



Systems of Systems in Transport and Logistics

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Distributed reliable and efficient management



Operations control

- From local to national to European wide***
- From point to point to the integrated journey***

Key R & I challenges

- Decision structure and system architecture***
- Real time monitoring, fault detection & mitigation***
- Adaptation for system growth***
- Humans in the loop***
- Trust in large distributed systems***

Network Capacity



Meeting the capacity requirements of the 2011 Transport White Paper is the greatest technical challenge for the railway sector.

Capacity is restricted by signalling, train control, switches and system integrity.

These issues are addressed by having wide train separation.

Running trains close coupled could double capacity

An affordable high capacity railway



An affordable high capacity railway



Requirements for running close coupled trains

- ***Multiple low cost sensor systems on trains and infrastructure to ensure track integrity***
- ***Predictive models for infrastructure degradation***
- ***Real time advanced analytics and automated train control for fast response***
- ***Fast acting switch systems***

Engineering support for the Railway Network



Privatisation separated responsibility for infrastructure and train operation resulting in failure at the systems interface



Engineering support for the Railway Network



The problem of rolling contact fatigue due to the contact conditions at the wheel rail interface was reduced through the development of predictive models to determine precisely the likely rail break locations and cost mitigation strategies. Many more tools are required

Needs:

- ***System models at strategic (route) and local (high resolution) levels for engineering, maintenance and investment decisions***

Shift2Rail Master Plan – Energy Systems



- ***Smart metering for a railway distributed energy resource management system, in order to finely manage the different energy flows within the railway system as a whole***
- ***Smart energy storage systems***
- ***All solutions will have to guarantee the quality of energy, solve EMC issues and adhere to specific railway standards and regulations.***

A single European transport system



The future for railway transport is as the backbone of a single cross modal transport system

- ***Door to door and producer to end user***
 - ***Sharing data and information systems with***
 - ***All transport modes***
 - ***Customers and society***
- And improved safety and security***

Co-modal Infrastructure Roadmap



Towards one cohesive programme on infrastructure innovation over all modes

By 2030 R & I should enable an improvement of 50% in infrastructure performance versus cost against a 2010 baseline - as well as enable seamless door-to-door services for passengers and freight

The 8 guiding goals are

- 1. optimal capacity and availability of transport infrastructure**
- 2. optimal inter-connectivity between the modes**
- 3. optimal cross-modal investment decisions**
- 4. enhanced safety and security**
- 5. reduced impact on environment, spatial quality and society**
- 6. fully shared data/information base across the modes**
- 7. interoperable interface, open to the infrastructure user**
- 8. affordable in terms of Total Cost of Ownership (TCO)**