The ICONET Project:

Overview of a first European Physical Internet (PI)

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INTERMODAL EUROPE 2019

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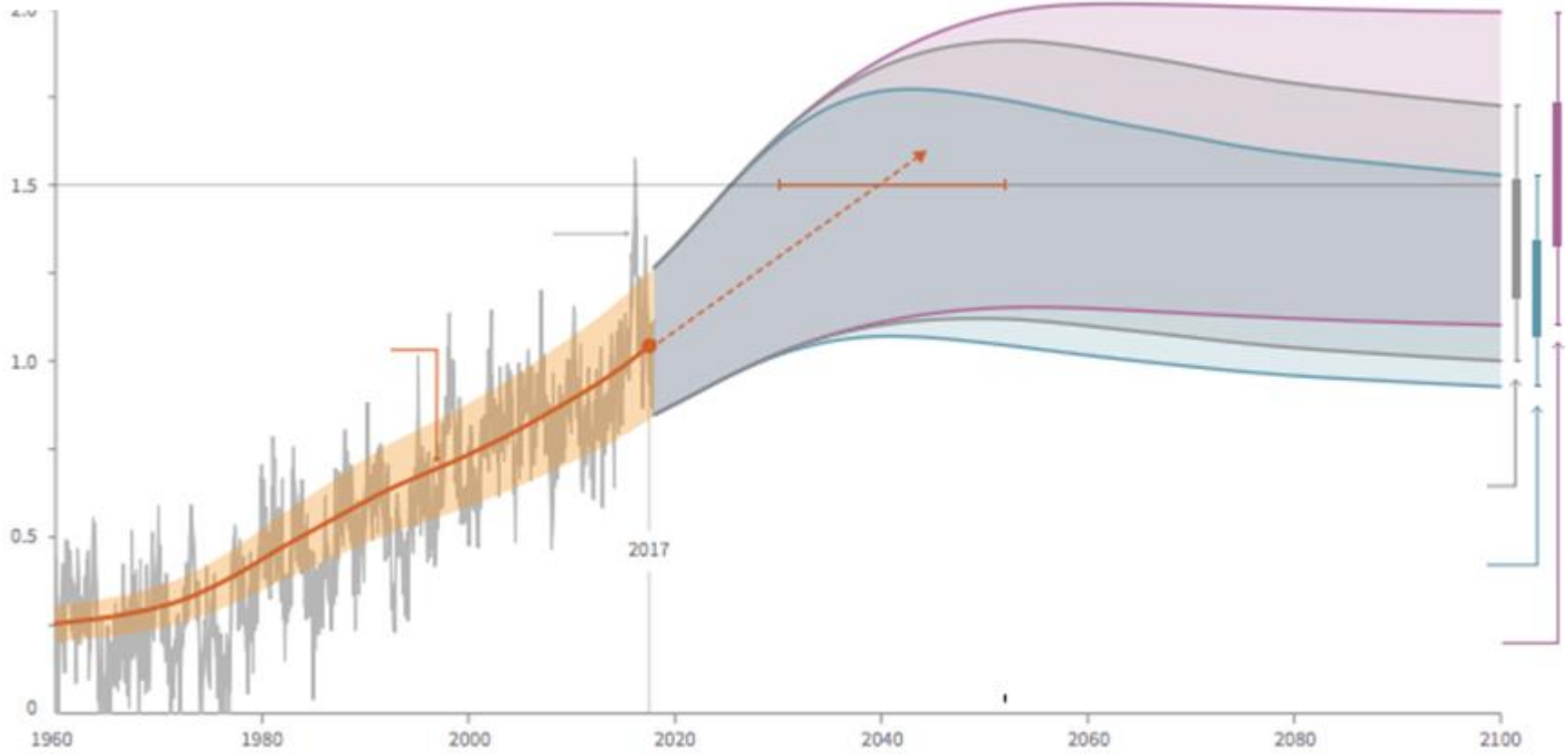
02 ICONET Project Overview

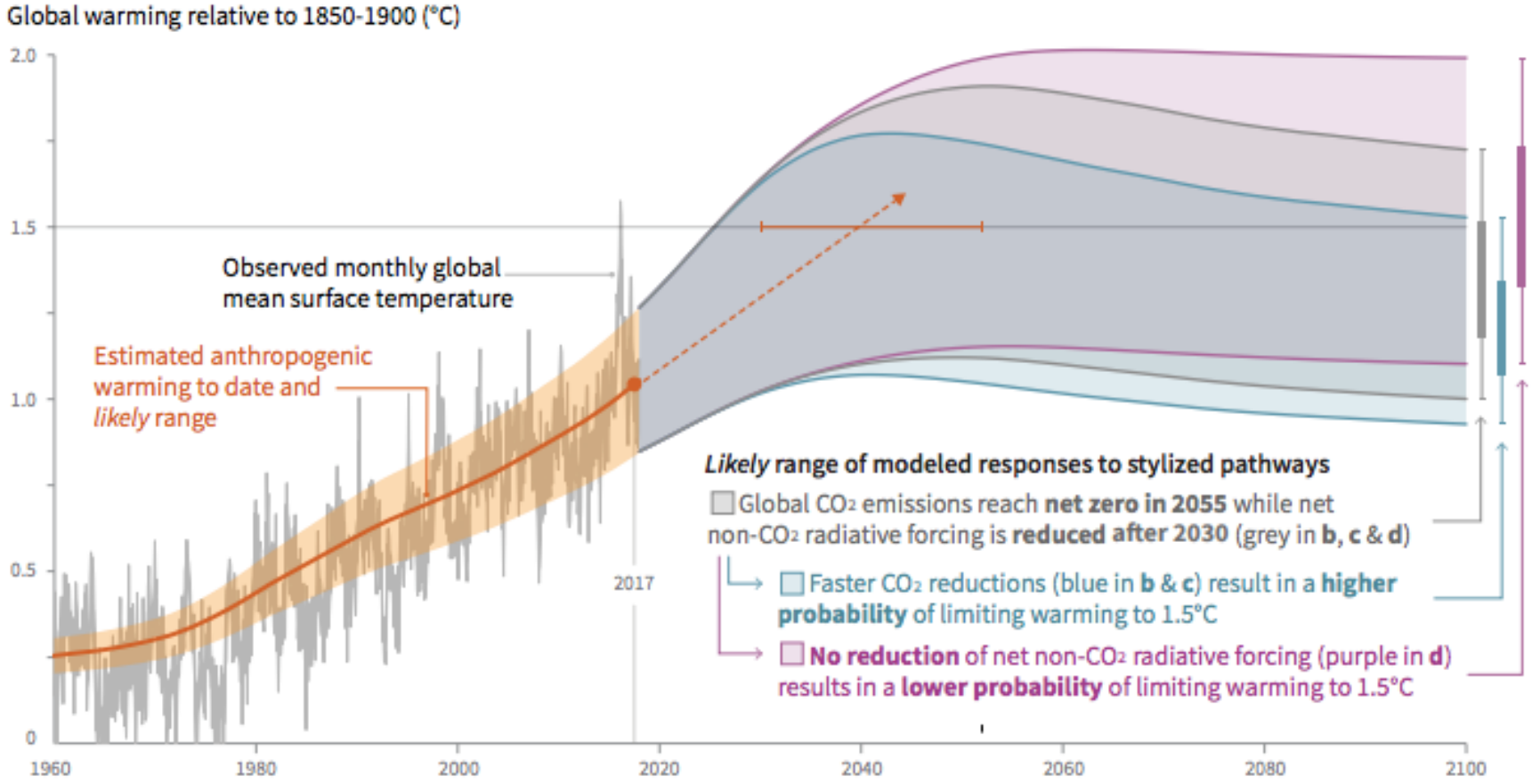
03 NGS srl New Generation Sensors Contribution in ICONET

04 Outlook and Impact - eGer@Link

Physical Internet - PI



Climate change – opportunity or threat?

