OPENTRACK: Simulation of complex nodes
Case Studies in Italy

Zurich, 21st January 2010
Important railway university in Italy
OT Users since 2004
Spin-off since 2007
Close Cooperation with RFI

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

- Stochastic 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

NODES
- Torino
- Milano
- Verona
- Venezia
- Bologna
- Firenze
- Roma
- Napoli
- Bari
- Palermo

and....
- Zagreb - Vinkovci
- Beograd - Bar
- Ferrocarril Transandino
TRENO

Planned timetable

Train traffic data

Planned

- Line Layout
- Station Layout
- Calendar
- Rolling stock
- Timetable Graph

Delay analysis

- Check Panel
- Network Analyzer
- Corridor view
- Timetable Graph
- Distributions

Timetable

Delay Distributions

OPEN TRACK
A Case Study: Milano

- Timetable validation (2008/09):
  - New HSL Milano - Bologna
  - New services
  - Impact within the nodes?
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I segnali di partenza di Milano Centrale sono stati inseriti al posto dei segnali di avvio.
Milano: Simulation area

- 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
Delay Analysis and Model Validation

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- Initial delays
- Stop time variability
- Timetable
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Simulation and comparison of results (multiple simulations):
- Calibration: Train movement, Itineraries, Dispatching, interlocking rules...
Network analyzer
Corridor view
Scenarios and simulation

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

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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
Results...

- 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)
Conclusions

- 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