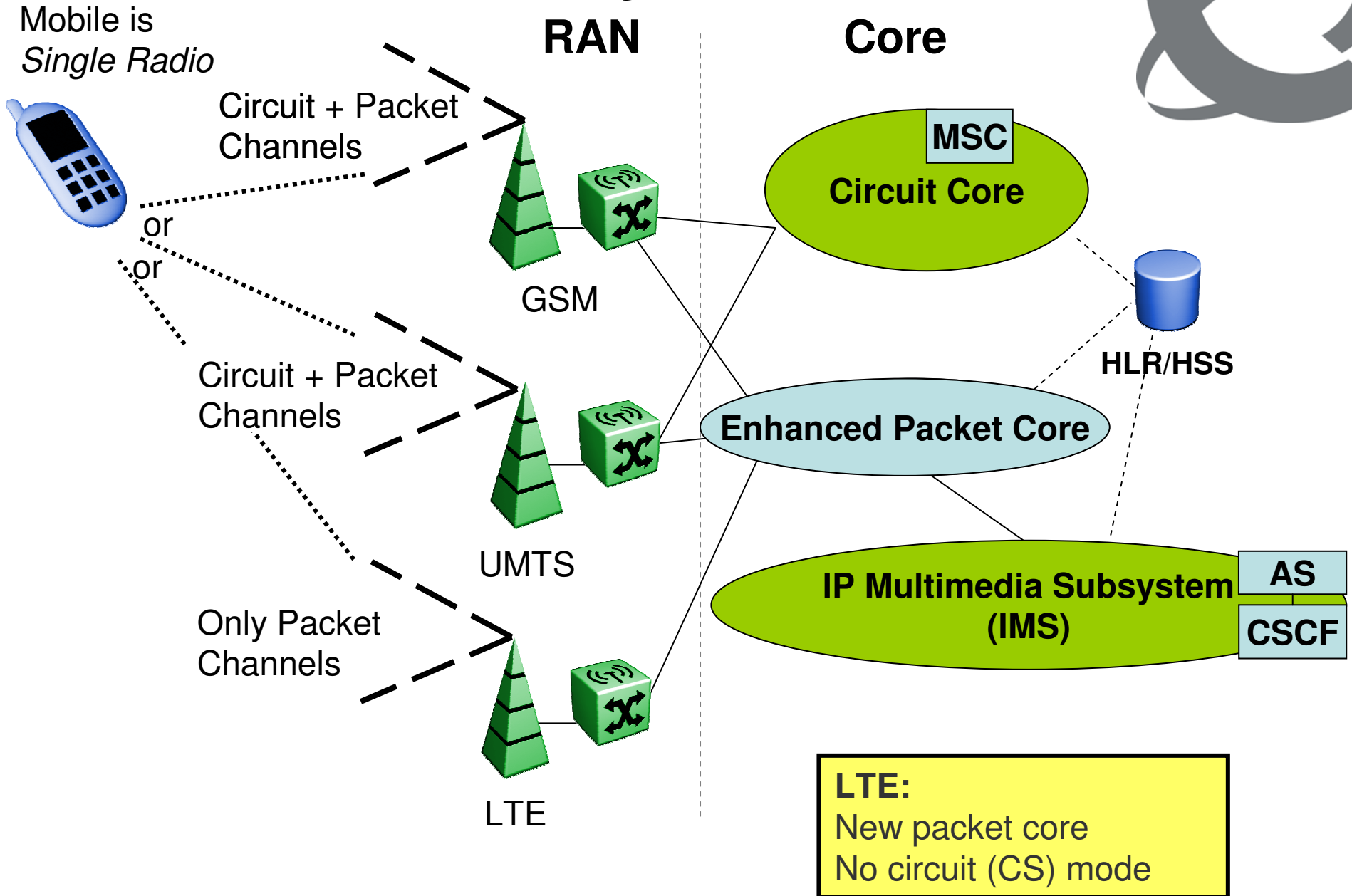
- Voice was planned to use IP and IMS...
 - ... but adoption of IMS has been slower than expected creating a technology gap...
 - so 3GPP can joke....



NO VOICE OR SMS FOR YOU!

- ... or we can find solutions.

