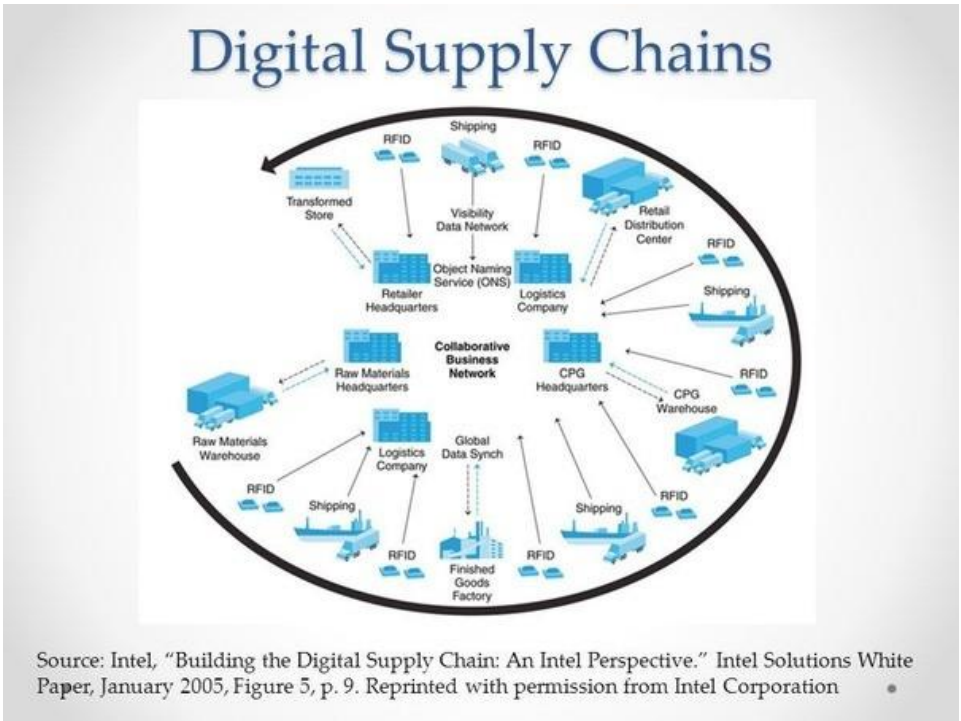


AGENDA

- Digital challenges for the logistics industry – your view
- Digital implications for transport and logistics operations
 - Automation
 - Autonomy
 - Information
 - The “Cloud”
 - Collaboration
- A potential future? A “Physical Internet”
- Your challenge – what should you do?
- Summary and questions

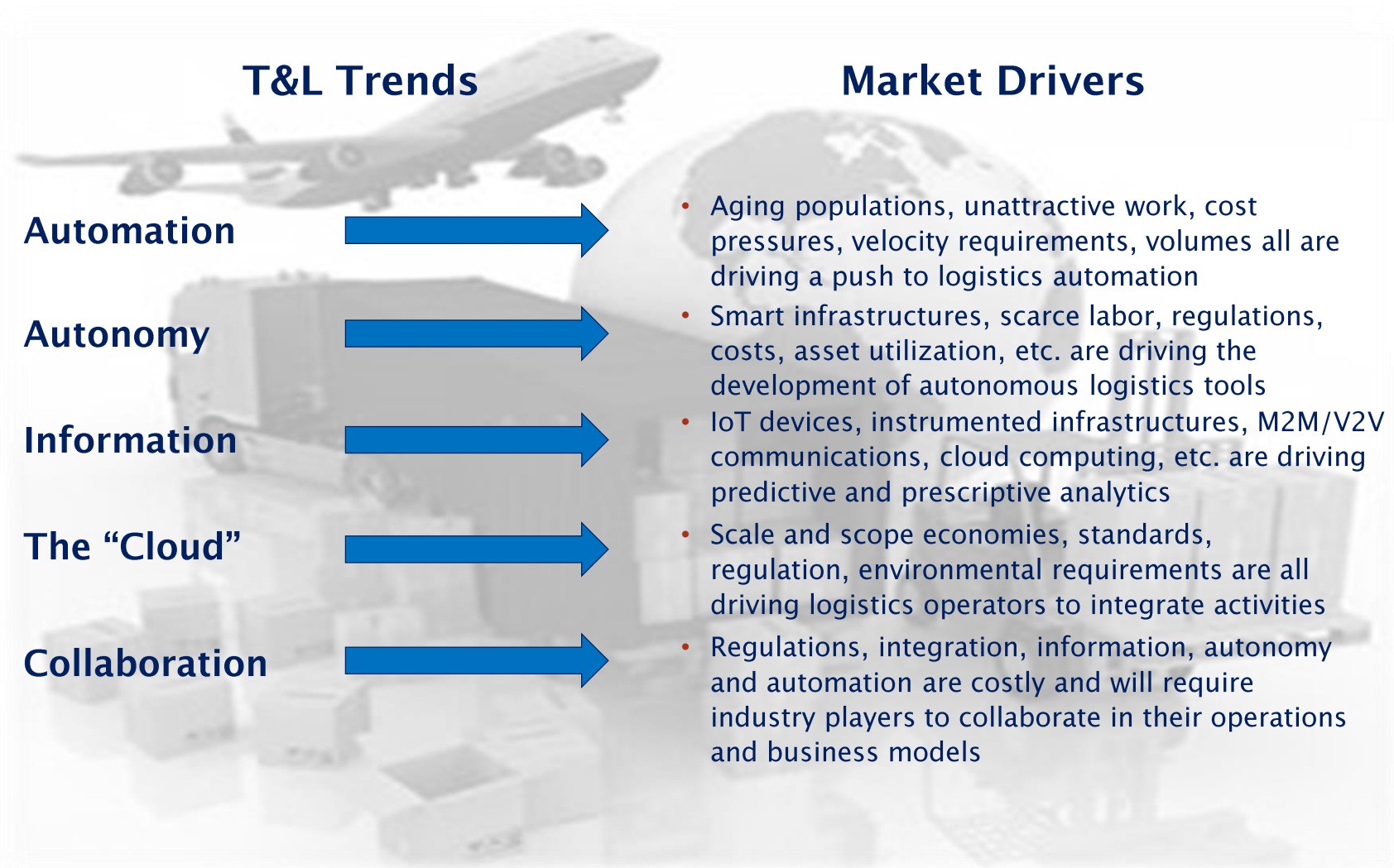
BEFORE WE START THE WORKSHOP, WHAT DO YOU SEE AS THE MAIN CHALLENGES THAT “DIGITALIZATION” HAS/IS/WILL BRING TO YOUR BUSINESS?



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TECHNOLOGICAL ADVANCES ARE DRIVING SIGNIFICANT CHANGE IN THE TRANSPORT AND LOGISTICS INDUSTRY



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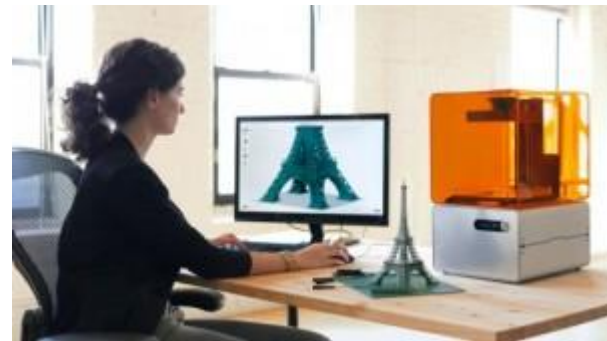
THE NEED TO INCREASE VELOCITY, LOWER UNIT COSTS, AND ADDRESS WORKFORCE SCARCITY IS DRIVING NEW FORMS OF AUTOMATION

- Automated Guided Vehicles – while not the newest form of automation, AGVs are gaining in popularity as software improves and new applications are developed
 - Warehouse operations (work to worker systems)
 - Ports (automated container handling)
 - Production (intra-logistics operations)
 - Healthcare (inter-facility logistics)
 - Chemicals (automated filling and tanker movement)
 - Etc.



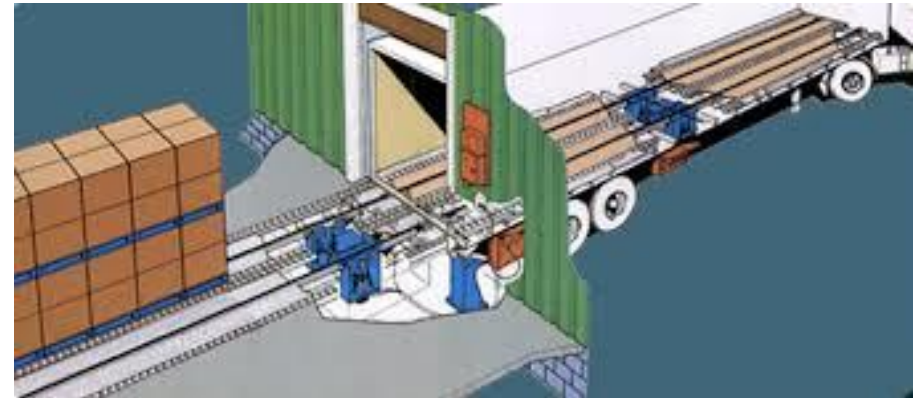
ROBOTICS IS ONE OF THE FASTEST GROWING AREAS OF INNOVATION IN LOGISTICS OPERATIONS

- Robots are used in many applications in logistics
 - Palletization
 - Unloading
 - Layer picking
 - Goods picking
 - Goods carriage
 - Packing
- Robots increase productivity, reduce injuries and improve quality
- Robots today are more flexible than humans and far easier to “program”
- Note: 3D printing or, “additive production,” is nothing but distributed robotic production



OTHER AREAS OF LOGISTICS ARE SEEING INCREASING INTEREST IN AUTOMATION

- Material handling
- Storage and retrieval
- Packaging
- Conveying
- Sorting
- Loading/Unloading



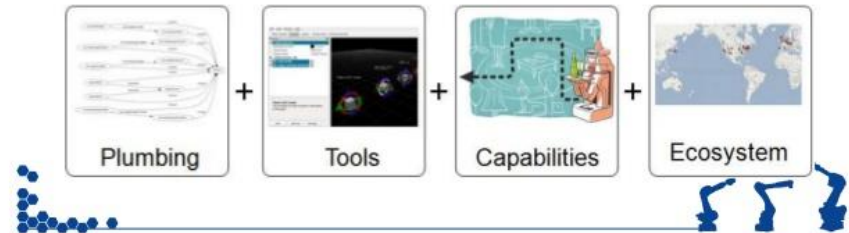
FACILITATING THE ADVANCE OF AUTOMATION HAS BEEN THE EVOLUTION OF STANDARDS AND SOFTWARE

- Modular packaging
- Graphical configuration of software
- Standard automation interfaces
- Process oriented control software
- Standardized containers
- PLC interfaces
- The Robot Operating System (ROS)
- Etc.

