Railway Operational Communications Industry Group

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Preparing Infra-structure transition toward FRMCS (Next Generation)

Michael Klöcker
Head of Strategy Railway Solutions
Nokia Networks

ETSI headquarters, Sophia-Antipolis
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GSM-R Industry Group becomes *Railway Operational Communication Industry Group*

- GSM-R Industry Group was established in 2001, since then supporting the railway sector by the active global promotion of the GSM-R technology:
  - The supply of interoperable end-to-end systems
  - The minimization of integration efforts and railway migration costs
  - The continued development of the EIRENE standards in line with railway requirements
  - Supporting UIC, European Union Agency for Railways and the ERTMS users group

- 30th of August, the GSM-R Industry Group changed the name in the **"Railway Operational Communications Industry Group"**.

- The ROC Industry Group maintains the role and commitments as in the former name for GSM-R, but the mission and vision are technology enhanced and future oriented, including the Evolution of the Radio Communication System.
- The ROC Industry Group is committed to support GSM-R until at least 2030 including supporting the controlled migration of the entire system towards a Next Generation as part of the ERTMS program.

Agenda

1. Main Cornerstones
2. The System Architecture
3. Radio and Spectrum
4. Migration aspects

Next Generation: main cornerstones

Key success factors (I)

3GPP

- Benefit from 3GPP architecture and eco system for smooth migration, interworking, roaming
- Flexible 3GPP IMS Architecture : supporting 3GPP, fixed and non 3GPP bearer

IP

- IP evolution enables future path to an IP based railway communication system
  - Core network elements are already IP capable, Radio transmission becomes IP
  - IP already introduced and used for ETCS message transport

Spectrum

- Reuse of existing ER GSM band -> reuse of existing assets
- Dedicated network for Critical Communication Applications
- Non 3GPP access/WiFi: integrated in core or aggregation in radio
- Sharing options with PPDR

Next Generation: main cornerstones

Key success factors (II)

PPDR and Mass Transit / Urban Rail	• Commonality with PPDR market to increase the economy of scale (standardization, products) • Trend in Mass Transit to deploy LTE based systems • Worldwide demand for next generation networks for rail
Products	Currently deployed products support future migration: • Packet Core typically supports all 3GPP as non 3GPP (WiFi) access • Rel. 4 Core supports PSTN interworking and SIP interfacing • Flexible BTS architectures to ease multi technology introduction • Subscriber databases (HLR) to be seamlessly evolve to HSS • Dispatcher becomes all IP

Smooth migration from GSM-R to Next Generation supported by the Industry: From studies, standardization, trials, products and deployments

3GPP releases: Driven by public safety market, relevant for railways as well….

Common base network technology and functionality for public safety and railways to benefit from economy of scale

Release 8-10	Release 11	Release 12	Release 13 (3/2016)	Release 14 (2017)	*Release 15* (2018)
• VoLTE • QoS • Ciphering • eMBMS • HighSpeed (velocity) support	• High power UEs for Band 14	• Group Communication Service Enablers (GCSE) • Proximity Services (ProSe) • Mission Critical QoS Classes (QCI)	• Enhanced Proximity Services • Mission Critical Push To Talk (MCPTT) • Isolated E-UTRAN operation	• Mission Critical Video • Mission Critical Data • MCPTT improve. (roaming, preemption, service continuity) • High Speed train support (>> 350km/h) • *Spectrum (Europe)*	• ***FS_FRMCS Study on Future Mobile Communication System (URS Input),*** • ***Spectrum (Europe)***

3GPP SA1 Work Item FS-FRMCS:
Analyses how railway requirements from Next Generation can be fulfilled

