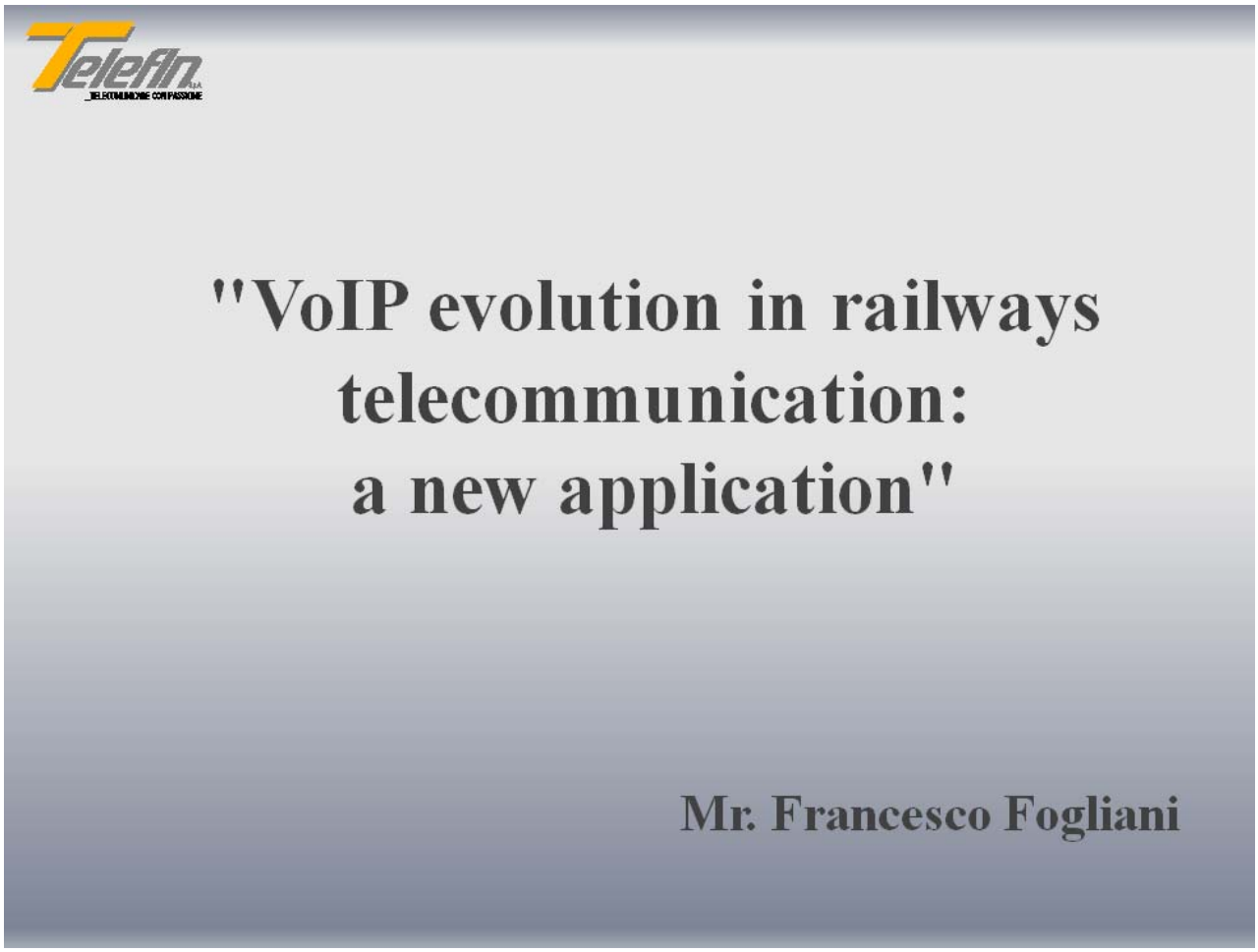
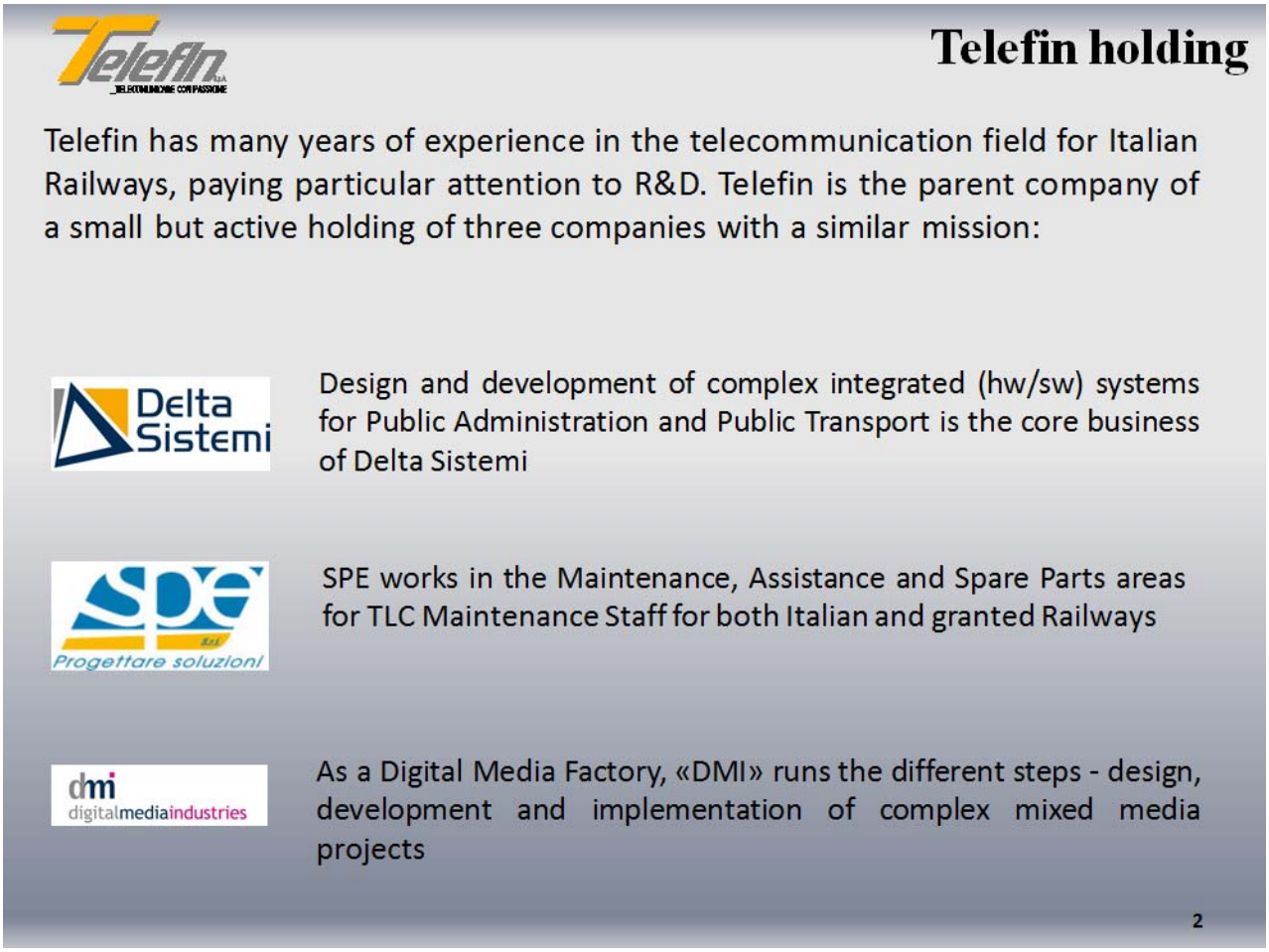
"VoIP evolution in railways telecommunication: a new application"

Mr.Francesco Fogliani



SLIDE 1 –Presentation and greetings

Presentation and greetings



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.

