

# IoT, IIoT, IoE??? Internet of... -＼(ツ)／-

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# O que é IoT - Internet of Things?

Internet das coisas é um **conceito** que se refere à **interconexão** digital de **objetos cotidianos** com a internet, conexão dos objetos mais do que das pessoas. Em outras palavras, a internet das coisas nada mais é que uma **rede de objetos físicos** capaz de **reunir e de transmitir dados**.

*Wikipédia*

# IoT: a origem



# Timeline de IoT

1935s / 1960s	1973	1989	1990s	2000s	2011
<b>Radar de Radiofrequênci</b> a	<b>RFID Tag</b>	<b>Internet</b>	<b>Trojan Room coffee pot</b>	<b>Comercializando IoT</b>	<b>IPv6</b>
Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.	Steven Depp, Alfred Koelle e Robert Freyman demonstraram as primeiras etiquetas RFID no Laboratório Nacional de Los Alamos.	Provedores de serviços comerciais de Internet (ISPs) surgiram nos Estados Unidos e na Austrália	Máquina de café localizada ao lado da chamada Trojan Room no antigo Laboratório de Computação da Universidade de Cambridge, exibida em uma webcam	A LG anunciou uma geladeira inteligente que determinaria se os alimentos precisam ser reabastecidos	o lançamento do IPv6 desencadeou um grande crescimento e interesse neste campo. Gigantes como Cisco, IBM, Ericsson realizaram várias iniciativas educacionais e comerciais com a IoT.

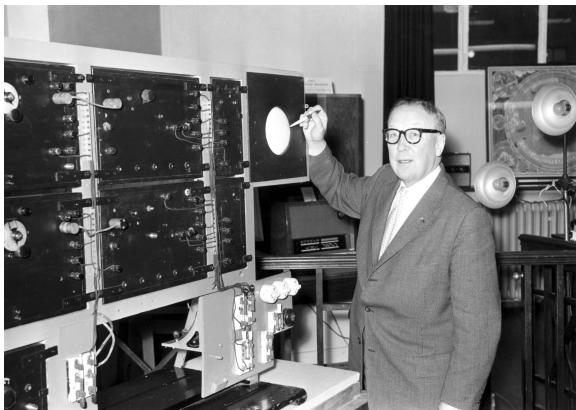


# RFID

1935s / 1960s

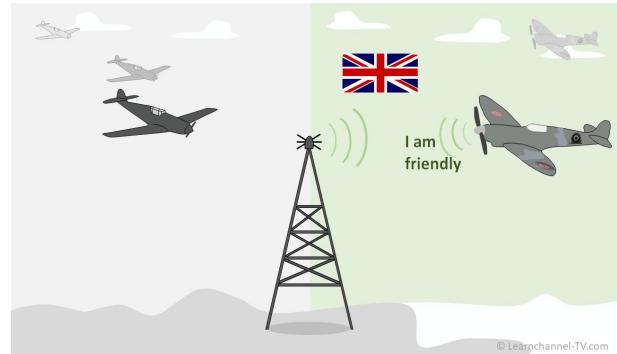
## Radar de Radiofrequênciā

Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.



Sir Robert Alexander Watson-Watt (1892-1973) é visto aqui com o aparelho que ele desenvolveu para detectar ecos de rádio refletidos de aeronaves inimigas.

fonte: <https://learnchannel-tv.com/sensor/rfid-in-automation/history-of-rfid-technology/>



© Learnchannel-TV.com



# Timeline de IoT

1935s / 1960s

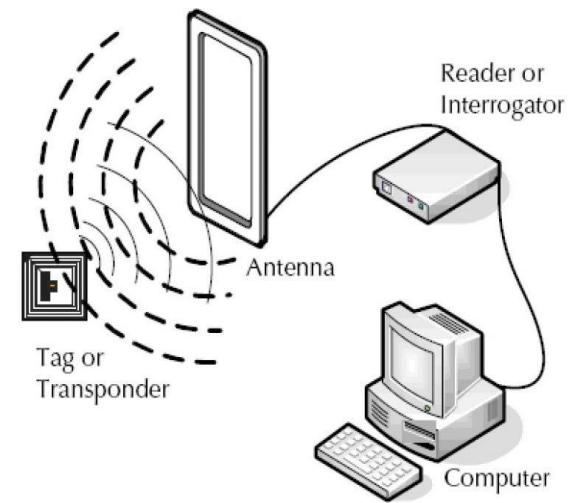
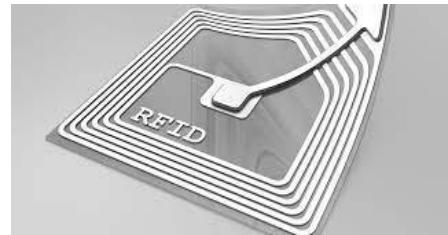
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Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.

1973

## RFID Tag

Steven Depp, Alfred Koelle e Robert Freyman demonstraram as primeiras etiquetas RFID no Laboratório Nacional de Los Alamos.





# É pra isso que serve a internet!!!



1935s / 1960s

## Radar de Radiofrequênciā

Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.

1973

## RFID Tag

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1989

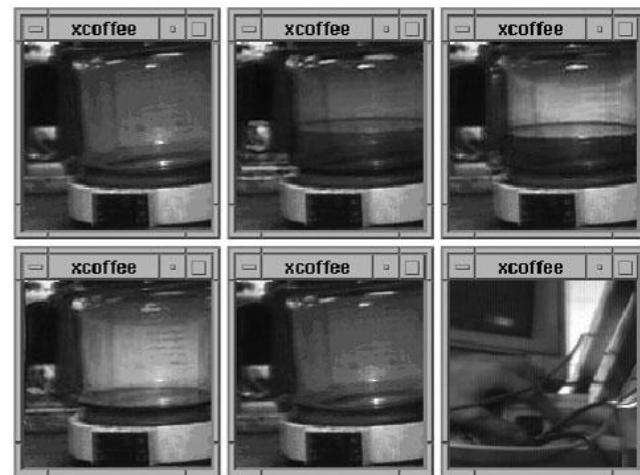
## Internet

Provedores de serviços comerciais de Internet (ISPs) surgiram nos Estados Unidos e na Austrália

1990s

## Trojan Room coffee pot

Máquina de café localizada ao lado da chamada Trojan Room no antigo Laboratório de Computação da Universidade de Cambridge, exibida em uma webcam





# Comercialização IoT

1935s / 1960s

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Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.

1973

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Steven Depp, Alfred Koelle e Robert Freyman demonstraram as primeiras etiquetas RFID no Laboratório Nacional de Los Alamos.

