

Wayside Monitoring Trains and Infrastructures: Information Management in a Railway Control Centre



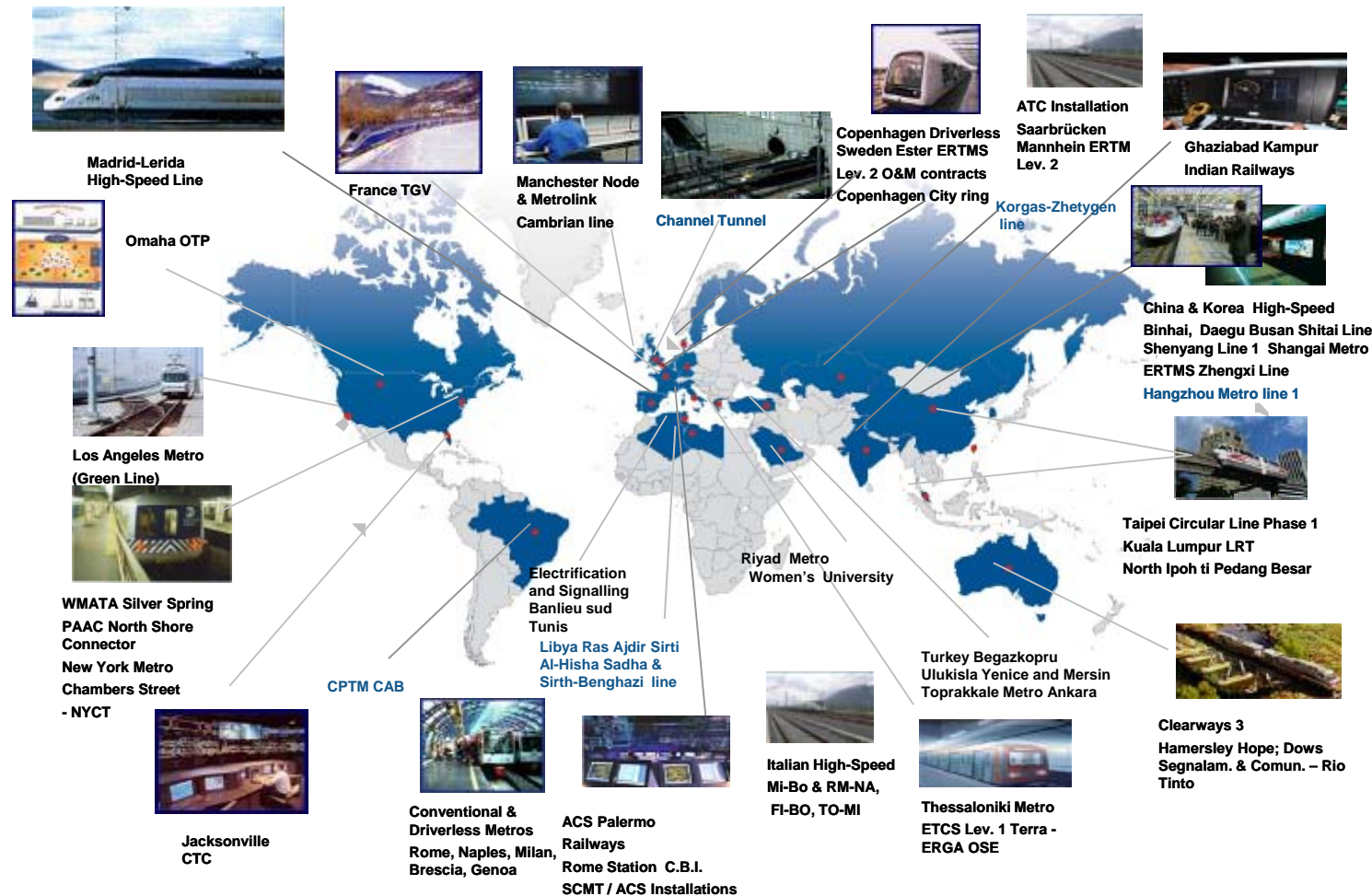
Nadia Mazzino
VP of Innovation Project

Genova, 5 September, 2012



Ansaldo STS Worldwide presence

150 Years of Expertise and References Across the Globe



-> Headquarter in Genoa, Italy

-> 4.100 people

-> 28 countries

-> 2,1+B€ orders (2011)

-> 5,4+B€ backlog (2011)

-> 1,2+B€ revenues (2011)

Ansaldo STS – Market Positioning

Ansaldo STS: Lead Contractor and System Integrator for Railways and Metro.



We can act as General Contractor or Leading Technology Partner

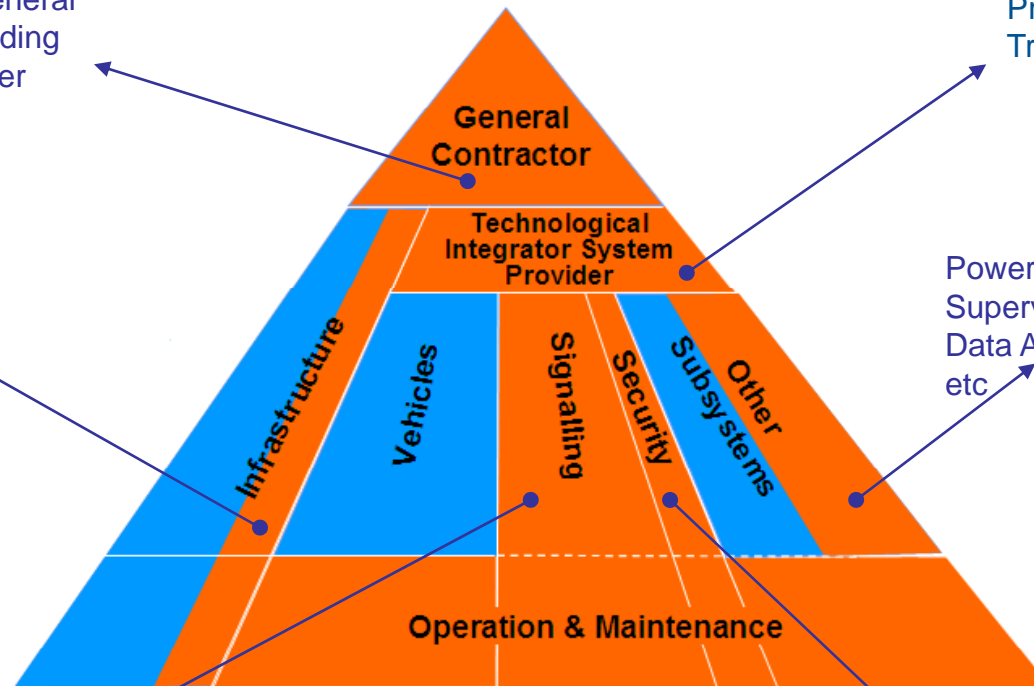
Primary area of focus of Transportation Solution BU

