

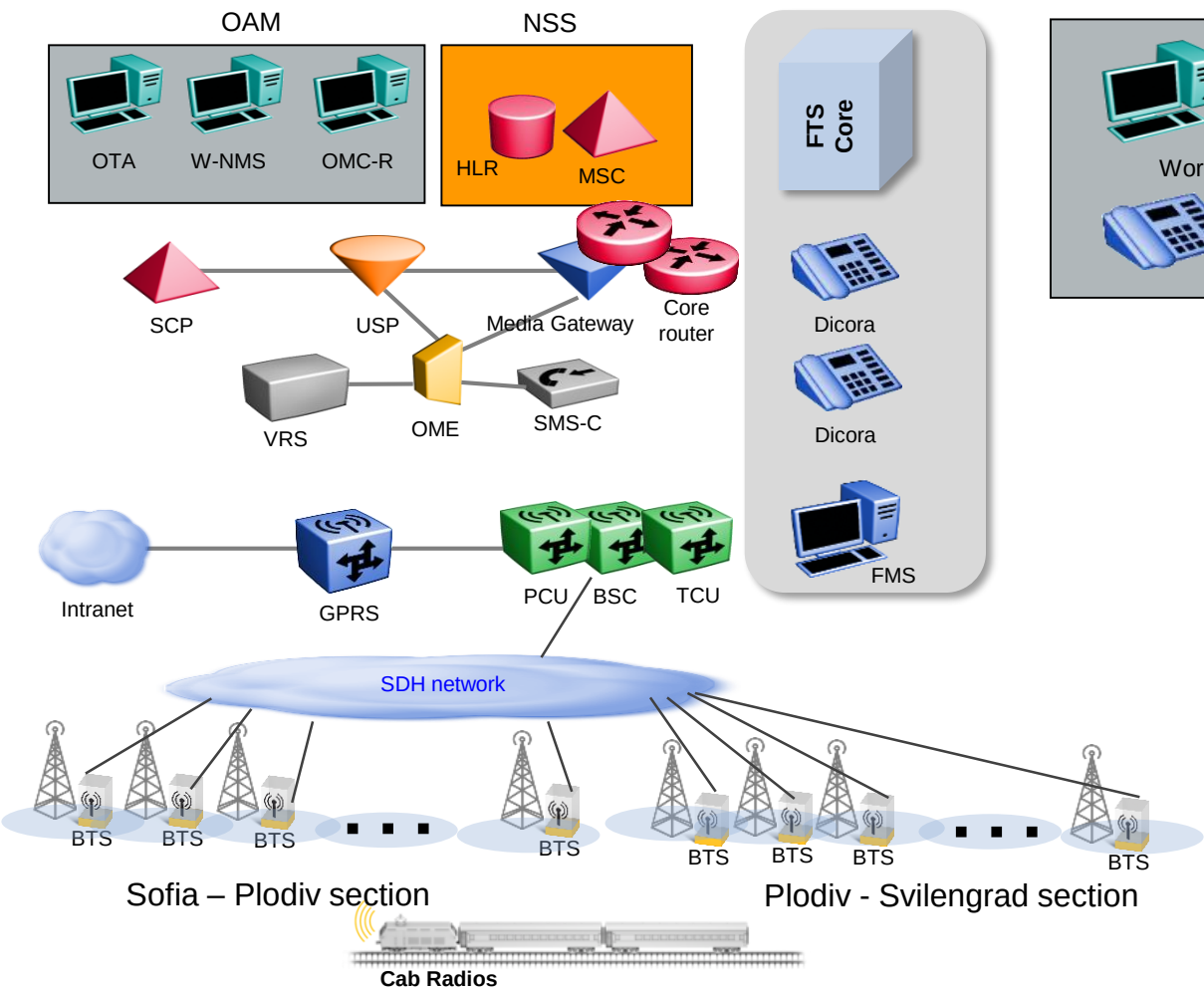


Installed GSM-R System @ NRIC

Installed Base

@ Plovidv

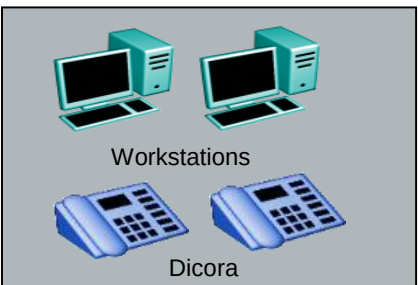
NSS network in Plovidv



Plovidv



Remote management in Sofia



Installed base according to Technical specification

Product	QTY	Comments
BTS9k	36	
BSC3000	1	
TCU3000	1	
PCUSN	1	
MSC/HLR	1	
MGW-R	1	
SGSN/GGSN	1	
USP	1	
SCP	1	
SPDC	1	
COLAN	1	2x site
OMC-R	1	
W-NMS	1	
OTA	1	
SMS-C WingCon	1	
BBRC WingCon	1	
Dispatcher switch 3020	1	
DICORA S15	14	
DICORA P15	31	
GPH TIGR155	150	
OPH TIGR 550	45	
Power supply, Batteries	36	

Why GSM-R & ERTMS?

Railway Telecommunication Network principles as per European Union's directives:

- Be open and non-proprietary, i.e. standardized;

- Be nationally interoperable

- Allow for international train traffic

- Allow for open competition between train operators

- Support new, standardized train control systems (ETCS)

- Be future-proof

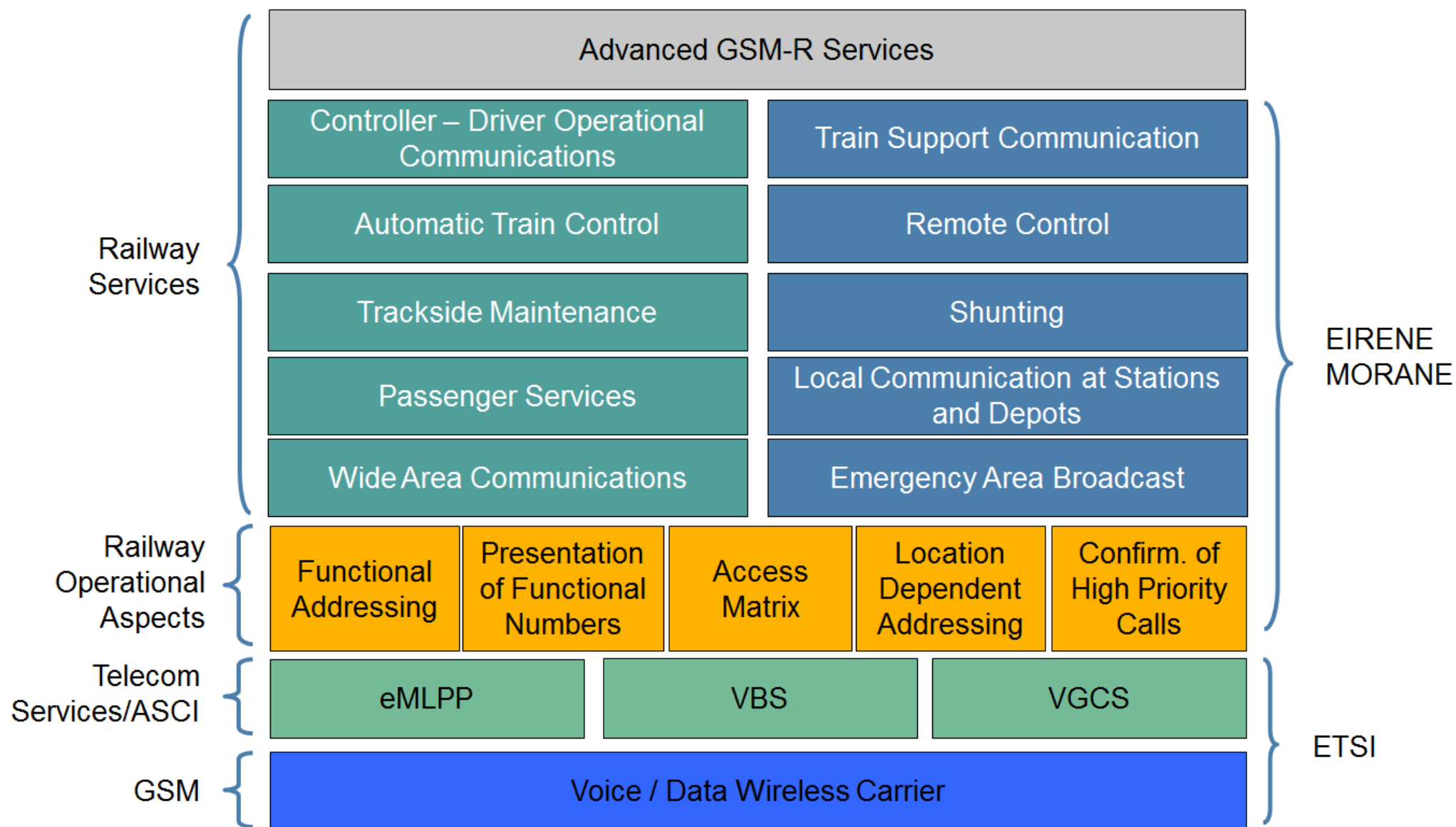
- Be able to support safety voice communication and other railway functionality

