

On the road with 3GPP



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

3GPP Evolution LTE AND SAE

Francois COURAU
TSG RAN Chairman



A GLOBAL INITIATIVE

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



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



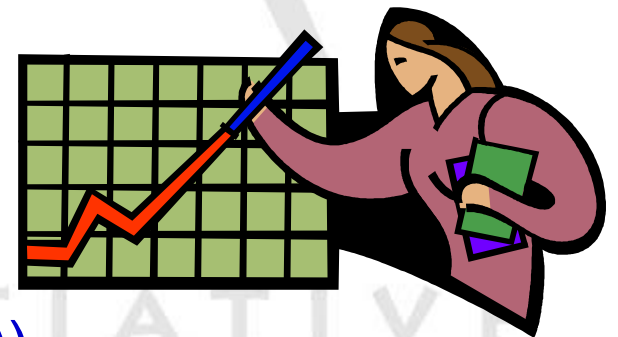
A single home for all these technologies helps to ensure
global interoperability

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

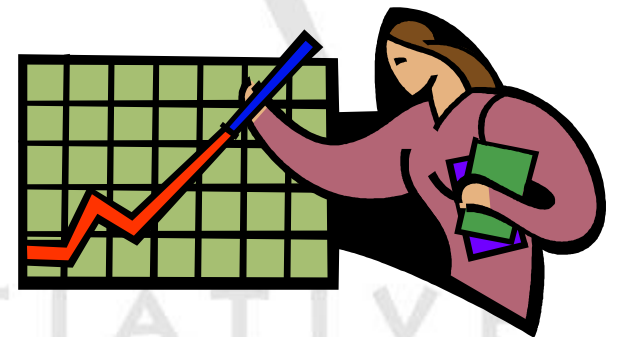
3GPP Long Term Evolution (LTE) philosophy

- 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



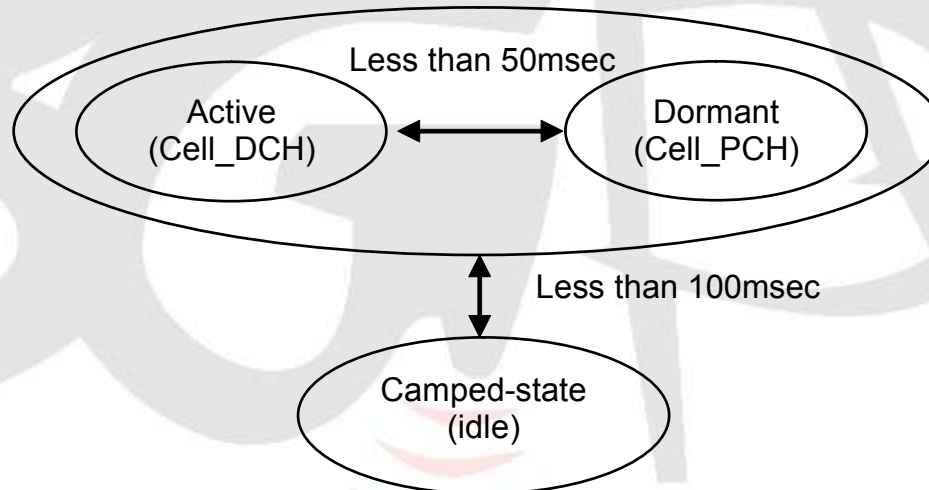
Peak data rate

- 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



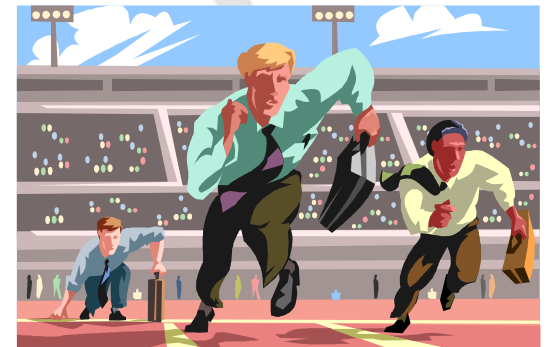
Spectrum efficiency

- 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)

