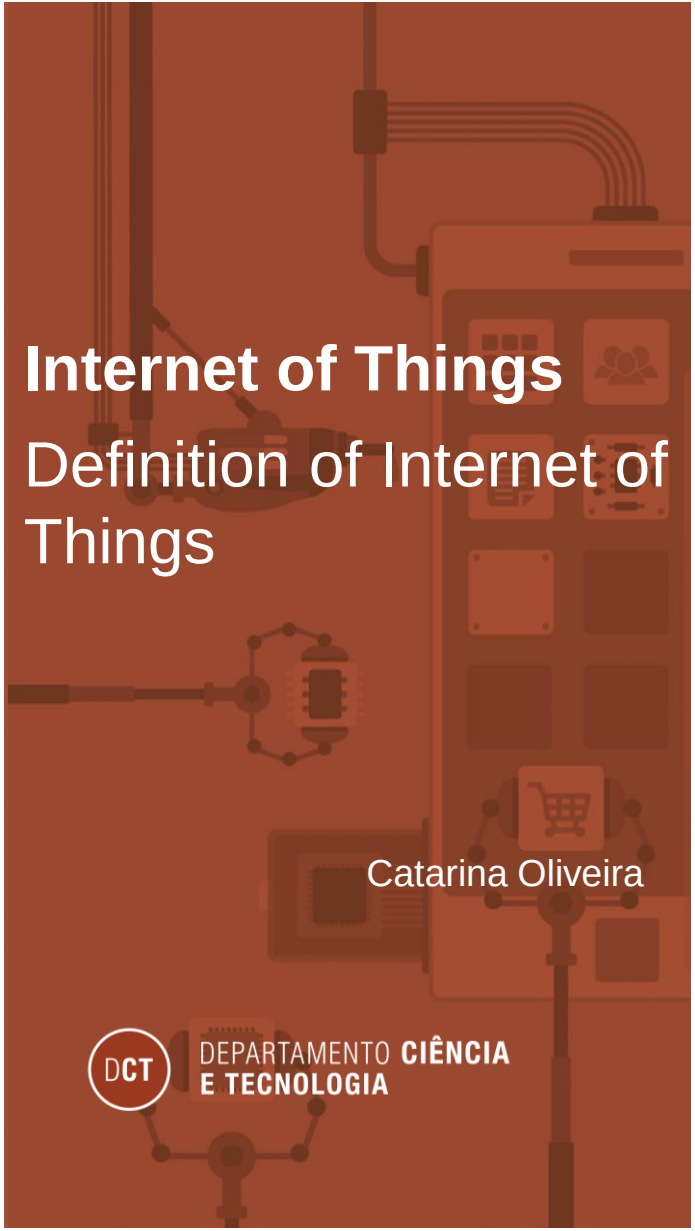


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# CONTENT

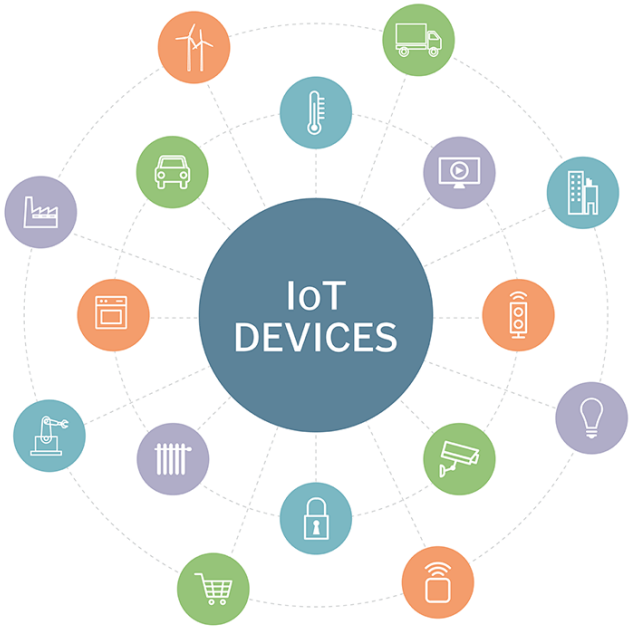
1. Overview
2. Applications
3. Potential
4. Challenges
5. Performance measures

