OPENTRACK: Simulation of complex nodes
Case Studies in Italy

Zurich, 21st January 2010

LABORATORIO DI INGEGNERIA FERROVIARIA E TRAFFICO

University of Trieste

About Us

- Important railway university in Italy
- OT Users since 2004
- Spin-off since 2007
- Cloose Cooperation with RFI

- FOCUS:
  - Railway traffic studies
  - Simulation of large networks
  - Software development

References

- Stochatic micro-simulation in large nodes

  - Roma, Firenze, Torino, Milano, Venezia, Napoli...

- Infrastructure improvement evaluation

  - Roma - Pescara, Venezia, Roma, Milano, Corridor X...

- Functional design and capacity evaluation

  - Ferrocarril Transandino (ARG-CHI)

- Temporary timetables during maintenance or improvement works

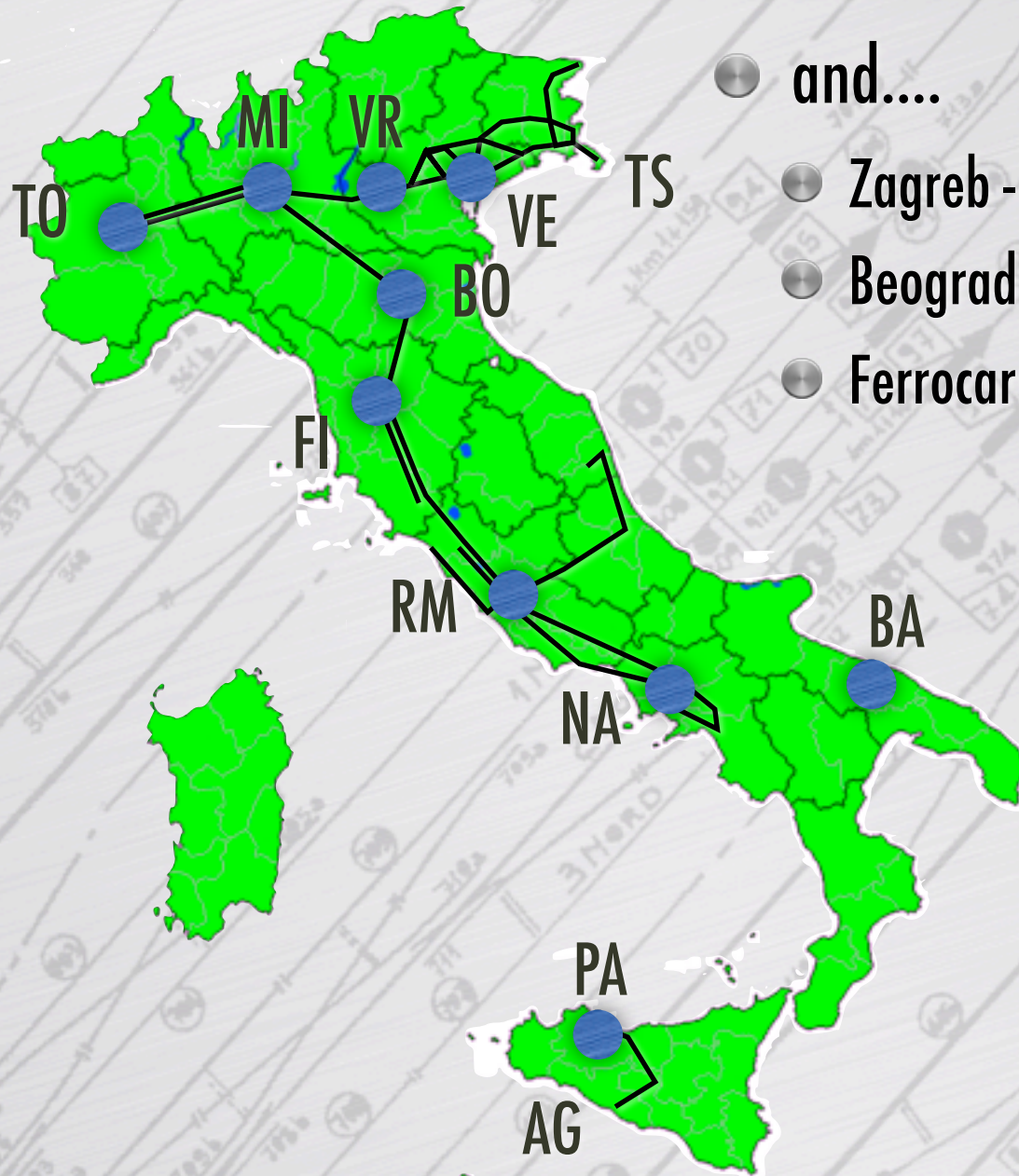 - Bologna - Firenze, Salerno, Milano - Treviglio, Roma, Palermo...

