THE ROLE OF INTRALOGISTICS IN THE PHYSICAL INTERNET

Prof. Dr. J. Rod Franklin, P.E.
Managing Director & Academic Director
Executive Education
Adjunct Professor of Logistics
Kühne Logistics University
Grosser Grasbrook 17
D-20457 Hamburg
Germany
Wk: +49 40 328 707 231
Mb: +49 160 969 44 870
rod.franklin@the-klu.org
www.the-klu.org

IPIC 2017

LET'S START THIS PRESENTATION WITH A FEW DEFINITIONS

- I define:

1. Intralogistics as those processes, procedures, systems and tools used to operate and manage the movement of material within the "four walls" of an operation

2. The Physical Internet as 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

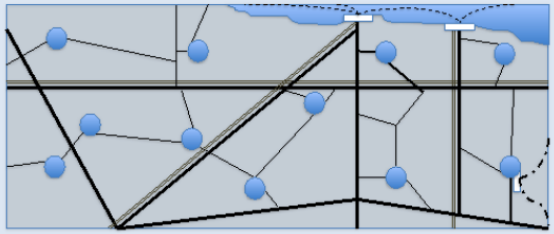
TO UNDERSTAND THE RELATIONSHIP OF INTRALOGISTICS WITH THE PHYSICAL INTERNET REQUIRES UNDERSTANDING THE FOUNDATION OF THE PHYSICAL INTERNET CONCEPT

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

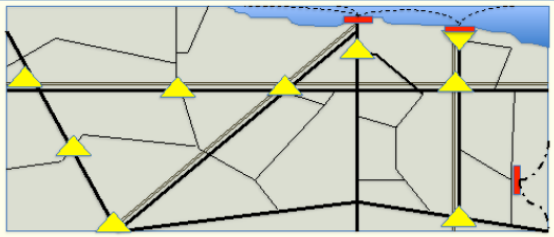
Realization Web
Realizing products

Interconnected open production, personalising & retrofit centers



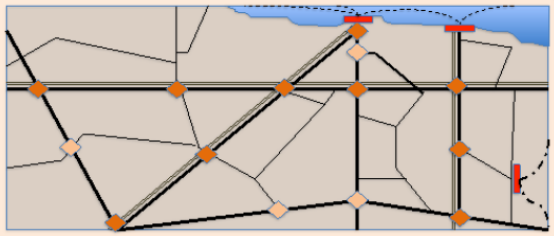
Distribution Web
Deploying, storing products

Interconnected open warehouses & distribution centers



Mobility Web
Moving goods & people

Interconnected open unimodal & multimodal infrastructures, movers, hubs and transits



Supply Web
Supplying goods

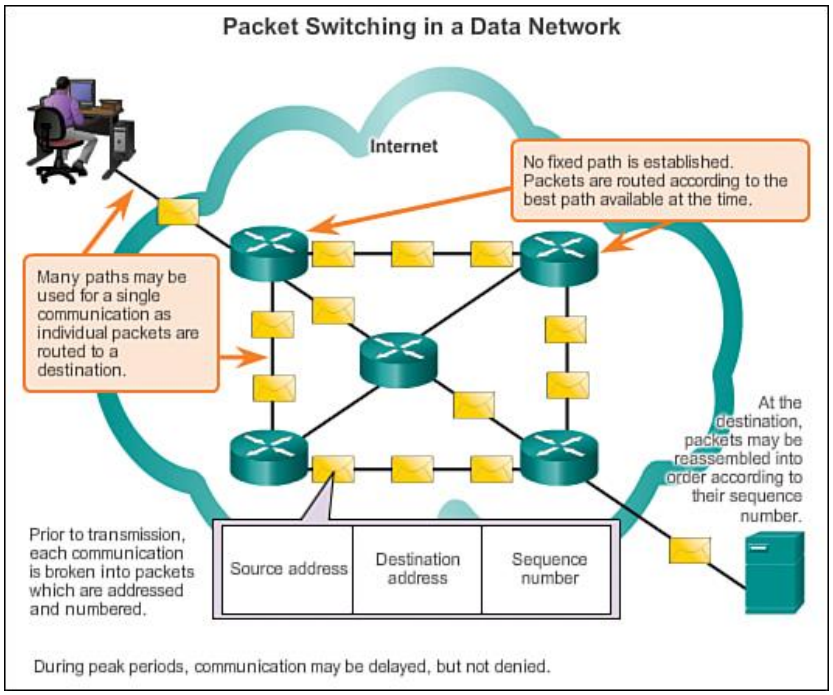
Interconnected open suppliers and subcontractors

Service Web
Enabling and sharing access and usage of services rendered by goods & people

Interconnected open users and service providers

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

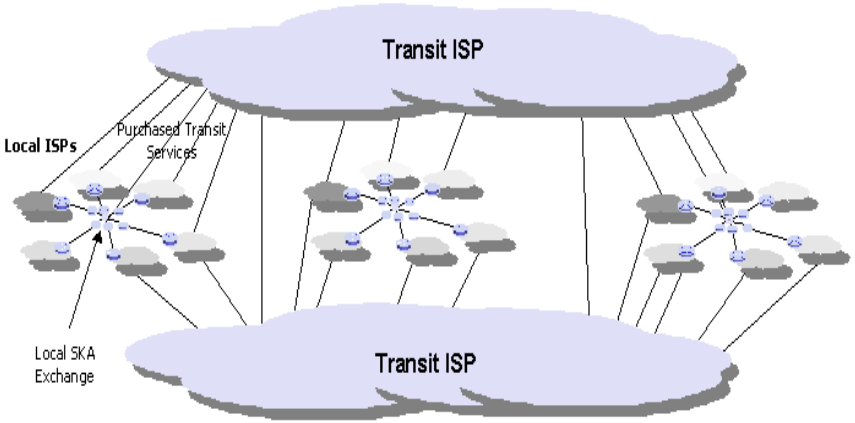
THE PHYSICAL INTERNET IS BASED ON TWO FUNDAMENTAL CONCEPTS – JUST LIKE THE INTERNET



Source: http://www.ciscopress.com/articles/article.asp?p=2164577&seqNum=6, accessed 30 June 2017