- Be able to support the business needs of track owners and train operators (telemetry, freight tracking etc.)

- Allow for competition between telecom suppliers.

GSM-R fulfills the requirements to reduce the technical and economical trade barriers

EIRENE GSM-R Services



Main Network Elements

GSM-R User equipment – Dispatcher terminals

Dicora S15 / P15



	DicORa S15/p15	
	STANDARD	PREMIUM
Technical DaTa		
Display (color VGA, LCD, adjustable mounting)	S15: 12.1" with touch	P15: 15" external with touch
Keypad & Keys	72 virtual direct access keys and keypad in the graphical user interface + 2 direct access keys on the audio module	372 virtual direct access keys and keypad in the graphical user interface + 2 direct access keys on the audio module
Handset	•/° with PTT	•/° with PTT
Headset Interface	•	•
Mouse and keyboard support	•	•
Hands free operation	•	•
Gooseneck microphone	•	•
Ethernet interface	•	•
ISDN BRI interface	•	•
USB interfaces	S15: 2, P15: 3	
GSM-R 8W radio module (for exposed areas)	°	°
Power supply	110–240V AC or 36–60V DC, S15: 30W,	110–240V AC or 36–60V DC, S15: 30W, P15: 95W
UPS		
Transmission media	SIP/RTP , ISDN	SIP/RTP , ISDN, Wireless
Dimensions (W x H x D)	S15: Display opened 476 x 249 x 299 mm P15: Processing module: 312 x 249 x 299 mm Audio Module: 164 x 126 x 299 mm Monitor: 355 x 286 x 265 mm	
Operating temperature		
Relative humidity		

- Allows the main railway operational communication of the
- Primary controller
- Secondary controller
- Electro dispatchers and
- Other Railway Specific dispatcher communication
- Possibility to integrate the existing analogue communication system

GSM-R User equipment – Mobile Handhelds

General Purpose Handheld (GPH)



TiGR 155R	
Main features	Color screen, 65536 colors, 128 x 128 pixel
	Supports ASCI (VBS, VGCS, Emergency call)
	SMS/MMS
	Bluetooth
	WAP 1.2
	JAVA
Characteristics	Triple band GSM-R / EGSM 900 / GSM1800
	GPRS class 10
Technical specification	
Battery	Li-Ion
Talk time	Approx. 4 hours
Standby time	350 hours
Weight	88 g
Dimensions	(105 x 46 x 14) mm

Allows the mobile communication of the:

General Railway (different operational, administrative personnel)

Comprehensible operations to access GSM-R networks

With ASCI and EIRENE features

PTT functionality

GSM-R User equipment – Mobile Handhelds

Operational Purpose Handheld (OPH)



TiGR 350R	
Main features	Color screen, 65536 colors, 176 x 220 pixel
	Supports ASCI (VBS, VGCS, Emergency call)
	Compliant to EIRENE FRS and SRS
	SMS/MMS
	Bluetooth
	WAP 2.0
	JAVA
	Verticality detection (as an option)
Characteristics	GPS Sirf III embedded (as an option)
	Triple band GSM-R / EGSM 900 / GSM1800
	GPRS class 10
	Rugged housing
	Water dust resistant IP 54
Technical specification	
Battery	Li-Ion, 2300 mAh
Talk time	Approx. 7h50
Standby time	450 hours
Weight	230 g with battery
Dimensions	(142 x 60 x 36) mm

Allows mobile operational communication of the

- Maintenance stuff,
- Track line construction, stuff,
- ... other operational stuff

GSM-R User equipment – Mobile Handhelds

Operational Purpose for Shunting (OPS)



