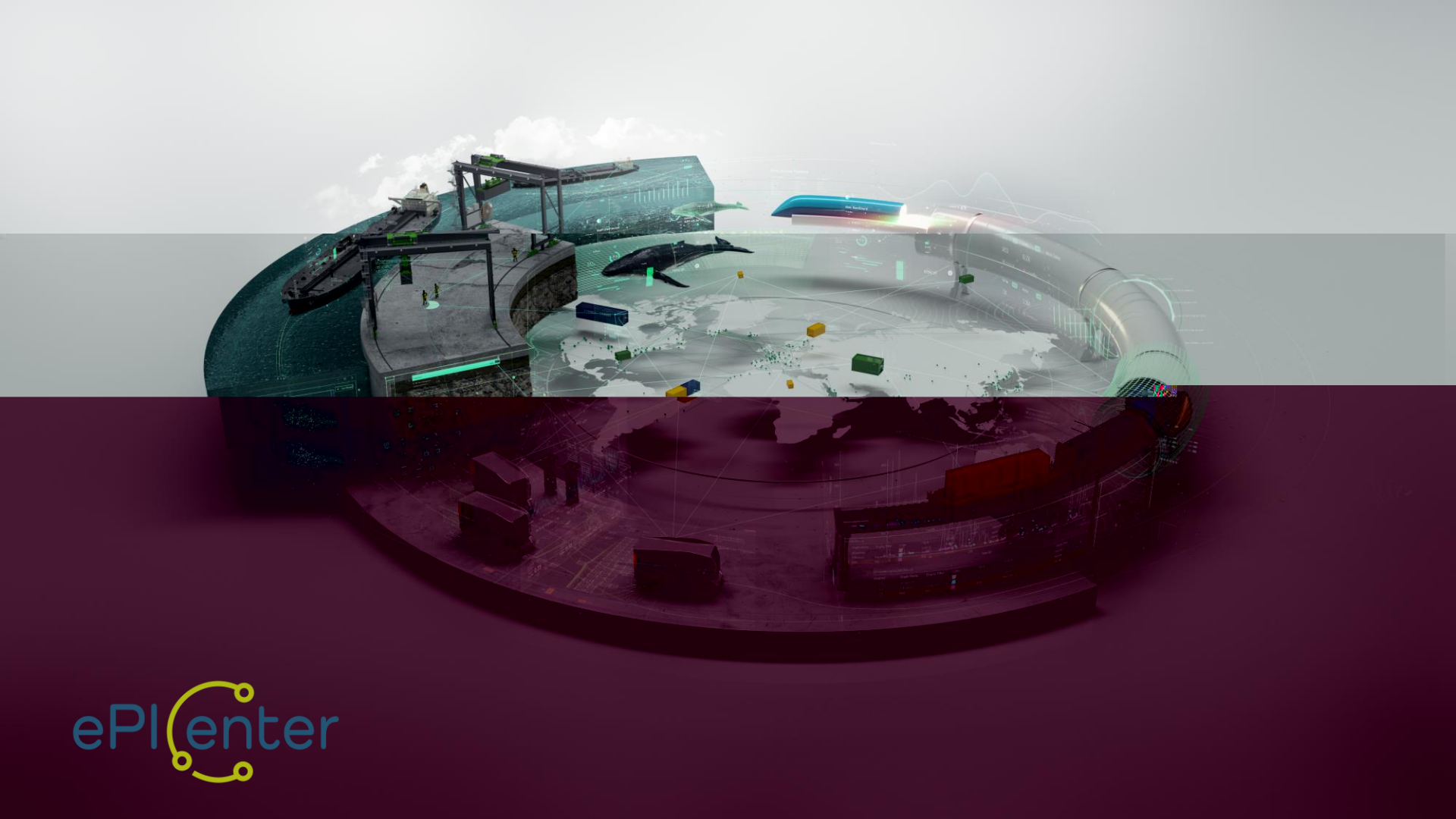

ePIcenter

Enhanced Physical Internet-Compatible Earth frieNdly freight Transportation answER

Synchromodal Algorithms in the Physical Internet

Julian Stephens - MJC²

IPIC 2021

ePIcenter

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 861584.

