

WHAT IS THE FUTURE OF IOT?

IN JUST 5 YEARS

**80 ZETTABYTES GENERATED IOT DATA
90 BILLION IOT DEVICES WORLDWIDE
100 TIMES INCREASE IN DATA SPEED**

THINK ABOUT THIS

**IOT IS NOT JUST DEVICES
THEY ARE THE SENSES,
THE EYES AND THE EARS,
OF A FUTURE GLOBAL**

AI

What defines “Internet of Things”

A physical device that

Must

Sense

non-IoT

Process

IoT

Local



Communicate



Internet

Could

Interact

Agenda for today

The future of the foundational pillars of IoT

INTERNET

WIRELESS COMMUNICATION

SENSORS

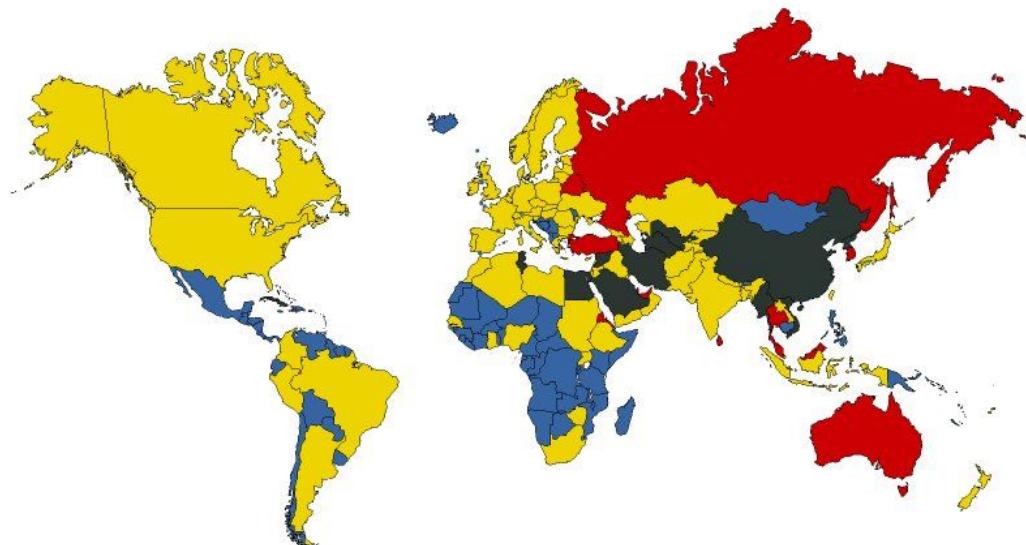
My personal field

THE FUTURE OF HEALTHCARE IoT

- Future of the internet -

The world is always at some balance

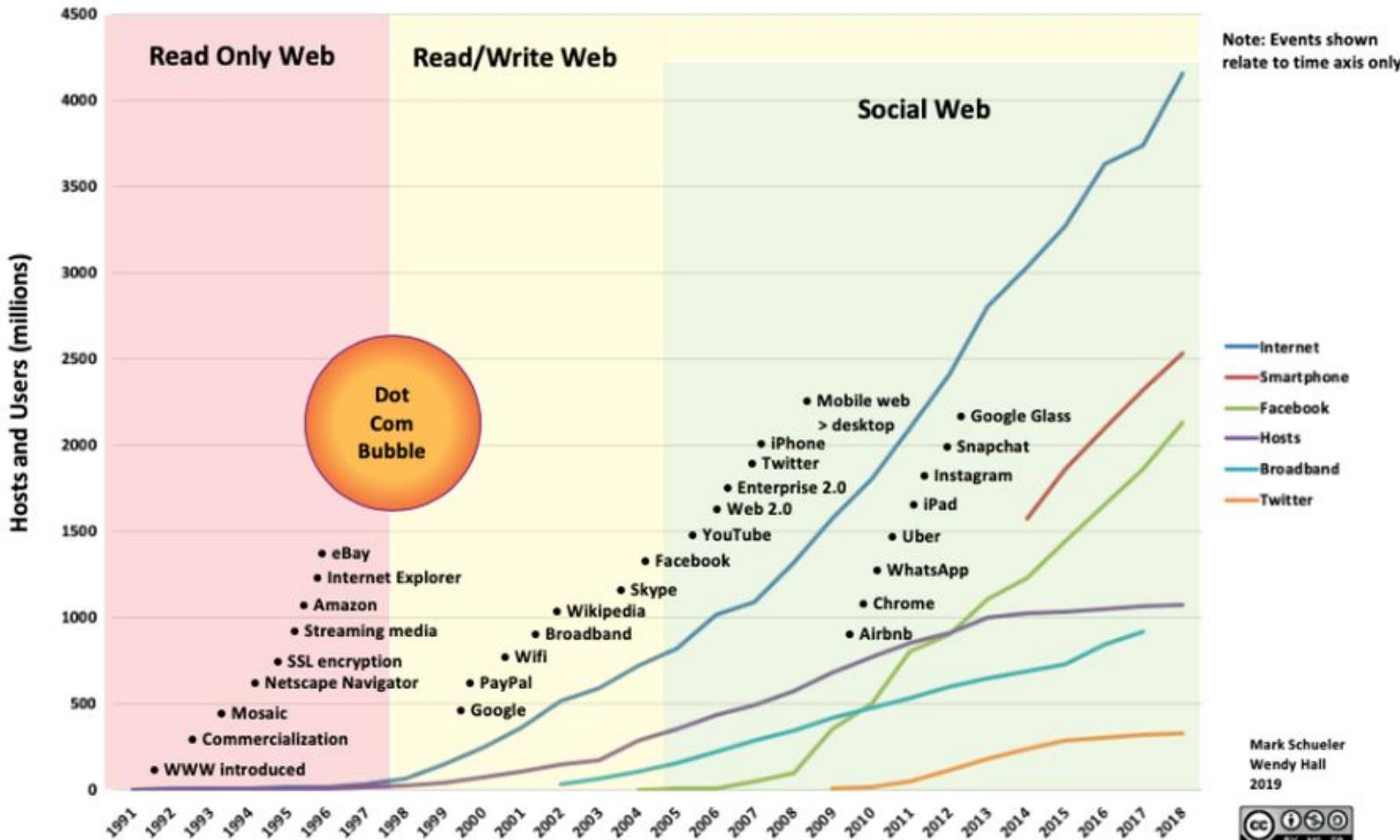
Internet censorship



Counter balance

- Proxies
- Block chain
- Cryptocurrency
- TOR network

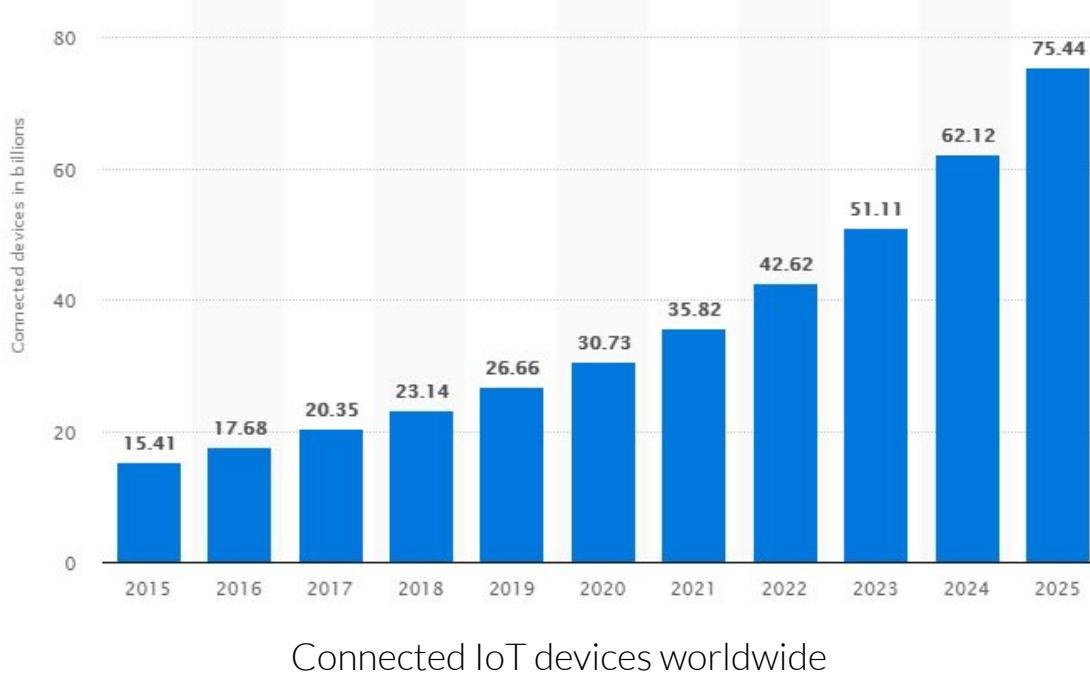
Internet Growth – Usage Phases – Tech Events



