Workshop 3.1
“Synchromodality”

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Introduction: Synchromodality

• Promising concept to foster modal shift
• Based on „amodal booking“
• Network orchestrator plans and optimizes flows of goods
• Real-time switching of transport modes
• Resilience through back-up function
Introduction: Synchromodality

Flexibility

Cooperative Networks

Real-time switching

Customers determine only basic requirements in terms of ....

• Sustainability
• Costs
• Time

Bundling of transports, optimized and sustainable use of resources to support the PI vision
Conclusion and outlook

- Impressive modal shift achieved within pilot (2011) → Nevertheless still quite unknown in the rest of Europe
- Technical requirements are realizable
- Existing solutions demonstrated practical feasibility
- „Soft factors“ rather more critical for implementation
This work has been funded by the State of Upper Austria as part of the research program ‘FTI Struktur Land Oberösterreich’
Optimized and flexible railway logistic solutions from Innofreight for industries with high raw material consumption

IPIC 2017
The Company

We specialise in systems for the innovative transport of goods and logistics on rails.

From the very idea to a concept, through its implementation and last but not least the service – we are the perfect business partner for you.

SHARE YOUR LOGISTICS CHALLENGES WITH US – TOGETHER WE WILL ACHIEVE THE OPTIMAL SOLUTION!
The Company

- As many as 100 Innofreight block trains run daily for our customers all across Europe.
- We are transporting ca. 15 Mio.t mass goods per year (= ca. 1 Mio unloadings of containers with our machines).
- Ca. 10.000 containers and more than 50 unloading forklift trucks and 6 stationary unloading systems in 14 countries guarantee a smooth and reliable operation at our customer’s locations.
- Members of our staff offer you assistance on the spot and in your own language!
Innofreight delivers logistic solutions
Business model railway/IF/end-customer

- Innofreight is investing in containers, loading and unloading technology.
- Railway company buys or rents InnoWaggons (from Innofreight) and rents our containers.
- The staff of the end-customer takes care of the material handling on site.
InnoWaggons – the best container wagons
InnoWaggon Sggrrs 2014

LIGHT WEIGHT CONTAINER WAGON, START IN JULI 2014 FOR COMPANY KNAUF:
InnoWaggon Sggrrs 2017

LIGHT WEIGHT CONTAINER WAGON:

- Till end 2017 ca. **800 InnoWaggons** will be in service.
- Äquivalent: 1,600 single wagons, first traffics: Start was in Juli 2014.
- Main users: Steel industry, power plants and construction companies.
- Owners: 400 wagons Innofreight, 400 wagons railway companies.
RAILWAY COMPANIES BELIEVE IN MODULAR CONCEPT AND INNOFREIGHT TECHNOLOGIES:

InnoWaggon Sggrrs 2017
InnoWaggon Sggrrs for wide gauge

LIGHT WEIGHT CONSTRUCTION WAGON FOR WIDE GAUGE FOR VR CARGO:

Prototype in service in Q4/2017!
Modular = the InnoWaggon + a special container + the unloading technology.

Higher load than in special wagons.

The container and unloading technology is optimized depending on the type of load and the customer’s specific needs.

All components may be combined with one another.

Great availability and flexibility due to easy maintenance and a swift exchange of components.

MODULAR = FIT FOR THE FUTURE!
Cooperation railway - Innofreight

ADVANTAGES FOR THE RAILWAY COMPANY BECAUSE OF SPLITTING CHASSIS FROM CAR BODY:

- Compared to special wagons low investment costs and risks, speed to renew the fleet can be accelerated significantly.
- Innofreight offers high availability and flexibility according to the needs of the market.
- Different life cycles of container wagons and containers are improving the competitiveness (e.g. higher payload by using high-tensile-steels).
- Standardization of the fleet is possible, reduction of variety of railcars.
- Reduction of maintenance and infrastructure costs.

