Introduction to IoT

Pavel Genevski & Vladimir Savchenko - SAP Labs Bulgaria
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Teachers

Pavel Genevski

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Administrative Q&A

Кога?

Четвъртък от 17:15 до 21:00

Къде?

MS Teams

Как да минем?

Защита на групов проект + индивидуални впечатления

Let's get started!

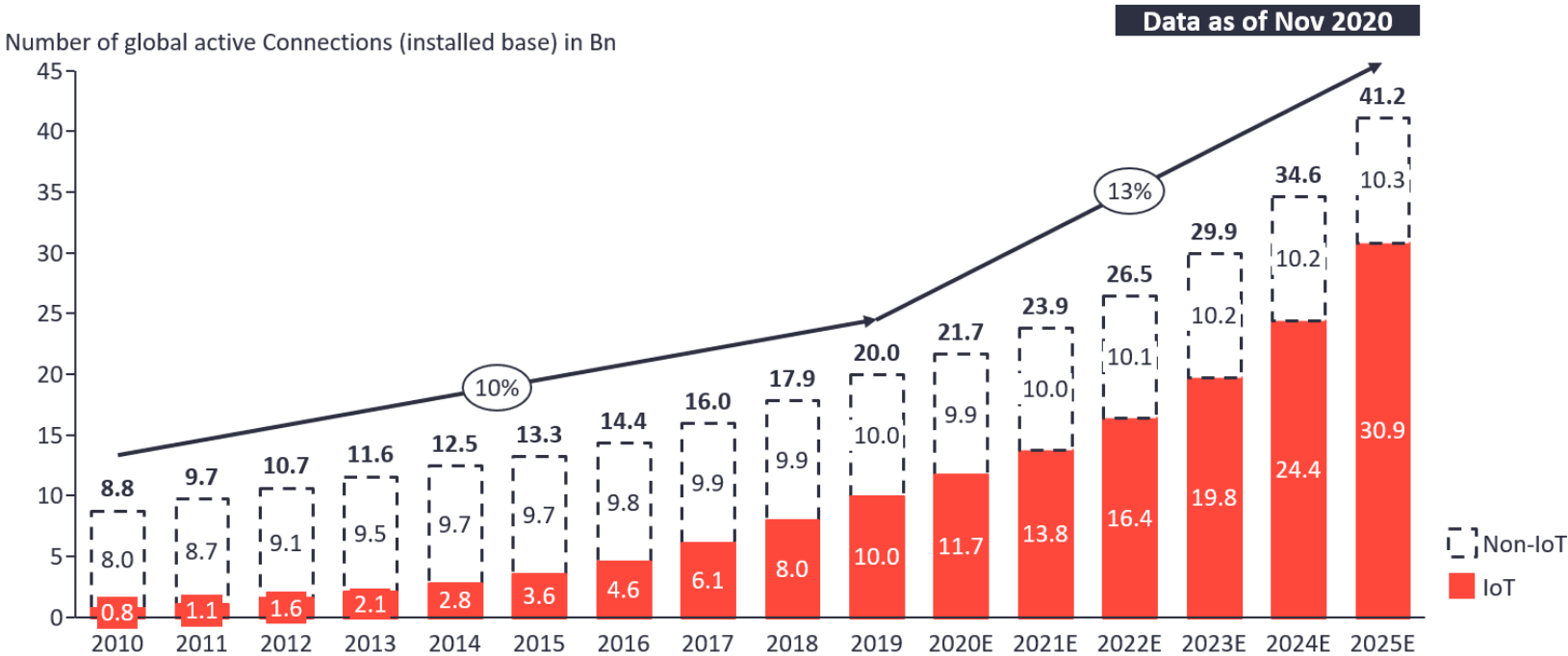# Over 20 billion connected devices

IOT ANALYTICS

Insights that empower you to understand IoT markets

Total number of device connections (incl. Non-IoT)

20.0Bn in 2019– expected to grow 13% to 41.2Bn in 2025

Number of global active Connections (installed base) in Bn

Data as of Nov 2020

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E	2025E
Total	8.8	9.7	10.7	11.6	12.5	13.3	14.4	16.0	17.9	20.0	21.7	23.9	26.5	29.9	34.6	41.2
Non-IoT	8.0	8.7	9.1	9.5	9.7	9.7	9.8	9.9	9.9	10.0	9.9	10.0	10.1	10.2	10.2	10.3
IoT	0.8	1.1	1.6	2.1	2.8	3.6	4.6	6.1	8.0	10.0	11.7	13.8	16.4	19.8	24.4	30.9

10%   13%

Non-IoT
IoT

⎛Xx%⎞ = Compound Annual Growth Rate (CAGR)

Note: Non-IoT includes all mobile phones, tablets, PCs, laptops, and fixed line phones. IoT includes all consumer and B2B devices connected – see IoT break-down for further details

Source(s): IoT Analytics - Cellular IoT & LPWA Connectivity Market Tracker 2010-25

Source: https://iot-analytics.com

How did we get here?