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2000s

## Comercializando IoT

A LG anunciou uma geladeira inteligente que determinaria se os alimentos precisam ser reabastecidos





IPv4: 32-bit ip address  
192.168.2.33

# IPv6

IPv6: 128-bit ip address  
FDEC:BA98:7654:3210:ADFC:BDFF:2990:FFF

1935s / 1960s	1973	1989	1990s	2000s	2011
Radar de Radiofrequênci	RFID Tag	Internet	Trojan Room coffee pot	Comercializando IoT	IPv6
Tecnologia de identificação por radiofrequência usada na WWII para identificar aviões.	Steven Depp, Alfred Koelle e Robert Freyman demonstraram as primeiras etiquetas RFID no Laboratório Nacional de Los Alamos.	Provedores de serviços comerciais de Internet (ISPs) surgiram nos Estados Unidos e na Austrália	Máquina de café localizada ao lado da chamada Trojan Room no antigo Laboratório de Computação da Universidade de Cambridge, exibida em uma webcam	A LG anunciou uma geladeira inteligente que determinaria se os alimentos precisam ser reabastecidos	o lançamento do IPv6 desencadeou um grande crescimento e interesse neste campo. Gigantes como Cisco, IBM, Ericsson realizaram várias iniciativas educacionais e comerciais com a IoT.



# IoT vs Smart “Things”



# Smart Home





This Jen, is “The Internet”.

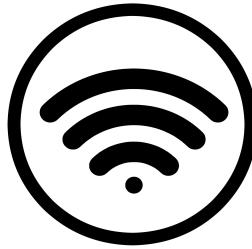




# Princípios da IoT



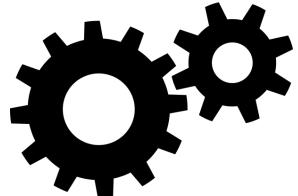
Sense



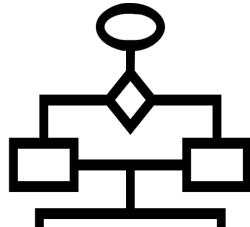
Connect



Store



Act



Control



Analyze



# Demo

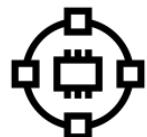


Referência obrigatória ao filme Tenacious D <https://www.youtube.com/watch?v=nKDcgsUzGxk> (e não a figurinha do WhatsApp :P

# Como funciona



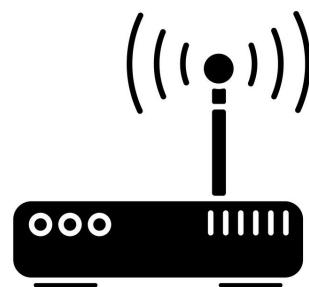
# Arquitetura



IoT Device



Antena



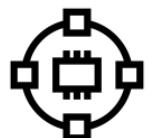
Gateway



The “Internet”



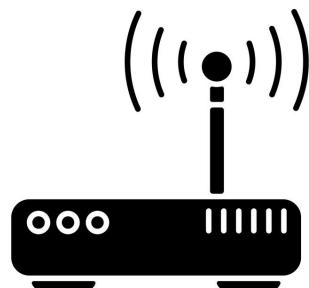
# Arquitetura



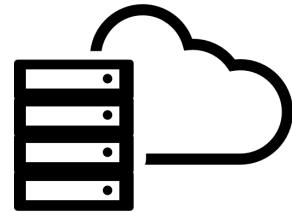
IoT Device



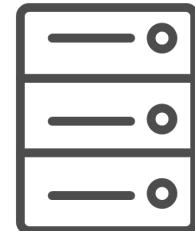
Antena



Gateway



Cloud



Server



# Comunicação



802.11 / 802.11a  
100m / 50m  
2Mbit / 50Mbit



10m a 100m  
20 a 900 kilobits



1m a 100m  
25Mbit / 50Mbit



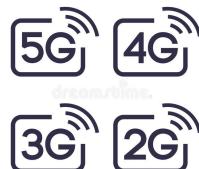
> 10km  
0,3kbps a 50kbps



30cm a 150m  
30 a 480 Mbp

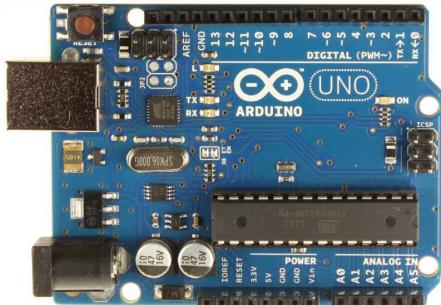
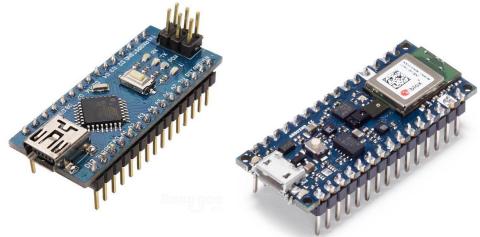


10 cm  
106, 212 ou 424  
kbps

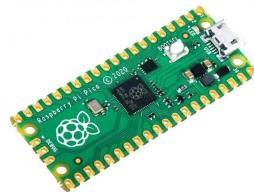




# Microcontroladores / Placas de Desenvolvimento



Arduino



Raspberry



Thunderboard  
BG22



NodeMcu  
(ESP8266)

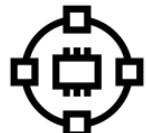


# Comunicação

HTTP

/

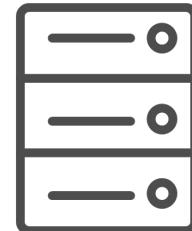
MQTT



IoT Device



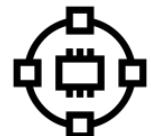
Gateway  
(opcional)



