



**UiO** : **Department of Technology Systems**  
University of Oslo

**Elektro Fagdag, 22Mar2019, Oslo Met**

# **Tingenes Internett (IoT - Internet of Things) Hvordan vil det forme framtiden for forbruker og fagfolk?**

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## Outline

***“The last time I was connected by wire was at birth”***

- Mobile development
  - ➔ From Network development
  - ➔ To 6G and Internet of Things (IoT)
- Change in Business
  - ➔ New Models, new Actors,
  - ➔ IoT Economy
- Security, Privacy, Internet and net-neutrality
  - ➔ Sustainability
  - ➔ India: “We have been colonised once...”



## Conclusions



# The Internet of Things (IoT)

- IoT =
  - ➔ Things +
  - ➔ Internet +
  - ➔ Semantics
- Things that communicate
  - ➔ with Things: computer,
  - ➔ understand the meaning,
  - ➔ takes own decisions

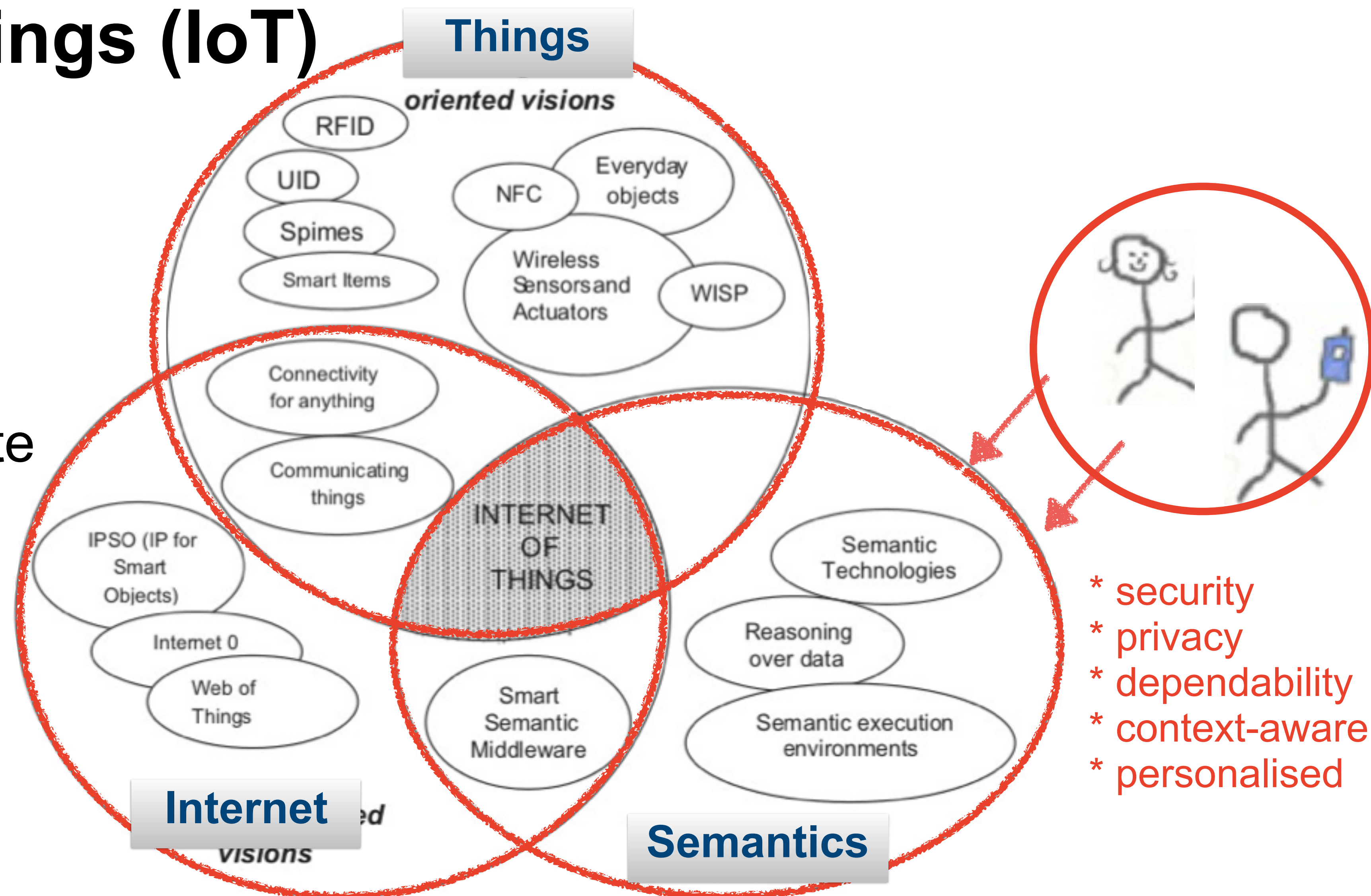


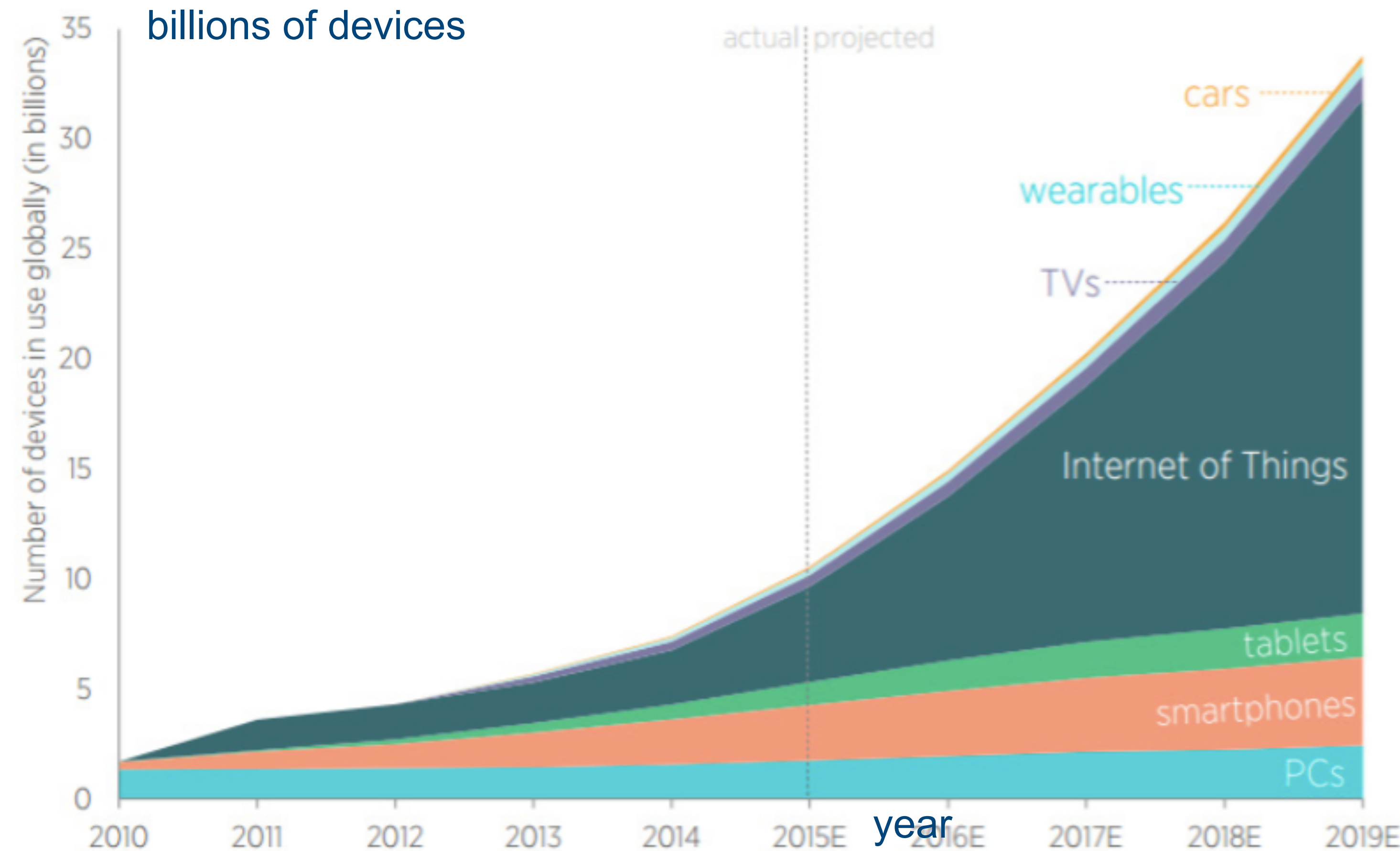
Fig. 1. "Internet of Things" paradigm as a result of the convergence of different visions.



# IoT expected impact, only for “the connected”?

[Source: A. Thinner and A. Castillo, 2015]

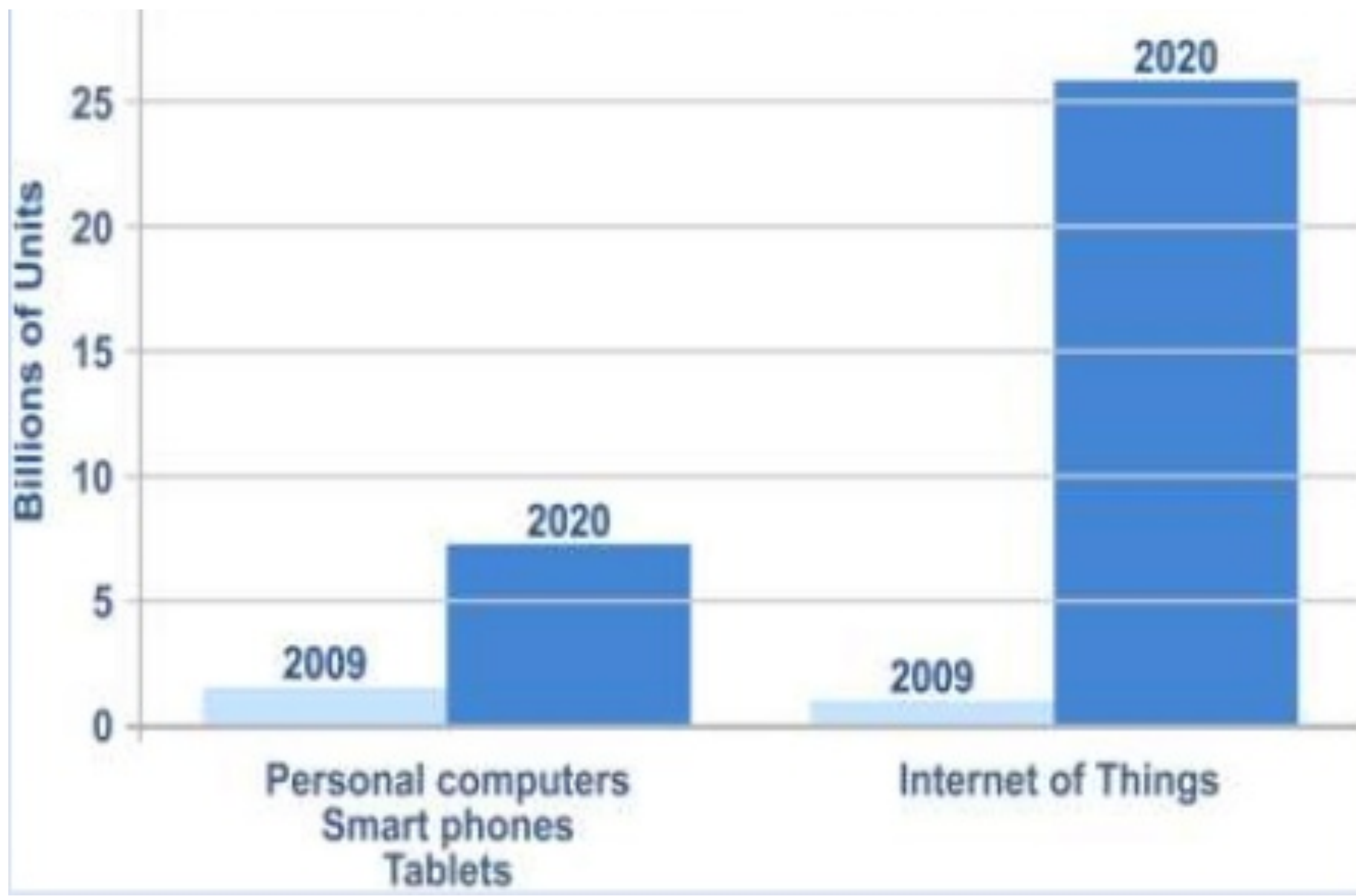
- Smart home appliances, “wearables”, smart metering, autonomous vehicles,...
- 10 billion (2013) -> 19 - 40 billion (2019)
- total global impact: US\$ 2.7 - 14.4 trillion by 2025
- ~3/4 of devices from IoT++  
~1/4 from tablet, mobile,...



