

A NEW CONCEPT FOR LOGISTICS: A PHYSICAL INTERNET

GS1 Transport & Logistics Workshop, Warsaw 12-13 October 2015

Sergio Barbarino Research Fellow Supply Network Innovation Center
Procter & Gamble



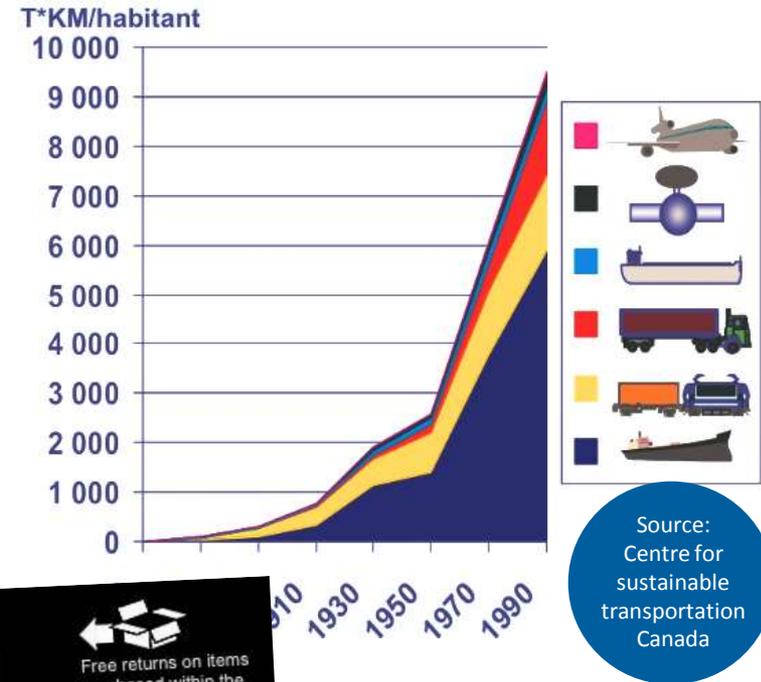
"In the main, organizations become large because they are good organizations and well-managed ones. They grow large because they steadily succeed in bringing new and better services and products to the public. And what are the basic elements behind new and better services and products? They are ideas, imagination, innovation, initiative, and a healthy dissatisfaction with things as they are."

~ Howard J. Morgens (P&G CEO 1957-1971)
Washington University, 1958

Current Supply Chain Challenges

○ Efficiency, trends and innovations

- Trends...
 - Flow exponential growth (even if they will not reach the sky)
- Shipments fragmentation
 - Shipment median weight divided by 4,5 from 160 kg in 1988 to 30 kg in 2004
Source IFSTTAR 2013



Source: Centre for sustainable transportation Canada



- A no cost illusion for the consumers

- **Expectations: better services and economic support to growth**

How to take advantage of economy of scale when each shipment are going smaller?

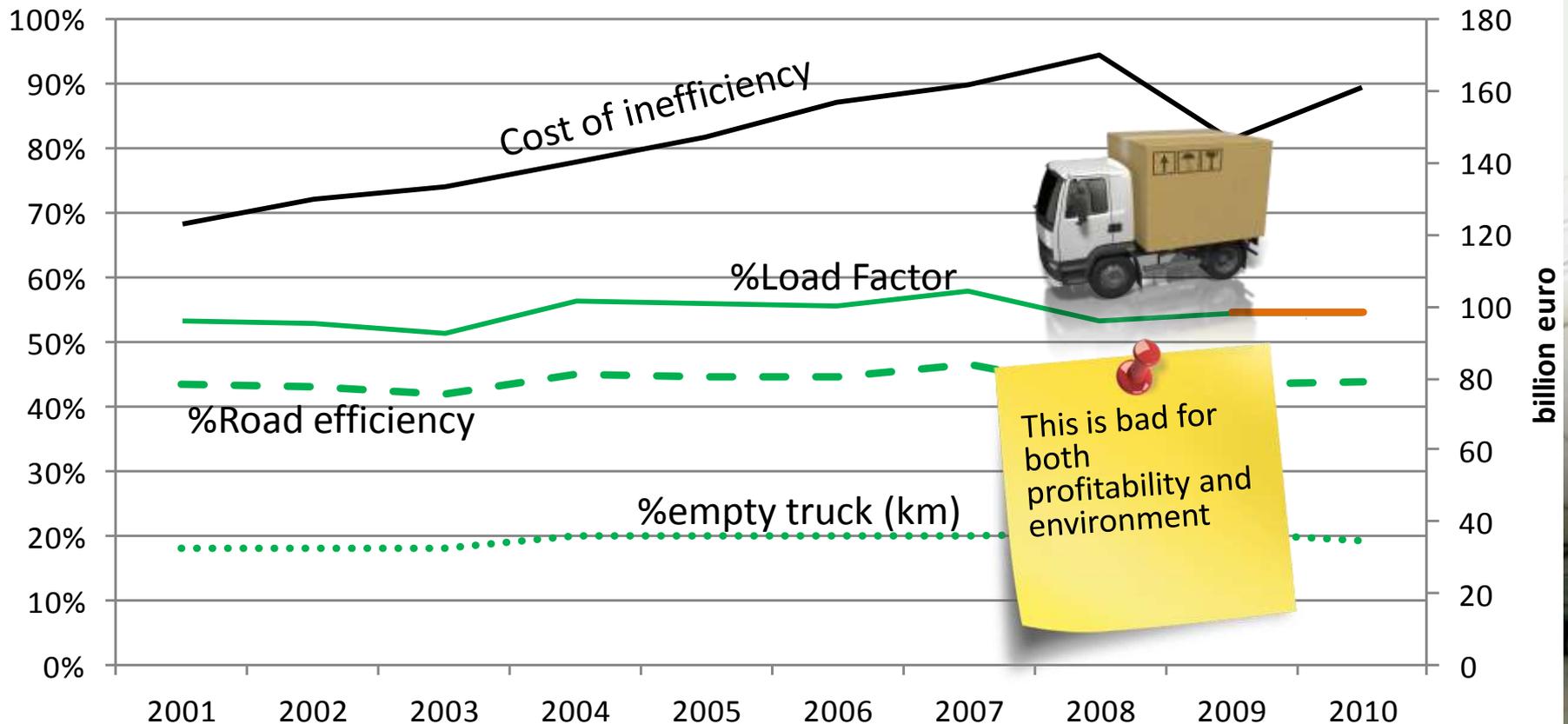
How to mitigate the environmental effects? Decoupling / economic activity?

How to cope with the demand and without a new physical infrastructure?

Current Supply Chain Challenges

Transport inefficiency is a €160 Billions loss
and 1.3% of EU27 CO2 footprint!!!