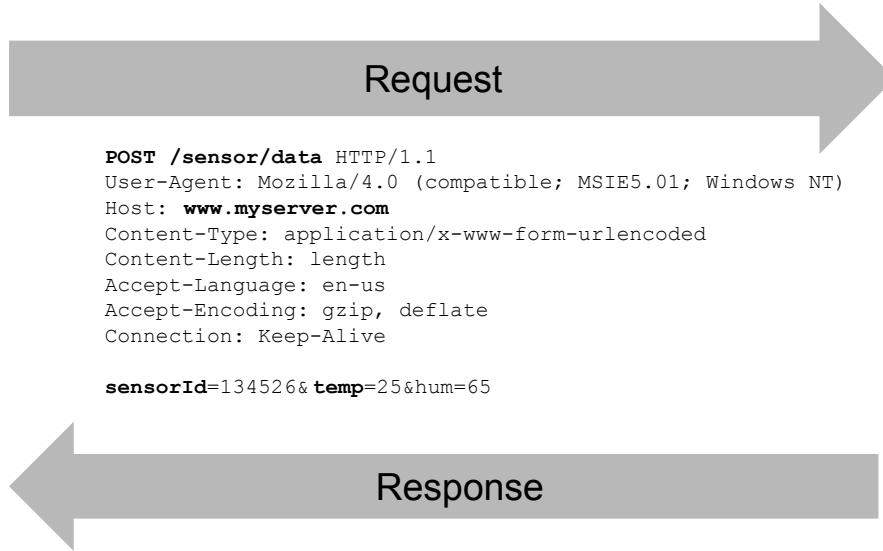
Server



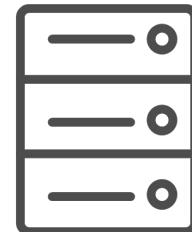
# HTTP



IoT Device



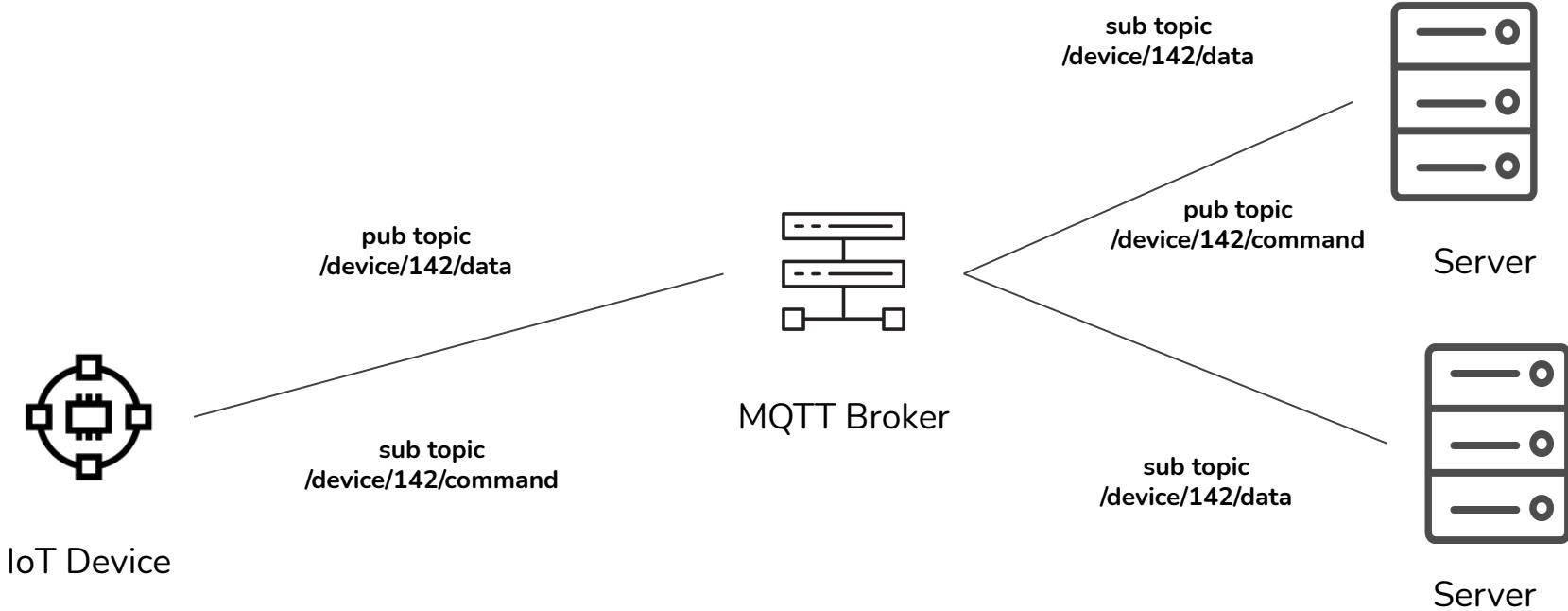
```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
Content-Length: 0
Content-Type: text/html
Connection: Closed
```



Server



# MQTT - publish / subscribe protocol





# MQTT Brokers





# MQTT - HiveMQ Demo

<http://www.mqtt-dashboard.com/index.html>

HiveMQ | Public Broker | MQTT Dashboard

**Broker**

The HiveMQ Dashboard utilizes the HiveMQ MQTT broker. You can use any MQTT client or library to publish to the broker.

Testing and Usage is for free but please do not use it for sensitive information because everybody is allowed to subscribe to every topic, including wildcard. Feel free to play with MQTT and the HiveMQ broker. Please consider to add a reconnect logic to your client because we may update the underlying HiveMQ instance at any time, so we cannot promise 100% uptime.

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With our free, fully managed MQTT Cloud Platform [HiveMQ Cloud](#) you can create reliable, scalable and secure MQTT cloud-broker clusters that are built for production. Sign up and you are ready to connect up to 100 IoT devices at no cost (no credit card required).

**Outgoing Messages** 742595534    **Incoming Messages** 1340363910

**Clients**

**MQTT connection settings**

Host: broker.mqttdashboard.com  
TCP Port: 1883  
Websocket Port: 8000

Subscriptions	Retained Messages
16033	42524

Bytes Read	Bytes Written
67.62 GB	125.02 GB

Queued Messages	MQTT Sessions
4077	5728

**HiveMQ Cloud**  
HiveMQ Cloud Basic is now free for up to 100 MQTT clients.  
[Learn more](#)

<http://www.hivemq.com/demos/websocket-client/>

**HIVEMQ**  
ENTERPRISE MQTT BROKER

Websockets Client Showcase

**Connection**

Host: broker.mqttdashboard.com    Port: 8000    ClientID: clientId-o6ukmszCFV    Connect

Username:    Password:    Keep Alive: 60    Clean Session:

Last-Will Topic:    Last-Will QoS: 0    Last-Will Retain:

Last-Will Message:

**Publish**    **Subscriptions**

**Messages**



# MQTT - HiveMQ Demo / MQTT Explorer

**HIVEMQ**  
ENTERPRISE MQTT BROKER

## Connection

**Publish**

Topic: testtopic/1      QoS: 0      Retain:  Publish

Message:

## Subscriptions

Add New Topic Subscription

QoS: 2      testtopic/#

## Messages

2021-06-18 20:11:04      Topic: testtopic/base/hum      QoS: 0  
{"Date": "2021-06-19 00:11:00", "Hum": 25}

2021-06-18 20:11:02      Topic: testtopic/RL\_CL      QoS: 1  
{"adhoc": 0, "connected": 1, "historic": 0, "tags": [{"GetDeviceStatus\_Sled\_1\_new": "Connected", "GetDeviceStatus\_Sled\_1\_o\_id": 0, "GetInterfaceSignal\_Sled": 4, "GetInterfaceStatus\_Sled\_1": "3G", "GetNetID\_Sled\_1": "10.42.75.194", "IoT\_Hub\_Status": 1, "Time\_Now": "23"}, {"fimest

Websockets Client Showcase

connected

## MQTT Explorer

Search...  DISCONNECT

### Connections

- raspberry\_casa (mqtt://192.168.1.6:1883/)
- raspberry (mqtt://10.42.0.230:1883/)
- HiveMQ demo (mqtt://broker.mqttdashboard.com:1883/)
- aws (mqtt://ec2-18-228-42-172.sa-east-1.amazonaws.com:1883/)
- rasp\_rio.co0 (mqtt://10.0.10.138:1883/)
- localhost (mqtt://localhost:1883/)

### MQTT Connection

mqtt://broker.mqttdashboard.com:1883/

Name:  Validate certificate:  Encryption (tls):