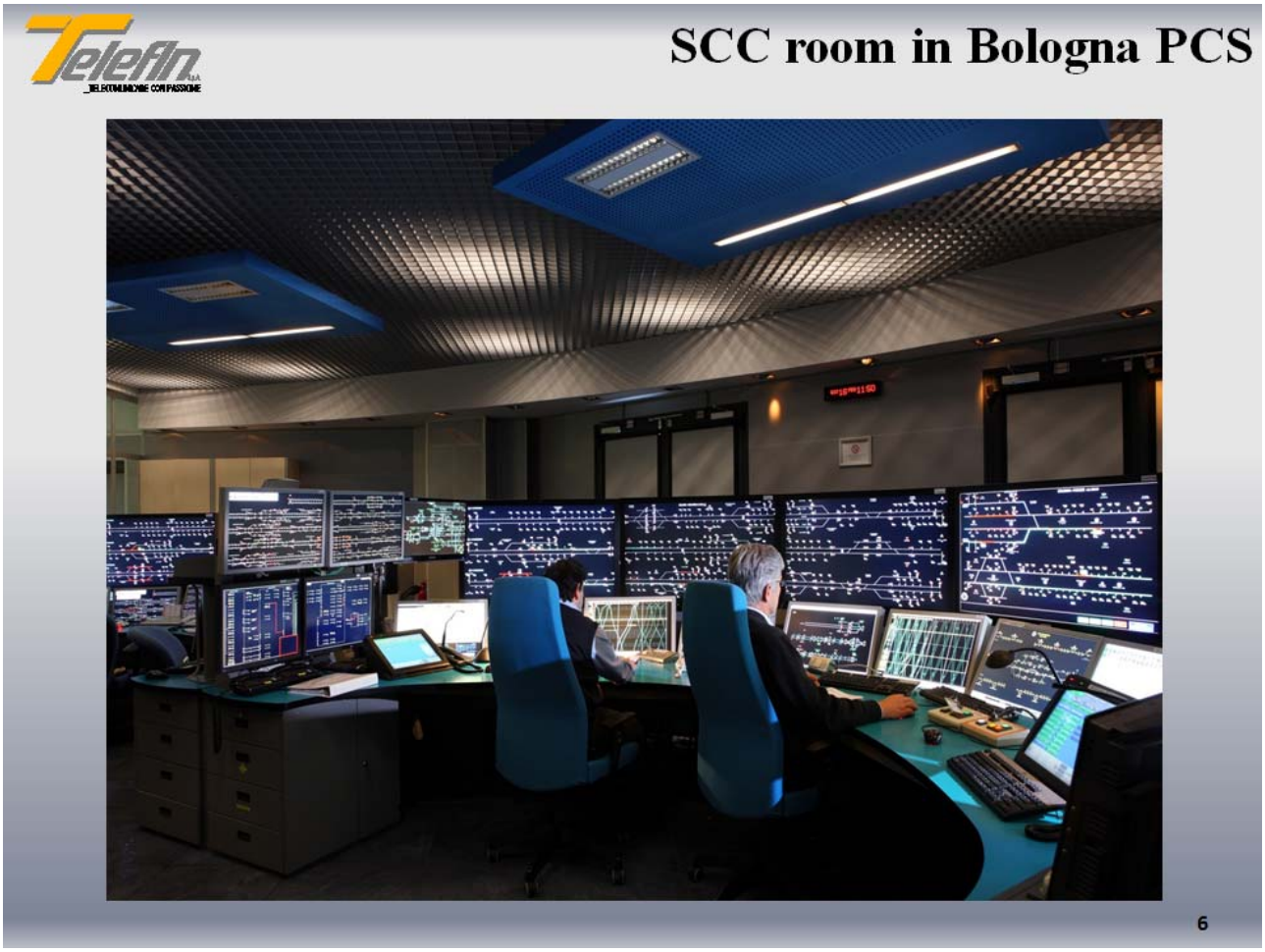
In this regard, the design, development and implementation of new integrated telephony plants (STI) has helped Telefin to acquire great in the field. STI represents a subsystem of SCC, the system