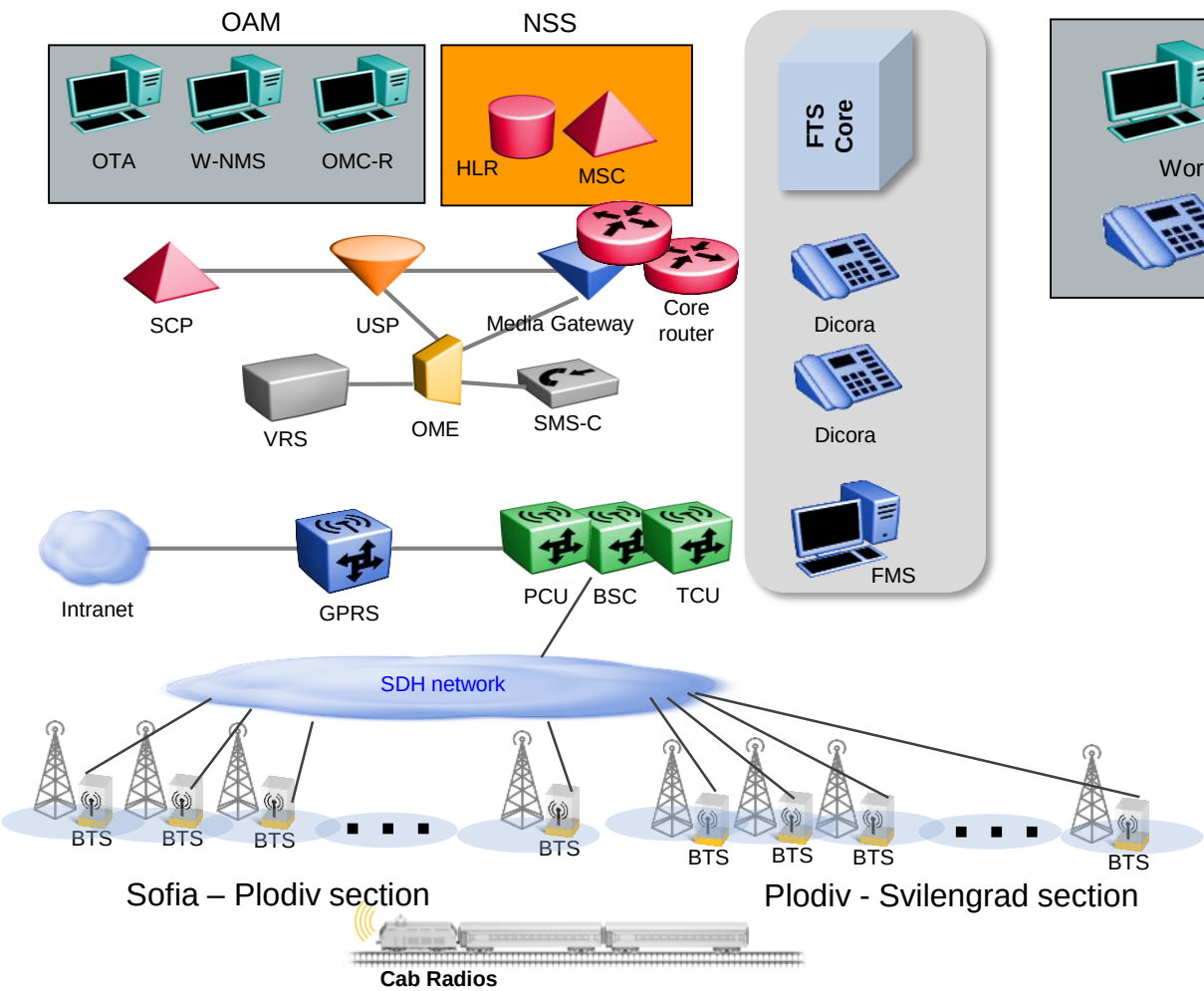
TiGR 550R	
Main features	Color screen, 65536 colors, 176 x 220 pixel
	Supports ASCI (VBS, VGCS, Emergency call)
	Compliant to EIRENE FRS and SRS
	SMS/MMS
	Bluetooth
	WAP 2.0
	JAVA
	Verticality detection (as an option)
Characteristics	GPS Sirf III embedded (as an option)
	Triple band GSM-R / EGSM 900 / GSM1800
	GPRS class 10
	Rugged housing
Technical specification	Water dust resistant IP 54
	Battery
	Li-Ion, 2300 mAh
	Talk time
	Approx. 7h50
	Standby time
	450 hours
Technical specification	Weight
	230 g with battery
Technical specification	Dimensions
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Allows mobile operational communication of the

- Maintenance stuff,
- Track line construction, stuff,
- ... other operational stuff