10 YEARS: ZERO IMPROVEMENT ON LOAD FACTORS



Current Supply Chain Challenges

Whilst logistics is the backbone sustaining our life, global logistics are inefficient and unsustainable

- Economically, environmentally & socially

Current Status – *inefficient & unsustainable supply chains*



Non standard load size & dimensions



Full, but only 25% of weight limit



60% empty, but at weight limit



24% of trucks run empty



Network congestion & emissions



Inefficient networks

This is bad for both profitability and environment

Current Supply Chain Challenges

In addition



Poorly used
storage facilities



25% wastage
of retail produce



- Fast & reliable multimodal transport remains an aspiration
- Networks are neither secure nor robust
- Innovation is constrained

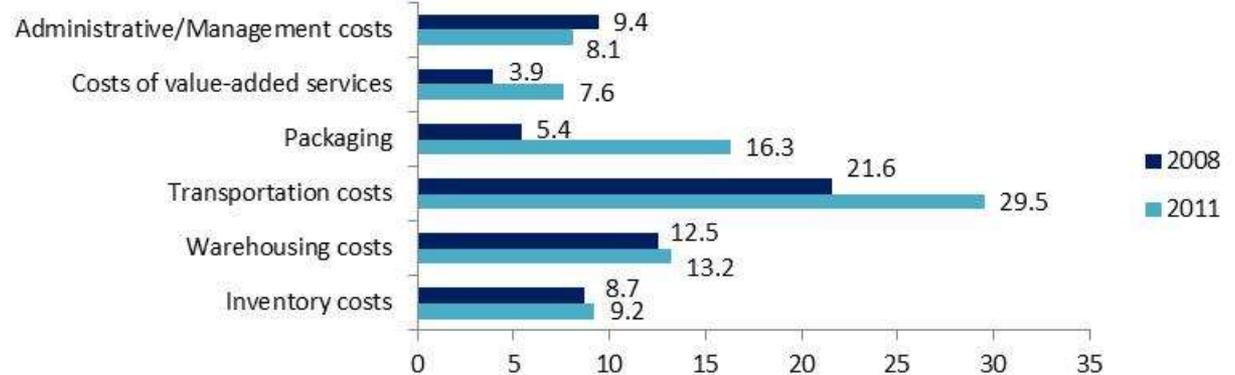
This is bad
for both
profitability
and
environment

Current Supply Chain Challenges

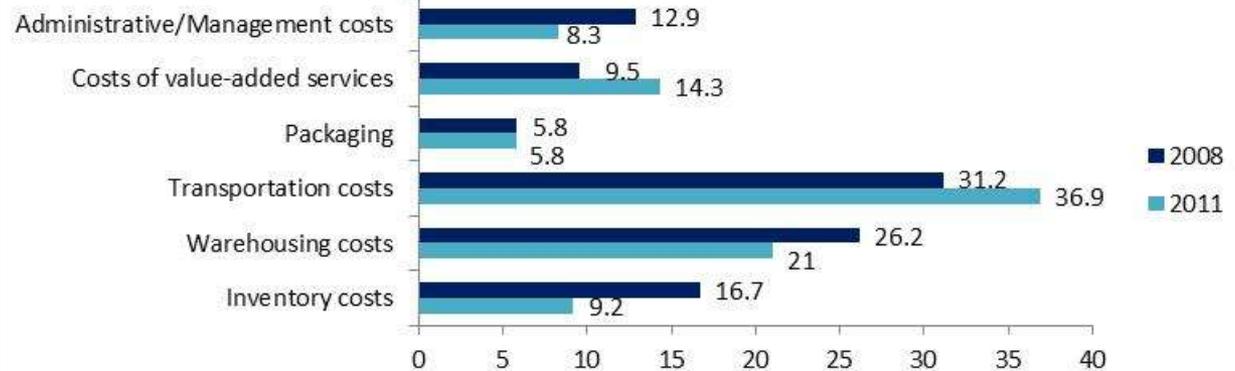
Logistic is a growing component of Product Costs

Logistics costs in Germany¹

**Manufacturing
(in %)**



**Retail
(in %)**

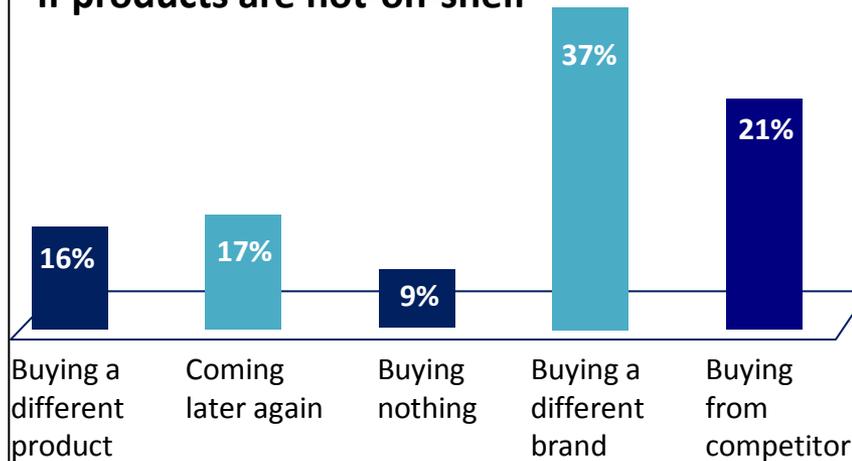


Source: ¹Preliminary results of the study „Trends und Strategien in Logistik/ SCM (2012)“.

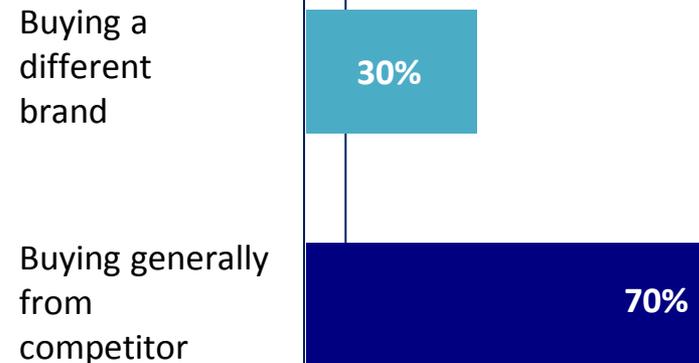
Current Supply Chain Challenges

In the average supermarket, 8.2% of all goods are not available (6.5% of sales volume)

Average reaction of customers, if products are not-on-shelf



Reaction of the customers, if products are not-on-shelf permanently



- If preferred products are not available permanently, consumers are drifting to competitive products for a long-lasting period
- Decreasing sales and market shares
- Despite all efforts made in the supply chains still a major subject

Source: Accenture (2009). ECR Europe (2009).

