

On the road with 3GPP



3GPP's Long Term Evolution and
System Architecture Evolution projects

3GPP Evolution LTE AND SAE

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TSG RAN Chairman



What 3GPP is

- A collaborative agreement between Standards Development Organizations (SDOs) and other bodies for the production of a complete set of globally applicable Technical Specifications and Reports for:
 - 3G (IMT-2000) systems based on the evolved GSM core network and the Universal Terrestrial Radio Access (UTRA), in FDD and TDD modes;
 - GSM, including GSM evolved radio access technologies (GPRS/EDGE/GERAN)

What 3GPP does

- 3GPP prepares and maintains specifications for the following technologies:

- GSM
- GPRS
- EDGE
- W-CDMA – FDD (Frequency Division Duplex)
- TD-CDMA – TDD (Time Division Duplex) – in High Chip Rate and Low Chip Rate (TD-SCDMA) modes



BT



*i.e. all of the technologies
on the GSM evolution path*



NTT DoCoMo

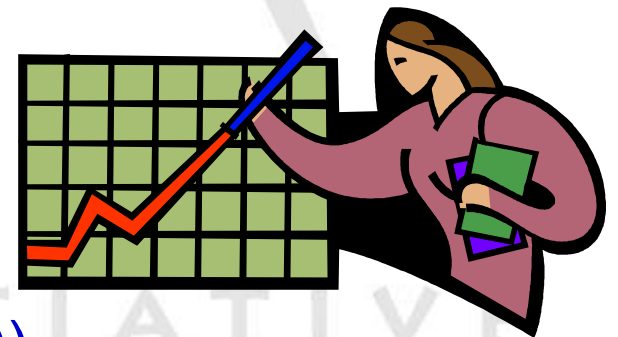
A single home for all these technologies helps to ensure
global interoperability

3GPP TSG RAN

- TSG RAN Objectives
 - Define and further develop the UMTS (WCDMA and TDD including TD SCDMA) Radio Access Network
 - Specify tests for User Equipment as well as Base Station
- TSG RAN Organization
 - Five subgroups
 - WG1 specifying the Layer 1
 - WG2 specifying the Signalling over the radio Interface
 - WG3 specifying the architecture and the interface within the Access Network
 - WG4 specifying the requirement for the radio performances including test specifications for Base Station
 - WG5 specifying tests for the User Equipment inclusive of the core networks aspects

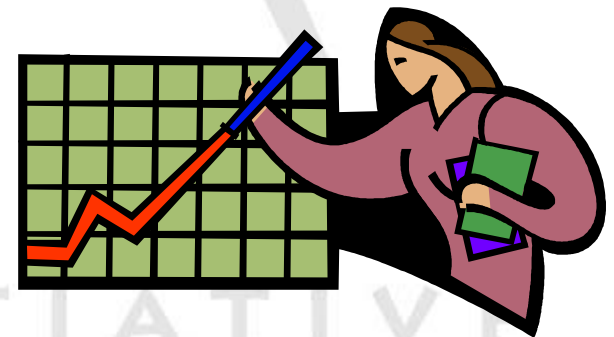
3GPP Long Term Evolution (LTE) philosophy

- LTE focus is on:
 - enhancement of the Universal Terrestrial Radio Access (UTRA)
 - optimisation of the UTRAN architecture
- With HSPA (downlink and uplink), UTRA will remain highly competitive for several years
- LTE project aims to ensure the continued competitiveness of the 3GPP technologies for the future
- (There is also an ongoing programme of enhancements for GERAN (GSM/EDGE radio access))



3GPP System Architecture Evolution (SAE) philosophy

- SAE focus is on:
 - enhancement of Packet Switched technology to cope with rapid growth in IP traffic
 - higher data rates
 - lower latency
 - packet optimised system
 - through
 - fully IP network
 - simplified network architecture
 - distributed control
- More of this later...



Basic criteria for LTE

- Demand for higher data rates
- Expectations of additional 3G spectrum allocations
- Greater flexibility in frequency allocations
- Continued cost reduction
- Keeping up with other (unlicensed) technologies (eg WiMAX)
- Growing experience with the take-up of 3G is helping to clarify the likely requirements of users, operators and service providers in the longer term



LTE targets

- Significantly increased peak data rates
- Increased cell edge bitrates
- Improved spectrum efficiency
- Improved latency
- Scalable bandwidth
- Reduced CAPEX and OPEX
- Acceptable system and terminal complexity, cost and power consumption
- Compatibility with earlier releases and with other systems
- Optimised for low mobile speed but supporting high mobile speed



