Tecnologie Abilitanti per le Citta' Sostenibili

strategie di sviluppo per IoT

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STMicroelectronics

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ANIE FEDERAZIONE

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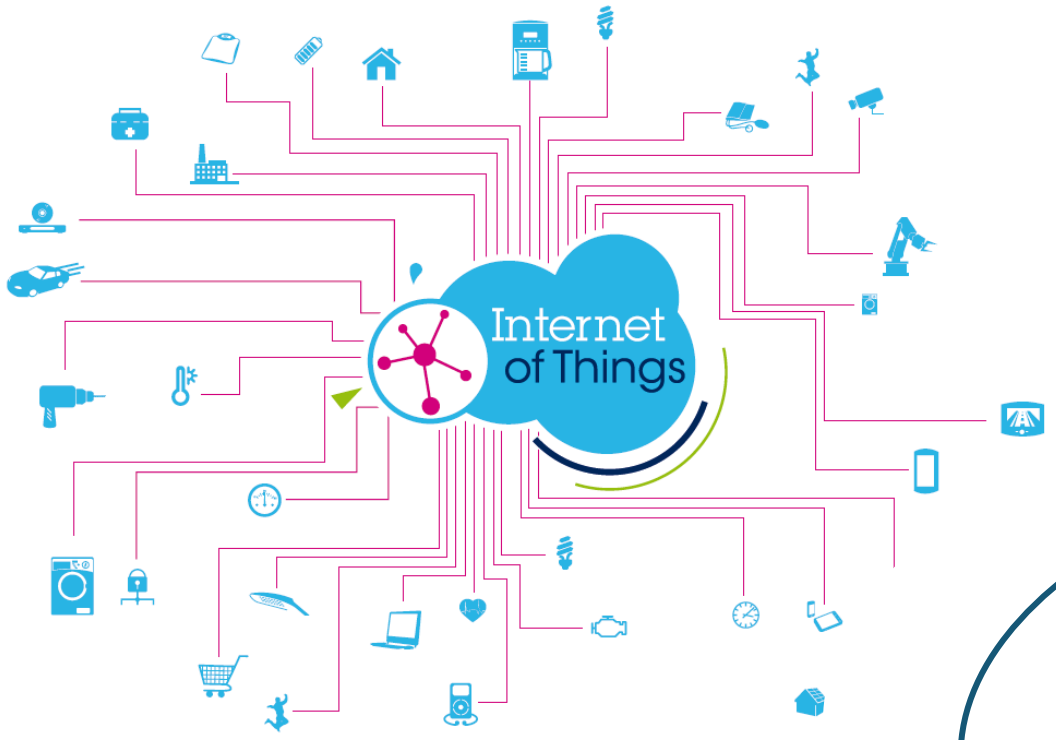
The Sustainability Challenge

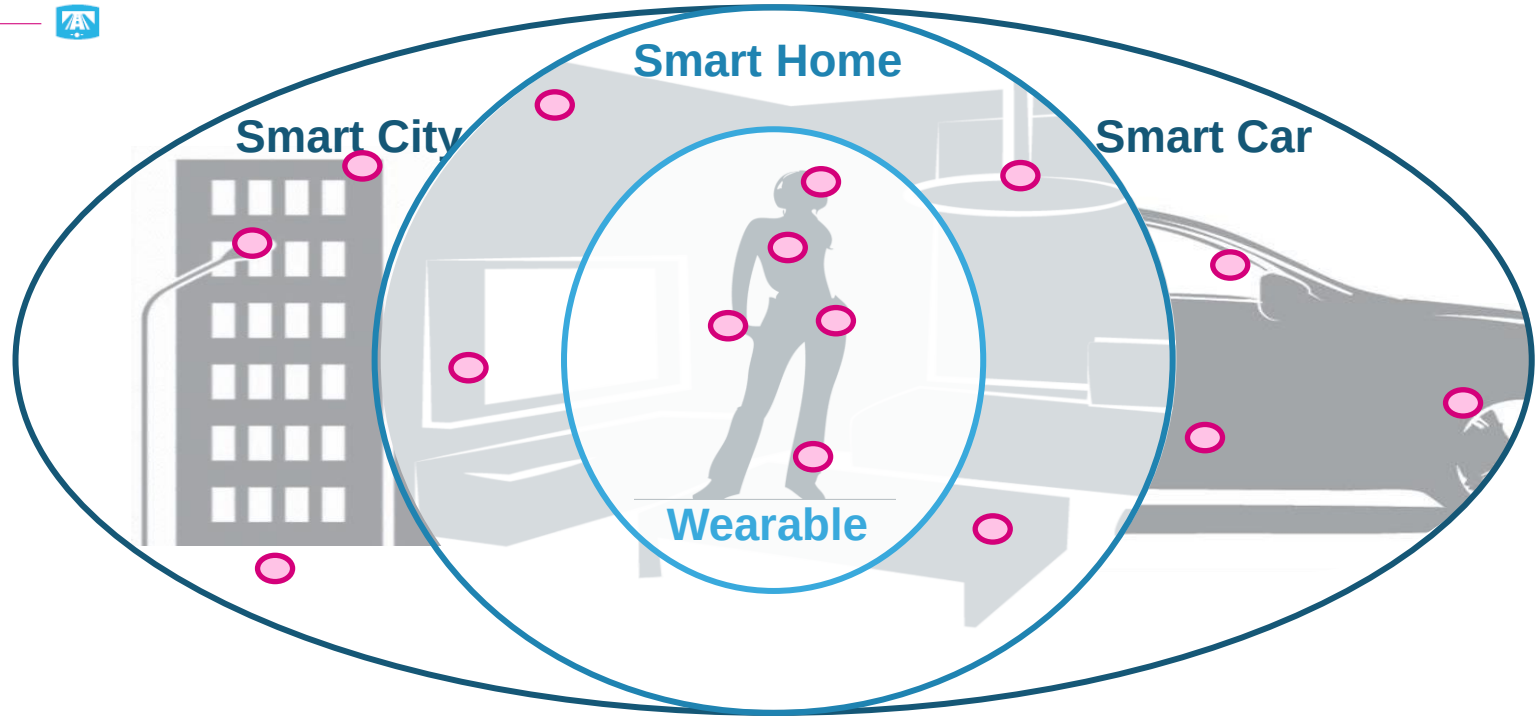
- Less/Limited resources availability versus increased needs (consumption):
  - Energy
  - Water
  - Food
  - …….
  - Time
  - Money
- What can a Semiconductor Company bring here? Smart and low power devices to control and optimize the available resources and to limit the wastes.
- ST IoT solutions designed to tackle the Challenge.

