



# Workshop Verticals in 3GPP

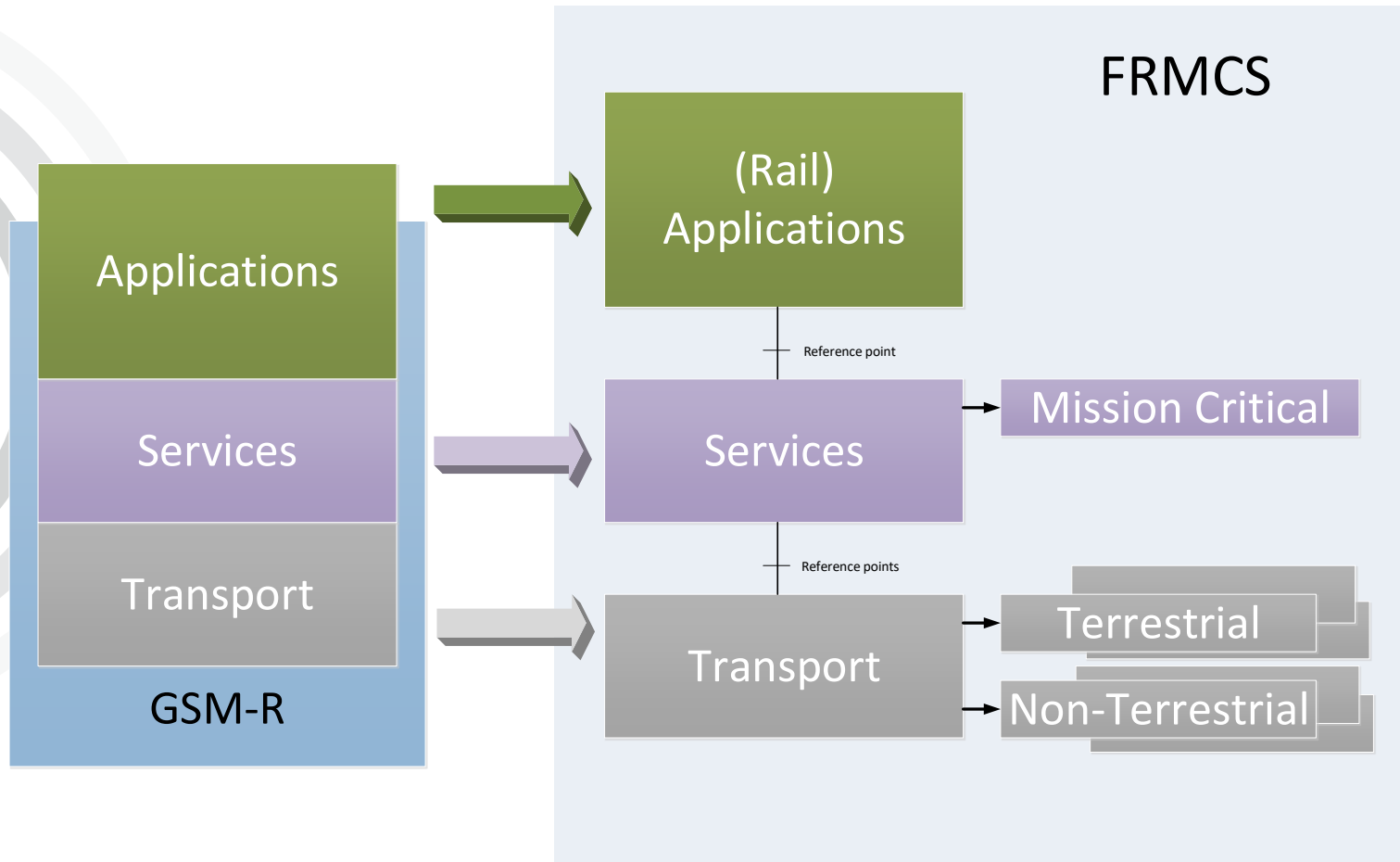
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# Targets

- Successor of GSM-R
- Digitalisation/Automation of the Railway system and its operation → requires broadband system
- Remains as Safety related System
- Fully Interoperable between the countries → seamless cross-border operation
- FRMCS – GSM-R co-existence ≈ 10 years
- 5GS target technology that may allow the integration of LTE – E-UTRA
- <https://youtu.be/R4viEXd2VzU>

