Pr. Eric Ballot

Quand la logistique s'inspire du numérique. Vers un Internet Physique

Palaiseau– 23 Feb. 2017

Agenda

- ## How supply chains shapes the logistics demand
  - Moving from mass to focused
  - Moving from few to many channels
  - Faster and faster!

- ## A new approach of logistics networks to cope with new needs
  - The concept
  - Impacts on several dimensions
  - Potentials

- ## It becomes real
  - ALICE
  - Start-up
  - Opportunities

- ## IT challenges…

Moving to a focused global supply

○ Smart phone simplified supply map

- Just-in-Time, global and specialized plants
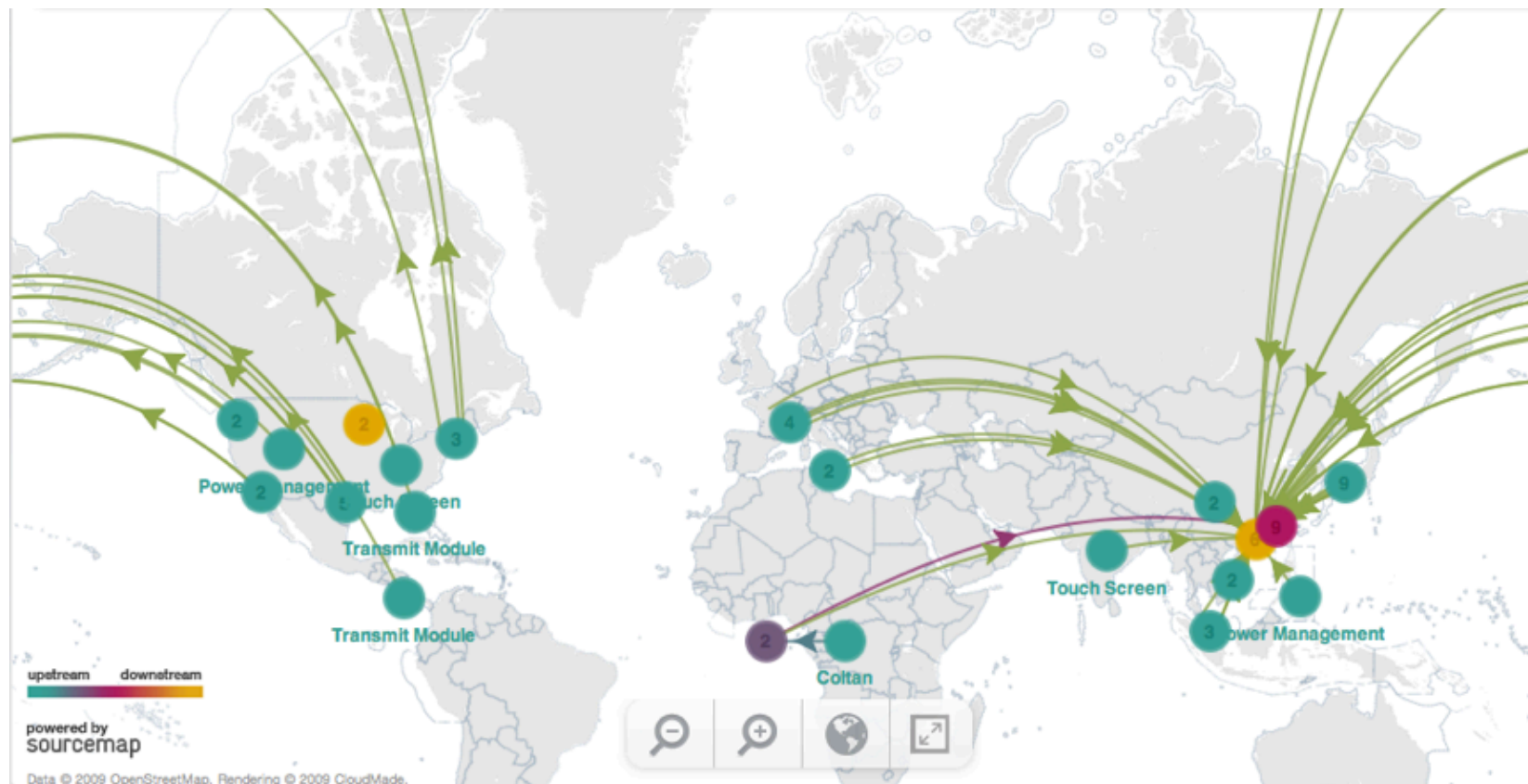
Moving an omni-channel demand

○ Much more fragmented flows!

- **Shipment median weight divided by 4,5 in 16 years, next 16?**

  160 kg in 1988 - 30 kg in 2004

  Source IFSTTAR 2013 – freight network

- A **no cost illusion** for most consumers

Vending machine

Poster store

Ecommerce

Drive

Pop Up stores

Source Nathalie Damery

Faster and faster deliveries!

○ Consequence on transport

- **An increase of delivery frequency**
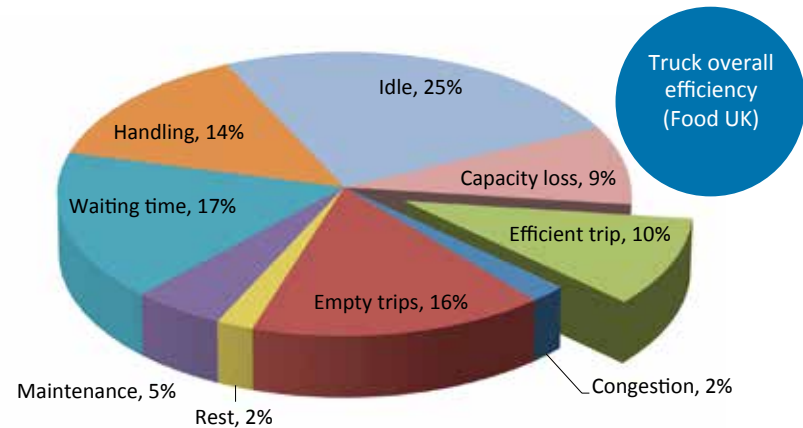
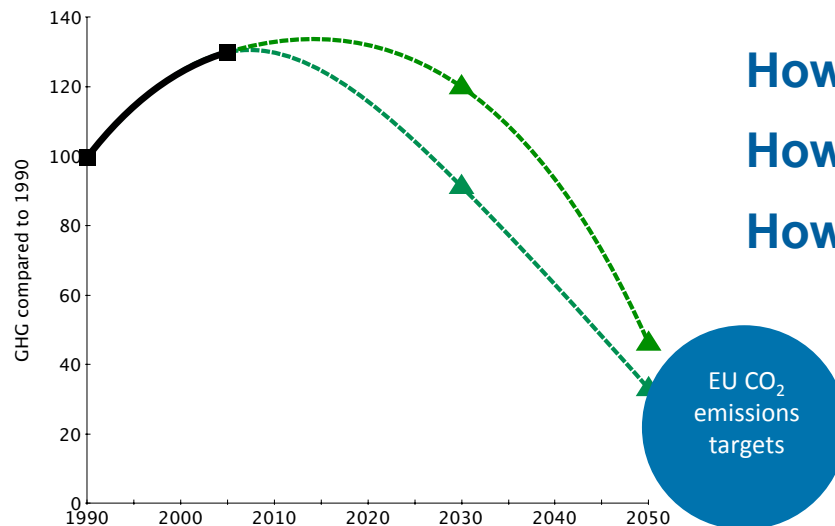- **A reduction of delivery lead time**

Two major concerns

○ An incredible performance but with contradictions

- **Asset utilization**

McKinnon, A., Y. Ge, and D. Leuchars, *Analysis of Transport Efficiency in the UK Food Supply Chain*, L.R. Centre and S.o.M.a. Languages, Editors. 2003: Edinburgh. p. 38.


Truck overall efficiency (Food UK)

Idle, 25%
Handling, 14%
Waiting time, 17%
Capacity loss, 9%
Efficient trip, 10%
Empty trips, 16%
Congestion, 2%
Maintenance, 5%
Rest, 2%

- **Sustainability**

GHG compared to 1990

EU CO$_2$ emissions targets

How to rebuild economy of scale ?

How to mitigate the environmental effects?

How to cope with the demand ?

Future vision: we need a paradigm shift

○ Technology? Sustainability? Collaboration?