A bit of history



IMS - IP Multimedia Subsystem



- The bright new future (well it was back in 2000)
- Main aims
 - Builds on IETF SIP technology
 - Internet scaling and perceived low cost
 - Split the access network from the service network
 - Common service network across fixed, mobile and internet
 - Multimedia in addition to voice
 - No need to standardised services only enablers
- What happened ?
 - IMS got “standardised” - eventually
 - Complicated. Many, many options added to SIP
 - More “services” became standardised
 - Large legacy service load
 - Service parity with CS is complicated
 - Technology bubble burst

Is this parrot dead, or just resting?



IMS – today's reality



- Commercial systems available
 - take up has been very slow
- IMS mass deployment dates undefined for most operators
- Issues relate to
 - Cost – IMS requires a complete new core network
 - Risk – Scaling up to support 10's of millions to subscribers is still an unknown. Performance is also seen as a risk
 - Integration – Existing services have to be integrated with IMS based service
 - Operator business models – Services run as separate P&L centres
- The good news
 - Gears are turning to bring IMS to mass market
 - Convergence still seen as positive business model
 - Demonstration infrastructure and mobile clients well down the development lifecycle

IMS still seen as the target architecture
(the parrot is just resting)

Five LTE Voice Options



Mobile networks are typically very standards driven

- Decentralized architecture with open multi-vendor interfaces
- International roaming

1) Data Only

**Voice Based on
Legacy MSC**

- 2) CS Fallback**
- 3) VoLGA**

**Voice Based on
New Infrastructure**

- 4) IMS**
- 5) Over-The-Top**

LTE as data only



- Devices with no native voice support - eg PC Dongles
- Likely the initial offering for many carriers

Pros

- Simple
- Device availability
- Debug/test LTE

Cons

- Not useful for smartphones
 - Single radio limitation
- May encourage over the top voice



Data only common for initial roll-out

LTE with voice on legacy



“CS Fallback”

- Use legacy CS on GSM, UMTS or CDMA for voice
- 3GPP Release 8 standard
- Driven by NTT DoCoMo

Pros

- Supports smartphones
- Supports migration from CDMA as well as GSM/UMTS

Cons

- Standard is ‘barely adequate’
 - eg call setup delay
- Needs MSC upgrade
- No LTE during voice call

Japan



Korea



+

+ Others?

Interim solution. Will it be popular?

Tunnelled CS voice over LTE

“CS over PS” or “VoLGA”

Voice over LTE via Generic Access Network

- CS signalling and bearers are tunnelled over IP
- Similar to the GAN standard for WLANs
- Rejected by 3GPP – forced in to dedicated forum



Pros

- Voice and data on LTE
- Supports Smartphones

Cons

- Only T-Mobile strongly enthusiastic right now
- Rejected by 3GPP
- Scaling and roaming

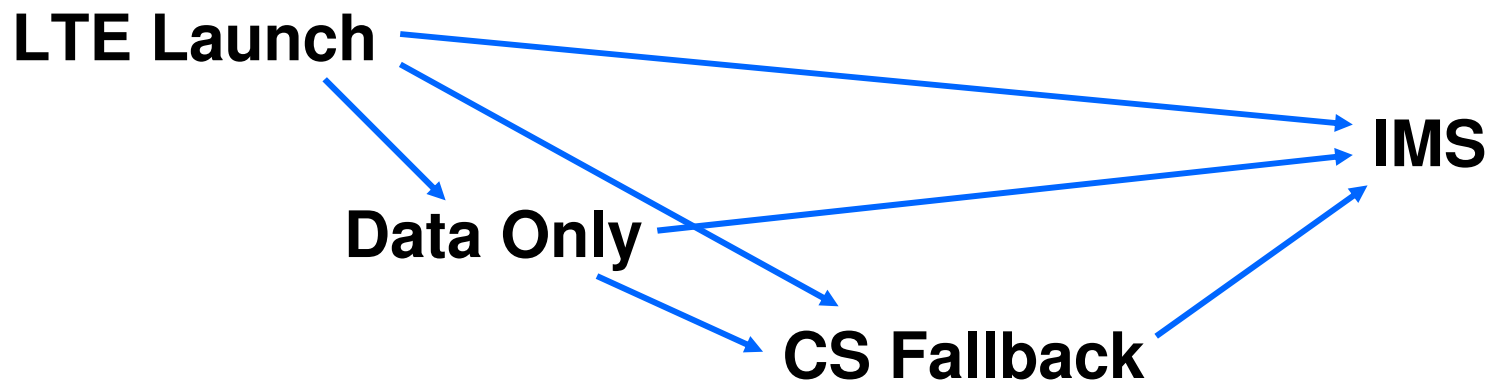
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Single operator solution