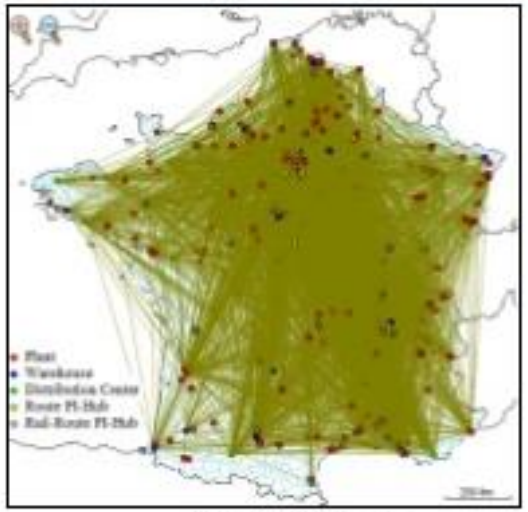


Exploiting the concepts of the Digital Internet (DI) to the physical world

Exploiting a Physical Internet Enabled Bimodal Mobility Web for the Consumer Goods Industry in France

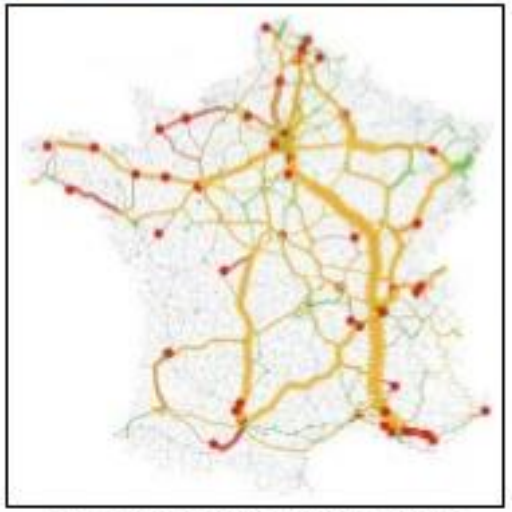
Road and rail transport seamlessly integrated into the PI backbone network

Simulation based on product distribution flow to two top retailers in France, from their 100 top suppliers



Current flows

Physical Internet flows



Physical Internet traffic

Preliminary results using existing infrastructures, facilities, demand patterns and service levels

Economical: From 4% to 26% overall cost saving

Environmental: About 3 times better in terms of greenhouse gas emissions,

by combining road-to-rail modal transfer and more efficient road transport

https://www.slideshare.net/physical_internet/physical-internet-manifesto-eng-version-1111-20121119-15252451

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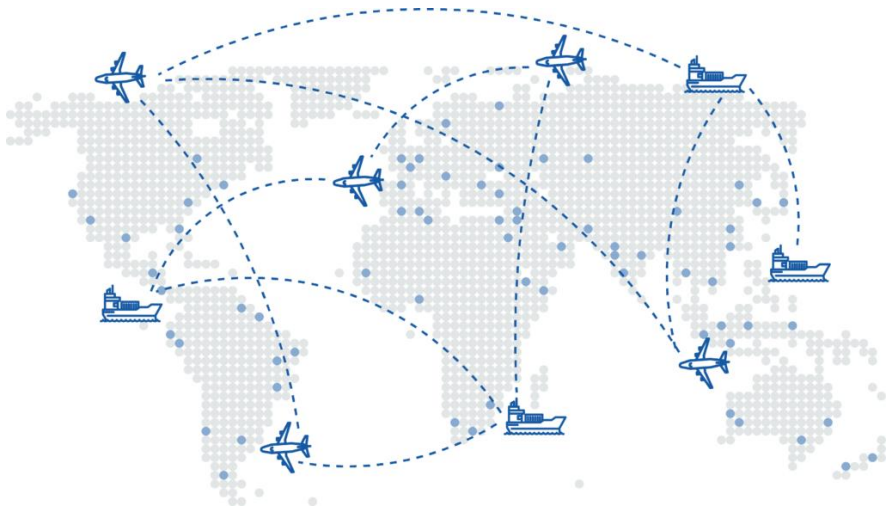
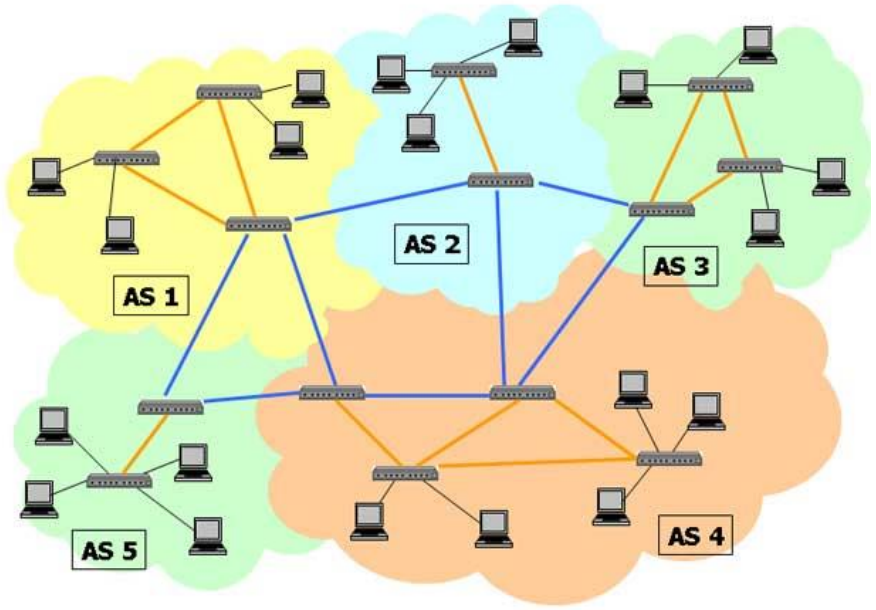
Exploiting the concepts of the Digital Internet (DI) to the physical world

