THE PHYSICAL INTERNET – JUST WHAT IS THIS IDEA

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LET’S START THIS PRESENTATION WITH A FEW DEFINITIONS

- Definition:

The Physical Internet is a vision of how physical objects might be moved via a set of processes, procedures, systems and mechanisms from an origin point to a desired destination in a manner analogous to how the Internet moves packets of information from a host computer to another host computer.
TO UNDERSTAND THE CONCEPT OF THE PHYSICAL INTERNET REQUIRES AN UNDERSTANDING OF HOW THE INTERNET WORKS

Logistics Web
Set of openly interconnected physical, digital, human, organizational and social agents and networks aiming to serve efficiently and sustainably the logistics needs of people, organizations, territories and society

Realization Web
Realizing products
Interconnected open production, personalising & retrofit centers

Supply Web
Supplying goods
Interconnected open suppliers and subcontractors

Distribution Web
Deploying, storing products
Interconnected open warehouses & distribution centers

Service Web
Enabling and sharing access and usage of services rendered by goods & people
Interconnected open users and service providers

Mobility Web
Moving goods & people
Interconnected open unimodal & multimodal infrastructures, movers, hubs and transits

Source: Montreuil, B. (2012), Physical Internet Manifesto ver. 1.11.1
THE PHYSICAL INTERNET IS BASED ON TWO FUNDAMENTAL CONCEPTS – JUST LIKE THE INTERNET

1. Standard sized packets switched and transported from host to host

See Kleinrock, L (1964), Communication Nets

2. Connection of independent networks operating based on independent concepts connected through routers and switches

See Roberts, L (1967), Multiple Computer Networks and Intercomputer Communication
THIS ANALOGY BETWEEN THE INTERNET AND LOGISTICS OPERATIONS ASSOCIATES TRANSPORT NETWORKS WITH DIGITAL NETWORKS
THE LOGISTICS INDUSTRY IS COMPOSED OF NUMEROUS INDEPENDENT NETWORKS SIMILAR TO THE MANY DIGITAL NETWORKS THAT MAKE UP THE INTERNET
IF THESE INDEPENDENT LOGISTICS NETWORKS COULD BE CONNECTED, THEN THERE WOULD EXIST A NETWORK OF LOGISTICS NETWORKS, A PHYSICAL INTERNET
INTERCONNECTED NETWORK OPERATORS WOULD NOT HAVE TO ABANDON THEIR OWN NETWORKS, JUST INTEROPERATE WITH OTHER NETWORKS
STANDARDS WILL BE REQUIRED FOR PHYSICAL GOODS TO SEAMLESSLY TRAVEL THIS NETWORK OF LOGISTICS NETWORKS
THE NEED FOR STANDARDS, PARTICULARLY CONTAINER STANDARDS, IS A CRITICAL FACTOR FOR SUCCESS OF THE PHYSICAL INTERNET

Source: Montreuil, B. (2011), Physical Internet Manifesto ver. 1.10
TO UNDERSTAND HOW THE PHYSICAL INTERNET WOULD NEED TO OPERATE REQUIRES UNDERSTANDING HOW LINKS AND NODES OPERATE IN THE INTERNET
LINKS, LIKE TRANSPORT LANES, CONNECT SENDERS (CONSIGNORS) TO RECEIVERS (CONSIGNEES) FORMING THE ARCS OF THE NETWORK
WITHOUT LINKAGES SENDERS (CONSIGNORS) CANNOT SEND AND RECEIVERS (CONSIGNEES) CANNOT RECEIVE…

Source:  http://creative.colorado.edu/~rami2897/dm1/digital-divide.html
...AND INADEQUATE LINK CAPACITY LEADS TO NETWORK CONGESTION
EVEN IF LINKAGES EXIST, THEIR CAPACITIES, AND THE PROTOCOLS USED, DETERMINE HOW FAST TRAFFIC CAN MOVE AND WHAT TRAFFIC IS ALLOWED ON THE LINK

Source: Nielsen, J: (2016), Nielsen's Law of Internet Bandwidth
As Internet use growth accelerates there is increasing concerns about link congestion.

