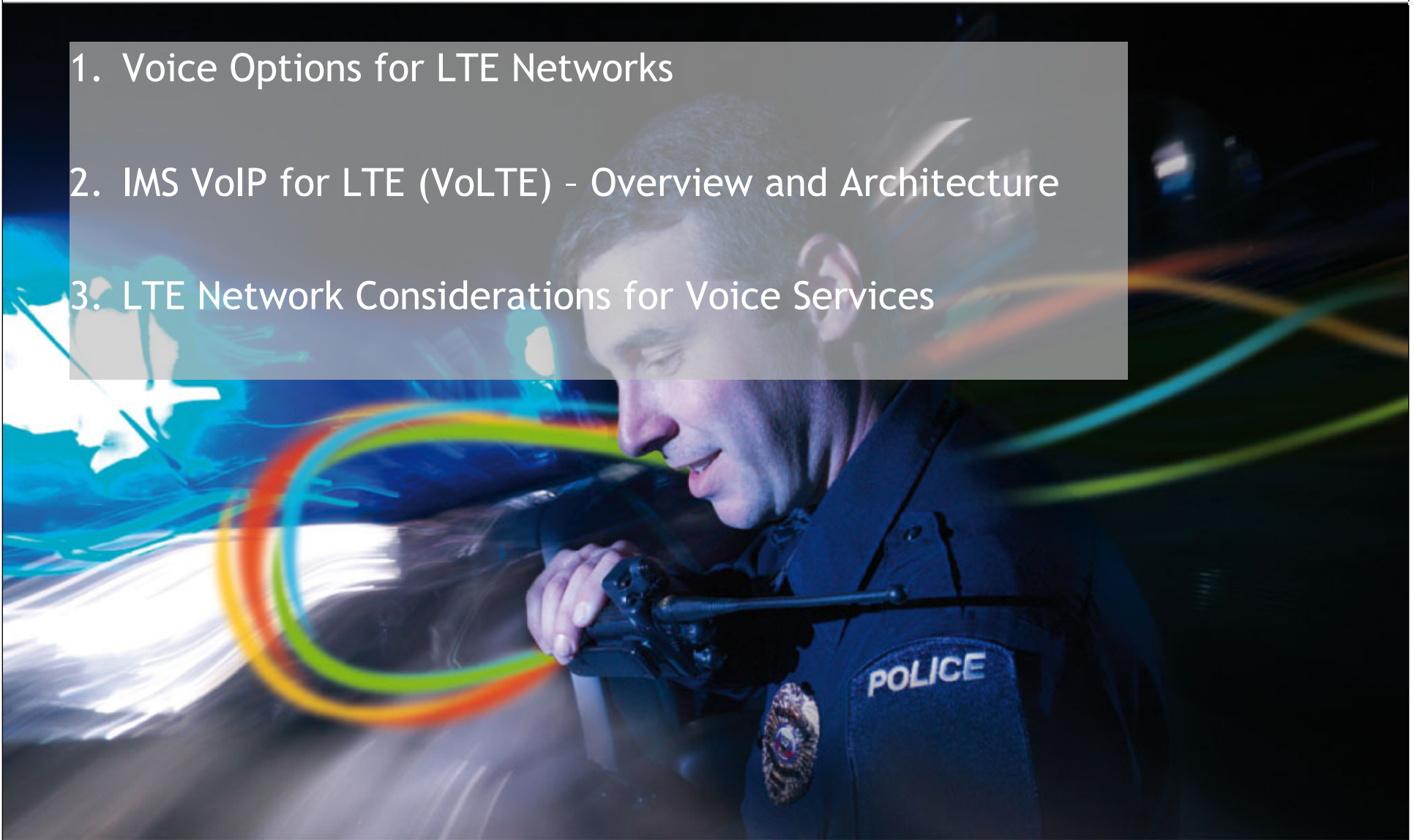# VoLTE for
Public Safety Broadband Networks

