



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

**Kunnskapsbyens Hus - Realfagsseminar 11Mar2020**

# **Internet of Things og tillit i samfunnet**

-

## **hvordan kan vi lære sensorer til å snakke norsk?**

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

- “Det er gøy å forstå”
  - ➔ min vei
- Kjeller og Norden
  - ➔ Internett
  - ➔ Tingenes Internett
  - ➔ (Cyber-, IoT-)sikkerhet,
  - ➔ Samfunnssikkerhet og våre globale utfordringer
- Bærekraftig innovasjon
  - ➔ digital inkludering
  - ➔ Return on SDGs (RoSDGs)

“våre utfordringer” - oppsummert





# My Background



- "Traditional German"
  - ➔ Radio, Communications, Remote Sensing
  - ➔ Siemens, European Space Agency (ESA)
  - ➔ Global: Sea surface, snow coverage, soil moist
  - ➔ Cycling "all year", environment & health
- From Norway to the World
  - ➔ Telenor R&D: Group leader 3G/UMTS (Kjeller)
    - "always online, always connected"
  - ➔ Internet Pioneer
    - TCP/IP communication protocol
  - ➔ "Internet to Africa" (2010)



Source: Akers Avis Groruddalen, 2013





# Internet and the Nordics

- 1. Arpanet Connection to **Kjeller** (June 1973)
- List\_of\_Internet\_pioneers [Wikipedia]
  - Yngvar Lundh, **Paal Spilling**
- Anwendungsentwicklung
  - .php, OpenSource, Linux, Skype, Spotify
  - **OperaSoftware**, FAST Search
  - Nokia, Ericsson
  - **Telenor**, TeliaSonera
- Mobiles Internet:



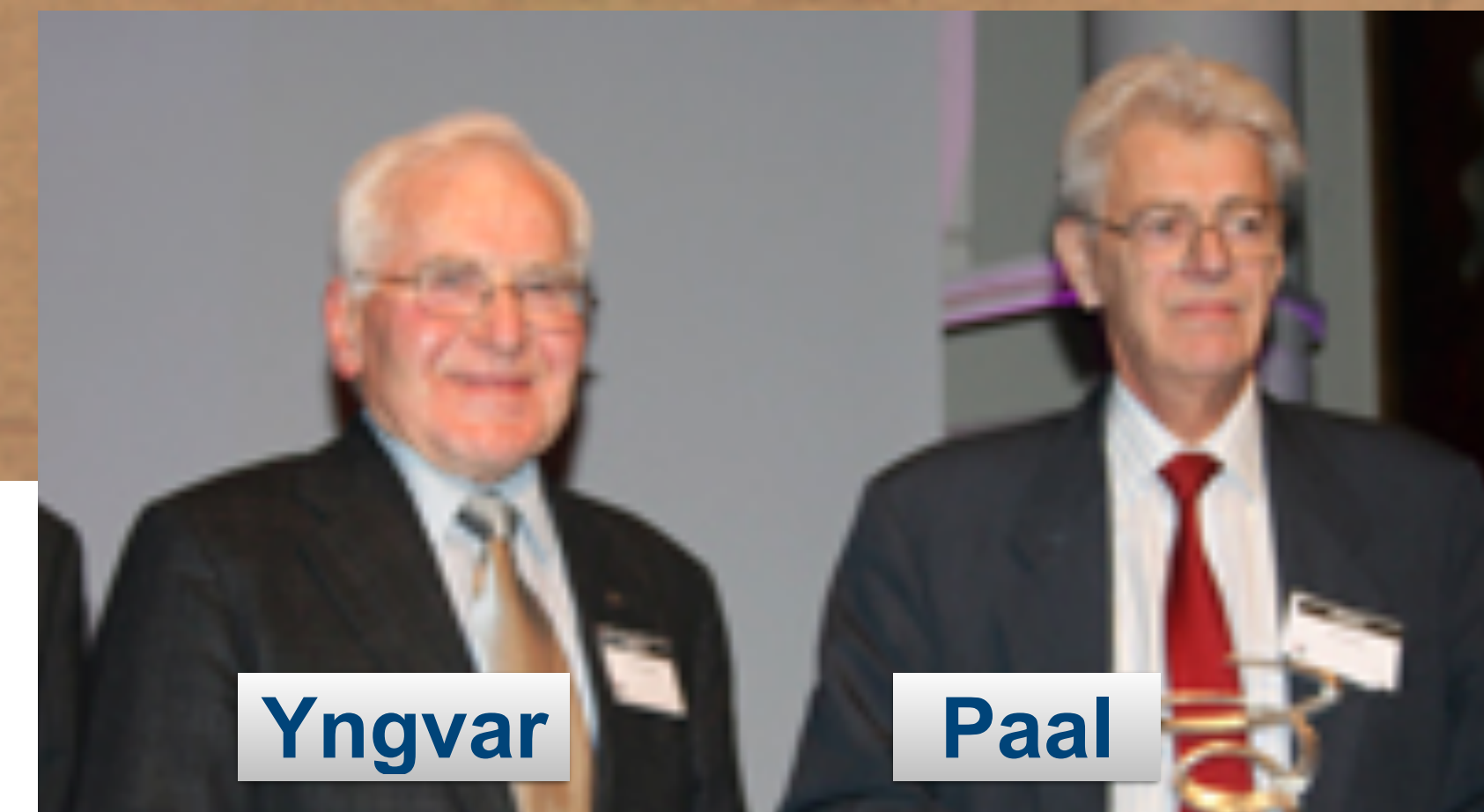
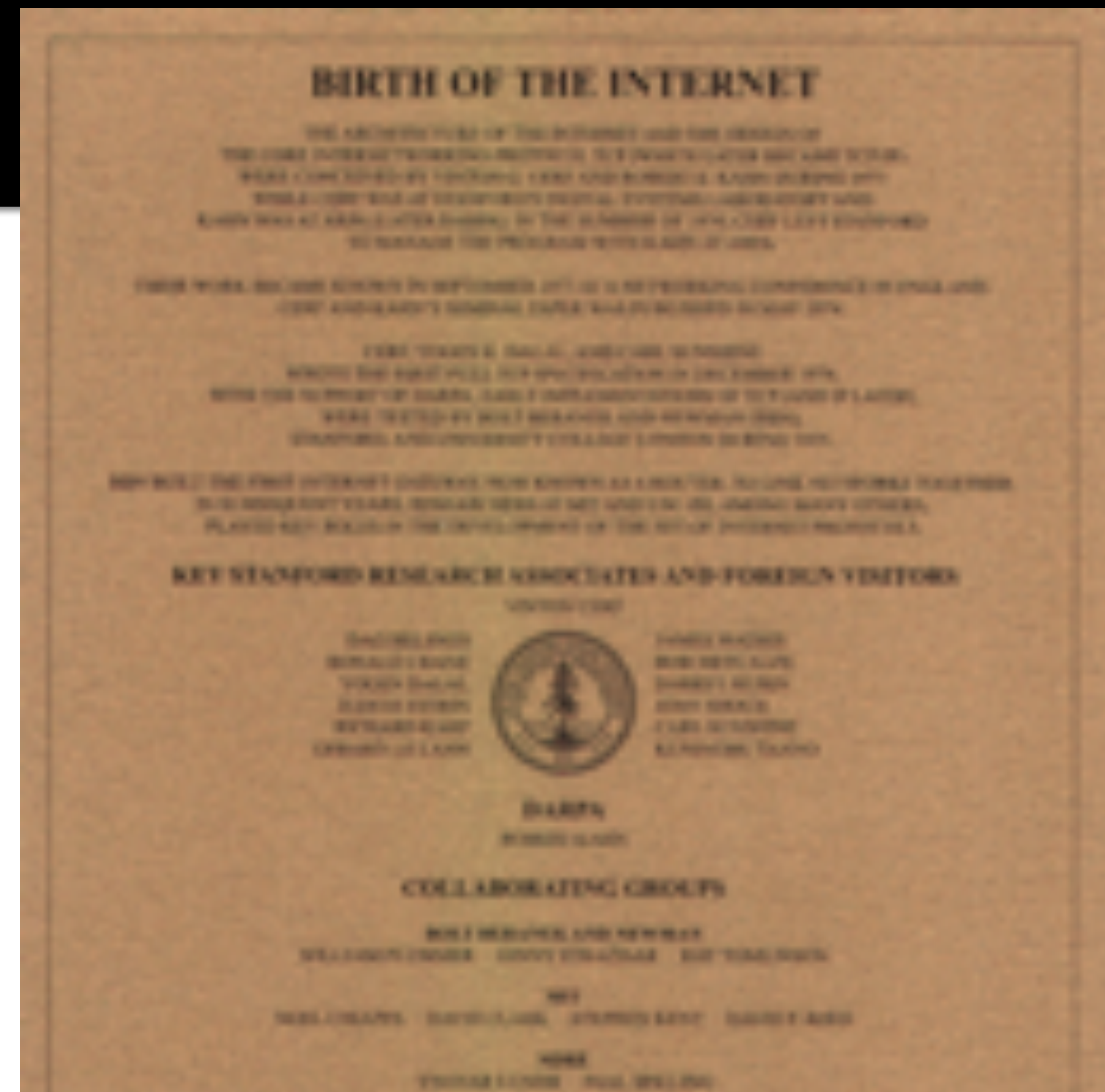
GSM

