



Capacity for Rail

# Digital operations for enhanced performance and capacity in European railways

*Introduction*

27<sup>th</sup> April 2017, Olomouc, Czech Republic

Egidio Quaglietta

SP3 Leader



# Background: EC Objectives

EC White paper on transport (2011) set objectives to be achieved by 2050

Improving competitiveness by increasing mobility and removing barriers

Reduce EU dependence on imported oil and cut carbon emissions by 60%



No more conventionally-fuelled cars in cities



40% use of low carbon fuels in aviation 40% cut in shipping emissions



50% shift of medium distance IC passenger and freight journeys from road to rail and waterborne transport

# Background: EC Roadmap to achieve 2050's objectives



2020

EU Framework for multimodal transport information, management and payment system

Complete modernisation of Europe's air traffic control system. Completion of the European Common Aviation Area

2030

30% of road freight over 300 km shift to rail or waterborne transport

Functional EU-wide core network of transport corridors (TEN-T) including intermodal facilities

2050

more than 50% of road freight shift to rail or waterborne

connect all core airports and seaports to the rail network (possibly HS)

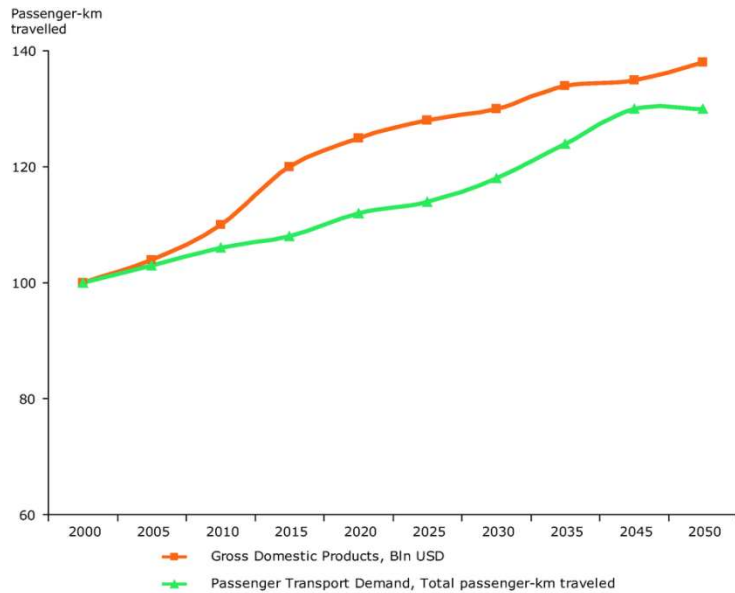
High Quality – High Capacity for TEN-T network

# Criticalities: Rail network saturation

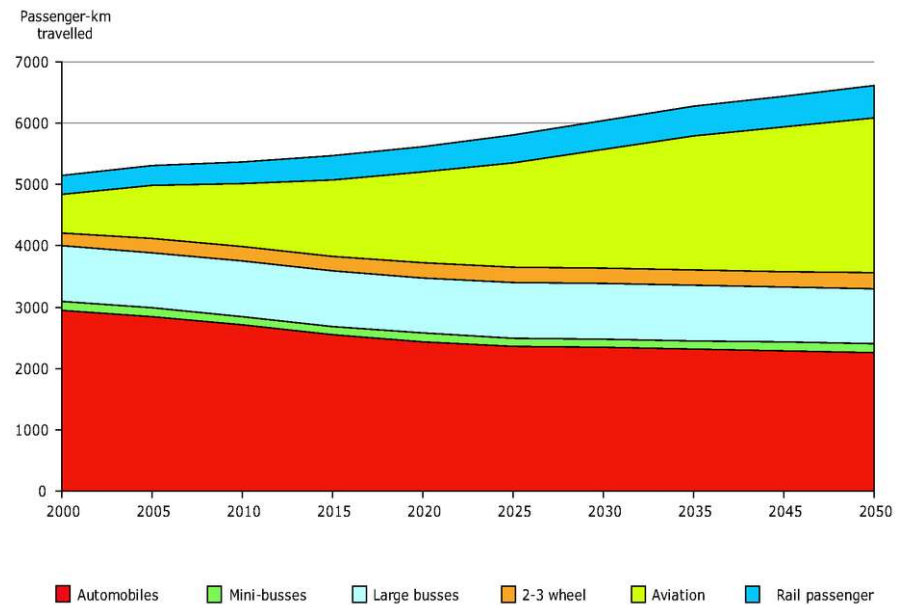


- Poor customer satisfaction
- Poor performance

- Reduced robustness
- Reduced resilience
- More frequent faults
- Higher maint. costs



Source: European Environment Agency



Source: European Environment Agency

# Criticalities: Example of current situation in UK



## Britain is running out of space for the trains it needs

- Britain's railway carries twice as many passengers as it did just two decades ago.
- Key routes are overcrowded, nearly a quarter of all commuters travelling into London are reported as standing.
- A billion extra journeys is expected to load the network by 2030. At the same time, more space for freight trains is needed, which shift £30 billion of goods annually saving 76% of CO<sub>2</sub> emissions w.r.t road alternative.