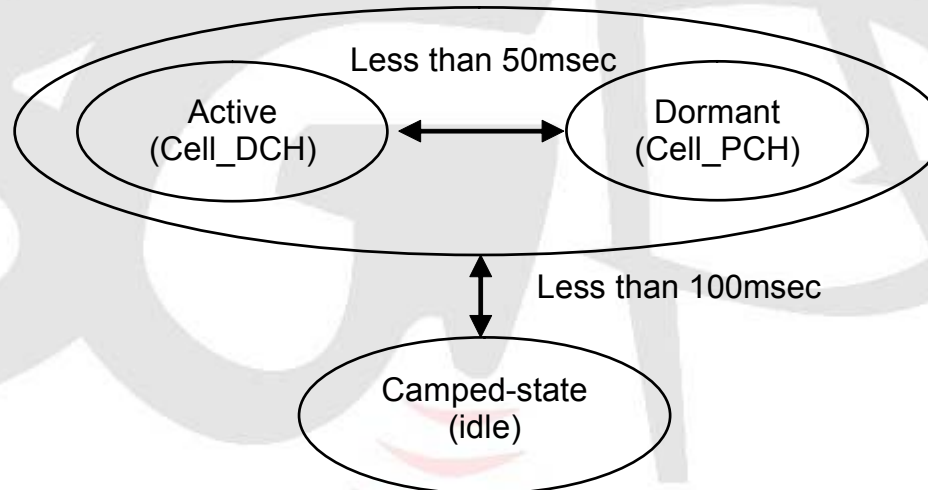
Peak data rate

- Goal: significantly increased peak data rates, scaled linearly according to spectrum allocation
- Targets:
 - Instantaneous downlink peak data rate of 100Mbit/s in a 20MHz downlink spectrum (i.e. 5 bit/s/Hz)
 - Instantaneous uplink peak data rate of 50Mbit/s in a 20MHz uplink spectrum (i.e. 2.5 bit/s/Hz)



Latency

- Control-plane
 - Significant reductions in transition times from idle or dormant states to active state



- User-plane
 - Radio access network latency below less than 5 ms in unloaded condition (ie single user with single data stream) for small IP packet
- Latency also being addressed in SAE



User throughput

- Downlink target:
 - 3-4 times that of Release 6 HSDPA
 - Scaled according to spectrum bandwidth
- Uplink target:
 - 3-4 times that of Release 6 Enhanced Uplink
 - Scaled according to spectrum bandwidth



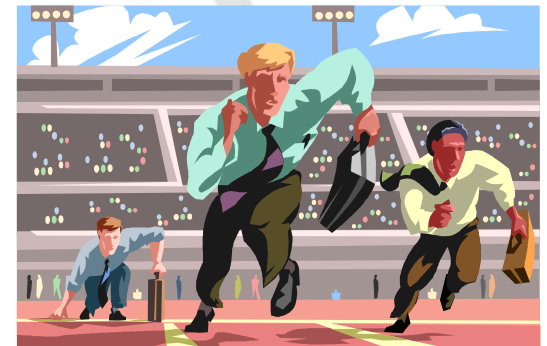
Spectrum efficiency

- Significantly improved spectrum efficiency and cell edge bitrate
 - whilst maintaining same site locations
- Downlink target (bits/sec/Hz/site):
 - 3-4 times that of Release 6 HSDPA
- Uplink target (bits/sec/Hz/site):
 - 3- 4 times that of Release 6 Enhanced Uplink



Mobility

- The Enhanced UTRAN (E-UTRAN) will:
 - be optimised for mobile speeds 0 to 15 km/h
 - support, with high performance, speeds between 15 and 120 km/h
 - maintain mobility at speeds between 120 and 350 km/h
 - and even up to 500 km/h depending on frequency band
 - support voice and real-time services over entire speed range
 - with quality at least as good as UTRAN



MBMS

- Enhanced UTRA to support enhanced Multimedia Broadcast Multicast Service modes
 - Reuse of same physical layer components as for unicast, to reduce complexity/cost
 - Simultaneous, integrated and efficient voice and MBMS to the user
 - Support of MBMS in unpaired spectrum



Spectrum issues

- Spectrum flexibility
 - E-UTRA to operate in 1.25, 1.6, 2.5, 5, 10, 15 and 20 MHz allocations...
 - uplink and downlink...
 - paired and unpaired
- Co-existence
 - with GERAN/3G on adjacent channels
 - with other operators on adjacent channels
 - with overlapping or adjacent spectrum at country borders
 - Handover with UTRAN and GERAN



Cost considerations

- Optimisation of backhaul
- Maximised use of existing sites
- Multi-vendor
- Terminal complexity and power consumption to be optimised/minimised
- Avoidance of complicated architectures and unnecessary interfaces
- Efficient OAM&P (Operation, Administration, Maintenance and Provisioning)



Timescales and status

- LTE plan endorsed by 3GPP Project Co-ordination Group
- Initial studies and work-plan creation to be completed by June 2006
- Relevant standards to be developed afterwards
- 3GPP2 also considering an LTE plan
 - Chance to align and remove unnecessary differences for IP core network
 - Maybe a single air interface will result?