The IoT: *Leveraging the Internet to make things smarter…*



Existing Things
augmented…

New Things to
augment life



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Internet of Things Technologies

Existing Infrastructure

Global smartphone availability (personal network)

Residential broadband penetration

IPv6

Cloud computing

Available Technologies

Inexpensive low-power processing

Tiny, inexpensive sensors + sensor-fusion software

Ultra-low-power connectivity

Battery technology + energy harvesting

Opening new business models

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Existing Things Augmented
(Making Things Smarter)

It used to tell you the time

Now it tells you what to do

It used to remind you of someone close to your heart

Now it reminds you to take care of your heart

It used to just provide power

Now it talks to your machines and tells how much they are consuming

They used to help you see clearly

Now they help you to see more

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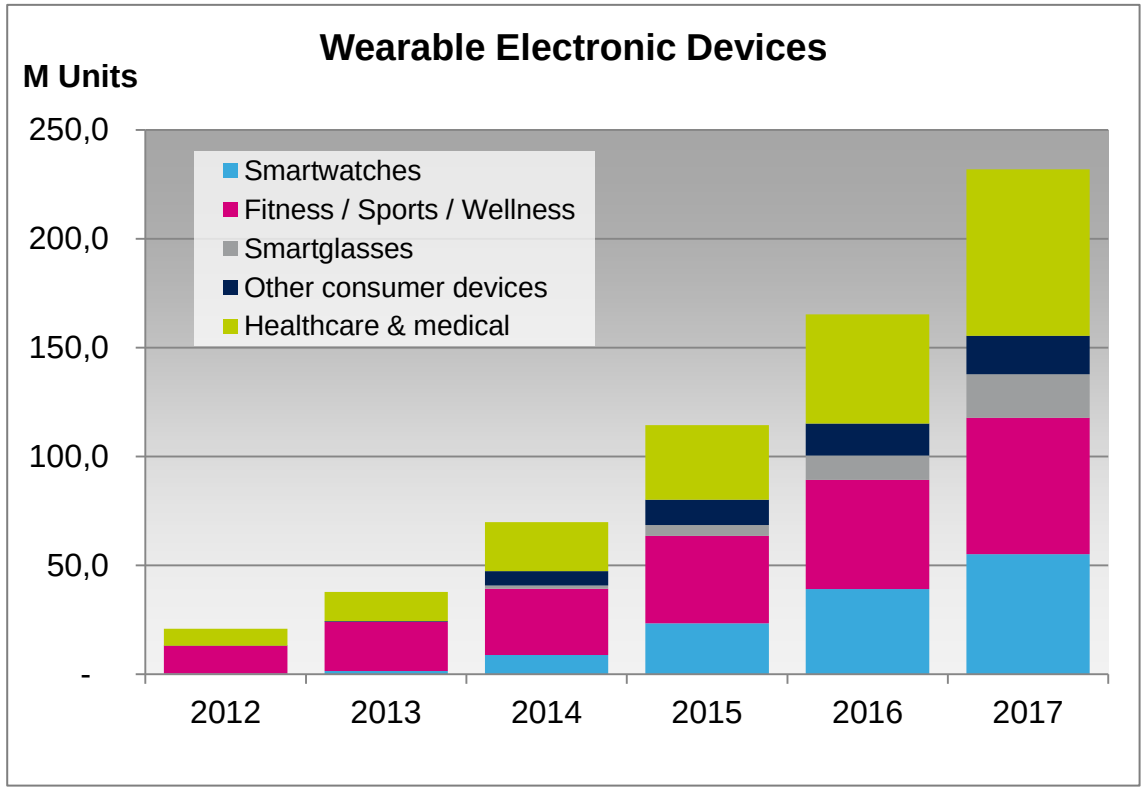
Wearables – the First Wave of the IoT

Why wearable devices have taken off

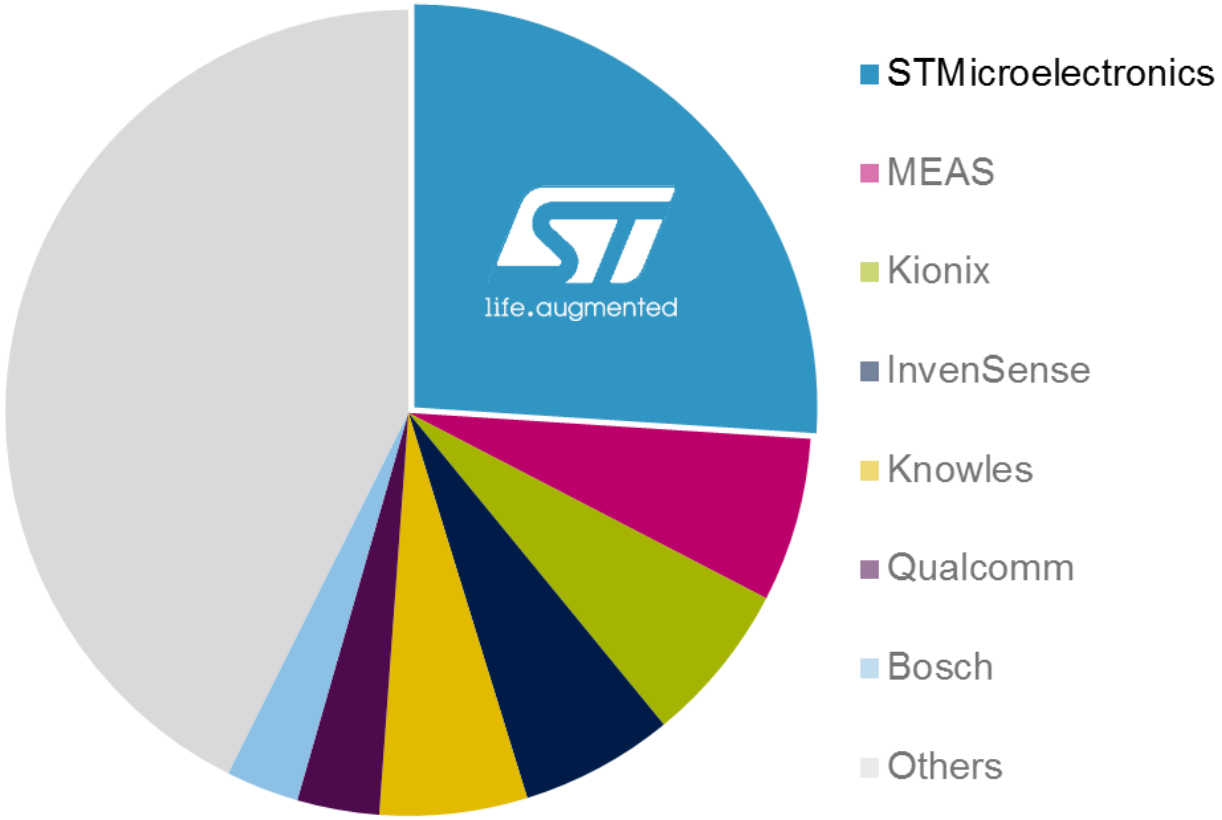
- Addressing existing needs
- Building on the personal infrastructure of the smartphone – providing local and Internet connectivity as well as the screen and interface capabilities
- Based on a existing connectivity standards
- Motivated entrepreneurs seeing lower barrier to entry than more complex electronic devices
- High volume availability of tiny components allows reasonable cost and size end devices



