



GreenRail: energy efficiency as a benefit for all stakeholders

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Environment of traction energy cost

- Traction is the main energy consumer in railway operation (SNCB Holding: 80%)
- Huge consumption (SNCF: 10 billion of Kwh)
- Invoicing issue of traction energy cost:
 - Energy is bought by Infrastructure Managers
 - Energy is consumed by Railway Undertakings
- Introduction of energy meters allows:
 - Fair invoicing based on accurate metering
 - Traction energy savings benefit to both IM and RU



Key drivers of traction energy cost

- Traction energy cost has two components:
 - Cost of power (generally averaged on 15 min): Kw
 - Cost of energy: Kwh
- Some key drivers influence energy cost:
 - Driving style of train driver
 - Amount of energy recovered
 - Dynamic time schedule assigned to train
 - Occurrence of conflicts causing unforeseen stops
- An efficient system to save energy cost should address all these key drivers, not only one



Saving levers available

- On-board driving assistance system suggesting ecodriving commands
- Trackside traffic coordination system:
 - Interfacing with Automatic Train Supervision system to fetch dynamic time schedule (target points)
 - Interfacing with signaling system to detect and resolve conflicts
- Trackside scheduling assistant optimizing seasonal timetable:
 - Improving braking energy recovery
 - Optimizing distribution of time buffers to support ecodriving

