
SORBONNE
UNIVERSITÉ
CRÉATEURS DE FUTURS
DEPUIS 1257

Summary

- C1 : Introduction
- C2 : Technologies IoT
- C3 : WiFi
- C4 : HTTP Rest, MQTT, CoAP
- TP1 : REST et MQTT
- C5 : LPWAN
- C6 : Radio transmission and propagation
- C7 : LoRaWAN Physical Layer
- C8 : LoRaWAN Protocol
- TP2 : LoRaWAN
- Mini-Projet : géolocalisation par Wi-Fi sniffing

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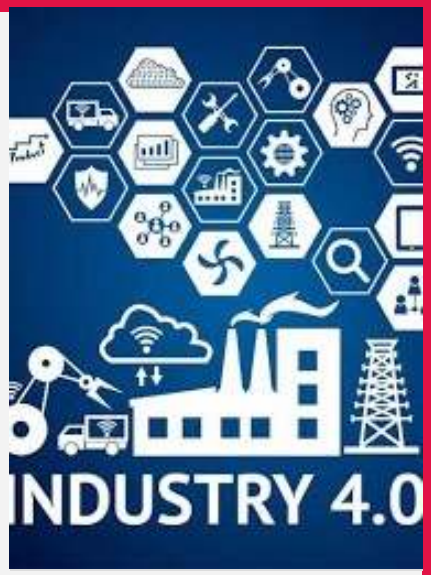
The Internet Of Things
C1 : Introduction

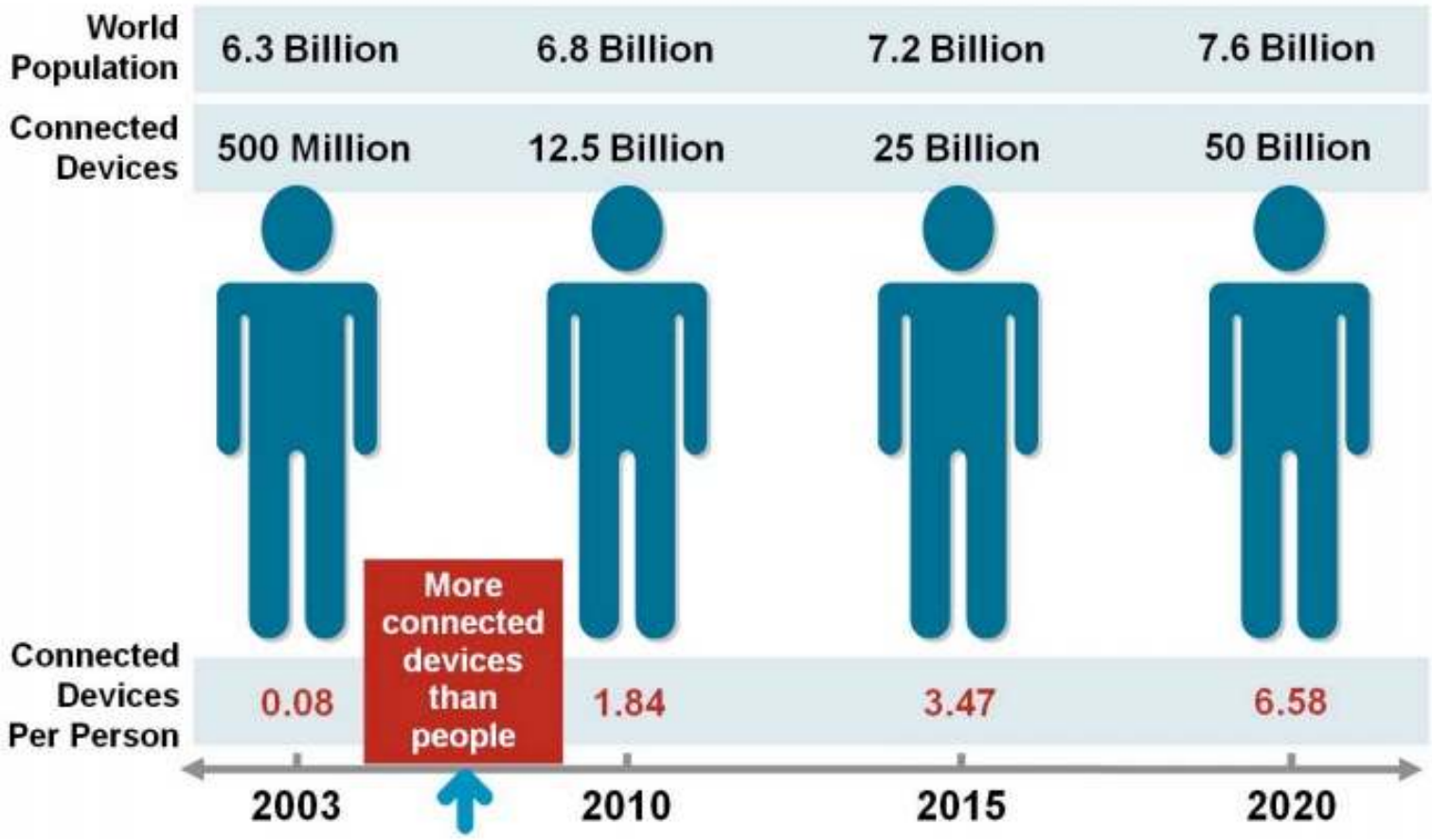
Introduction to what is the Internet of Things, why does it change the world where we live, what are the technologies behind the scene ?
How des it apply to your domain ?