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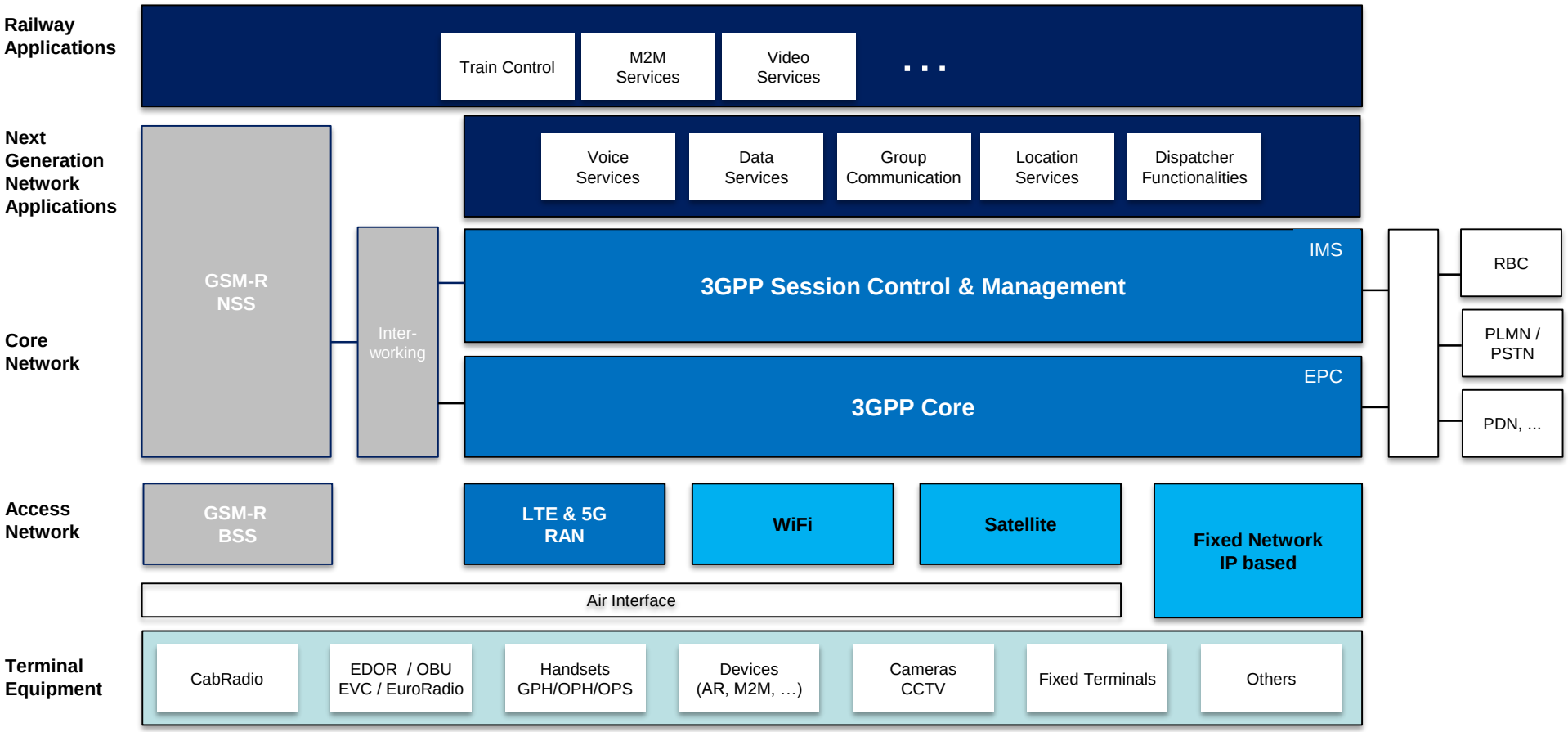
GSM-R and Next Generation

End to End System Architecture



Design target: Railway specific function on application layer.

