Internet das Coisas

Concepts and Domains

FACULDADE ENGENHARIA
Departamento de Informática

2022/2023

Today's Class

- Introduction to the Internet of Things (IoT)
- Historical Context
- Areas of Application of IoT
  - Sub-areas
- Introduction to IoT System Architectures

Introduction

Imagine that on the way home, you forget to buy milk.

Introduction

Imagine that on the way home, you forge

But you have a smart fridge!

Introduction

Imagine that on the way home, you forget to buy milk.

However, you had a smart refrigerator connected to the Internet that automatically purchased the milk for you.

Utilizing the world of connected and intelligent devices to facilitate our lives.

Internet of Things: Definition

- Network of objects (refrigerators, watches, vehicles, houses, buildings, etc.) capable of collecting and transmitting data.
- Enables everyday objects to have computational and communication capabilities connected to the Internet.
- IoT, in simple terms, occurs when electrical, electronic, or mechanical devices communicate with each other over the Internet.

Internet of Things: Definition

- The Internet of Things (IoT) represents a network where physical objects, embedded with sensors and electronics, communicate with each other via the Internet.

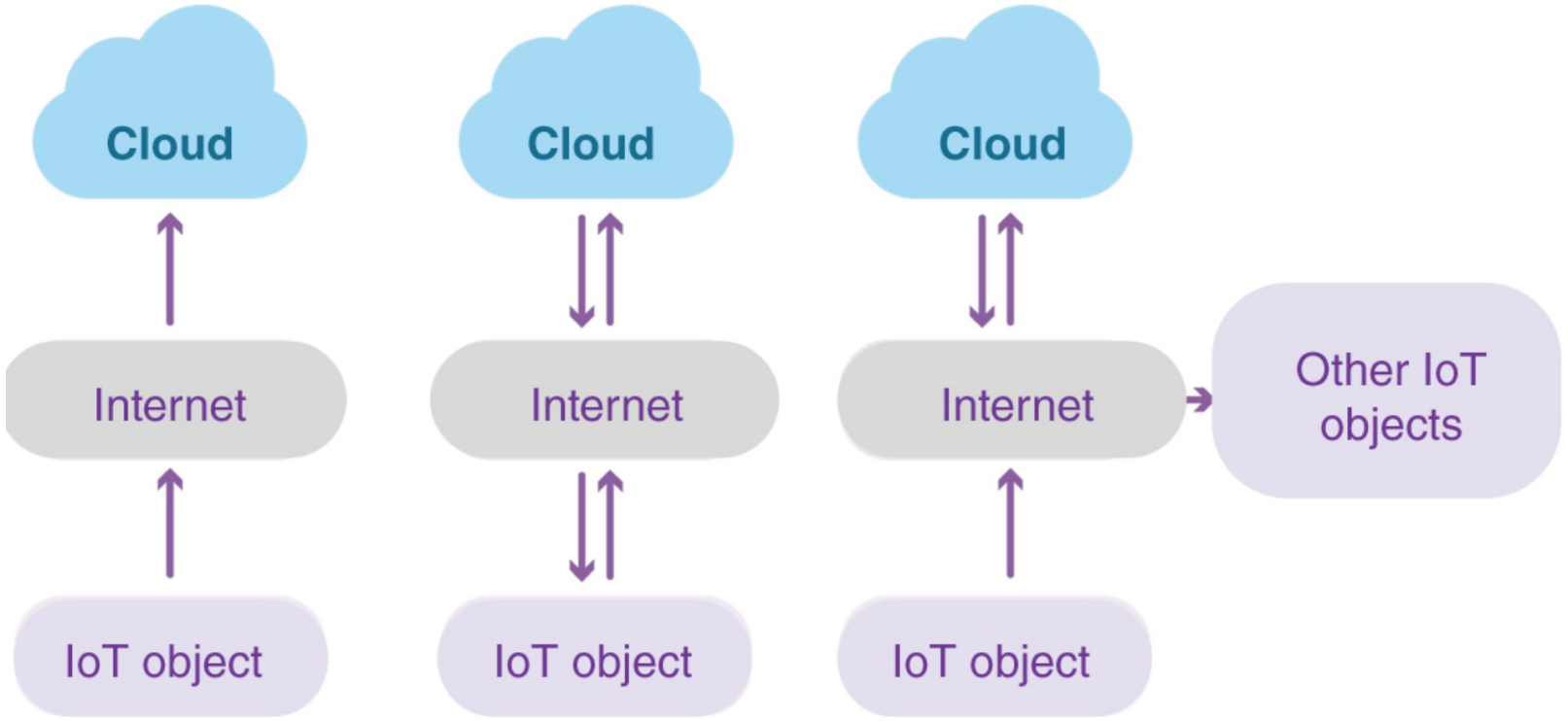
- IoT facilitates seamless data exchange, enabling objects to improve performance and make informed decisions autonomously.

Internet of Things: Definition

- Physical objects range from simple household devices to sophisticated industrial ones.
- Telecommunications, low-power sensor design, cloud computing, and analytics, have made IoT technology a reality.
- In an IoT ecosystem, after an IoT-based object sends its data to the cloud or a database system.

