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*Designing fluidity*

# What is ICONIS?

ICONIS (Integrated CONTROL and Information System) is ALSTOM Traffic Management System product.



Security



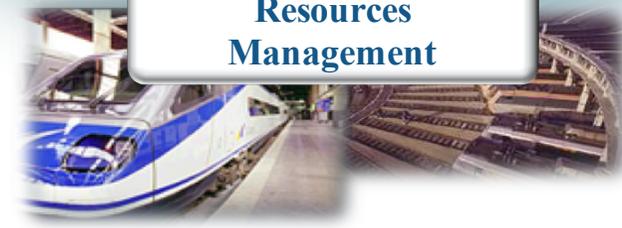
Passenger  
Information



Signalling

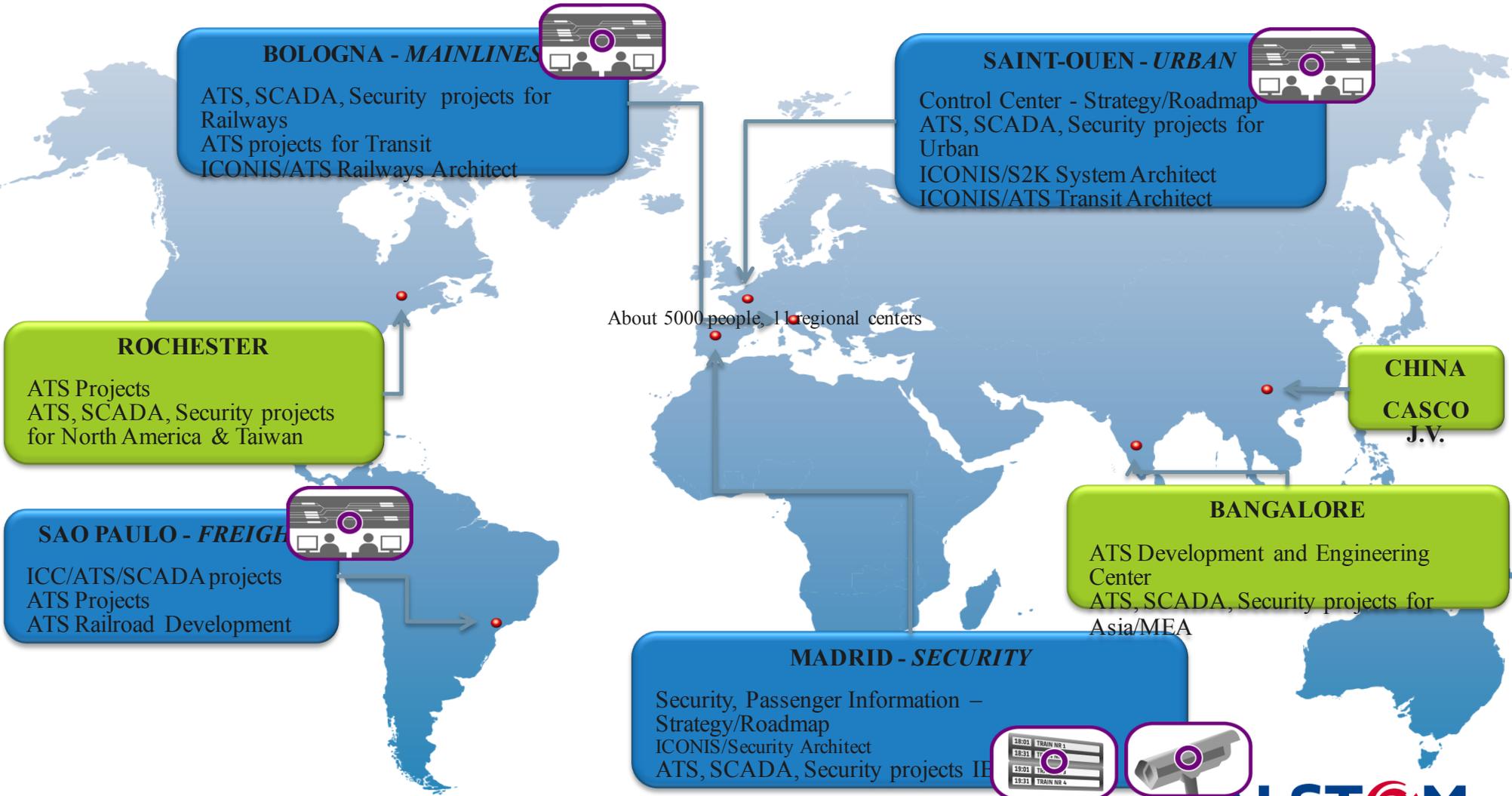


Maintenance  
Systems



Resources  
Management

# Control Center development and deployment sites



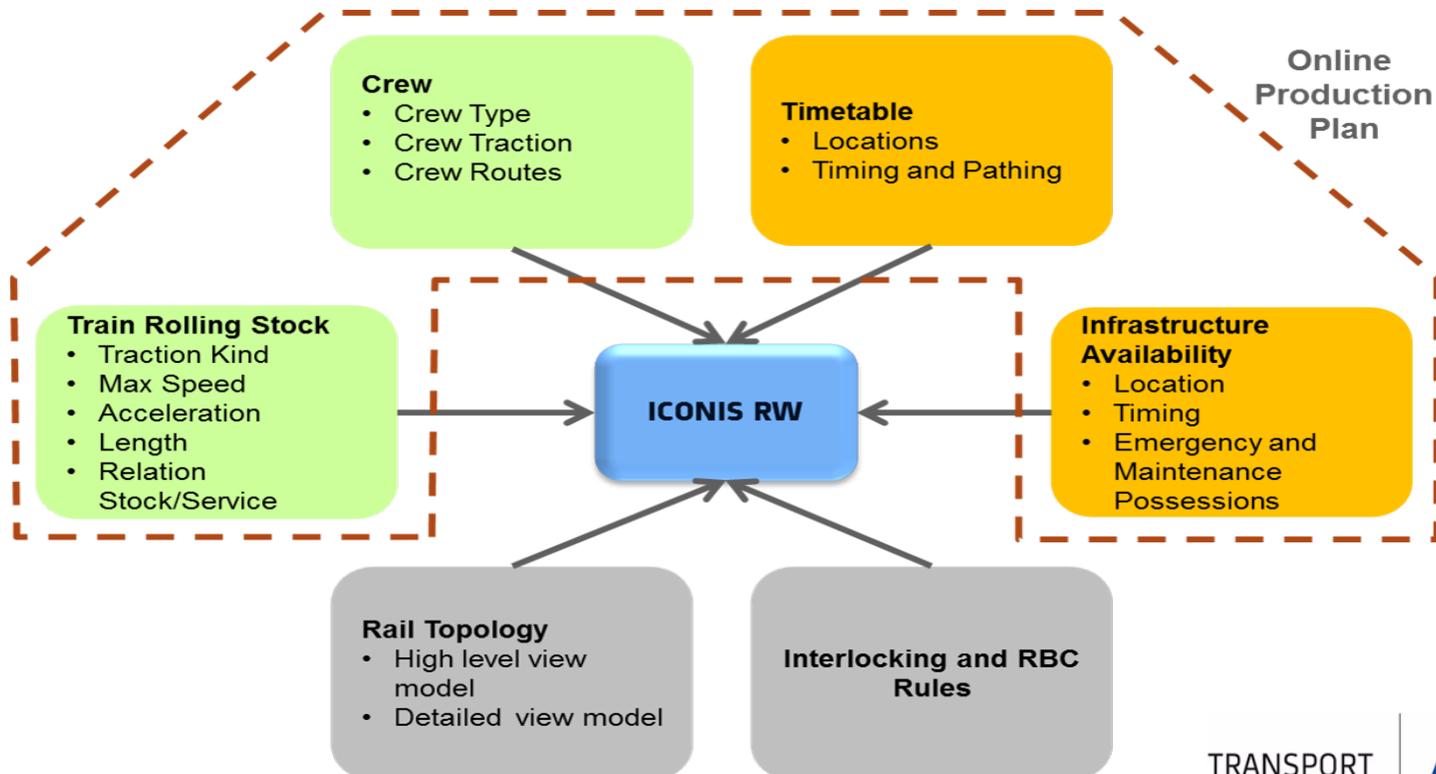
# TMS Functional Overview



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# ICONIS Online Production Plan