*Capacity challenges are most acute in our major cities*

- ◆ London will need nearly 50% more capacity by 2043 than it has today- equivalent to 180,000 seats and standing places.
- ◆ Even with schemes including Crossrail and Thameslink demand for seats will increasingly outstrip supply from 2020
- ◆ By 2043, approximately 80,000 additional seats and standing spaces will be needed over and above existing plans – equivalent to increasing current London rail journeys by 20 per cent

Official forecast by NR for the DfT, source [www.digitalrailway.co.uk](http://www.digitalrailway.co.uk)

## *Possible solution*

Enhancing current railways  
with advanced technologies  
and optimised operations



This is expected to provide:




- Higher **Capacity**
- Improved **Robustness**
- Better **Resilience**
- Increased **Affordability**
- Full **Automation**
- Enhanced **Adaptability**



# *Objectives of C4R*



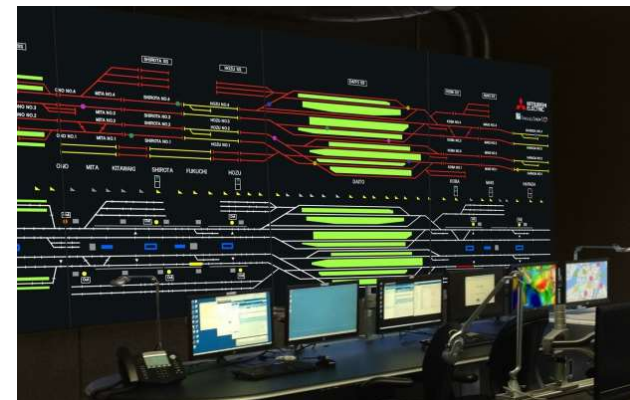
## **Improving Capacity, Robustness, Resilience, Affordability, Automation and Adaptability of railways by:**

-  Setting up a vision for the railways in 2030 and 2050
-  Developing innovations for enhanced infrastructure and operations
-  Assessing the impact of developing technologies with on-track demonstrations and multi-criteria analyses

# Innovations of C4R

## C4R innovations include step changes to:

- Infrastructure design,
- Construction and maintenance, including advanced monitoring
- Operation management
- Incident recovery through real-time data management
- Freight operations, with a particular focus on trans-shipment and improved performance of rolling stock