Video Accounts for Half of Ever-Growing Internet Traffic
Estimated global IP traffic per month (in exabyte)

Source: Cisco Visual Networking Index
... WHICH HAS LED TO NEW PROTOCOLS BEING DEVELOPED TO ASSIST IN BETTER MANAGING BANDWIDTH FLOWS
PACKETS (SHIPMENTS) MOVING OVER THE NETWORK REQUIRE ROUTING BETWEEN THE VARIOUS LINKS THAT LIE BETWEEN THE SENDER (CONSIGNOR) AND RECEIVER (CONSIGNEE)

Source: http://www.highteck.net/EN/Network/OSI_Network_Layer.html
 ROUTERS AND SWITCHES ARE USED TO PERFORM DISASSEMBLY, SWITCHING, STORAGE AND REASSEMBLY OF MESSAGES. . .
VERY MUCH LIKE CROSS DOCK, PORT AND SIMILAR “DECONSOLIDATE/RECONSOLIDATE” OPERATIONS IN THE PHYSICAL WORLD
ROUTER CAPACITY (INBOUND AND OUTBOUND) AND SWITCHING SPEED (TRANSFER RATES) DETERMINE HOW FAST MESSAGES MOVE BETWEEN LINKS

THESE SPEEDS HAVE BEEN INCREASING, BUT ARE APPROACHING THEORETICAL LIMITS

Source: Stanford University
IN PHYSICAL NETWORKS “INTRALOGISTICS” ACTS AS THE MECHANISM TO RAPIDLY DECONSOLIDATE AND RECONSOLIDATE SHIPMENTS

Evolve from material to $\pi$-container transport, handling & storage means and systems

$\pi$-containers moving and storage means and systems, with innovative technologies and processes exploiting the characteristics of $\pi$-containers to enable their fast, cheap, easy and reliable input, storage, composing, decomposing, monitoring, protection and output through smart, sustainable and seamless automation and human handling

Source: Montreuil, B. (2012), Physical Internet Manifesto ver. 1.11.1
THE SPEED OF INTRALOGISTICS SYSTEMS DETERMINES HOW FAST THE PHYSICAL INTERNET OPERATES, AND THE QUALITY OF SERVICE IT PROVIDES.
STANDARDIZED CONTAINERS WILL ALLOW INTRALOGISTICS OPERATIONS TO OPTIMIZE THE DISASSEMBLY, STORAGE, REASSEMBLY AND TRANSFER OF GOODS

Multimodal logistics centers designed for the Physical Internet, enabling seamless, fast, cheap, safe, reliable, distributed, & multimodal transport and deployment of $\pi$-containers across the Physical Internet

Source: Montreuil, B. (2012), Physical Internet Manifesto ver. 1.11.1

References
THESE FUNDAMENTAL AND ANALOGOUS OPERATIONS BETWEEN THE INTERNET AND PHYSICAL INTERNET PROVIDE THE BASIS FOR ENVISIONING A FUTURE PHYSICAL INTERNET

A Supply Web with Myriads of π-Certified Suppliers, Open & Global Access, Standardized Contracts, Open Monitoring and Supplier Ratings

Multi-tiered, from raw materials to final products

Each exploiting the Mobility, Distribution & Realization webs

Source: Montreuil, B. (2012), Physical Internet Manifesto ver. 1.11.1
HOWEVER, WE ARE STILL A LONG WAY FROM REALIZING THE VISION OF THE PHYSICAL INTERNET
FORTUNATELY, THE ADVANCES BEING MADE IN THE WORLD OF LOGISTICS TECHNOLOGY IS PROVIDING HOPE FOR THE ULTIMATE DEVELOPMENT OF A PHYSICAL INTERNET
WHAT IS STILL NEEDED IS THAT SET OF VISIONARIES WHO, LIKE VINT CERF AND ROBERT KAHN, HAVE THE VISION AND DETERMINATION TO CREATE A DIFFERENT FUTURE FOR LOGISTICS.
THANK YOU FOR YOUR ATTENTION!