IoT is a revolution, changing the way the industries are going to execute these processes



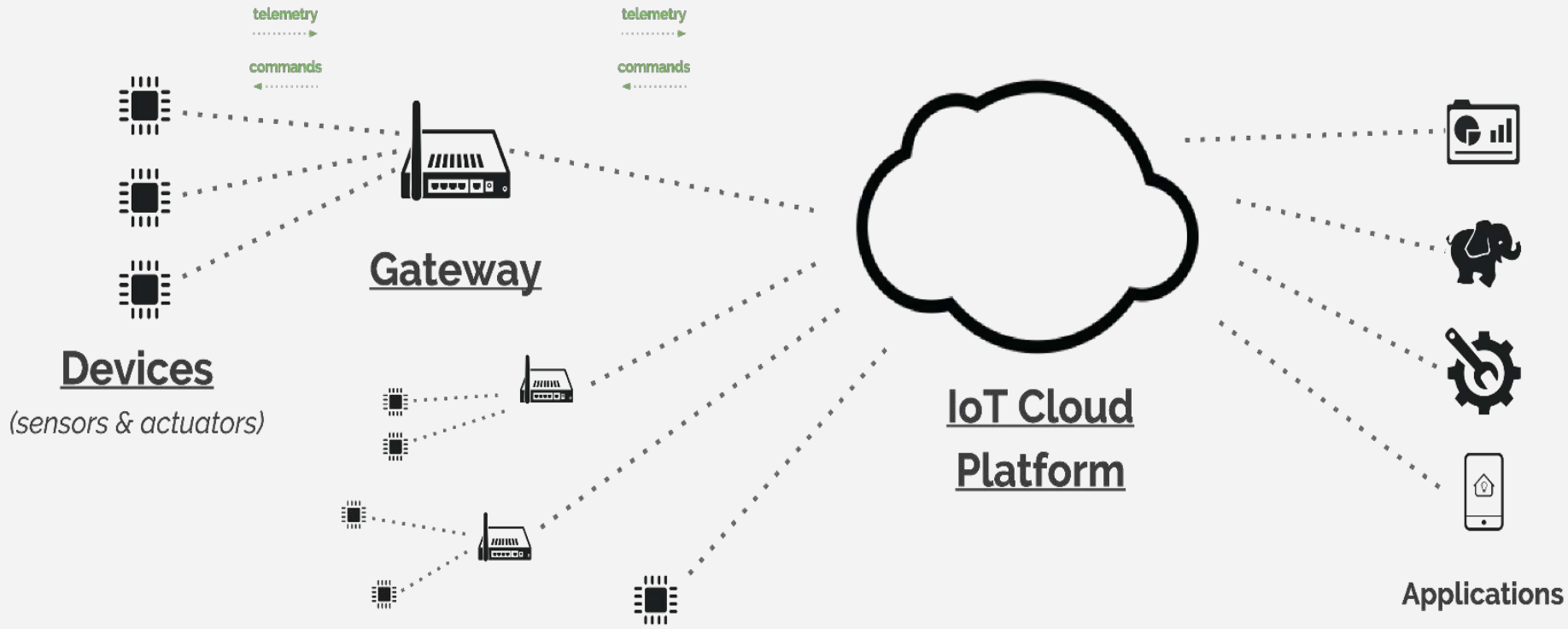
IoT : became a reality between 2008 and 2009

Figure 1. The Internet of Things Was "Born" Between 2008 and 2009



Source: Cisco IBSG, April 2011

IoT is a solution, based on data collected from physical world, directly, by things

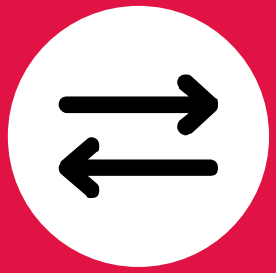


Source : IoT Working Group, The Three Software Stacks Required for IoT Architectures.

IoT has 3 layers to compose a solution.

DEVICES

To capture the data from the physical world
Devices are numerous. Larger the fleet is and larger the value created by the platform will be.