01 ePIcenter

Project Overview

ePIcenter – Introducing the Project

- Innovations and new technology for global logistics:
  - AI, digitalisation, visibility, autonomous vehicles, Hyperloop, innovative containers, navigation and propulsion systems for ships, etc.
  - Many of these technologies will be needed for the Physical Internet
- Research the impact on European and global logistics networks:
  - Reduced costs, congestion and environmental impact
- International Cooperation Flagship Project:
  - Coordinated by Port of Antwerp
  - 36 Partners from Europe, China, North America & South America
  - Supported by the European Union's Horizon 2020 research and innovation programme under grant agreement No 861584

ePIcenter


ABInBev
Aker Arctic
Algeciras Port
ASTAZERO
BALance
Technology Consulting
TE
BITA
BLOCKCHAIN IN TRANSPORT ALLIANCE
BIBA
DEN HARTOGH
DHL
duisport
excellence in logistics
einride
ESES
Creating a new future
HERIOT WATT UNIVERSITY
UK | DUBAI | MALAYSIA
Logistics Initiative Hamburg
LOGIT ONE
MARITIME INSTITUTE
GDYNIA MARITIME UNIVERSITY
NxtPort
Panasonic
PKP
Port of Antwerp
SHANDONG UNIVERSITY
Stena
PORT MONTRÉAL
HOCHSCHULE EMDEN·LEER
TIS
to-be-now-logistics-research-gmbh
TTI ALGECIRAS
Total Terminal International Algeciras
TSI
TRANSPORTA UN SAKARU INSTITŪTS
Universidad de La Sabana
UNIVERSITÉ LAVAL
University of Victoria
VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

Practical Developments for the Physical Internet

- Develop and trial in real-world industry scenarios many innovations which form key components and stepping stones to the Physical Internet:
  - Operational Synchromodality in a “physical intranet”
  - Secure data exchange between logistics networks and organisations
  - Innovative modularisation and intelligent containers
  - Autonomous operations in nodes
  - Governance models for data exchange and sharing
- This presentation will focus on synchromodal logistics algorithms.

Global Context

- ePIcenter will also contemplate many other important aspects:
  - Research, models & algorithms to understand the impact of new trade routes/flows on TEN-T and global networks such as the Belt and Road Initiative and possible Arctic shipping routes
  - New technologies and research to reduce environmental impact of shipping operations
  - Analyse priorities of developing countries and markets
- => Develop a wider understanding the possible impact of Physical Internet developments on global logistics

Industry Pilots & Demonstrators

- Wide geographical scope and many stakeholder groups represented.
- Example trade lanes, networks and nodes include:
  - Canada – Europe
  - Asia – Europe
  - Intra-Europe (TEN-T optimisation)
  - Major ports, terminals, factories and warehouses
  - Multiple modes: ocean, rail, inland waterway, truck (and Hyperloop)

02

Synchromodality

Developing the algorithms needed for the Physical Internet

ePIcenter

MJC^2 : Synchromodal Logistics Algorithms

- Develop the real-time algorithms needed for the Physical Internet to enable automated end-to-end planning of multimodal freight.
- A key enabler for "*Seamless, flexible and resilient, door-to-door services*"
- These algorithms can be also used by shippers to develop strategic synchromodal logistics strategies.
- Trial and prove in complex multimodal freight operations