# Targets



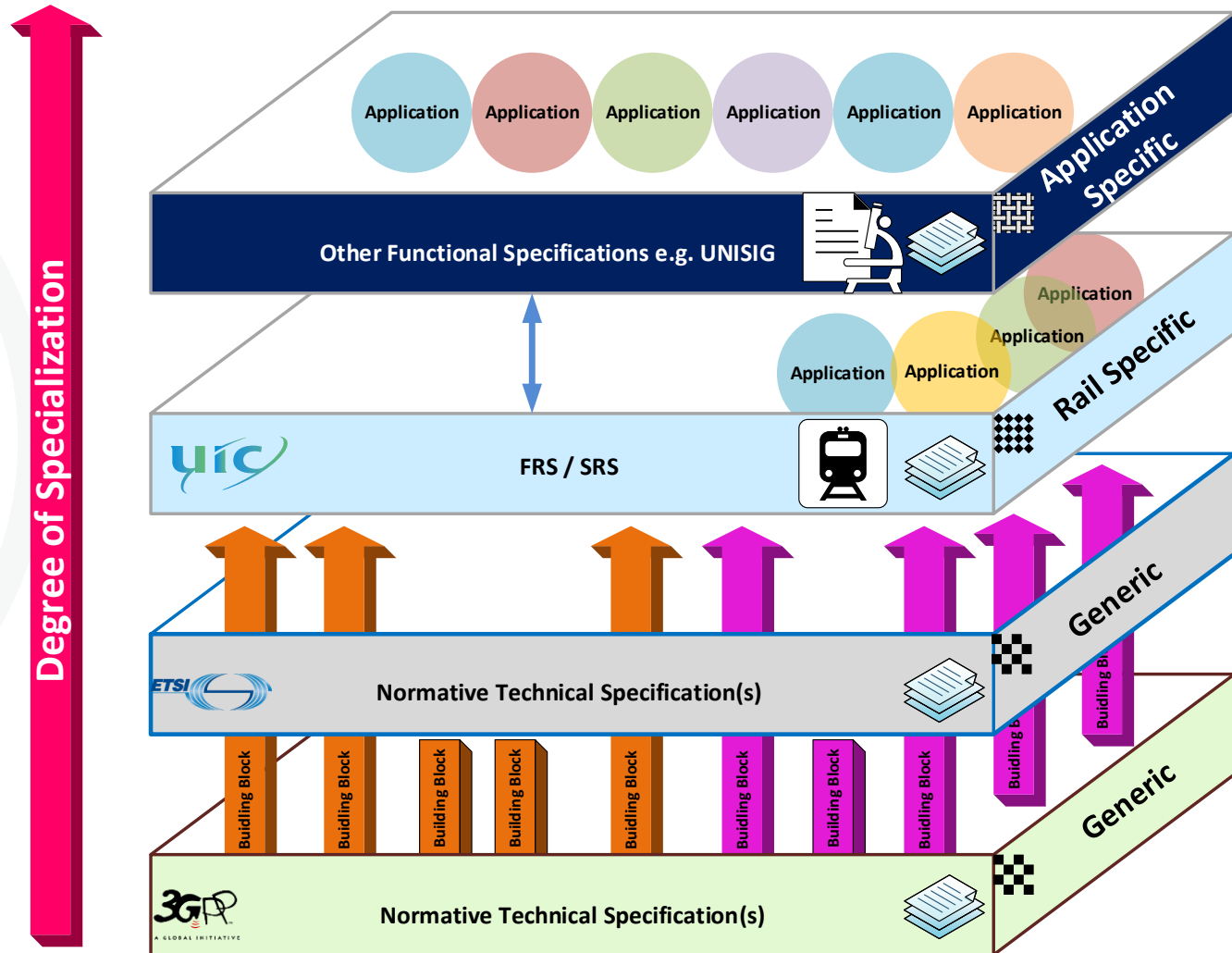
## Independence

- Decoupling application stratum, service stratum and transport stratum;
- Remove dependencies;
- Timely use of new Access Technologies;

## Transport Bearer Flexibility

- Vertical or horizontal (combined) use of various access technologies;
- General simultaneous use of access technologies or depending on user location;
- Extend flexibility and modularity for various operational scenarios;