Sources: Strategy Analytics, ABI

ST leading in Wearables

MEMS & Sensors revenue share for wearables – year 2013 (*)



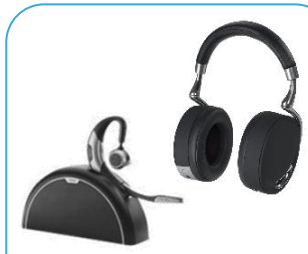
Smart Watch

Activity Monitor

Sports

Heart Monitor

Glasses & Goggles



Accessories

(*) Source: IHS MEMS & Sensors for wearables report 2014

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Enhancing your life style

Fitness & optimized sports performance

Early warning of illness

UV Sensor
Monitoring of exposure to sun

Inertial modules
Activity monitoring & positioning

Analog sensors
For heart monitoring

Temperature and humidity
Real time monitoring & dosage

Inertial modules, Pressure sensors
Optimized sport technique, impact monitoring

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Take care about your health

Empowering patients, improving healthcare quality & affordability

Gas sensors
For asthma prevention (air quality, pollen count)

Inertial modules
For activity monitoring in **Alzheimer**, **Obesity** or **sleep disorders**

Pressure sensor
In the eye for **Glaucoma diagnostic**

Chemical sensors & analog
For blood analysis and ECG

Chemical sensors and actuators
Glucose monitoring & Insulin nano-pump for **diabetics**

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To better enjoy your home

Improving quality of living
Save energy
Entertain

Gas and optical sensors
Home safety and security

Zero Power stdby

Motion, optical & sound sensors
Interactive and immersive entertainment

Environmental sensors
Home control and automation

Environmental sensors
Optimized energy management

smart metering

smart plug

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To make our cities smarter

Making cities smarter, safer and more efficient

Temperature, Humidity & Gas sensors
Air quality monitoring, gas leak detection

Optical, sound sensors
Smart Street lights

Optical sensors
Free parking slot detection

Pressure sensor
Water pipe monitoring for leakage and maintenance

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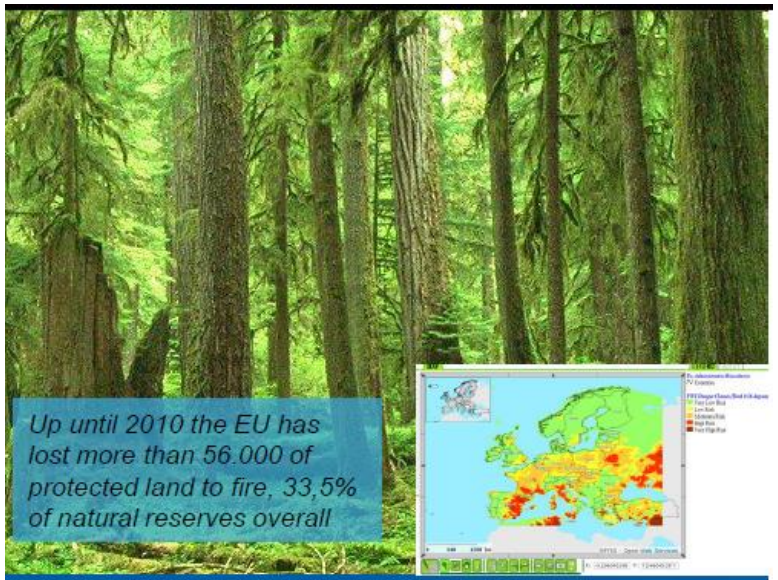
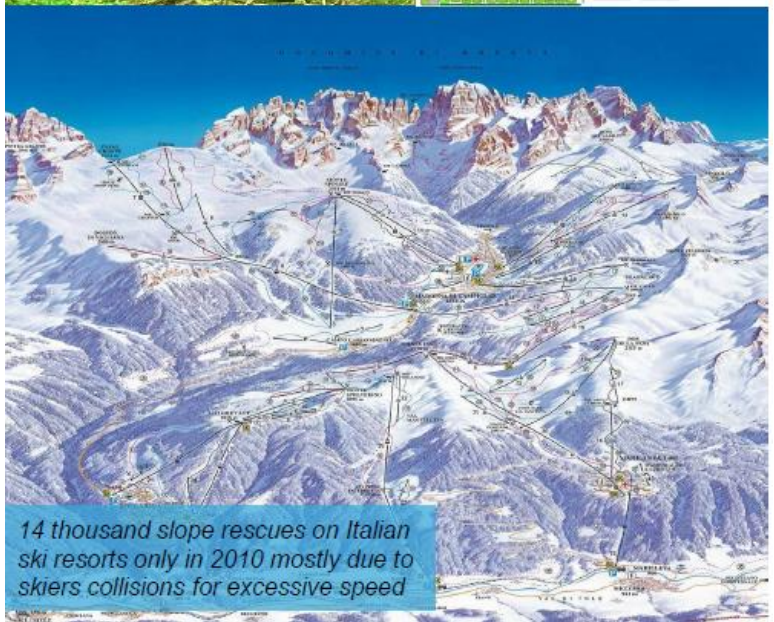
Smart Cities