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

See Kleinrock, L (1964), Communication Nets

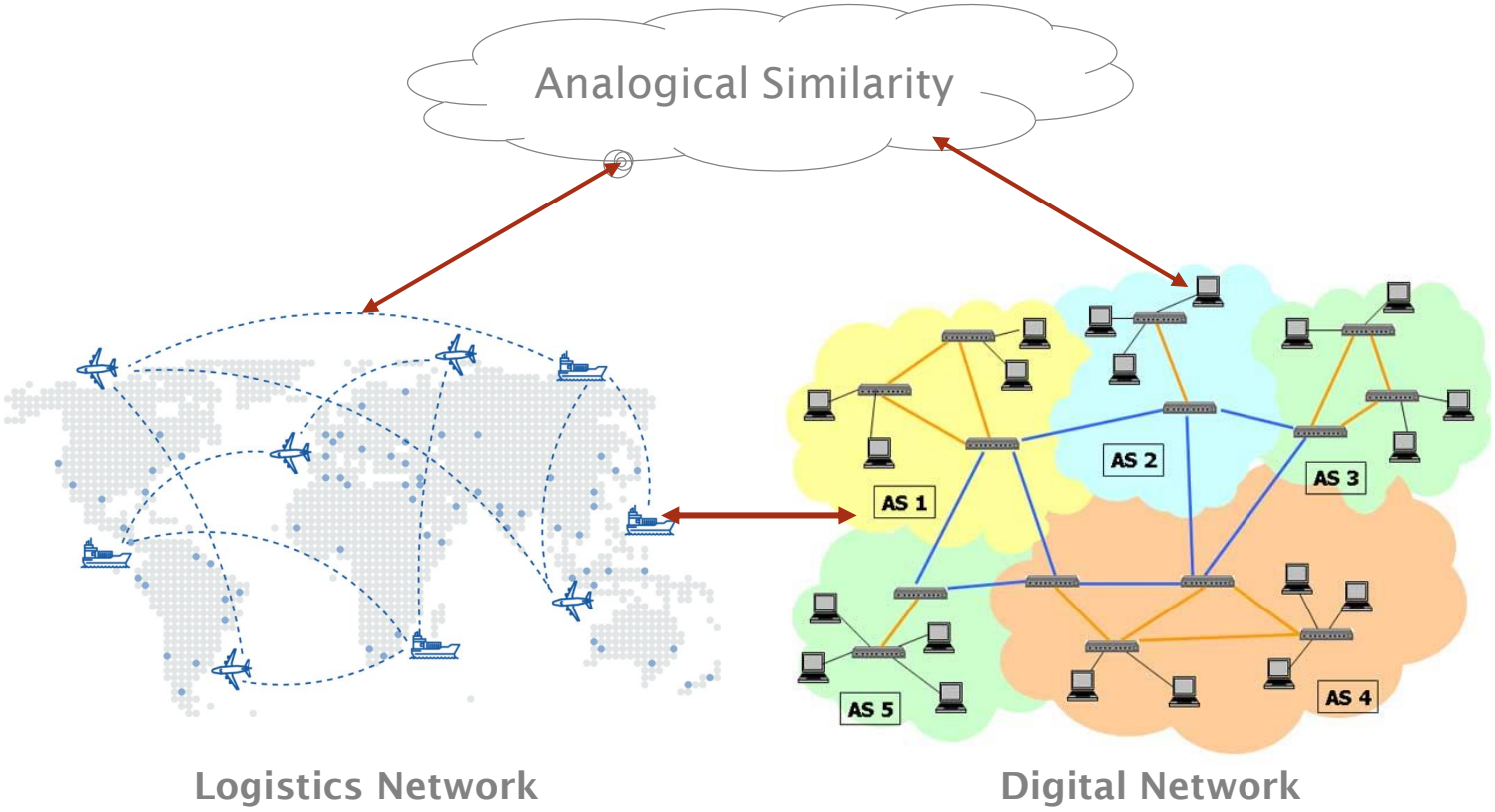


Source: Huston, G., Interconnection, Peering, and Settlements

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

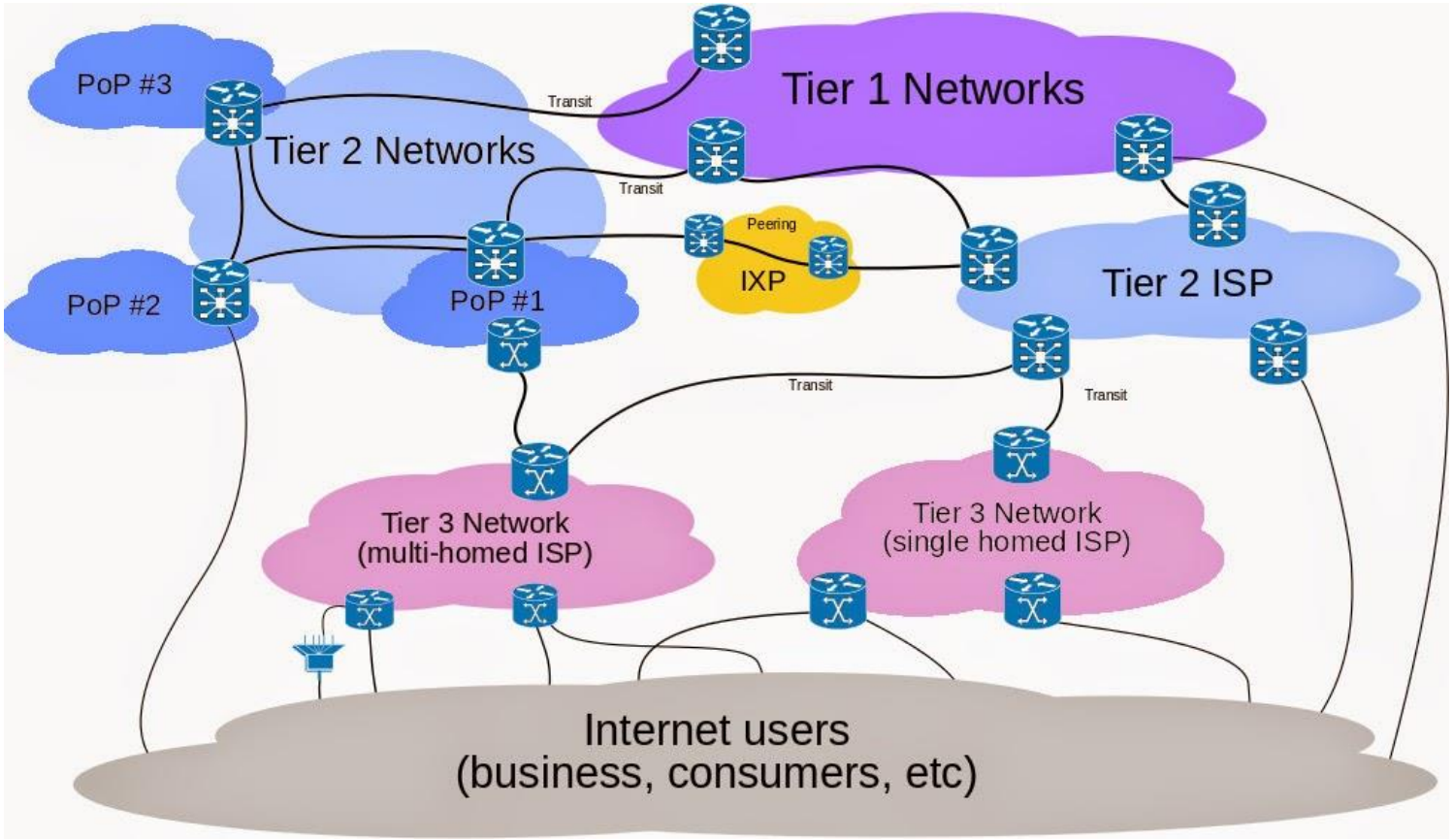
THIS ANALOGY BETWEEN THE INTERNET AND LOGISTICS OPERATIONS ASSOCIATES TRANSPORT NETWORKS WITH DIGITAL NETWORKS



LOGISTICS 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

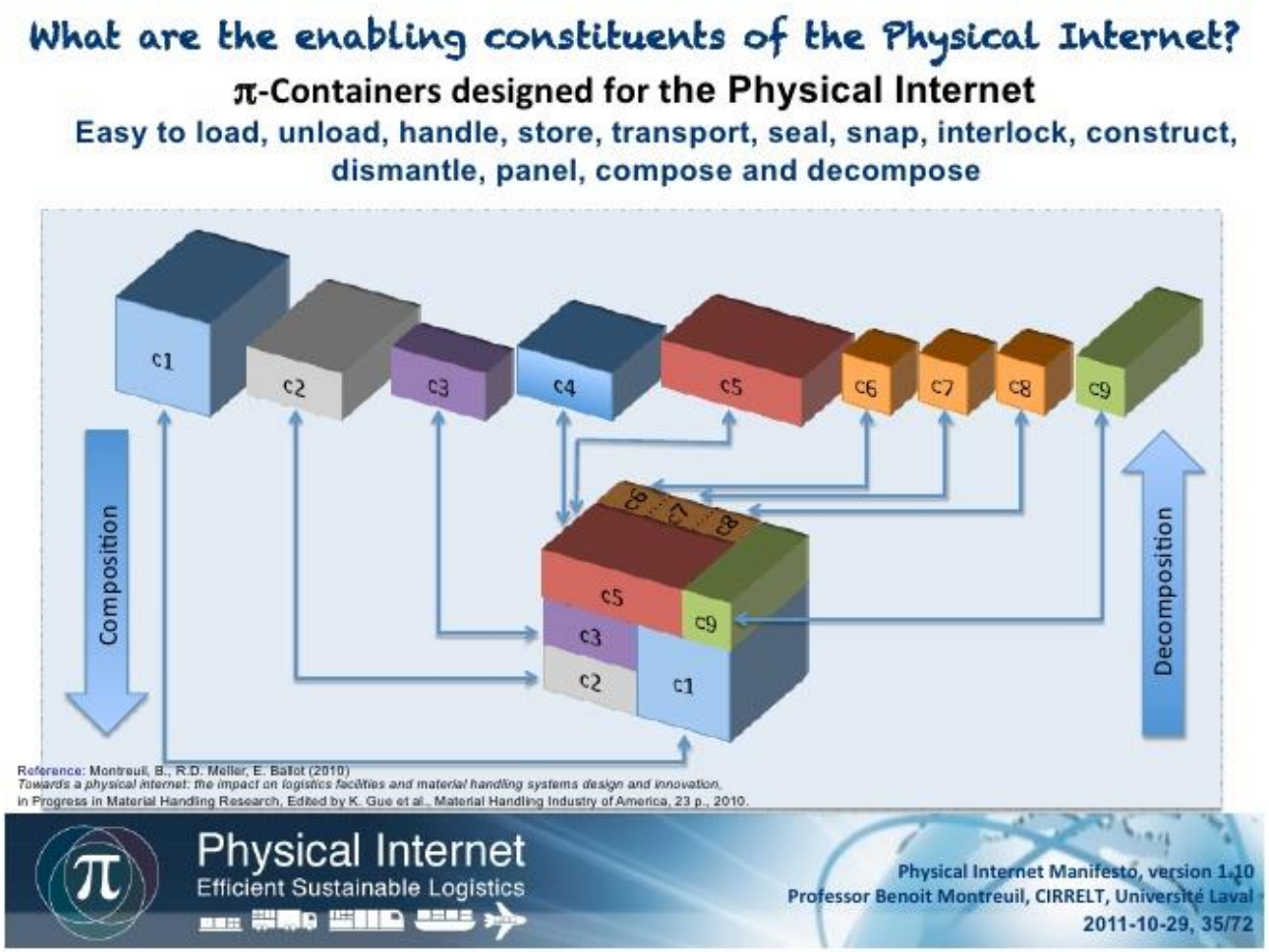
THESE INTERCONNECTED NETWORK OPERATORS WOULD NOT HAVE TO ABANDON THEIR OWN NETWORKS, JUST INTEROPERATE WITH OTHER NETWORKS