Source: John Greenough, “The Internet of Everything 2015,” *Business Insider Intelligence*. Produced by Adam Thierer and Andrea Castillo, Mercatus Center at George Mason University, 2015.

## IoT - 10 x impact of Internet

### Commercial & Consumer M2M Device Connections Worldwide 2020



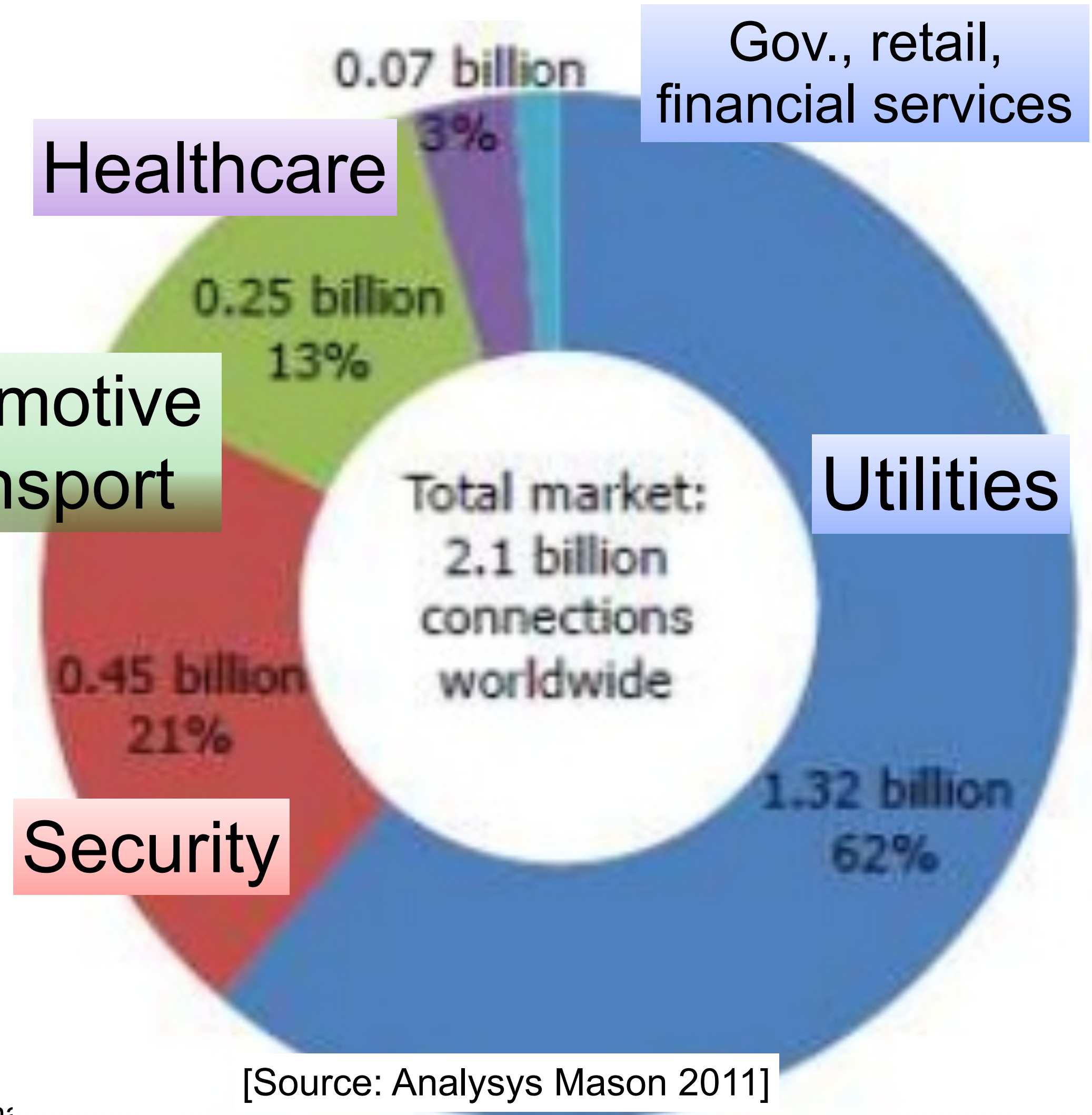
Automotive  
Transport

Security

Healthcare

Gov., retail,  
financial services

Utilities



[Source: Analysys Mason 2011]