- **Smart Lighting**
  Intelligent and adaptive LED lamps real-time control based on traffic, weather, context (rural areas, suburbs, etc.).
- **Smart Parking**
  Monitoring of parking spaces availability in the city, automated parking violation and metering
- **Structural health**
  Monitoring of structural integrity for buildings, bridges, monuments.
- **Traffic Congestion**
  Monitoring of both car and pedestrian flow to optimize traffic lights, route planning, 3d intersection management, optimized deployment of law enforcement, etc.
- **Trash management**
  Detection of curbside trash levels for collection routes.
- **Real-time annotated urban maps**
  Air quality, sound pollution, crowd density and hang out spots, live street-view, data collected and aggregated via web aggregators

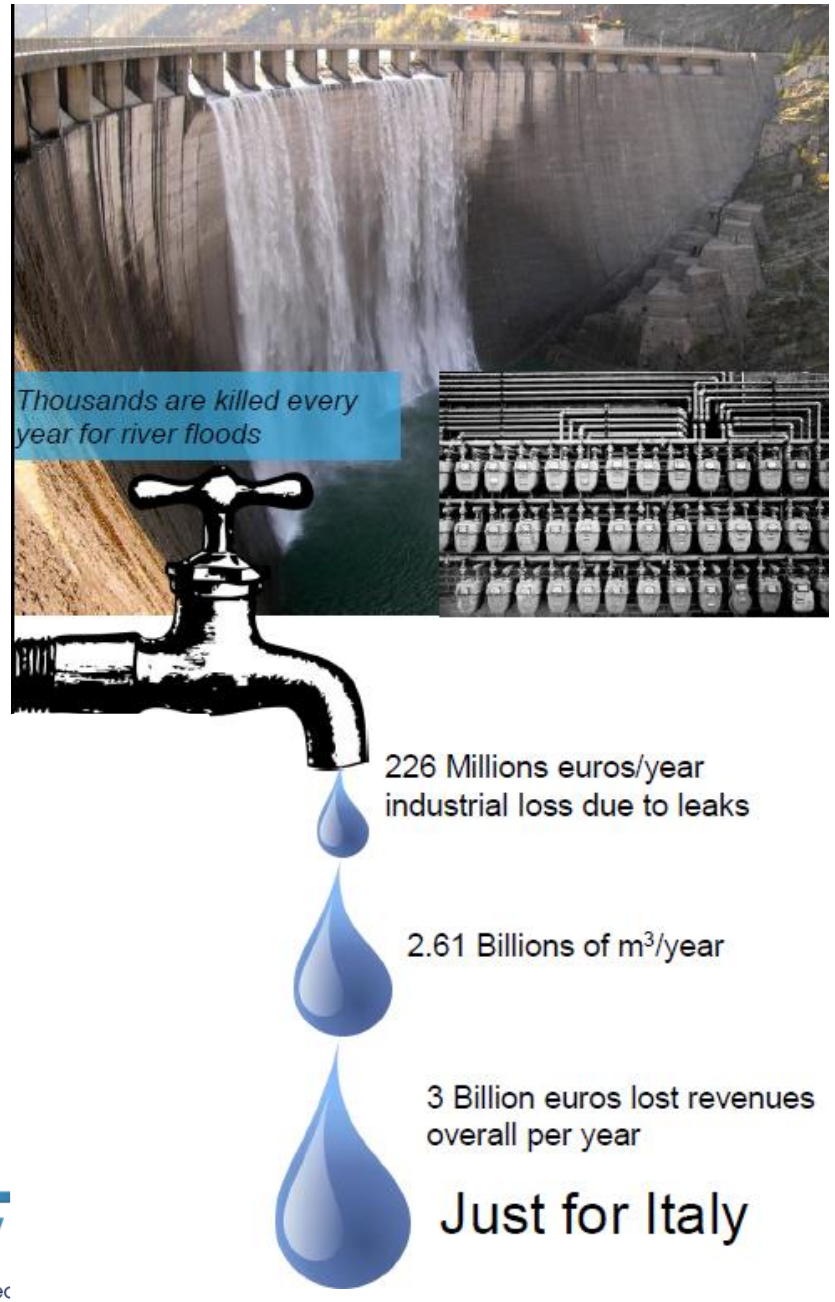
Smart Environments





- **Forest Fire Detection**
  Monitoring of smoke and fire detection, e.g. improve current facilities such as the European Forest Fire Information System
- **Air Pollution**
  CO2 emissions of factories, toxic gases generated in farms and biomass energy plants.
- **Landslide and Avalanche**
  Monitoring of soil moisture, vibrations and earth density to detect early signs of landslides in high risk areas
  Visual monitoring of snow levels and crack patterns to detect avalanche risk
- **Ski and sea resorts**
  Monitoring of skiers for falls, speed and erratic behaviors, off-limits trespassing, monitoring of skilifts
  Monitoring of swimmers to detect distress signs to aid lifeguard duty, beach littering detection

Smart Water and Gas



- **Water and gas metering**
  Remote water & gas metering (wireless, energy scavenging)
- **Water Quality**
  Fine grained monitoring of water quality and pollution for rivers, reservoirs, tanks, etc.
- **Water and gas Leakages**
  Detection of liquid presence outside tanks and pressure variations along water & gas pipes, illegal water connections, etc.
- **River Floods**
  Monitoring of water level variations in rivers, dams and reservoirs
  Visual monitoring of river beds and banks for obstructions and litter

