

IoT Trends and Innovative Applications including AI !

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What is IoT?

first proposed by Kevin Ashton in 1999

- The Internet of Things connects every day consumer objects and industrial equipment onto the network, enabling information gathering and management of these devices via software in order to increase efficiency, enable new services, or provide health, safety, or environmental benefits.*

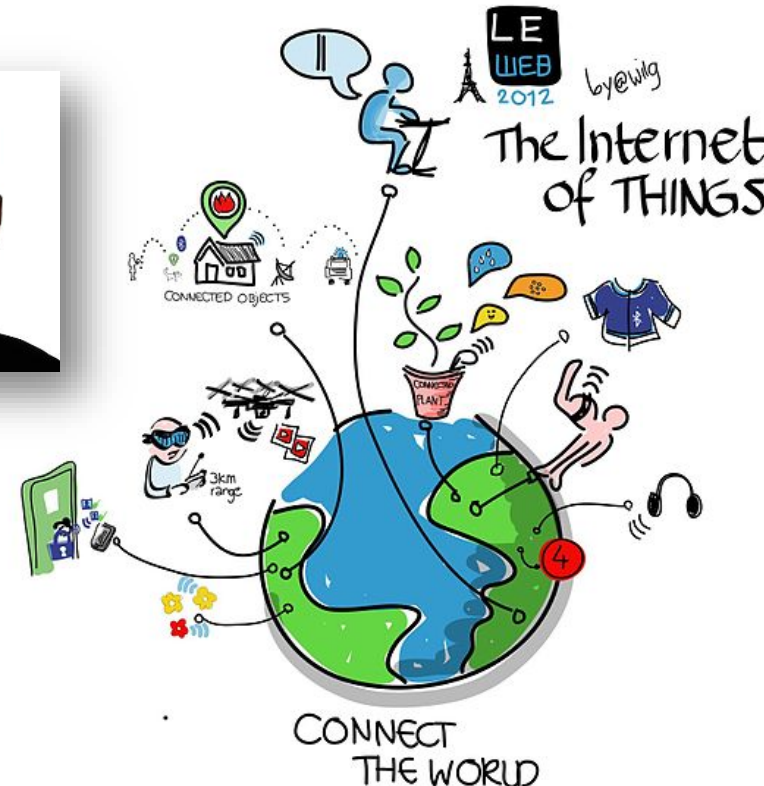


@Kevin_Ashton



Kevin Ashton, a British technologist in 1999 was Executive Director at MIT's Auto-ID Center, an RFID research consortium