Hardware is now …

Cheaper

Smaller

More connected

Less power hungry

Easier to develop

Ecosystem

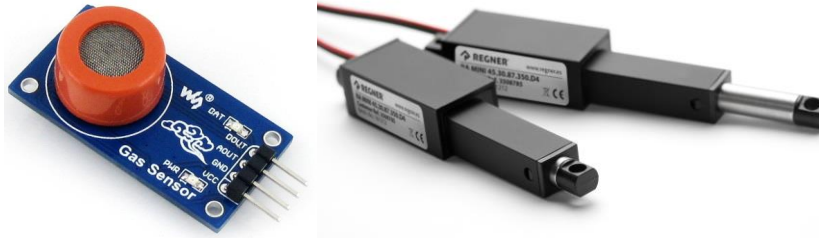More tools & knowledge

More investment

More opportunities
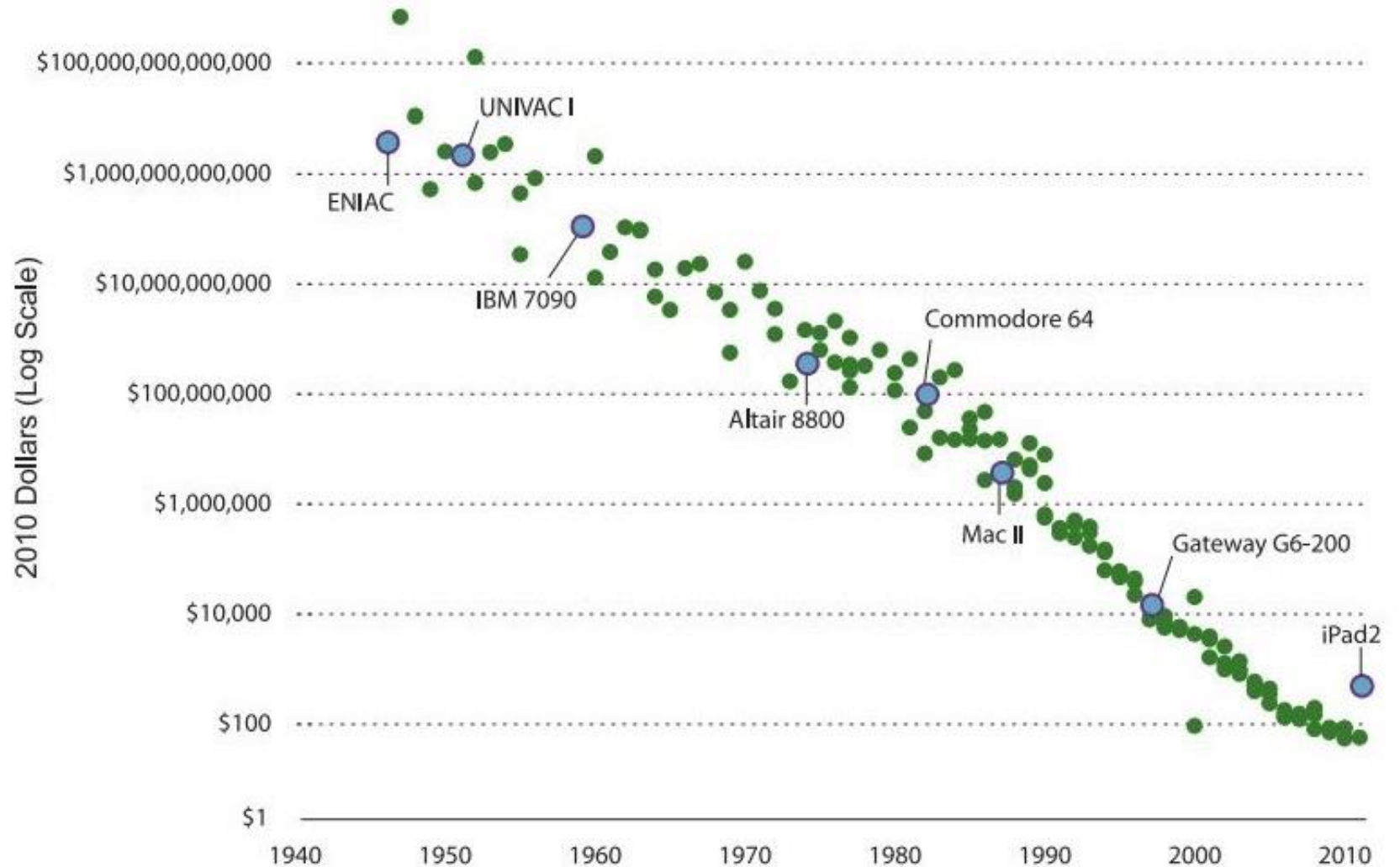
What is IoT?

