alice | Alliance for Logistics Innovation through Collaboration in Europe

AIMING TO THE PHYSICAL INTERNET
A Practical Approach
Napoli 29/9/2016

Sergio Barbarino

Research Fellow P&G
Supply Network Innovation Center.

Sergio Barbarino, FRSC, MBA, MSc

Born in Naples 1967

Chemical Engineer in 1991 (Federico II Napoli)

MBA 2004 Solvay Business School Brussels

1991: Joined P&G in Belgium – Process Development Mr. Clean/Viakal

1998: Italy – Section Head Global Bleach Process design

Saved 7$/su on 30% of Bleach business by qualifying the Transiberian line

2002: Relocated to Belgium – Principal Engineer Process Breakthrough

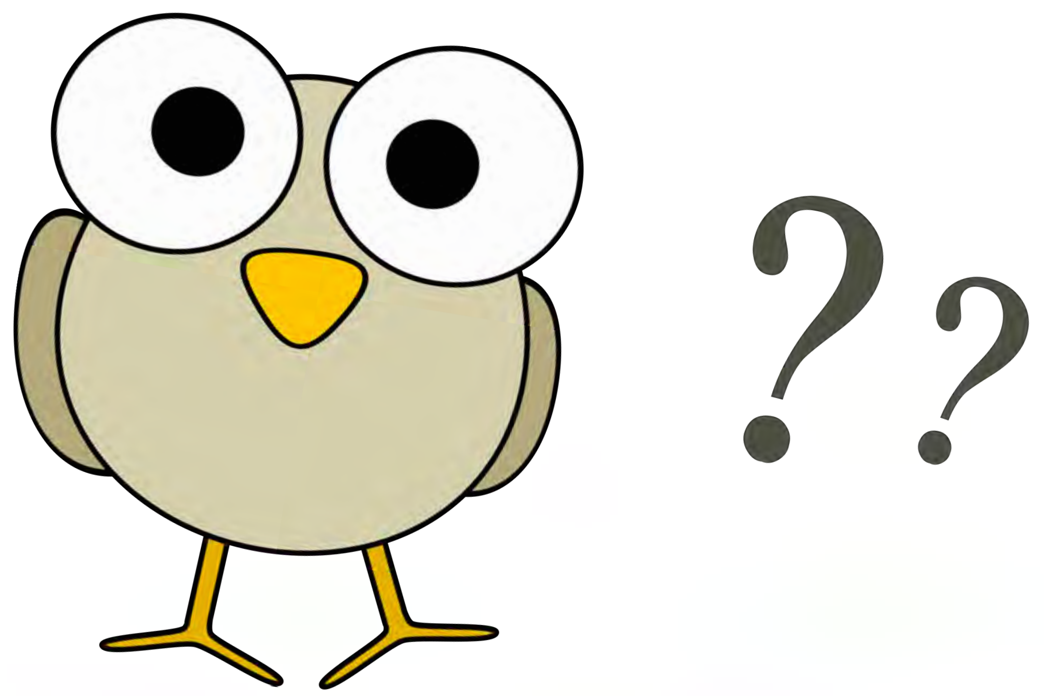
Qualified the Flexibags for DISH paste supply to Philippines, Mexico, Argentina, Japan (5 MM$ savings/year)

2007: Cincinnati Ohio – Leader Low cost Manufacturing demo project

2008: Brussels First Externally funded project on Microprocessing: P&G Leader of IMPULSE and F3 FP7 Projects

2009: Founder & Leader: P&G Supply Network Innovation Center

2011: Research Fellow (P&G Top Technical Talent Position)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ASSET
NETWORKS
EFFICIENCY
SUPPLY-CHAIN
BOXES
PRODUCTIVITY
EDUCATION
COLLABORATION
CARBON-FOOTPRINT
PHYSICAL-INTERNET
CIRCULAR-ECONOMY
ZERO-MARGINAL-COSTS
MODULUSHCA
CONTAINERS
LIVING-LABS
DIGITAL
SUSTAINABILITY
KNOWLEDGE-MANAGEMENT
SHARING

Colloquium stimuli:

Can we reduce footprint with labour?

(2 drivers ->lower speed, more deadpile)

Is it true it will be necessarily more expensive?

Is more expensive sustainable?

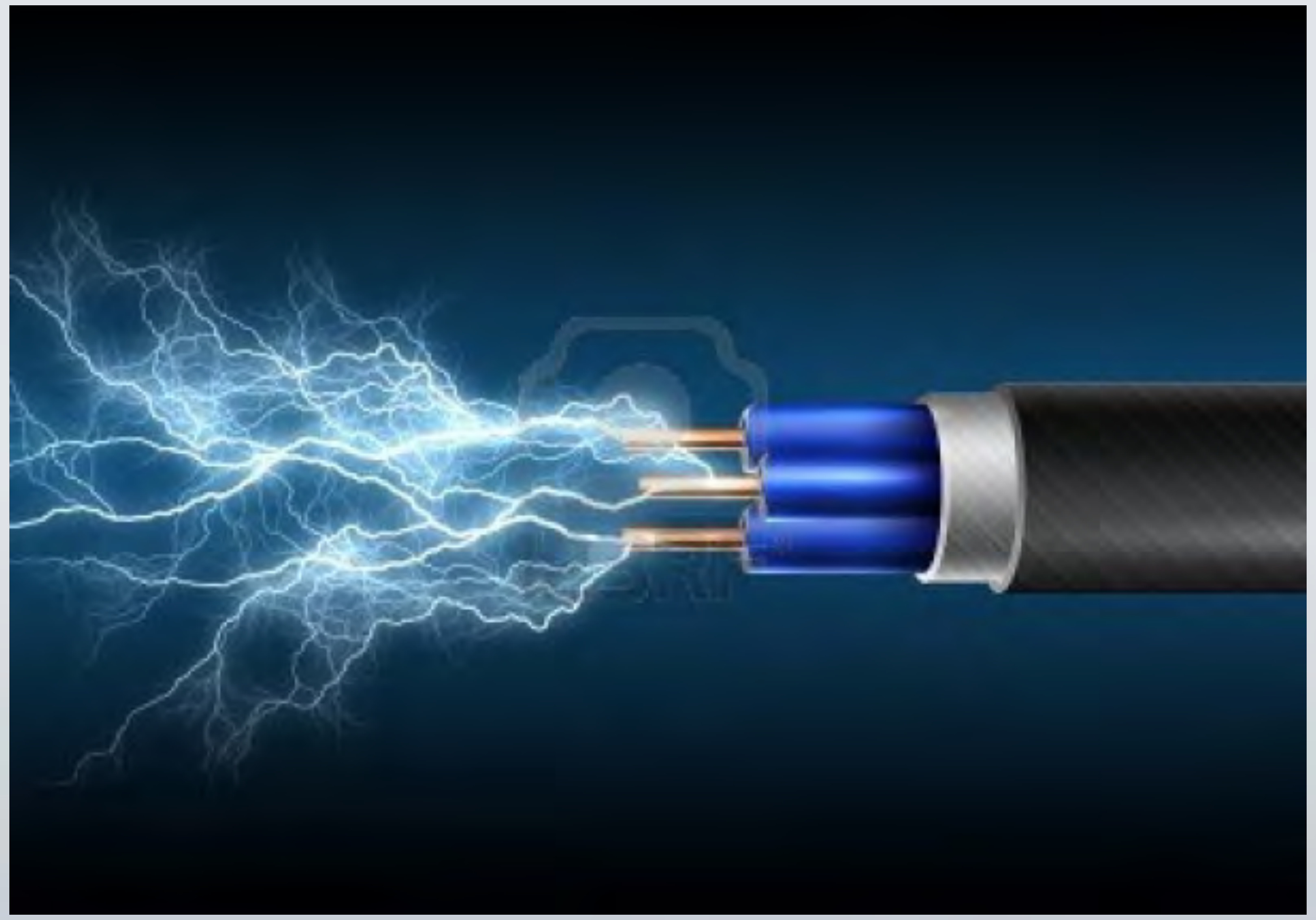
Toilet paper

SOURCE: Modified from OPTIANT TRAINING

Exercise

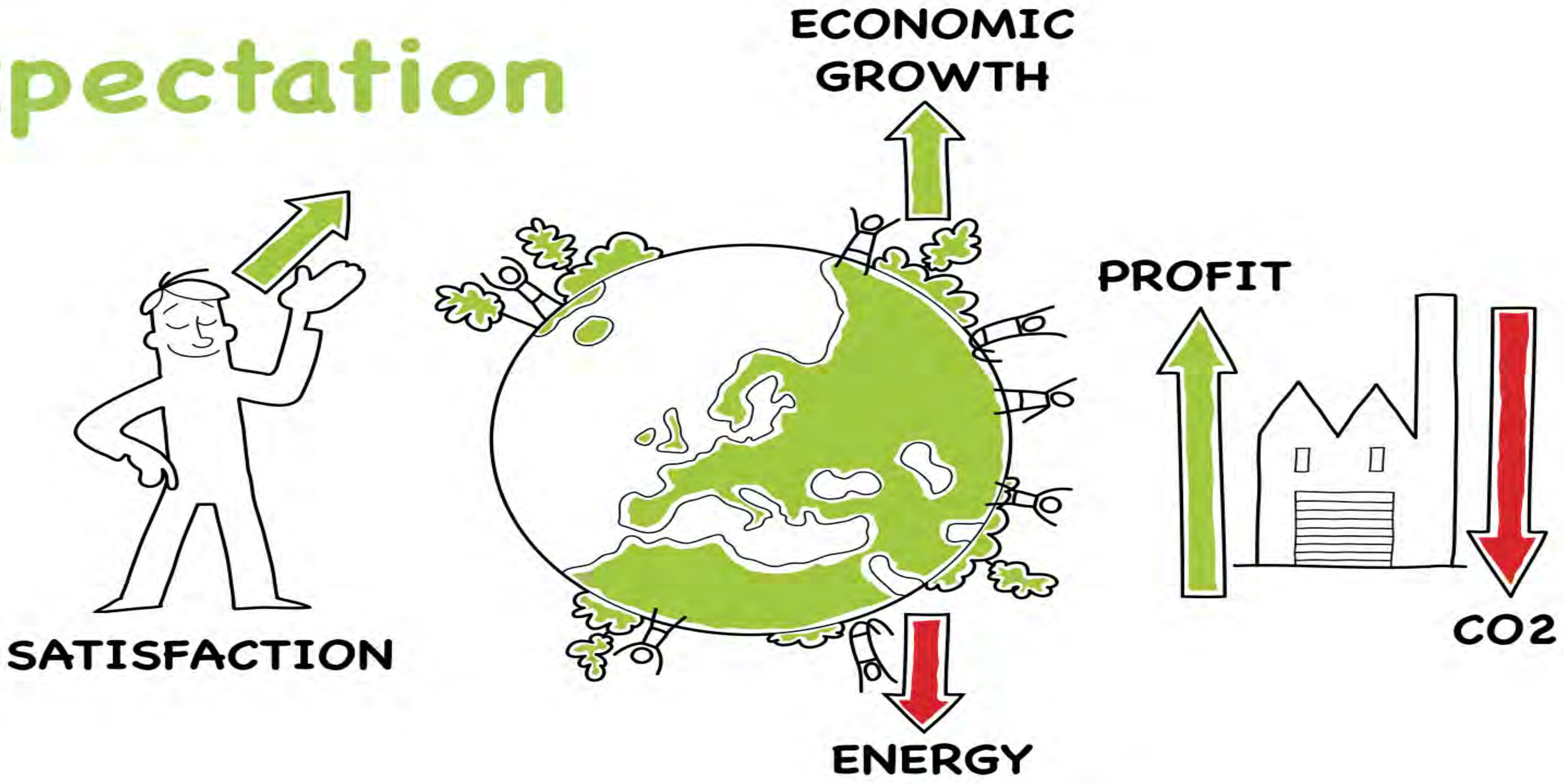
For the products below what we have said so far is impossible to apply, why?

Electricity



Wine

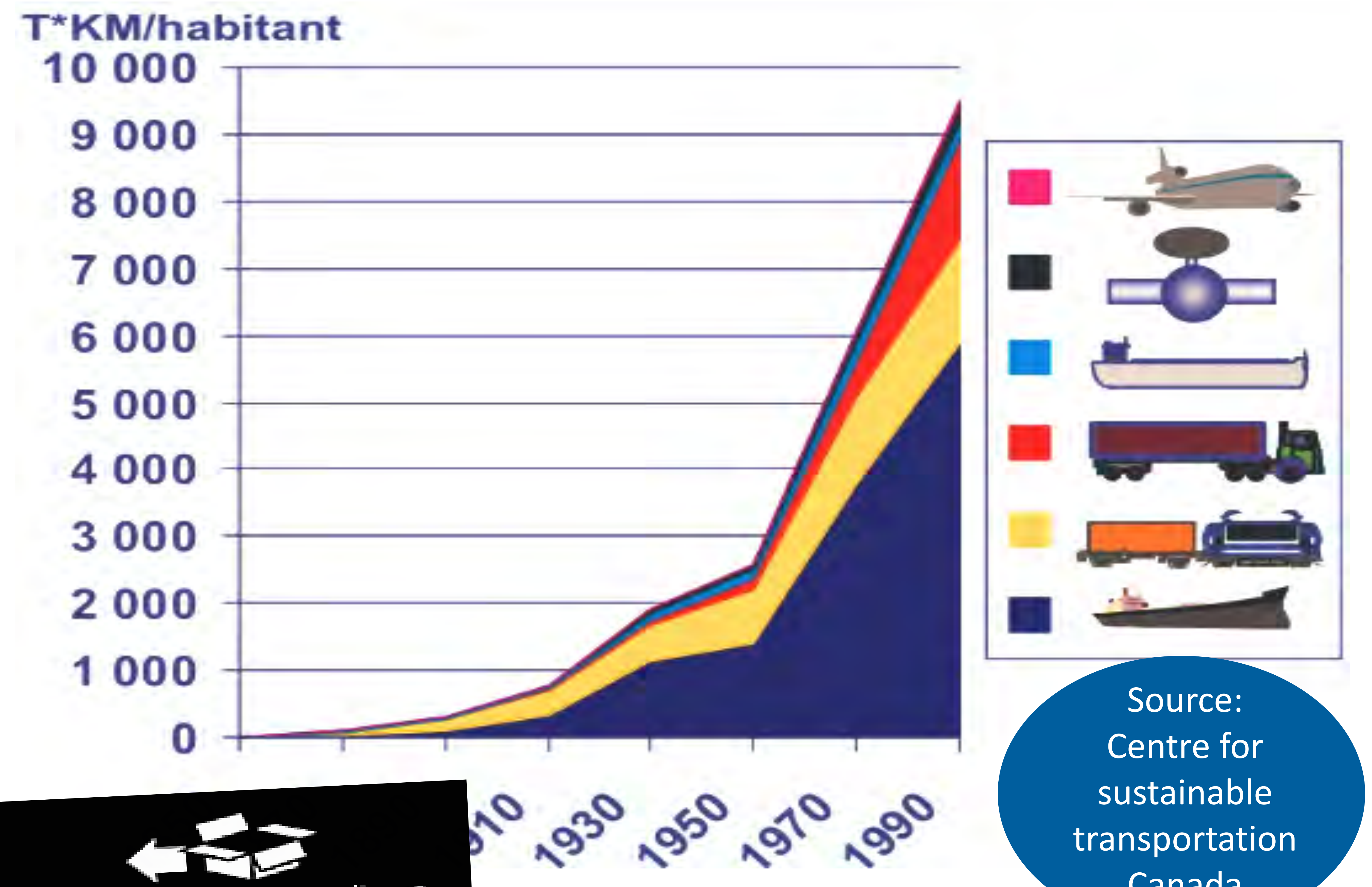
Expectation



Logistic is a growing component of Product Costs

Why do we need a Physical Internet?