Maria Palamara
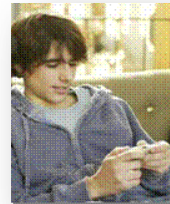December 2010

Agenda

1. Voice Options for LTE Networks

2. IMS VoIP for LTE (VoLTE) – Overview and Architecture

3. LTE Network Considerations for Voice Services

LTE voice options: effect on subscriber services

	Mike	Derek	Maria
retain LTE bandwidth	🎞		🎞
minimize call setup delay	🕐		🕐
all-IP services: video, wideband audio	📷		
roaming, interoperability	🌐	🌐	
	Operator "A"	**Operator "B"**	**Operator "C"**
	IMS VoIP	Circuit Switched Fallback	Custom Methods: circuit core, with packet access

**IMS-Based GSMA VoLTE is the approach embraced by
global standards, industry associations, and operator community for voice on LTE**

Alcatel·Lucent

Comparing services and deployment factors

- Focus investment on creating the next gen service, not limited capability legacy infrastructure.
  - Commercial operators have embraced GSMA VoLTE (IMS VoIP) on a global scale
    - Some operators start with IMS
    - Many will transition from CSFB to IMS on the heels of the LTE data overlay
  - Public Safety Broadband networks have no legacy MSC Infrastructure to leverage
  - Public Safety networks should embrace a solution based on IMS VoIP for LTE
  - GSMA VoLTE offers 2 way, full duplex voice telephony services, also considered to enable mission critical communications by modern public safety communities (vs. just push to talk)

Service and Deployment factors	IMS VoIP	CSFB	Custom Methods
Converged Service Control	Yes	No	No
Flat all-IP benefits: subscriber services, OpEx	Yes	No	No
3GPP Standards • Roaming, global interoperability • Ecosystem of network and handset vendors	Yes	Yes	No
Avoid LTE network upgrade for Voice with LTE?	No	Minor	No
Avoid 2G/3G MSC network upgrade for Voice with LTE?	Yes (VoIP in LTE and 3G PS)	No	Yes
Avoid investment in interim method	Yes	No	No

IMS VoIP is the right solution for Public Safety voice telephony services, enabling nationwide PSBB interoperability as well as with commercial LTE networks

Alcatel·Lucent

GSMA VoLTE overview

- In LTE and 3G PS: Fully packet switched VoIP
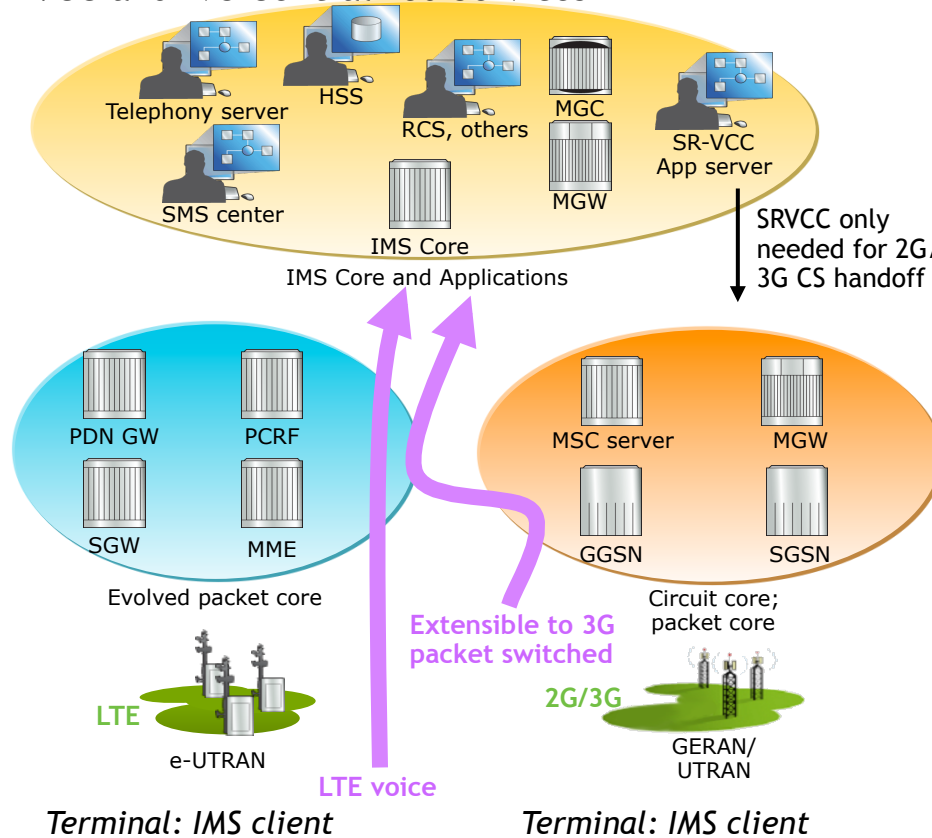- In 2G/3G CS, use SR-VCC and IMS Centralized Services