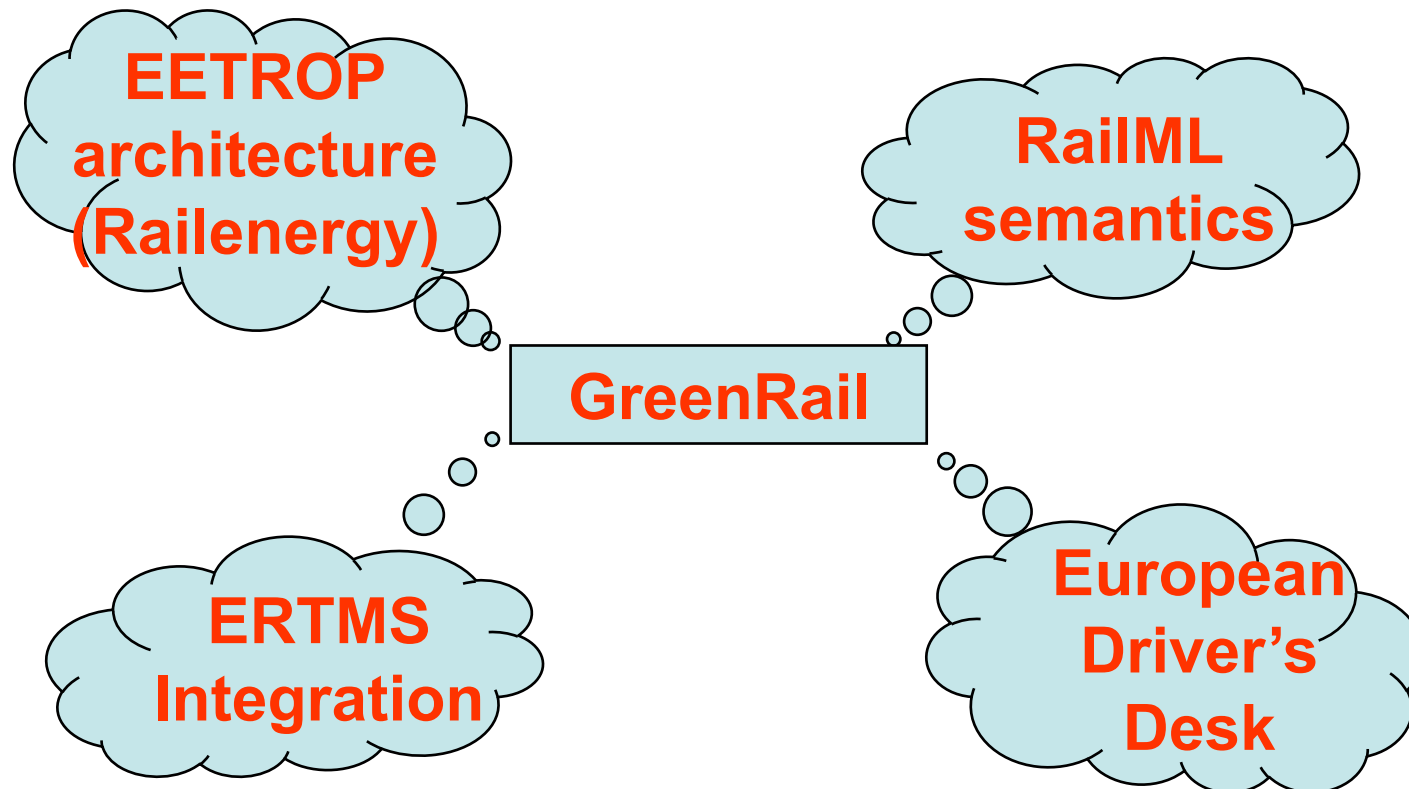


GreenRail System

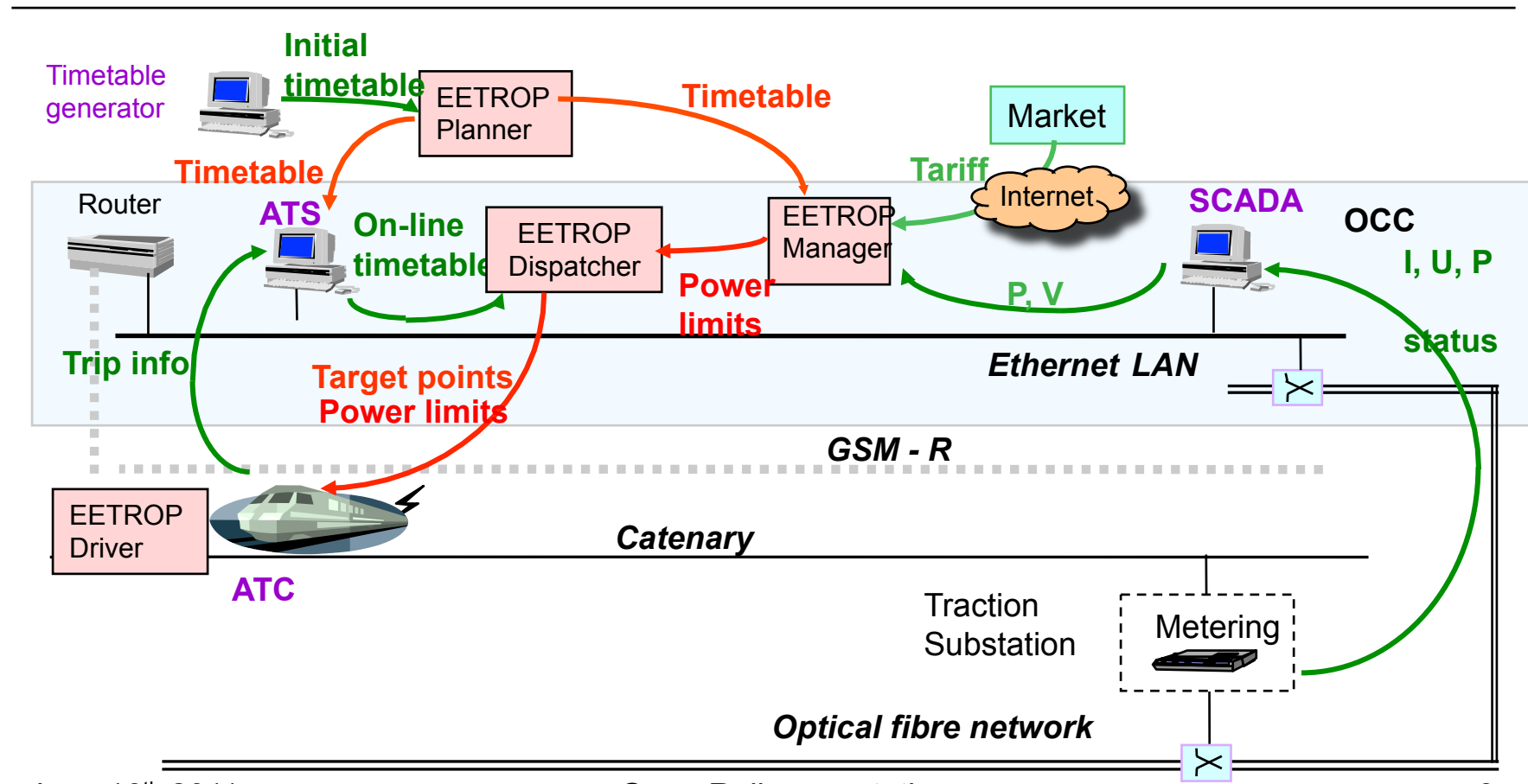
- GreenRail is a comprehensive system featuring all defined saving levers
- GreenRail aims easy integration in modern control systems:
 - With on-board systems of Railway Undertakings
 - With trackside systems of Infrastructure Managers
- GreenRail follows recognized European railways standards



GreenRail standards



EETROP architecture (Railenergy)





GreenRail project

- GreenRail is a research project involving three poles providing the largest scope of skills:

Operator:
expertise of
needs,
testing support

GreenRail

University:
scientific
power

Industry:
R & D , train control
ERTMS, signaling



GreenRail team

The logo for Infrabel, featuring a blue stylized map of Belgium above the word "Infrabel" in a blue, sans-serif font.