Supplier of track works for metros & railways

Power supply, Telecommunications, Supervisory Control Data Acquisition (SCADA), Ticketing, etc

Primary area of focus of Signalling BU

Security: asset, infrastructure and passenger protection against criminal and vandalism acts



ASTS - Innovation & Competitiveness Unit

The Innovation & Competitiveness Business Unit born some years ago with the aim to explore and develop new markets, developing railway and metro innovative projects.

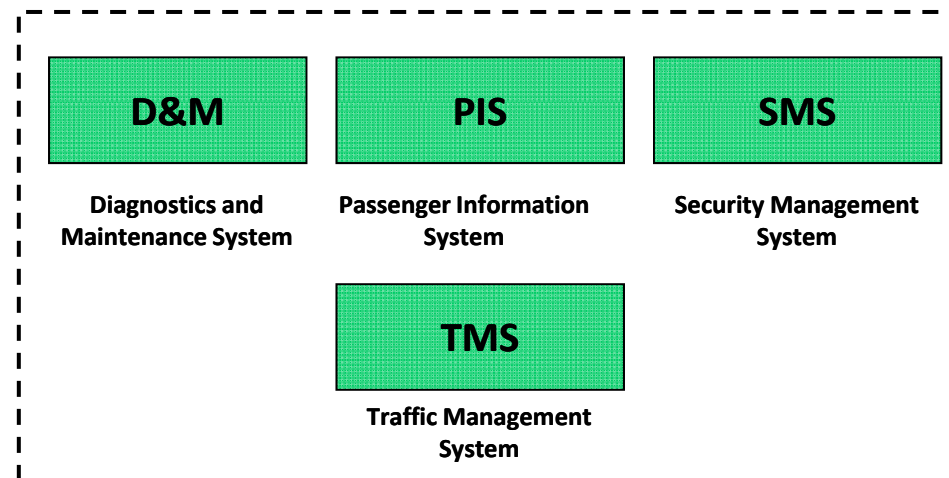
Among the innovative projects, ASTS has developed wayside monitoring systems such as the Train Conformity Check System (TCCS) and the Train Weight & Unbalance Check System (TWUCS).

In this way, ASTS has developed a platform to manage the information coming from the wayside monitoring systems in order to control them in a unique platform.

Railway Control System

Main Goals:

- Integration of many different components, both traditional and innovative,
- Management of relevant geographic extension and applications contemporaneousness,
- Parallelism with development of systems and innovative technologies to be integrated,
- Support of asset and organization changes in the Customer Organization.



Railway Control System Description

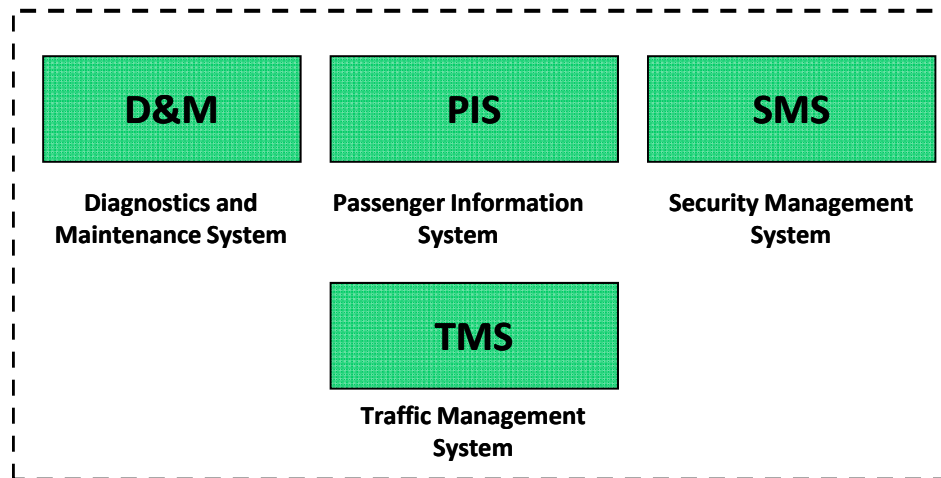


TMS manages automatically train routes based on dynamic scheduling, optimizes the traffic, manages conflicts/abnormalities between trains. TMS is fully integrated with PIS, SMS and D&M.

