



Въведение в **Internet of Things**

Teachers



Pavel Genevski



Vladimir Savchenko



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!

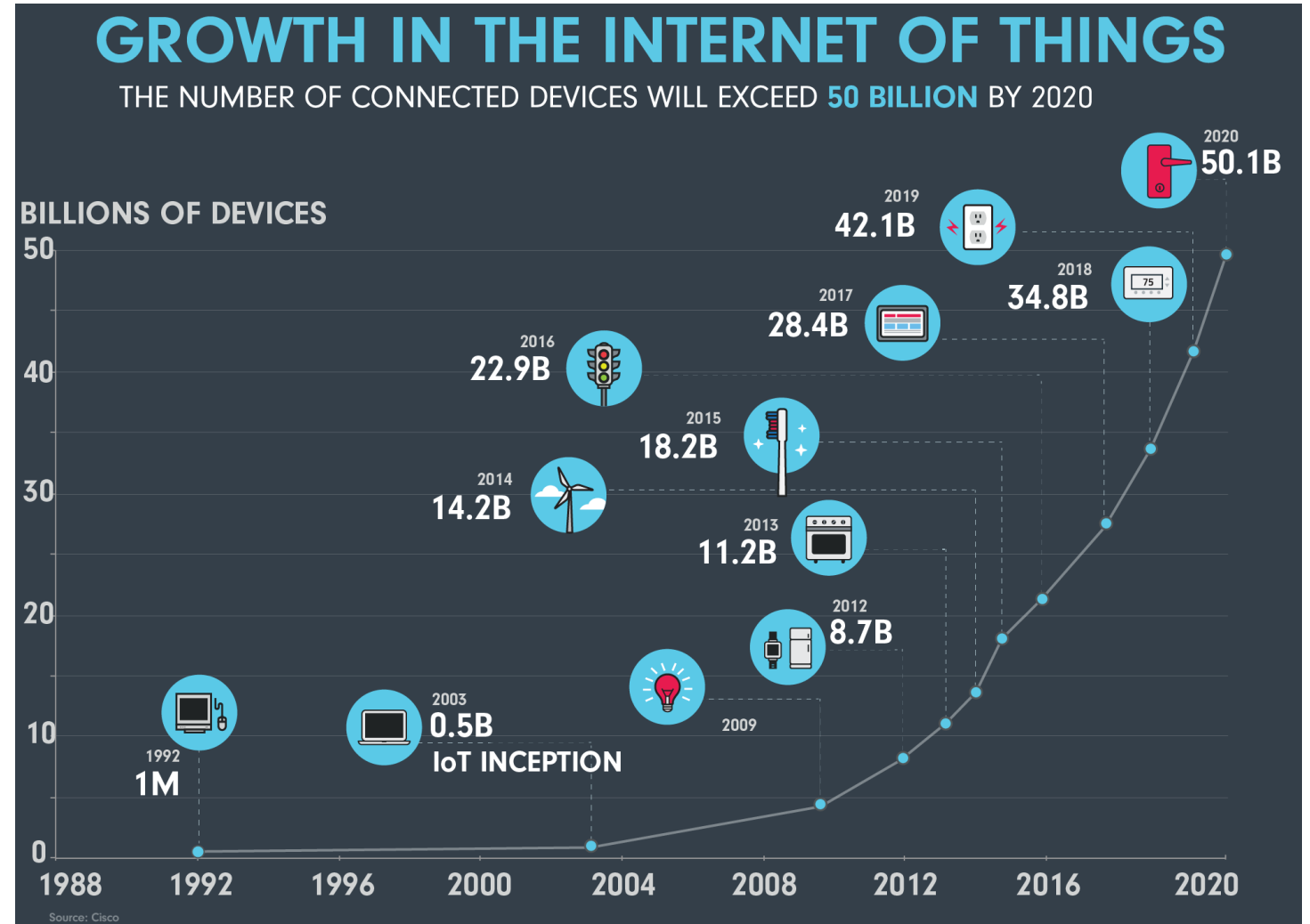
Over 20 billion connected devices

Consumer market: ~\$546B

- 1.4B smartphones (flat*)
- 157M tablets (7% decline)
- 21M smartwatches (flat*)

