

Introduction to IoT

Pavel Genevski & Vladimir Savchenko - SAP Labs Bulgaria
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Teachers



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Administrative Q&A

Кога?

Четвъртък от 17:15 до 21:00

Къде?

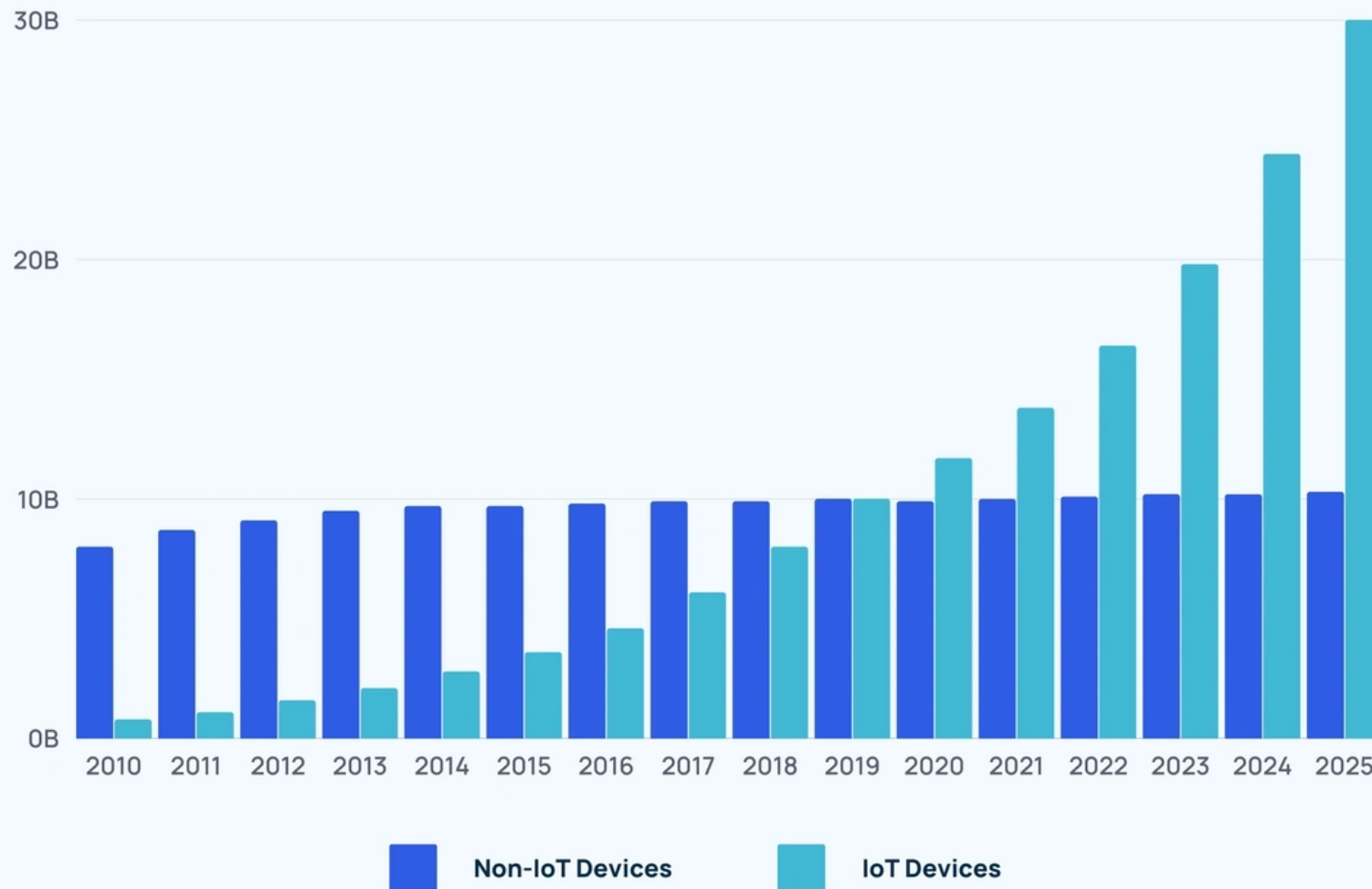
Зала 320

Как да минем?