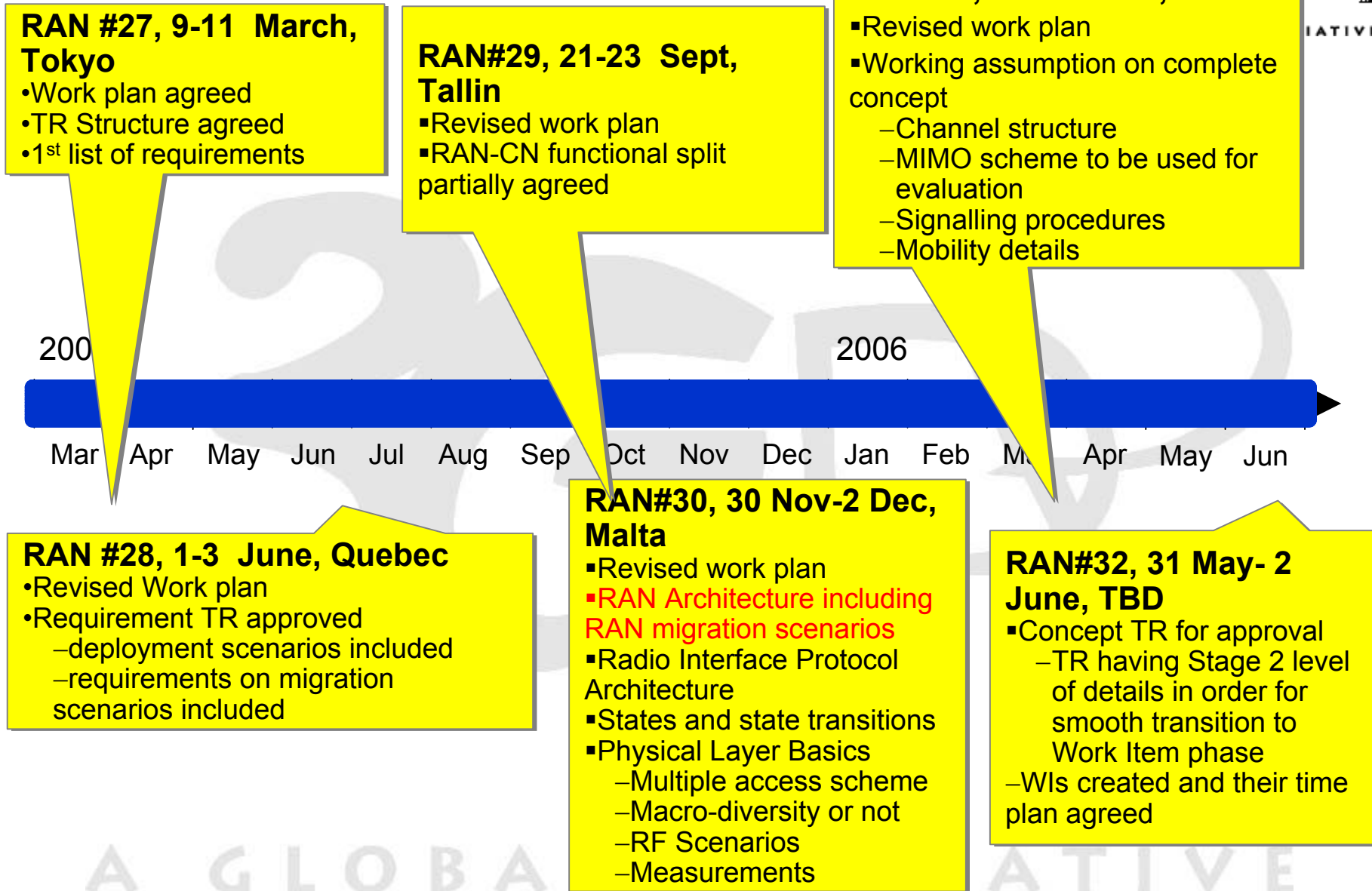


Timescales and status

- 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?

