

Convegno Sezione Automazione ANIMP

**SISTEMI DI AUTOMAZIONE
NUOVE SFIDE E OPPORTUNITA'**

6 Ottobre 2016

MILANO

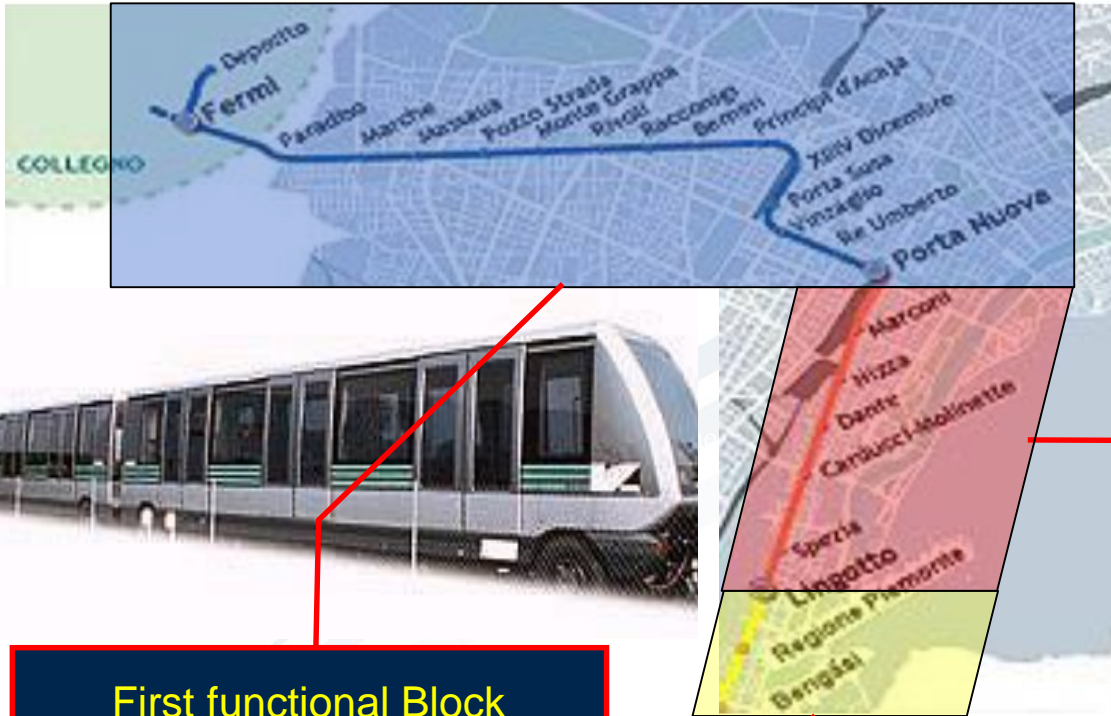
Summary

- Line 1 : Turin Subway : VAL (Light Automatic Vehicle)
- Train Details
- Stations and Tunnel equipments
- Electric and Power Supply Equipments
- Automatic Driveless System
- Telecommunication IP over Ethernet Network (MAV)
- Technological and Electric Control Equipments(SCADA)



Turin sub way is a full automatic driveless metro system . The system solutions adopted consist in :

- Train driven from a Transmission Line Antenna without any man or driver control on board (TLA) ;
- Sliding-Doors sincronised with the Train-Doors and complete coverage and isolation of the platform of the stations from the tunnel ;
- **IP based over Ethernet, electric and electronic signal handling from the control and remote terminal system at each station and along the Tunnel and technical rooms mixed in a high bandwidth backbone based signal combination transported with optical fibers at the PCC control room main servers ;**
- PCC is the brain system of the complete VAL turin system;
- Advanced MAV software system put in the TOP of the networking and hardware subsystems ;
- MAV1 to MAV2 evolution of the software to solve the up coming obsolescencies and to improve the availability and flexibility for the future expansions of the system .



**Second functional Block
Porta Nuova - Lingotto**

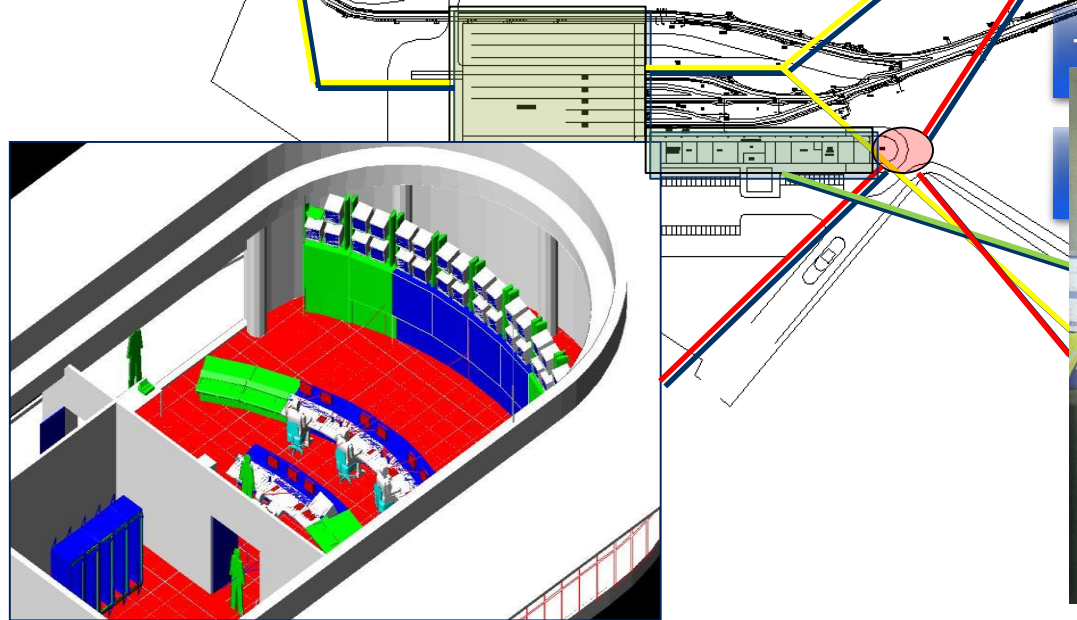
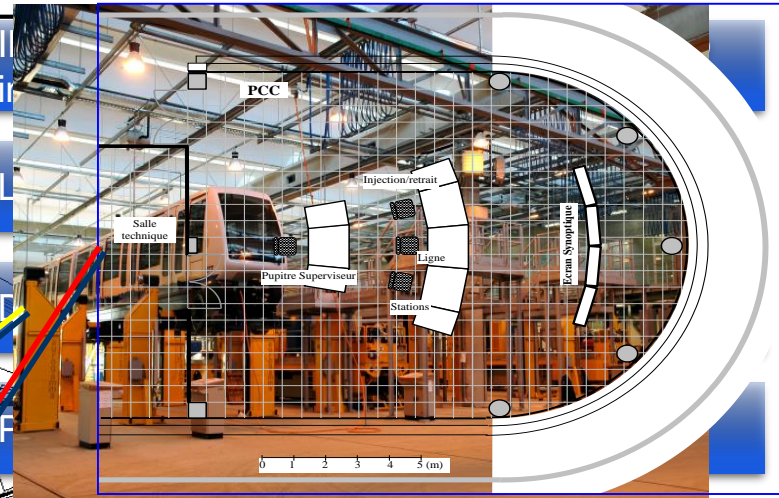
**Station n.: 6
Tunnel length : 3.7 km**

**First functional Block
Fermi – Porta Nuova**

**Central Control Area : 1
Station n. : 15
Tunnel length: 9.5 km**

**Third functional Block
(in progress)
Lingotto - Bengasi**

**Station n i: 2
Tunnel length : 1.9 km**



Train washing machine



● Porta Susa Station



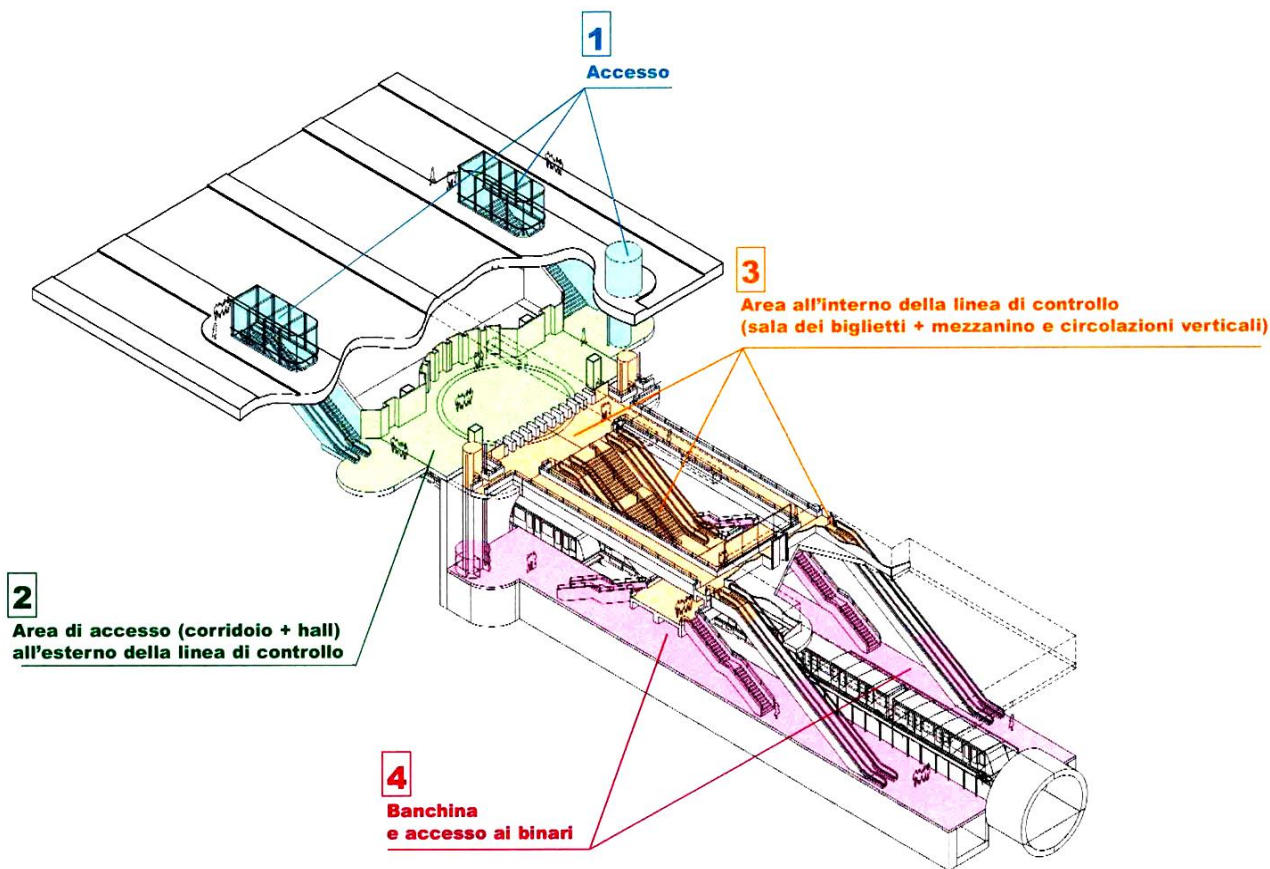
Turin Subway consist of 21 Stations in particular :