Mobile Anwendungen



Vint

Sigrid



Yngvar

Paal



# The Internet of Things (IoT)

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

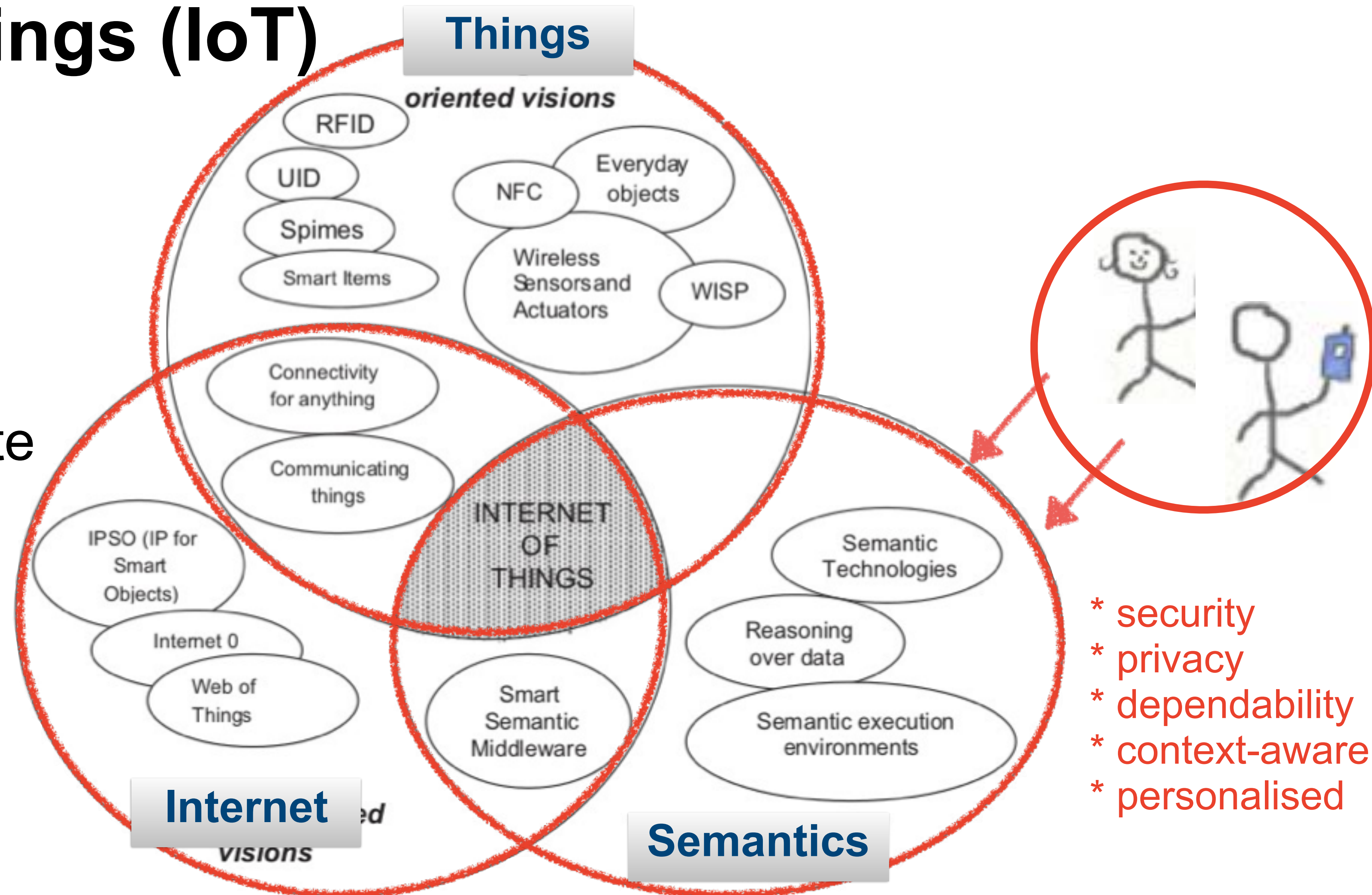


Fig. 1. Internet of Things paradigm as a result of the convergence of different visions.





