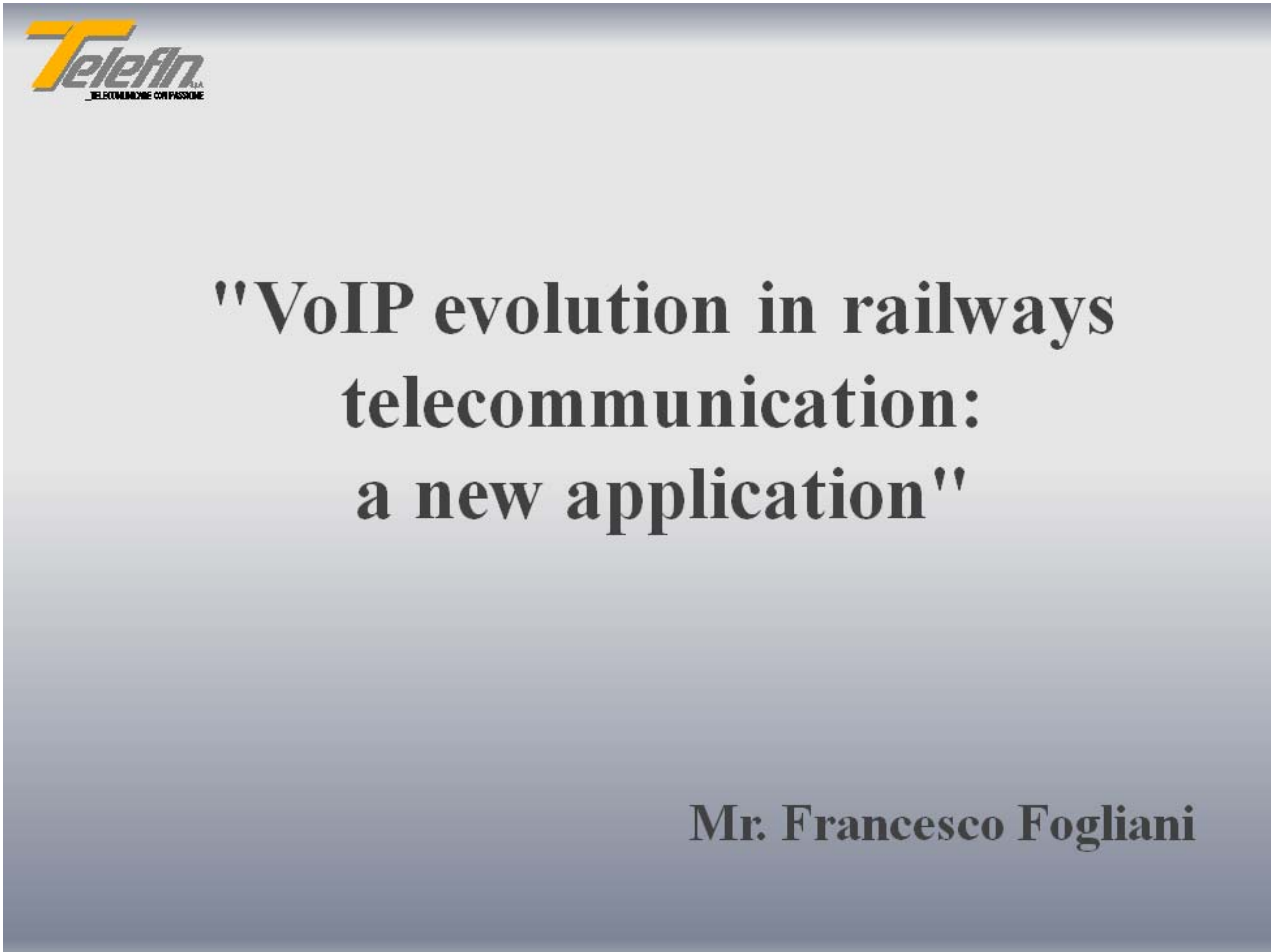



# "VoIP evolution in railways telecommunication: a new application"

Mr. Francesco Fogliani




  
**"VoIP evolution in railways  
telecommunication:  
a new application"**

**Mr. Francesco Fogliani**




SLIDE 1 –Presentation and greetings

## Presentation and greetings



**Telefin holding**

Telefin has many years of experience in the telecommunication field for Italian Railways, paying particular attention to R&D. Telefin is the parent company of a small but active holding of three companies with a similar mission:

	Design and development of complex integrated (hw/sw) systems for Public Administration and Public Transport is the core business of Delta Sistemi
	SPE works in the Maintenance, Assistance and Spare Parts areas for TLC Maintenance Staff for both Italian and granted Railways
	As a Digital Media Factory, «DMI» runs the different steps - design, development and implementation of complex mixed media projects

2

### SLIDE 2 –Telefin holding

The simplification and renewal of traditional telecommunications plants for Italian Railways has been made possible by the massive introduction of TCP/IP-based technologies. The challenge met by Telefin was to apply these technologies to existing plants characterized by a certain degree of complexity without setting either functionalities or performances aside. As a result, Telefin set up prestigious telecommunications systems.