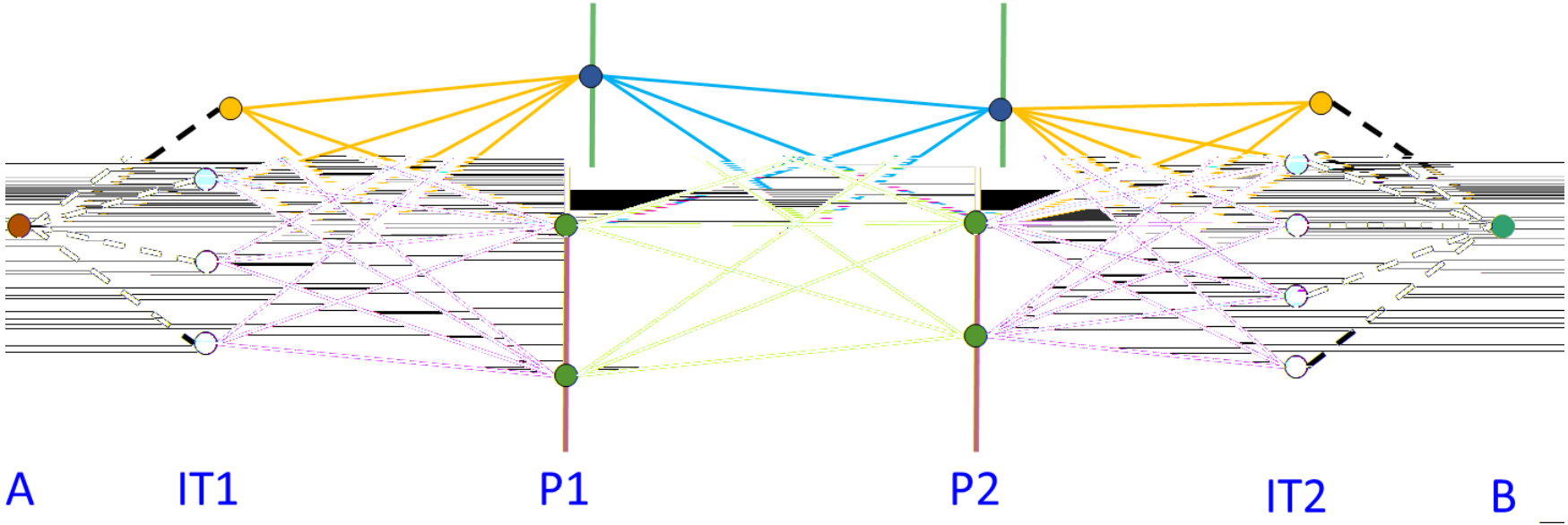
ePIcenter

Technical Challenges

- The search space when selecting the best* route for a shipment is vast. Existing algorithms cannot cope with the computational requirements.
- Specific governance models, business rules and data confidentiality constraints need to be followed.
- Speed is a key factor. Logistics networks change on a minute-by-minute basis.
- * “Best” – this could mean cost, speed, GHG, reliability, ……

ePIcenter

Multimodal Routing



Leg 1	Factory A	**to**	Intermediate Terminal IT1	**via**	Truck
Leg 2	Intermediate Terminal IT1	**to**	Port of Loading P1	**via**	Rail/Barge/Feeder
Leg 3	Port of Loading P1	**to**	Port of Discharge P2	**via**	Ship
Leg 4	Port of Discharge P2	**to**	Intermediate Terminal IT2	**via**	Rail/Barge/Feeder
Leg 5	Intermediate Terminal IT2	**to**	Customer B	**via**	Truck

Very Large Optimisation Problem

- For such a movement there are many choices:
  - **Leg 1** - ~10 reasonable choices for the inland terminal
  - **Leg 2** - ~5 reasonable choices of deep sea port for loading the container
  - **Leg 3** - ~5 possible ports for discharging the container
  - **Leg 4** - ~10 possible inland terminals close to the final destination
- =>2500 possible route combinations.
- However, for each leg multiple options (transport companies and services). Assuming just 10 options for each leg there would be a total of **250,000,000** possible options.
- This is for <u>just one</u> shipment – there are millions of these.

Reasons for Optimism

- Many of the algorithmic components already exist and have been successfully proven in complex real-world example networks.
- Early successes include:
  - Integrated hub/trunking/last-mile optimisation for parcel networks.
  - Integrated ocean/rail/truck synchromodality centred on major multimodal logistics hubs.
  - Integrated resource sharing and automated backhaul scheduling in national distribution networks.
- ePIcenter will build on these initial successes, extending the capability of the synchromodal algorithms.

Why is ePIcenter focussing on this challenge?

- A key step in the development of the Physical Internet concept, with the potential to accelerate adoption:
  - A “quick win” for industry stakeholders (and for the environment)
  - Increase intrinsic operational efficiency, creating an “immediate” benefit
  - Provide a demonstrably strong and achievable business case to break down the silos that can exist within large companies e.g.:
    - end-to-end planning of all transport modes
    - close integration between hub and transport
    - synergies across divisions
- Encourage the change in thinking needed to embrace the Physical Internet concept

Thank you

Julian Stephens

Technical Development Manager – MJC^2

jas@mjc2.com

This project has received funding under the Horizon 2020 Framework Programme of the European Union – Grant Agreement No. 861584

ePIcenter