INTRODUCTION TO INTERNET OF THINGS FOR SDGS

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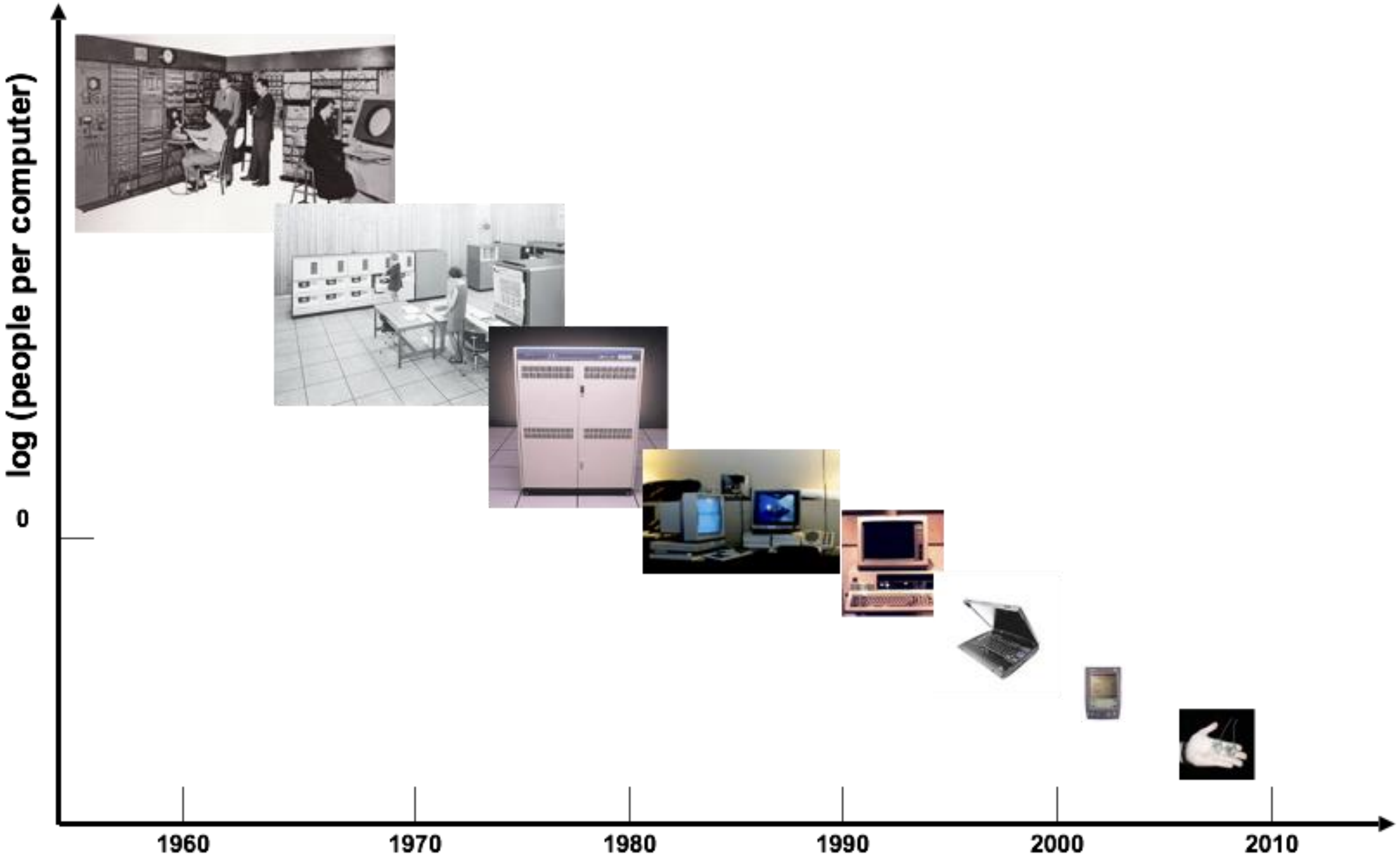
IOT VISION



[Culler:2004]

Internet of Things (IoT)

"Internet-connected computers, with sensors and actuators." — @tamberg

"Physical objects with a Web API." — @hansamann

IoT: "Global network of computers, sensors and actuators, connected through Internet protocols.”

Web of Things: "RESTful Web services that measure or manipulate physical properties." — @gsiot

Internet of Things (IoT)

“The IoT can be viewed as a global **infrastructure** for the information society, enabling advanced services by interconnecting (**physical** and **virtual**) things based on existing and evolving interoperable information and communication technologies (ICT).”— Recommendation ITU-T Y.2060

History of IoT (not new!)

The first telemetry system was rolled out in Chicago way back in **1912**. It is said to have used **telephone lines** to monitor data from power plants.

Telemetry expanded to weather monitoring in the **1930**s, when a device known as a **radiosonde** became widely used to monitor weather conditions from balloons.

History of IoT (not new!)

Broad adoption of M2M technology began in the 1980s with wired connections for **SCADA** (supervisory control and data acquisition) on the factory floor.

In the 1990s ADEMCO built their own **private radio network** because cellular connectivity was too expensive.
In 1995, Siemens introduced the **first cellular module** built for M2M.

History of IoT (not new!)

“Machine to Machine” (M2M)
(~1970s +)

Internet of Things Beginnings

Carnegie Mellon Internet
Coke Machine (1982, 1990)

Trojan Room Coffee
Pot
(first webcam)
(1991)

Internet Toaster
(1990)

Drivers of IoT

Small, inexpensive, low power computers.

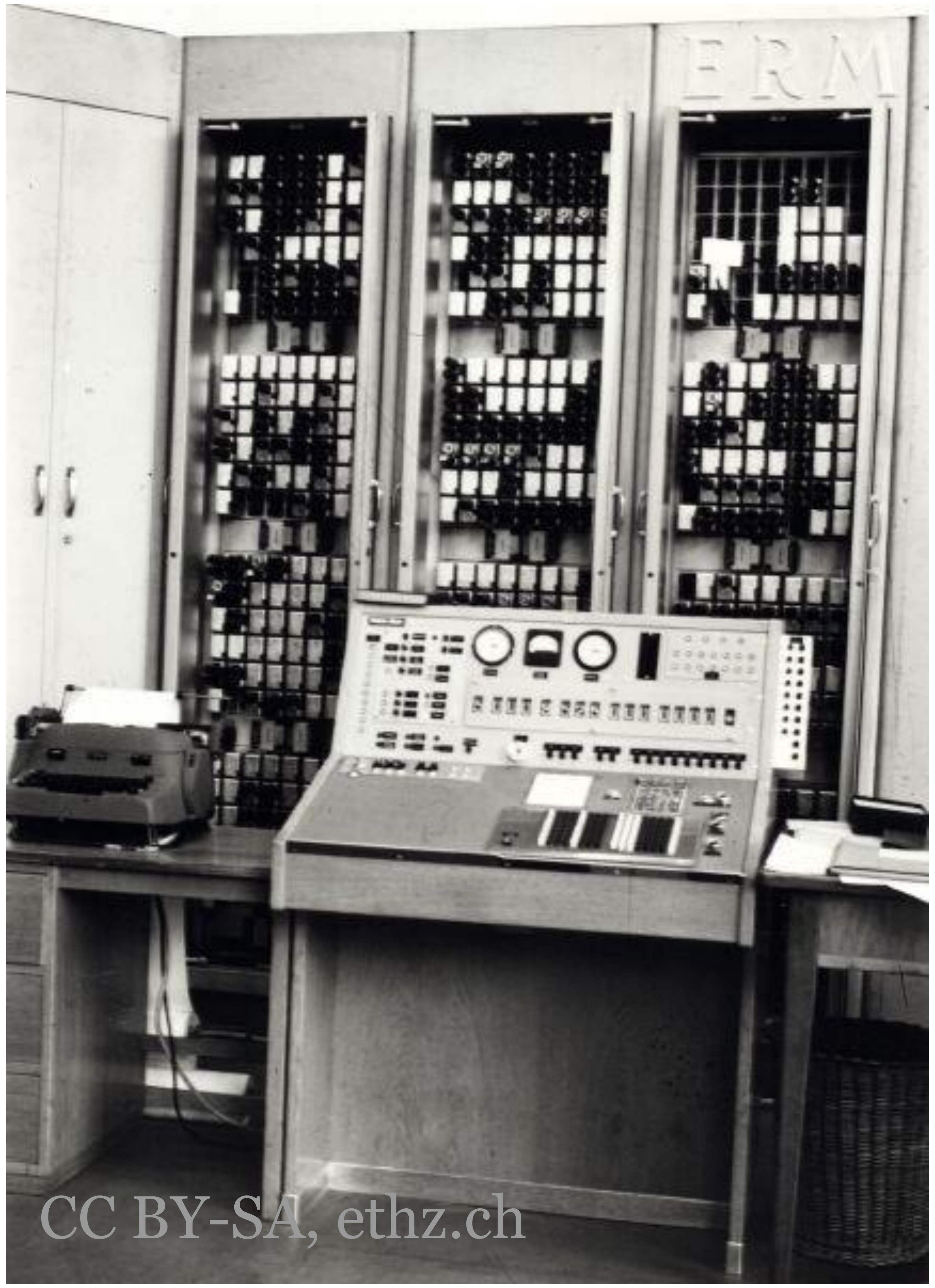
Small, inexpensive, low power sensors.