Source: Elctrospace.blogspot.com

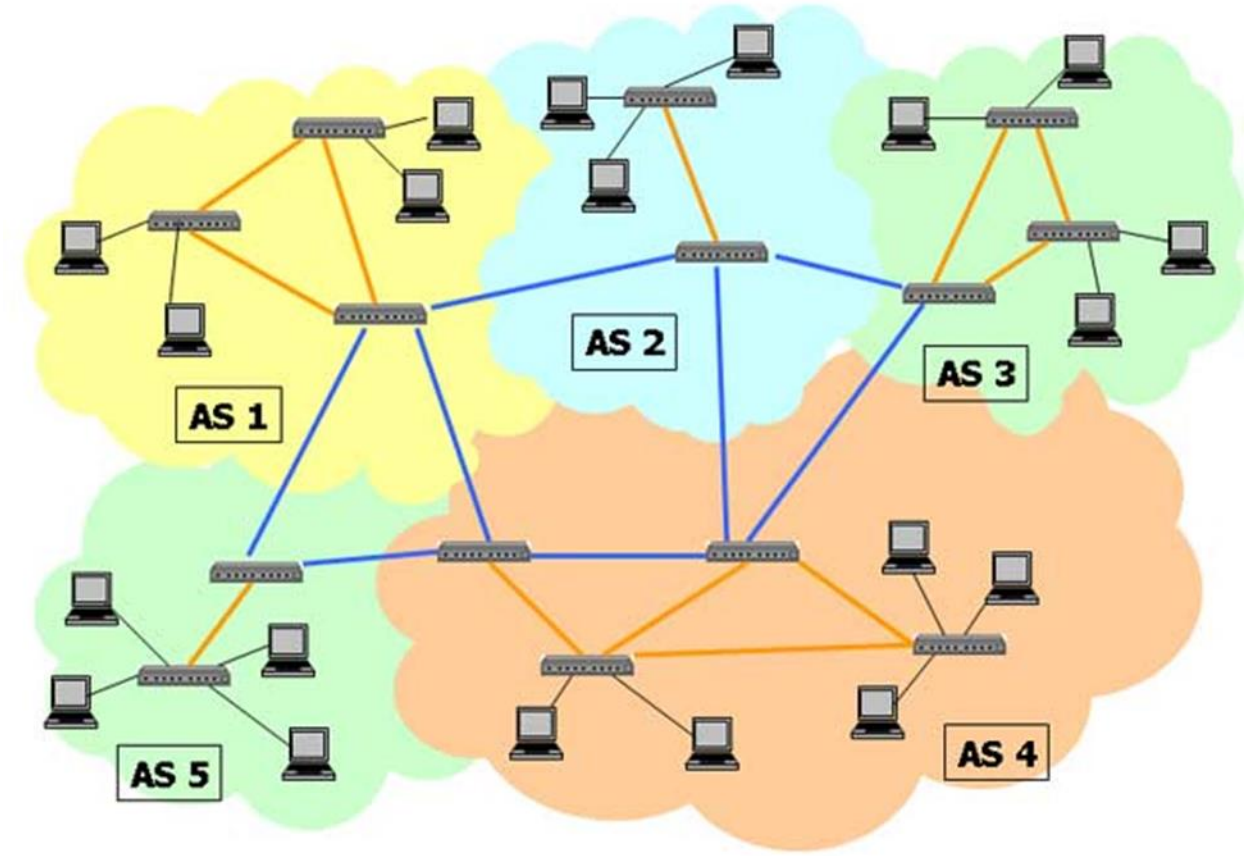
STANDARDS ARE REQUIRED FOR PHYSICAL GOODS TO TRAVEL THIS NETWORK OF LOGISTICS NETWORKS

THE NEED FOR STANDARDS, PARTICULARLY CONTAINER STANDARDS, IS A CRITICAL CONCEPTUAL SUCCESS FACTOR FOR THE PHYSICAL INTERNET

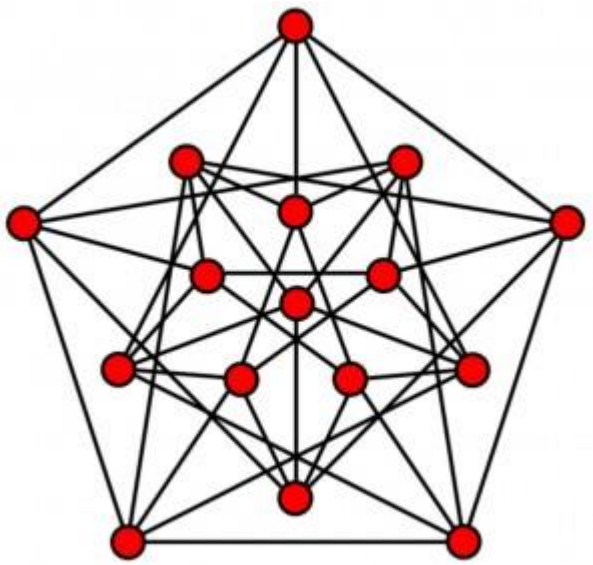


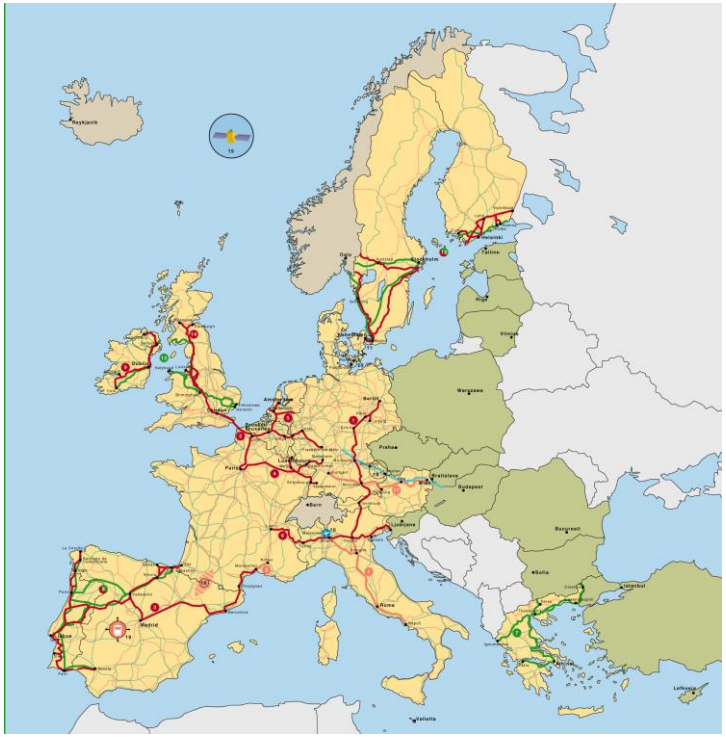
Source: Montreuil, B. (2011), Physical Internet Manifesto ver. 1.10

THE CONNECTION BETWEEN THIS INTRODUCTION AND INTRALOGISTICS IS BASED ON THE CONSTRAINTS THAT LINKS AND SWITCHING NODES PLACE ON THE INTERNET