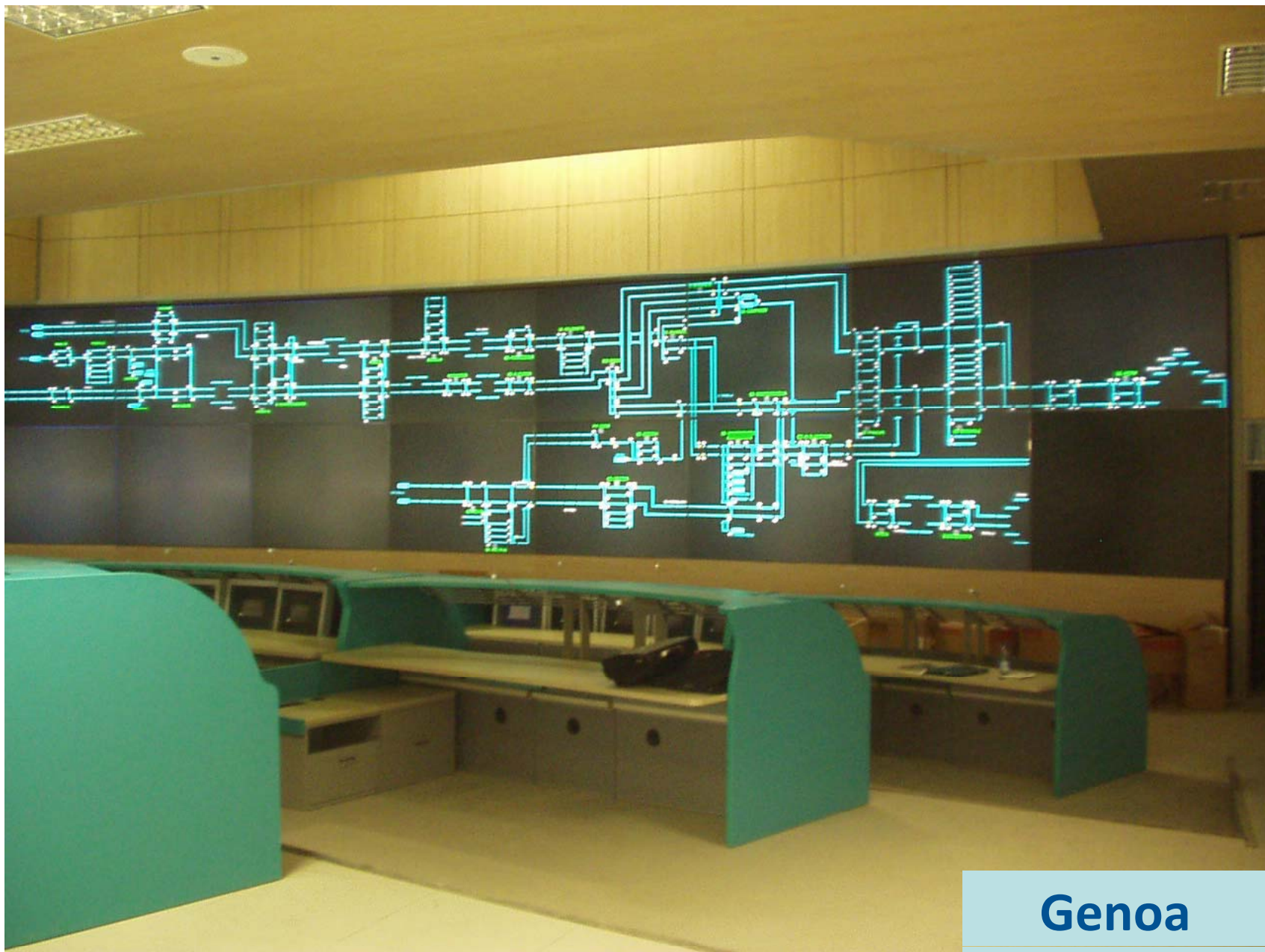
PIS manages voice Information and display information for passengers, linked to the real-time position of trains.

D&M manages diagnostic and maintenance of peripheral equipment (interlocking, TLC, etc) and of Control Centre HW.

SMS manages CCTV, Anti-intrusion and fire alarm systems. SMS provides OCC operators information to manage critical situations.



From a unique Control Centre the operators can control, in real time way, traffic and infrastructures status.



Genoa



Venice



Pisa



Bari

Some Main Issues



Different Operators, depending upon customer organization, are present to manage Traffic, diagnostics security and Infrastructures.



In case of critical situation it is necessary to deliver information in a short time, efficiently and effectively, to the relevant operator.

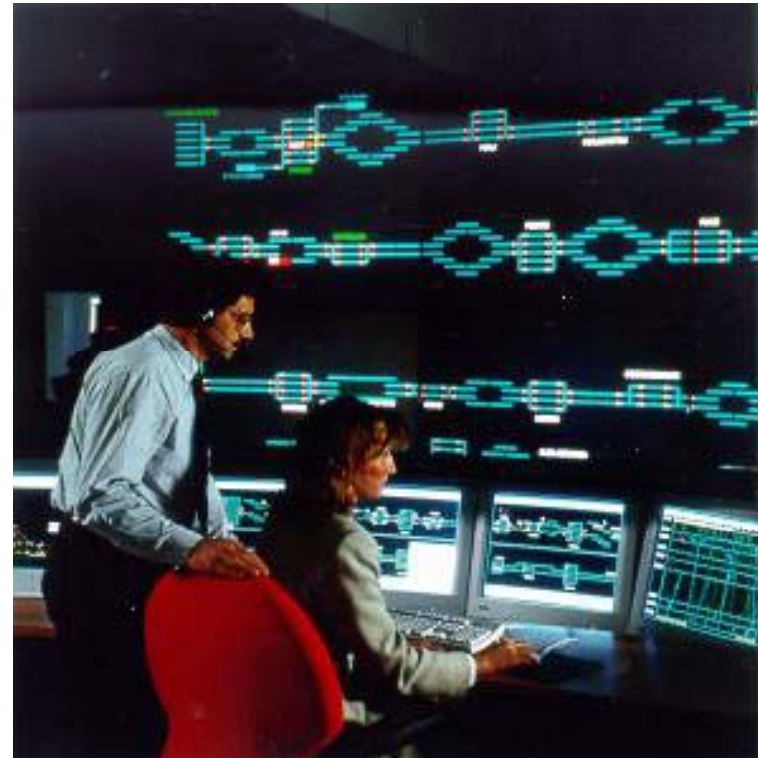


In case of alarm situation, the Infrastructure Manager objective is to manage the event adequately with the purpose of restoring train circulation in a short time.

