RAIL ACADEMY

FRMCS Engineering

Duration: 2 Days

Course Modules:

- FRMCS – An Introduction
- FRMCS Reference Architecture
- FRMCS On-Board Architecture
- FRMCS Addressing
- Common Functions and Applications
- 5G
- The IP Multimedia Subsystem (IMS)
- Mission Critical Push to Talk (MCPTT)
- Mission Critical Data (MCDATA)
- Mission Critical Video (MCVIDEO)
- Radio Spectrum and Coverage

Course Code: MB2020

Powered by:
wray castle
empowering the telecoms world

www.wraycastle.com/uic

Programme Summary

Description

GSM-R end of life is anticipated to be around 2030 which only leaves a few years to find a replacement system. The International Union of Railways (UIC) have published a document called FRMCS- Future Railway Mobile Communications System which outlines what will be required of a future system. The document does not describe the replacement technology it is essentially a wish list of what a future technology should be capable of doing. The railway community have detailed the communications requirements of the future railway networks and are looking for telecommunications manufacturers and standards bodies to provide a suitable solution.

This course looks at the documents published by the UIC to gain an understanding of the requirements of a future communications system. One of the challenges faced by the railways is the lack of radio spectrum so the course analyses the current spectrum options. This leads to an overview of how 5G could be a potential candidate for FRMCS.

Who Would Benefit

The course is open to anyone that would like to gain an insight into how mobile telecommunications for railways may migrate from GSM-R to the system known as FRMCS.

Prerequisites

Attendees ideally will have a background in telecommunications gained from working in the railway industry and have technical knowledge of GSM-R.

Course Modules

- FRMCS – An Introduction
- FRMCS Reference Architecture
- FRMCS On-Board Architecture
- FRMCS Addressing
- Common Functions and Applications
- 5G
- The IP Multimedia Subsystem (IMS)
- Mission Critical Push to Talk (MCPTT)
- Mission Critical Data (MCDATA)
- Mission Critical Video (MCVIDEO)
- Radio Spectrum and Coverage

The Programme

FRMCS – An Introduction

- Time is Running Out for GSM-R
- FRMCS Milestones
- UIC Documents
- FRMCS, ETSI and 3GPP
- FRMCS URS (User Requirement Specification)
- GSM-R Services
- Critical Communications Applications
- Performance Communication Applications
- Business Communication Applications
- Critical Support Applications
- Performance Communication Applications
- Business Support Applications
- 5Grail

FRMCS Reference Architecture

- Railway Application, Service and Transport Strata
- System Reference Architecture
- FRMCS System and FRMCS Domains
- FRMCS Interworking with other Domains
- High Level Architecture of Communicating Entities
- FRMCS Reference Points
- The Coordinating Function

FRMCS On-Board Architecture

- On-Board FRMCS Architecture
- Gateway and Radio Function(s)
- Access Modes
- Tight Coupled Mode
- Loose Coupled Mode
- Support for OBAPP
- OBAPP Physical Characteristics
- OBAPP Procedures
- OBAPP Functional Services Messages
- OBAPP Protocols
- Local Binding Operation
- Session Start Feature
- Example of a Session Start Procedure

FRMCS Addressing

- FRMCS System Identities
- 3GPP and non-3GPP Access
- Non 3GPP Access Architecture
- 5G Network Identifiers
- 5G UE Identifiers
- Host to Host (H2H) Addressing
- Host to Network (H2N) Addressing
- Identities in the FRMCS Service Stratum
- Identities and their Location
- Functional Identities
- Train Function Identities
- Controller Identities
- Team Identities
- Vehicle and Equipment Identities
- Profile Addressing

Common Functions and Applications

- Common Functions
- Applications
- Point to Point Voice Call
- Multi-train Voice Communications for Drivers Including Ground Users
- Railway Emergency Communications (REC)
- Automatic Train Protection (ATP) Communication
- Automatic Train Operation (ATO) Communication

5G

- Drivers for 5G
- 3GPP Use Cases
- Performance Evolution from LTE to 5G
- Performance Targets for 5G
- Key Technical Features of 5G
- 5G System Architecture
- The Next Generation Node B (gNB)
- Objectives of the 5G New Radio
- FDD and TDD Modes
- 5G Frequency Bands
- Evolution to 5G Open RAN
- Possible Frequency Deployment
- Possible Hardware Deployment
- Distributed RU
- Different Split Options
- Network Design Principles
- Network Function Virtualization (NFV)
- Software Defined Networking (SDN)
- Network Slicing
- 5G Core Network Functions
- Architecture and Reference Points
- Roaming with Home Routed Traffic
- Roaming with Local Breakout
- Service Based Interfaces
- Possible Roaming Scenario
- User Plane Architecture and Protocols
- IMS and Voice Services
- PDU Sessions
- QoS Flows
- 5G QoS
- Additional 5QI Non-GBR Values
- 5QI Delay Critical Guaranteed Bit Rates
- Standardized 5QI for FRMCS
- 5G Security

The IP Multimedia Subsystem (IMS)

