

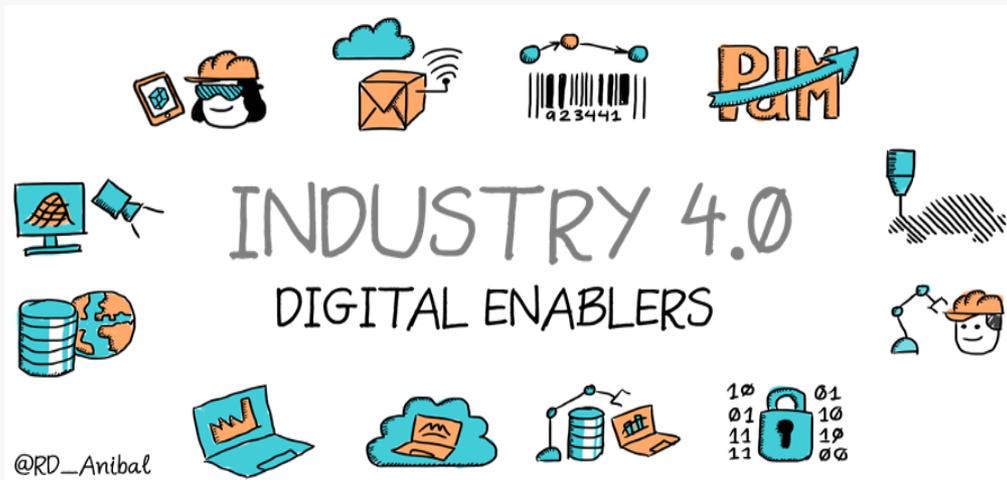
# INDUSTRY 4.0

## For

### INTELLIGENT and

### SMART

### TRANSPORTATION



Nov. 13, 2019

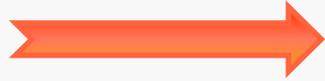


# Is it Evolution or Revolution?



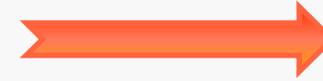
Early Carriage

Evolution



More Fancy

Revolution



Early Automobile



Vintage Analog Phone

Evolution



Fancy Digital Phone

Revolution

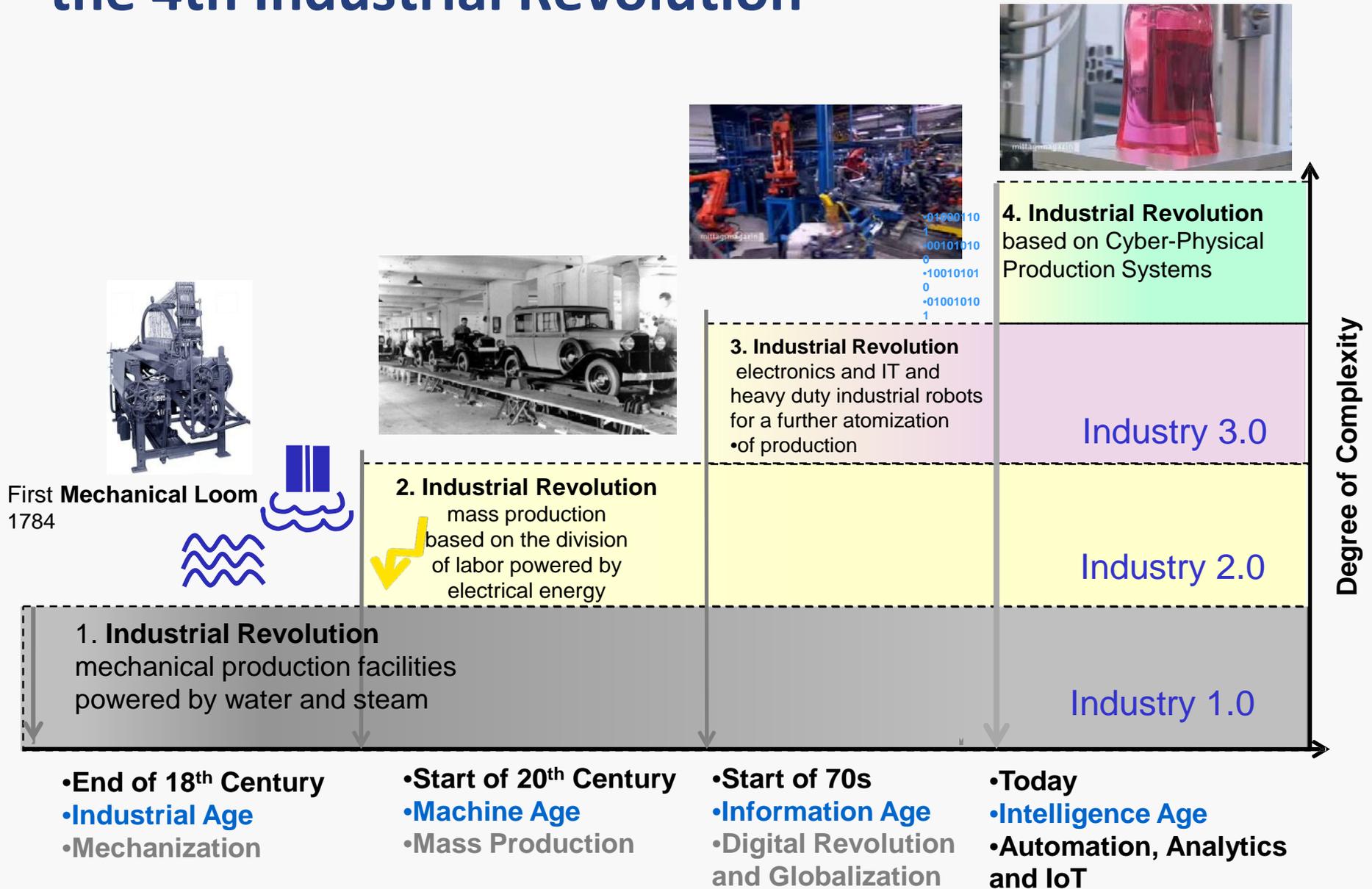


Smart Internet Phone

Entrigna Inc. Internet of Things Virtual Conference 16

- **Evolution** - A gradual process in which something changes progressively from one stage to another
- **Revolution** - A total turn around; a sudden, complete, or fundamentally radical change in something
- Typically, Revolution leads to further Evolution – For example, Invention of Automobile was Revolutionary however innovations such as Ground Mail and Commercial Transportation evolved Automobile invention into a Commercial Enterprise