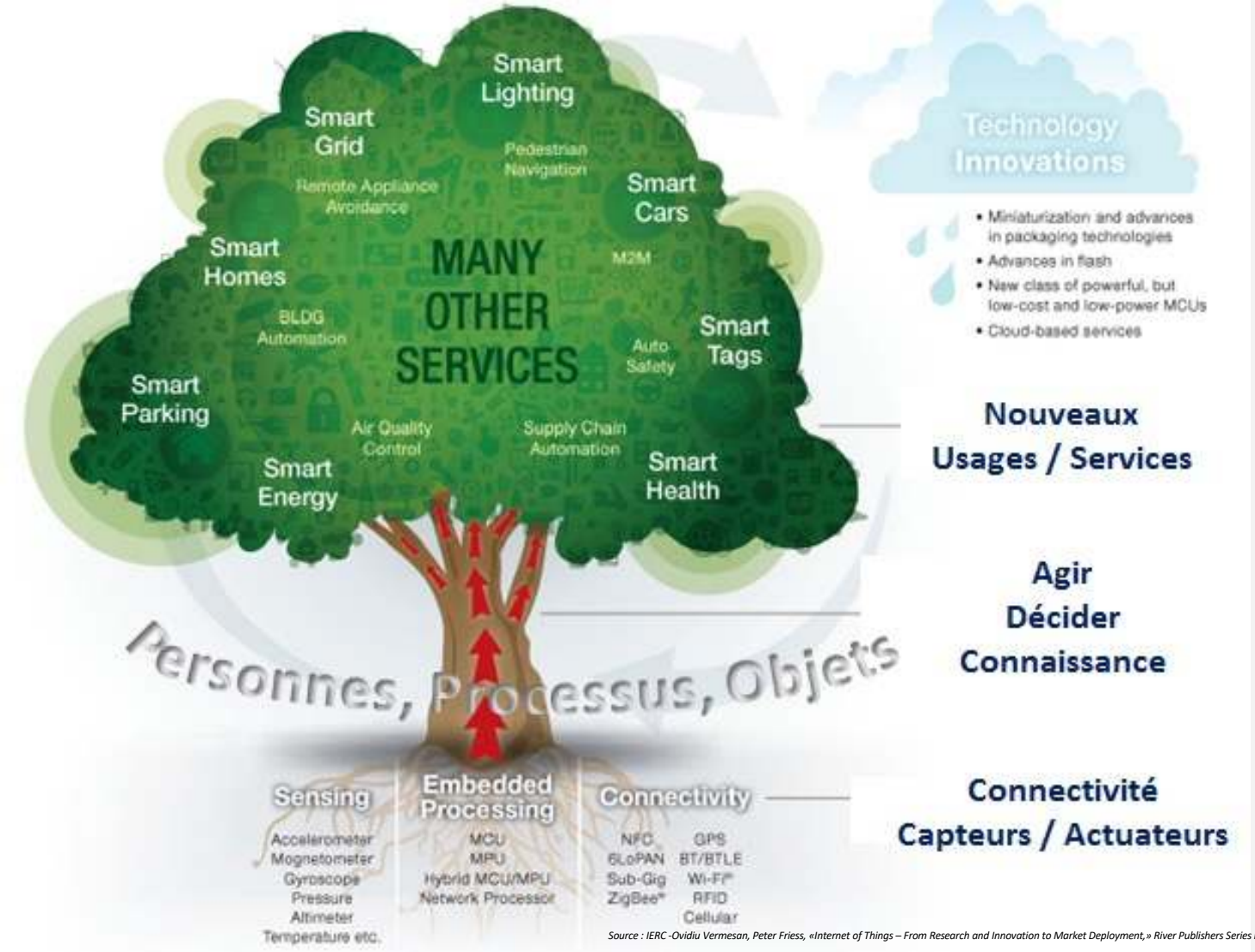
COMMUNICATION

To transmit, autonomously, the captured data from the fields to the consumers.
Communication key feature is not to be fast; it is to be energy efficient.

PLATFORM

Makes the data meaningful and accessible to the end-user.
Process large set of data. Mix different source of data. Create individual and aggregated value.
Manage the device fleet

The 3 layers of the Internet of things



Source : IERC -Ovidiu Vermesan, Peter Friess, «Internet of Things – From Research and Innovation to Market Deployment,» River Publishers Series in Communication

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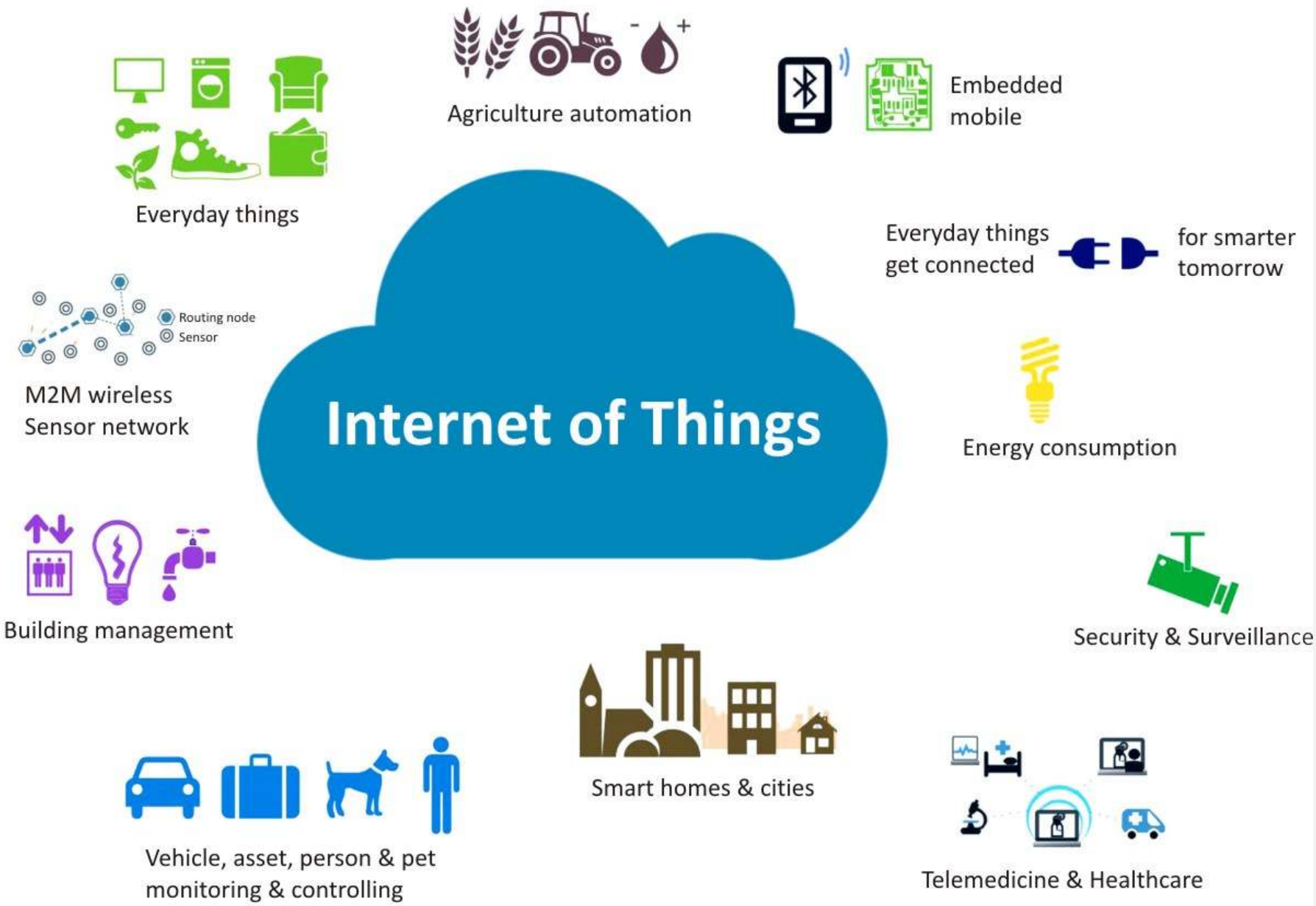

Agriculture automation
Embedded mobile
Everyday things
Everyday things get connected
for smarter tomorrow
Routing node
Sensor
M2M wireless Sensor network
Internet of Things
Energy consumption
Building management
Security & Surveillance
Smart homes & cities
Vehicle, asset, person & pet monitoring & controlling
Telemedicine & Healthcare

FITBIT USE CASE

Get personal activity & health data from million of different people world-wide. Process them and propose:

- Individual feedback
- Global data studies and partnership programs

MULTIPLE DEVICES

Collecting the same type of Data

USING BLUETOOTH

And the customer smartphone as a Gateway to internet

WITH APP AND BIG DATA

To propose a valuable customer experience and B2B services like heath insurances

NETATMO USE CASE

Get home environmental information – Temperature, Hygro, Sound…
- Individual feedback
- Global data studies and partnership programs