Logistics Network



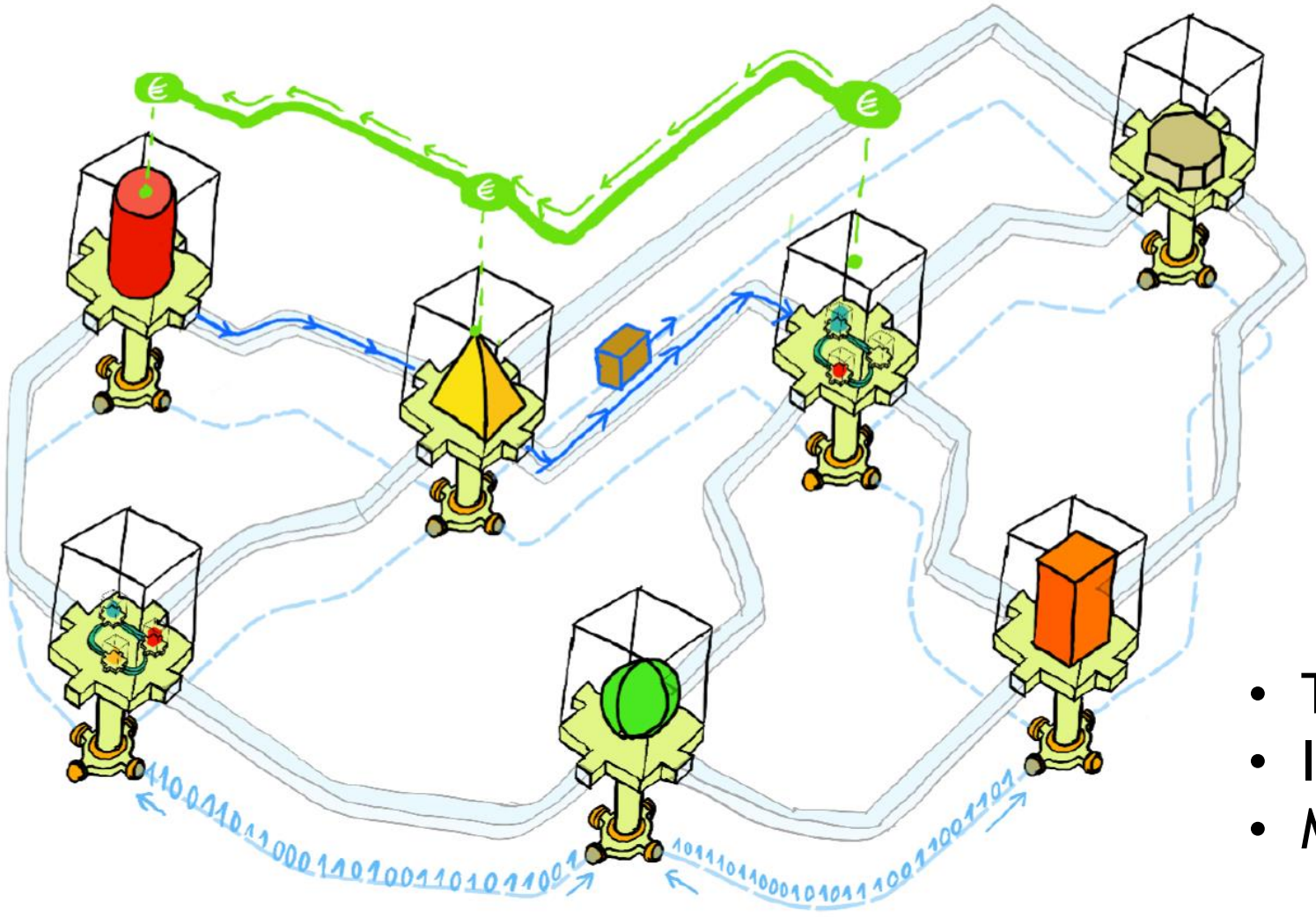
➔ The optimization of logistics processes

Digital Network



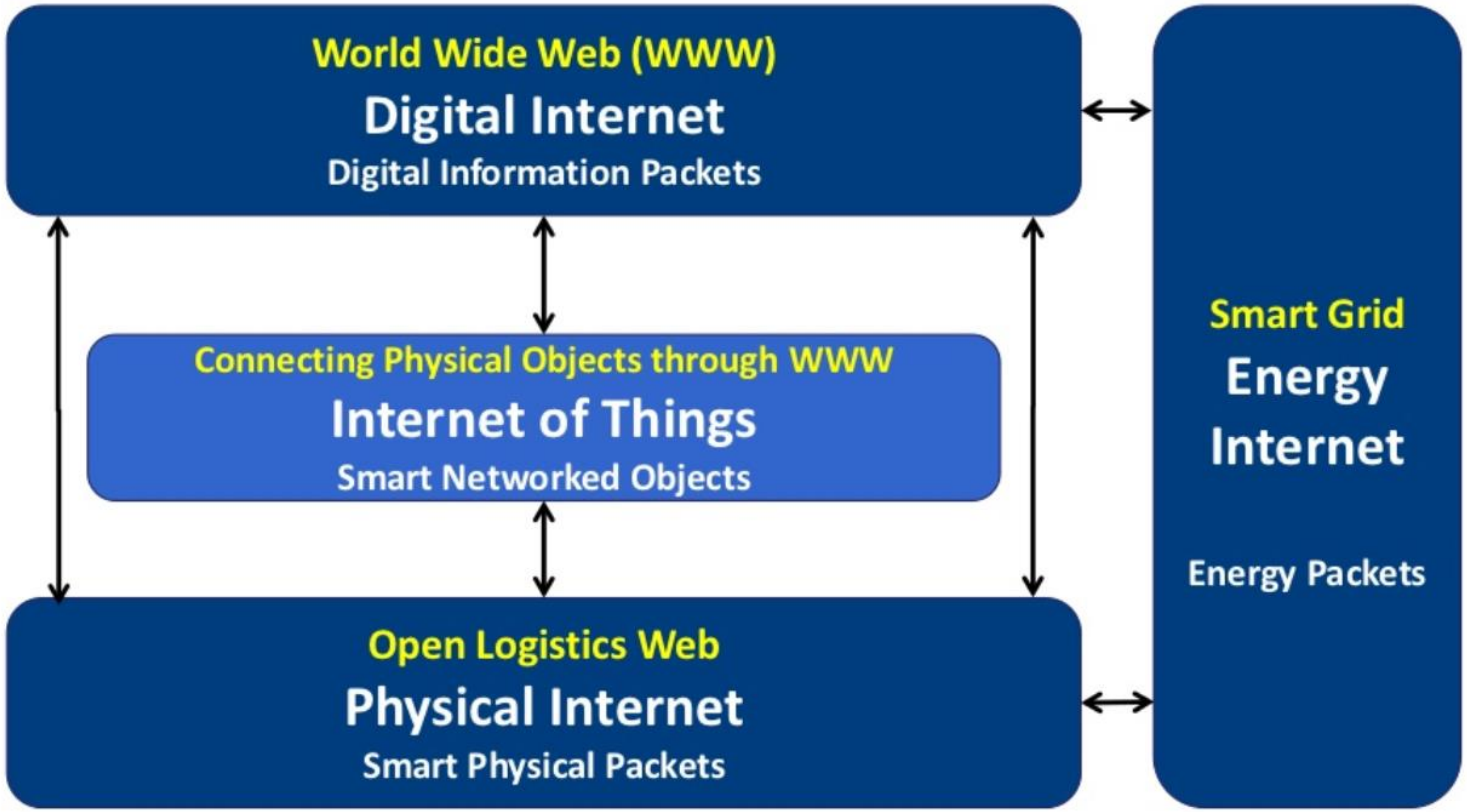
➔ The implementation of a more cost-effective, eco-friendly, service-driven, sustainable supply chain