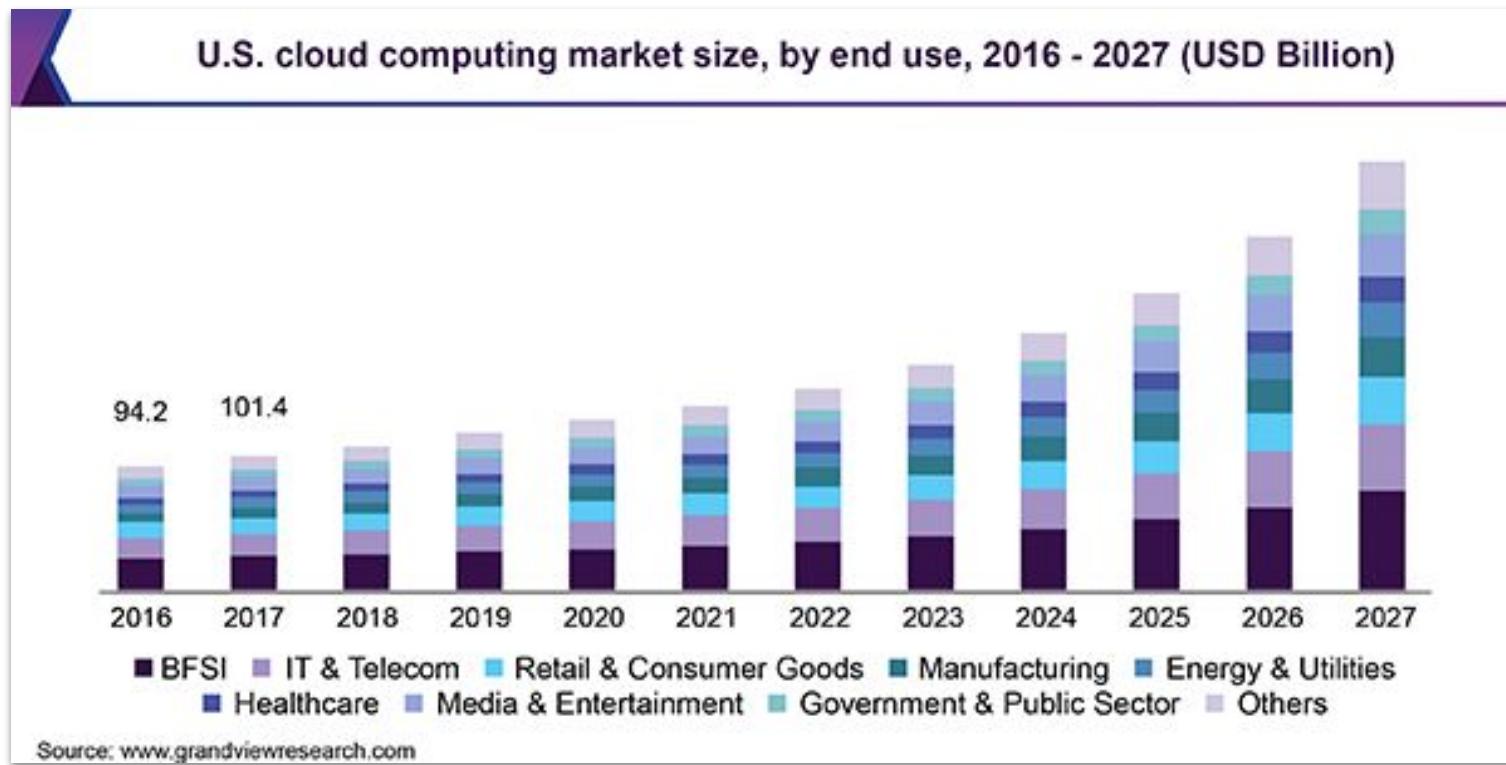
Mark Schueler
Wendy Hall
2019



The internet has between 50-70 billion connected nodes
A human brain has 86 billion neurons
IoT devices account for 30 billion nodes



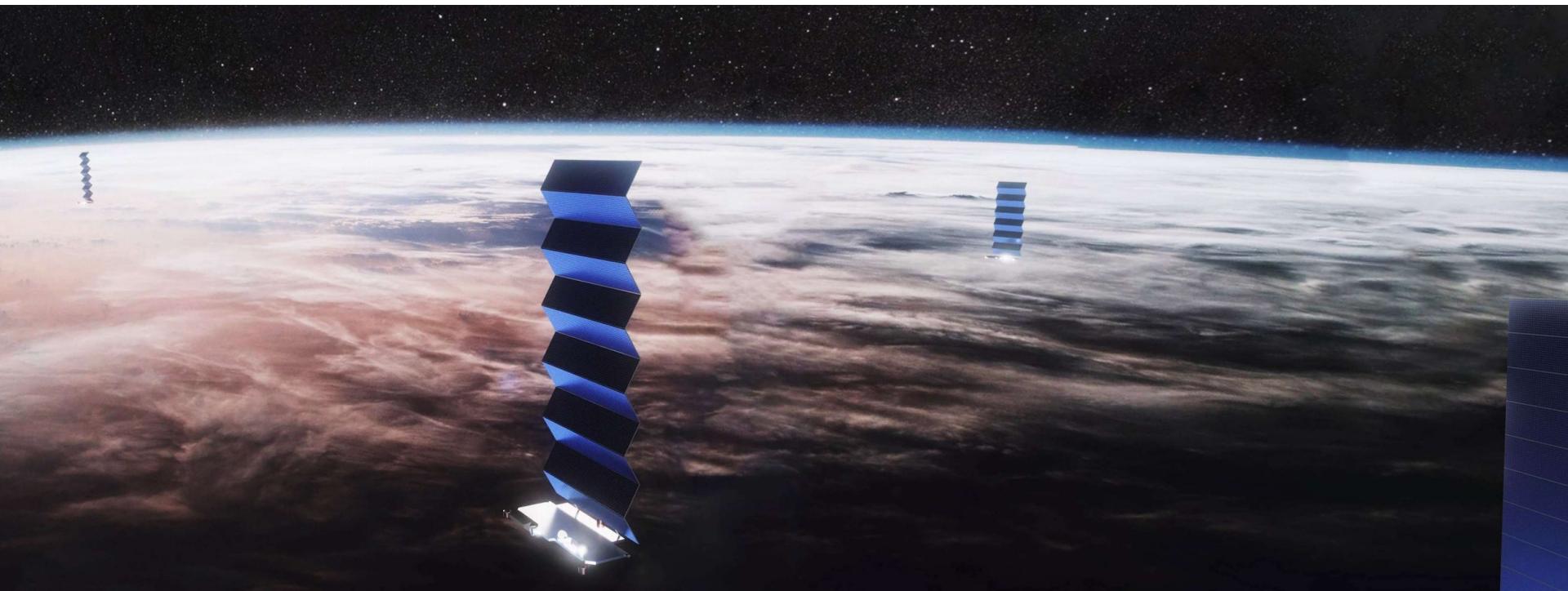
The cloud economy is growing, financial services is trending most