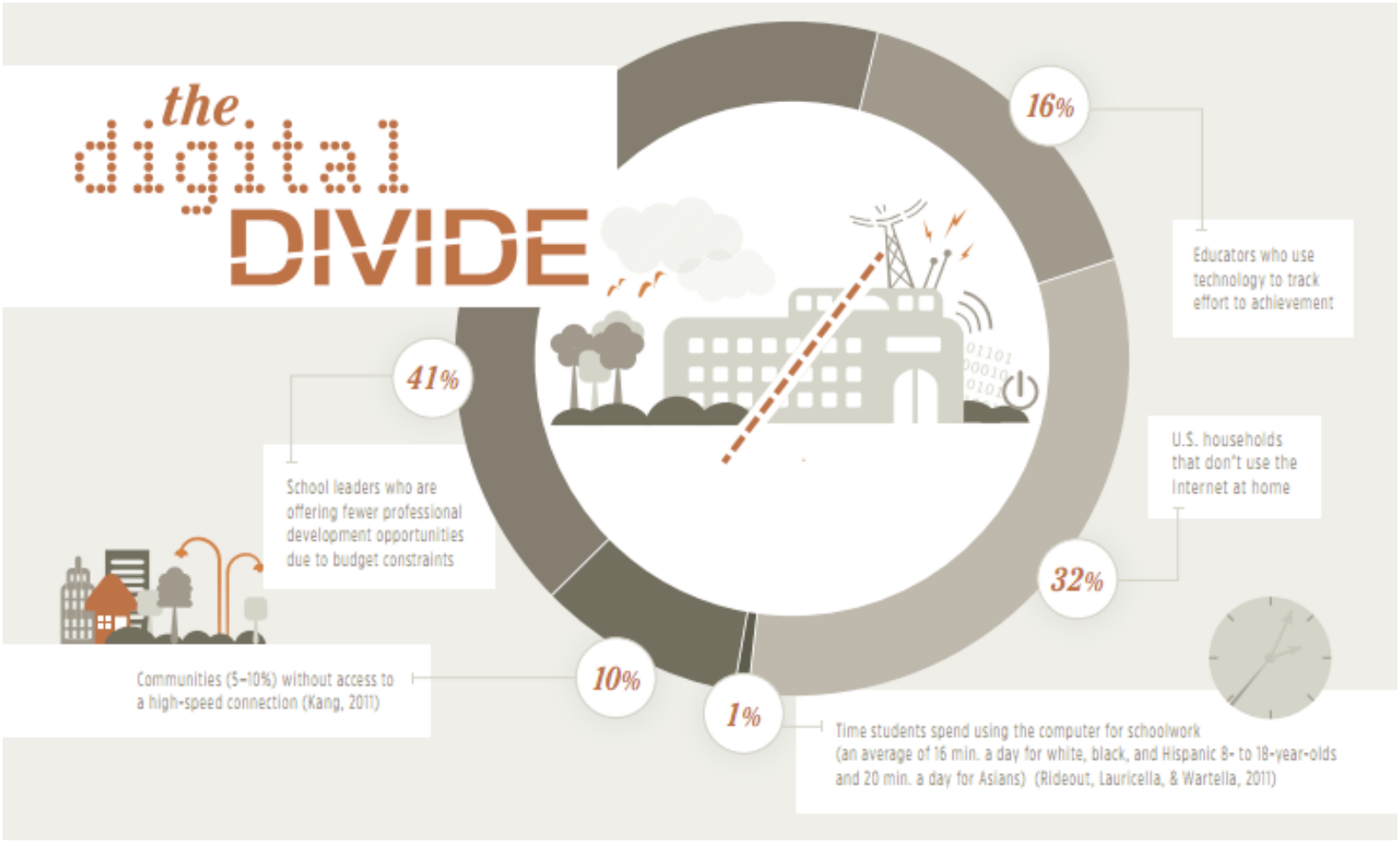


LINKS, LIKE TRANSPORT LANES, CONNECT SENDERS TO RECEIVERS FORMING THE ARCS OF THE NETWORK





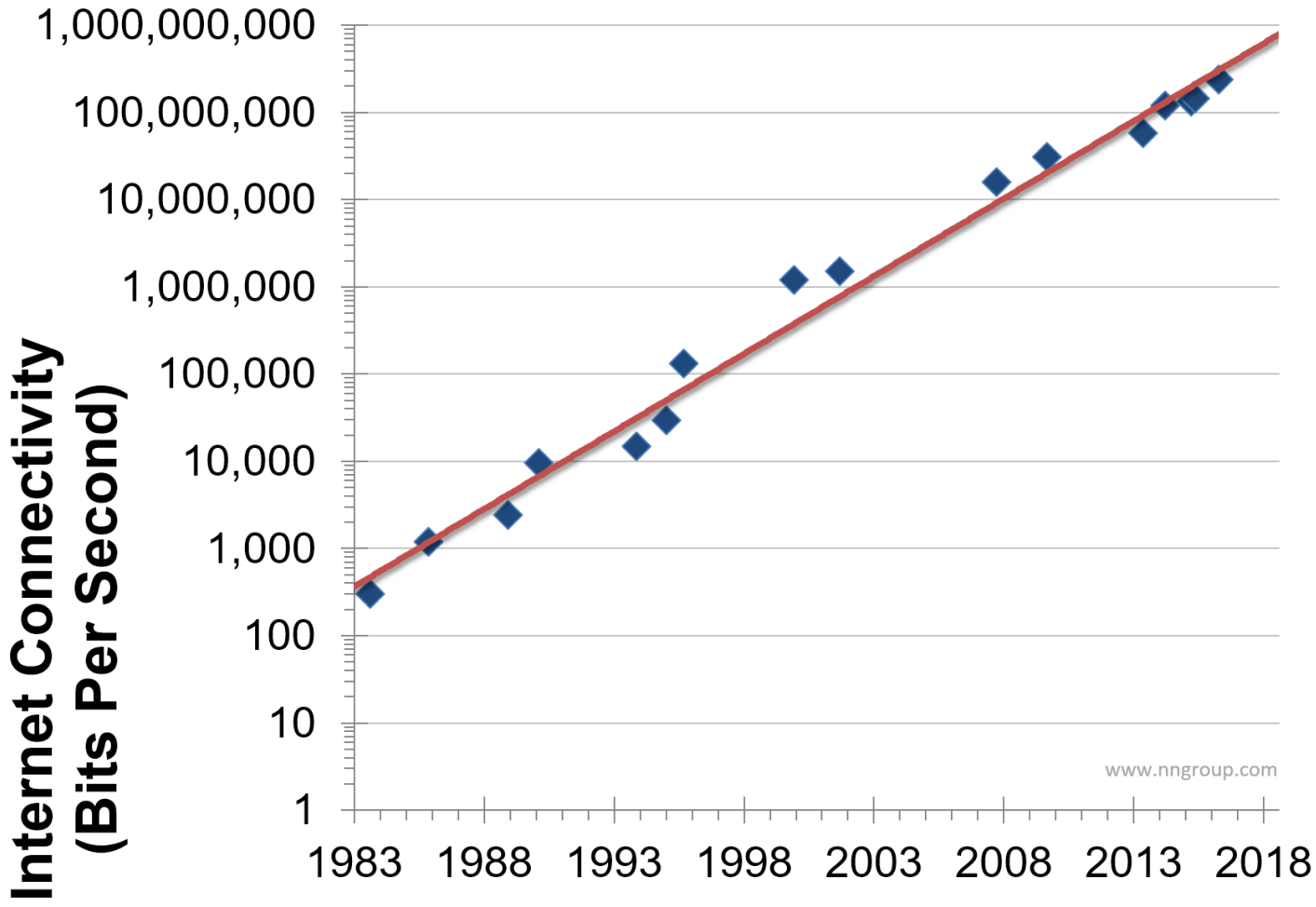
WITHOUT LINKAGES SENDERS CANNOT SEND AND RECEIVERS CANNOT RECEIVE…



Source: http://creative.colorado.edu/~rami2897/dm1/digital-divide.html

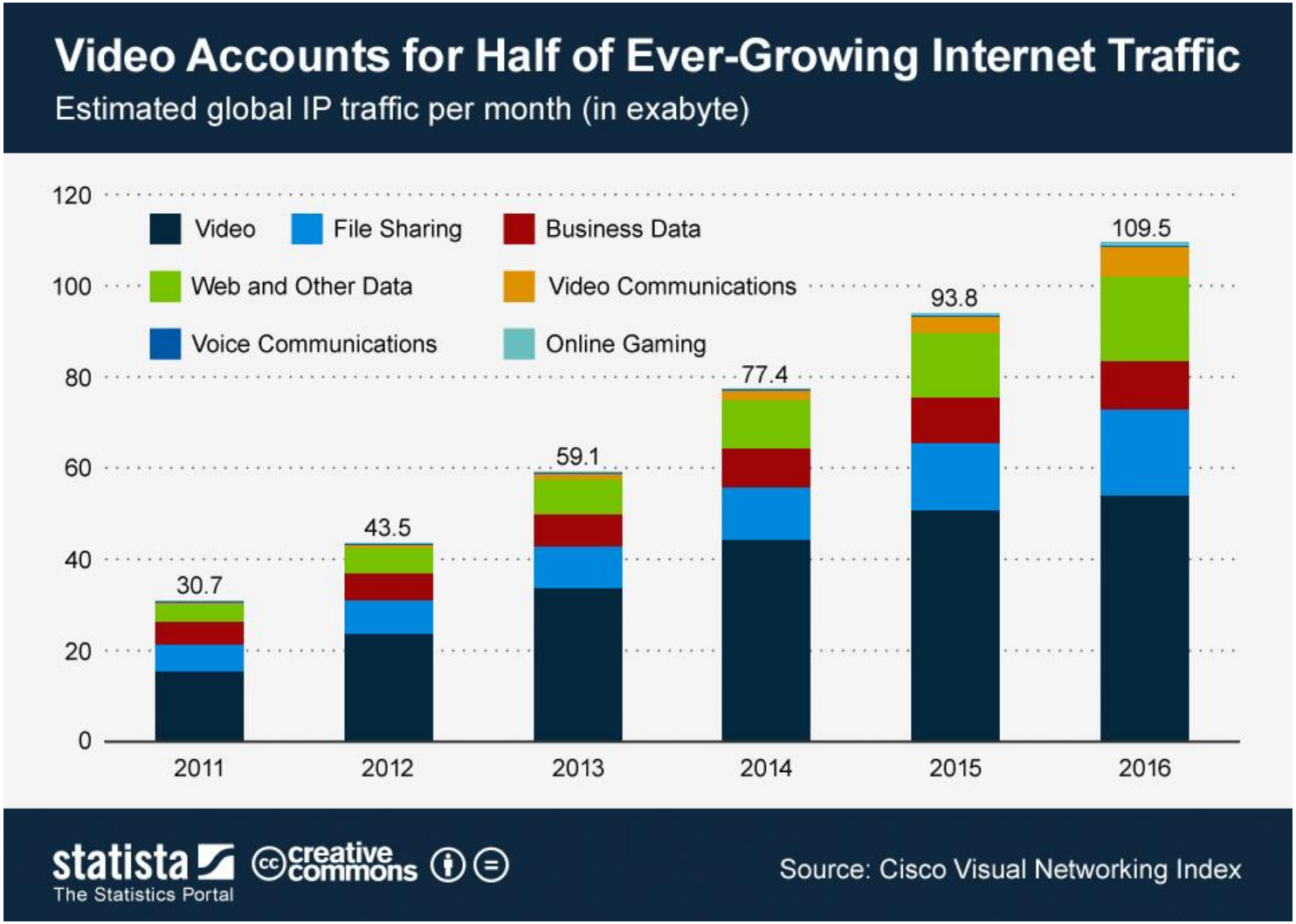
…AND INADEQUATE LINK CAPACITY LEADS TO NETWORK CONGESTION