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

SLIDE 4 – STI locations

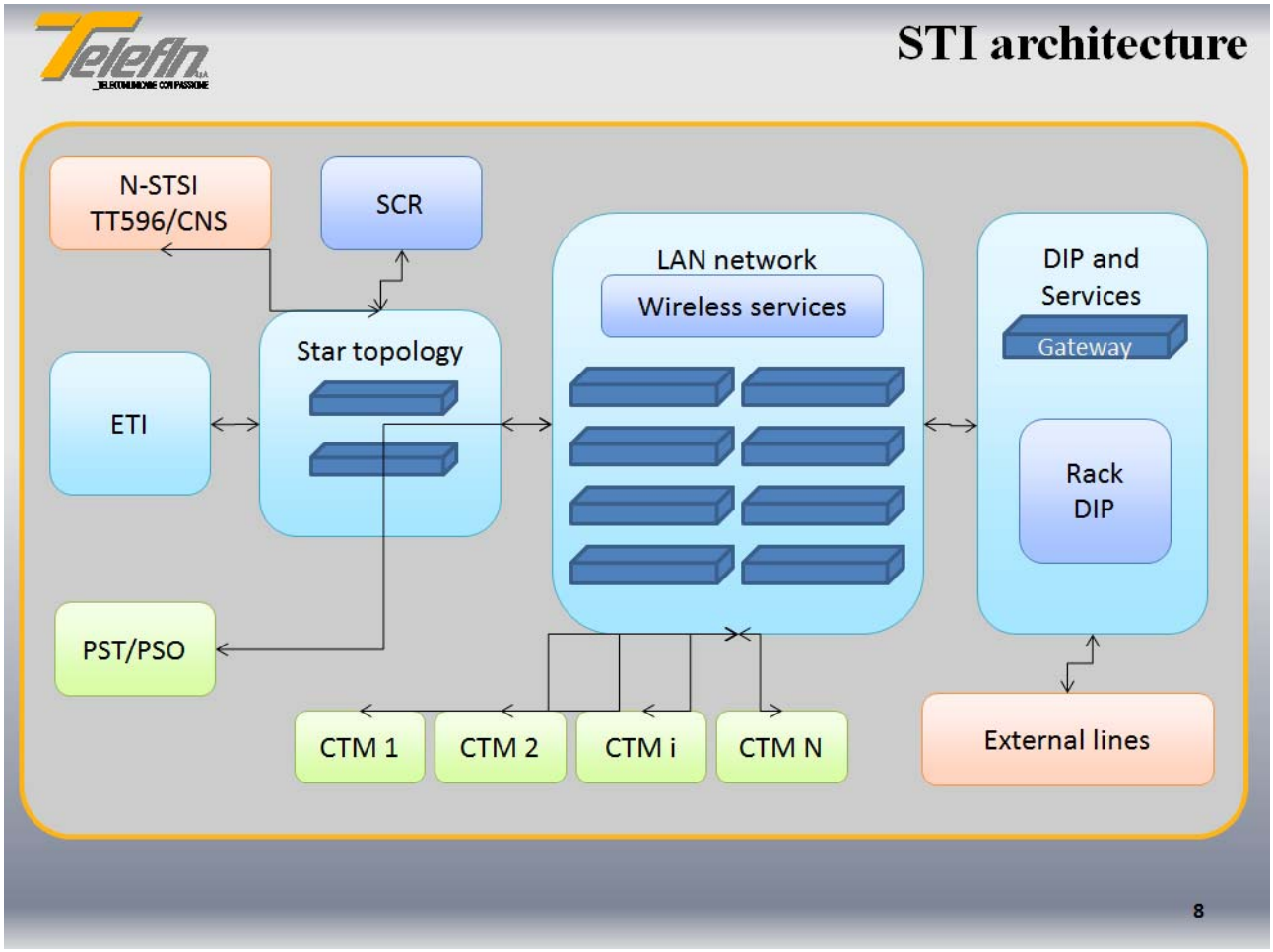
SLIDE 5 – STI locations



SLIDE 6 – SCC room in Bologna PCS

SLIDE 7 – CTM components

Slides3,4,5,6, 7show 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. railways 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 (seeslide 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.

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 elementsstatus and alarms. This information is graphically represented on easy to understand maps.

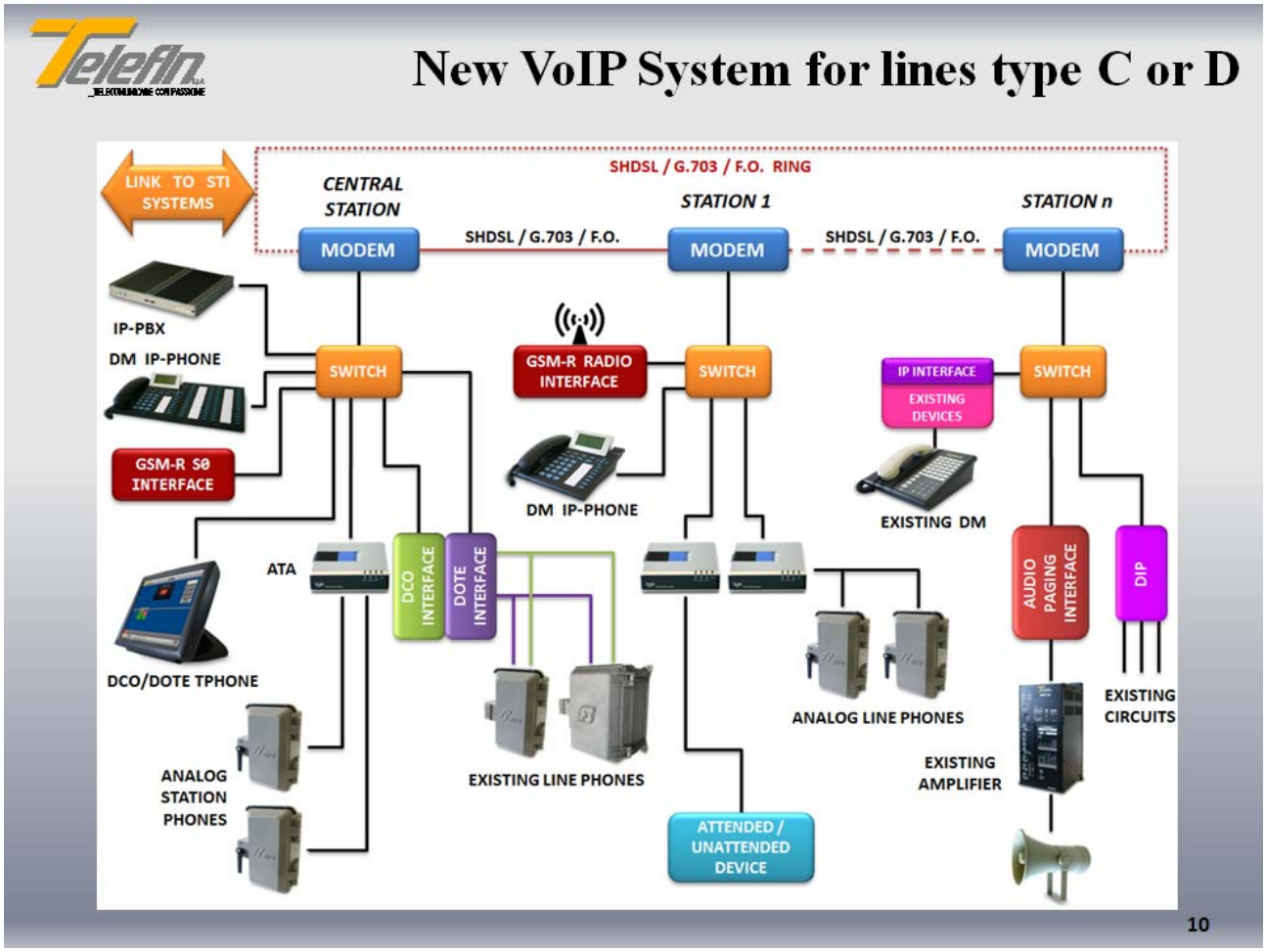
The deep knowledge of both existing telecommunication technologies owned by Italian Railways and progress in Telecommunications in general, has enabled the R&D Telefin Department to produce hw/sw cards to convert the most different and heterogeneous telephonic circuits/services in useto/from VoIP.

For obvious economic and rational reasons,Telefin has alwaysbeen 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 inthe above described VoIPimplementations, Telefin has extendend 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 permanentlyattended location, unlike a plant for lines type C or D which works in more critical operational and environmental conditions: it is sufficient to think ofthe working temperature range, or the location of racks equipment which is placed in rooms without air conditioning of unattended stations.