- Trends…
  - Flow exponential growth
    (even if they will not reach the sky)



Source:
Centre for
sustainable
transportation
Canada

- Shipments fragmentation
  - Shipment median weight divided by 4,5
    from 160 kg in 1988 to 30 kg in 2004
    Source IFSTTAR 2013

- A no cost illusion for the consumers

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

Supply Chains inefficiency

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

10 YEARS: ZERO IMPROVEMENT ON LOAD FACTORS

Why is that so?

Full, but only 25% of weight limit

60% empty, but at weight limit

This is bad for both profitability and environment

Total food waste along the value chain: 32%

Agriculture & supply 16% | Retailer <1% | Consumer 16%

This docum
therein may

Physical Internet

Physical Internet Concept

Physical
Internet

An open network approach to
Physical Distribution:

- By encapsulating any type of goods in standard modules
- Like in the Internet It allows the creation of a very tight and efficient network maximizing transport and logistic assets utilization.

Physical Internet
Efficient Sustainable Logistics

The key to an open network approach: modules

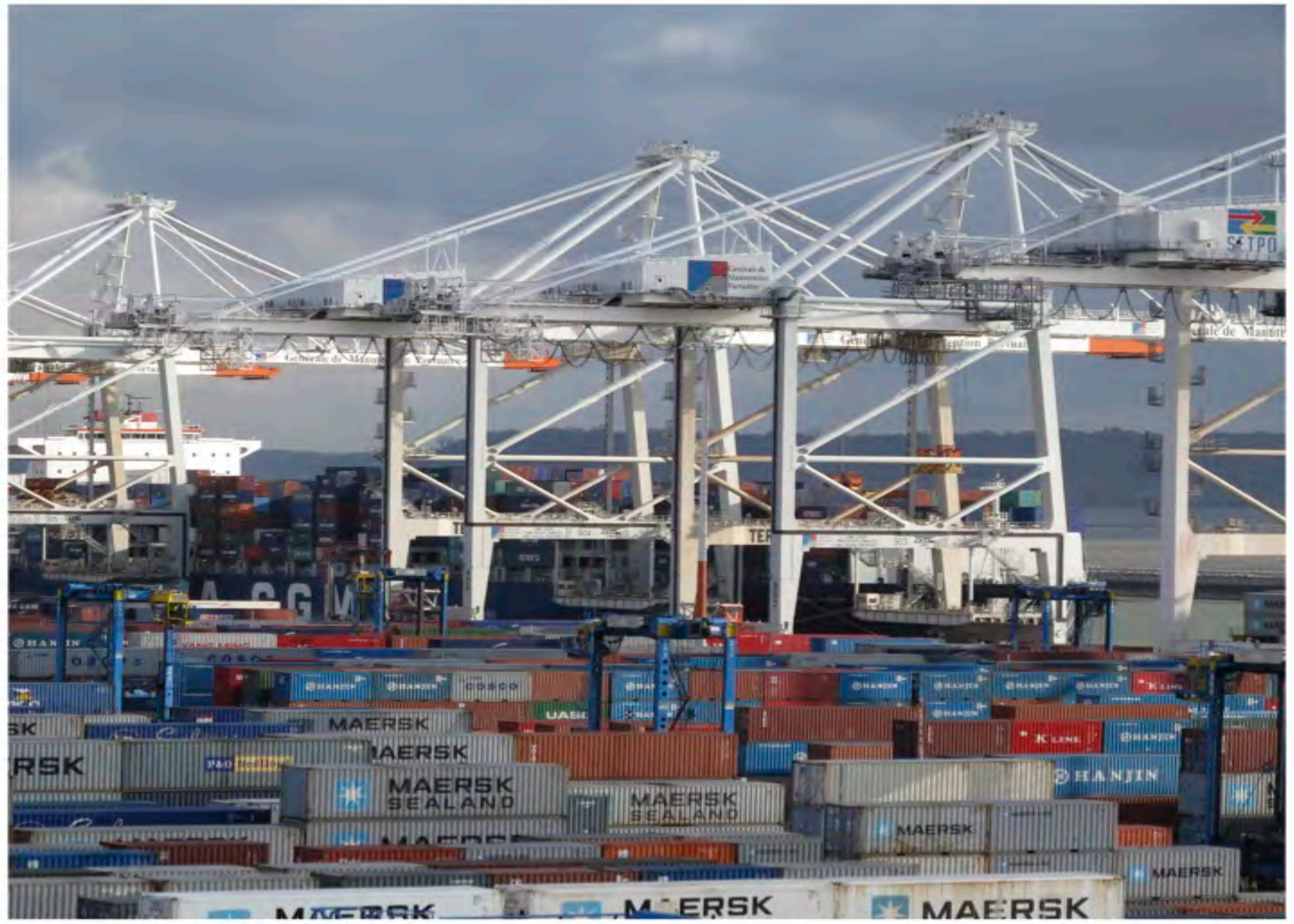
- A generalization of containerization

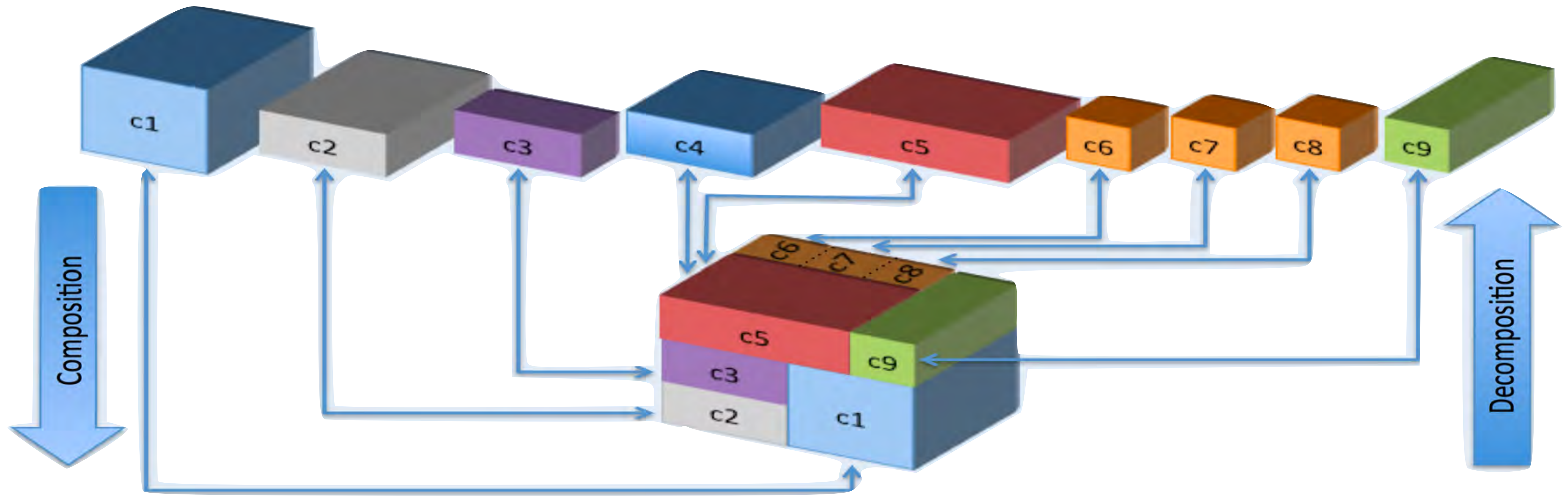
The Box (2006) Marc Levinson, Princeton Press

Cost Port = 2xOcean shipping=2xInland

>>

Cost Port = 0.4xOcean =0.8xInland

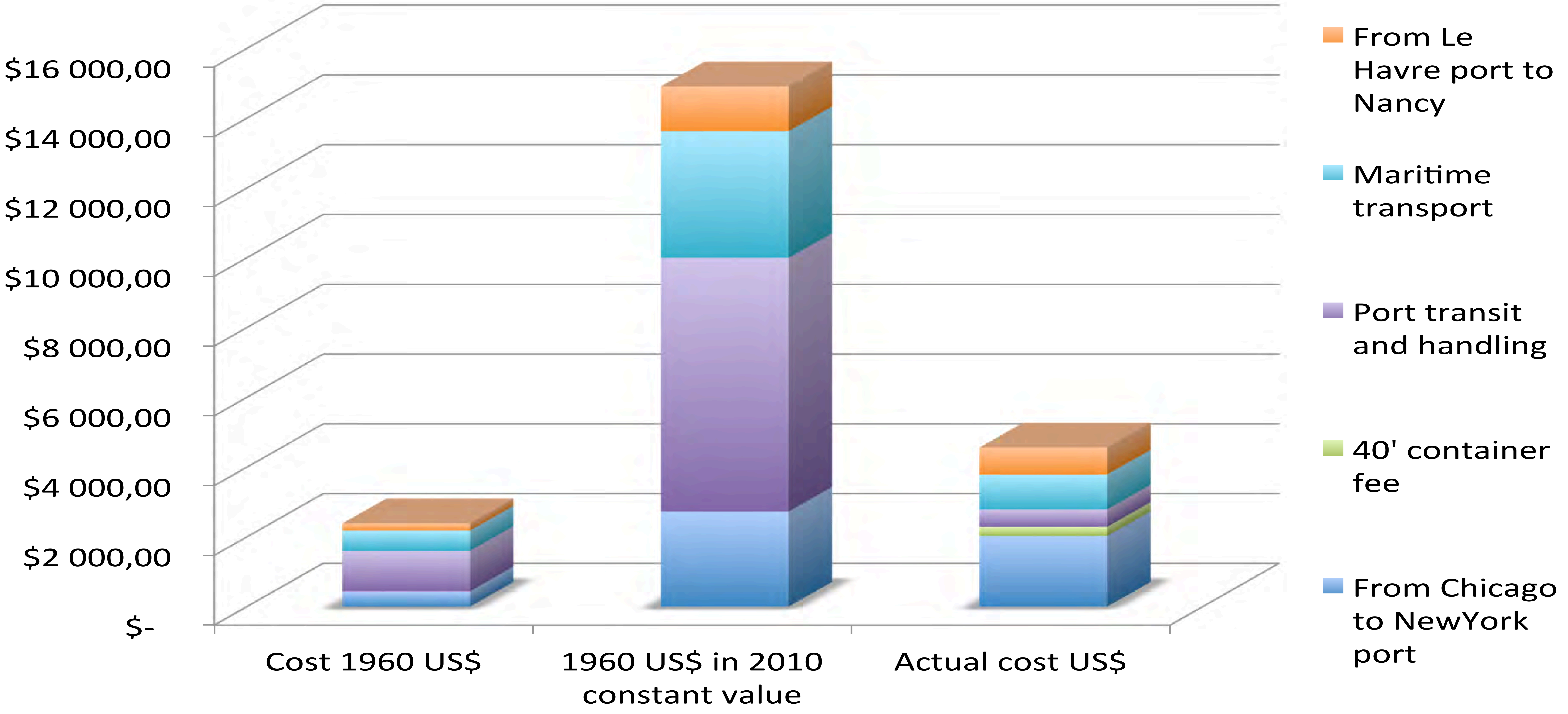




Montreuil, B., Meller, R. D. and Ballot, E. (2010). Towards a Physical Internet : the impact on logistics facilities and material handling systems design and innovation. *In: AL., K. G. E. (ed.) Progress in Material Handling Research. Material Handling Industry of America*

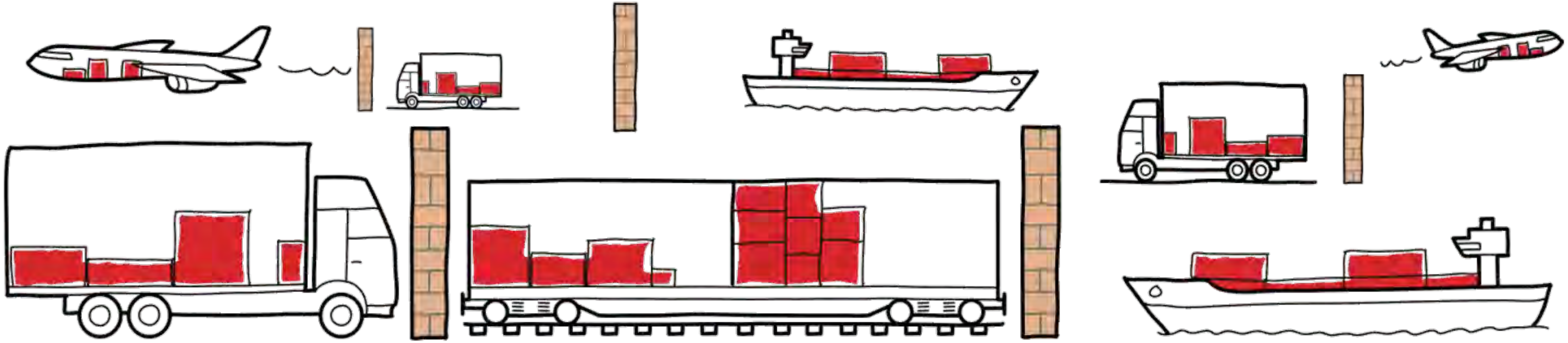
How containers changed everything in Ocean shipping