Protocol:  Host:  Port:

Username:  Password:   CONNECT

DELETE ADVANCED SAVE CONNECT



# MQTT - Mqtt Explorer

MQTT Connection      mqtt://broker.mqttdashboard.com:1883/

+ ADD

Subscription

- #
- \$SYS/#
- testtopic/base/hum
- testtopic/base/temp

MQTT Client ID

mqtt-explorer-6f0192e5

CERTIFICATES    BACK

Connections

- raspberry\_casa  
mqtt://192.168.1.6:1883/
- raspberry  
mqtt://10.42.0.230:1883/
- HiveMQ demo  
mqtt://broker.mqttdashboard.c...
- aws  
mqtt://ec2-18-228-42-172.sa-e...
- rasp rio.co0  
mqtt://10.0.10.138:1883/
- localhost  
mqtt://localhost:1883/

MQTT Explorer      DISCONNECT

Search...

broker.mqttdashboard.com

testtopic

base

temp = {"Date": "2021-06-19 00:15:17", "Temp": 32}  
hum = {"Date": "2021-06-19 00:15:09", "Hum": 22}

Topic    1

testtopic / base

Value

History

Publish

# MQTT - Java

```
@Component
public class ApplicationListener {

    @EventListener
    public void handleStart(ApplicationStartedEvent event) {
        try {
            String id = UUID.randomUUID().toString();
            IMqttClient client = new MqttClient("tcp://broker.mqttdashboard.com:1883", id);
            MqttConnectOptions options = new MqttConnectOptions();
            options.setAutomaticReconnect(true);
            options.setCleanSession(true);
            options.setConnectionTimeout(10);
            client.connect(options);
            client.subscribe("testtopic/base/#", (topic,msg) -> {
                System.out.println(topic + " -> " + new String(msg.getPayload()));

            });
        } catch (MqttException ex) {
            ex.printStackTrace();
        }
    }
}
```

```
<dependency>
    <groupId>org.eclipse.paho</groupId>
    <artifactId>org.eclipse.paho.client.mqttv3</artifactId>
    <version>1.2.5</version>
</dependency>
```



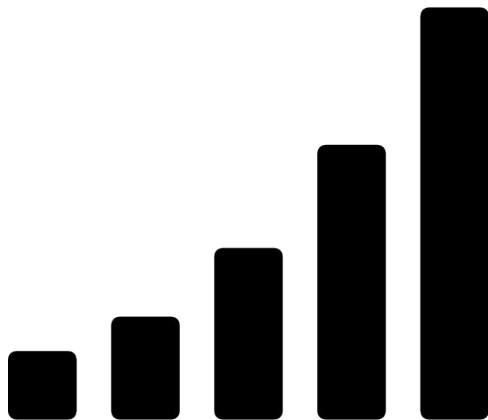
# Demo



Referência obrigatória ao filme Tenacious D <https://www.youtube.com/watch?v=nKDcgsUzGxk> (e não a figurinha do WhatsApp :P



# Desafios



# IIoT: Industrial IoT

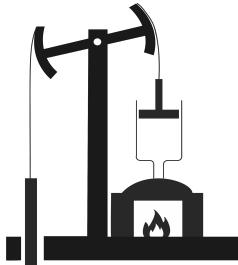


# Indústria 4.0



## Indústria 1.0

Força a Vapor, início da  
mecanização



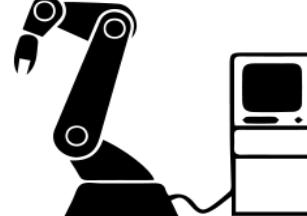
## Indústria 2.0

Produção em escala, linha de  
montagem, eletricidade e  
combustão



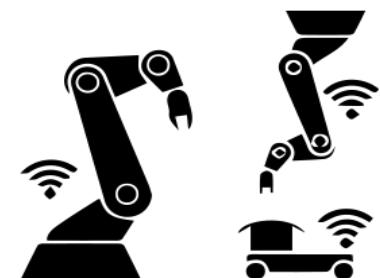
## Indústria 3.0

Automação, robótica,  
computadores, eletrônicos e  
internet



## Indústria 4.0

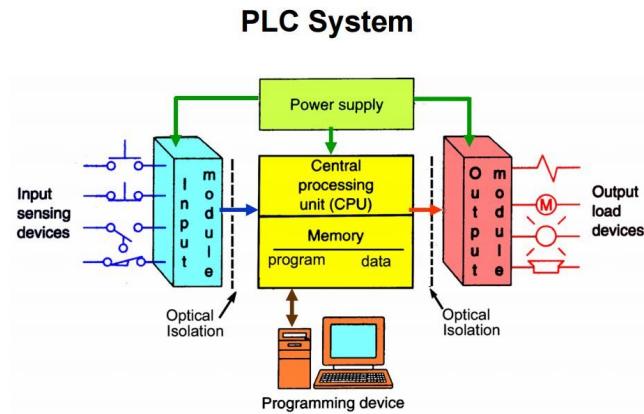
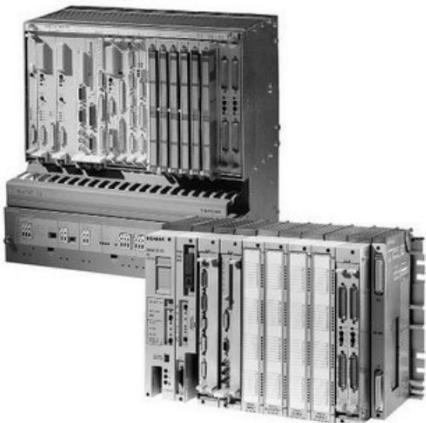
Internet das Coisas, Redes e  
Inteligência Artificial





# PLC - Programmable Logic Controller

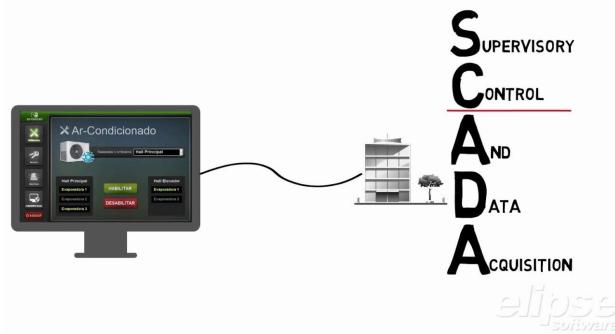
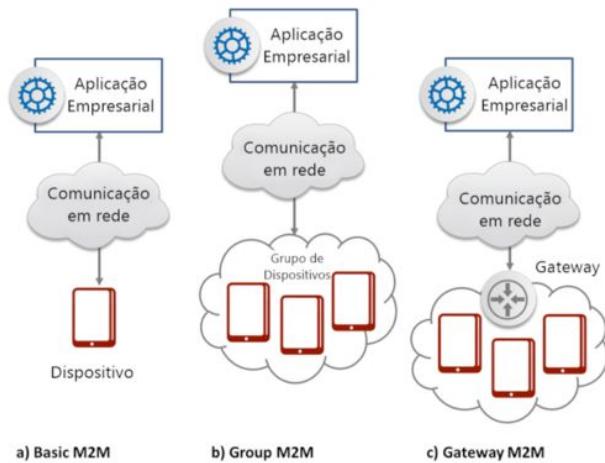
(CLP - Controladores Lógicos Programáveis)