Internet of Things: Definition

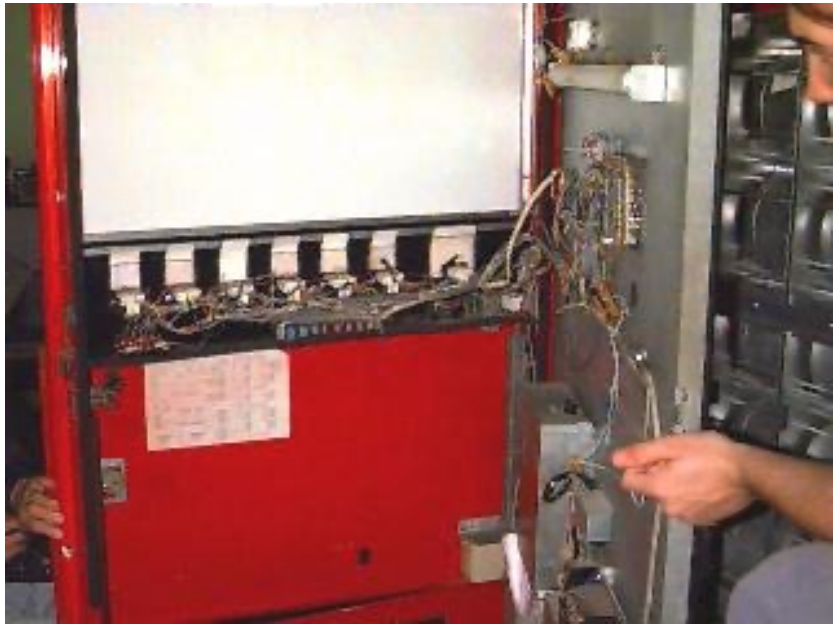
- The data is analyzed and usually it is used in one of the following three possible scenarios.



Fundamentals of Internet of Things, by F. John Dian, Wiley Press

Historical Context

- IoT is a technological buzzword of the 21st century.
  - However, it has been around for 35 years!
- The Coca-Cola vending machine at Carnegie Mellon in 1982.
  - https://www.cs.cmu.edu/~coke/history_long.txt