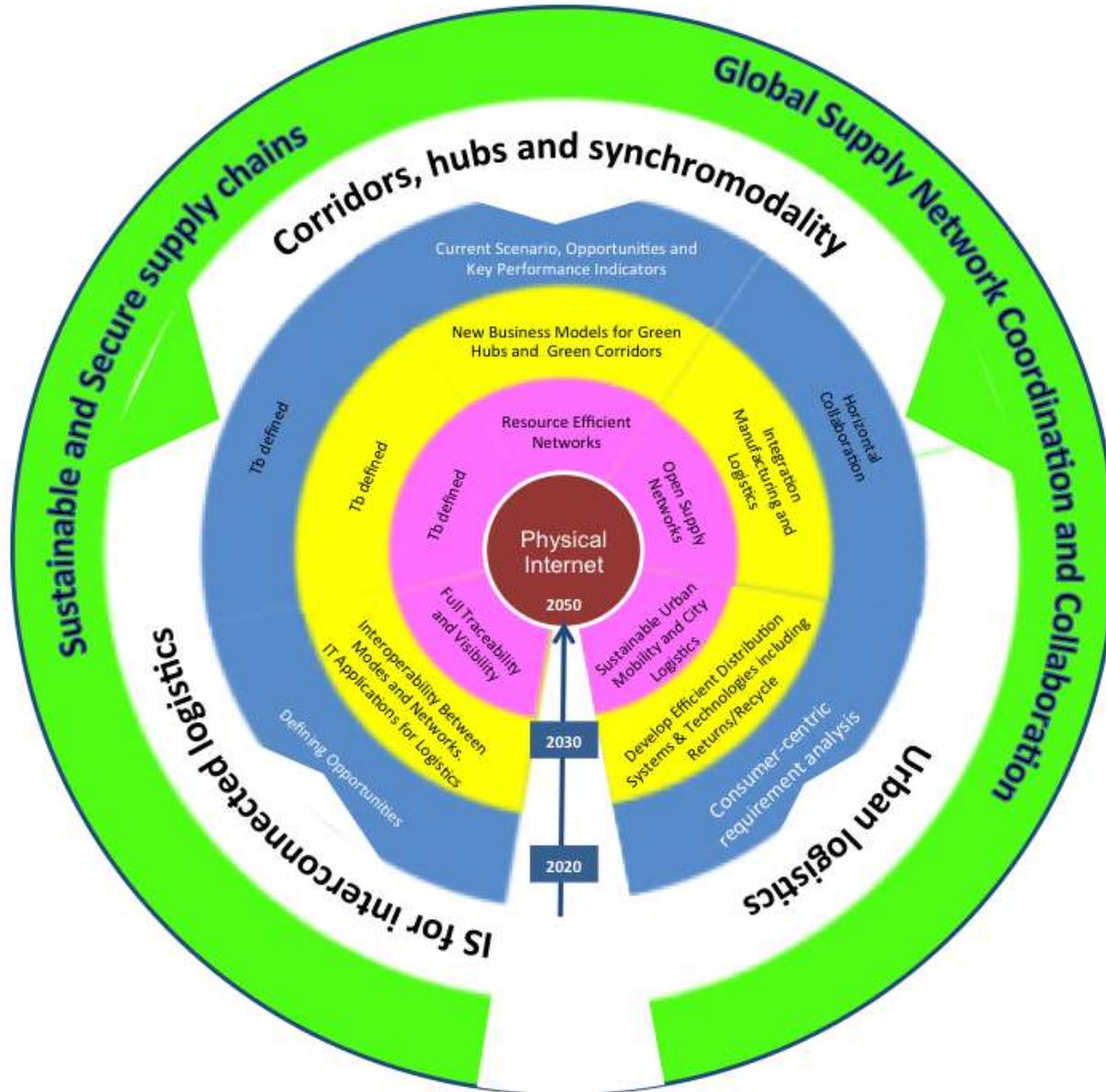
Current Supply Chain Challenges



<i>Ahold</i>	<i>Lidl</i>
<i>Argos</i>	<i>Mercadona (3 DC's)</i>
<i>Boots</i>	<i>Migros</i>
<i>Condis</i>	<i>Müller</i>
<i>Coop Denmark</i>	<i>netto</i>
<i>Coop Norway</i>	<i>Rewe</i>
<i>Debenhams</i>	<i>Rossmann</i>
<i>Delhaize</i>	<i>S Group (Inex DC)</i>
<i>dm</i>	<i>Sainsbury (3 DC's)</i>
<i>Edeka (5 DC's)</i>	<i>SOK (Inex DC)</i>
<i>Eroski (2 DC's)</i>	<i>SPAR</i>
<i>Hema</i>	<i>Teva</i>
<i>Kruidvat (AS Watson)</i>	<i>TJ Morris</i>
<i>Leclerc (2 DC's)</i>	<i>Woolworths</i>

European Automated DC Landscape (2013)





The Physical Internet definition

**An open global logistics system
based on
the physical, digital and operational interconnectivity
enabled by
smart modular containers, interfaces and protocols
for increased efficiency and sustainability**

B. Montreuil, R. D. Meller & E. Ballot

In other words: a universal interconnection of logistics services



Physical Internet
Efficient Sustainable Logistics



www.physicalinternetinitiative.org



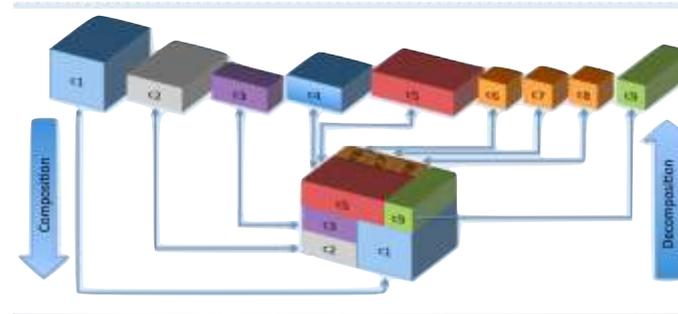
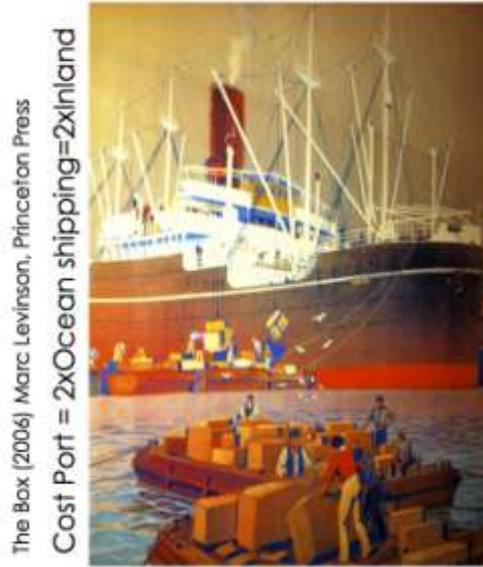
E. Ballot