# M2M, SCADA e ERP

## M2M - Machine-to-Machine



## ERP - Enterprise Resource Planning





# M2M vs IoT

## M2M

Comunicação direta entre máquinas

Suporta comunicação ponto a ponto

Dispositivos não contam necessariamente com conexão à internet

Tecnologia baseada principalmente em hardware

Geralmente se comunica com uma máquina por vez

Pode conectar um dispositivo via mobile ou outras redes

## IoT

Automação de sensores com plataforma de internet

Suporta comunicação em nuvem

Dispositivos contam com uma conexão de internet ativa

Tecnologia baseada em hardware e software

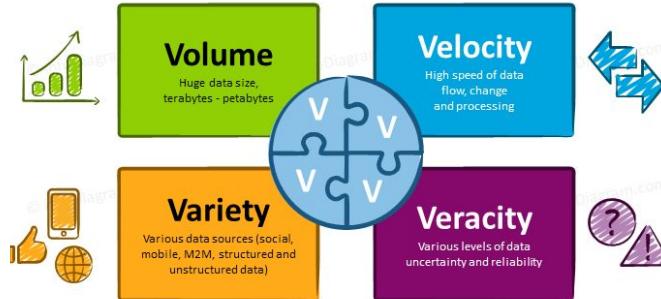
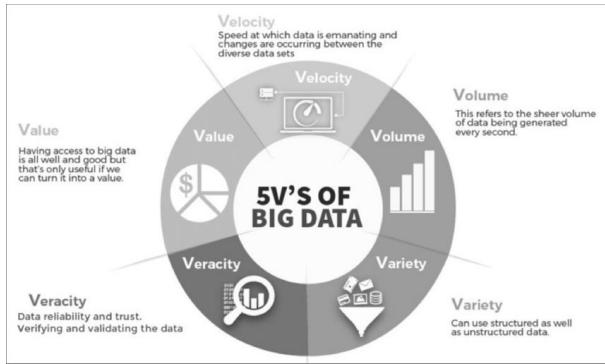
Vários usuários podem acessar os dados ao mesmo tempo pela internet

A entrega de dados depende de um protocolo de internet (IP)