- The benefit of standard: the maritime container example

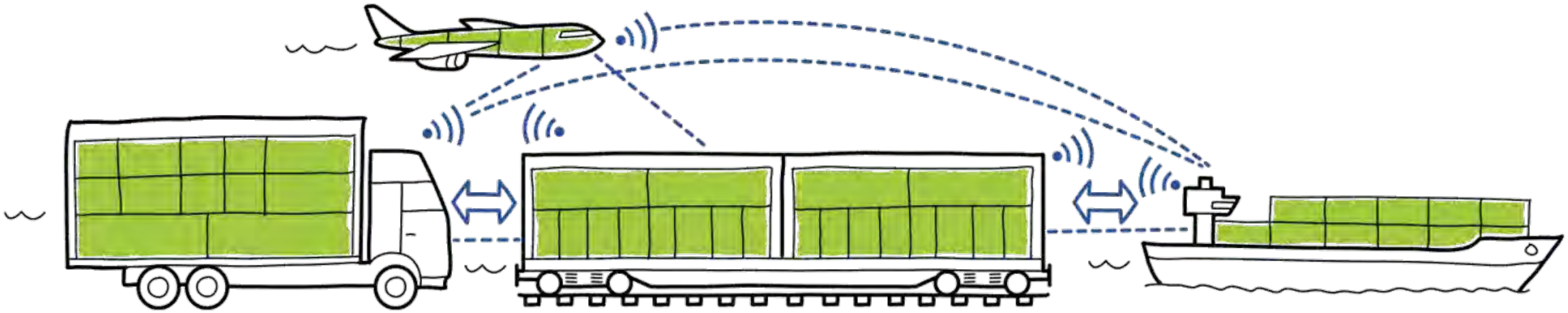


Cost evolution Source The Box, HAROPA & JB Hunt

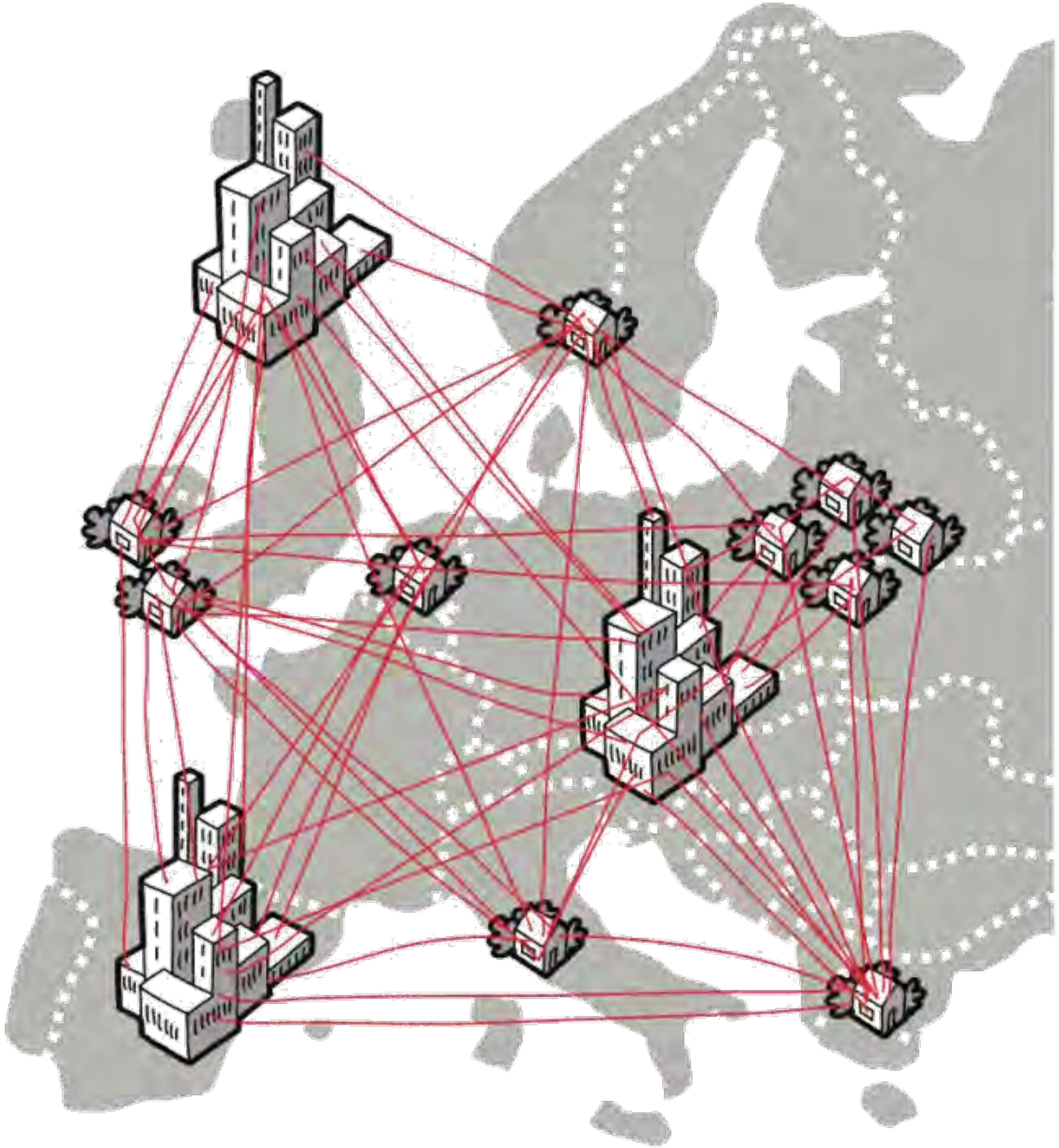
Physical Internet

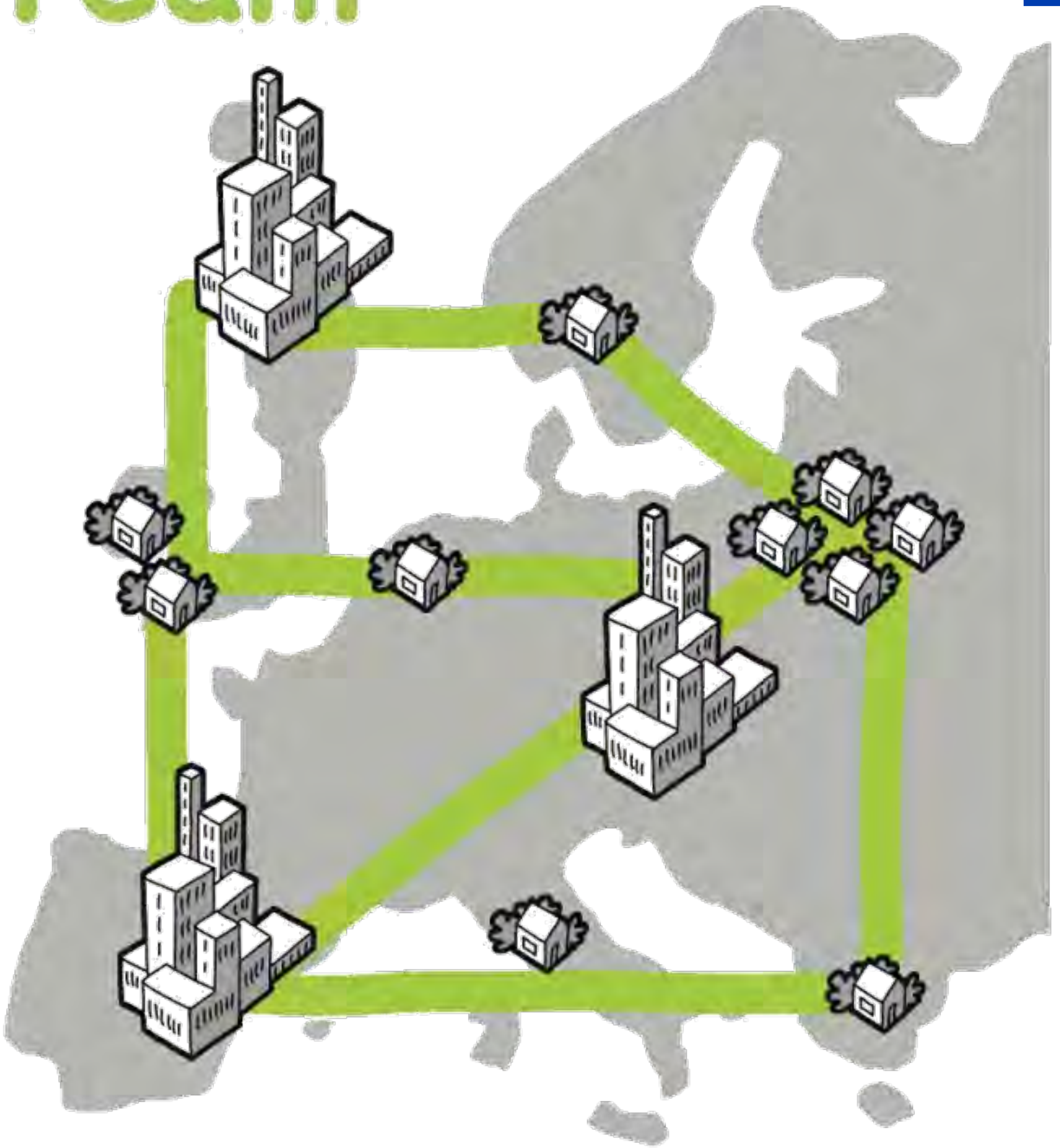


Challenge



Dream





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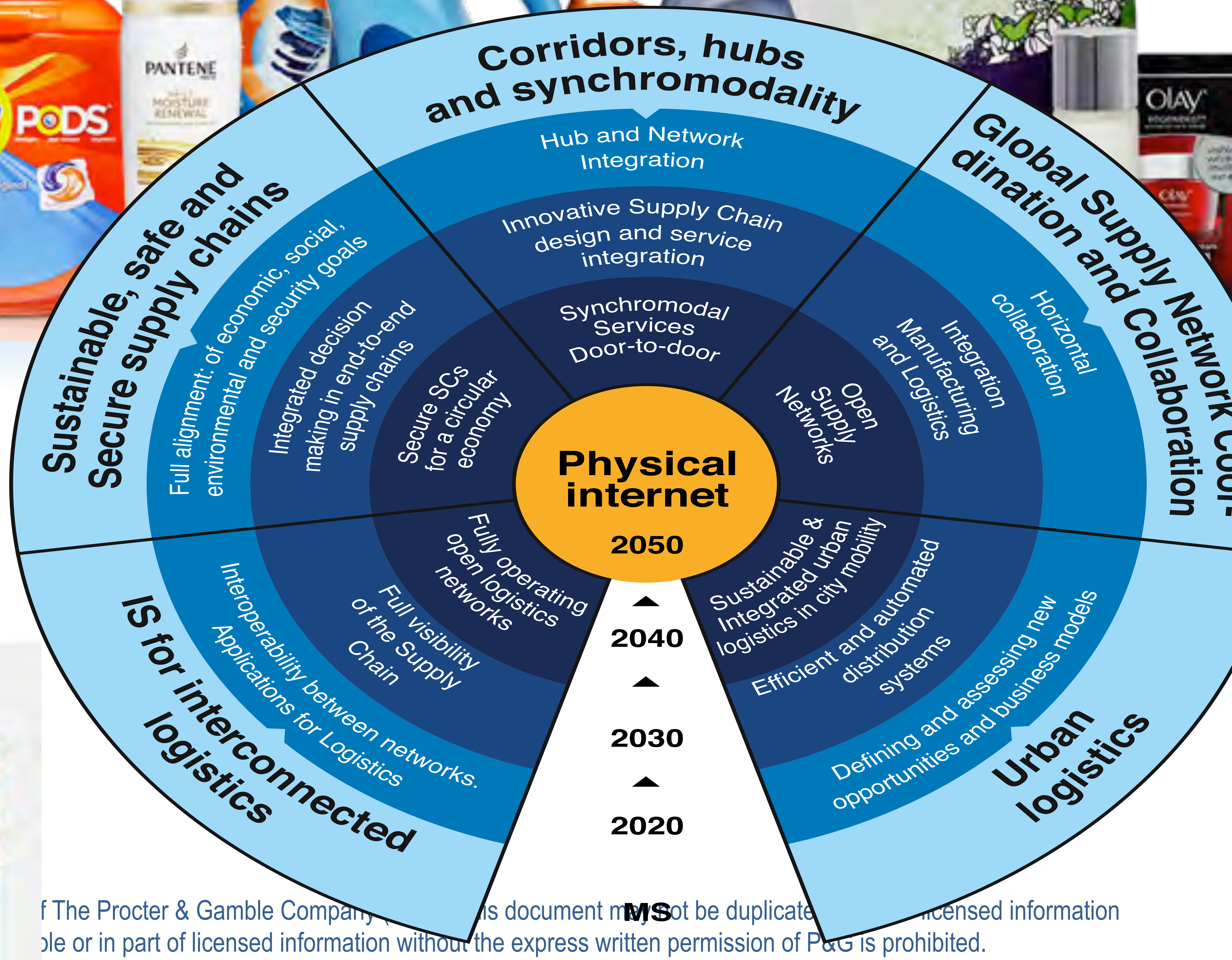
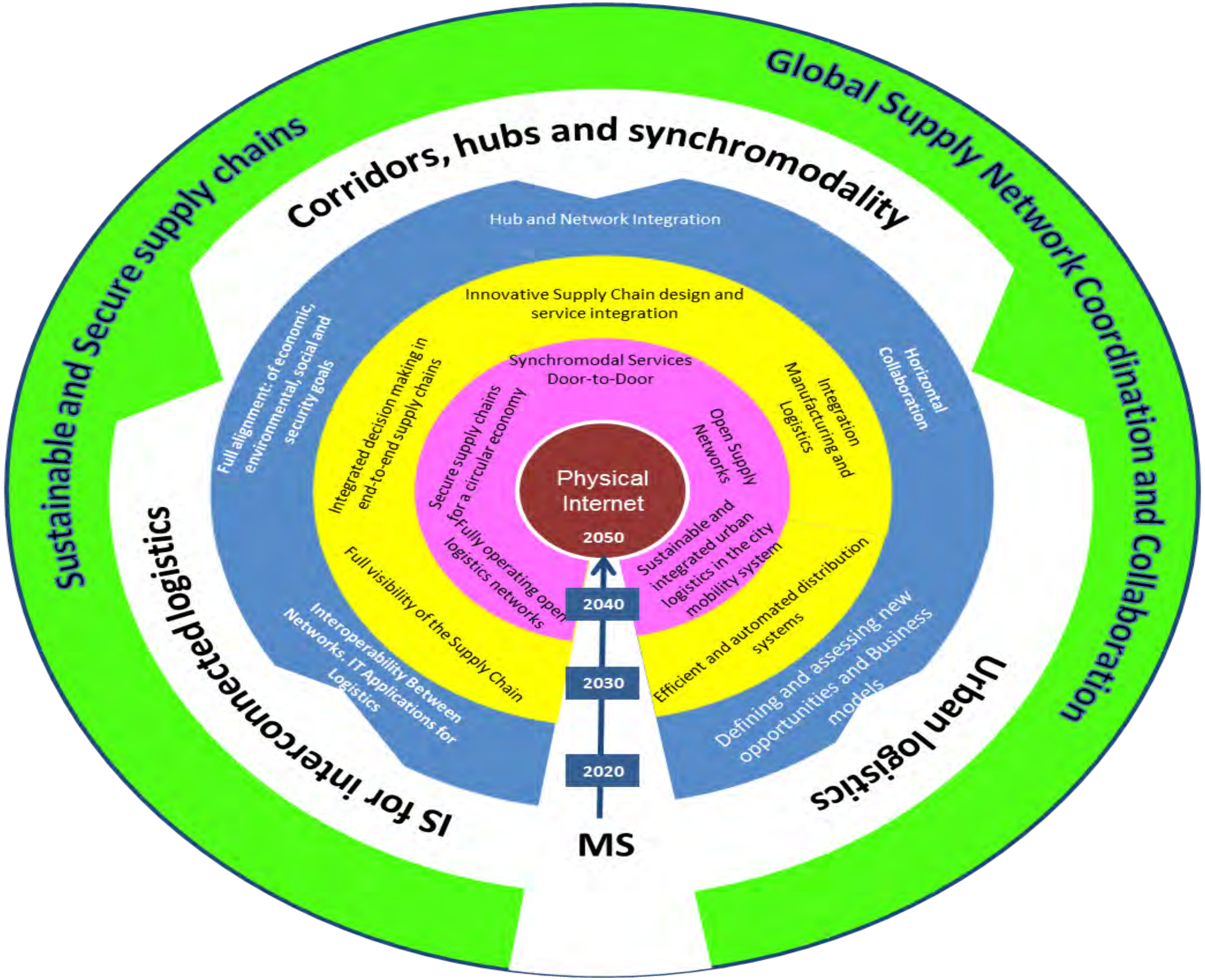