E. Ballot   Palaiseau – 23 février 2017
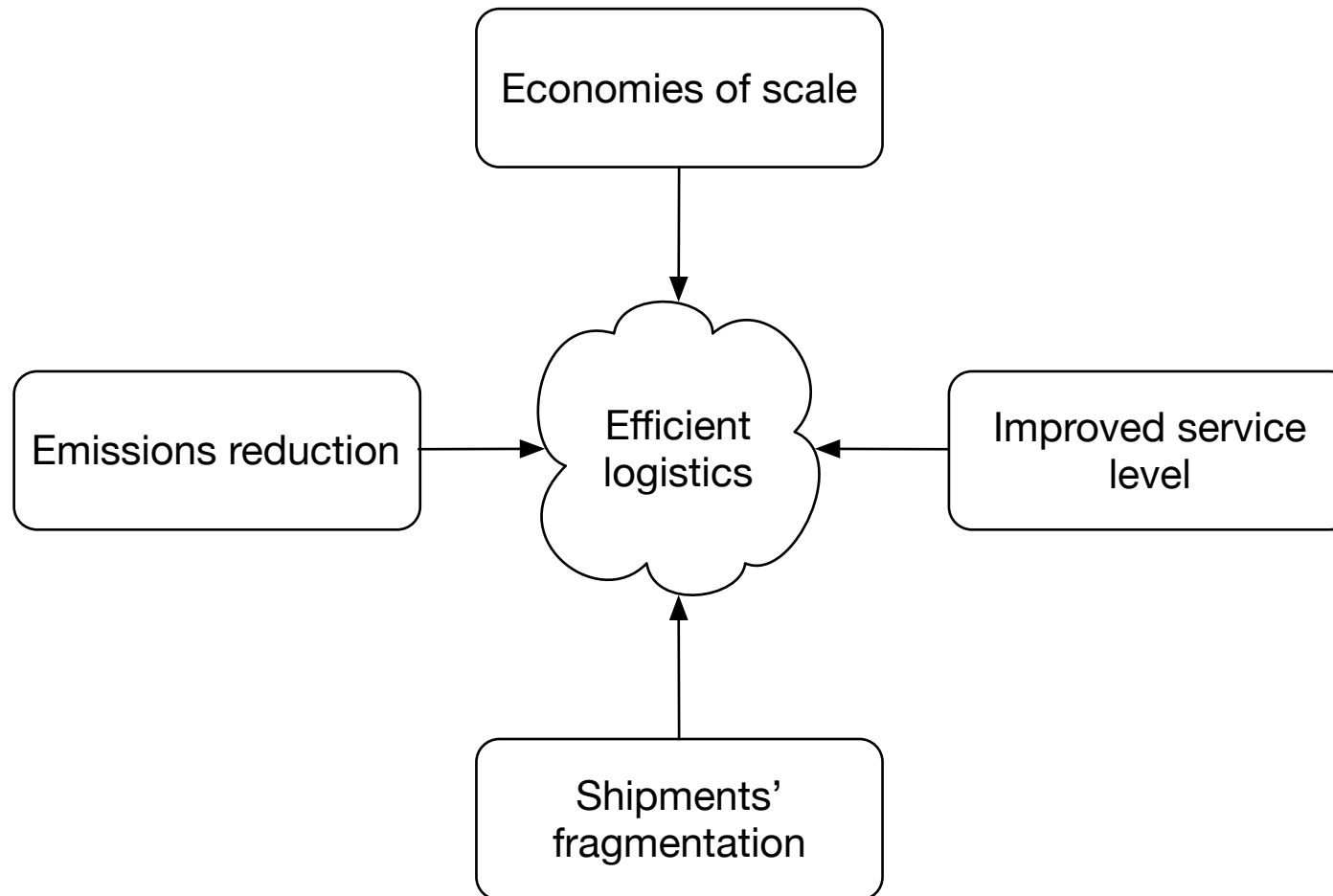
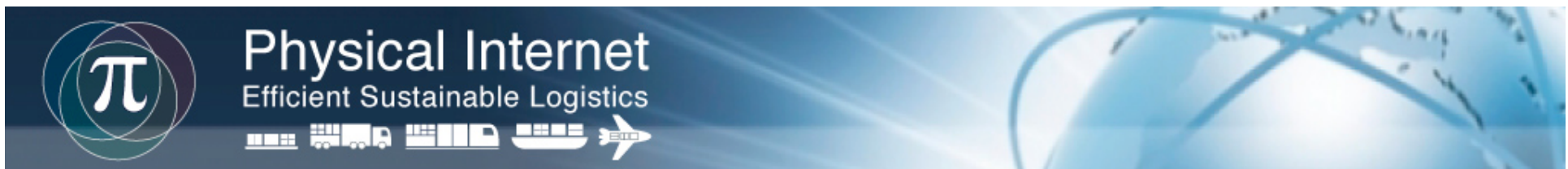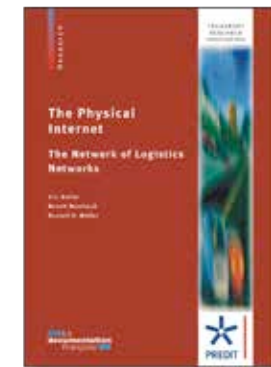# The Physical Internet concept

○ Definition

The Physical Internet is an interconnected global logistics system enabling seamless asset sharing and flow consolidation

The Physical Internet is founded on
universal physical, digital, operational, business and legal
interconnectivity achieved through
standard open protocols, "encapsulation", certification,
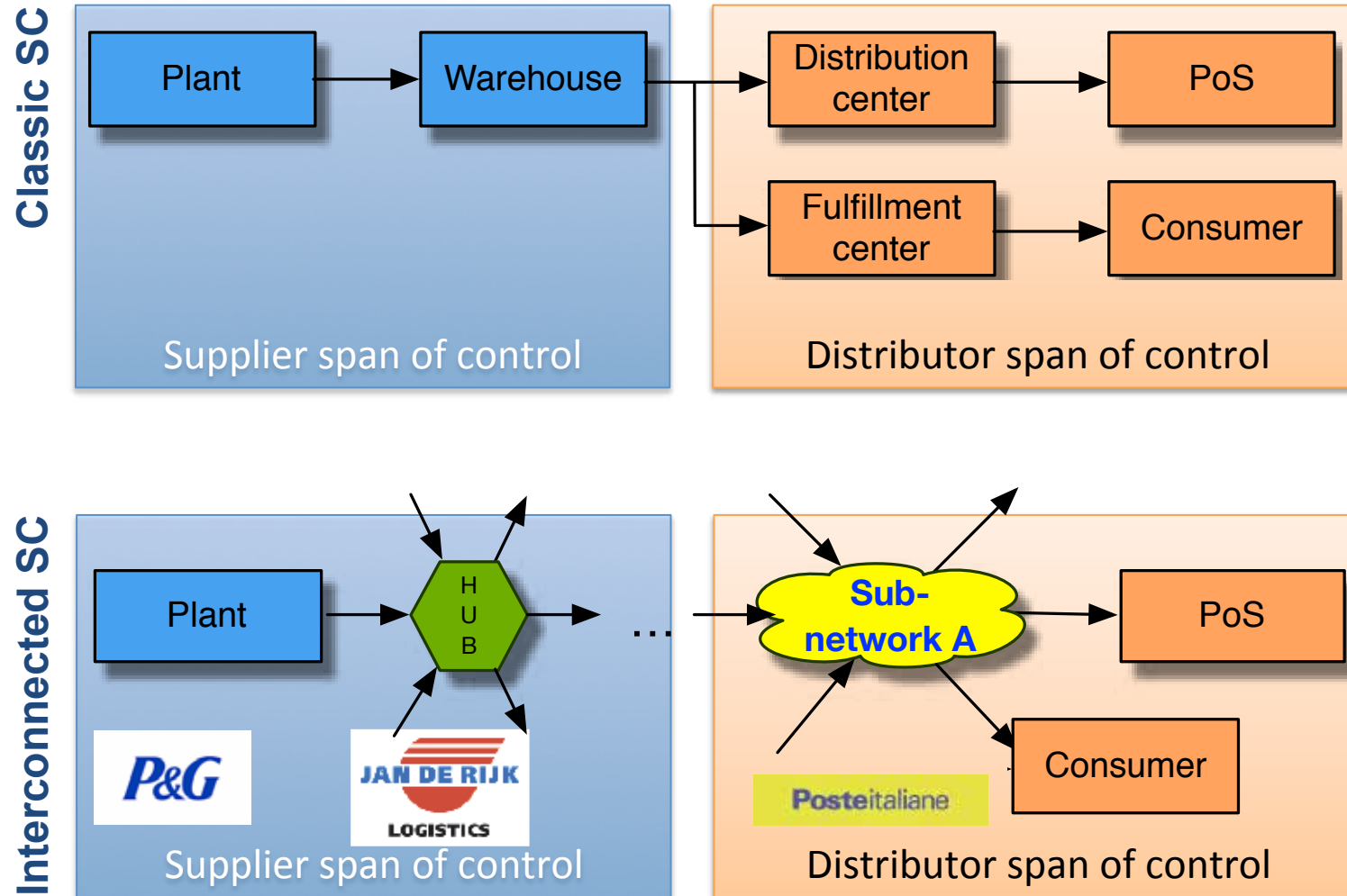performance assessment and monitoring.