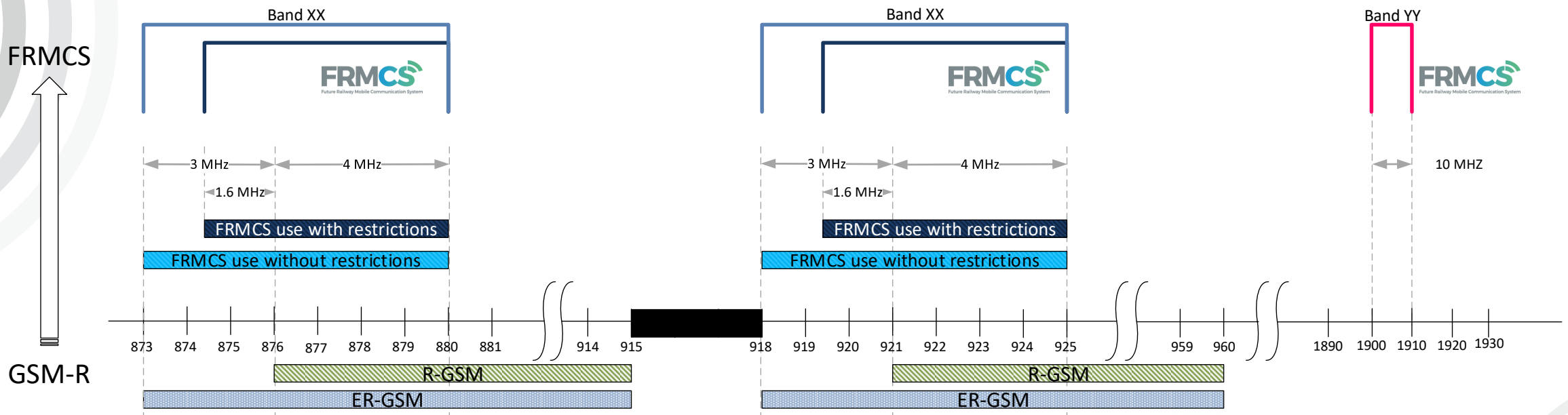
# Specification Context 3GPP-ETSI- FRS/SRS-FIS



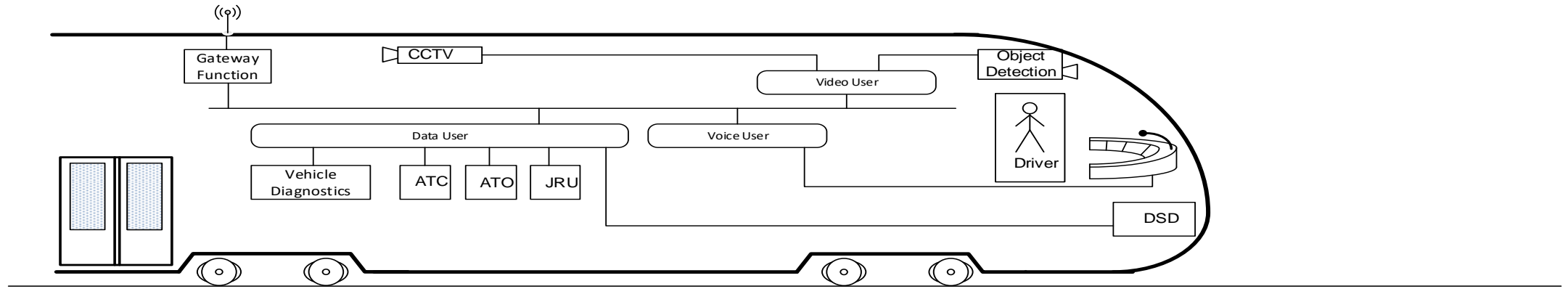
- ▶ 3GPP Technical Specifications provide generic building blocks for transport and services.
- ▶ ETSI Technical Specifications will sum up the necessary FRMCS System building blocks for transport and services.
- ▶ UIC SRS/FRS incl. Onboard reflects the view of the functional user requirements and provides the bridge to other applications.

# Challenges - Limited spectrum

- ▶ During and after co-existence limited spectrum availability
- ▶ Channel bandwidth of 1.6MHz during co-existence – channel bandwidth not supported in 5G NR. → Narrowband approach