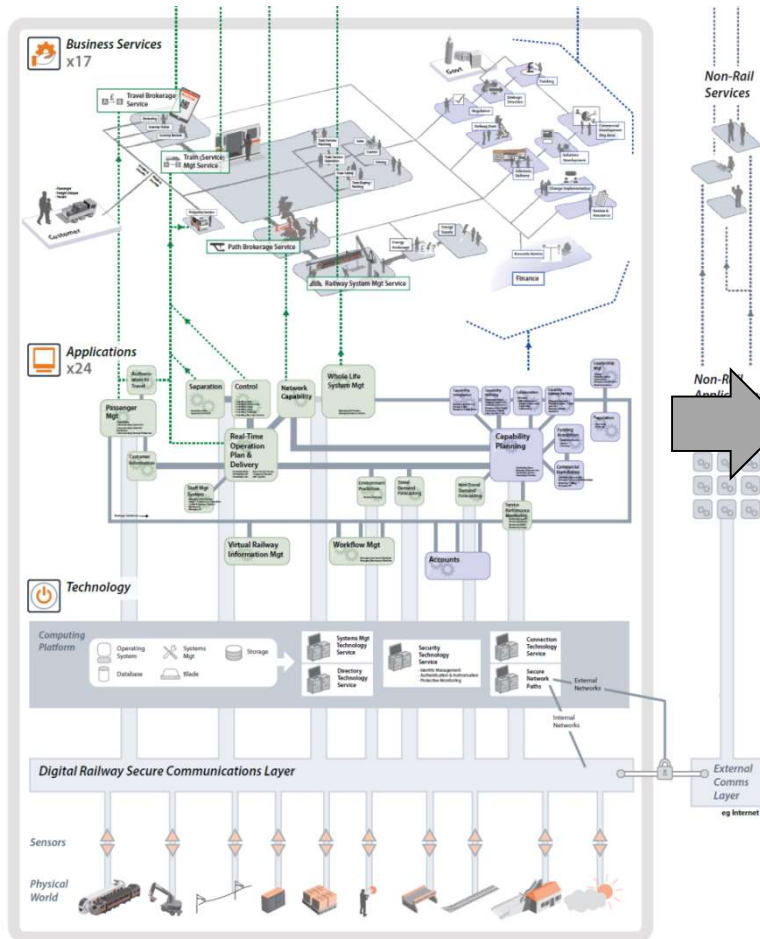




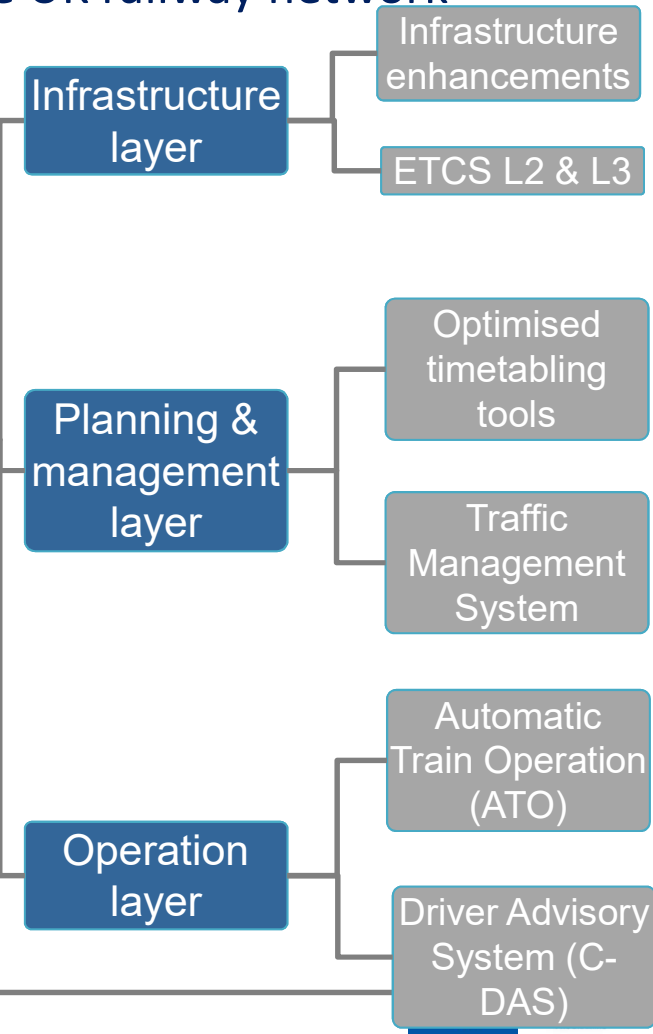
# Similar C4R innovations in UK National development programme “DR”



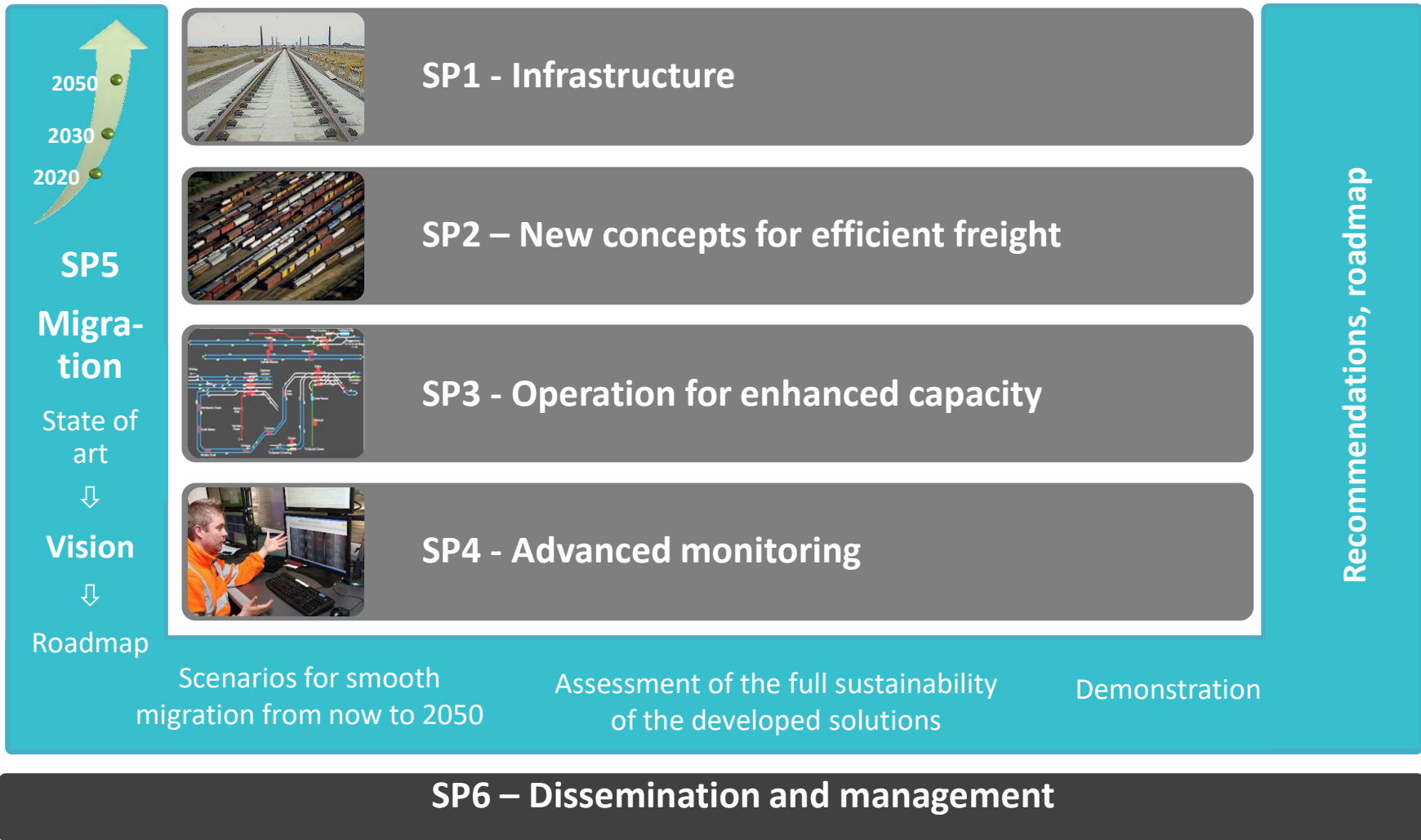
The Digital Railway (DR) is a UK National programme which will deploy infrastructure enhancements and advanced technologies to increase capacity, improve connectivity and reliability of the UK railway network