Services:

- IMS VoIP, SMS
- GSMA RCS (Rich Communication Suite)
- Voice blending
- Video telephony
- All-IP service

Retain LTE's bandwidth during voice calls

Network:

- IMS, new or reuse
- SR-VCC for 2G/3G Circuit
- MME software, interface
- eUTRAN software, interface
- IMS client

Telephony server
HSS
RCS, others
MGC
SR-VCC App server
SMS center
MGW
IMS Core

IMS Core and Applications

SRVCC only needed for 2G/3G CS handoff

PDN GW   PCRF
SGW   MME

Evolved packet core

MSC server   MGW
GGSN   SGSN

Circuit core; packet core

Extensible to 3G packet switched

LTE
e-UTRAN

LTE voice

2G/3G
GERAN/ UTRAN

Terminal: IMS client

Terminal: IMS client

Alcatel-Lucent Status:
Trials: today
Commercial: 1H 2011
SR-VCC: 2H 2011

IMS VoIP ensures global roaming and interoperability while retaining LTE's high-bandwidth services

Alcatel·Lucent

IMS Based VoLTE

## Required Solution Enhancements

The approach:

- Provide voice to LTE UEs using IMS to provide the voice services

Key elements:

- IMS core with Telephony Application Server (TAS) to provide end-user services
- LTE E-UTRAN enhanced for VoIP delivery
- Service Centralization to provide a consistent service delivery across radio access technologies using IMS Centralized Services (ICS)
- Single Radio VCC to provide handover capabilities between different radio technologies