Traffic Management System (TMS)

High Modularity provides the solution that better fits different customers needs. Traffic Management System main functions are:

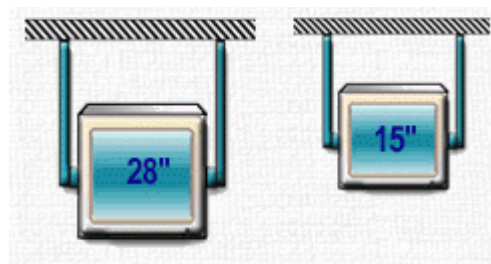
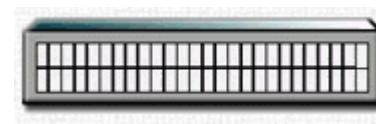
- CTC (Core application for Command & Control),
- Train Graph (dynamic scheduling),
- Train Stepping,
- Alarms management,
- Information Management,
- Event Logging, Recording and Playback.



Passenger information System (PIS)

The Passenger Information System works in strong cooperation with Traffic Management System and provides the following functions:

- Control Centre data management (timetable, configuration, multi-language support),
- Voice information management (Automatic, local, OCC operator announcements),
- Display of Information for passengers (Color VDUs, column display, etc).



TREN IN ARRIVO					
DESTINAZIONE	STATUS	GAT	PIATT	ORA	MIN

TREN IN PARTENZA					
DESTINAZIONE	STATUS	GAT	PIATT	ORA	MIN

Diagnostic and Maintenance System (D&M)

Diagnostic and maintenance system continuously monitors all the equipments.

Diagnostic and Maintenance system main functions are:

- Diagnostic and Maintenance of the equipments along the railway line (Interlocking, telecommunications, power supply, security systems, ticket machines),
- Diagnostic and Maintenance of the equipments located in the Operational Control Centre (HW, SW, LAN),
- Spares Management (location, inventory, replacement),
- Management of system documentation.



Security Management System (SMS)

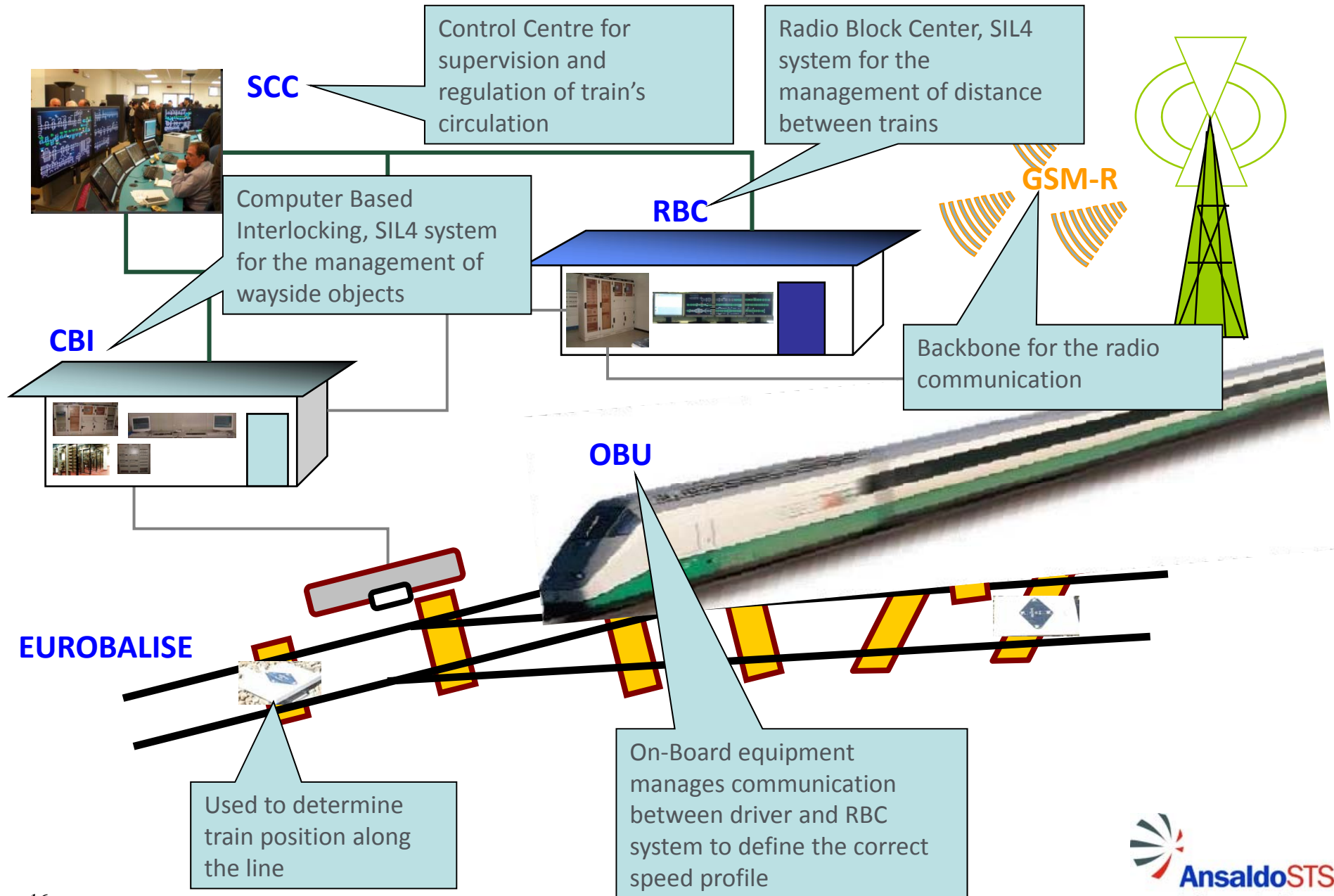
ASTS Security Management System (SMS) is a platform for the management of railway security (CCTV, Access Control, Intrusion Detection Systems).