17 standard Stations

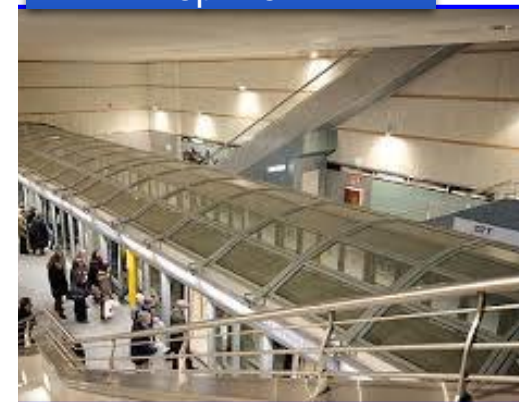
4 Particular Stations

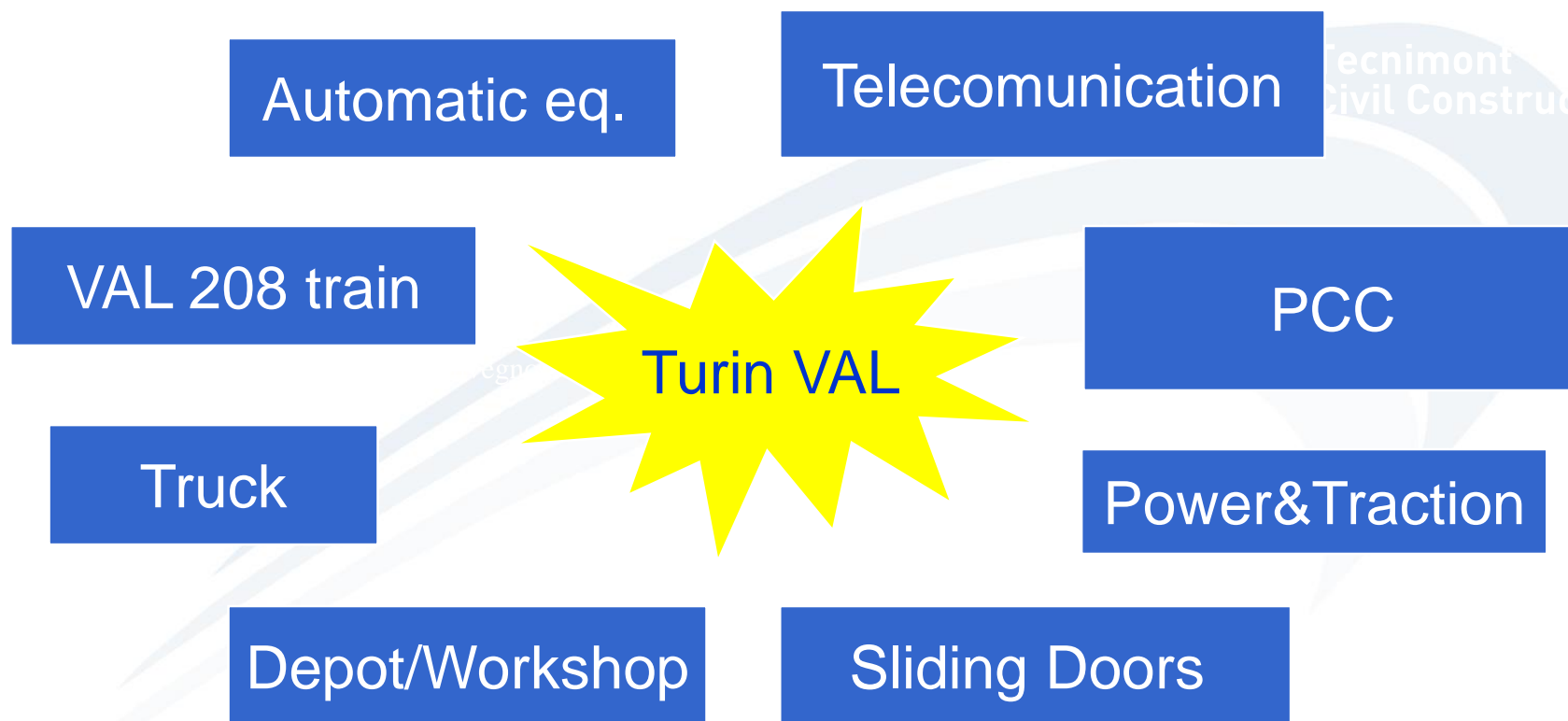
2 new Standard stations are under development.

Gli spazi funzionali della stazione tipo



● Standard Station Top View

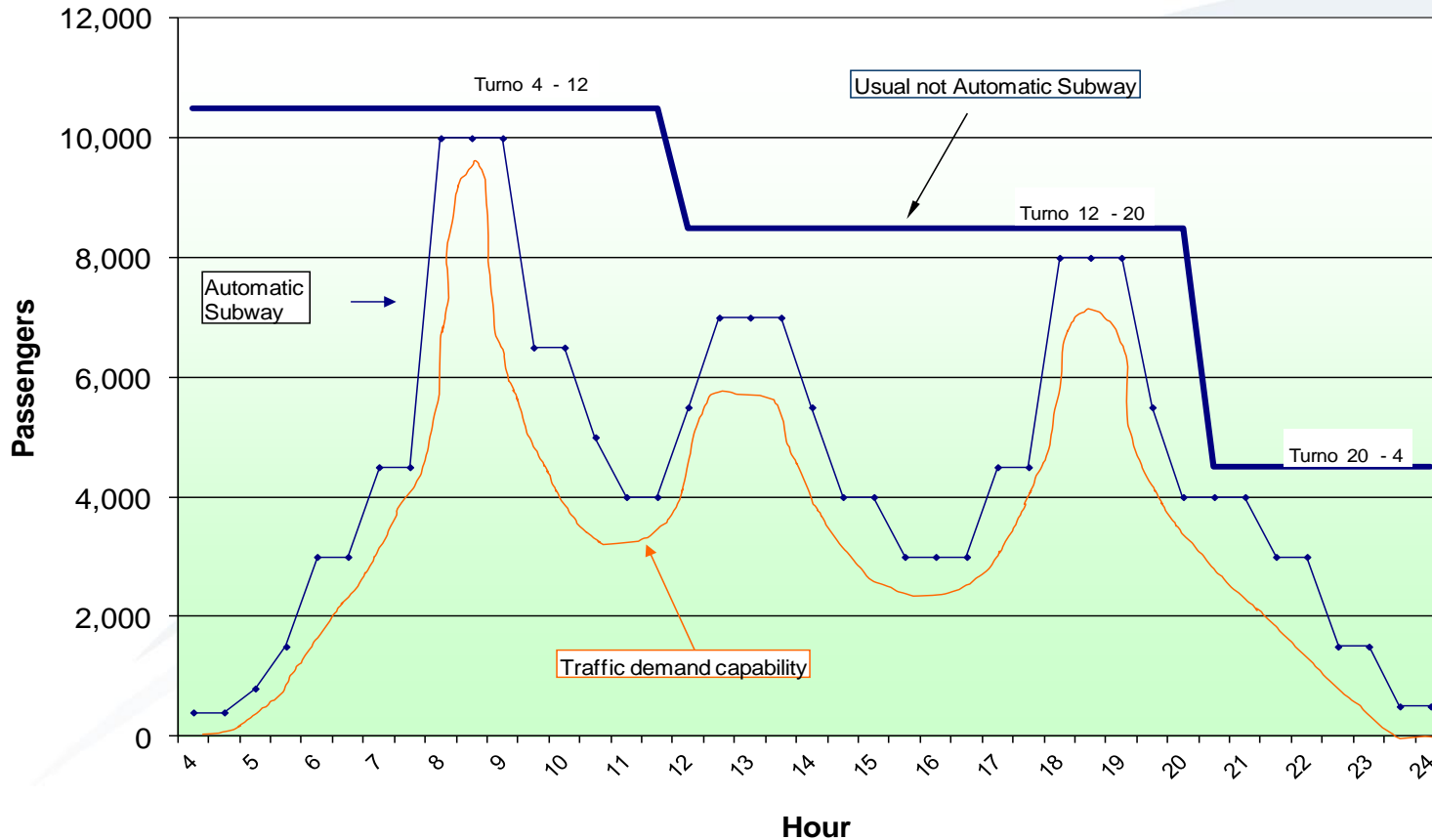






More flexible matching between the transportation demand and the train number and frequency:

- Automatic Train insertion – Flexibility in the train number and time table frequencies



• Turin Subway Line 1 : Length: **14.600 m** **21stations**

• Train details:

Max. Capabilities **440 passengers/train**

Max speed : **80Km/h**

Average Speed:**32Km/h**





Isolatori

Traversa

**TLA
(Transmission
Line Antenna)**

**Passerella
laterale**

Barre di guida

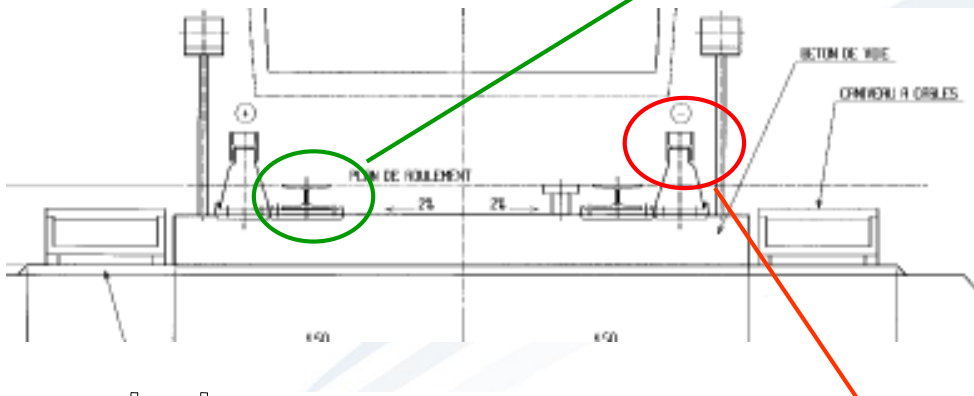
**Pista di
rotolamento**

Blocchetto

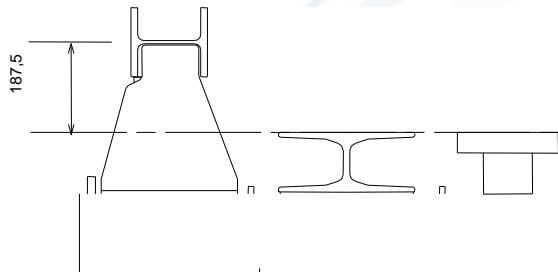
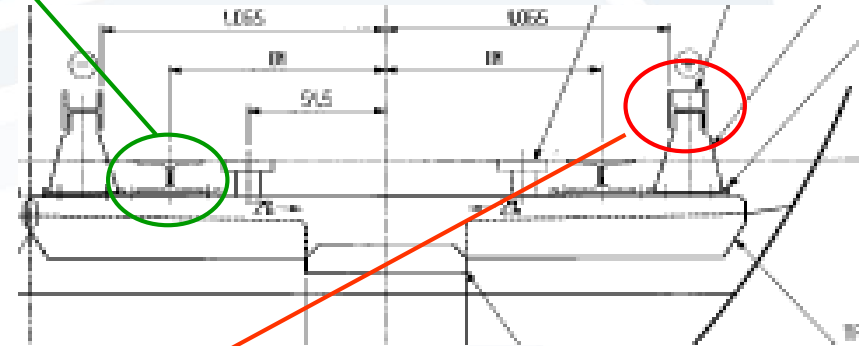
Piste di rotolamento:

- profilati in acciaio a forma di T 250x120
- striate e riscaldate in tratte particolari

All'aperto : ancorata nella soletta e sopraelevate su piastrelle di ghisa



In galleria su traversine in calcestruzzo



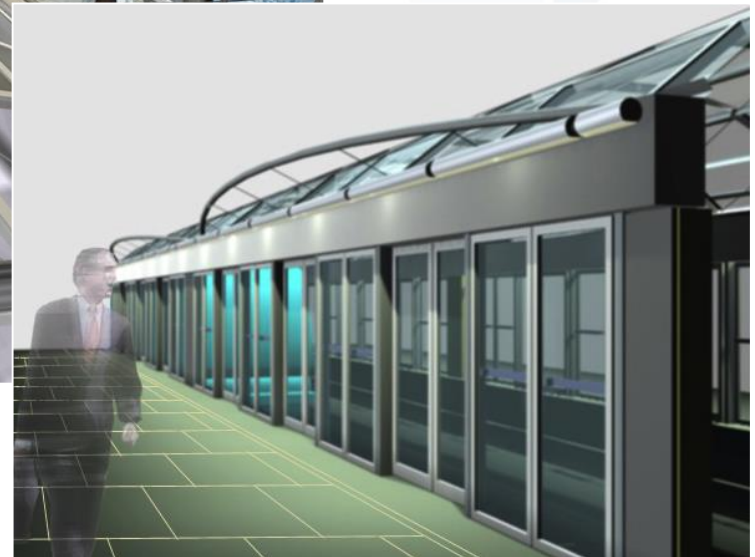
Barre di guida e di alimentazione di trazione :

- profili in acciaio a forma di T 140x140
- fissati su isolatori
- riscaldate all'aperto
- coperte da guaine isolanti (barre positive e all'aperto)