25 June 2014

Physical expected impact

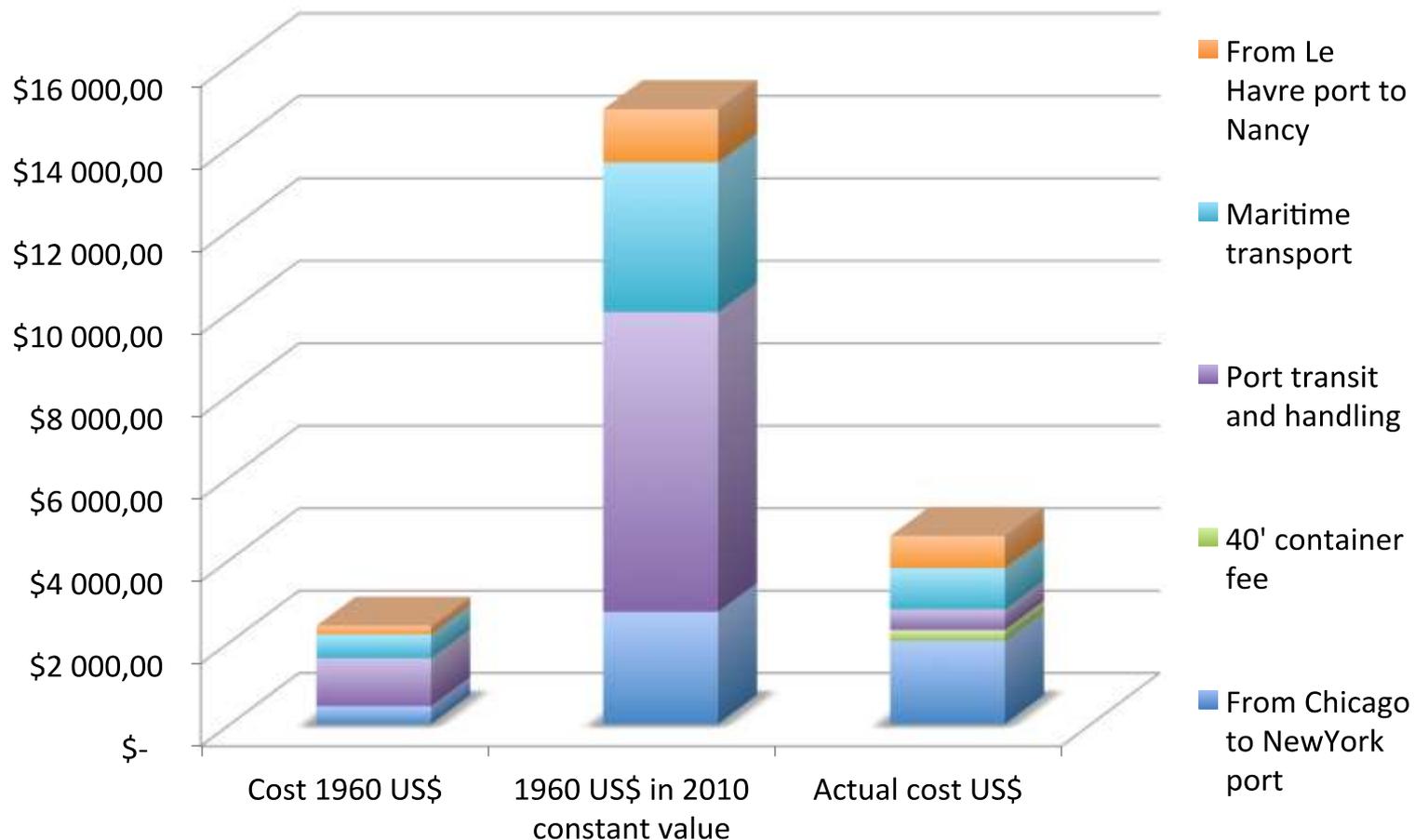
- A generalization of containerization



Montreuil, B., Meller, R. D. and Ballot, E. (2010). Towards a Physical Internet : the impact on logistics facilities and material handling systems design and innovation. In: AL, K. G. E. (ed.) *Progress in Material Handling Research. Material Handling Industry of America*

Physical expected impact

○ The benefit of standard: the maritime container example



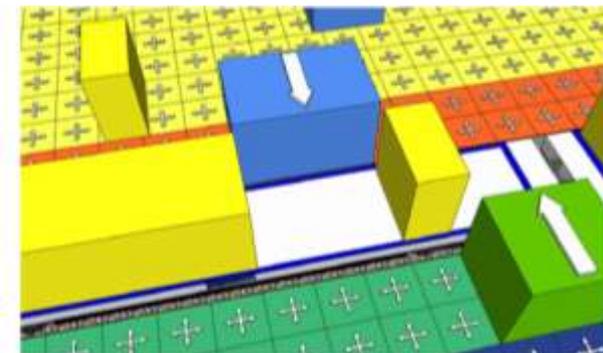
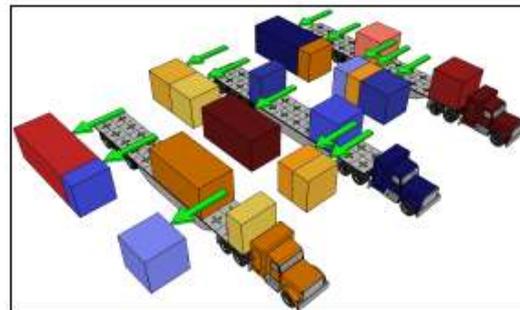
Build interconnection with full collaboration



THE COLLABORATION CHALLENGE

Build interconnection with new hubs

- Containers' routing.
- A call for more efficient transshipments.



Build interconnection with modular boxes

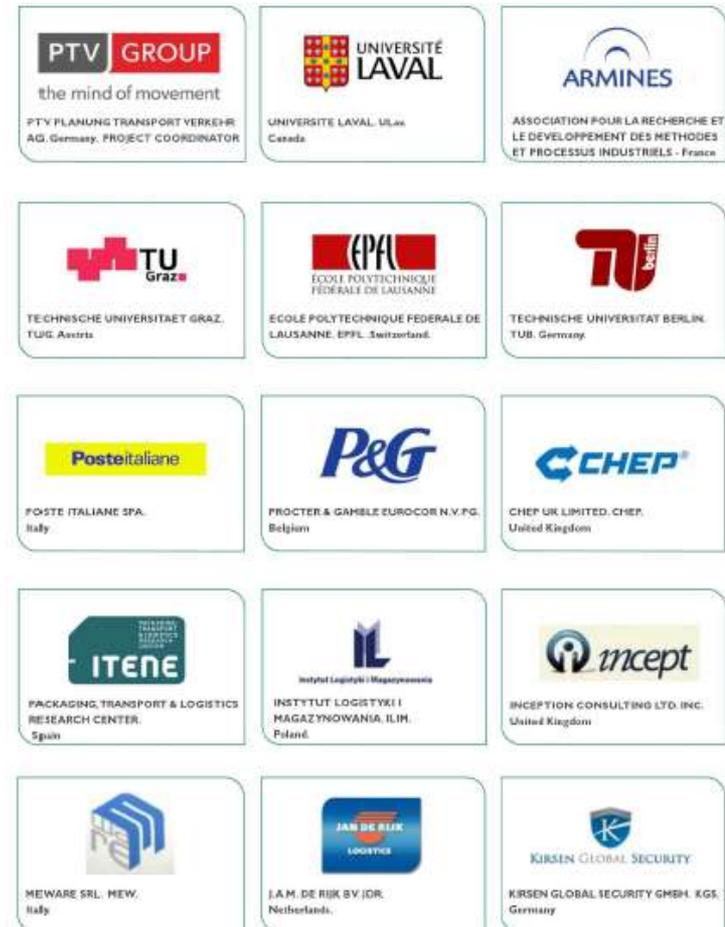
MODULUSHCA: A Practical Approach

Objectives

To enable more efficient flows of fast-moving consumer goods (FMCG)

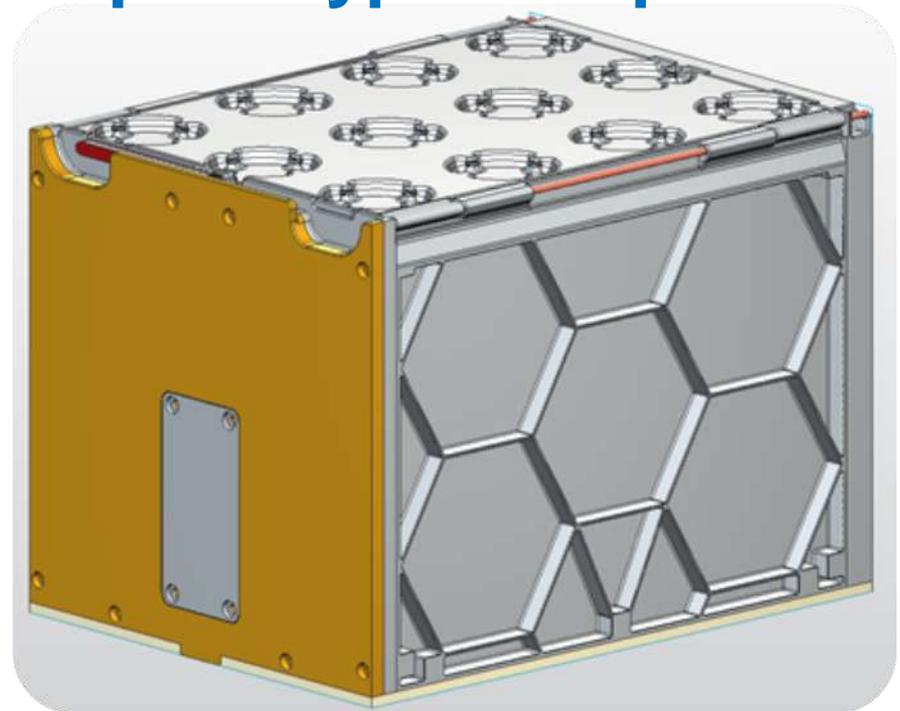
- operate with developed iso-modular logistics units of adequate size
- provide a basis for a fully interconnected logistics system by 2030.
- identify and address the necessary changes to the logistics system
- exploit progress in digital, physical and operational interconnectivity
- build on current assets & infrastructure.