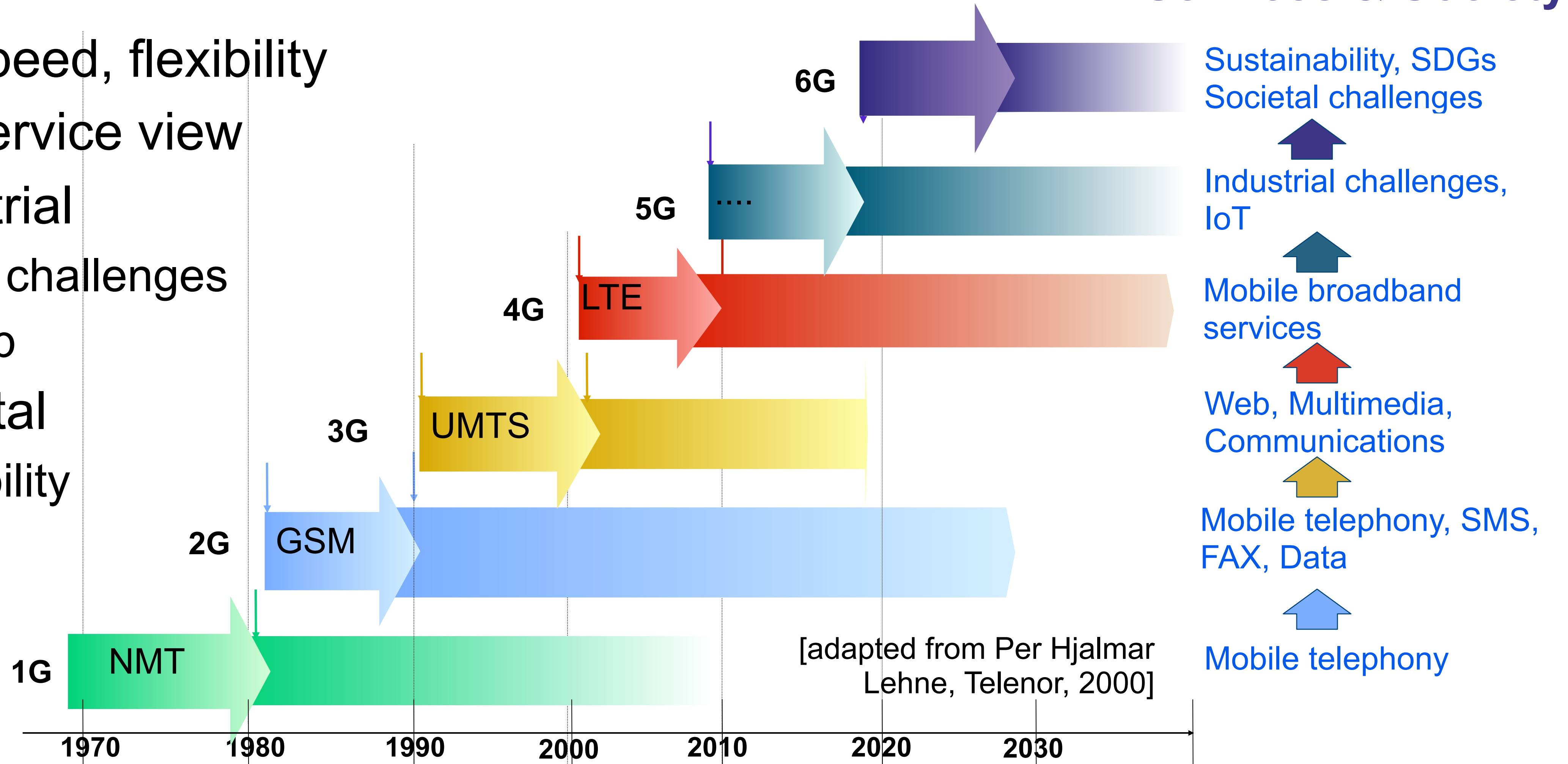
# Mobile Development

## - 5G and 6G



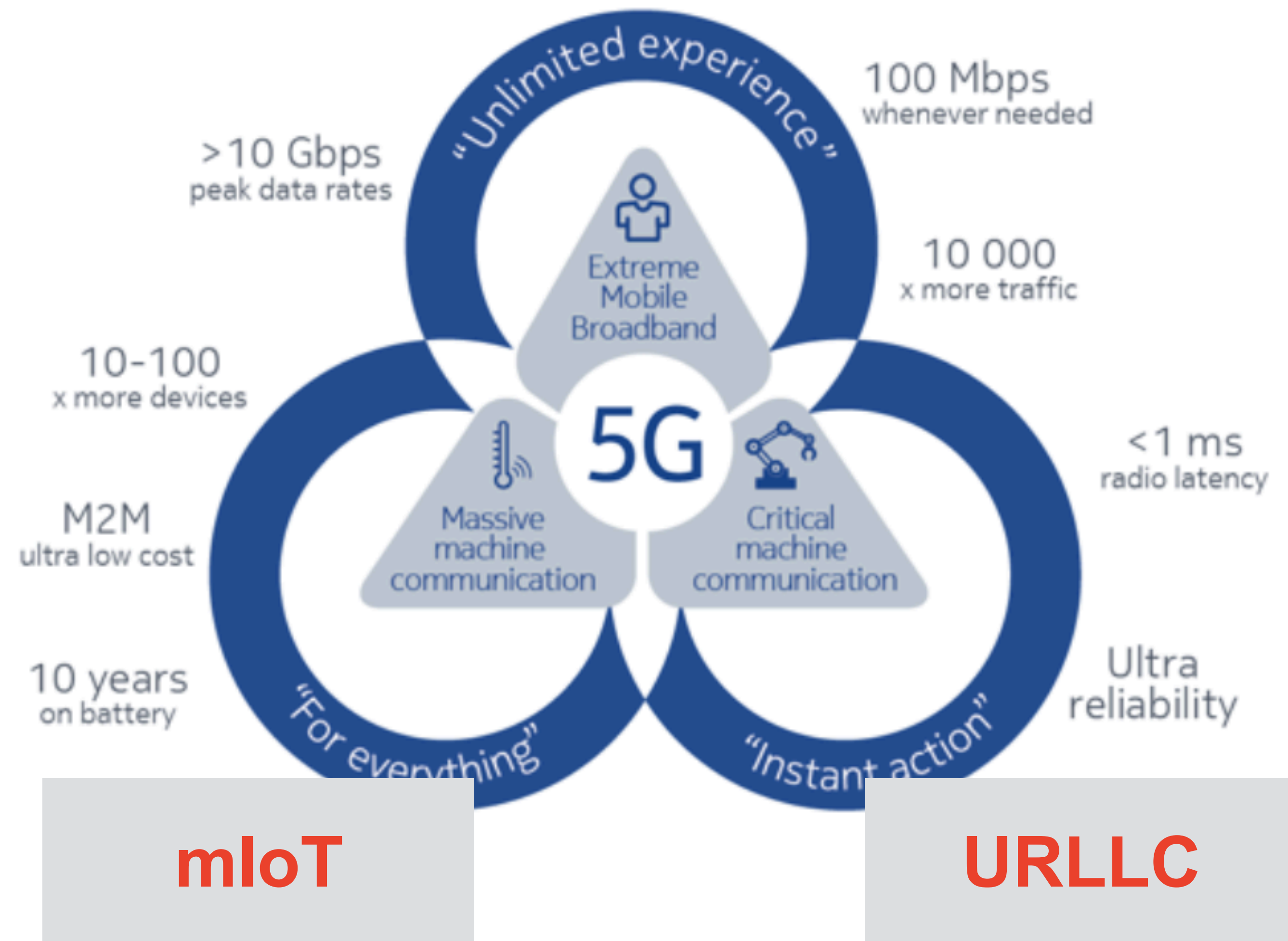
## 6G: Digitisation of the Society

- 1G-3G: Speed, flexibility
- 3G-4G: Service view
- 5G: Industrial
  - ➔ Business challenges
  - ➔ ownership
- 6G: Societal
  - ➔ sustainability



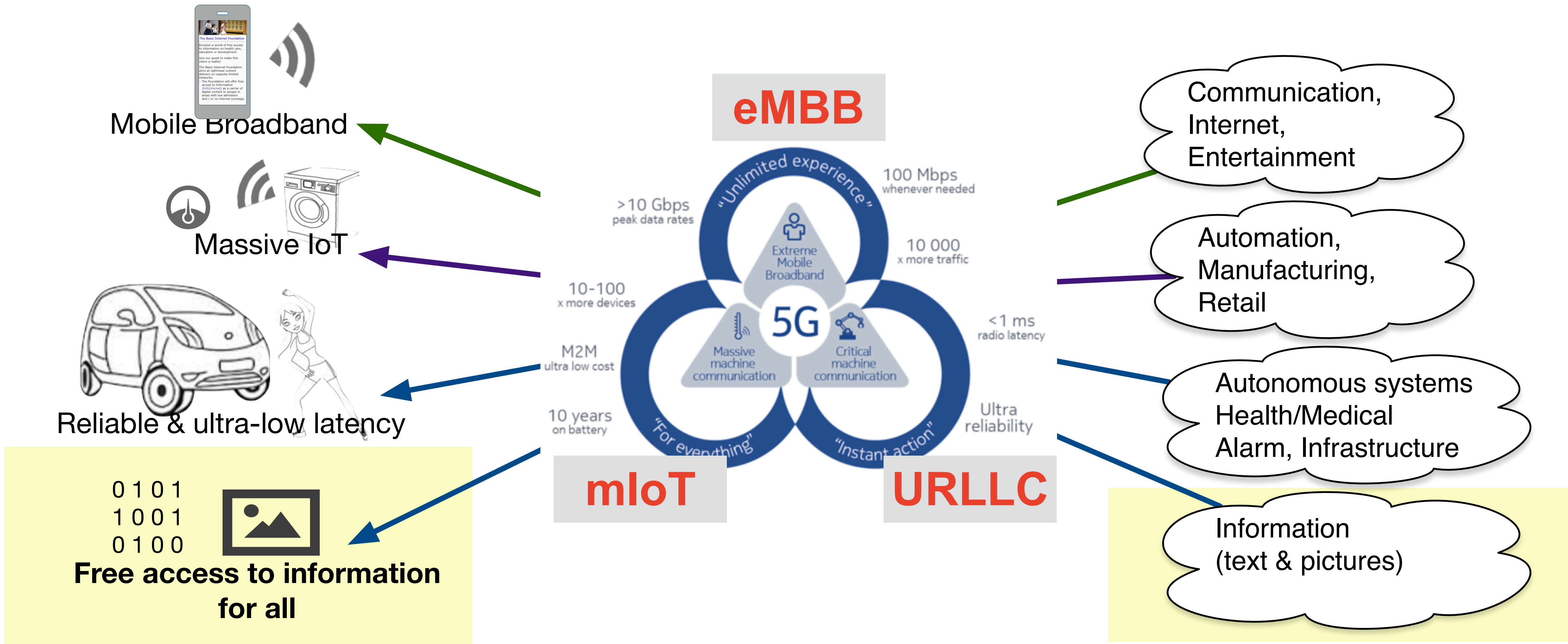
## 5G Goals

- enhances Mobile Broadband
  - ➔ 100 Mbit/s to mobile devices
- massive IoT
  - ➔ Connected and Smart Things
- ultra Reliable, Low Latency communication
  - ➔ Latency <1 ms
  - Reliability >99.999%



[source: Nokia <https://networks.nokia.com/5g/get-ready>]

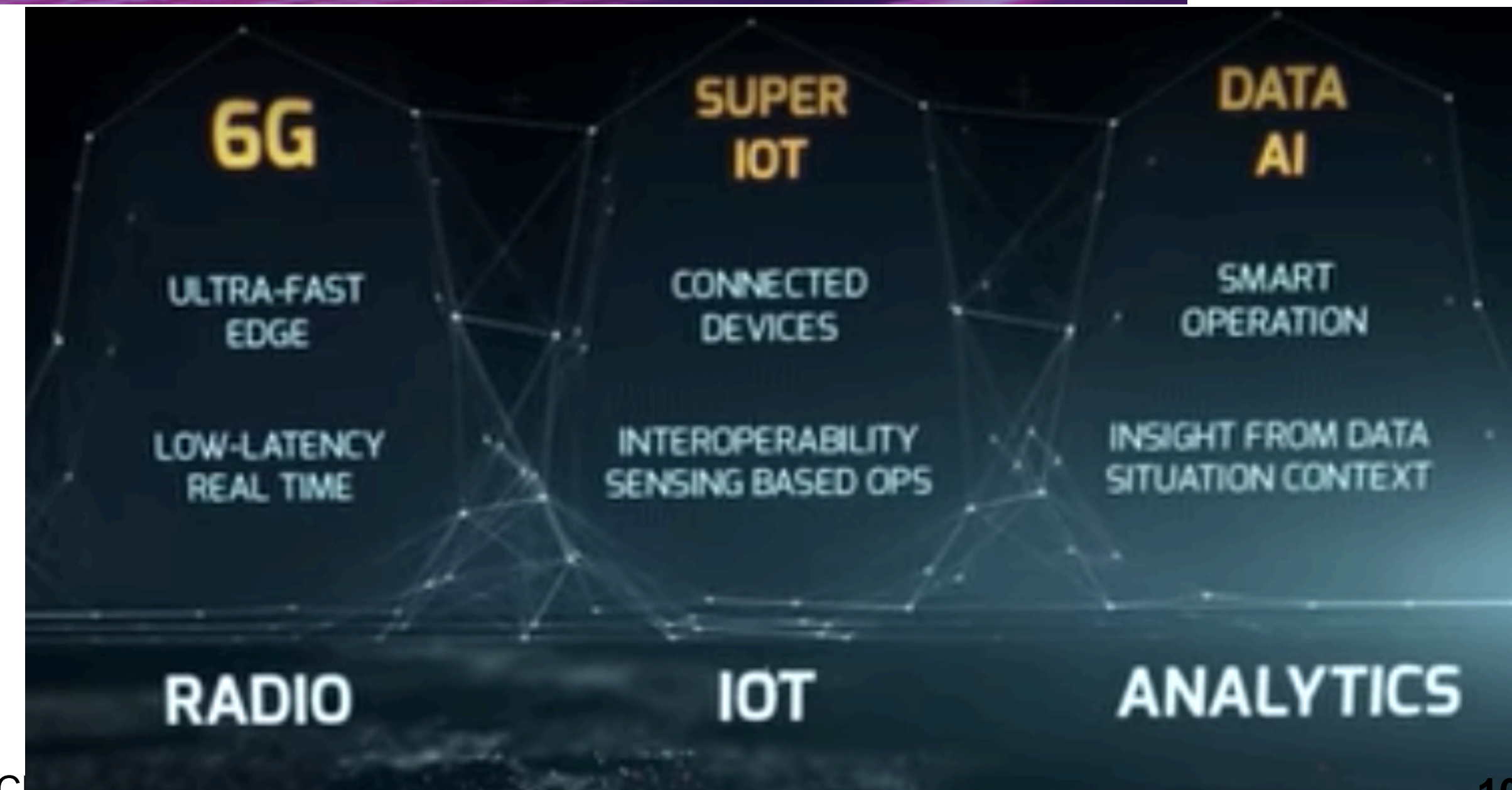
# 5G network slicing for Free Access to Information for All