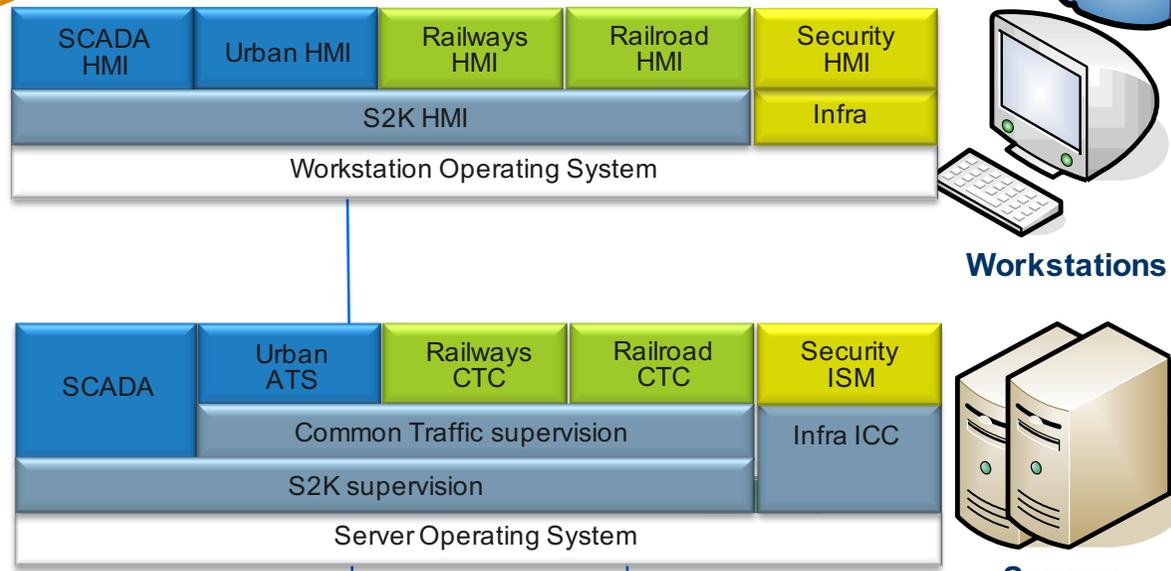
- ICONIS manages in real time information regarding Timetable, Infrastructure, Rolling Stock and Crew; all this information are called Online Production Plan
- ICONIS, based on topological and network information updates the Online Production Plan in order to forecast correctly the future status of the traffic permitting an early identification and solution of any traffic problems.
- The free of conflict Online Production Plan is used by the system to issue automatically controls needed to route the trains.



# A modular architecture for scalability

Components Off-the-Shelf  
Standard SOA

Standalone or Integrated  
Products



Urban	HMI - User interface with domain specific applications Train Distance Graph, Timetables
Railways	
Railroad	
Security	

Server Applications	
SCADA Urban ATS	Level 1: Manual functions
Railways CTC	Level 2: Automation functions
Railroad CTC	Level 3: Optimization and Operations Management
Security	

S2K	General supervision package
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IT	Information technologies, Operating systems, Non Vital Software engineering
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Network	Ethernet LAN / WAN
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Field Level	Remote terminal units, Programmable Logic Controllers, Fieldbus, I/Os
	Communication System