B. Montreuil, R. D. Meller & E. Ballot, June 9th, 2015
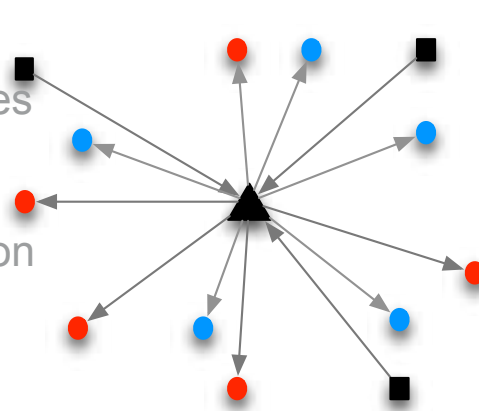
The Physical Internet concept
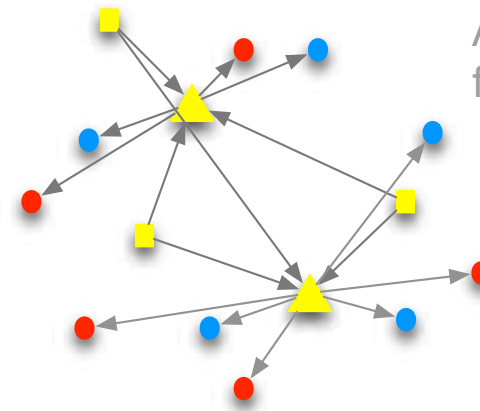
○ Illustration

Impact on logistics networks design

○ Actual supply networks design

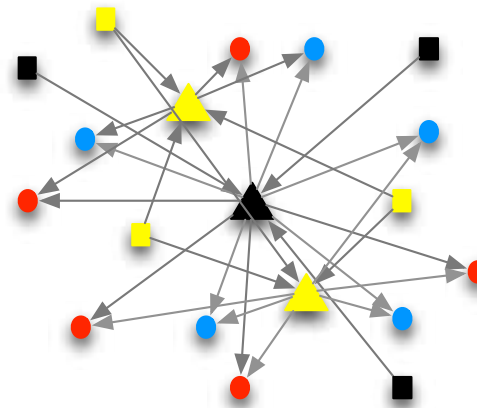A supplier with 3 factories distributes via a central warehouse 10 regional distribution centers of two customers

Another supplier with 3 factories distributes via 2 warehouses to 10 regional distribution centers of two customers

● DC of retail chain 1
● DC of retail chain 2
■ Plant of manufacturer 1
▲ WH of manufacturer 1
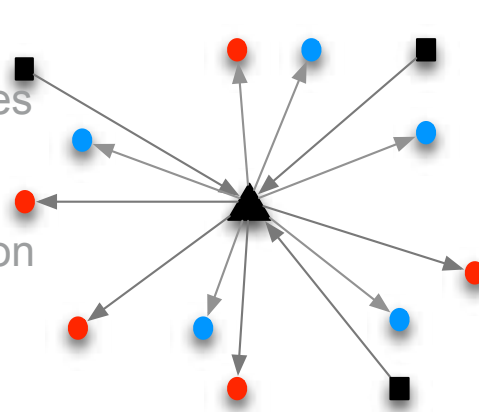■ Plant of manufacturer 2
▲ WH of manufacturer 2
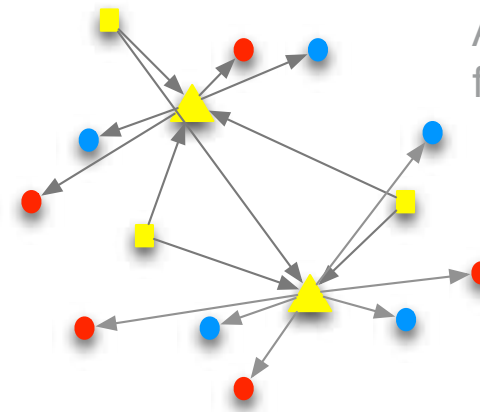
Two dedicated supply chains: overlapping each other

Expected impact on logistics networks

○ Interconnected networks

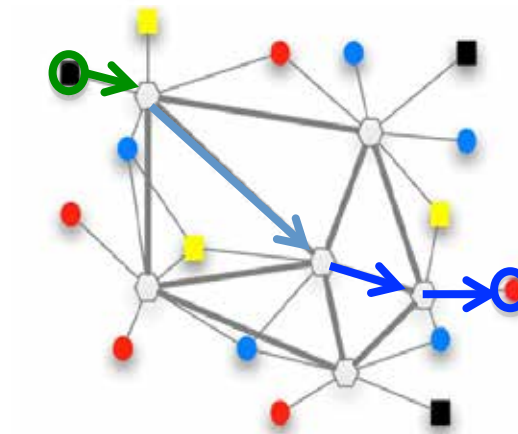A supplier with 3 factories distributes via a central warehouse 10 regional distribution centers of two customers

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+

=

● DC of retail chain 1
● DC of retail chain 2
■ Plant of manufacturer 1
▲ WH of manufacturer 1
■ Plant of manufacturer 2
▲ WH of manufacturer 2

An interconnected network

Physical aspect

○ A generalization of containerization: transport and handling containers small and modular boxes, pallets footprint free

**Handling
cost
/ 10
in 50 years**

**How to achieve
the same
improvement?**

Information aspect

○ Logistics information structure and communication could be more <u>independent</u> of operators

- Enterprise Resources Planning

- Software As A Service

- IoT

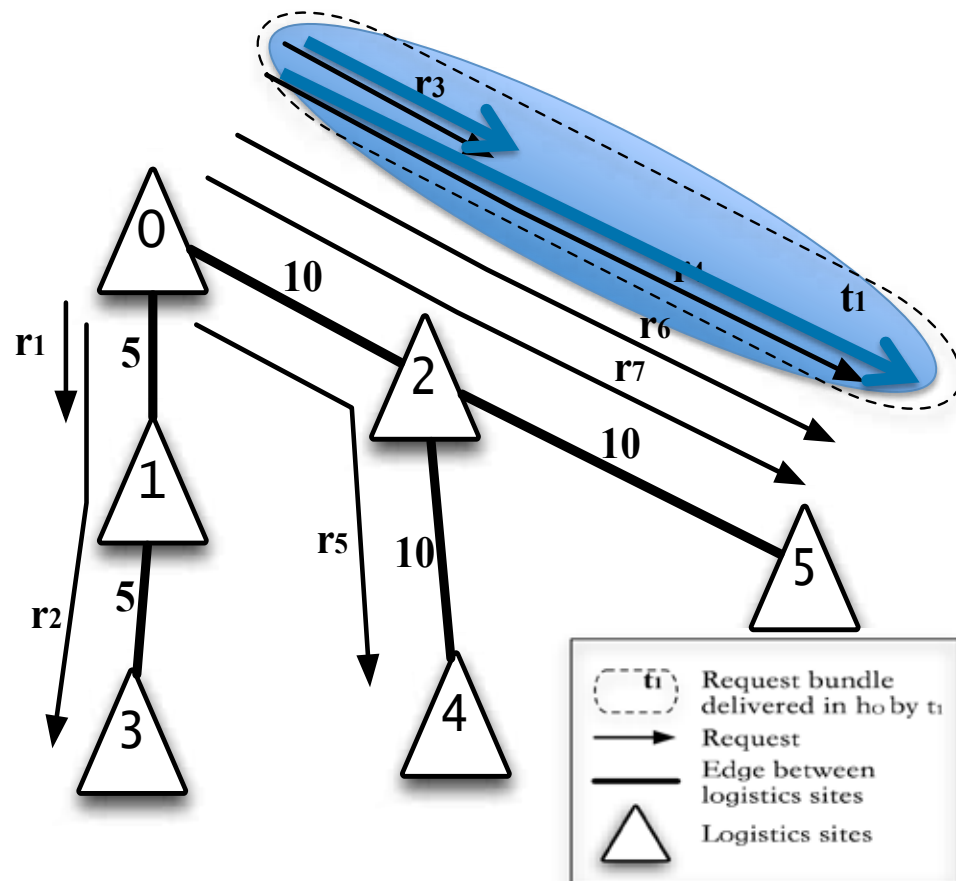- Capture

- Smart objects

- Objects

○ How to give an incentive to dynamic collaboration?

● When a hub becomes a marketplace for independent operators!

Request	Destination	Load units	Current carrier
r_1	h_1	5	
r_2	h_3	5	
r_3	h_2	5	t_1
r_4	h_5	4	t_1
r_5	h_4	5	
r_6	h_5	3	
r_7	h_5	3	

Legend:
- t_1 (dashed) — Request bundle delivered in h_0 by t_1
- → Request
- — Edge between logistics sites
- △ Logistics sites

What is needed: a new type of market place

○ How to give an incentive to dynamic collaboration?