Alcatel·Lucent

Voice via IMS
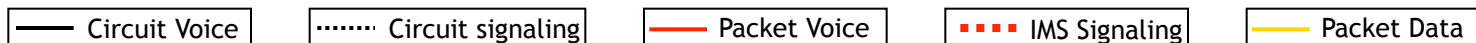# High Level Architecture
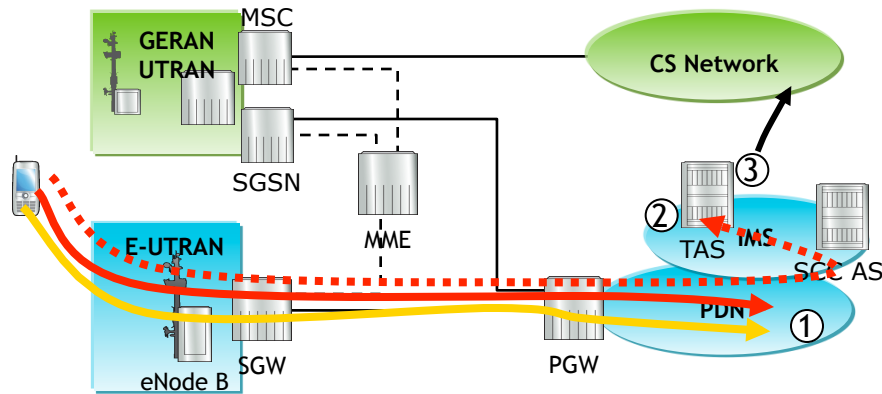
- **Simultaneous Voice and Data on LTE**
  - Handset has concurrent access to:
    1. Data services including internet access
    2. IMS Services including VoIP end-end calling
    3. IMS interworking towards legacy PSTN/PLMN networks
  - Offers all of the benefits of IMS including:
    - Multimedia services including video
    - Differentiated services even while roaming via home-network control
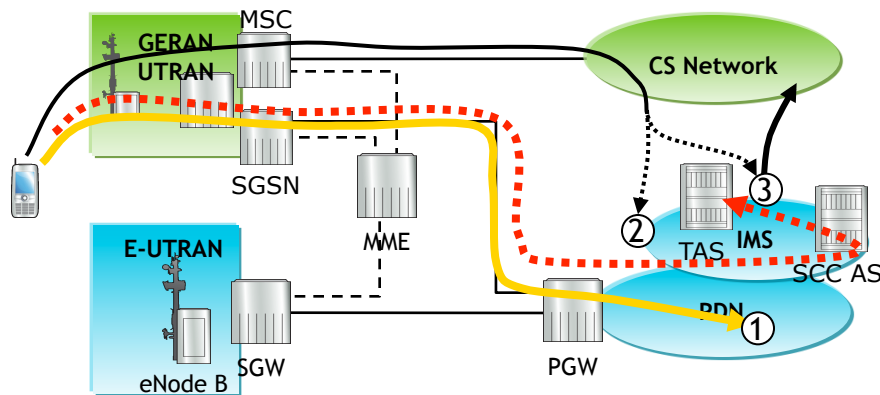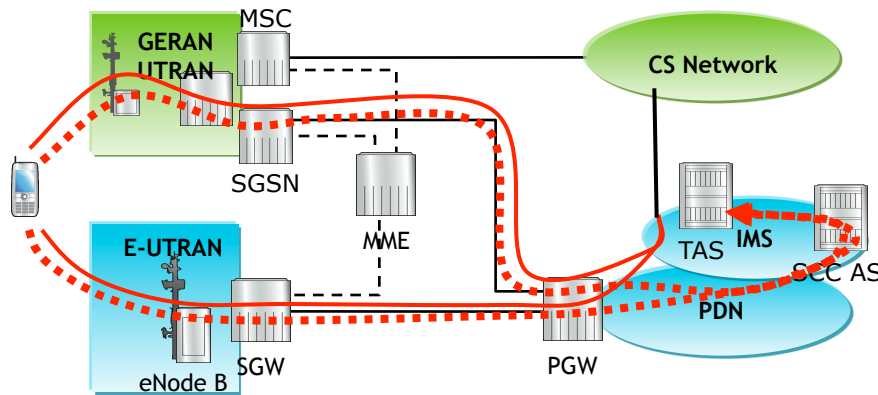
- **IMS Services outside of LTE coverage**
  - For service transparency, IMS Centralized Services (ICS) provides IMS services even when the handset is out of LTE coverage
  - In 3G handset has concurrent access to:
    1. Data Services including internet access
    2. IMS Services including circuit-mode transport of voice path
    3. Calls to-from the PSTN/PLMN legacy network as well as calls to VoIP end users in IMS
 - While on 2G network the handset has access to data services, but not concurrently with voice

| —— Circuit Voice | ⋯⋯ Circuit signaling | —— Packet Voice | ▪▪▪▪ IMS Signaling | —— Packet Data |

Alcatel·Lucent

VoIMS handover to legacy mobile network

Handover while remaining in PS (PS HO)

GERAN UTRAN
MSC
CS Network
SGSN
MME
E-UTRAN
TAS   IMS
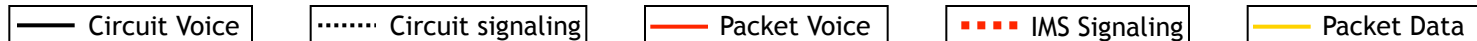SCC AS
PDN
eNode B   SGW   PGW