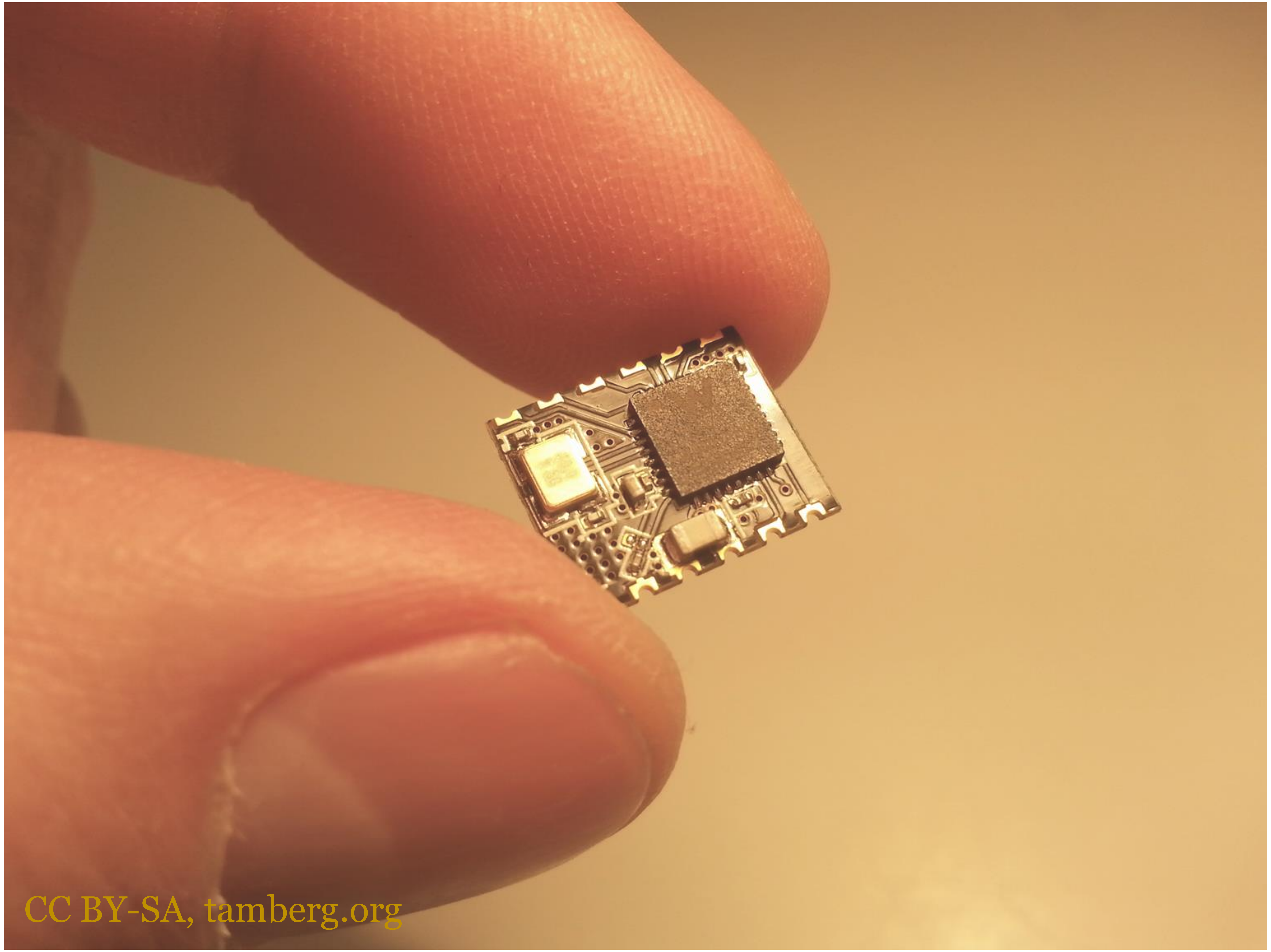
Short and long range connectivity.

Cloud computing and storage.

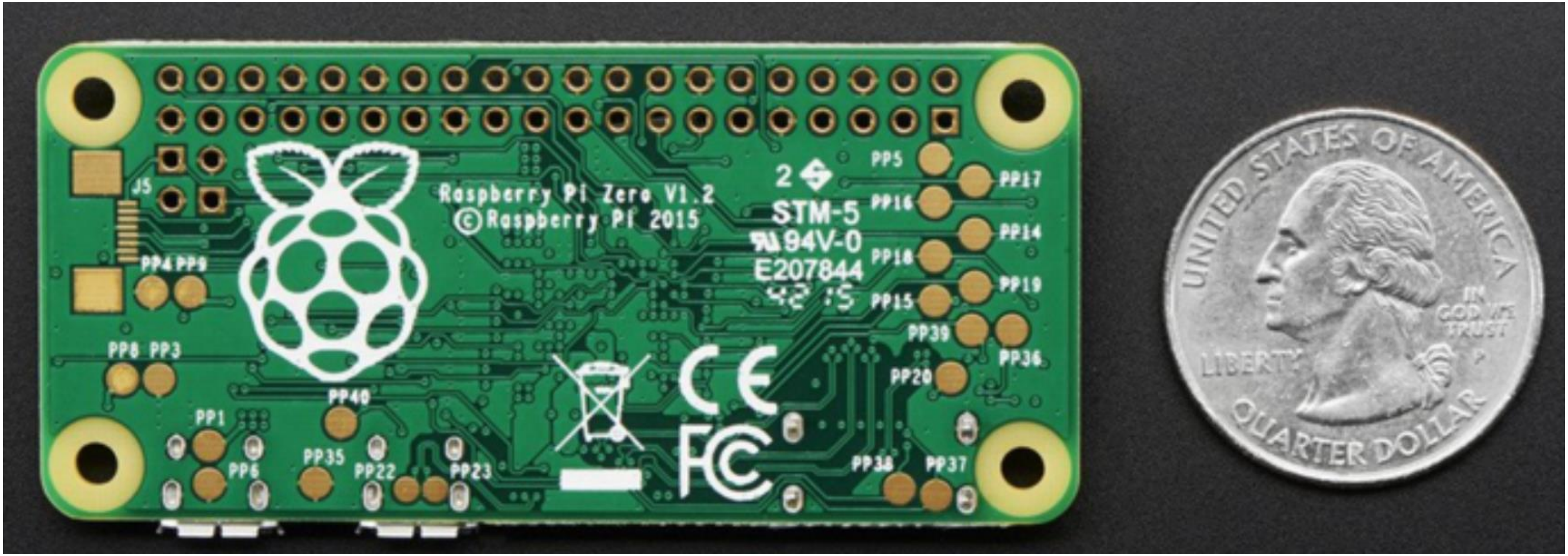
Standard (IoT) protocols.