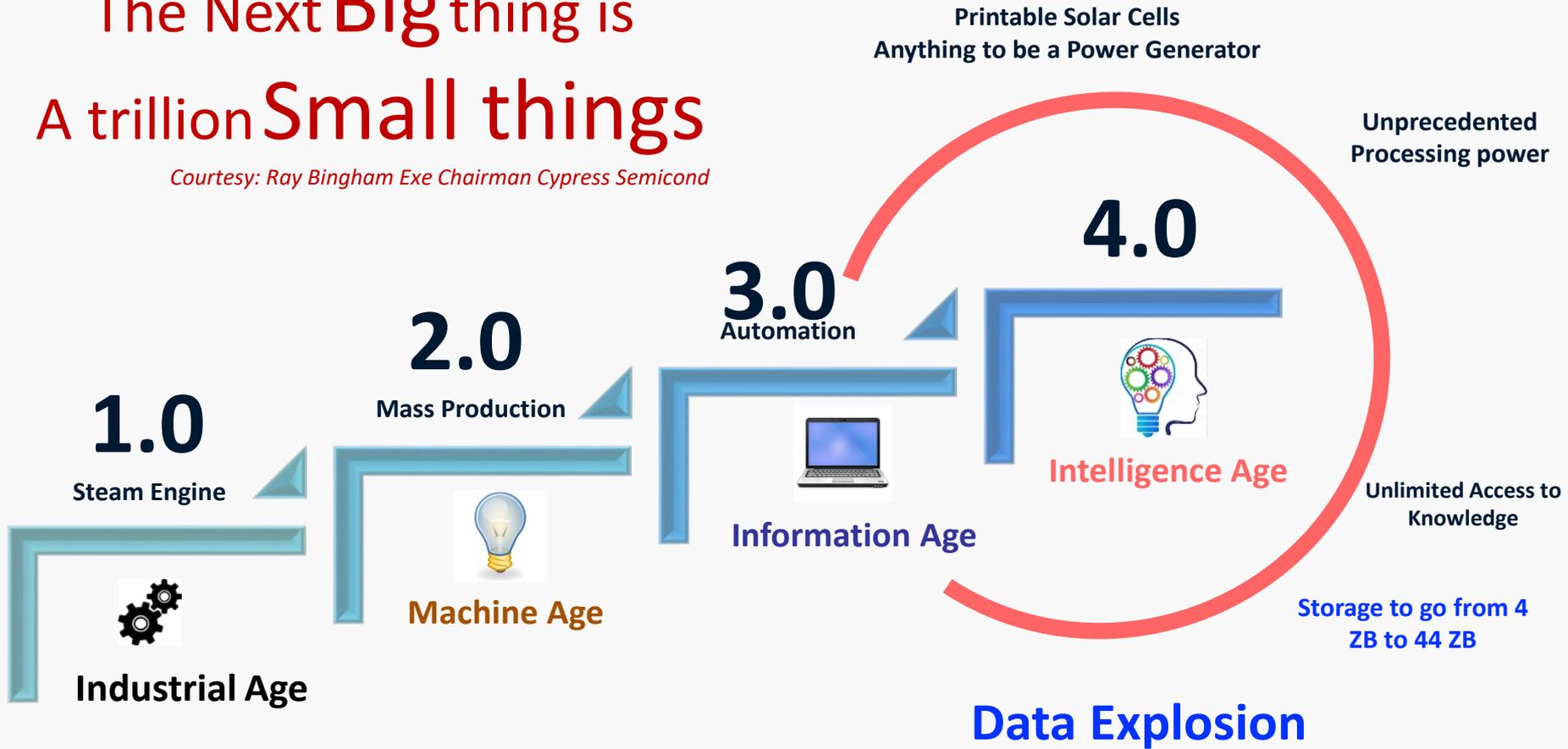
# From Industry 1.0 to Industry 4.0: Towards the 4th Industrial Revolution