EVEN IF LINKAGES EXIST, THEIR CAPACITIES, AND THE PROTOCOLS USED, DETERMINE HOW FAST TRAFFIC CAN MOVE ON THE LINK

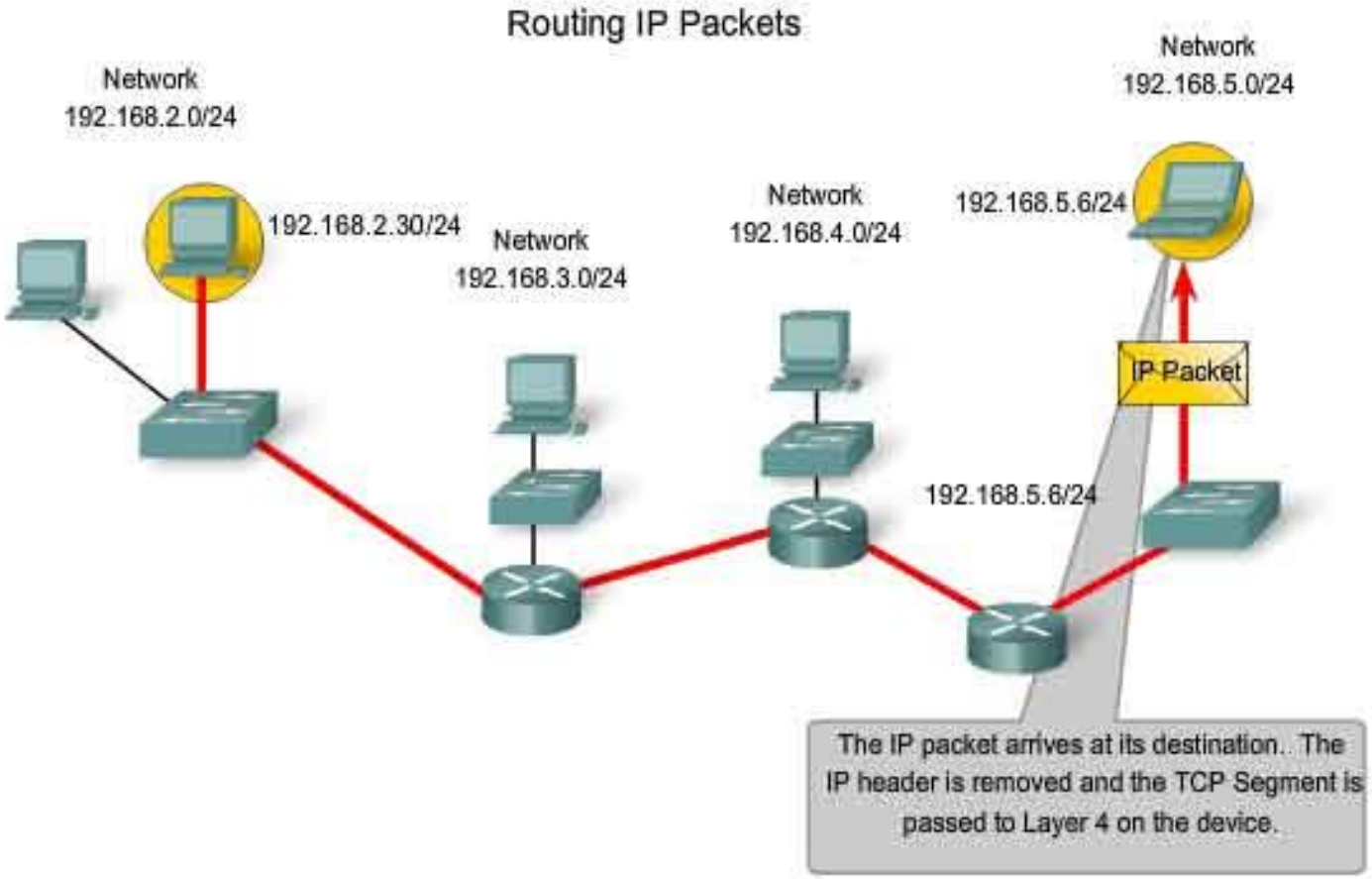


Source: Nielsen, J: (2016), Nielsen's Law of Internet Bandwidth

AS INTERNET USE GROWTH ACCELERATES THERE IS INCREASING CONCERNS ABOUT LINK CONGESTION

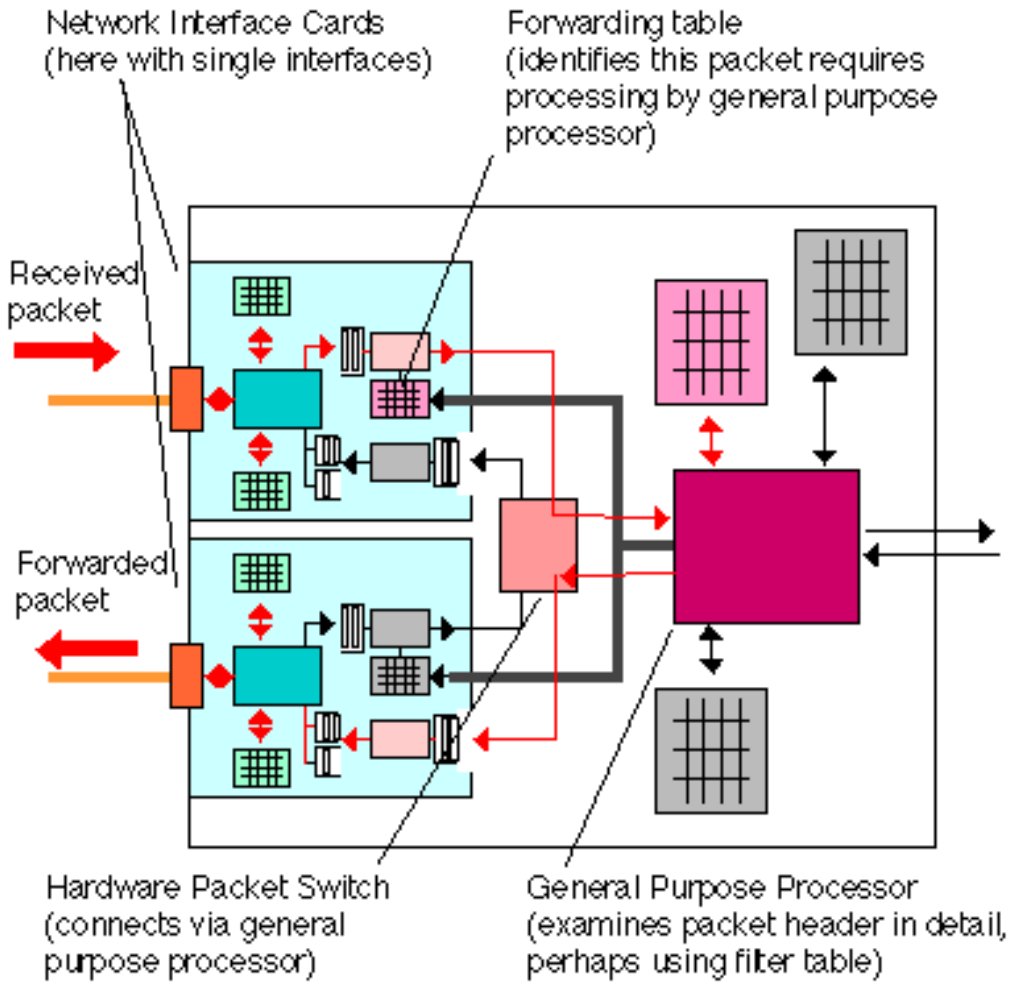