Sliding Doors and Stations

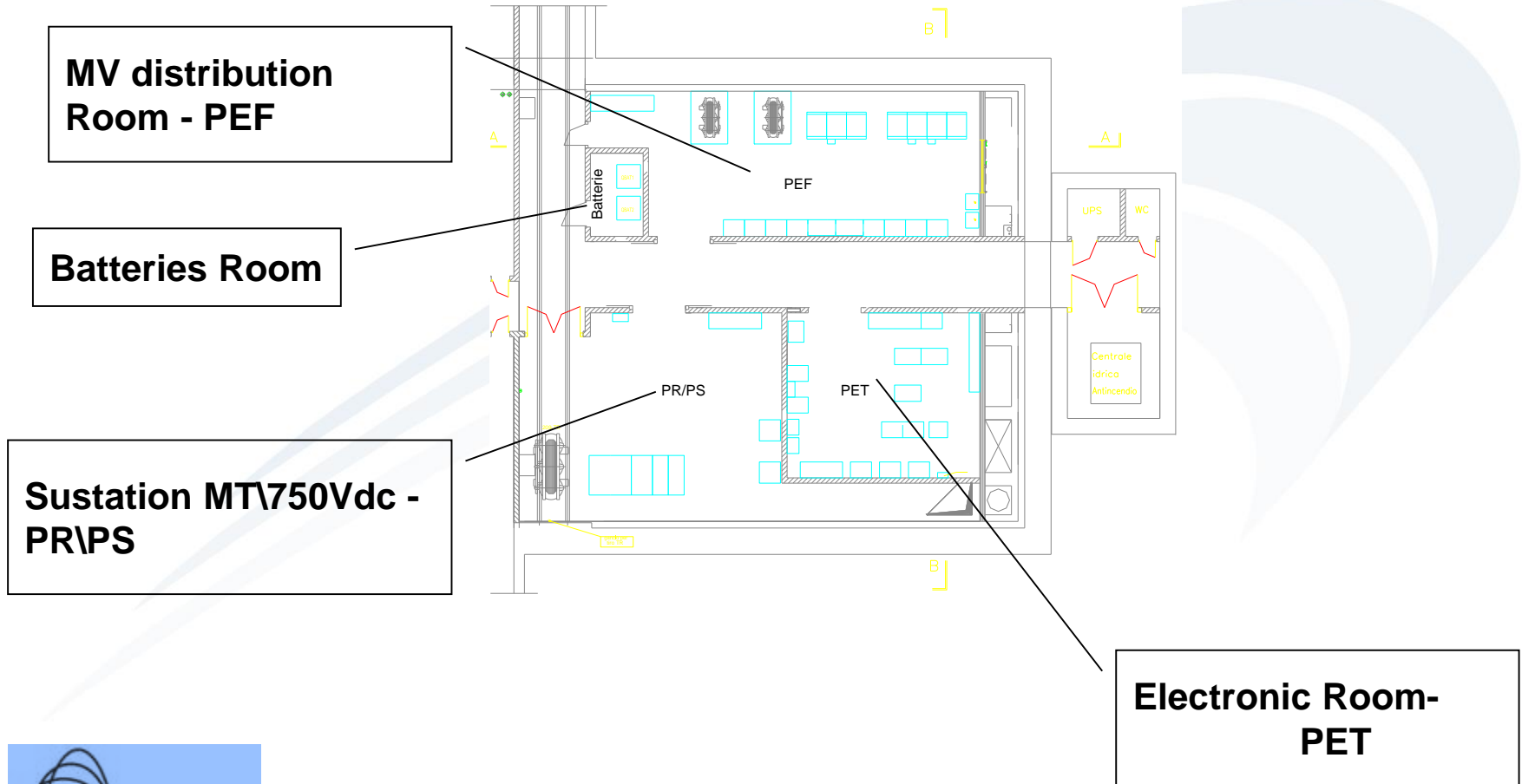


Platforms and
sliding doors /
coverages

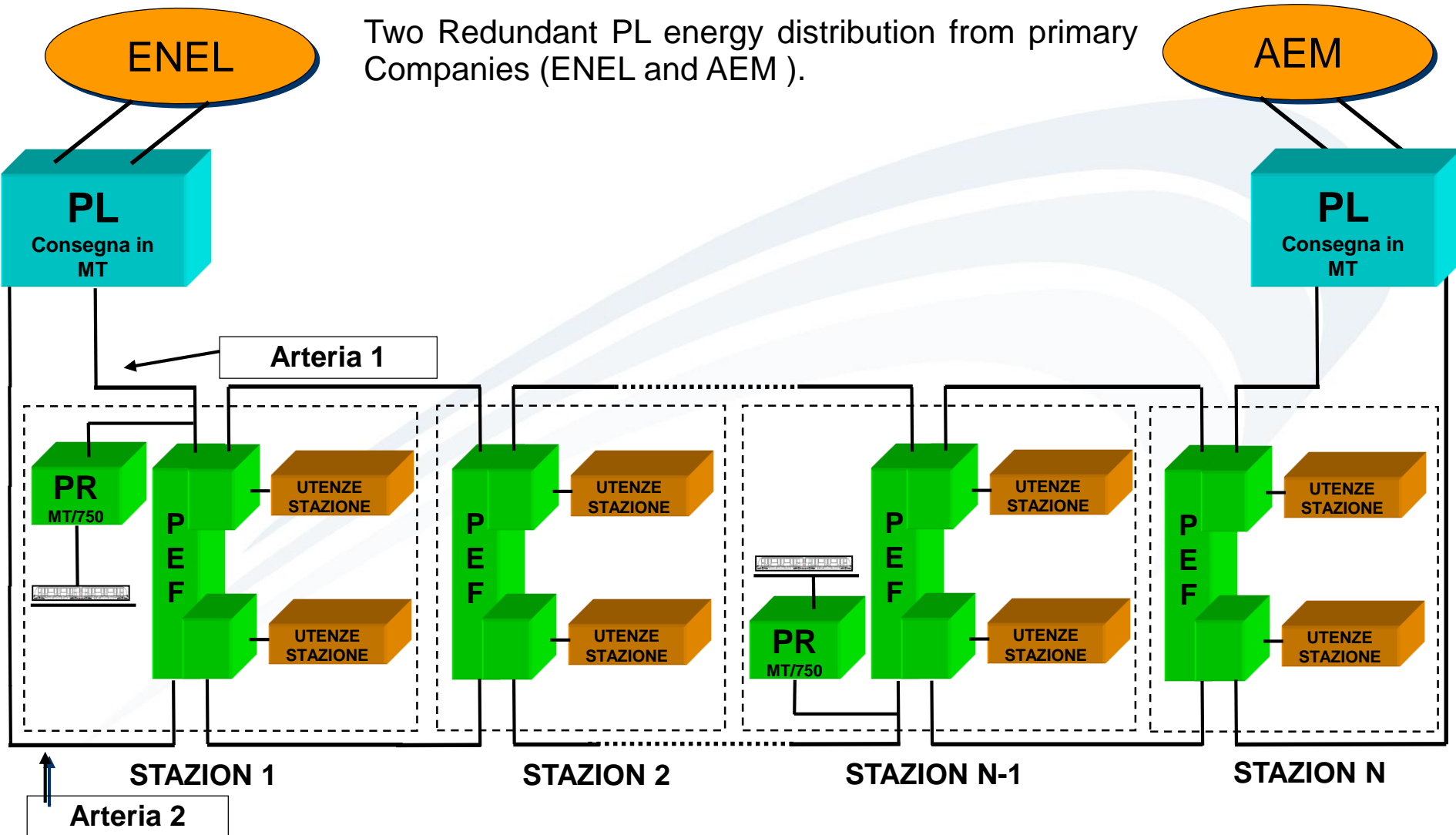


Station Layout

Technical rooms in Turin Subway station



Two Redundant PL energy distribution from primary Companies (ENEL and AEM).





The driveless and the automatic equipments has been designed to guarantee the maximum performances and safety and security environment with fast actions in case of drawbacks.

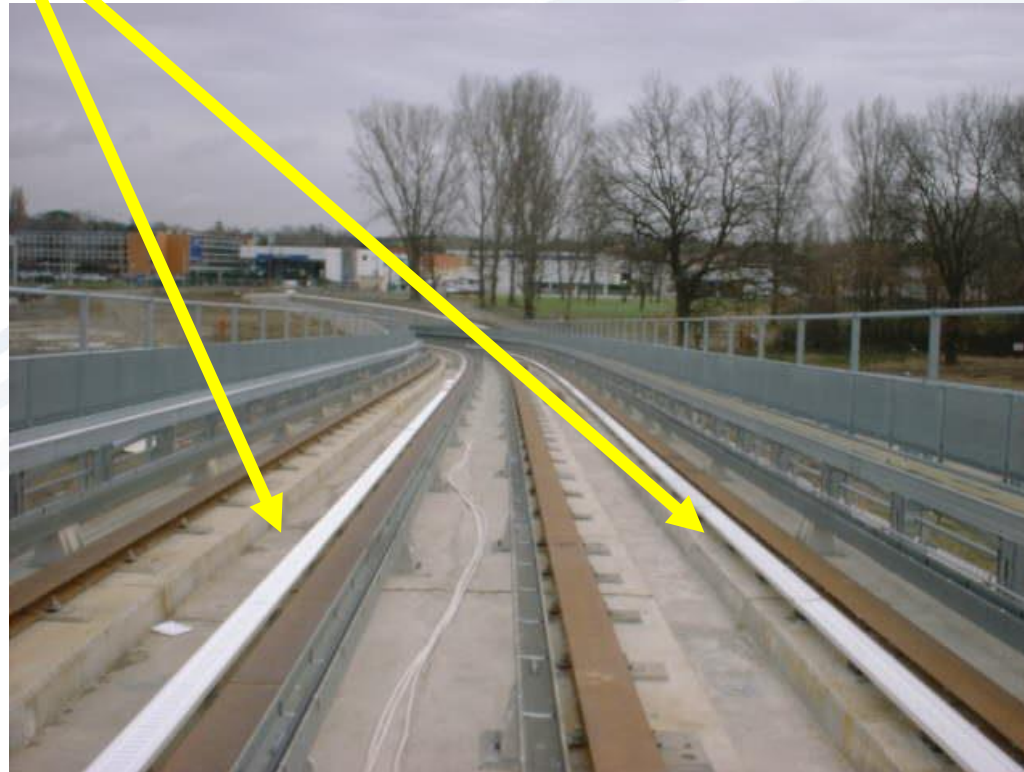
- Automatic Train Protection: ATP
- Automatic Train Operations : ATO
- Supervision : ATS



- **TLA (TRANSMISSION LINE ANTENNA)**
- **Negative Logic infrared detectors (DN)**
- **Wheels deflation detection (DDRAG)**
- **Technical rooms : PA and Distribution panels/cabinets**

TLA (Transmission Line Antenna)

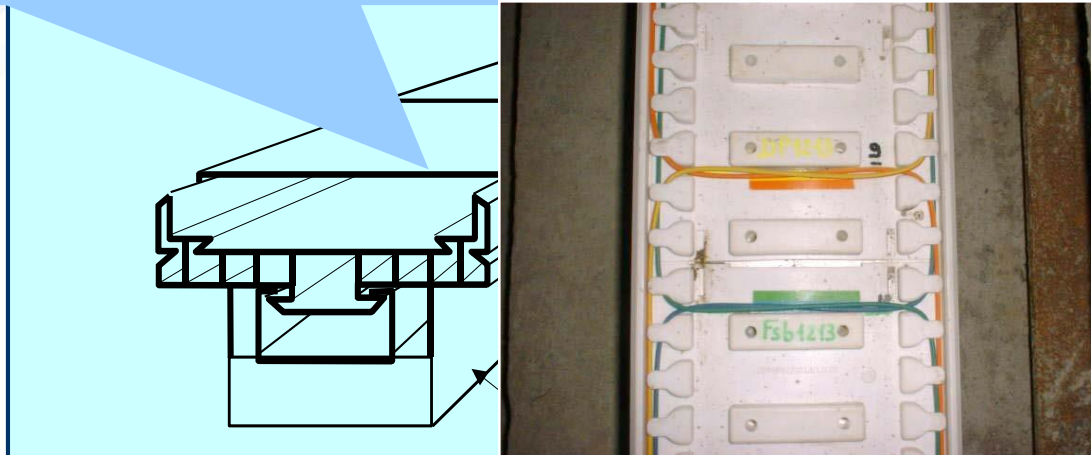
TLA (Transmission Line Antenna) location along the train direction .



TLA (Transmission Line Antenna)



- TLA is the rigid support of the transmission cable loop between the ground and the train receiver antennas . A continuous signal transmission between the train and the automatic equipments (PA , EAS , UAS ..) ensure the correct speed profile for the driveless train along the tunnel.
- A proper coding of the speed profile is cabled inside the support of the TLA antenna , with a particular cable disposition and in proper position along the tunnel profile .



Infrared Detectors(DN)



- DN's devices detect the train passage or presence and send a logic signal to the proper Automatic Equipment .



- This is performed by an interruption of an infrared beam generated from a transmission radiator along the truck and received from an infrared receiver on the opposite truck position .