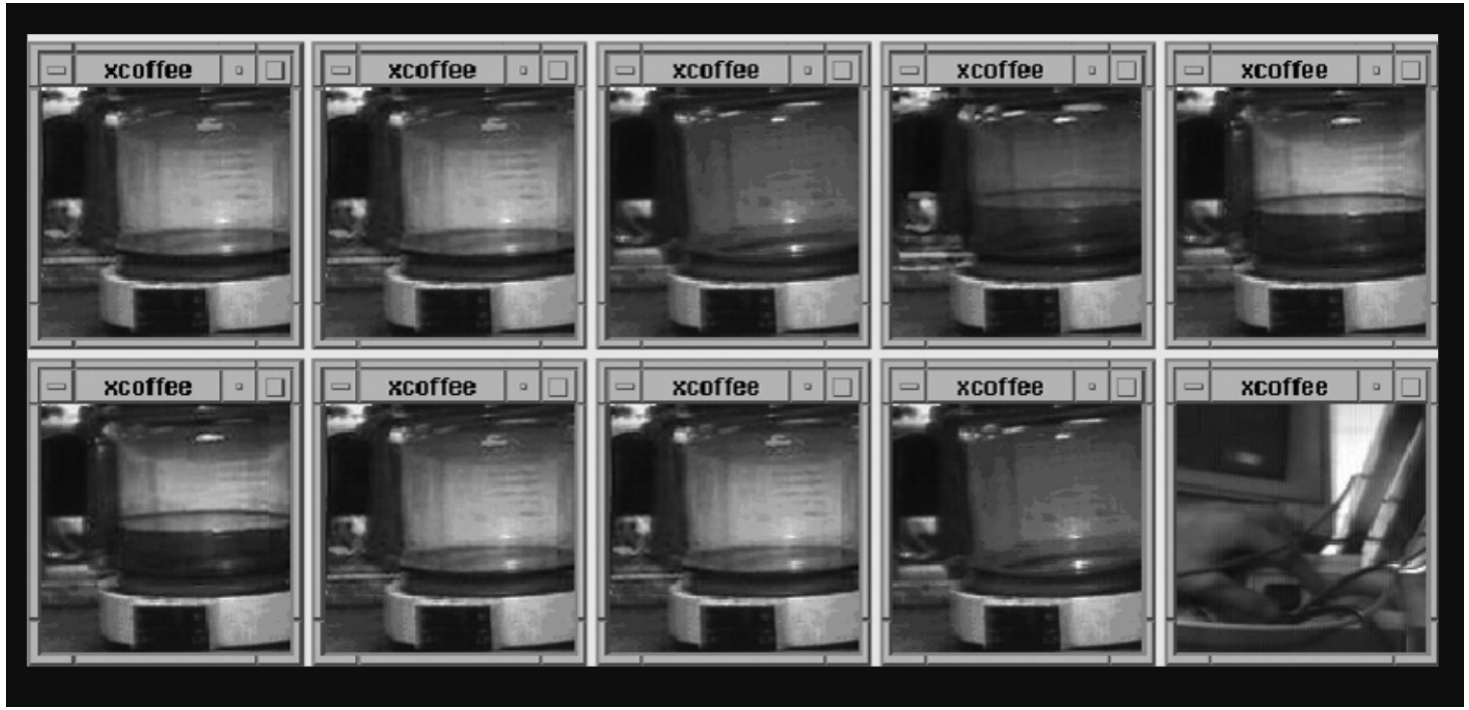


Historical Context

- John Romkey's Internet Toaster – 1990
  - https://www.livinginternet.com/i/ia_myths_toast.htm
  - 1991 a small robotic crane was added to the system
- *TCP/IP* networkingd
- Controlled SNMP Protocol

Historical Context

- Trojan Room coffee pot – University of Cambridge, 1993
  - https://en.wikipedia.org/wiki/Trojan_Room_coffee_pot



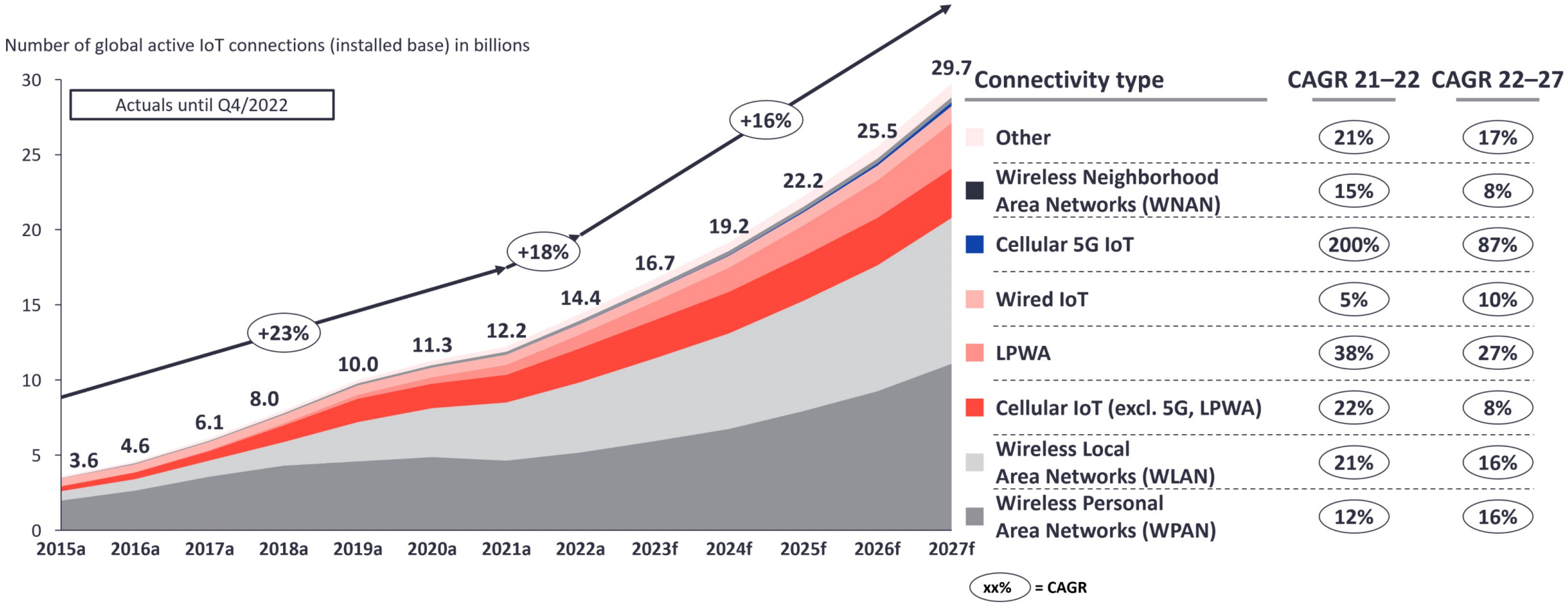
"Laziness is the mother of Invention."

- Agatha Christie

Internet of Things : Components

- Sensors: Collect data from the physical environment.
- Electronics: Process and transmit data.
- Connectivity: Internet-based communication / Communication Protocols.
- Cloud-based Analytics: Analyze data for actionable insights.