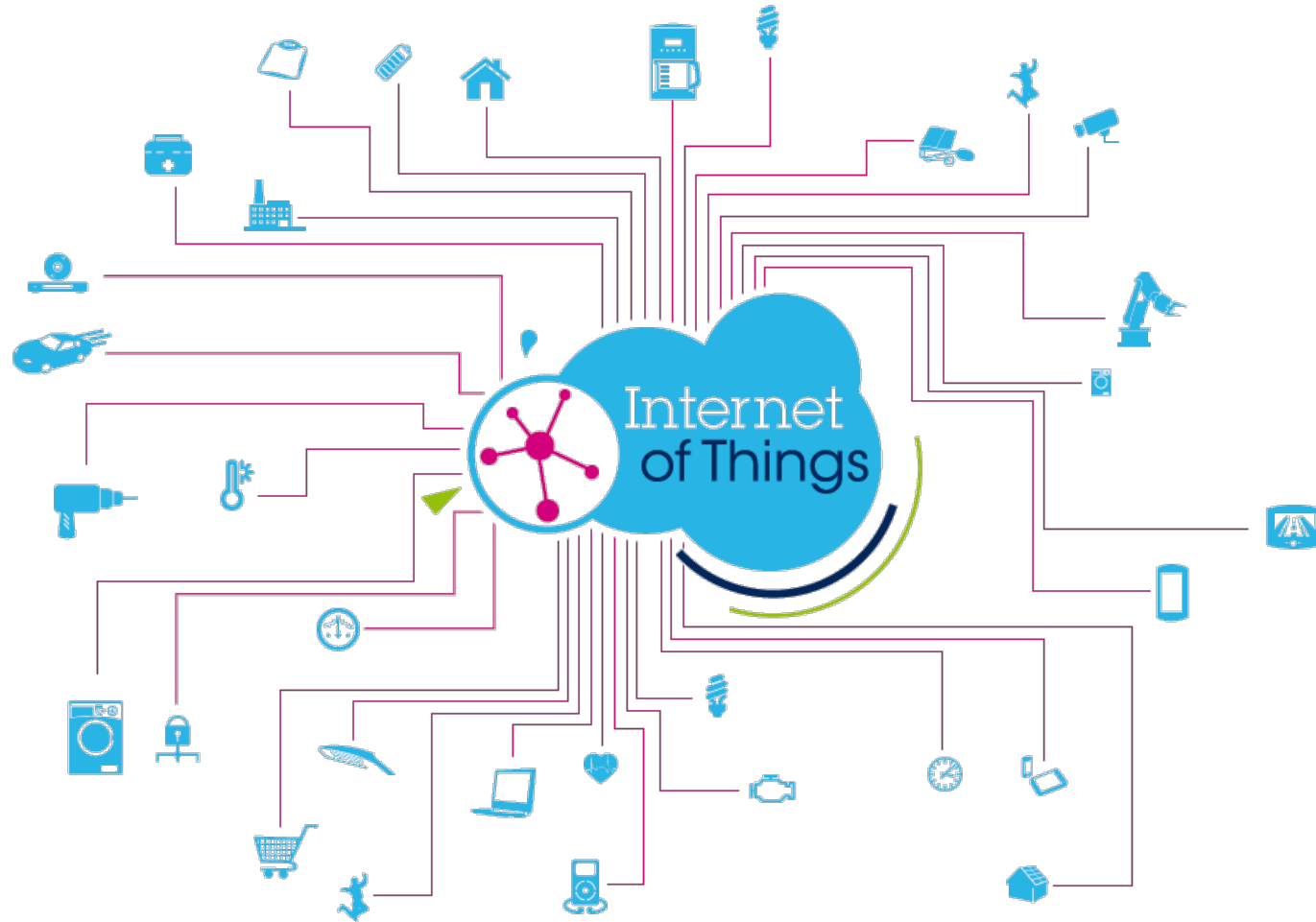
[Wired 2013 talk on YouTube](#)



The Internet of Things Opportunity