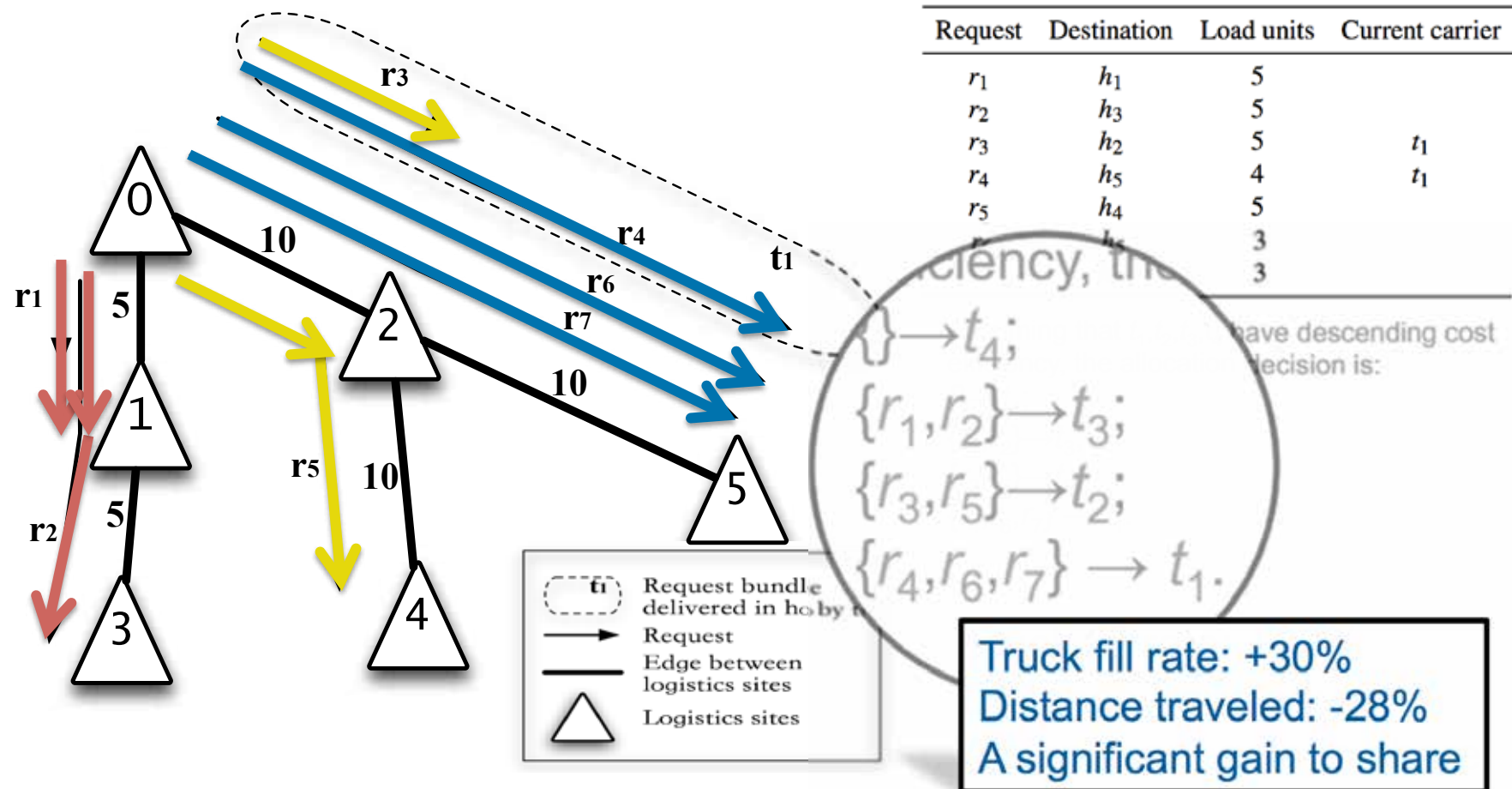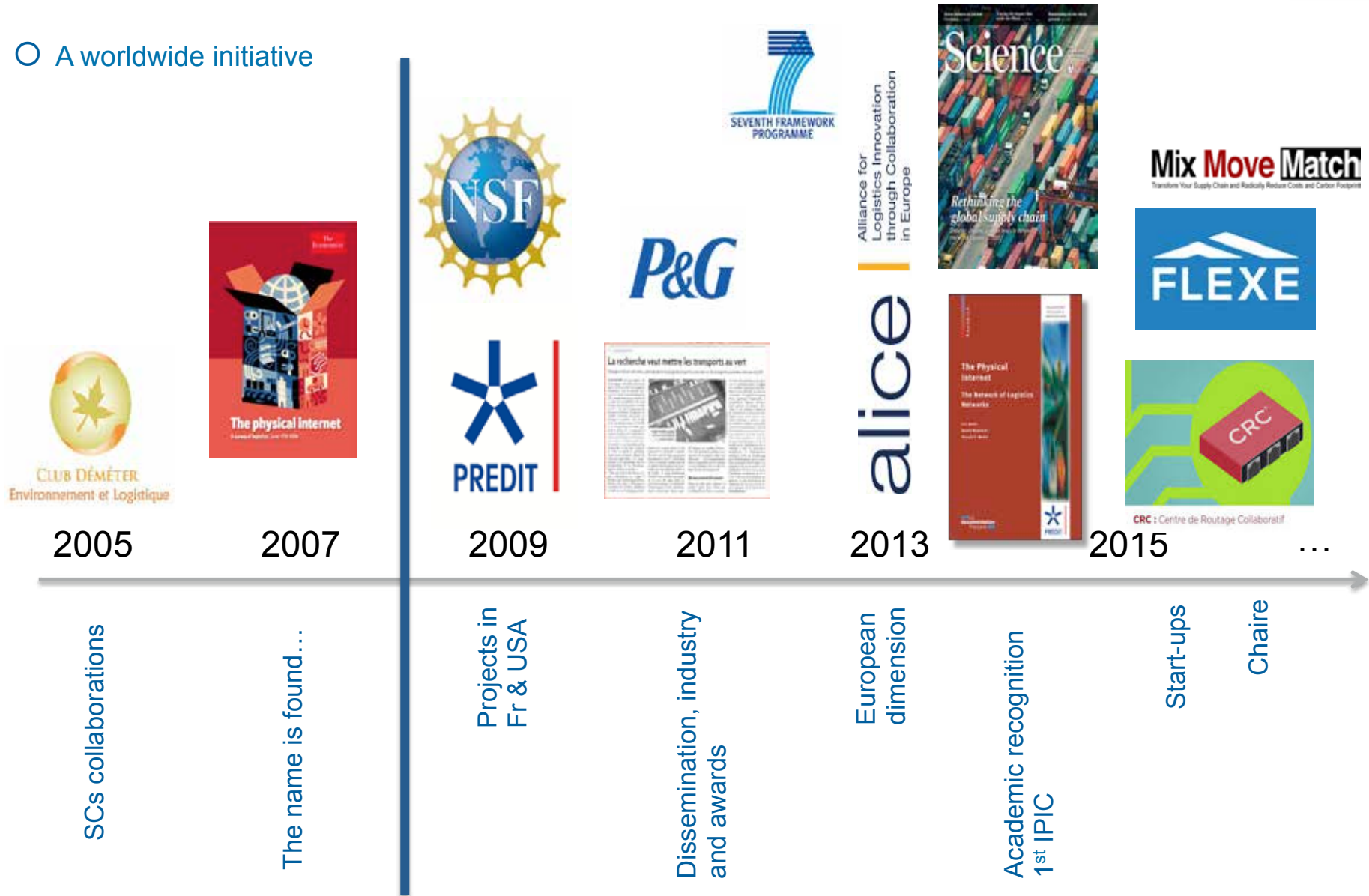● When a hub becomes a marketplace for independent operators!

Request	Destination	Load units	Current carrier
r_1	h_1	5	
r_2	h_3	5	
r_3	h_2	5	t_1
r_4	h_5	4	t_1
r_5	h_4	5	
	h_6	3	
		3	

...iency, the... have descending cost decision is:

$$\{\}\rightarrow t_4;$$
$$\{r_1, r_2\}\rightarrow t_3;$$
$$\{r_3, r_5\}\rightarrow t_2;$$
$$\{r_4, r_6, r_7\} \rightarrow t_1.$$

Legend:
- t_i : Request bundle delivered in h by t
- → Request
- ─ Edge between logistics sites
- △ Logistics sites

Truck fill rate: +30%
Distance traveled: -28%
A significant gain to share

Many aspects

Function	Current logistics	Physical Internet
Shipping	Goods	Containers
Network	Specific services	Network of open and shared networks
Trip	Logistics service	Dynamic routing
Information system	Proprietary	Internet of Things Platform of services on the Cloud
Standard	Proliferation of standards	Market movement to agreement on interfaces, identification and protocols
Storage	Time-intensive (centralized)	Deployment logic
Capacity management	Private	Market-based