Main Network Elements & Roles

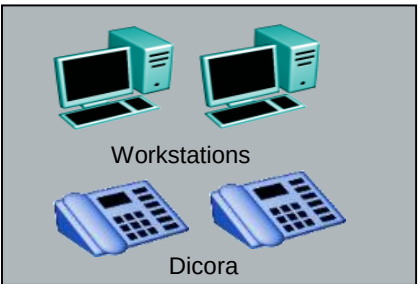
NSS network in Plovdiv



Plovdiv



Remote management in Sofia

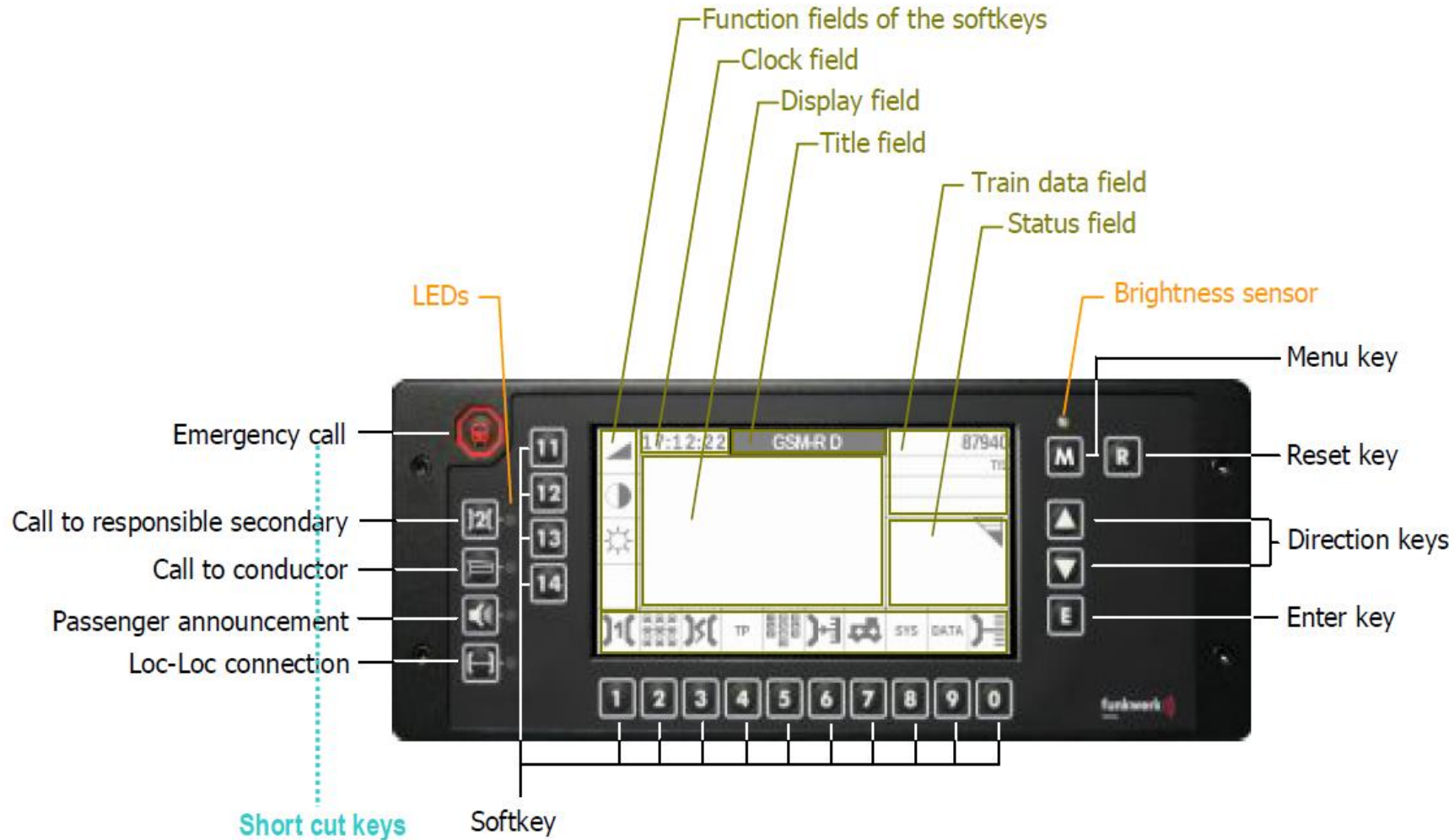


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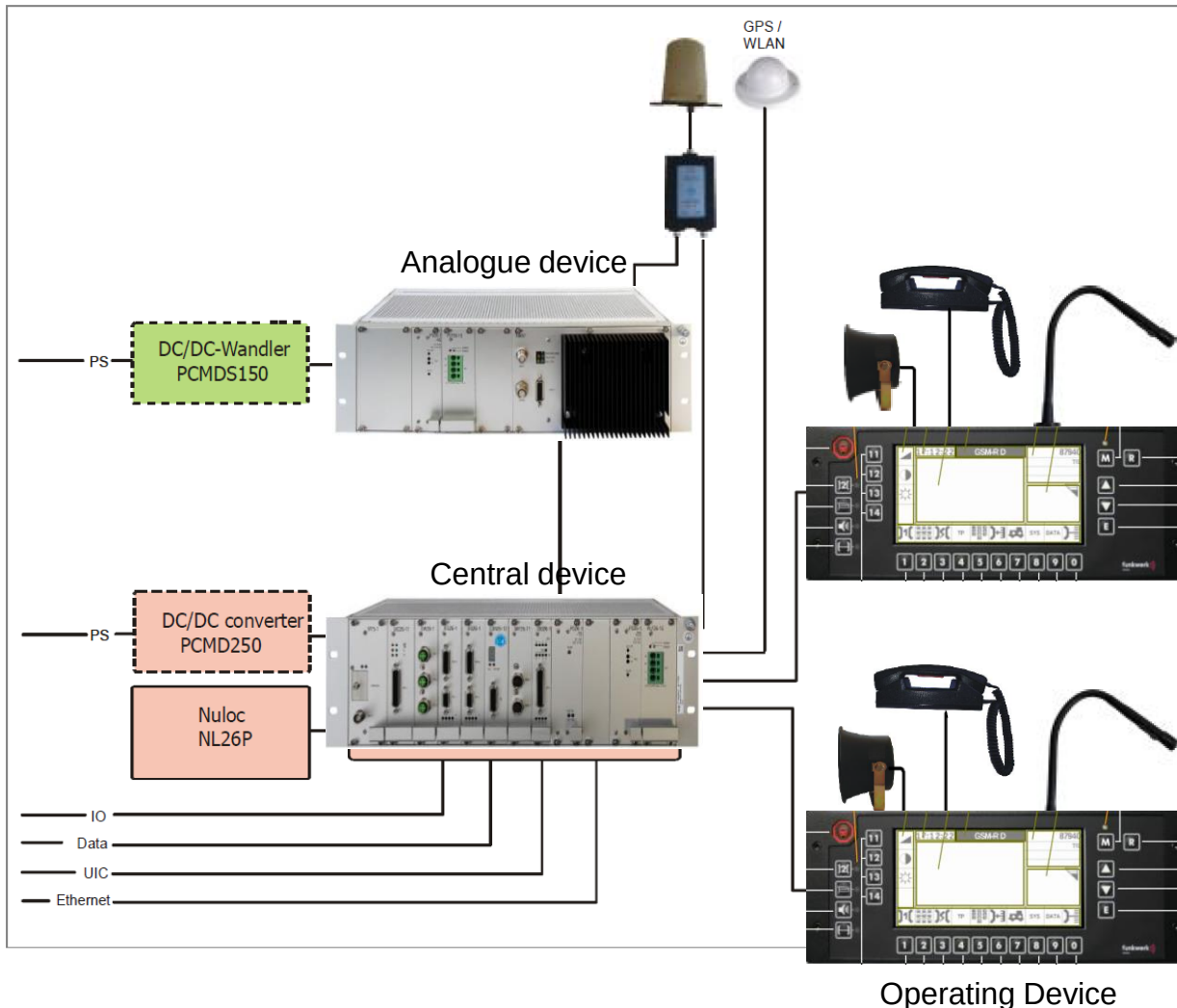
GSM-R User equipment – CAB Radios

MMI (Man Machine Interface) Locomotive Radios



GSM-R User equipment – CAB Radios

Locomotive Radios



The MESA 2x is a mobile train radio system for voice and data transmission used for railway internal communication between fixed and mobile subscribers or between mobile subscribers together.

Elements:

Central device, nuloc

The device controls the radio connection of the digital and analogue radio modules and the whole data communication to the operating devices and to the optional interface modules.

Analogue device

The analogue radio component

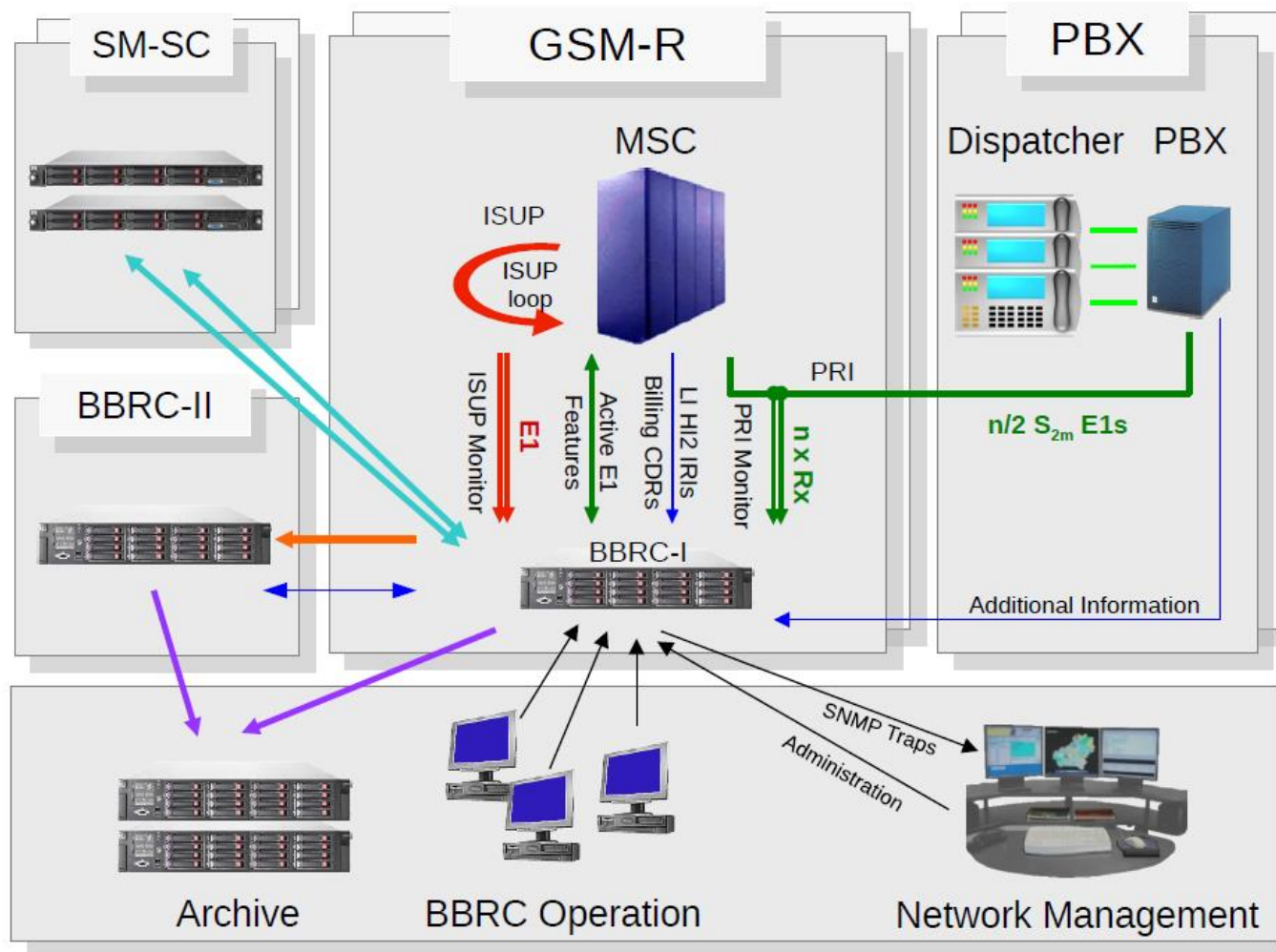
Operating Device

Man-machine interface of the train radio system and is designed for the menu-driven operation of digital and analogue train radio. It has 10 fixed and 14 freely assignable keys