## Why Semantics?

- Syntax vs. Semantics

Arab



الهندسة فعلم التطور : الاسم  
أسنسيون غومز بيرز : المؤلفون  
السعر: \$74.95  
الكتاب : المنتج

<الاسم>الهندسة فعلم التطور </الاسم><>  
<المؤلفون>أسنسيون غومز بيرز </المؤلفون><>  
<السعر>\$74.95 </السعر><>  
<الكتاب>المنتج </الكتاب><>

English



**Title:** Ontological Engineering  
**Authors:** Asunción Gómez-Pérez...  
**Price:** \$74.95  
**Product:** Book

<Title>Ontological Engineering</Title>  
<Author>Asunción Gómez-Pérez...</Author>  
<Price>\$74.95</Price>  
<Product>Book</Product>

What do the tags **mean** for the machine?

Source: Juan Miguel Gomez, University Carlos III de Madrid





## Why Semantics?

- Conceptual Level



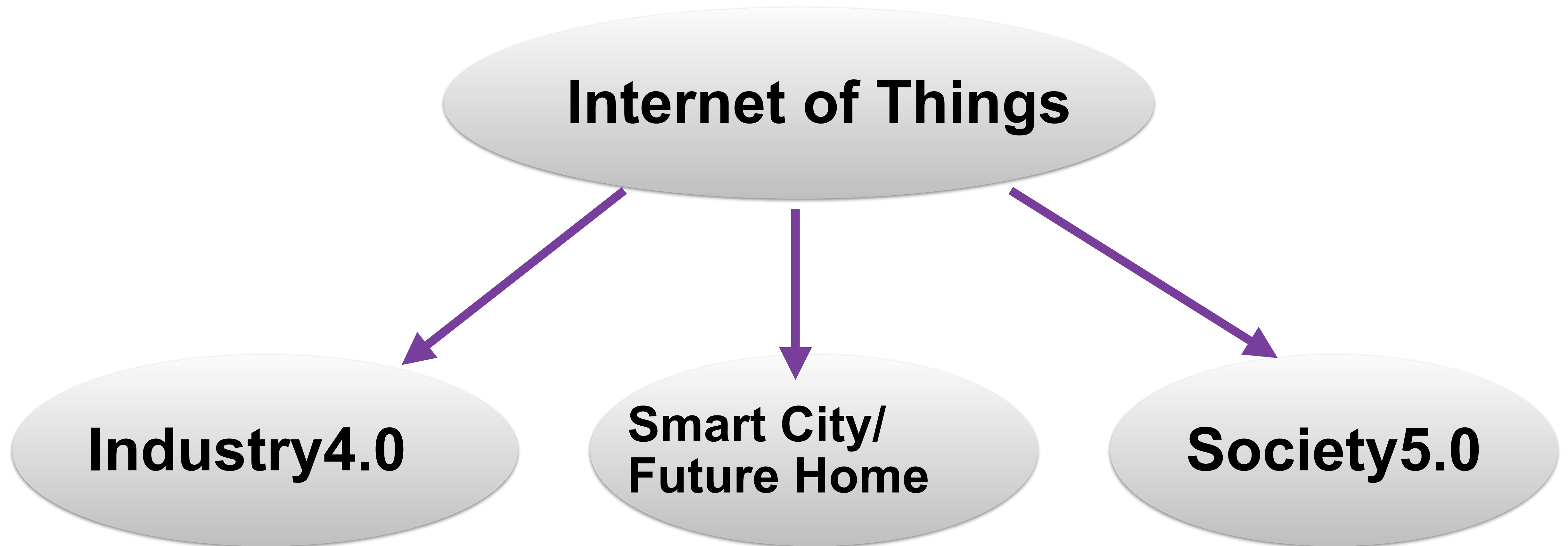
lunch (.no)



lunch (.es)

Source: Juan Miguel Gomez, University Carlos III de Madrid







## Internet of Things (IoT)

- Interconnected power systems

- ➔ measure:

- Voltage,
- Frequency variation

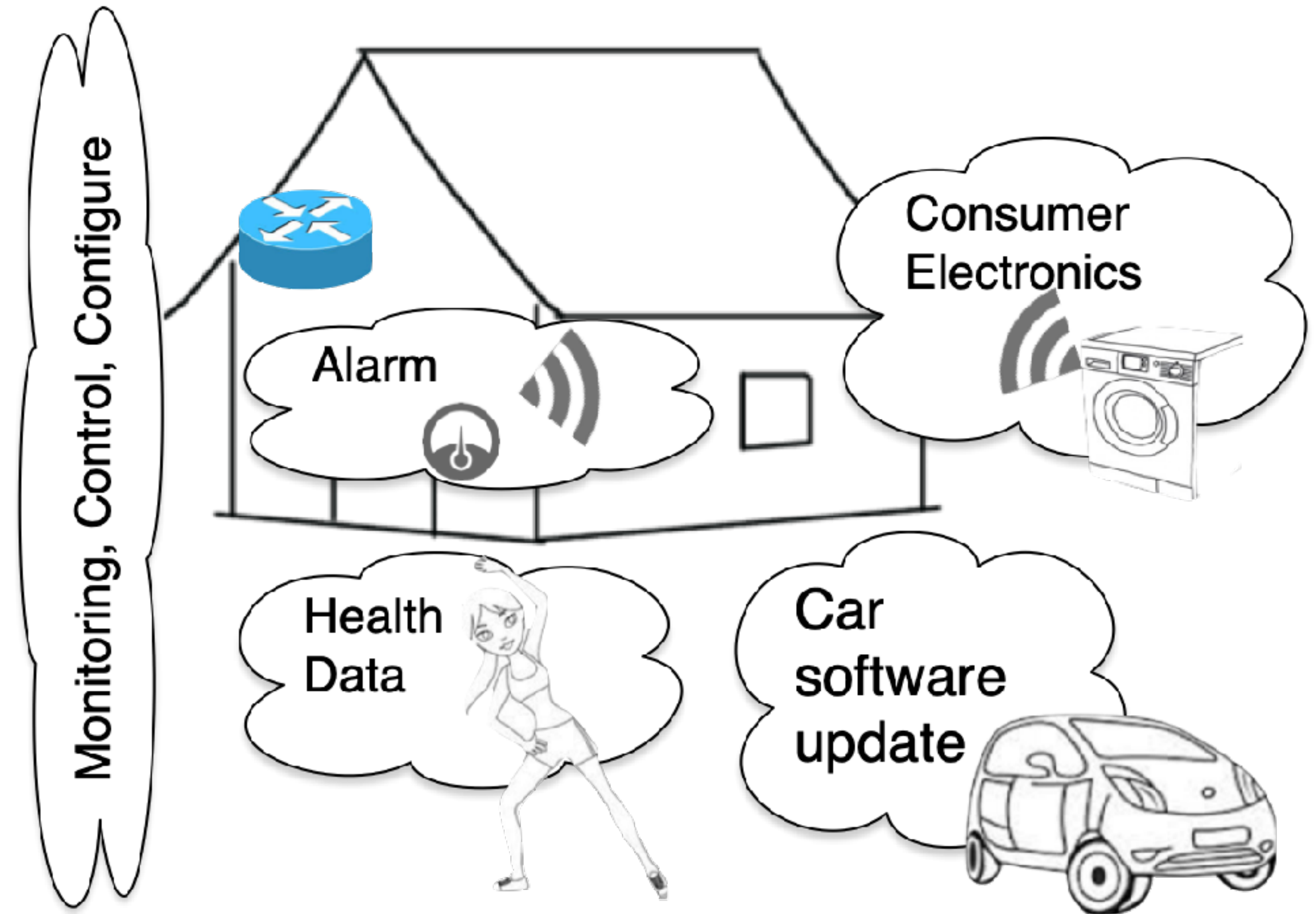
- ➔ automatic control

- Controlling home appliances

- ➔ Power consumers:

- heat pump, water heater
- car charger
- washing machine, dish washer

Convenience & Security





## 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



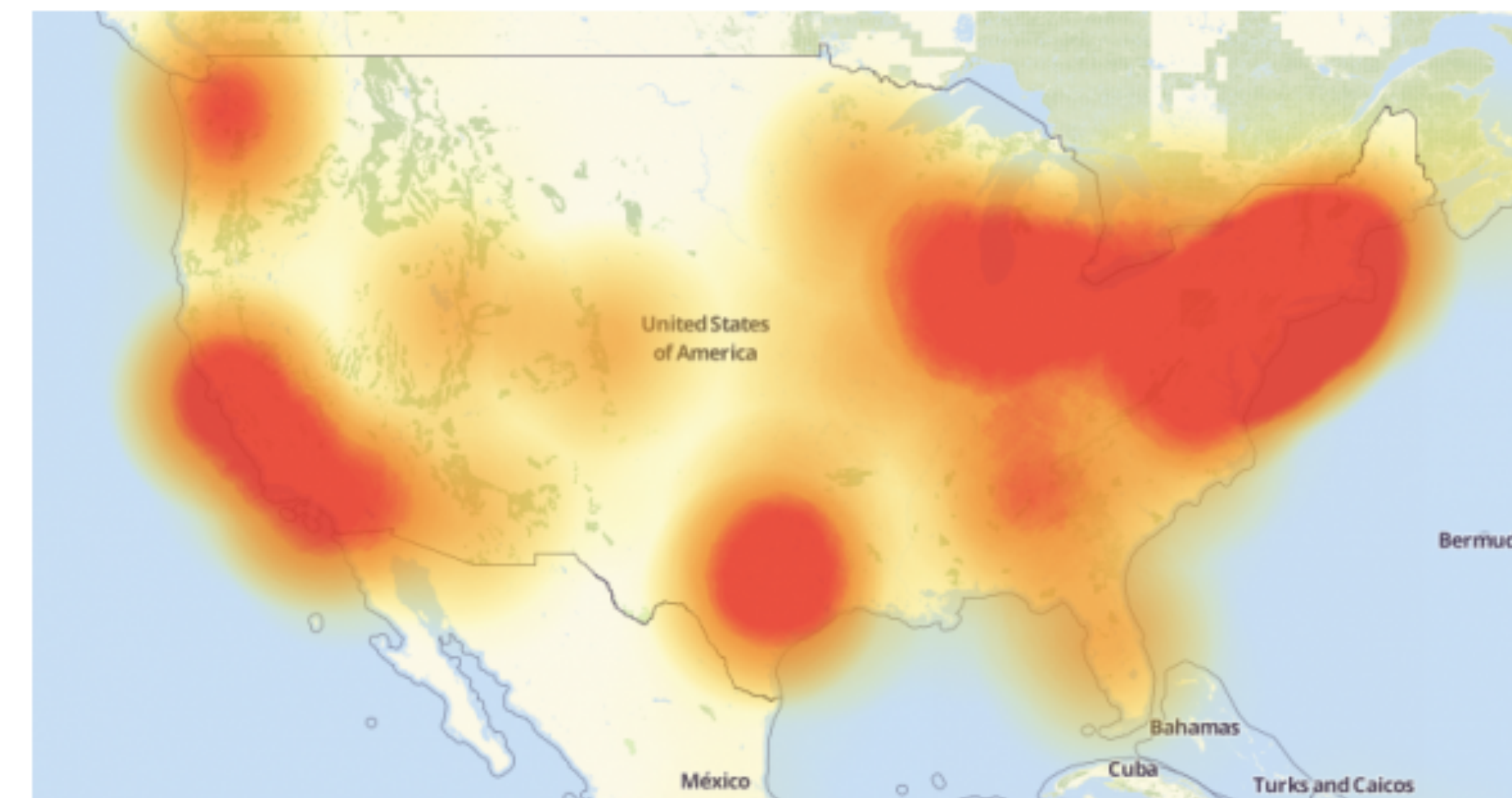
## 21 Hacked Cameras, DVRs Powered Today's Massive Internet Outage