Moore's law





RPi zero: $5


Raspberry Pi Zero V1.2
©Raspberry Pi 2015
STM-5
94V-0
E207844
PP5
PP17
PP16
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PP19
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PP36
PP20
PP4 PP9
PP8 PP3
PP40
PP1
PP6
PP35
PP22
PP23
PP37
J5
UNITED STATES OF AMERICA
LIBERTY
IN GOD WE TRUST
QUARTER DOLLAR

Device — ITU definition

“A device is a piece of equipment with the **mandatory capabilities** of **communication** and optional capabilities of sensing, actuation, data capture, data storage and data processing. Some devices also execute operations based on information received from the information and communication networks.” — Recommendation **ITU-T Y.2060**

Fundamental characteristics — ITU

Interconnectivity: With regard to the IoT, anything can be interconnected with the global information and communication infrastructure.
Heterogeneity: The devices in the IoT are heterogeneous as based on different hardware platforms and networks. They can interact with other devices or service platforms through different networks.

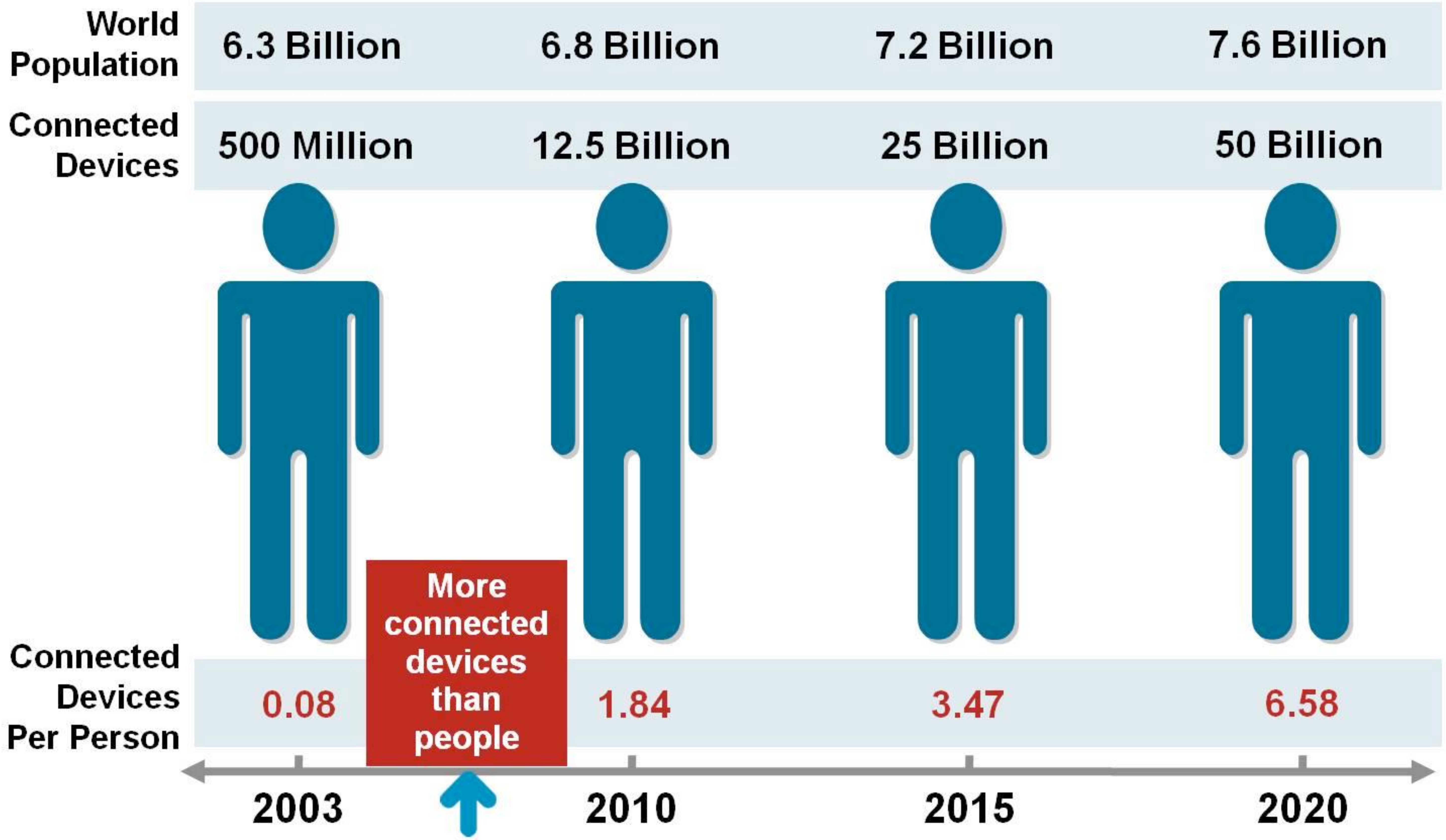
Fundamental characteristics — ITU

Dynamic changes: The state of devices change dynamically, e.g., sleeping and waking up, connected and/or disconnected as well as the context of devices including location and speed. Moreover, the number of devices can change dynamically.