Consortium



Build interconnection with modular boxes

the prototype box presented



MODULUSHCA New Modular Concept

- Modular dimensions from cargo containers down to tiny sizes
- Easy to handle, store, transport, interlock, load, unload, construct, dismantle, compose and decompose
- Smart tag enabled, with sensors

Executive Summary

Reusable transport items (RTI), crates, pallets and roll cages, represent the "back and forth" of the European Fast Moving Consumer Goods (FMCG) supply chain. This recommendation may apply to other industries or other regions.

At the end of the previous millennium we saw an increasing variety of equipment, managed in a variety of different ways, being used to handle an expanding catalogue of products, all with the aim of reducing supply chain costs for individual elements within the total supply chain.

But different incompatible management systems for RTI (aim for standardised methods) to organise their distribution and returning.

In fact RTI are considered to be assets which need to be tracked & traced through the supply chain to enable their efficient use for all involved parties. RTI may have commercial implications if they are subjected to discounts or fees related to their use. For tracking purposes RTI have to be accounted separately.

To do this, a unique identification of RTI and standardised communication of the related information is required. In the following it is explained how the EAN UCC system should be used for this purpose.

The application guidelines is designed to provide more precise guidance on the use of the EAN UCC system for RTI-management.

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- Figure 2: process description "informational flow"
- Figure 3: Barcoding of the GDAI

REUSABLE TRANSPORT ITEMS (RTI) - ORGANISATIONAL RECOMMENDATIONS

Under no circumstances should this application guide be considered as stand alone document or a replacement for the full EANCOM® manual as well as for the General EAN.UCC specifications. To implement the EAN UCC system effectively these recommendations of IC-RTI must always be used in conjunction with the mentioned guidelines.

This recommendation reflects the current state of the art regarding communication and identification technologies. It should be considered that technological developments may cause changes or amendments of the contents of this recommendation.

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Recommendations For The Compatible Stacking Of Crates
International Council For Reusable Transport Items (IC-RTI)



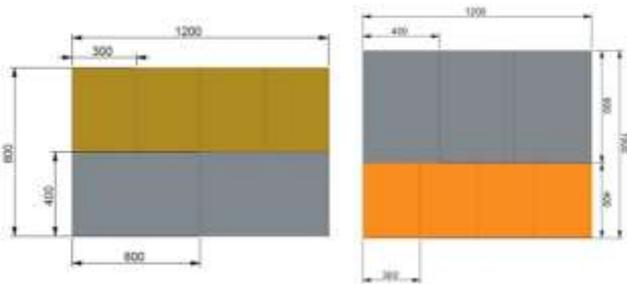
Basic requirements for a new R(P)C standard

HARD

SOFT

NO

RPCs have to be ISO-MODULAR.



EURO pallet type

UK pallet type

RPCs have to have straight walls.

RPCs have to be Stackable up to 2.40 meters .

when they stack, the top of one RPC connects with the bottom of another to prevent the stack from slipping.



RPCs have to have flat inside surfaces.

RPCs must have the capability to have a lid

RPCs can be foldable as a way to favour reverse logistics. However rigid walls are an option.

RPCs Lid "ability" We don't need to have every RPC with lid BUT RPCs must have the ability to install a lid in case of specific requirements [e.g. Dangerous Goods].



Protection can be realized through one RPC on top at the other and at the top either we put an empty RPC (if we store them in column) or we put a layer lid that will seal the top layer of the pallet (when we created a pallet of RPCs).

RPCs wall thickness reduction is highly desirable in order to increase the inner dimensions.

RPCs should preferably be hermetic. However, in certain applications could have holes in the walls allowing manual handling

RPCs should preferably be fully interlockable. Interlockability in all dimensions would be desirable.

RPCs should be suitable for direct use as a retail merchandising unit.

RPCs must not be nestable.



Where is the opportunity?

Industry benchmarking - Fruit & Vegetable:

Significant reduction of damage to goods in storage and transportation (4.2% to 0.1%)

Reduction of staff costs through improved handling

Reduced costs for warehousing

No costs for waste disposal

Total cost savings up to 23% compared with cardboard (Fraunhofer study)



RPC logistics:

RPC can be used up to 100 trips

100% recyclable

Damaged RPCs will be granulated and new RPCs will be manufactured



Ecologically superior compared to one way packaging:

53% lower greenhouse emission potential

38% lower ozone depletion potential

51% lower summer smog potential

IFCO

- Recollection and Inspection
- Cleaning and Disinfection
- Storage and Dispatch

Grower / Packer

- Retail
- Retail Distribution Center
- Retail Sales Outlet
- Retail Distribution Center

Where is the opportunity?

Reusable Plastic Containers (RPC)

Key Cost Drivers:

- Positive:
- Eliminate cost of corrugated shippers.
 - Eliminate manual handling at DC.
 - RPC 25x more expensive vs. corrugated box, but can be used 100 times.

Neg.:

- Pallet utilization perfect due to modular box design, however box utilization is critical for overall T&W cost (15-50% less efficient)
- Low cost EOL RPC filling is needed
- Reverse logistic is a key cost part (need to define inspection/clean criteria)
- RPC turnover/inventory significantly impact cost structure



Data to Manage Physical movements in the Physical Internet of RPCs

Acknowledgement to: Giancarlo Tretola, Meware S.r.l.

Interoperability

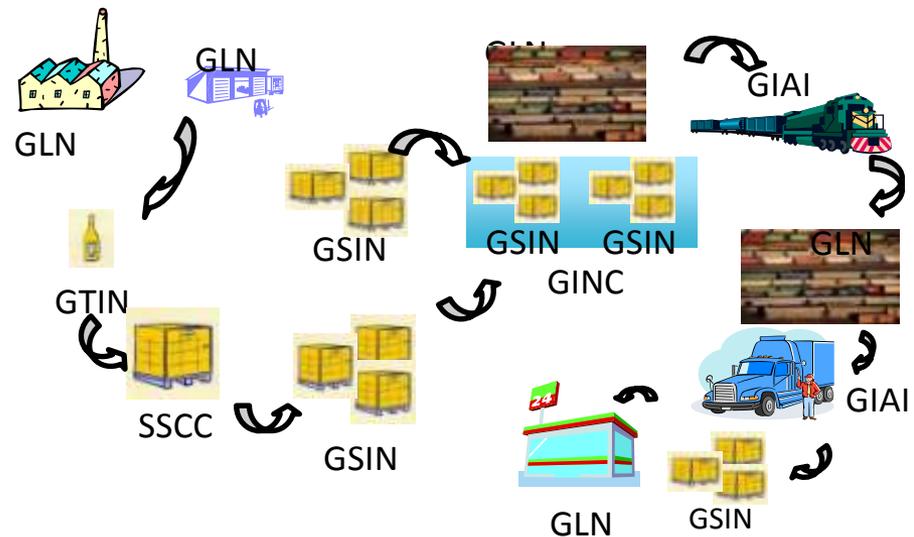
- Sharing the delivering goods with a collaborative approach that needs interoperability between information systems
- Interoperability needs a supporting ICT approach for information exchange, which defines data organization, access roles and covers security issues;
- It is important to consider all the objects and various assets in the logistics processes (location, warehouse, trucks, trailers, etc.) it is not only a matter of goods to be shipped