Based on thirty years' experience on periphery plants, Telefin has extended VoIP technology to RFI lines type C and D as well.

In this regard, the design, development and implementation of new integrated telephony plants (STI) has helped Telefin to acquire great in the field. STI represents a subsystem of SCC, the system

conceived by Italian Railways to automate train circulation in the principal lines and nodes. In the following we will show a summary of our STI implementations, which we are proud of.



SLIDE 3 – Bologna PCS

## STI locations

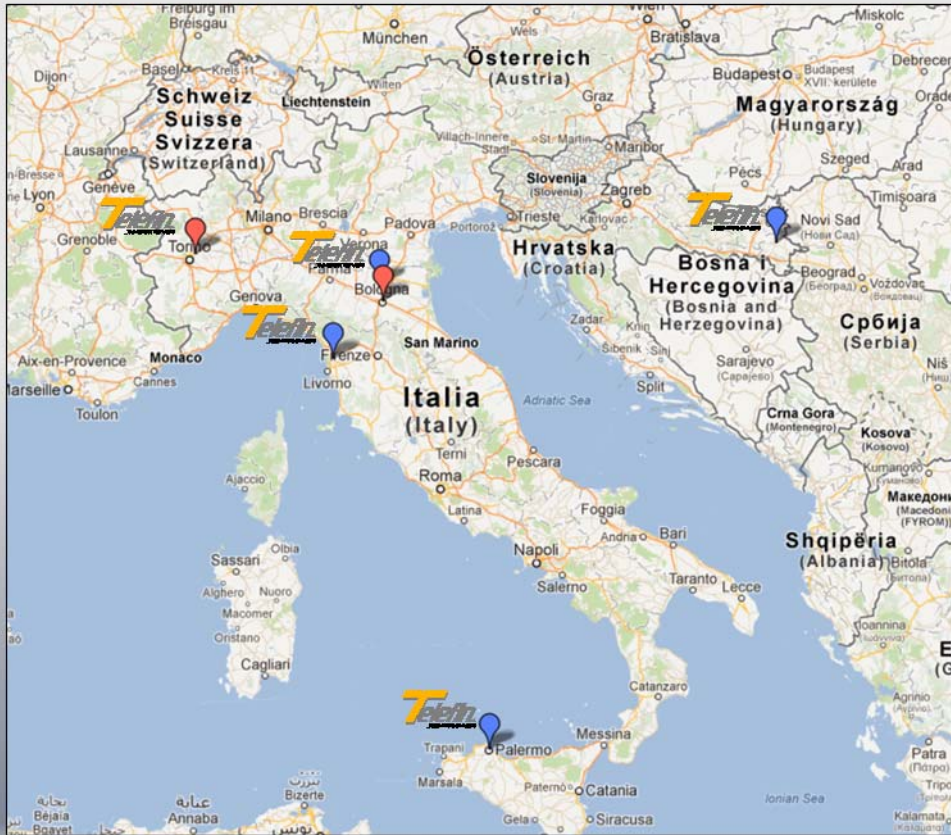
2008 – Palermo  
2008 – Bologna AV  
2009 – Bologna LS  
2010 – Turin AV  
2010 – Pisa  
2010 – Croatia  
(Vinkovci)