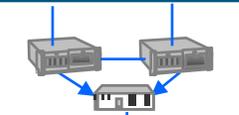
Transport Application Domain

Automation / Software Domain

Tools  
Simulators



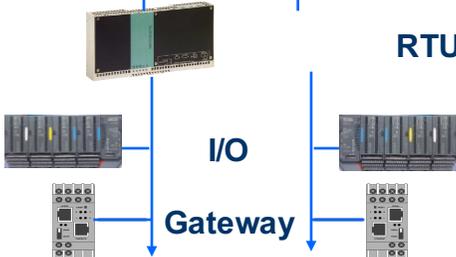
Network



FEP



ATS Acquisition



I/O  
Gateway

SCADA Acquisition

RTU

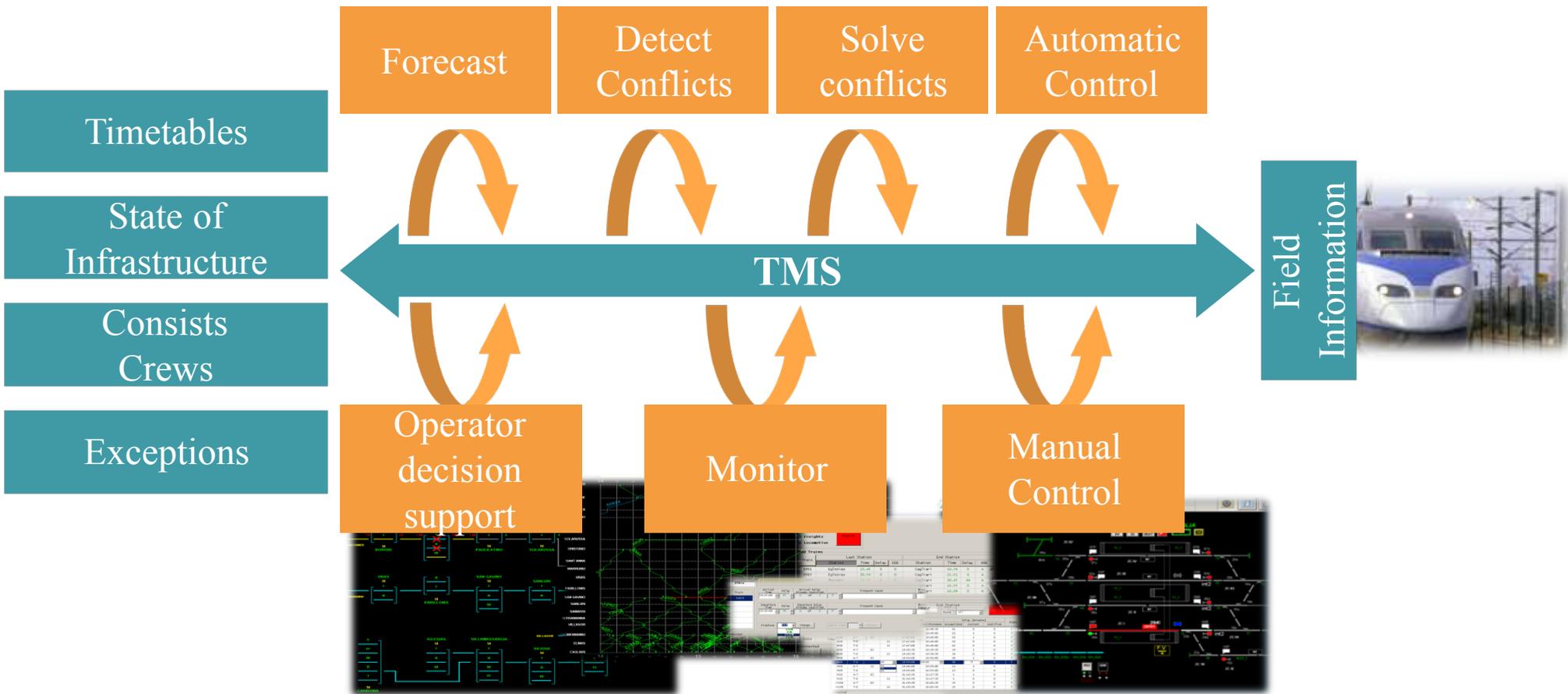


Security Components

Workstations

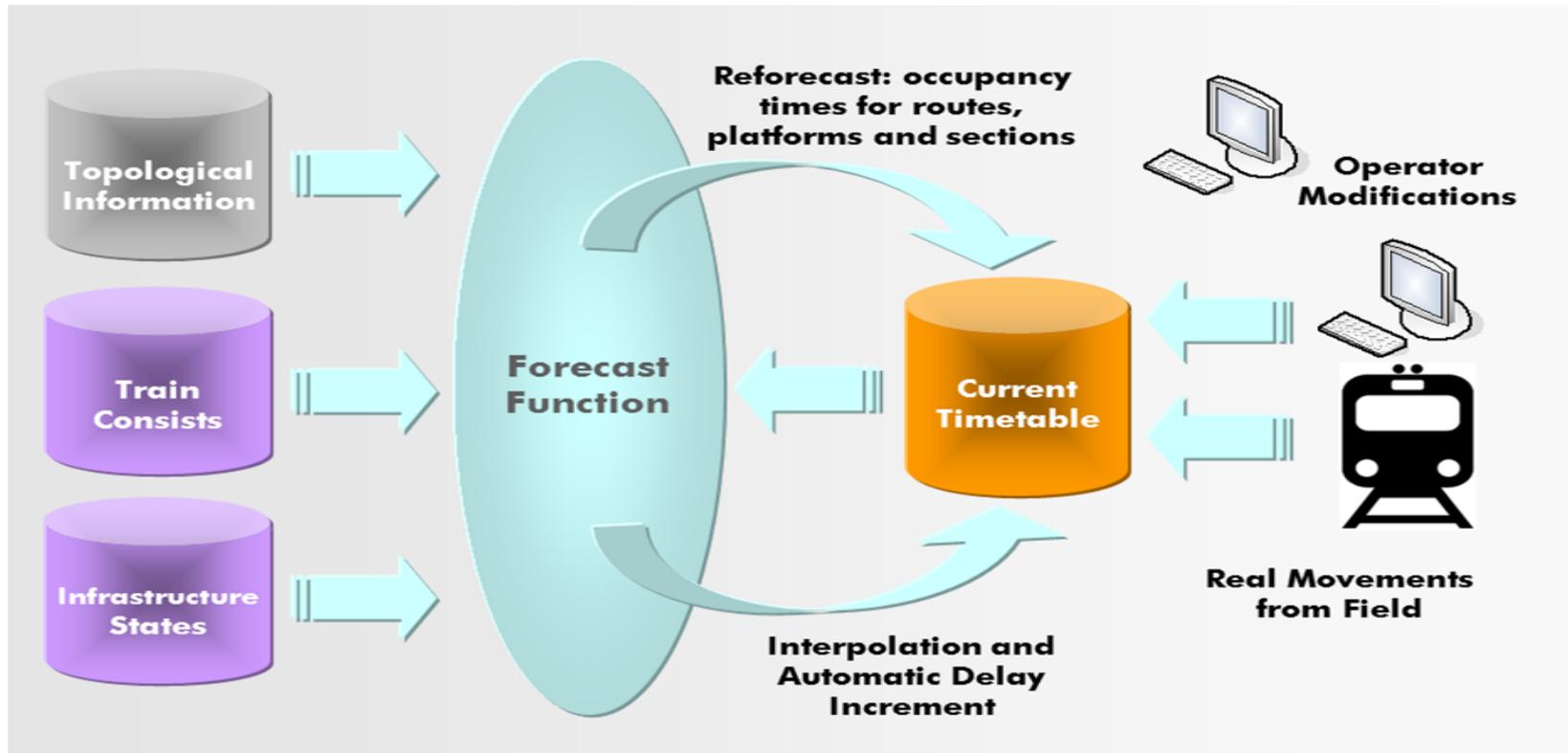
Servers

# Monitor & Control ▶ Plan ▶ Automate



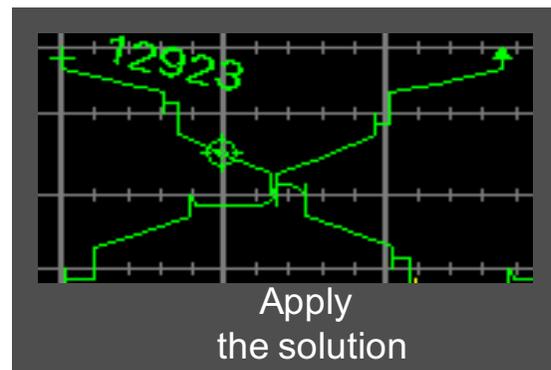