ROS: Robot Operating System



- Open source (BSD)
- Created by Willow Garage
- Maintained by Open Source Robotics Foundation (OSRF)

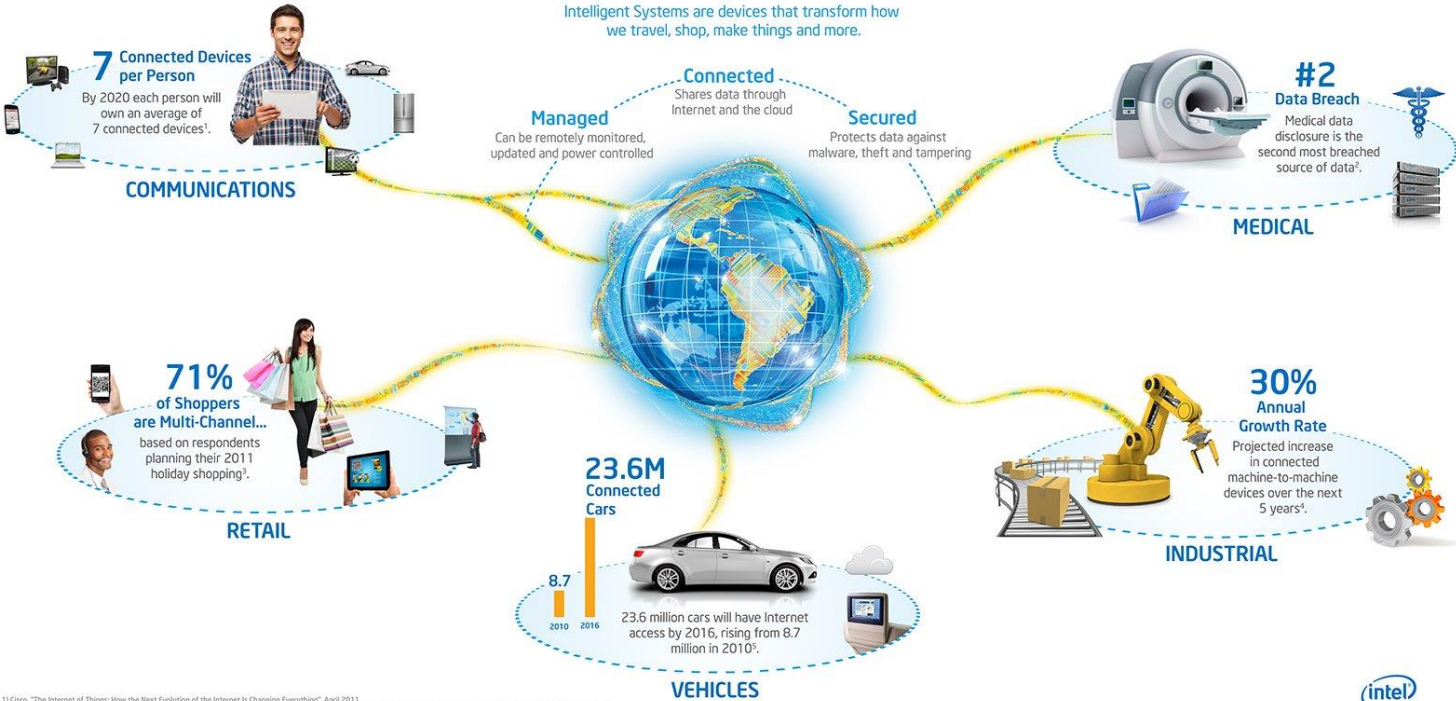


THE INTERNET OF THINGS PROMISES TO FURTHER INCREASE THE POTENTIAL OF AUTOMATION IN LOGISTICS

Intelligent Systems for a More Connected World

WHAT ARE INTELLIGENT SYSTEMS?

Intelligent Systems are devices that transform how we travel, shop, make things and more.

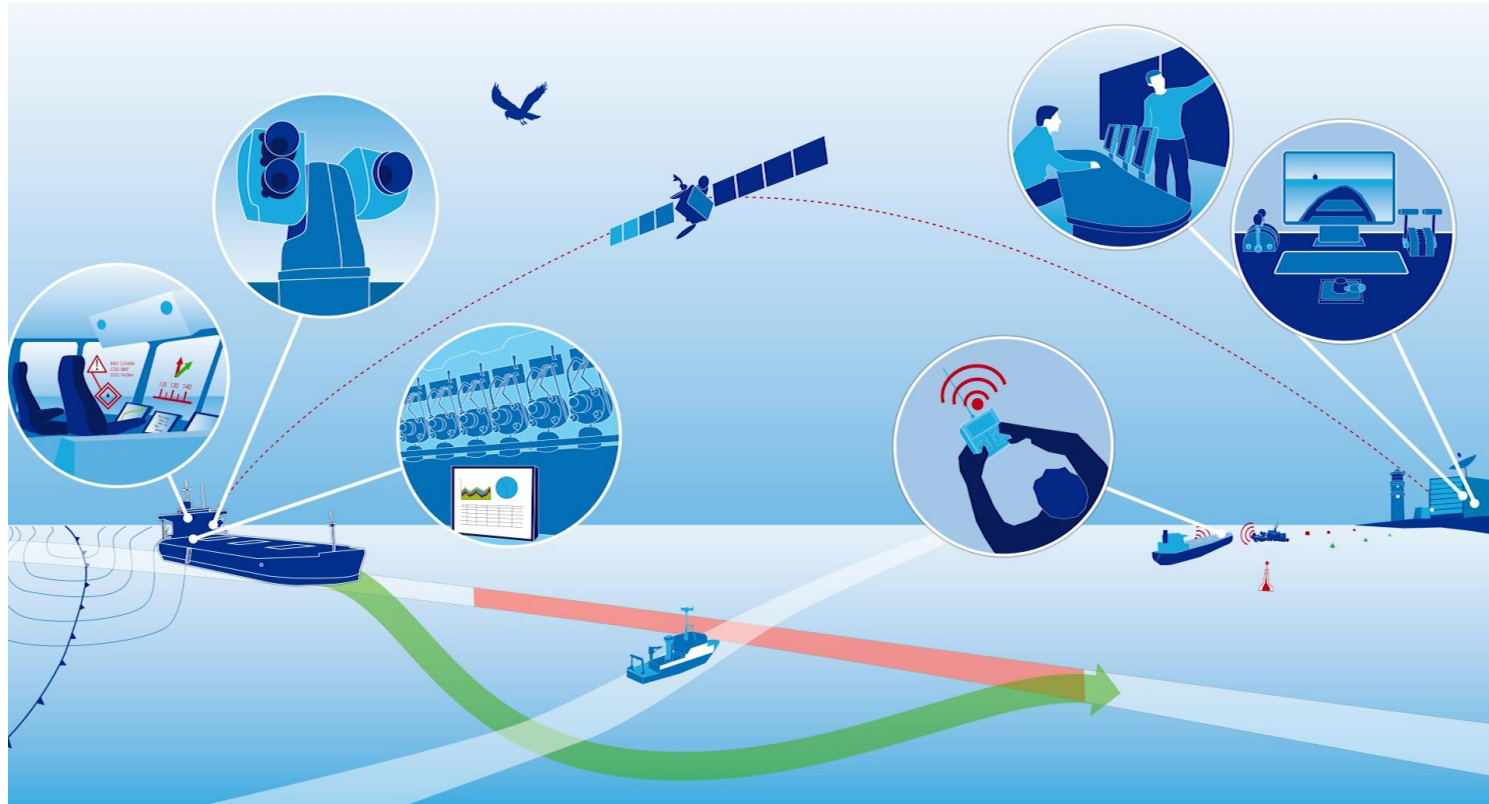


¹ Cisco, "The Internet of Things: How the Next Evolution of the Internet is Changing Everything", April 2011
² Black Research, "Security challenges in the US healthcare sector" white paper, December 2010, <http://www.mcafee.com/us/resources/whitepapers/wp-bior-healthcare-security.pdf>
³ Deloitte U.S., 2011 Annual Holiday Survey, http://www.deloitte.com/assets/Docum/UnitedStates/Research/2011Assets/Documents/Consumer%20Business/us_retail_AnnualHolidaySurvey_2011_pr_102611.pdf
⁴ McKinsey Global Institute analysis, "Big data: The next frontier for innovation, competition, and productivity", June 2011
⁵ Wall Street Journal, <http://online.wsj.com/article/SB100014240527023040665045763497614933044.html>, estimates from research firm, Frost & Sullivan

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WITH MORE INTELLIGENCE IN SYSTEMS THE CONCEPT OF SELF ORGANIZED LOGISTICS OPERATIONS BECOMES POSSIBLE



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AUTONOMOUS OPERATIONS OF LOGISTICS ASSETS IS BECOMING A REALITY

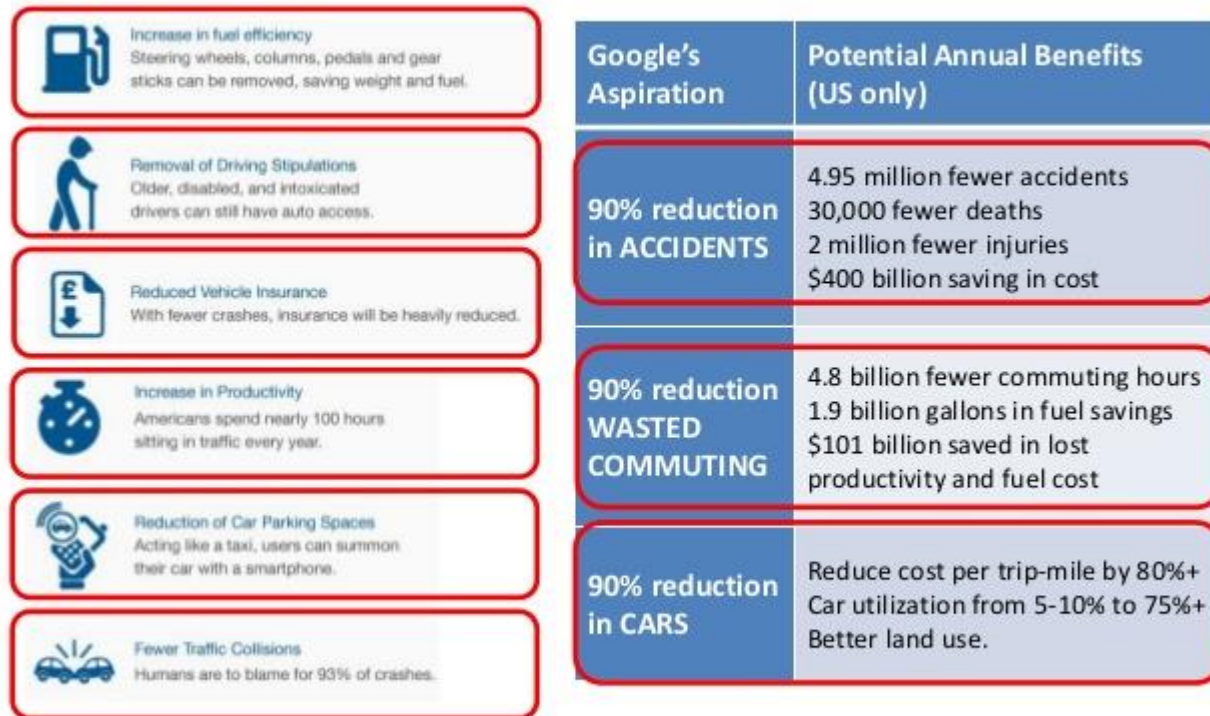
The Building Blocks of Autonomy

Prepared by VISION SYSTEMS INTELLIGENCE



THE BENEFITS OF AUTONOMOUS OPERATIONS CAN BE SIGNIFICANT – CARS....