Research and Innovation Roadmaps

MS

ALICE Roadmaps



A practical approach

Conserving Resources: Distribution
Optimizing Outbound Transportation

Our strategies for fewer and friendlier miles:

- Flow management
- Operational excellence by optimizing our distribution networks and vehicle fill
- Shifting to intermodal transportation
- Collaboration

2020 Goal:
20%
Reduction km/unit of volume

"Cube-Fill" Concept

Container Limit = $87m^3$ & 24 tonnes
Overall efficiency = 80% weight & 80% volume

Cube Fill

Optimising Light & Heavy Goods Mix

Light Goods: Only 25% of weight limit

Heavy Goods: Only 40% of volume limit

This is bad for both profitability and environment

Mixed Goods: Target 80% weight & volume limit

+

P&G TINA PROJECT 2008-2015

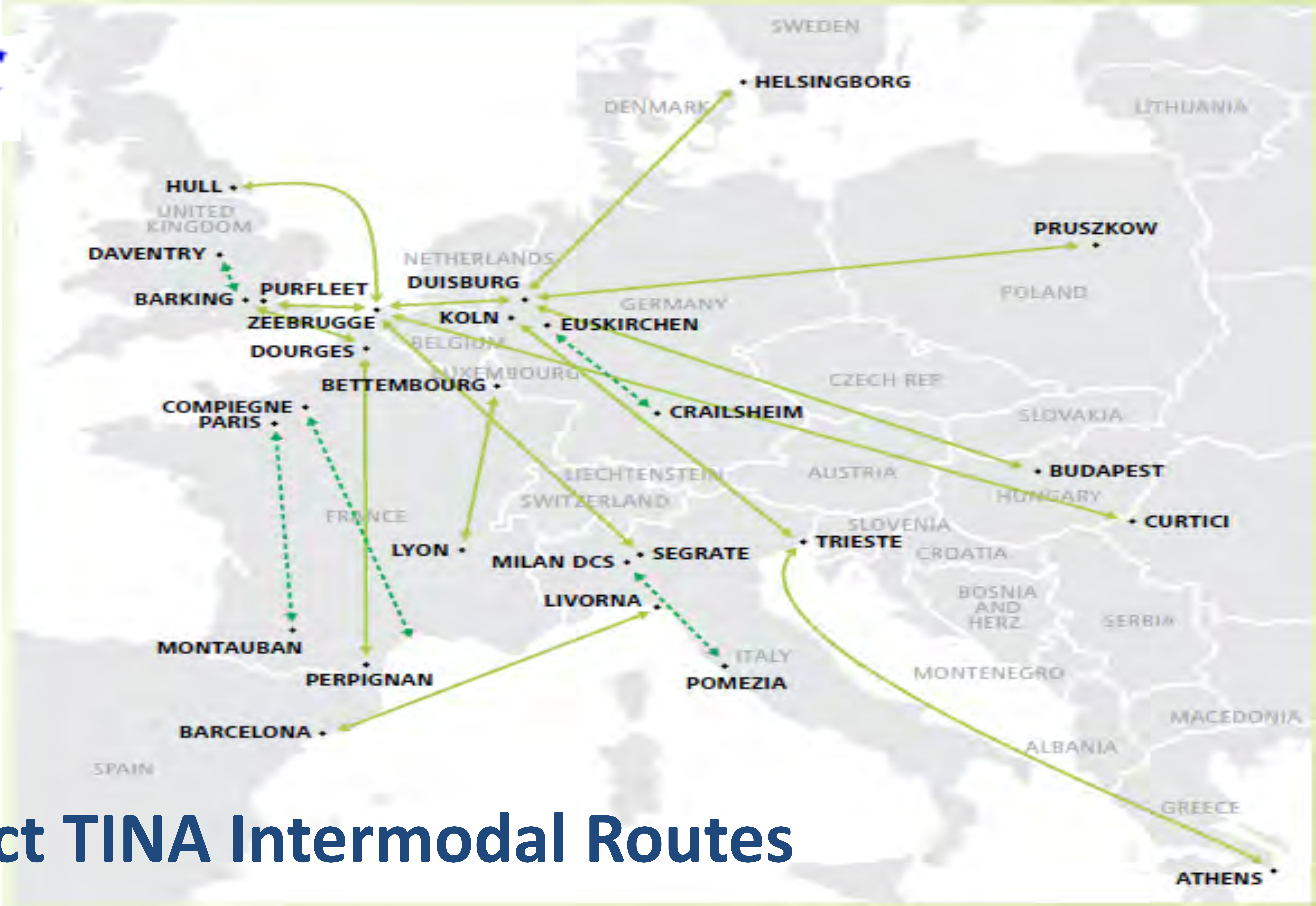
30% TonKms shifted with no compromise on cost

45 M tons of CO_2 reduction

Flow Focusing (parallel and roundtrips, High Frequency)

Big flows – Product mix (more company's = more potential)

Show Industry Leadership



Project TINA Intermodal Routes

How it can evolve...

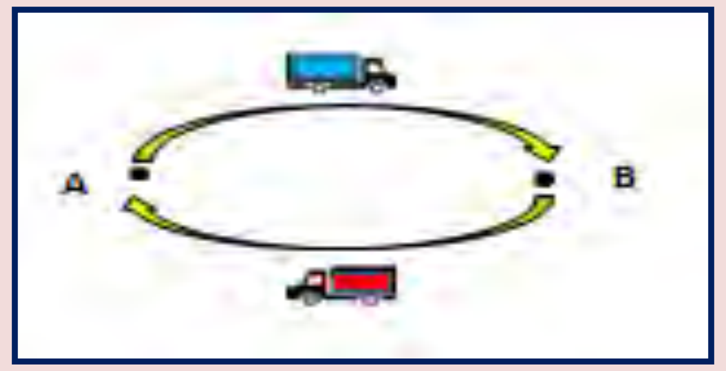
Geographic Expansion

MEA

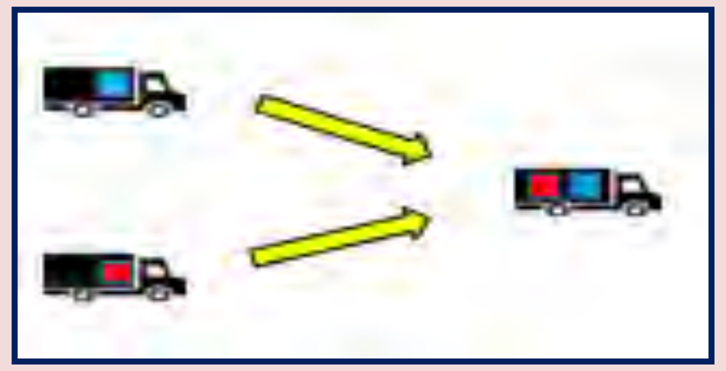
NA

Functional Expansion

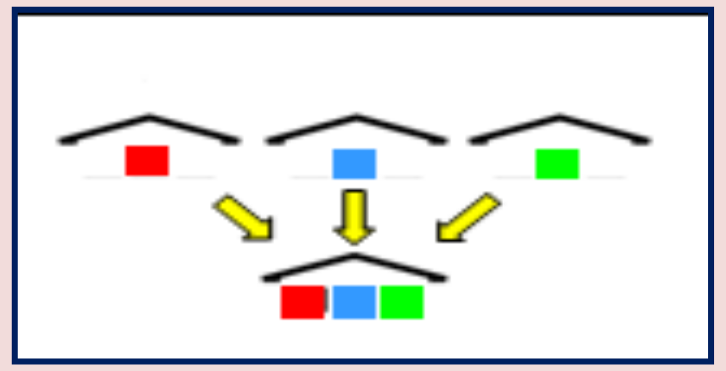
ROUND TRIP



VEHICLE FILL



WAREHOUSING



Logistics Expansion

BARGES

SHORTSEA

Digital Expansion

APPS

BIG DATA

SC CONTROL

LOGISTICS CLUSTERS

PHYSICAL INTERNET

NINA/CARGOSTREAM

PAST

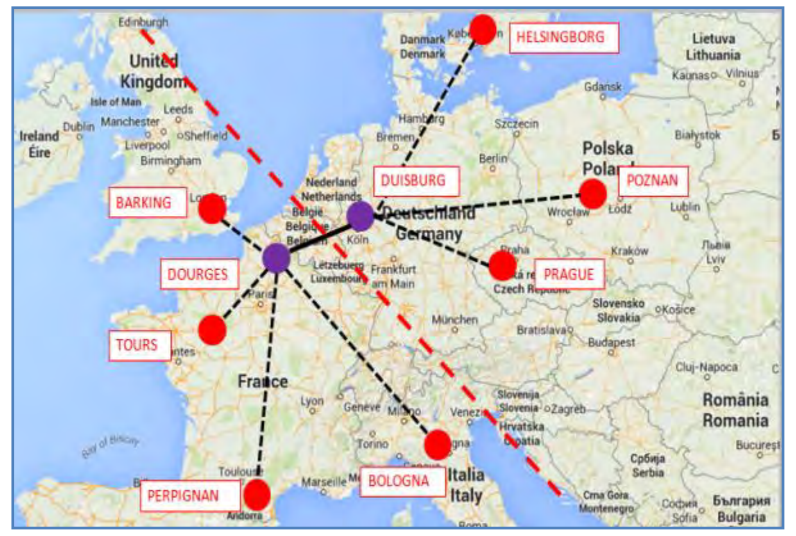
All transportation by road

CURRENT

TINA/NINA - Dourges - Barking Collaborative Connection (Amiens - London)

TINA/NINA Italy - GS1-ECR Collaborative Connection (Pomezia - North of Italy)

FUTURE



New Intermodal Network Approach

Networked

Integrated & Connected

WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?

WE ARE NOT ABLE TO SET UP AND SUSTAIN INTERMODAL CONNECTIONS

NO CONNECTIVITY

NO VOLUME

NO FREQUENCY

HIGH COSTS

LONG LEAD TIMES

NO VISIBILITY

WHY DO WE NEED A CHANGE IN THE INTERMODALITY APPROACH?