OCT 16

16Oct2016

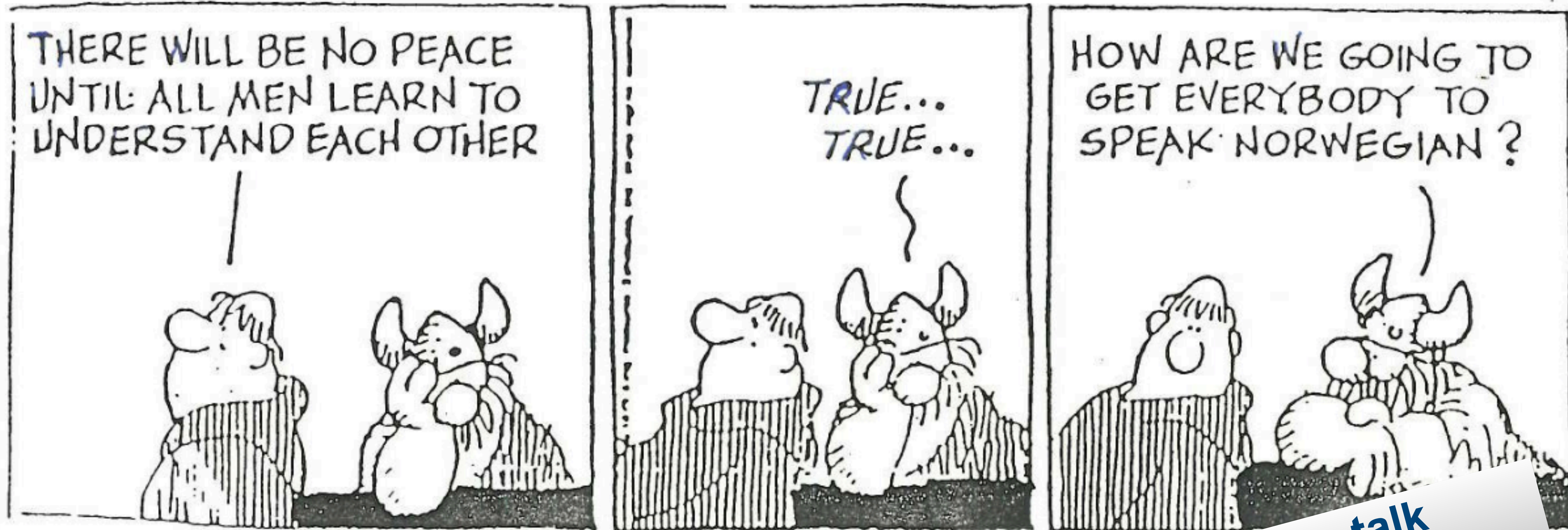
A massive and sustained Internet attack that has caused outages and network congestion today for a large number of Web sites was launched with the help of hacked “Internet of Things” (IoT) devices, such as CCTV video cameras and digital video recorders, new data suggests.

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/>]