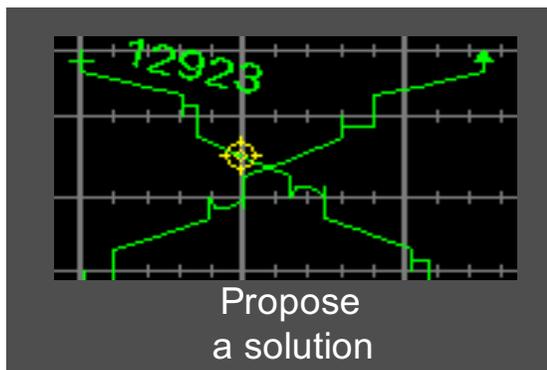
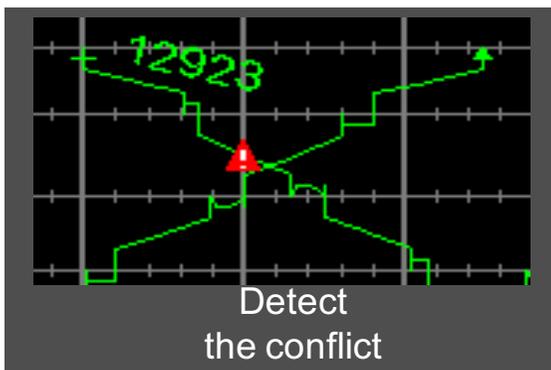
# ICONIS Forecast function

The Forecast function is the key function of ICONIS permitting to estimate precisely for each train the behaviour in the near future following any modification of the Online Production Plan. The forecast function calculates in real time a precise evaluation for each train of the occupancy time of platforms, routes and sections