# IoT overview

**What is Internet of Things?**

Devices with
- Electronic components
- Software
- Sensors
- Network connection

Information obtained
- Gathering
- Sharing




[https://internetofthingsagenda.techtarget.com/definition/IoT-device]

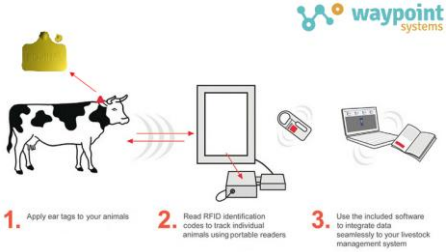
**What does it allow?**

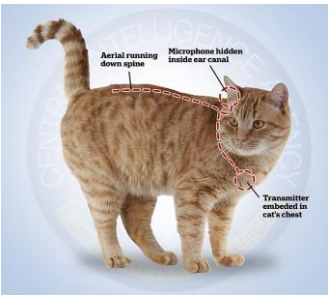
- "Things" to be controlled remotely
- More direct integration between physical and virtual
- Improves:
  - Efficiency
  - Precision
  - Economical benefits

# IoT Overview

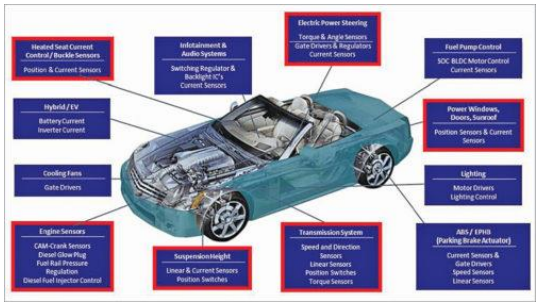
## What “things”?

Microchips in animals




Cars with embedded sensors




Implants that monitor heart problems


“Smart fitness” devices


Firefighter assistance devices


**Sources**
http://waypoint-systems.com/Blog/?p=133
https://www.dailymail.co.uk/sciencetech/article-4455714/The-CIA-implanted-microphones-skin-CATS.html
https://electronicsforu.com/technology-trends/tech-focus/automobile-industry-sensor
https://venturebeat.com/2019/01/16/medtronic-debuts-first-apps-to-let-heart-patients-monitor-their-pacemakers/
http://blueapp.io/blog/iot-and-fire-safety-go-hand-in-hand/
https://www.mi-store.se/en/sports-health/fitness-tracker/xiaomi-mi-band-4

# IoT Overview

**How does it work?**

By joining different technologies

Examples:

- “Miniaturization”
- Communication
- Cooperation
- Identification
- Routing
- Location
- Sensors
- Actuators
- Embedded processing
- Graphical interfaces

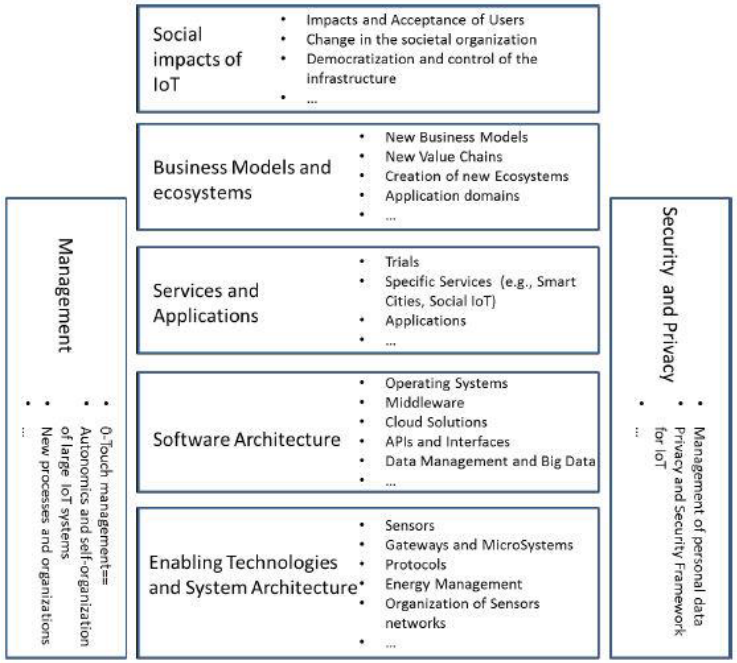
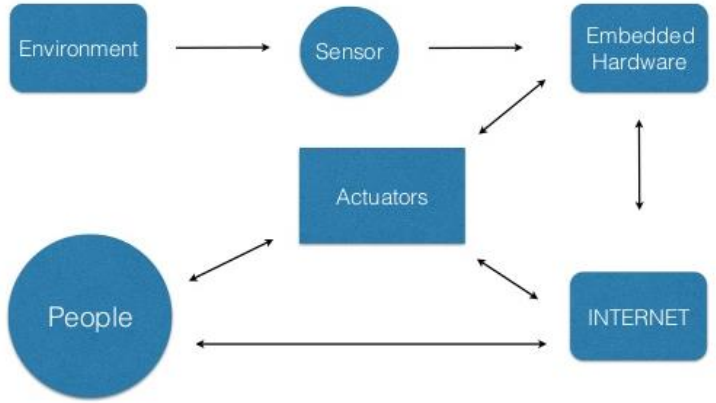