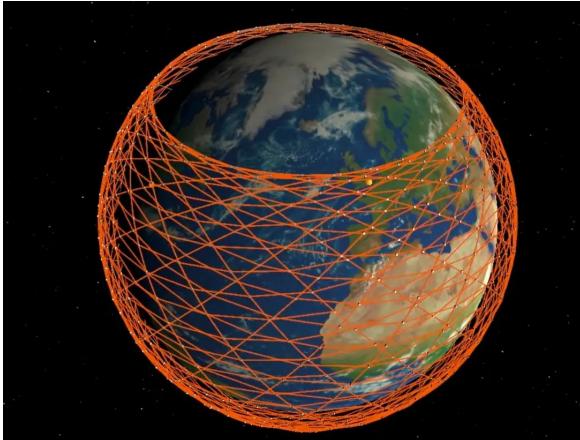
Satellite networks

- Starlink
- Iridium
- OneWeb
- Facebook
- Google

Potentially not affected by local governmental policies, good for censorship mediation.



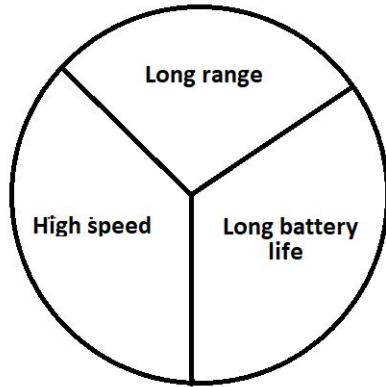
2.300 starlink satellites deployed out of 12.000. This is the beta tester results:



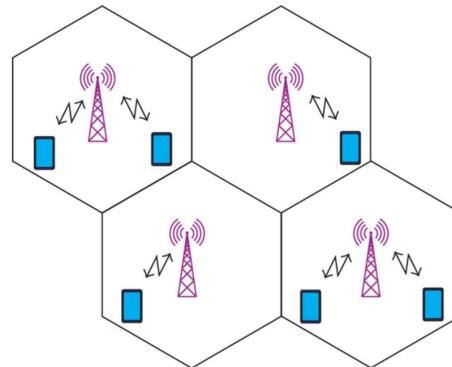
Future of wireless
communication

Fundamental radio theory

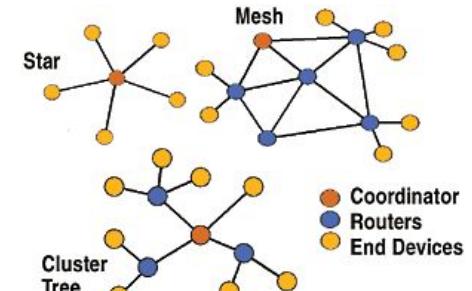
The rule



You can only have two features



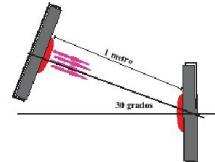
"Hacking" the rule



High speed + long battery life + "long range"

Wireless short range

IRDA
Infrared Data Association



Wireless cellular



Wireless new cellular



The Landscape of 5G

5G will differentiate itself by delivering various improvements:



Decrease in latency:
Delivering latency as low as 1 ms.



Connection density:
Enabling more efficient signaling
for IoT connectivity.



Experienced throughput:
Bringing more uniform, multi-Gbps
peak rates.



Spectrum efficiency:
Achieving even more bits per Hz with
advanced antenna techniques.



Traffic capacity:
Driving network hyper-densification
with more small cells everywhere.

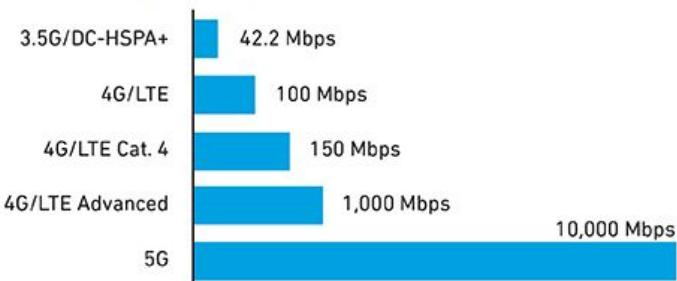


Network efficiency:
Optimizing network energy consumption
with more efficient processing.

Higher frequency increases data speed
Higher frequency decreases range

5G frequencies in Europe
3.5 Ghz
25 GhZ

Downlink Speeds by Technical Generation



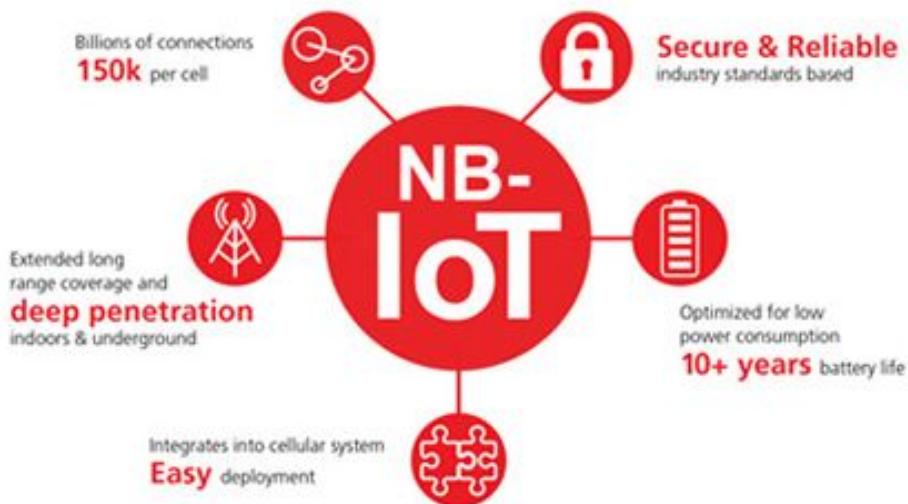
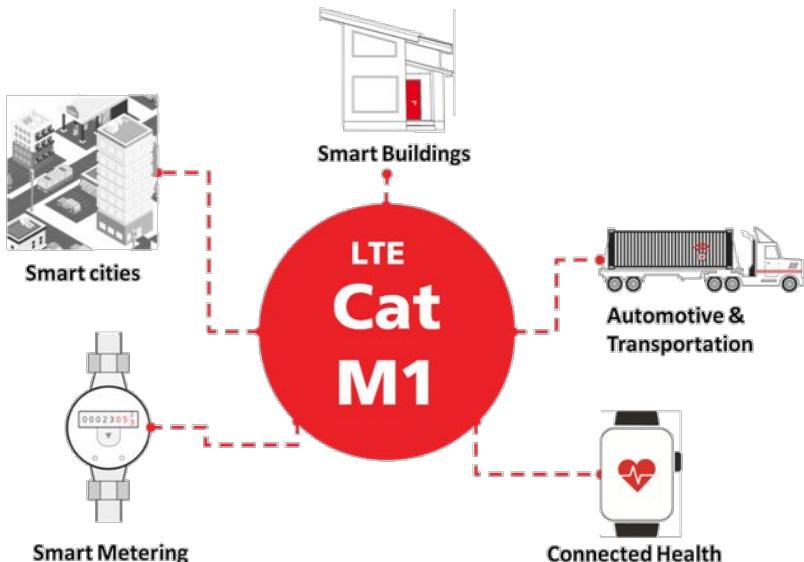
QORVO

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Let's agree
that this is
not the
path to stop
a pandemic
:)