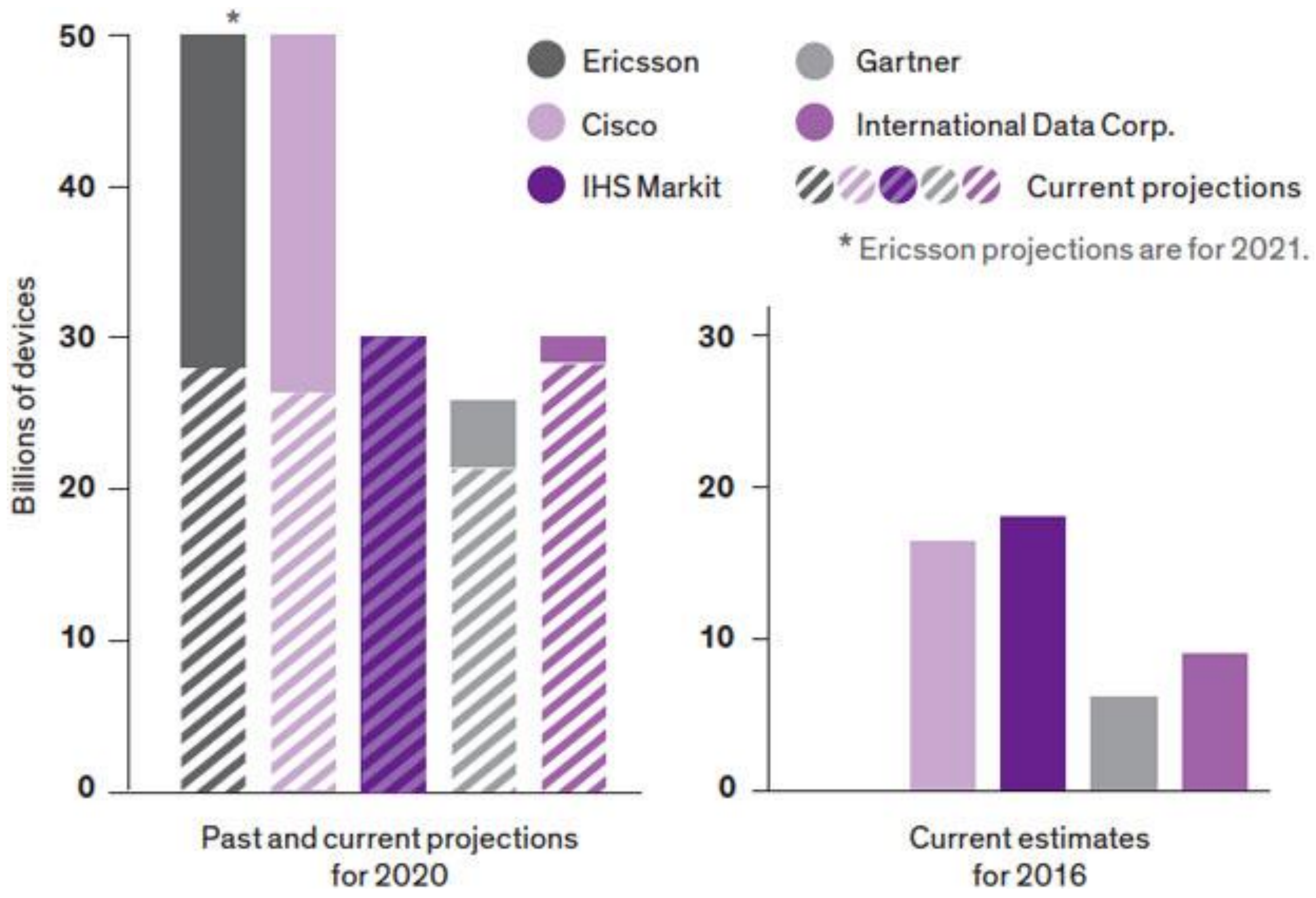
Fundamental characteristics — ITU

Enormous scale: The number of devices that need to be managed and that communicate with each other will be at least an order of magnitude larger than the devices connected to the current Internet. The ratio of communication triggered by devices as compared to communication triggered by humans will noticeably shift towards device-triggered communication.

PREDICTIONS



NEW PREDICTIONS



http://spectrum.ieee.org/telecom/internet/the-internet-of-fewer-things

NEW PREDICTIONS

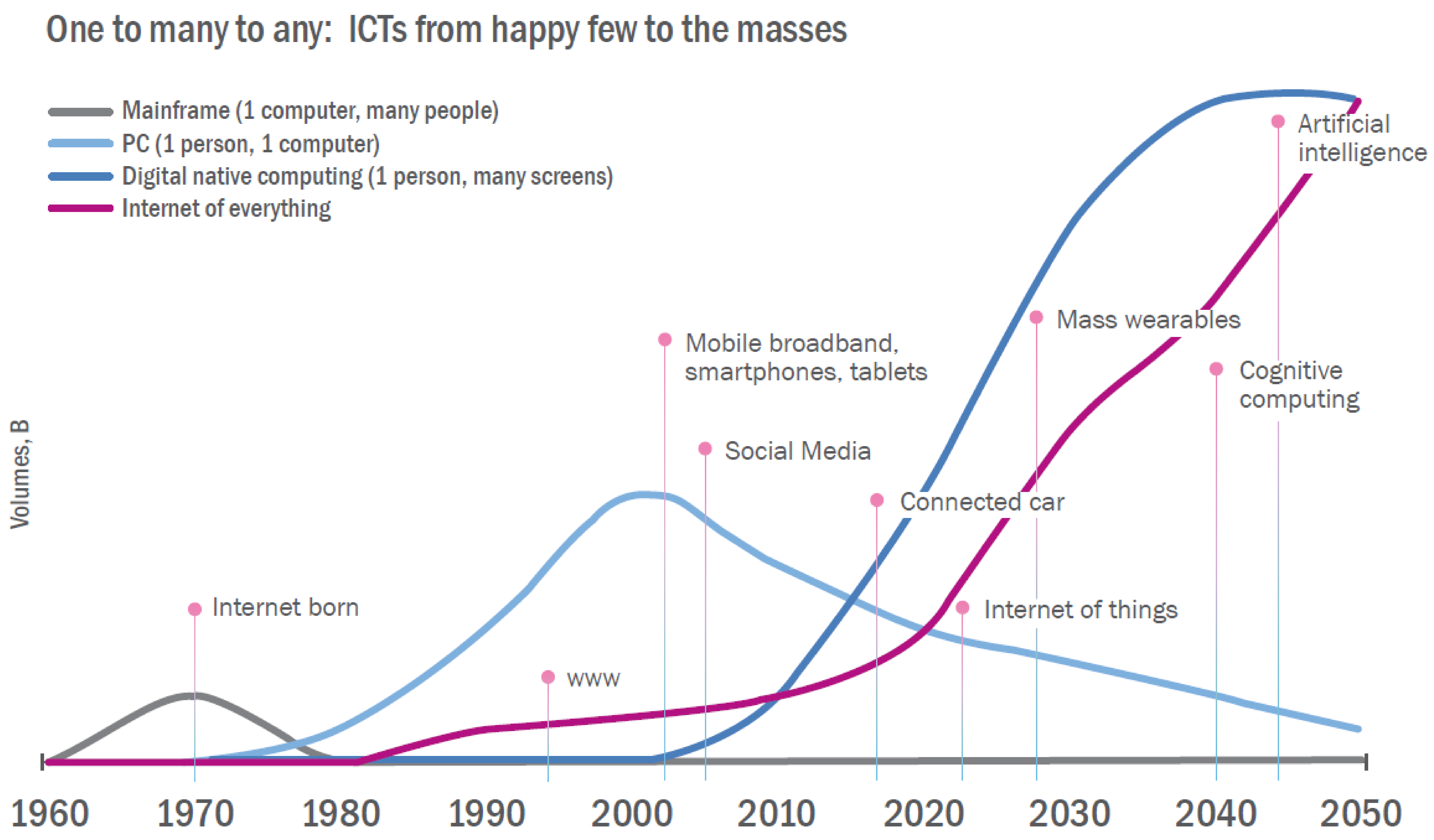
Internet of Things

Connected Means Informed

According to Cisco, 500 billion devices are expected to be connected to the Internet by 2030. Each device includes sensors that collect data, interact with the environment, and communicate over a network. The Internet of Things (IoT) is the network of these connected devices. These smart, connected devices generate data that IoT applications use to aggregate, analyze, and deliver insight, which helps drive more informed decisions and actions.

http://www.audentia-gestion.fr/cisco/pdf/at-a-glance-c45-731471.pdf

History of the future



Connectivity

Ability to communicate with another device.

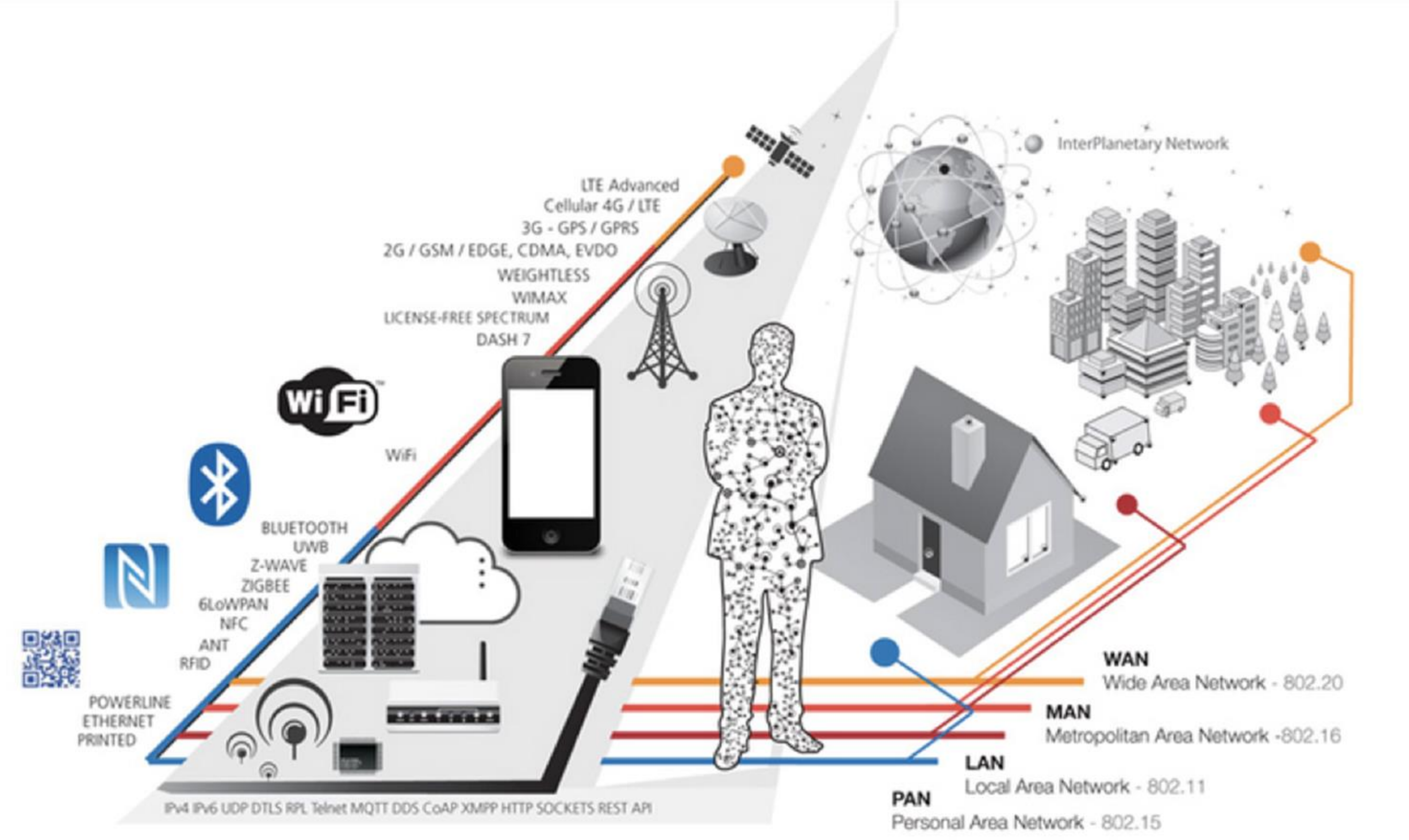
Personal area network (PAN, e.g. BLE, Zigbee).

