IP Migration of GSM-R

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Content overview

- Evolution from a circuit-switched to a packet-switched communication system

- IP based communication systems for railway communication

- Standardisation works – present and future

- Implementation works and roll-out
Current circuit-switched GSM-R systems …

GSM-R Infrastructure / Network

GSM-R Mobiles
ETCS OBU
Circuit Switched

NSS

BSS

ISDN PRI

ETCS RBC

ISDN PRI

ISDN PRI

ISDN PRI

ISDN PRI

ISDN BRI

ETCS RBC

GSM-R Fixed Terminal Subsystem

Line-side Phones

PSTN / PABX

SS7 ISUP

ISDN PRI

QSIG

ISDN PRI

QSIG

Circuit Switched
… evolve to IP based ones
IP based applications and sub-systems

• Applications and services evolving to IP
  – ETCS
  – Recording
  – Fixed-line voice communication

• Sub-systems evolving to IP
  – GSM-R Infrastructure / Network “Release 4“, “GPRS/EDGE“
  – GSM-R Fixed Terminal Subsystem “IP based“
  – GSM-R Mobiles “GPRS/EDGE“
IP based interfaces

• Interfaces evolving to IP
  – GSM-R NSS – FTS  “SIP”
  – GSM-R Network – Mobiles  “GPRS/EDGE”
  – GSM-R Mobiles – ETCS on-board  “IP”
  – GSM-R Network – ETCS RBC  “IP”

• Legacy interfaces and sub-systems (e.g. line-side phones, PSTN) as well as voice mobiles may remain at circuit switched technology
Requirements for the Railway Communication Systems

- Railway specific services
  - Group Calls and Broadcast Calls (with & w/o talker change)
  - Priority of Calls (precedence and pre-emption)
  - Functional Addressing
  - ETCS data transport

- Quality-of-Service, guaranteed call setup times

- Well defined and guaranteed capacity on interfaces

- Simple integration of legacy systems

- Re-use of existing infrastructure (such as BTS sites and transmission)
IP Benefits

- One multi-service network for different types of applications
- Increase of reliability & availability (redundancy & resilient architecture)
- Efficient use of limited capacity at the interfaces in question
- Reduced cost for implementation and operation – use of off-the-shelf components and systems
- Re-use of existing infrastructure, add new applications
- Ease of interconnectivity of IP based networks
IP Challenges

• Quality-of-service
  – permanent resource allocation vs. dynamic one
  – determined transmission time(s) vs. efficient use of capacity
  – Critical services vs. best effort services on one single network

• Security
  – “non-disclosed“ dedicated circuits vs. “free to connect“ IP cloud
  – operate IP systems and interfaces in “trusted environment“

• Interconnection and interworking with legacy systems

• Future proof implementation vs. decreasing life-cycle of off-the-shelf components
UIC specifications are on their way …

- **UIC IP Guidelines**
  - Definition of requirements for IP based interfaces and networks
  - Consider best practices and future developments

- **EIRENE FRS 7.4.0 / SRS 15.4.0**
  - Change request for “Release 4 core network architecture“
    - approved
  - Change request for „core network redundancy“
    - under discussion
  - Change request SIP based interface between core network and controller equipment
    - under discussion
... projects and evaluation are ongoing

- **UIC – ETCS over GPRS working group is ongoing**
  - GPRS relevant technical features identified: first draft of engineering requirements has been circulated
  - Traffic model for testing is approved: test cases finished, including some EDGE specific test
  - Lab/field test (RFF-phase 1) have been successfully performed
  - Lab-Test is on-going/done in UK(NR) and in Denmark(BDK)
  - UNISIG ETCS over GPRS field testing planned for October

- **ETSI – TC RT**
  - consider change requests in the PS domain, which are relevant for usage of GPRS/EDGE for ETCS operation
  - consider standardisation of “A-bis over IP“ interface (BTS – BSC)
  - consider standardisation of “voice recorder interface over IP“
Technical Specifications already published

• ETSI TS 103 147 – version 1.1.1
  – GSM-R Core Network Redundancy

• ETSI TS 103 166 – version 1.1.2
  – Rel-4 Core Network requirements for GSM-R

• ETSI TS 103 389 – version 1.1.1
  – Usage of Session Initiation Protocol (SIP) on the Network Switching Subsystem (NSS) to Fixed Terminal Subsystem (FTS) interface for GSM Operation on Railways
Technical Specifications upcoming

• ETSI TS 103 389 – version 1.2.1
  Usage of Session Initiation Protocol (SIP) on the Network Switching Subsystem (NSS) to Fixed Terminal Subsystem (FTS) interface for GSM Operation on Railways
    – Publication anticipated for Q4/2013
    – Errata to version 1.1.1
      • length of User-to-User Information Element
      • applicability of User-to-User Information Element in response to SIP methods
      • Early Media Handling
    – Enhancements and Amendments
      • Explicit signalling for Group Call Control (empower avoidance of DTMF)
      • Media Inactivity Detection via RTP monitoring (avoid “dead connection“)
    – Issues left for future releases
      • Security
      • Supplementary Services
Implementation works and roll-out

• Evolution of GSM-R core network from “Release 99“ to “Release 4“
  – Austria, Germany, Great Britain, Ireland, …

• Roll-out of IP based controller equipment
  – Norway, Ireland, Lithuania, Tunisia, …

• Possible implementation of SIP based interface between NSS and FTS
  – Hungary, …

• ETCS over GPRS
  – Denmark, …
Going beyond current IP evolution

• Current IP evolution enables future migration to an IP based railway communication system
  – core network elements are already IP capable
  – key interfaces are already based on IP
  – IP already introduced and used for ETCS message transport
• IP transport will be extended to legacy interfaces
• IP capable user-devices will be introduced
• Services, including railway specifics, will be accessible
  – via IP based networks and interfaces
  – independent of access technology and service distribution
On track!

Thank you!