# 6Genesis.com by Oulu University

- Lighthouse project in Finland
  - ➔ 251 M€ funded
- Goals
  - ➔ Support industry in finalization of 5G
  - ➔ Develop the fundamental technology needed to enable 6G
  - ➔ Speed up digitalization in society
- Focus on Sustainable Development
  - ➔ FI, SE, NO, DK academic collaboration



# The change of Business Models

- **Car industry: Liability in IoT driven business models**
- **Energy: Cost of providing of Energy -> Cost of Reliable Network**
- **Telecom: uO (MicroOperator), Partnership**

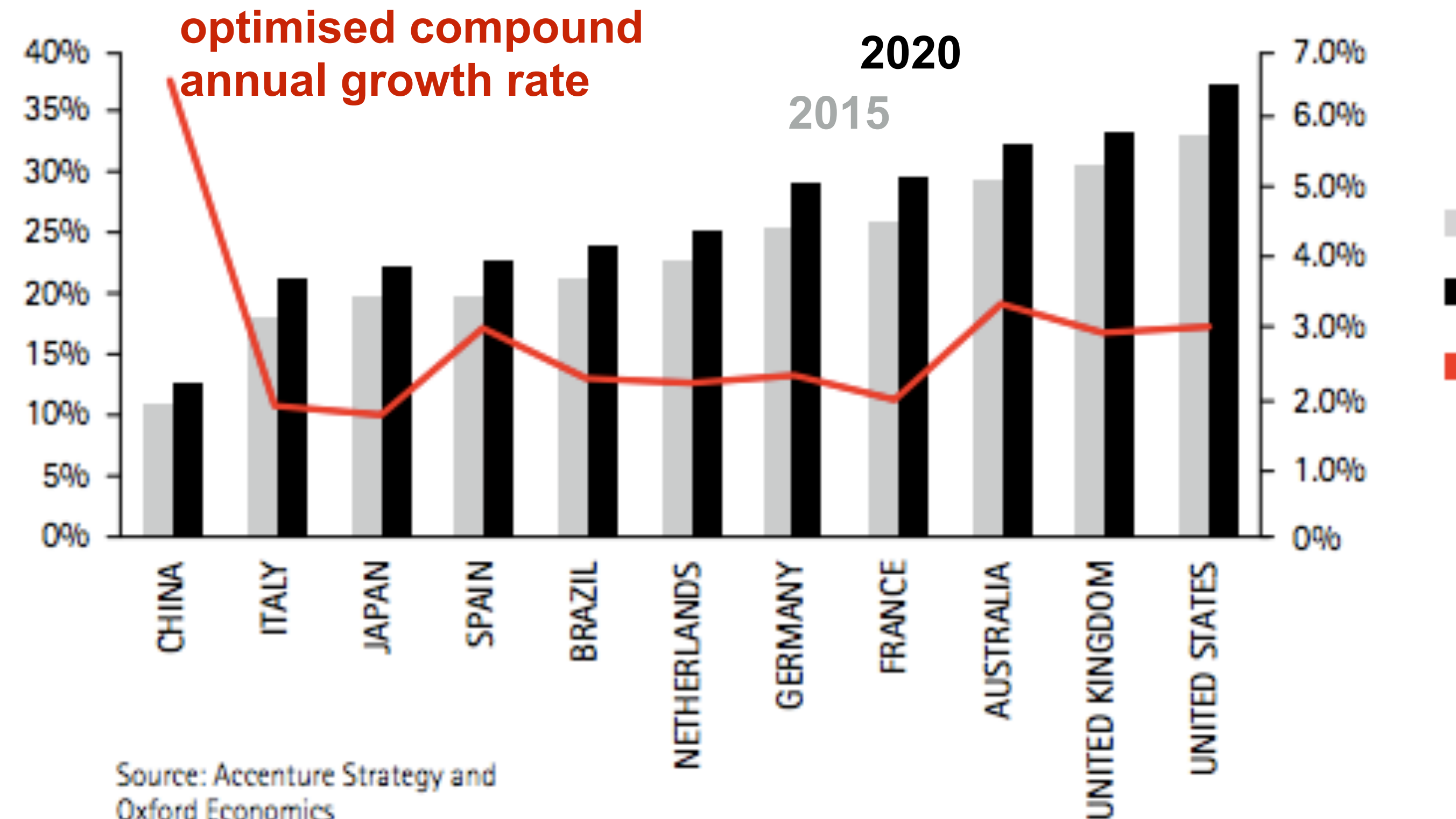


## Digital share of GDP (2015 - 2020)

- Accenture Strategy & Oxford Economics, 2016
- Today: USA, 33% of GDP due to digital
- Financial Services 57% digital  
Business Services 54%  
Communications 47%
- 22% of global retail from digital,  
28% in health,  
20% in consumer goods
- digital achievements: *technology, skills, accelerators*



Figure 1. Country-by-country digital share of gross domestic product (2015 and 2020) showing Compound Annual Growth Rate under optimized scenario\* (right hand axis)



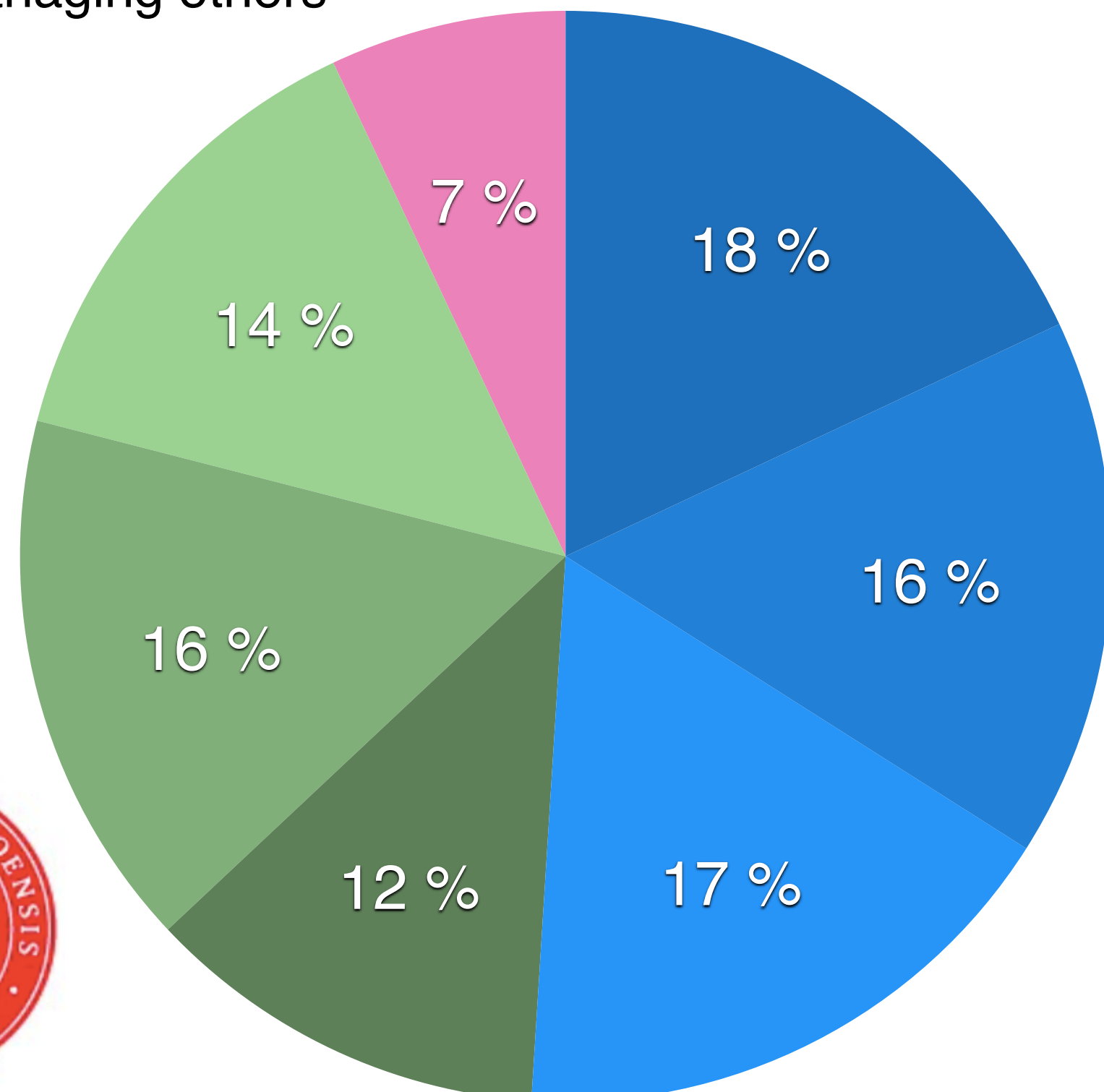
Source: Accenture Strategy and Oxford Economics

[Source: Accenture, "Digital Disruption Growth" 2016]

## The challenge from automation

USA work force time spent [%]

- Predictable physical work
- Data collection
- Stakeholder interactions
- Managing others
- Data processing
- Unpredictable physical work
- Applying Expertise



Technical automation potential 2016 [%]