Wireless new cellular



<https://iot-analytics.com/iot-modules/>

Future of sensors

Vehicle Sensors

Lane departure system

Night vision

Front object CCD camera

Front airbag sensors

ASCD

Nighttime pedestrian warning

Drowsiness sensors

Front object laser radar

Nighttime pedestrian warning IR sensor

Active park assist

Tire pressure sensor

Rear object monitor
CCD camera

Rear camera

Side curtain sensor

Blind spot detection
Cross traffic alert

Central computer

Rear object laser radar

Wheel speed sensor

Tire pressure sensor

Collision sensor

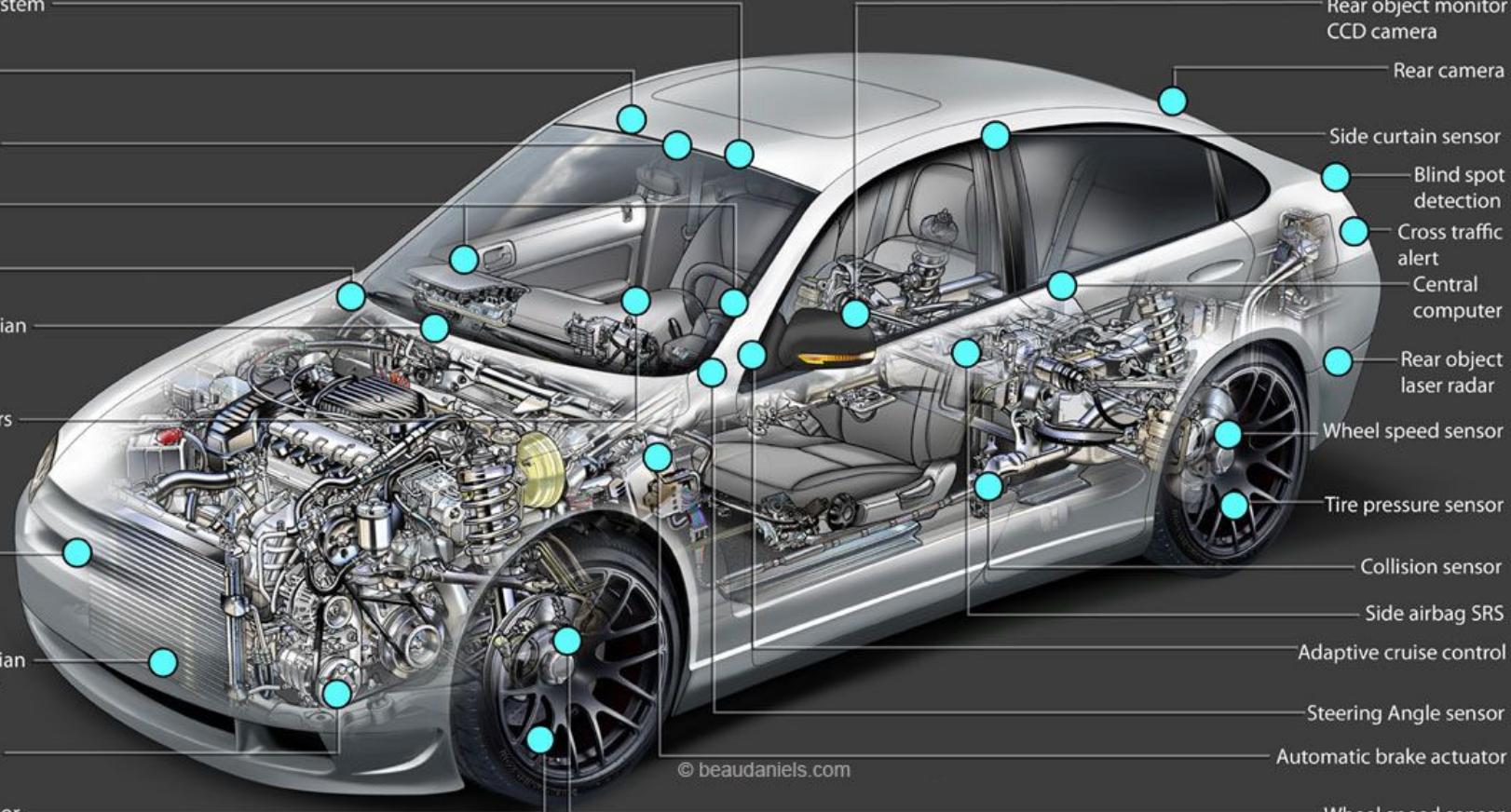
Side airbag SRS

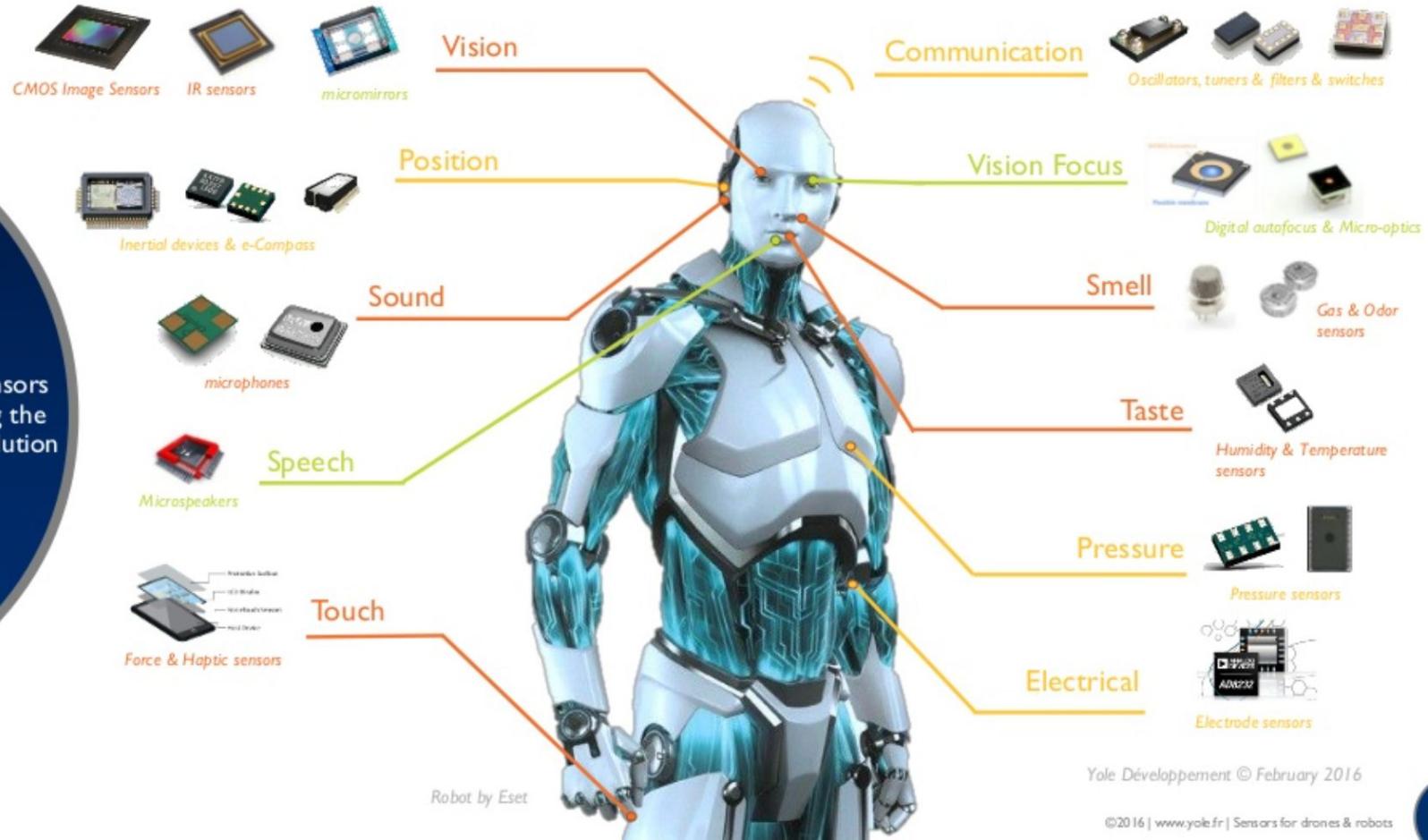
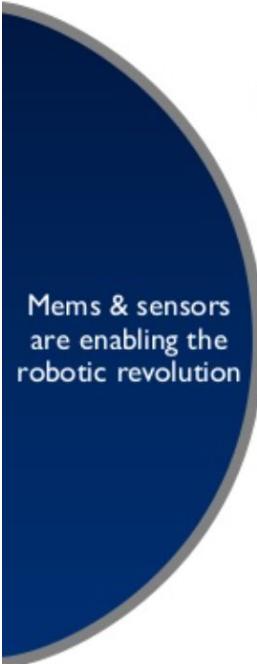
Adaptive cruise control