Защита на групов проект + индивидуални впечатления

Let's get started!

Non-IoT and IoT active devices from 2010 to 2025



Source: <https://explodingtopics.com/blog/iot-stats>

How did we get here?

Hardware is now ...

Cheaper

Smaller

More connected

Less power hungry

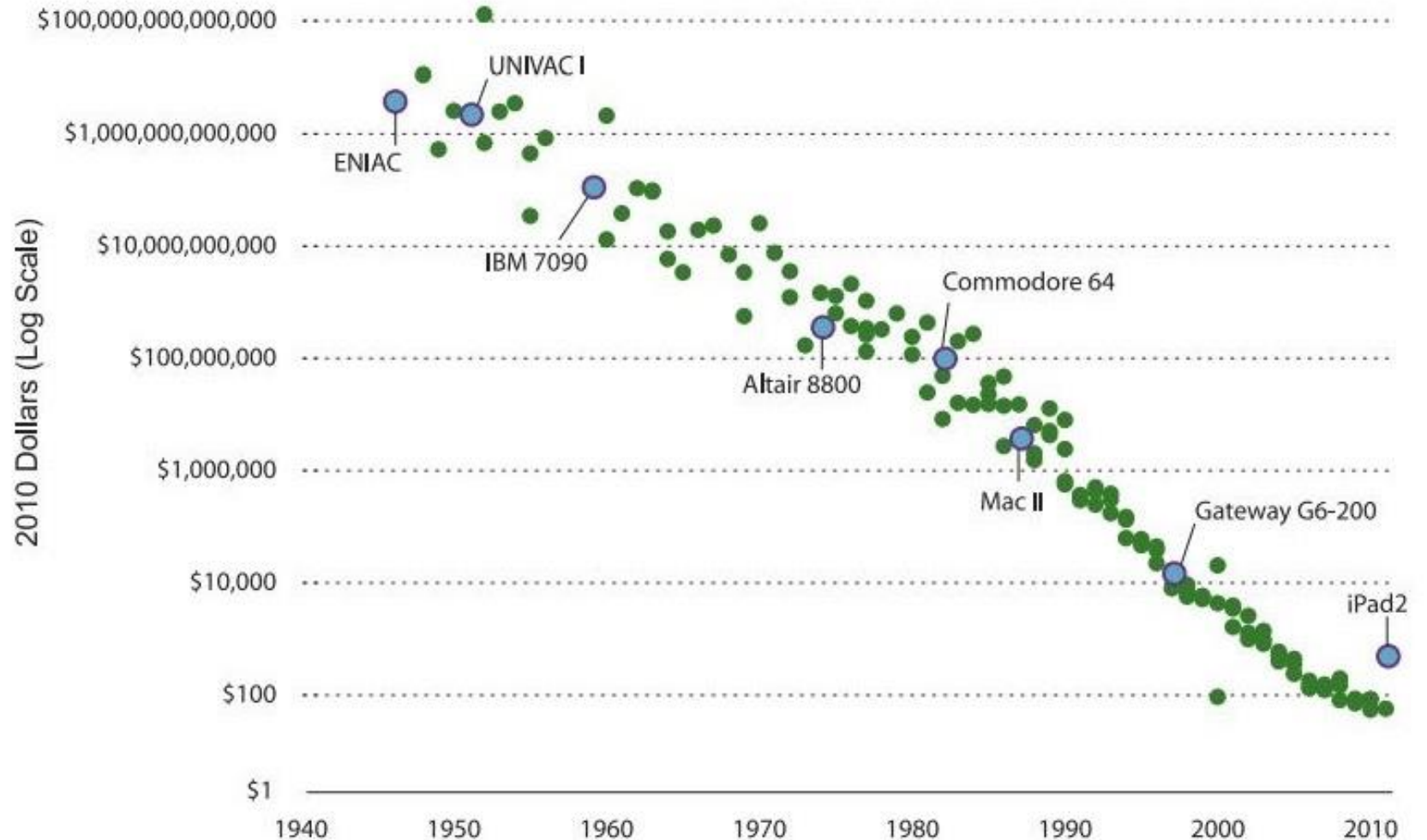
Easier to develop

Ecosystem

More tools & knowledge

More investment

More opportunities

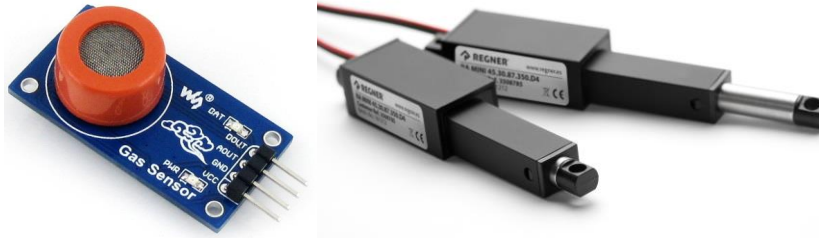


Source: http://www.hamiltonproject.org/ee-ce-image/made/assets/img/uploads/charts/cost_of_computing_power_equal_to_an_ipad2_1017_685_80.jpg

What is IoT?

Physical

Sensors, Actuators



Connected

WiFi, Bluetooth, Cellular, LPWAN ...



Programmable

Arduino, C/C++, Python, Java, Assembly ..