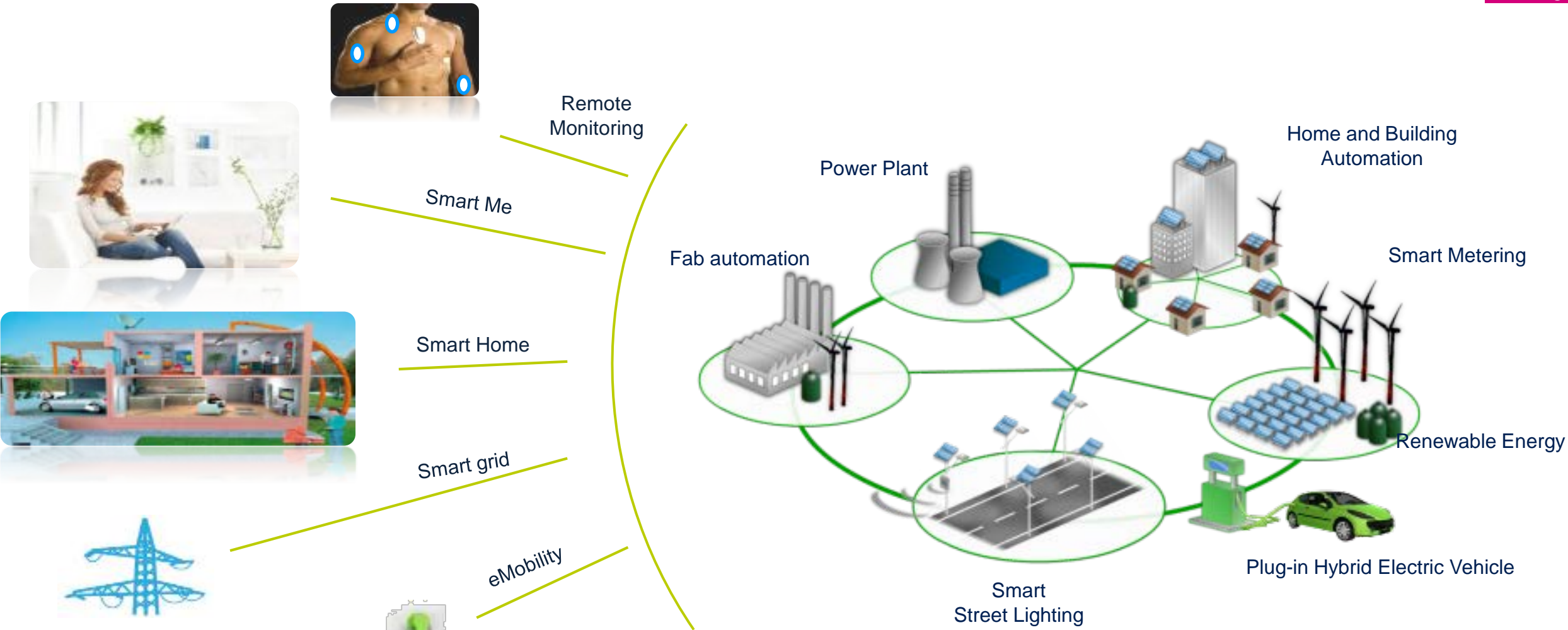
CONNECTED TO THE PHYSICAL WORLD VIA UBIQUITOUS SENSORS! [1 MIN]