Benefits of Autonomous Car



Ref: <http://www.carloan4u.co.uk/infographics/the-ultimate-car-of-the-future/>
 Google, US NHTSA, AAA, Texas A&M Transportation Institute, Columbia University Earth Institute and Devil's Advocate Group's analysis

... AND TRUCKS TOO 😊

FREIGHTLINER INSPIRATION TRUCK

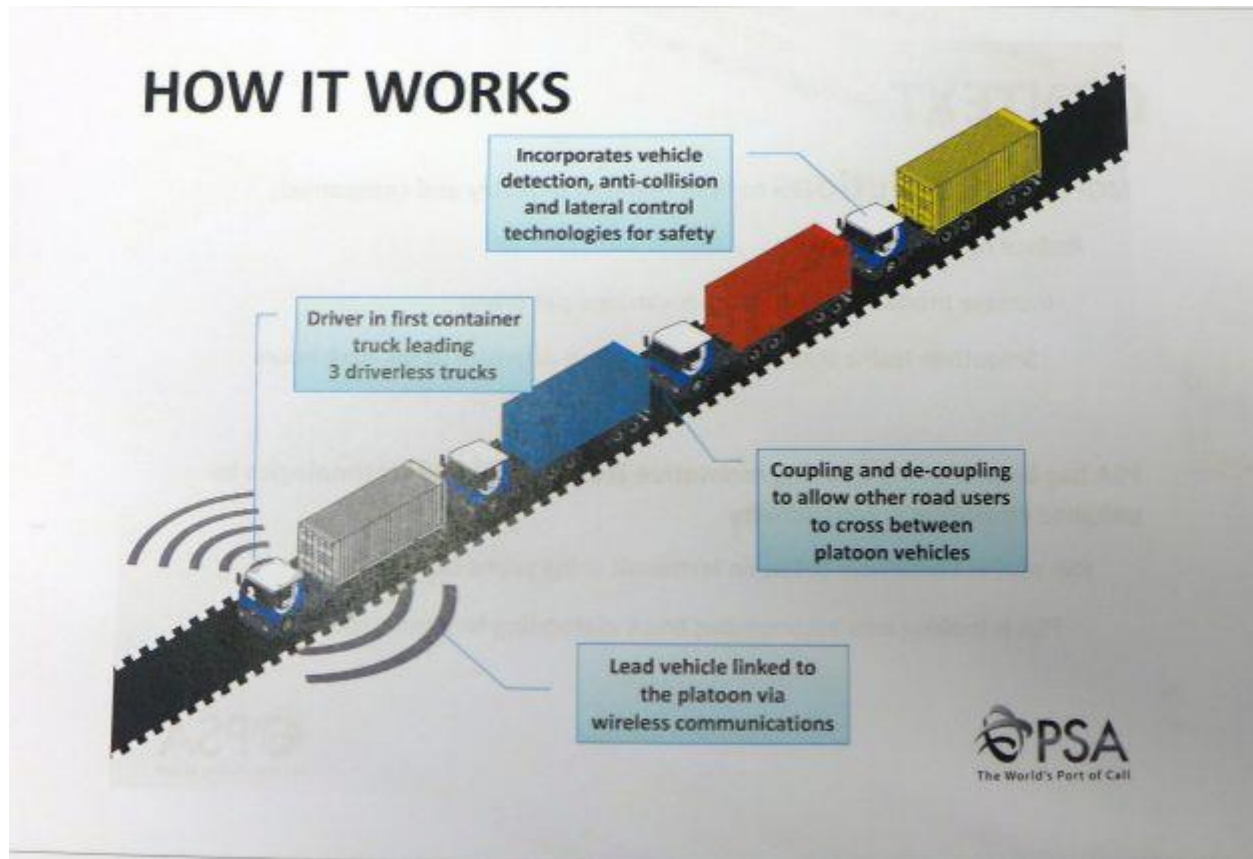
The first licensed autonomous truck

INFINITE INSPIRATION

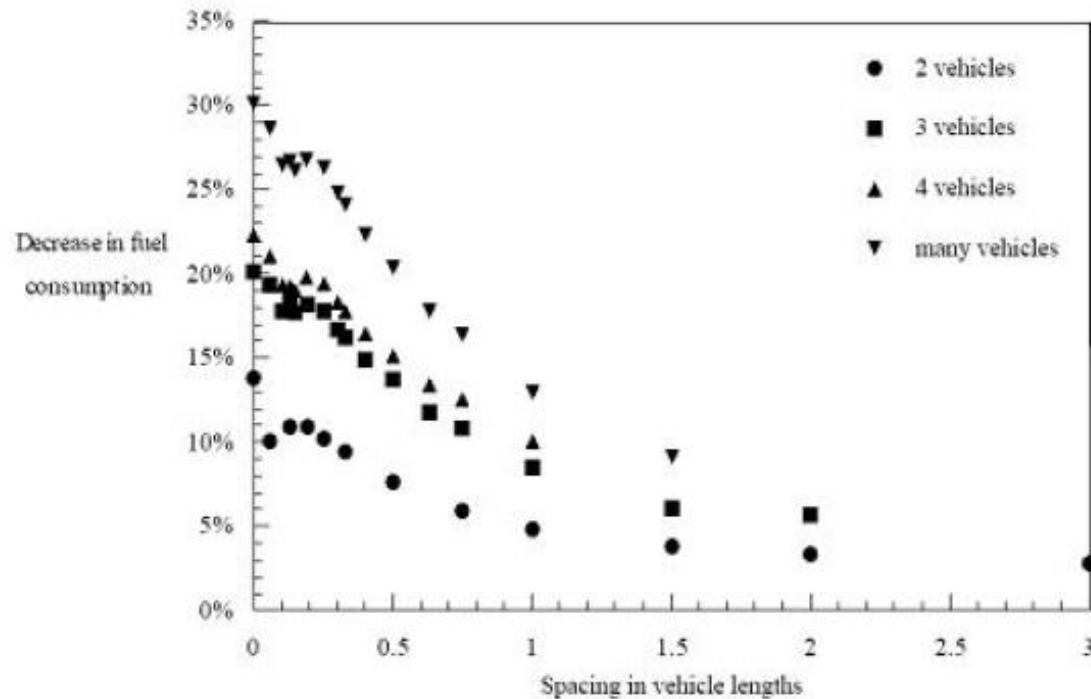
The infographic depicts a truck's path through a landscape with mountains, a river, a factory, and a forest. Eight numbered callouts (1-8) highlight key features and benefits of the autonomous truck technology. The truck is shown in various scenarios: receiving maintenance, navigating complex roadways, interacting with emergency services, and traveling in a platoon formation.

CONNECTIVITY	SAFETY	EFFICIENCY
<ol style="list-style-type: none"> Uptime performance enhanced through wireless predictive maintenance Drivers can optimize time with connection to the business and truck's performance while on the road Predictive route planning improves logistic system performance and reduces highway congestion 	<ol style="list-style-type: none"> Integrated networking of active safety systems reduces accidents Driver alertness improves by reducing monotonous tasks 	<ol style="list-style-type: none"> Uniform traffic flow and powertrain optimization help reduce fuel consumption by up to 5% Less component strain and reduced accidents lower overall maintenance costs Wirelessly linking 5 trucks in a platoon formation delivers up to 6.0% fuel savings on average

TRUCK PLATOONING IS ONE EXAMPLE WHERE AUTONOMOUS OPERATIONS CAN PROVIDE SIGNIFICANT BENEFITS

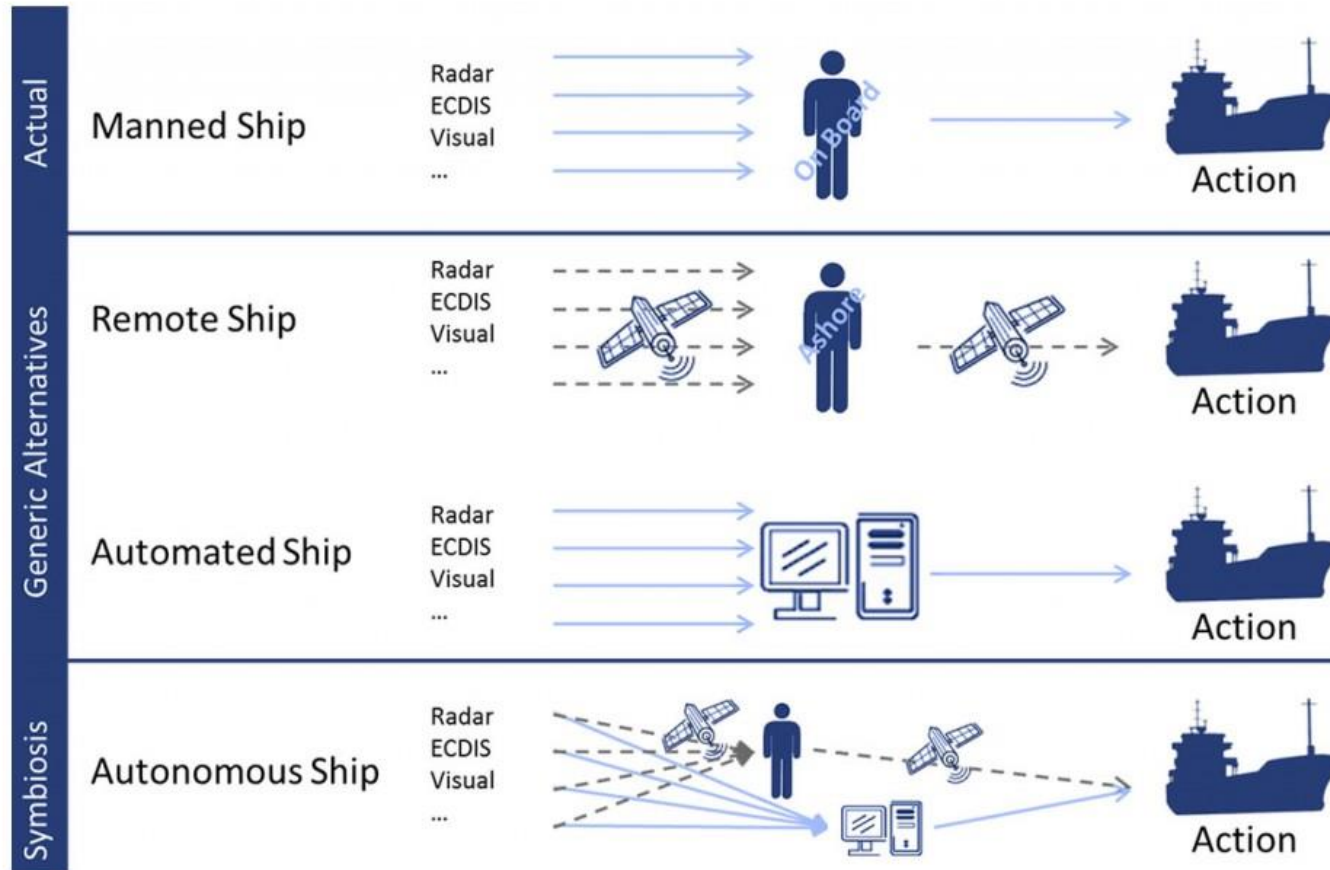


THESE BENEFITS HAVE BEEN UNDERSTOOD FOR MANY YEARS, BUT ONLY NOW CAN TECHNOLOGY FACILITATE THEIR REALIZATION



Source: Partners for Advanced Transit and Highway Program (1992)

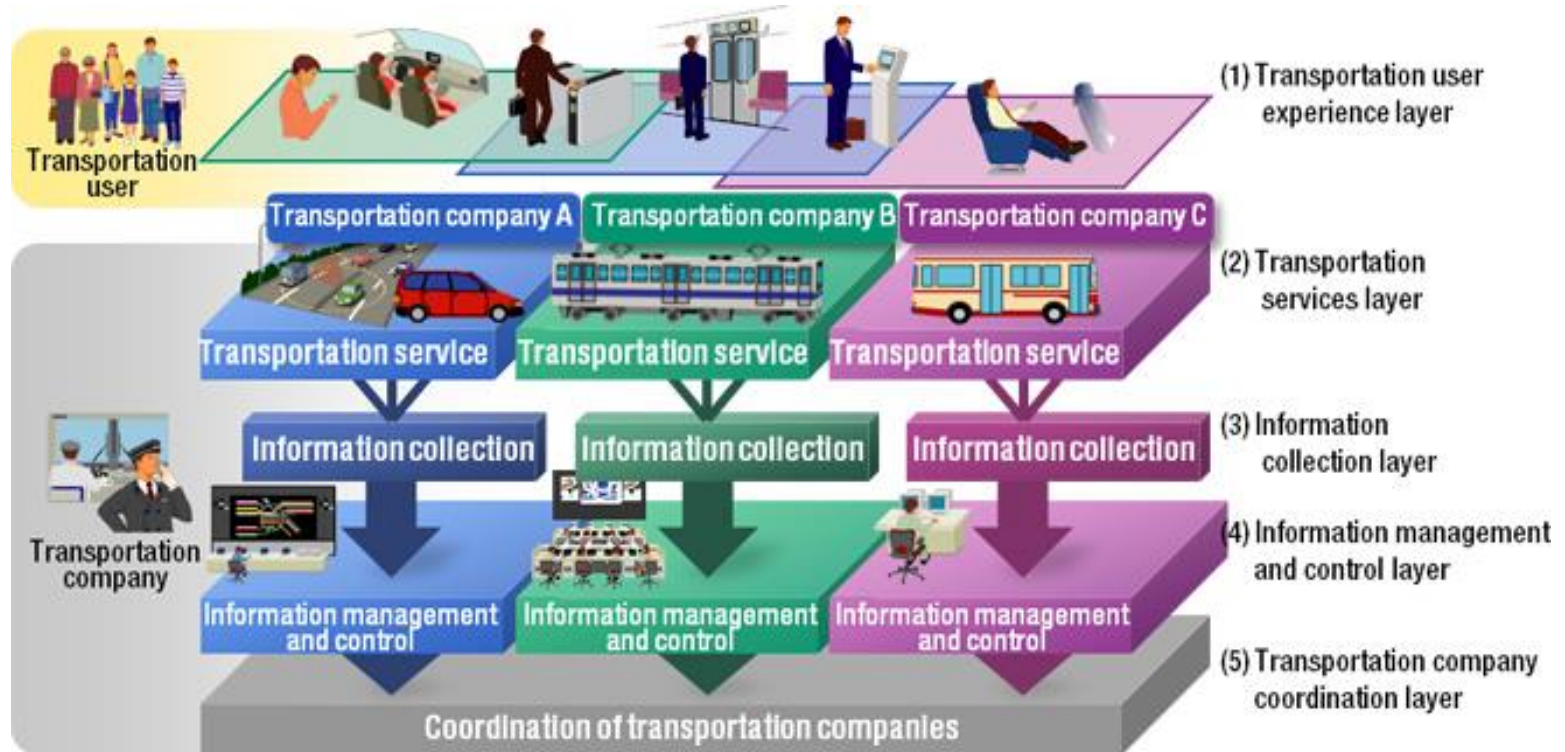
AUTONOMOUS SHIPS ARE ALSO BEING EXAMINED...