teach our sensors to talk  
Norwegian

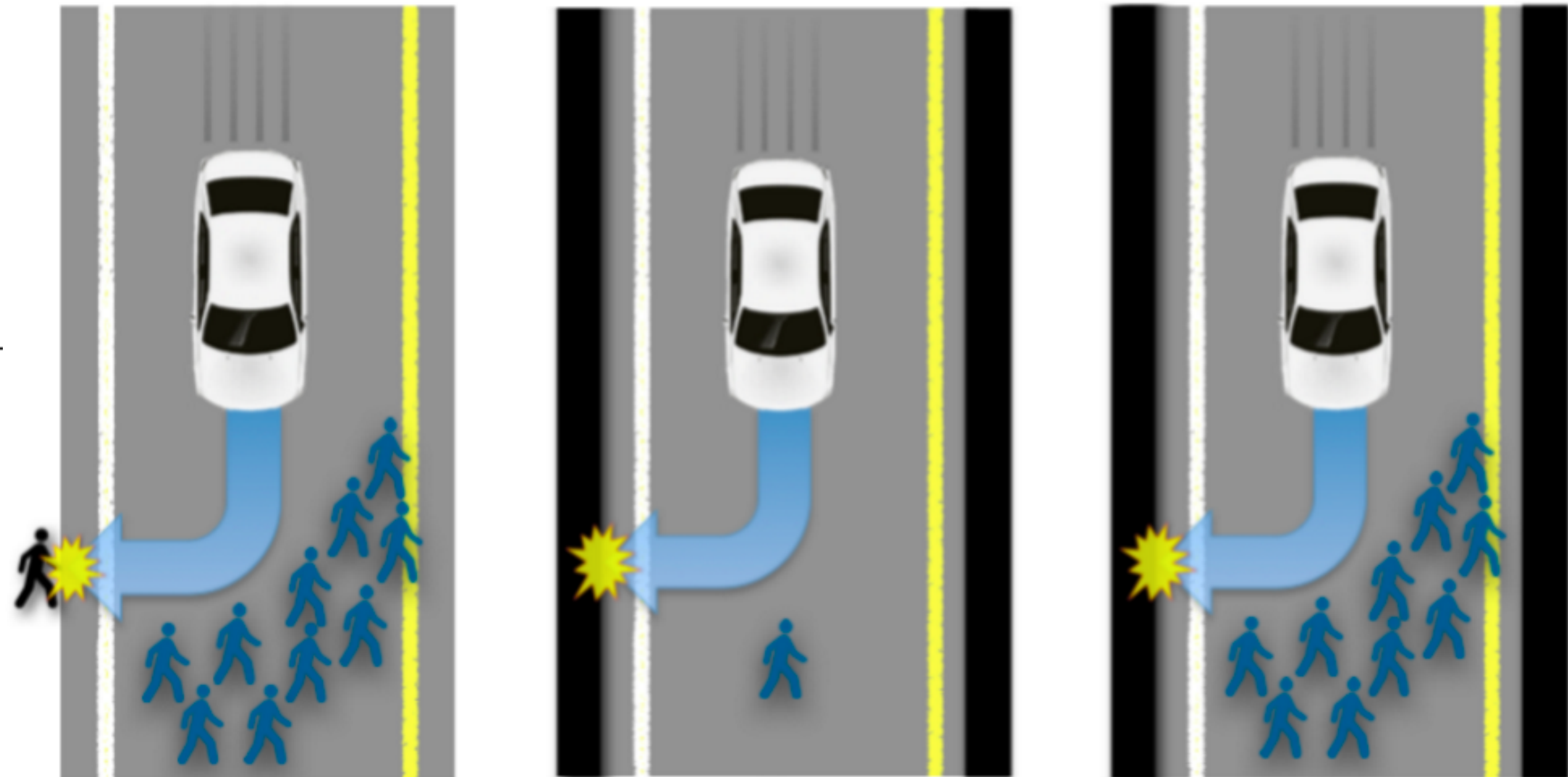


## IoT challenges - “programmed to kill”

### Why Self-Driving Cars Must Be Programmed to Kill

Self-driving cars are already cruising the streets. But before they can become widespread, carmakers must solve an impossible ethical dilemma of algorithmic morality.

October 22, 2015



<https://www.technologyreview.com/s/542626/why-self-driving-cars-must-be-programmed-to-kill/>





# Change in Business Models due to IoT

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 changes, panel says

Share this article:



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."

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



## 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.



## Grand Challenges

- Grand Challenges

- ➔ Climate
- ➔ Resources (radio, minerals)
  - Kobald (East - DR Congo)
- ➔ Divide

- Digitisation

- ➔ Mobile Networks
- ➔ IoT
- ➔ Automation

“Internet had the ability to  
dismantle the divide.  
Internet failed miserably, the  
divide is bigger than ever.”  
Kate Gilmore, Human Rights, UNO





## ~~Challenge 1: Climate~~

not today





## Challenge 2: Resources






## Resources: Recycling rates of Metals

- 30+ elements have <1% recycling rate

Ref: T. E. Graedel, B. Reck, M. Buchert, C. Hagelüken et al. "Recycling rates of metals", United Nations Environment Programme, (UNEP edits.) 2011



1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	** 	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
* Lanthanides			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
** Actinides			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



Source: HyProS Arena Meeting UiO, 6Dec2018



## Challenge 3: Societal Security, here: the Digital Divide





# Starting Point:

**JOSEPH E. STIGLITZ**  
WINNER OF THE NOBEL PRIZE IN ECONOMICS



# THE PRICE OF ~~ON~~ INEQUALITY

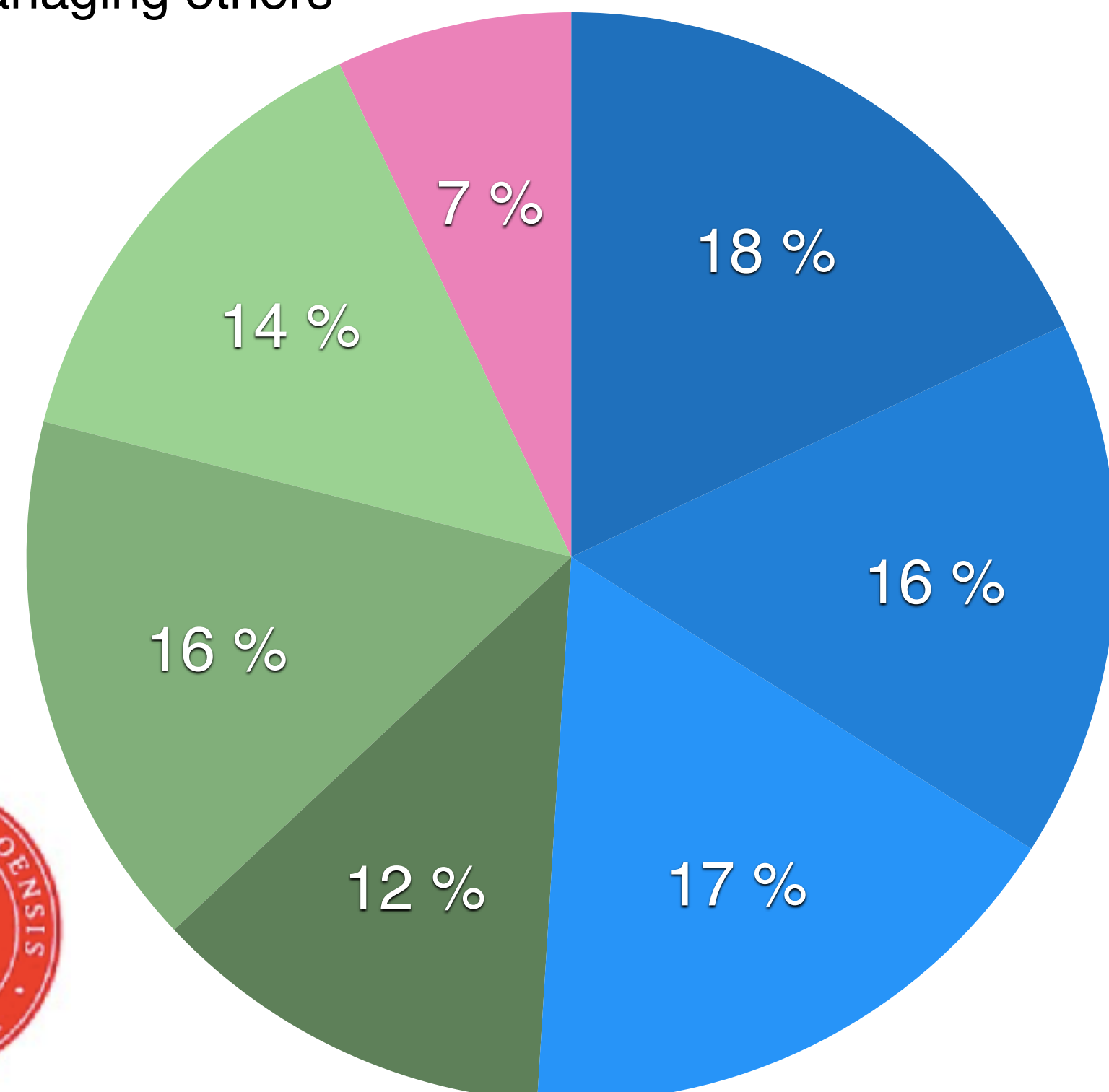
HOW TODAY'S DIVIDED SOCIETY  
ENDANGERS OUR FUTURE



