Improvements to GSM, GPRS and EDGE to interact with the LTE experience

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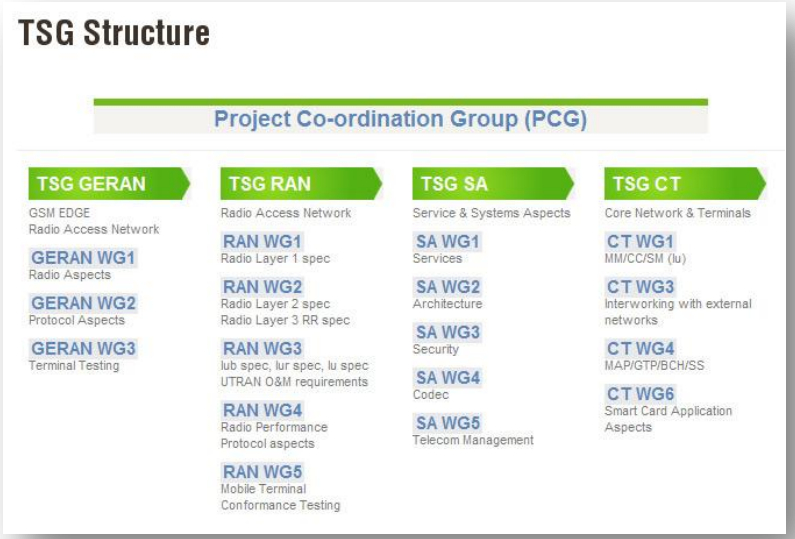
TSG GERAN Overview

TSG GERAN Overview (1/2)

- The TSG **GSM/EDGE Radio Access Network (GERAN)** specifically has responsibility for the following areas:
  - RF aspects of GERAN, including:
    - Radio performance specification
    - RF system aspects
  - GERAN Radio specifications (L1, L2, RR L3)
  - A interface specification, Gb interface specification
  - Internal GERAN interface specifications such as Abis
  - Conformance test specifications for testing of all aspects of GERAN terminals and base stations
  - GERAN specific O&M specifications for the nodes in the GERAN

TSG GERAN Overview (2/2)

- 3GPP TSG GERAN is one of the four 3GPP TSGs:



- GSM Phase 1 started out as a voice centric service but over time there has been an ever increasing rise in the need for data
- Operators of GSM/GPRS/EDGE systems need a strategy for future growth and interoperability
- The evolution of GSM/GPRS/EDGE radio access technologies offers such a path

Setting the scene

Setting the Scene (1/2)

- First there was voice, then as systems matured and with the arrival of the internet the need for data started to increase
- So the 3GPP GERAN based systems evolved from GSM to GPRS to EDGE to the feature package GERAN evolution
- GERAN Evolution (Release 7)
  - A number of improvements to further enhance the service performance of EDGE have been included in Release 7 of the 3GPP standard.
    - Latency reduction (LATRED)
    - Downlink Dual Carrier
    - Higher-order modulation, turbo codes and increased symbol rate
    - Mobile Station Receive Diversity (MSRD)
  - With these features, peak bit-rates can be improved and latency reductions can be expected

Setting the Scene (2/2)

- Now with increased use of smart phones and the introduction of mobile broadband, supported by HSPA and LTE, the need for higher data rate and seamless end-user experience between RATs is becoming even more apparent in cellular systems
- To cater for this increasing demand the cellular systems are continuously evolving
- And TSG GERAN is continuing to work on features that support service continuity between 3GPP GERAN based systems and 3GPP LTE based 4th generation systems

Impacts of LTE

Impacts of LTE (1/4)

- There are work items for the evolution of the 3GPP radio-access technology (RAT) towards a high-data-rate, low-latency and packet-optimized radio access on-going
- Many GSM/GPRS/EDGE networks deployed worldwide
- One of the key aspects of standardisation work is to enable continuity of service across an operator's network, no matter which RAT is in use
- As 3GPP GERAN networks have developed and as new RATs have been introduced so interworking with these 3GPP GERAN networks has developed

Impacts of LTE (2/4)

- General requirements for the co-existence and interworking between Long Term Evolution (LTE) and existing 3GPP RATs (including GERAN) are captured in TR 25.913

- A couple of the key requirements for interworking:
  - E-UTRAN Terminals supporting GERAN operation should be able to support measurement of, and handover from and to, 3GPP GERAN systems
  - There needs to be efficient support for inter-RAT measurements with acceptable impact on terminal complexity and network performance

Impacts of LTE (3/4)