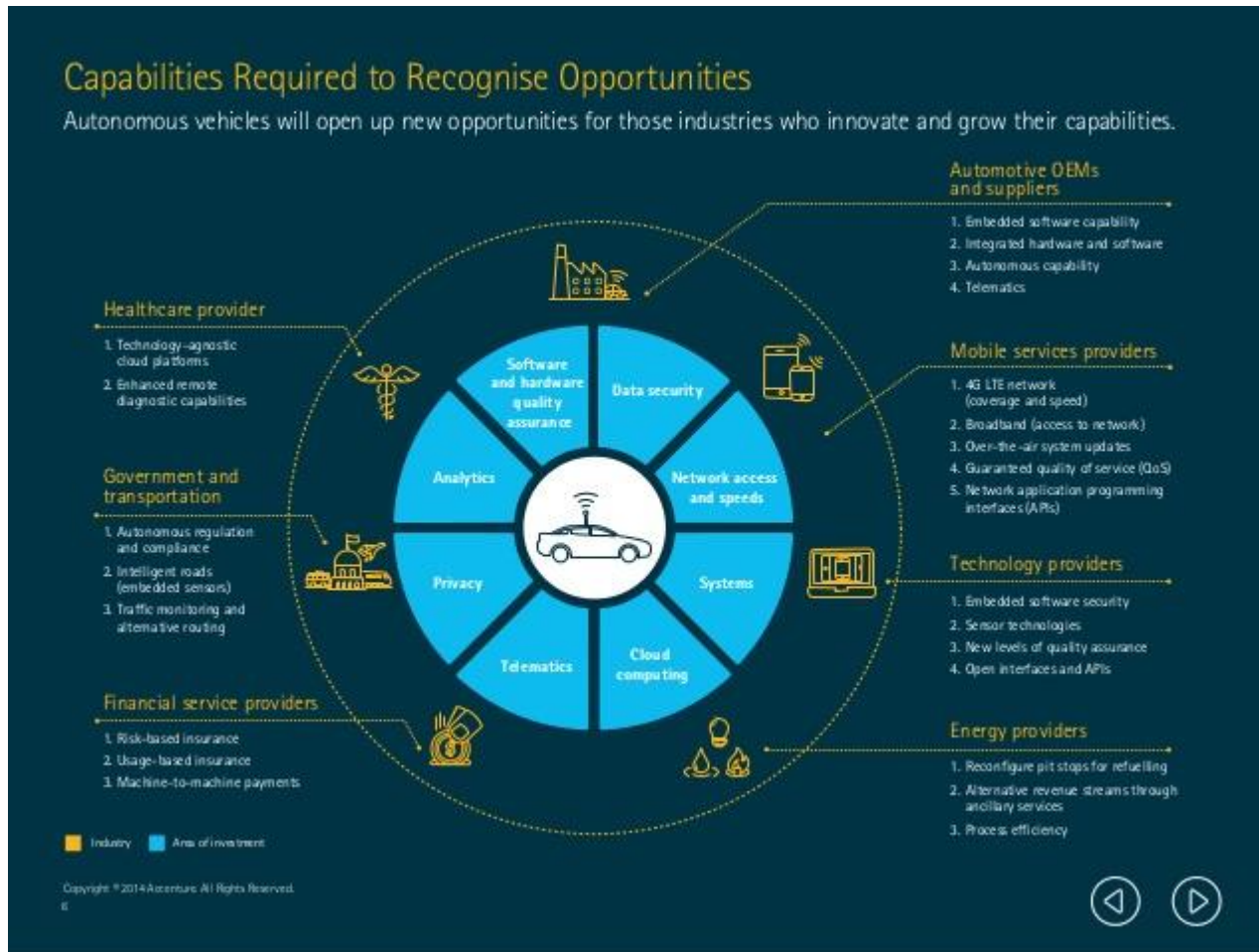
...AS ARE AUTONOMOUS AIRCRAFT



OPERATION OF AUTONOMOUS VEHICLES REQUIRES SIGNIFICANT INVESTMENT IN SMART INFRASTRUCTURES...



...BUT REMOVING THE HUMAN ELEMENT FROM VEHICLE OPERATION ALSO PROMISES NUMEROUS BENEFITS

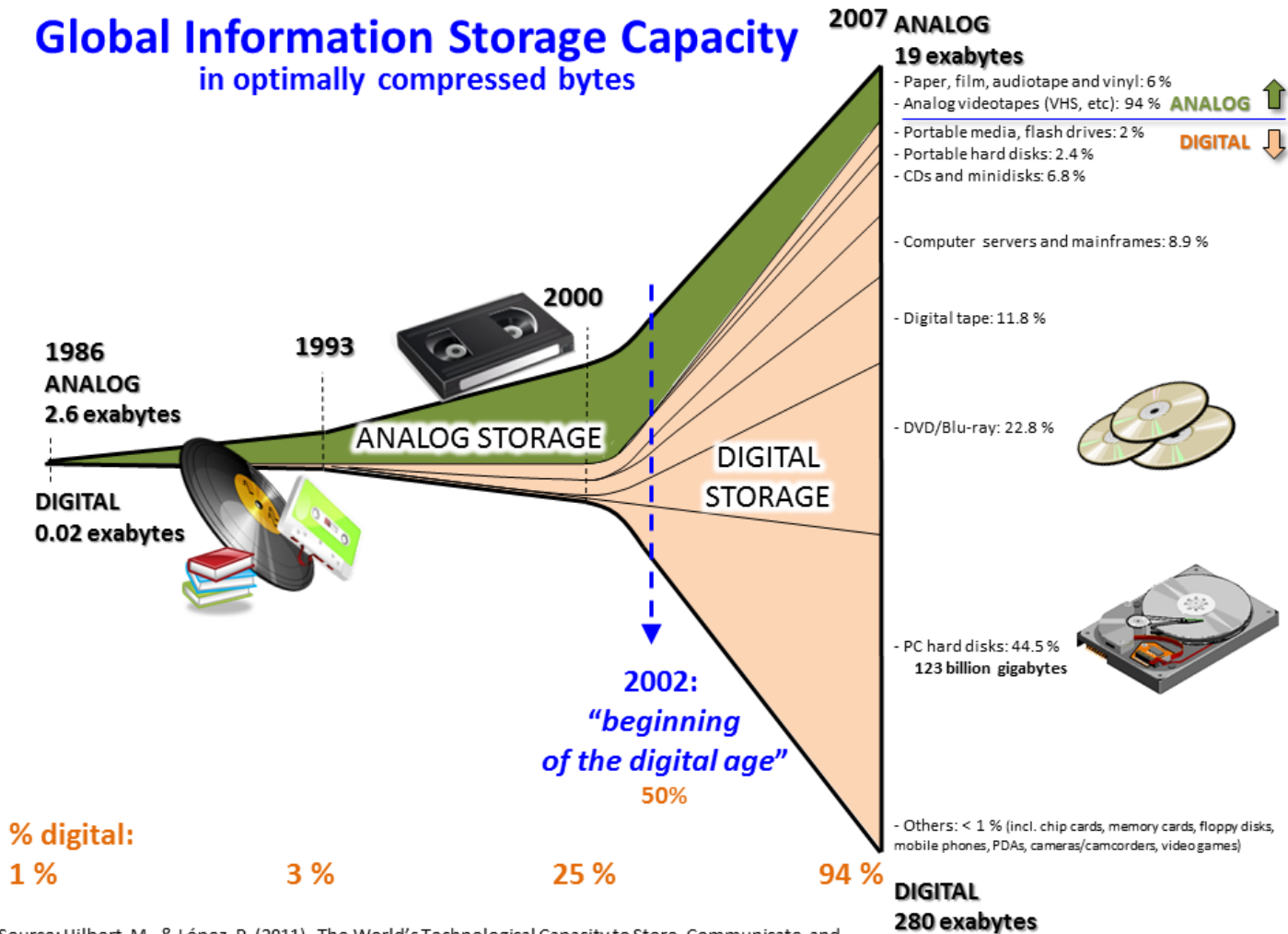


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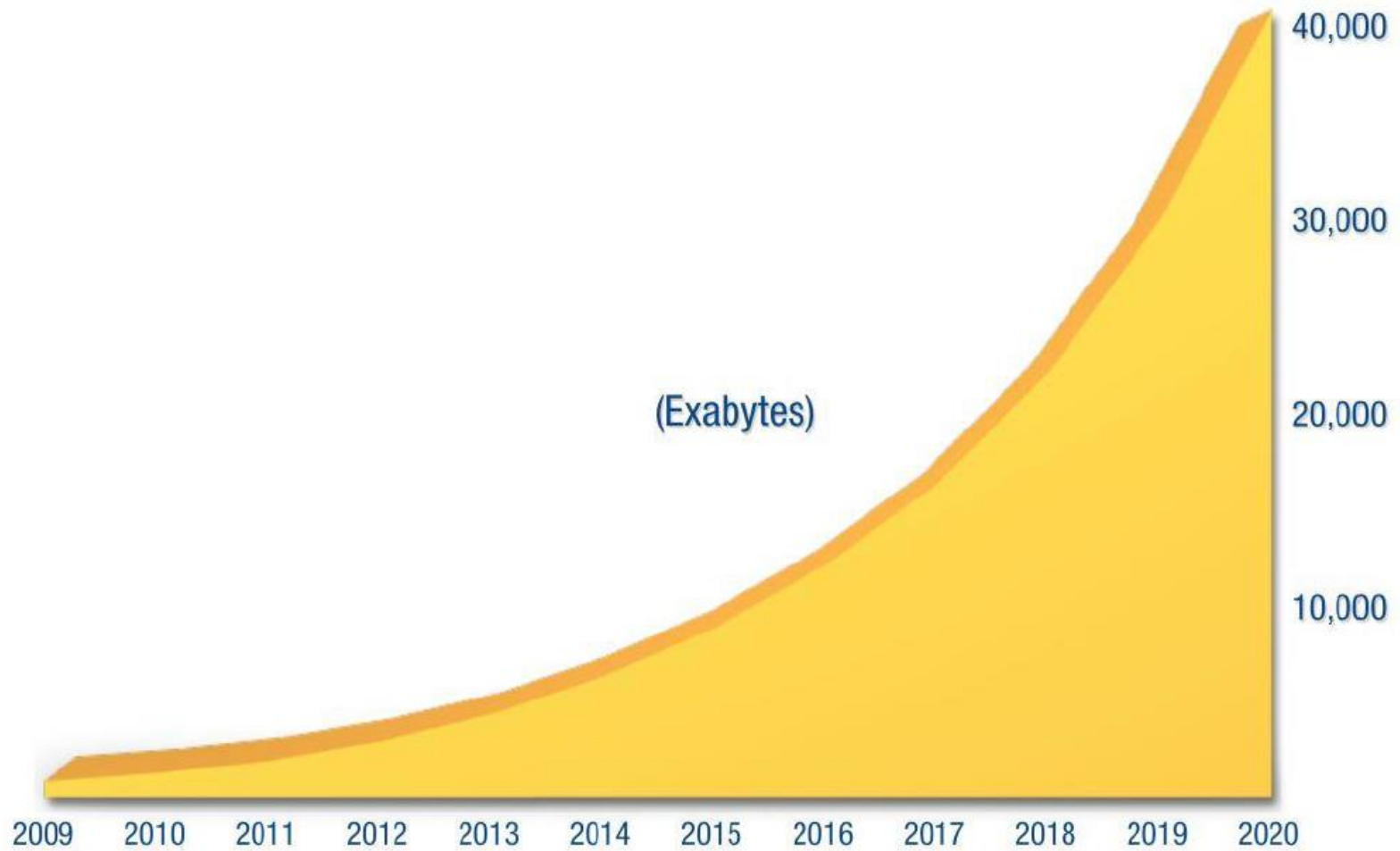
THE AMOUNT OF DATA THAT IS BEING STORED IN VARIOUS MEDIA HAS BEEN GROWING EXPONENTIALLY SINCE THE TURN OF THE CENTURY