PI Combination of Flows



- Transport (Physical)
- IT (Virtual)
- Money (Financial)

IoT as the enabling technology for the PI



Original schematics from Benoit Montreuil, 2010, Physical Internet Manifesto, www.physicalinternetinitiative.org

- The Internet of Things enables the “virtualisation” of the physical objects, connecting these with the DI

ICONET

Project Overview

ICONET Project Factsheet

- Horizon 2020 Framework of UE
- Project start: 01/09/2018
- Project finish: 28/02/2021
- Duration: 30 months
- Budget: EUR 3,078,698.25
- 16 partners
- GA no: 769119
- Coordinator: Inlecom
- Website: www.iconetproject.eu

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ICONET Consortium

ICONET Living Labs

PI Hub

- Hub types capabilities and the possible topologies
- PI containers travel according to synchromodality principles

PI Corridor

- Transformation (modelling) of TEN-T corridors into IoT-enabled PI corridors

e-Commerce as a Service

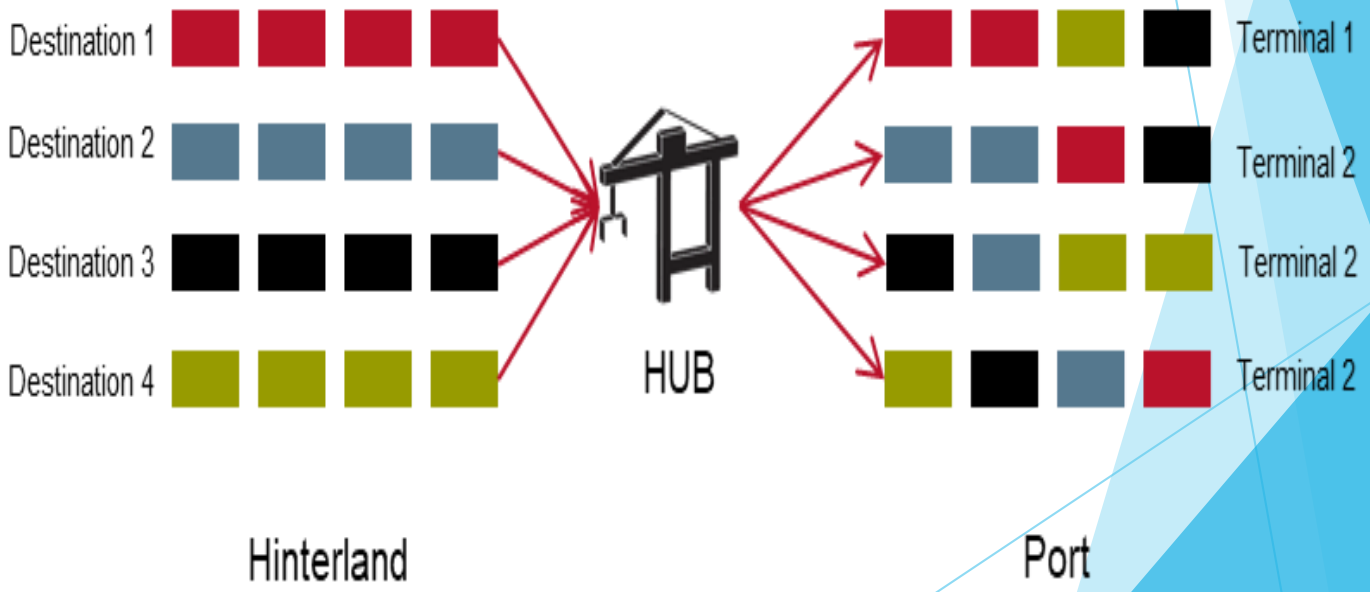
- PI impact on e-commerce fulfilment models
- Redesigning last-mile distribution centres to fulfil PI hub roles
- Investigating the role of other forms of mobile or multirole last-mile hubs fall within this scope.

Warehousing as a Service

- Investigates the role of the warehouse as a key PI node
- A dynamic buffer for flow between other PI hubs, to increase throughput of hubs, reduce congestion, etc

Highlight 1 – Optimization Services – IBM

- Optimization of Internal Node/Hub Operations
  - Incorporating **advanced cognitive capability** into the components of the PI Node using machine learning and or graph analytics techniques to **support PI Node operations in smart decision making**
  - Use Cases taken from Living Lab (**Wagon** Bundling, **Container Bundling**, Local & Global Resource Utilisation)



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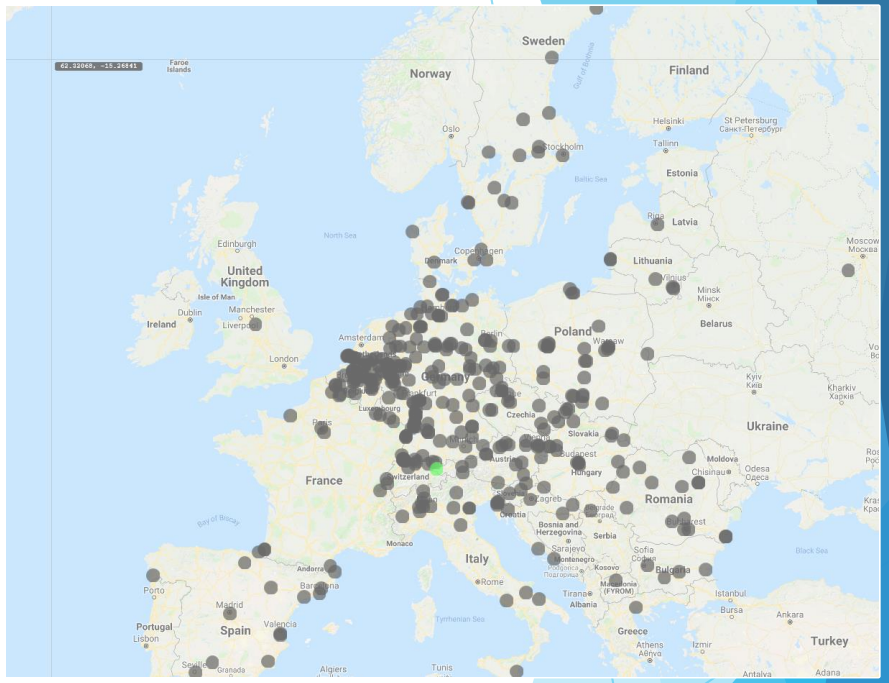
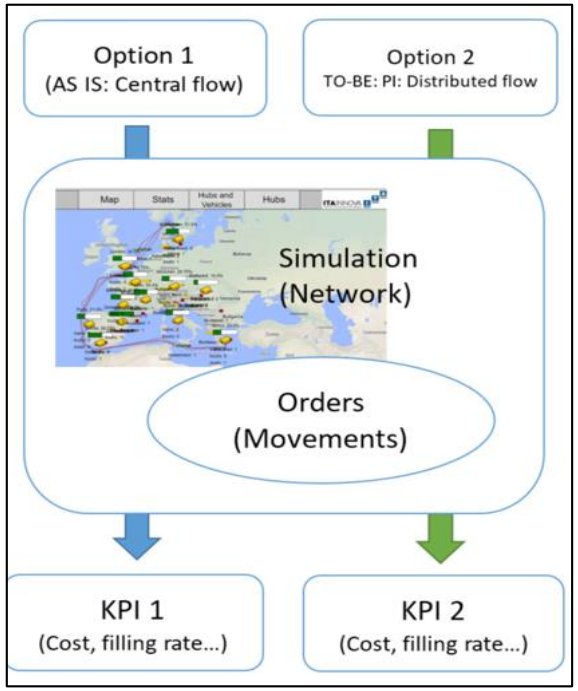
Highlight 2 – PI Routing Algorithms