PS handover

- Approach
  - Simple PS handover triggered by MME involving SGSN and S/PGW
- Service restrictions
  - Full IMS services maintained during handover and remainder of call
  - PS voice bearer support required
  - Not recommended over GSM

Handover from PC to CS (SRVCC)

GERAN UTRAN
MSC
CS Network
SGSN
MME
E-UTRAN
TAS   IMS
SCC AS
PDN
eNode B   SGW   PGW
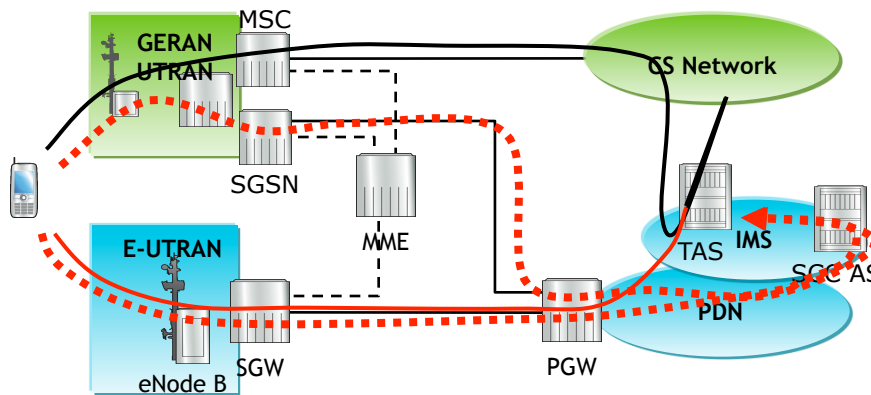
Single Radio VCC

- Approach
  - SRVCC mechanism triggered by MME, involving MSC and SCC
- Service restrictions
  - IMS services maintained during handover and remainder of call (depends on available ICS options)
  - Available over all mobile networks with SRVCC roaming agreements

| —— Circuit Voice | ······· Circuit signaling | —— Packet Voice | ▪▪▪▪ IMS Signaling | —— Packet Data |

Alcatel·Lucent

Selected Network Functionality Required for Voice Services

- **eNB Foundations**
  - HARQ
  - Dedicated bearers – up to 8 per UE
- **Service Continuity**
  - SR-VCC
  - ISIM support for UE
  - QCI dependent triggers (set HO triggers for VoIP only traffic)
- **eNB Scheduler**
  - Semi persistent scheduling for HARQ (SPS)
  - QOS aware scheduler
  - Delay-based scheduler
  - Proportional Fair Scheduler
 - Frequency Selective Scheduler UL/DL
  - Service Aware Buffer Est. (SABE)

- **Other eNB Optimizations**
  - Robust Header Compression (RoHC)
  - TTI bundling
  - Inter-Carrier Interference (ICI) coordination over X2
  - Dynamic Admission Control (AC)
  - GBR with differentiated admission control (AC)
  - QOS aware link adaption (codec rate adaption)
  - QCI aware load balancing
  - EPS bearer modification
  - Discontinuous Reception (DRX), VoIP optimized DRX (battery life)

Ingredients of a high quality, high capacity Mobile Voice over IP offering!
Optimizations for voice traffic patterns and wireless codecs balance quality and capacity