Global IoT market forecast (in billions of connected IoT devices)



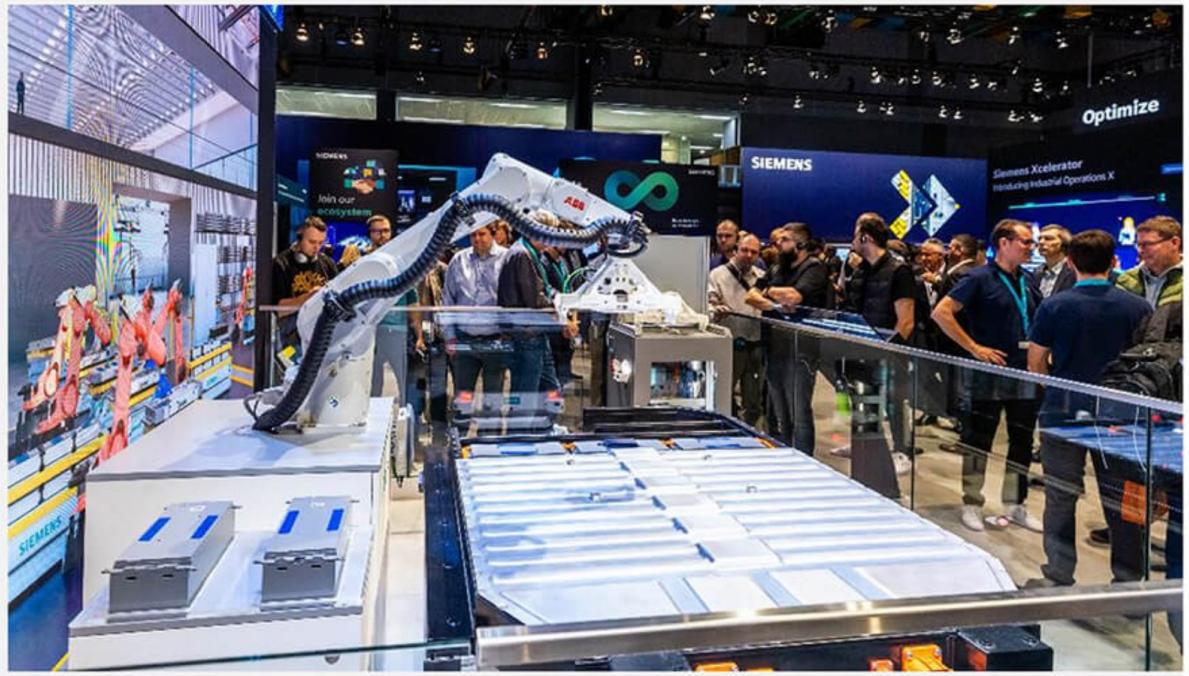
Note: IoT connections do not include any computers, laptops, fixed phones, cellphones, or consumers tablets. Counted are active nodes/devices or gateways that concentrate the end-sensors, not every sensor/actuator. Simple one-directional communications technology not considered (e.g., RFID, NFC). Wired includes ethernet and fieldbuses (e.g., connected industrial PLCs or I/O modules); Cellular includes 2G, 3G, 4G, 5G; LPWA includes unlicensed and licensed low-power networks; WPAN includes Bluetooth, Zigbee, Z-Wave or similar; WLAN includes Wi-Fi and related protocols; WNAN includes non-short-range mesh, such as Wi-SUN; Other includes satellite and unclassified proprietary networks with any range.

IOT ANALYTICS

sps Nuremberg, Germany 14 – 16 November 2023
smart production solutions

Top 10 industrial automation trends—as seen at SPS 2023

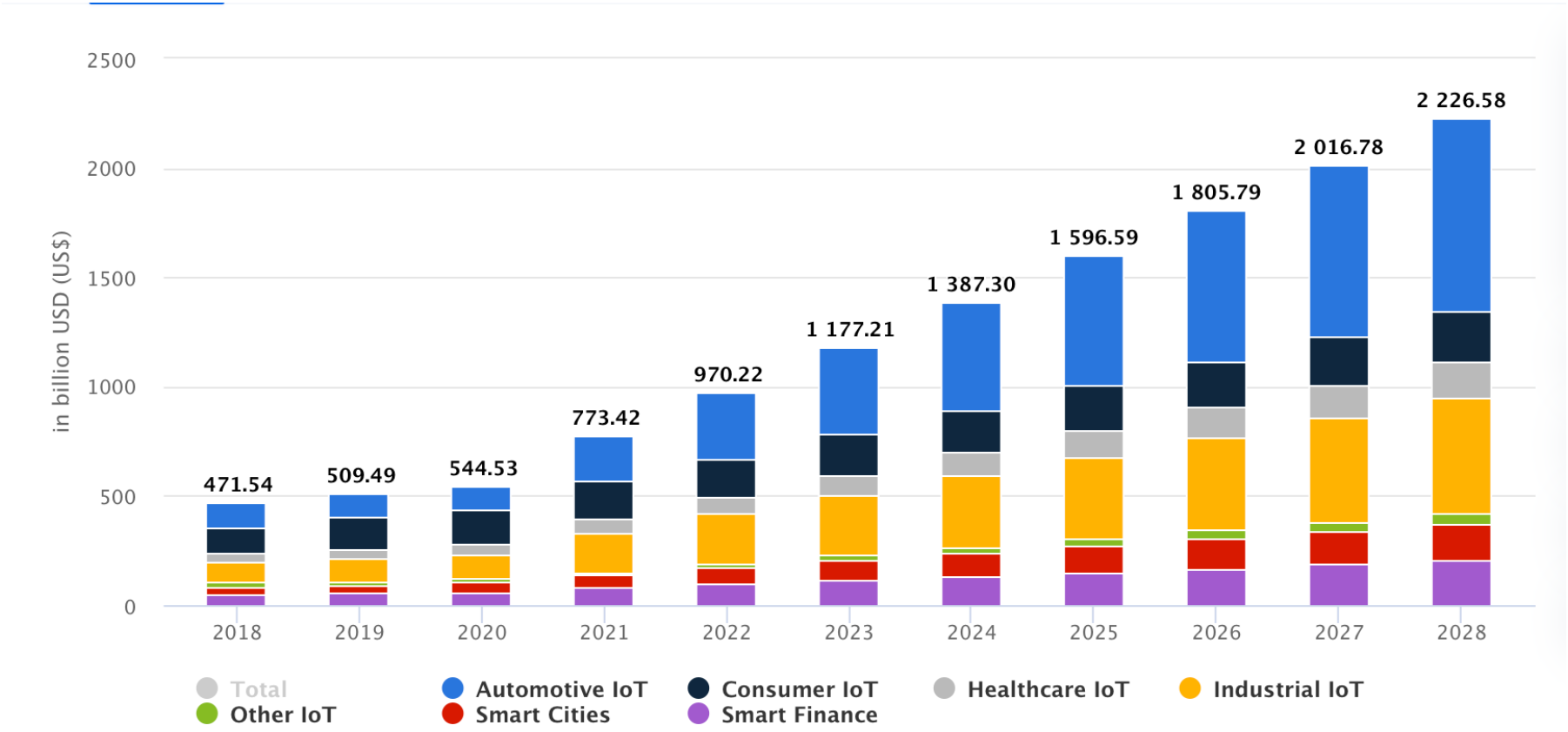
1. Solutions that enable flexibility
2. IT/OT convergence
3. Emphasis on sustainability
4. Energy management a bigger priority
5. Generative AI solutions
6. Integration of AI accelerators into OT
7. Rising importance of cyber regulation
8. Wireless connectivity innovations
9. Synchronization of software&chip design
10. Solutions addressing labor/skill shortage