# Start of another Industrial Revolution..

The Next **Big** thing is  
A trillion **Small** things

*Courtesy: Ray Bingham Exe Chairman Cypress Semicond*



# Global Transformation on Industrial Revolution 4.0



Smart Production



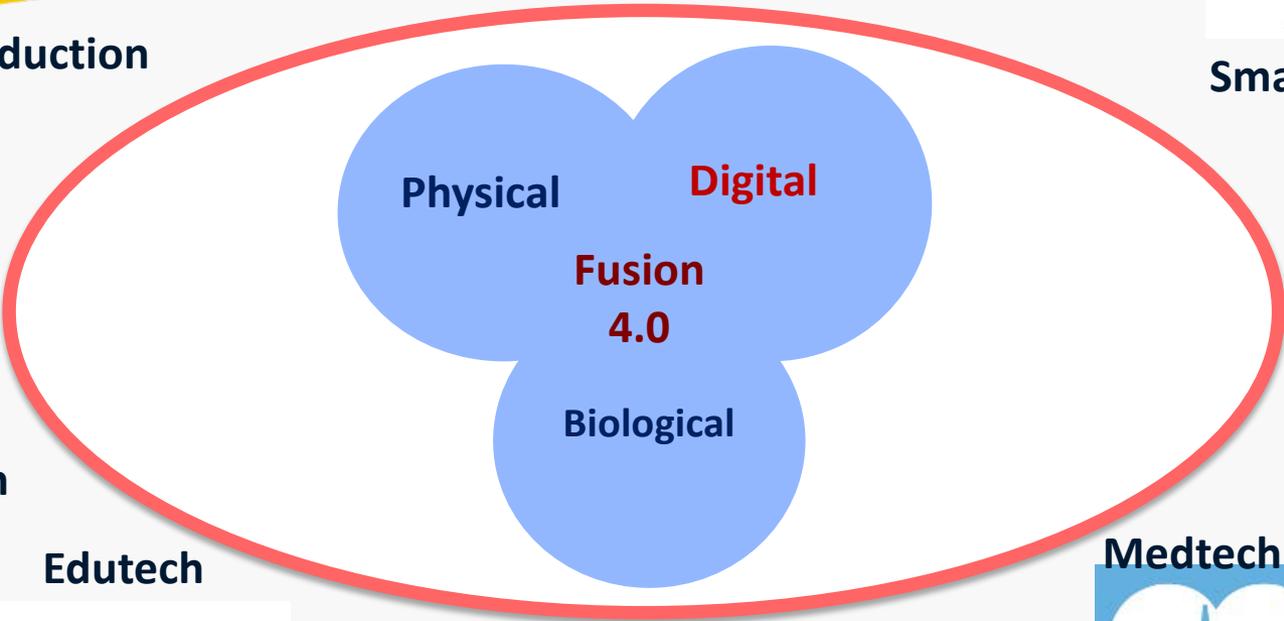
Connected Mobility



Smart Retail



Home Automation



Smart Decision

Edutech



Medtech



Smart Logistics



# Data is the Next Oil

*Mukesh Ambani, 2017*



**Oil Wells**



**Oil Production**



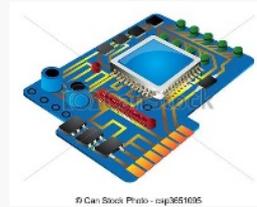
**Refinery**



**Transportation**



**Pump**



**Data Sensing and generation**



**Data collection**



**Data Analytics**

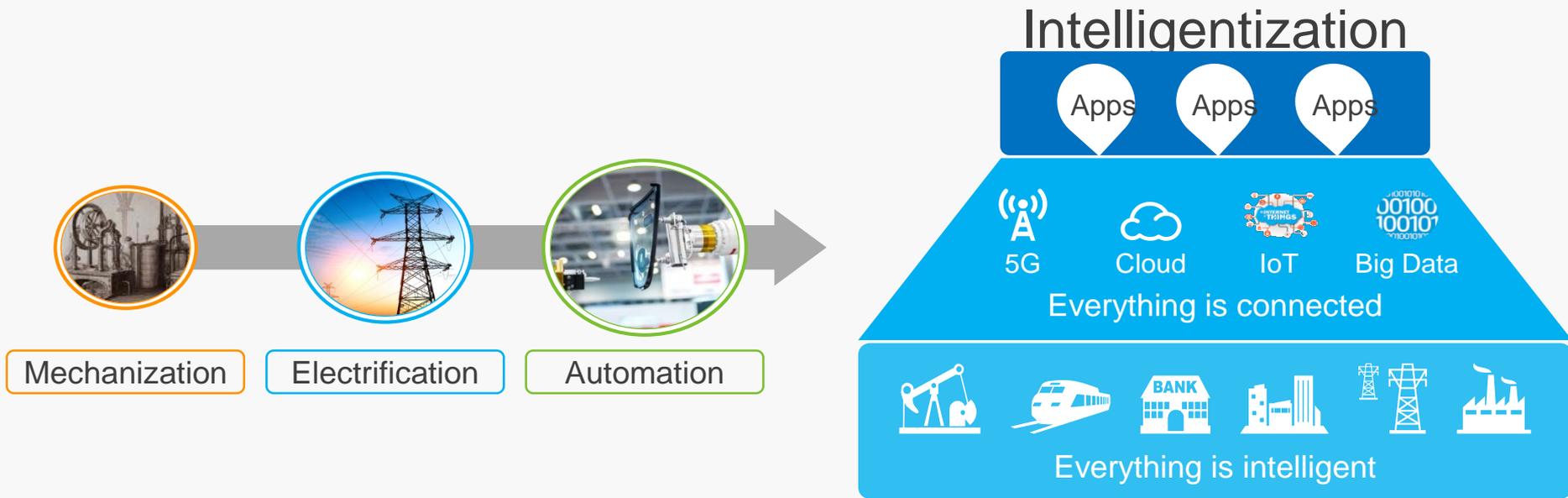


**IoT  
Intelligence of Things**



**Data Centre &  
Storage**

# ICT is Enabling the Fourth Industrial Revolution – Intelligentization

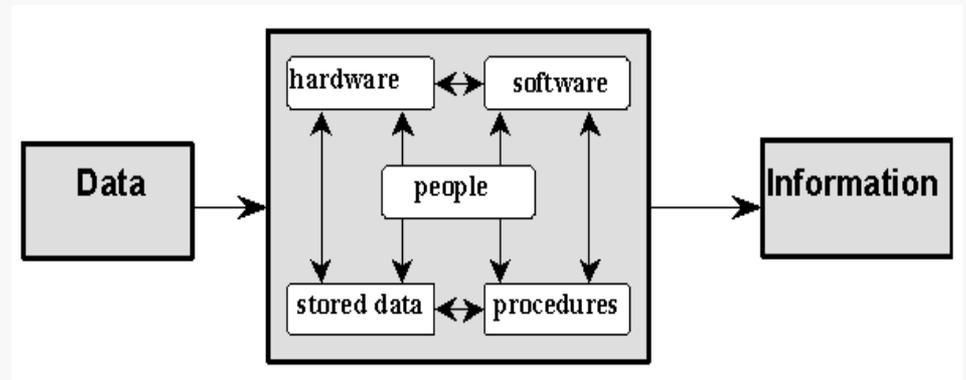
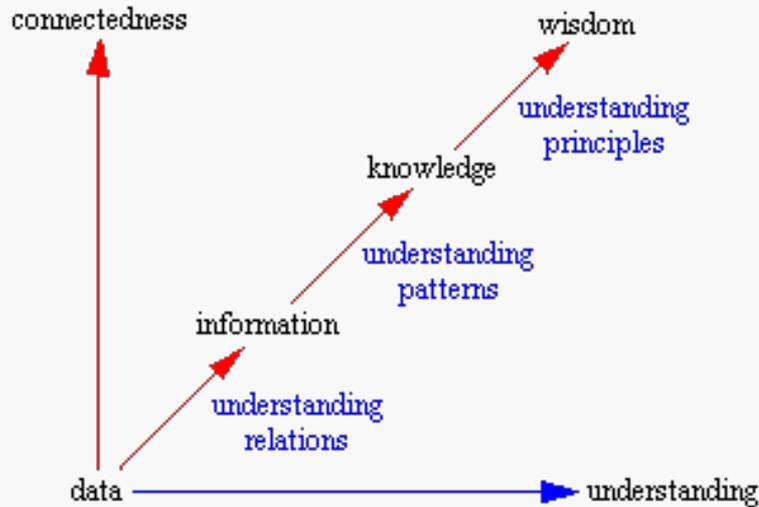
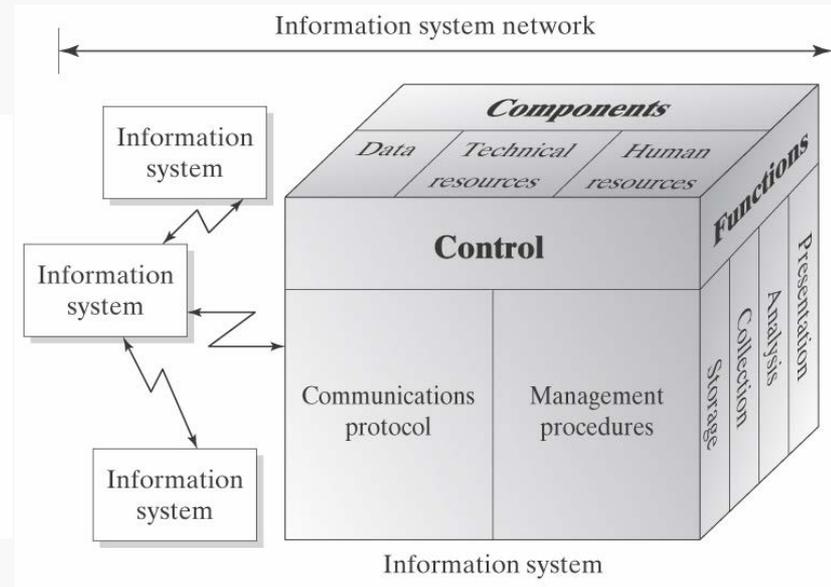
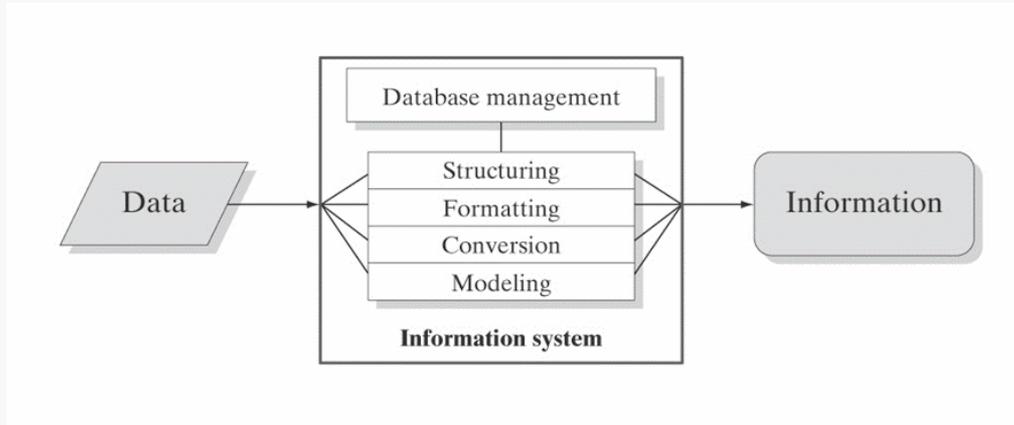