**Figure 1.** Technological and social aspects related to IoT

IEEE Internet of Things, “Towards a definition of the Internet of Things (IoT)” Ver 1., 27 May 2015




[https://www.navitrac.co.ke/iot/]

# IoT Overview


[http://garibaldimortgage.com/the-smart-home-room-by-room-smart-home-series/]

1) User is going out (detect user)

   What kind of sensor?
   Difference between father and son
   Identify the reason of going out
   Identify other things (example: store Schedule)

2) There is no milk (detect object)

   What kind of sensor?
   No milk, or not enough milk? (prediction)

3) Use the information to decide (processing)

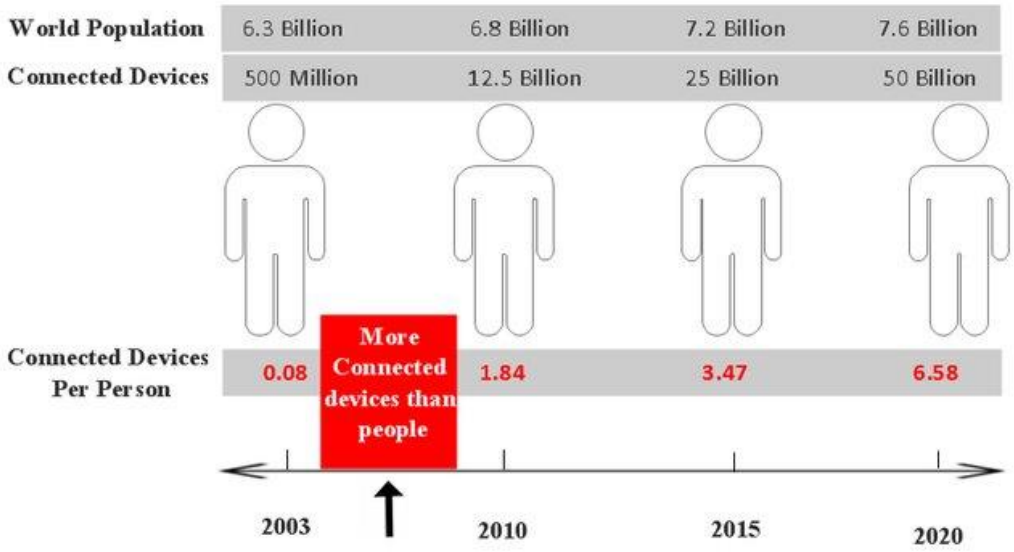
   Where is the processor?
   What are the rules?
   Fixed or dynamic rules (learning)

4) Inform the user (communicate)