Supporting Standards

- GS1 standards, for identify assets (GRAI), shipment (GSIN), consignment (GINC), location (GLN) and so on, for enabling exchange of information
- EPCglobal initiative for allowing interoperability and information exchange
- UPU Standards (a postal standard) is interesting as an example of handling information interchange and forwarding between “abroad” partners, tracking and borders crossing
- Tracking of group of M-Boxes (dynamic aggregation) in order to simplify the tracking and tracing approach

GS1 Standards

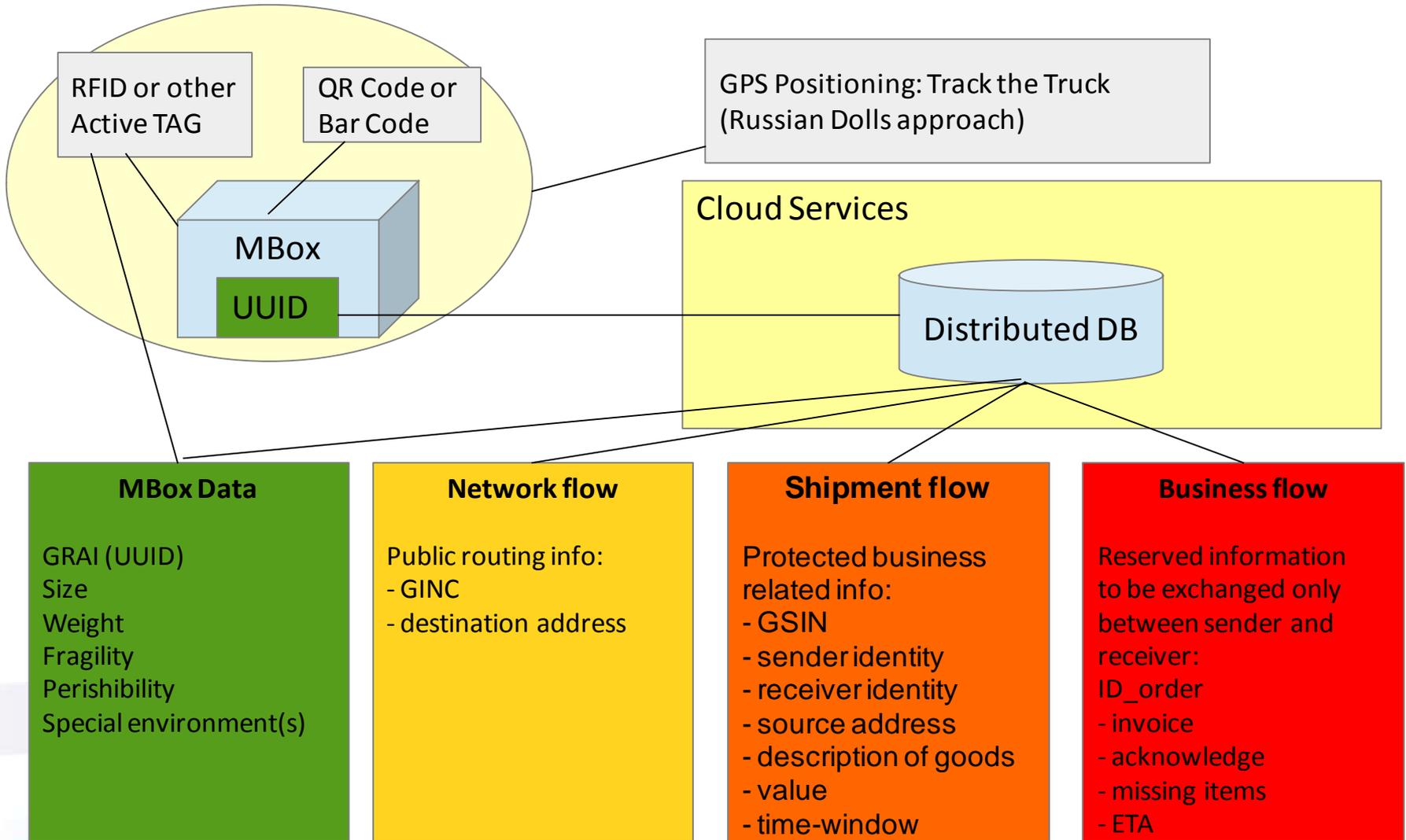
- Identifiers are important and helpful:
 - GLN - Global location number
 - GIAI - Global Individual Asset Identifier
 - GRAI – Global Returnable Asset Identifier
 - GTIN and SGTIN - Global Trade Item and Serial Global Trade Item
 - GSIN - Global shipment identification number
 - SSCC (Single Shipment Container Code)



M-Boxes UUID

- The M-Boxes may be identified using a UUID (Unique Universal ID): GRAI (Global Returnable Asset Identifier) is used to identify Reusable Assets.
- GRAI is a GS1 ID that stay with an asset throughout all lifetime of the asset. Is particularly indicated for asset s that have to be re-used in several processes