An average of 274 euros per m^3/year are invested in Europe for water infrastructures

Smart Logistic

1 every 200 shipments is lost

- **Quality of Shipment Conditions**
  Monitoring of vibrations, strokes, container openings and data logging
- **Food & perishable products safety**
  Monitoring of temperature for maintenance, validation and data logging of cold chain
- **Item Location**
  Locate individual containers in warehouses, harbors or even trucks
- **Fleet Tracking**
  Control of routes for parcels, acoustic or visual cues for misplaced crates

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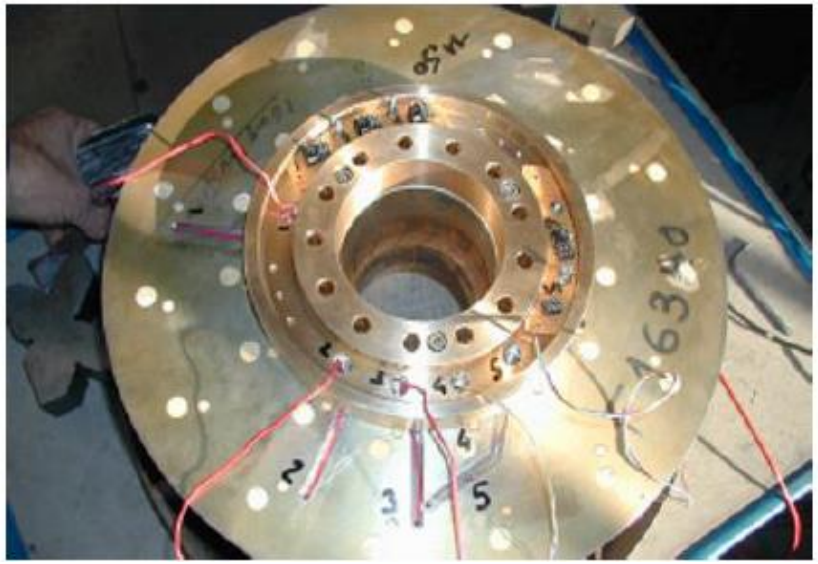
Industrial Control



- **M2M Applications**
  Machine auto-diagnosis and assets control.
- **Indoor Air Quality**
  Monitoring of toxic gas and oxygen levels inside chemical plants to ensure workers and goods safety.
- **Temperature Monitoring**
  Control of temperature inside industrial and medical fridges with sensitive merchandise.
- **Acoustic levels and Electrosmog monitoring**
- **Ozone Presence**
  Monitoring of ozone levels in food factories
- **Indoor Location**
  Asset indoor location by using active and passive tags (RFID/NFC).

Building Blocks for the IoT

Augmented Things

Sensors & Actuators

- Motion MEMS
- Environmental Sensors
- MEMS microphones
- Touch Sensor
- Micro-actuators
- Proximity sensor
- Image sensors

processing

- Low-power brain and processing
- Sensor fusion

Communication

- Ultra-low power connectivity

Interfaces

- Analog

Energy

- Smart energy Management

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ST Leading Positions in the Key Building Blocks

ULP Microcontrollers & Memories

General-Purpose Microcontrollers

Leadership in 32-bit architecture based on Cortex-M™ platform

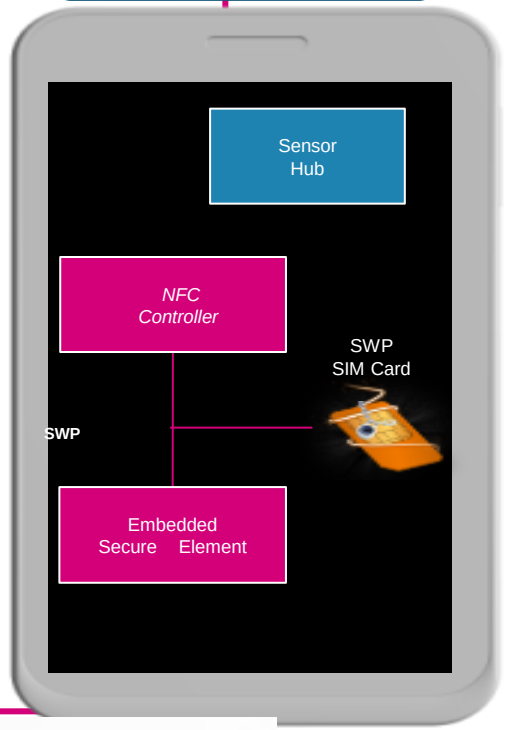
Memories

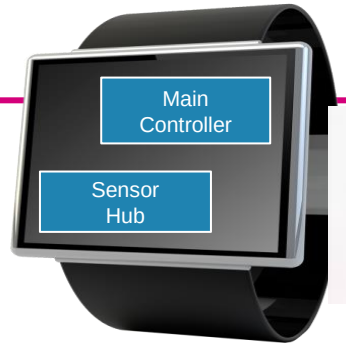
Leadership in RF EEPROM Near-Field-Communication compliant

Secure MCU

Leadership in 32-bit architecture based on Secure Cortex™- SCxxx platform

Number 2 in MCU (GP + Secure)





Dynamic NFC / RFID tags

MEMS & Sensors

Number 1 in MEMS Sensors and Micro-actuators

- MOTION
- ACOUSTIC
- ENVIRONMENTAL
- ACTUATORS
- TOUCH
- ANALOG

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ST, the only company to offer the full range of Sensors & Micro-actuators