Steering Angle sensor

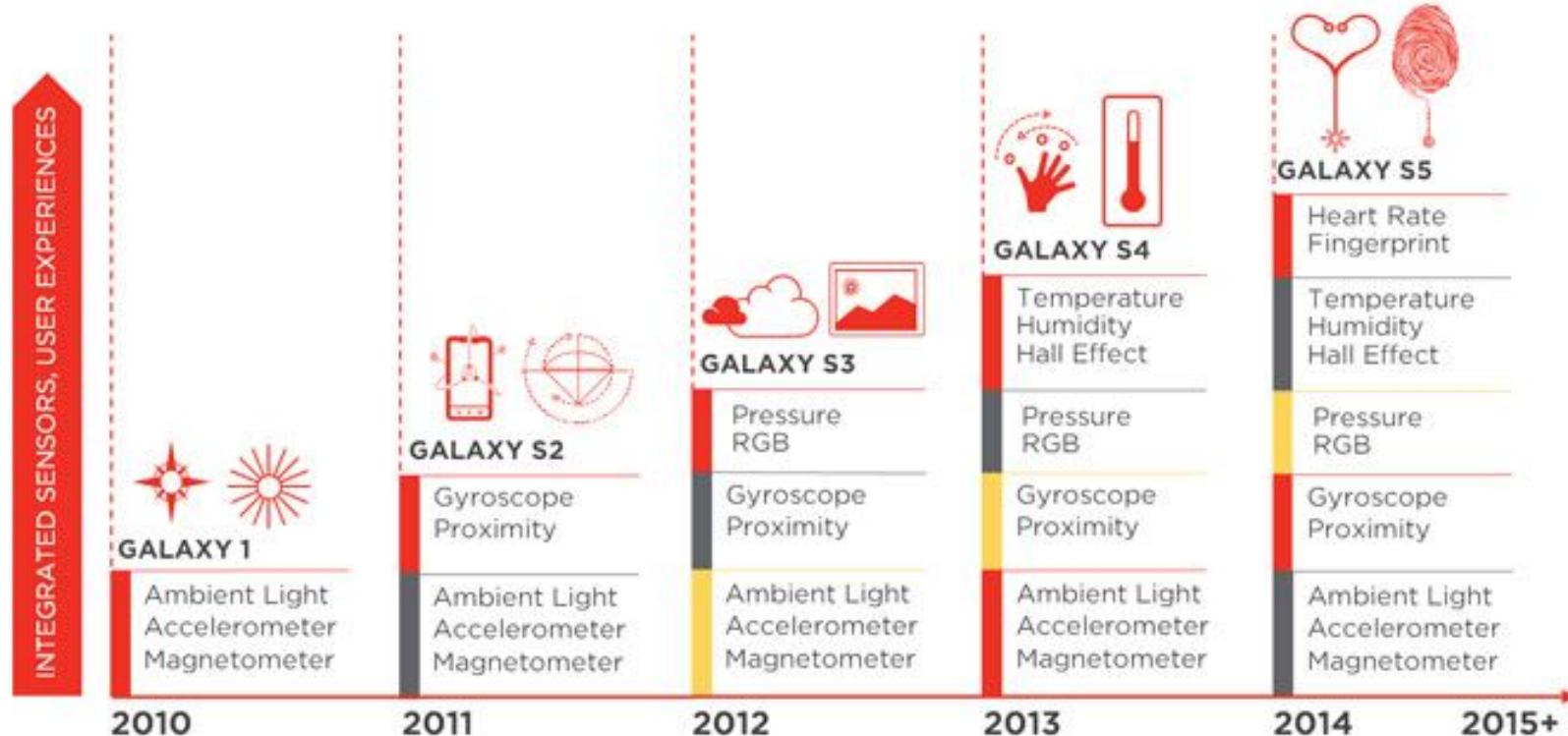
Automatic brake actuator

Wheel speed sensor





SENSOR GROWTH IN SMARTPHONES

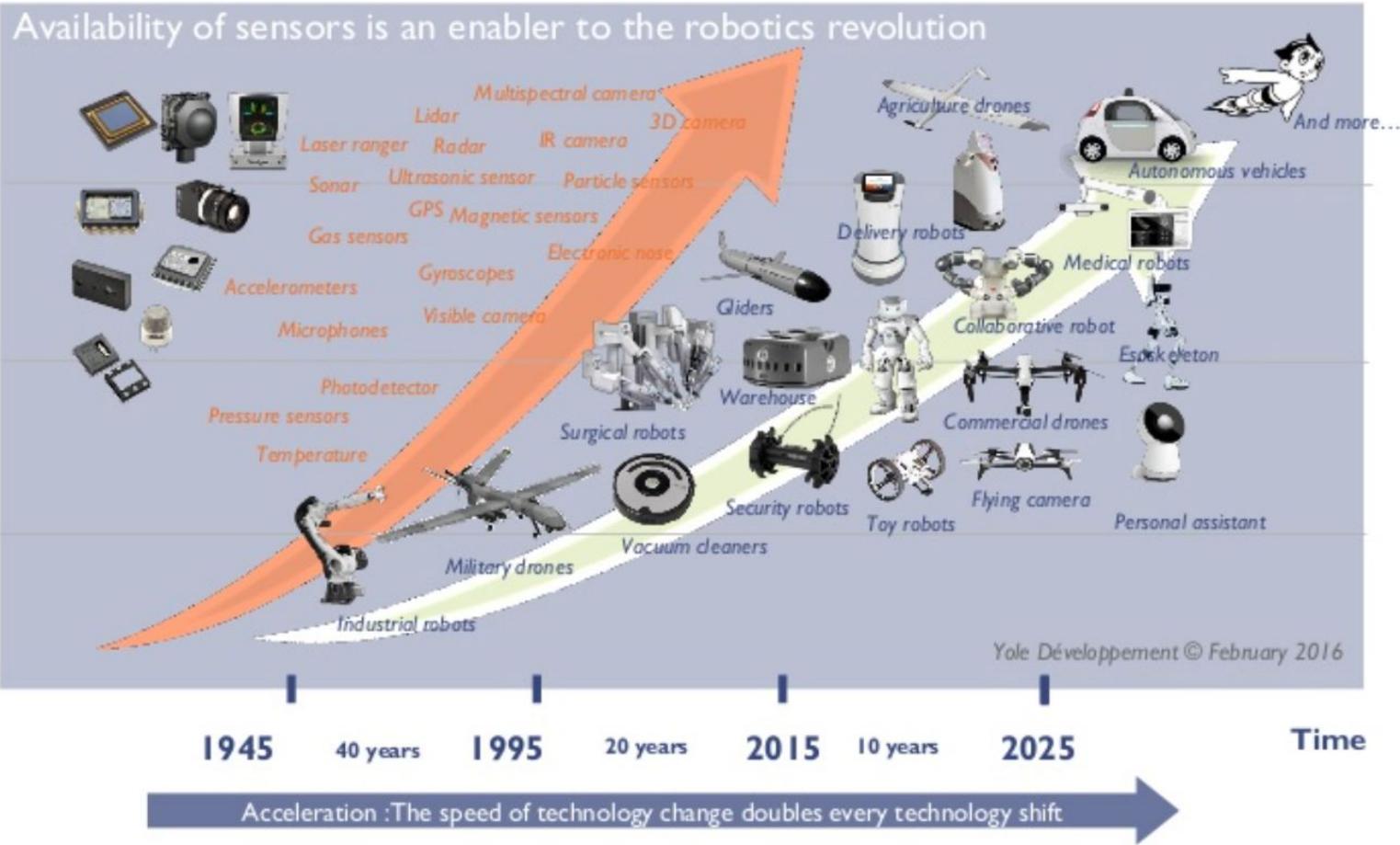


Technology

Advanced
sensing
technology

Replication
of human
senses

Basic
sensing