PA and Distribution Panel



PA (Automatic Pilot) Cabinet

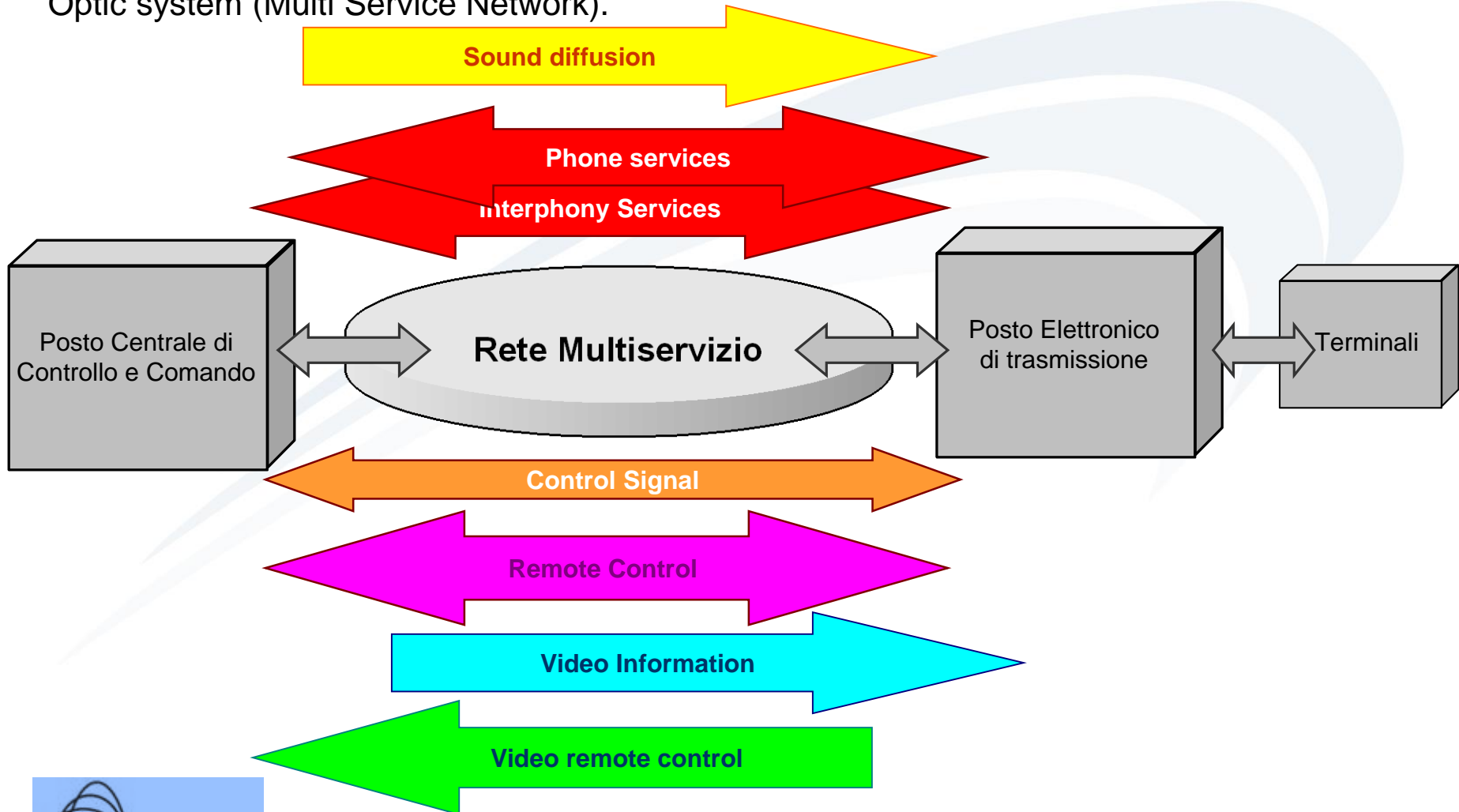


Cable Distribution Panel

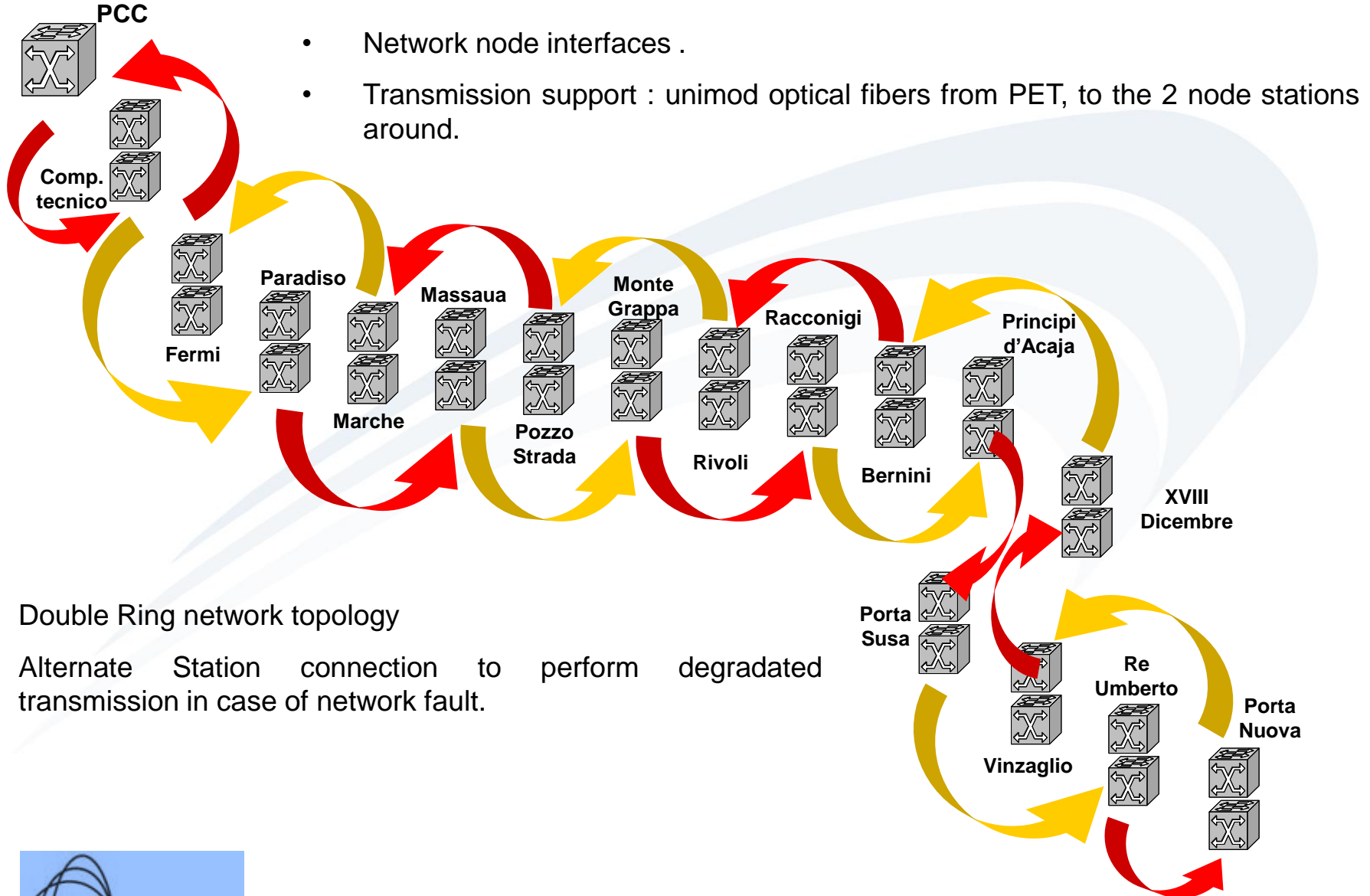




The signal transportation of each electric and electronic sub system is performed from a dedicated Multi purpose Backbone Network using an IP over Ethernet protocol and a Fiber Optic system (Multi Service Network).



