



Future Railways Mobile Communication Systems

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Future Railways Mobile Communication System (FRMCS)

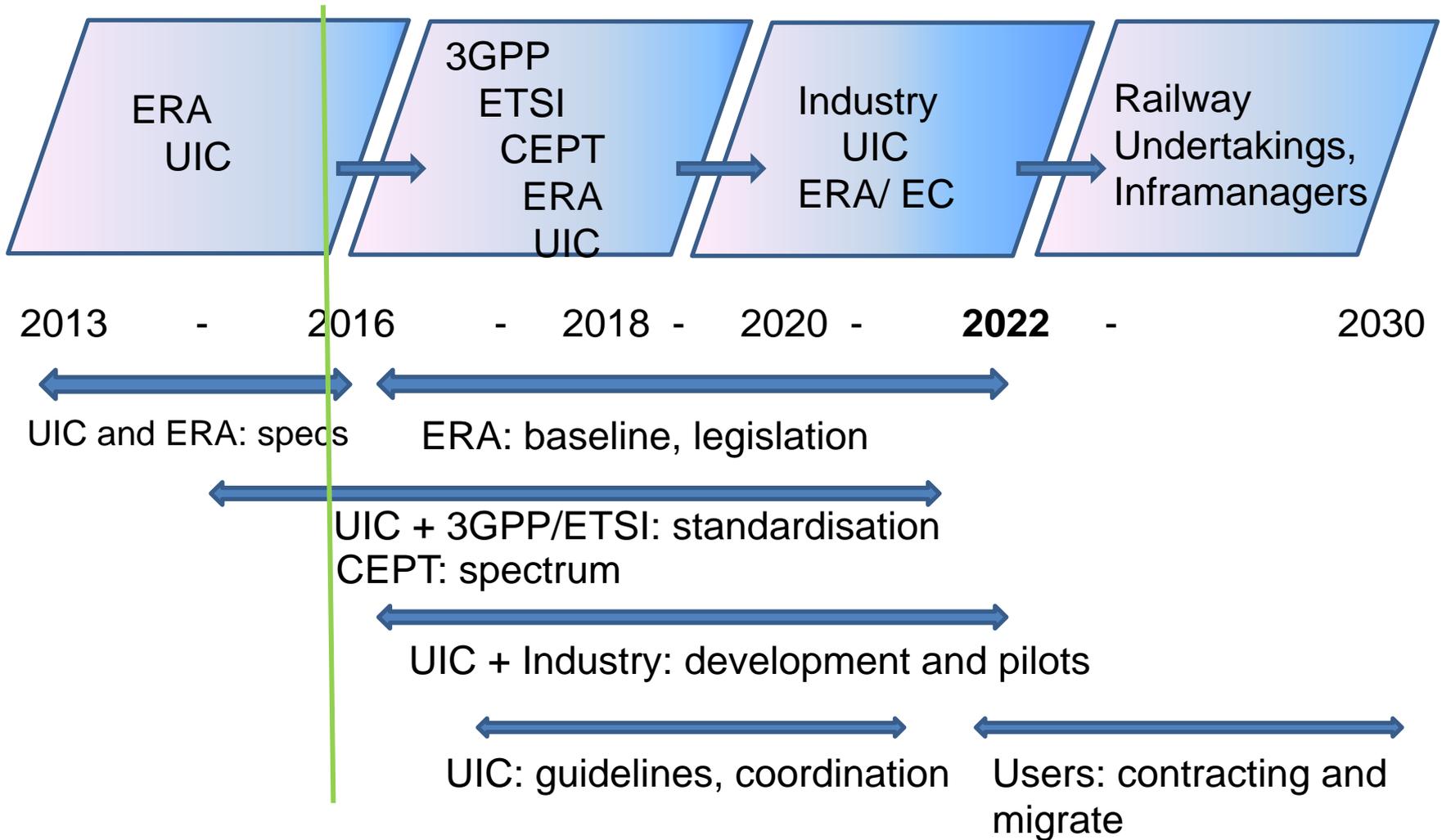
What is the FRMCS project?

- FRMCS is a UIC project launched in 2014 for three years, after 5 years of preliminary investigations.
- FRMCS is the provisional name of the system which will succeed to GSM-R.
- Standardization, pilot and product availability time plan is evaluated to 5 years.
- FRMCS must be available in 2022 and future proof for at least 20 years.

- The decision for this new system must be well prepared, and takes into account:
 - User needs,
 - Spectrum availability vs. needs,
 - Operational impact, migration strategy,
 - Technology

- FRMCS, as the GSM-R successor will be an ERTMS subsystem, interoperable, enforced by EU law, harmonized in Europe.**

FRMCS: The main steps of the new system introduction



Why FRMCS? GSM-R obsolescence

- Railways are happy with GSM-R, and wish to keep it as long as possible.
 - GSM-R is a narrowband system: Railways could need broadband services but not for critical communications.
 - Broadband services can be purchased from mobile network operators.
 - Critical services are and will remain for a long time Train Radio, Shunting and ETCS.
 - With addition of GPRS or E-GPRS, GSM-R will comply to these railways critical communication - at least for ETCS L2, and at finest view also for ETCS L3.
- GSM-R support is promised for “until 2030” by the GSM-R Industry Group.
- But railways cannot forget the GSM End of Life. When does it arrive? This could affect Industry commitment at least in financial terms.
- If 2030 is the GSM-R End of Life, railways need a new solution for the new lines to be covered by 2022 - 2025 at latest.