Principal SMS features :

- User friendly web-based interface for managing alarms, video streams and remote commands,
- Animated graphical maps showing the status of all security devices,
- Automatic selection of video streams and activation of PIS in case of alarms (ex. intrusions),
- Management of the emergency procedures with step-by-step operation monitoring,
- Alarm priorities and escalation management,
- Reports for all events,
- Integrates another systems as Fire Detection & Extinguishing system and Building Automation System.

High Speed Control Centre – ERTMS Level 2



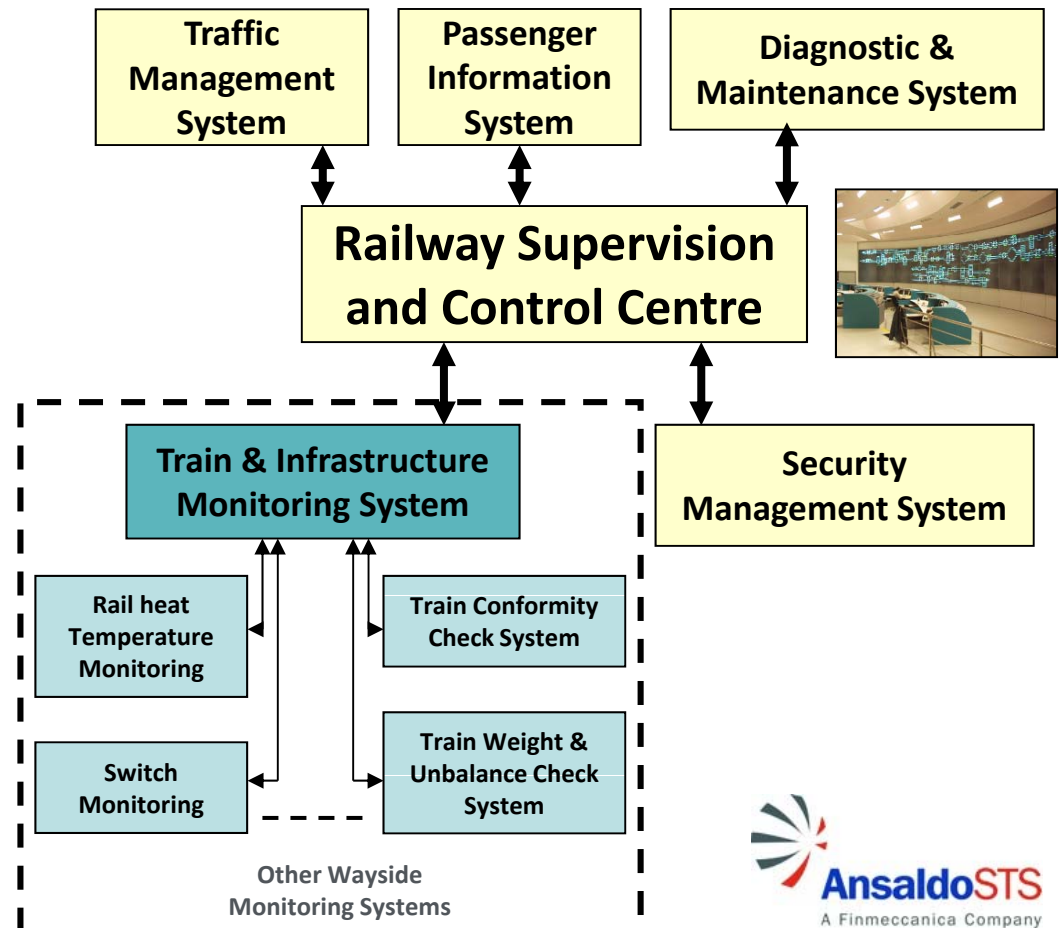
Railway Control Center – New Requirements

The Railway Control system main systems manage and correlate traffic, passenger, maintenance and security information.

Nowadays new requirements are asked from our customers: the use of **new technologies with high level performances** and the need to **improve safety and optimize maintenance**.

Train & Infrastructure monitoring system allows to prevent dangerous events, alerting railway staff in case defects or unconformities are found in trains or infrastructure.

Data, images and measurement are used to optimize maintenance actions.



Train & Infrastructure Monitoring System

The main task of T&I Monitoring system is to acquire functional data and measurements related to the train in transit and infrastructures.

The T&I Monitoring system :

- Monitors the whole train in transit;
- Monitors the infrastructures under supervision (rails, switches, etc);
- Detects defects and alerts operators;
- For each infrastructure and train in transit, the system gives information/images to help the operators to take the most suitable decisions in order to avoid accidents;
- Records all the information.

The T&I Monitoring system allows operators to get real time status of the transit train in order to take appropriate measures in case of train failures.

The T&I Monitoring system command and control all the wayside monitoring systems interfaced to it.

Railway Control System

System of systems (of systems)

Railway Control system main systems are:

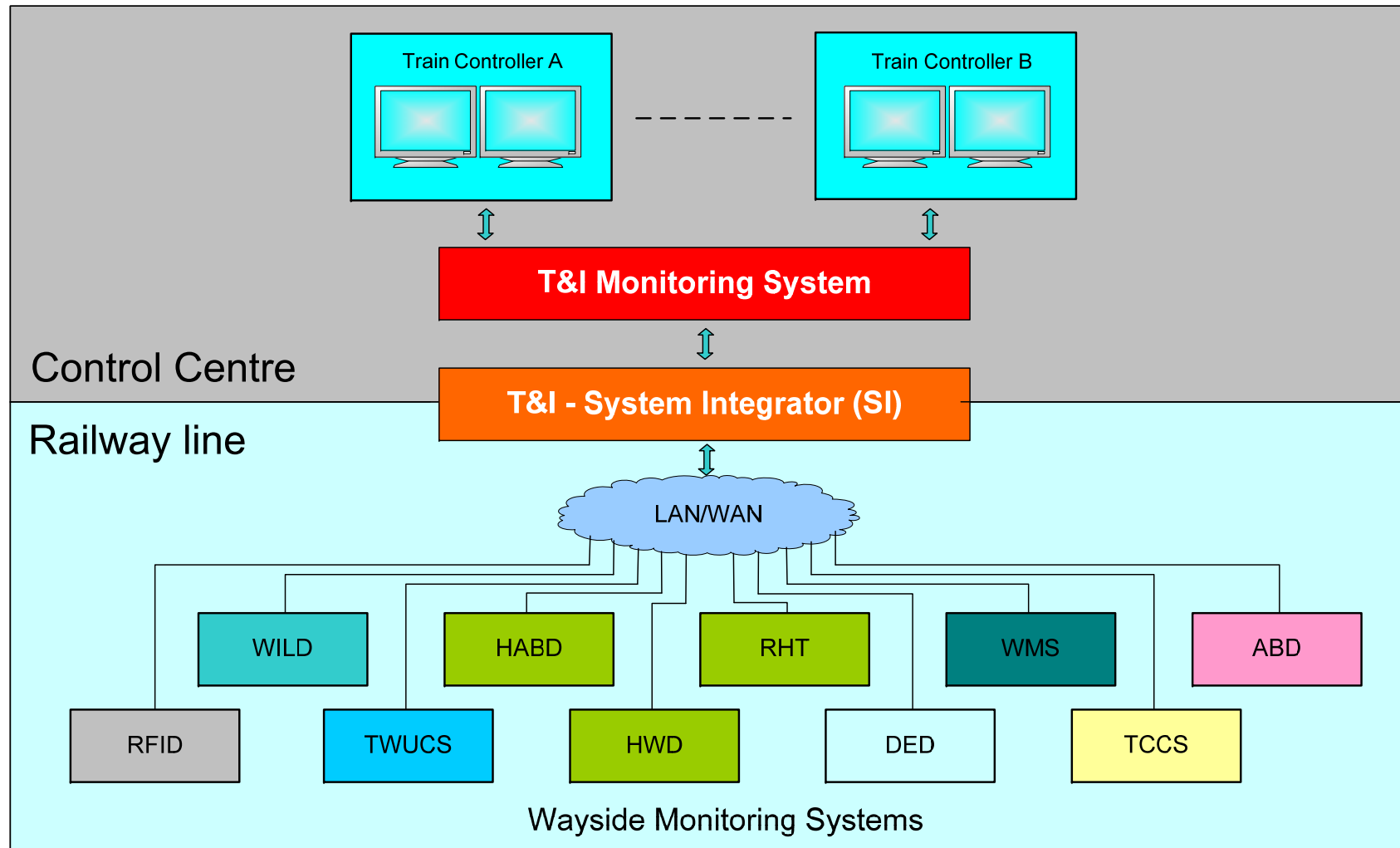
- Traffic Management system,
- Passenger Information system,
- Diagnostic & Maintenance system,
- Security Management system,
- Train and Infrastructure Monitoring system.

T&I Monitoring system also is composed by several wayside monitoring systems such as Train Conformity Check System (TCCS), Rail Heat Temperature system, etc.

Each wayside monitoring system, depending of its performances, could be composed by other systems, for example TCCS is composed by:

- Tracking system,
- Thermographic scan system,
- 3D scanning system,
- High Resolution Image system.

Train & Infrastructure Monitoring System Architecture Layout (1)



Wayside Monitoring Systems

Some wayside monitoring systems:



Hot Axle Bearing Detection (HABD)/
Hot Wheel Detection (HWD) & (RHT)



Dragging Equipment Device (DED)



Track Conformity Check System (TCCS)



Wheel Impact Load Detection (WILD)



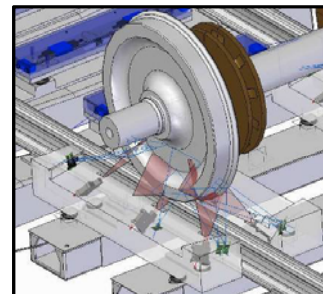
Radio Frequency Identification (RFID)



Train Weight Under balance
Check System (TWUCS)



Acoustic Bearing Detector (ABD)