technology



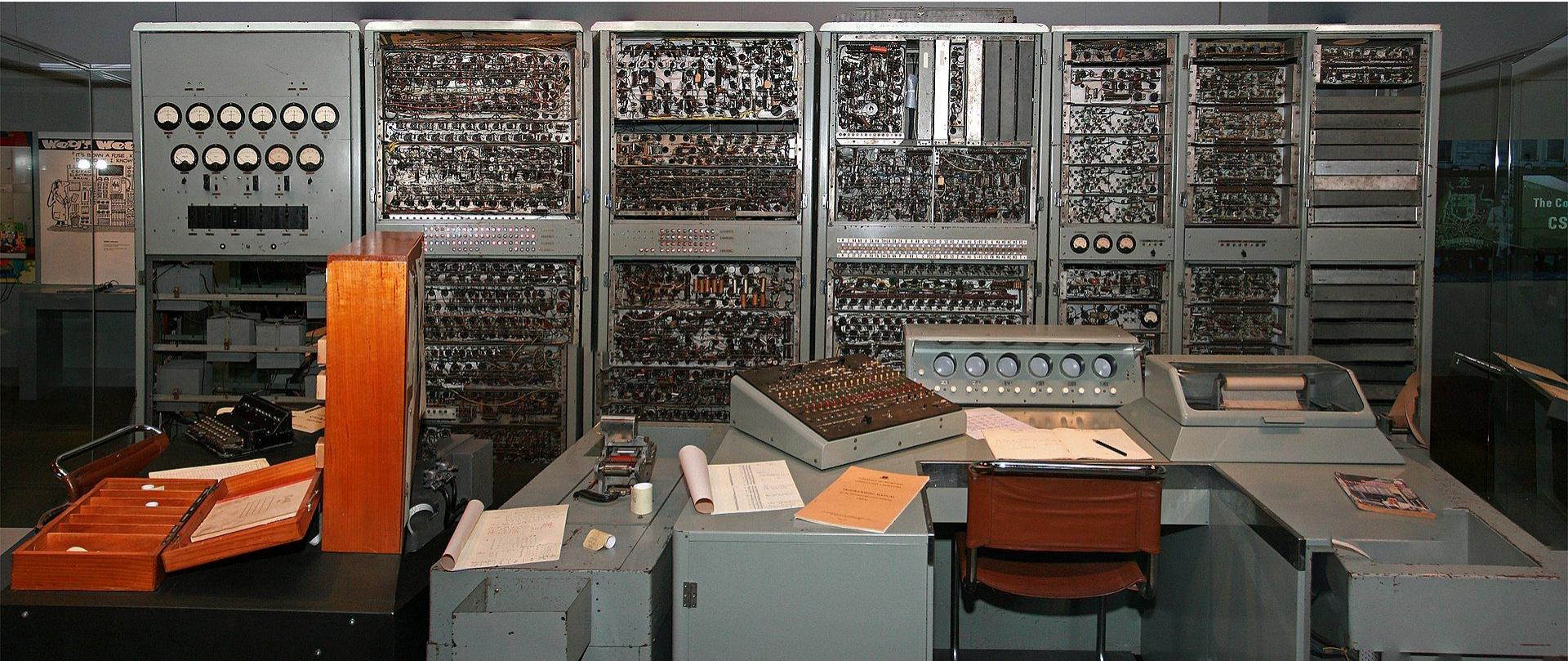
Future sensors

- Ultrasonics
- Radar
- Laidar
- Chemical / biological
- AI driven sensor fusion (audio localization, gesture)

Future of wearable IoT

We have an inherent need to bring technology closer to ourselves.