# BUZZWORDS

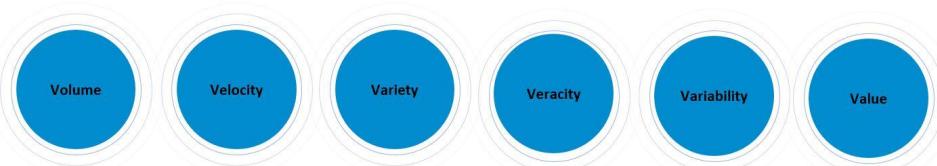


# Big Data - 4Vs, 5Vs, .... ∞Vs?!?



## 6Vs of DATA

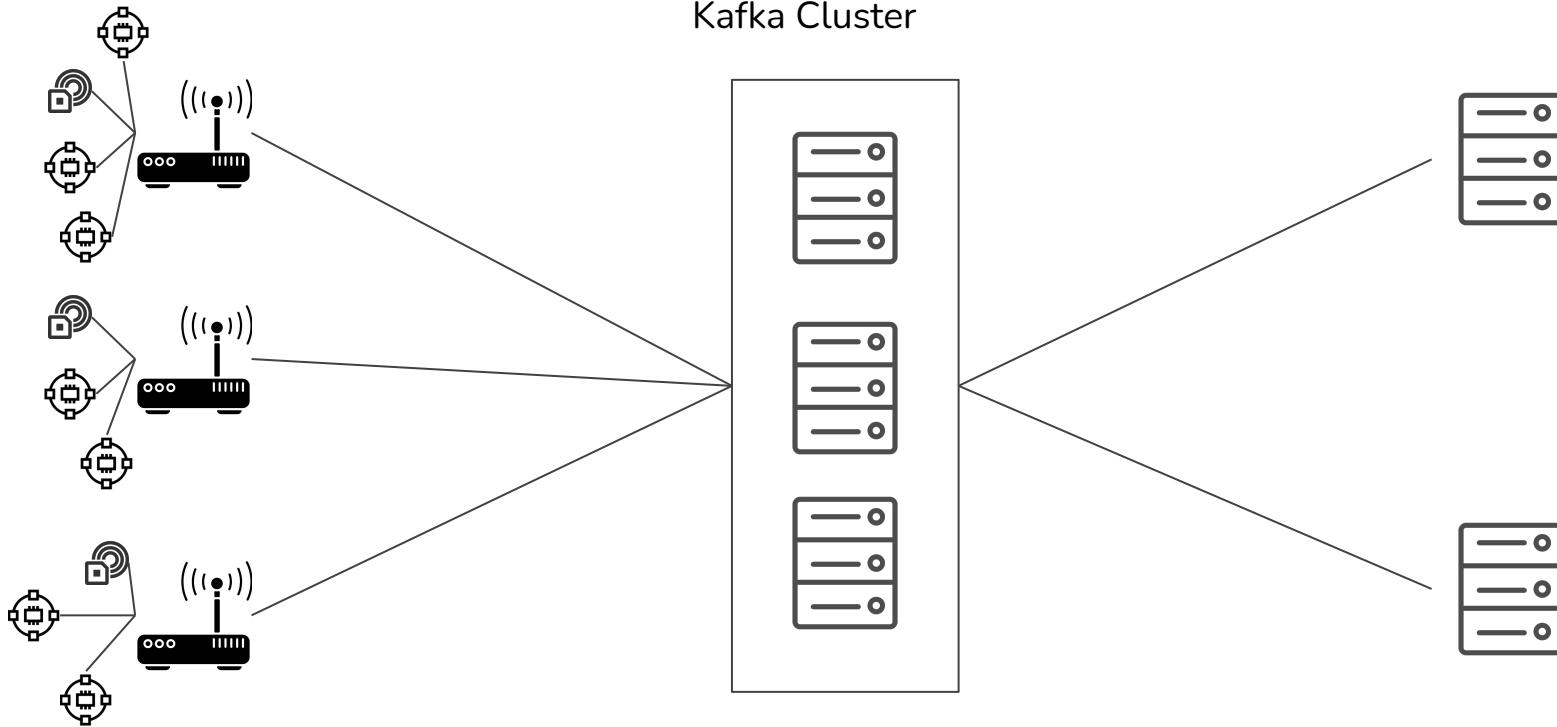
WWW.SATHISHTK.COM



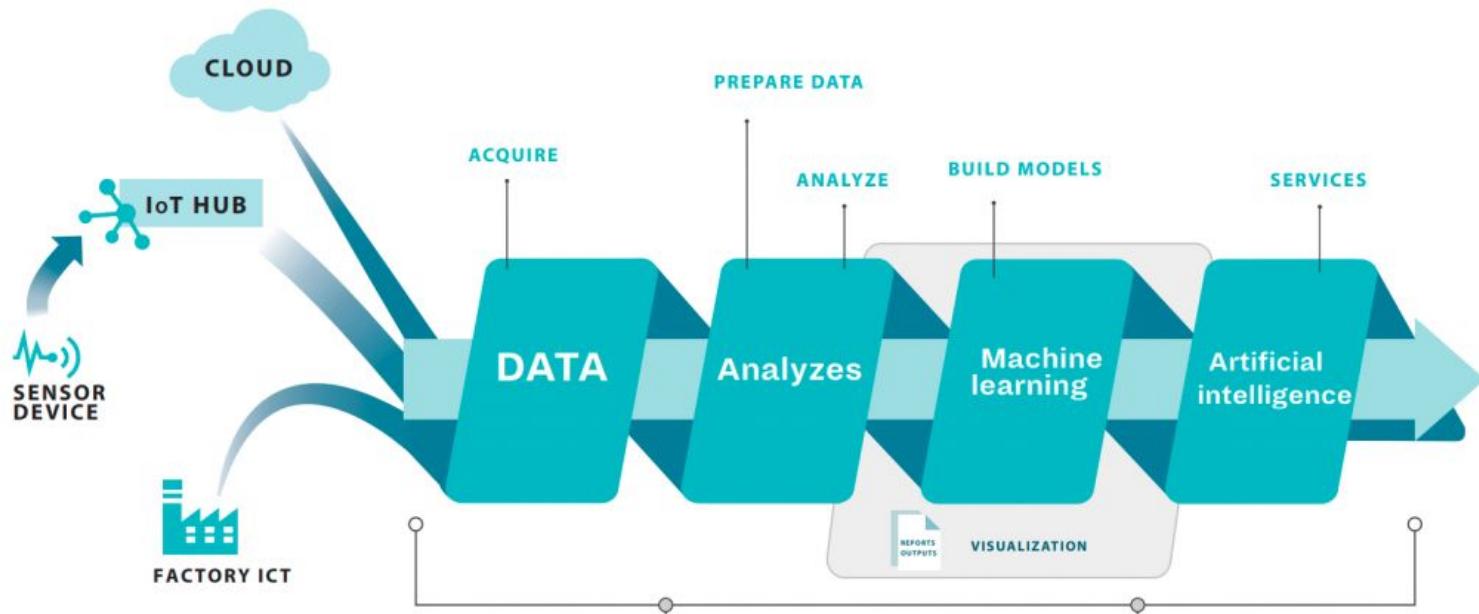
- How much data?
  - Yottabytes
  - Scalability of systems
- How fast can I access?
  - Hot Data path
  - Cold Data path
- What type of data?
  - Structured & Unstructured
  - Heterogeneous formats
- Is it reliable data?
  - Accuracy of data
  - Quality of data streams
- How varied is the data?
  - Different data sources
  - Data Outliers
- Usability of Data
  - Utility of Data
  - Usefulness of Data



