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• “Optimal Networks for Train Integration Management across Europe”
• European project, Seventh Framework Programme
• Start: Nov. 2011 (3 years)
• Mission:
  • Increase capacity and decrease delays for passengers and freight.
• Objectives:
  • Apply the results of academic based research in the area of timetable planning and real-time traffic management for railways.
  • Understand the nature of delay initiation and propagation.
  • Provide real-world case studies and demonstrations that will allow research organization to test their approaches.
Partners

• 19 Partners:
  • 5 European railway undertakings:
    - NetworkRail
    - RFI
    - DB
    - SNCF
    - TRAFIKVERKET
  • 5 Industrials:
    - D‘APPOLONIA
    - AnsaldoSTS
    - NTT DATA
    - Graffica
    - transrail
  • 9 Research organizations:
On-Time

• WP1: User and technical requirement elicitation and validation
• WP2: Examination of existing approaches and specification of innovations
  ⇒ High level principles (ex: how to define the “quality of service”)
  ⇒ Select business scenarios
• WP3: Development of robust and resilient timetables
• WP4: Methods for real-time traffic management (perturbations)
• WP5: Operation management of large scale disruptions
• WP6: Driver advisory systems
• WP7: Process and information architecture
• WP8: Demonstration
• WP9: Dissemination, training and exploitation of knowledge
• WP10: Project management
On-Time
Business Scenarios

• Selected infrastructures:
  • Single track freight line on the Iron ore line (Sweden)
  • 2 Complex nodes: Gonesse (France) and Bologna (Italy)
  • Mixed traffic on multi-line track on ECML (East Coast Mainline, GB)
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- WP1: User and technical requirement elicitation and validation
- WP2: Examination of existing approaches and specification of innovations
- **WP3: Development of robust and resilient timetables**
  - Robust: “able to cope with statistical variations that occur every day”
  - Resilient: “easily recoverable in case of incidents or disturbances”
- WP4: Methods for real-time traffic management (perturbations)
- WP5: Operation management of large scale disruptions
- WP6: Driver advisory systems
- WP7: Process and information architecture
- WP8: Demonstration
- WP9: Dissemination, training and exploitation of knowledge
- WP10: Project management
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• WP1: User and technical requirement elicitation and validation
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• WP3: Development of robust and resilient timetables
• WP4: Methods for real-time traffic management (perturbations)
  • Reduce delay propagation by:
    ⇒ varying the order of trains via messages to the signaling system
    ⇒ varying the speed of trains via communication with drivers
    ⇒ using minor re-routing (not involving changes to the scheduled stopping points)
• WP5: Operation management of large scale disruptions
• WP6: Driver advisory systems
• WP7: Process and information architecture
• WP8: Demonstration
• WP9: Dissemination, training and exploitation of knowledge
• WP10: Project management
On-Time

- WP1: User and technical requirement elicitation and validation
- WP2: Examination of existing approaches and specification of innovations
- WP3: Development of robust and resilient timetables
- WP4: Methods for real-time traffic management (perturbations)
- **WP5: Operation management of large scale disruptions**
  - Large disruption: “perturbations that need a change to the way in which resources were originally planned” (train cancelation, rolling stock, crew)
  - Design an optimal human supervisory control of the recovery process
- WP6: Driver advisory systems
- WP7: Process and information architecture
- WP8: Demonstration
- WP9: Dissemination, training and exploitation of knowledge
- WP10: Project management
On-Time

- WP1: User and technical requirement elicitation and validation
- WP2: Examination of existing approaches and specification of innovations
- WP3: Development of robust and resilient timetables
- WP4: Methods for real-time traffic management (perturbations)
- WP5: Operation management of large scale disruptions
- WP6: Driver advisory systems
  - Speed indication to the driver: optimal train path, energy consumption
  - Propose a standard DAS interface between control centers and rolling stock
- WP7: Process and information architecture
- WP8: Demonstration
- WP9: Dissemination, training and exploitation of knowledge
- WP10: Project management
On-Time

• WP1: User and technical requirement elicitation and validation
• WP2: Examination of existing approaches and specification of innovations
• WP3: Development of robust and resilient timetables
• WP4: Methods for real-time traffic management (perturbations)
• WP5: Operation management of large scale disruptions
• WP6: Driver advisory systems
• WP7: Process and information architecture
  => define a standardized network interface between traffic control systems and algorithms
• WP8: Demonstration
• WP9: Dissemination, training and exploitation of knowledge
• WP10: Project management
On-Time
Standardized interface

1. Test Algorithms
   Network Open interface
   Hermes Simulator

2. Test Algorithms
   Network Open interface
   Traffic Control System

3. Validated Algorithm
   Network Open interface
   Any Traffic Control System

=> 3 steps:
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Standardized interface

=> 3 steps:

1. Test Algorithms
2. Test Algorithms
3. Validated Algorithm

Network Open interface

Network Open interface

Network Open interface

Hermes Simulator

Traffic Control System

Any Traffic Control System

Use of RailML format for data exchanges
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RailML

• Use RailML version 2.2 for:
  • infrastructure data
  • timetable data
  • rolling stock data
• Schema under development for interlocking data.
• RailML is used for static and dynamic data.
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Data sources

- Infrastructure managers
- Some conversions are necessary to model infrastructure data:
  - Sweden uses **RailSys** simulator:
    - RailSys data => railML
  - UK uses **Graffica** simulator:
    - text based format => railML
  - Netherlands uses internal database:
    - InfraAtlas => OpenTrack data => railML 1.0 => Converter (TUD) => railML 2.2
  - France / Italy formats not converted yet.
- Same problem with timetable data:
  - Compatibility of **timetable** and **infrastructure** data not always given.
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Data sources

- Size of data might become an issue for real-time applications
- East coast main line:
  - Infrastructure (9MB):
    - 2751 tracks (microscopically defined, from switch to switch)
    - 1628 switches
    - 2978 signals
    - 4772 track circuit borders
  - Interlocking (12 MB):
    - 3591 routes defined in interlocking
  - Timetable (42 MB):
    - 1448 trains
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Conclusion

• For the purpose of traffic management, most of the data is available in RailML 2.2:
  • microscopic tracks are definitely appropriate
  • routes can be defined in timetable in detailed way

• Most critical open issue: Interlocking
  • working group: signaling industry, RailML consortium, ON-TIME partners
  • three meetings since November 2011
  • a draft version of RailML interlocking is implemented in HERMES Simulator and optimization tools
Thank you for your attention

http://www.ontime-project.eu/

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