4

SLIDE 4 – STI locations

## STI locations



5

SLIDE 5 – STI locations



## SCC room in Bologna PCS



6

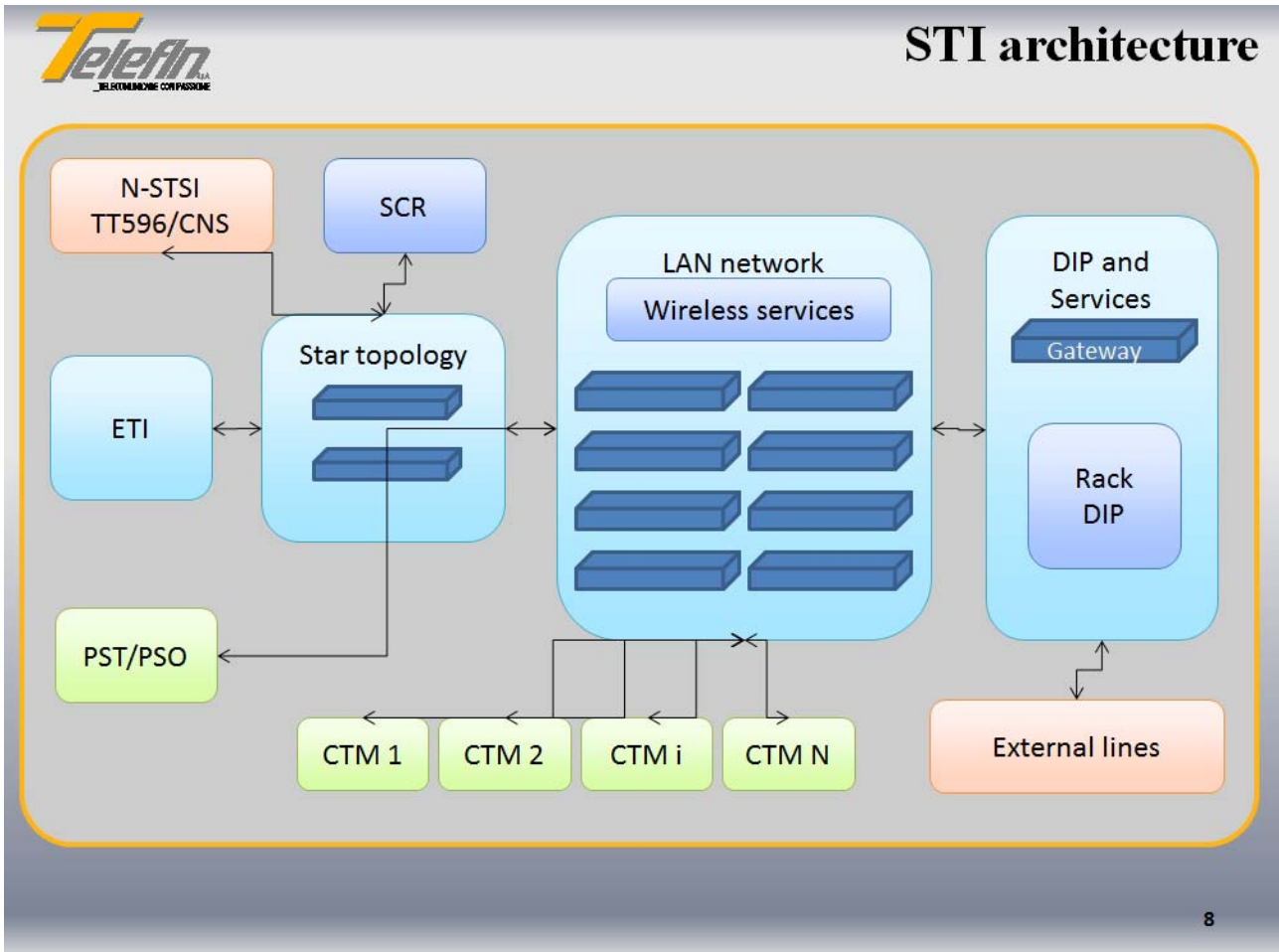
SLIDE 6 – SCC room in Bologna PCS

## CTM components



SLIDE 7 – CTM components

Slides 3, 4, 5, 6, 7 show Telefin STI plants in the High Speed/High Capacity nodes of Bologna (Bologna AV) and Settimo Torinese along with those referring to the normal circulation lines of Bologna (Bologna LS), Palermo and Pisa.



SLIDE 8 – STIarchitecture

The architecture of STI is presented in slide 8: the system backbone is a redounded Ethernet network based on TCP/IP protocols which connects five functional macro blocks:

- **ETI**, which is composed of clustered servers (two by two), assures to STI the vital software services (database, WEB servers, Asterisk calls routing);
- **DIP** (Programmable Interface Device) card is responsible for connecting ETI to peripheral telephonic lines (GSM-R; Italian Railways proprietary technologies) by homogeneously converting signals from/to VoIP; commercial gateways are used to connect STI to switching networks (public/private);
- **PSO** e **PST** are workstations for Operative and Technical Supervisors. As web clients, they connect to ETI to configure and monitor real-time STI;



- **CTM** represents the multi-function telephonic platform provided to SCC personnel; its hardware equipment is composed of Main Control Unit, Touch Screen, Professional Handset with PTT, Handsfree Speaker with advanced AEC, Handsfree Headset (DECT technology), Optional Cordless Set (DECT technology).

The whole STI system is equipped with Linux OS and is based on two independent mission-critical redundant TCP/IP-based LAN networks; each STI network device has two IP ports linked to normal/reserve switches.

The STI system engineered by Telefin is able to manage all telephonic technologies in use on Italian Railways and to centralize them on CTM.

Thanks to a simple but appealing GUI, it is possible to quickly navigate into CTM internal menus. CTM implements the different GSM-R functionalities based on EIRENE-MORANE specs as well; being configured as a Dispatcher or a Normal User, it allows GSM-R VGC/VBS/DSD/OTDI. Moreover, CTM enables typical PBX functionalities such as call forwarding, call hold, phonebooks, different types of conference, etc.. Operators may also be legally recorded.

## **SCC – STI Interface**


Among the various key aspects of our system, we'd like to draw attention to the STI-SCC interface based on a special TCP/IP protocol.

Through information received by STI (phonebooks, status of ongoing calls, ...), SCC workstations of different control subsystem can implement main phone services of CTM; i.e. they can start or end a call by a mouse click.