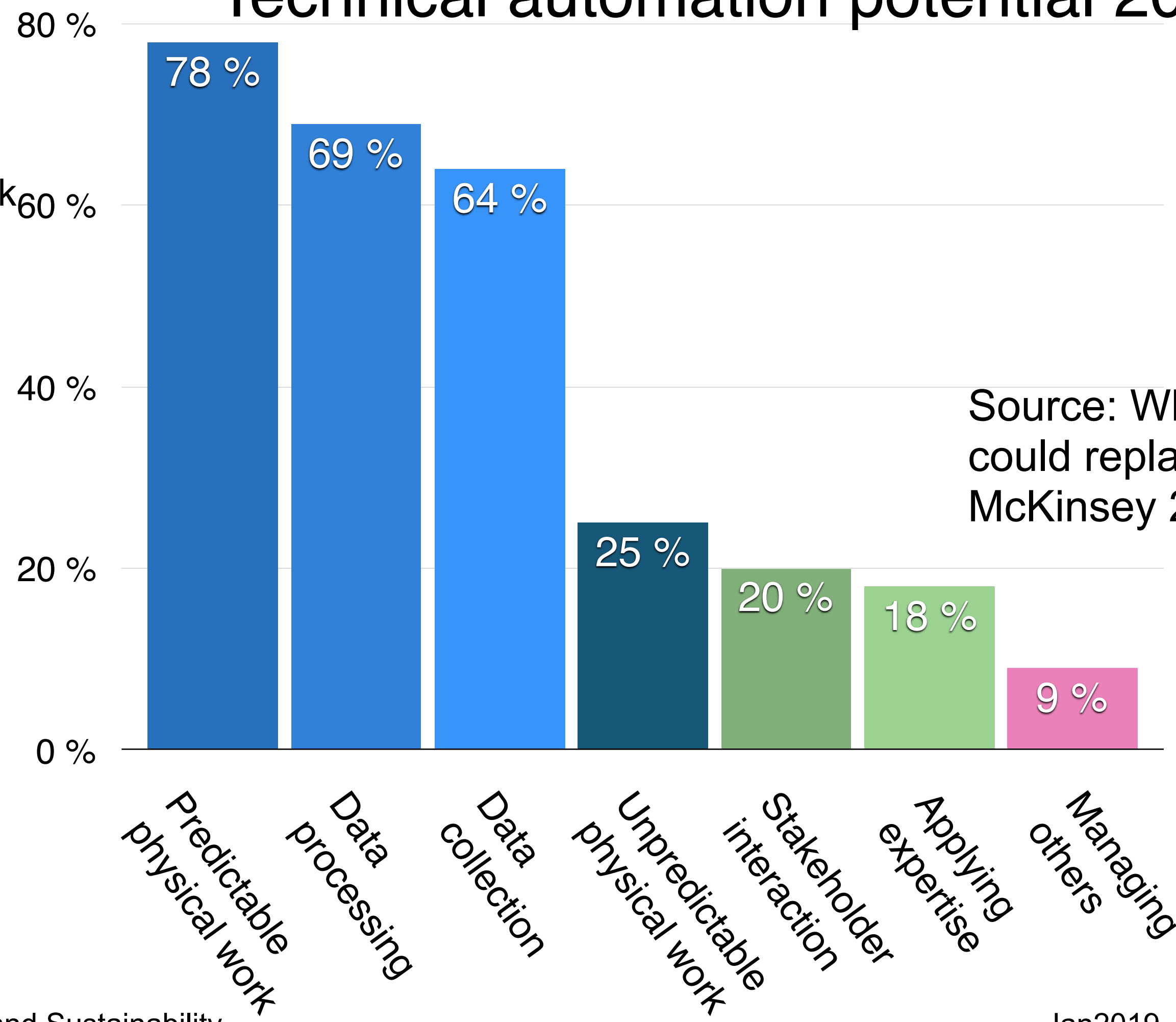
## Automation will come

USA work force time spent [%]

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



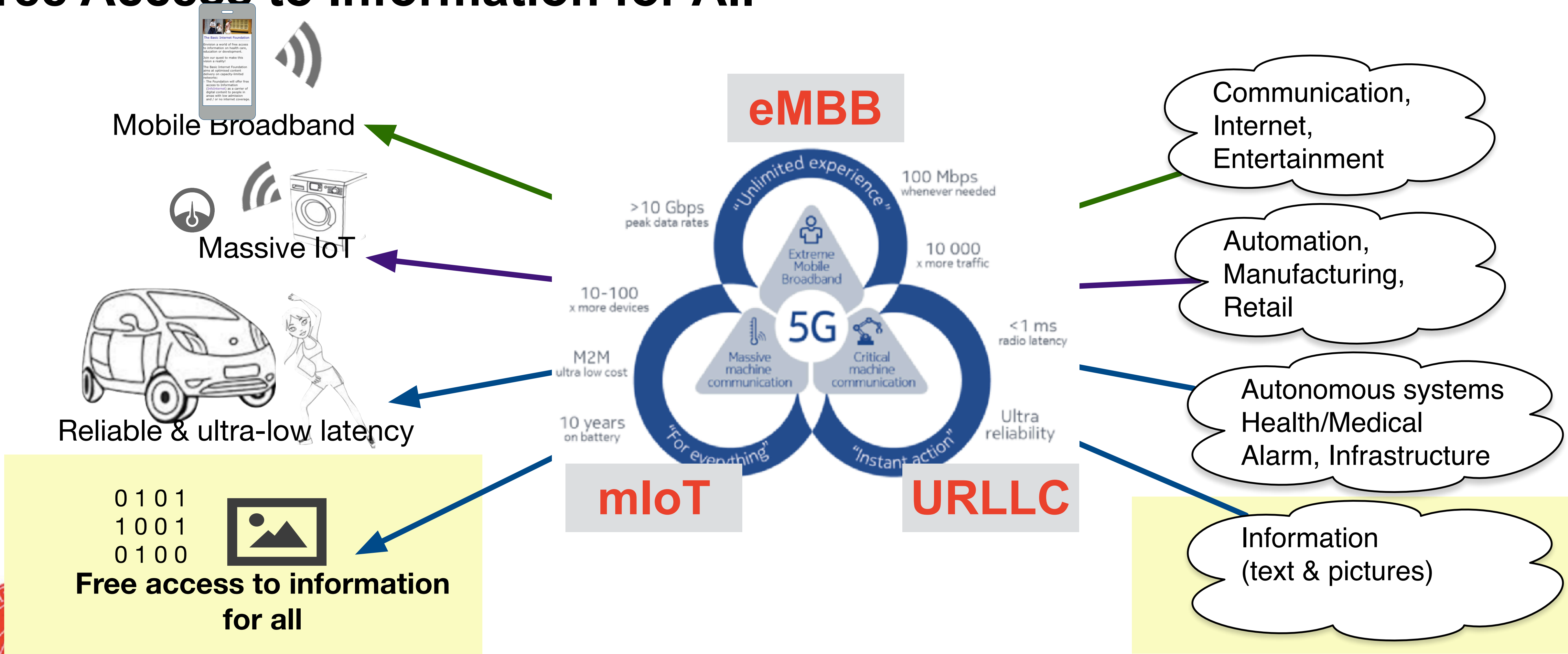
Technical automation potential 2016 [%]