**DR solutions**



# Project structure breakdown



# Project structure breakdown





Capacity for Rail

SP1 Infrastructure



# *SP1-Scope and main objectives*



To develop new concepts for railway track of the future, in view of potential application for mixed traffic, but also very high speed.

SP1 is focusing on:

- Developing low maintenance and modular designs of slab tracks for mixed traffic
- Understanding and solving the current obstacles to very high speed traffic (over 350 km/h).
- Analysing the failure mode and developing breakthrough innovative concepts to improve the reliability of switches and crossings.

# SP1-Scope and main objectives



- ✓ *“New track concept generation, selection & design - Slab track concept”*  
*Amador Quintana – INECO*
- ✓ *“Effect of very high speed on track and bridges”*  
*Erica Calatozzo, SYSTRA*
- ✓ *“New approach to maintenance based on advanced sensors and monitoring technologies in S&C”*  
*Edd Stewart, University of Birmingham*
- ✓ *“Understanding root causes of S&C defects and assessing effective remedies”*  
*Yann Bezin, University of Huddersfield*



Capacity for Rail

## SP4 Advanced monitoring



## *SP4-Scope and main objectives*



The objective of SP4 is to develop new concepts for railway structural and operational monitoring, in order to enhance the availability of the track, combined with automated maintenance forecasts and a prediction of the structural lifetime.



# SP4-Scope and main objectives



- Monitoring strategies
  - Monitoring technologies and sensors
  - Implementation in new structures
  - Migration of innovative technologies to existing structures
- 
- ✓ *“Advanced Monitoring and diagnostics of track infrastructure for predictive track maintenance”*  
*Gunnar Baumann, DB*
  - ✓ *“Sustainable strategies for monitoring in slab track”*  
*Javier Morales, CEMOSA*



Capacity for Rail

SP5 System assessment and migration to 2030/2050



# SP5-Scope and main objectives



SP5 is drawing the common vision for an affordable, adaptable, automated, resilient and high-capacity railway.

SP5 is developing a 'roadmap' to pave the way for the target system.

The SP ensures a whole system approach across the SPs to identify the visions, future requirements and boundaries:

- By identifying the necessary steps
- Developing the migration scenarios
- Improving the tools for assessment
- Assessing of technologies/scenarios
- Identifying the optimal capacity enhancement scenarios
- Performing demonstrations

✓ *“Migration strategies for innovative track solutions 2030/2050”*

*Burchard Ripke, DB*



Capacity for Rail

SP2 New concepts for efficient freight systems



## *SP2-Scope and main objectives*



### Develop the rail freight system of the future

- Describe today's and future demand for rail freight.
- Analyse existing/future customer requirements for different goods segments.
- Describe scenarios up to 2030/2050.
- Specify requirements for an efficient rail freight system 2030/2050.
- Conceptually design the rail freight vehicles of the future to enhance capacity.
- Conceptually design transshipment technologies of the future.
- To produce a catalogue on rail freight systems to contribute to the EC goals.
- To suggest standards for fully integrated rail freight systems.