Work Plan for the Long term evolution for the UTRA and UTRAN



RAN #27, 9-11 March, Tokyo

- Work plan agreed
- TR Structure agreed
- 1st list of requirements

RAN#29, 21-23 Sept, Tallin

- Revised work plan
- RAN-CN functional split partially agreed

RAN#31, 8-10 March, China

- Revised work plan
- Working assumption on complete concept
 - Channel structure
 - MIMO scheme to be used for evaluation
 - Signalling procedures
 - Mobility details

200

2006

Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun

RAN #28, 1-3 June, Quebec

- Revised Work plan
- Requirement TR approved
 - deployment scenarios included
 - requirements on migration scenarios included

RAN#30, 30 Nov-2 Dec, Malta

- Revised work plan
- RAN Architecture including RAN migration scenarios
- Radio Interface Protocol Architecture
- States and state transitions
- Physical Layer Basics
 - Multiple access scheme
 - Macro-diversity or not
 - RF Scenarios
 - Measurements

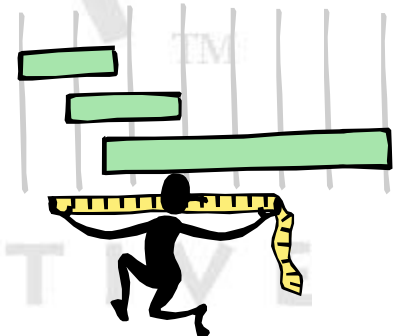
RAN#32, 31 May- 2 June, TBD

- Concept TR for approval
 - TR having Stage 2 level of details in order for smooth transition to Work Item phase
- WIs created and their time plan agreed

A G L O B A I N I T I A T I V E

Progress to date

- Work is underway
 - TR 25.913 on LTE requirements under change control
 - Several CRs approved already
 - Joint work with TSG SA WG2 (Architecture) on system architecture issues – TR 23.882 currently in draft
 - Work well advanced in TSG RAN WG1 (Radio Layer 1), where a set of six basic Layer 1 proposals was evaluated:
 - FDD UL based on SC-FDMA, FDD DL based on OFDMA
 - FDD UL based on OFDMA, FDD DL based on OFDMA
 - FDD UL/DL based on MC-WCDMA
 - TDD UL/DL based on MC-TD-SCDMA
 - TDD UL/DL based on OFDMA
 - TDD UL based on SC-FDMA, TDD DL based on OFDMA
- and the choice was...



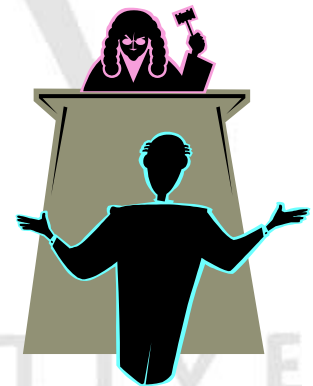
Current working assumption

- Downlink based on OFDMA
 - OFDMA offers improved spectral efficiency, capacity etc
- Uplink based on SC-FDMA
 - SC-FDMA is technically similar to OFDMA but is better suited for uplink from hand-held devices
 - (battery power considerations)
- For both FDD and TDD modes (User Equipment to support both)
 - With Similar framing + an option for TD SCDMA fr
- Macro-diversity (soft handover) not required
- But...