On the other hand, STI receives from SCC information displayed in real-time on CTM, about the status of: SCC Operators (login/logout); railway lines (i.e. railway lines charging to Operators); ID of trains present on controlled lines; railroad stations (with or without control personnel).


In the following, we list the main functionalities of SCC-STI protocol:

- Real-time update of train ID present on SCC controlled lines (see slide number 9)
- Automatic railway line assignation to Operators
- Phone services extended to SCC/CTC consoles (QL): calls start/hang-on end/hang-up by clicking on QL and visualization of STSI broken phones.



## SCC – STI Interface

- Real time train ID update
- Automatic rail management
- Phone functions on SCC/CTC workstations



9

SLIDE 9 – SCC-STI Interface

The STI system is real-time monitored by means of the open-source software Zabbix which, either with snmp-based procedures or proper agents permits delivery to PST of detailed information about network elements status and alarms. This information is graphically represented on easy to understand maps.

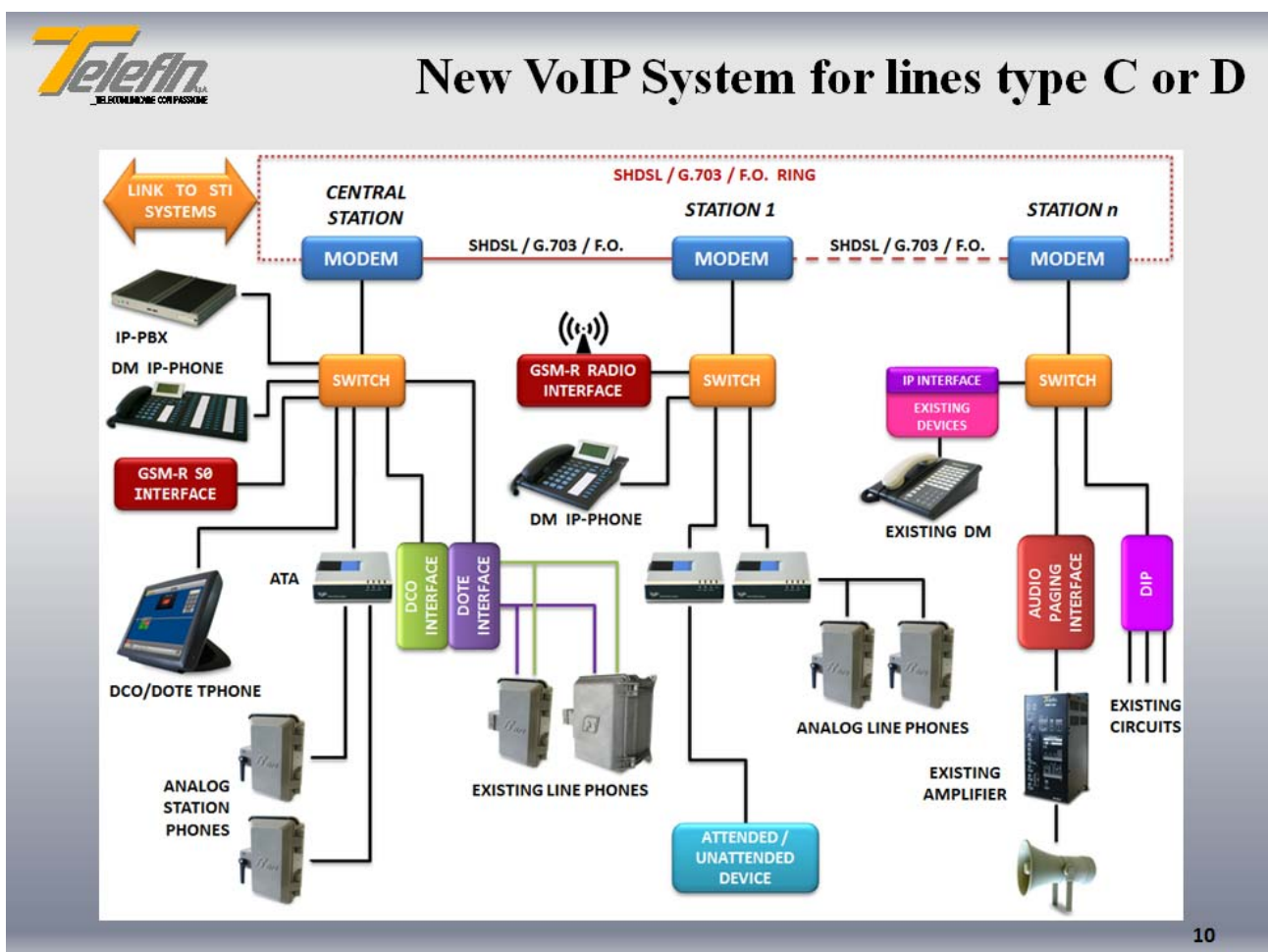
The deep knowledge of both existing telecommunication technologies owned by Italian Railways and progress in Telecommunications in general, has enabled the R&D Telefin Department to produce hw/sw cards to convert the most different and heterogeneous telephonic circuits/services in use to/from VoIP.