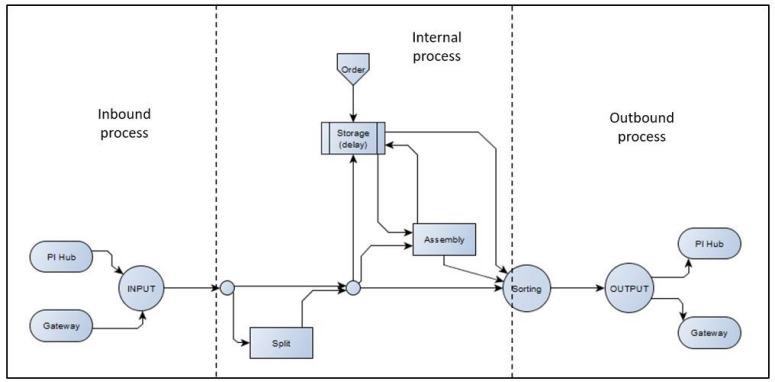
- Routing Algorithm that uses ‘one hop at a time’ strategy (similar to digital Internet)
- 386 existing intermodal terminals connected together as potential ‘PI-hubs’, to form a hypothetical PI network
- 165478238 calculated shortest routes connecting them
- A route contains between 1 and 9 hops (average: ~7)
- In our PI model a hub has on average ~66 direct connections



Highlight 3 – Simulation Framework

- Main Simulation objective: represent the PI network
- PI modeling: through agents
- The simulation model is dynamic
- The simulation contains also the network configuration for the scenario
- Scenarios:
  - Set of orders, with different PI options
  - Simulation model measures the KPI





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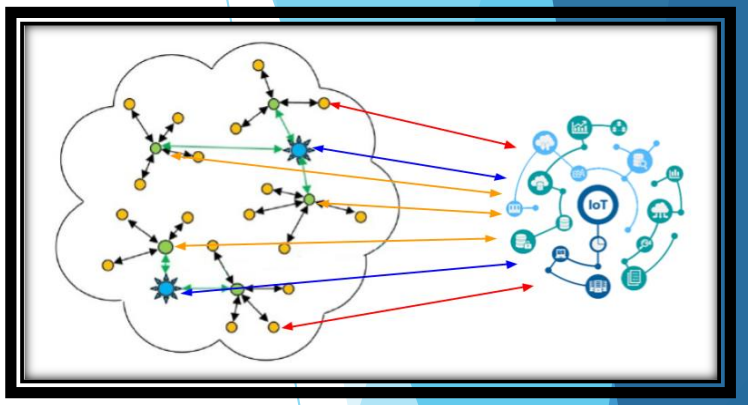
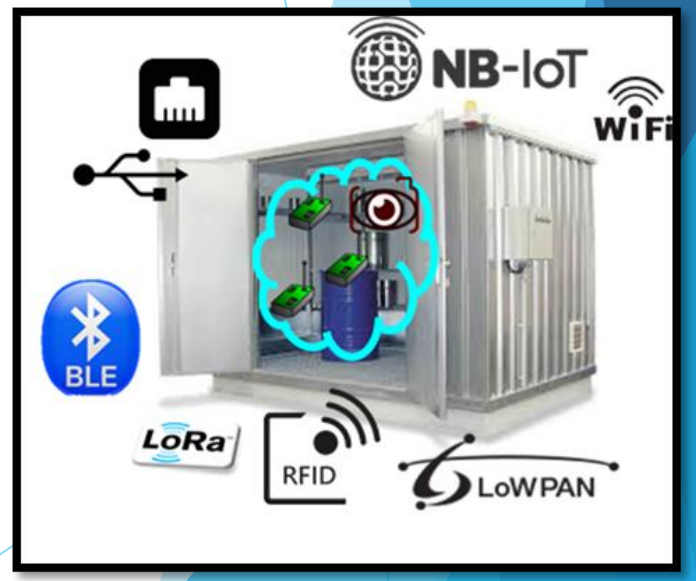
Highlight 4 – IoT Devices - NGS srl New Generation Sensors

- Definition of a tailored and interoperable IoT architecture to support Goods encapsulation
- **Tracker**
  - Stand-alone and battery powered device
  - Provides information regarding time and position
  - Can measure added-value information with on-board sensors (e.g., bump, temperature)
  - Different IoT protocols for data dispatchment (C-IoT or short-range communication)
- **Container gateway**
  - Same functionalities of the tracker and capability to establish a sensor network inside the container
  - Internal monitoring sensor network (inventory, distributed measurement, door closed/open)





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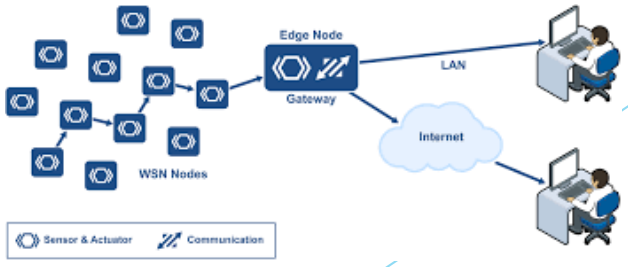
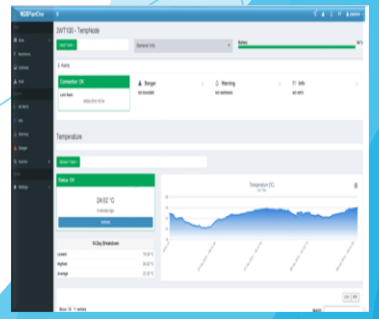
Contribution in ICONET

NGS srl New Generation Sensors - the IoT company

Spin Off
Impresa Spin-Off della Scuola Sant'Anna

- IoT systems and solutions
- Multi-protocol gateway powered by battery or cable
- Scalable solutions
- Consulting and customization





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Examples of solutions developed by NGS srl New Generation Sensors

- Predictive Maintenance
  - Monitoring of machineries and early detection of faults
- Tracking of goods in intermodal logistic
  - Pallet's beacon, tracker/gateway, cloud platform and web interface
- Smart Agriculture
  - Monitoring of environmenltal parameters from distributed sensors
- Smart Lamppost
  - Monitoring of traffic and pollution
- Monitoring of hills and mountain slopes for early detection of landslides
- … And many more!