Capacity for Rail

## SP3 Operations for enhanced capacity

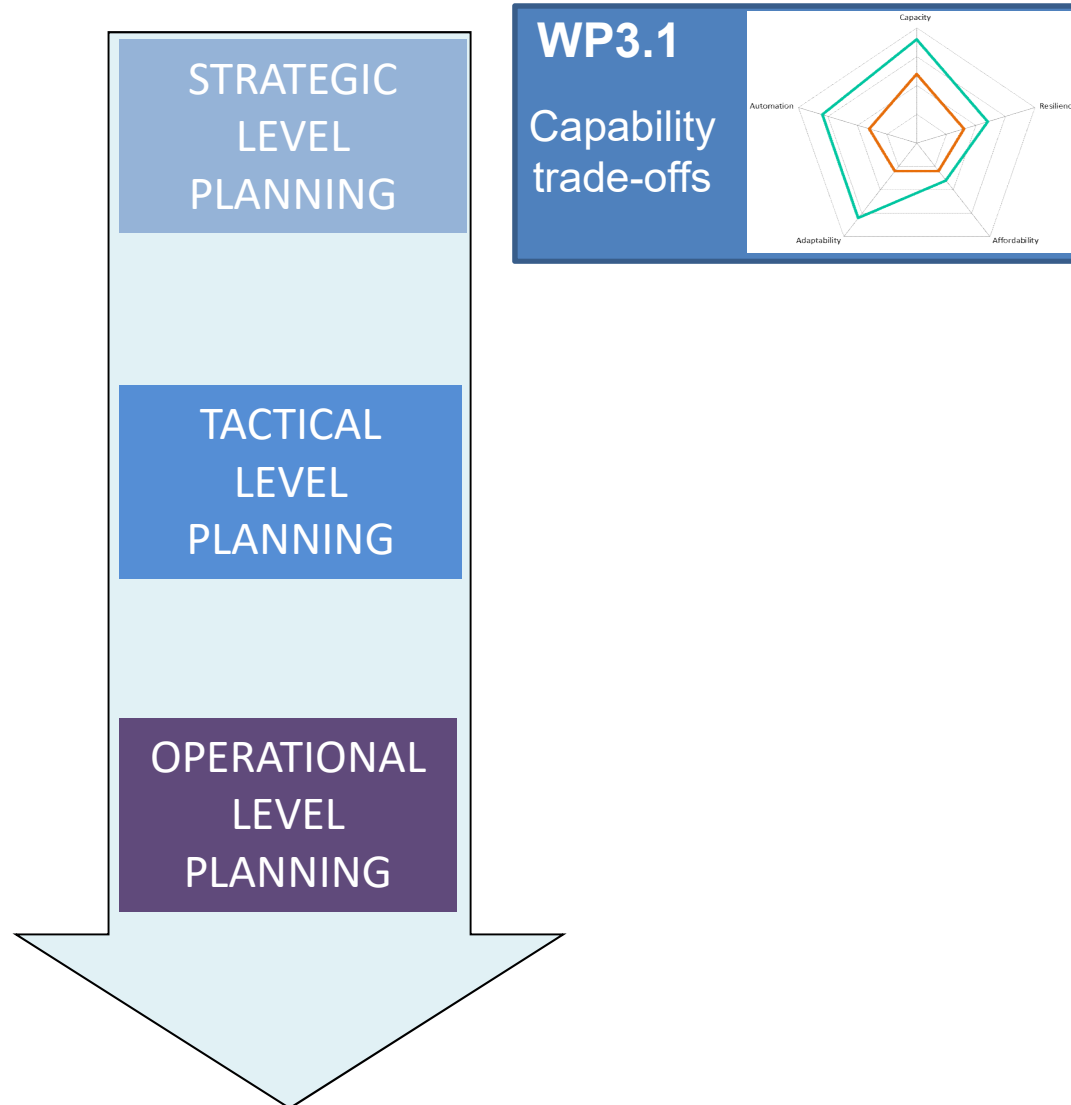


# SP3-Scope and main objectives

Developing a set of tools and guidelines supporting decisions across the entire 'operational process' chain from strategic planning to real-time traffic management.