References

TRENO

Planned timetable	Train traffic data

Planned

Line Layout	Station Layout
Calendar	Rolling stock
Timetable Graph	

Delay analysis

Check Panel	Distributions
Network Analyzer	Corridor view
Timetable Graph	

Timetable

Delay Distributions

OPEN TRACK

- Timetable validation (2008/09):
  - New HSL Milano - Bologna
  - New services
  - Impact within the nodes ?

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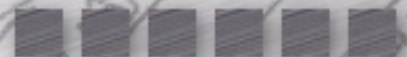 - New services
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Milano

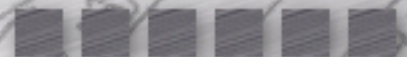# A Case Study: Milano

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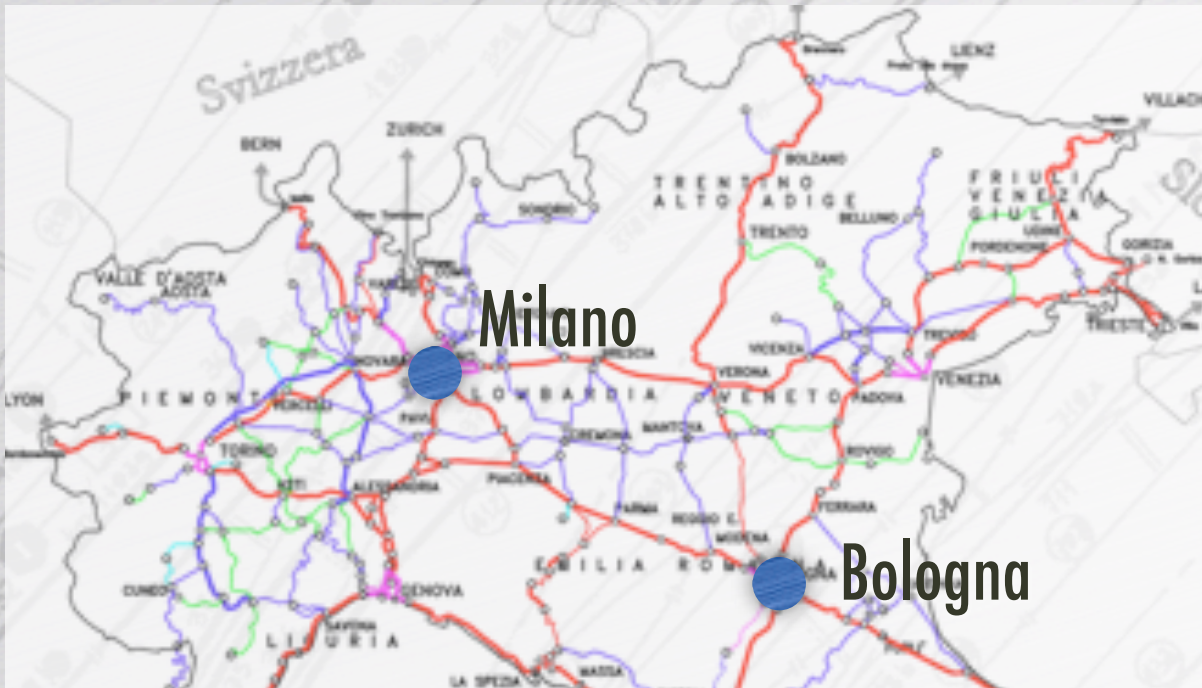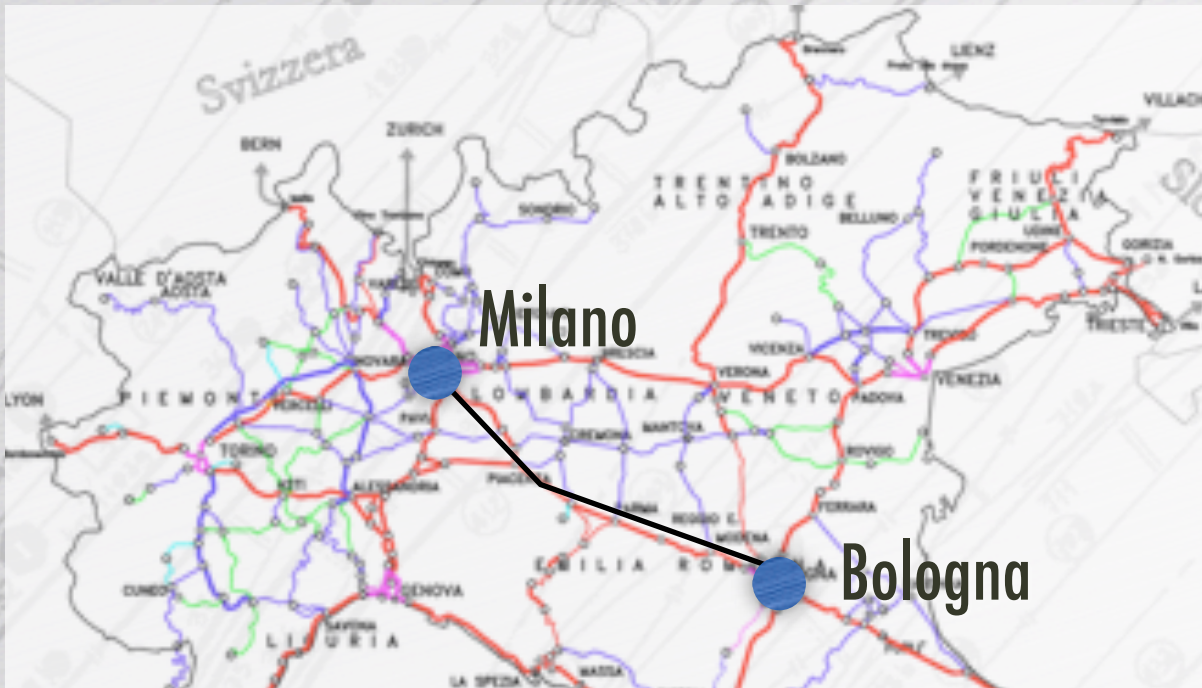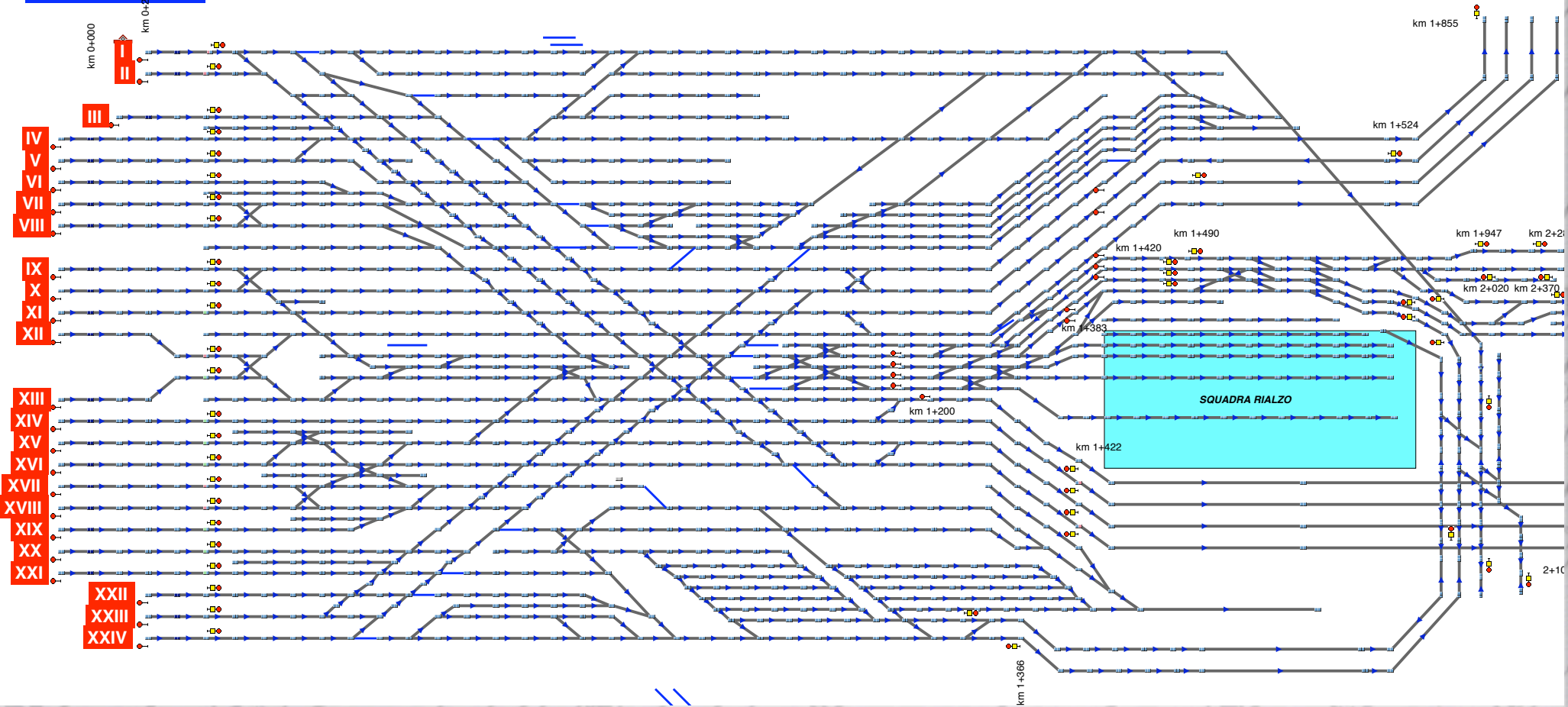 - New services
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Milano: Simulation area