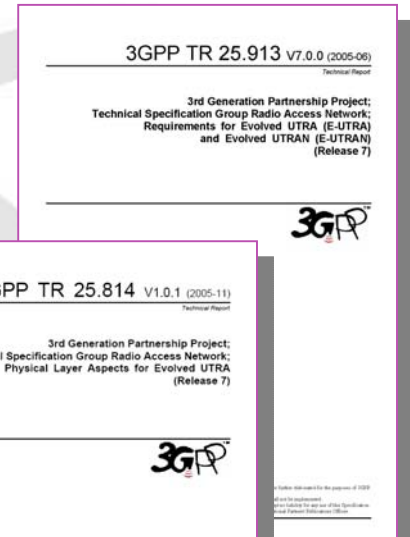
But it's not just a technology issue

- The final choice of LTE technologies is not simply technological...
- ...it may be determined ultimately by IPR issues
- ETSI Working Group currently examining the need for an updated IPR regime for standards



For more information

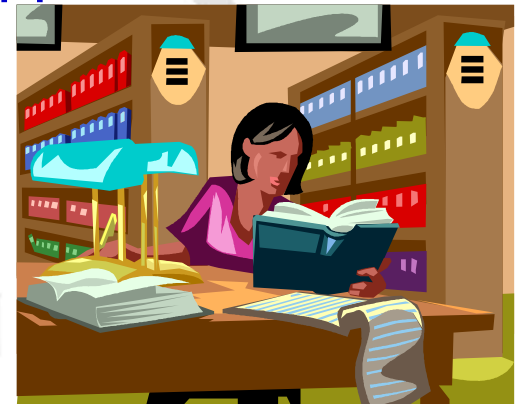
- Technical Report TR 25.913, Requirements for Evolved UTRA & UTRAN
- Technical Report TR 25.814, Physical aspects for Evolved UTRA
- Freely available at:
http://www.3gpp.org/ftp/Specs/archive/25_series/
- Current thoughts on architecture in draft TR 23.882 (on 3GPP website also)
- Participate in the discussion on the e-mail exploder list:
http://list.3gpp.org/3gpp_tsg_ran_wgs_long_term_evolution.html
- Or mail 3GPPContact@etsi.org



3GPP System Architecture Evolution (SAE) study

Objective:

- "to develop a framework for an evolution or migration of the 3GPP system to a higher-data-rate, lower-latency, packet-optimized system that supports multiple Radio Access Technologies.
- The focus of this work is on the PS domain with the assumption that voice services are supported in this domain".



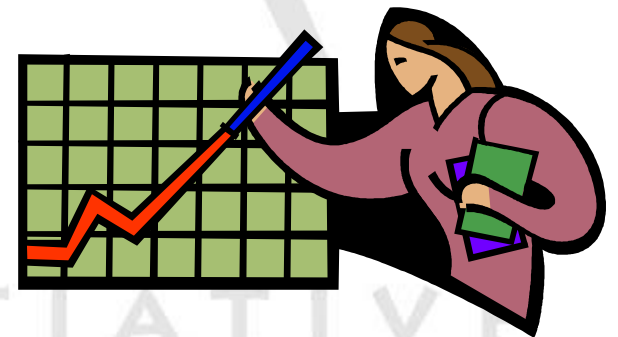
SAE study

- Looking at the implications for the overall architecture resulting from:
 - 3GPP's (Radio Access Network) LTE work
 - 3GPP All-IP Network specification (TS22.978)
 - the need to support mobility between heterogeneous access networks



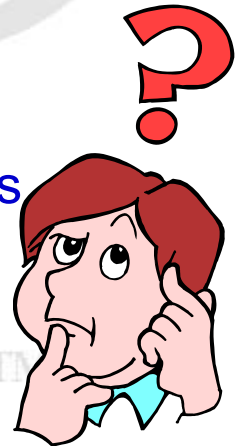
3GPP SAE philosophy

- SAE focus is on:
 - enhancement of Packet Switched technology to cope with rapid growth in IP traffic, i.e.
 - higher data rates
 - lower latency
 - packet optimised system
 - through
 - fully IP network
 - simplified network architecture
 - distributed control
- Various access technologies assumed (wireless and wired)



Some big issues to address...

- Achieving mobility within the Evolved Access System
- Implications of using the evolved access system on existing and new frequency bands
- Will the Evolved RAN need to be connected to the legacy PS core?
- Adding support for non-3GPP access systems
- Inter-system Mobility with the Evolved Access System
- Roaming issues, including identifying the roaming interfaces
- Inter-access-system mobility
- Policy Control & Charging
- How does User Equipment discover Access Systems and corresponding radio cells? Implications of various solutions on User Equipment, e.g. on battery life
- Implications for seamless coverage with diverse Access Systems