Source: IoT Analytics Research 2023. Image: https://sps.mesago.com/nuernberg/en/press/press-material.html#pictures. We welcome republishing of images but ask for source citation with a link to the original post and company website.

https://iot-analytics.com

Revenue



Notes: Data shown is using current exchange rates and reflects market impacts of the Russia-Ukraine war.

Most recent update: Sep 2023

https://www.statista.com/outlook/tmo/internet-of-things/worldwide#revenue

Popular application sub-areas (some)

- Smart Cities
  - Mobility
  - Environment
- Smart Homes
  - Energy Efficiency
  - Quality of Life
- Rural Areas
  - Agriculture 4.0
  - Mobility
- Industry
  - Automation
- Monitoring
  - Health
  - Telehealth

Internet of Things Service Providers

- Enough capacity to provide connectivity to a large number of smart homes. Smart utility meters such as gas, electricity, or water are other use cases of IoT.

- Good coverage for IoT devices that are located in challenging areas.
  - sensors generate very large amounts of data. Processing, analyzing, and transmission of huge amounts of data require a very fast network with high processing capacity.

- Need to consider processing time and communication delay as part of their design specifications

- IoT technology needs to support low power consumption.

IoT Traffic Model

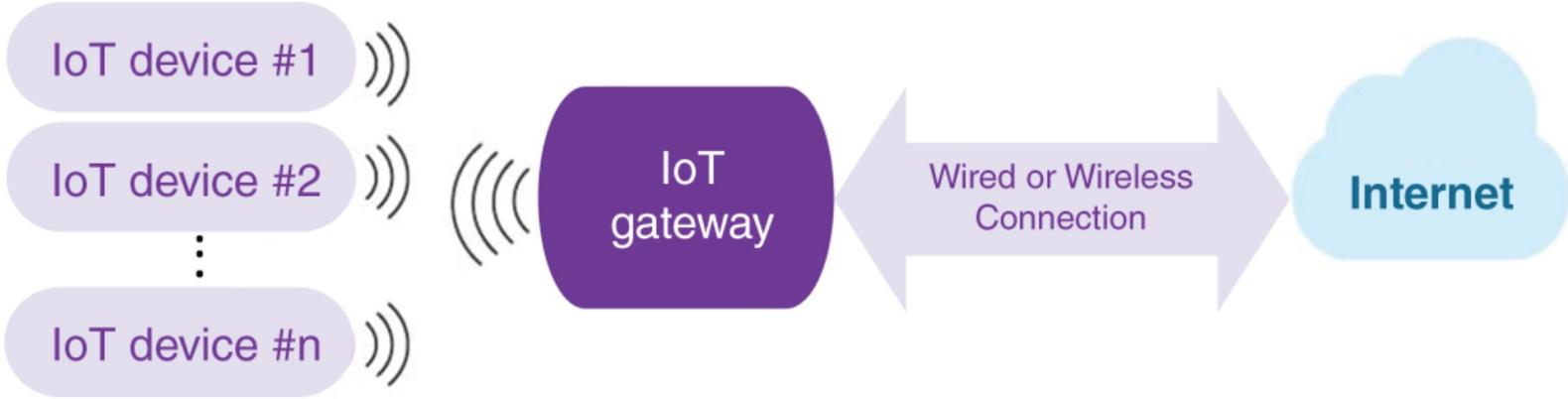
- Almost Uniform traffic all the time
- Substantially higher or lower traffic as compared to the traffic generated by humans
- Low or high data transmission rate