PACKETS MOVING OVER THE NETWORK REQUIRE ROUTING BETWEEN THE VARIOUS LINKS THAT LIE BETWEEN THE SENDER AND RECEIVER



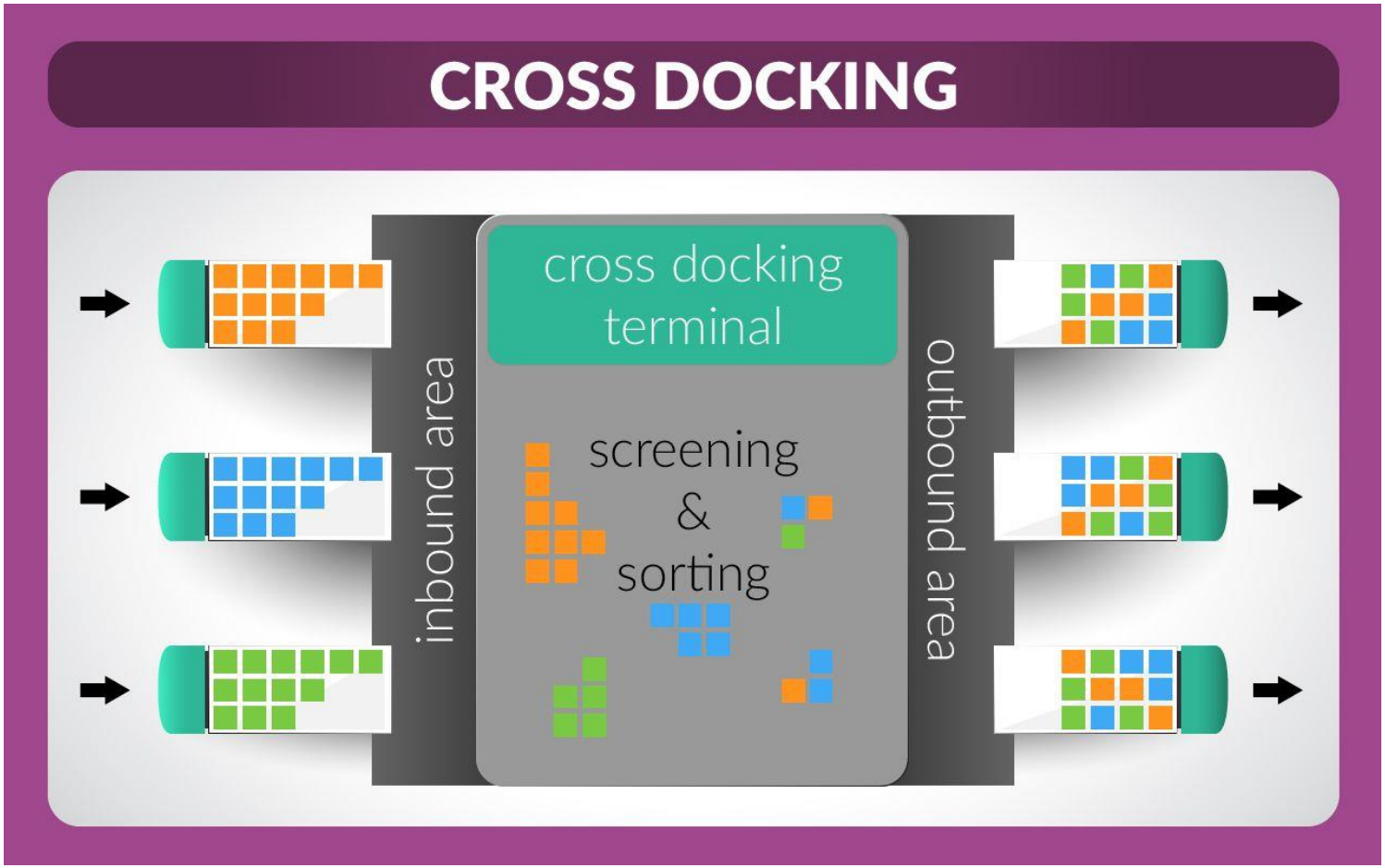
Source: http://www.highteck.net/EN/Network/OSI_Network_Layer.html

ROUTERS AND SWITCHES ARE USED TO PERFORM DISASSEMBLY, SWITCHING, STORAGE AND REASSEMBLY OF MESSAGES. . .



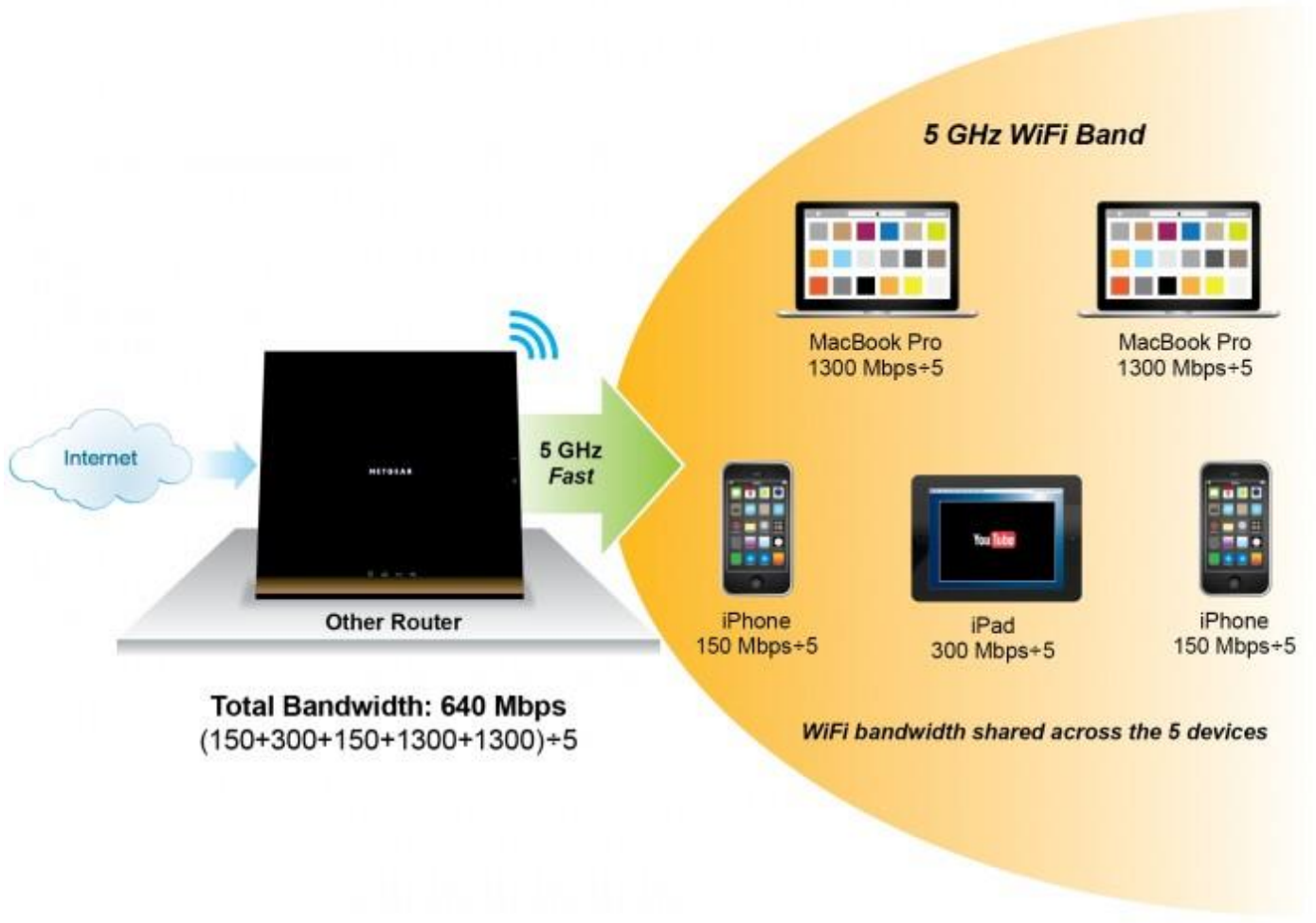
Source: http://www.erg.abdn.ac.uk/users/gorry/course/inet-pages/router-opn.html