Alcatel·Lucent

A Glance at Performance: VoIP Capacity

VoIP Capacity in 5 MHz
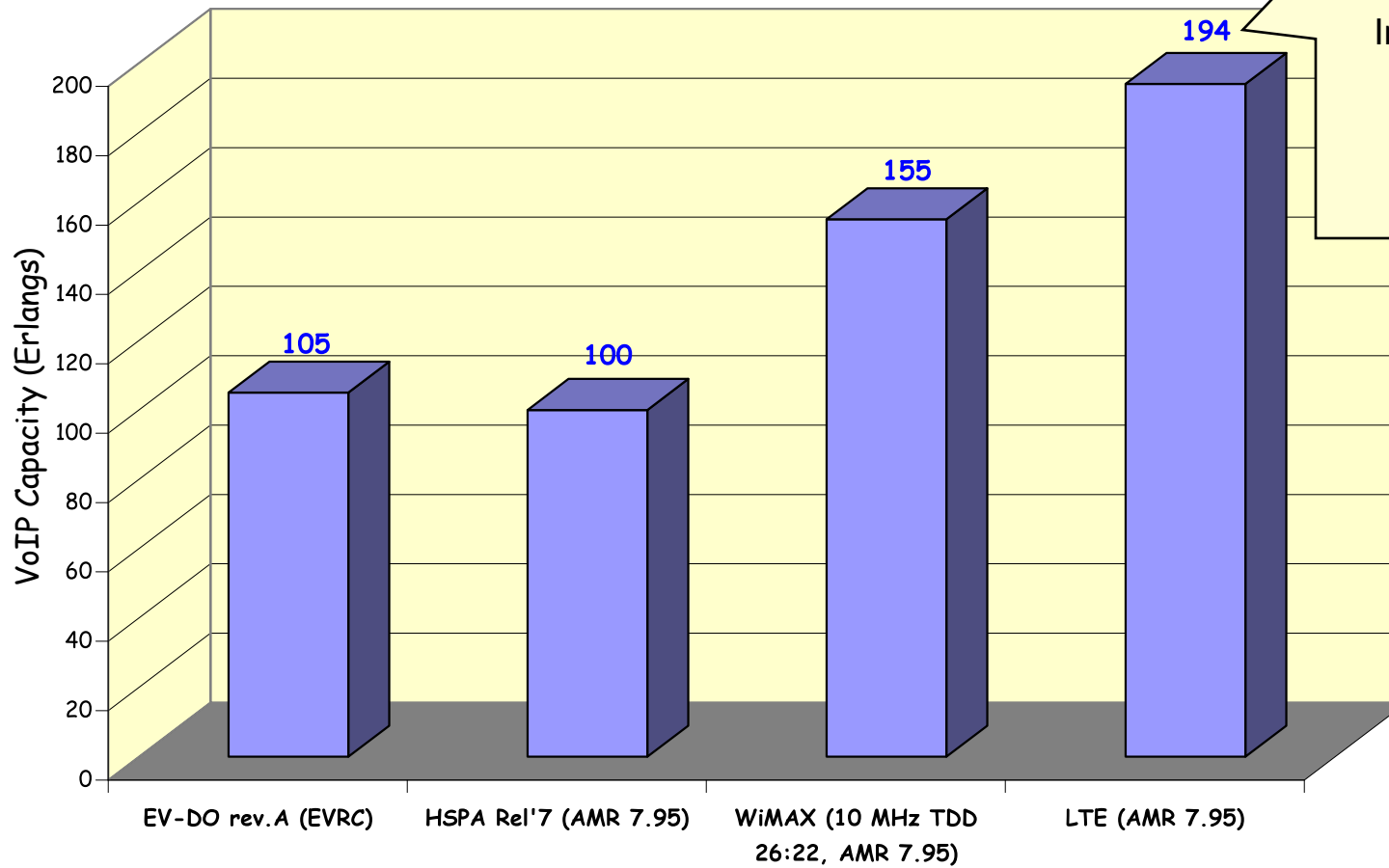
3GPP Capacity Estimates:
AMR 12.2 codec

Interference limited:
241 Erlangs

Coverage limited:
123 Erlangs

Source: Alcatel-Lucent simulation results

Alcatel·Lucent

Regulatory Considerations and Features

- **Emergency Calls including E911 Location**
  - Geo-location basics – Assisted GPS, ECID, OTDOA
  - Control plane location based services
  - User plane location based services

- **CALEA support for VoIP**
  - Support required in IMS for lawful intercept of voice calls

Alcatel·Lucent

www.alcatel-lucent.com