- Following mechanization, electrification, and automation, we are now standing on the threshold of the fourth industrial revolution – intelligentization. Intelligence will be embedded into everything, including business processes.
- ICT technologies such as mobility, cloud, Big Data, and IoT will form the foundation of intelligentization.

# Data, Information, Intelligence

- ➔ **Data** - raw facts that describe the characteristic of an event
- ➔ **Information** - data converted into a meaningful and useful context
- ➔ **Intelligence** – applications and technologies that are used to gather, provide access to, and analyze data and information to support decision-making efforts

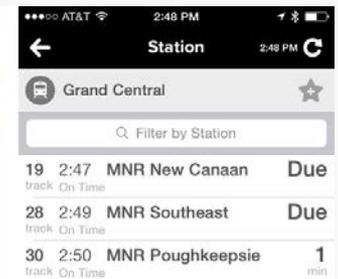
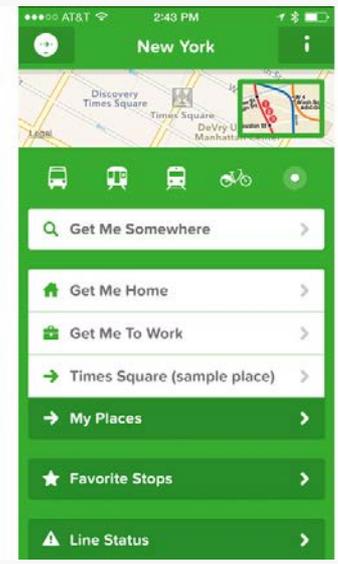
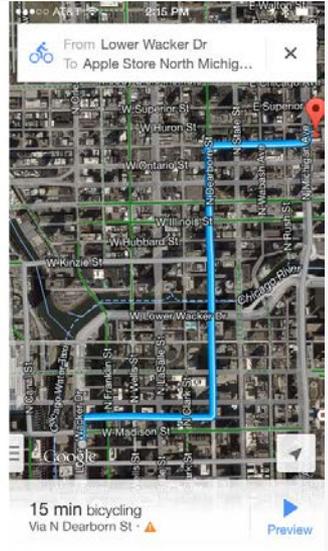
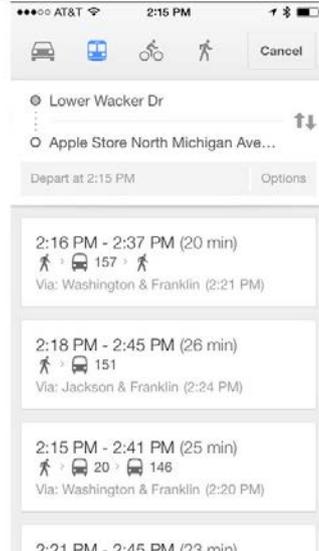
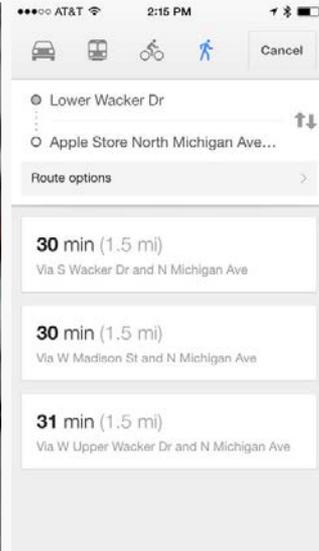
# Intelligent Transportation Systems