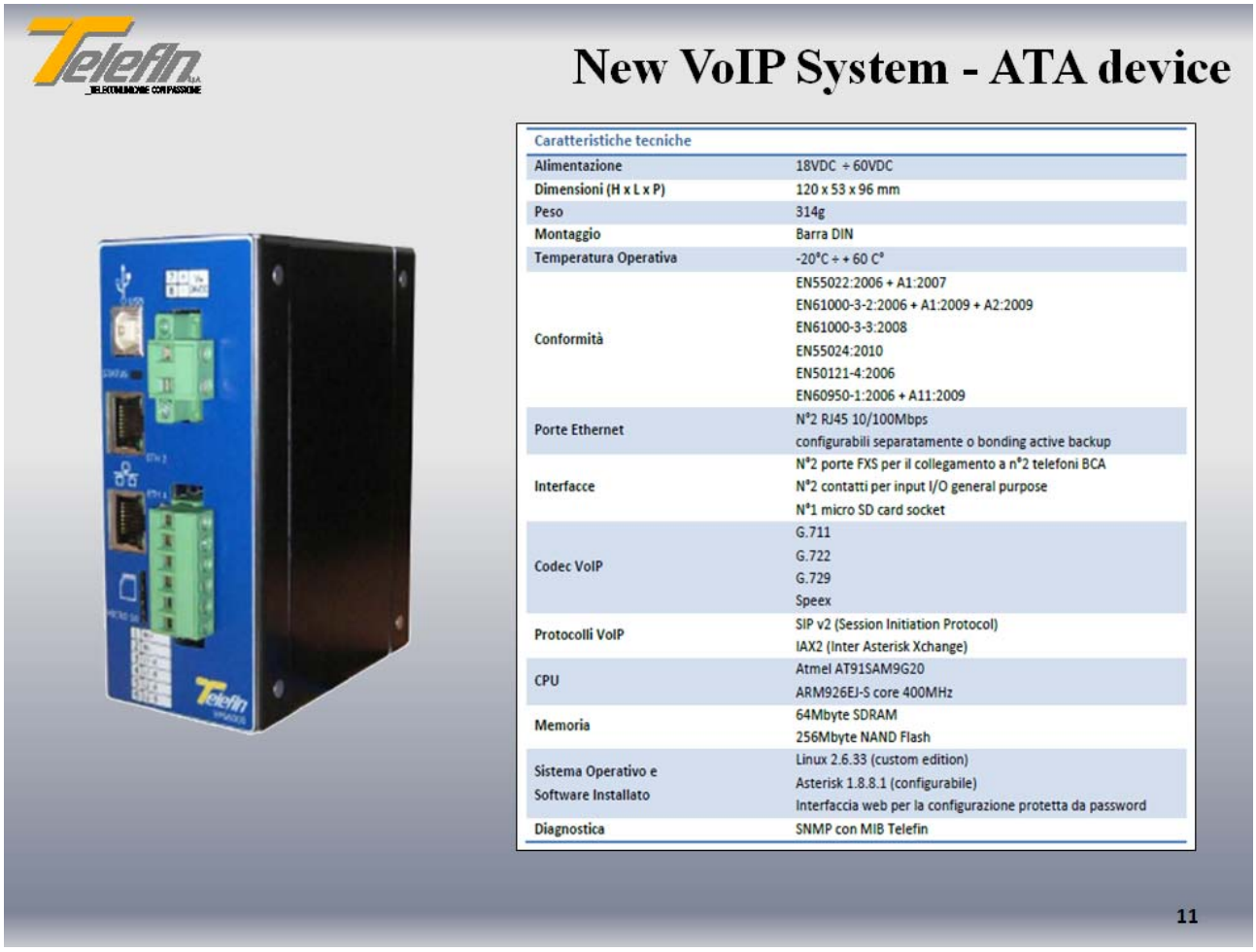
SLIDE 10 – New VoIP system for lines type C or D

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 railways 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 railwayor 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 (seeslide number 11).

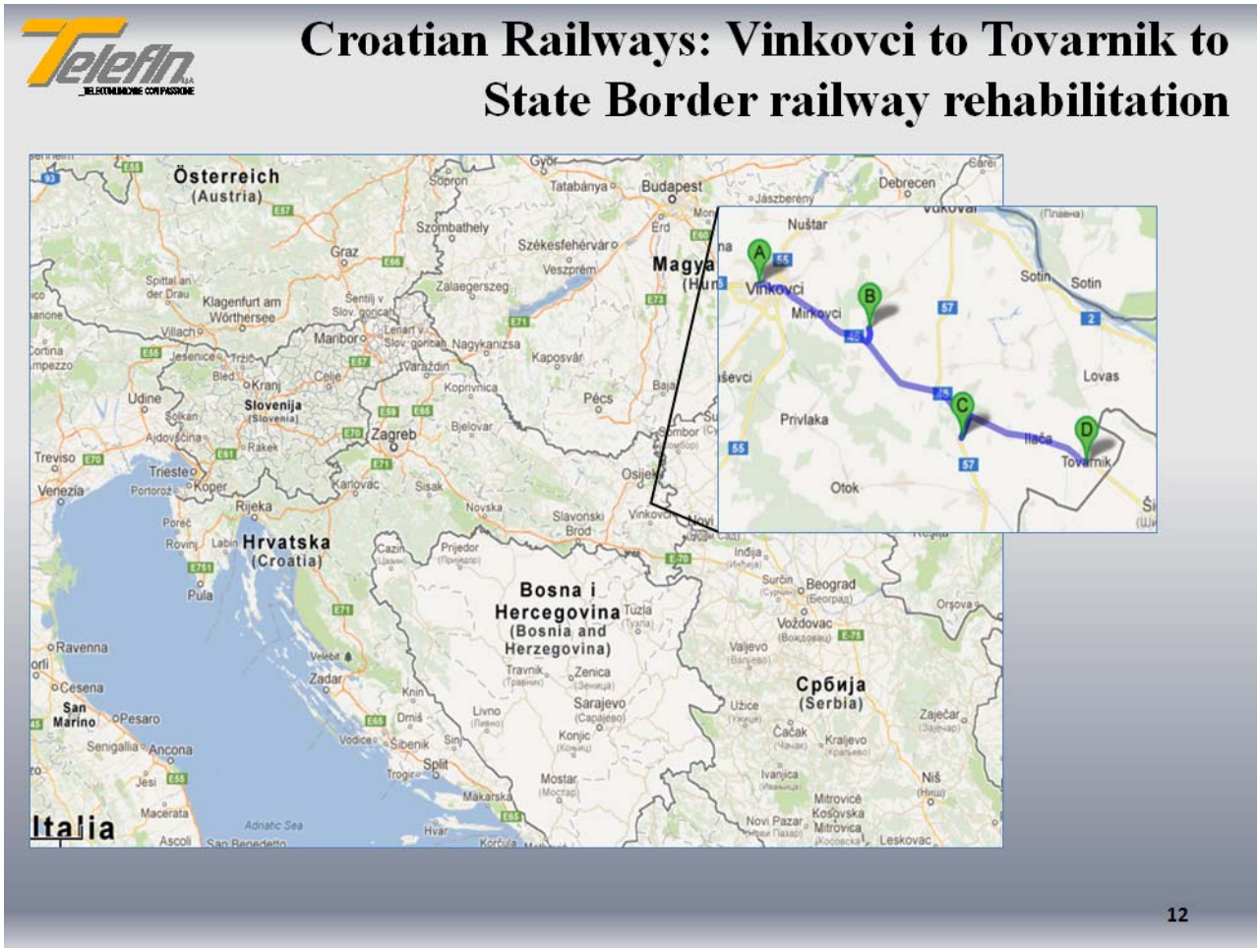


SLIDE 11 –New VoIP System - ATA device

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 newAsterisk-based technologies meet international standards as well as being characterized by ease of use, flexibility and modularity.