Local area networks (LAN, e.g. Ethernet, Wi-Fi).

Wide area networks (WAN, e.g. 3/4G, LoRaWAN).

The range grows from "room" to "building" to "city" (e.g. BLE, 30m; Wi-Fi, 100m; LoRaWAN, 2-15km).

Connectivity



Device

Embedded computer with sensors and actuators.

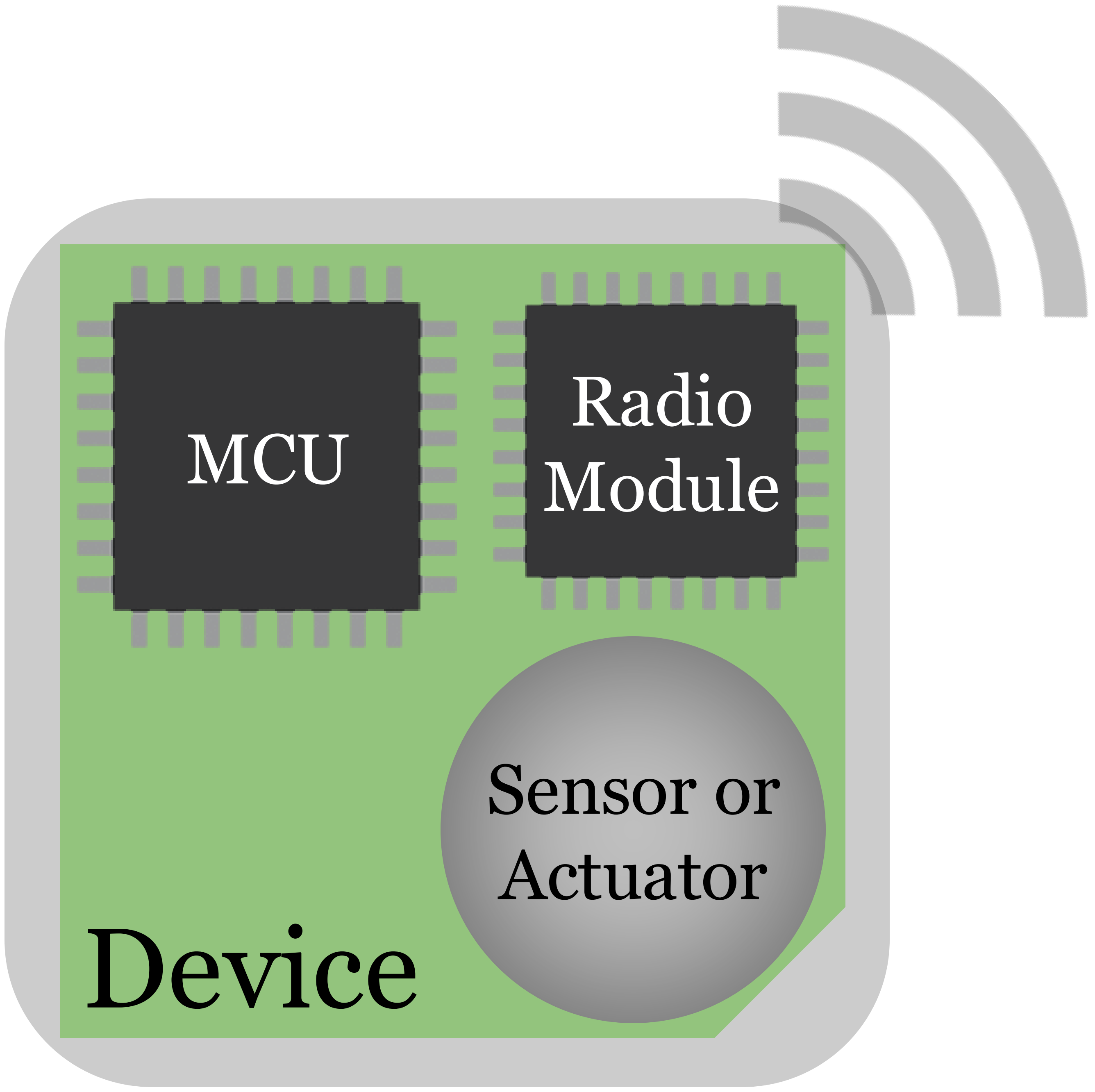
Connectivity on the chip or as an external module.

Microcontroller (MCU) with constrained resources.

Small, slow processor, limited memory, low power.

Often battery powered or harvesting energy.