MULTIPLE DEVICES

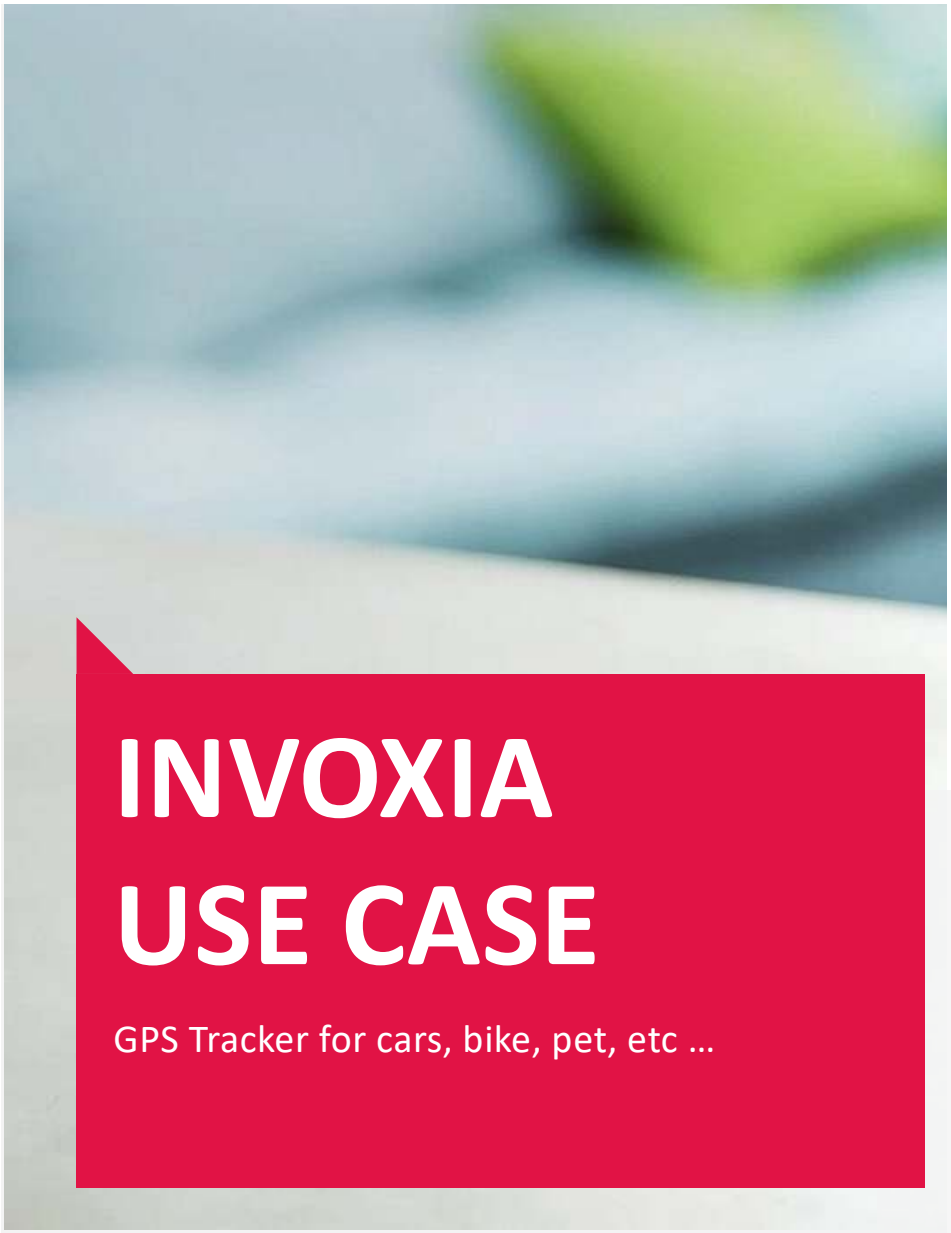
Collecting the different type of data all related to your home

USING Wi-Fi

And the customer Internet connectivity to reach the backend services

WITH APP AND BIG DATA

To propose a valuable customer experience and B2B services like city map of environmental noise