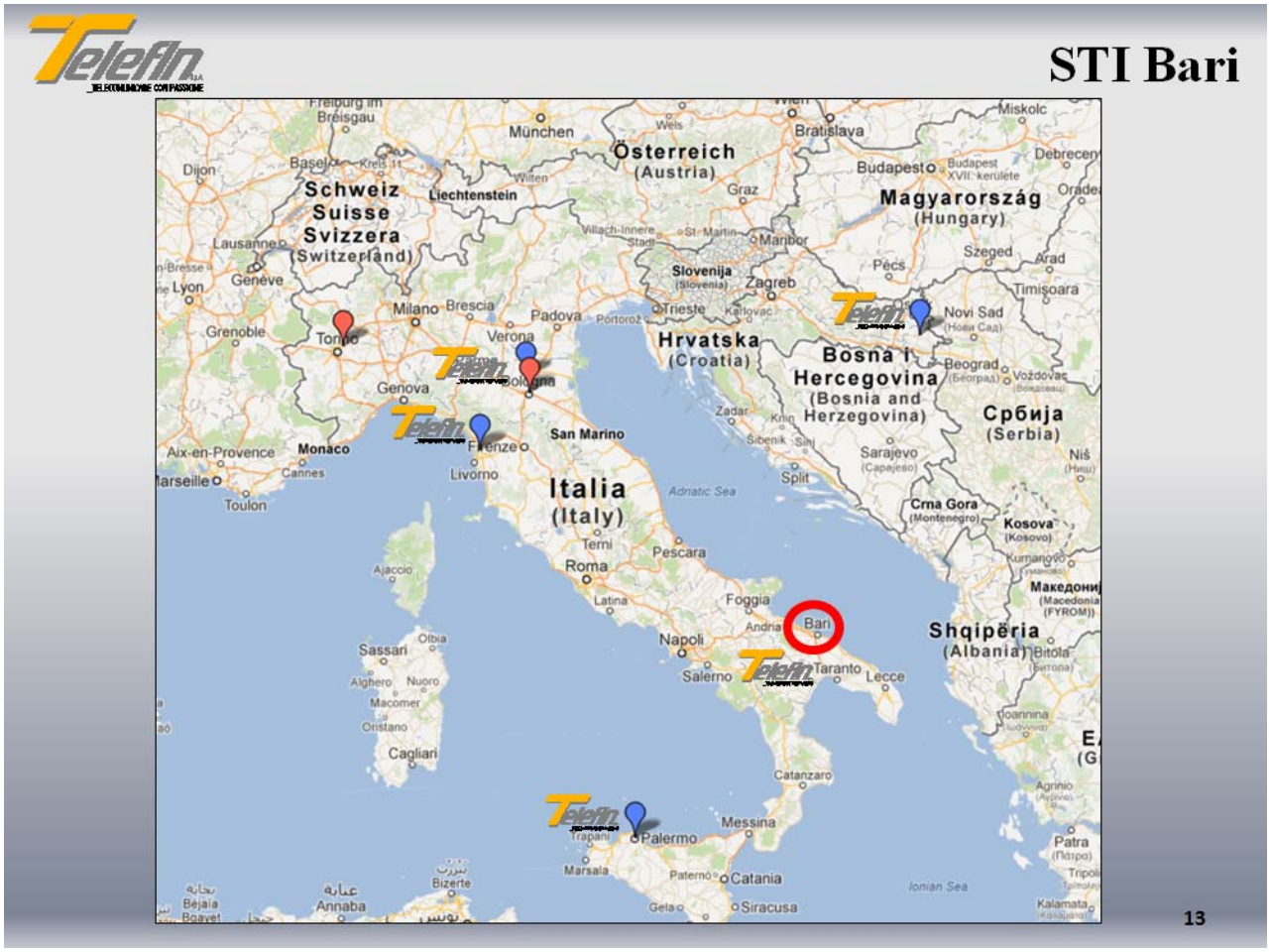
A relevant example is constituted by our recent implementation for the Croatian Railways (see slide 12) whose technical and infrastructural conditions are of coursea noveltyfor Telefin.



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).



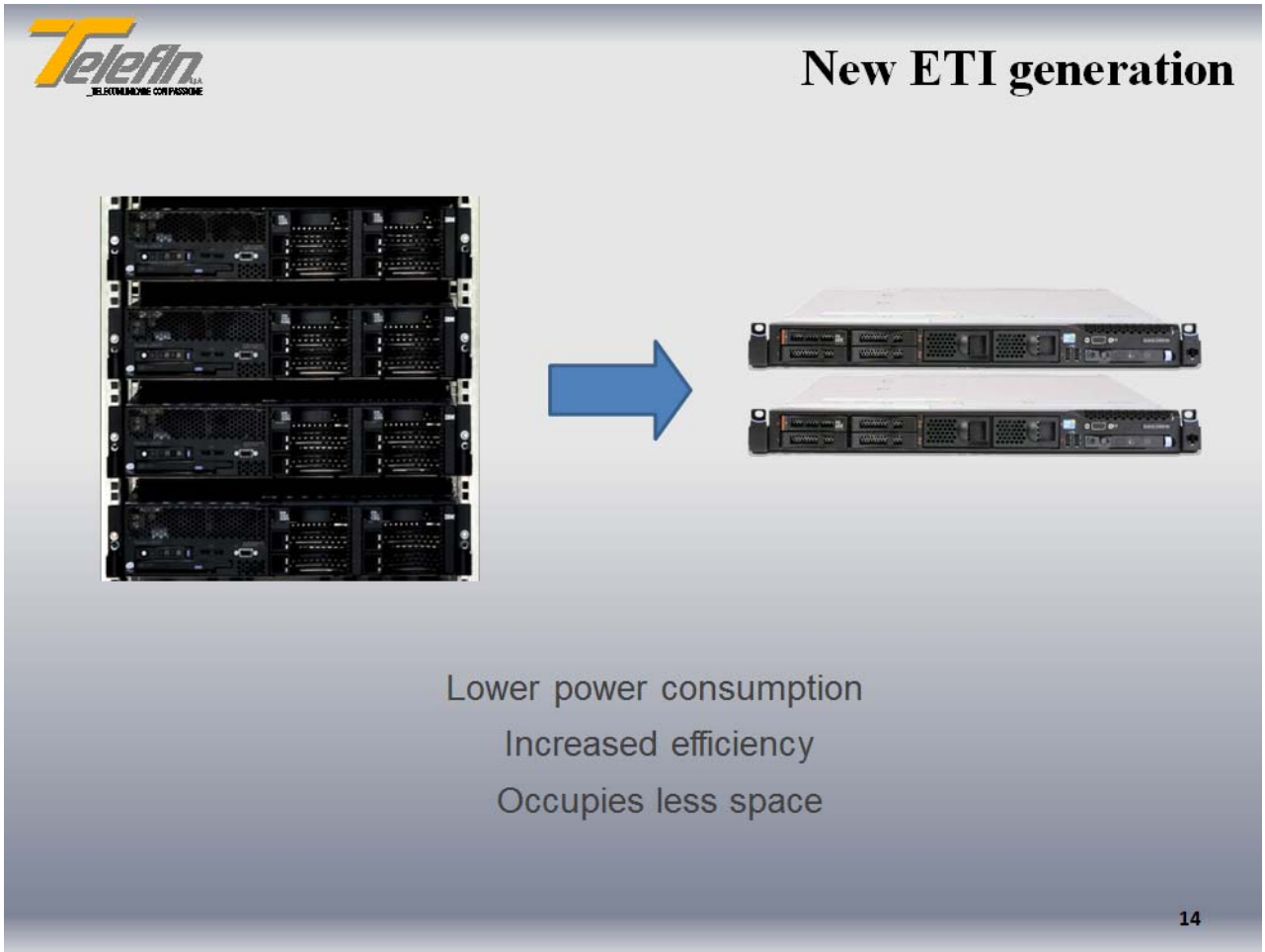
SLIDE 13 –STI BARI

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.