- The Need for IMS
- About the IMS
- Architecture and Interfaces
- Protocols used by the IMS
- The Role of SIP, SDP and RTP in the IMS
- Creating an Account with a SIP Service Provider (SP)
- Registration Principles
- Proxy Call Session Control Function (P-CSCF)
- Interrogating CSCF (I-CSCF)
- SDP Basics
- IMS User to IMS User Session Establishment

Mission Critical Data (MCData)

- MCData Services
- Generic Application Plane Functional Model
- Generic Application Plane Functional Model – Reference Points
- Generic Data Capabilities – SDS
- SDS Applications

Mission Critical Push to Talk (MCPTT)

- MCPTT On-network Architecture
- Functional Model for the On-Network Application Plane
- MCPTT Server Internal Functions
- Application Plane Interfaces
- Relationships Between MCPTT Reference Points and Signalling Control Planes
- Common Services Core
- Functional Model for Off-Network MCPTT Service
- MCPTT User Database
- MCPTT UE Configuration
- Functional Aliases
- MCPTT Procedures and Services
- Authentication and Authorization
- End-to-End Communication Security
- Affiliation
- Pre-established Sessions
- Call Connect Using Pre-established Session
- Pre-arranged Group Call Set-up
- Pre-arranged Group Call Release
- Late Entry
- Deaffiliation
- Rejoin Call
- Emergency Group Alert
- Location Reporting
- Entering MC Service Emergency Alert Area
- Leaving MC Service Emergency Alert Area
- Emergency Group Call
- Emergency Group Call Cancel
- Imminent Peril Group Call and Emergency Alerts
- Broadcast Group Calls
- Private Calls – Automatic Commencement
- Private Calls – Manual Commencement
- Private Call Release
- Floor Control

- SDS Functional Model
- SDS Signalling – Standalone One-to-One
- MCData SDS – Other Signalling Scenarios
- Enhanced Status
- File Distribution, File Transfer
- File Distribution Functional Model
- MCData File Distribution – Signalling
- Data Streaming
- IP Connectivity (IPcon)
- Functional Model for IP Connectivity
- Functional Model for IP Connectivity – Reference Points
- Establishing Point-to-Point IP Connectivity
- Remote Initiated Point-to-Point IP Connectivity

Mission Critical Video (MCVideo)

- MCVideo Potential
- MCVideo Services and Capabilities
- MCVideo Control and Group Capabilities
- Camera Discovery
- MCVideo Functional Model – On-Net
- MCVideo UE
- MCVideo Server
- MCVideo: similarities and differences to MCPTT Service
- NON-Video Aspects of MC Video
- Characteristics of MCVideo
- Video Latency
- MCVideo Procedures
- Procedures in General
- Group call – Pre-arranged
- Private Call
- Ambient Viewing
- Transmission Control/Media Plane Control
- Request Queueing
- Client and Server Message Set

Radio Spectrum and Coverage

- Current GSM-R Spectrum
- ER-GSM Non-Harmonised Spectrum
- ECC Decision (20)02
- Migrating to FRMCS
- Radio Spectrum Requirements

About UIC Rail Academy

Wray Castle have partnered with the UIC (Union internationale des chemins de fer), the worldwide rail organisation to develop the UIC Rail Academy featuring a suite of specialists training solutions for the railway industry covering rail radio engineering technologies.

With the introduction of FRMCS, a technology based upon the latest 5G technologies, the international rail industry faces a period of transition from the existing GSM-R technology first introduced in 2000. The partnership is designed to build knowledge and upskill experienced engineers as well as those new to rail radio engineering and associated industries.

Our expertise as the leading provider of telecoms technology training ensures we can help you develop the skills you need to plan, build and optimise rail communications networks as technologies evolve.

About Wray Castle

Wray Castle empowers the global telecoms world by developing the specialist knowledge, skills and competencies organisations need to build, maintain, optimise and operate the cutting-edge communications networks of today and tomorrow.

Trusted by the global telecoms industry since 1958, we've helped upskill over 300,000 industry professionals from over 85 countries worldwide. Our learners come from many major mobile and fixed operators, vendors, regulators, consultants, rail operators, energy suppliers and government organisations.

Each course features continuously updated content, our courses cover all the major global communications technologies including:

- 5G Technology
- Essential Technologies
- LTE/4G
- UMTS & HSPA
- GSM & GPRS
- IMS & SIP
- Radio Engineering
- ORAN
- Professional Mobile Radio
- IP Engineering
- Network Virtualisation
- Telecoms Business

About UIC (Union Internationale des Chemins de fer)

UIC is the worldwide organisation for the promotion of rail transport at a global level and collaborative development of the railway system. It brings together some 200 members on all 5 continents, among them rail operators, infrastructure managers, railway service providers, etc. UIC maintains close cooperation links with all actors in the rail transport domain around the world, including manufacturers, railway associations, public authorities and stakeholders in other domains and sectors whose experiences may be beneficial to rail development. UIC's main tasks include understanding the business needs of the rail community, developing innovation programmes to identify solutions to those needs, as well as preparing and publishing a series of documents such as reports, specifications, guidelines and IRS that facilitate the implementation of the innovative solutions.