Principles on migration to Next Generation

Dispatcher evolution

- Dispatcher system (“Fixed Terminal System”) as of today will be deeper integrated in Next Generation
- Applications and Services specified in UIC URS will not be spread among FTS and NSS … but be unified in Next Generation
  - Location and presence
  - Role management
  - Call handling
- Console specific application and service integration will remain in tailored dispatcher system
  - Information services, such as telephone books
  - Information management, such as incidents
  - HMI backend
- Integration and connection of legacy systems yet to be analysed
  - Train position
  - Analogue radio
  - Line-side telephony

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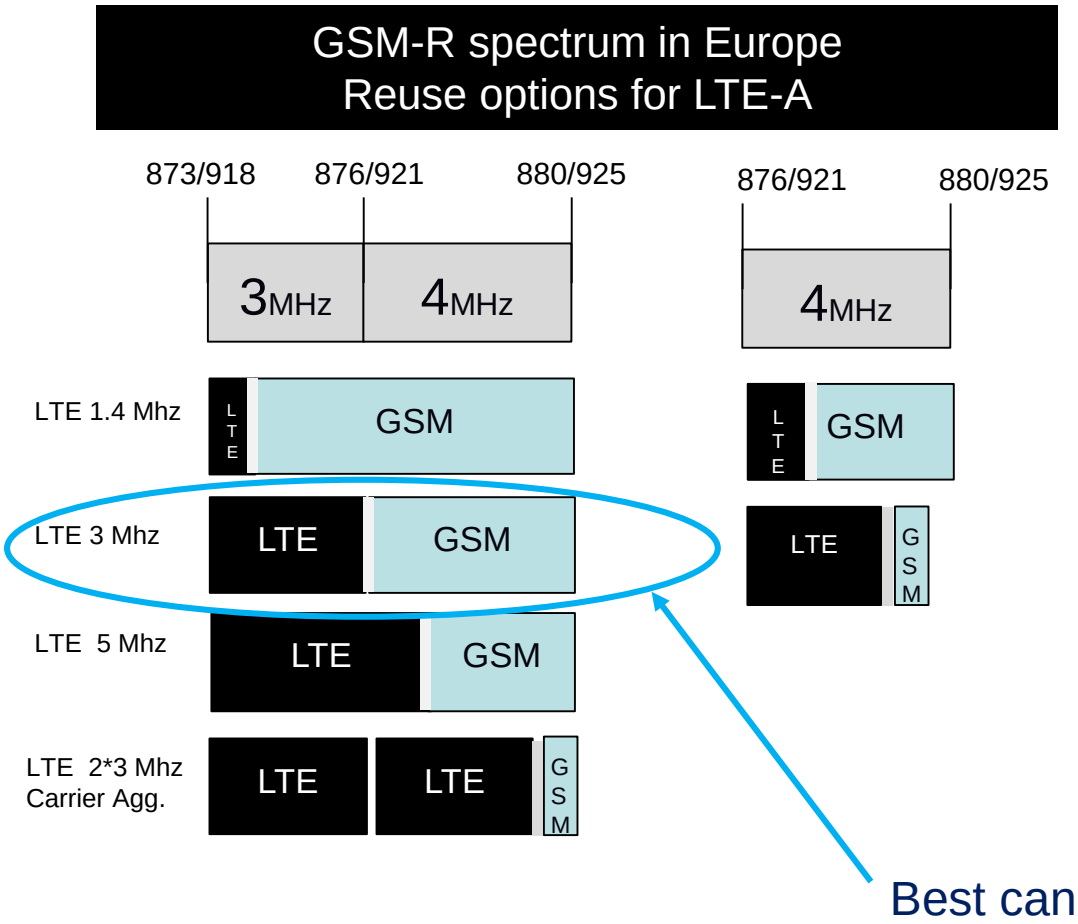
Principles on migration to Next Generation

Spectrum options for Next Generation



Public Safety Spectrum Sharing ?

700 MHz

400 / 450 MHz

Public Network Sharing ?