WHILE RAIL INFRASTRUCTURE IS UNDERUTILIZED

	EU 27 - FREIGHT TRANSPORT STATISTICS					
	ROAD			RAIL		
	NETWORK (1)	VOLUME (2)	INTENSITY (4)	NETWORK (3)	VOLUME (2)	INTENSITY (4)
1995	47970	1289	26.9	227139	386	1.7
2000	54719	1519	27.8	217857	404	1.9
2005	62218	1794	28.8	212384	413	1.9
2009	66814	1690	25.3	212693	361	1.7
% CHANGE	+ 39%	+31%	-6%	-6%	-6%	0%

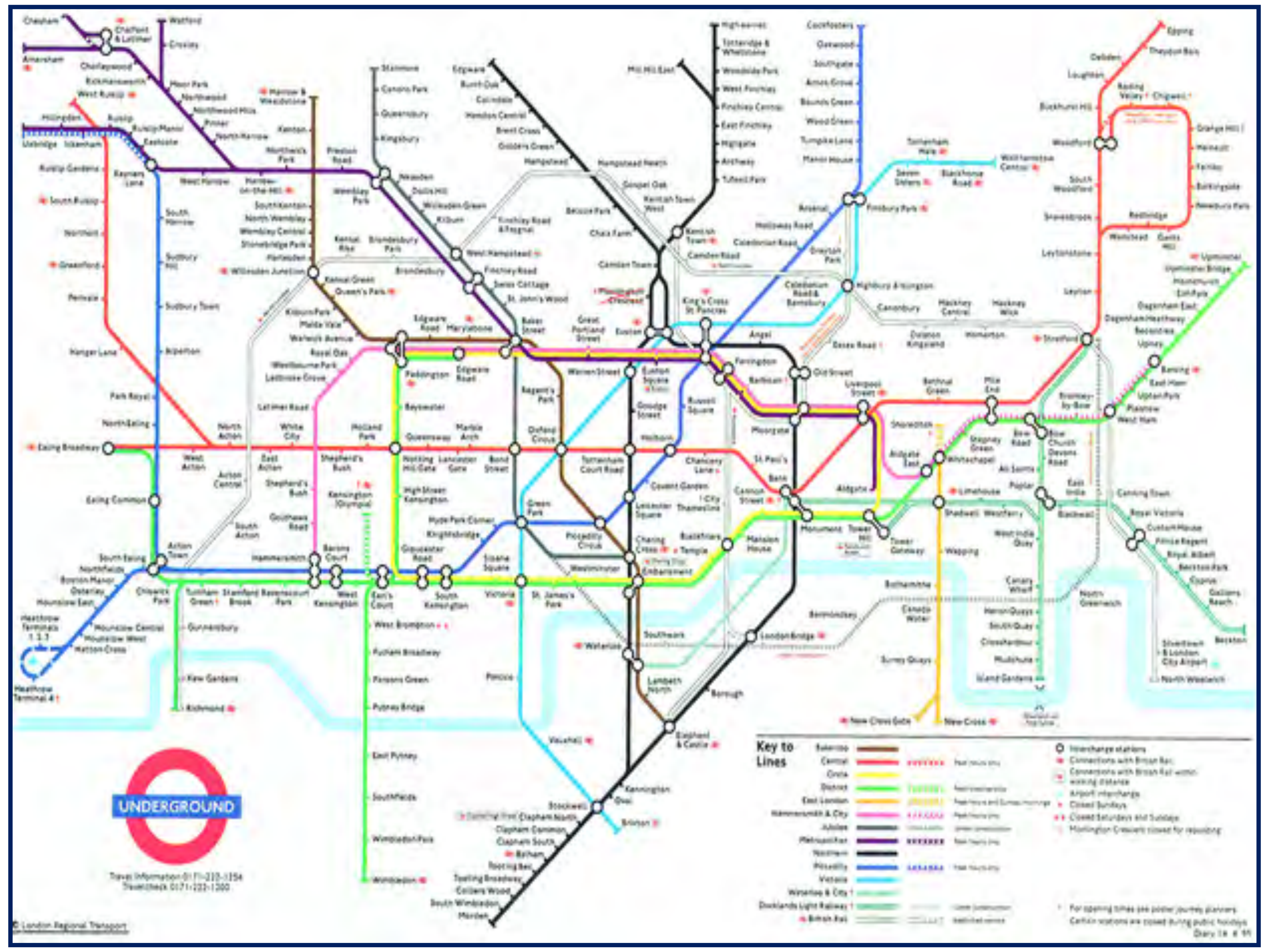
(1) Length of EU-27 Motorway Network in Kilometer
(2) Freight volume shipped in EU-27 in Ton-Kilometer
(3) Length of EU-27 Railway Network in use in Kilometer
(4) Million Ton-Kilometer per Network Kilometer

Source : EU Commision - Transportation Booklet

HOW WILL WE CHANGE
THE INTERMODALITY APPROACH ?

THROUGH A NEW WAY IN WHICH WE LOOK AT INTERMODALITY.

OPEN NETWORK APPROACH



MULTIDIMENSIONAL COLLABORATION

SYNCHROMODALITY

THE ALPHA ALPHA CASE

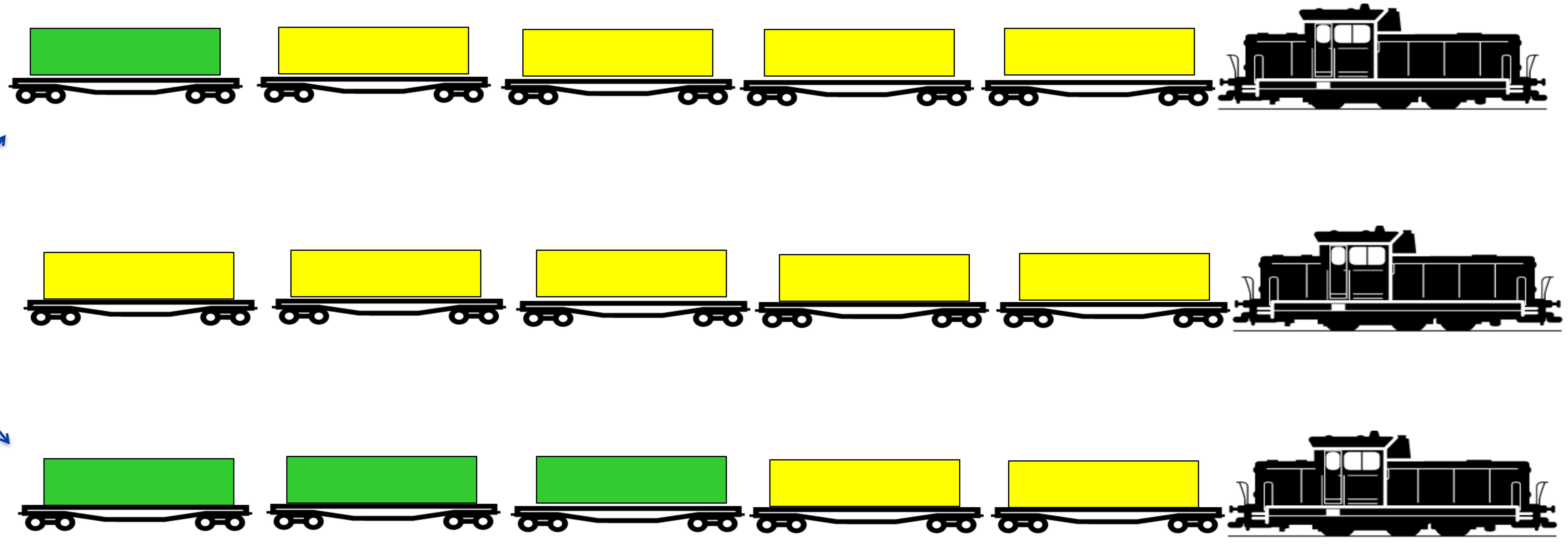
ZARAGOZA REGION
THE BEST
ALPHA ALPHA GRASS

THE NETHERLANDS
THE BEST
MILK COWS

SYNCHROMODALITY

HOW DO WE GET THE GRASS TO THE COWS?

ALPHA ALPHA LOADS ARE NOT URGENT AND USED AS A FILLER



ALPHA ALPHA GRASS LOAD

REGULAR LOAD

SYNCHROMODALITY

FROM A ONE LEAD TIME MODEL WITH PLANT STOCK

CURRENT SUPPLY CHAIN SET-UP				
PRODUCTION		PERIOD N	PERIOD N+1	PERIOD N+2
PLANT INVENTORY				
FAST AND AGILE TRANSPORTATION MODE				

TO A MULTIPLE LEADTIME MODEL WITH PIPELINE STOCK

SYNCHROMODAL SUPPLY CHAIN SET-UP				
TIME		PERIOD N	PERIOD N+1	PERIOD N+2
PLANT INVENTORY				
FAST AND AGILE TRANSPORTATION MODE				
FAST AND STABLE TRANSPORTATION MODE				
SLOW AND STABLE TRANSPORTATION MODE				

SYNCHROMODALITY

BENEFITS OF SYNCHROMODALITY.

- ❖ Reduction in transportation cost if slow mode is used for non-urgent volume (40% of total volume).
- ❖ Reduction in warehousing cost due to the shift from warehouse inventory to pipeline inventory.

PREREQUISITES FOR SYNCHROMODALITY.

- ❖ Supply chain visibility at tactical level through a tactical control tower to design lanes.
- ❖ Supply chain visibility at operational level for the PSCs.
- ❖Multiple leadtimes set-up in SAP APO DRP system versus one leadtime today.

Eurasian Freight Corridors – A Synchromodal Opportunity

Freight traffic China-Europe
~ 90% Sea/40 days
< 10% Air/1 day
~ 1% Railway/ ~15 days
~ 30 freight trains per week

Inland Road Transport – Extreme Scenario

100% mode shift to non-road above 300 KM

SOURCE: Eurostat (rail_go_typeall) , (iww_go_atygo) and (road_go_ca_c) – 2014 EU-28 Data.. For (road_go_ta_dctg) - Averaged Data from the year 2008 to 2014 and SNIC calculations

Assumption: Modal shift does not cause increase in the total Tn-km of a journey

Transformers

TRANSFORMERS

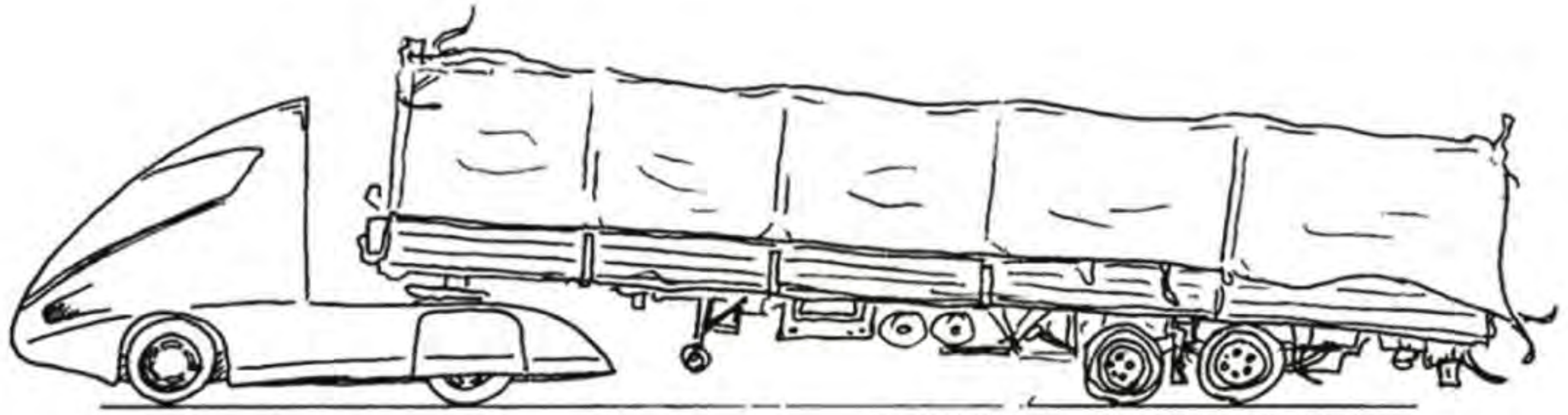
Configurable and Adaptable Trucks

PAST

Rigid Body irrespective of transport mission

Simple Cube Design

CURRENT



source: Dr. Harald Ludanek, Scania CV AB (Zukunftskongress 2013, Ludwigsburg)

DHL

INTERNATIONALE LKW WALTER TRANSPORTORGANISATION AG
Transport hat immer Zukunft

C.H. ROBINSON WORLDWIDE, INC.