SLIDE 14 – NewETI generation

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- **Wireless ServicesforSCC room Coordinator and Maintenance Staff**
  - A web-based application runs on Android Tablet or IOS (seeslide number 15), thus enablingcoordinators and maintenance staff to quickly accomplish tasks concerning STI operations from everywhere within the SCC room. Among them, we mcan ention (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

STI wireless service

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

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

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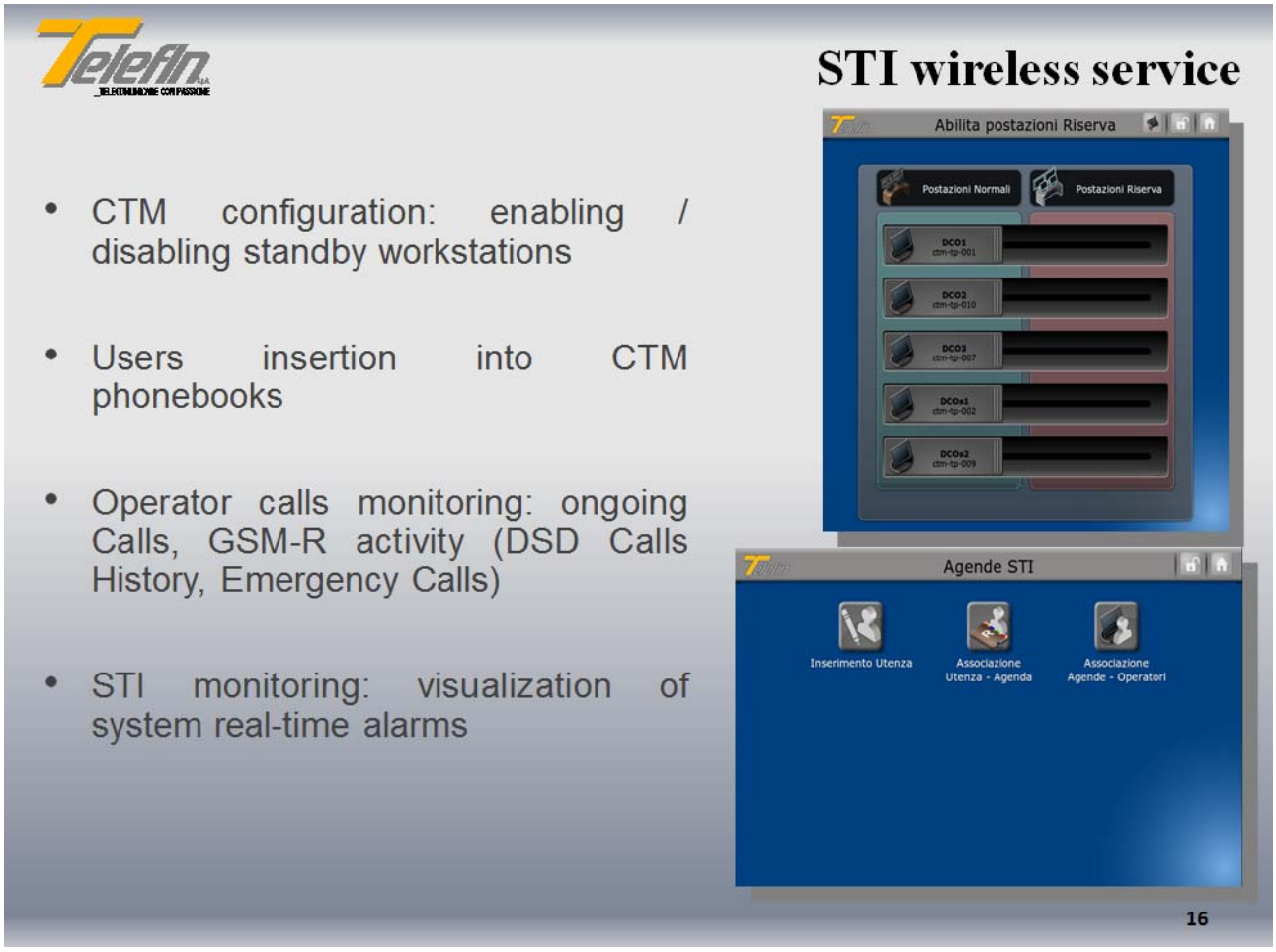
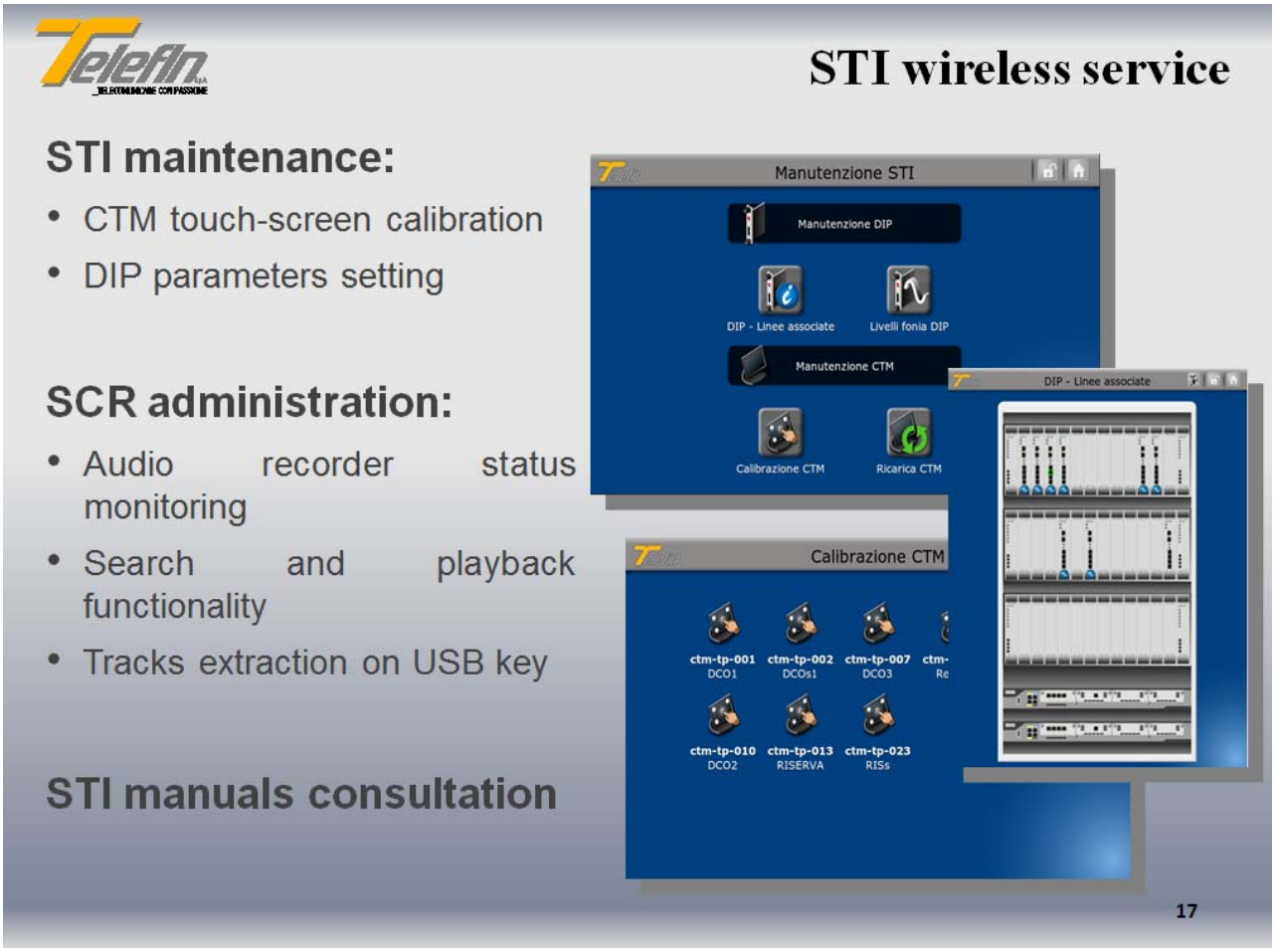
SLIDE 15 – STI wireless service