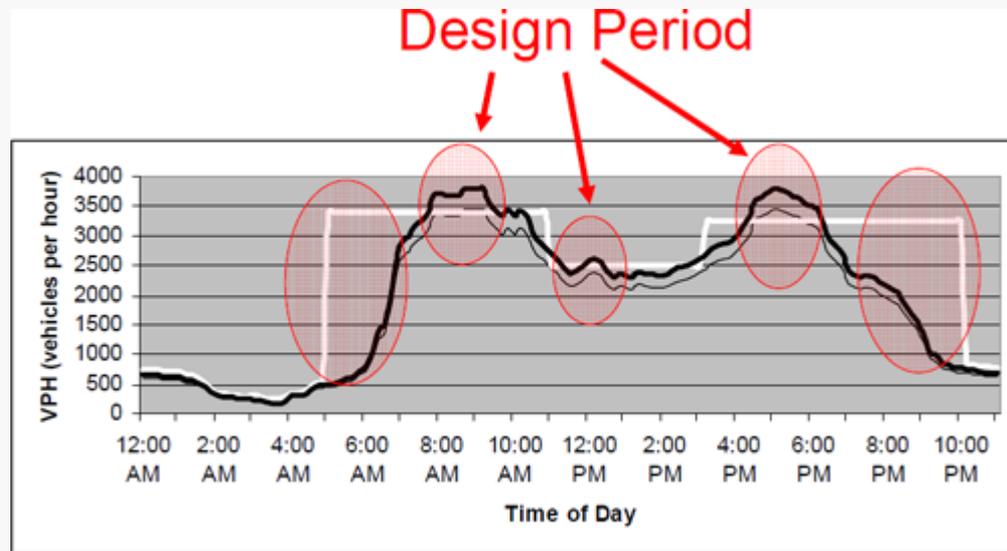
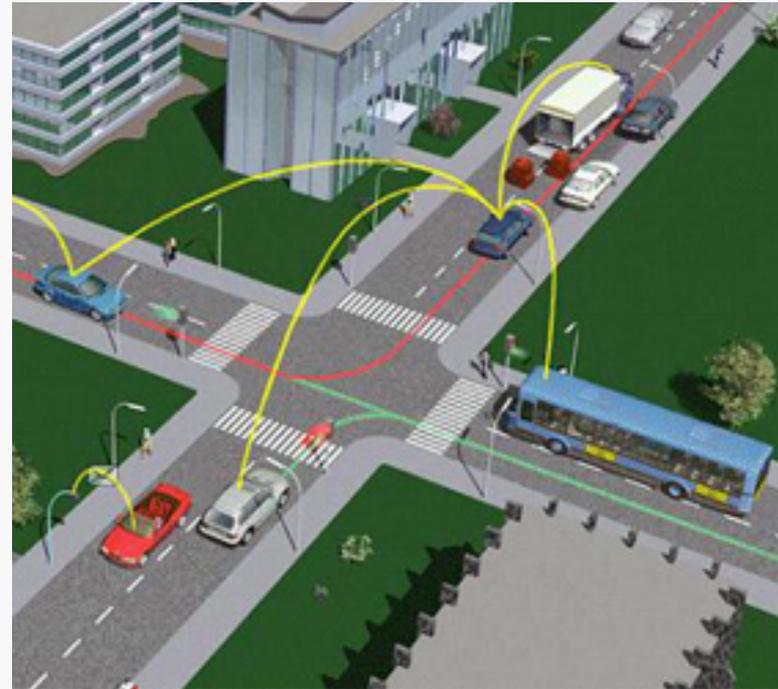
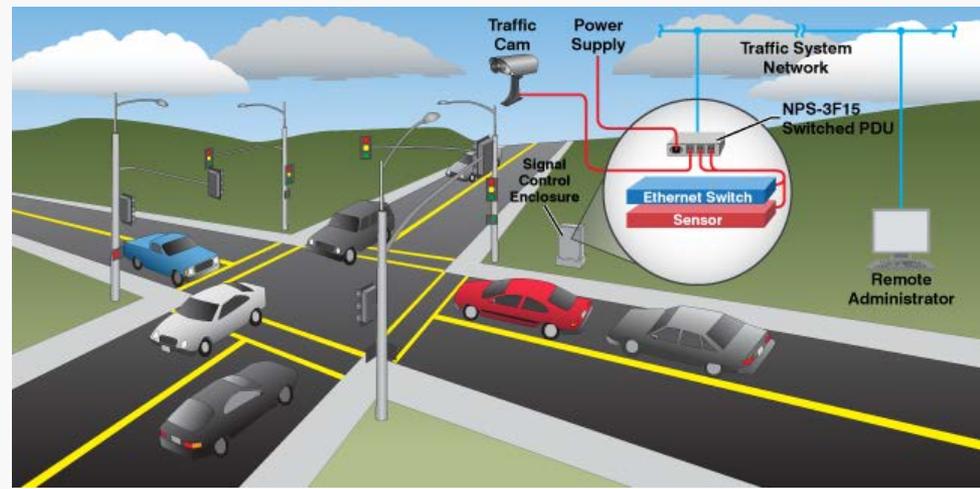


Schultheis & Sumner's system model of an information system (Schultheis, 1998: 40)

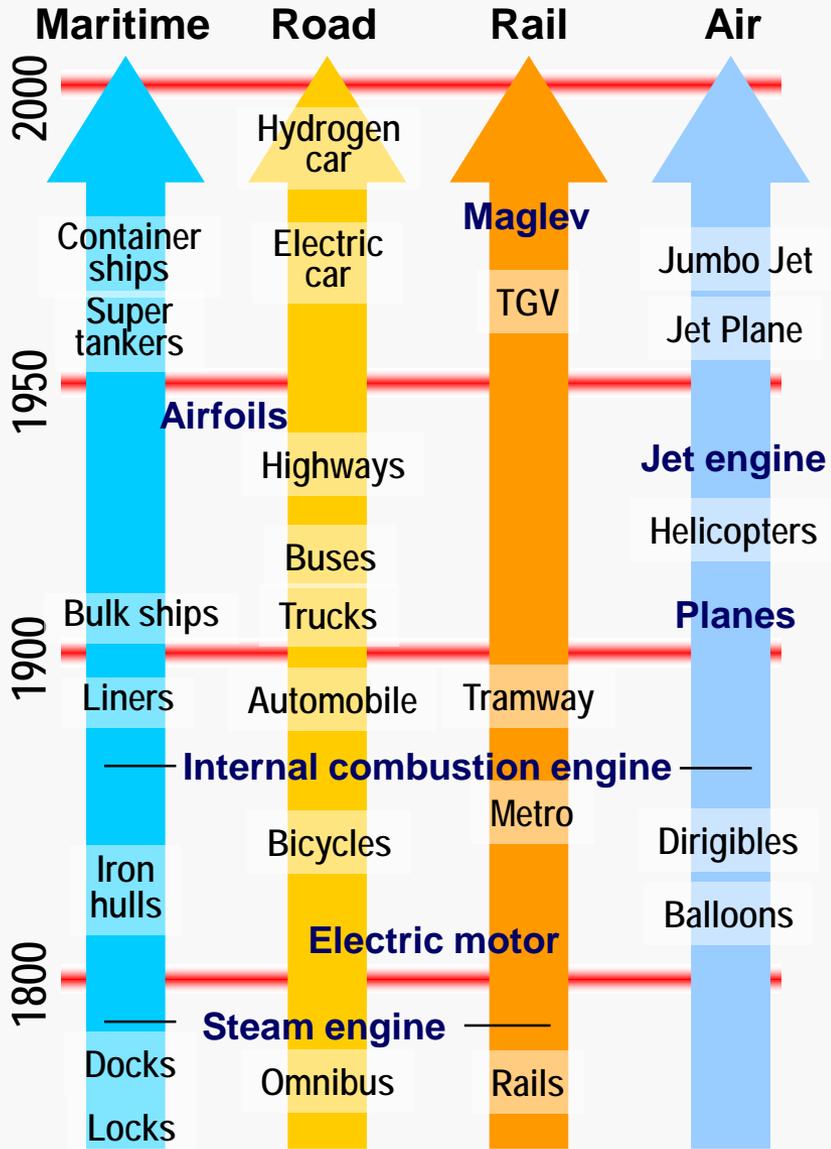
## Data, Information, Knowledge, and Wisdom

Data, Information, Knowledge, and Wisdom by [Gene Bellinger](#), [Durval Castro](#), [Anthony Mills](#)