Device

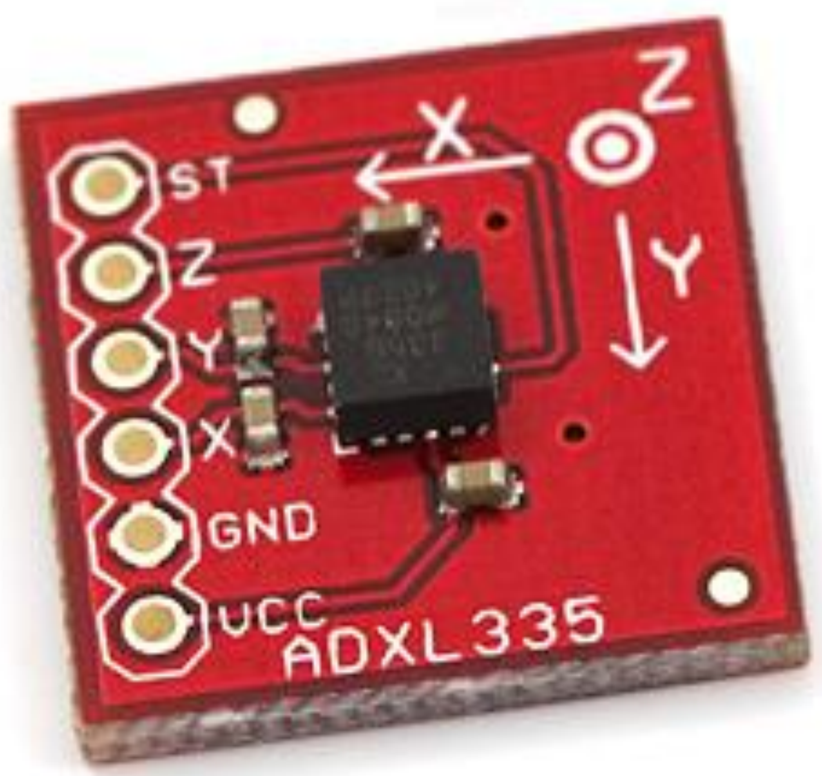

MCU
Radio Module
Sensor or Actuator
Device

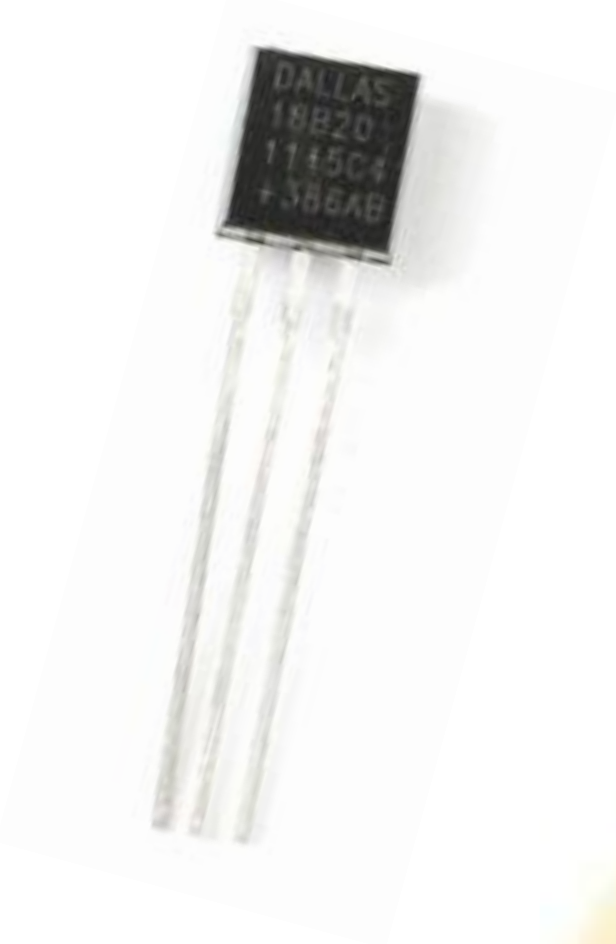

AVELON
turn your information into benefit
Hardware type
AVEMM01
Carrier
TTN
SW version
2.1
Initial setup
600 / 6
Integrated with Alcedo Cloud
CC BY-SA, tamberg.org

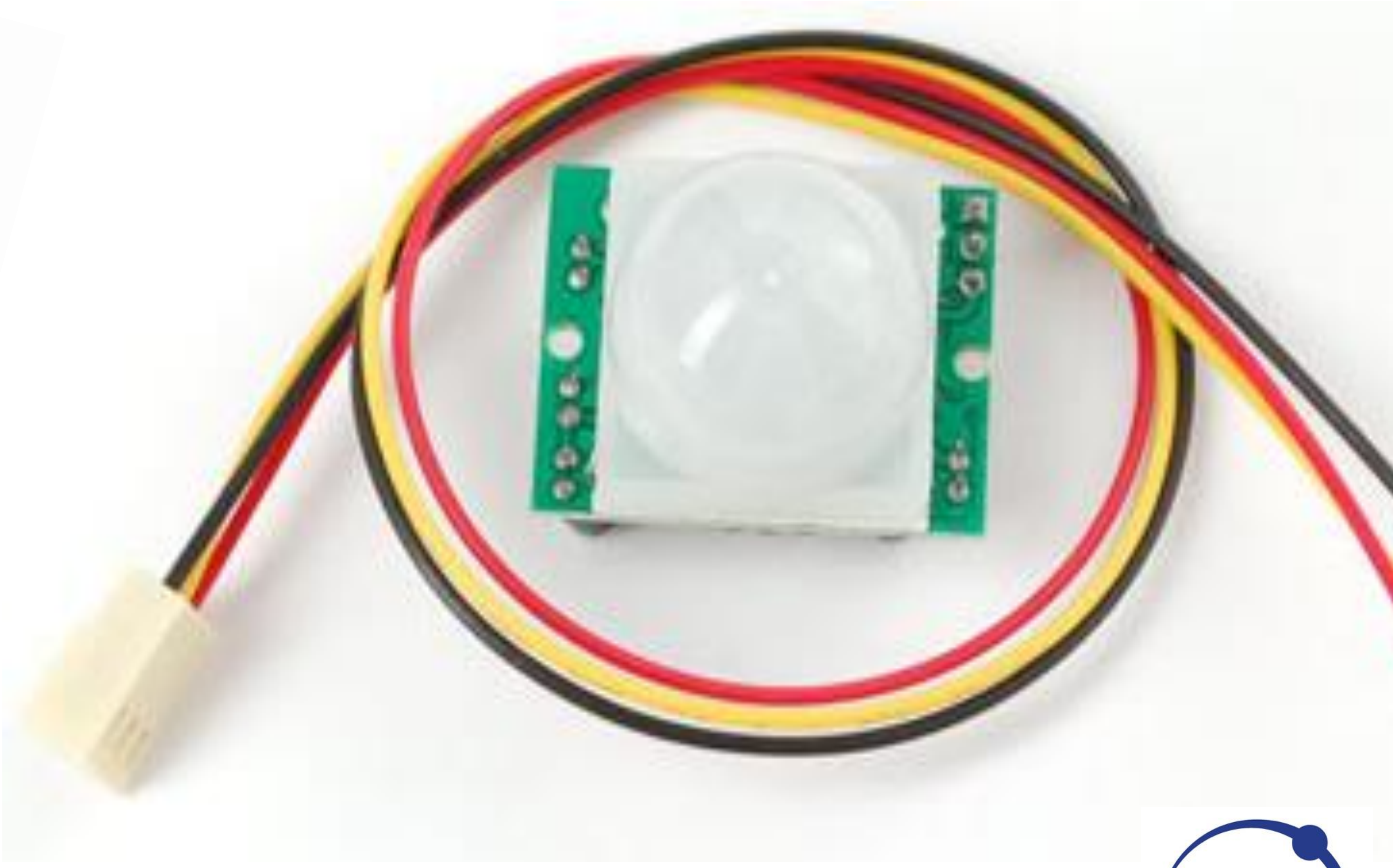
Sensors

Convert physical properties to electrical signals.