INVOXIA USE CASE

GPS Tracker for cars, bike, pet, etc …

MULTIPLE DEVICES

Collect the GPS position

USING LPWAN

WITH APP

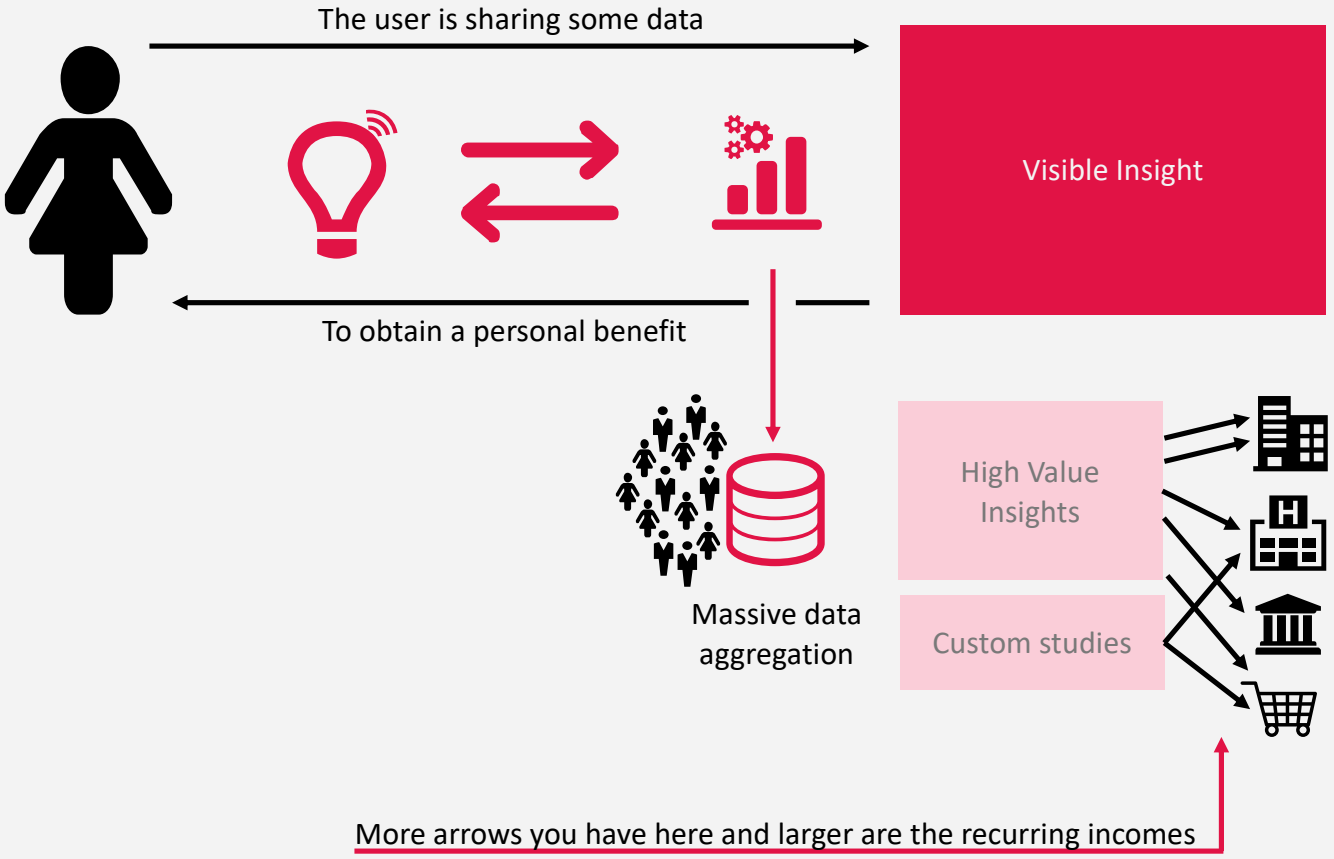
IoT revenue model

There are many revenue model, an illustration here is on B2C direct solution with indirect B2B markets

1 **There is the reason why you accept / want the solution.**

2 **There are the market where the solution creates value, sometime the reason why the solution has been created.**

This is a win-win deal for human generated data



https://app.wooclap.com/RBFRPD?from=instruction-slide

Let’s make a short break

LEARNING AT THIS STEP

IoT is a Solution

Composed by Hardware, Network and Software.
It needs maintenance and the associated business model is a service

Belonging on multiple technologies

The communication layer uses different technologies depends on the context.

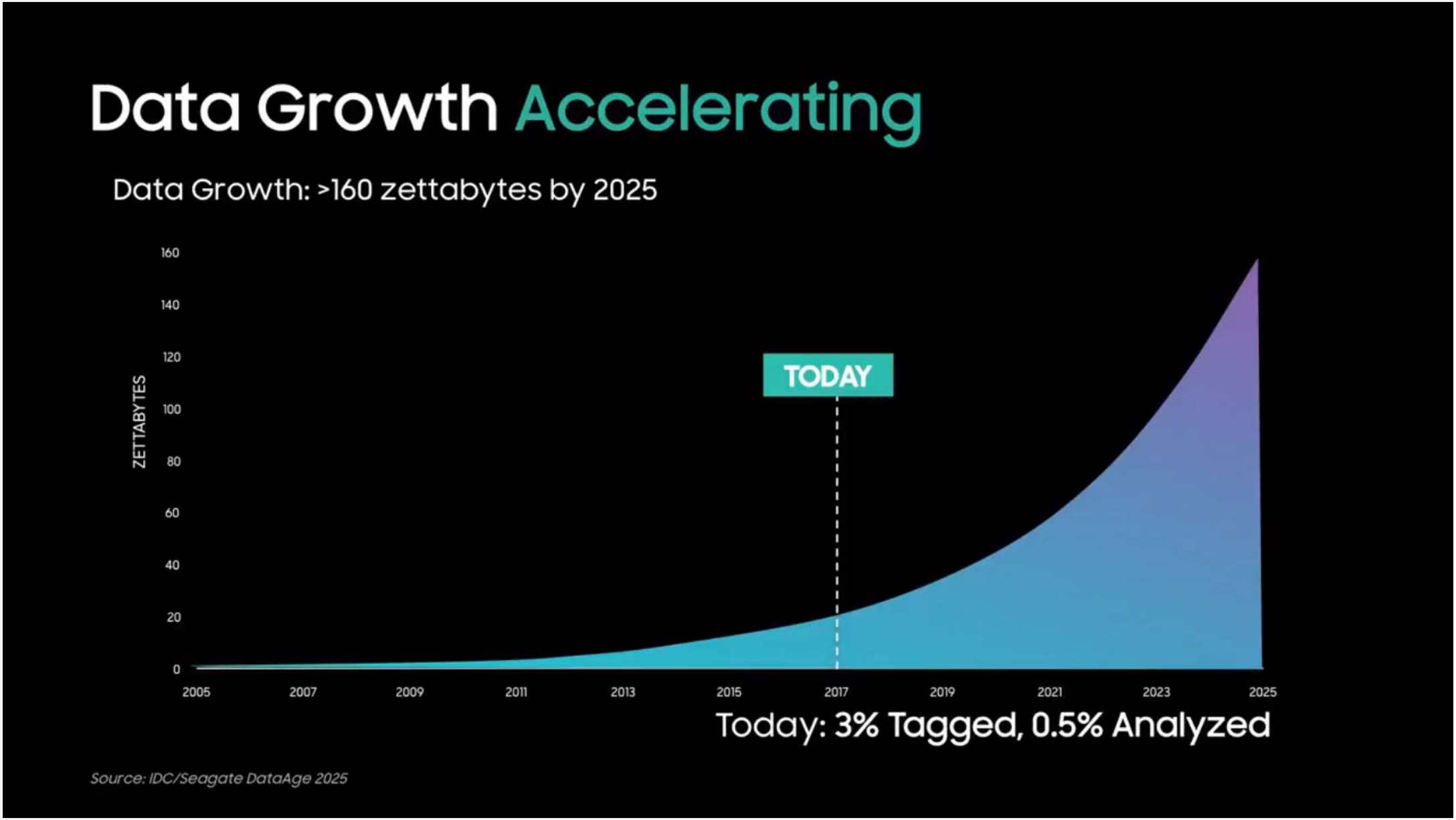
With a two sides source of value

A direct benefit for the end-user (the reason why he buy it) and a B2B source of revenue obtained thanks to the massification of the collected data