Internet of Things Connectivity

- Wired connections are fast, secure, and extremely reliable.
  - wired Internet access point
- Short-range wireless Technologies
  - Bluethooth
  - Zigbee
- Wi-Fi tecnhologies
  - wireless access points

Internet of Things Connectivity

- IoT Gateways
  - receive and send the data to the Internet using a wired or wireless broadband technology.
  - edge of the network
  - limited processing power
  - some processing, if needed



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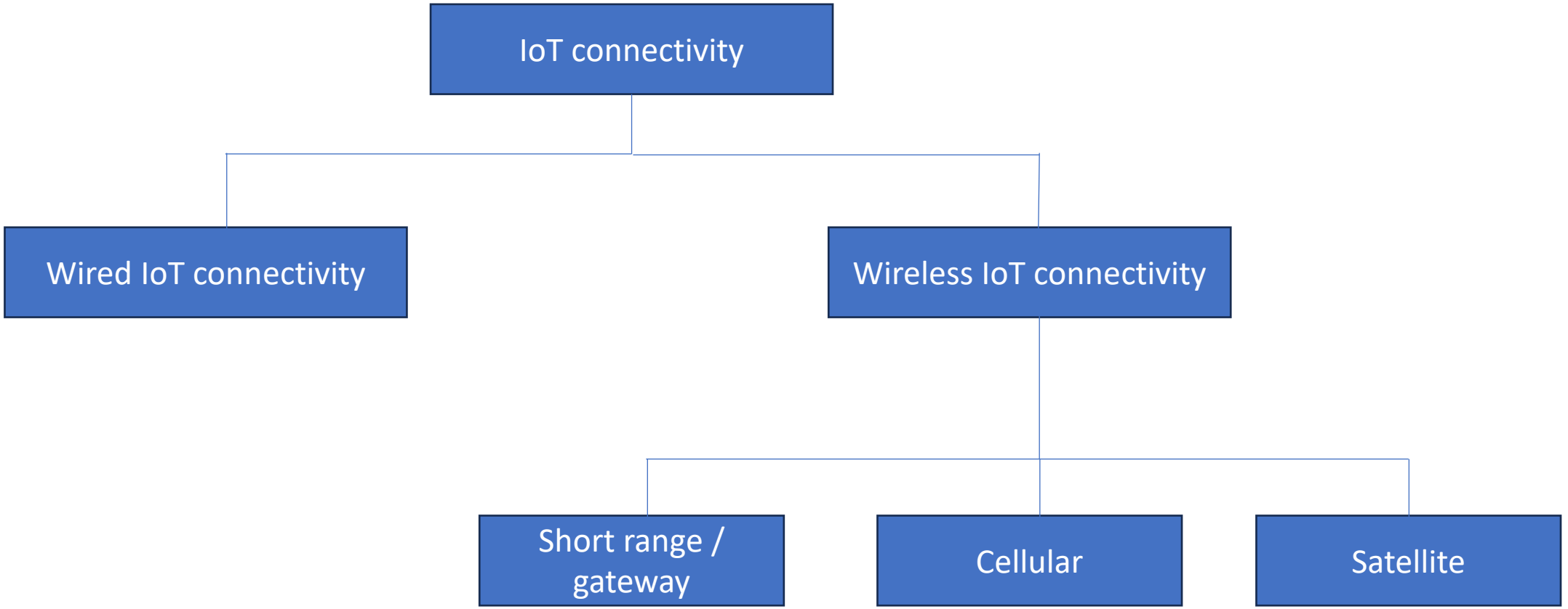
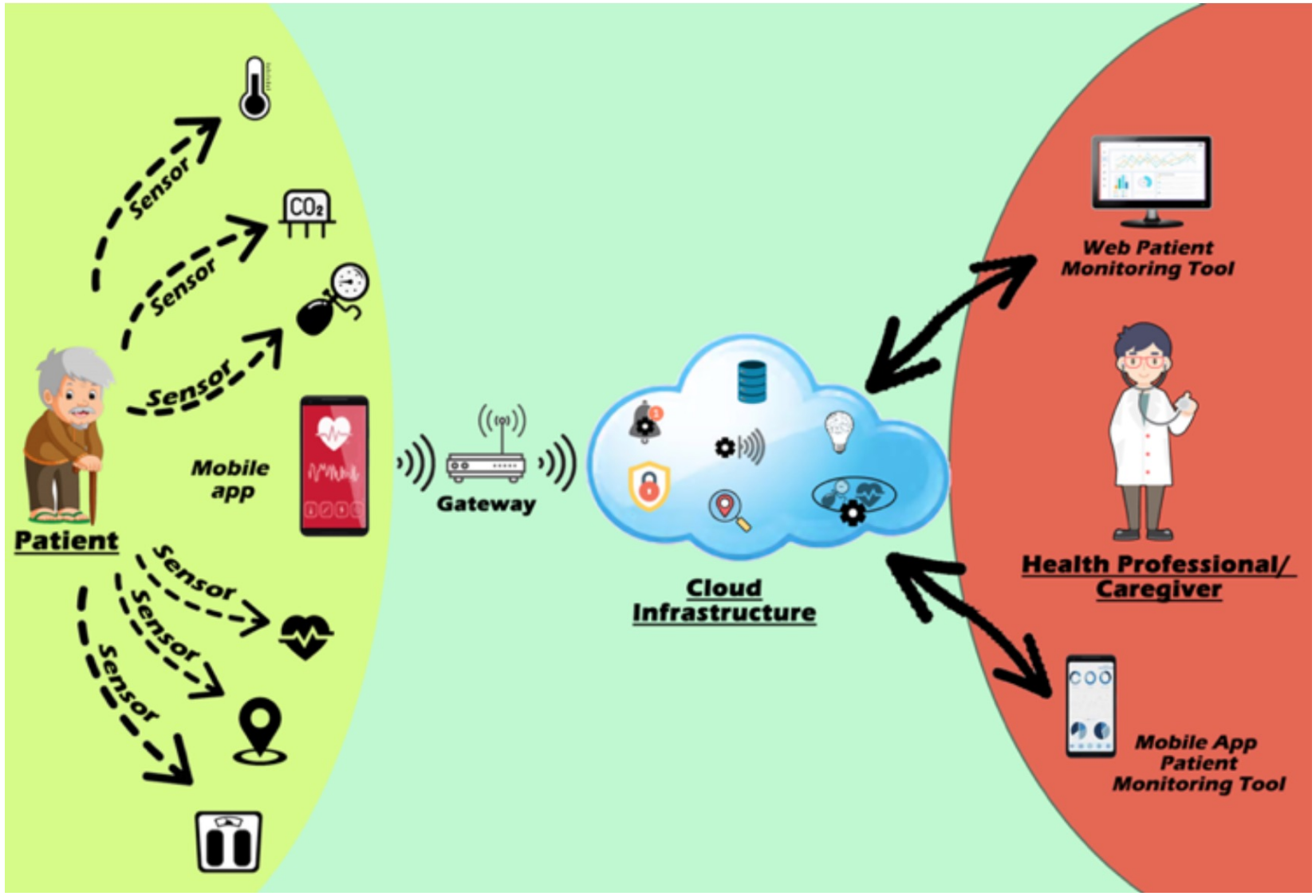
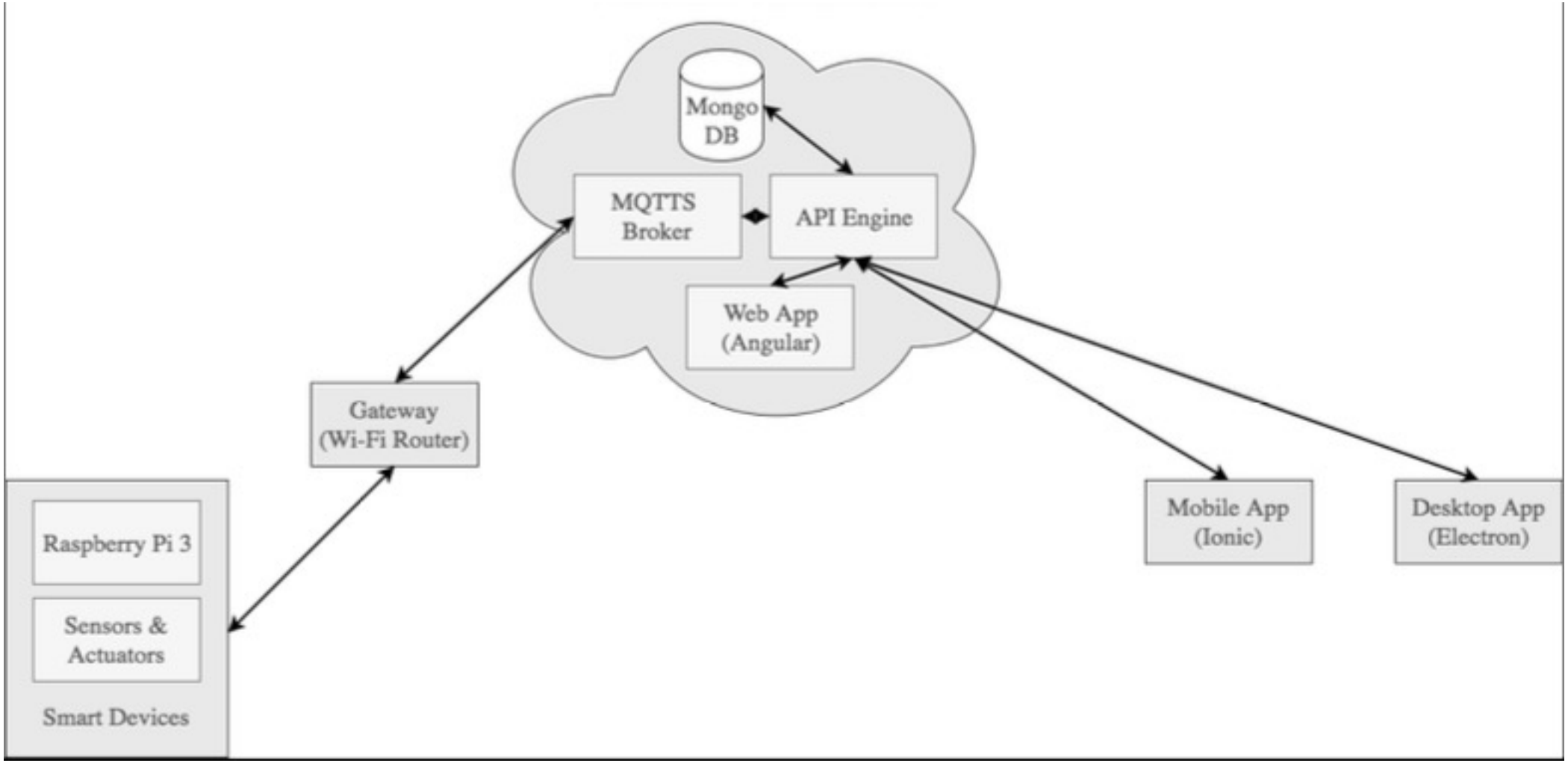
Internet of Things Connectivity