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- **250 Stations and stops**
- **5000 Signals**
- **13000 Itineraries**
- **2700 km track**
- **40.000 vertexes**
- **800 trains**
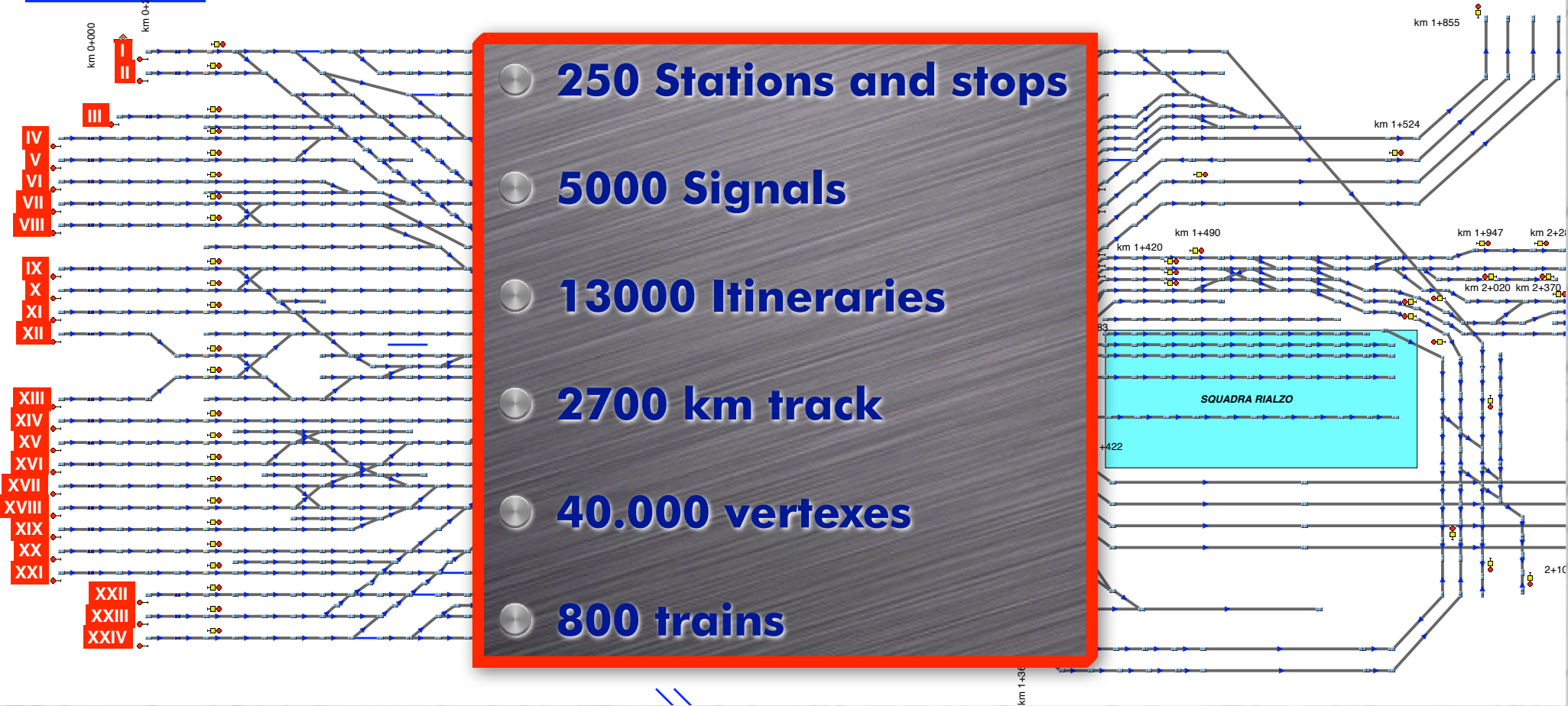
Delay Analysis and Model Validation