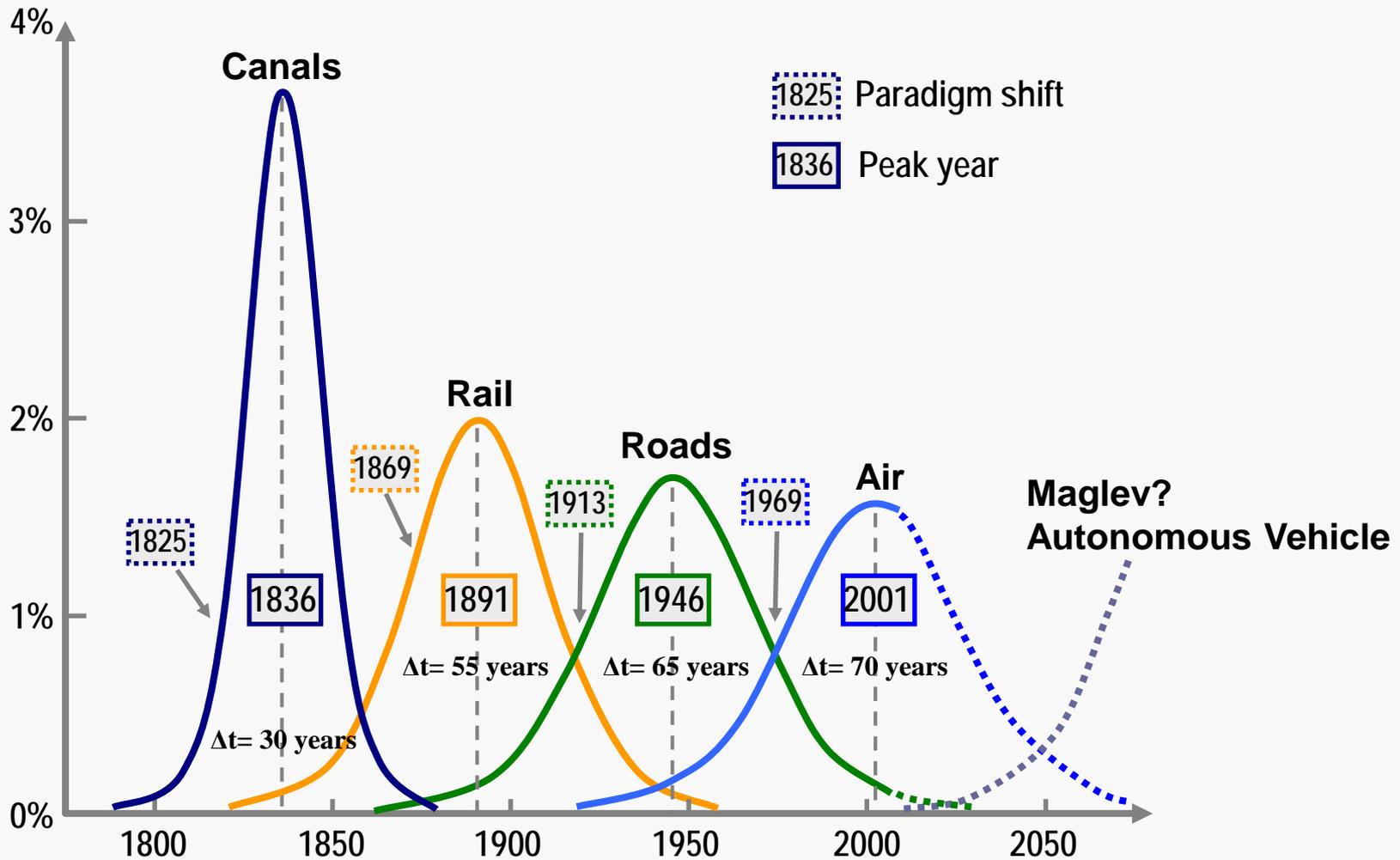


# Evolution of the Transportation Technology, 1750-2000



•Source: adapted from Williams, A. (1992) "Transport and the Future", in B.S. Hoyle and R.D. Knowles (1992) Modern Transport Geography, London: Belhaven Press, pp. 257-270.

# Growth of the Transportation System, 19<sup>th</sup> – 21<sup>st</sup> Century



# Evolving Transportation Ecosystem

- Population growth
- Changes in demographics
- Highest transit ridership
- Technological advances
- Financial and infrastructure challenges
- Need new approach to meet challenges of tomorrow

## ***TRADITIONAL ITS ENABLED***

- Privately owned vehicles
- Lack of mobility options
- Services in Siloes

- Integrated services and payment
- Transit prioritization
- Trip planning applications

## ***TRENDING***

- Mobility options presented through mobile technology
- Personalized mobility choices
- Growing shared use business models

## ***CONNECTED***

- Real-time multimodal information
- Dynamic management of infrastructure
- Universal payment systems

## ***SMART***

- Automated vehicles
- Seamless mobility connections
- Predictive data and real-time info exchange

# Advanced Technologies and Smart Cities

Technology convergence will revolutionize transportation, dramatically improving safety and mobility while reducing costs and environmental impacts

Connected Vehicles

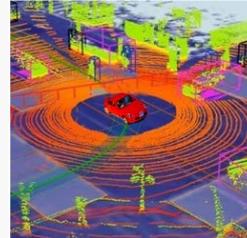
Vehicle Automation

Internet of Things

Machine Learning

Big Data

Mobility on Demand



Connected-Automated Vehicles



Smart Cities

## Benefits

- Order of magnitude safety improvements
- Reduced congestion
- Reduced emissions and use of fossil fuels
- Improved access to jobs and services
- Reduced transportation costs for gov't and users
- Improved accessibility and mobility

# Beyond Traffic: The Smart City Challenge

## Technology Elements (*Highest Priority*)



**Vision Element #1**  
Urban Automation



**Vision Element #2**  
Connected Vehicles



**Vision Element #3**  
Intelligent, Sensor-Based Infrastructure

## Innovative Approaches to Urban Transportation Elements (*High Priority*)



**Vision Element #4**  
User-Focused Mobility Services and Choices



**Vision Element #5**  
Urban Analytics



**Vision Element #6**  
Urban Delivery and Logistics



**Vision Element #7**  
Strategic Business Models & Partnering

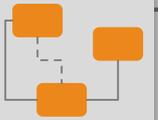


**Vision Element #8**  
Smart Grid, Roadway Electrification, & EVs



**Vision Element #9**  
Connected, Involved Citizens

## Smart City Elements (*Priority*)



**Vision Element #10**  
Architecture and Standards



**Vision Element #11**  
Low-Cost, Efficient, Secure, & Resilient ICT



**Vision Element #12**  
Smart Land Use

# Enabling Technological and Operational Solutions

- New technological and operational solutions have emerged including new business models and partnerships that can be leveraged to solve transportation problems in new ways.
  - Shared Use Economy
  - Advances in ITS
  - Smart Payment and Parking
  - Integration of Data and Systems
  - Connected Travelers
  - Bus Rapid Transit (BRT)
  - Wayfinding and Navigation
  - Open Data Standards
  - Connected Automation
  - Wearable and Mobile Technologies
  - Robotics and Machine Vision
  - Innovative Partnerships and Business Models
  - Transportation Network Companies

# Shared Use Economy

- The sharing economy uses the Internet and mobile apps to allow individuals to monetize underutilized space, assets, and skills.
- New business models are proliferating faster than the legal and regulatory arenas can adapt to them.
- Over the next 30 years, our legal and regulatory system may be increasingly challenged by emerging forms of business and travel that transcend traditional legal and planning concepts.



