French institute of science and technology for transport, spatial planning, development and networks

RailML use in the project

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IFSTTAR

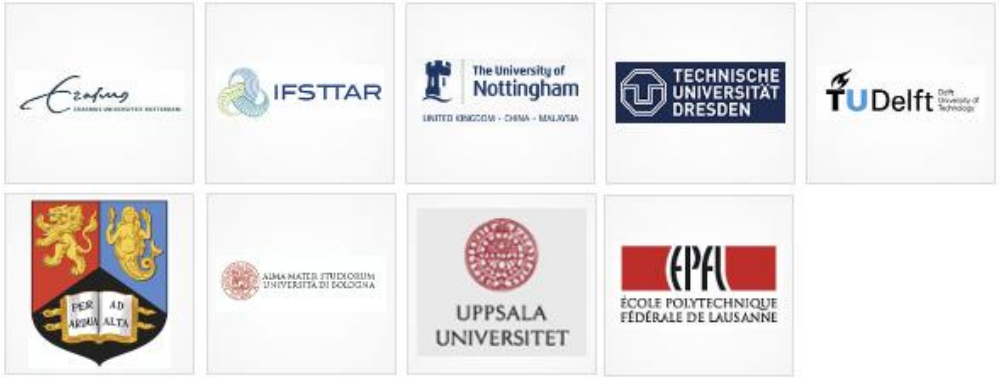
- “Optimal Networks for Train Integration Management across Europe”
- European project, Seventh Framework Programme
- Start: Nov. 2011 (3 years)
- Mission:
  - Increase **capacity** and decrease **delays** for passengers and freight.
- Objectives:
  - **Apply the results of academic based research** in the area of **timetable planning** and **real-time traffic managemen**t 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:

  - 5 Industrials:

  - 9 Research organizations:



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- **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

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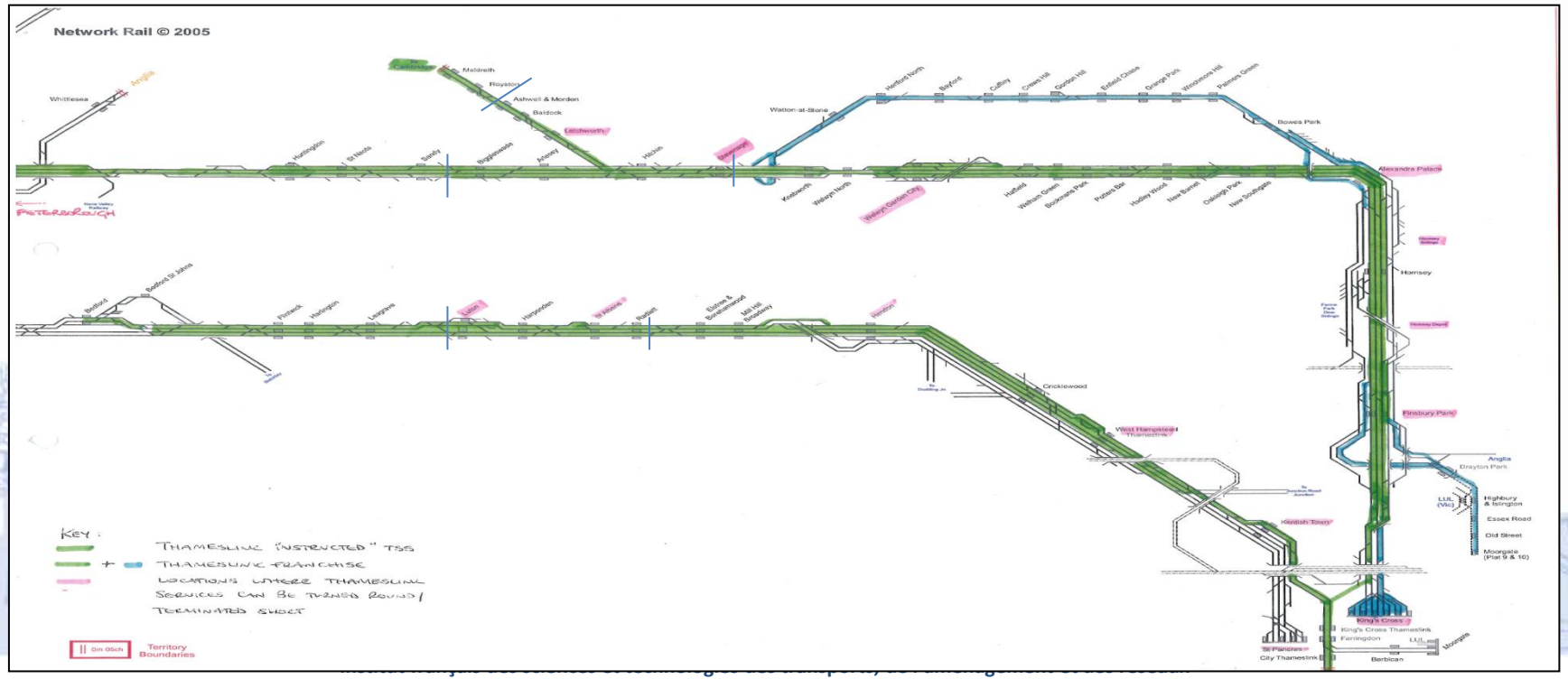
Business Scenarios