There are no limits for possible combinations!
Many applications – one universal wagon:

ADVANTAGES FOR THE RAILWAY COMPANY BECAUSE OF SPLITTING CHASSIS FROM CAR BODY:
...to be continued...
Utility pyramid:
Railway logistics of the future

- Modularization of logistic components and containers
- Unification of waggon materials
- Technical limits (axle load, profiles, train lengths, etc.) adjusted to nowadays technical standards
- Modernization and clearing of railway law and regulation
- Modern infrastructure and terminals as hubs and service centers with multiple functions
- Modularization bases for digitalization and PI
Benefits of modularity

FOR THE CUSTOMERS (E.G. STEEL INDUSTRY):

It is the model of a platform wagon (= the InnoWaggon) and the load-optimised containers that render it possible to transport goods more efficiently than ever before. We offer you higher loads along with a more efficient and reliable unloading.

FOR THE RAILWAY COMPANY:

A perfect opportunity to standardise and modernise the wagon fleet as well as optimise its maintenance process.

FOR INNOFREIGHT:

An expansion of the logistics services (our current primary focus is on the paper and chemical pulp industry). In the future: also building materials, steel and power stations. Short life cycles – as a result we meet our customers’ needs to an optimal extent.
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INNOFREIGHT — YOUR PARTNER FOR OPTIMISING YOUR LOGISTICS!
Inducing a new paradigm shift: A different take on synchromodal transport modelling

Tomas Ambra

4th International Physical Internet Conference
Graz, Austria
04/07/2017
MOBI
Mission statement

supporting and studying the transition towards a more sustainable mobility & logistics system
Key assets

Sustainable logistics

Electric and hybrid vehicles

Battery Innovation Centre

Urban mobility
40 years of expertise

140 projects over last 5 years

12 current EU Projects

3.6 M€ turnover 2016

70+ team members

18 nationalities
MOBI
Expert tools

MAMCA ©
Business Modelling
Battery Models
LAMBIT

LCA
Consumer Behaviour
Power Electronics
TRABAM

ECC
Big Data
VSP
Location Analysis
2) Synchromodality

Intermodal
From A to B using barge or train and from B to C (the ‘last mile’) by truck.

Synchromodal
Maximum flexibility and sustainable system: in A one can chose among different modal options, but also in B and in C for the return.

Source: ECT, 2011
2) Problem statement

Freight flows in Flanders (share tonkm)

Index (2000=100)

Year


Source: www.milieurapport.be, based on numbers of Eurostat, FOD MV, NMBS, NV De Scheepvaart, PBV, VMM, W&Z
2) Review of state-of-the-art

**Synchromodal Transport**

- **Concept**
  
  (Tavasszy et al., 2010; Verweij, 2011; Behdani, et al., 2016; Tavasszy et al., 2015; van Riessen et al., 2015a; Buiel et al., 2015; Putz et al., 2015; Prandtstetter et al., 2016; Tsertou et al., 2016)

- **ICT**
  
  (Hofman, 2014; Singh and van Sinderen, 2015; Heilig et al., 2015; Tsertou et al., 2016)

- **Models**
  
  (Ziliaskopoulos and Wardell, 2000; Chang et al., 2007; Bock, 2010; Behdani et al., 2016; van Riessen et al., 2015b; van Riessen et al., 2015c; Nabais et al., 2015a; Nabais et al., 2015b; Li et al., 2015; Xu et al., 2015; van Riessen et al., 2016a; van Riessen et al., 2016b; Mes and Iacob, 2016; Zhang and Pel, 2016, Rivera and Mes, 2016)

**System Unification**

- **Concept**
  
  (Montreuil et al., 2010; Montreuil et al., 2013)

- **ICT**
  
  (Sallez et al., 2015a; Landschützer et al., 2015; Tretola et al., 2015; Zhong et al., 2015a; Hofman, 2015; Zhong et al., 2015b; Krommenacker et al., 2016; Hofman et al., 2016; Lin & Cheng, 2016)

- **Models**
  
  (Furtado, 2013; Furtado et al., 2013; Sarraj et al., 2014; Pach et al., 2014; Kong et al., 2015; Sallez et al., 2015b; Walha et al., 2016; Crainic & Montreuil, 2016; Yao, 2016)
2) Synchromodal characteristics

Real-time  Re-routing  Re-scheduling  A-modal

Asset planning to Network planning  Predict & Prepare to Sense & Respond
2) Current modelling environments

Source: (Van Riessen et al., 2014)
2) Current modelling environments

Source: (Negenborn and De Schutter, 2013)
2) The role of GIS

- Capture, store, check and display data
- Analyze patterns and relationships
- Record and represent temporal change and states of agents over time
- GIS spatial queries allow ‘where’ to be physical location, ‘in’ to be enclosure and ‘from’ to be directional

Source: Smart Max Geosystems
2) Why now?