(Atmel, **Espressif**, TI, Microchip, MIPS, ARM ...)

```
/**
 * 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, curiosity

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, tracking

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



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

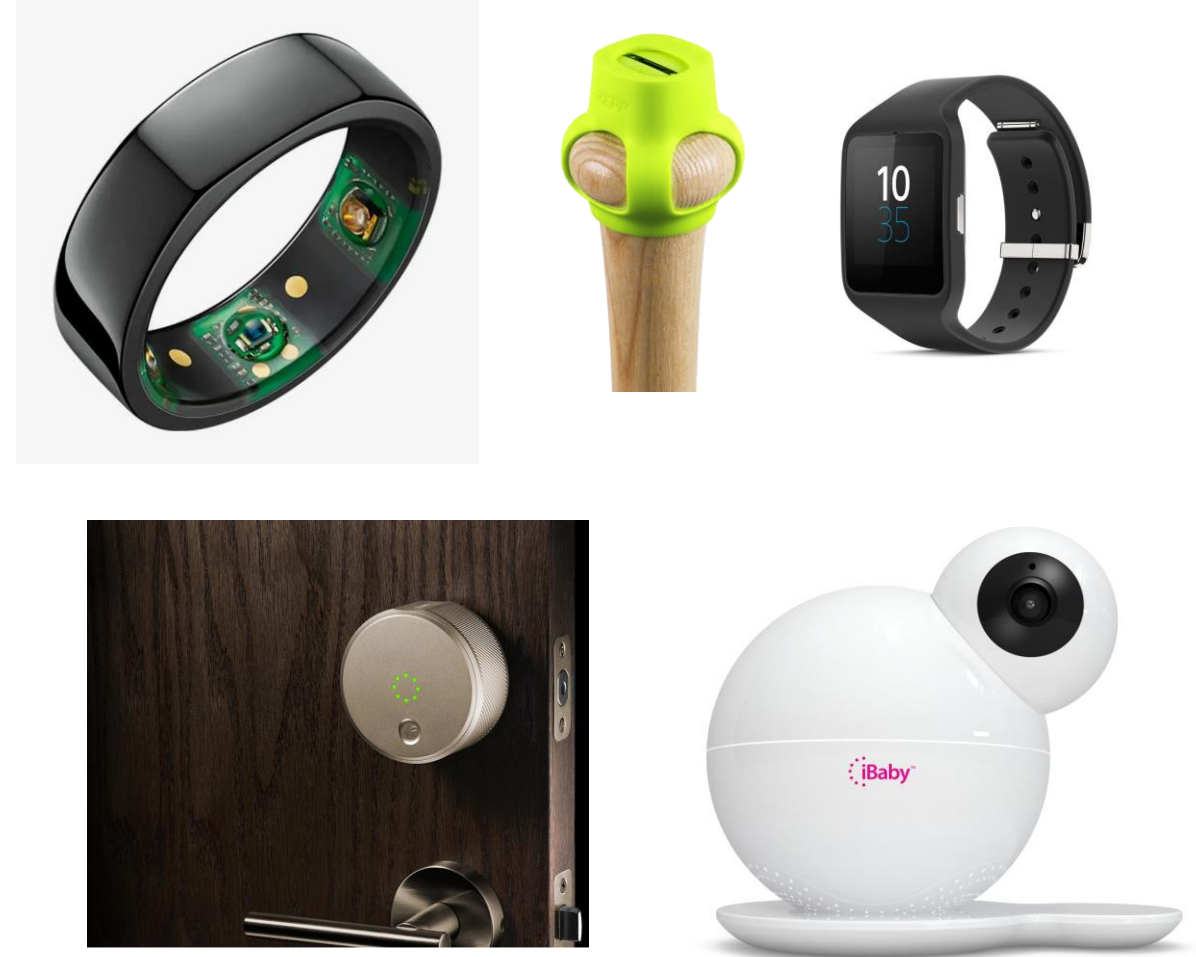
Consumer IoT examples

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 ...😊



