An Innovative Transport Model Architecture Aiming at Forecasting a Passenger Railway's Future

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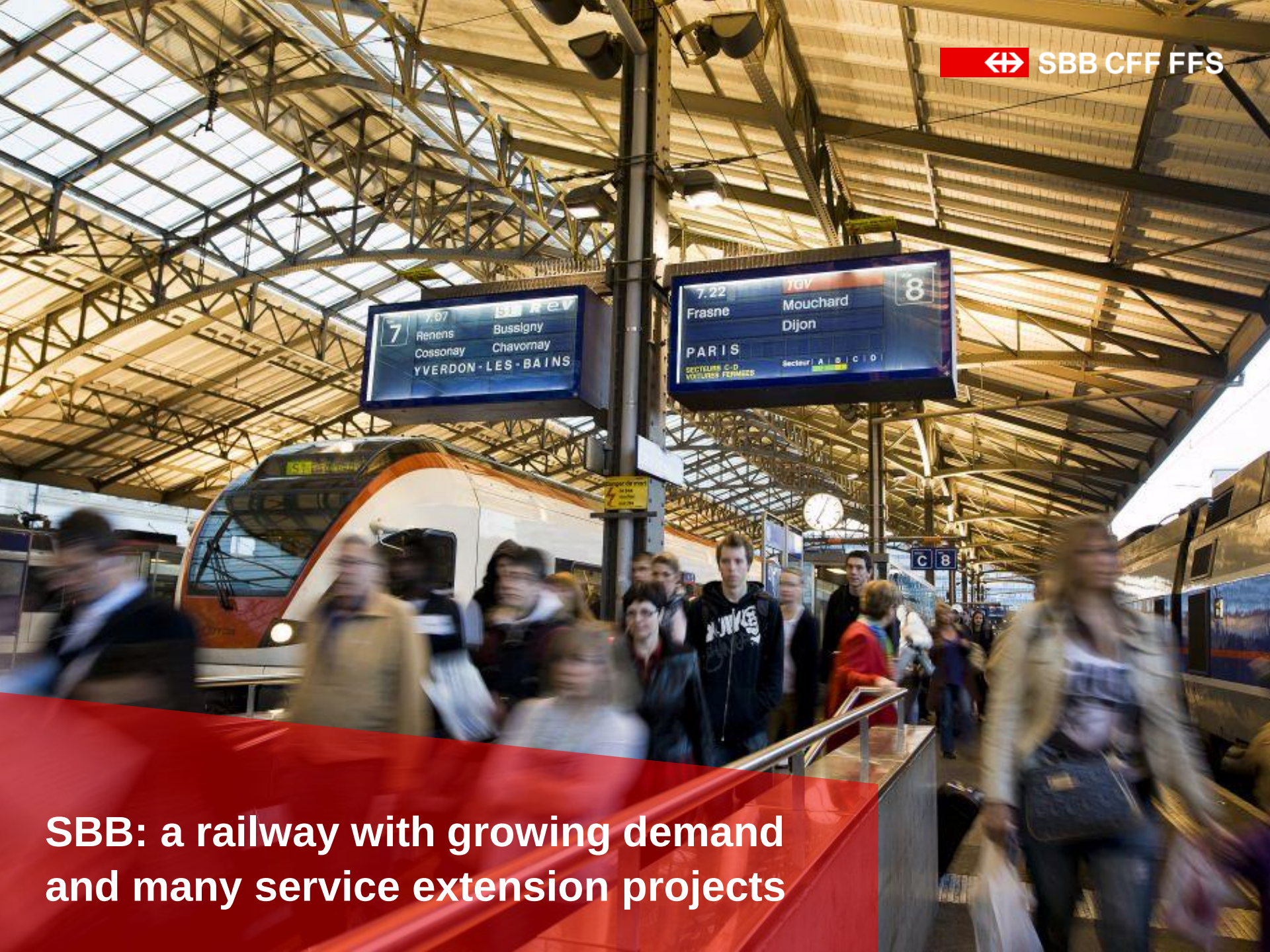
What type of innovation do we pursue:

→ not so much:

- invention of new algorithms or new methods

→ but rather:

- application of better solutions to meet new requirements



SBB: a railway with growing demand and many service extension projects

Swiss Federal Railways (SBB) in numbers 2017

- Leading railway in Switzerland (population 8.4 million)
- 1.3 million passenger trips ADT
  - over the past 15 years: +3.5% in average p.a.
- 3’200 km network length (standard gauge)
  - most densely used rail network in the world
- 33’000 employees
- Punctuality
  - 89% of passengers arrived with less than 3 minutes delay
- Renewable energy
  - > 90% of all electricity used in rail transport

Mission and purpose of travel modeling @ SBB

SBB mission statement: “Rail system under control while shaping the future”

… applied to travel modeling it implies:

- → consistent coverage of demand and production
- → prediction success
- → long-term outlook (2040, 2050 ...)
  - long product and investment cycles in the rail business

Purpose of modeling:

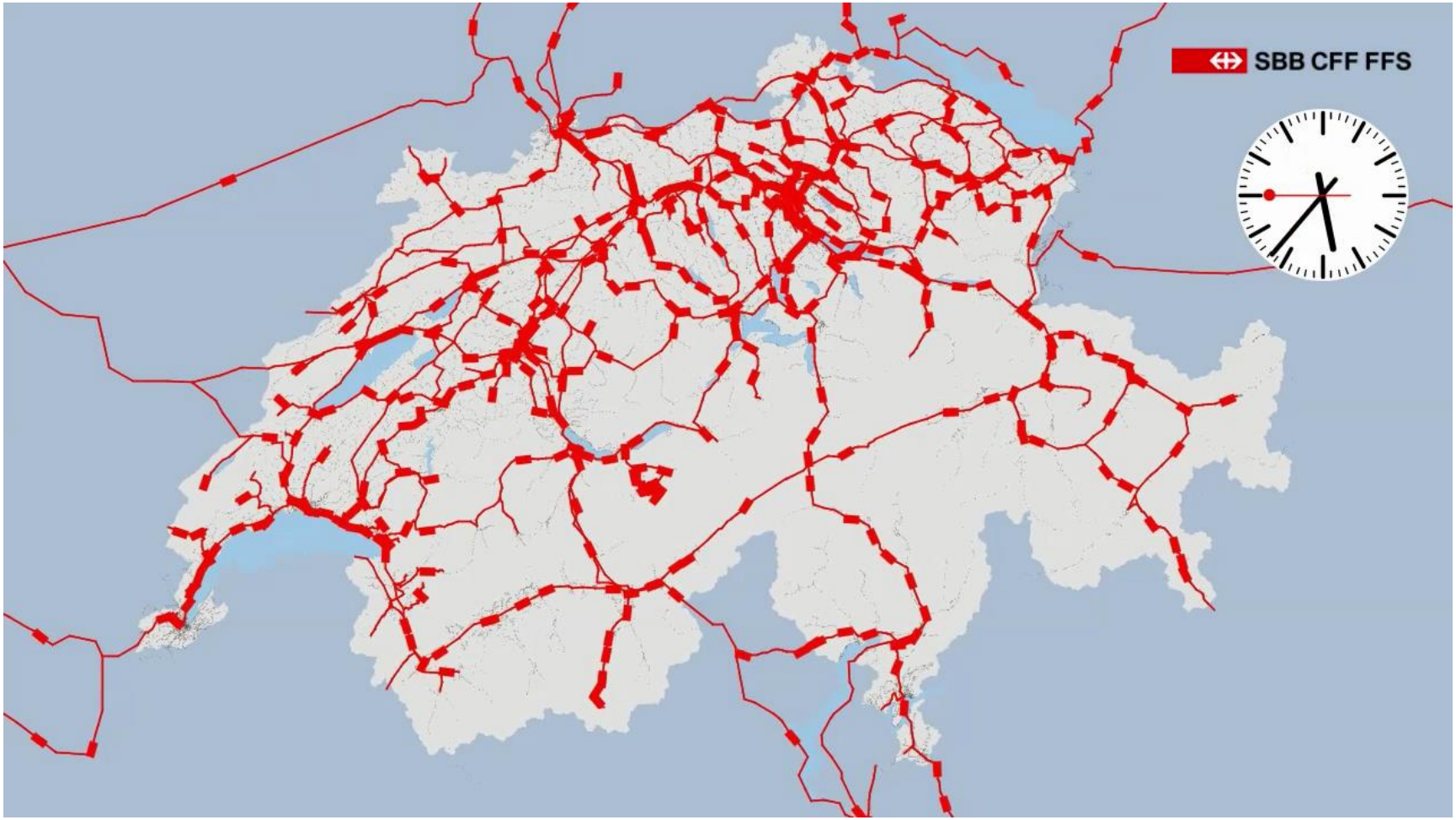
- → Support business decisions and feed corporate processes in:
  - service planning
  - fleet planning
  - financial planning