Global Information Storage Capacity in optimally compressed bytes



Source: Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, 332(6025), 60 –65. <http://www.martinhilbert.net/WorldInfoCapacity.html>

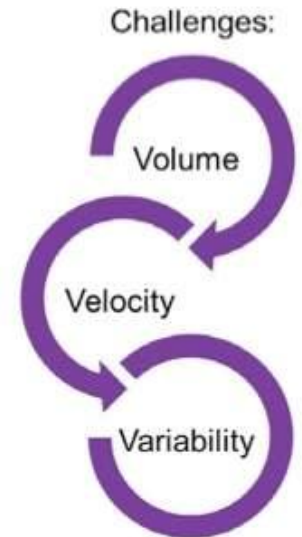
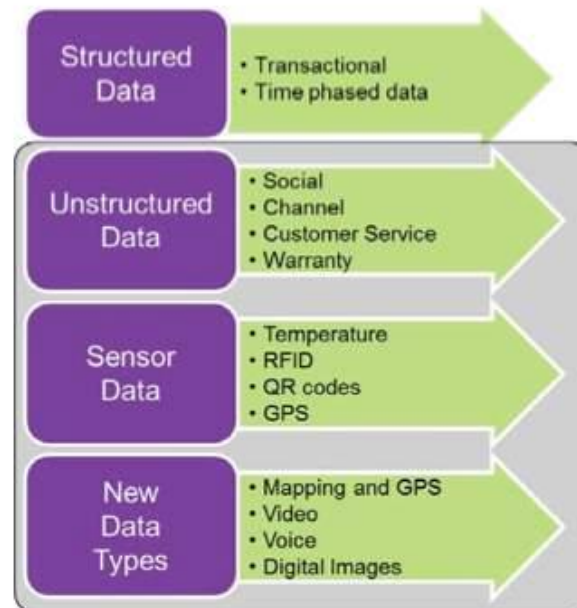
IDC PROJECTS THAT THE GENERATION OF STORABLE DATA WILL GROW TO APPROXIMATELY 40,000 EXABYTES BY THE END OF THIS DECADE



Source: IDC's Digital Universe Study, sponsored by EMC, December 2012

BIG DATA RESULTS FROM THE INCREASED USE OF THE INTERNET TO BUY, INTERACT WITH, REPORT ON, MONITOR, VISUALIZE AND STORE THINGS

- The majority of data generated today is the result of electronic image creation, video streaming, surveillance images, blogs, email, online catalogues, etc.
- Autonomous data sources (i.e., the Internet of Things), such as autoID tagged items, automobiles, mobile telephones, webcams and sensor networks are also adding to the electronic data that is generated
- All of these sources of data create vast amounts of unstructured and difficult to process data that form what industry calls “Big Data”



VALUE FROM DATA, WHETHER BIG OR SMALL, ONLY ARISES WHEN IT IS USED TO INFORM DECISION MAKERS

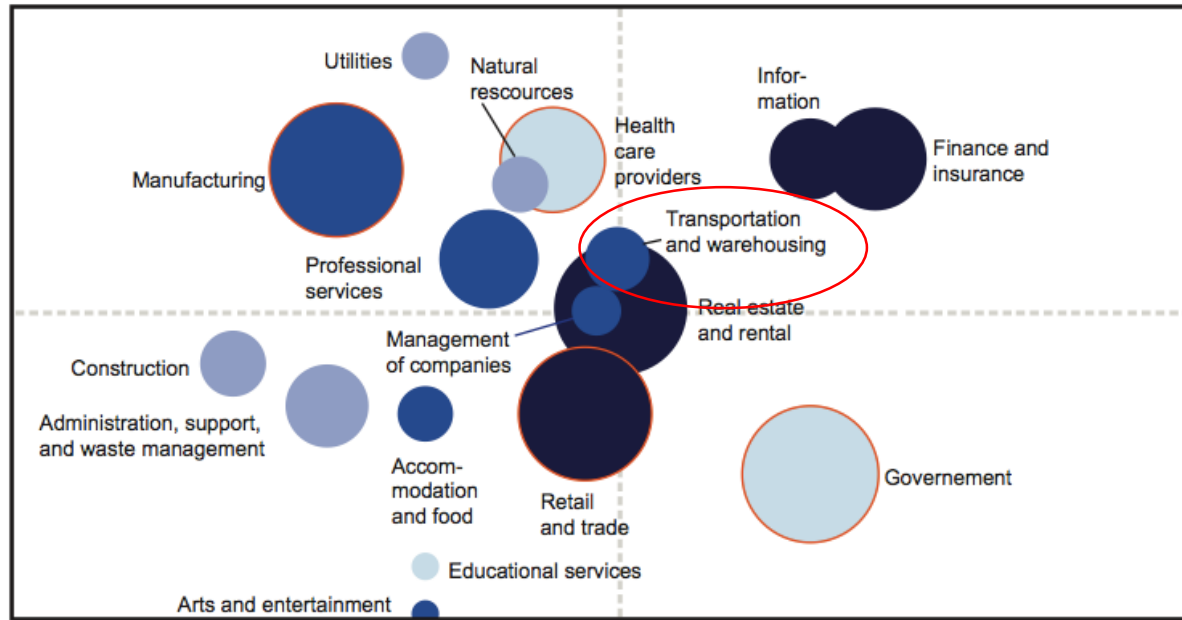
Sectors differ in their ability to use and obtain value from big data analytics

Big data ease of capture

Reflects ability to own or access data and analytics

Higher

Lower



○ Bubble size = GDP

○ Sectors studied in this report

Competitive Intensity to adopt big data

● Highest ● Moderate
● High ● Low

Lower

Higher

Big data value potential

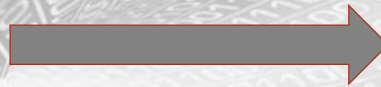
Reflects value of data and/or competitive advantage achieved

SOURCE: US Bureau of Economic Analysis; McKinsey Global Institute analysis

FOR LOGISTICS OPERATIONS, VALUE FROM DATA ARISES IN FOUR PRIMARY AREAS

Big Data Value Dimensions for Logistics Operations

Strategic Direction



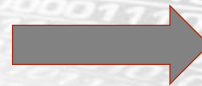
Information on markets, political situations, goods flows, etc. allow companies to anticipate where they should be investing and developing new goods and services

Operational Improvement



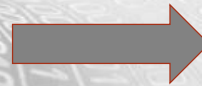
Real time information on goods flows, traffic, customer demands, weather, disruptions, etc. can assist in optimizing routes, asset utilization and risk reduction

Improved Customer Service



Multiple touch points with customers, shippers, suppliers and regulators allow companies to gather data on sentiments and needs creating opportunities to better serve stakeholders

New Business Opportunities



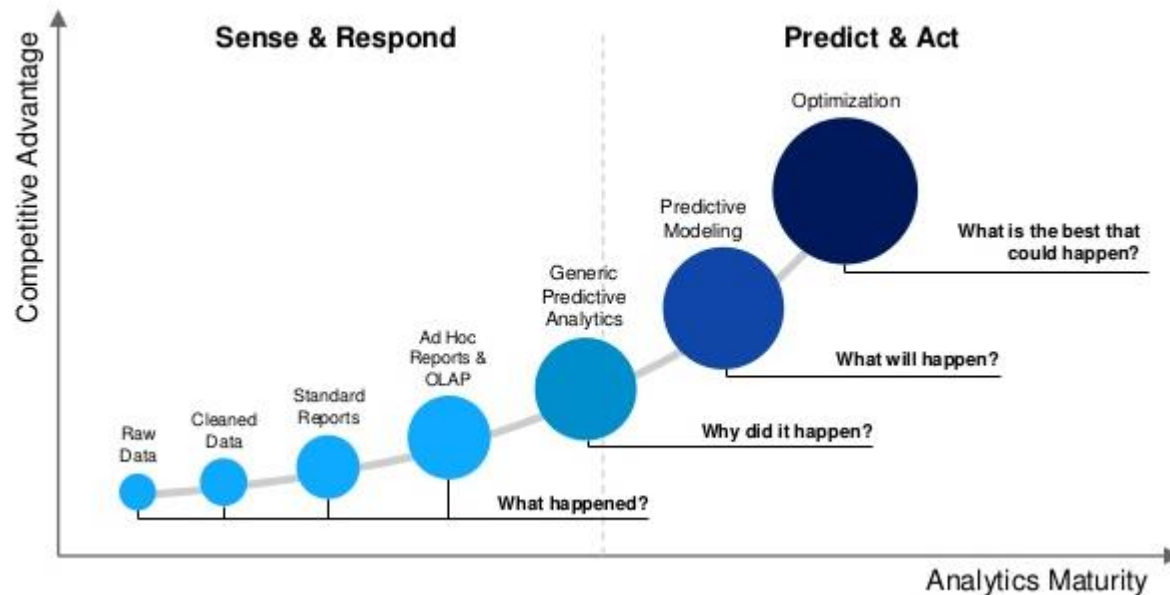
Aggregation of data on goods flows by locale, region, and lane and integrating these data with macroeconomic data, environmental data, etc. allows companies to create new business opportunities

Data Collection and Storage

Data Analysis and Refinement

Operational Improvement and New Business

INTEGRATING BOTH OPERATIONAL AND THIRD PARTY DATA CAN PROVIDE MANAGEMENT WITH EXTREMELY POWERFUL PREDICTIVE TOOLS FOR MARKET COMPETITION



BETTER USE OF INTERNAL OPERATIONAL DATA CAN IDENTIFY OPPORTUNITIES FOR IMPROVEMENT AND OPERATIONAL COMPETITIVE ADVANTAGE



Air Cargo Weight Analytics Study 1/2

Background and Motivation

- Air freight constitutes a primary channel for shipping perishable and expensive goods
- Improved management of air transport significantly reduces cost and carbon emissions
- Key issues hampering supply chain efficiency:
 - No Shows / Late Cancellations
 - Hi / Lo Shows, i.e. discrepancy between booking and actual (e.g., weight\volume\#items)



Proactive discrepancy management approach

- Exact weight cannot be pre-determined by shippers may only be observed upon acceptance at airline
- Discrepancies can be found in ~50% of shipments, inducing high costs or delays
- Prediction model: **Significant weight discrepancy** **Everything known so far**

$$\text{Predict: } p^{Hi} := P \left\{ \sum_{r \in R_f^A} W_r^A > \sum_{r \in R_f^P} W_r^P + \tau \mid \left\{ W_r^A \right\}_{r \in R_f^A}, \left\{ W_r^P \right\}_{r \in R_f^P}, I \right\}$$