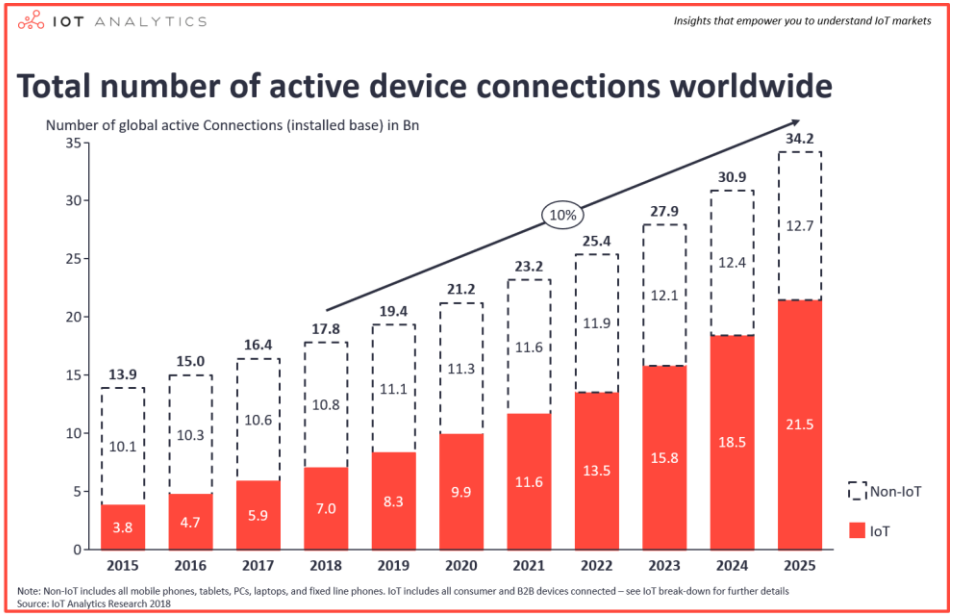
   How?
   When?
   Privacy?
   Information overload?