# On-Demand Services & Ride Sourcing

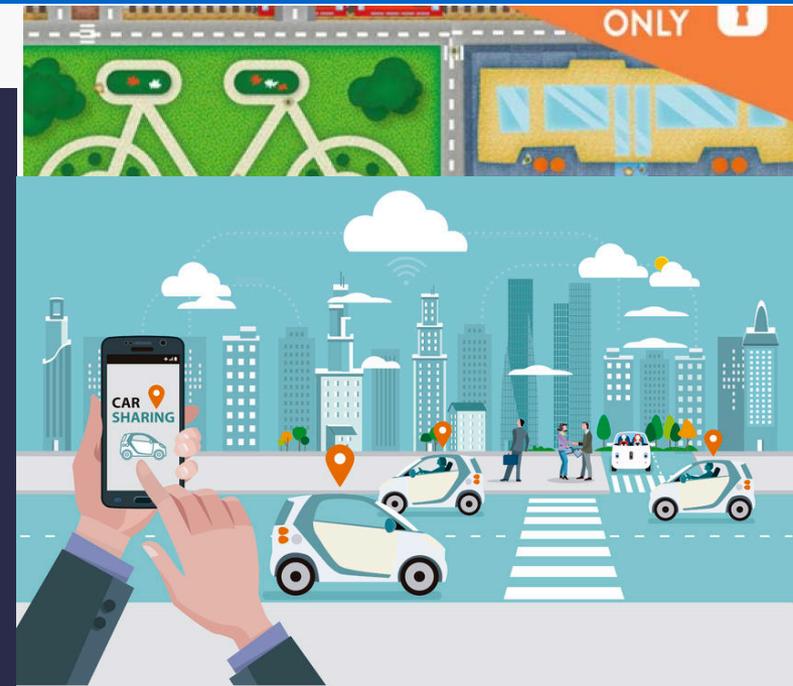
- On-demand systems such as bikesharing and carsharing combined with new ride sourcing application and transportation network companies are changing the people move about.
- Microtransit companies engaging the public sector through new partnerships are changing the way we think about integrating transit and solving first and last mile access issues.
- These new opportunities are changing the way we travel throughout our cities and provide real point-to-point mobility in real-time.



Uber Lyft

# 에타

바로가다, 이동의 기본 타다





# Mobility as a Service (MaaS)

- SEOUL is deploying a systems that integrate various forms of shared and public transport in a single payment network.
- These systems allow people to purchase mobility in real-time, straight from their smartphones.
- Furnish riders with an array of flexible and well-coordinated options so that alternative modes.

**출발** 서울특별시청      **도착** 서울연구원

서울특별시청 → 서울연구원

45분 / 5,100원      요금 통합결제

따릉이 100원, 버스 1200원, 택시3,800원

**오늘의 추천경로**    최소비용    빠른길    이용자맞춤

30분 후 강수 확률 80%  
버스하차 후 택시이용 추천

45분 / 5,100원

🚲 따릉이 / 2분   
 🚌 406번 / 41분   
 🚗 택시 / 2분

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44분 / 5,150원

🚶 도보 / 4분   
 🚇 2호선 / 6분   
 🚝 3호선 / 30분   
 🚗 택시 / 4분

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**따릉이** 서울시청 따릉이 대여소      따릉이 대여신청

따릉이 이동  
소요시간 2분

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**버스** 삼성본관앞(02-131) 따릉이 반납

406번 승차 (3분 후 도착예정, 혼잡도 : 여유)  
소요시간 40분

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**택시** 서울시인재개발원(22-111) 하차      택시 호출

택시승차  
소요시간 2분

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**도착** 서울연구원

## 2019 서울 통합이동서비스(MaaS)

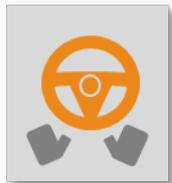


# Autonomous Vehicles

Driverless cars to **maintain a safe distance** from other vehicles and comply with speed limits automatically, hence eliminating human errors

Driverless vehicles can **move in platoon formation** in compact and systematic manner to optimise road capacity





# Connected Automation for Greatest Benefits

## Autonomous Vehicle

Operates in isolation from other vehicles using internal sensors



## Connected Automated Vehicle

Leverages autonomous and connected vehicle capabilities

## Connected Vehicle

Communicates with nearby vehicles and infrastructure



# Connected and Autonomous Cars – Change the Industry

- Business models will change – sale of mobility instead of cars
  - Link between public and private transport
  - Car-sharing
- New competitors
  - IT companies enter the market to get data
  - Auto-companies developing new business models to incorporate the collected data
- New products, new production methods
- Will the Automobile supplier become a contract manufacturer for the IT industry?

# Industry 4.0

## Six Design Principles in ITS

**Interoperability:** the ability of **cyber-physical systems**, humans and ITS to connect and communicate with each other via the **Internet of Things** and the **Internet of Services**

**Virtualization:** a virtual copy of the Information which is created by linking sensor data (from monitoring physical processes) with virtual models and simulation models