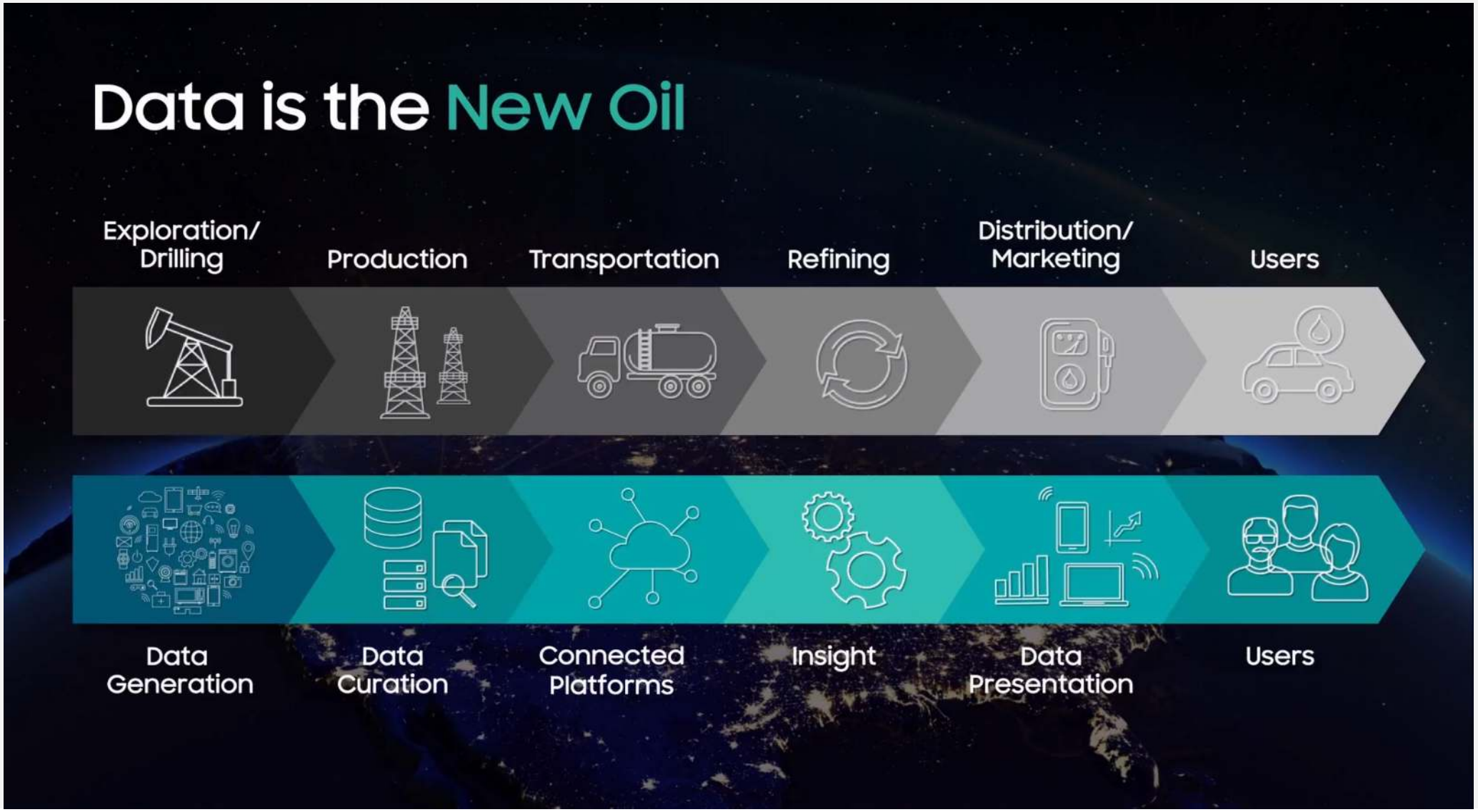
IoT is an enabler of disruptive business model & services boosted by Cloud, Mobile, Social & Big Data…

… and deep industry **Transformation** from **Products** to **Services.**
Examples : Spotify/Kugou, Netflix/iQIYI, TIER/Mobike, Uber/Didi, etc…

Data Growth Accelerating



Data = oil of the 21 century ?