For obvious economic and rational reasons, Telefin has always been able to design and build plants which must coexist with working plants. You should have just noticed how much attention we pay to developing GUI interfaces: they are distinguished by efficiency and ease of use and therefore they are greatly appreciated by SCC operators and Telecommunications maintenance staff.

### **New VoIP system for lines type C or D**

More recently, according to new RFI specs, thanks to the experience in the above described VoIP implementations, Telefin has extended VoIP technology to Italian Railways lines type C or D (DC, DU, DCO, MAN and DOTE operators) by creating a system, compliant to TT596 RFI spec.

There is certainly no comparison between the architectural and functional complexity of STI and that of lines type C or D. But STI is placed in a permanently attended location, unlike a plant for lines type C or D which works in more critical operational and environmental conditions: it is sufficient to think of the working temperature range, or the location of racks equipment which is placed in rooms without air conditioning of unattended stations.




SLIDE 10 – New VoIP system for lines type C or D

Slide number 10 shows the architecture of the new VoIP system for lines type C or D: as everyone knows an IP network is the only transmission frame allowed for all telephonic circuits on such lines.


Core devices of this system are represented by drop-insert modems: they are installed in each station and they can adapt to different physical layers. Within each station a LAN network originates from a switch Ethernet which is linked to the drop-insert modem. To this switch a set of devices, typical of VoIP railway installations, is connected: IP-PBX server, IP-Phones, a Touch-Screen Console for Operators, ATAs (Analog Telephone Adapter) to connect PSTN Watertight Telephones (along the railway or within the station).

In order to minimize DOS (Deny of Service), each network element is remotely configured and monitored by means of a centralized supervision system; moreover the transmission backbone has a ring topology to compensate for possible line breaks.

As shown in the next slide, Telefin has designed and implemented a set of devices which, for their reliability, are particularly adapted to operate under the above mentioned critical conditions (see slide number 11).



## New VoIP System - ATA device



Caratteristiche tecniche	
Alimentazione	18VDC + 60VDC
Dimensioni (H x L x P)	120 x 53 x 96 mm
Peso	314g
Montaggio	Barra DIN
Temperatura Operativa	-20°C + + 60 C°
Conformità	EN55022:2006 + A1:2007
	EN61000-3-2:2006 + A1:2009 + A2:2009
	EN61000-3-3:2008
	EN55024:2010
	EN50121-4:2006
Porte Ethernet	EN60950-1:2006 + A11:2009
	N°2 RJ45 10/100Mbps configurabili separatamente o bonding active backup
Interfacce	N°2 porte FXS per il collegamento a n°2 telefoni BCA
	N°2 contatti per input I/O general purpose N°1 micro SD card socket
Codec VoIP	G.711
	G.722
	G.729
	Speex
Protocolli VoIP	SIP v2 (Session Initiation Protocol)
	IAX2 (Inter Asterisk Xchange)
CPU	Atmel AT91SAM9G20
	ARM926EJ-S core 400MHz
Memoria	64Mbyte SDRAM
	256Mbyte NAND Flash
Sistema Operativo e Software Installato	Linux 2.6.33 (custom edition)
	Asterisk 1.8.8.1 (configurabile) Interfaccia web per la configurazione protetta da password
Diagnostica	SNMP con MIB Telefin

11

SLIDE 11 –New VoIP System - ATA device



Moreover, Telefin has introduced such features into line VoIP technology that allow it to cope with any requirement from different railway control regimes. Telefin has also endowed the system for lines type C or D with GSM-R technology by adhering to “EIRENE MORANE” specs.

For these reasons the goal we set ourselves is to meet the demands of foreign countries, since the new Asterisk-based technologies meet international standards as well as being characterized by ease of use, flexibility and modularity.

A relevant example is constituted by our recent implementation for the Croatian Railways (see slide 12) whose technical and infrastructural conditions are of course a novelty for Telefin.