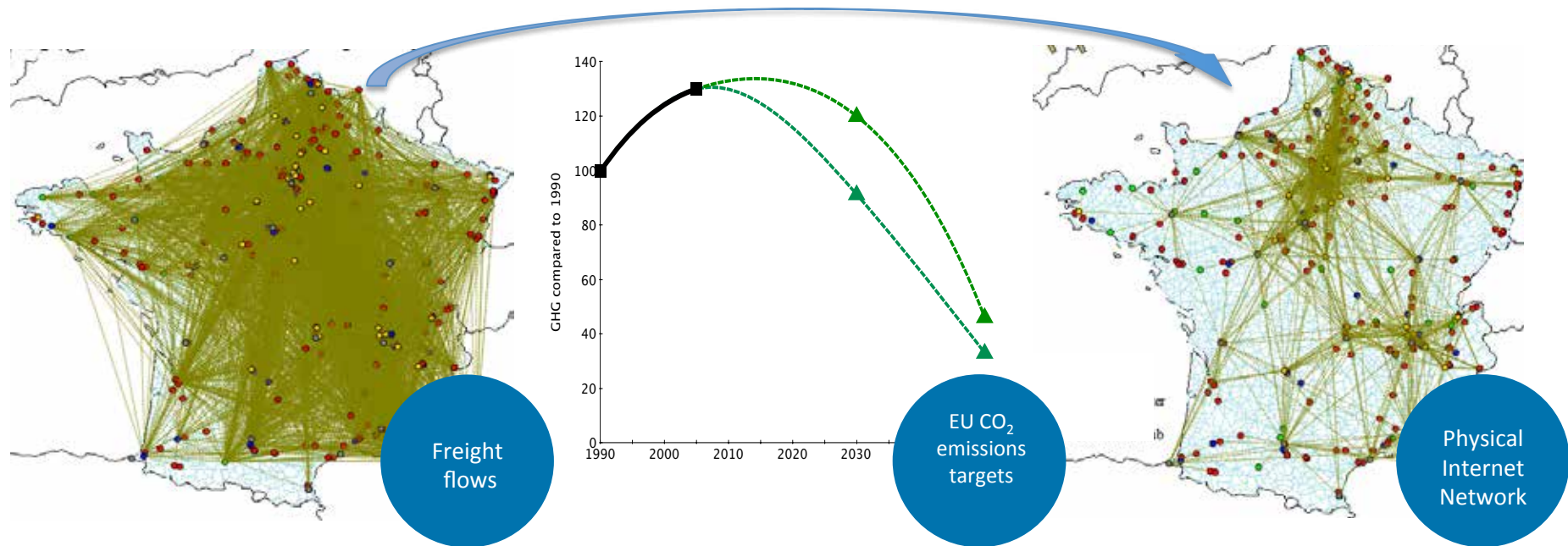Eric Ballot, Benoit Montreuil, and Russell D. Meller. « The Physical Internet. » iBook or Kindle.

Development timeline

○ A worldwide initiative

| 2005	2007	2009	2011	2013	2015	…
SCs collaborations	The name is found….	Projects in Fr & USA	Dissemination, industry and awards	European dimension	Start-ups	
				Academic recognition 1st IPIC	Chaire	

Potential: transportation efficiency

○ What if we are able to dynamically consolidate freight?

Freight flows

EU CO$_2$ emissions targets

Physical Internet Network

(chart y-axis: GHG compared to 1990; x-axis: 1990, 2000, 2010, 2020, 2030)

- Interconnection of logistics services potential is:

  - 15% in distance, +35% in transport mean fill rate, up to -60% CO$_2$ (modal-shift)

- More resilient supply chain

Ballot É., B. Montreuil, R. Meller (2015), The Physical Internet: The Network of Logistics Networks, Doc. Française.

Potential: supply chain inventory

○ What if push inventory gradually towards consumers?

Classic supply chain
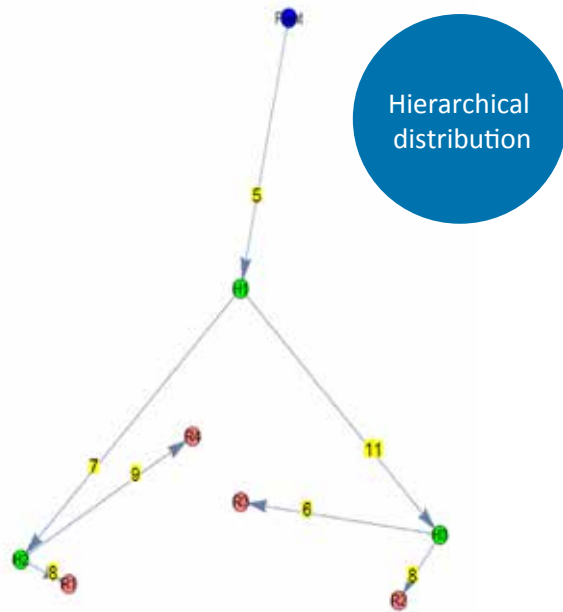
Physical internet supply network
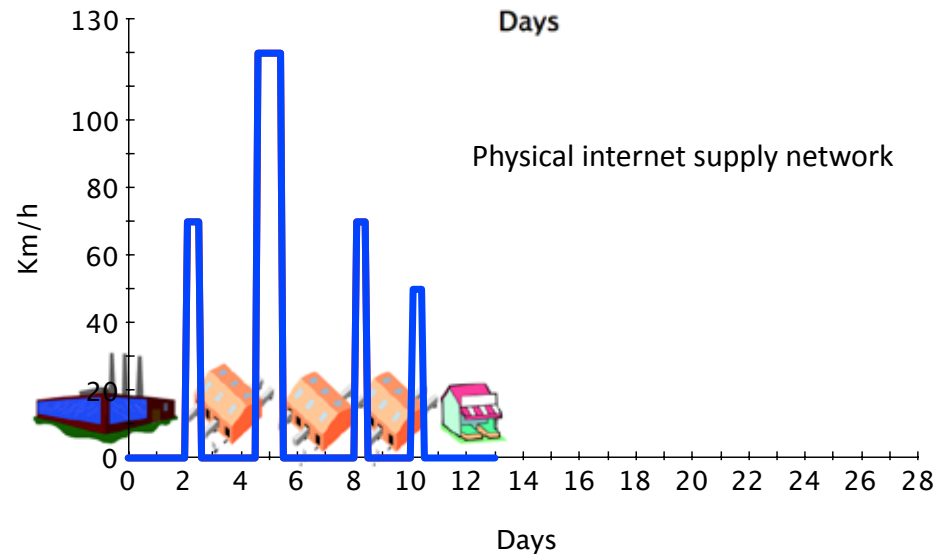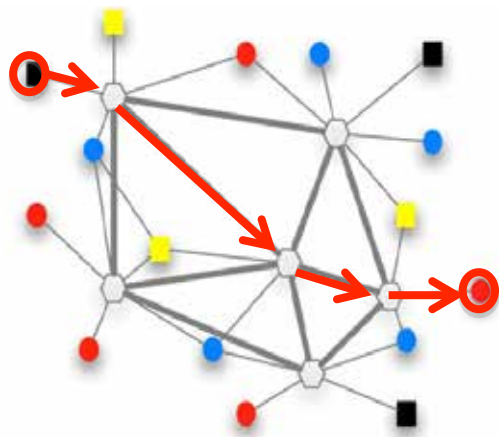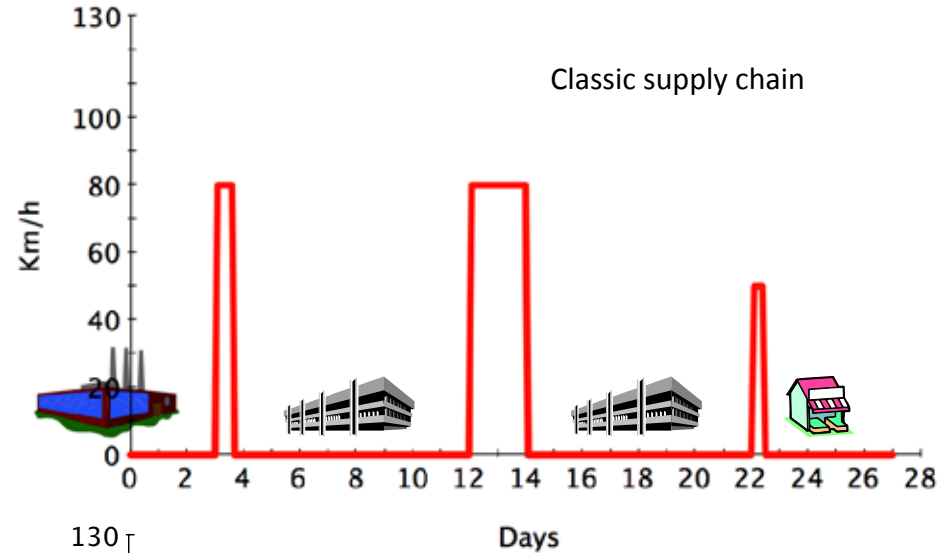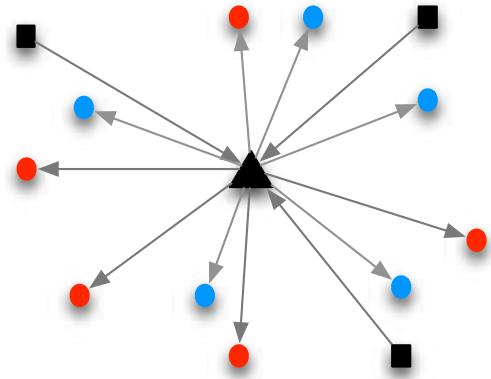
Without points of sales