Loudspeaker, handset, gooseneck microphone

Recording System of the End User Communication

BBRC Voice recording system



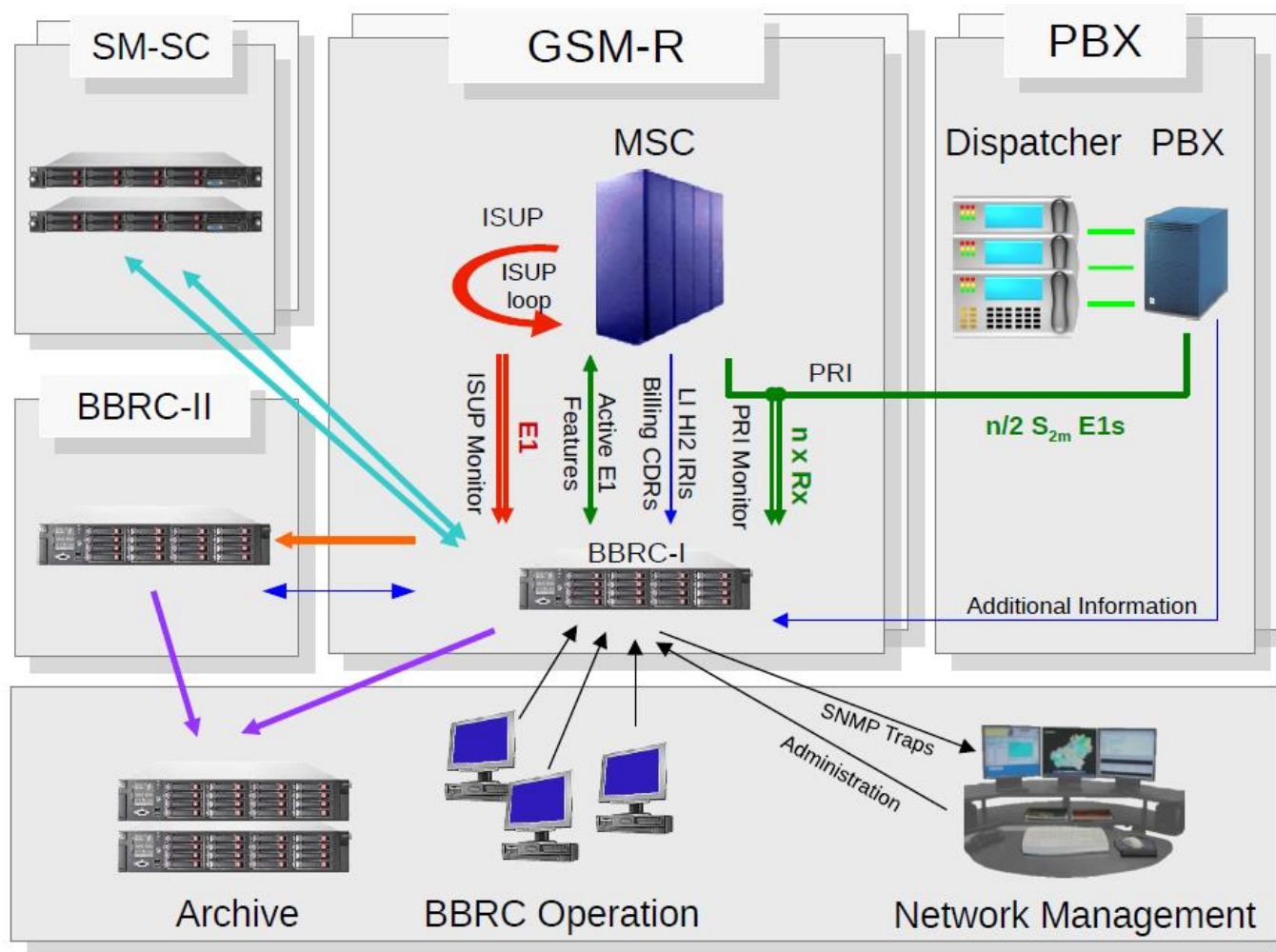
The whole operational communication which is routed in the GSM-R network is recorded through the Voice Recording System (VRS) aka Black Box Recording Center (BBRC)

Currently supported E1 based protocols for passive monitoring are ETSI ISUP and ETSI PRI/QSIG

we got all voice conversation over the ISUP loop

Shot Message Service Center E2E Communication

SMS-C



For sending and receiving Text Messages (SMS), specific for the operational communication. Between Dispatcher system and the GSM-R network.

E1 are provided in N+1 redundancy mode to connect the SMS-C to the GSM-R network and via Ethernet connection to the Dispatcher System.

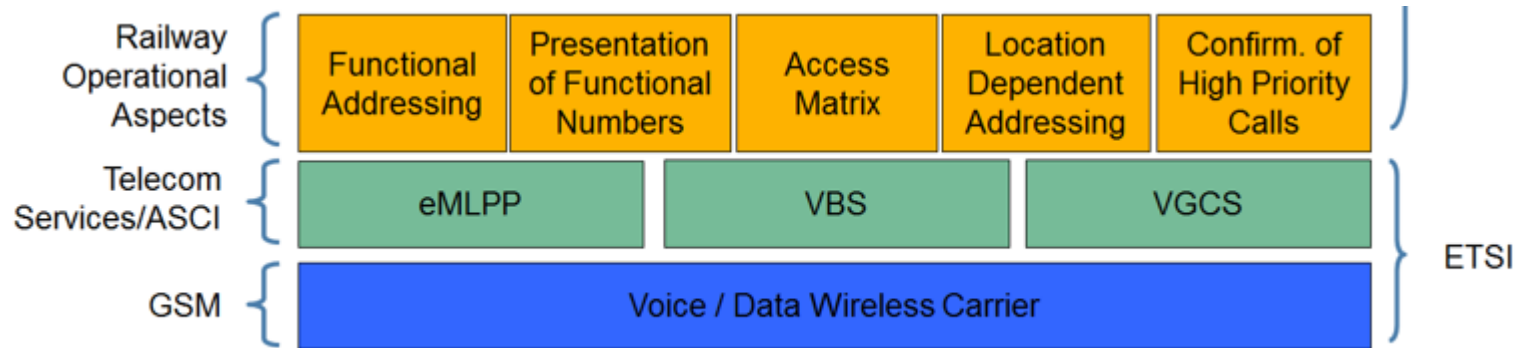


3) GSM-R Specific Functionalities

Benefits of GSM-R

In principle analog radio only provides voice communication: e.g. point to point, group calls