The future evolution of GIS as a DSS is dependent upon improvements in technology since the lack of integrated spatial model management subsystems keep GIS at the thresholds below true DSS (Murphy, 1995).

- **ESRI’s ArcMacro, AML or Avenue-ArcView**

- **Java, C++, Visual Basic, Python, VBscript, Jscript**

- **Integration of GIS libraries (OpenMap, ArcGIS, GeoTools)**
3) Our approach

SYMBIT

A multimethod model:

- Agent-based modelling
- Discrete event simulation
- Geographic Information System

Simulates:

- Bundling and business logic
- Physical flows
- Information flows
3) SYMBIT (regional)

Source: MOBI
3) SYMBIT (EU)
3) SYMBIT (EU)

Source: MOBI
3) SYMBIT (EU)

Assesses values per each node or an entity under study

Source: MOBI
3) SYMBIT – under the hood

Decision algorithms
Actioncharts

Routing calculations and fill rates
Statecharts

Terminal bundling, crossdocking
Discrete event simulation

Decision algorithms
Actioncharts

Source: MOBI
3) SYMBIT - Architecture summary

Geo locations of:
- Shippers
- Terminals
- DCs
- Retailers
- Consumers

Routes followed by:
- Trains
- Barges
- Trucks and Lorries

Output:
- Distances covered,
- Delivery duration,
- Fill rates,
- Emissions,
- Cost (fixed, variable, handling)

Source: MOBI
4) Unifying synchromodality and physical internet

- Synchromodal Transport
  - Concept
  - ICT
  - Models

- System Unification
  - Physical Internet
    - Concept
    - ICT
    - Models
4) Unifying synchromodality and physical internet

Integrated view of the elements necessary to achieve synchromodal service design. (Source: own setup, based on Behdani et al. (2016))
4) Unifying synchromodality and physical internet

Integrated view of the elements constituting the Physical Internet (Source: own setup, based on Montreuil et al. (2010))

- \(\pi\)-Hubs
- \(\pi\)-sorters
- \(\pi\)-composers
- \(\pi\)-storage/warehouse
- \(\pi\)-gateway

- \(\pi\)-Containers
  - Smart tagging
  - Confidentiality
  - Track & Trace

- \(\pi\)-Nodes

- \(\pi\)-Movers
  - \(\pi\)-vehicles
  - \(\pi\)-carriers
  - \(\pi\)-conveyor
  - \(\pi\)-handler

- Efficiency
- Interconnectivity
- Openness
- Accessibility
- Sustainability
- Compatibility
4) Unifying synchromobdality and physical internet
4) Unifying synchromodality and physical internet

PI box - trust

p- and h-containers/warehouse level
t-containers/Interregional management
4) Unifying synchromodality and physical internet
4) Unifying synchromodality and physical internet

External + Internal developments

Network flow/ Cost structure

ETAs/ Predictive control
5) Where do we stand?

Conceptual illustration of a transparent and resilient freight network
Thank you for your attention!
Business Models in Physical Internet Systems - Findings from the ATROPINE project

Brandtner Patrick, Plasch Michael, Simmer Laura, Schauer Oliver
Research Background

• By seamlessly integrating locating technologies, sensors, mobile data transmission, cloud computing, data analytics and other technologies, the physical internet (PI) seeks to create open, global logistic systems, which
  • significantly increase capacity utilization of transport routes by generating and taking advantage of synergies through bundling effects along the entire supply chain,
  • open up several new opportunities but also challenge existing routines & business models.

• In order to realize PI systems and to benefit from their effects, several innovations and advancements in different areas are inevitable, one of these being business model innovation:
  • Innovative strategies and business models and the consideration of their effects on existing processes and routines represent the basis for progressing from traditional SCs to collaborative PI systems.

• This presentation discusses current findings (WIP!) in the area of business model innovation in PI systems gained in the research project ATROPINE.
ATROPINE – The Project

The project ATROPINE (Fast Track to the Physical Internet) aims to **demonstrate a PI region in Upper Austria and to bring regional businesses and especially all participating logistics partners** on a ‘Fast Track to the Physical Internet’.