- Up to 42% of inventory reduction (same service level)
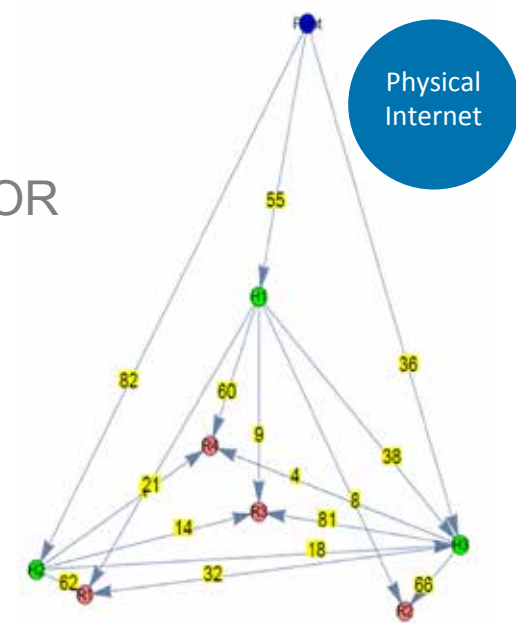
Decentralized inventory models

○ What if we are able to open hubs for storage ?

A case study with fast moving consumer goods in France

Hierarchical distribution

OR

Physical Internet
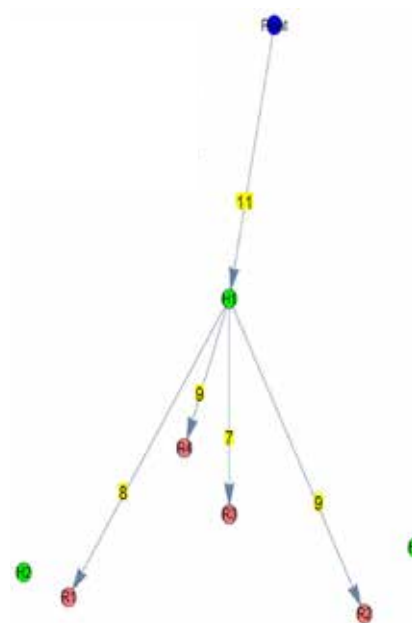
- In FMCG decentralized storage could make sense
  - New vendor managed inventory model
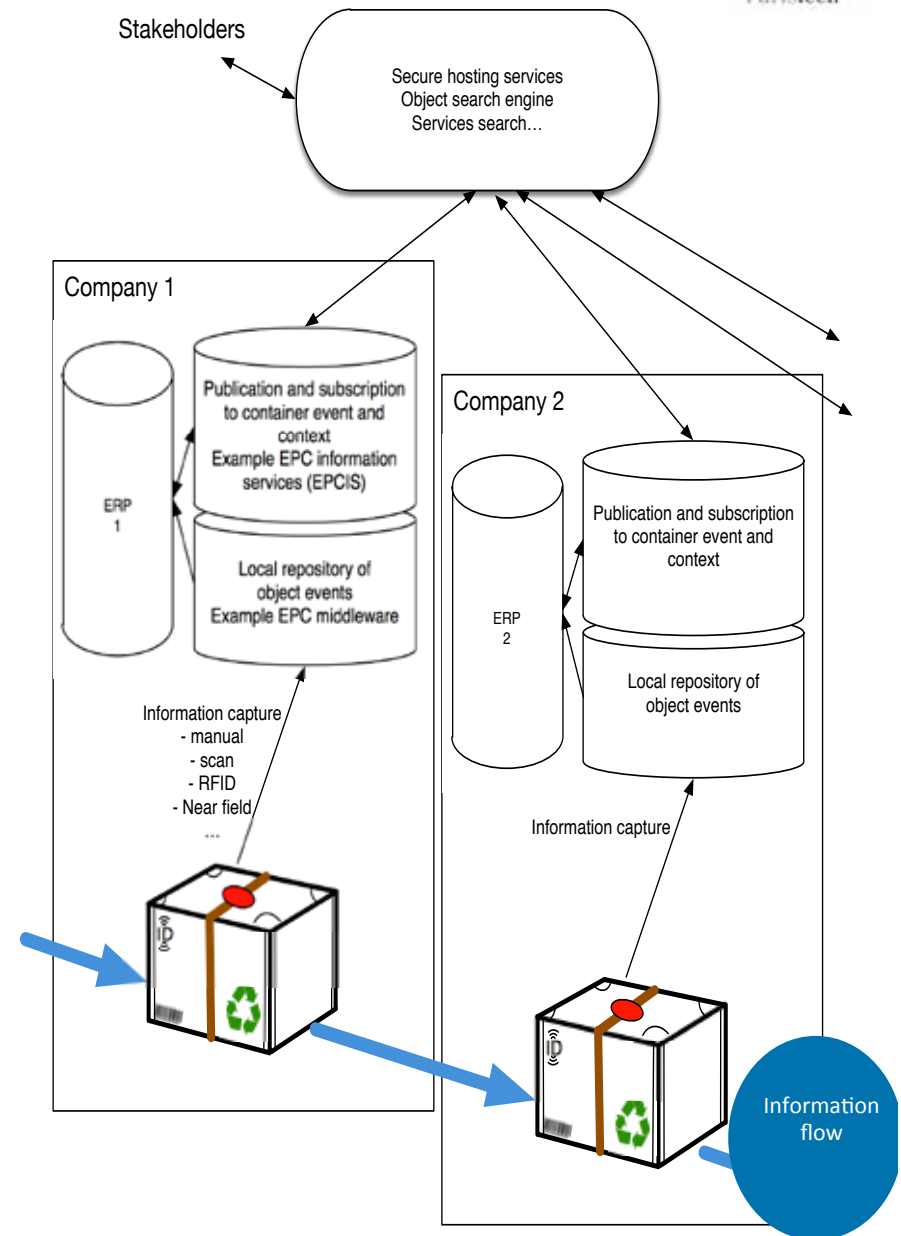 - One virtual inventory with different access cost and time

Up to -30%

What is needed: structured information

○ Be part of the **Internet of Things**

- All logistics assets could be connected soon… thanks to the IoT

- We need
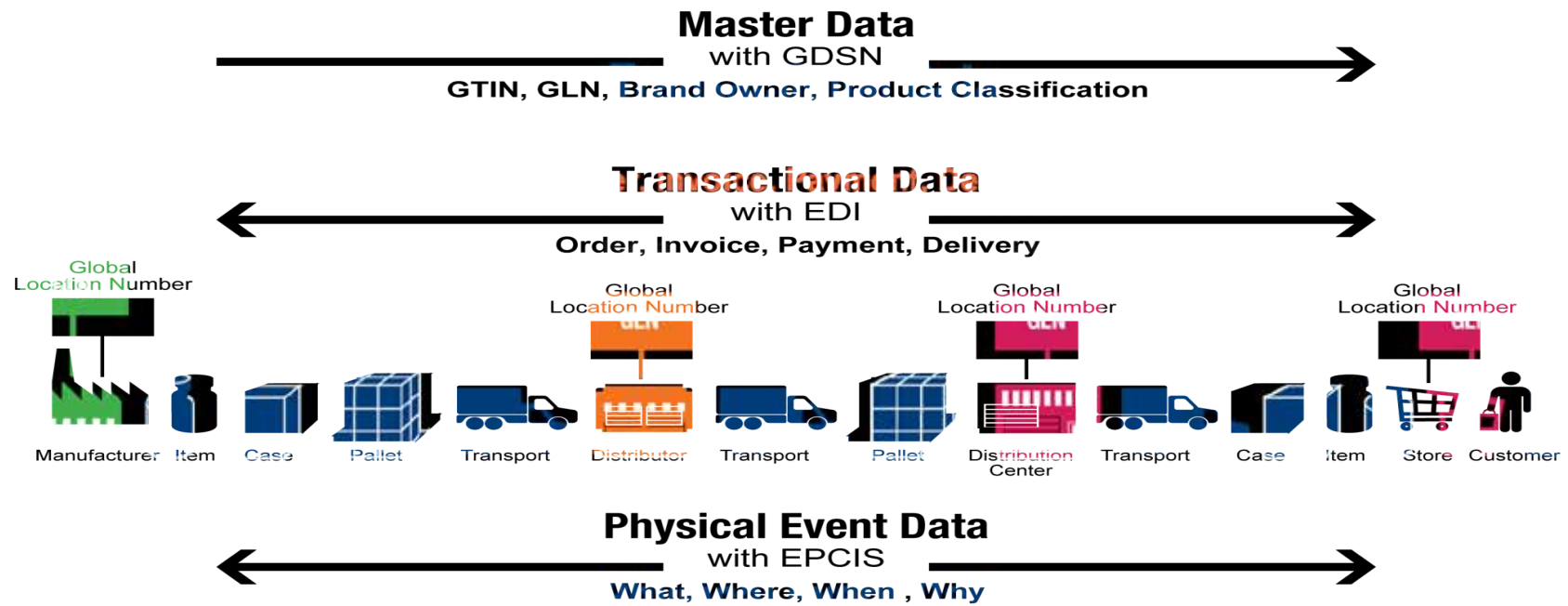 - **communications technologies**