- 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
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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
- **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
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- WP10: Project management

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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
- 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

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- WP1: User and technical requirement elicitation and validation
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- 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

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- WP1: User and technical requirement elicitation and validation
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- **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

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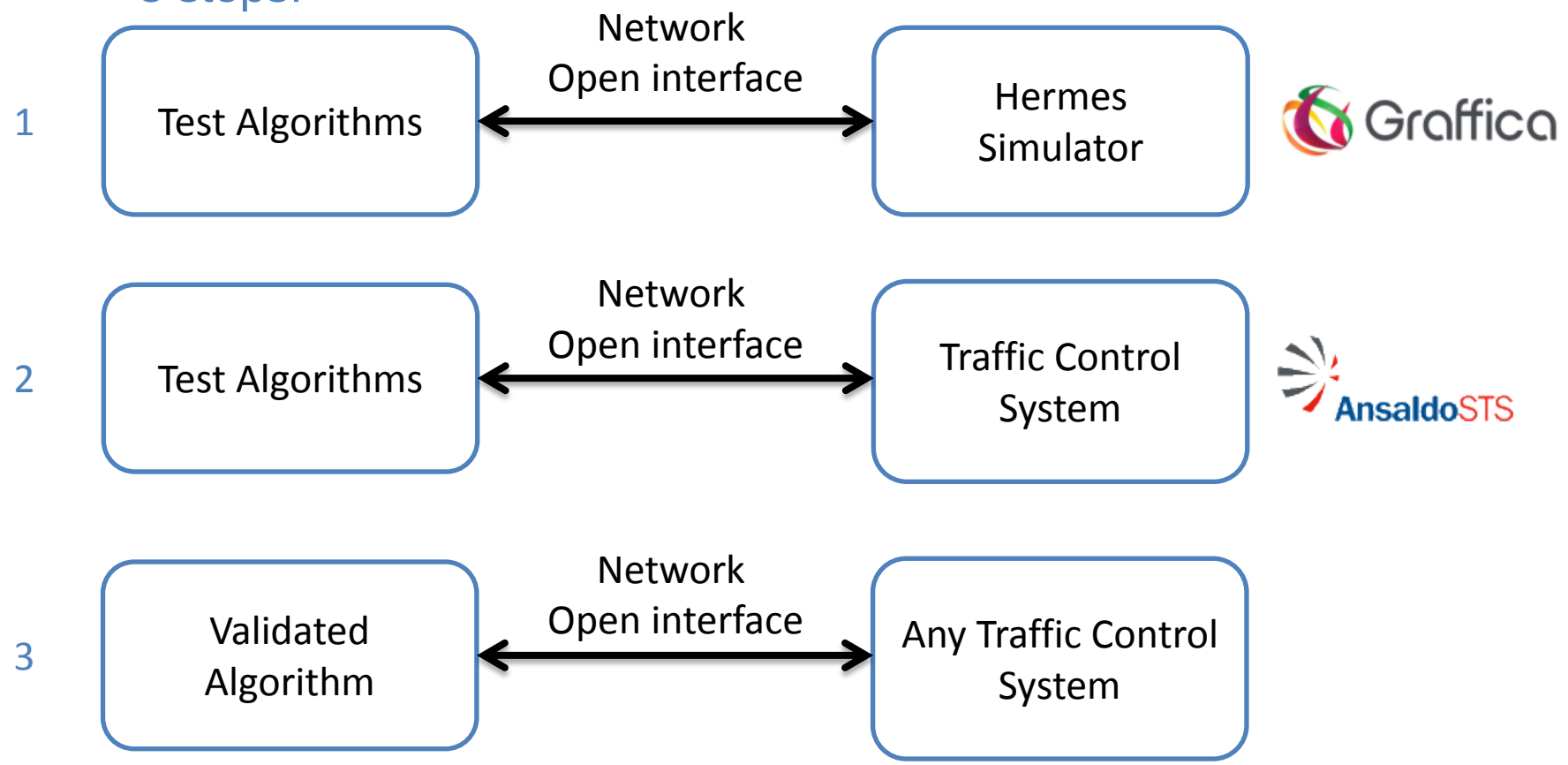
Standardized interface