Physical

Sensors, Actuators

Connected

WiFi, Bluetooth, Cellular, LPWAN …

Programmable

Arduino, C/C++, Python, Java, Assembly ..
(Atmel, **Espressif**, TI, Microchip, MIPS, ARM …)

```c
/**
 * Test led: Arduino uno
 */

#include "Arduino.h"

int redPin = 9;
int greenPin = 10;
int bluePin = 11;

void setColor(int red, int green, int blue)
{
    red = 255 - red;
    green = 255 - green;
    blue = 255 - blue;
}

void setup() {
  Serial.begin(9600);
  Serial.println("Setup");
  pinMode(redPin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}
```

Industrial vs Consumer IoT

Industrial IoT

Drivers: cost and risk reduction, business insights

Challenges: compatibility, compliance, reliability, security

Consumer IoT

Drivers: coolness, convenience, health, quriosity

Challenges: UX, hype vs value, time to market, some privacy and security

Source:http://www.clipartpanda.com/clipart_images/stacks-of-money-clipart-1-57831954

Industrial IoT examples

Remote maintenance & management

Energy: Solar & wind power

Construction: Pipelines, bridges, buildings

Agriculture: Soil properties, crop health …

Smart vehicles

Remote and continuous metering of cargo temperature, truck position and health …

Source:http://inmolecular.com/index.php/cold-chain-monitoring-solution/

Consumer IoT examples

Personal productivity & fashion

Smart phones & watches

Fitness & sleep trackers

Professional sports gadgets

Home Automation

Smart locks, Bulbs, TVs

Baby monitors

Appliances health monitors

Source: https://42xaiz2iny9m45jqzf36ofk2-wpengine.netdna-ssl.com/wp-content/uploads/2014/08/Front.jpg
https://c.slashgear.com/wp-content/uploads/2011/12/NO-4.jpg

What?

Course assignment

Objective

Try to make something useful

No idea is too brave!

Learn new things

Examples

Smart beehive, waste bin

Smart plant pot

You name it …☺

Made in FMI ☺ →

How?

IoT development platforms

Bare metal

SDK: Espressif, NXP, TI, Atmel, Microchip …

Arduino: Atmel, **ESP32 (we will use this one)**

Linux

Raspberry PI, Beaglebone …

Android & iOS

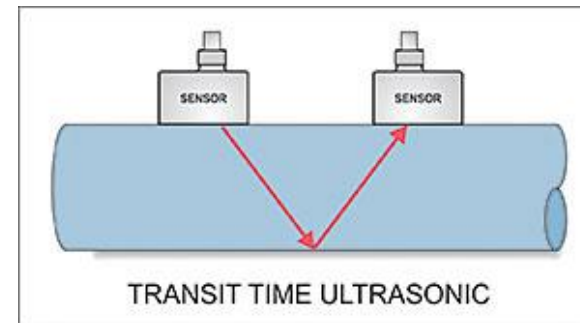Phones, Wearables, TVs …

Sensors & Actuators

Sensors

- Touch, movement, force, location, acceleration
- Light, sound, video, sound
- Temperature, humidity, moisture, pressure
- Pressure, proximity, gas detection
- Liquid level, flow, magnetic field (hall), radiation
- Fingerprint, heart rate …

Actuators

- Lights, sound, movement, heat

TRANSIT TIME ULTRASONIC

Source: http://www.imagesco.com/geiger/buying-a-geiger-counter-pg3.html, http://www.greyline.com/twotechnologies.htm, http://www.noshok.com/force_2351_series.shtml