# Local Conflict Detection and Solution

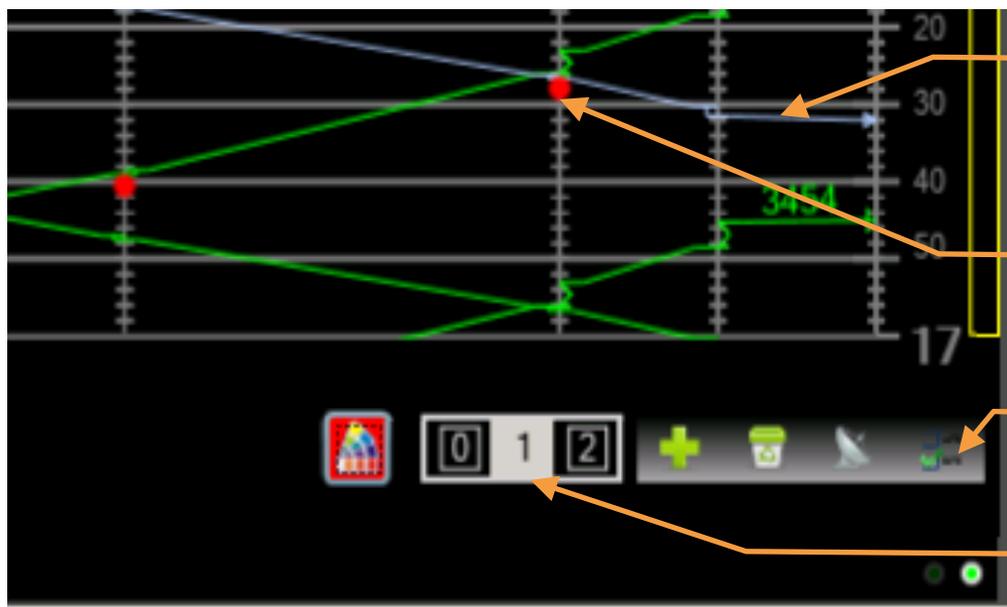
- Conflict detection between trains (train/train) or usage of unavailable track (train/infrastructure)
- Violation of Service Intention
- Immediate Conflict representation on TDG
- Real time detection and solution
- Three steps process (manual and automatic)
  - Detection phase
  - Solution phase
  - Validation phase
- Usage on priority curves for classes of train/current delay/current time
- Optimization based on several Objective Functions



# Scenario Management: What if ?

Real-time management of different scenarios (not impacting real circulation):

- Available on graphical HMI (E.g.: Time Distance Graph)
- All modifications to timetable are limited to the scenario
- Optimization algorithm can work on a specific scenario
- Optimization algorithm can save several solutions on different scenarios



Specific color highlight for trains modified in the selected scenario

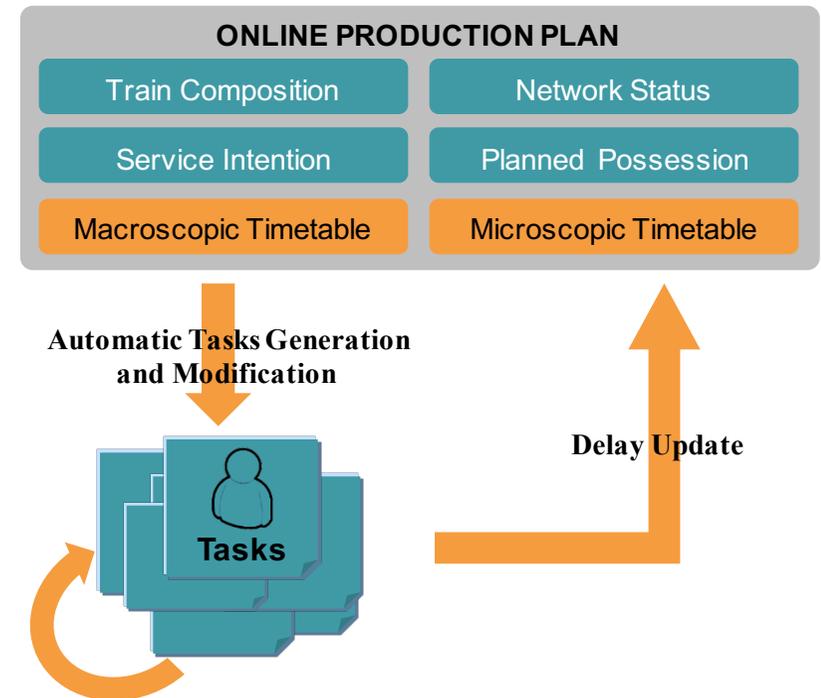
Conflicts are detected and solution proposed for the selected scenario

Scenario can be added, deleted, visualized and committed turning them into the real situation

Scenario Selection.  
0 is the real situation

# Task Management

- Coordination of all actors involved in the traffic management (Drivers, shunters, guards, maintainer,...) to guarantee the correct and on-time implementation of the Online Production Plan by the (automatic) definition of tasks assigned to any operator (task owner)
- Follow up of tasks execution with possibility to define check points/milestones for a proactive management and early delay detections
- Definition of task template for incident management or other procedure defined by the Customer
- Coordination with **portable** devices (Eg.: tablet, mobile,... ) connected to TMS