Why FRMCS? GSM-R renewals

Railways are regularly planning GSM-R subsystems renewals, due to obsolescence of the equipment or the ETCS L2 introduction.

- As these are significant investments, following questions should not be a surprise:
 - Should railways renew a GSM-R voice system still with GSM-R?
 - Should railways upgrade GSM-R for ETCS still with GSM-R? The cost for the network hardening is considerable.
 - Should railways consider installing something else? Is it possible?
- These questions are more than valid, since railways expect a GSM-R life span of 15 years or more, and with a even greater life expectation for ETCS.
- What would be the impact of modifying the ETCS radio for existing rolling stock - by changing the EDOR? With Packet Switch introduction for ETCS, this aspect must be carefully considered towards technology free.

FRMCS vs. GSM-R legacy

FRMCS will make use of the GSM-R legacy.

There is no need to restart building a completely new network. The situation is very different compared with the GSM-R start of rollout.

GSM-R legacy:

- **Frequency band:** The GSM-R 2x4 MHz band and the new 2x3 MHz extension band. A need to keep these frequencies for railways or to share them very carefully in exchange of equivalent new bands.
- **Radio sites:** Most of GSM-R capital expenses. Lots of difficulty to build new sites due to environmental and regulatory constraints.
- **Transmission networks – fibre, equipment, technical rooms, power supply:** available assets and competency, with just possibly a need for upgrade to IP.
- **Core network:** IP GSM-R core network could probably seamlessly evolve to become the FRMCS Core network. FRMCS Core network could be common with other like eg. PPDR's.

Replacement of GSM-R by a FRMCS system must be an evolution and not a revolution.

Why FRMCS? New business needs

We should also consider the new and increasing railways mobile communications business needs.

- Mobile phones usage has evolved so much in such a short time. Having real time data available on a phone or being able to join conference calls or video calls or to input data wherever you are is transforming so many business concepts.

Railways are no exception.

- TOC's and FOC's need on board to track side specific communications, from train maintenance to catering.
- Railways have a continuous increased need for wireless communications, from M2M to data in isolated places. Real Time information is a necessity. Aspects like maintenance, or work, Processes can be semi-automated. Not to mention that wireless can bring efficiencies
- For such needs, railways are using today MNO services for applications like M2M, General Purpose Handhelds, etc., services which implies developments, costs, with sometimes lack of means, availability or Quality of Service (QoS).

Would it be possible that a broadband Railway System, initially developed for critical communications could be used also to support all radio communication services at supplementary marginal costs, and avoid expensive outsourcing?

FRMCS progress: Functionalities

After 12 meetings and ~780 comments processed from the initial draft, the “User Requirements Specification” **was delivered**.

It is in the final UIC approval process, and will be very soon posted on UIC Internet site, for larger Industry consultation.

Next Step are the building of the Use Cases, and preparing the Functional Requirement Specification.

The Use Cases will be input for the ETSI Next Generation to Railways NG2R assesment against the existing 3GPP specifications.



FRMCS progress: Spectrum

– The **System Reference Document (SR Doc)** “Work Stream on Spectrum for Railways” has been accepted by ETSI as a work item, to be finalised Q3 2016.

The Spectrum Working group drafted a Liaison Statement to TCCA/CCBG to initiate work to understand better if & how sharing of spectrum and maybe more with the “blue light” community may work, with which a first meeting was held in January, with good results.

Given spectrum scarcity and price of the bandwidth, FRMCS is studying different options, which are not only related to **frequency** but also to **network model** and **system architecture**, with some **technology choices**.

FRMCS Project currently is following a plan to engage with ETSI, ERA and ECO, to pave the way for a decision on spectrum, to be discussed in World Radio Communication Conference 2019.

FRMCS progress: Architecture and Technology

This working group is in charge of:

- Proposing architecture, System, QoS and Security Requirements – based on the User Requirements Specification,
- Identifying mobile radio system evolutions, trends, feature perspectives and assessing compatibility with the Railways requirements,
- Evaluating synergies and differences with CCBG/MNO.

The WG decide for the possible systems:

- 4G, 5G,
- Possible: Satellite communications e.g.for low traffic rural lines,
- Possible: WiFi to increase capacity in stations .

End March 2016 a Technical Report on the group findings will be made available for the ETSI NG2R (Next Generation to Railways) WG, for review by Suppliers and Professional Organizations.

Conclusion

Change is necessary, it has to and it will be done at a certain time.

We have an European Roadmap. Main actors – EC, ERA, Railways Organizations, ETSI, are around the table. Interest from out of Europe is increasing.

We must use the GSM-R lessons learnt.

Migration must be smart. Multimode Radio will be the key for migration and for technology flexibility.

The new system must be as good as the existing one, and cost effective.

The new system will be a COTS.

We depend on **Frequency allocation** and on the **Gaps between 3GPP releases and our needs** – which we are currently assessing .

FRMCS starts to deliver.

We have built the basis – URS, Frequency actions prepared, and decided on the architecture main policy.

Thank You for Your Attention
Questions?