  - **Standard to structure the data**

Stakeholders

Secure hosting services
Object search engine
Services search…

Company 1

ERP 1

Publication and subscription to container event and context
Example EPC information services (EPCIS)

Local repository of object events
Example EPC middleware

Information capture
- manual
- scan
- RFID
- Near field
…

Company 2

ERP 2

Publication and subscription to container event and context

Local repository of object events

Information capture

Information flow

Sharing information

○ 3 levels to share information

■

Identify

Capture

Share

Master Data
with GDSN
GTIN, GLN, Brand Owner, Product Classification

Transactional Data
with EDI
Order, Invoice, Payment, Delivery

Global Location Number

Global Location Number

Global Location Number

Global Location Number

Manufacturer   Item   Case   Pallet   Transport   Distributor   Transport   Pallet   Distribution Center   Transport   Case   Item   Store   Customer

Physical Event Data
with EPCIS
What, Where, When , Why

What is needed: trusted transactions

○ What do we need?

- Interconnection of logistics services comes with much more:
  - Transshipments
  - Parties involved
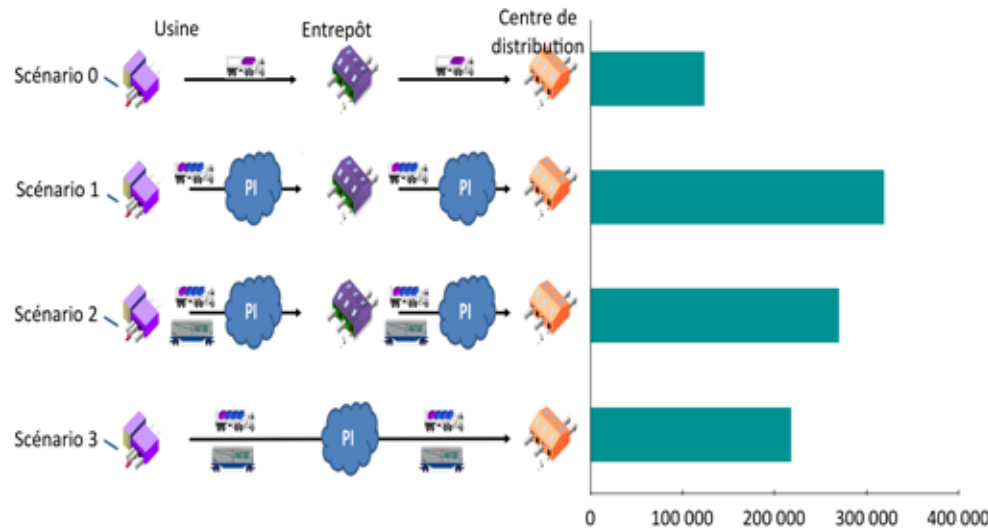
- Traditional approach:
  – Certification, ISO or a new UN agency

Autonomous Research

- But we look for a decentralized, low cost, fast and secure solution to run operations…
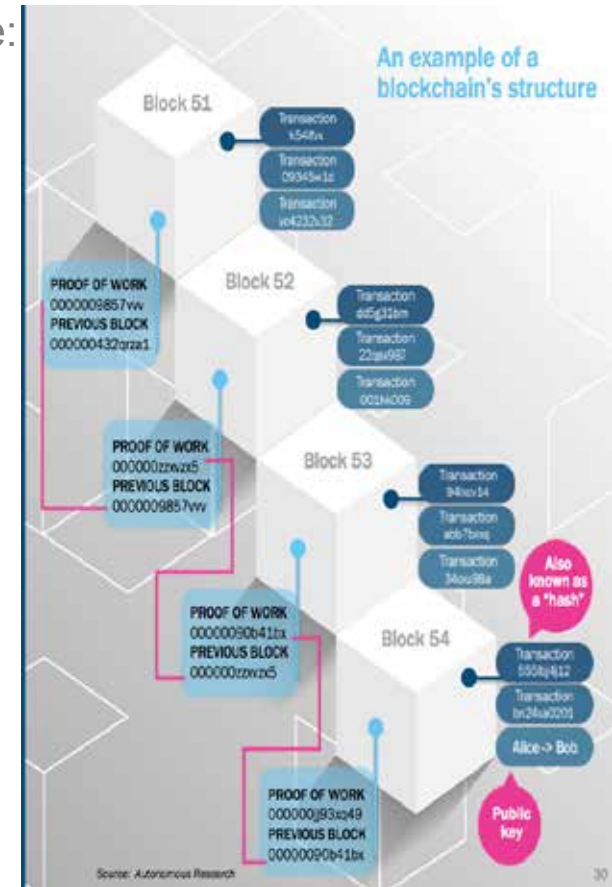
Supply chain applications

- Certification
  - Product traceability (passport)
  - SC asset and journey record
  - Service completed

- EPC global in blocks
  - Proof of delivery
  - A way to implement (or protect) EPCIS?
  - …

- A way to implement transactions and payment
  - Carrier tender
  - A proof of delivery
  - A smart contract release the money
  - …

- A collaboration booster

A full history of all transactions: M2M and…

○ Physical Internet and collaborative logistics based on IoT
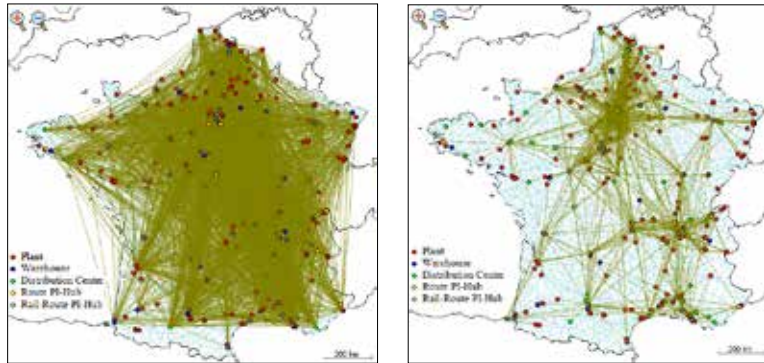
Current flows

Physical Internet flows

Ballot É., B. Montreuil, R. Meller (2015), The Physical Internet: The Network of Logistics Networks

Vectors of disruption	Liquification of the physical world
Unlock excess capacity of physical assets	Instantly search, use and pay for available physical assets
Create liquid, transparent marketplaces	Real-time matching of supply and demand for physical goods and services
Enable radical re-pricing of credit and risk	Digitally manage risk and assess credit, virtually repossess and reduce moral hazard
Improve operational efficiency	Allow unsupervised usage of systems and devices, reduce transaction and marketing costs
Digitally integrate value chains	Enable business partners to optimize in real-time, crowdsource and collaborate
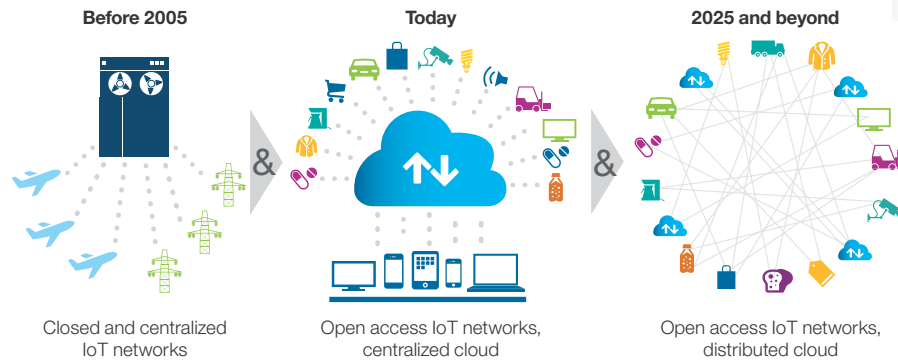
Device democracy Saving the future of the Internet of Things IBM

Before 2005

Today

2025 and beyond

&

&

Closed and centralized IoT networks

Open access IoT networks, centralized cloud

Open access IoT networks, distributed cloud

Source: https://public.dhe.ibm.com/common/ssi/ecm/gb/en/gbe03620usen/GBE03620USEN.PDF
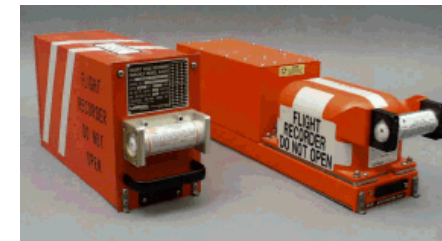
- More than 100 European companies and universities involved