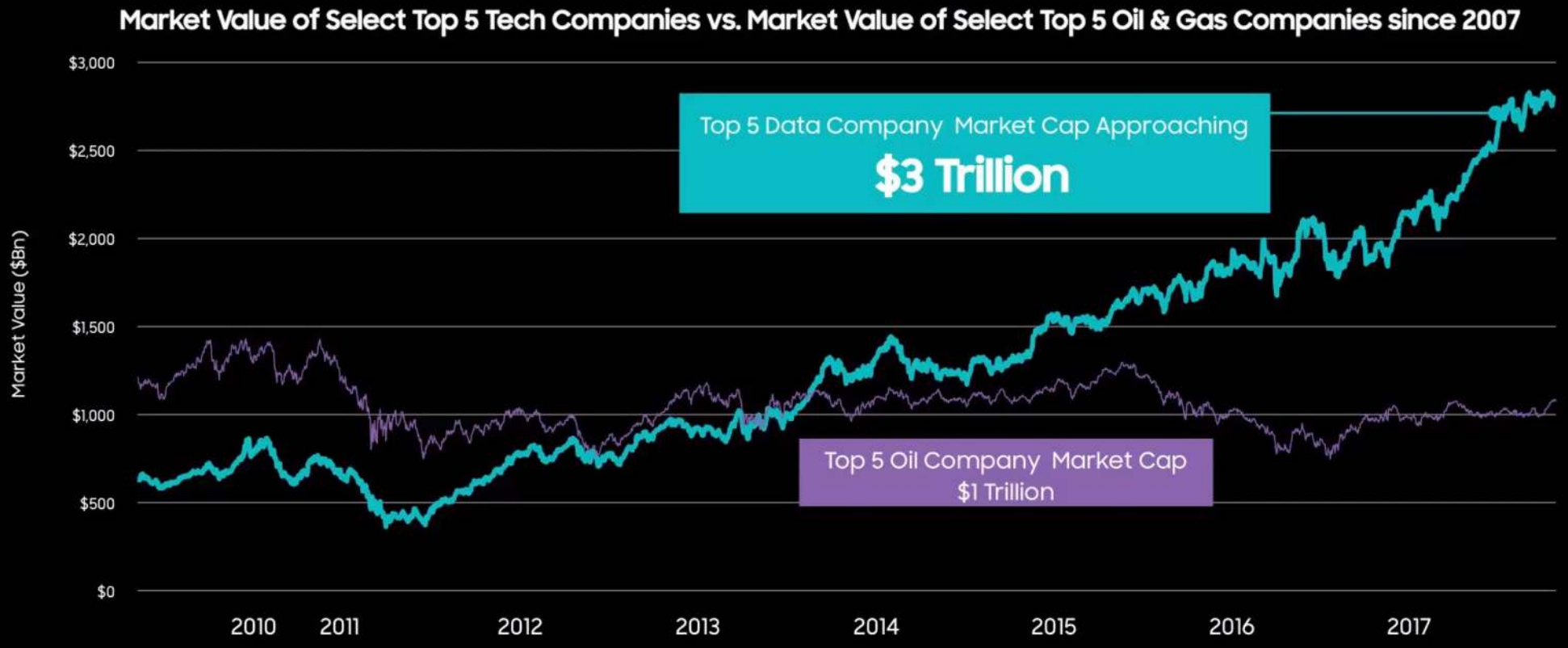
Oil Economy vs. Data Economy

10 Years of Change

	2007	2017
1	ExxonMobil	Apple
2	GE	Alphabet
3	Microsoft	Microsoft
4	citigroup	facebook
5	PetroChina	amazon.com
6	Bank of America	Berkshire Hathaway Inc.
7	Shell	Alibaba Group 阿里巴巴集团
8	bp	Tencent 腾讯
9	ICBC 中国工商银行 Industrial and Commercial Bank of China	Johnson & Johnson
10	Toyota	ExxonMobil

Source: Capital IQ

Data Companies Driving Valuations



Select top 5 technology companies include: Samsung, Apple, Alphabet, Amazon, and Microsoft

Select top 5 oil & gas companies include: Exxon Mobil, Royal Dutch Shell, Chevron, BP, and TOTAL

Source: CapitalIQ

The Cloud Platform

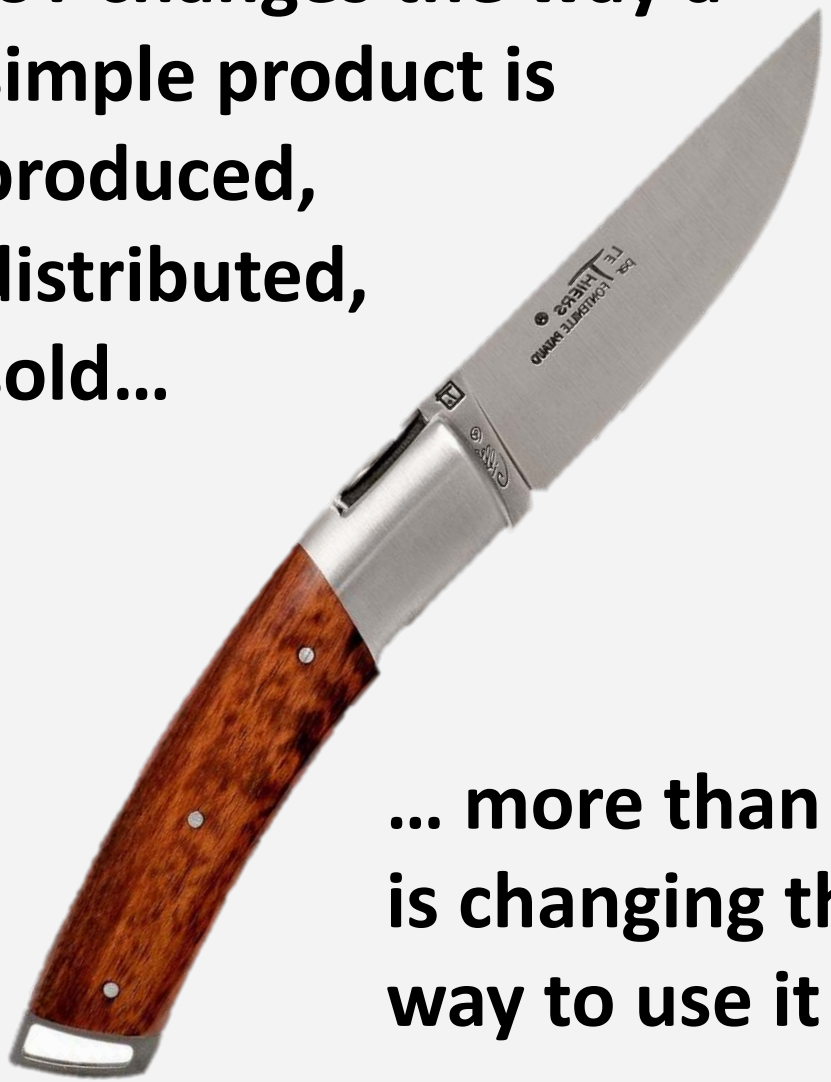
- IaaS : Infrastructure as a Service
- PaaS : Platform as a Service
- Les principaux acteurs :
  - AWS : Amazon Web Services
  - Microsoft Azure
  - Google Cloud Platform
  - Tencent Cloud
  - Alibaba Cloud
  - IBM Cloud
  - OVH Cloud
  - Ubidots
  - Etc..

IoT is an opportunity to innovate like Internet or smartphones transformed our environment

Adding a connectivity feature on an existing things does not make innovation happen.