Arquitecture design



Example of Arquitecture



Arquitecture core concepts

Core concepts!

- Cloud

- Server
- Web server

- API
- Restful API
- Web services

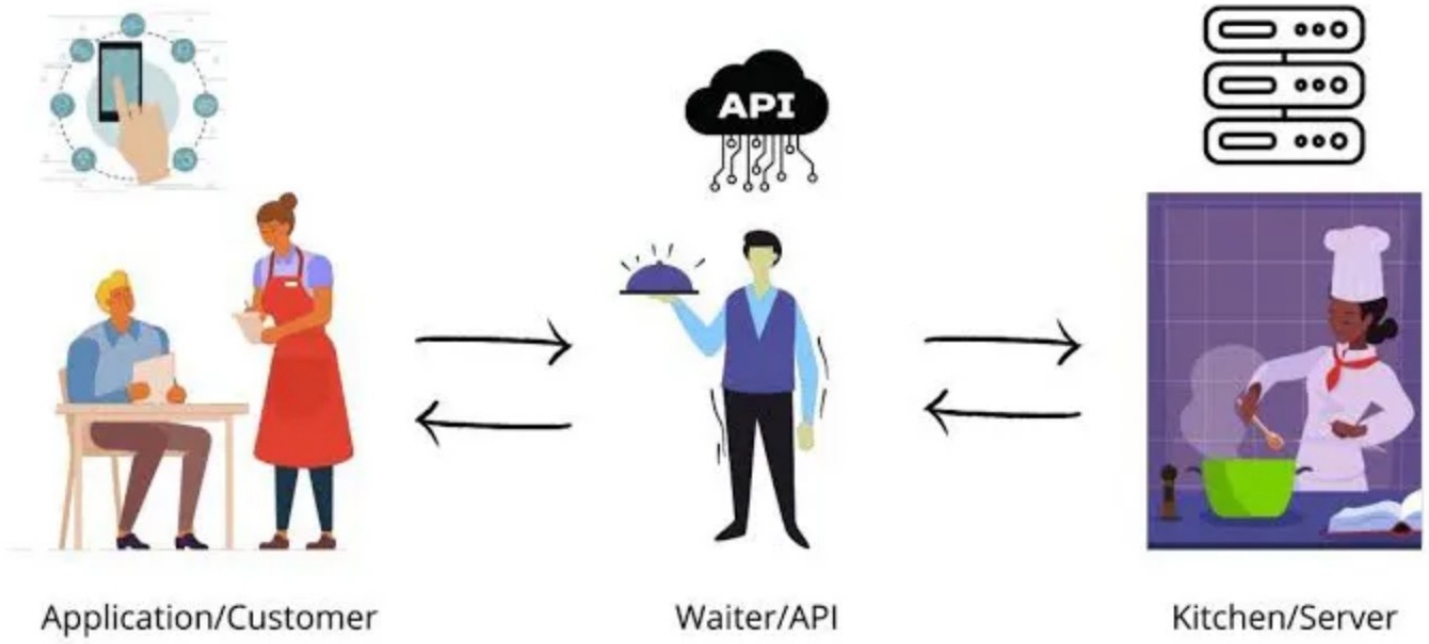
- Client x Server model

You should also know

- Computer Networks
    - Communication Protocols

RESTFUL APIs

- RestFUL API(Application Programming Interface) is responsible for answer requests between client and server.
  - “http routes”, aka endpoints.
  - HTTP GET e HTTP POST.



Antes de Ir... (em grupos)

- Imagina que te esquecias de algo...
- Constrói uma narrativa de uma “coisa” que podia melhorar a tua vida cheia de esquecimentos.
- Desenha uma arquitetura semelhante à anterior.