KUEHNE+NAGEL

CEVA
Making business flow

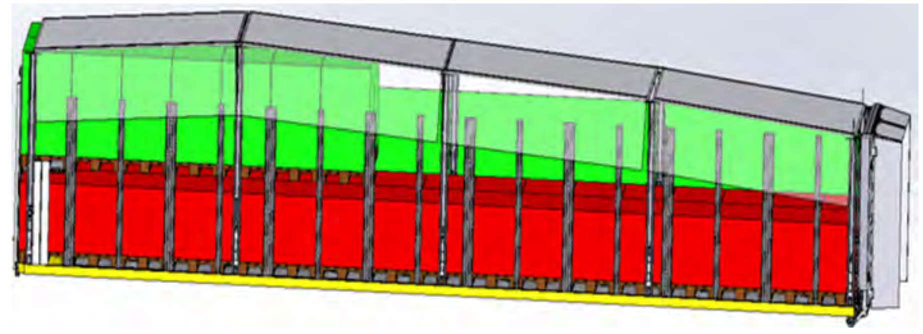
FedEx

ups

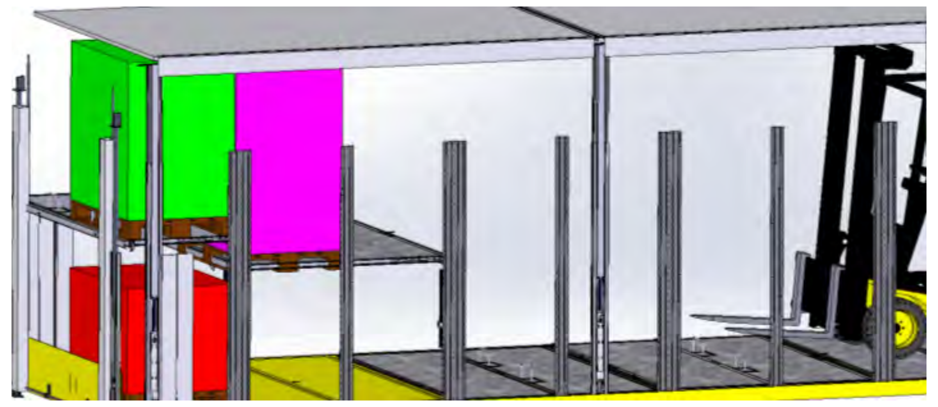
NIPPON EXPRESS

DB SCHENKER

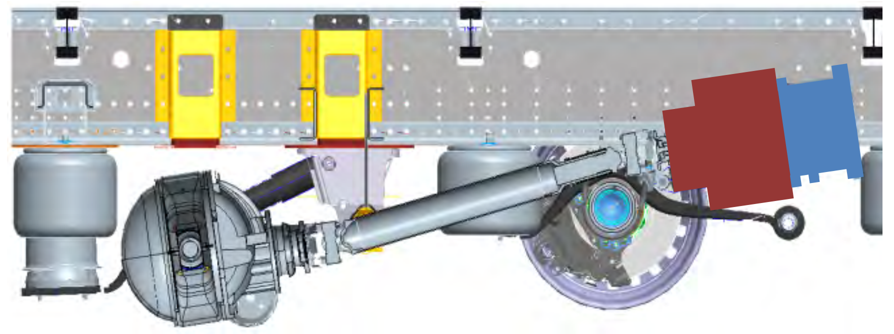
FUTURE



Mission Adaptable



Flexible Stacking

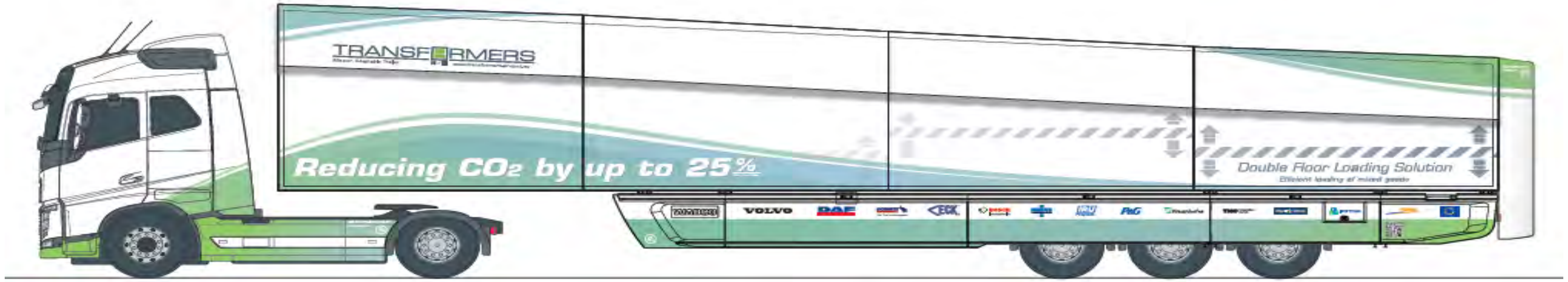


Hybrid Driveline

Physical Internet Vehicle

TRANSFORMERS

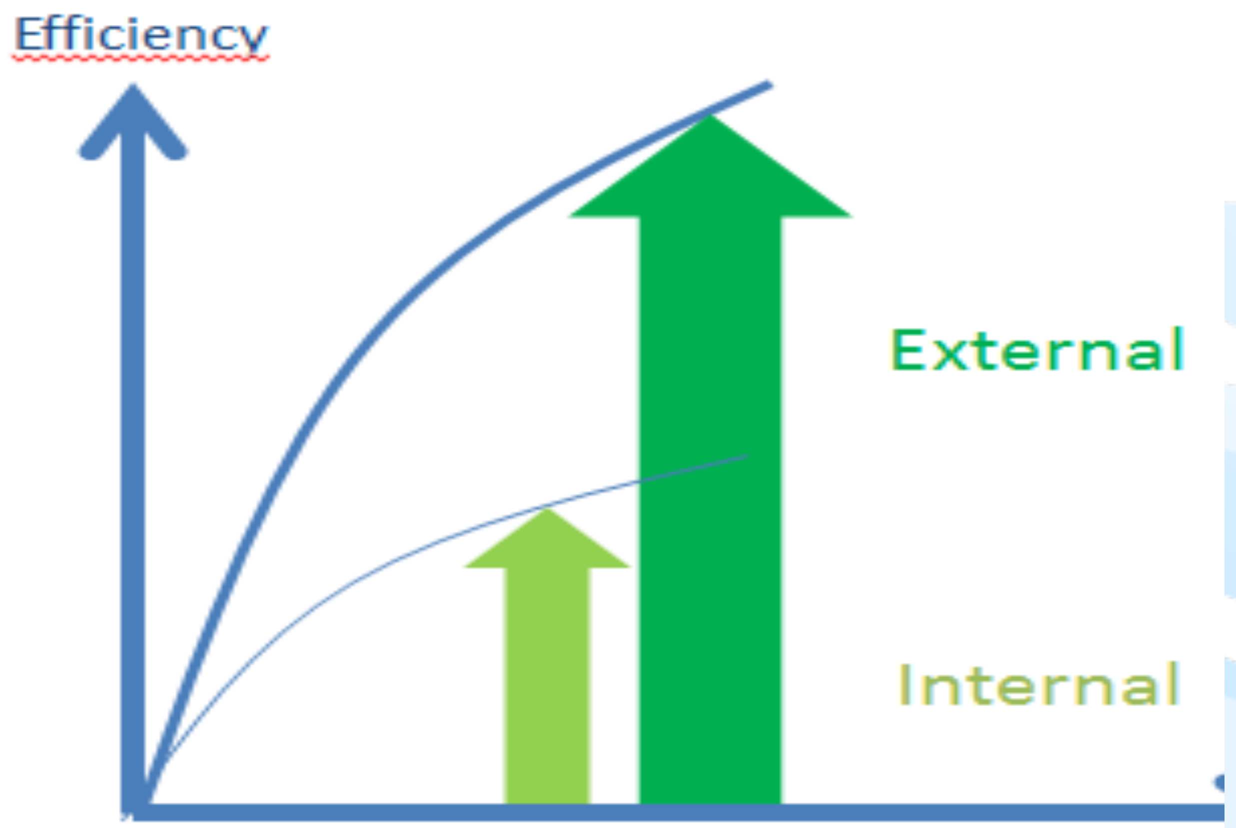
Trailer Mounted
Electric Driveline
“Hybrid on Demand”



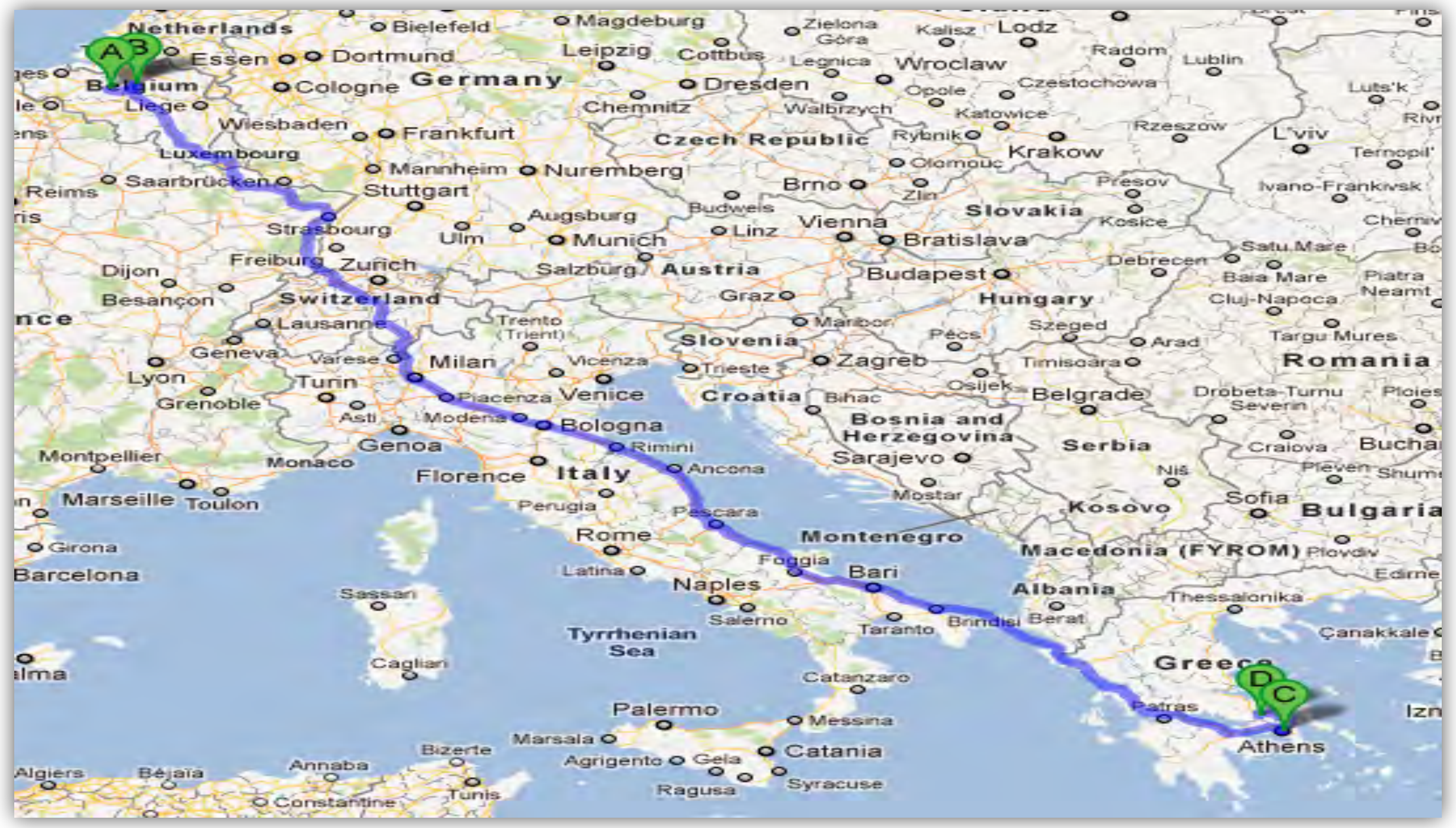
Whole Vehicle
Combination
Aerodynamics

Load Capacity Optimisation

TRANSPORT COLLABORATION



TUPPERWARE VEHICLE ‘FILL‘ COLLABORATION



>15% less Cost

Save> 2M Tons CO_2

Vehicle Cube Fill improvement

55% → 85%

by heavy & light mixing

Optimize Warehouse

Productivity

Show Industry Leadership

Way forward...?