Existing Things
augmented



New Things to
augment life

“Internet of Every Things” Scenario



Smart Systems are pervasive, converging through “Internet of Every Things”!

How to deploy Smart Grid?

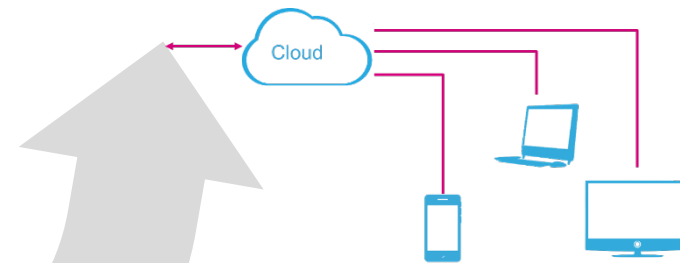
Enables two-way communication and digital control throughout the electricity delivery infrastructure



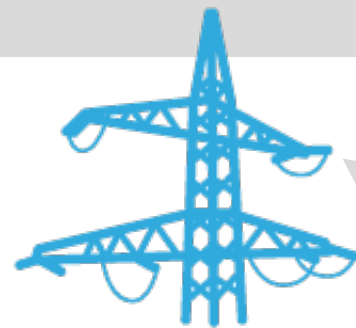
Energy resources



Information infrastructure
Megabytes of data



Multi-way communication and power flow



Electrical infrastructure
Megawatts of electricity efficiently

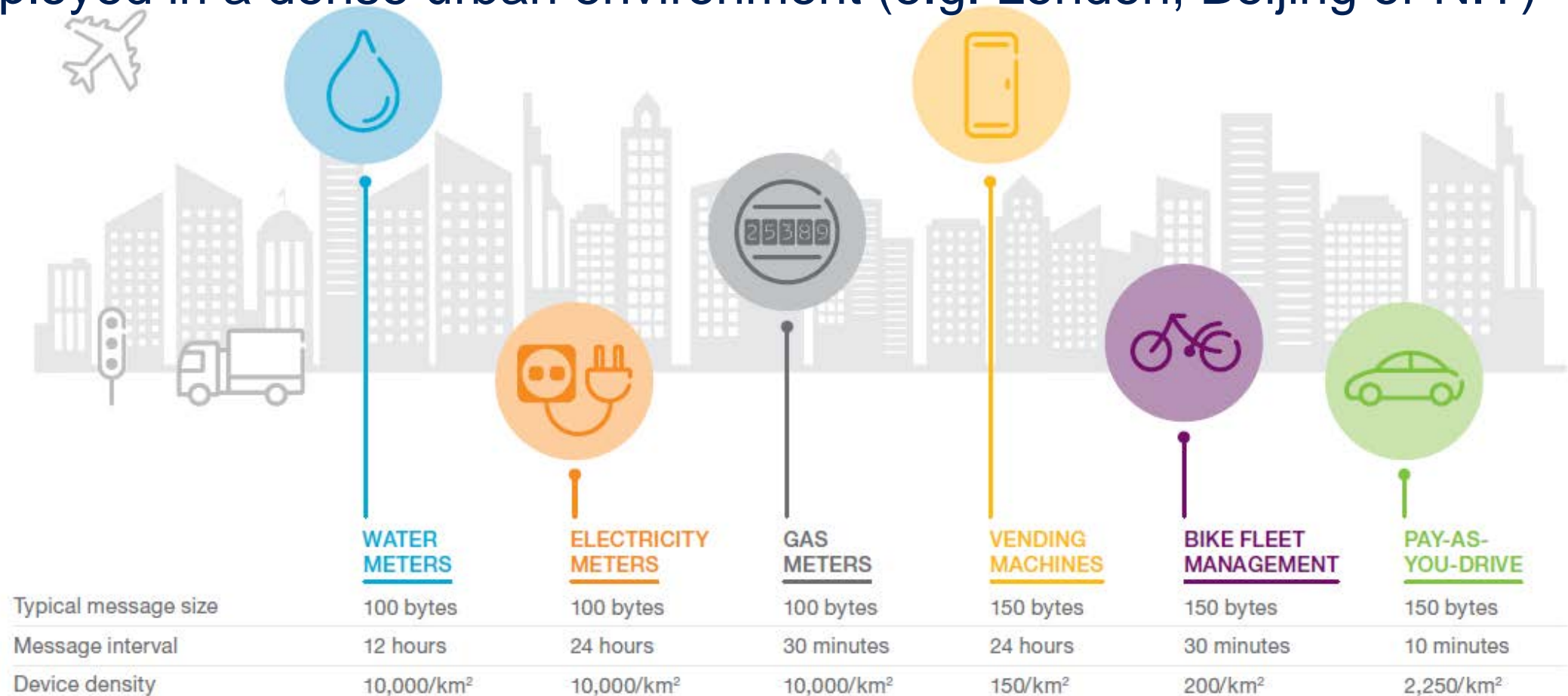


Energy consumer



Smart-City scenario: Deploy massive IoT connected devices

- Realistic range of massive IoT use cases that are expected to be deployed in a dense urban environment (e.g. London, Beijing or N.Y)



Smart Home Energy Savings

Energy saving and CO₂ reduction

30% Energy saving

Air conditioning
From analog to digital
From AC to BLDC control

25% Energy saving

Lighting & dimming
From on-off light control to PWM dimming

80% Energy saving

Electronic lighting
From bulb lamps to tube lamps & LED

40% Energy saving

Washing machine
From Class D to Class A++

40% Energy saving

Refrigerator
From on-off control to PWM

77% Energy saving

Digital consumer power supply
Increasing efficiency above 98% in run mode
Decreasing stand-by power to < 1mW



Semiconductors are key to reduce power consumption
with an estimated impact up to 27% on average of energy savings from now to 2030

ST Pioneered Smart Grid: The Smart Meter

Broad system know-how thanks to 20+ years proven partnership with key players worldwide



Over 60 Millions PLC
and metering SoCs
installed

Driving standards worldwide
with market leaders



The most highly
integrated, secure
and flexible
solutions in the
market

IoT-related semiconductor content estimated up to \$75B by 2019-2020

- **Semiconductor mix:** communication 35%; logic 22%; sensors 18%
- **Communication technologies:**



Ultra-low power
Connectivity

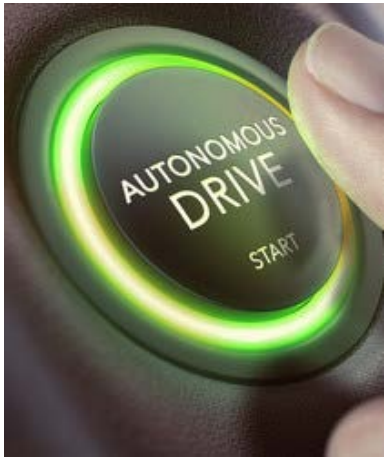


- **Key end-markets:**

1. **Industrial:** smart meters, smart buildings, farm, city, and smart fab
2. **Consumer:** smart appliances, smart homes and cars
3. **Wearables:** fitness bands, smart watches

- **MCUs with integrated radios:** ST, Atmel, NXP, TI, Toshiba.
- **Other semiconductor derivatives:** InvenSense, Knowles, Lattice.