- Analysis of 100 days
- Point out critical sections and trains
- Check corresponding timetable graph
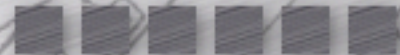
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- Initial delays
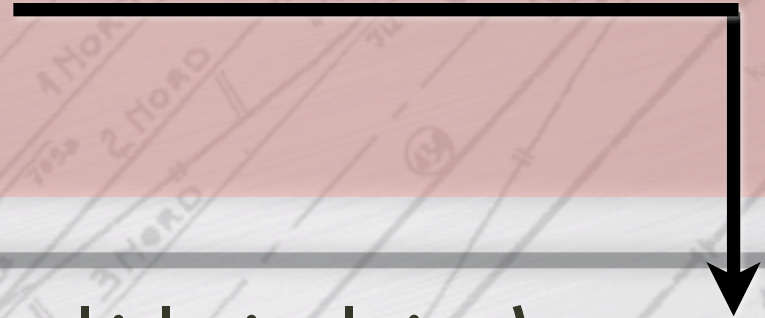- Stop time variability
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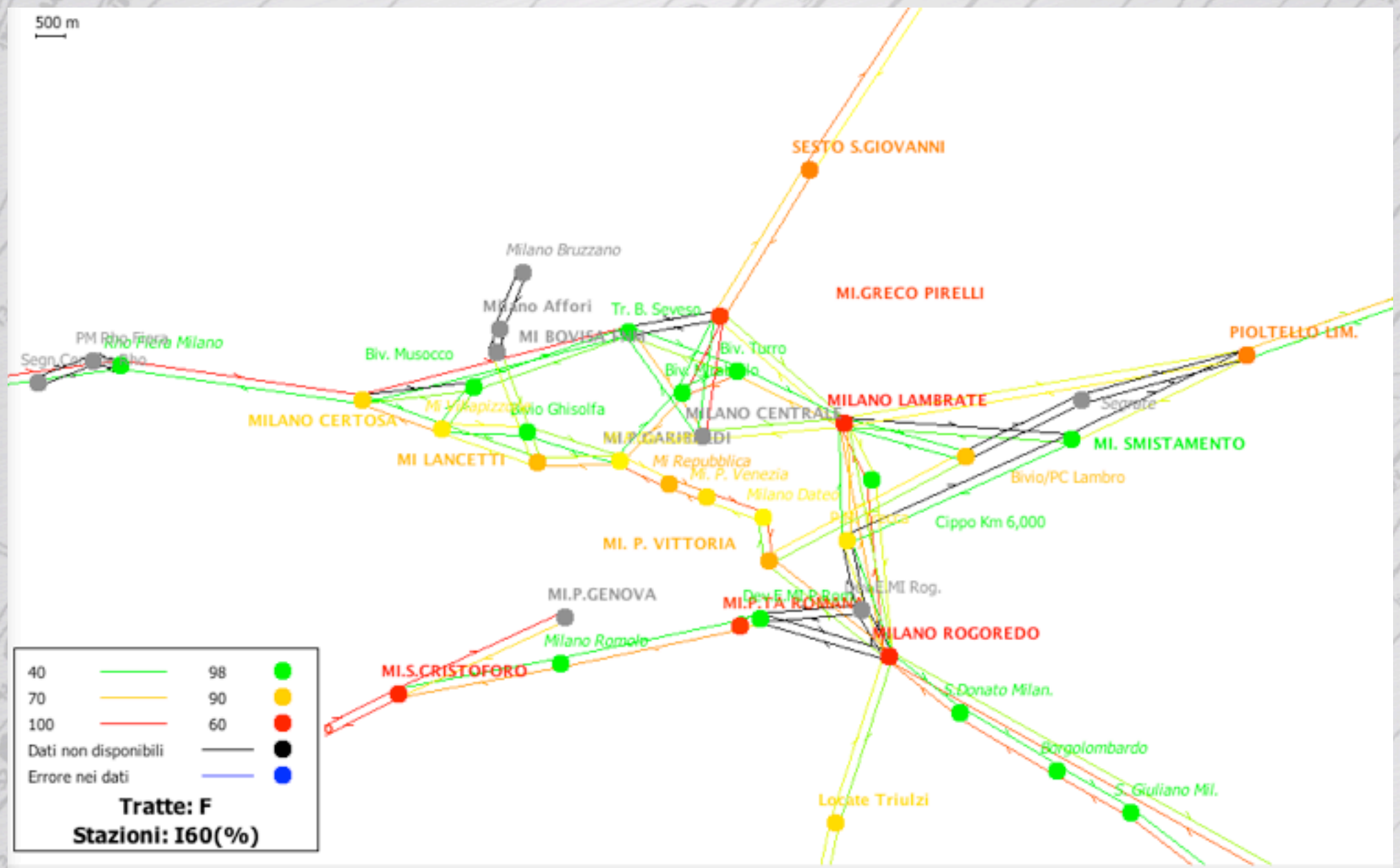- Check corresponding timetable graph