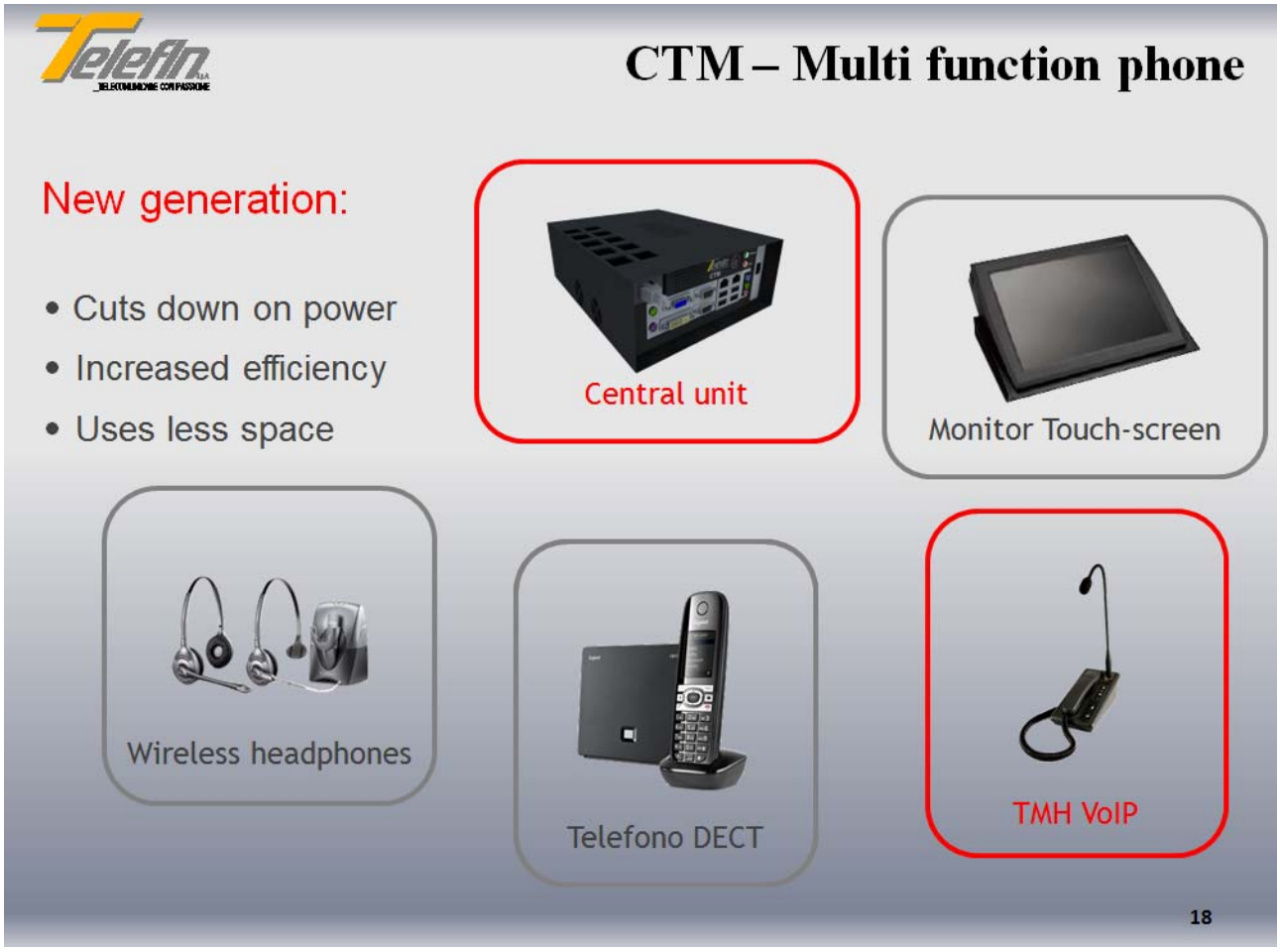


SLIDE 16 – STI wireless service



SLIDE 17 – STI wireless service

- **New CTM HW**



SLIDE 18 – CTM Multi function phone

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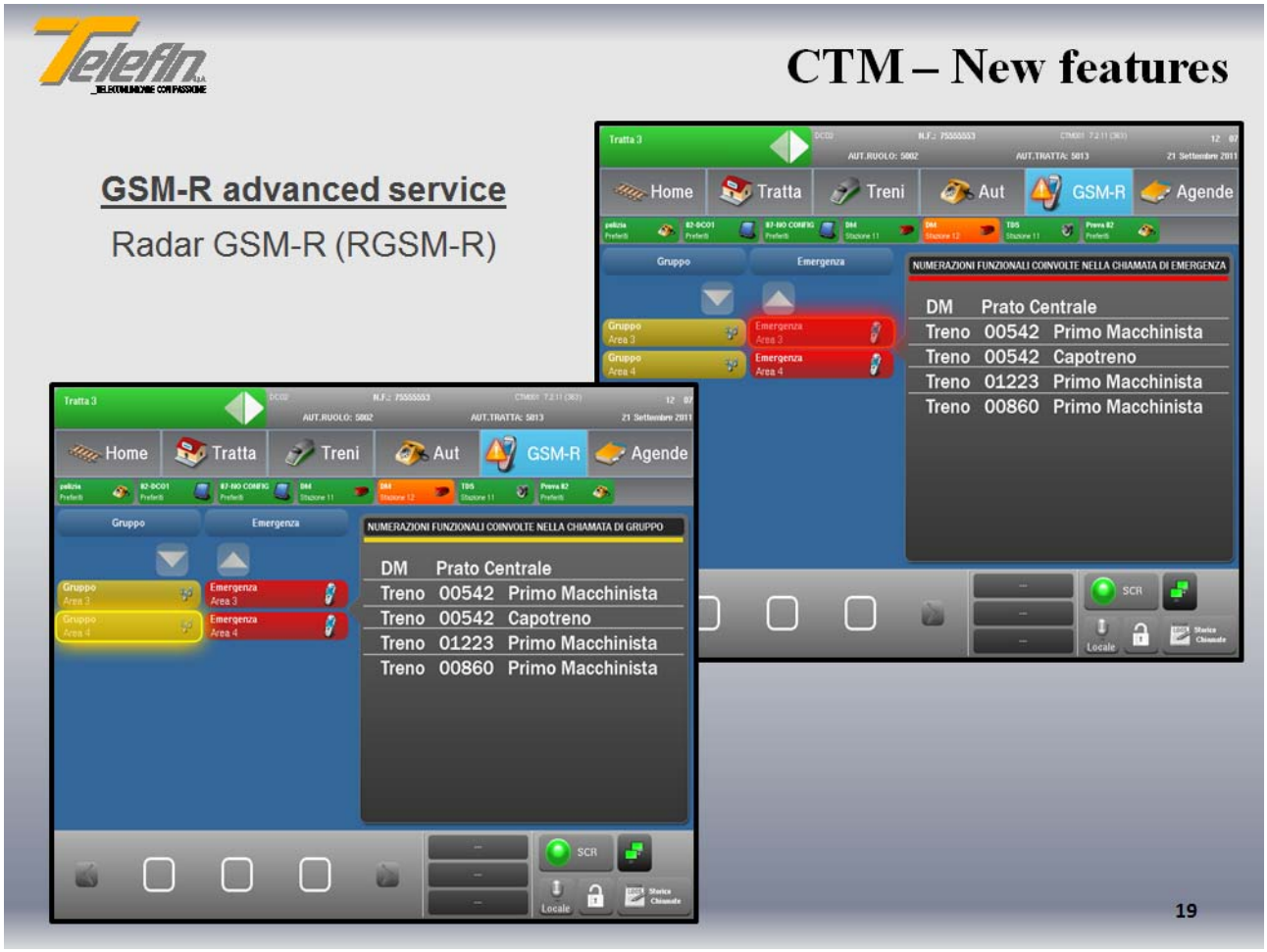
- **New CTM functionalities (see slide number 19, 20, 21)**