. . .VERY MUCH LIKE CROSS DOCK OPERATIONS IN THE PHYSICAL WORLD



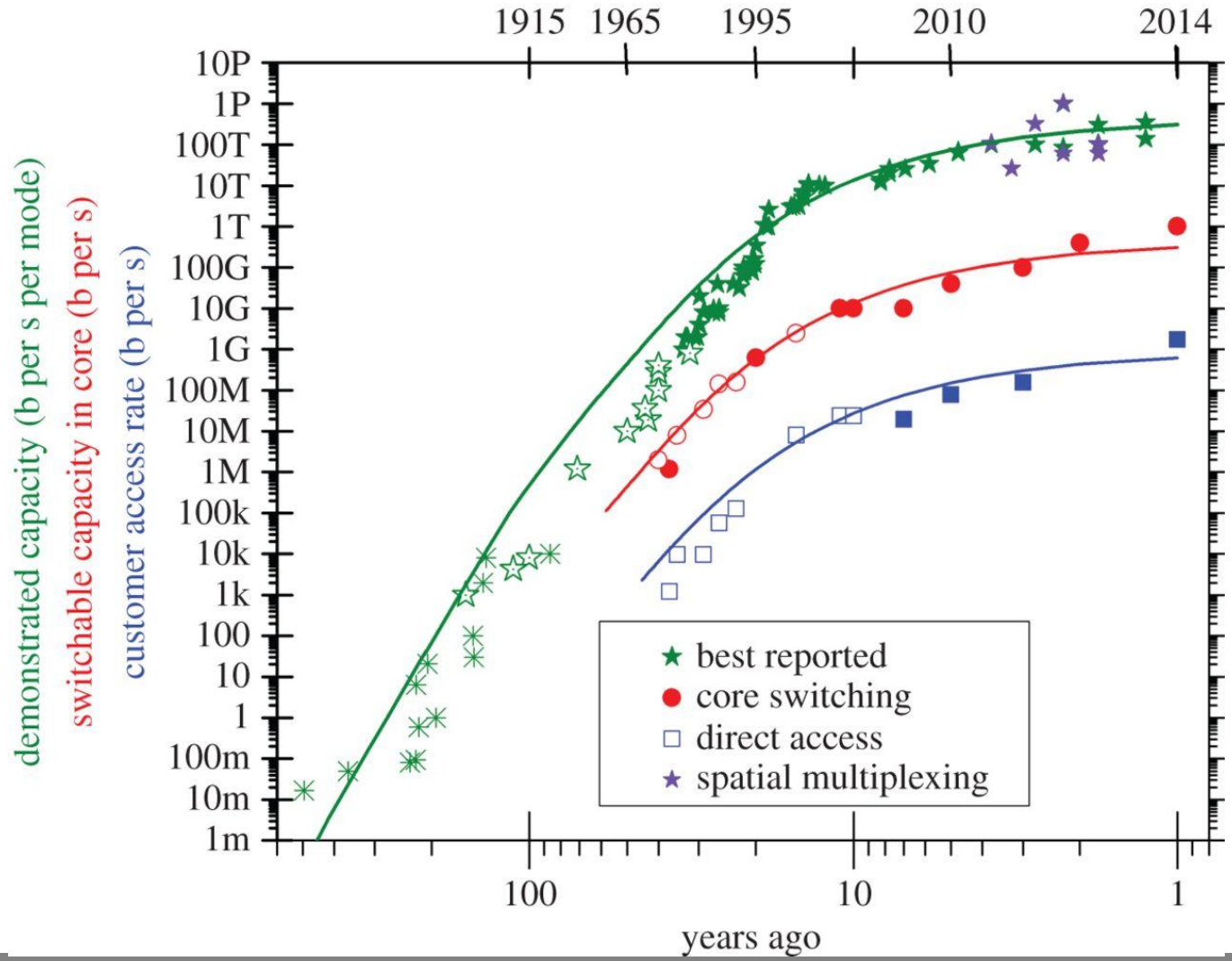
Source: Nebraskawarehouse.com

ROUTER CAPACITY (INBOUND AND OUTBOUND) AND SWITCHING SPEED (TRANSFER RATES) DETERMINES HOW FAST MESSAGES MOVE BETWEEN LINKS



Source: https://kb.netgear.com/25362/How-does-my-Nighthawk-router-s-tri-band-WiFi-feature-improve-the-speed-and-performance-of-a-device

THESE SPEEDS HAVE BEEN INCREASING, BUT ARE APPROACHING THEORETICAL LIMITS



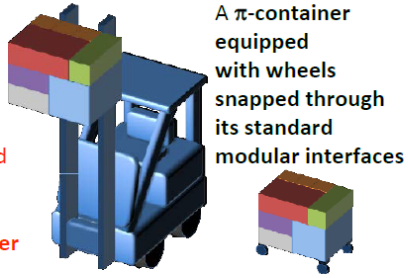
Source: Stanford University

INTRALOGISTICS ACTS WITHIN THE CONNECTING NODES AS THE SWITCHING FABRIC THAT MOVES ENCAPSULATED GOODS BETWEEN INTERCONNECTED NETWORKS

Evolve from material to π-container transport, handling & storage means and systems

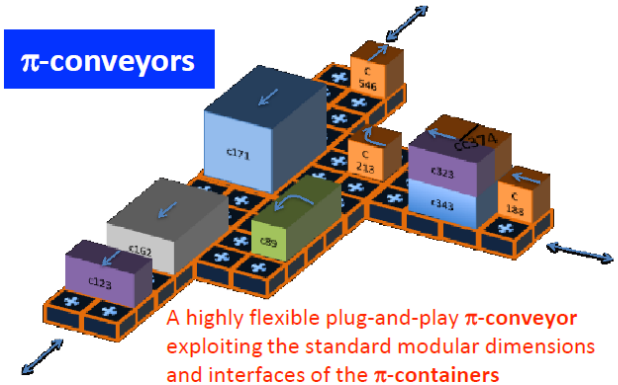
π-movers

A fork-less lift exploiting the snapping and interlocking functionalities of the π-container



A π-container equipped with wheels snapped through its standard modular interfaces

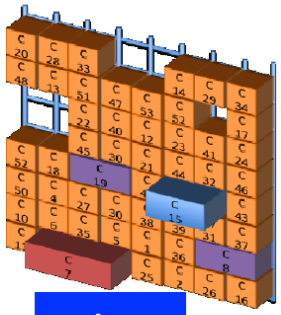
π-conveyors



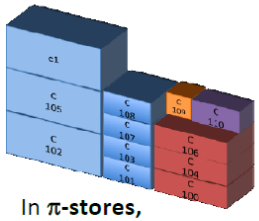
A highly flexible plug-and-play π-conveyor exploiting the standard modular dimensions and interfaces of the π-containers

π-containers moving and storage means and systems, with innovative technologies and processes exploiting the characteristics of π-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

In π-stores, contemporary racking can be used, however innovations in storage technologies exploiting the functional characteristics of modular π-containers are bound to be exploited