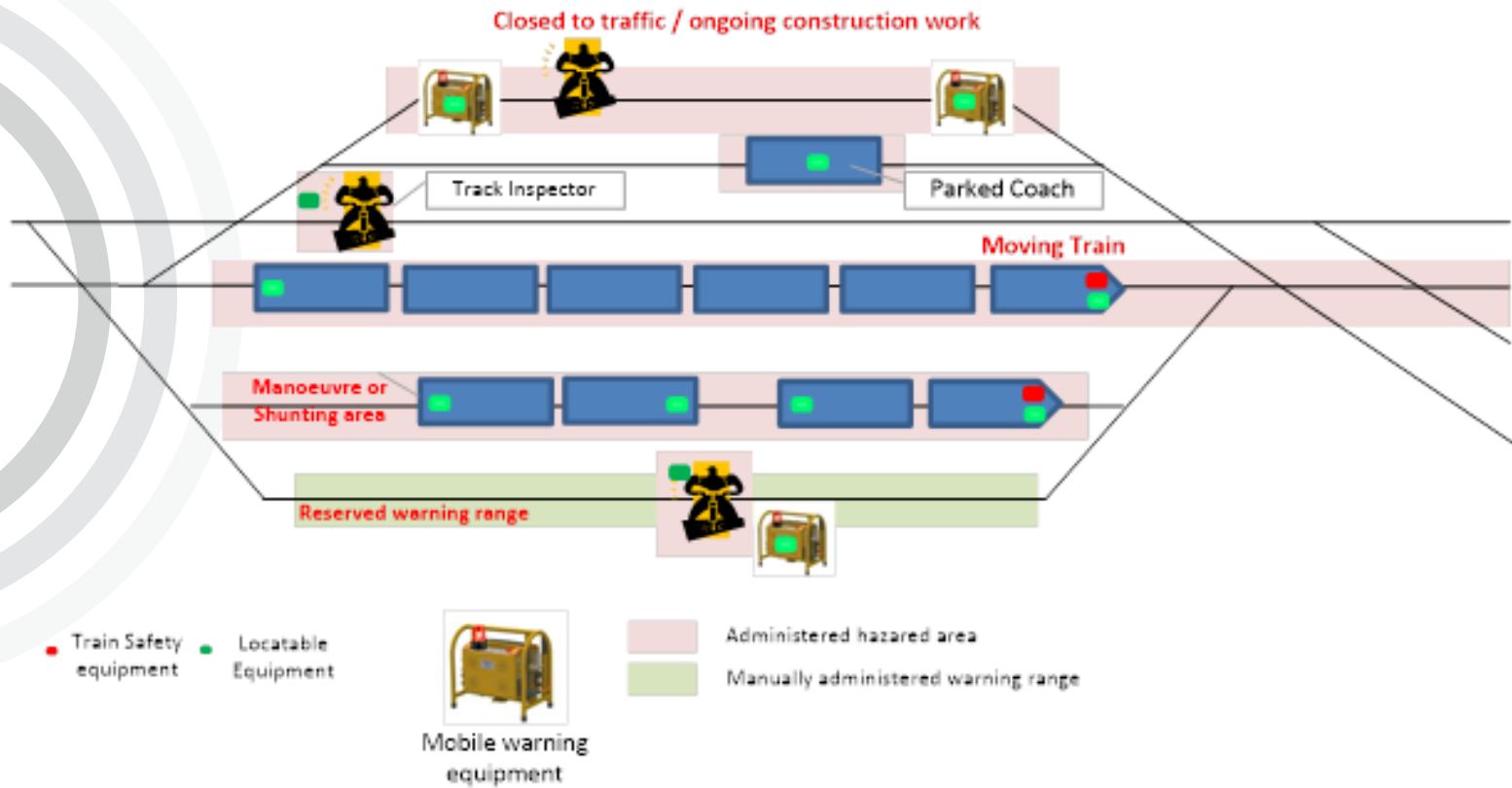
# Challenge Train Life cycle



- ATC** Automatic Train Control
- CCTV** Closed Circuit Television
- ATO** Automatic Train Operation
- DSD** Driver Safety Device
- JRU** Juridical Recording Unit

- ▶ Life Cycle up to 30 years
- ▶ Decoupling Application, Services and Transport to avoid recertification for safety relevant applications e.g. ETCS
- ▶ Multiple users on-board have to share 2-3 UEs, gateway function between trains required
- ▶ regulated access between train and ground – unauthorised access will be dropped!
- ▶ SBA approach envisaged
- ▶ Off-network (sidelink) to control integrity of the train

# Challenge Positioning



- ▶ Positioning Balises mounted on the track will not solve train positioning in stations
- ▶ Accuracy <1m @speeds up to 500km/h
- ▶ Multiple sources required
- ▶ Position Estimates have to be integer and need to fulfil SIL-4 requirements

# Other Challenges

- ▶ Train Speed → up to 500km/h, radio access need to provide robust channel estimation and robust transmission
- ▶ The use of 3GPP Satellite as an alternative radio access or lines where terrestrial coverage is uneconomical
- ▶ Interoperability between FRMCS systems located in different countries
- ▶ Off-network communication



Thank You!