Industry supporting in analysis, simulation and field trials

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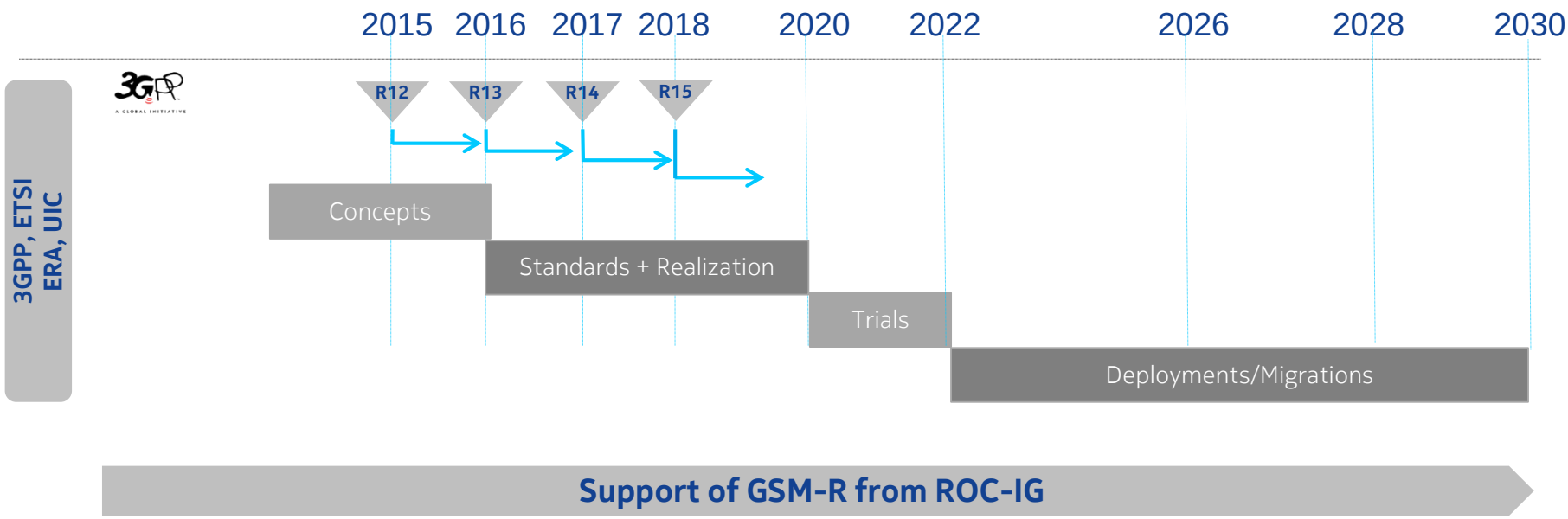
Migration to Next Generation - Timeline



- Deployment and Migration requires Interoperability/Multivendor Testing
- TSI certification to be considered for realization and deployment phase
- Proof of concepts could be possible for base functionality before 2020

Principles on migration Next Generation

Addressing, Numbering

- UIC URS defines flexible subscriber identification/addressing
- SIP based addressing allows for any alphanumerical addressing

SIP URI:
- Sip:John.Smith@operator.net
- Sip:ICE841@DB.net

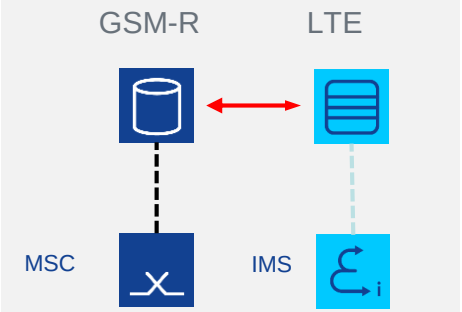
- During migration subscriber from each system must be capable to address subscriber in other system
- Mapping from/to EIRENE MS-ISDN to SIP URL scheme needed
  - Translation Database
  - “Static policy: build TEL URL for MS-ISDN to be used in Next Generation

- tel:+1-201-555-0123
- Current EIRENE numbering scheme possible in Next Generation as well.
- Common numbering scheme of Next Generation and GSM-R

Where to have the database ...