**Telefin**  
TELECOMUNICARE CON PASSIONE

## Croatian Railways: Vinkovci to Tovarnik to State Border railway rehabilitation

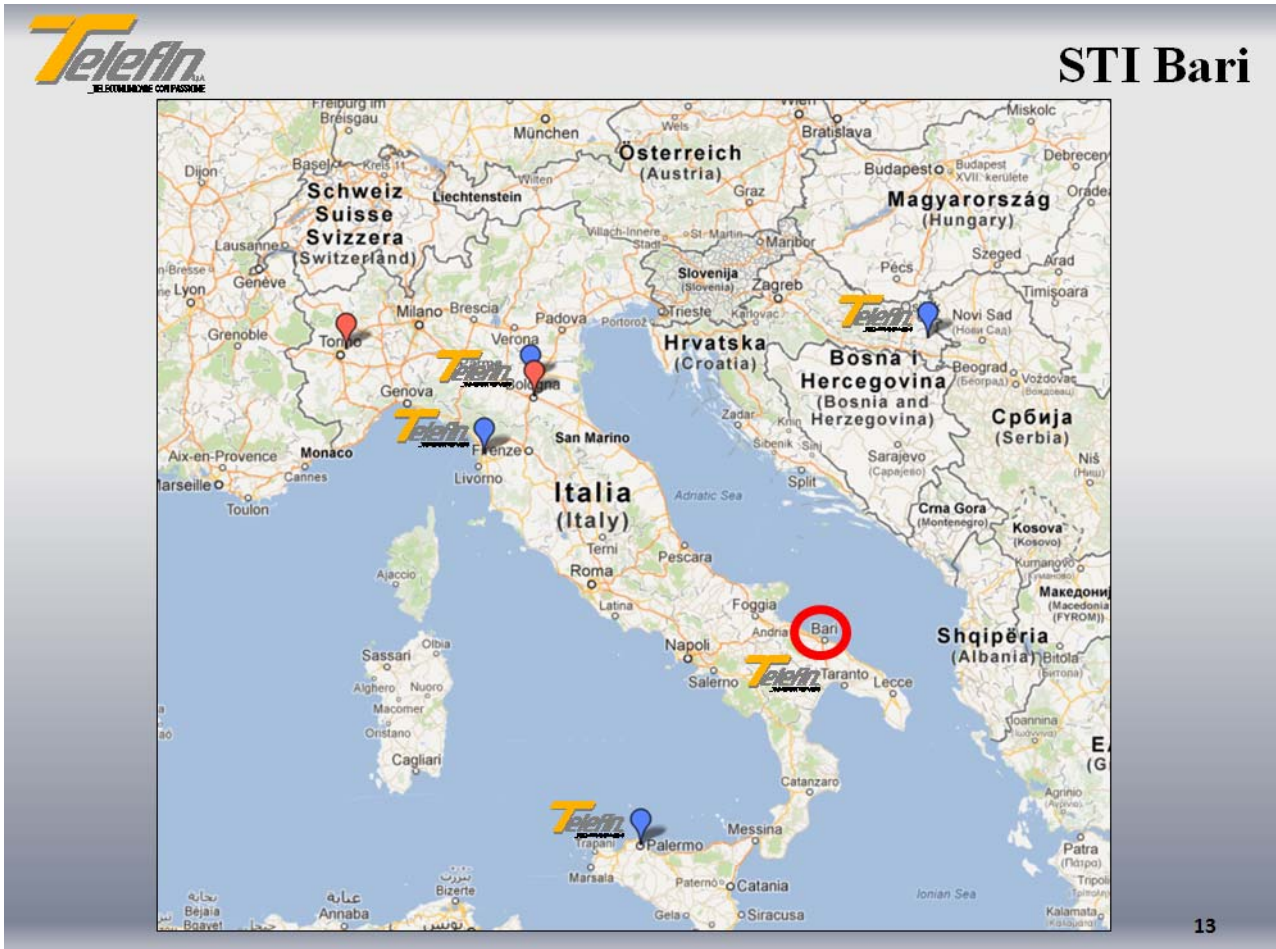
The image shows a map of Croatia and its neighboring countries: Austria (Österreich), Slovenia (Slovenija), Bosnia and Herzegovina (Bosna i Hercegovina), and Serbia (Србија). A blue line with green markers labeled A, B, C, and D indicates a railway route starting from Vinkovci, passing through Mirkovci, Privlaka, and Ilče, ending at Tovarnik. An inset map provides a closer view of this route. The Telefin logo is present in the top left corner of the slide.

12

SLIDE 12 – Croatian Railways: Vinkovci to Tovarnik to State Border railway rehabilitation

## A new STI application in Bari

I am pleased to tell you about our latest effort, still in progress. Right here, under the direction of this department, chaired by Mr. Pagone (see slide number 13).



SLIDE 13 –STI BARI

I will briefly sketch only the new features in addition to those previously described.

## New functionalities

- **NewHW/SW ETI architecture (seeslide number 14)**

A new cluster management is activated when both server nodes are not available: aperiodical synchronization of the ETI database takes place on PSO which therefore becomes a server in the above mentioned condition.