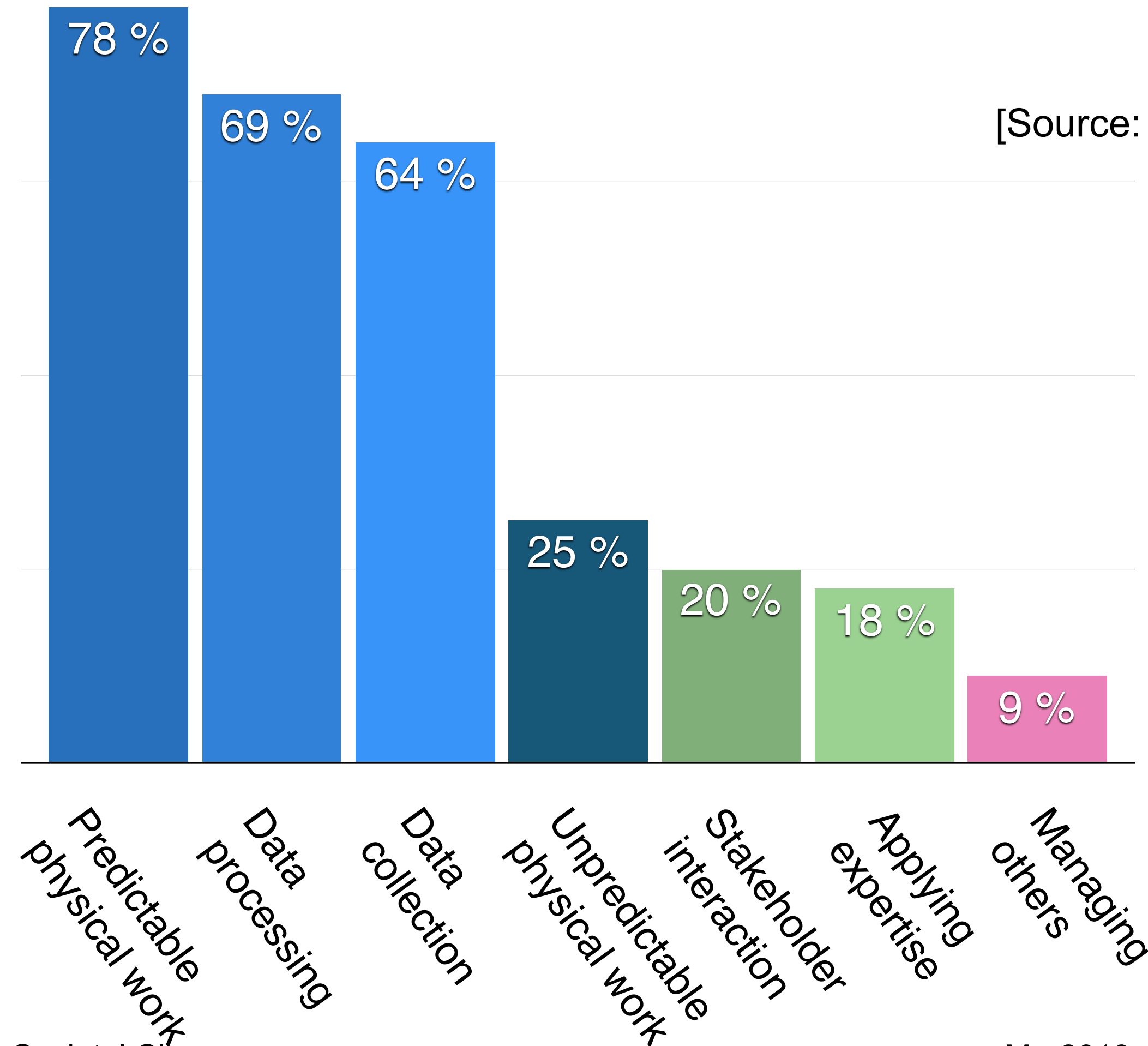
80 %

60 %

40 %

20 %

0 %



[Source: McKinsey, 2016]



# Volvo to 'accept full liability' for crashes with its driverless cars

But decide on rules so we can make the dang vehicles



13 Oct 2015 at 06:04, OUT-LAW.COM



68



22



78

Volvo will "accept full liability" for collisions involving its autonomous vehicles, the company has confirmed.

<http://www.scmagazine.com/iot-security-forcing-business-model-changes-panel-says/article/448668/>

SC Magazine > News > IoT security forcing business model changes, panel says

Teri Robinson, Associate Editor

[Follow @TeriRnNY](#)

October 22, 2015

## IoT security forcing business model panel says

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To secure the **Internet of Things** and to build trust with customers, the way that vendors approach manufacturing, distributing and supporting devices and solutions must change, a panel of security pros said Monday at the National Cyber Security Alliance's (NCSA's) Cybersecurity Summit held at Nasdaq.

"Business models will have to change. We used to build them [products], ship them and forget about them until we had to service them," said John Ellis, founder and managing director of Ellis & Associates. "We've moved to a new world where we have to ship and remember."



# The “sharing economy” for energy companies?



Ved å bygge internett for alle, og ved å skape relevante og uunnværlige digitale tjenester, kan vi bidra til en bedre verden, skriver Sigve Brekke.

FOTO: Heiko Junge, NTB scanpix

**IKT er den nye oljen! | Sigve Brekke**

[Source: [aftenposten.no](https://aftenposten.no)]

**Sharing Economy:  
“Telenor will create a  
digital ecosystem in  
Pakistan”**



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Visit [esmartsystems.com](https://esmartsystems.com)

Prosumer bidding and  
scheduling in electricity  
markets

🕒 12. January 2016

📁 Ukategorisert

👤 Administrator

[Source: [eSmartSystems.com](https://eSmartSystems.com)]



# Challenges with IoT

- ➔ **Security: Distributed Denial of Service, Ransomware**
- ➔ **Privacy: All our data to IT companies?**
- ➔ **Digital Inclusion: Empowering the Society**



## Addressing the Threat Dimension for IoT

- Hollande (FR), Merkel (DE) had their mobile being monitored
- «and we believe it is not happening in Norway?

18. Dezember 2014, 18:14 Uhr Anhören von Handys

**So lässt sich das UMTS-Netz knacken**



[source: Süddeutsche Zeitung,  
18Dec2014]

[source: [www.rediff.com](http://www.rediff.com)]

Zwei Hacker zeigen  
UMTS-Antenne lassen  
sich knacken (Foto dpa)

# Significance

## IoT security challenges

- Mirai attack
  - ➔ “security by obscurity”
  - ➔ different security viewpoint
- “it is just the beginning”
  - ➔ 4x increase in capability in 2018



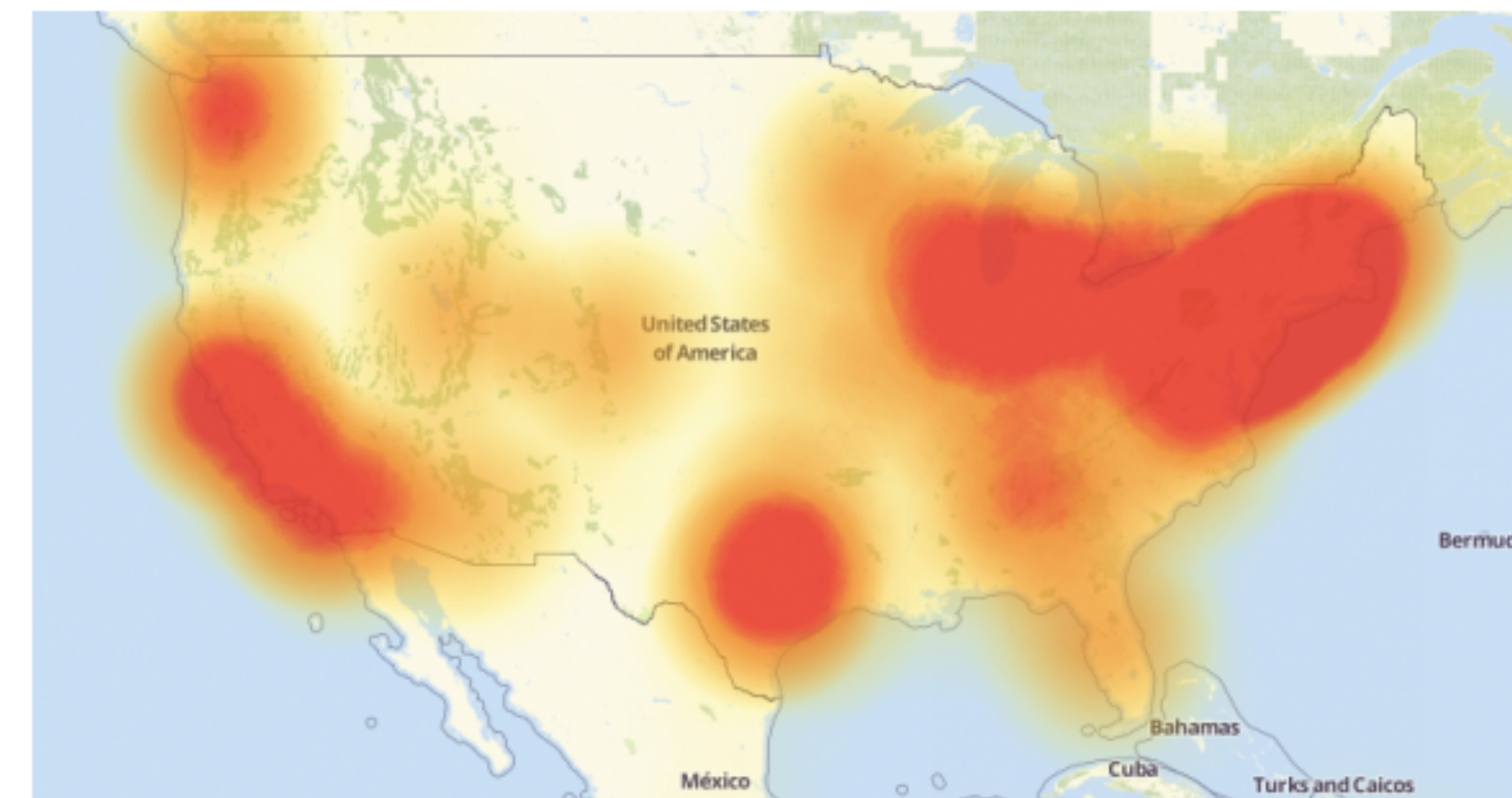
## 21 Hacked Cameras, DVRs Powered Today's Massive Internet Outage

OCT 16

16Oct2016

A massive and sustained Internet attack that has caused outages and network congestion today for a large number of Web sites was launched with the help of hacked “Internet of Things” (IoT) devices, such as CCTV video cameras and digital video recorders, new data suggests.

Earlier today cyber criminals began training their attack cannons on **Dyn**, an Internet infrastructure company that provides critical technology services to some of the Internet's top destinations. The attack began creating problems for Internet users reaching an array of sites, including Twitter, Amazon, Tumblr, Reddit, Spotify and Netflix.



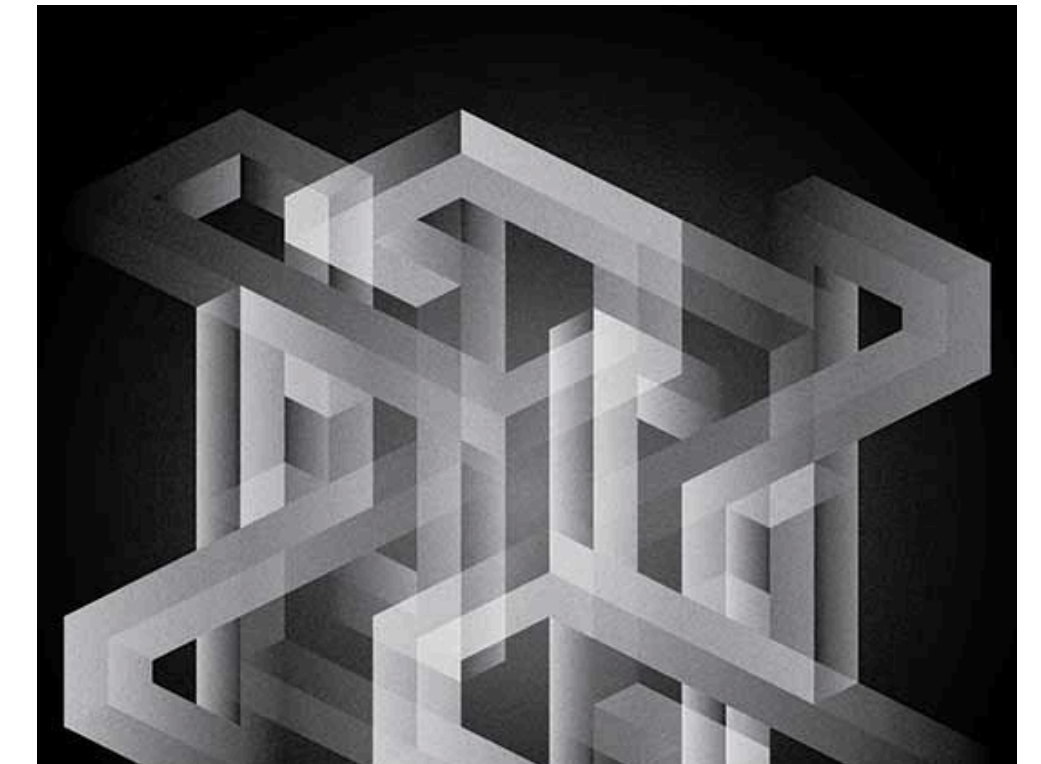
[Source: <https://krebsonsecurity.com/2016/10/hacked-cameras-dvrs-powered-todays-massive-internet-outage/>]