15 years of experience in transport modeling with «SIMBA Rail»: a data-driven macroscopic model

https://www.youtube.com/watch?v=vPfFQWfXcXo&feature=youtu.be

- Dynamic, capacity-constrained 24-H passenger assignment
- Empirical passenger demand, elasticity-based forecasting
- Rail production model (schedule, fleet, operations)

1 year of experience in agent-based modeling
SIMBA MOBi 1.0



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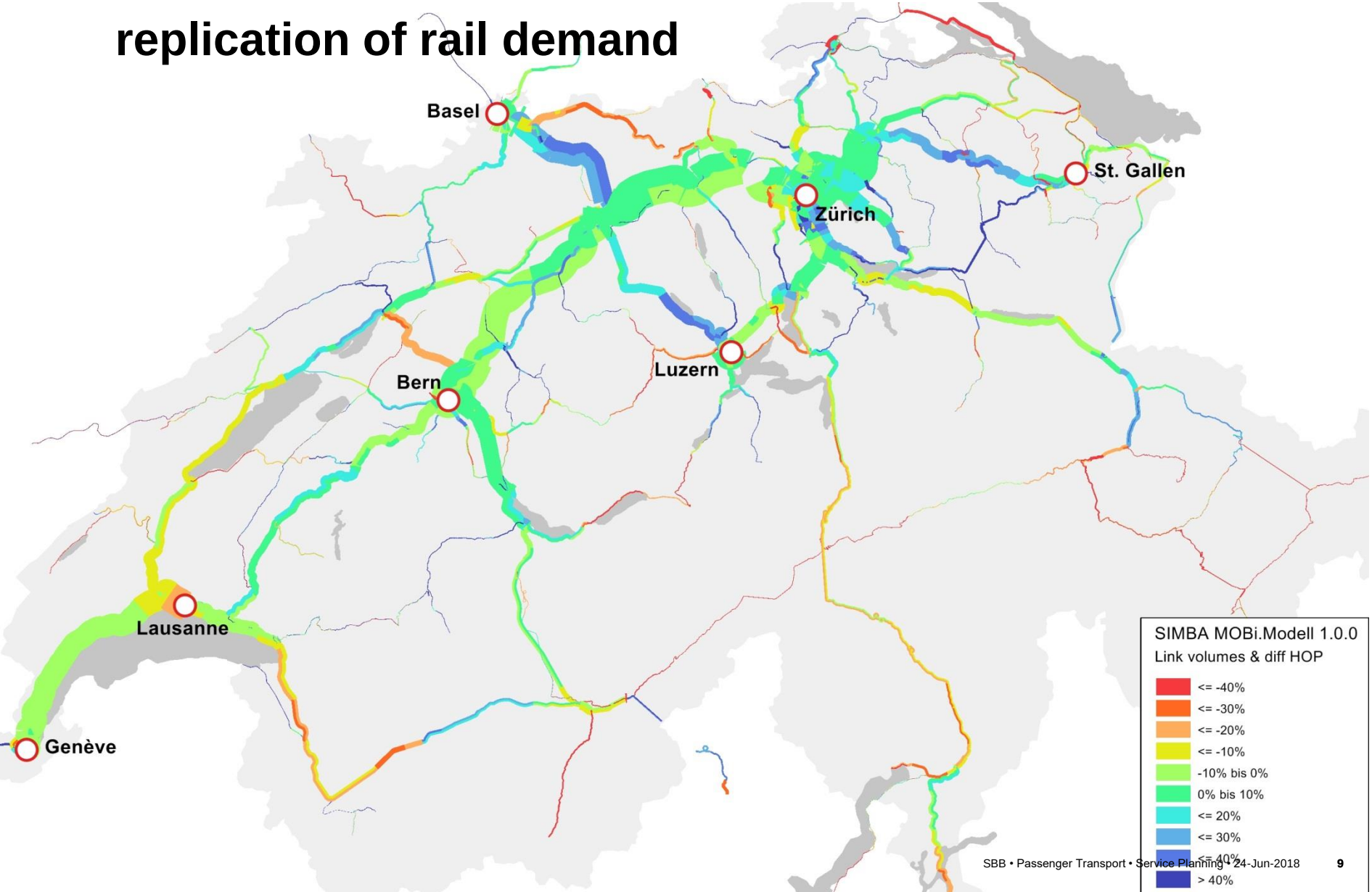
Validation of SIMBA MOBi 1.0: replication of rail demand