**New ETI generation**

Lower power consumption  
Increased efficiency  
Occupies less space

14

SLIDE 14 – NewETI generation

- 

- **Wireless Services for SCC room Coordinator and Maintenance Staff**

- A web-based application runs on Android Tablet or IOS (see slide number 15), thus enabling coordinators and maintenance staff to quickly accomplish tasks concerning STI operations from everywhere within the SCC room. Among them, we mention (see slide number 16, 17):

- ✓ Management of STI Phonebook
- ✓ STI Monitoring Supervision
- ✓ STI Plant Supervision
- ✓ STI Manuals Consultation
- ✓ STI Configuration
- ✓ STI Maintenance
- ✓ Administration of SCR Services
- ✓ FAX services
- ✓ SMS Broadcasting



### Tablet Android / IOS + Web application «Wizard STI»:

- Possibility for Maintenance Staff and SCC Coordinators to operate anywhere from the SCC control room



- CTM configuration: enabling / disabling standby workstations
- Users insertion into CTM phonebooks
- Operator calls monitoring: ongoing Calls, GSM-R activity (DSD Calls History, Emergency Calls)
- STI monitoring: visualization of system real-time alarms

## STI wireless service



16

SLIDE 16 – STI wireless service

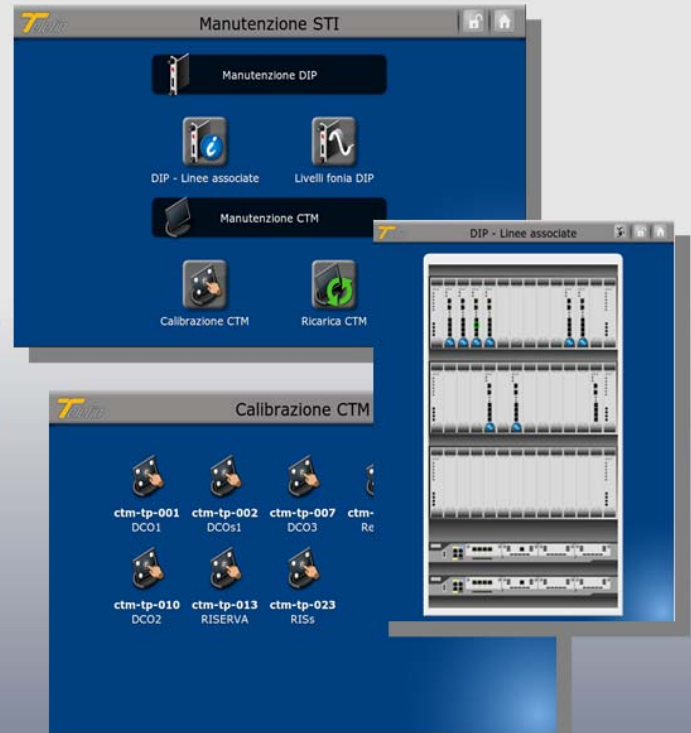
### STI maintenance:

- CTM touch-screen calibration
- DIP parameters setting

### SCR administration:

- Audio recorder status monitoring
- Search and playback functionality
- Tracks extraction on USB key

### STI manuals consultation




- New CTM HW

**Telefin**  
S.p.A.  
TELECOMUNICARE CON PASSIONE


## CTM – Multi function phone

**New generation:**


- Cuts down on power
- Increased efficiency
- Uses less space




Central unit




Monitor Touch-screen



Wireless headphones



Telefono DECT



TMH VoIP


18

SLIDE 18 – CTM Multi function phone



- 
- **New CTM functionalities (see slide number 19, 20, 21)**

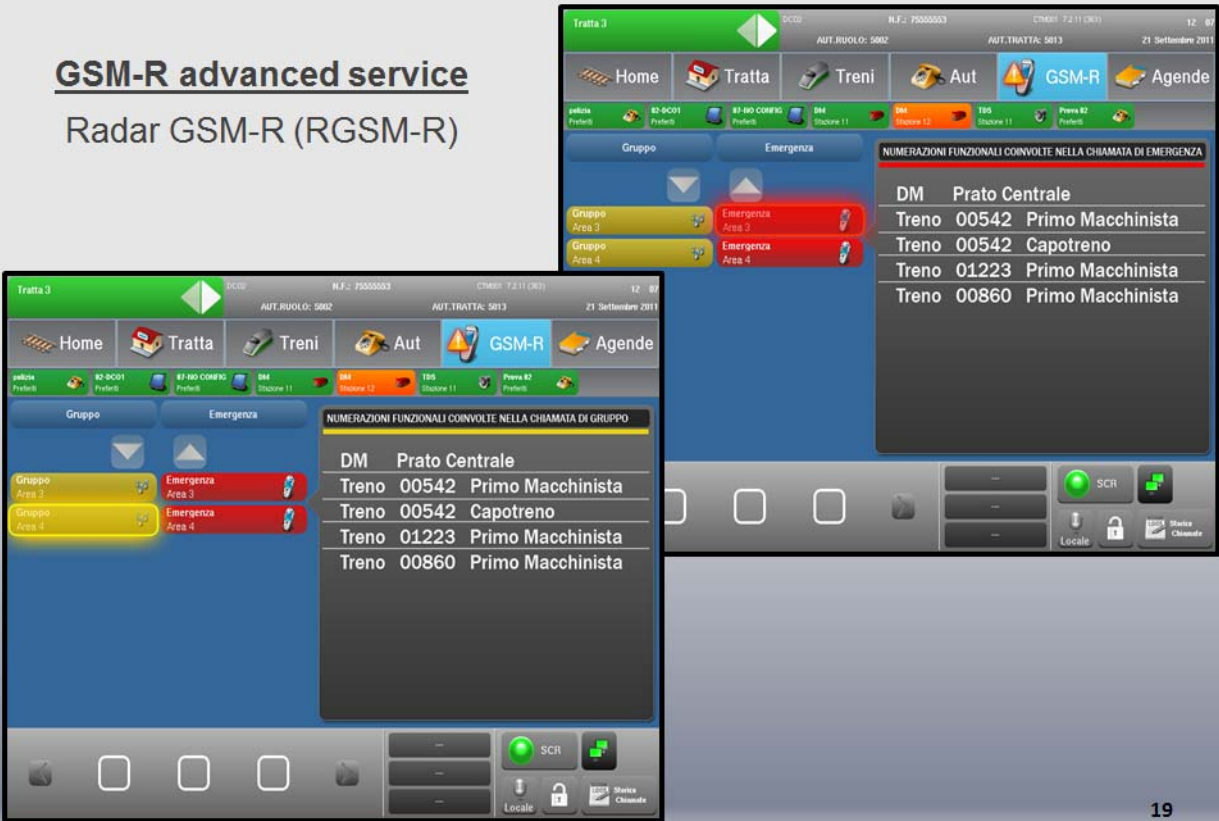
By interfacing MGW (MediaGateWay) applications, RGSM-R Service allows us to get more information for VGCs, thus enabling each SCC Operator to speed up operations in such events (Emergency Calls) and therefore avoid train delays.