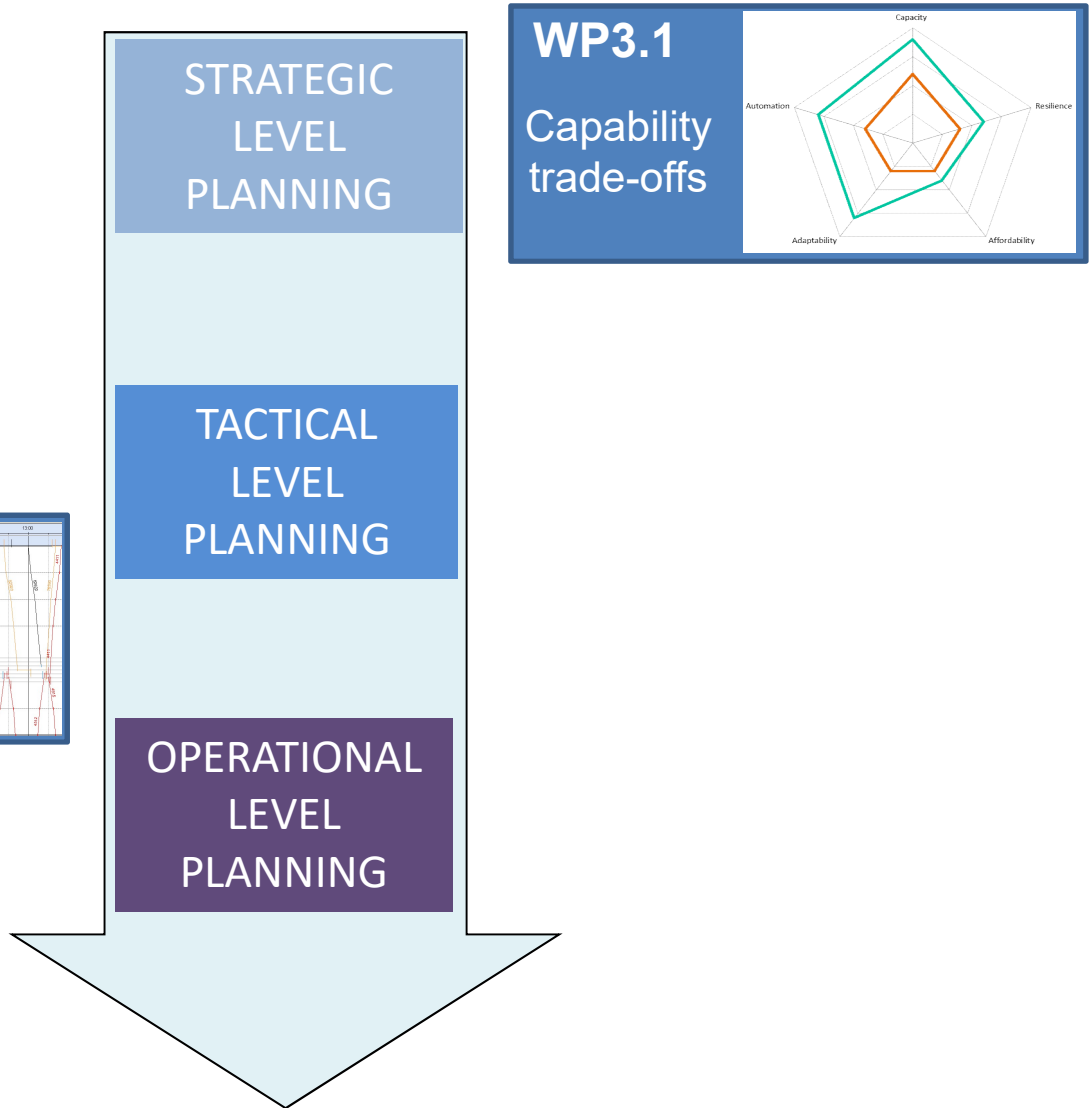


# SP3-Structure and WP

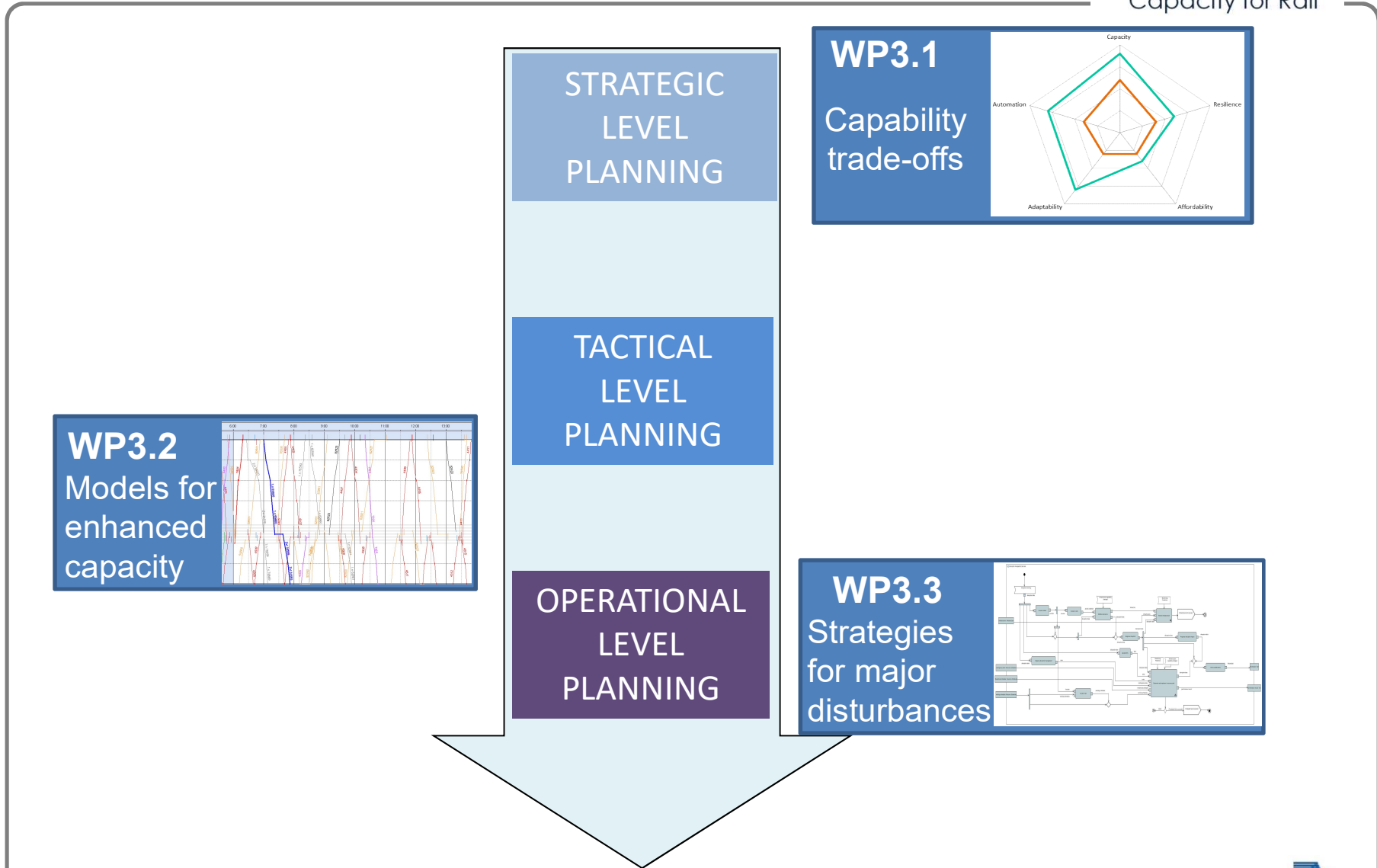




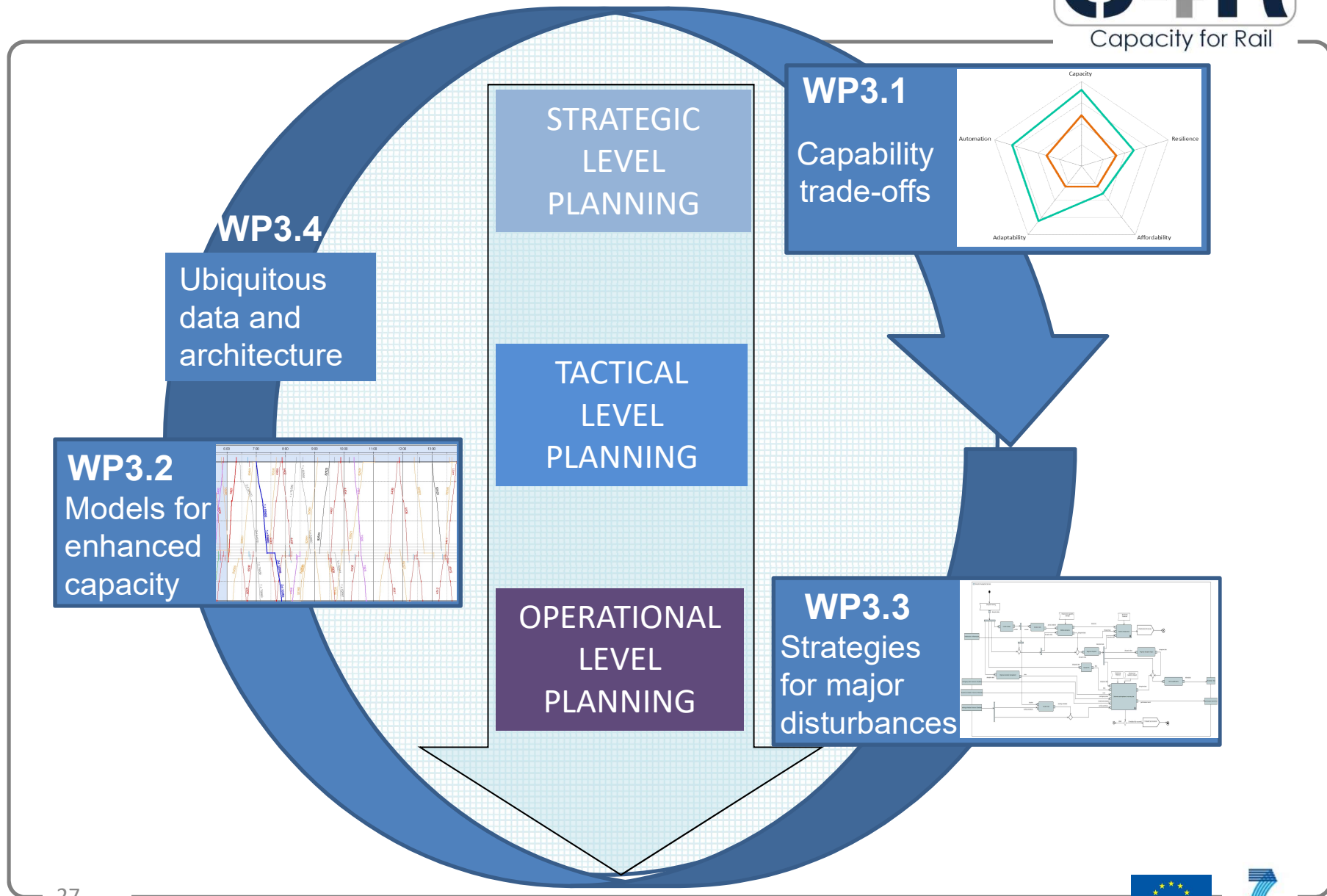
# SP3-Structure and WP



# SP3-Structure and WP



# SP3-Structure and WP



# SP3 - Vision for European operational