



# 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



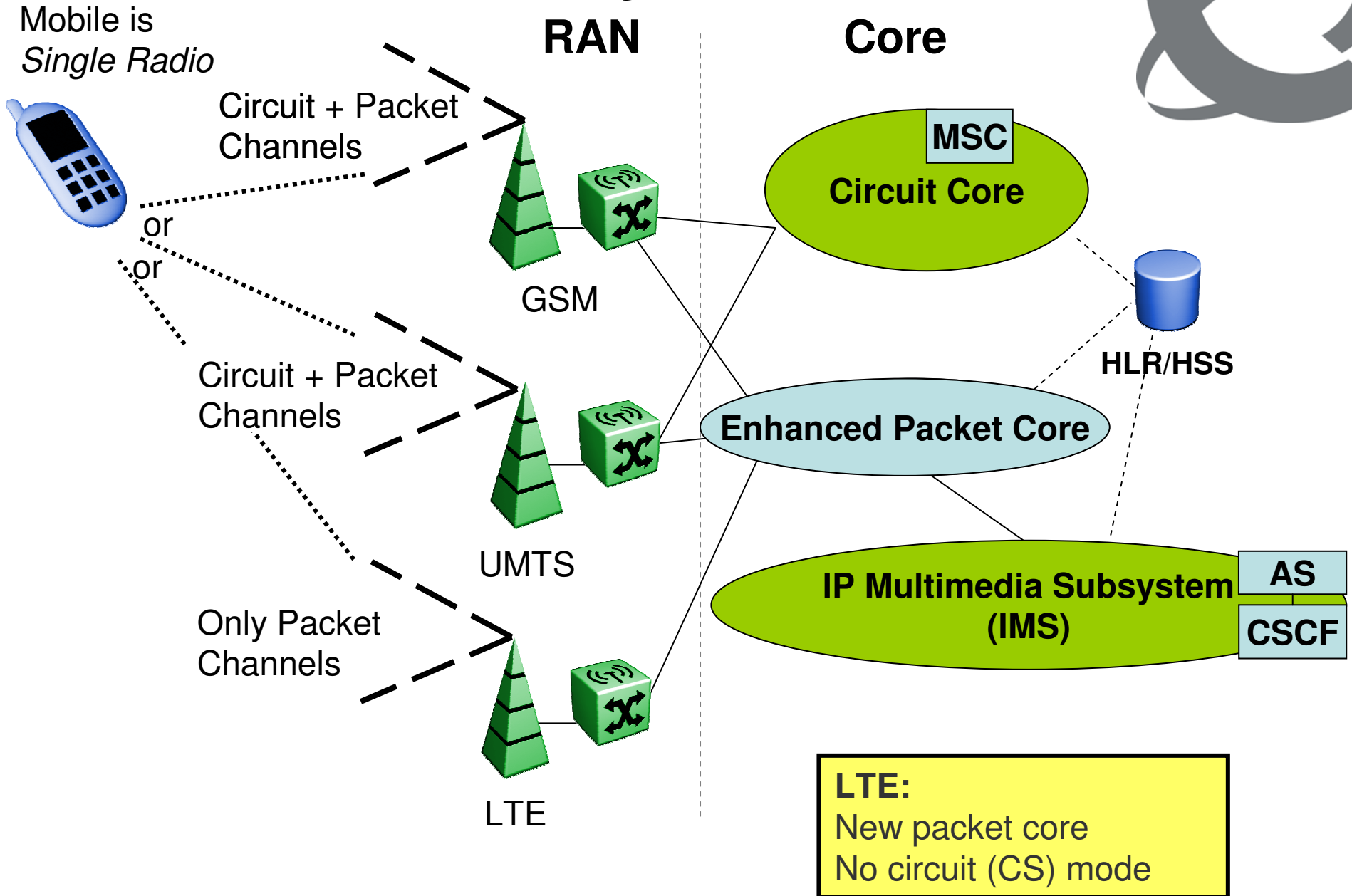
- Voice was planned to use IP and IMS...
  - ... but adoption of IMS has been slower than expected creating a technology gap...
  - .... so 3GPP can joke....



**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

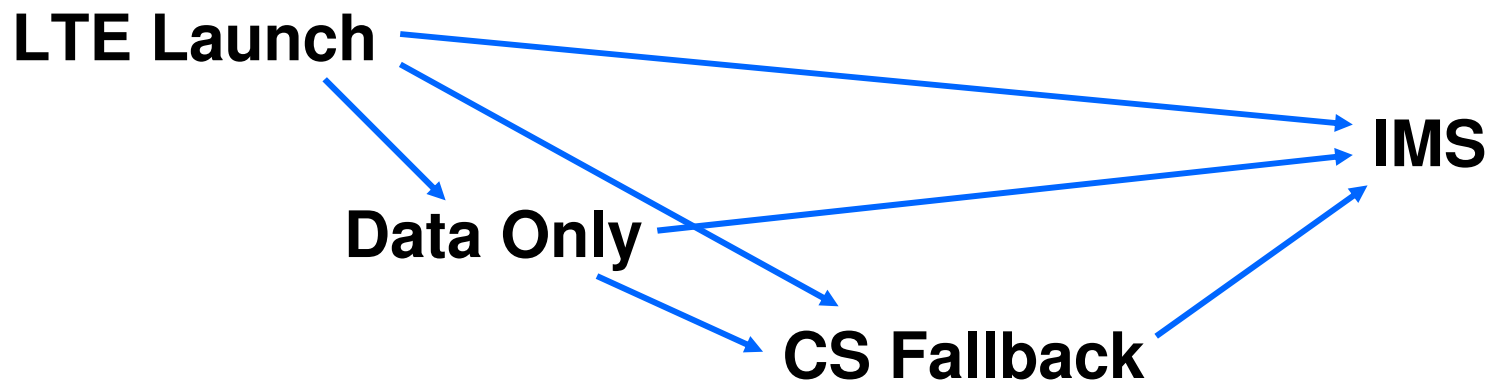
•• **T** •• Mobile •

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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