Solo

1 Company
optimization

P&G Supply Chain

Tupperware
Supply Chain

In Partnership

Tupperware
+
P&G

Expand partnership

Multi-lane collaboration

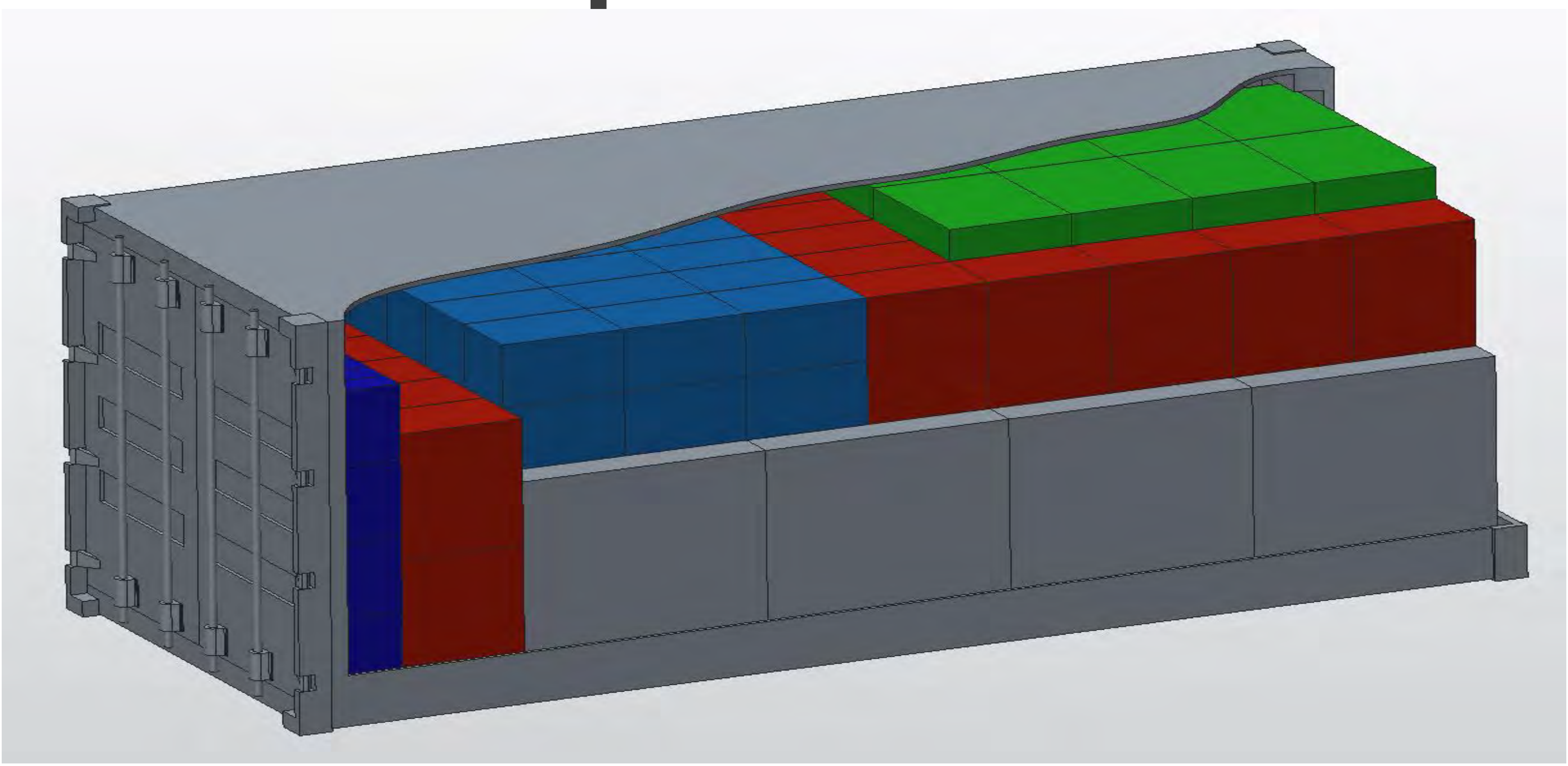
Multi Party
collaboration

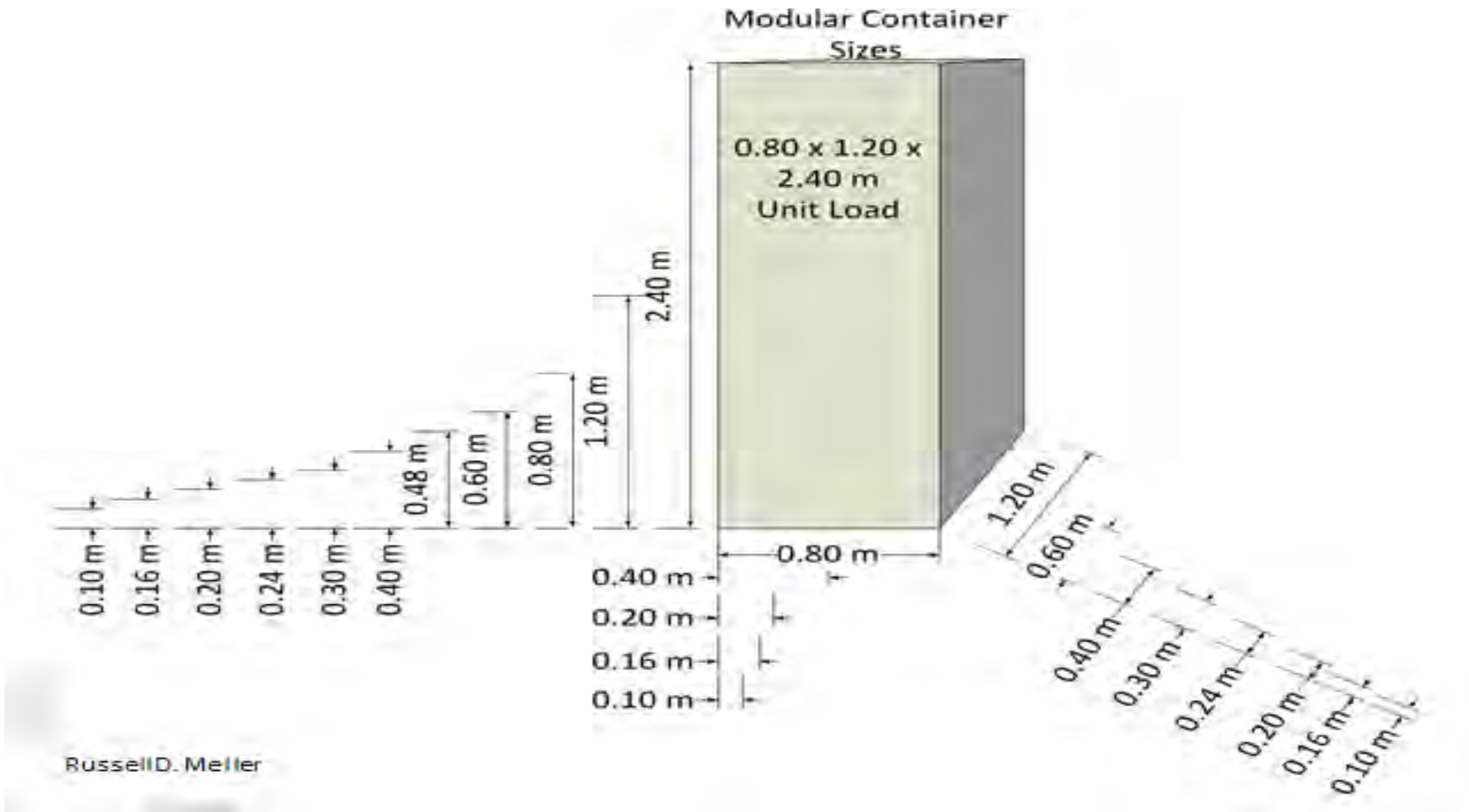
3+ partners
(C03 framework)

Future
Market Place

10-30+ partners

Has the time arrived for a new Modular Concept?





Reusable Intermediate Containers - RICs

ISO-MODULAR REUSABLE CONTAINERS

P&G PILOT SUMMARY

Financially attractive on E2E basis

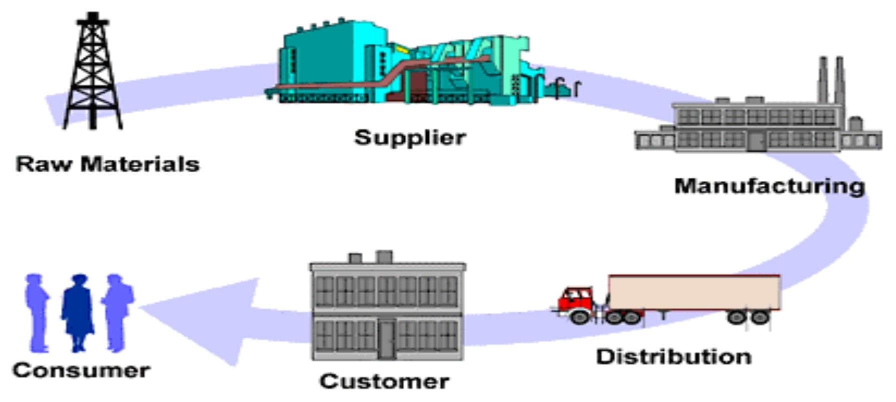
The Consumer Goods FORUM
The Global Network Serving Shopper & Consumer Needs

Standard Container

Low cost reverse logistics

High container cube utilization

Low cost option to pack container



Shorten Supply Chain length

Reusable Intermediate Containers - RICs

Physical Internet

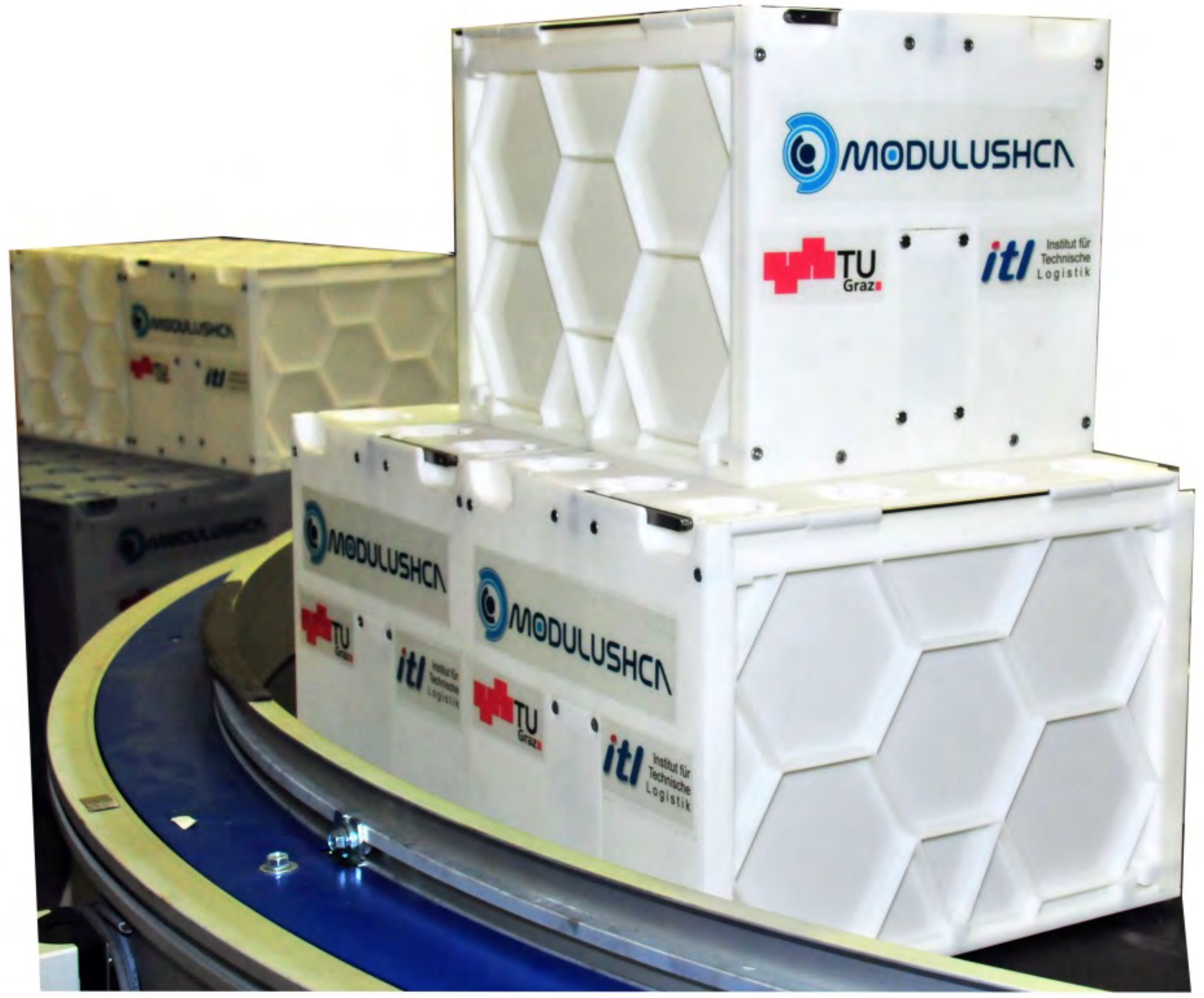
MODULUSHCA CONCEPT

TODAY

TOMORROW

Reusable Intermediate Containers - RICs

MODULUSHCA



MODULUSHCA

Reusable Intermediate Containers

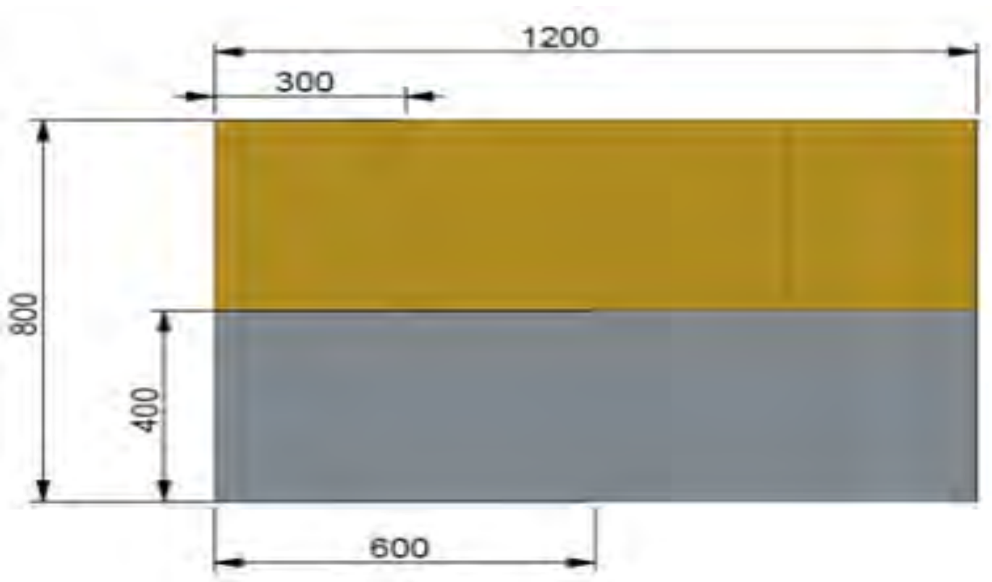
PAST

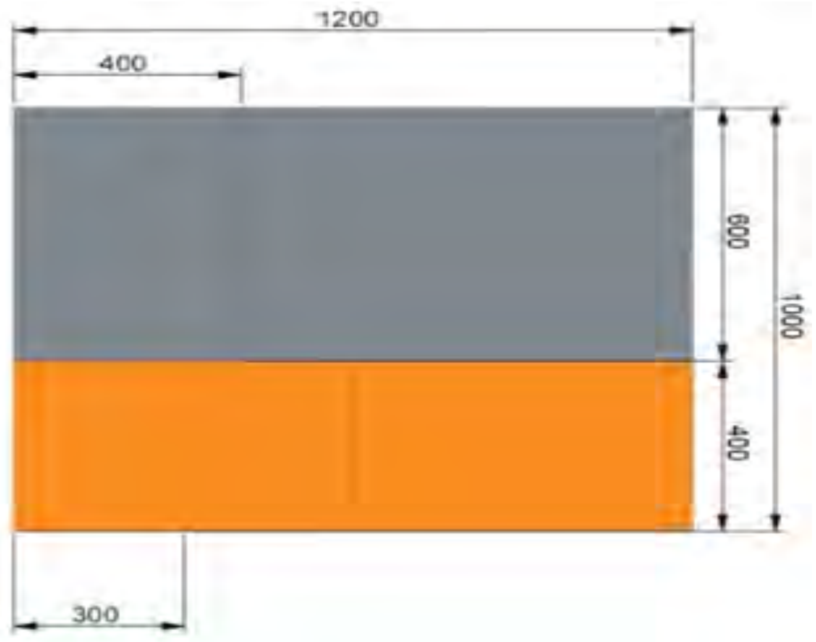
CURRENT

FUTURE

HARD

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

SOFT

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.

NO

RPCs must not be nestable.

Reusable Intermediate Containers - RICs

Physical Internet

P&G CHALLENGE

Temperature controlled containers/trucks are EXPENSIVE and not always AVAILABLE.

Most P&G products require just protection from T peaks.

SOLUTION

Battery operated Ice cube reservoir in normal trucks & seatainers with thin distribution blanket.