concepts



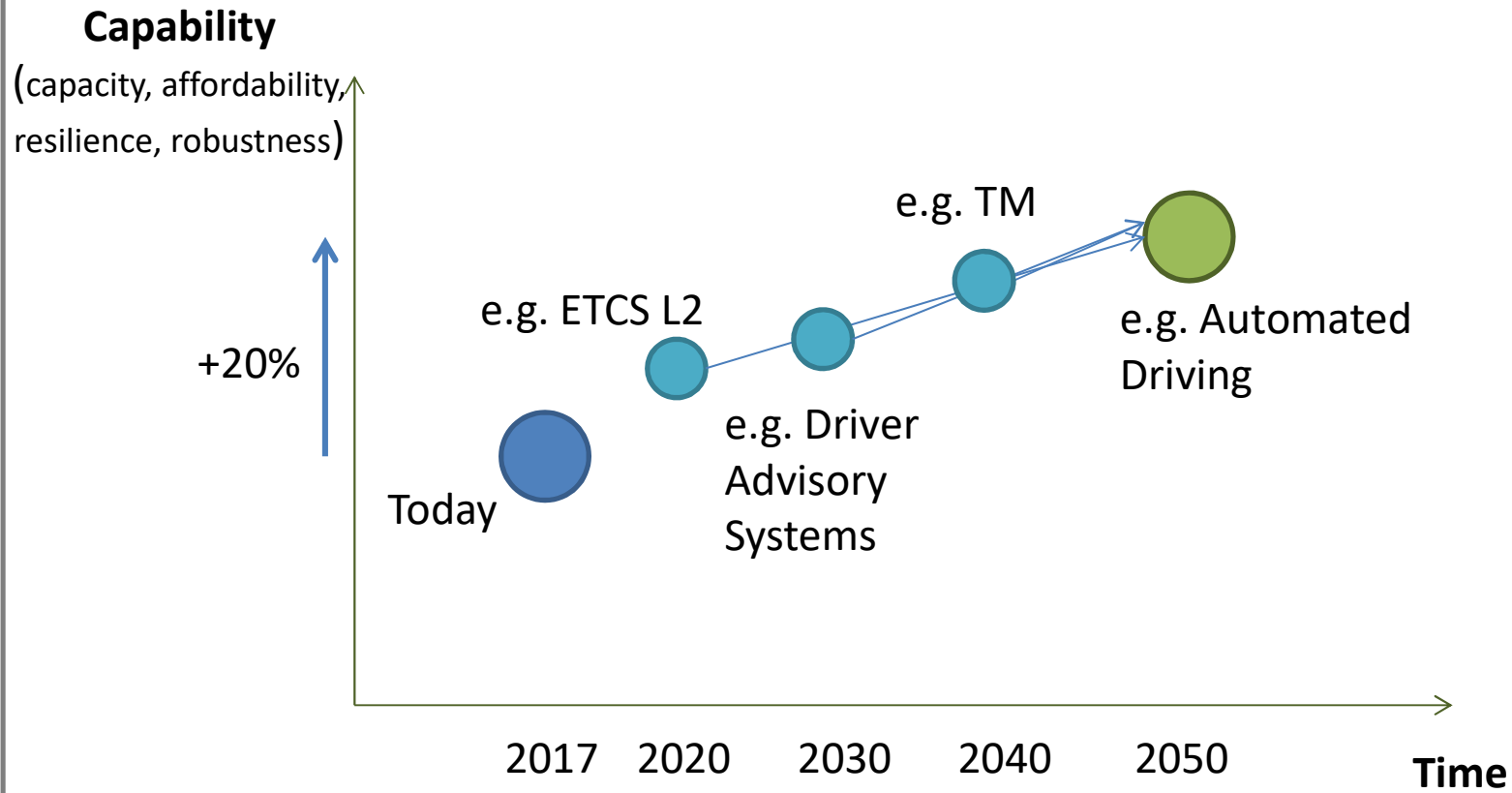
Tools for strategic, tactical and operational planning are provided together with recommendations to pave the way for an improved process for managing disruptions in European railways



# Roadmap of levels of automation to increase railway capabilities



The roadmap to increase automation is given together with the architecture layout to enable data communication among the different systems, traffic control centre, customers and other modes of transport.





# Questions