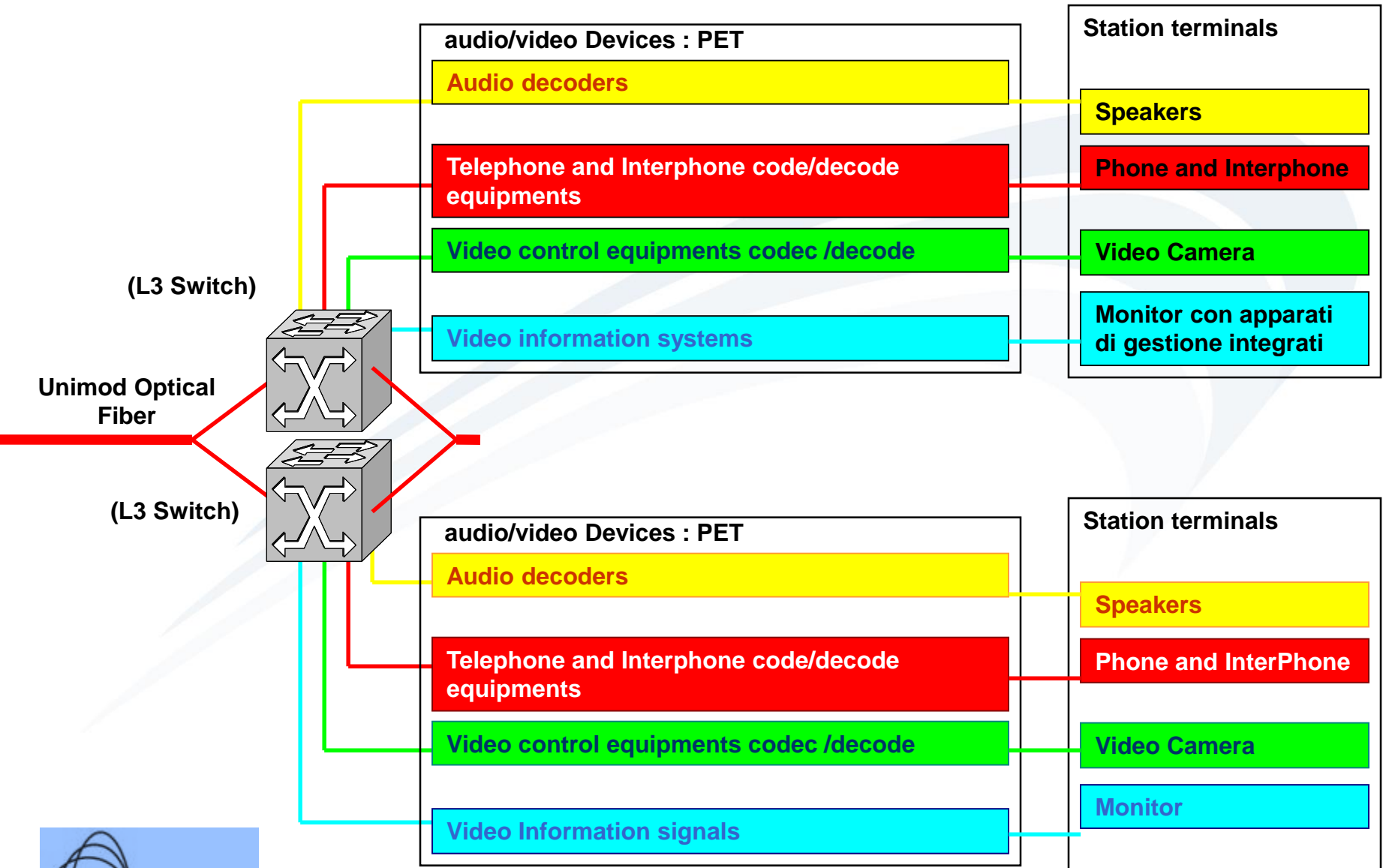
Backbone Network : Layout



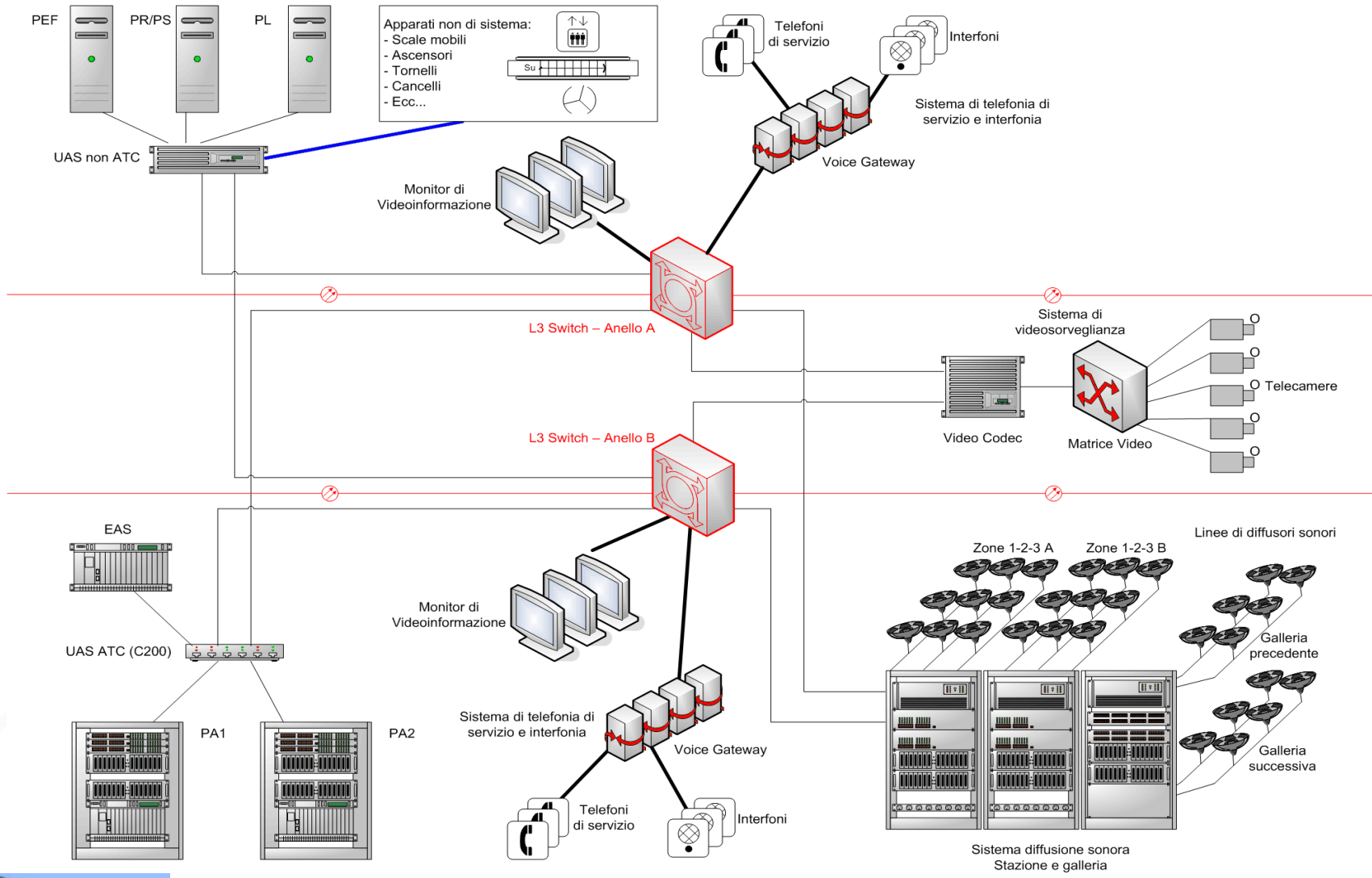
- Network node interfaces .
- Transmission support : unimod optical fibers from PET, to the 2 node stations around.

- Double Ring network topology
- Alternate Station connection to perform degraded transmission in case of network fault.

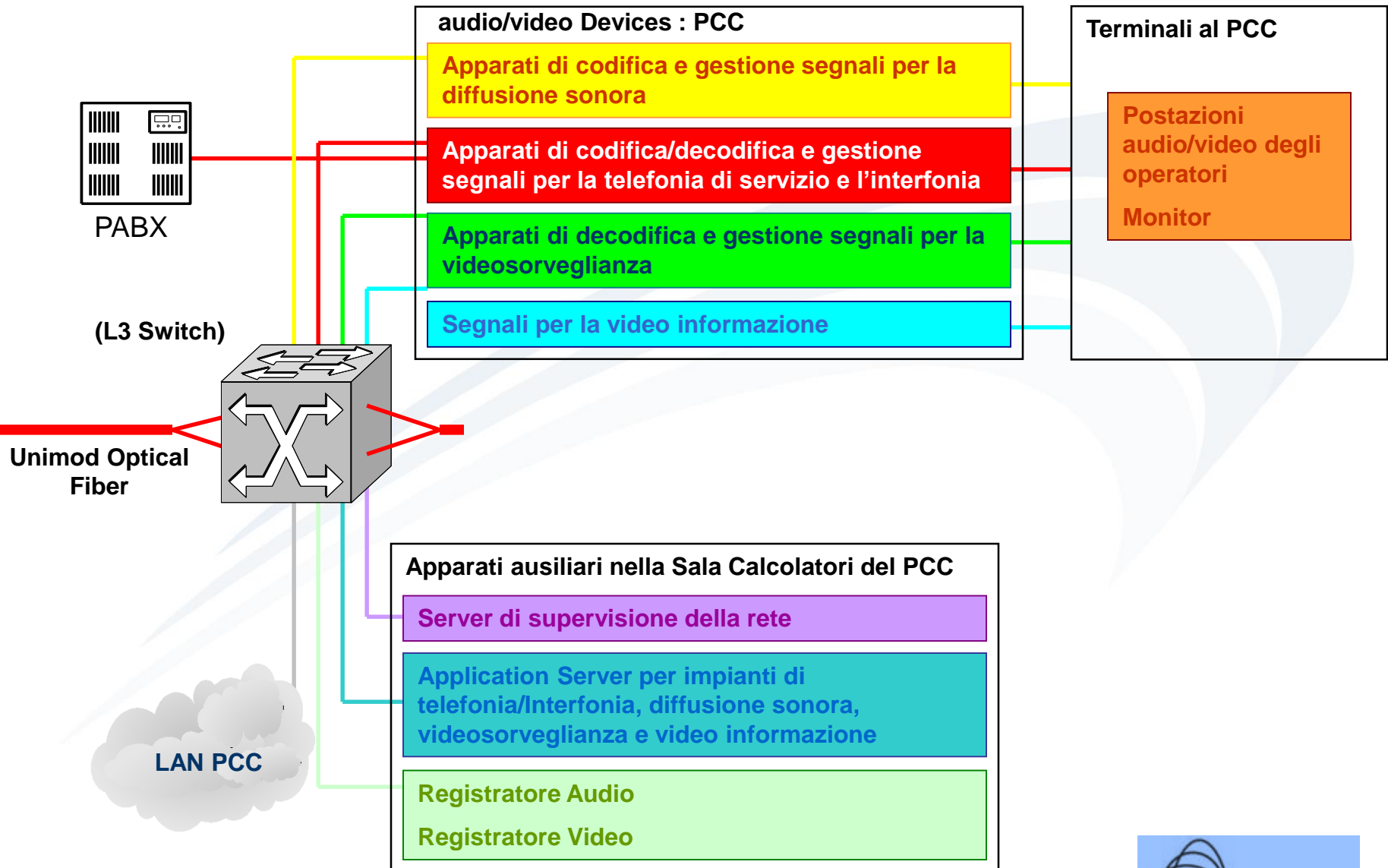
Backbone Network station connections Layout