The Smart PI-Container

Smart Container is:

A container…

… equipped with a battery powered gateway…

… capable to manage several and different sensor nodes …

… in charge of dispatching remotely geo&time-referenced information regarding:

The presence of goods

The status of the goods

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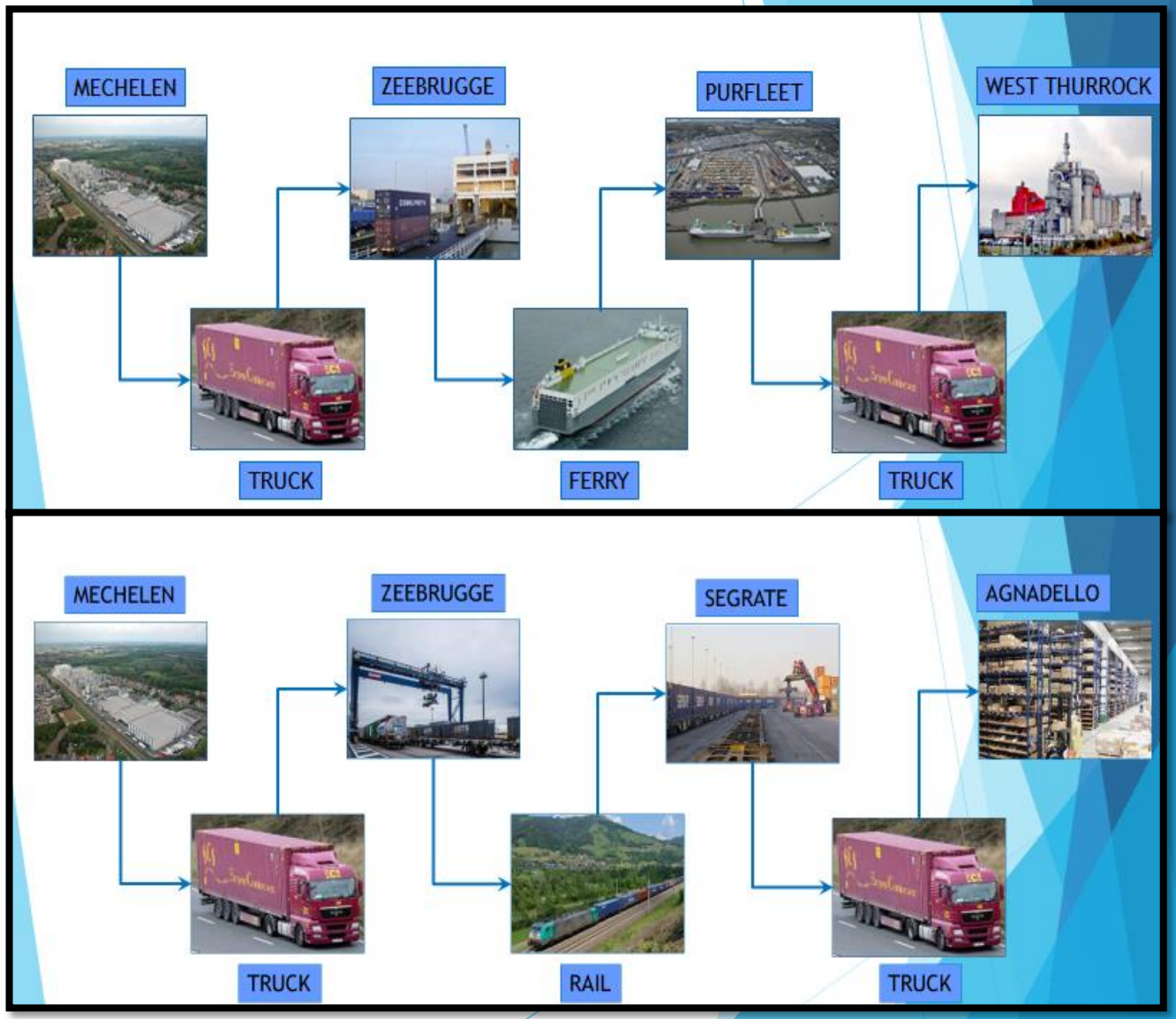
ICONET Living Lab 2

Living Lab 2 (LL2) of the ICONET project, called Corridor-centric PI Network.

Realisation of the PI corridors

- enhancement of the reliability of intermodal connections
- Realisation of the synchromodal corridor