Source: <https://www.smartbin.com/markets/level-sensor-general-waste-recyclables/>

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

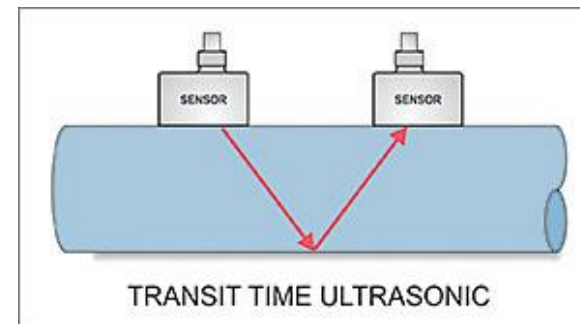
Sensors

- 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



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, 3G/GPRS ...

Medium range

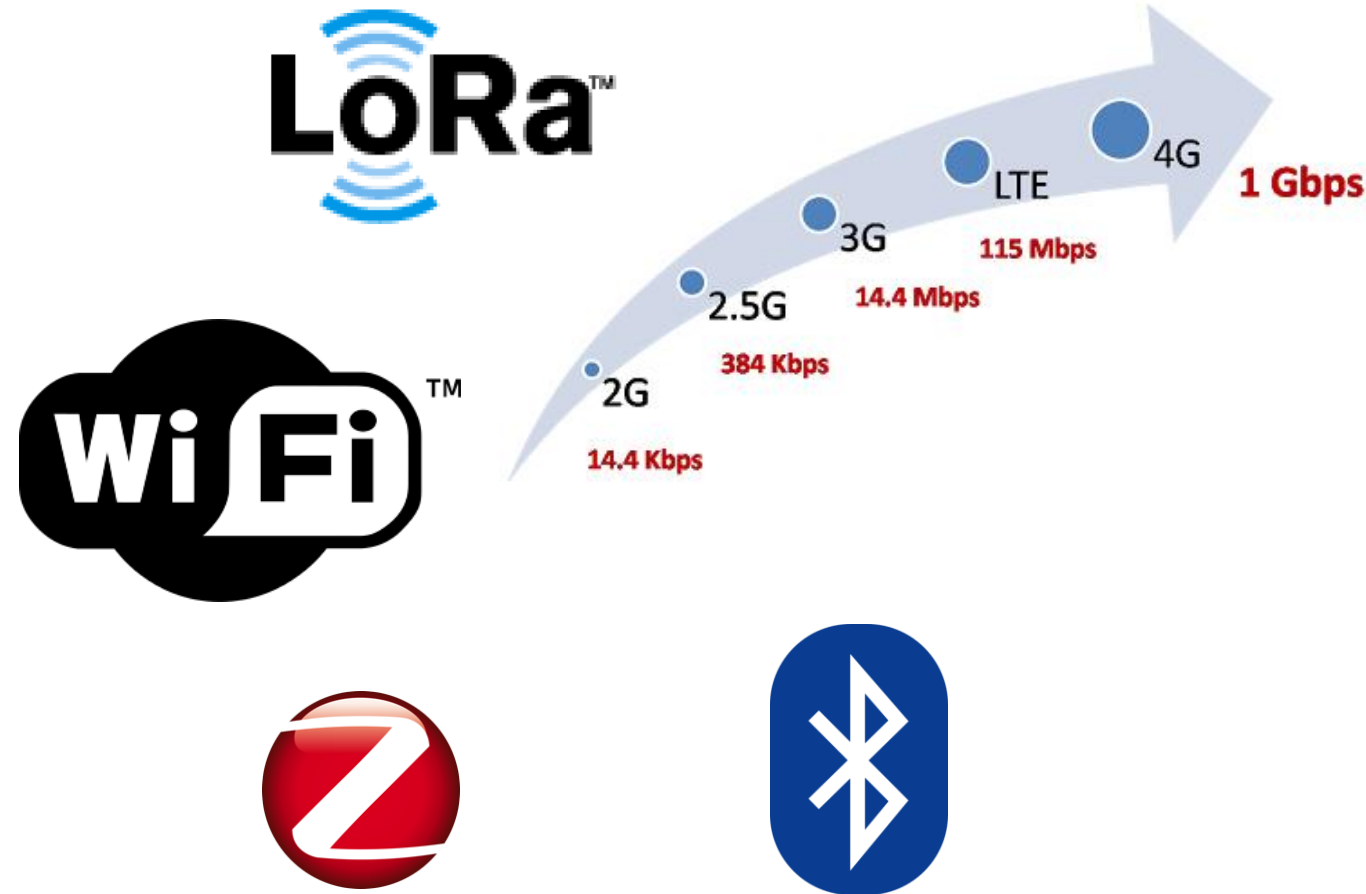
ZigBee, WiFi, Thread/Matter

Short range

Bluetooth/BLE, NFC/RFiD

Wired

Ethernet, RS-485, 4-20 mA ...