## CTM – New features

### GSM-R advanced service

#### Radar GSM-R (RGSM-R)



NUMERAZIONI FUNZIONALI COINVOLTE NELLA CHIAMATA DI EMERGENZA	
DM	Prato Centrale
Treno	00542 Primo Macchinista
Treno	00542 Capotreno
Treno	01223 Primo Macchinista
Treno	00860 Primo Macchinista

NUMERAZIONI FUNZIONALI COINVOLTE NELLA CHIAMATA DI GRUPPO	
DM	Prato Centrale
Treno	00542 Primo Macchinista
Treno	00542 Capotreno
Treno	01223 Primo Macchinista
Treno	00860 Primo Macchinista

19

SLIDE 19 – CTM - New features

## CTM – New features

GSM-R advanced service  
 Automatic resolution site code  
 Report Link Fault GSM-R S0



## CTM – New features


New VoIP System for lines type C or D integration  
(«Tratta» menu on CTM)



21

SLIDE 21 – CTM - New features

- 
- **New SCR: VoIP technology with high ease of use, voice quality, modularity and fewer maintenance operations (see slide number 22, 23)**



## VoIP Recorder Central System

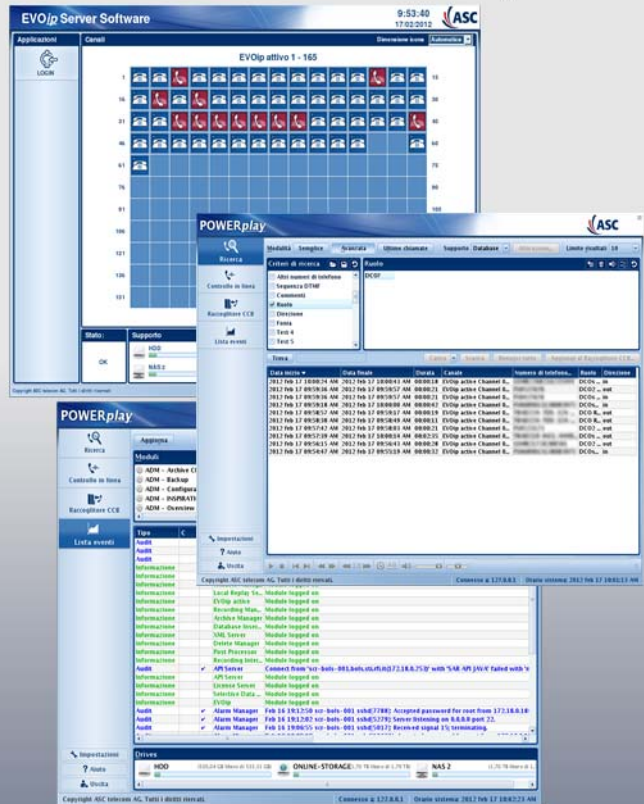
- Server Linux based + NAS/SAN/DAS
- VoIP active technology
- Warning tone
- Performance, audio quality and recording security
- New archiving mode (parallel archiving)
- High data security standard
- Browser-based and client-server based search with flexible search criteria
- Monitoring and remote assistance

22

SLIDE 22 – VoIP Recorder Central System

# VoIP Recorder Central System

- User friendly interface
- Quick visualisation of status and alarms
- Simple way of searching with possibility of storing tracks on USB key
- Communication recording directly from the IP network



23

SLIDE 23 – VoIP Recorder Central System



**Thanks for your attention**

SLIDE 24 – Thanks for your attention