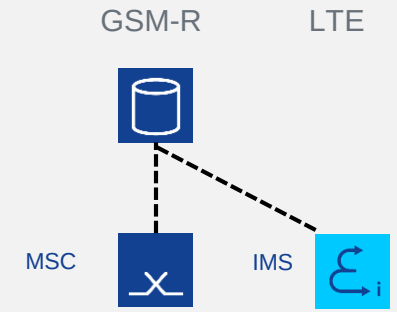
like Functional Numbering, Access Matrix, Location Data,…

System in parallel



Con: Two Databases

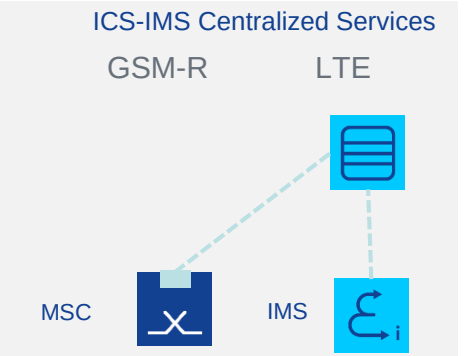
a) Reuse existing GSM-R Database



Pro: No change in GSM-R

or

b) Shift database to Next Generation system.

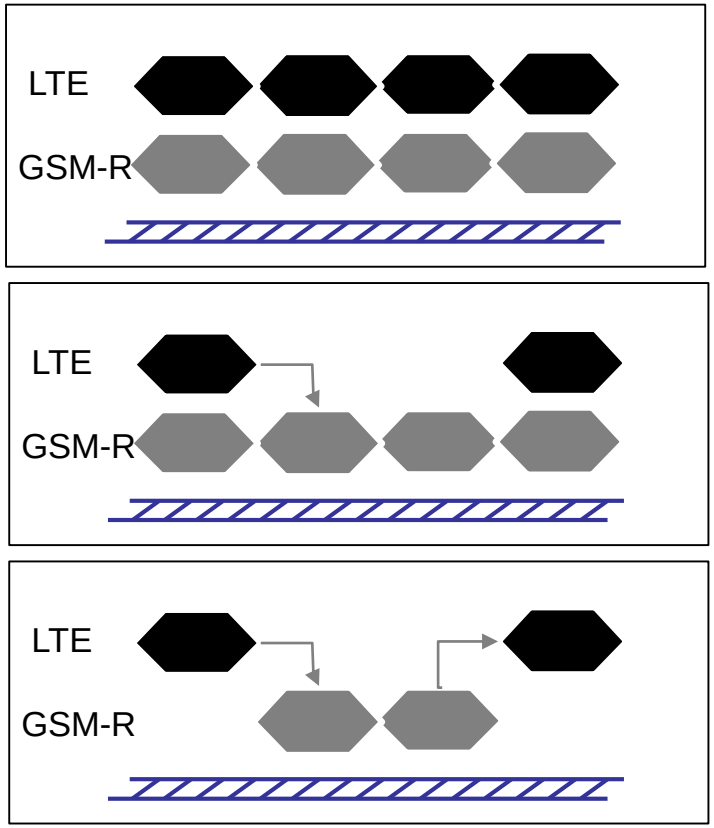


Pro: Modern architecture

- Railway application databases needs to be accessible by both technologies
- Data to be kept synchronized (Registration Data,…)
- Use of one common database preferred
- 3GPP provides means to transparently access from each system (IM-SSF, IMS centralized Services)
- Target to provide application in Next Generation, migration scenarios could benefit from scenario a)

Deployment strategies

Big impact on complexity



Full Overlap of LTE

- Group Calls established in both technologies
- Device remains on selected layer
- Avoid complex interworking – loose coupling
- Required for European corridors

LTE islands / no overlay

- Handover from LTE to GSM-R
  (other direction rarely used in todays networks)
- Inter System NACC available
- Islands need to have sufficient size
- High complexity for group call
- Handover from GSM-R to LTE with high complexity, not used today in public operator markets

Summary

- The architecture of the future communication system for railways is aligned with 3GPP and embraces a high level of reuse of already specified building blocks and functionality
- Benefit from evolutions in PPDR market with respect to standards and products
- Sufficient radio spectrum for the future communication system is required
- Industry work closely together and support the introduction of a next generation with studies, proof of concepts, trials and products capable for a smooth migration

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Thank you

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