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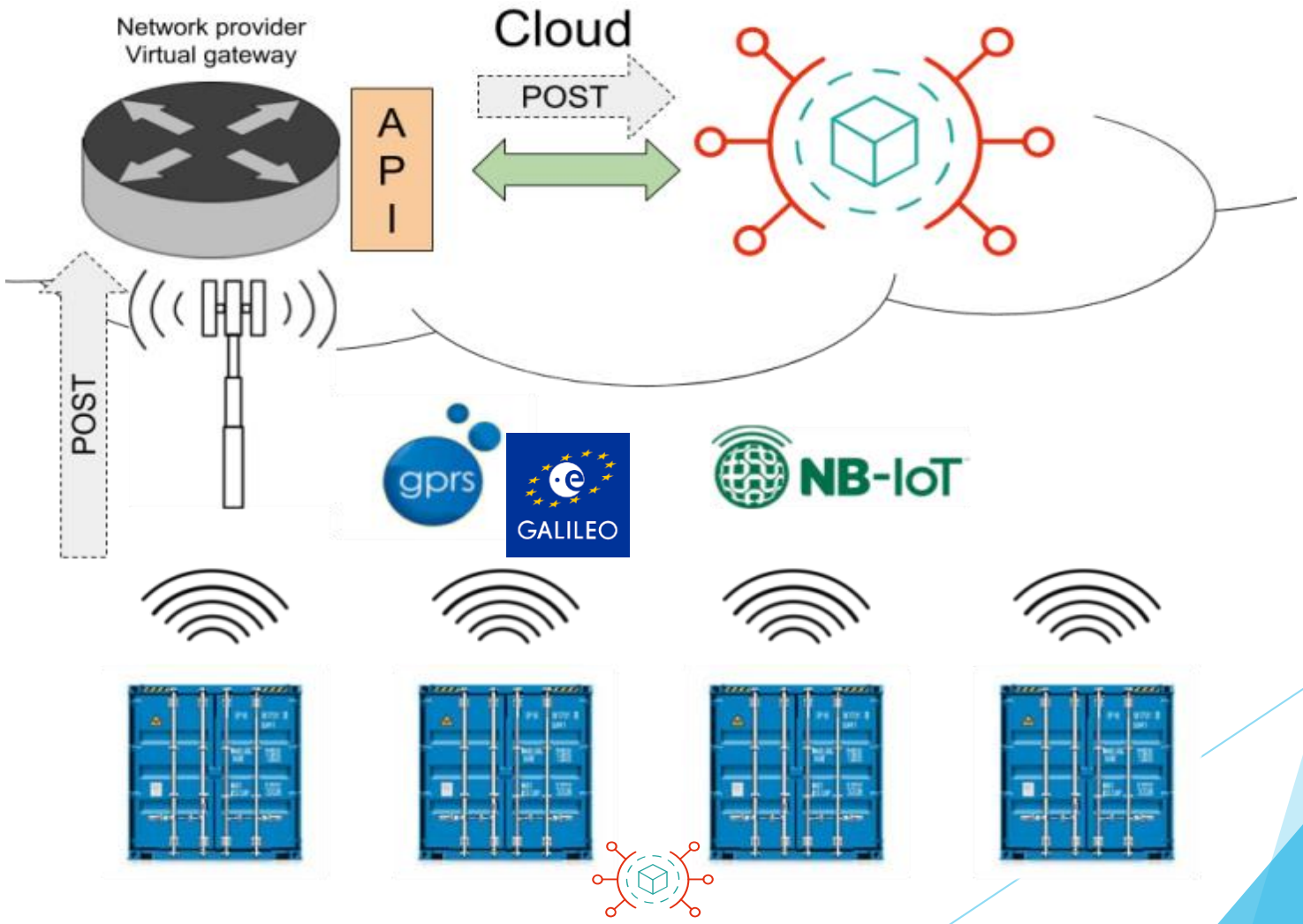
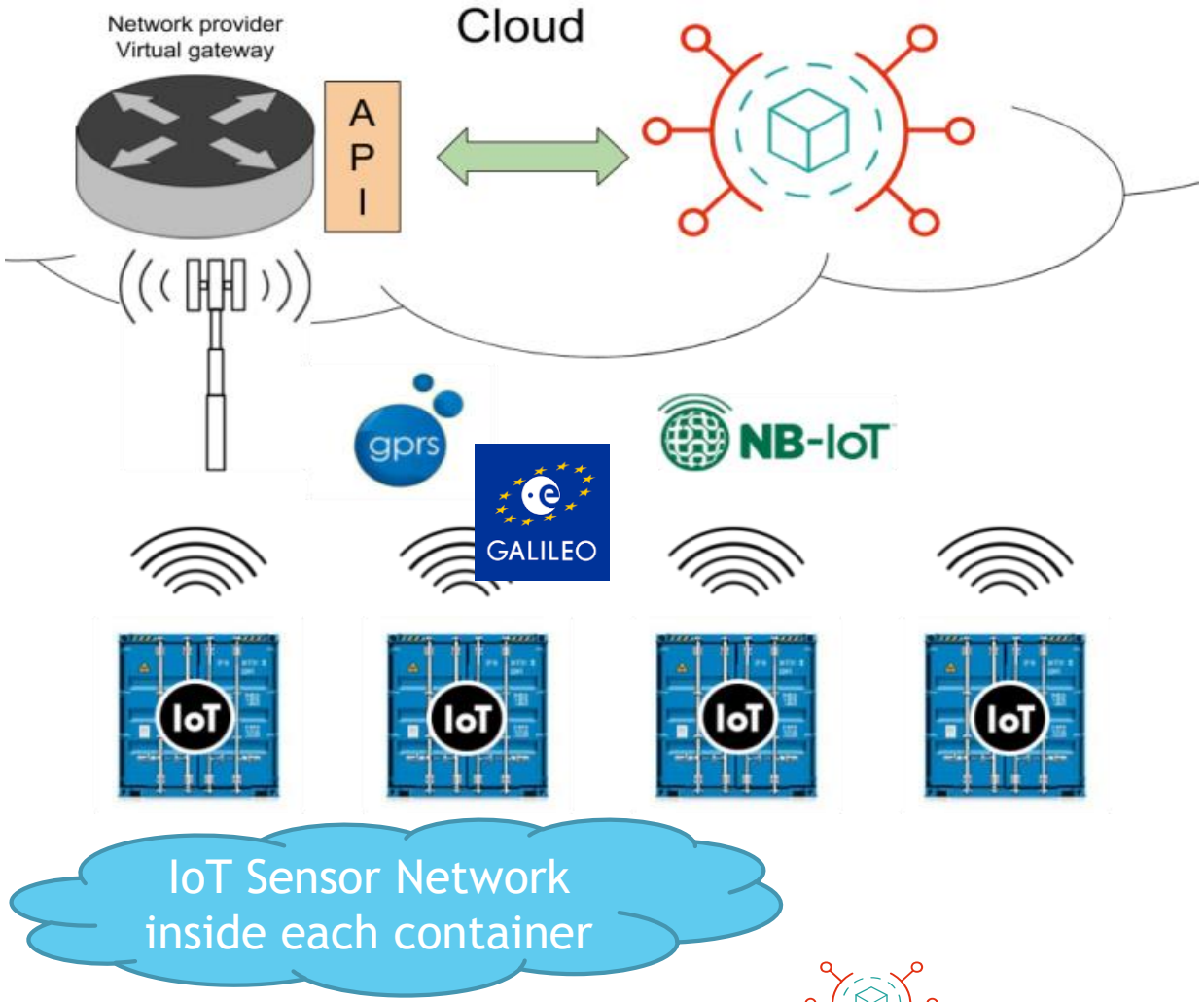
Solution for Smart Container - 1/2