Source: <http://hitlistsofts.blogspot.bg/2015/05/difference-between-gsm-gprs-edge-3g.html>

What else?

Power management

Batteries, sleep modes ...

Security & Device management

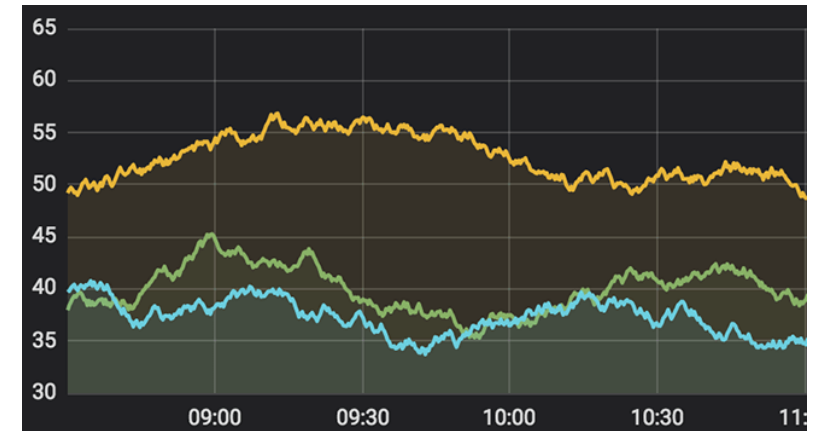
Authentication, Onboarding ...

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>



Thank you

Important. Register for the exam!!!

<https://t.ly/Cil9O>

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