Source: Where Machines could replace humans, McKinsey 2016



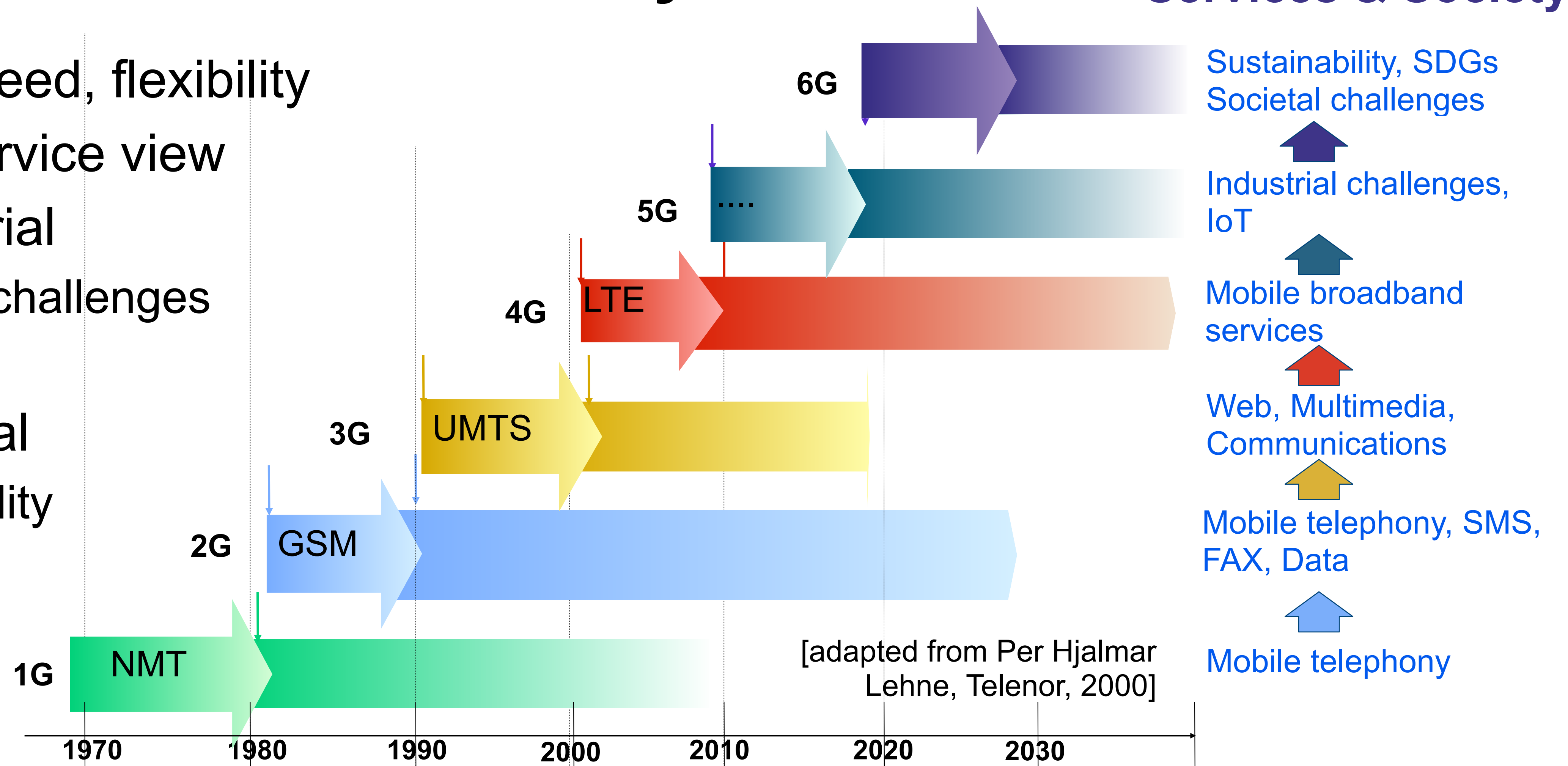
# 5G network slicing for Free Access to Information for All





## 6G: Digitisation of the Society

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





# “Connect the Unconnected” Izazi



Antenna

Village office

Installation time: 1,5 h  
catching the signal from the Vodacom  
tower in Migoli (~10km away)



# Mbaash (Selela) Medical Dispensary



The mobile phone has  
replaced the machete  
(even in places without Mobile Broadband)





## Oppsummert

**“det er bra å forstå hvordan ting fungerer”**

- Teknologiske utviklinger *møter* globale utfordringer
  - ➔ Milliarder av sensorer  $\Leftrightarrow$  elektronisk søppel
  - ➔ Cyber-/IoT-sikkerhet  $\Leftrightarrow$  Trygghet og samfunnssikkerhet
  - ➔ Automatisering, Industry4.0  $\Leftrightarrow$  Tillit og transparens
- Digital partnerskap
  - ➔ “Alle skal ha fri tilgang til informasjon”
  - ➔ Internett og teknologi til samfunnsstøtte
  - ➔ Mine/våre data - privacy labels



**lær sensorer å  
snakke norsk**