=> 3 steps:



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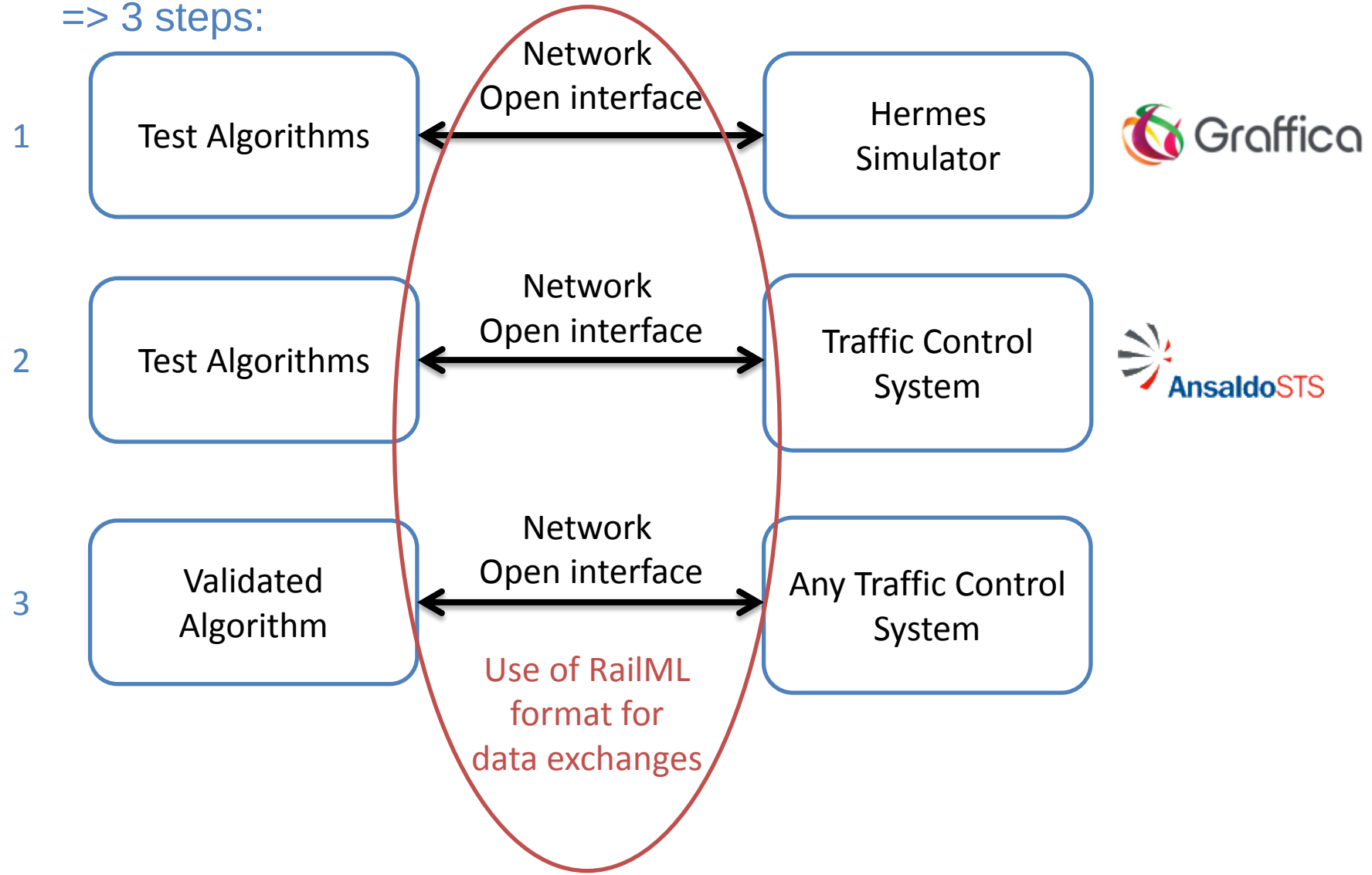
Standardized interface

=> 3 steps:



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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

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Thank you for your attention

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