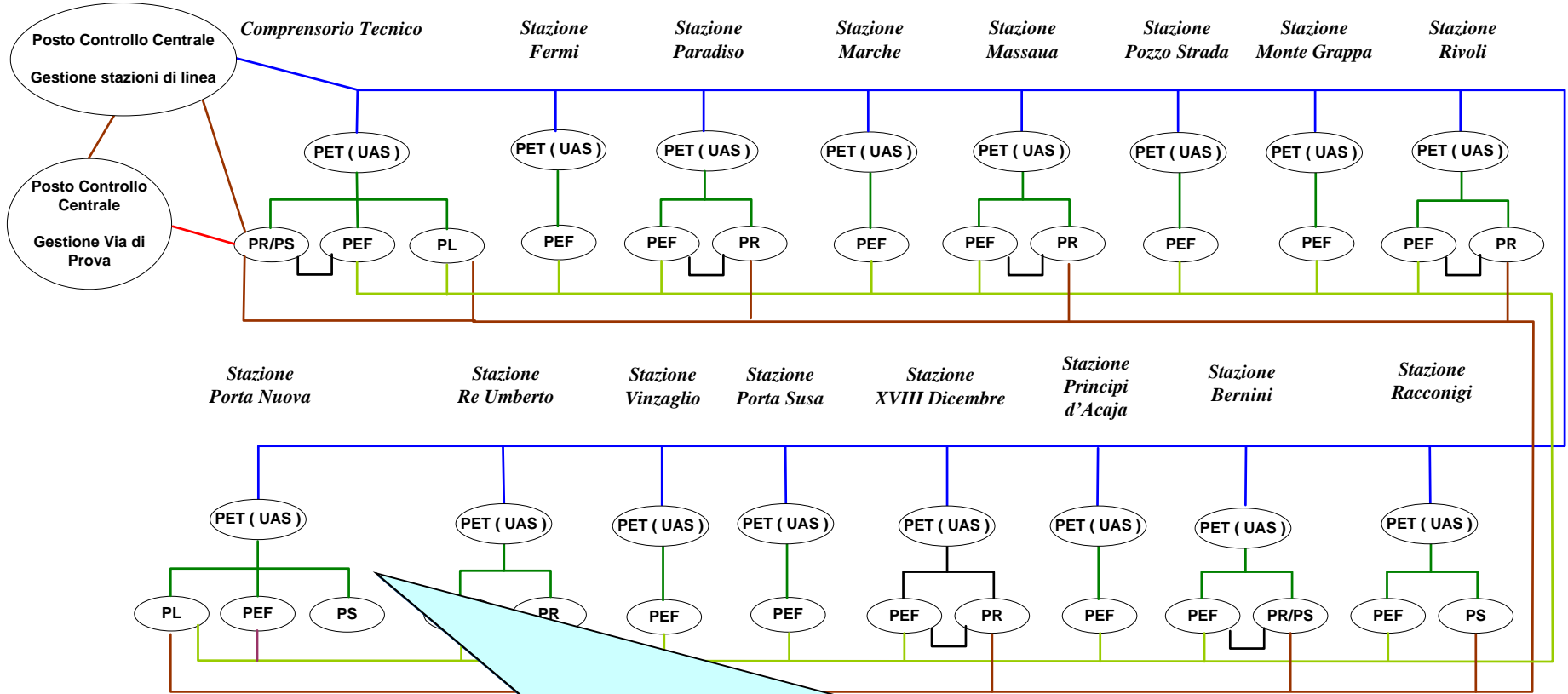
Station PET Backbone connections



Backbone Network: PCC connections



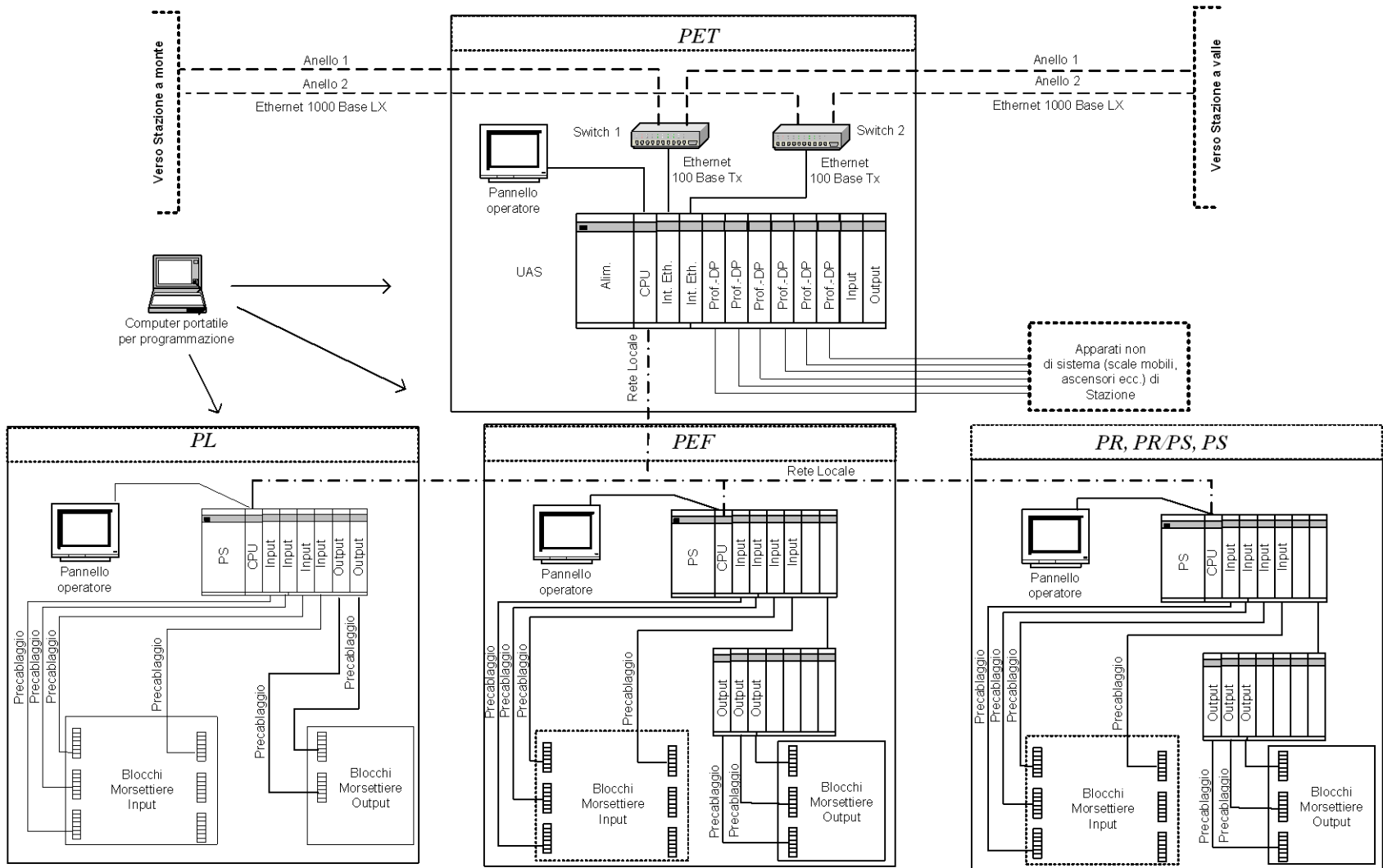
System Layout

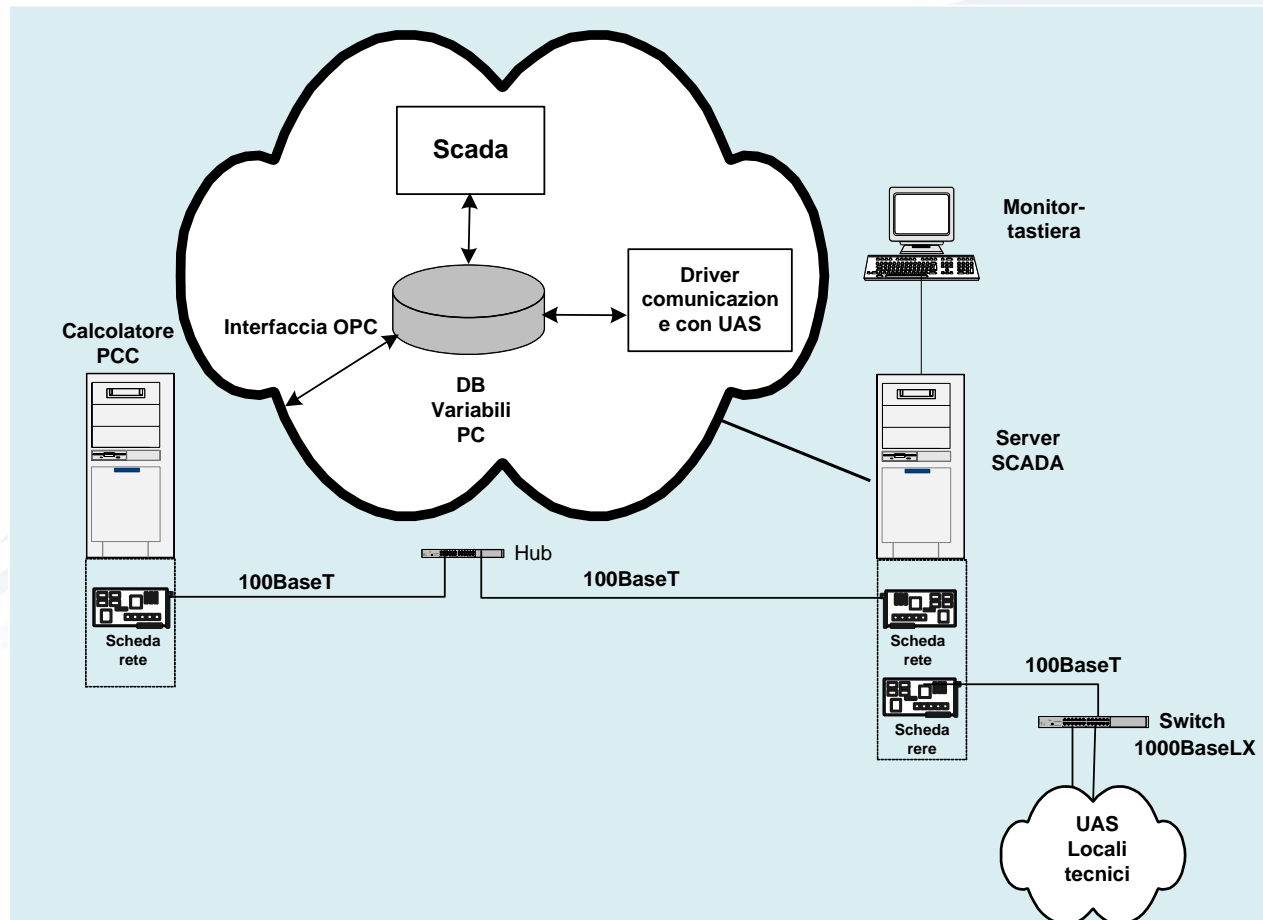


Station Technical Rooms

- UAS** – Data acquisition Station Unit
- PEF** – Medium/Low transformation cabinet rooms
- PR/PS** – Rectifier Cabinets for Train Traction transformation to 750V_{DC} Voltage.
- PL** – Electric distribution cabinet for Medium Voltage energy.

System Layout :Details



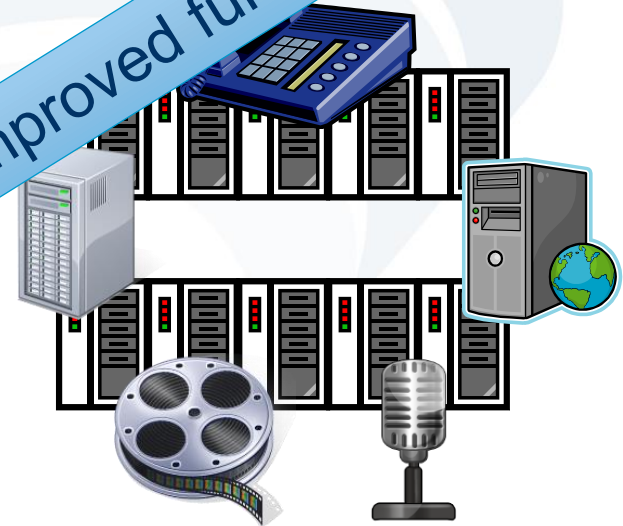




- Obsolete technology in the next years:
- Difficulties to expand or improve it:
 - Audio/Video messages
 - Integrated monitoring
 - Video wall
 - IP Terminal management
 - other



“PATCHWORK” obsolete not improved further





- Inhomogeneous architecture
- Hardware multiplication
- High Power dissipation
- Critic to be maintained
- Lower affidability
- Lower flexibility to change or improve





■ Maintenance :