AI is Making Smart Systems Smarter



Assisted and Autonomous Driving



Scene Analysis
Smart Assistant



Activity Tracking
Health Diagnosis



Intelligent Appliances



Predictive Maintenance



Smart Surveillance Cameras



AI Application Processing Requirements

Low



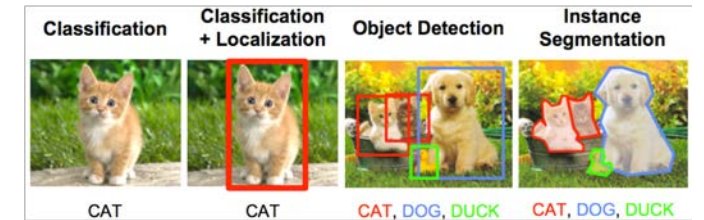
- Sensor analysis
- Activity Recognition (motion sensors)
- Stress Analysis or Attention Analysis

Medium



- Audio & sound
- Speech Recognition
- Object Detection

High



- Computer Vision
- Multiple Objects Detection/Classification/Tracking
- Speech Synthesis

General Purpose Microcontrollers

GP Microcontrollers with dedicated AI accelerators

Dedicated AI System on Chip

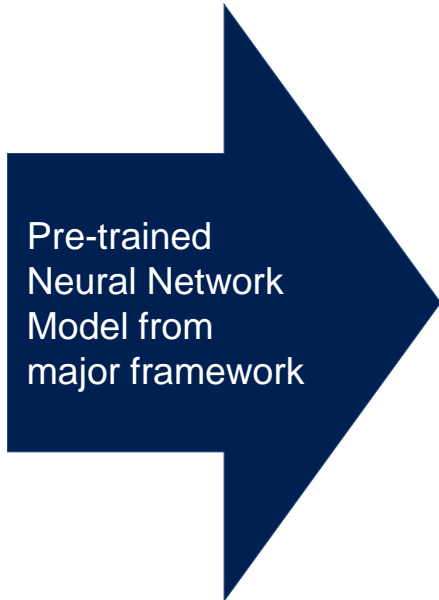


Artificial Intelligence on Microcontrollers

Microcontrollers are the brains of billions of 10's of billions of existing Smart Things
ST has invented an easy way to allow them to us AI Already

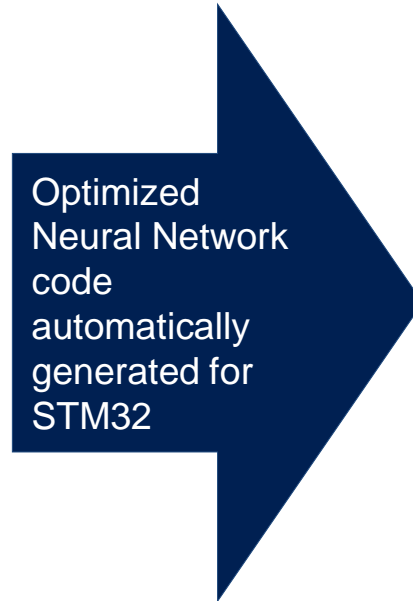
Off-the-shelf tools

Lasagne
TensorFlow
theano
Microsoft
CNTK
Caffe
Keras



SW tools

ST
STM32
CubeMX.AI



AI solution

STM32 + Deep Learning Software

Barriers to IoT's Adoption

Security concerns

Ability to remotely manipulate physical assets



Privacy violations & safety issues



Security concerns escalate up!

Regulation and compliance

IoT implementations ruled by the governments

Examples:

- eCall connected car in Europe
- Rail safety act in the US
- Smart grid mandates around the world

Interoperab. Standards

Lack of standards



Business is hesitant to invest in connecting assets

Ease of use

Some of the early success stories in IoT have benefited from their ease of use



Key Factors to Serve the IoT Market

Platform ready solutions

Providing integrated platforms to address vertical markets

Innovation & product diversification

- Improving existing technologies to new uses
- Developing new technologies
- Broad product portfolios

Smart Systems

Highly integrated features

Ultra-low power devices

Partnerships & (SW) Ecosystem

- Build-up new skills and competences
- Accelerate time to market

Gathering the whole Supply Chain

Risk share business model