## Blockchain, IOTA, and automated money

- ✓ Increased security in micro-data handling
- ✓ Trust enabler for IoT data

- ❑ No trustworthy organisation backing crypto cur
- ❑ US\$ covered by U.S. Department of Justice, U.S. Treasury, the Federal Reserve

→ centralized digital currencies



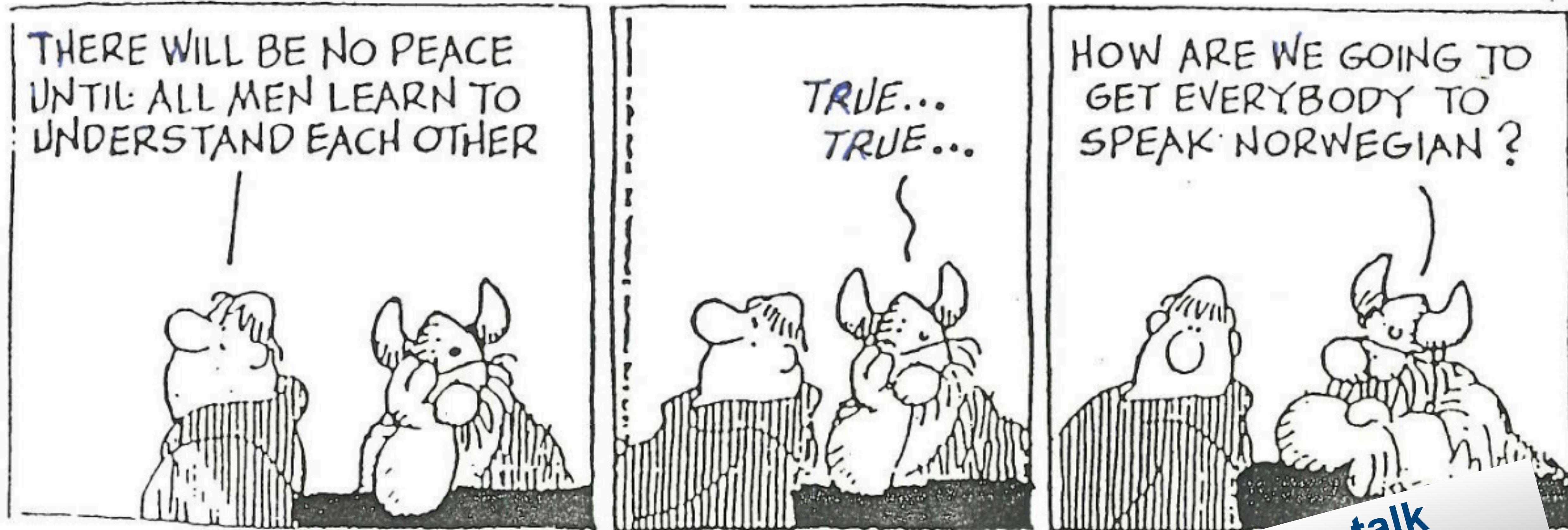
Price Manipulation in the Bitcoin Ecosystem

Neil Gandal <sup>a</sup>, JT Hamrick <sup>b</sup>, Tyler Moore <sup>a,b</sup>, Tali Oberman <sup>a</sup>



**The Blockchain Will Do to the Financial System What the Internet Did to Media**





teach our sensors to talk  
Norwegian

# SCOTT key message "elevator pitch"

largest security  
project in EU

57 partners from  
12 countries

80 M€ budget  
35 M€ EU & national

8 partners from  
Norway

IoT is the game changer and driver for digitalisation, and SCOTT contributes through:

- Answer the **IoT** need for a new and **more advanced security paradigm** through **security classes**
- Create a **Convincing privacy assessment** through **privacy labelling**
- Establish a **clear link** between **security and safety**

SECURITY



PRIVACY

TRUSTABILITY



USABILITY



SAFETY

Automotive

Home

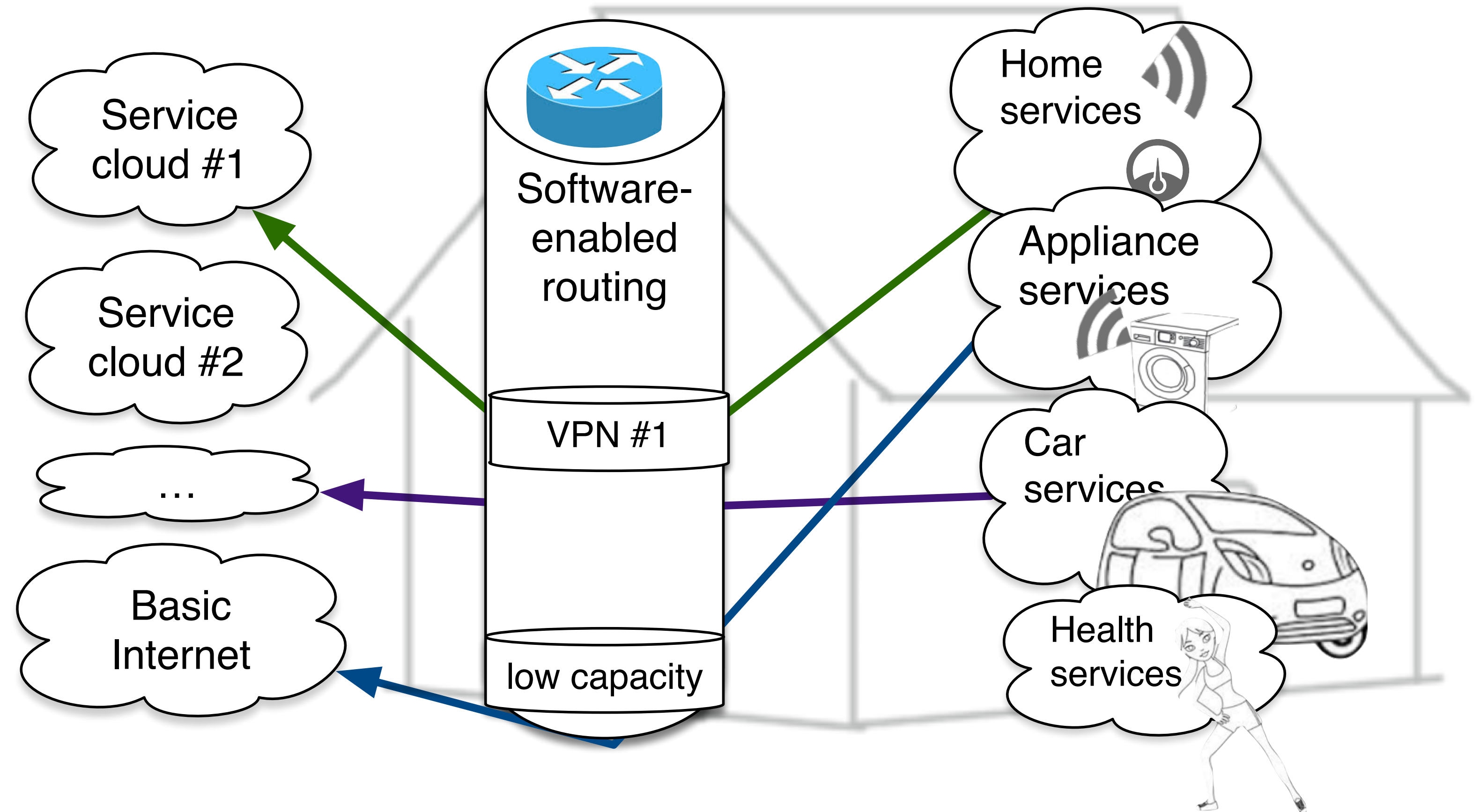
Rail

5G

Avionics

## Learn from Industrial Automation and Mobile Networks

- “What to secure?”
- Network segregation  
→ *Network slicing*
- From Confidentiality, Integrity, Availability (CIA)
- to Availability, Integrity, Confidentiality (AIC)



# Privacy in IoT

→ **Privacy: All our data to IT companies?**



# Instantaneous and high-resolution

- HAN Port
  - energy usage
  - online monitoring (1/s ... 1/min)
- Typical Norway
  - Power (every 2.5s)
  - Current (every 10s)
  - Voltage (every 10s)
- Connected devices
- Security

physical security, encryption



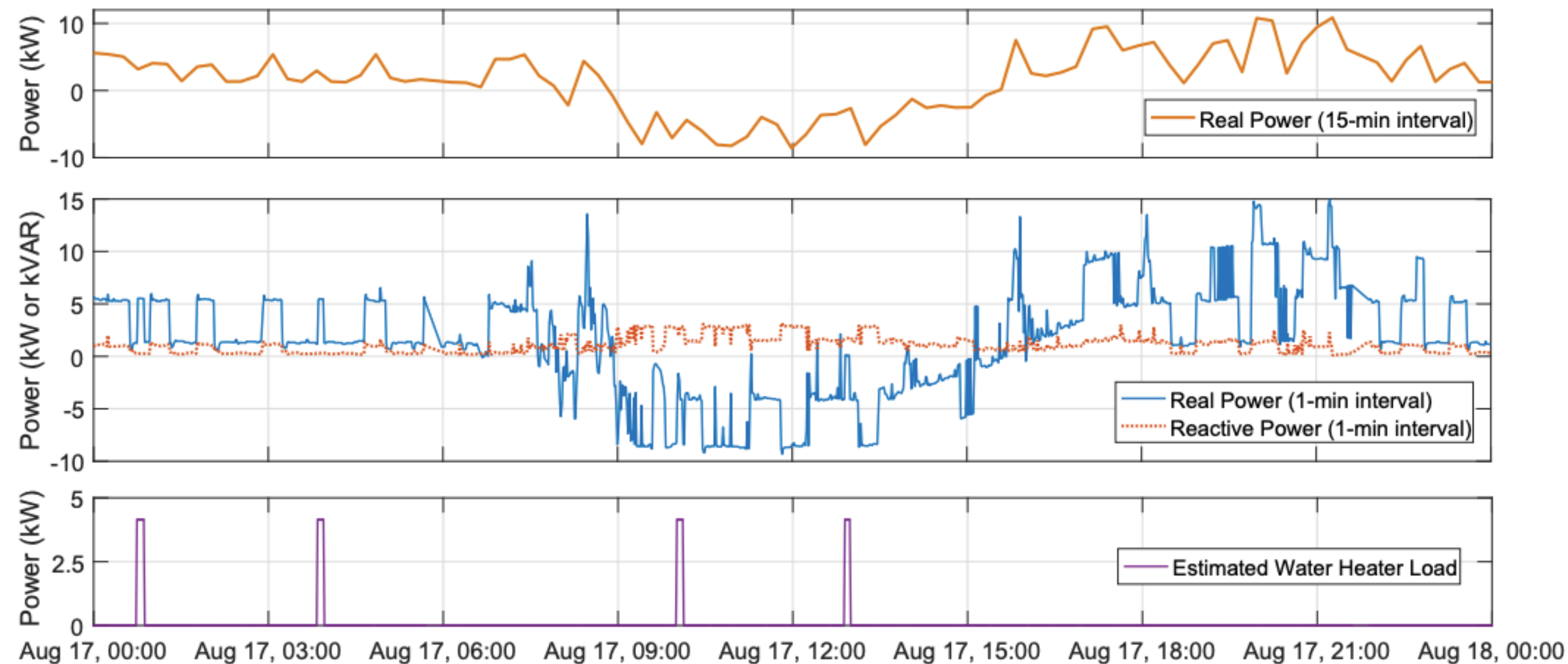
AMS HAN port (NEK)