New requirements have led to a new model architecture

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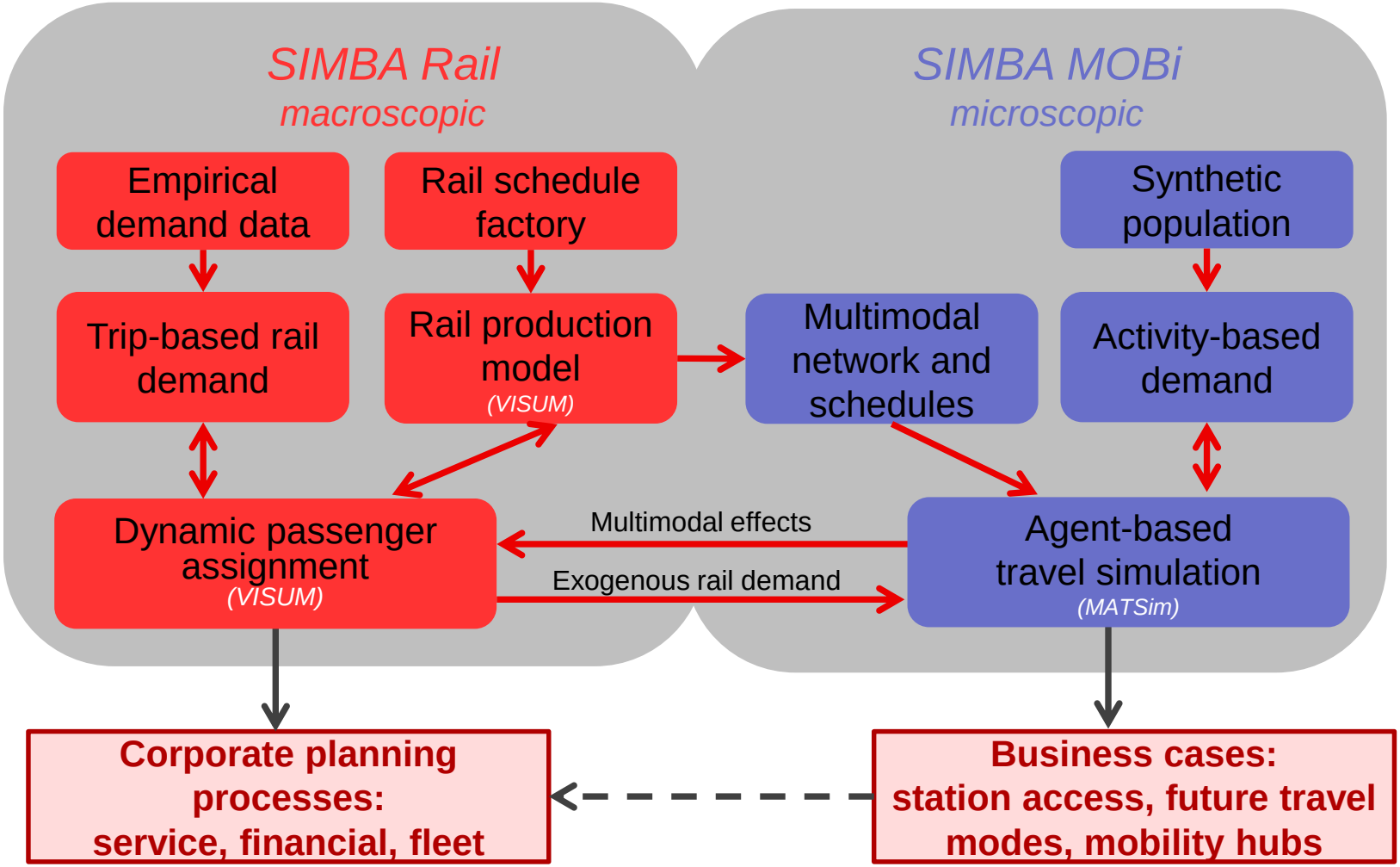
Communication inside of the corporation about model requirements and model properties