W_r^A - Actual weight of RouteMap r

W_r^P - Planned weight of RouteMap r

R_f - Route maps scheduled on flight f

R_f^A - Accepted Route maps scheduled on flight f

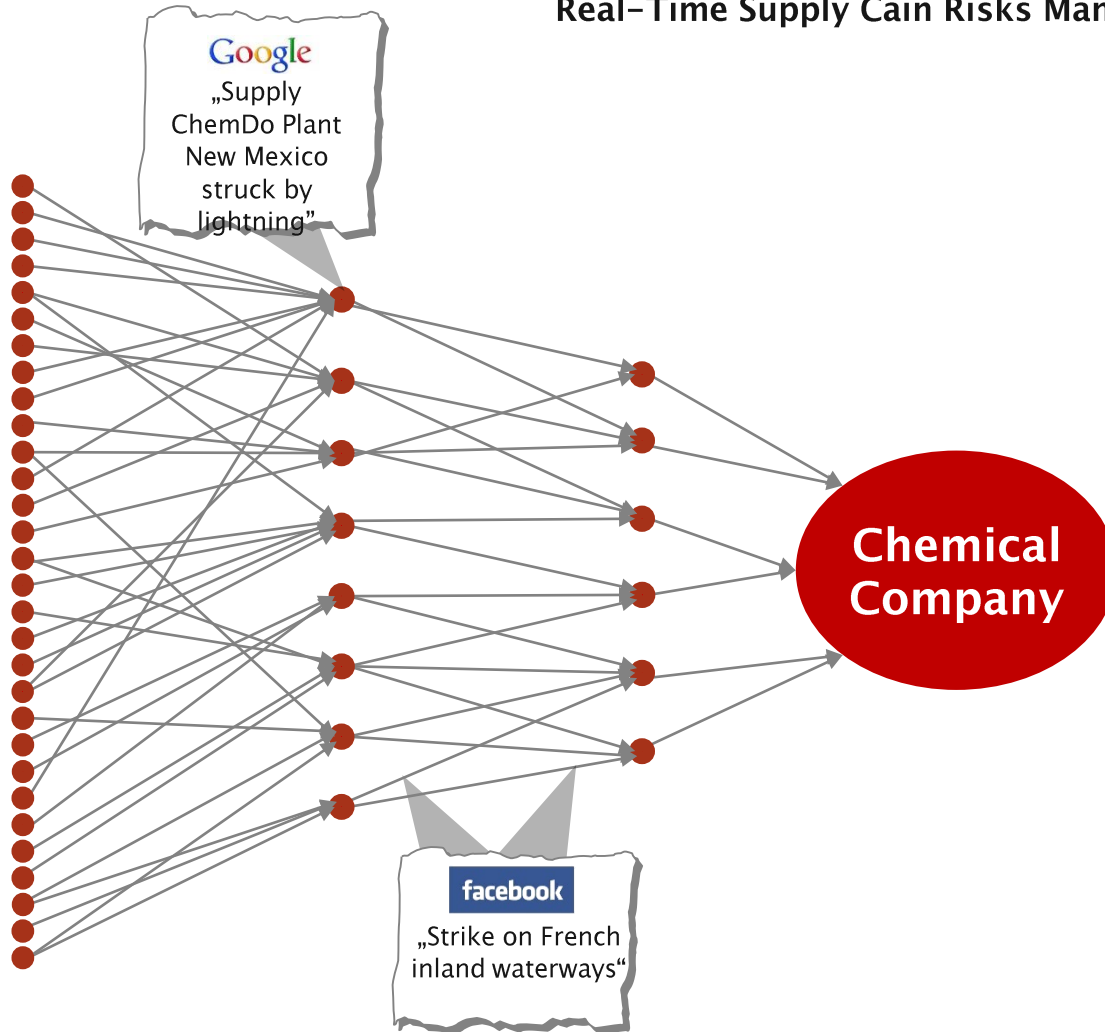
Additional information: airports, airlines, sources, destinations, etc.

Alert: IF $p^* > \delta^*$ THEN alert about "**-load"

* = Over\Under

SUPPLY DISRUPTIONS CAN BE ANTICIPATED EARLY BY USING BIG DATA AND DATA ANALYTICS TO UNDERSTAND SUPPLIER PROBLEMS AND PROVIDE CUSTOMERS WITH BETTER SERVICE

Real-Time Supply Chain Risks Management



Challenge

- Chemical company with **1000s of suppliers** would like to understand when certain **suppliers face challenges and disruptions**
- **Create short-term transparency** against supply disruptions based on Internet chatter

Approach

- **Leverage supply chain maps** to identify impact of activities of 2nd and 3rd tier suppliers
- Use **real-time text mining procedures** to tap data-rich Internet news and social media chatter
- **Define response scenarios** as required
- **Identify trade-off** between true-false and false-true alerts based on pilot performance and criticality of suppliers

CREATIVE USE OF COMPANY GENERATED BUSINESS DATA, LINKED TO EXTERNAL SOURCES, CAN GENERATE SIGNIFICANT NEW OPPORTUNITIES FOR BUSINESS

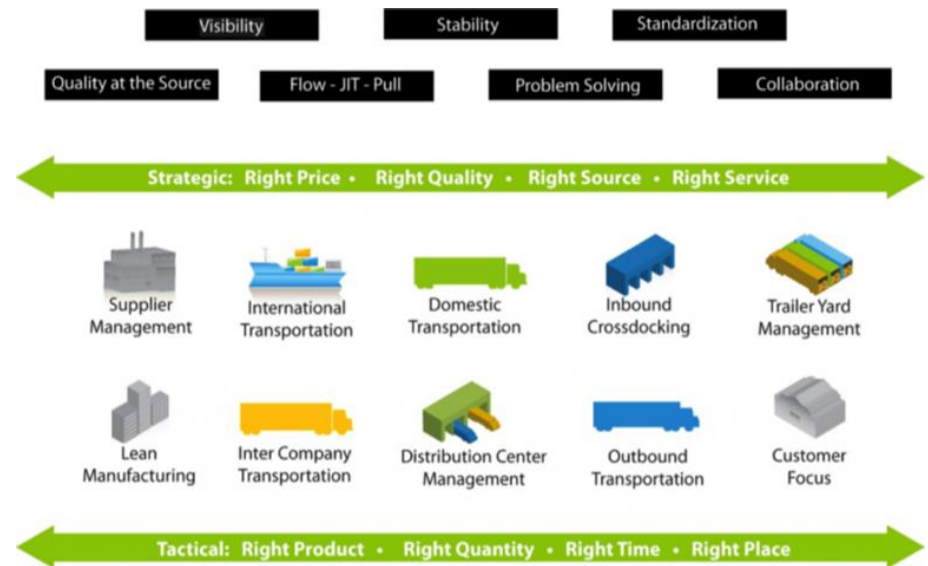


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THE DISAGGREGATED NATURE OF LOGISTICS OPERATIONS TODAY LEADS TO INEFFICIENT OPERATIONS AND UNNECESSARY EXPENSE

- End-to-end visibility does not exist
- Quality of shipping process is not controllable
- Assurance of deliveries is problematic
- Costs are not transparent
- Border crossings are problematic
- Vendor quality, reliability, capability, etc. is difficult to ascertain
- Risk management is not uniform
- Information sharing is difficult
- Collaboration does not exist



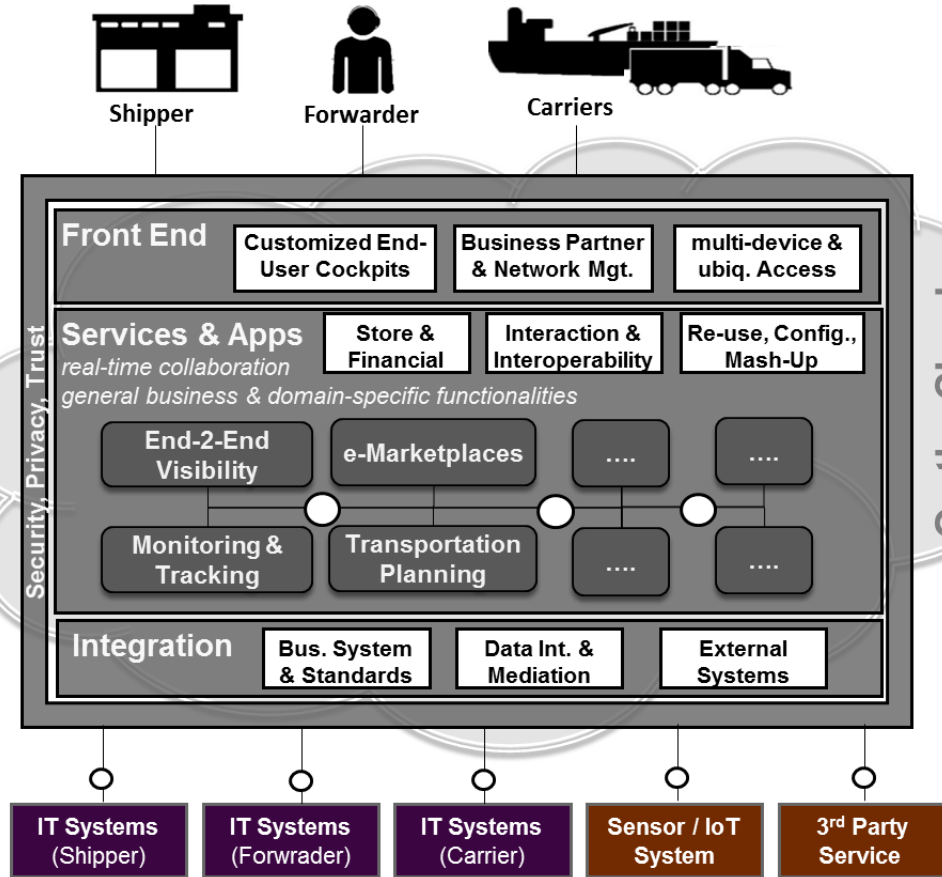
NEW TECHNOLOGIES, SUCH AS CLOUD COMPUTING AND LOGISTICS AS A SERVICE, ARE MAKING IT EASIER FOR COMPANIES TO OPERATE “ON DEMAND” LOGISTICS

Conduct all Business Activities via FISpace (integrated seamless Business Collaboration)

- ❖ Single point of access
- ❖ Personalized End-User Cockpits
- ❖ Social Networking & Collab. for Bus. Partners & Communities
- ❖ Access anywhere via any device

- ❖ Use On-Demand Solutions for business tasks & collaboration
- ❖ Combine & configure for individual business needs
- ❖ Re-use for rapid development of new Services & Apps