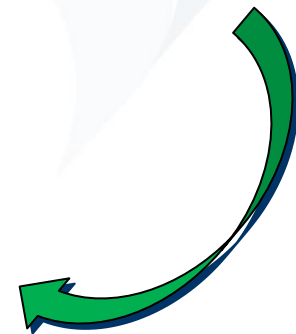
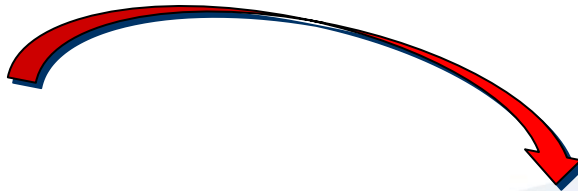
- Backup of the hardware;
- Hardware rationalization;
- New graphic interface;
- Monitoring and reporting improve;
- Remote control at the same price;
- Signal and remote messages handled with modern technologies

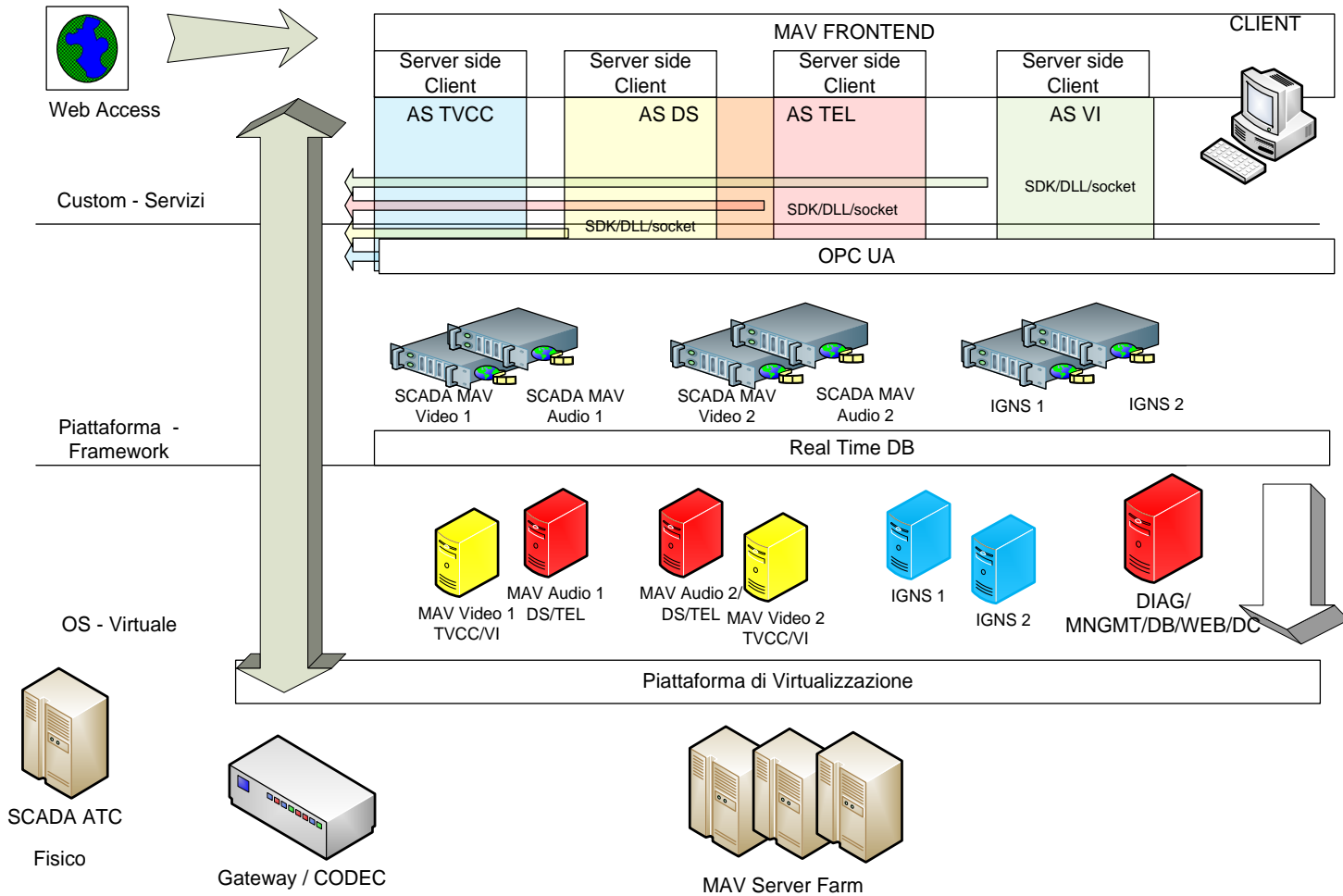
■ New capabilities with MAV2 :

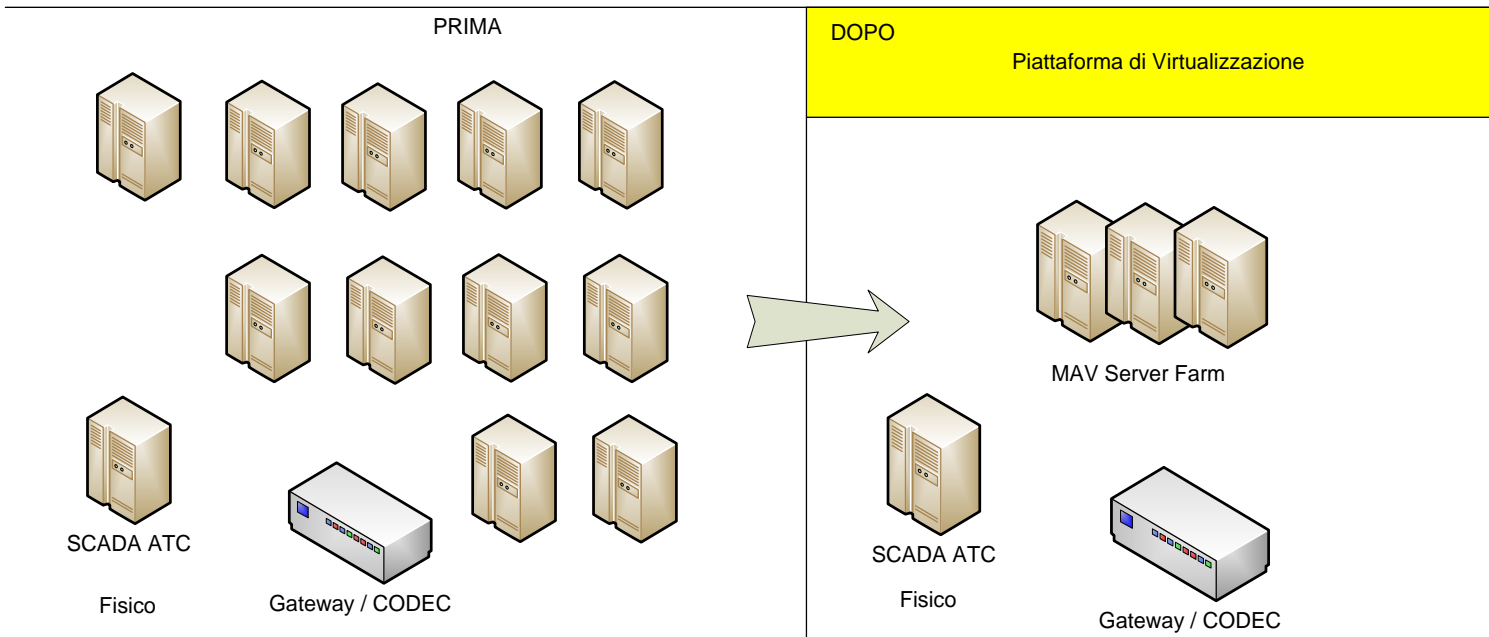
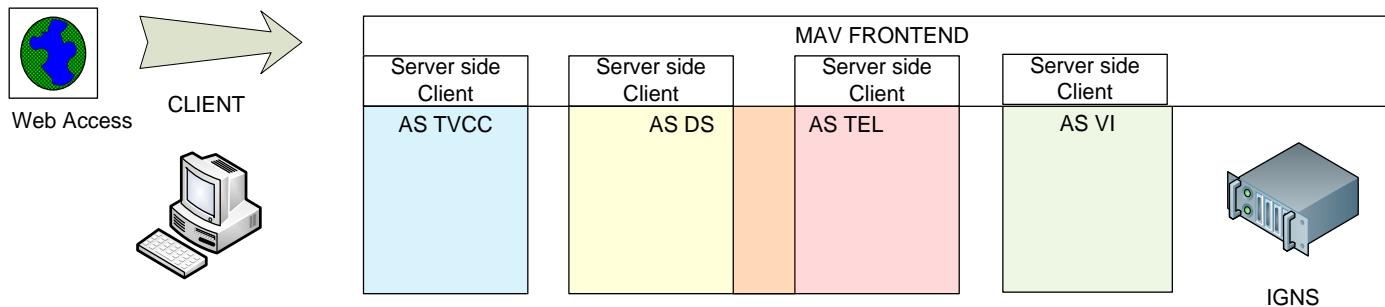
- Remote device IP based ;
- Video Wall
- audio/video integration ;
- Virtualization of DAR;
- Virtualization and integration of OPC Bridge and IGNS;
- Monitoring and supervision integration at PCC;

■ Obsolescences elimination:

- New Software MAV2
- Telephone devices
- Digital Audio Recording (DAR)
- CODEC video
- New Server architecture









- Turin subway is the first automatic driveless system manufactured in Italy.
- Based on Siemes SAS VAL Patent the Turin subway has further improved the high efficient Val system performances around the world with innovative solution in mechanical , electrical , automatic control and ITC networking equipments improving the system availability near to 99.9%;
- The overall electrical signal coming from the station and tunnel equipments and from the remote terminals , are properly connected and guided through an optical backbone fiber network cable using the Standard Ethernet IP protocol and proper software completely developed by Transfima Geie;
- The IP protocol and the MAV1 and 2 software allow to select standard market devices and allow to improve the integration between different technologies.



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Fine Presentazione