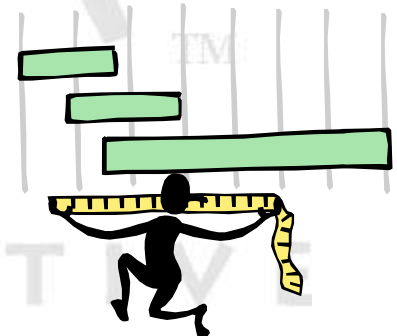


Work Plan for the Long term evolution for the UTRA and UTRAN



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...



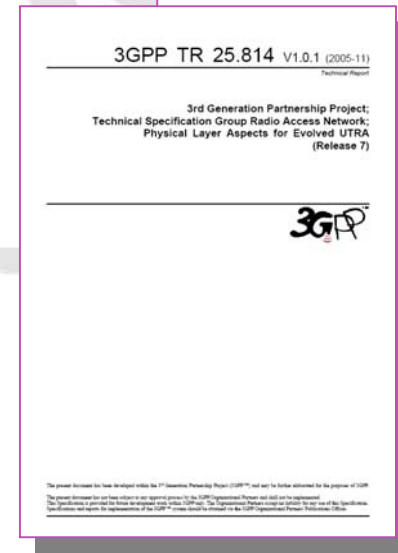
But it's not just a technology issue

- 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

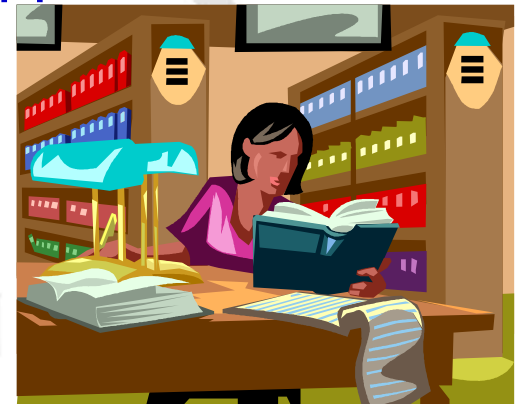
- Technical Report TR 25.913, Requirements for Evolved UTRA & UTRAN
- Technical Report TR 25.814, Physical aspects for Evolved UTRA
- Freely available at:
http://www.3gpp.org/ftp/Specs/archive/25_series/
- Current thoughts on architecture in draft TR 23.882 (on 3GPP website also)
- Participate in the 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".