- A research roadmap

- Dissemination actions

- Based on:
  collaborative development of the vision of the future and competition in the search for solution
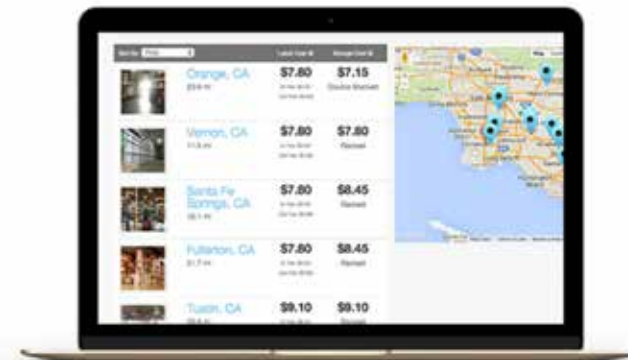

http://www.etp-logistics.eu/?page_id=292
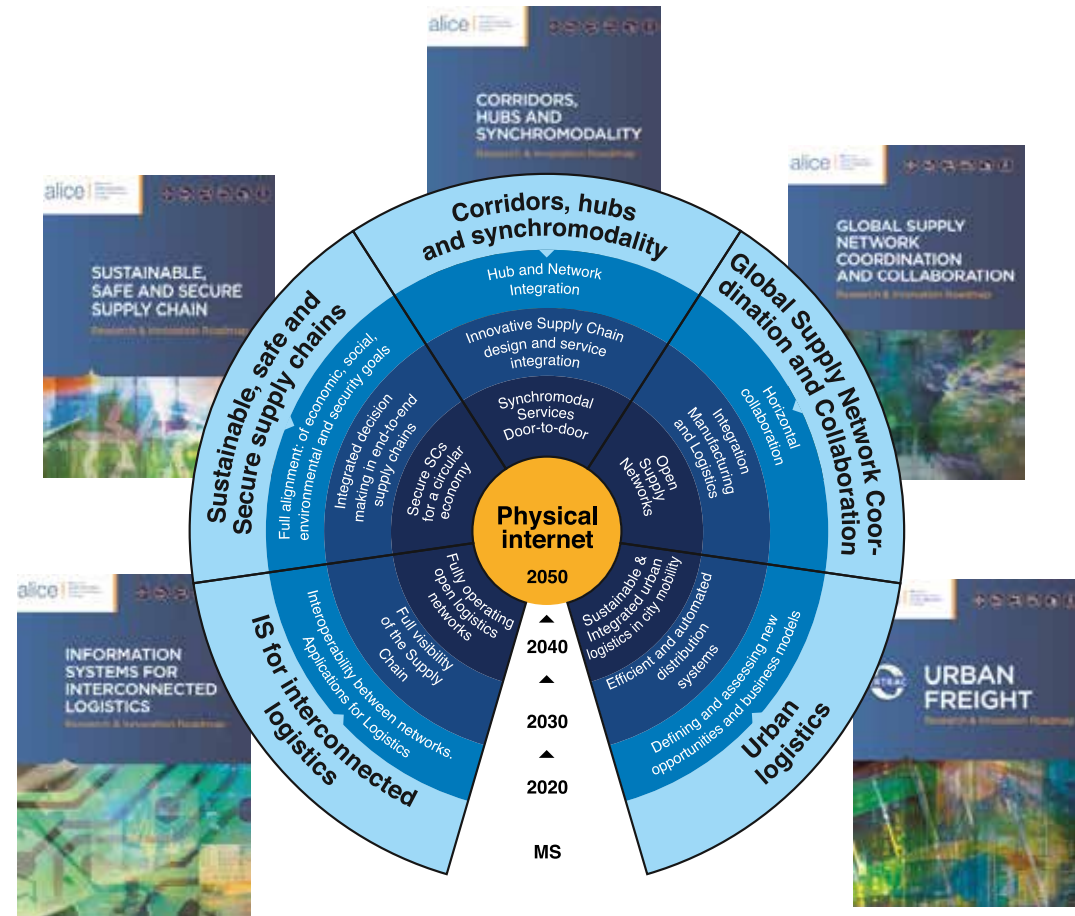
Opening of logistics networks starts now

○ Online platforms

- More and more IT solutions implemented
  - Freight market places

Mix Move Match
Transform Your Supply Chain and Radically Reduce Costs and Carbon Footprint

- Readiness level of the sector is increasing
  - Transport
  - Warehouse
  - Control towers
  - Marketplaces
  - …

FLEXE connects you to warehouse capacity **when, where,** and **how** you need it.

- A call for a new level of optimization!

A first pilot in 2015 and a start-up: CRC®

○ Flow routing centers

- Proof of concept in South East of France

- Open to all FMCG suppliers and retailers

- Doesn't change current supply networks

- Each participant is still able to manage its supply chain "independently"
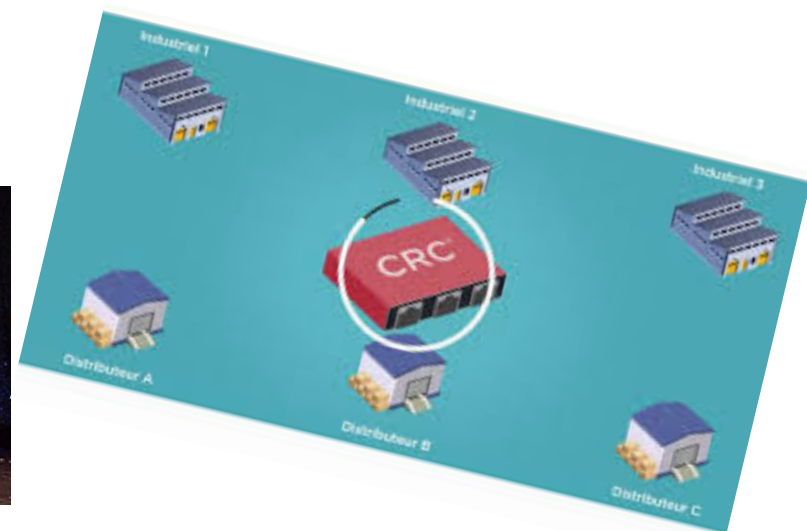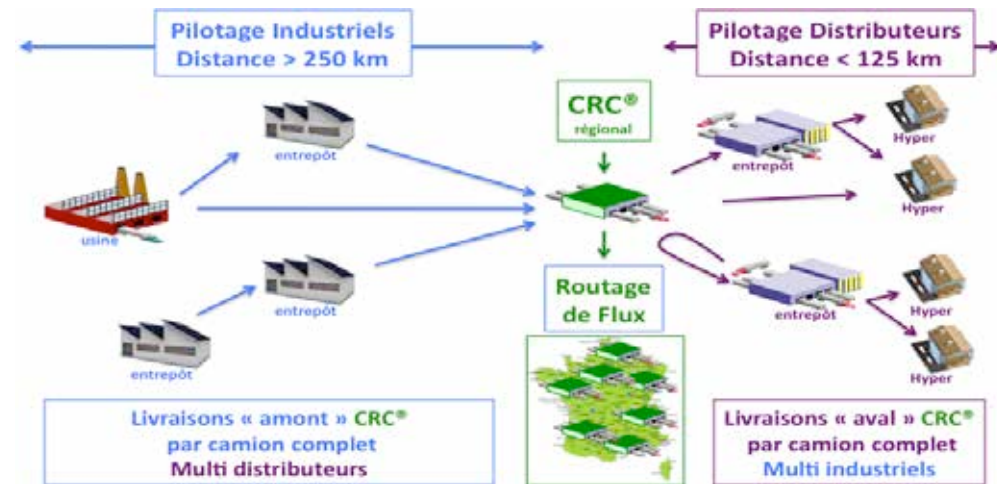
Confirmed by actual operations: CRC® achieves 87% tuck fill rate in average since the beginning of 2016

A vision of a gradual but drastic change!

- **An innovation framework**
  - A **physical internet access provider** for all
    It groups my deliveries, my shipments and knows me!

  - **The consumer is part of the SC!**
    A bonus when I announce my car journey
    Invent your app!

- **A major change for shippers and all logistics operators**
  - **New advantages:** better asset utilization, less stock-outs, Lower environmental impact…
  - **Some fears:** losing control, losing competitive advantages…
  - **A new approach of operations and business models**

- **An alternative to integration**

A NEW WAY TO DO OLD ACTIVITIES

If you want to know more and participate

○ About to started in Autumn 2016

- A supply chain research chair dedicated to logistics services interconnection

- Research program 2016 - 2020
    1. Theory of interconnection and components design
    2. Performance assessment and transition phase
    3. Intermediation and decentralized governance

- Method
    – Workshops
    – Collaboration with start-ups
    – Projects application
    – Dissemination
    – Annual conference

- **New members welcome!**

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