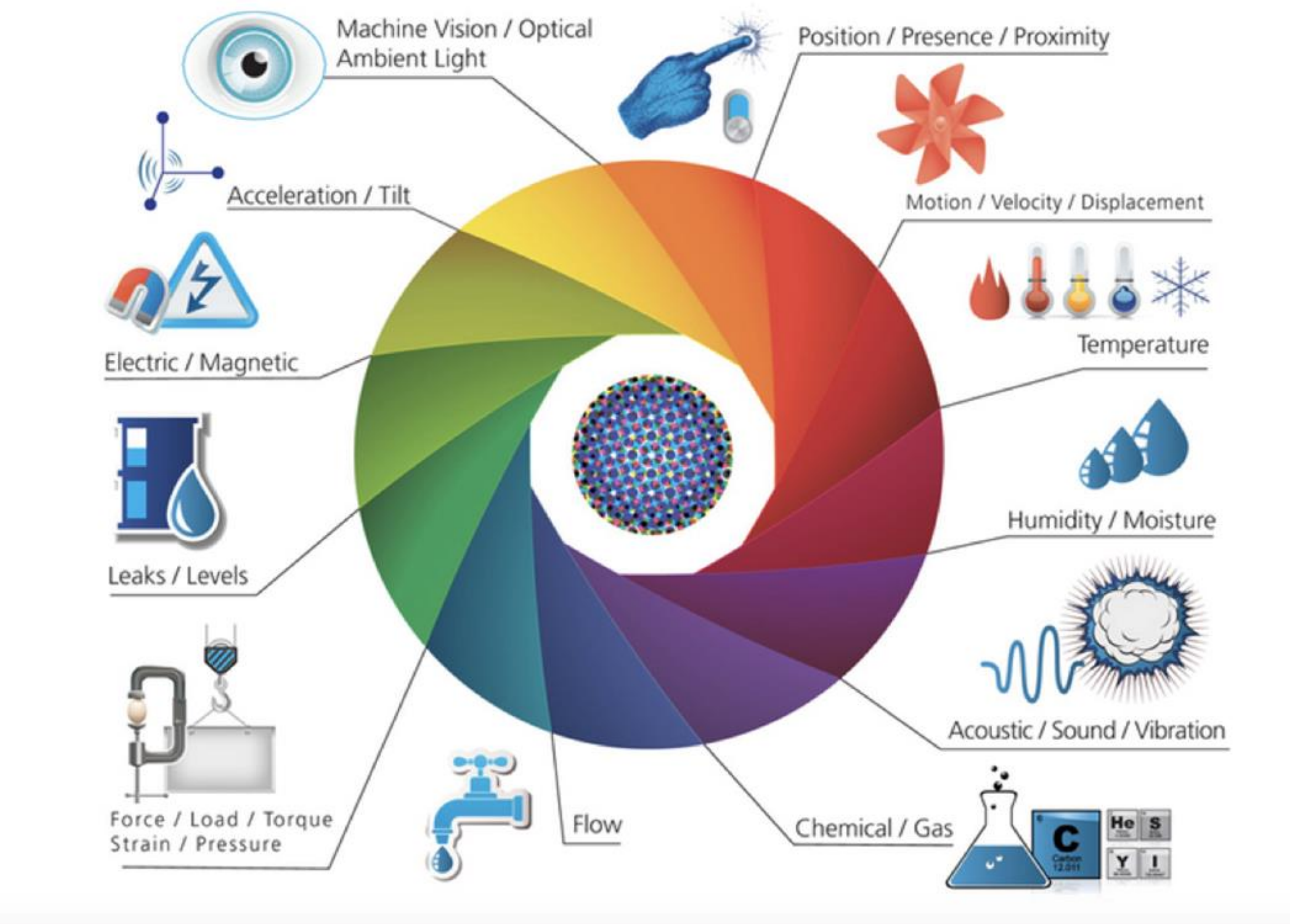
E.g. temperature, sound, light, distance, flow.







Sensors


Machine Vision / Optical
Ambient Light
Position / Presence / Proximity
Acceleration / Tilt
Motion / Velocity / Displacement
Electric / Magnetic
Temperature
Leaks / Levels
Humidity / Moisture
Acoustic / Sound / Vibration
Force / Load / Torque
Strain / Pressure
Flow
Chemical / Gas
C
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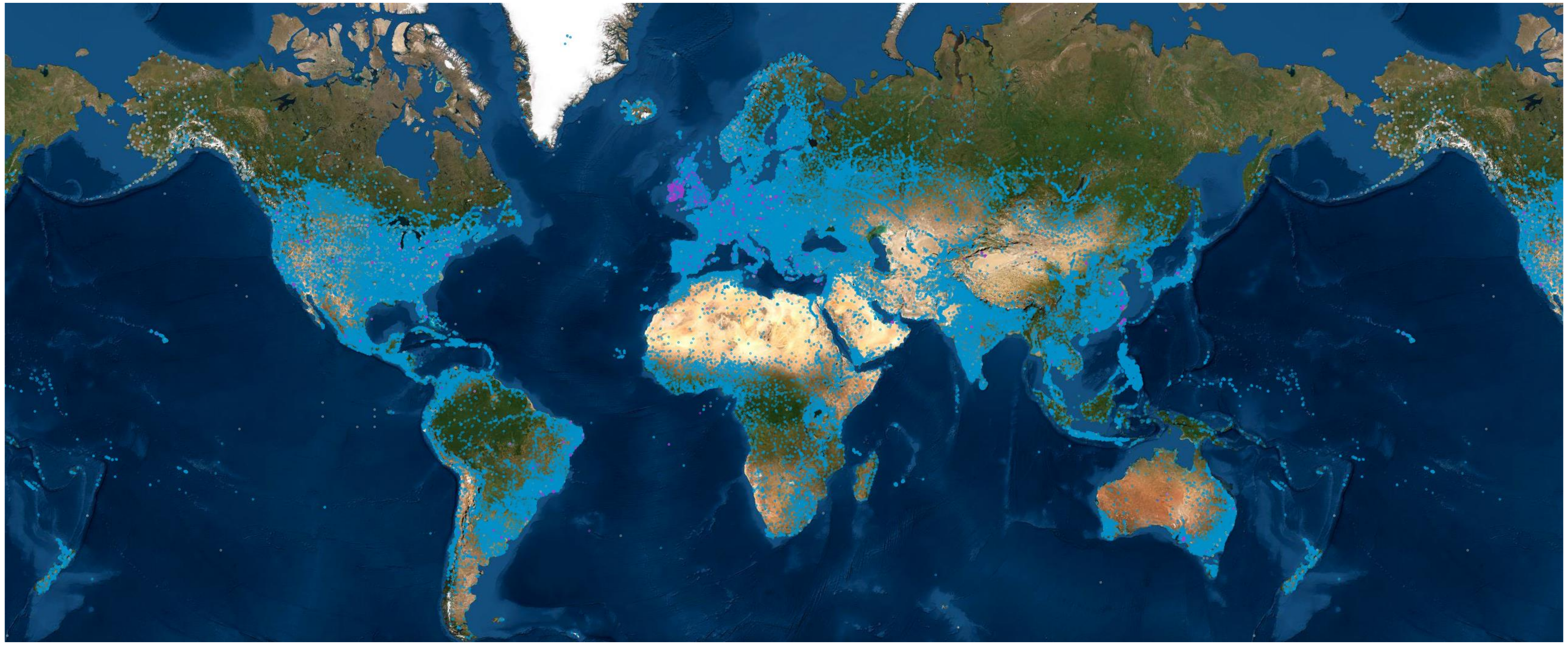
Actuators

Convert electrical signals to physical properties.