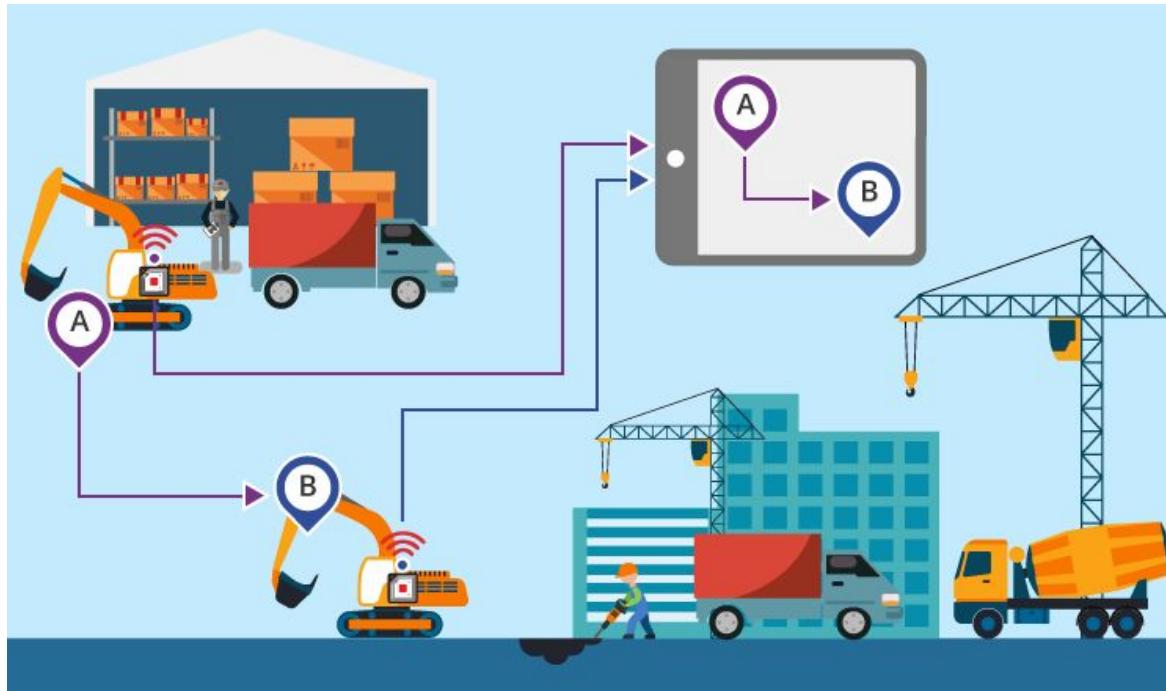
Kafka Cluster



# Inteligência Artificial

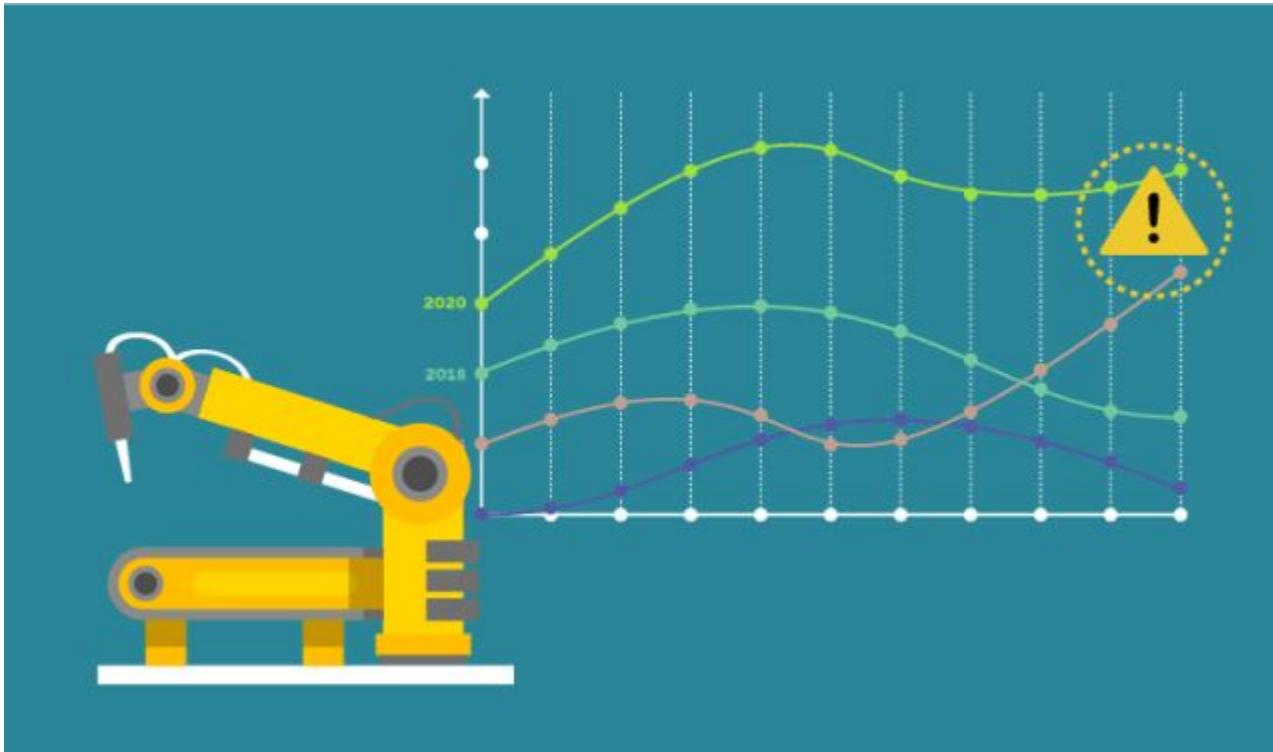


# Cases de IIoT - Asset Tracking





# Cases de IIoT - Predictive Maintenance

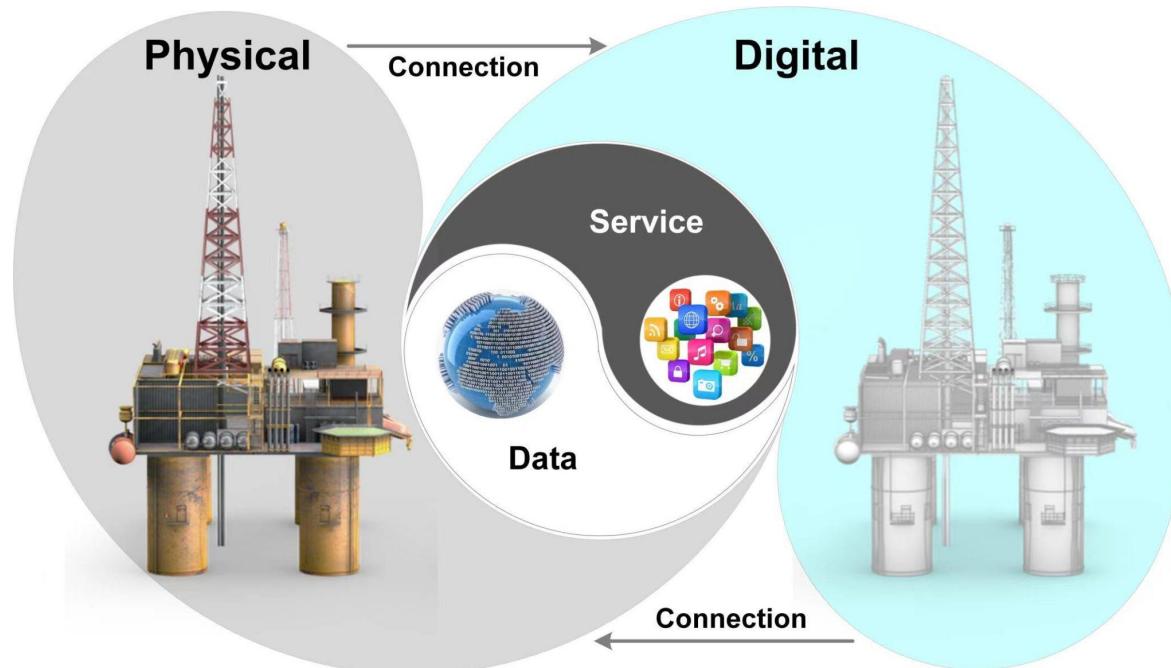




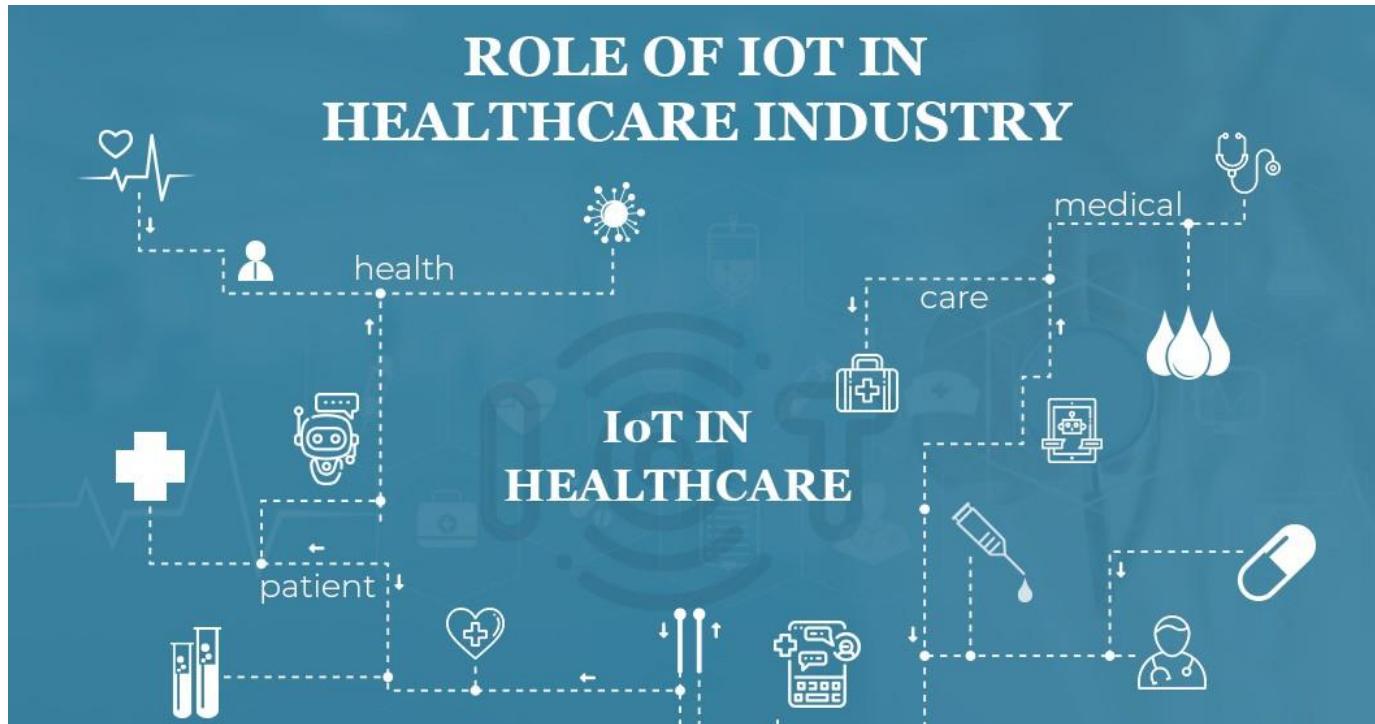
# Cases de IIoT - Energy Efficiency/Automation