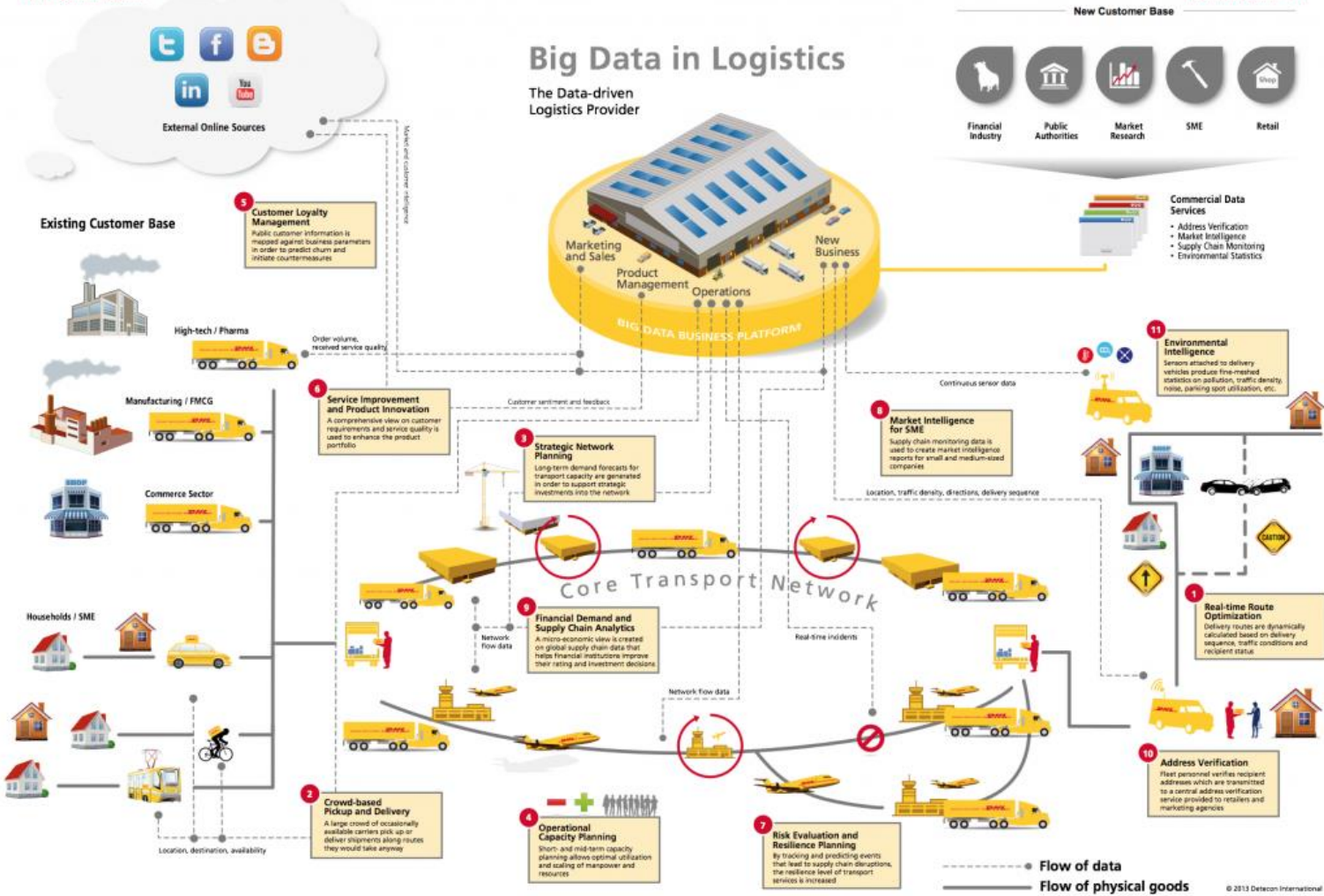
- ❖ Continue using existing IT systems for in-house purposes
- ❖ Import / export relevant information for collaboration
- ❖ Handle heterogeneous data
- ❖ Connect external systems (e.g.: IoT syst., 3rd-party & public services)



THE "INTERNET OF THINGS" IS ALSO HELPING TO FACILITATE AN "ON DEMAND" MODE OF OPERATIONS

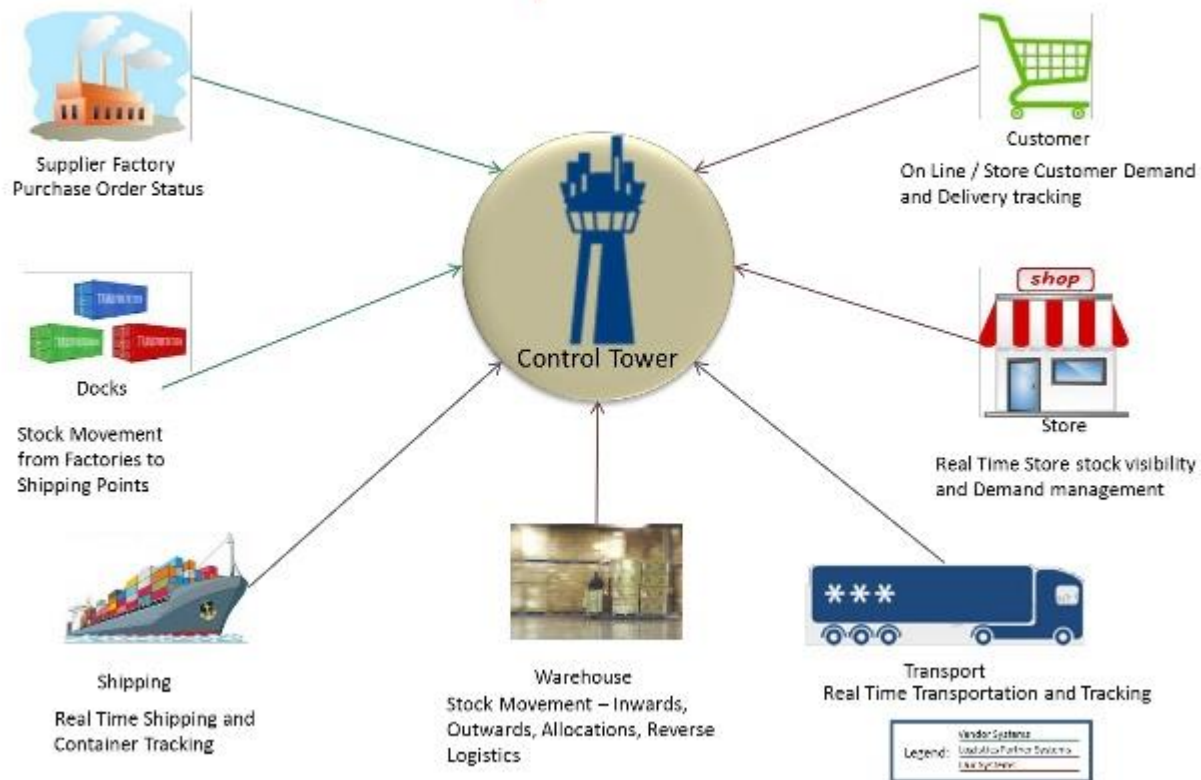
16 | Big Data in Logistics

Big Data in Logistics | 17



THERE ARE CONSIDERABLE BENEFITS TO THINKING OF LOGISTICS OPERATIONS AS A MORE INTERCONNECTED SET OF ACTIVITIES THAN WE DO TODAY

Control Tower Operations



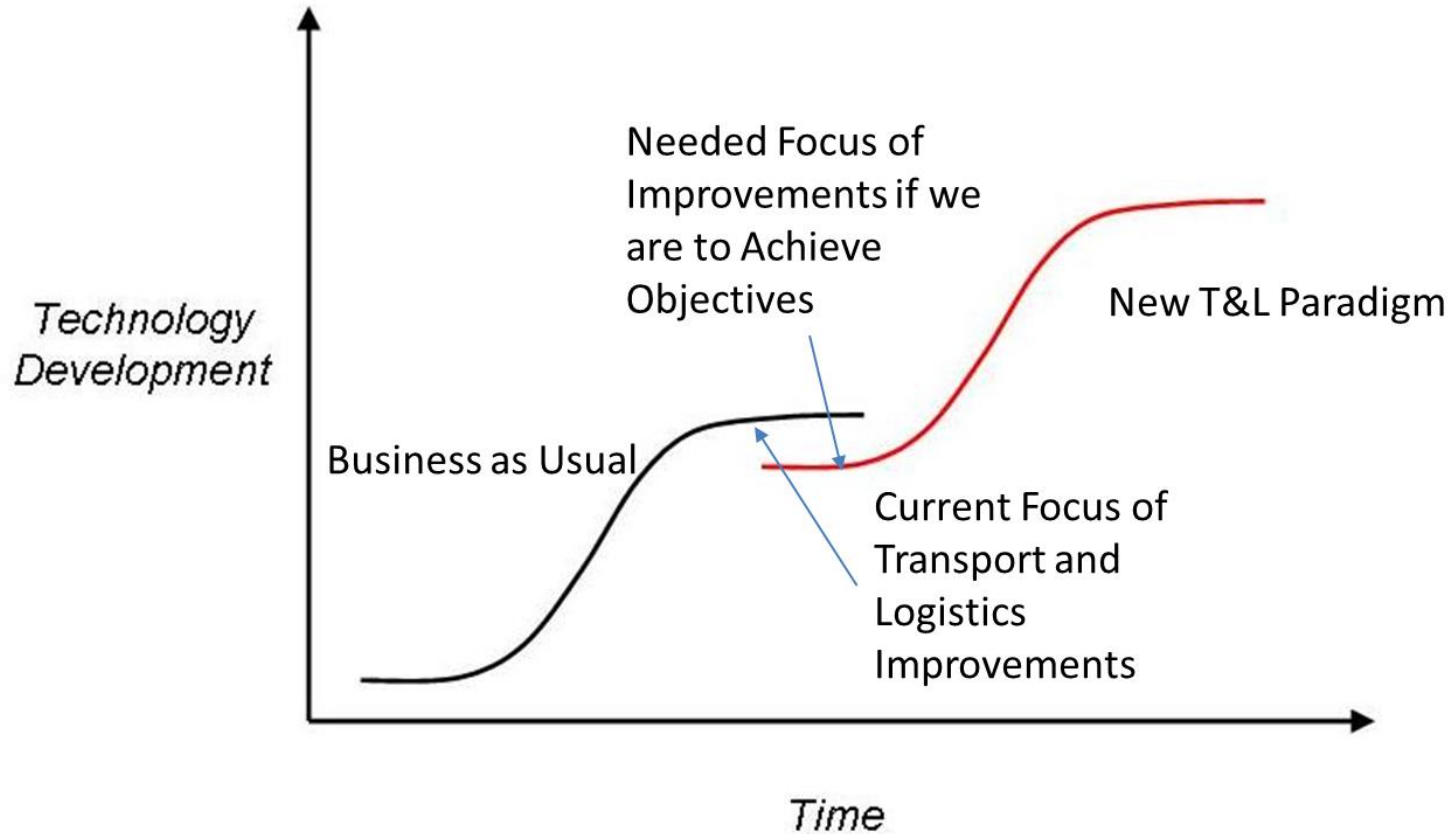
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ALL OF THE WORLD'S TRENDS LEAD TO BUSINESS MODELS THAT DIFFER FROM TODAY'S COMPETITIVE INDUSTRY STRUCTURE



THE CURRENT FOCUS THUS FAR HAS BEEN ON HOW INDUSTRY IMPROVES ITS CURRENT OPERATIONS, NOT ON WHETHER IT NEEDS AN ENTIRELY DIFFERENT APPROACH



WHAT ACTUALLY IS NEEDED IS SOMETHING ENTIRELY DIFFERENT FROM THE CURRENT APPROACH



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OUR CURRENT APPROACH TO SUPPLY CHAIN OPERATIONS IS MOST LIKELY NOT SUSTAINABLE

- We ship mostly air and packaging in our non-bulk shipping operations
- Empty travel of vehicles is the norm, not the exception
- Human resources for logistics services (trucking, warehousing, stevedoring, etc.) are becoming scarce
- Products sit idle most of the time, positioned or stored where not need and unavailable to those who need them
- Much of what is sold ends up simply being scraped or not used
- City logistics is becoming increasingly problematic
- Product movements due to repositioning and demand changes provide for product tourism and unnecessary shipping issues
- Integrated inter-modal shipments are not possible due to a lack of common systems, planning approaches, transfer operations, etc.
- Networks are fragile and insecure
- Automation is costly and difficult to implement
- Innovation is limited

OUR GOAL AS LOGISTICIANS SHOULD BE TO ASSIST IN CREATING A SUSTAINABLE WORLD

Why do we need to change ?