MEMS Landscape

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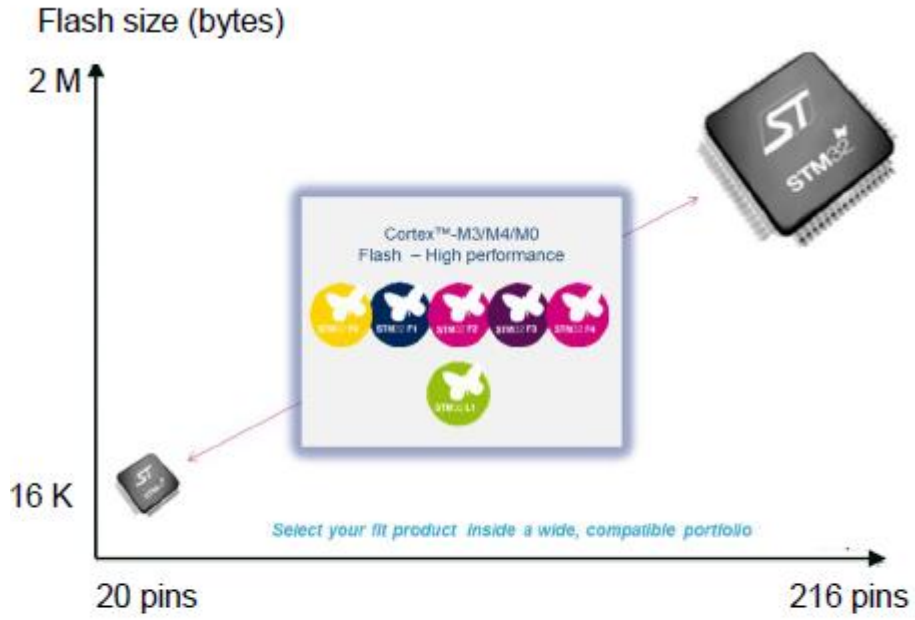
STM32 MCU – ARM Cortex Platform



More than **450 compatible** devices
Releasing your creativity

Real Time Performance: ART Accelerator, up to 180MHz/215DMPIS

Outstanding power Efficiency: <1uA RTC, 188uA/MHz, 0.3uA standby

Standard and Advanced peripherals: USB-OTG HS, Camera, Ethernet, CAN, CRYPTO, SD 16-bit ADC, PGA

Maximum Integration: Reset Circuit, Voltage Reg., Int. RC, PLL, PVD, POR

Extensive Ecosystem: ARM+ST ecosystem (EVAL boards, discovery kits, SW lib, RTOS)

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ST Leading Positions in the Key Building Blocks

Smart Energy Management

Largest portfolio of power management IP for smartphone and tablet

2 in Industrial power

- Power management ICs
- Lighting ICs
- Diodes
- Analog & Mixed Signal ICs
- Thyristors & AC switches
- Transistors
- EMI filtering & signal conditioning
- Protection devices

Analog and mixed signal components

Wide range of analog products needed by our customers to complete product design

Operational amplifiers

Large portfolio of highly power-efficient op amp in tiny packages

Analog switches

Compact single and dual switches for audio and USB

Current sensors

High accuracy current measurement for contactless battery chargers

Battery gas gauges

Low-power gas gauge providing very accurate battery life indicators

Audio amplifiers

High-efficiency Class D and G amplifiers for headsets and speakers

Smart reset

Customizable products providing safe and convenient reset

ST Leading Positions in the Key Building Blocks

Low Power Connectivity

Bluetooth Low Energy (4.0 / 4.1)

State of the art BTLE chipset, increasing market share at IoT customers

WiFi

802.11 a/b//d/e/g/e/n/r standards available

Proprietary SubGhz

Design Win at most of Gas / Water metering tenders in Italy.

GPS/ GLONASS / GALILEO / BeiDou

Positioning systems in MP for both automotive and consumer applications.