<https://www.nek.no/info-ams-han-brukere/>



## Meter analysis - knowledge about you

- Security
  - ➔ (unencrypted) wireless data
  - ➔ Cloud computing
  - ➔ “is my HAN port open?”
- Information & control
  - ➔ energy saving (water heater)
  - ➔ load control
  - ➔ Fridge, freezer, heat pump,...
  - ➔ usage pattern, “door is open”
  - ➔ “which TV channel do you watch” (every 2s)



[http://nilmworkshop.org/2018/proceedings/Poster\\_ID17.pdf](http://nilmworkshop.org/2018/proceedings/Poster_ID17.pdf)

**Dites NON ! aux compteurs communicants LINKY**

<https://www.cnet.com/news/researchers-find-smart-meters-could-reveal-favorite-tv-shows/>



## “Amazon Echo” in your smart meter

- Amazon/Google/Apple home control
  - works on your command
- “Amazon HAN connect”
  - works all the time
  - brings all your information to the cloud

**Amazon Echo/  
Alexa**



**Apple  
Home Kit**



**Google  
Home/Nest**



## Comparison with the Mobile Network

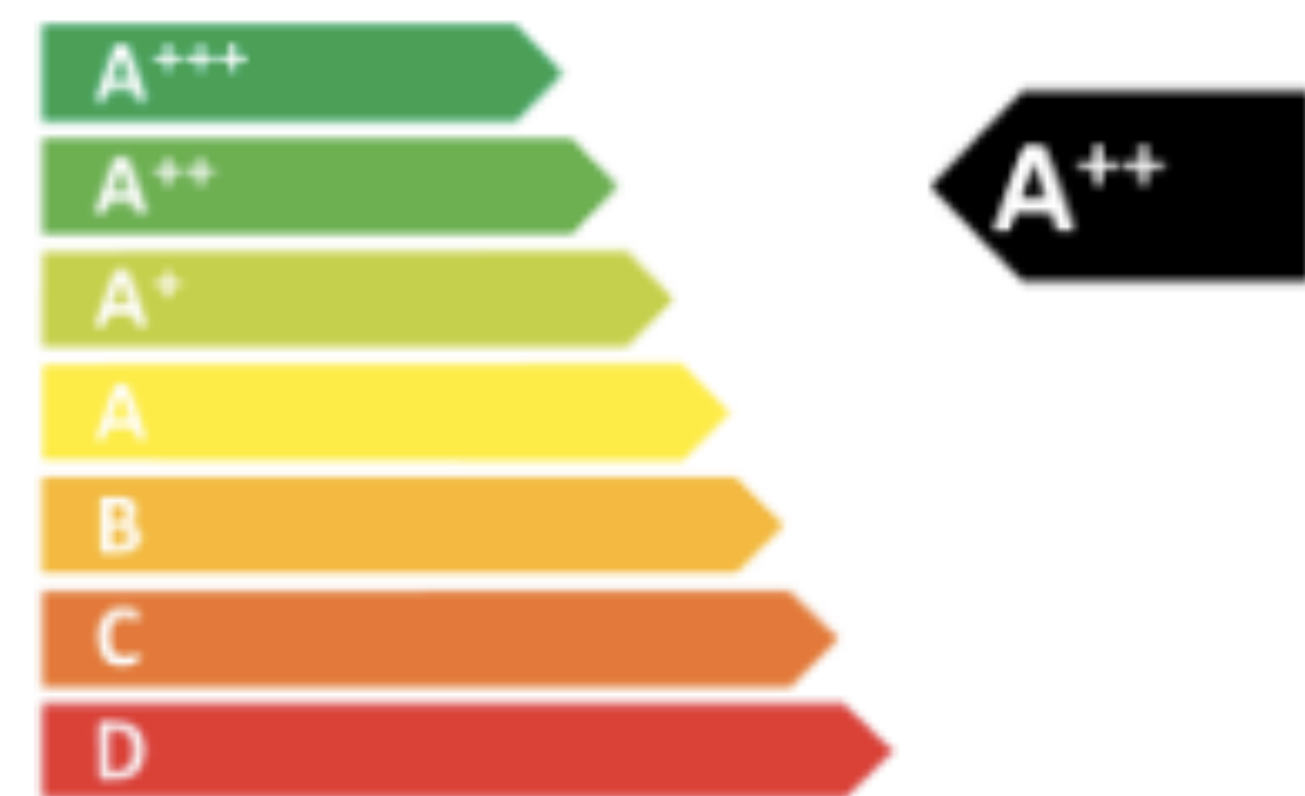
- Facebook's Free Basics
  - ➔ 0-rated content (free usage)
  - ➔ 3-months break even
- The con's of Free Basics
  - ➔ every click goes to Facebook
  - ➔ Net-neutrality
- HAN port
  - ➔ who owns my power consumption?
  - ➔ cloud analysis?



**Premier Minister  
Narendra Modi (India)**

“no to  
Free Basics”  
we have been  
colonised once

## Towards Measurable Privacy - Privacy Labelling

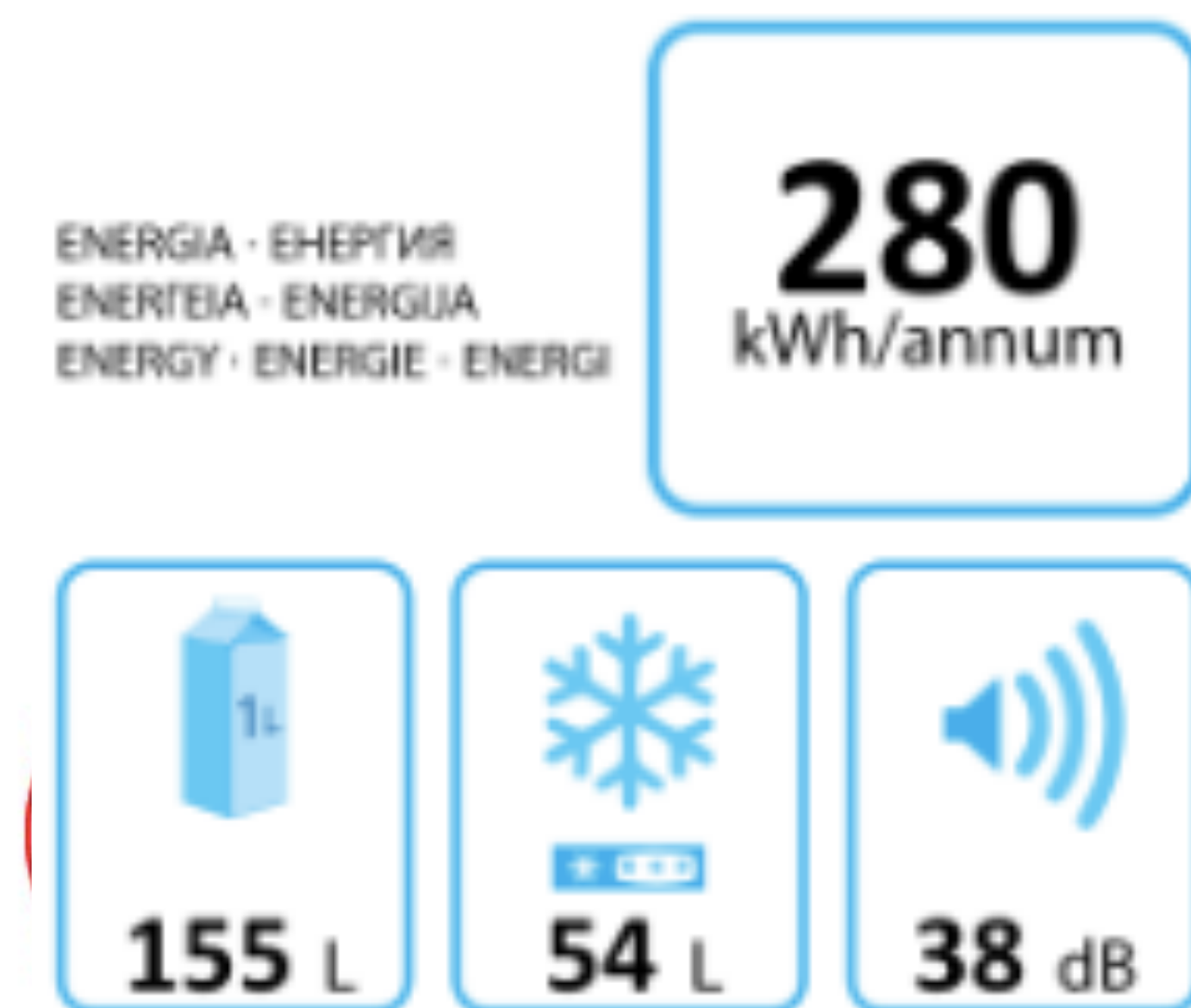


- “Measure, what you can measure  
- Make measurable, what you can’t measure” - Galileo

- Privacy today
  - based on lawyer terminology
  - 250.000 words on app terms and conditions

- Privacy tomorrow
  - A++: sharing with no others
  - A: ...
  - C: sharing with ....

- The Privacy label for apps and devices



### Appfail Report - Threats to Consumers in Mobile Apps

The Norwegian Consumer Council analysed the terms of 20 mobile apps. The purpose is to uncover potential threats to consumer protection hidden in the end-user terms and privacy policies of apps.