Operating pole

GreenRail

Scientific pole

The logo for fucam, featuring the word "fucam" in a blue, sans-serif font with a stylized orange and yellow graphic element to the left. Below the word is the tagline "We create the future" in a smaller, blue, sans-serif font.The logo for POLYTECH.MONS, featuring a blue stylized graphic of three stacked blocks above the text "POLYTECH.MONS" in a blue, sans-serif font.The logo for Multitel, featuring a stylized blue and white 'M' shape above the word "Multitel" in a blue, sans-serif font. Below the word is the text "A.S.B.L. fondée par la F.P.M." in a very small font.

Industrial pole

The logo for ALSTOM, featuring the word "ALSTOM" in a bold, blue, sans-serif font with a red circle around the 'O'.The logo for deciZium, featuring the word "deciZium" in a blue, sans-serif font with a stylized yellow and blue 'Z' in the middle.The logo for logiplus, featuring the word "logiplus" in a blue, sans-serif font with a red stylized graphic element above the 'i'.

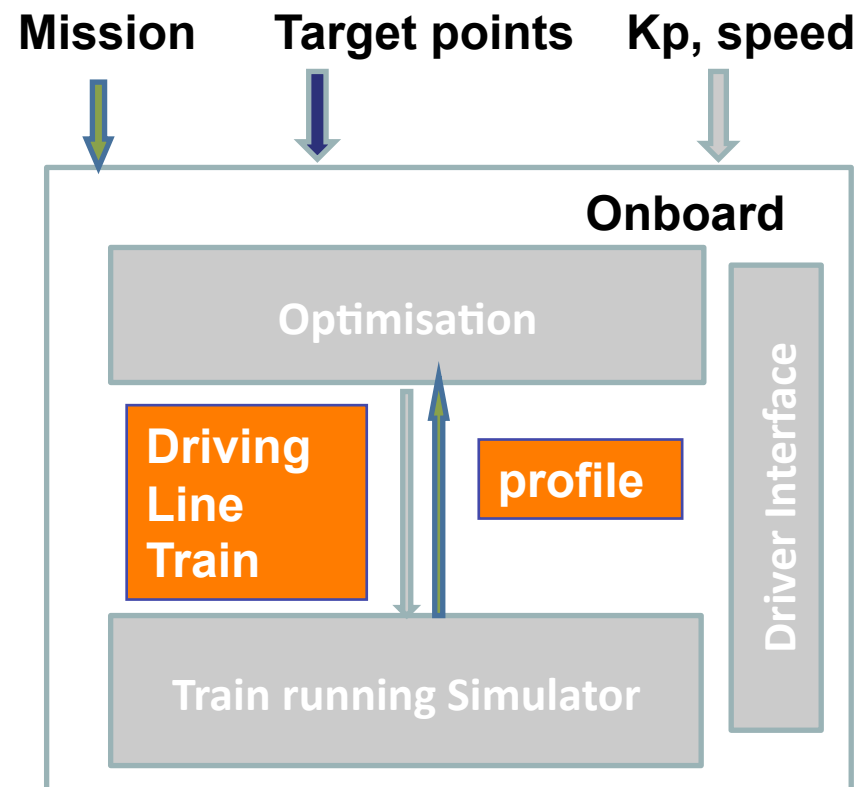


GreenRail technology

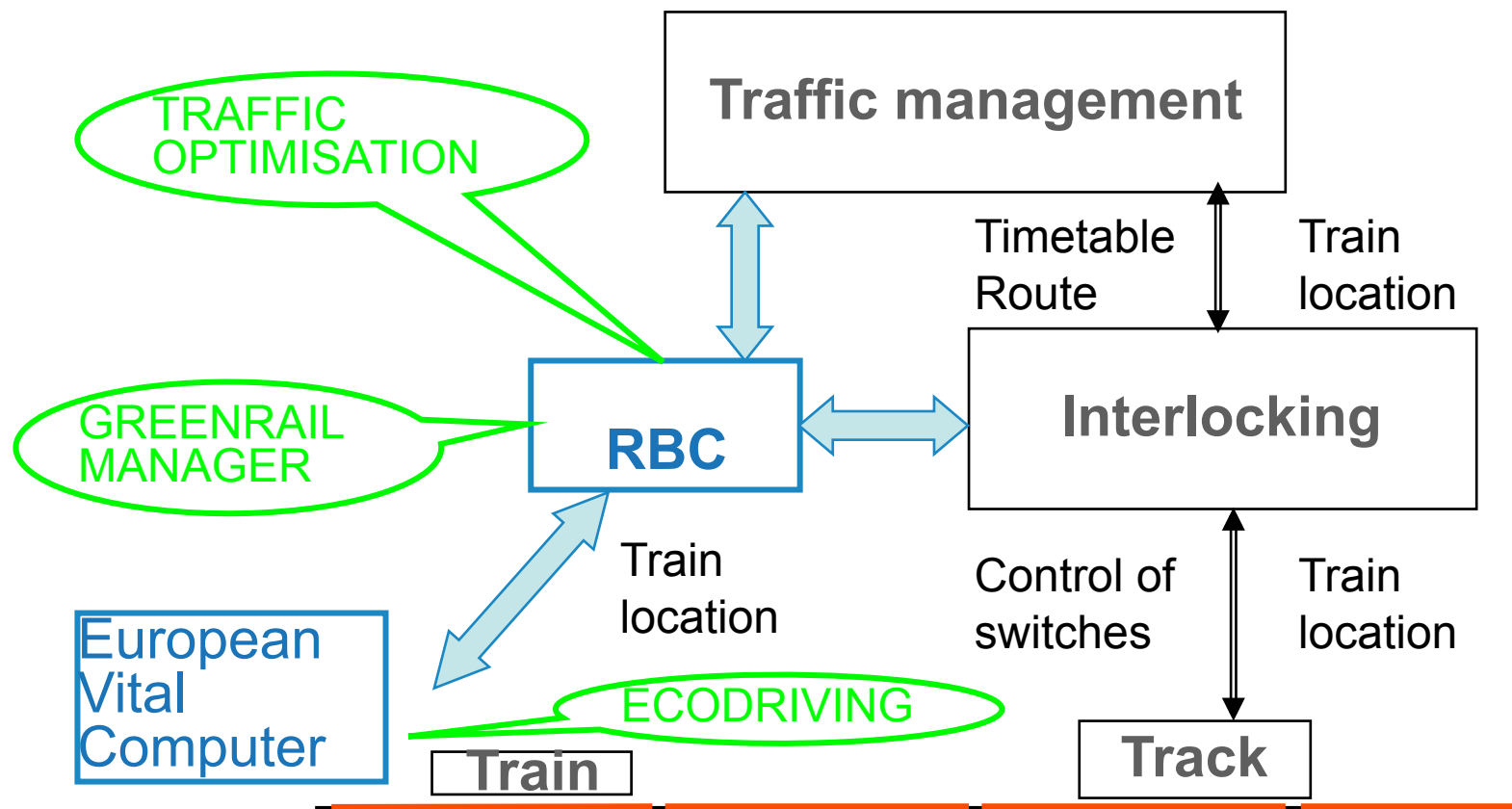
- GreenRail involves advanced, accurate and efficient tools:
 - Train speed profile always computed with fine and fast iterative model
 - Multi-train simulation based on same model
 - Optimizer uses fast meta-heuristic method:
 - High level of optimization
 - Real time adjustment during mission after perturbation

Ecodriving architecture

- Real time operation based on dynamic data from Greenrail Manager
- Optimized speed profile computed by interaction optimizer / simulator



Integration of GreenRail with ERTMS





GreenRail implementation

- GreenRail project is sponsored by Wallonia Region (Plan Marshall)
- Present program 2009 – 2011 includes:
 - State of the art
 - Specification of solutions
 - Development of models and algorithms
 - Field testing on real line
- Extension of the system envisaged in 2012 - 2013



GreenRail benefits

- First comparison of ecodriving algorithm with real train speed record: energy saving from time margin is doubled (reference is tight run)
- Optimization of seasonal timetable may reduce averaged peak power by 15 to 20 %
- Benefits for Railway Undertakings
 - Decreasing cost of train circulation
 - Increased punctuality
- Benefits for Infrastructure Managers
 - Decrease of Power Utility Invoice
 - Better use of Traction Power Infrastructure



Thank you for your attention

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