**Project goals**

- promoting the vision of the Physical Internet in Upper Austria
- establishing a PI model region
- bringing key elements of the Physical Internet to life in real business environments
- triggering the innovation chain along industry, education and research

**Funded by**

- Upper Austrian Government
- Industry partners

**Project volume**

- € 1.400.000,- (including industry contributions of € 410.000,-)
ATROPINE - Research Team

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ATROPINE – Company Partners

Application partners from business:

Best-in-class partner from industry & trade
• ALDI/HOFER, Lenze, Vetropack, delfortgroup...

Integrators, IT & Logistic Technology Provider
• SAP, SHI, Knapp, barcotec...

Logistics service providers
• Quehenberger, Eurotrans, Schneckenreither, ...

Representations of interest
• Chamber of Commerce, Industrial Association
Project Setting: ATROPINE “Peer Groups”

- Project team of about 30 researchers and industry partners

- Work in 3 different ‘peer groups’:
  - Modeling, interaction, simulation and optimization
  - Legal Framework
  - Business Model
Peer Group - Business Model Objectives and Outputs

• Analyze the **framework conditions for collaborative business models and operational structures** which allow and promote cross-industry, synergetic use of existing infrastructures and transport resources.
  • Data?, Legal Aspects?, Coopetion-Readiness?, Value Creation?, etc.

• Understand the **shape and levels of an ATROPINE-like / PI-ready business model** including the platform user’s, operator’s and investor’s point of view and motivation / drivers (in theory and practice).

• Develop **concrete business model concept** for potential platform operators and investors.
Starting with a vision.

**ATROPINE Vision**

Creation of an IT-based PI-Platform that:

- **Connects** LSPs, Shippers and third parties

- Allows for more efficient capacity **utilization** by identifying and recommending **bundling effects** between platform members

- Enables the **creation** of new / adapted business models
Elaborating the framework conditions for a PI platform.
Developing specific business model(s) for PI Platform.

ATROPINE Vision

Technological Framework

Legal Framework

Specific Business Model Concept for PI-Platform
Peer Group Business Model: Elements of a Business Model

**WHAT?** (Which Value?) → **VALUE PROPOSITION**

**WHO FOR?** (For who is the Value „of Value“?) → **CUSTOMERS**

**HOW?** (How is the Value delivered?) → **VALUE CHAIN**

**Simulator**
*Theoretical savings potential through platform membership in 2016*

**Demonstrator**
*Actual savings through platform membership during test period*

**Vision „PI-Plattform ATROPINE“**
*Business Model Concept(s) for future PI-Plattform Operators and Investors*

**WHY?** (What revenue is made and how is it generated?) → **REVENUE STREAMS**

**WHERBY?** (What costs incur?) → **COSTS**

**WHAT FOR?** (How are profits shared?) → **PROFIT SHARING**
Peer Group Business Model: Creating and Influencing BMs

ATROPINE Strategy (Vision, Mission)

Platform-Operators & Investors

ATROPINE Steering & Collaboration Model

ATROPINE-Operating Model

ATROPINE-Business Model

Platform-Members

Adapted and new (Industry 4.0) Operating Models of Organisations

Cost reduction, optimal capacity utilization, increased sales

Adapted and new (Industry 4.0) Business Models of Organisations

New Business Fields

Transaction-based Fees, Subscription Fees, etc.
ATROPINE – Status Quo & Next Steps

• Simulation-Phase currently running
  • Identify hypothetical savings in 2016
  • → PoC for actual value delivered by platform in terms of monetary benefits

• Demonstrator-Phase to start in 2018
  • “real-life” test in defined environment and time-frame
  • → PoC for platform in terms of practical applicability of underlying algorithms and optimization recommendations

• Further develop and adapt Business Model(s) for PI Platform based on simulation and demonstration results
ATROPINE – Future Work

ATROPINE
strategic program „Innovative Upper Austria 2020“
(PI model region)

Go2PI / ProtoPI
LOGISTIKUM pre-projects

Potential of the PI
HORIZON 2020 (call from 2018-20)

ATROPINE 2.0
FFG call „Mobility of the Future“
flagship project

K-Zentrum / ALPHA
further thematic deepening & networking

SpinOff
full version
(some elements earlier)
QUESTIONS?

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