Logistics inefficiency and unsustainability

ECONOMIC

Logistics: 5-15% burden on GDP of most countries
worldwide logistics costs grow faster than world trade

ENVIRONMENT

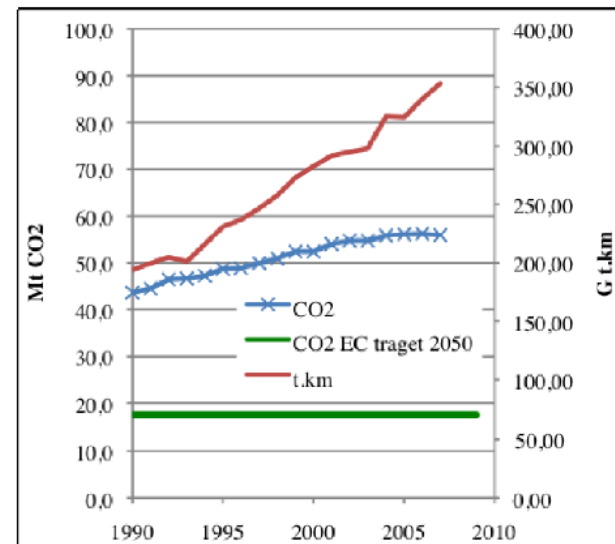
One of the heaviest greenhouse gas generators,
energy consumers, polluters and materials wasters

Growing negative contribution
while nations' goals aims for heavy reductions

SOCIAL

Lack of fast, reliable and affordable
accessibility and mobility of physical objects
for the vast majority of the world's population

Too often precarious logistic work conditions



European Commission: A Roadmap for moving to a competitive low carbon economy in 2050, Office of the European Union, Brussels, 16p. (2011)
Serveau, L.T.: Inventaire des émissions de polluants dans l'atmosphère en France. In: SECTEN, Citepa, Paris (2011)
European Commission: EU energy and transport in figures. Statistical Pocketbook, (2009)

ONE POTENTIAL "SOLUTION" MIGHT BE TO USE THE DIGITAL INTERNET AS AN EXAMPLE TO CREATE A PHYSICAL INTERNET

Today's Complex Extended Supply Chain

Multiple Sourcing Channels

- Branded
- Private Label
- Internal Sourcing
- Domestic
- International

Multiple Sales Channels

- Store
- eStorefronts
- Catalog/Call Center
- Special Order
- Self-Service Kiosk
- Mobile
- Resellers/Partners

Multiple Product/Service Choices

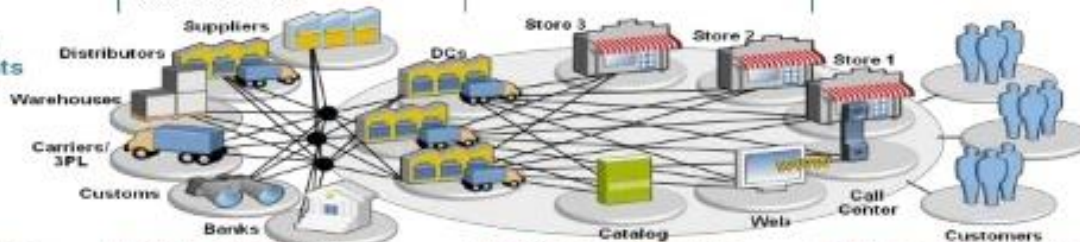
- A, B, C, and D Items
- Services/Support
- 3rd Party Products/Services
- Configurations
- Bundled Offerings

Multiple Customer Segments

- Consumers
- Multi-Channel Customers
- Loyalty Customers
- Commercial Accounts
- Geographic
- Demographic

Multiple Supply Chain Participants

- Suppliers
- Carriers
- Freight Forwarders
- Customs Agencies
- Customs Brokers
- 3PLs



Multiple Enterprise Units

- Brands
- Divisions
- Business Units
- Franchisees
- Acquisitions

Multiple Distribution Methods

- Supplier-to-DC
- Supplier-to-Stores
- DC-to-Stores
- Forward Stocking Locations
- Postponement
- Redeployment
- Reverse logistics

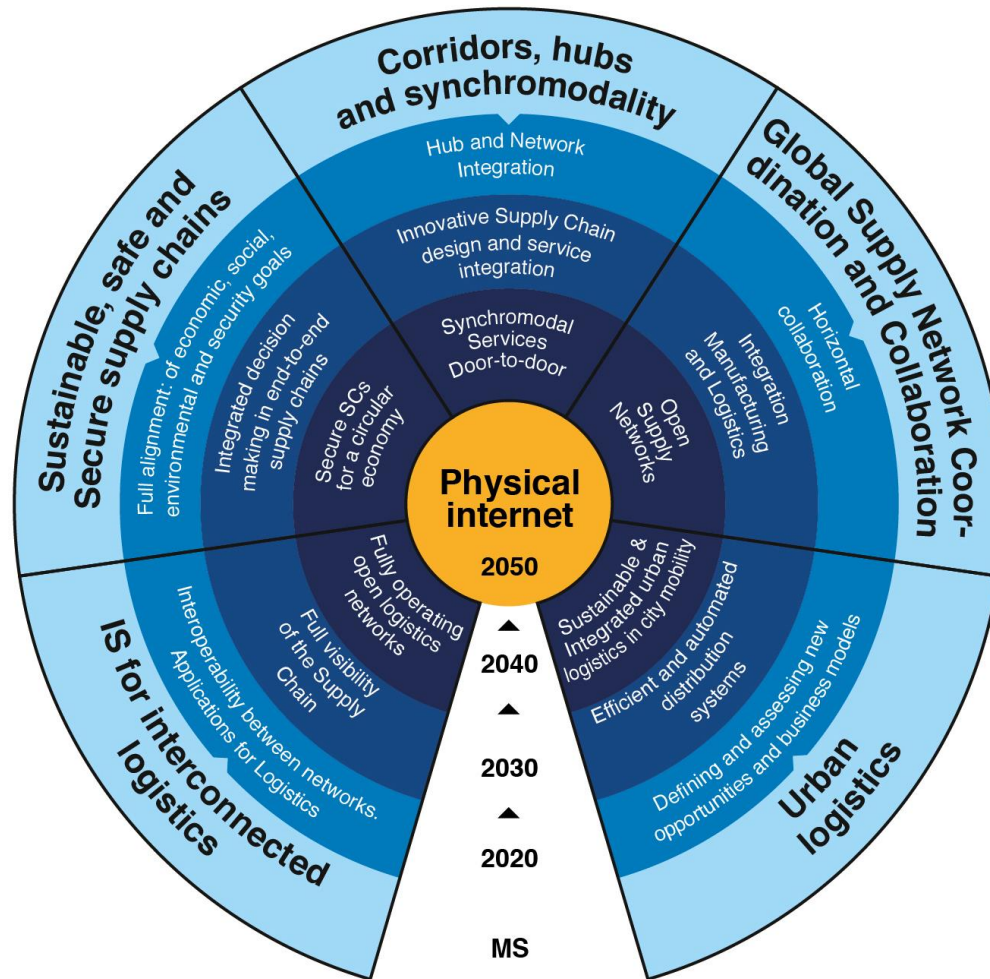
Multiple Fulfillment Methods

- Stores
- Warehouse
- Suppliers
- 3PL Networks
- Deconsolidation Centers
- Own fleet/TL/LTL/Parcel
- Delivery/Service Partners

Multiple Blind Spots

- On-hand and ATP Inventory (at stores, DCs, suppliers)
- Order Status
- Shipment Status
- Drop-Ship Status

A PHYSICAL INTERNET, BASED ON STANDARDS, COULD CONCEIVABLE BE IN PLACE BEFORE THE MIDDLE OF CENTURY



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SO WHERE DO YOU GO FROM HERE?

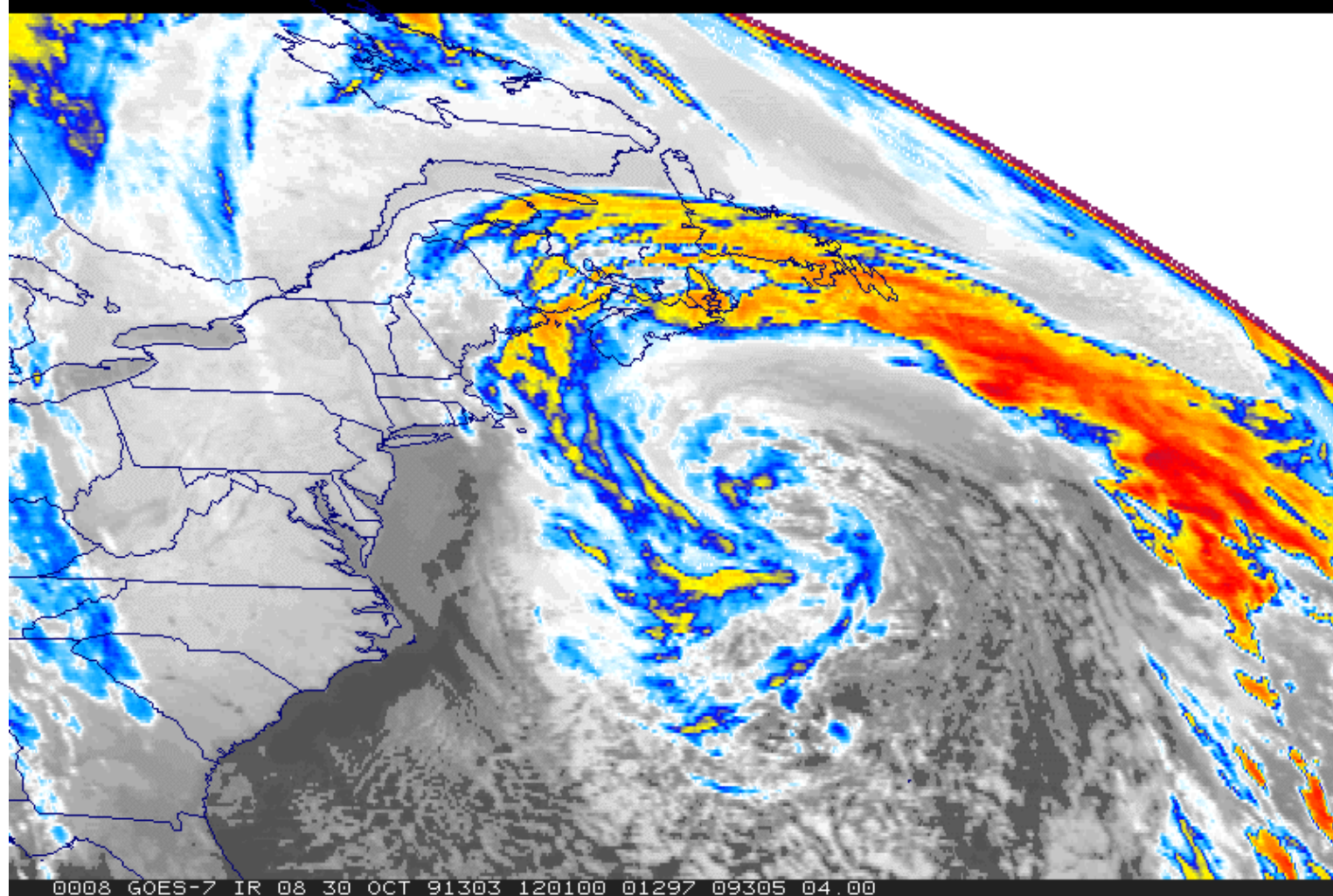


If you don't know where you want to go, well then,
any direction will do 😊

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THE WORLD IS GETTING MORE AND MORE COMPLEX CREATING A PERFECT STORM FOR THOSE PROVIDING LOGISTICS SERVICES



THE CHANGES OCCURRING IN OUR WORLD ENSURE THAT NO MATTER WHAT WE ARE DOING TODAY, OPERATIONS TOMORROW WILL CERTAINLY BE DIFFERENT

- Global change is an important topic for all of us
- Global operations and changing market pressures are challenging current “taken for granted” models
- New thoughts and ideas are needed to allow industry to move beyond where it is today
- If we do not take action ourselves governments and non-traditional competitors will make decisions for us
- Creative new approaches, e.g., the Physical Internet, will be required to achieve the goals needed
- It is truly time to “go where no one has gone before”



Thank you for your attention!

Prof. Dr. J. Rod Franklin
The Kühne Logistics University
+49 40 328 707 231
rod.franklin@the-klu.org



As long as I live, I'll hear waterfalls and birds and winds sing. I'll interpret the rocks, learn the language of flood, storm, and the avalanche. I'll acquaint myself with the glaciers and wild gardens, and get as near the heart of the world as I can.

John Muir