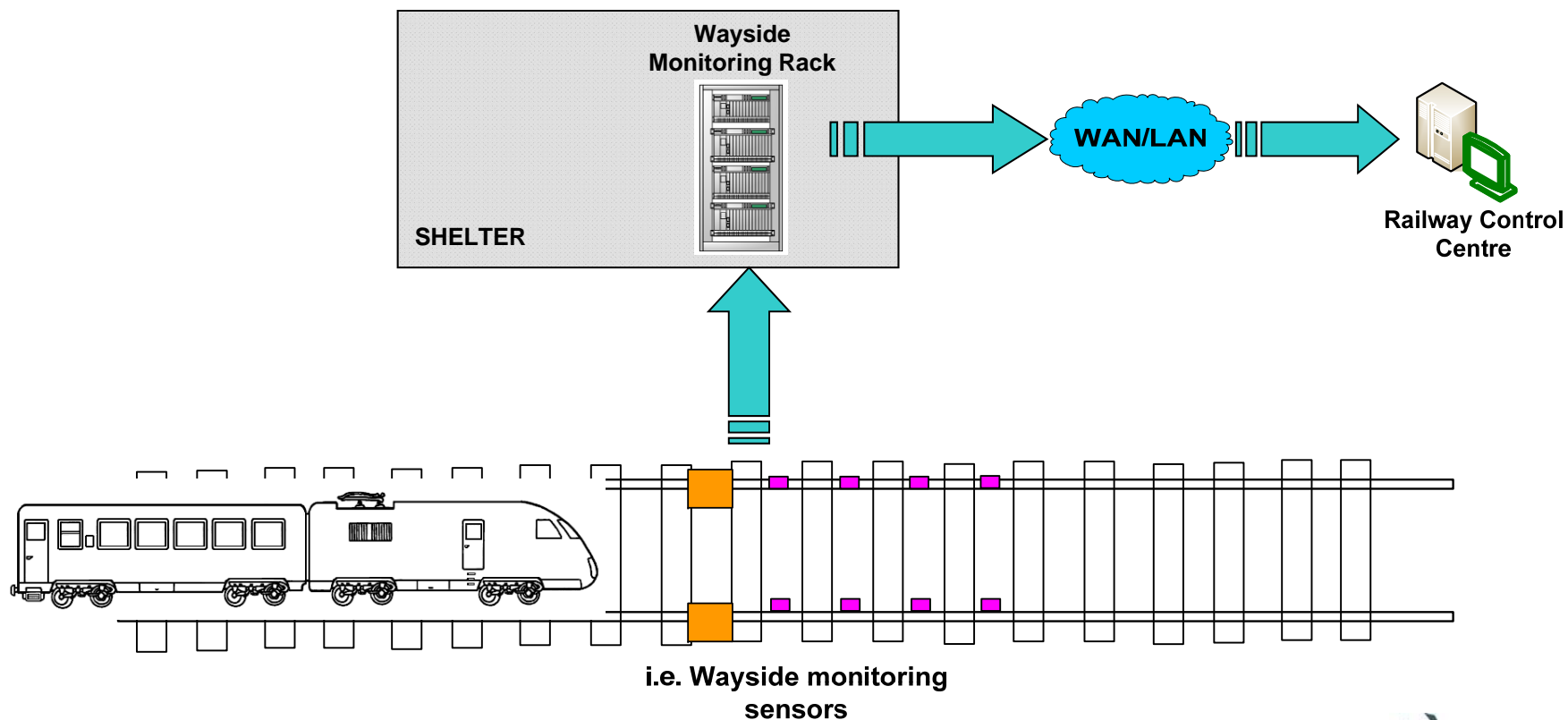


Wheel Measurement System (WMS)

Typical installation site

Typical installation site is composed of:

- Group or single wayside monitoring sensors (this zone is called 'measurement area');
- Local rack for local processing data, with WAN/LAN interfacing.



Advantages

The wayside monitoring systems are integrated in the T&I Monitoring system having the following advantages:

- View of all the information into an unique Human Machine Interface,
- The T&I Monitoring system collects all the data, alarms, diagnostic coming from each wayside monitoring system,
- The information of the wayside monitoring systems is associated to each train in transit and to each kind of infrastructure,
- The T&I Monitoring system manage accurately the alarms coming from the wayside monitoring systems,
- The T&I Monitoring system is a modular system, it is possible to add one wayside monitoring system each time is required.

Train & Infrastructure Monitoring System

Human Machine Interface



Overview

All information (measures, alarms and diagnostics) are transmitted via LAN/WAN to the T&I Monitoring system and displayed to the operators (Train Controllers).

For each train in transit T&I Monitoring system receives data regarding:

- Train approach and train exit from the site,
- Measurements and images collected from Wayside Monitoring Systems,
- Alarms generated by Wayside Monitoring Systems,
- Identification of train vehicles (Tag ID),
- Diagnostic state of Wayside Monitoring Systems.

For infrastructures monitored T&I Monitoring system receives measures and alarms.

HMI is web based and can be accessed by a standard browser installed at every operator desk

HMI Functionalities (1)

The information received is stored in a relational database.

T&I Monitoring system HMI allows operators to:

- Display the list of transits in all installation sites,
- Highlight any alarm with visual and acoustic (if required) signals,
- Display alarm details,
- Manage alarmed transits recognition,
- Manage data: measures, alarms, images, for each Wayside Monitoring System,
- Keep trace of the operator notes and comments on alarmed transits,
- Displays the diagnostic status for each Wayside Monitoring System,
- Activate/deactivate each Wayside Monitoring System,
- View statistical data analysis,
- Control measurement related to a particular infrastructure;
- Manage alarms related to a particular infrastructure.

HMI Functionalities (2)

T&I Monitoring system - HMI provides two levels of information management: Global level and Site level.

Global Level:

- The operator can monitor all Wayside Monitoring Systems,
- In the high level map are visualized the installation sites which are positioned in various points of the map,
- Generic information is available about transits, alarms and alarm management (Operator can choose a site and examine the transits).

Site level:

- The operator can manage the details for each site, for each transit and for each Wayside Monitoring Systems,
- For each transit it is possible to examine monitoring data, images, alarms and diagnostics.

Each transit is identified by: Type of installation site, Track and time of transit.

T&I Monitoring system authenticates operators by Username/Password.

HMI Site Level – Example (1)

Mirfa SuperSite

الاتحاد للقطارات ETIHAD RAIL | AnsaldoSTS

Buttons: Diagnostics, Logout(pco)

Speed: 36.93 Km/h | Track: 2 | N. axes: 16 | Len: 85.60 m.

Transit detail: 31/05/2012 15:23:50

Vehicle	S/N	Description	Len. (m)	Height	N. axes
1	19	E464 2 bogies locomotive	21.40 m	3.19 m.	4
2	12	MDVC-MDVE 2 bogies sulfur vehicle	21.40 m.	3.19 m.	4
3	14	MDVC-MDVE 2 bogies sulfur vehicle	21.40 m.	3.19 m.	4
4	13	MDVC-MDVE 2 bogies sulfur vehicle	21.40 m.	3.19 m.	4

Transit list

	Date	Track
!	31/05/2012 15:25:56	2
!	31/05/2012 15:23:50	2
!	31/05/2012 15:21:45	2
!	31/05/2012 15:19:39	
!	31/05/2012 15:17:34	
!	31/05/2012 15:15:28	
!	31/05/2012 15:13:23	
!	31/05/2012 15:11:18	
!	31/05/2012 15:09:12	
!	31/05/2012 15:07:07	
!	31/05/2012 15:05:01	
!	31/05/2012 15:02:56	
!	31/05/2012 15:00:50	2
!	31/05/2012 14:58:45	2
!	31/05/2012 14:56:40	2
!	31/05/2012 14:54:34	2
!	31/05/2012 14:52:29	2
!	31/05/2012 14:50:22	2

UI Version: 1.2.1-RC-5-SNAPSHOT

Buttons: VMS, WIM, WILD

Annotations:

- Train Composition:** Points to the vehicle list table.
- Alarms:** Points to the red exclamation mark icons in the transit list.
- Main information of selected train:** Points to the 'Last transit detail' section.
- List of the trains (passed and in transit) (it is possible to select the train):** Points to the 'Transit list' table.
- Wayside Monitoring System selection:** Points to the VMS, WIM, and WILD buttons.