# Cases de IIoT - Digital Twin



# Cases de IIoT - Healthcare



# Cases de IIoT - Safety





# Cases de IIoT - Safety



Dashboard

idk

EMERGENCY

Person: 150

Risk Area: 16

No Signal: 3

Access Control: 0

1th Floor

Cargo Area

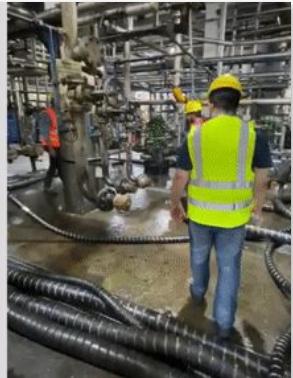
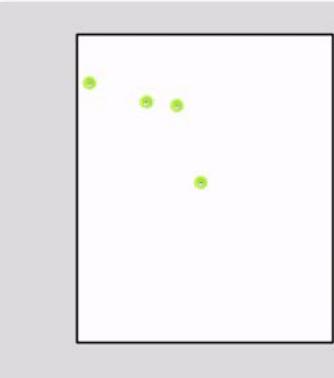
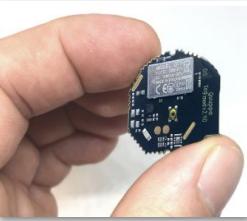
w.lillie Worker

5616/02/2021 10:17:50  
tag007  
102 ms  
volts

Sectors

Sector	Total
Cargo Area	Total: 11
Deposit Area	Total: 7
Lab	Total: 5
Production Area	Total: 14
Room 1	Total: 2
Room 10	Total: 1
Room 2	Total: 2
Room 3	Total: 2
Room 4	Total: 1
Room 5	Total: 0
Room 6	Total: 3
Room 7/8	Total: 2
Room 9	Total: 4

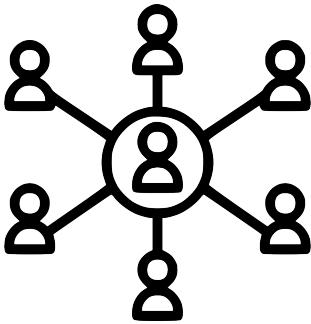
FATALITY PREVENTION - MITIGATE HAZARDOUS BEHAVIOR - SAFE PLANT - REDUCTION OF OPERATIONAL RISK - MONITORING PHYSICAL SPACE - ©IDK — Digital



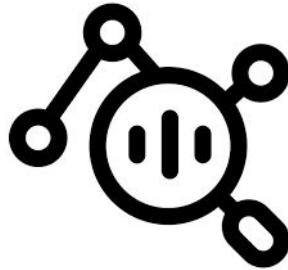
IoE:  $\neg \backslash (\forall) / \neg$



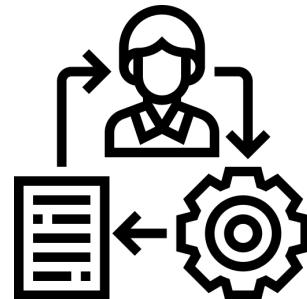
# IoE - Internet of Everything



Conectar pessoas de maneiras relevantes e valiosas



Converter dados em inteligência para auxiliar na tomada de decisões



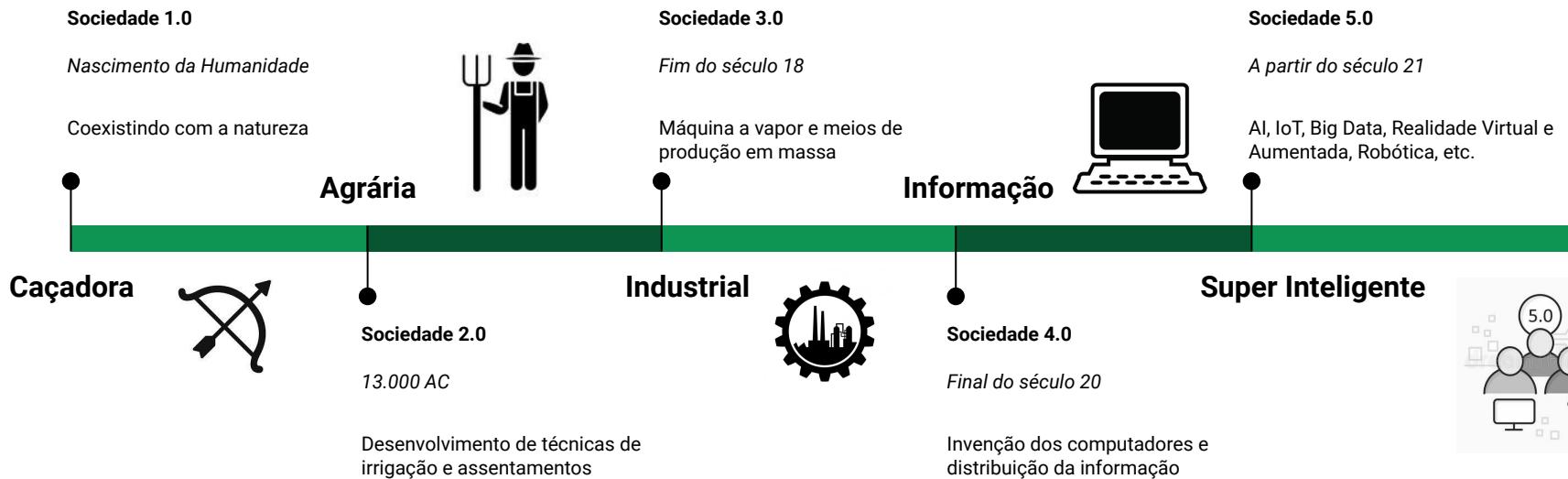
Fornecer as informações certas para a pessoa/máquina certa no momento certo.



Dispositivos físicos e objetos conectados à Internet (IoT)



# Sociedade 5.0





# Sociedade 5.0



 Japan. Shaping tomorrow.

and expand our infinite possibilities,



# Dúvidas???

Na história de hoje  
aprendemos sobre  
IoT, IIoT, IoE,  
Indústria 4.0 e Sociedade 5.0

Até mais amiguinhos!