# IoT Overview

**How is the future?**

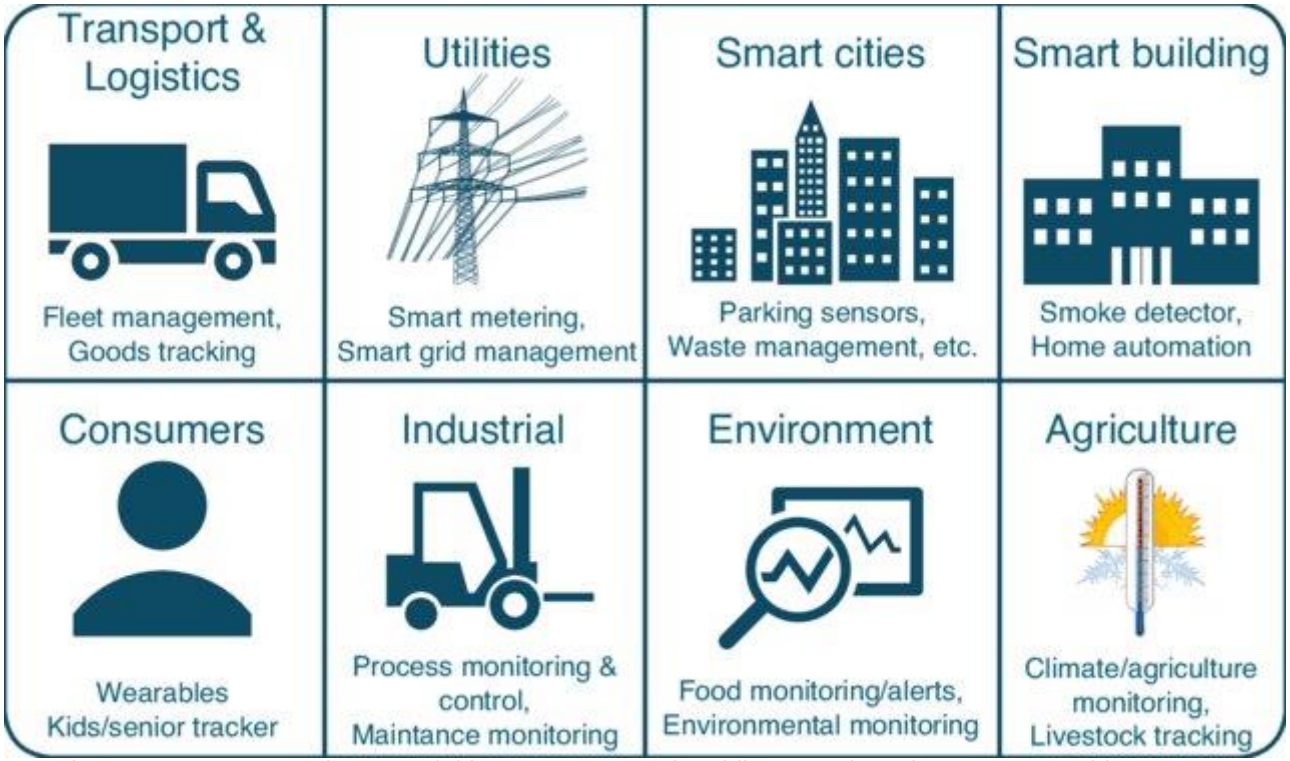



Militano, L., Araniti, G., Condoluci, M., Farris, I., & Iera, A. (2015). Device-to-device communications for 5G internet of things. *EAI Endorsed Trans. Internet Things*, *1*(1), 1-15.



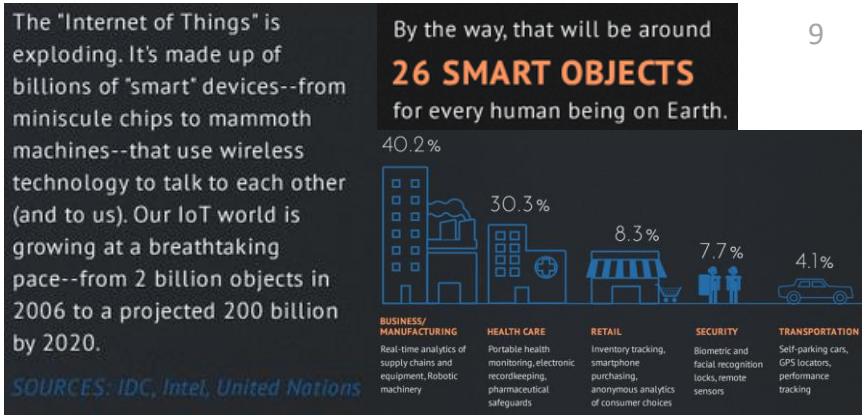

[https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/]

# IoT Applications

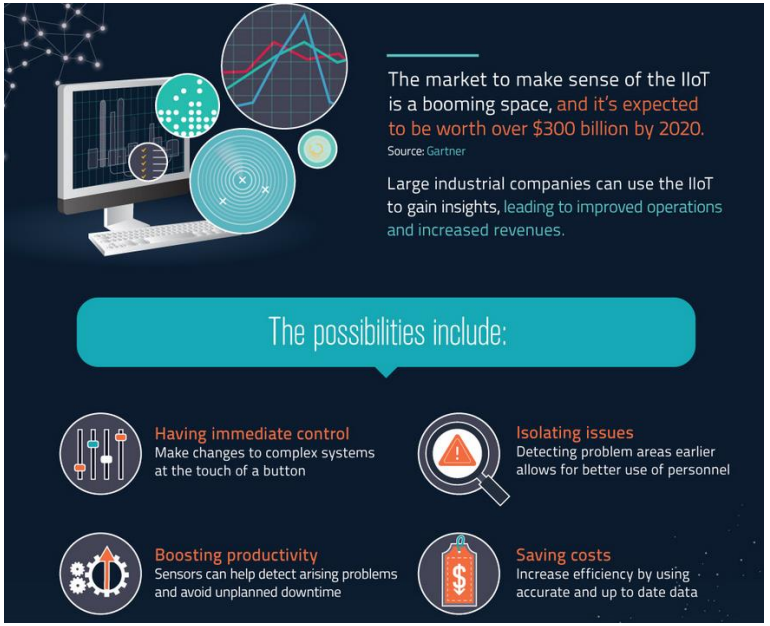



Boulogeorgos, A. A. A., Diamantoulakis, P. D., & Karagiannidis, G. K. (2016). Low power wide area networks (lpwans) for internet of things (iot) applications: Research challenges and future trends. arXiv preprint arXiv:1611.07449.