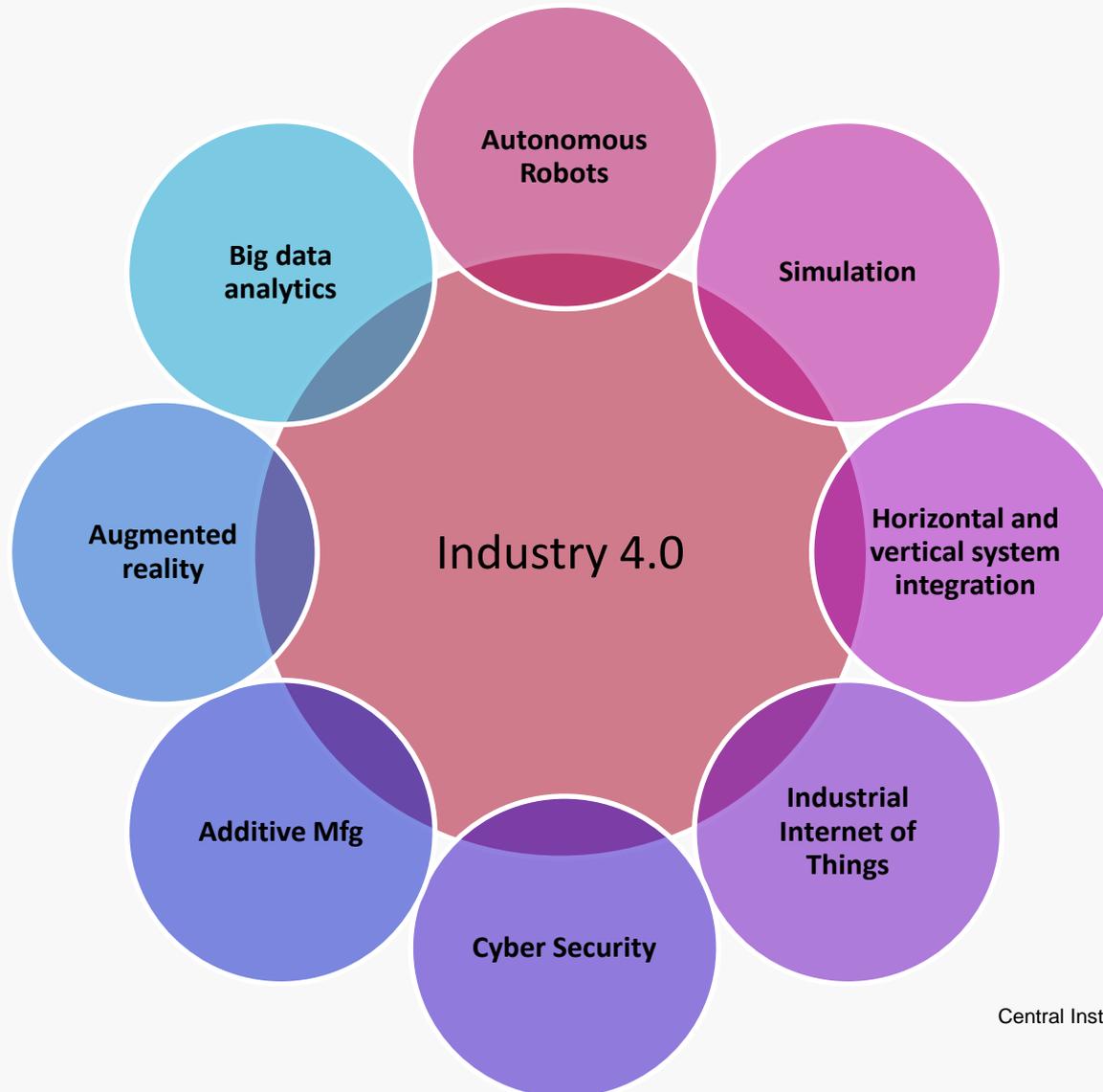
**Decentralization:** the ability of **cyber-physical systems** within ITS to make decisions on their own

**Real-Time Capability:** the capability to collect and analyze data and provide the insights immediately

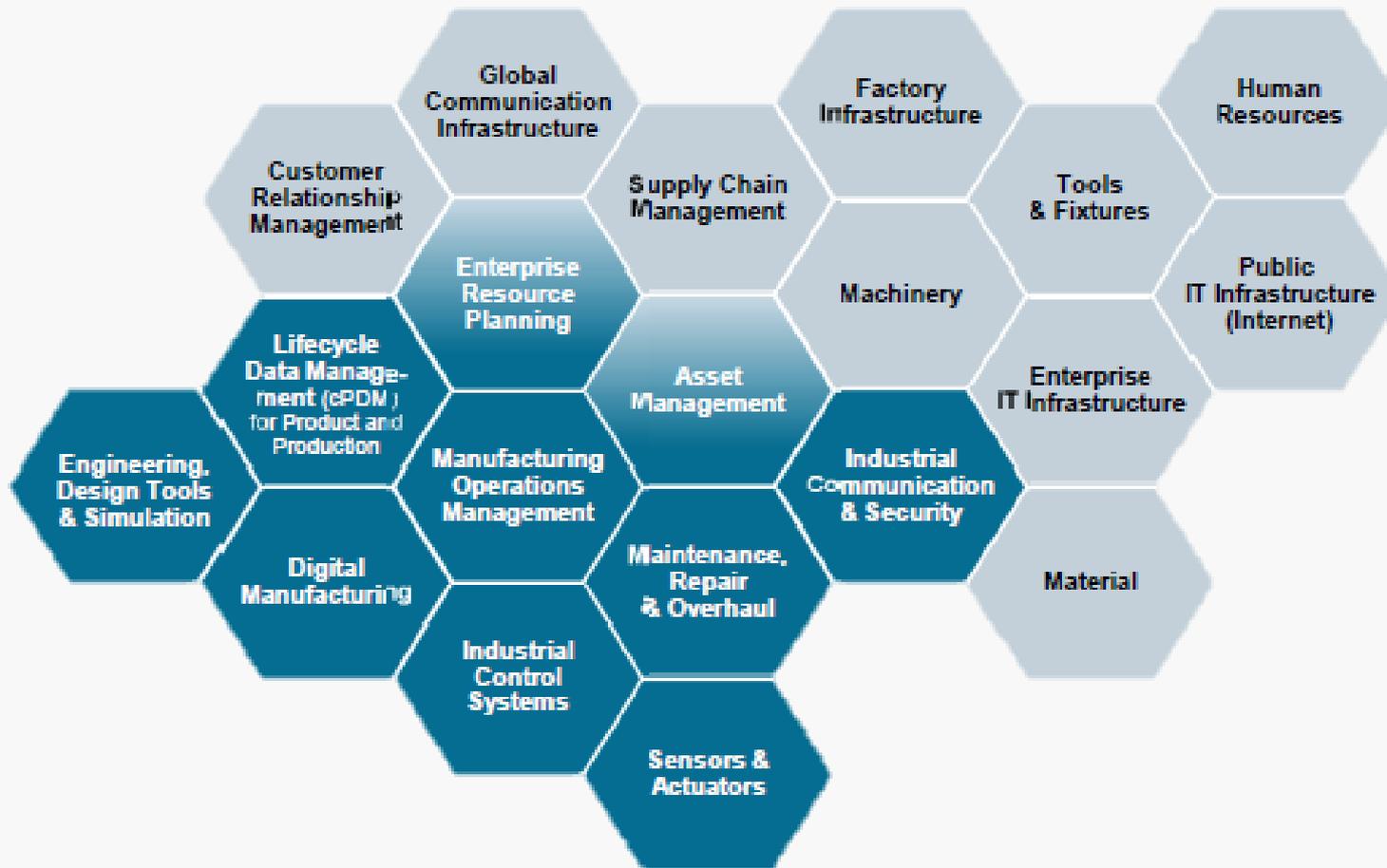
**Service Orientation:** offering of services (of **cyber-physical systems**, humans and ITS) via the **Internet of Services**

**Modularity:** flexible adaptation of ITS for changing requirements of individual services and modules

# Building blocks of Industry 4.0



# Impacting All Aspect of Value Chain



Thank **YOU**

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