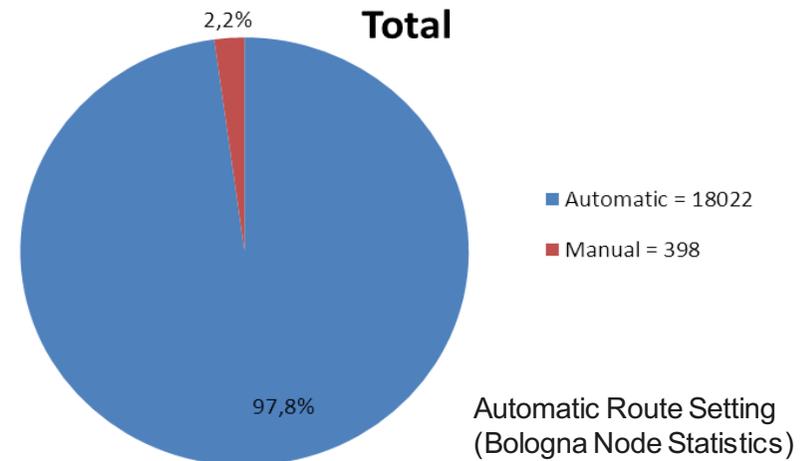
# The ICONIS Automation

Enables the operators to focus on problem solving rather than route controls

Automatic Route Setting avoids the signaller having to set routes manually

Automatic Route Setting determines the route to be set at the appropriate time for each train.

Studies demonstrate that the system automatically manages **98%** of the routes through the Bologna node according to the production plan.



# Technology Highlights



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# Blade solutions and Virtualization



Same technology on  
Denmark FBane,  
Roma, Bologna,  
Sweden

## Reliability

> 1.000.000 hours MTBF

## Maintainability

hot-swappable &  
configuration-less

## Obsolescence Management

Virtual Machines  
HW and SW independence

# HandHeld Terminal



No Drag & Drop = No mistakes with gloves

Big Buttons

High contrasted color under the sun

No multiple windows = No loss of info/focus

# Enabling Technology Platform

## Modern Graphical User Interface based on key technology enablers

- WPF – Windows Presentation Foundation
- WCF – Windows Communication Foundation

## Smart Touch HMI and Mobile architectures

## Multi-touch interfaces

# Enabling Technology Platform



Multi-touch screens



Kinect devices

Fast moving technology and a not so distant future

As soon as validated by usability analysis

# Enabling Technology Platform



# TRAFFIC MANAGEMENT SYSTEM

## References



# Mainline Iconis references



Switzerland - CTC  
Lausanne

Denmark - Banedanmark

Manche Link - Eurotunnel

UK TMS - Network Rail

Toronto - Metrolinx

USA - Chicago METRA

USA - Kansas City Southern

Porto Alegre - Trensurb  
Vittoria - CVRD  
MRS Logistica  
SGF Freight - VALE

Bologna Nodo  
Bologna Centrale ACF  
Belluno, Bolzano  
Prato, Pistoia  
Brescia Iseao Edolo  
Romagna  
Sardinia  
Verona-Mantova  
Viterbo