NFC / RFID

Leadership in 32-bit architecture based on Secure Cortex™- SCxxx platform

Wide RF connectivity Portfolio

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The opportunity

Sense

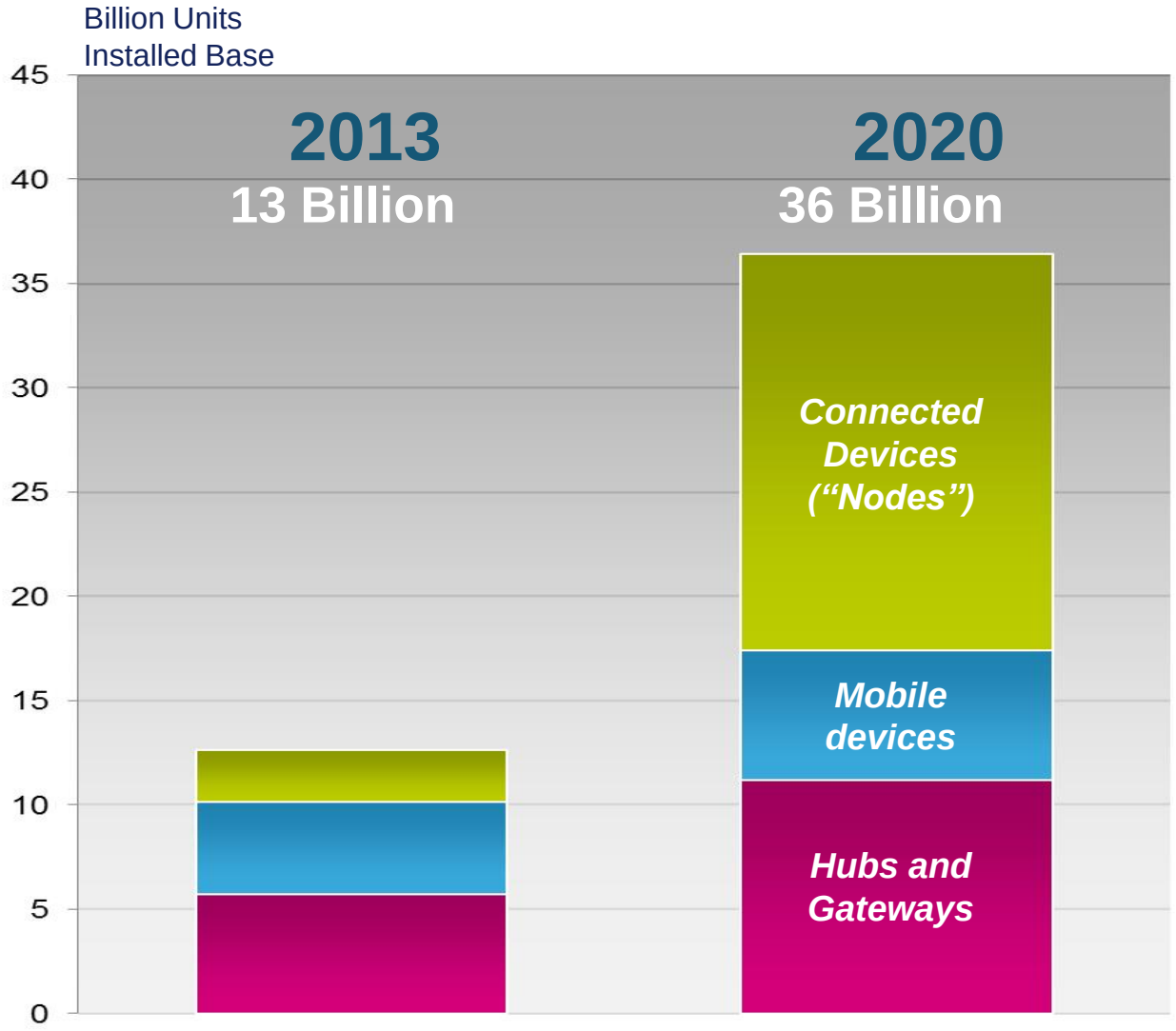
Process

Connect

Translate

Power

How to Win?



Source: ABI Research

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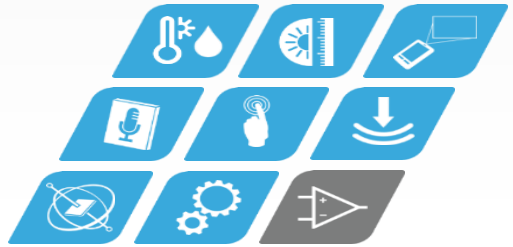
Continuous innovation

State-of-the-art lithography	Advanced packaging	SW integration	Product diversification
High reliability	High integration	Power efficiency	New usage
Great Performance	Robustness	Embedded intelligence	Complete system solution
Improved die size	Small form factor	Enhanced features	
THELMA* BASTILLE**	System-In-Package Through-Silicon Via Flip-chip	iNEMO	

SUSTAINABLE TECHNOLOGY

Innovative end products

Improved life quality

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*Thick Epitaxial Layer for Micro-gyroscopes and Accelerometers

Lowering the barriers for developers

Easy Access to technology

Idea

Device Prototype

Application Test SW

Form factor Device

Field Test

Final Device

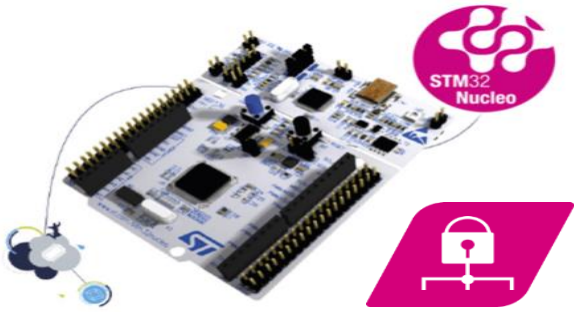
Commercial SW

Market

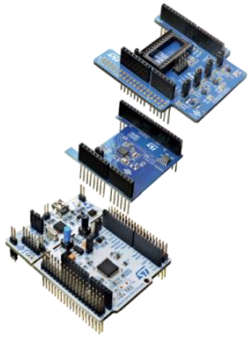
Fast, flexible, affordable and based on commercial components

Enabling the Ecosystem

ULP Microcontrollers & Memories



Security



Sensors

Ultra-low power connectivity

Smart Energy Management

Analog and mixed signal components

Software

STM32 Cube

Modular approach to create building blocks needed for IOT

STM32 Nucleo boards with standard connectors

Add-on modules featuring ST's broad range of ingredients for IoT applications

STM32CubeMX for rapid software development and maximum reusability

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ST FREE Apps made easy

Open.MEMS

mems.Sensors

- Activity tracking
- Pedestrian Dead Reckoning
- AHRS
- Head tracking
- Sensor Fusion
- MEMS calibration

Environ. Sensors | MOTION | RF LINK

magenta.Foundation

Bridging the silicon to the mass-market

Freely available libraries **enabling solutions** with MEMS sensors

Datasheet? No, thanks….
…I need drivers, libraries and solution-ready software frameworks.

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ST supporting Innovation

Wearable Technologies Innovation World Cup 2014/2015

STM32 Nucleo

- **STM32 Nucleo** board as a standard hardware platform connecting many ST devices
- **STMCube** allows rapid SW development with maximum reusability across ST's microcontroller devices

BlueNRG Shield

- An **STM32 Nucleo expansion board** based on BlueNRG
- Enables Bluetooth Low Energy connectivity and easy application development

BlueNRG USB Dongle

- An evaluation board based on BlueNRG.
  Supports both master and slave roles
- Features a low power STM32L on board.
  Primarily meant to interface with BlueNRG but can also be used for custom application development