## The economic perspective

- The big 5 IT companies have a GDP as big as that of France
- Amazon largest sector in terms of revenue is selling of data
  - 20% of revenue
- How can SMEs compete?
  - Each service and device gets a privacy label
- Four areas for Privacy Label
  - which data are collected
  - sharing to my phone, my cloud, public cloud,...
  - data communication integrity and storage
  - further distribution of data, ownership of data, further processing

### Privacy Label (A-F)

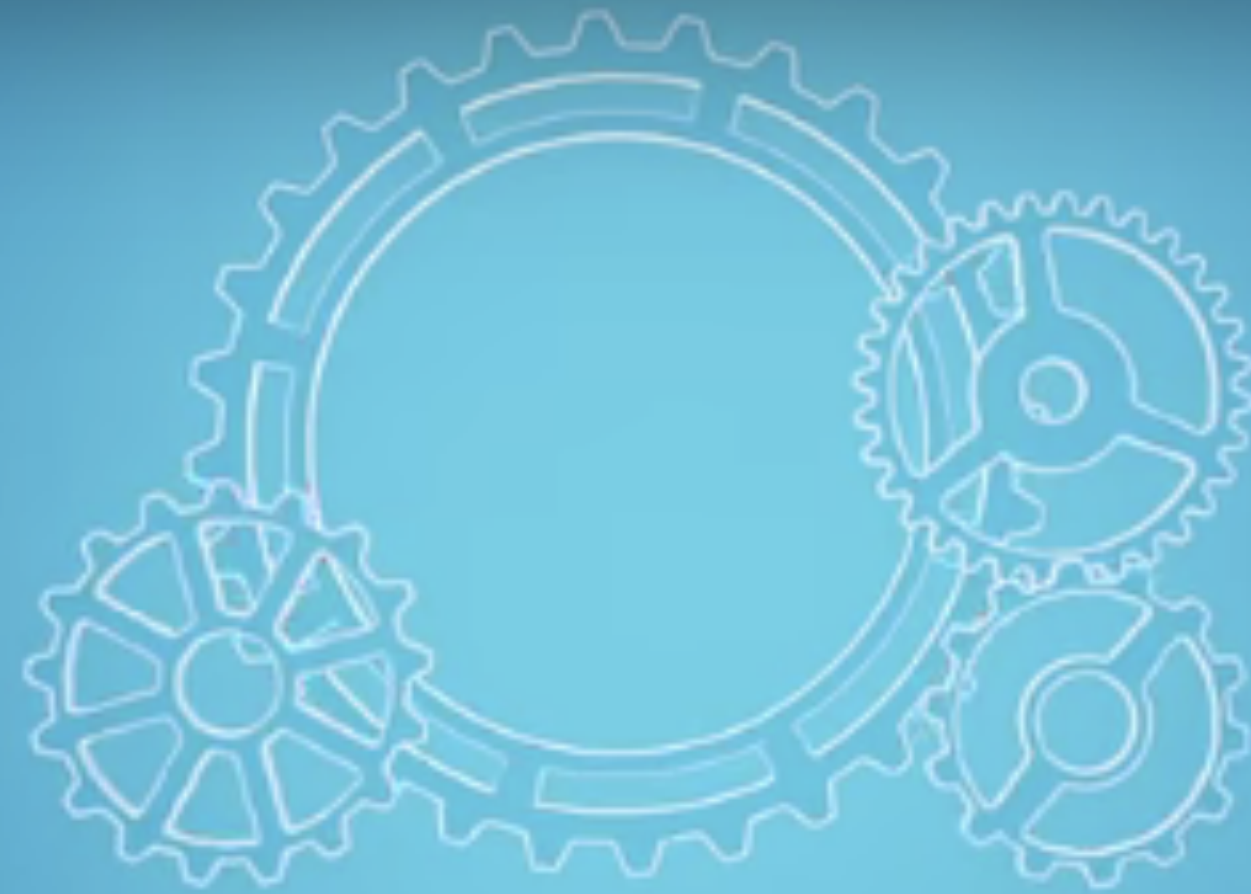
- easy visibility
- customer focus
- transparent



[privacylabel.ioTSec.no](https://privacylabel.ioTSec.no)



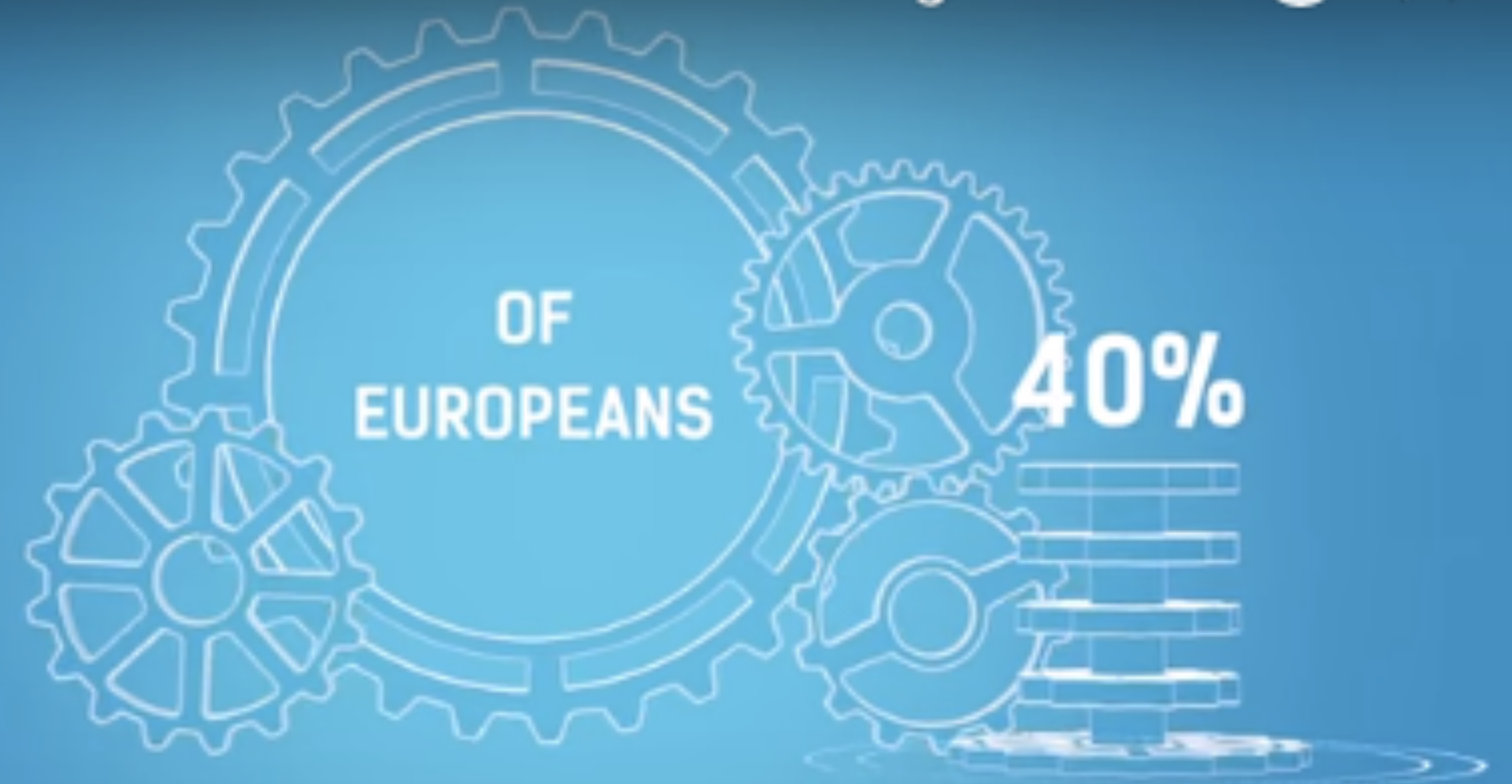
Digital Agenda Scoreboard 2015: Strengthenin...



A DIGITAL SOCIETY IS MADE OF  
DIGITALLY-SKILLED CITIZENS

n

Digital Agenda Scoreboard 2015: Strengthenin...



DON'T EVEN HAVE BASIC DIGITAL SKILLS



Source: EU commission(2015)

And what about IoT?



# SUSTAINABLE DEVELOPMENT GOALS

FREEDOM OF EXPRESSION

## We can't reach the U.N. goals for sustainable development without the internet

22 JUNE 2017 | 11:40 AM

Tweet Share

It's become common wisdom that the United Nations' ambitious "Global Goals for Sustainable Development" aren't just for the U.N., or even governments, to implement. Launched in September 2015, the 17 goals and 169 targets are "a series of ambitious targets to end extreme poverty and tackle climate change for everyone by 2030" (hence the alternative moniker, the "2030 Agenda for Sustainable Development").

Replacing the more arcane "Millennium Development Goals," these Sustainable Development Goals (SDGs) are everyone's goals, crowd-sourced to completion and promoted by companies and civil society alike. (Cue the hip, auto-playing video on the website.)



STEPHEN HAWKING CARES MOST ABOUT #GOAL 9 INDUSTRY, INNOVATION & INFRASTRUCTURE #GLOBALGOALS

Smartly, the goals, especially Goal 17, emphasize that **access to technology underpins every one of these commitments** to the eradication of extreme poverty.

However, not all connectivity is the same, nor yields the same benefits to societies in terms of economic, social, or cultural development. As we told the International Telecommunication Union (ITU), only **stable, secure, and open access** to broadband internet will ensure success for the U.N. SDGs. That's something civil society and our partners will continue to make clear, and we'll need to work in legislatures to get the point across, not simply at aid and development banks.

### To reach the SDGs, we need civil and political advocacy

Traditionally, information and communications technology (ICTs) have not been a major recipient of aid funding. That's one reason this crucial technology is "under-represented" in the SDGs and appears in only four of the 169 targets. It's assumed that telecommunications will take care of itself, having been largely deregulated and privatized in the 1980s and 1990s. Yet **more than half the world's population is not using the internet**, a statistic showing the failure of local, national, and global governance with economic, political, and moral implications.



PETER MICEK  
[@lawyerpants](#)

FREEDOM OF EXPRESSION

GLOBAL

#ITU4SDG

#KEEPITON

CONNECTIVITY

ITU

SDG

SUSTAINABLE DEVELOPMENT GOALS

UNITED NATIONS

RELATED

**Beyond connectivity: building an inclusive U.N. agenda for internet development** [Read More >](#)

**Access Now welcomes new report on economic impact of shutdowns** [Read More >](#)

<https://www.accessnow.org/cant-reach-u-n-goals-sustainable-development-without-internet/>

# Internet Lite for All

*the catalyst for the goals*



# Conclusions

- Things (IoT) are driving the digital societies
- IoT: Business merger
  - Internet + Semantics + Things = IoT
  - Digitisation of the Society
- IoT ecosystem
  - Automation will dominate
  - Promote the Nordic system
- Addressing the challenges
  - Security



Privacy label (A, B, - F)

a business advantage for SMEs