π-stores



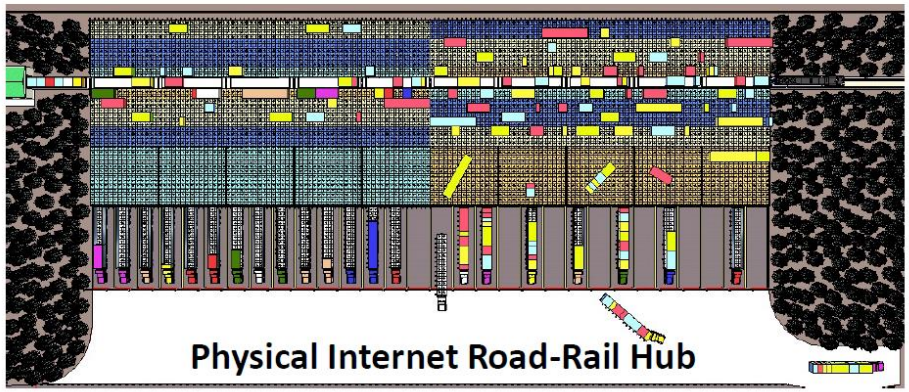
In π-stores, modular π-containers can be stacked as in container port terminals

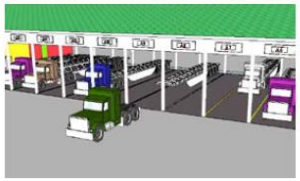
Source: Montreuil, B. (2012), Physical Internet Manifesto ver. 1.11.1

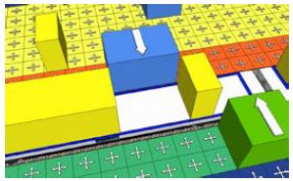
BASED ON HOW FAST INTRALOGISTICS SYSTEMS WORK DETERMINES HOW FAST THE PHYSICAL INTERNET OPERATES, AND THE QUALITY OF SERVICE IT PROVIDES

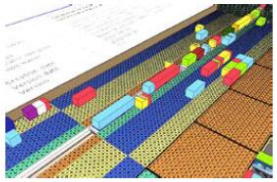
STANDARDIZED CONTAINERS SHOULD ALLOW INTRALOGISTICS OPERATIONS TO OPTIMIZE THE DISASSEMBLY, STORAGE, REASSEMBLY AND TRANSFER OF GOODS

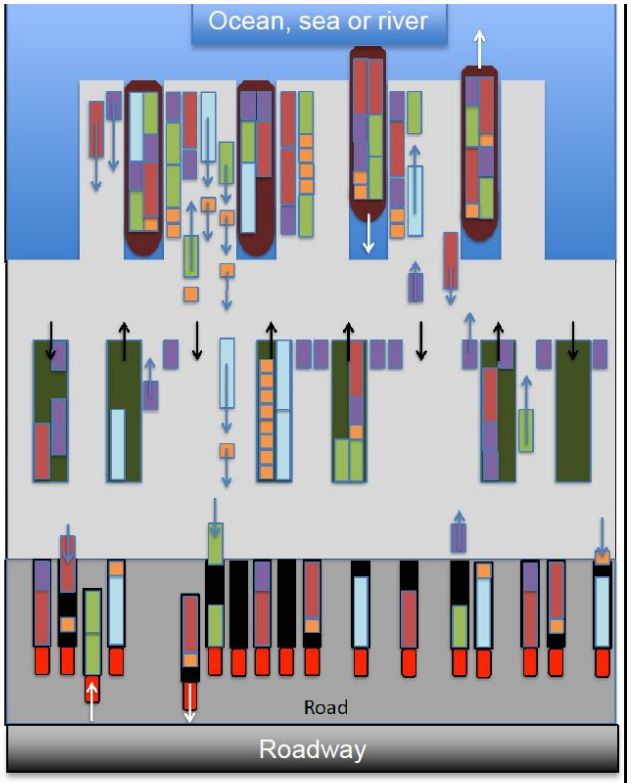
Multimodal logistics centers designed for the Physical Internet, enabling seamless, fast, cheap, safe, reliable, distributed, & multimodal transport and deployment of π-containers across the Physical Internet











References

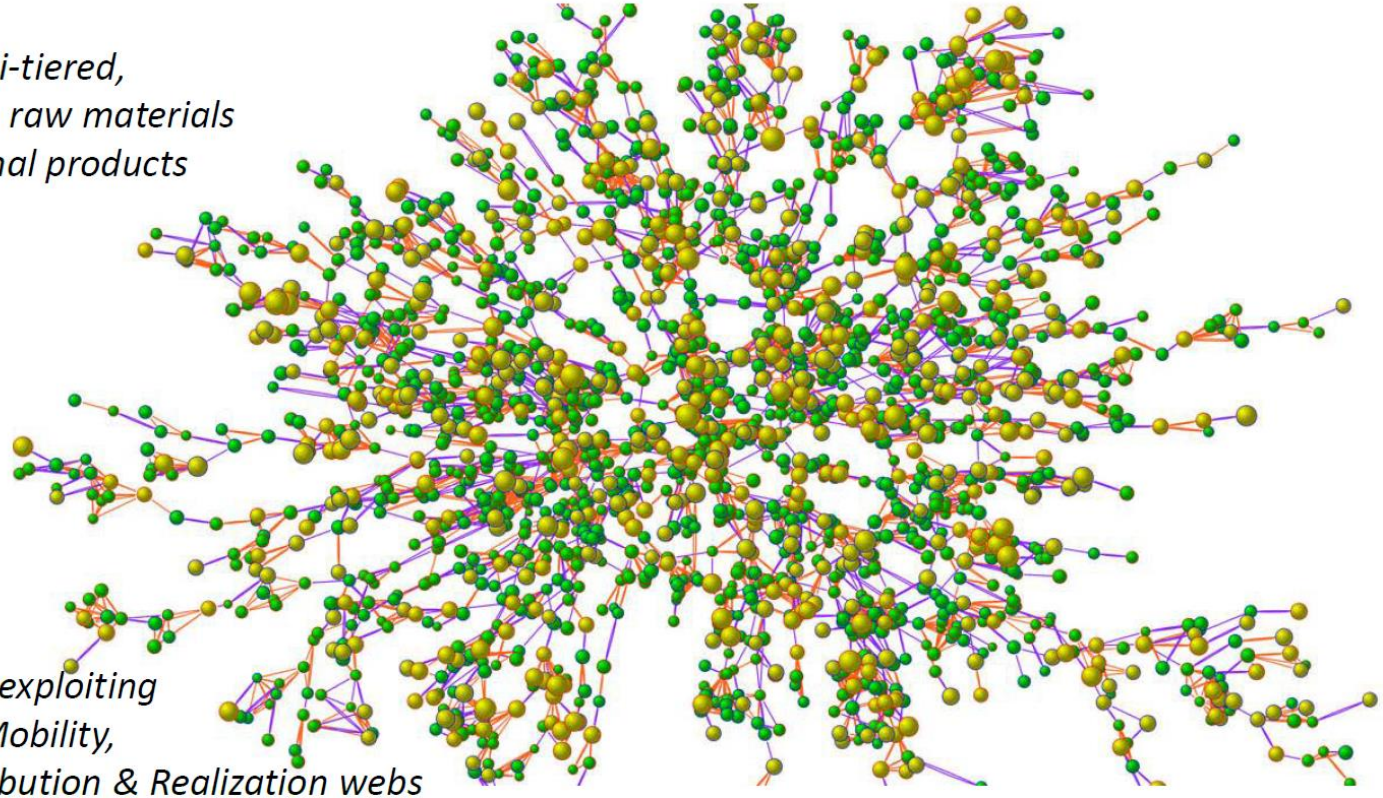
- Montreuil, B., R.D. Meller, E. Ballot (2010)
  Towards a physical internet: the impact on logistics facilities and material handling systems design and innovation,
  in Progress in Material Handling Research 2010, Edited by K. Gue et al., Material Handling Industry of America, 23 p.
- Ballot É., B. Montreuil & C. Thivierge (2012)
  Functional Design of Physical Internet Facilities: A Road-Rail Hub,
  in Progress in Material Handling Research 2012, Edited by B. Montreuil et al., Material Handling Industry of America, 34 p.

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

THESE FUNDAMENTAL AND ANALOGOUS OPERATIONS BETWEEN THE INTERNET AND PHYSICAL INTERNET ESTABLISH THE IMPORTANCE OF INTRALOGISTICS TO THE 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 LONG WAY FROM REALIZING THE VISION OF THE PHYSICAL INTERNET

FORTUNATELY, THE ADVANCES BEING MADE IN THE WORLD OF INTRALOGISTICS ARE ENCOURAGING

WHAT IS STILL NEEDED IS THAT SET OF VISIONARIES WHO, LIKE MALCOM MCLEAN, HAVE THE VISION AND DETERMINATION TO CREATE A DIFFERENT FUTURE FOR LOGISTICS

THANK YOU FOR YOUR ATTENTION!