GSM-R brings a lot of operational required features compared to analog:

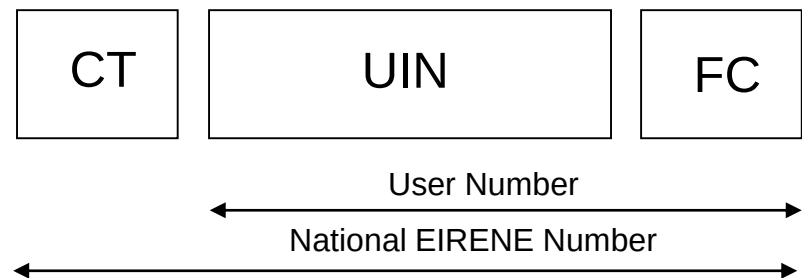


In addition GSM-R also allows:

Data transmission (CSD, GPRS)

GSM-R provides all features and functionality a railway needs for their operation procedures

EIRENE Numbering Plan



Examples:

FNs	Call Type	User Number	
Train Function Number	2	Running Number (5 to 8 digits)	TFC 2 digits
Engine Function Number	3	Engine Number (8 digits)	EFC 2 digits
Coach Function Number	4	Engine Number (9 digits)	CFC 2 digits
Maint. & Shunting Function Number	6	Location Number (5 digits)	Team Type (1 digit), Team Memb. Func. (1), Team Number (2 digits)

CT Call Type
UIN User Identifier Number
FC Function Code

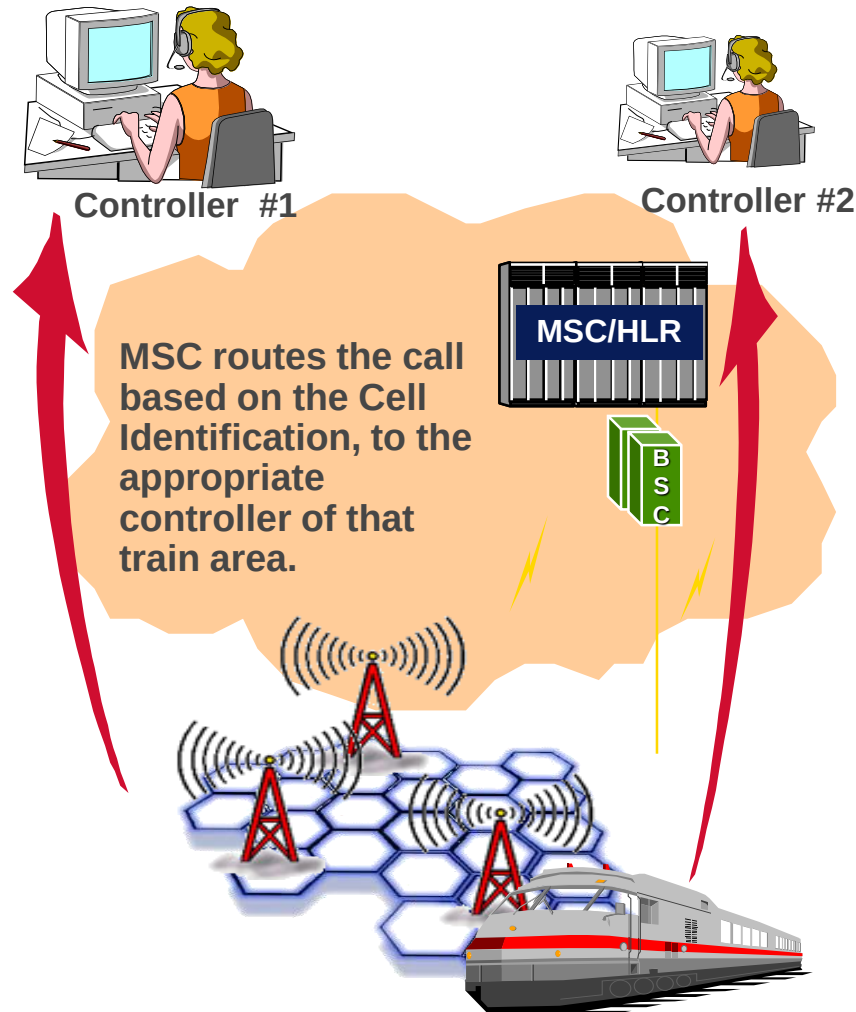
Call Type	EIRENE	Explanation
1	Short Codes	e.g. Location Depending Addressing (LDA)
2	Train Functional Number	Train Number
3	Engine Function Number	Engine Number
4	Coach Function Number	Coach Number
5	Voice Group Call Service or Voice Broadcast Service	VGCS, VBS (based on GCA & GID)
6	Maintenance & Shunting Group	Maintenance or Shunting Numbers
7	Train controllers (Dispatcher)	Fixed Line Dispatcher Terminals
8	Mobile Subscriber ISDN Number (MSISDN)	Mobile Terminals
9	Break out Codes	To other GSM-R Networks or PABX
0	Access Code	Calls to international public networks (00 or +)

Function Codes

00 Spare Alarm
01 Lead Driver
02-05 other Drivers
10 Chief Conductor
etc.

Location Dependent Addressing (LDA)

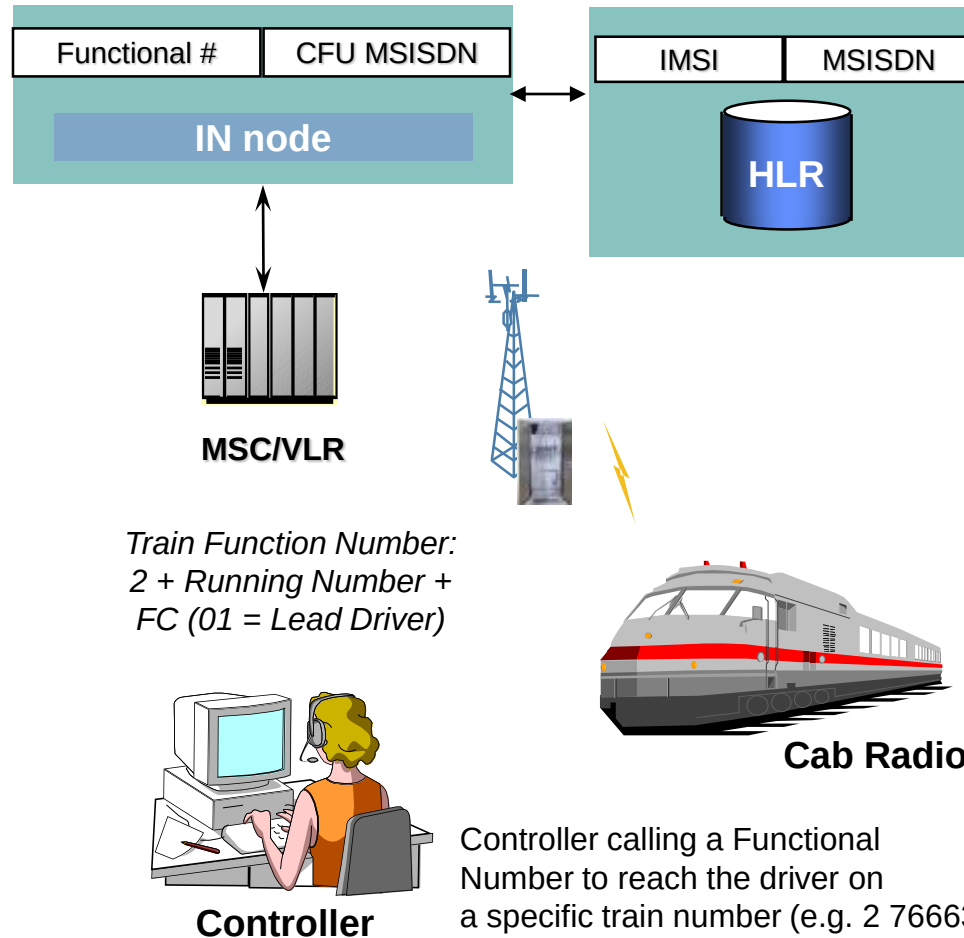
CT 1



Allows the routing of mobile originated calls to the correct controller by evaluating the mobile subscriber actual location (Cell Based) and using Short Codes (e.g. 1200)