Standards-based VoLTE



- 3GPP defines **IMS** as the LTE voice solution
- Majority of operators support the IMS path in principle
 - How/when will they migrate?
 - What about interworking to non-IMS operators?
- Verizon plan to launch in 2010



Many operators add IMS after initial LTE roll out

Service support and migration



- Carriers pushing for “seamless” service migration
- Keep CS infrastructure
 - Custom network services like pre-paid
 - Billing and provisioning systems
- MSC takes key role in migration
 - Direct platform for IMS
 - MSC as “Telephony Application Server” (TAS)
- IMS vendor will often follow MSC footprint

Major vendors will define migration options
for their platforms

Mobility & handover to non-LTE



- Solution needed to go back to GSM/UMTS
- Single Radio Voice Call Continuity (SR-VCC)
 - Swap between IMS and CS without preserving services
 - Basic user experience
- IMS Centralized Services
 - Service anchor in IMS to improve service consistency
 - MSC based
 - Medium service availability.
 - Strongest buy-in from operator community
 - User Equipment based IMS Centralized Services
 - Most feature rich
 - Requires simultaneous CS and PS access
 - Doesn't require MSC support

Mobility scenarios are complicated!

Proprietary Over the Top voice



- Gaps in carrier voice strategy
- OTT technically viable on LTE and UMTS
- Apps-stores make it easy for users to install clients
- Nokia/Skype leading way already

Pros

- Not limited by legacy continuity
- No “IMS complexity tax”
- Integration with presence and productivity apps
- Non-traditional voice apps (Voice Twitter?)

Cons

- Business case unproven
- QoS / DPI blocking?
- Relationship politics
- What happens outside LTE footprint?
- Regulation

Slow implementation of voice by carriers may give toe-hold to over the top voice

Failure in Standards Process?



- Why standards?
 - Multi-vendor interoperability
 - Economy of scale
 - Roaming and consistent user experience
- 3GPP has traditionally aimed for ONE approach
 - For VoLTE we have FIVE main options
- Is this a failure of the standards process?
 - “No”: Many operations and business scenarios – one size doesn’t fit all
 - “Yes”: LTE dependency on IMS never matched reality – should have reset assumptions earlier

Market reality moved faster than strategic thinking in standards

What might happen?



Scenario 1 – Market Driven

- Early years of LTE: variety of voice options
- Many operators will dodge the problem by going data only
- Confusion will lead to “experiments” including over the top providers
- Eventual convergence driven by roaming – probably to IMS

What might happen?



Scenario 2 – Industry Driven

- Industry renews efforts to simplify options
 - Possibly via GSM-Association
- Still data-only LTE operators for operational reasons
- Reduced uncertainty and more emphasis on rapid migration to single scenario – probably IMS

Despite its problems, IMS probably wins long-term

Conclusions



Predictions

- Variety of options for early LTE networks
 - Mostly no voice on LTE for 1-2 years
 - Few early runners will debug voice for the community:
 - Verizon using IMS – drive to migrate from CDMA
 - T-Mobile – VoLGA
 - DoCoMo, KDDI – CS Fallback
 - “CS fallback” may be further enhanced to improve its performance
- IMS still positioned to win in the long-term
- Service migration will be an advantage for incumbent MSC vendors in initial LTE voice core

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Backup



Biographical Notes



- Iain Sharp started working on GSM trial systems in the late 1980s while he was still a student. In 1990 he joined Nortel and became heavily involved in the standardisation of the GSM core network. He has participated in 3GPP since its inception and served as vice-chair of 3GPP Core Network and Terminals (CT) plenary from 2003-2005 and 2007-2009.
- Iain's technical contributions to GSM, UMTS and LTE include the design of advanced voice services for GSM and architectural design for GPRS and LTE.
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