- To support the required functionality in the 3GPP GERAN system the following areas had to be considered:
  - BCCH System Information
  - MS capabilities
  - Packet Switched handover
  - Session continuity
  - Inter-RAT Network Assisted Cell Change (NACC)
  - Idle Mode measurements and cell (re)selection
  - Connected and GPRS mode MS measurements on LTE, and measurement reporting;
  - MS timing aspects of inter-RAT change

Impacts of LTE (4/4)

- With the arrival of 3GPP LTE based 4th generation systems there are several areas that impact the 3GPP GERAN based systems:
  - Making spectrum available for LTE whilst continuing to support the same number of users
  - Sharing of GSM for coverage purposes
  - Service continuity
    - Voice services
    - Data
  - Separation of traffic

GERAN Developments

GERAN Developments (1/6)

- Making more spectrum available
  - With the need to start considering making more spectrum available for 3GPP LTE whilst needing to support the same number of users, TSG GERAN started to look at several features, including:
    - Voice services over Adaptive Multi-user channels on One Slot (VAMOS)
    - Tightened Link Level Performance Requirements for Single Antenna MS (TIGHTER)
    - General data rate improvements

GERAN Developments (2/6)

- Voice services over Adaptive Multi-user channels on One Slot (VAMOS)
  - The increase in user numbers and voice traffic puts a huge pressure on operators especially within populous countries
  - As voice service price gets cheaper, most operators face the challenge to obtain efficient utilization of hardware and spectrum resource
  - VAMOS is designed to increase voice capacity in the order of a factor of two per BTS transceiver by creating new types of speech traffic channels in GERAN and by means of multiplexing two users simultaneously on the same radio resource (downlink and uplink)
  - Changes to network hardware are minimised as much as possible
  - Maintains voice quality and robustness of signalling channels compared to legacy GMSK terminals

GERAN Developments (3/6)

- Tightened Link Level Performance Requirements for Single Antenna MS (TIGHTER)
  - The performance of single antenna MS have continuously improved over time
  - Tightening of the DL performance requirements for reference sensitivity and interference limited scenarios ensure a set of performance requirements reflecting “today’s“ possible DL single antenna MS performances
  - Improvements in the link level performance for single antenna GSM terminals lead to improved radio network capacity, for all GSM services, when terminals are operating in areas which are limited by sensitivity or interference

GERAN Developments (4/6)

Sharing of GSM

- As operators look to roll out their LTE networks alongside their existing GERAN networks they will be looking into sharing GSM for coverage purposes (this is also important as available GSM spectrum diminishes)
- Full support of multi-operator core network
  - GERAN already provides limited support for this
    - Single Common PLMN
  - Full support needs to be provided in GERAN
    - Multiple PLMNs
    - Network to supply supporting terminals with information about the PLMN IDs of the different operators
- TSG GERAN is working on the 3GPP Specifications in order to allow networks to manage supporting MSs/UEs sharing a GERAN network

GERAN Developments (5/6)

Service continuity

- The issue of service continuity, especially of voice, between systems is important and TSG GERAN has worked on features to support this
- In particular the CS Fall Back (CSFB) feature:
  - Needed to support LTE networks that do not offer an operator's voice service (namely Voice over LTE (VoLTE))
  - CSFB provides the ability for voice calls to be supported
  - CSFB allows a voice call to be placed (albeit with some extra delay) and fully controlled by the operator
  - CSFB also allows for emergency calls
  - CSFB also gives operators with GSM/LTE networks a way of separating out traffic (i.e. data on LTE while voice can be on GSM)
- Single Radio Voice Call Continuity (SRVCC) and Reverse SRVCC (rSRVCC) are being developed for full voice continuity in both directions

GERAN Developments (6/6)

- Study on GERAN Enhancements for Mobile Data Applications
  - Mobile networks are experiencing a significant increase in mobile data traffic (e.g. Instant Messaging applications in China)
  - This has introduced new challenges to the mobile networks
  - Work in 3GPP and TSG GERAN in particular, has been carried out as of Release 10 to address requirements and use cases from Machine-type communications, such as those of smart grids and Internet of Things (IoT).
  - TSG GERAN are studying ways of supporting extended usage of mobile data applications by multi-tasking capable mobile stations
    - Identify relevant traffic profiles from GERAN perspective
    - Review impacts on GERAN networks
    - Identify possible solutions to alleviate the impacts without effecting CS services

Conclusions

Conclusions

- 3GPP provides global standards that take into account requirements and use cases from all the different regions
- The 3GPP GERAN specifications continue to be evolved and extended to meet the needs of operators
- TSG GERAN continues to evolve GSM EDGE technology to account for impacts of LTE on legacy systems and spectrum
- Support is provided for interoperability between GERAN and other Radio Access Technologies to enable service continuity
- 3GPP GERAN based systems will continue to be a significant part of the mobile landscape for the foreseeable future

Thank You !

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More Information about 3GPP:

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