Functional Addressing

CT 2, CT 3 and CT 4



Allows a user or an application to be reached by means of a number which identifies the relevant function and not the physical terminal (MSISDN)

The GSM features involved are:

- USSD for Registration, deregistration and interrogation of functional numbers
- “Follow Me” for call setup

The IN node manages the mapping of Functional Number to MSISDN

Voice Group Call Service (VGCS)

CT 5 0



Voice Group Call Service allows a group of service subscribers in a pre-defined service area to have a speech conversation.

Voice Group Call Service includes all the functionality of Voice Broadcast Service.

Dispatchers involved in group calls can talk at any moment, while service subscribers have to grant the token (uplink) when they wish to talk.

Voice Broadcast Service (VBS)

CT 5 1



To a group or all service subscribers located in a pre-defined geographical area:

- **Voice Broadcast Service** allows the distribution of speech originated by a service subscriber or a dispatcher
- The network provides:
 - ✓ Standard full duplex channel for the VBS originator.
 - ✓ Simplex (downlink) channel for all listeners
 - ✓ One common simplex downlink channel per cell belong to VBS Group Call Area.
- Only the dispatcher or the VBS originator may talk.

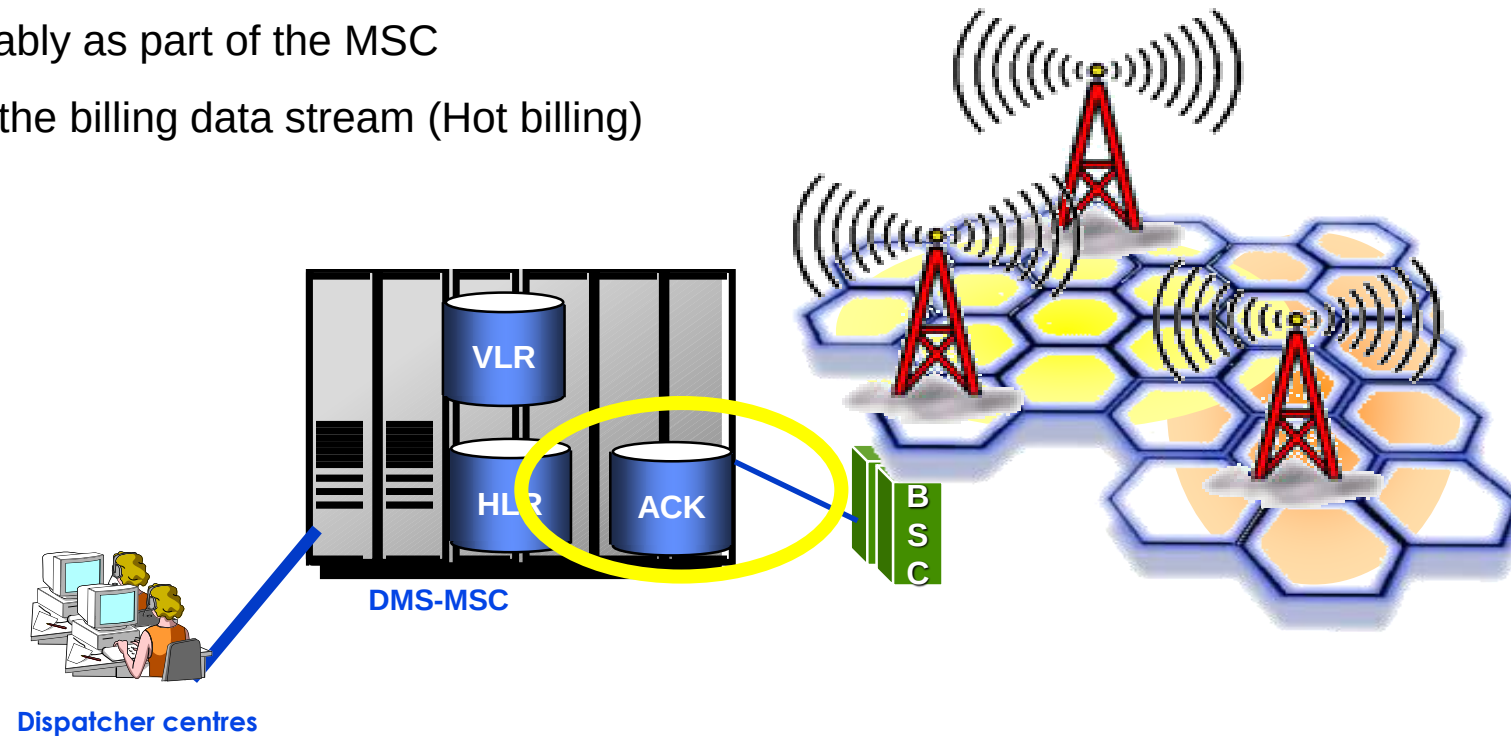
Railway Emergency Call

REC 299

Fully supported with the VGCS feature

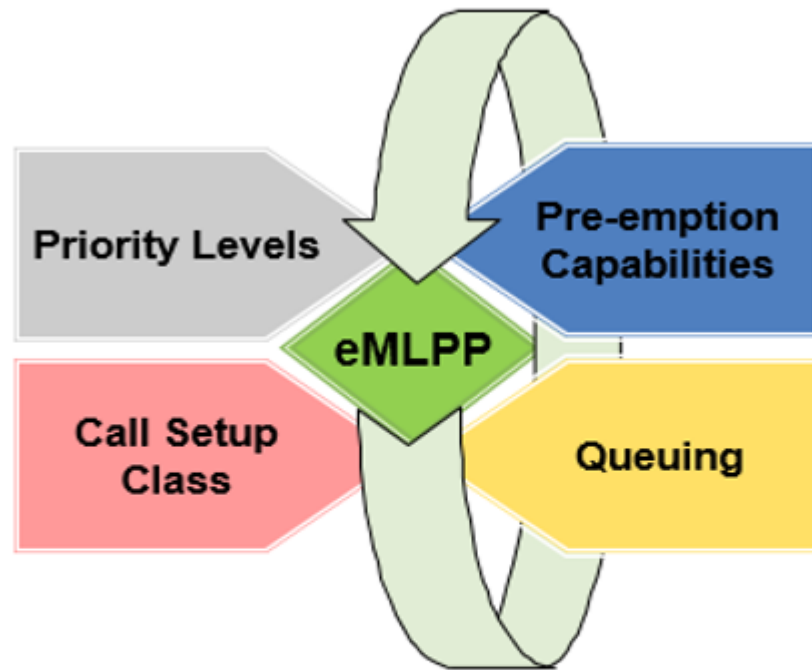
Built-in acknowledgement centre (Confirmation Centre)

- stores call attendance and call related information
- Highly reliably as part of the MSC
- Based on the billing data stream (Hot billing)



Enhanced Multi Level Precedence and Preemption

eMLPP



eMLPP service applies to:

- Point-to-point calls
- Voice Broadcast Service
- Voice Group Call Service

eMLPP service prevents network congestion while ensuring prioritized connection for emergency situations and specific users.