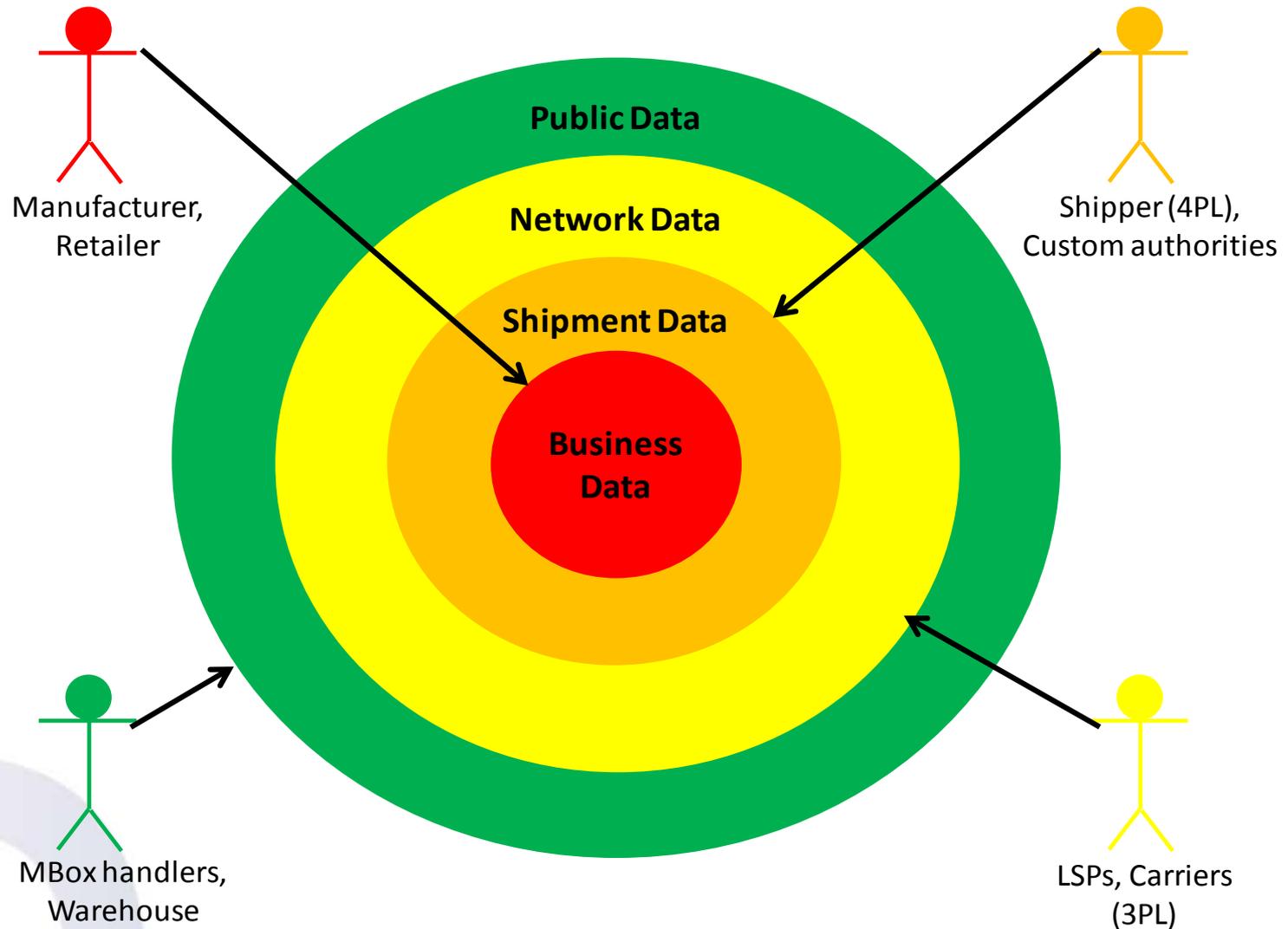
Modulushca Common Data Model



Colours

- Modulushca Common Data Model is identified also as the coloured model and is organized on four subsets of information (color coded):
 - MBox info (**Green**): data directly available on the modular unit (stored in the RFID or QR Code)
 - Network flow (**Yellow**): boxes are identified with UUID that allows retrieving of selective information from the IT Systems
 - Shipment flow (**Orange**): boxes are aggregated/unified in the IT system(s), where “restricted” information may be retrieved by authorised interests (eg. customs, police, agencies, etc.) in using a defined set of user-specific rules
 - Business flow (**Red**): commercial and reserved data are private and held by the main actors (customer and manufacturer)

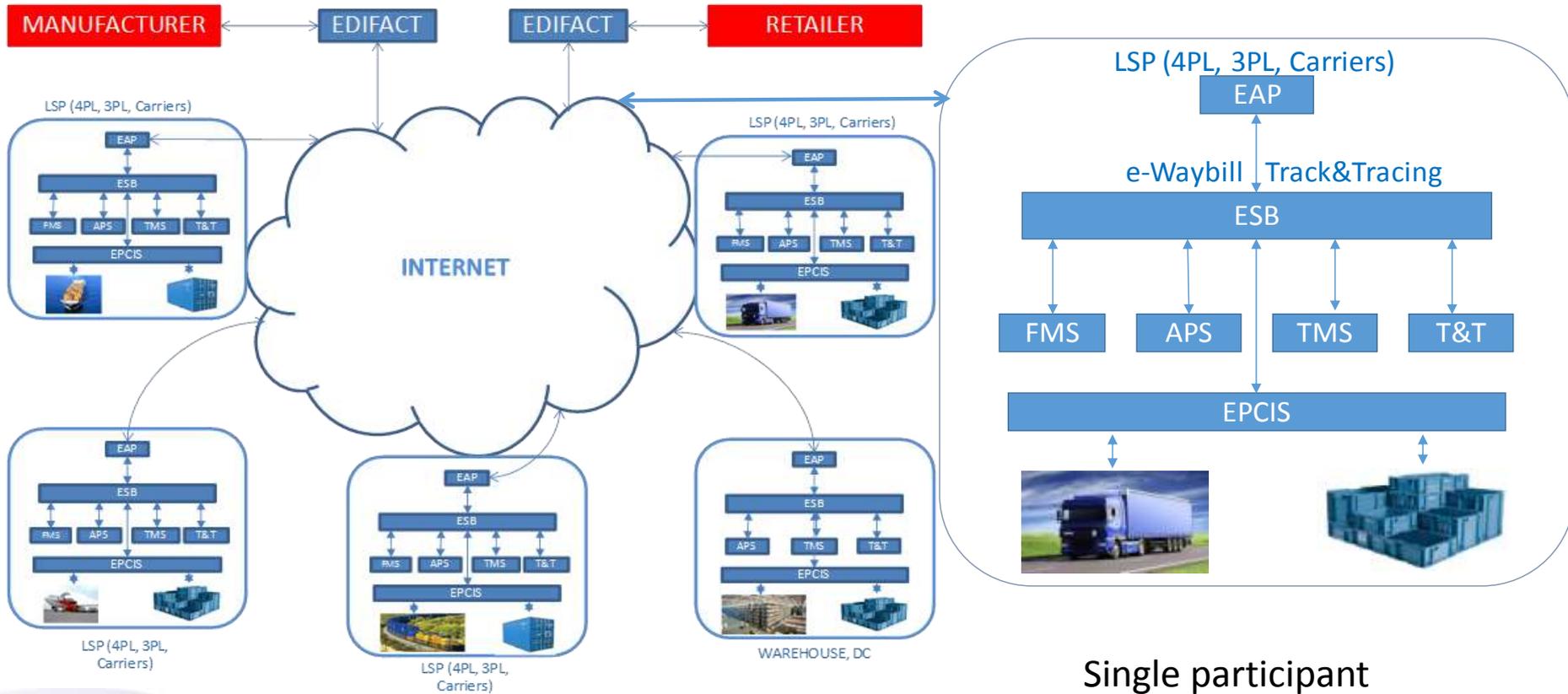
Roles of the Model



Roles description

- All the actors involved in the logistic processes may be tagged with a role, which allows for accessing to the data, which may be color tagged. In our conception the role may be the follows:
- green role: access granted only to the green data (i.e. systems and operators not involved in the logistic process but only in the handling, storing, stocking);
- yellow role: access granted only to green and yellow data (i.e. logistic service provider involved in the transport);
- orange role: access granted to all but red data (i.e. the shipper managing the shipment, the authorities);
- red role: access granted to all data (i.e. original sender and original receiver, involved in the business processes).

High level architecture



The proposed High Level Architecture

Single participant internal organization

Architectural layers

Business Layer

Business Process Management approach: business goals to be achieved is the delivery of goods to the retail point and/or to the final customer, encapsulating them in modular units.

Logistic Layer

Who, where, what and when: driving the movement of goods , from original sender to intended receiver, using an end2end approach for planning and routing the modular units flow

Transport layer

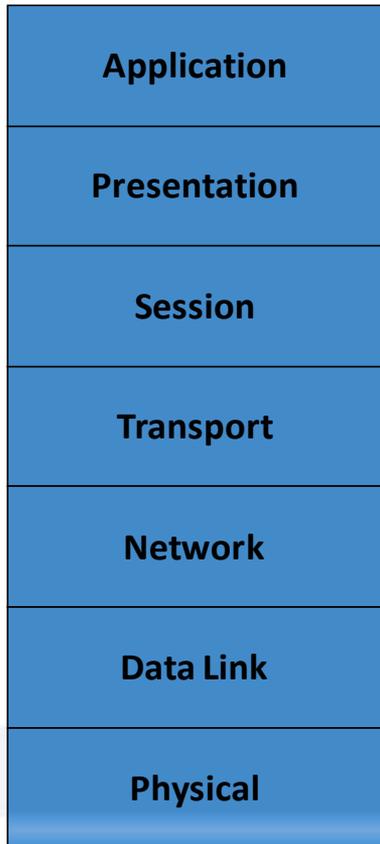
Deals with movement of goods considering the available means to be used, the modality, in order to move the modular units from one hub to another, following a point-to-point approach.