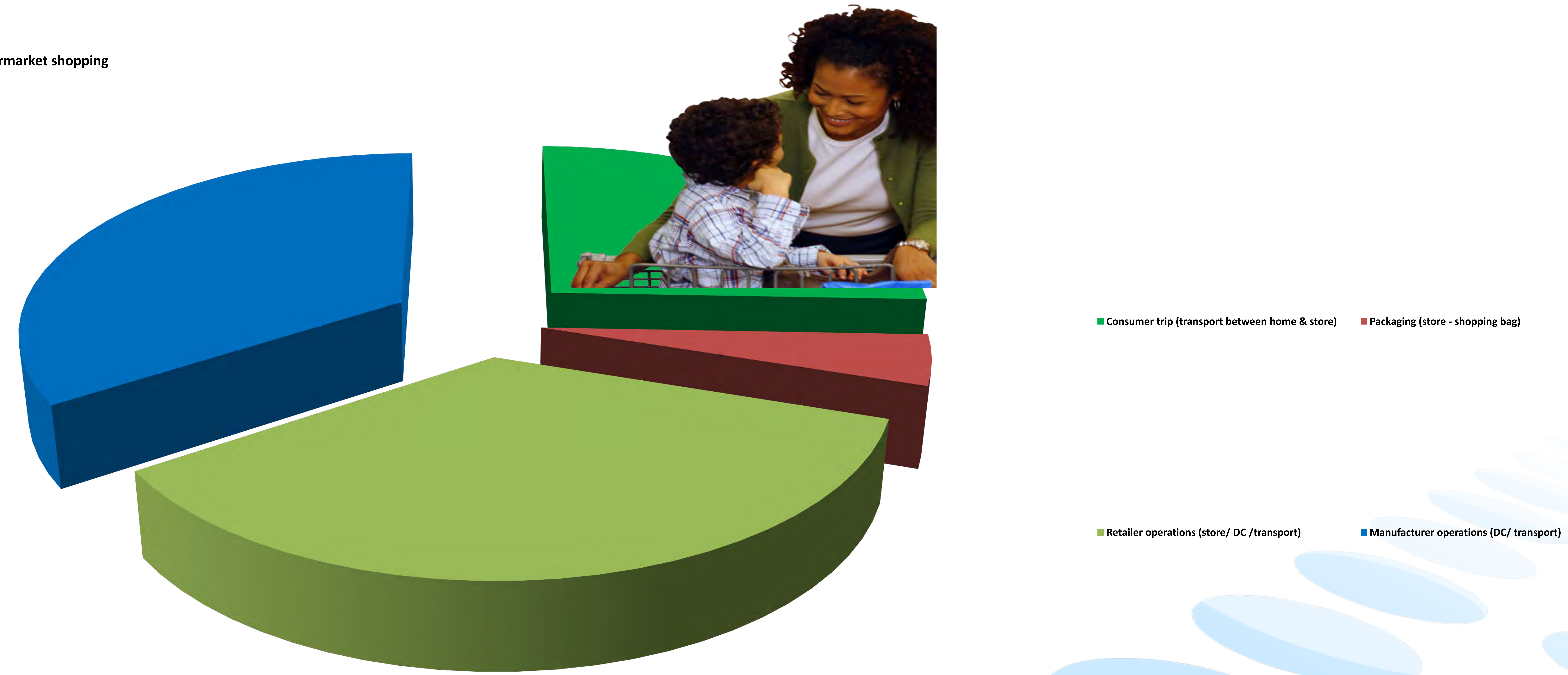
C+D with Sunwell[c]

- **BENEFITS**

- 30% less CO_2
- Business continuity
- Low Cost

The Last mile but not the Least

CO_2 emitted by supermarket shopping



Source: LCA study, P. van Loon, J. Dewaele, L. Deketele - Heriot-Watt University / P&G
30 items/shopping basket - UK B&M supermarket - typical (average) travel behavior (distance, transport mode)

IPIC 2016

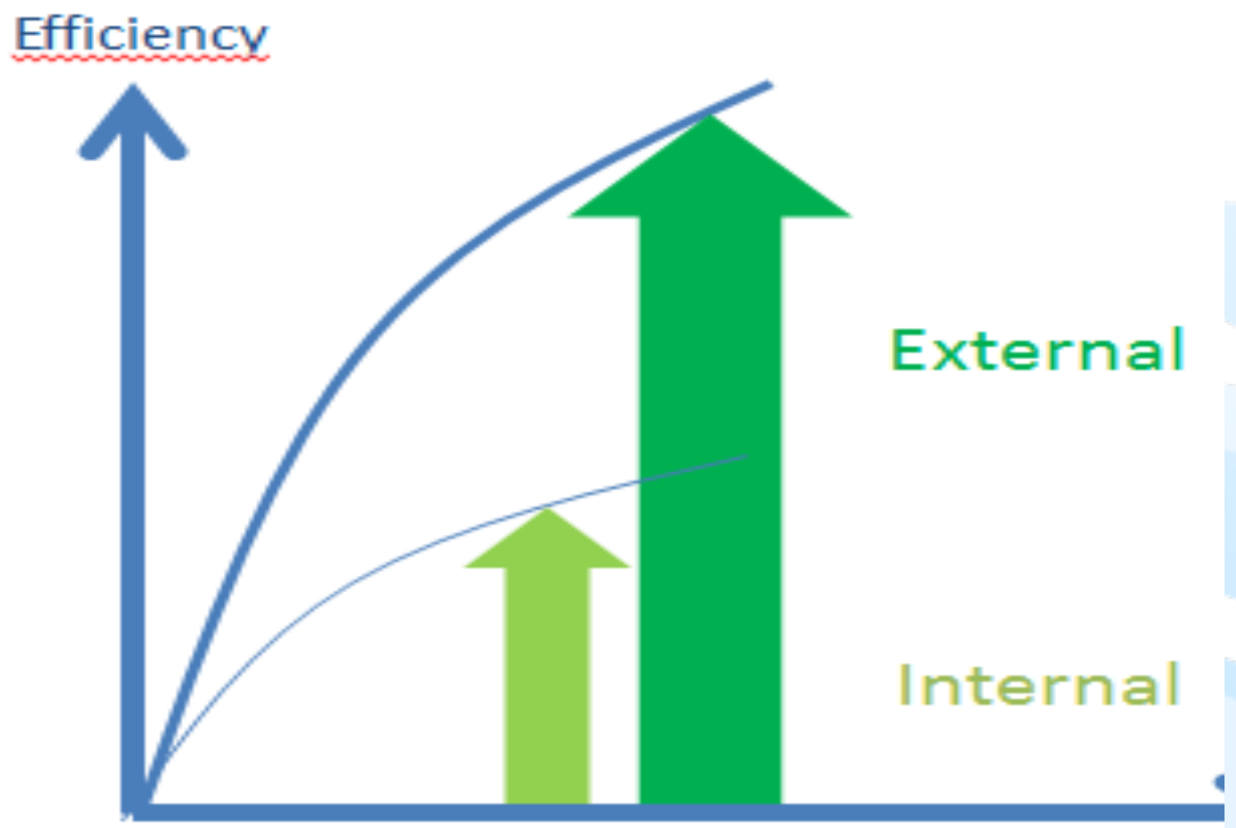
IPIC 2016 - 3rd International Physical Internet Conference
June 29-July 1, 2016 | Atlanta, GA USA

THANK YOU!

Everyday Better for People and the Planet

Touching lives, improving life. P&G™

TRANSPORT COLLABORATION



Cooperation experiment

Going to the beach

Going to the beach

3 persons

1 person

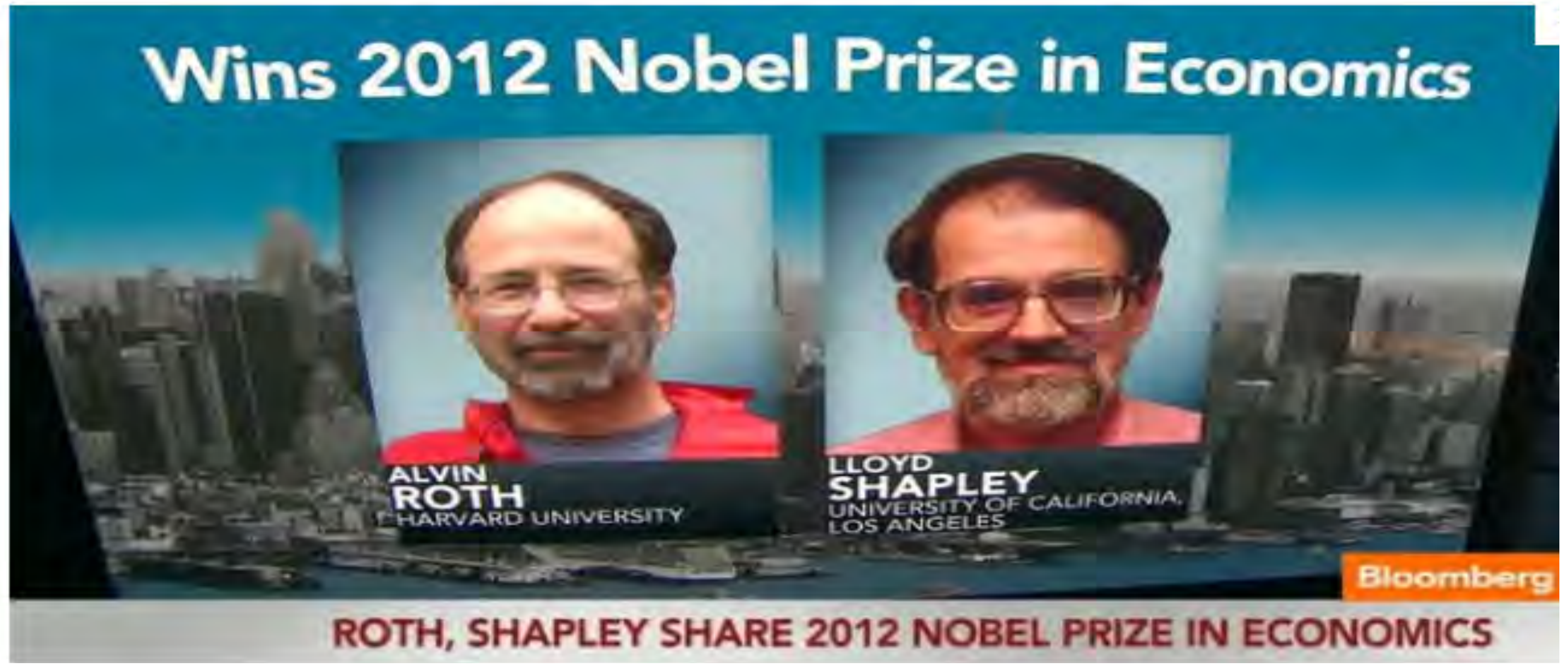
4 persons

Some insights in gain share

Legal Frame work

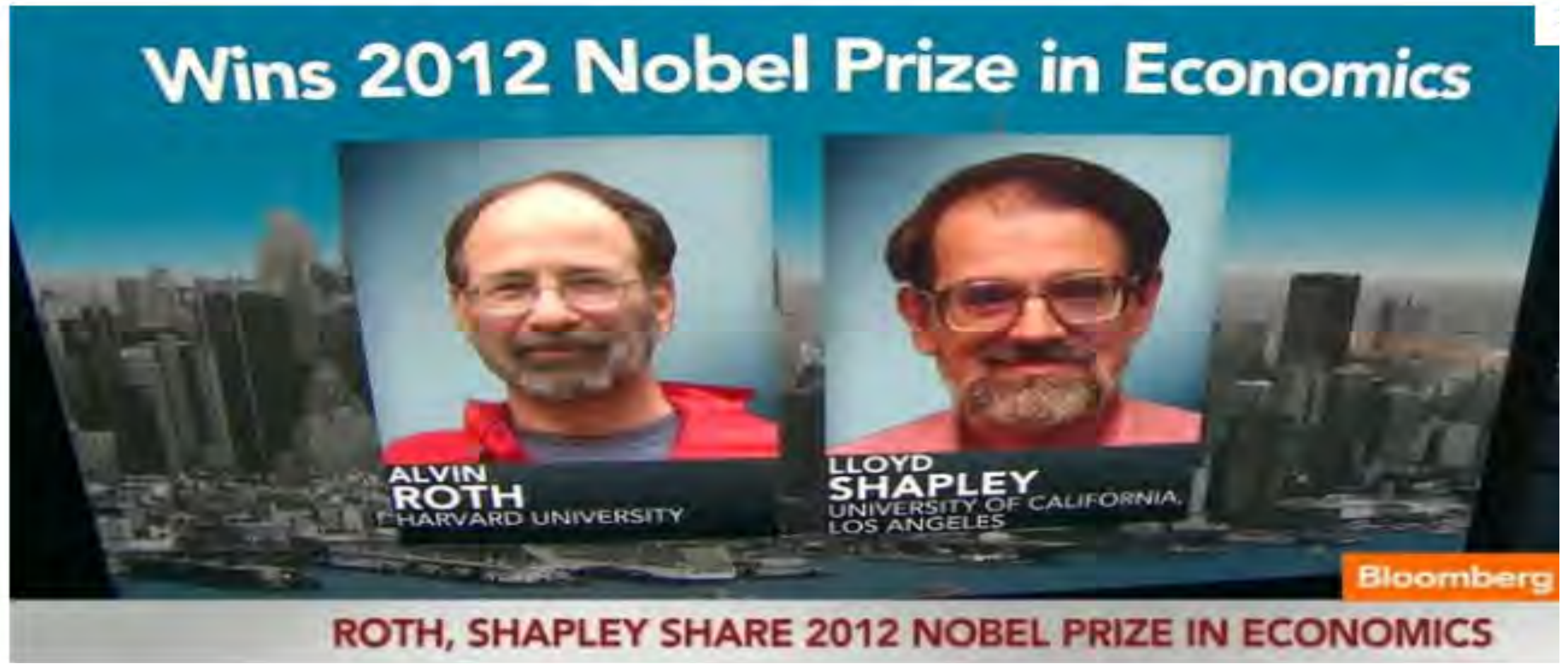
Fair Gain share

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|!\,(n-|S|-1)!}{n!}(v(S \cup \{i\}) - v(S))$$



NOBEL PRIZE FOR GAIN SHARING FORMULA: SHAPLEY VALUE

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|!\,(n - |S| - 1)!}{n!}(v(S \cup \{i\}) - v(S))$$



Shapley value is the only gain sharing concept that satisfies all the following fairness properties:

- **Efficiency**: The complete savings of collaboration are distributed
- **Monotonicity**: If player A adds more value to every coalition than player B, player A will get a higher payoff
- **Dummy**: A player that adds no value to any coalition, will receive no payoff
- **Symmetry**: If two players add exactly the same value to every other coalition, they will get the same payoff
- **Individual fairness**: No player will suffer from collaboration (cost level after collaboration is not higher then individually, i.e. without collaboration)

A competitive advantage!

Shapley solution? The new Passenger should pay 50% of the costs:

1) **The single passenger is now paying as if he is sharing with another passenger**

2) **The group of 3 are now paying as if <u>they were 6 passengers</u> sharing the costs ! ☺**

Note that: a scale of 6 is physically <u>IMPOSSIBLE if you do not COLLABORATE</u>

•A SNIC Concept

Physical Internet

THINK
MANY

THINK BIG