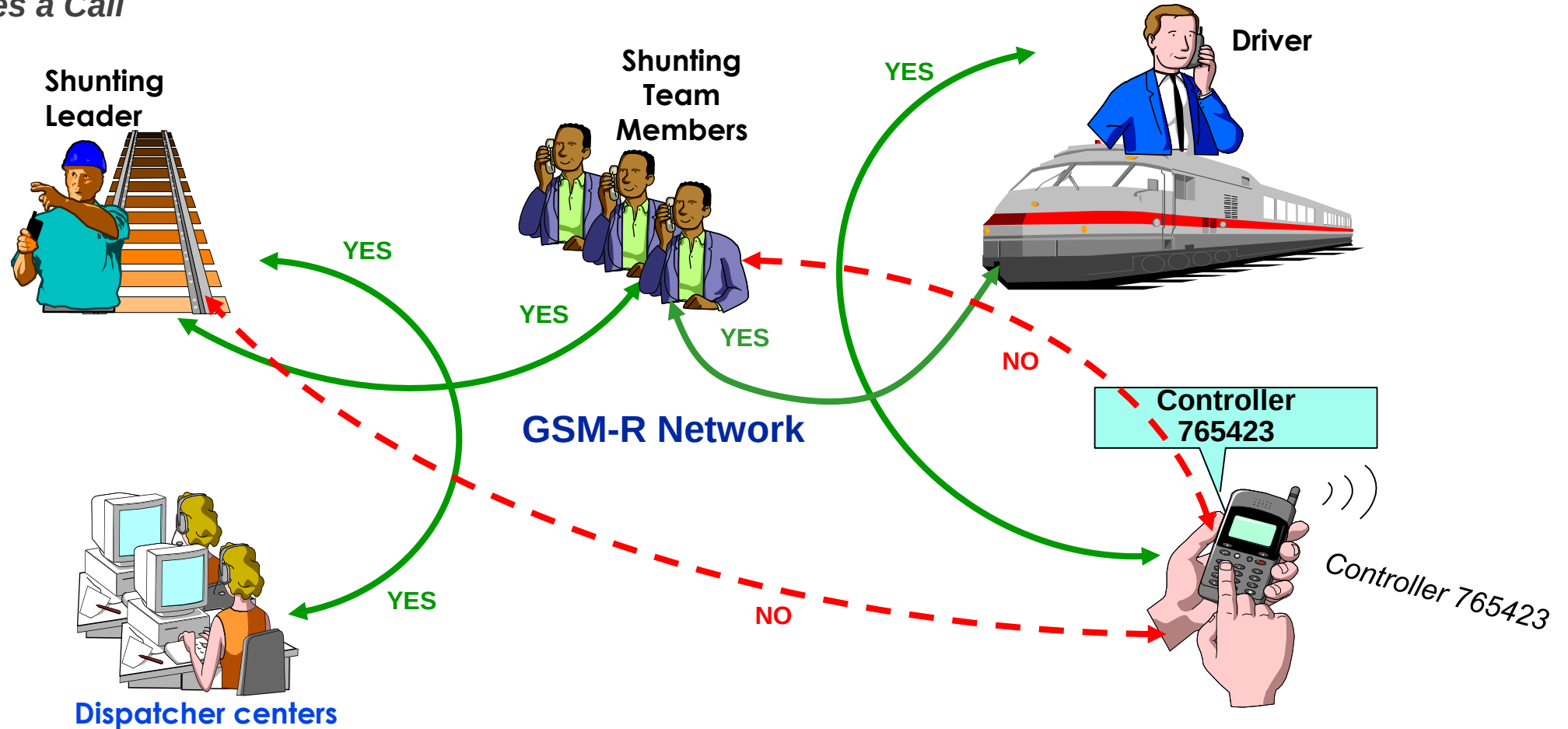
The eMLPP service consists of 2 parts:

Precedence - assigns a priority level for call setup and call continuity in case of handover.

Pre-emption - in the absence of idle resources, a call of higher level precedence can seize the resources being used for a call of lower precedence

Access Matrix

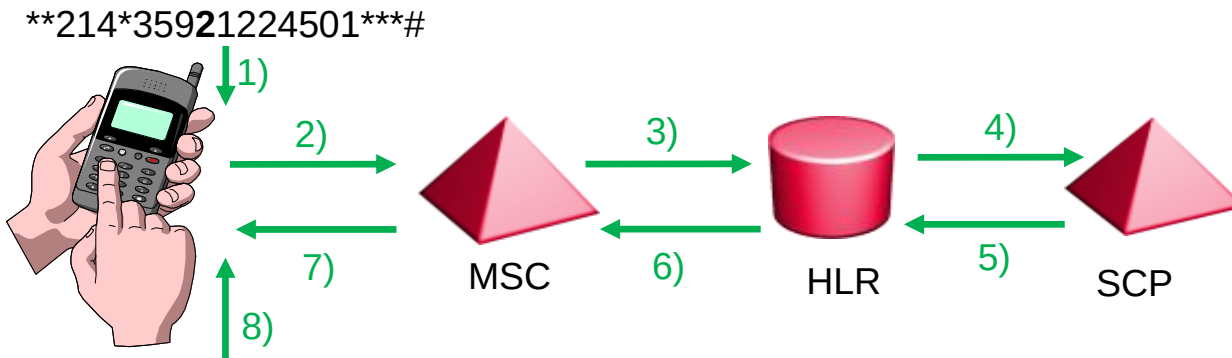
Allows or Denies a Call



The Access Matrix application allows or denies a call depending on the originator and terminator function in the GSM-R network

Registration Procedure

CT 2 registration



Registration for Train Number
12245 as Leading Driver (01)
was successful !

De-Registration:

- **##214*35921224501***#**

Interrogation:

- ***#214*35921224501***#**

Typical GSM-R FM Registration call flow:

- 1) The mobile user keys in the appropriate command requesting FM registration. The actual command format is dependent on the mobile MMI implementation. User input may actually be the USSD string itself.
- 2) The mobile terminal sends the registration USSD string to the MSC
- 3) MSC determines that this USSD request and forwards the request string to the HLR.
- 4) The initiating MSISDN determined by the HLR is shipped as parameter of the MAP USSD operation to the SCP.
- 5) SCP verifies that the FN is not already registered in the database and available for a registration. It updates the FN-to-MSISDN information. The SCP sends a response in a USSD string back to the HLR.
- 6) HLR forwards the SCP response USSD string to the MSC.
- 7) The MSC forwards the USSD response string to the mobile terminal.
- 8) Mobile terminal presents a success indication to the user.



***Thank you
for your attention.***