  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.



SLIDE 19 – CTM - New features

CTM – New features

GSM-R advanced service

Automatic resolution site code

Report Link Fault GSM-R S0

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SLIDE 20 – CTM - New features

CTM – New features

New VoIP System for lines type C or D integration

(«Tratta» menu on CTM)

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SLIDE 21 – CTM - New features

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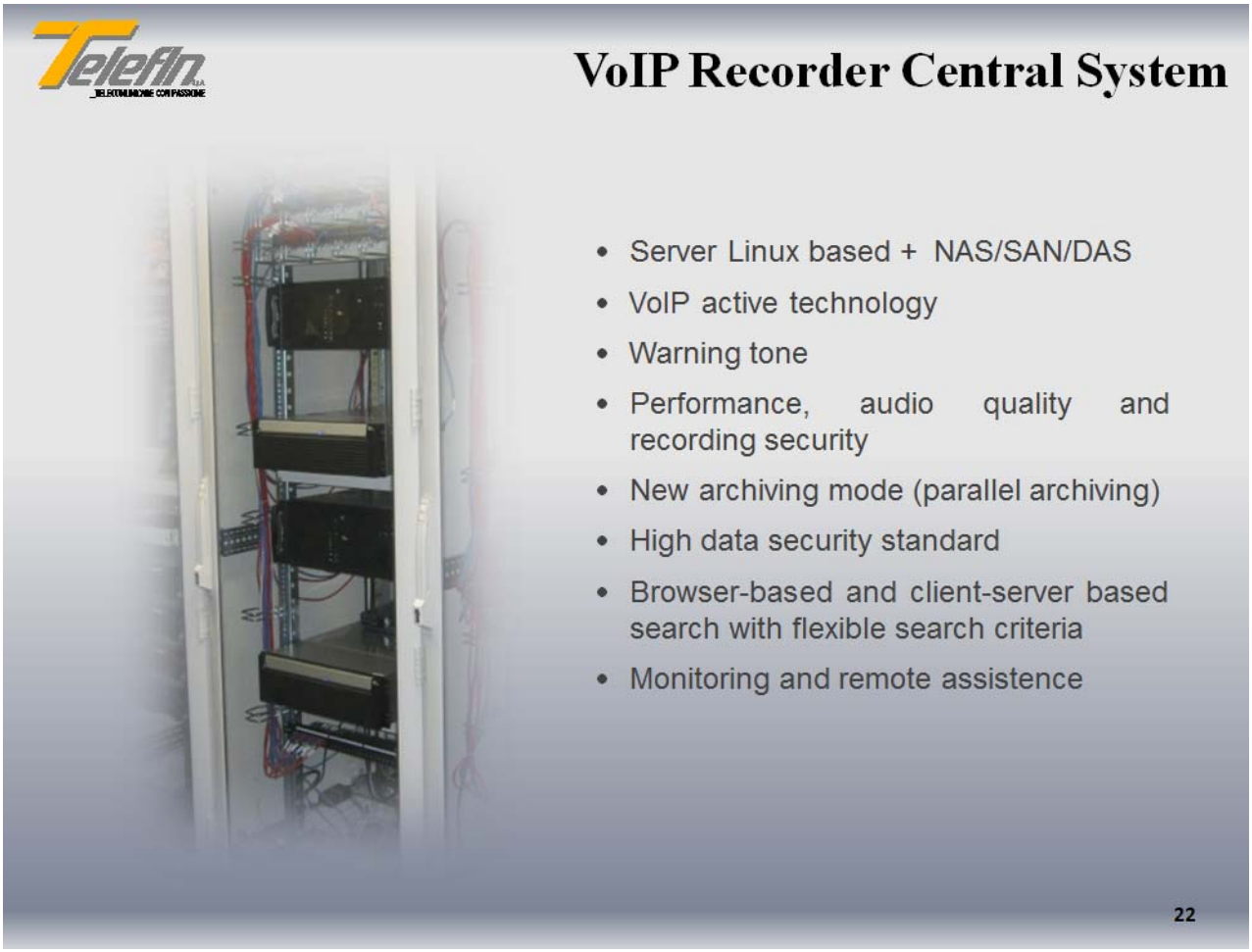
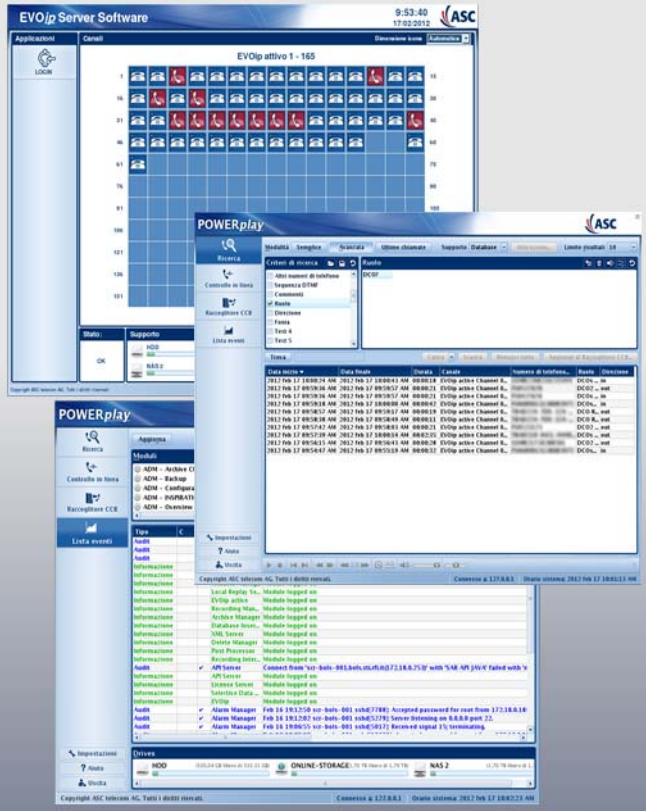
- **New SCR: VoIP technologywith high ease of use, voice quality, modularity and fewer maintenance operations(see slide number 22, 23)**



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



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SLIDE 23 – VoIP Recorder Central System

SLIDE 24 – Thanks for your attention