1950s



1970s



1990s



2000s



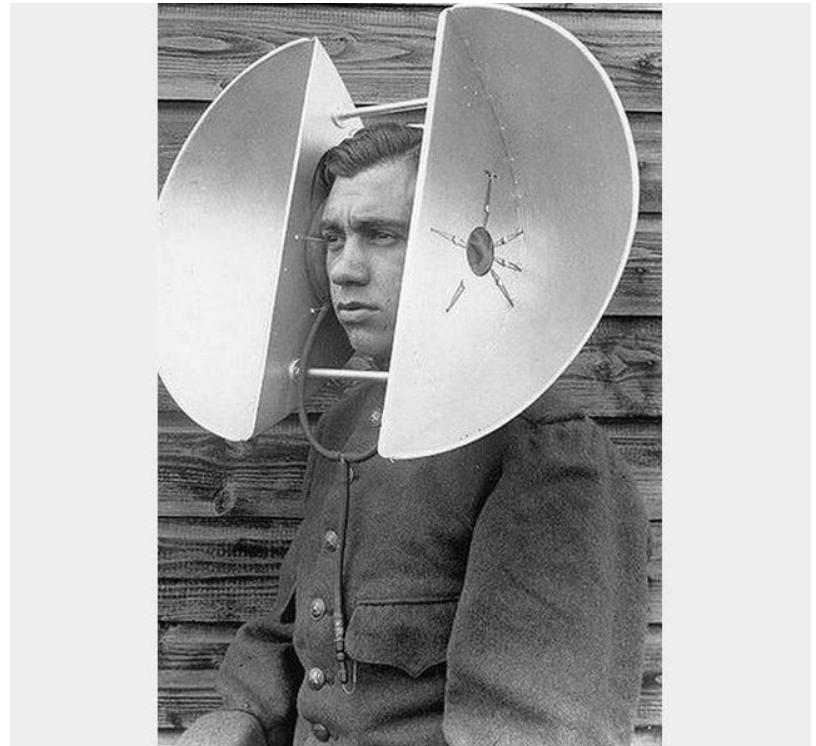
2010s



Wearables

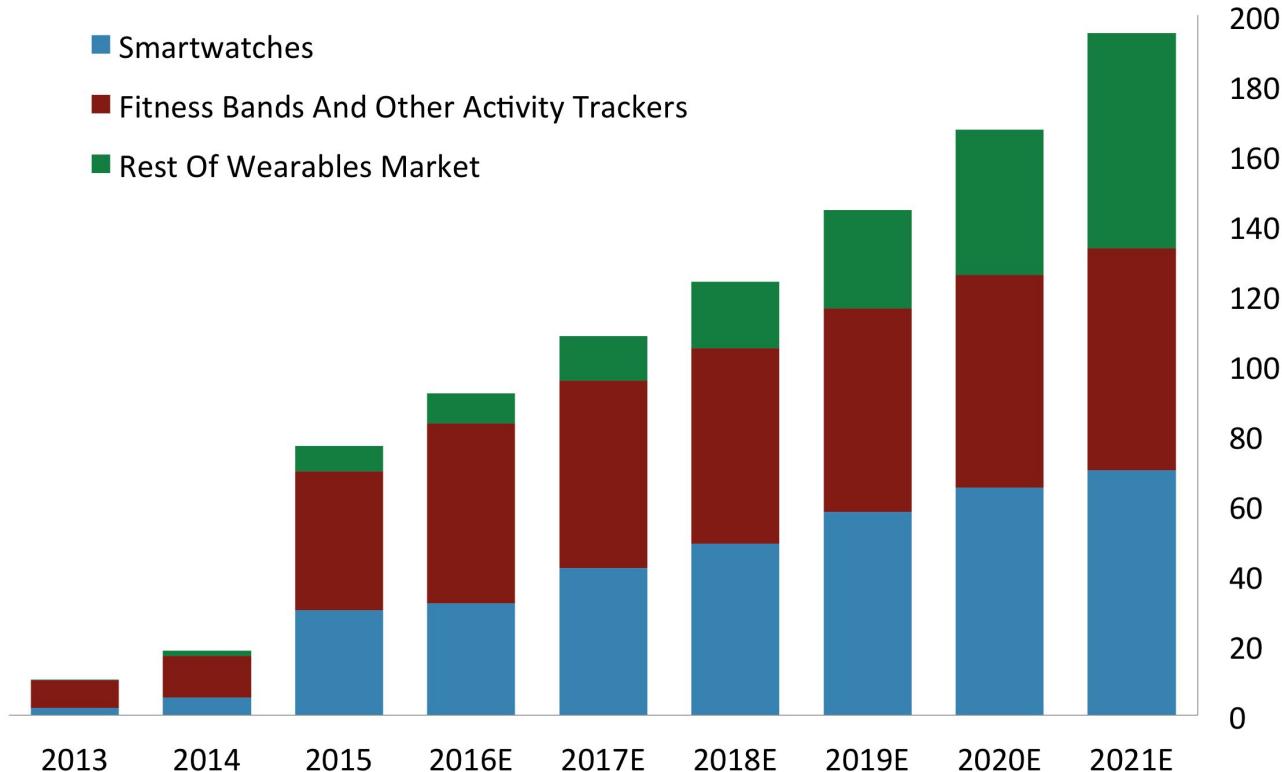
A device you wear, which has a functional purpose in your everyday life

The first wearables



Global Wearables Shipment Forecast, By Device

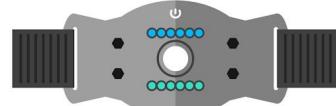
Millions



Source: IDC, BI Intelligence estimates

BI INTELLIGENCE

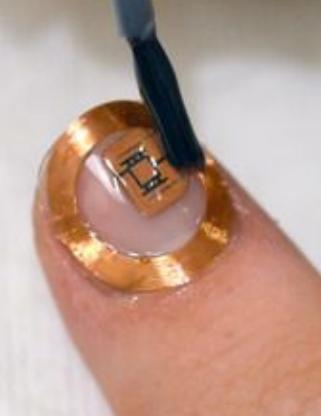
Yesterday's wearables



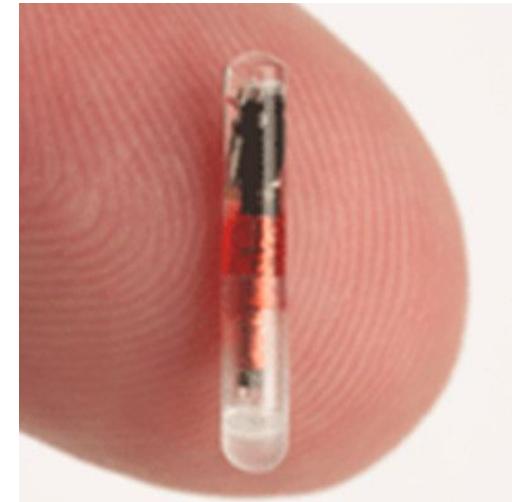
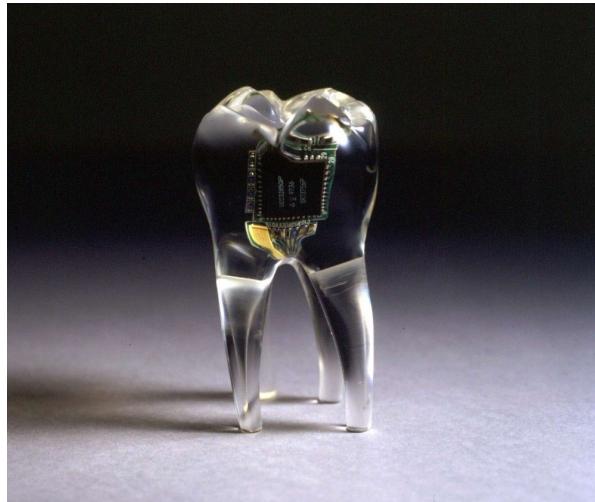
Wearables of today



Wearables of tomorrow



The next leap in wearables → implantables



Low human to computer bandwidth needs to be solved

Modern CPU has a bandwidth of **25.6 GB/s**

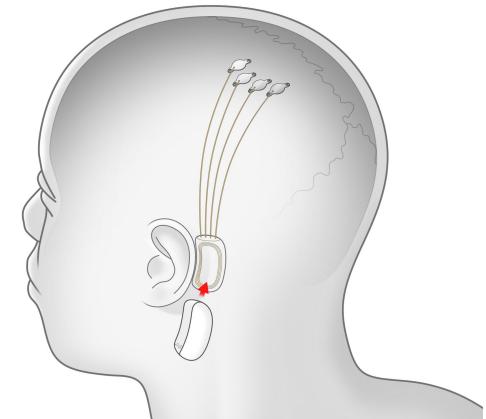
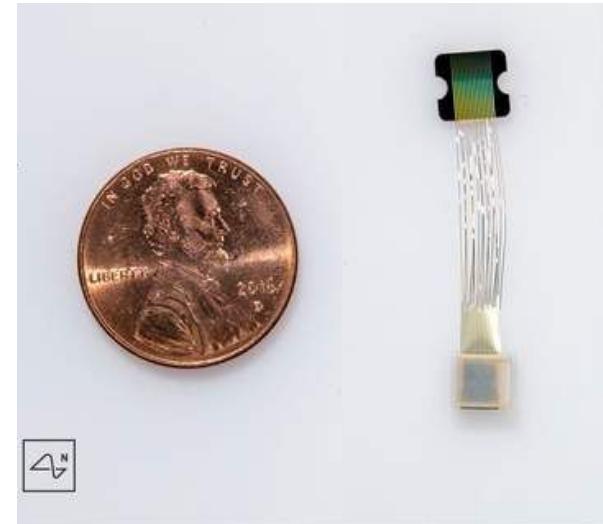
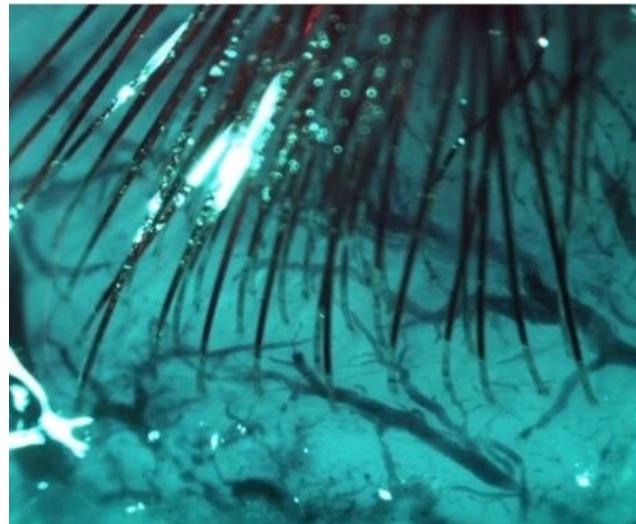
World champion in typing ia around 300 words/min

Min 8 keys a second x 8bits(ASCII) per key = **24B/s**

Difference: 1.000.000.000 times



Brain Machine Interface (BMI)



Implatables + human computer interface = Cyborg

Question:

- Will all of our IOT wearables and implatables constitute to a self aware AI?
- Are we then human or a drone of AI
- When are we or it in control?