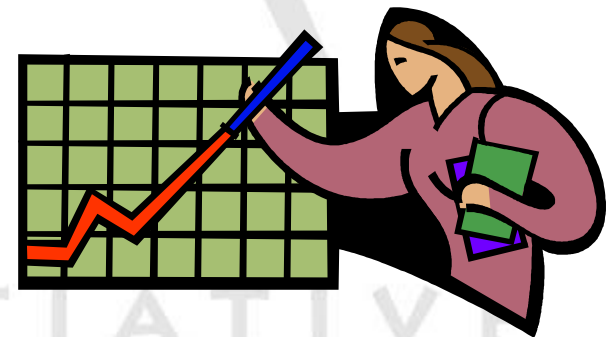
SAE study

- 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



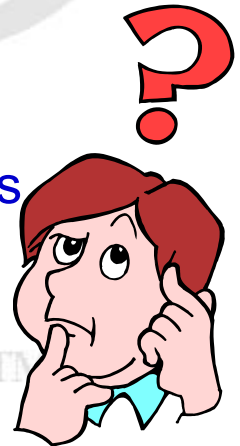
3GPP SAE philosophy

- 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

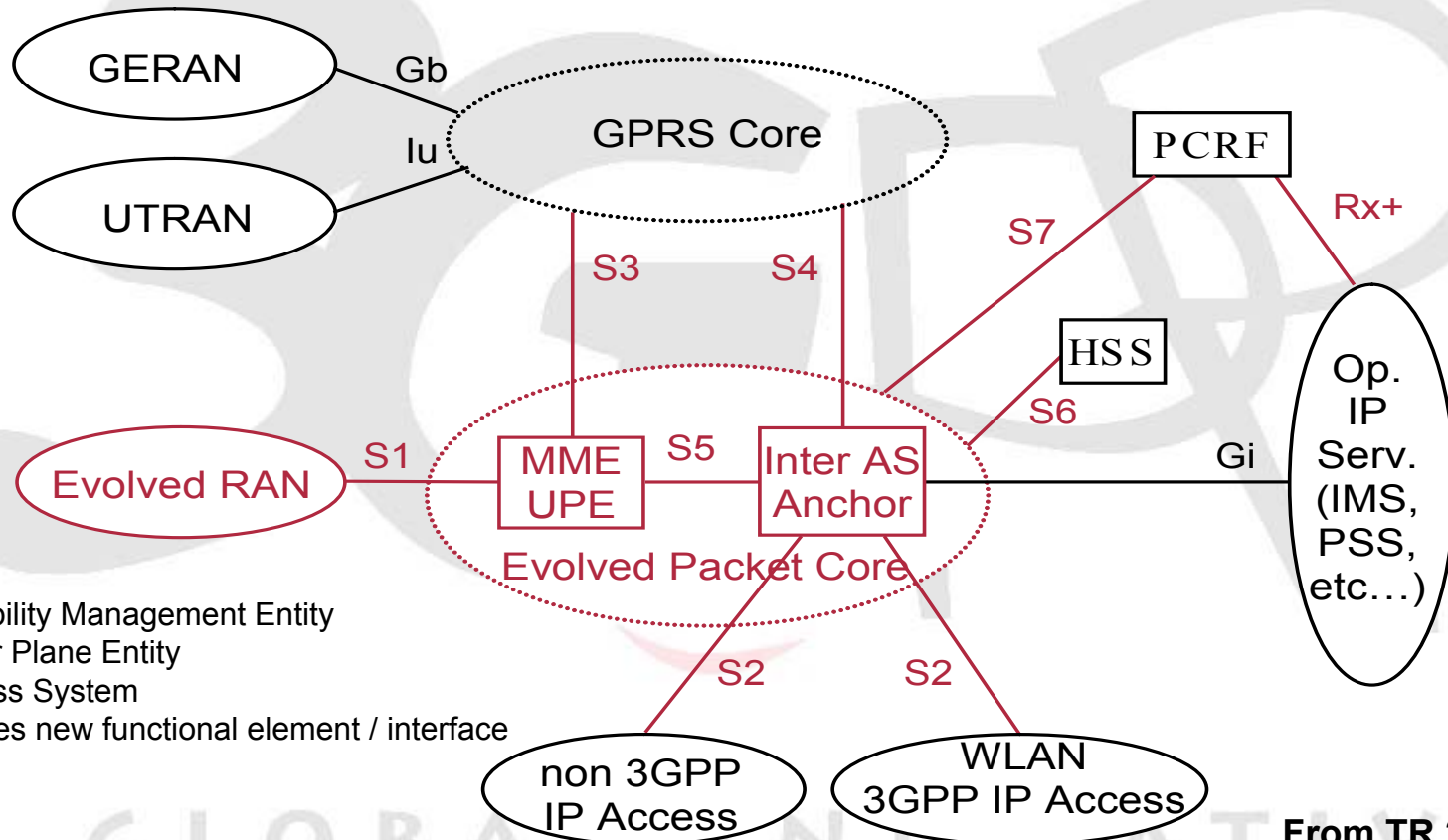


Timescales and status

- 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



The present document has been developed within the 3rd Generation Partnership Project (3GPP™) and may be further elaborated for the purposes of 3GPP.
The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented.
This Specification is provided for future development work within 3GPP only. The Organizational Partners accept no liability for any use of this Specification.
Specifications and reports for implementation of the 3GPP™ system should be obtained via the 3GPP Organizational Partners' Publications Offices.