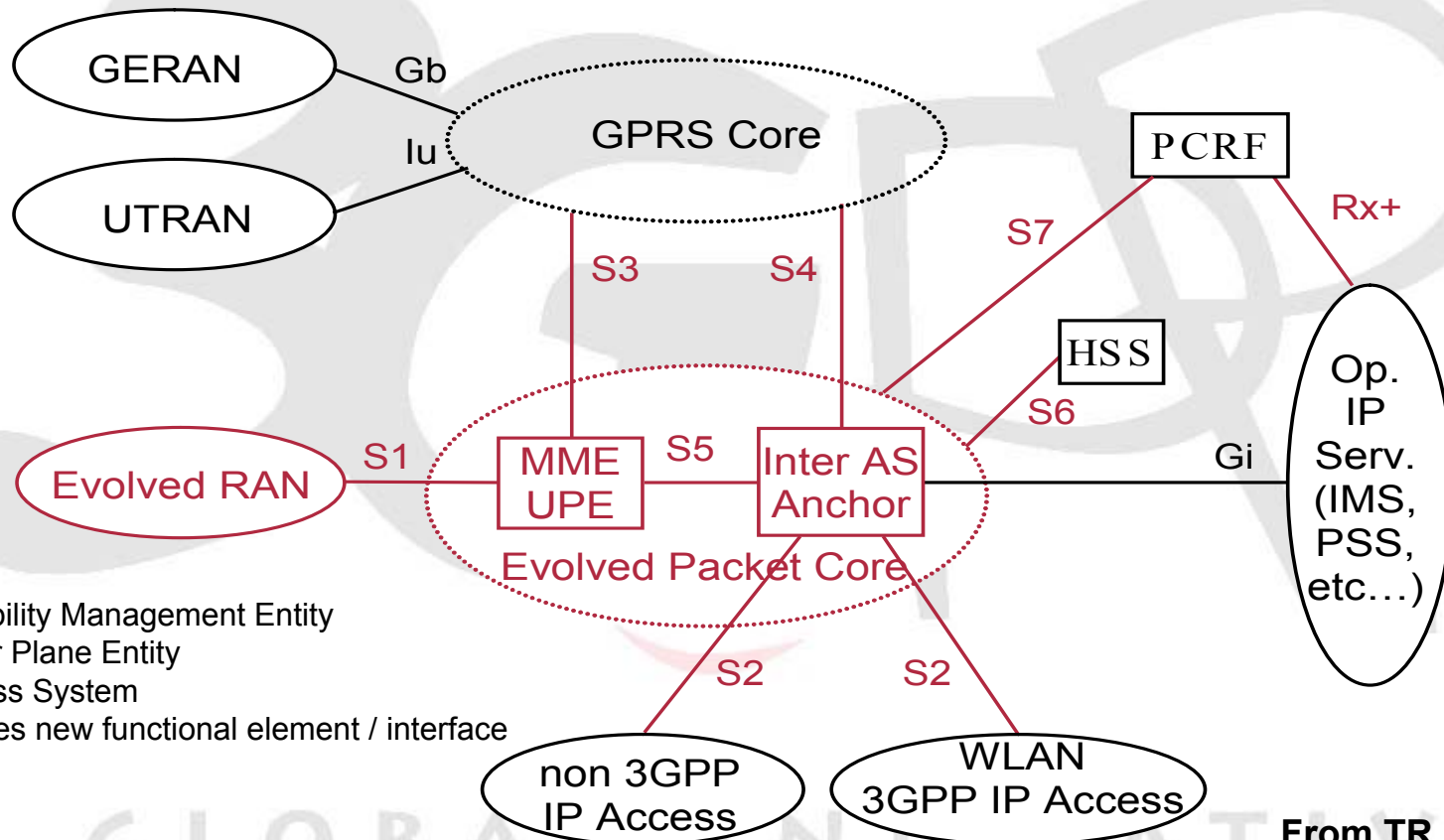


Timescales and status

- SAE Work Item started December 2004
 - Work being led by Working Group SA2
- Joint meetings with other Working Groups
 - e.g. on Security issues
- Study due to be completed by September 2006
- Migration from the current to the new architecture to be investigated with RAN including evolution of the Release 6 RAN (HSPA+) together with TSG RAN WG2 and TSG RAN WG3
- Two model architectures defined...
 - based on proposals received...
- ...now resolved into a single high-level model...



Draft logical high level architecture for the evolved system



MME – Mobility Management Entity
 UPE – User Plane Entity
 AS – Access System
 Red indicates new functional element / interface

From TR 23.882

For more information

- Technical Report TR 23.882
- Freely available at:
http://www.3gpp.org/ftp/Specs/archive/23_series/23.882/
- Or mail 3GPPContact@etsi.org

3GPP TR 23.882 draft V0.9.0 (2005-12)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
3GPP System Architecture Evolution;
Report on Technical Options and Conclusions
(Release 7)

GSM
GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS



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