Physical Layer

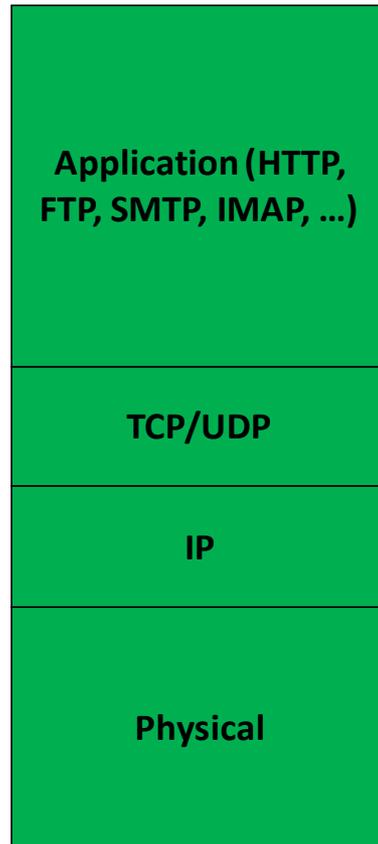
Regards the physical “objects” in the systems, the modular boxes, the transport means, the location, the links, T&T, loading and unloading, cross-docking and storing, supporting the handling operations.

OSI vs OLI

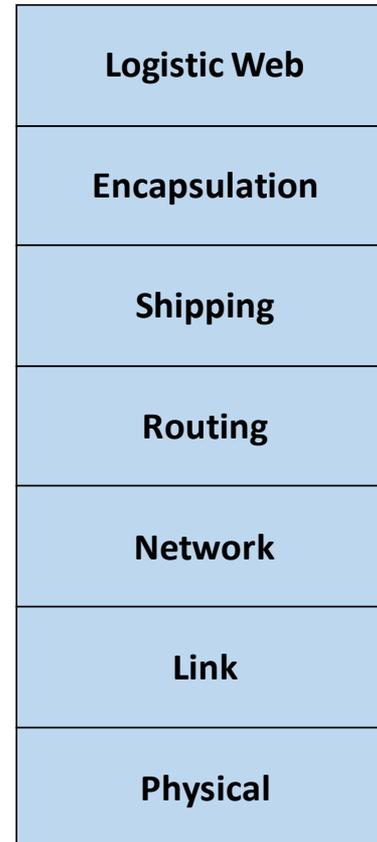
OSI referenceModel



Internet protocols



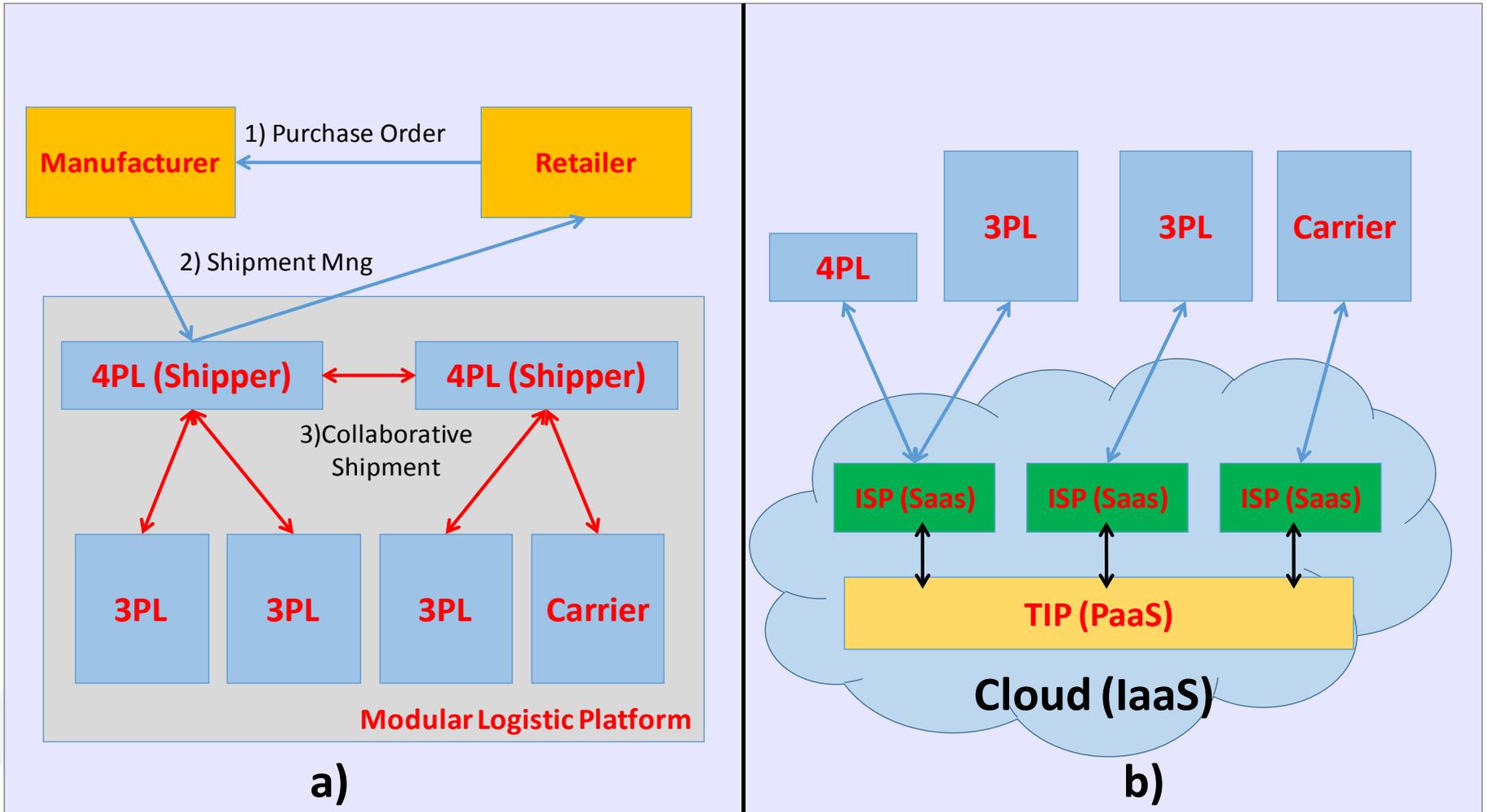
OLI reference Model



Architectural Layers



Architectural roles



Issues and future evolutions

- Further evolution of the model will be needed in order to address completely the needs of the modular logistics.
- Some issues emerges when evaluating the model:
 - **Security problems** have been only analyzed at high level, from ICT supporting tech point of view
 - M-Boxes can be obtained **assembling standards panels**. In such case there is an issue to solve, regarding how to generate the UUID for the assembled M-Box
 - Refining the model, could be done the introduction of **semantic description** of the data and operations, allowing a high level of interoperability and integration between the systems, enabling the machine understandable description of services, and the automatic service composition



THANK YOU!

Sergio Barbarino

Barbarino.s@pg.com