- Initial delays
- Stop time variability
- Timetable

- Simulation and comparison of results (multiple simulations):
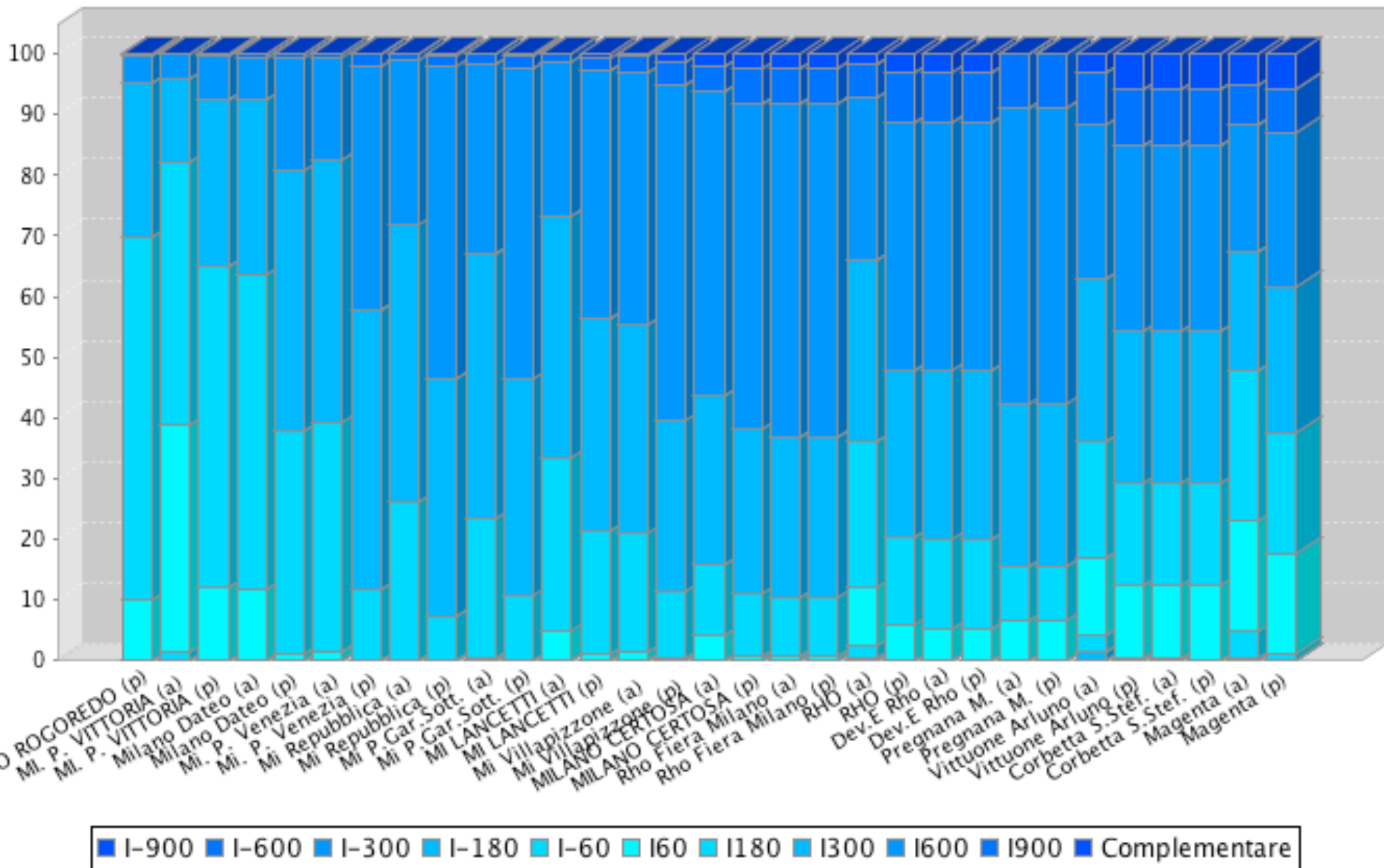 - Calibration: Train movement, Itineraries, Dispatching, interlocking rules…

Network analyzer

Corridor view

Legend: ■ I-900 ■ I-600 ■ I-300 ■ I-180 ■ I-60 ■ I60 ■ I180 ■ I300 ■ I600 ■ I900 ■ Complementare

Scenarios

- Past distributions
- Doubled delays for all trains
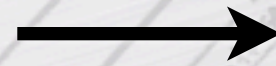- Doubled delays for selected train families
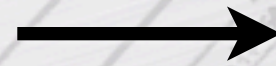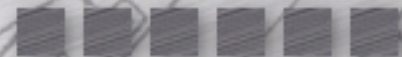- Impact of different priorities

Scenarios and simulation

Scenarios

- Past distributions
- Doubled delays for all trains → **OPEN TRACK**
- Doubled delays for selected train families
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Scenarios and simulation

Scenarios

- Past distributions
- Doubled delays for all trains → OPEN TRACK
- Doubled delays for selected train families
- Impact of different priorities

- Comparison 2008 - 2009
- Point out weaknesses in 2009
- Check corresponding timetable graph
- Evaluation of the Impact of higher delays
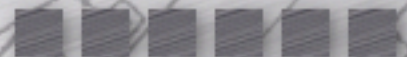- Evaluation of the Impact of different itineraries/priorities

- 2009 timetable more robust than 2008

- Higher punctuality

- But:

  - Smart use of possible itineraries

  - Priority to HS trains < 3'

  - Definition of dispatching rules, priority to trains to Verona

  - For Even HS trains, very important punctuality before Bologna

....and in the real world?

Mean punctuality +3% than forecasted (lower initial delays)

- OT useful to support decisions on wide range of problems

- OT works also on large networks

- But:

  - Importance of model calibration (field measurements)

  - Experience in railway operations required to avoid macro and minor mistakes

THANK YOU

FOR YOUR

ATTENTION!

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