HMI Site Level – Example (2)

The screenshot displays the Mirfa SuperSite HMI interface. At the top, the logos for Etihad Rail and AnsaldoSTS are visible, along with the site name "Mirfa SuperSite". Navigation buttons for "Diagnostics" and "Logout(pco)" are in the top right. The main interface shows a track status overview with a speed of 36.93 Km/h and Track 2 selected. A "Transit detail" table for 31/05/2012 15:00 is shown, listing vehicles 1 through 4. An "Alarm acknowledgement" window is open, displaying an "Alarms list" table with the following data:

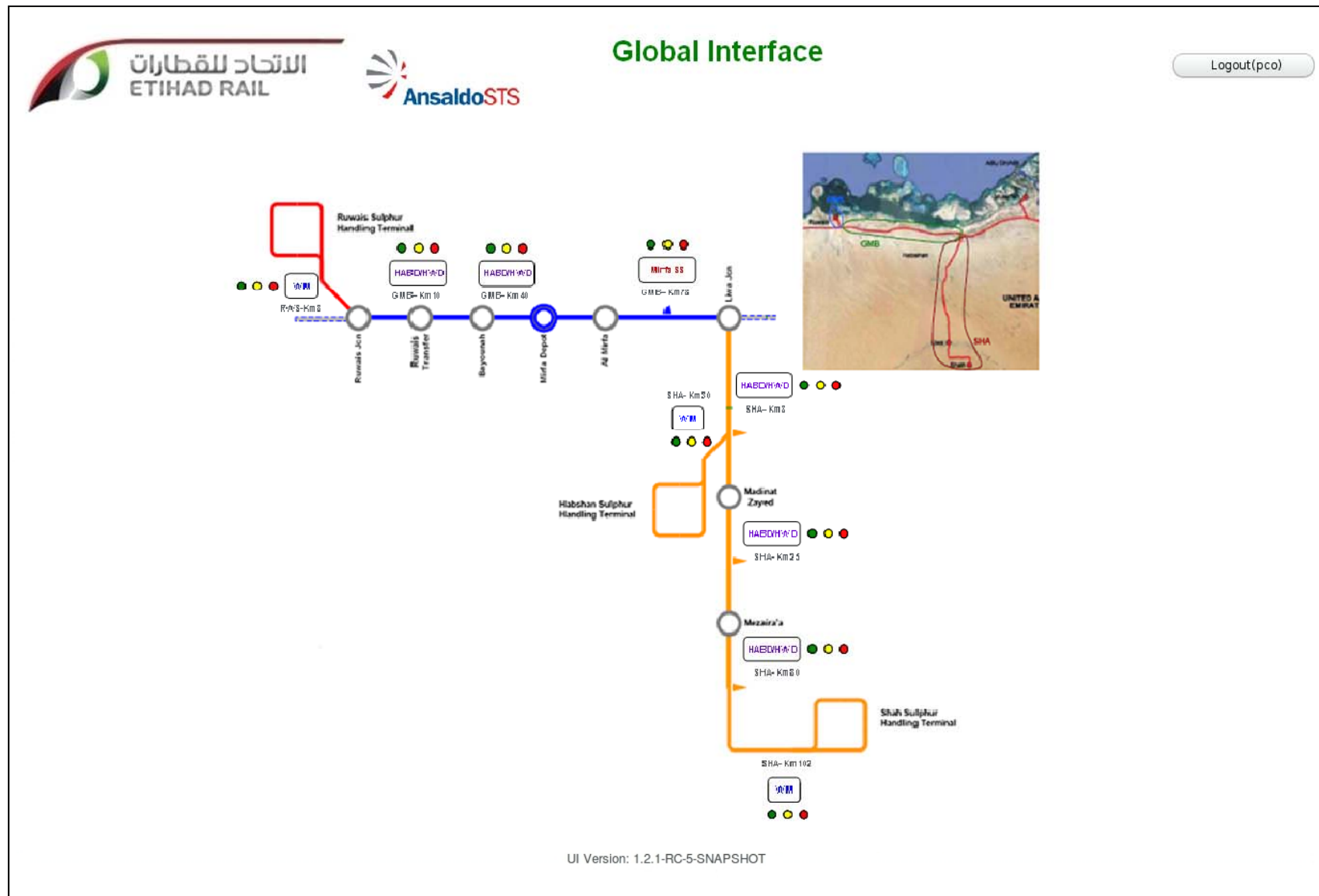
Severity	Type	Sensor code	Vehicle	Requires acknowledgement
Warning (Yellow Triangle)	Vehicle out of gauge alarm	IR01A00	2	Y

A callout box labeled "Alarm detail" points to the first row of the alarm list. The window also features "Acknowledge" and "Cancel" buttons. In the background, a track status table is visible:

Vehicle	S/N	Description
1	19	E464 2 bogies loco
2	12	MDVC-MDVE 2 bogi
3	14	MDVC-MDVE 2 bogi
4	13	MDVC-MDVE 2 bogi

At the bottom, there are navigation icons (VMS, WIM, WILD) and a log of recent events with timestamps like 31/05/2012 14:56:40. The UI version is noted as 1.2.1-RC-5-SNAPSHOT.

HMI Global Level – Example (3)



Thank you for your attention