Sweden - Trafikverket

Greece - Ergose

Turkey- Eskesehir-  
Balikesir

South Korea KTX - KHR

Hong Kong - KCRC  
Lantau Airport Rail - MTR

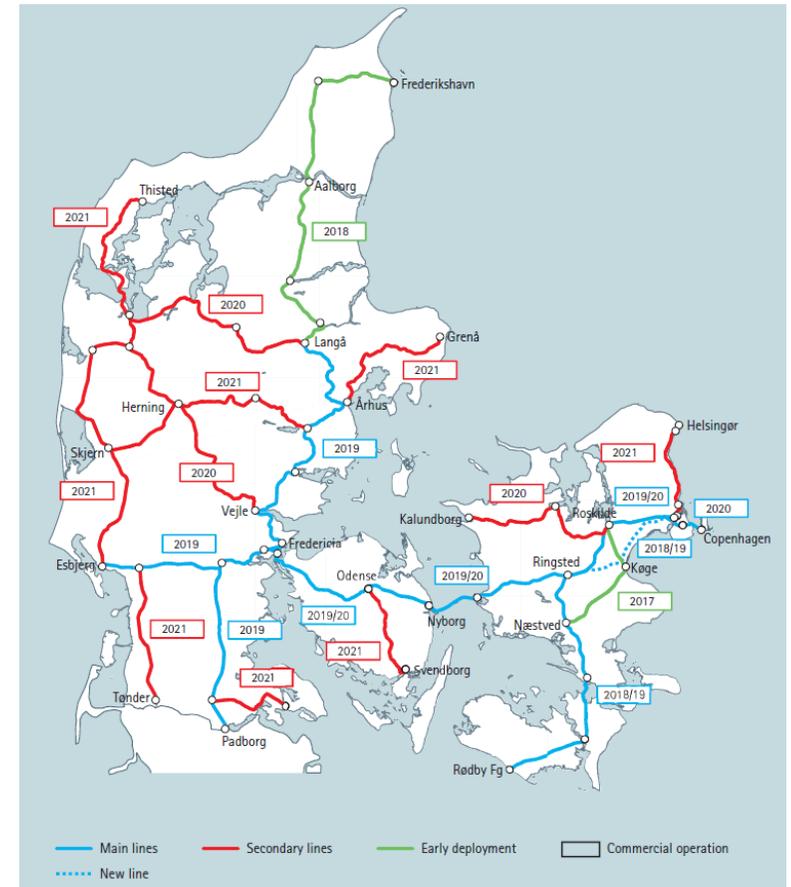
Vietnam - Hanoi-Vinh

Indonesia -  
Jakarta  
Cirebon  
Bandung

Australia -  
Sydney  
Adelaide  
Melbourne

<b>Country:</b>	Denmark
<b>Project:</b>	Fjernbane Infrastructure Project
<b>Scope:</b>	Denmark Resignalling
<b>Project start date:</b>	31 <sup>th</sup> January 2012
<b>Preliminary Design and Conceptual Design:</b>	November 2013
<b>Entry into revenue service:</b>	July 2017
<b>Final Acceptance of the last line:</b>	December 2021

ERTMS L2 -based signalling system (IXL, ERTMS, TMS) on the East part of the country (11 lines, 800 km and 76 stations ) and for the development of TMS Online and Offline Scheduler for the whole country.



Special focus has been given by Banedanmark on the Traffic Management System (TMS), as key subsystem of the future railway infrastructure. Alstom TMS is based on the latest ICONIS release, which includes all the advanced traffic management features, such as Task Management, Service Intention Management, Conflict Solution and Global Optimization.

<b>Country:</b>	Italy
<b>Project:</b>	CTC Bologna Node
<b>Scope:</b>	Regional Traffic Management System (TMS)
<b>Project start date:</b>	2004
<b>Entry into revenue service:</b>	Jan 2007
<b>Final Acceptance of the last line:</b>	Jan 2007



The Bologna Railway Node is the key junction between the North and the Centre of Italy's railway network. The Centralized Traffic Control controls 8 different lines, 78 stations or junctions and supervises the Bologna Centrale passing-through main station. An average of 1200 trains per day is managed by CTC.

The TMS has been deployed on the existing infrastructure from 2007 to 2009. All migration phases have been managed without service interruption and traffic perturbations taking advantage from the proven ALSTOM methodology based on testing in shadow mode and fast migration with mirror server technology.

<b>Country:</b>	Italy
<b>Project:</b>	TMS Roma Node
<b>Scope:</b>	Regional Traffic Management System (TMS)
<b>Project start date:</b>	2014
<b>Entry into revenue service:</b>	Jun 2016
<b>Final Acceptance of the last line:</b>	Jan 2018



Alstom as part of a consortium has been awarded a contract by RFI (Rete Ferroviaria Italiana), to upgrade the Rome railway intersection, one of Italy's busiest rail points where high-speed lines intersect with national and regional lines. To increase the efficiency of the railway intersection, which is 200 km long and sees the passage of 1200 trains per day, the project involves the implementation of railway signalling systems, as well as cab signalling systems, telecommunications and civil works. Alstom is delivering its Integrated Control and Security Centre (ICSC) on the entire network, based on Alstom's ICONIS platform, the latest Alstom technology which has been used for seven years at the Bologna railway intersection.

# Montreal ICC case study



## Montreal - STM

Period: 2003 - 2012

Customer: STM



Revamping of Integrated Control Centre

4 lines, 65+3 passenger stations

140K I/Os configured

7 pairs of servers, 15 general-purpose operator workstations at the Centre

170 operator workstations over the network

ATS: Tracking, routing, dispatching, regulation

Communications: Integration of radio, telephony, recording in workstations

Passenger Information: Interface with Public Address, passenger display (on-board and station)

Security: CCTV, Access Control, Fire Detection

SCADA: Ventilation (with Scenarios)

Power (HV substations, rectifier substations with load shedding, traction power)

Fixed Equipment (Lifts, Pumps, etc.)

Software-managed emergency cut-off of traction power

Maintenance Management: Maintenance reports, maintenance staff and train availability

Tracking of Personnel (drivers, maintenance, in station, valuables conveyors)

Activities Management (planned and unplanned)

Migration from existing system to ICC.