# IoT potential



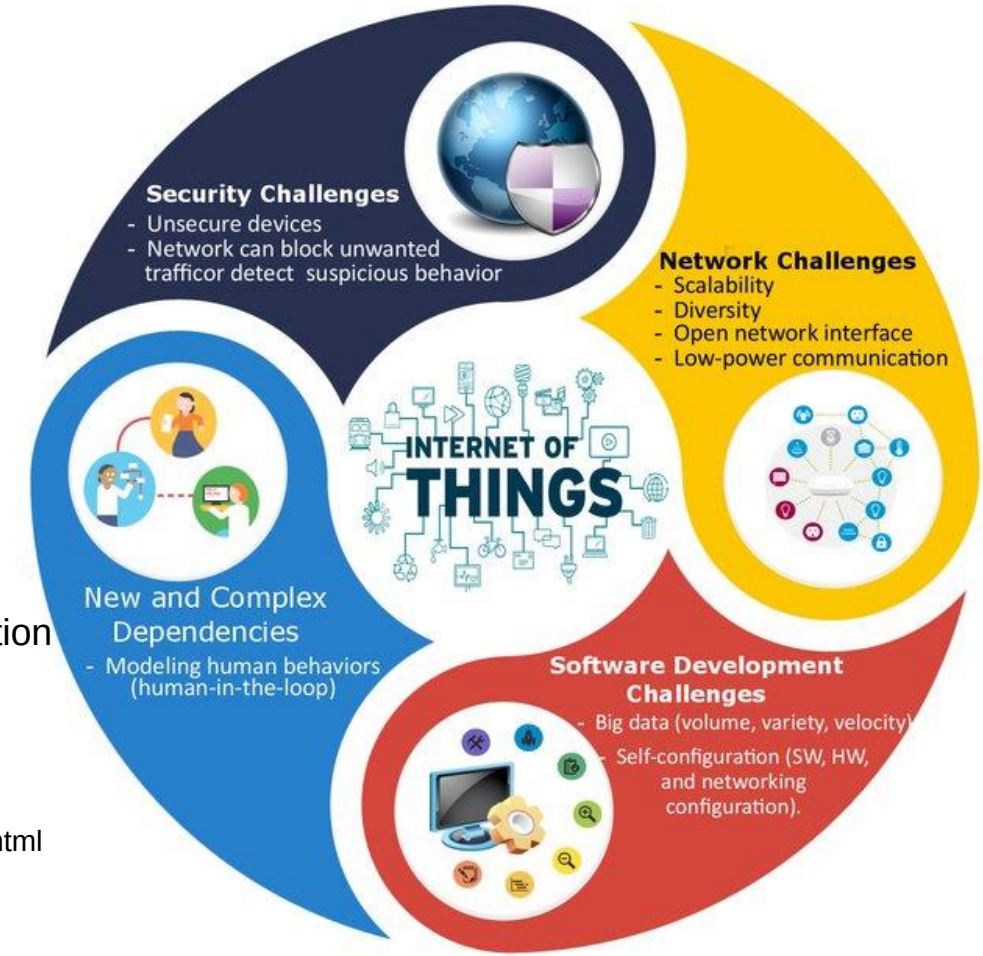




[https://www.visioncritical.com/blog/internet-of-things-infographics, Last updated April 14, 2019]

# IoT Challenges

Scalability
Technological Standards*
Interoperability
Discovery
Software complexity
Data interpretation and volume
Power source
Interaction and short-range communication
Wireless communication
Error tolerance

*ex: https://standards.ieee.org/initiatives/iot/index.html




Farhan, L., Shukur, S. T., Alissa, A. E., Alrweg, M., Raza, U., & Kharel, R. (2017, December). A survey on the challenges and opportunities of the Internet of Things (IoT). In 2017 Eleventh International Conference on Sensing Technology (ICST) (pp. 1-5). IEEE.

# IoT Challenges

**Possible problems regarding:**

- Privacy
- Safety
- Autonomy and control
- Social control
- Political manipulation
- Environmental impact
- Moral decision-making influence
- …

# IoT performance metrics


Value = Connected devices + Connected users

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Do conhecimento à prática.