Container Tracking

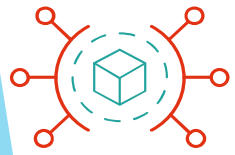


Solution for Smart Container - 2/2

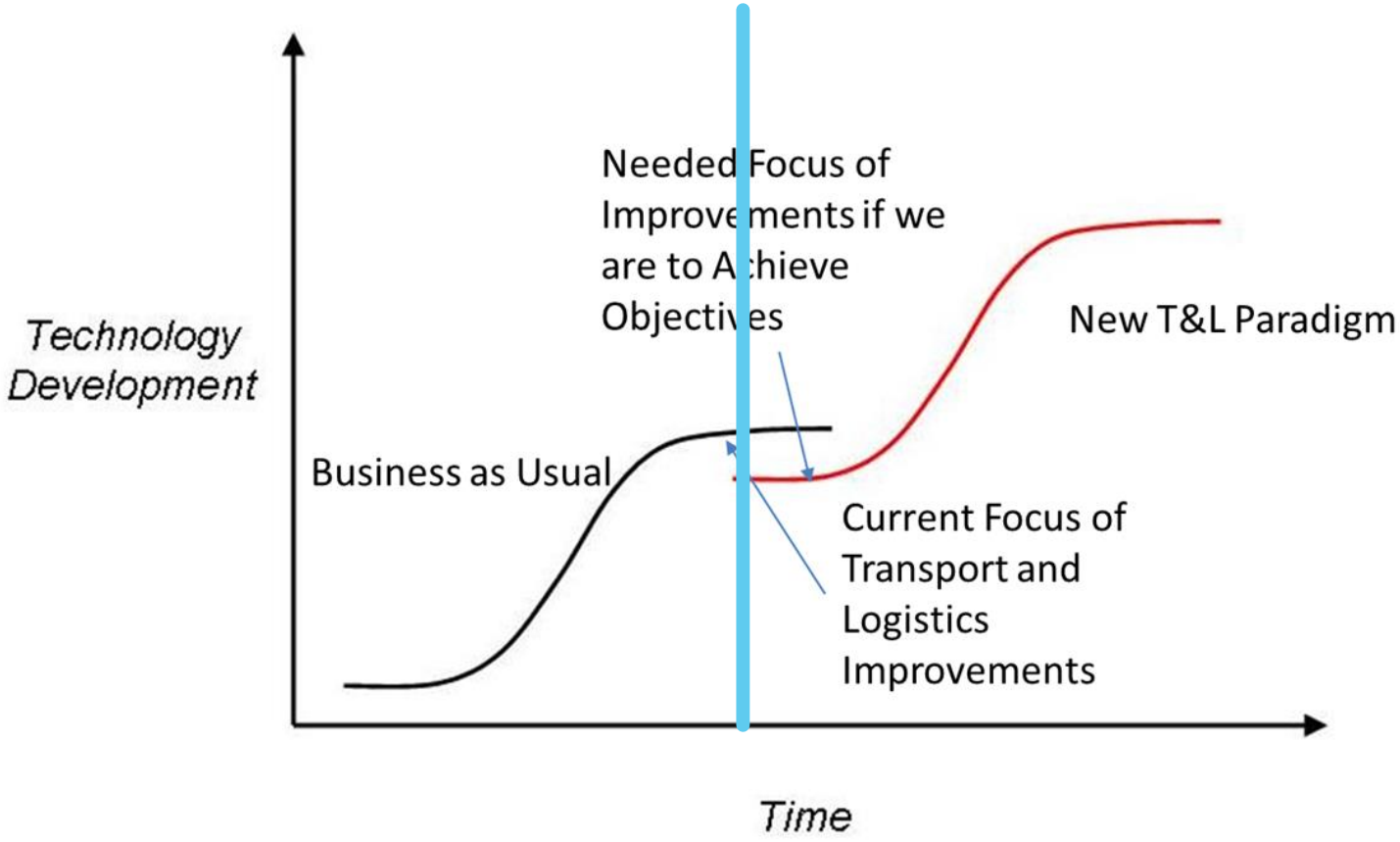
Tracking & monitoring



Outlook and Impact



Where are we today



Collaboration between stakeholders is key

- **Shippers**
  - will need to trust the network to properly secure, route, deliver and price their shipments
- **Asset operators**
  - will have to trust the network to efficiently allocate shipments and revenues based on usage
- **Governments and international governing institutions (EU)**
  - will have to trust the network to properly ensure security and privacy while reporting appropriately and enabling automated customs payments
- **Consumers**
  - will have to trust the network to deliver the goods that they have ordered on time, at acceptable costs, at appropriate quality levels, to expected destinations
- **All parties will have to trust one another in order for the system to work**

PI – Opportunity or Threat ?
existing examples of PI Intranets

IBM | MAERSK

TRADELENS

https://www.morethanshipping.com/tradelens-will-improve-operations-in-shipping/

Port of Rotterdam | PORT FORWARD

https://www.portofrotterdam.com/en/port-forward/boxinsider

https://www.forbes.com/sites/enriquedans/2019/05/17/the-battle-for-the-physical-internet/#42b4b1153baa

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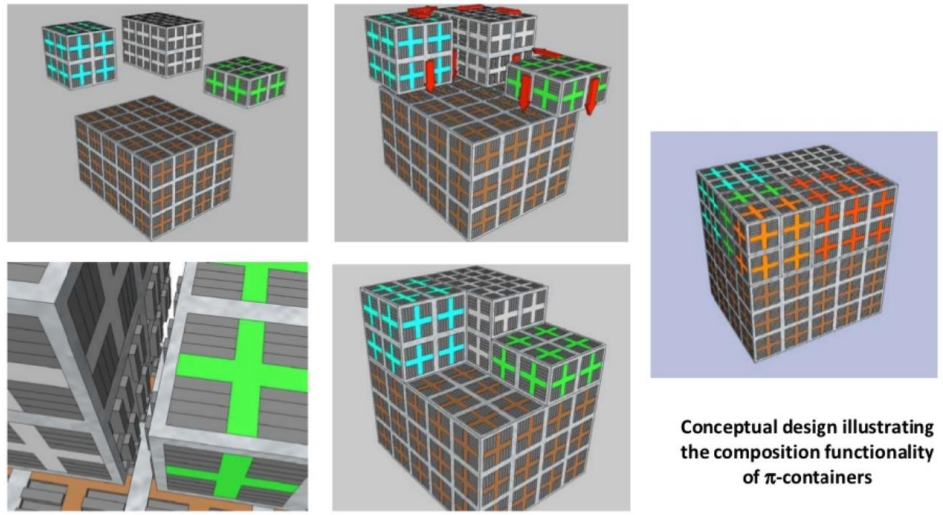
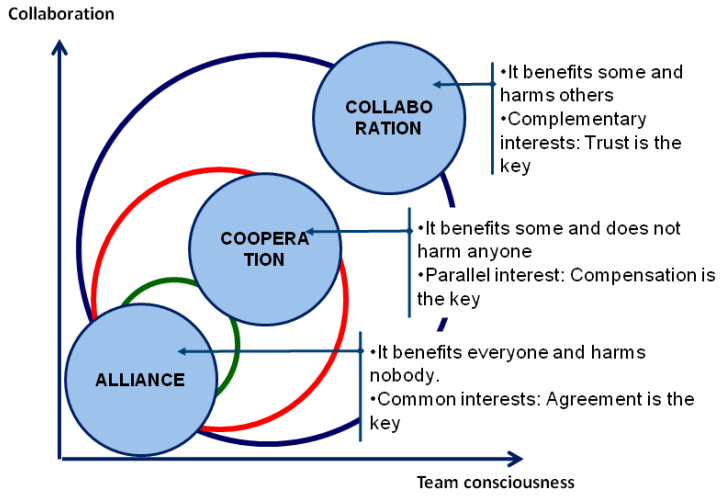
PI – Opportunity or Threat?



Conceptual design by Benoit Montreuil and Marie-Anne Côté
CIRRELT, Université Laval, Québec, Canada, 2012

Conceptual design illustrating the composition functionality of π-containers

The illustrated π-container design has a strictly conceptual and functional purpose: it has no prescriptive technical design and engineering intent



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PI – Opportunity or Threat?
Impact on other Sectors – Fair trade – fair labor- fair sourcing

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