14/15 WEARABLE TECHNOLOGIES INNOVATION WORLD CUP powered by life.augmented

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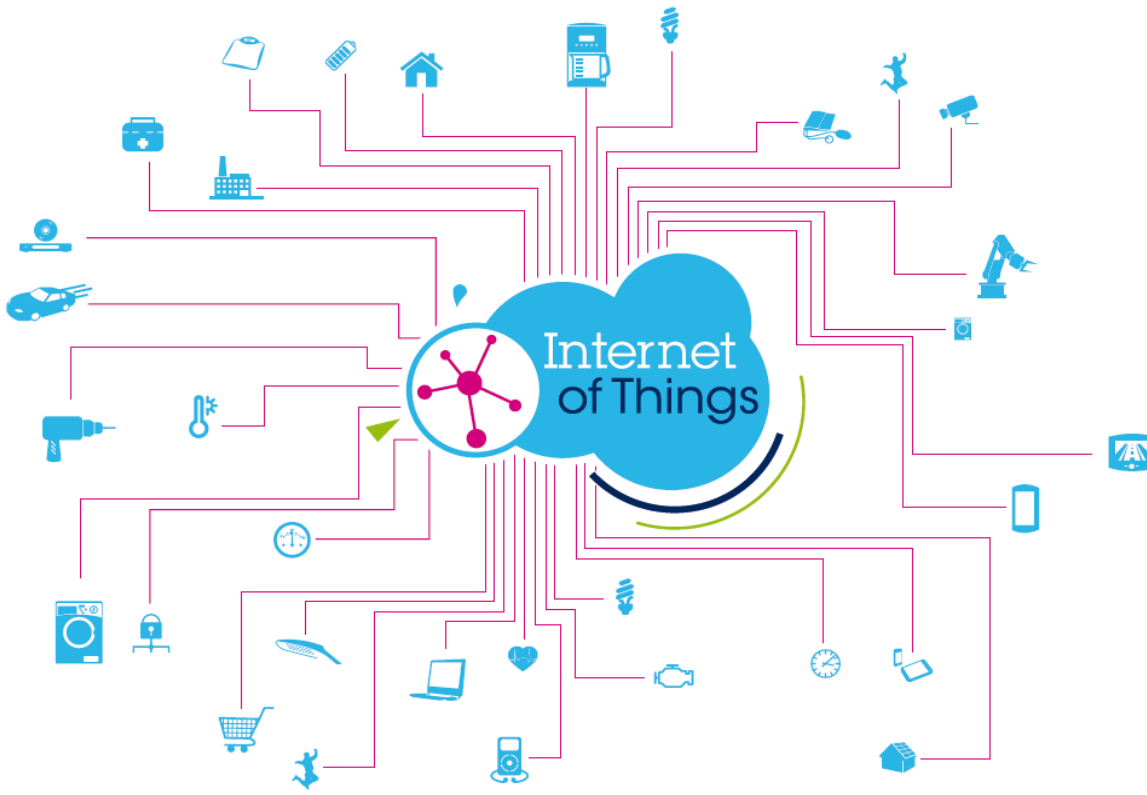
…..Another view on Sustainability

While big companies benefit from IoT there are big opportunities for many new companies

- Lower barriers to product creation
- Lower barrier for new services creation leveraging the open infrastructure
- Sufficient standards in place for market takeoff but not enough to allow domination by a few large players

By 2017 50% of Internet of Things solution will originate in start-ups that are less than three years old (Gartner, Inc.)



IoT is a Scattered World.

Opening new Business Models scenario.

Providing Local Business Opportunities. To boost Local Economy.

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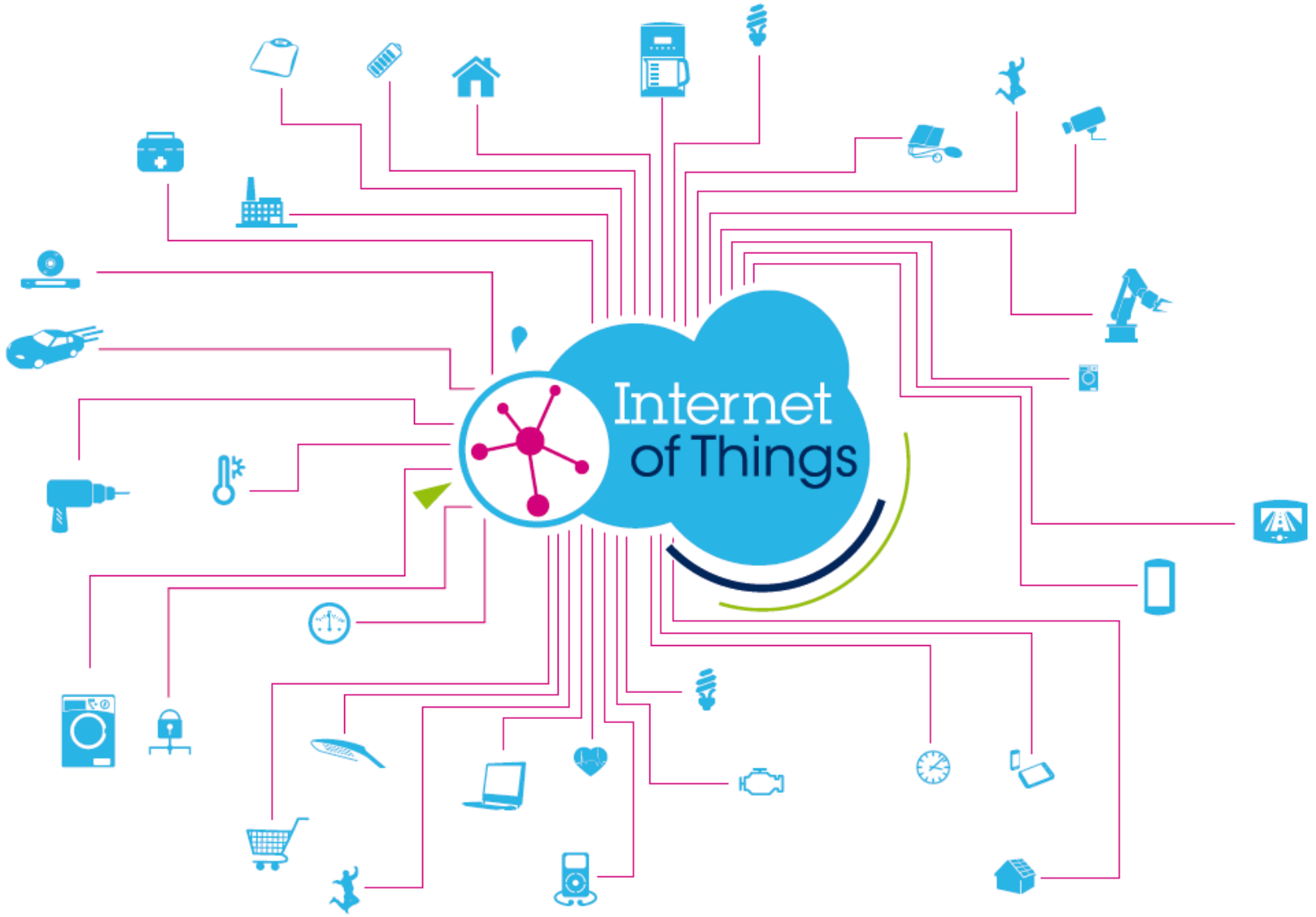

GRAZIE

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