Model requirements	SIMBA Rail (macroscopic)	SIMBA MOBi (microscopic)	Integration
Close fit of rail demand in the existing state	☑	☑	☑
Holistic modelling of the rail system (demand and production)	☑	☒	☑
Prediction success (rail demand)	☑	☑	☑
Effective feed into financial planning (demand and operations indicators)	☑	☒	☑
High degree of granularity of passenger flows	☒	☑	☑
Door-to-door description of passenger trips (including station access)	☒	☑	☑
Modelling competing travel modes	☑	☑	☑
Possibility to model future transport modes (e.g. autonomous vehicles, sharing modes)	☑	☑	☑
Complex new pricing schemes	☑	☑	☑
Interaction of land use and travel, based on accessibility	☒	☑	☑

Conclusions for the new architecture

- There is not one model that fits all purposes
- A combination of macroscopic and microscopic will best meet our requirements
- Innovation in new models requires investment in staff, know-how, IT resources

2-pillar architecture for the model landscape SIMBA*



* **S**tandardisierte **I**ntegrierte **M**odellierung und **B**ewertung von **A**ngebotskonzepten

Ongoing development …
… Acknowledgements …

We are looking for innovative solutions:

- → Agent-based models:
  - convergence
  - computational speed
  - calibration methods
- → Activity-based demand models:
  - pragmatic implementation
- → Modeling future mobility:
  - intermodal travel: rail ↔ AV
  - mobility on demand
  - forecasting utility functions that include cost and time

Acknowledgements

There is a team behind our model improvement project.
It includes/included:

- Patrick Bützberger, Stefan Buchmüller, Nathalie Frischknecht, Johannes Lieberherr, Denis Métrailler, Stefan Paschke, Marcel Rieser
- Patrick Manser (on the conference)
- Wolfgang Scherr (presenter, wolfgang.scherr@sbb.ch)

We have based our agent-based travel modeling
on previous work in Switzerland:

- ETH Zürich, IVT: team of Kay Axhausen
- senozon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Riding trains in Switzerland is fun ...