That's the questions you will have to answer during your careers

The current challenges of Wearables

Power

Current state of art: 250Wh/kg

Expect no more than 500Wh/kg in the next 5 years.

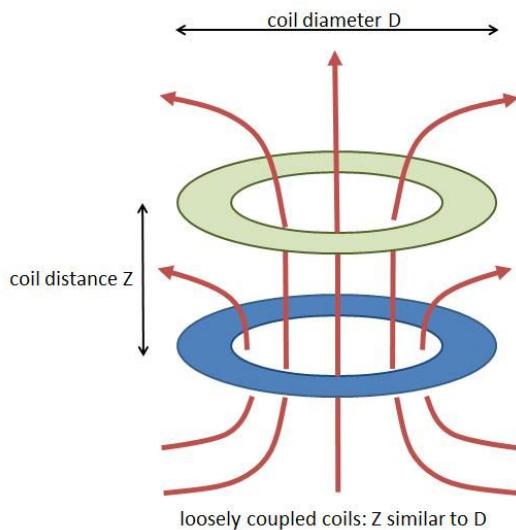
Wearables must get more power efficient in hardware, and software.

Clever wireless charging can help

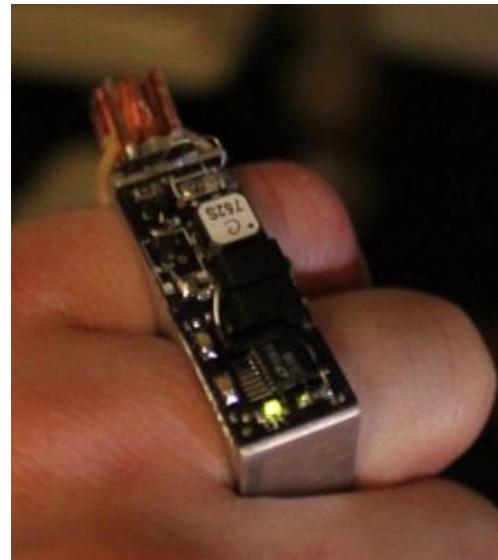
Storage material	Energy type	Specific energy (MJ/kg)
Deuterium (in Fusion reactor)	Nuclear fusion	87,900,000 ^[2]
Uranium (in breeder)	Nuclear fission	80,620,000 ^[3]
Thorium (in breeder)	Nuclear fission	79,420,000 ^[3]
Plutonium 238	Nuclear decay	2,239,000
Tritium	Nuclear decay	583,529
Hydrogen (compressed at 700 bar)	Chemical	142
Methane or Liquefied natural gas (compressed)	Chemical	55.5
Diesel	Chemical	48
LPG (including Propane / Butane)	Chemical	46.4
Gasoline (petrol)	Chemical	46.4
Jet fuel (Kerosene)	Chemical	42.8 ^[4]
Fat (animal/vegetable)	Chemical	37
Coal (anthracite or bituminous)	Chemical	~30
Carbohydrates (including sugars)	Chemical	17
Protein	Chemical	16.8
Wood	Chemical	16.2 ^[5]
TNT	Chemical	4.6
Gunpowder	Chemical	3 ^[citation needed]
Lithium metal battery (Li-Po, Li-On, Li-Hv)	Electrochemical	1.8
Lithium-ion battery	Electrochemical	0.36 ^[6] –0.875 ^[7]

Energy harvesting

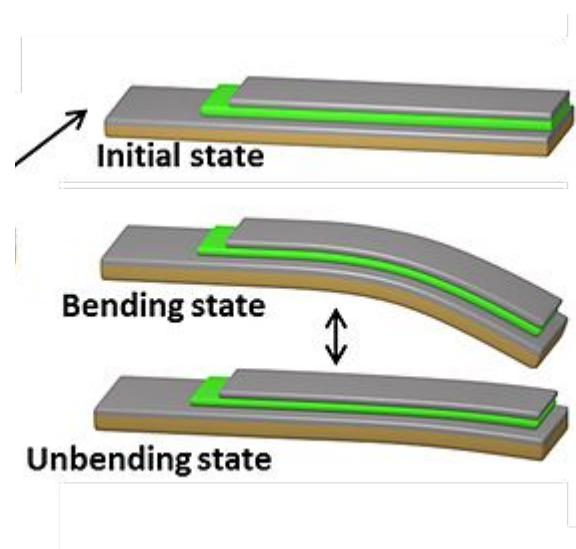
Magnetic induction



Seebeck effect



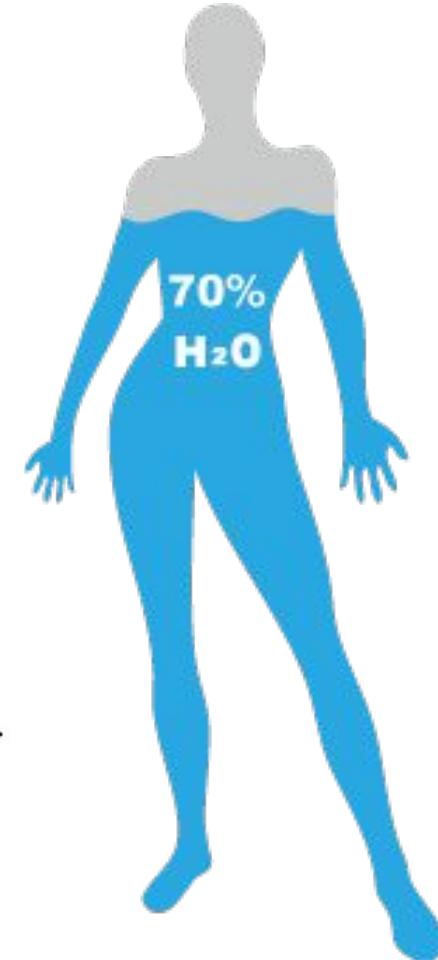
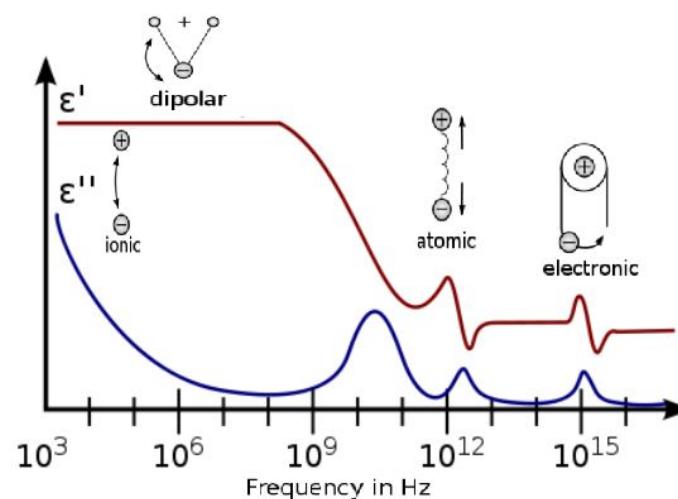
piezoelectric effect

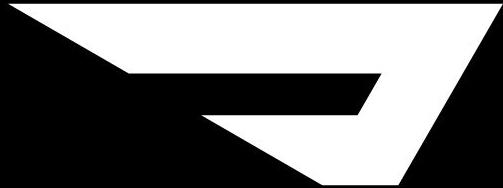


Wireless communication

Fundamental problem.. We are a sack of water!

- Electric fields
 - Normal monopoles detune
- Magnetic fields
 - Loop antennas work ok
- Skin surface communication
- Range
 - Shorter range less power





vokalo

UNLEASH PERFORMANCE

Vokalo improves athletes' performance through a highly advanced audio communication system that allows for real-time communication between coaches and athletes.