Connectivity

Long range

LoRaWAN, NB-IoT, 3G/GPRS

Medium range

ZigBee, WiFi

Short range

Bluetooth, NFC/RFiD

Wired

Ethernet, RS-485, 4-20 mA …

2G 14.4 Kbps

2.5G 384 Kbps

3G 14.4 Mbps

LTE 115 Mbps

4G 1 Gbps
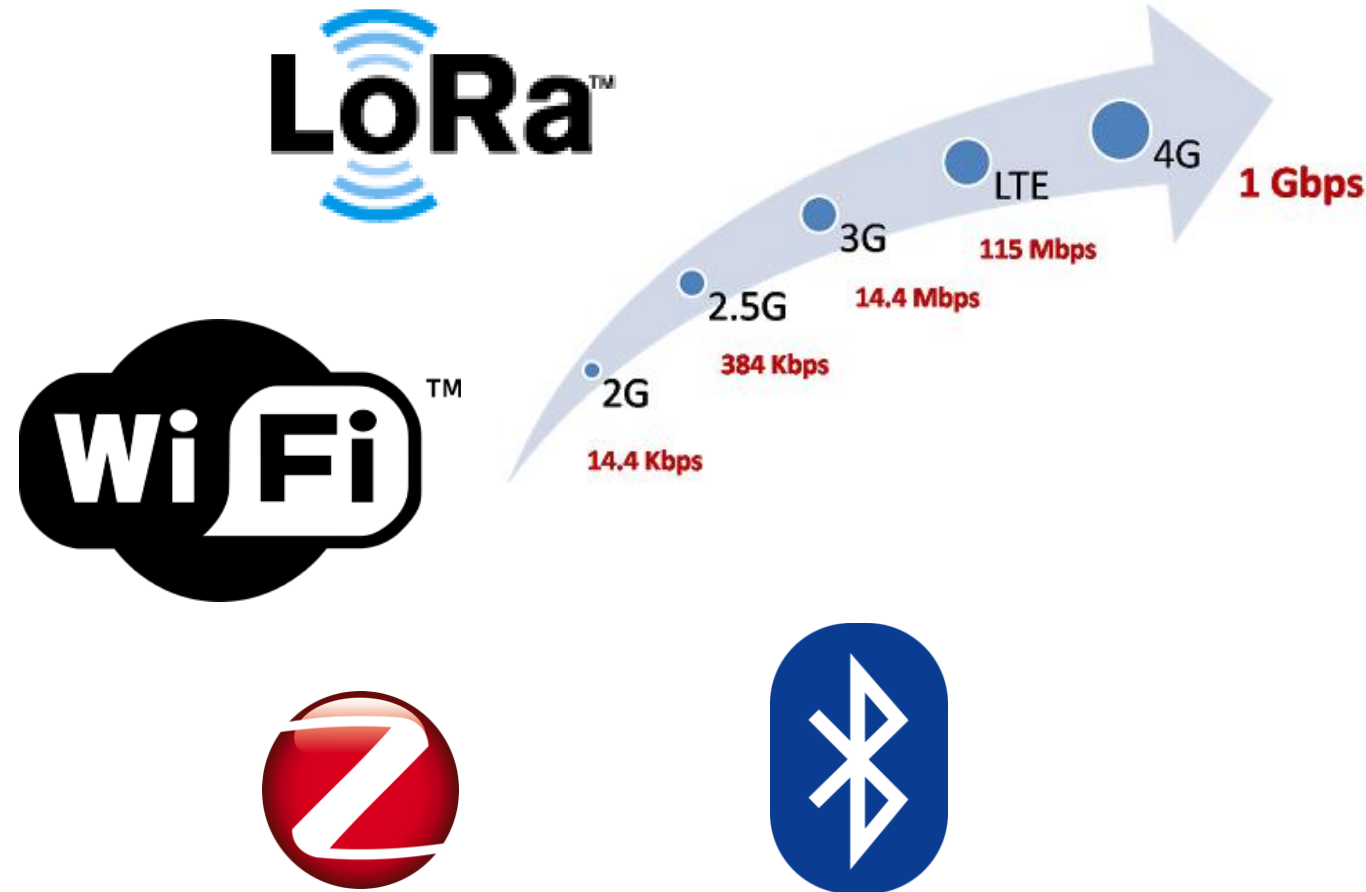
What else?

Power management

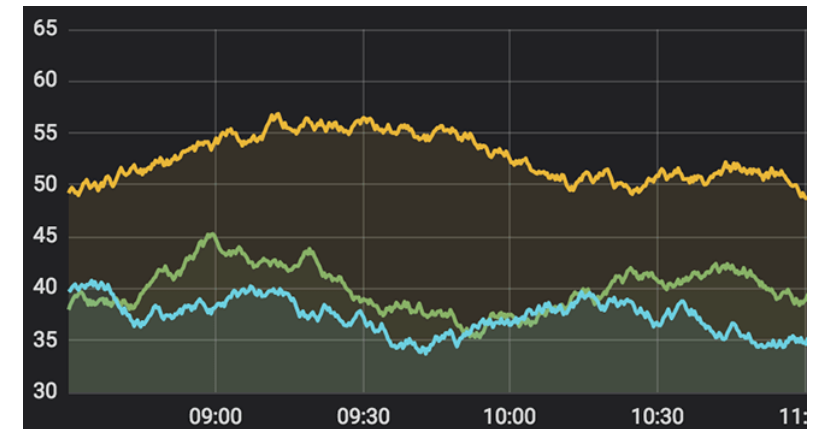Batteries, sleep modes …

Security & Device management

Authentication, Onboarding …

Monitoring

Data management

Data transport & storage

Processing and visualization

Source: http://djdamageonline.com/img/od-login-password-svg-icon-free-download-for-free-powerpoint-symbols-and-icons.jpg

Public

Thank you

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https://forms.gle/H3bX8XG276K5WBSk8