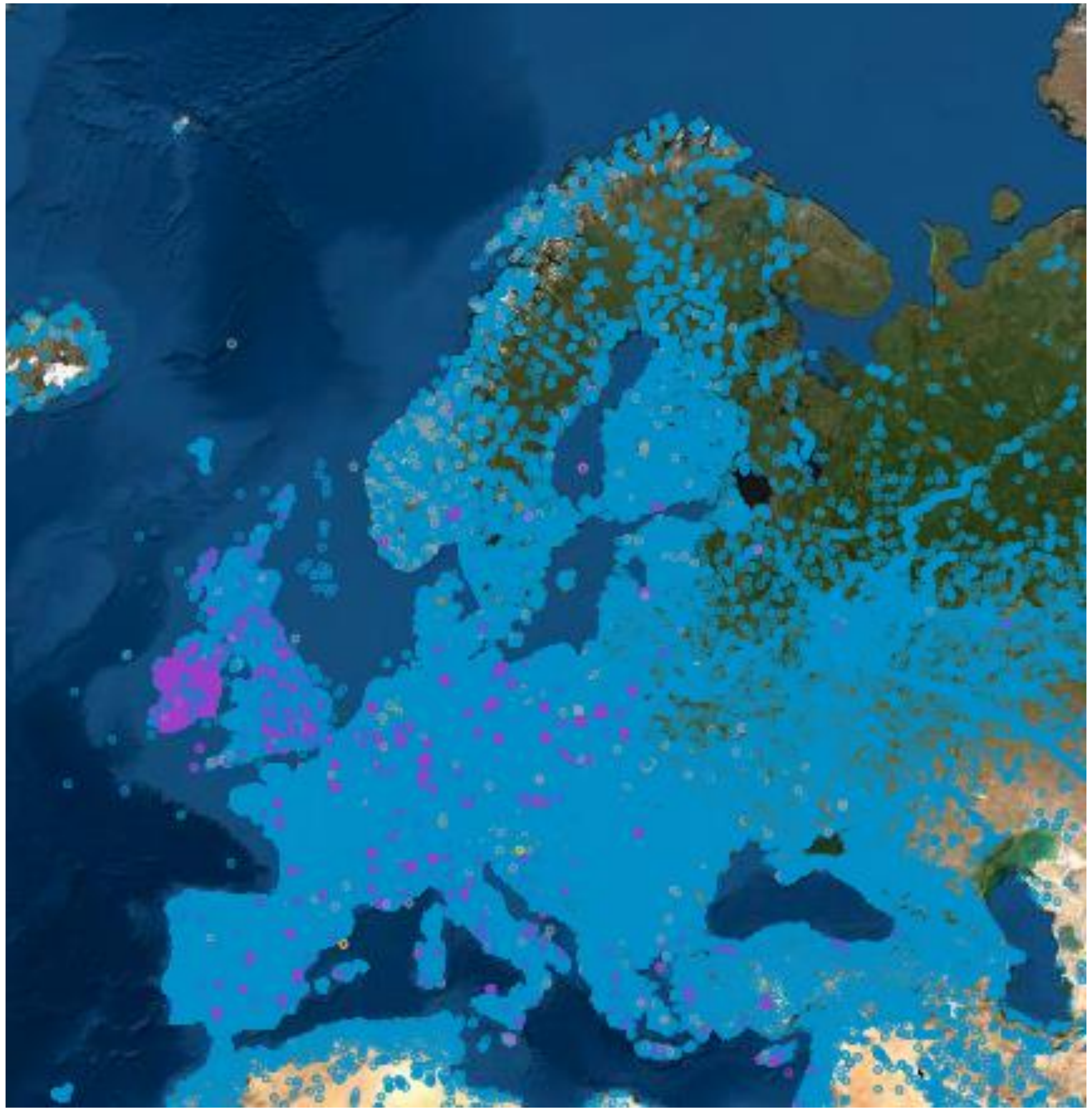
E.g. light, movement, sound, heat, current.

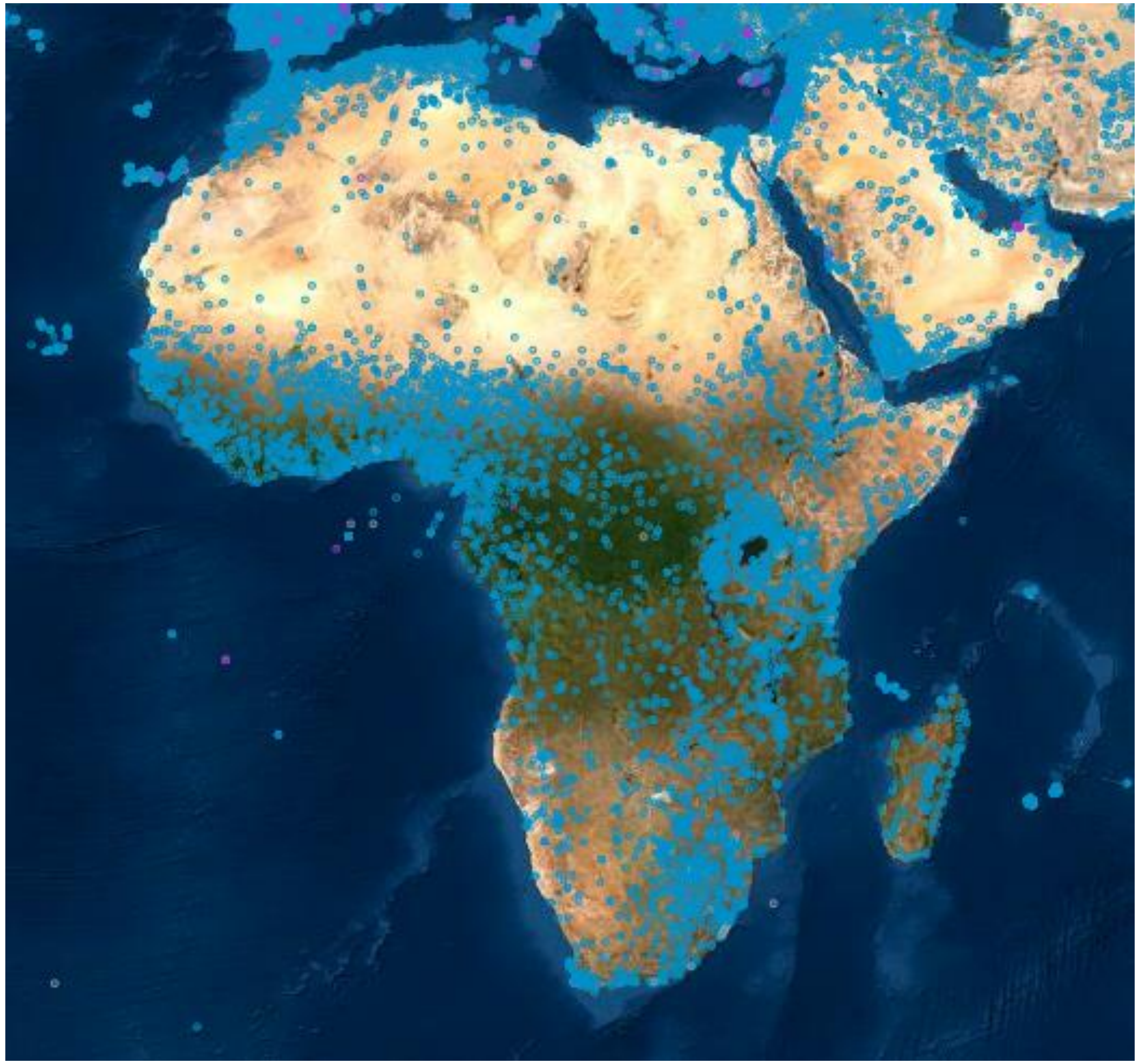
IOT AND DEVELOPMENT

Credit: https://www.thingful.net



IOT AND DEVELOPMENT





IOT AND DEVELOPMENT

CLIMATE CHANGE

54% of Africa's surface weather stations can't capture data properly

With extreme weather events becoming the new normal, forecasting has become more important than ever. It's time African nations invest in observation networks

NEXT NEWS >

By Maina Waruru
Last Updated: Tuesday 29 May 2018

IOT AND DEVELOPMENT

Antarctic seals recruited to measure effects of climate change

Deep-diving animals collected data that could be used to sharpen projections of rising seas.

Alex Fox

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past

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wake soon

Antarctic coast meltdow
ice-sheet collapse

SUBJECTS

Applied physics Climat

IOT AND SDG

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

IOT AND SDG

- SDG 2: ZERO HUNGER:

An estimated 821 million people were undernourished in 2017. Annual cereal production will need to rise to about 3 billion tonnes and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes to feed 9.1 billion people by 2050.

- SDG 3: GOOD HEALTH AND WELL-BEING:

3 billion people worldwide lack access to basic sanitation. Noncommunicable diseases alone will cost low- and middle-income countries more than $7 trillion in the next 15 years.

IOT4D AND ICT4D

There is a good paper on the use of ICT in Developing Countries:

The case for Technology in developing regions, E.Brewer et al., IEEE Pervasive Computing, 2005

The World Bank's infoDev site catalogs hundreds of ICT projects (http://www.infodev.org), albeit not all successful. Most of these projects use existing off-the-shelf technology designed for the industrialized world.

IOT4D AND ICT4D

The paper claims that there are **four technological requirements** for an ICT4D project to be successful:

Autonomous Connectivity

Low-cost equipment

Power resilience

Appropriate User Interface

IOT4D AND ICT4D

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Autonomous Connectivity

Low-cost equipment

Power resilience

Appropriate User Interface

Who owns the data?

Who benefits?

Risk of e-waste

Risk of "install and forget"

Not high in the agenda

THANK YOU!

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