Innovation transforms an existing market or create new markets

IoT changes the way a simple product is produced, distributed, sold…



… more than it is changing the way to use it

- Understand the use of product
- Propose renewal right on time
- Propose maintenance based on use
- Per use billing
- Unlock special blade
- Allow opening
- Track product in distribution circuit
- Fight against counterfeiting

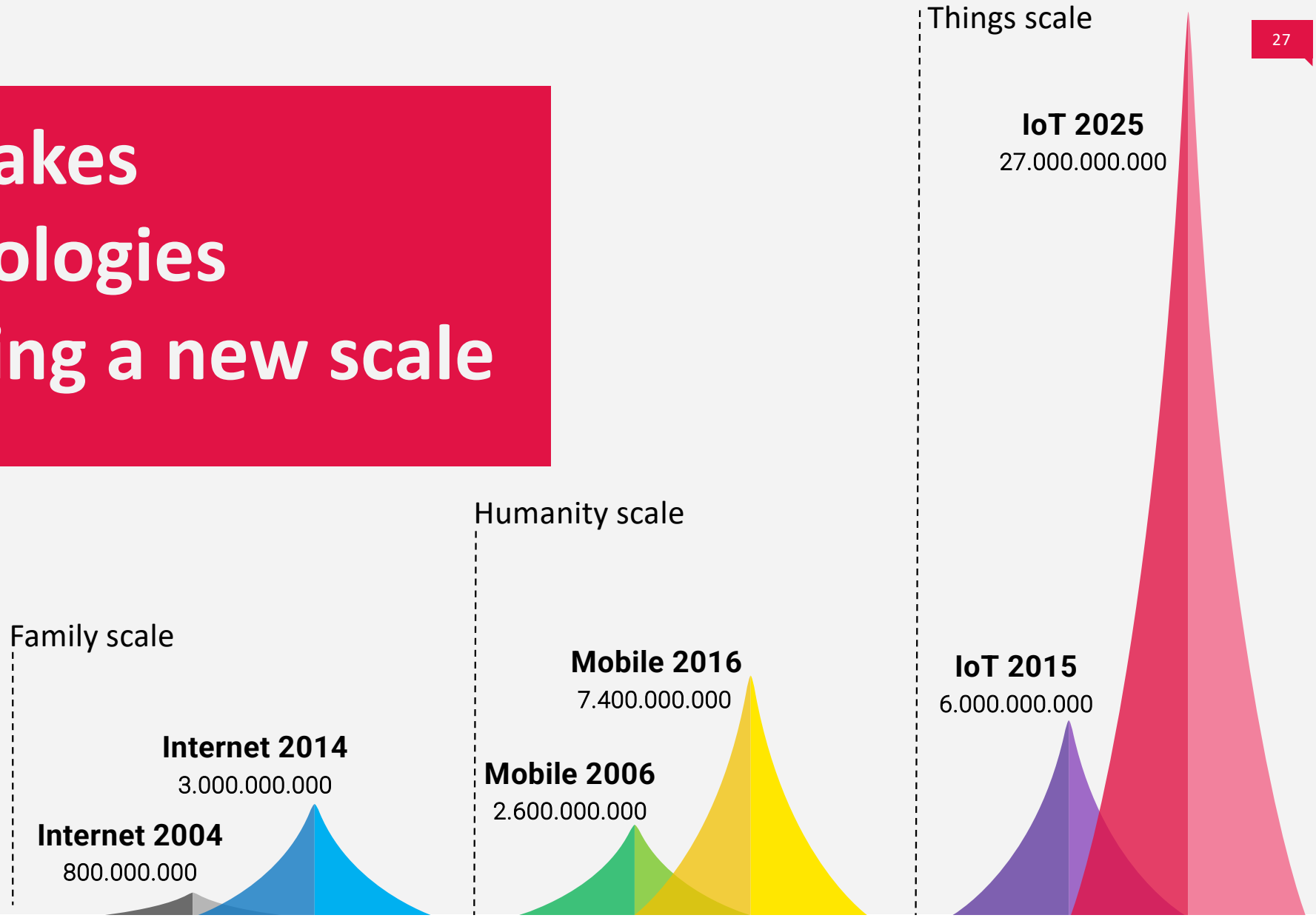
Why connecting tables ?

- Would it be for the end-user to master its dinner habits ?
  - Are your ready to pay for it ? **NO !**
- Would it be for the manufacturing process ?
  - Can we save money ? **YES !**

Manufacturers needs to forecast future order with accuracy to plan raw material purchase and flatten manufacturing process.

IoT can give them a real time view of the distribution stocks and move away from forecast to real-time market data.

IoT makes technologies reaching a new scale



IoT at scale

What makes the difference and innovation with IoT is the ability to **make it at scale**. The ability to **deploy millions of devices in the field**.

$1

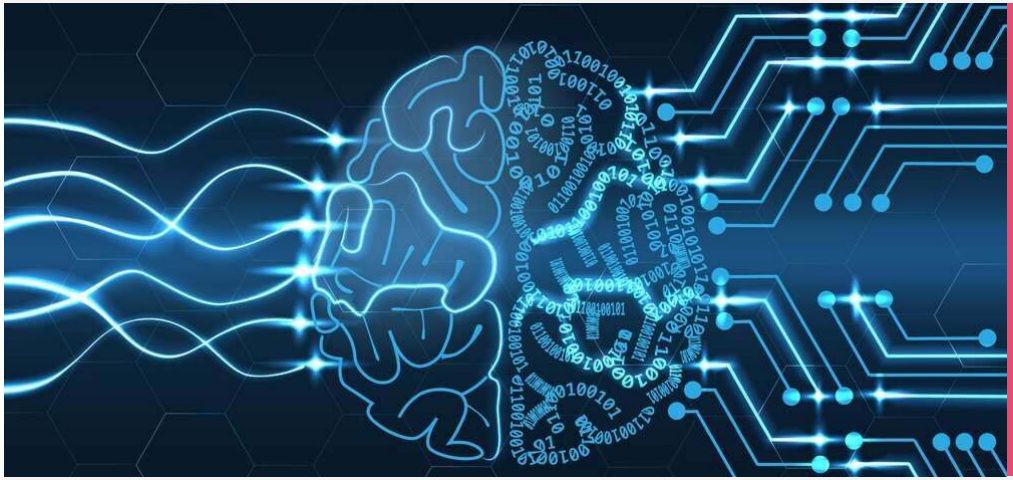
ULTRA-LOW-COST DEVICES

In 2020 we reached under $1 IoT devices firs condition to support at scale deployment

IN FIELD COST TENDING TO ZERO

The second condition to support at scale deployments.

IoT as the source of physical world AI



IoT CAPTURES THE ENVIRONMENTAL DATA
DATA FEED THE AI.

AI main domains of implementation **is digital world** (images, video, sounds, voice, social network, books …)
The AI capabilities in the physical world is huge (car driving, industrial maintenance, pollution, energy consumption reduction, climate prediction, health & pandemic…)

Currently, **physical world AI** is limited by the small number of data we have for training the neuronal networks.
IoT, by massively gathering physical world data **is enabling new AI capabilities**.