■ **Industrial market: ~\$868B**

- Factories (Industry 4.0)
- Logistics
- Meters
- Trains
- Cities
-

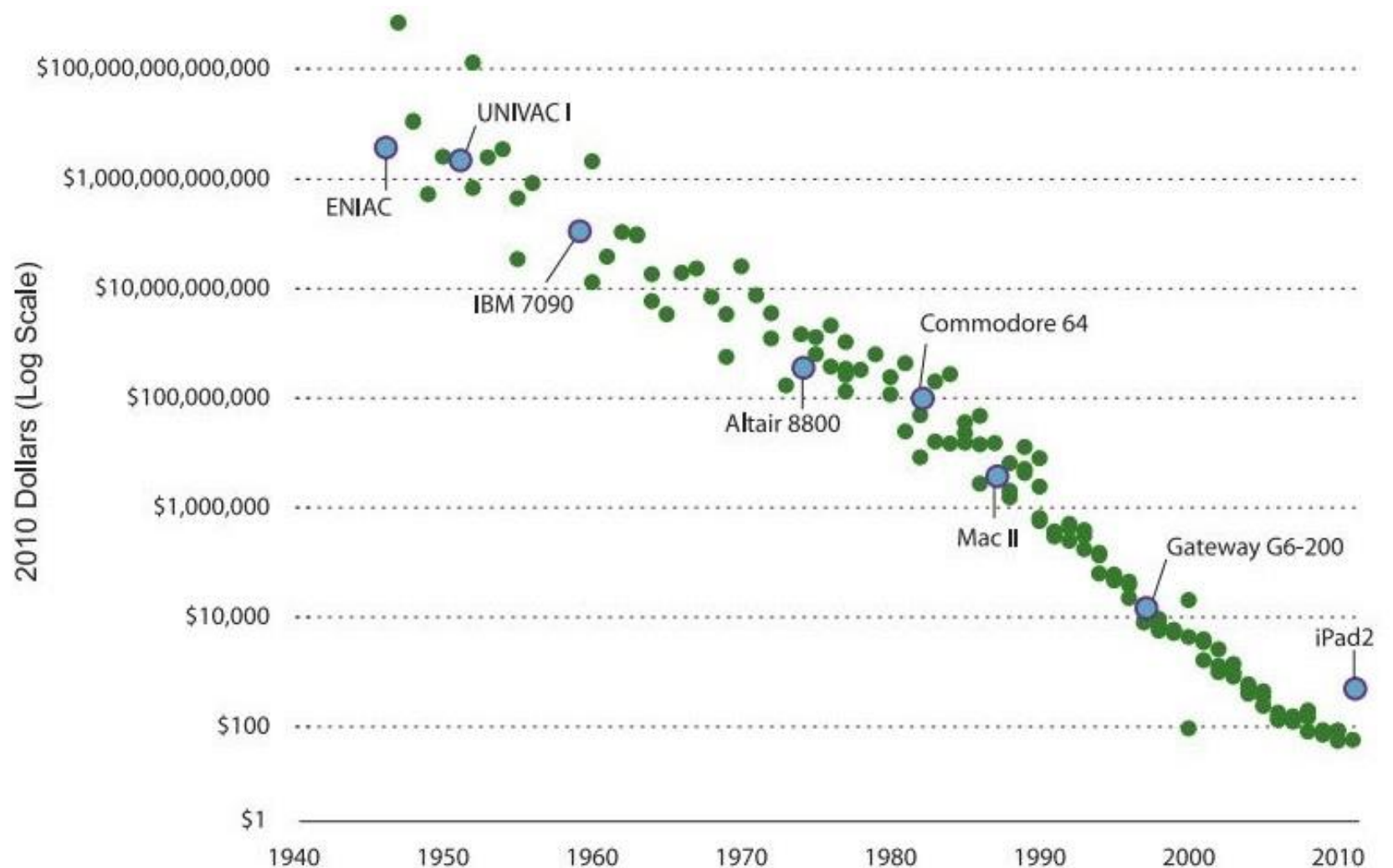


Source: https://www.ncta.com/sites/prod/files/GROWTH_IOT-091516-IF-2000w.png

How did we get here?

Hardware is now ...

- Cheaper
- Smaller
- More connected
- Less power hungry
- Easier to develop
- **Ecosystem**
- More tools & knowledge
- More opportunities
- More investment

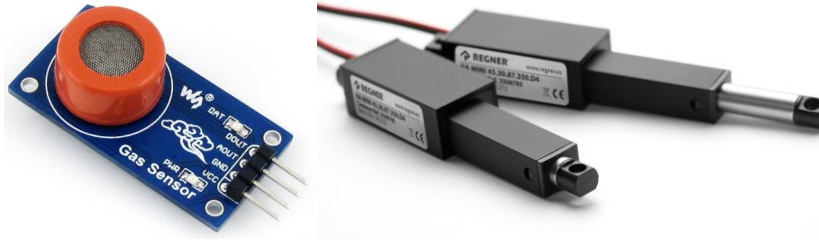


Source: http://www.hamiltonproject.org/ee-ce-image/made/assets/img/uploads/charts/cost_of_computing_power_equal_to_an_ipad2_1017_685_80.jpg

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 agility, informed decision making
- **Challenges:** security, compliance, compatibility, reliability, connectivity, support ...



Consumer IoT

- **Drivers:** coolness, convenience, health, some cost reduction
- **Challenges:** UX, hype vs value, time to market, some privacy and security



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
- A/C monitoring
- Smart home / company / city
- You name it ... 😊



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

How?

IoT development platforms

Bare metal

- **SDK:** Espressif, NXP, TI, Atmel, Microchip ...
- **Arduino:** Atmel, **ESP8266 (we will use this one)**



Linux

- Raspberry PI, Beaglebone ...



Android & iOS

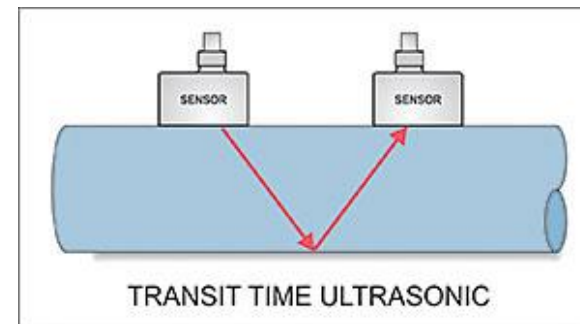
- Phones, Wearables, TVs ...



Sensors

So many sensors ...

- Touch, movement, compass, acceleration, video, sound
- Temperature, humidity/moisture, light / infrared
- Pressure, gas detection
- Force (tenso), proximity, motion
- Liquid level, flow, magnetic field (hall), radiation
- Fingerpring, heart rate ...



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, Sigfox, 6LoWPAN (868MHz), 3G/GPRS

Medium range

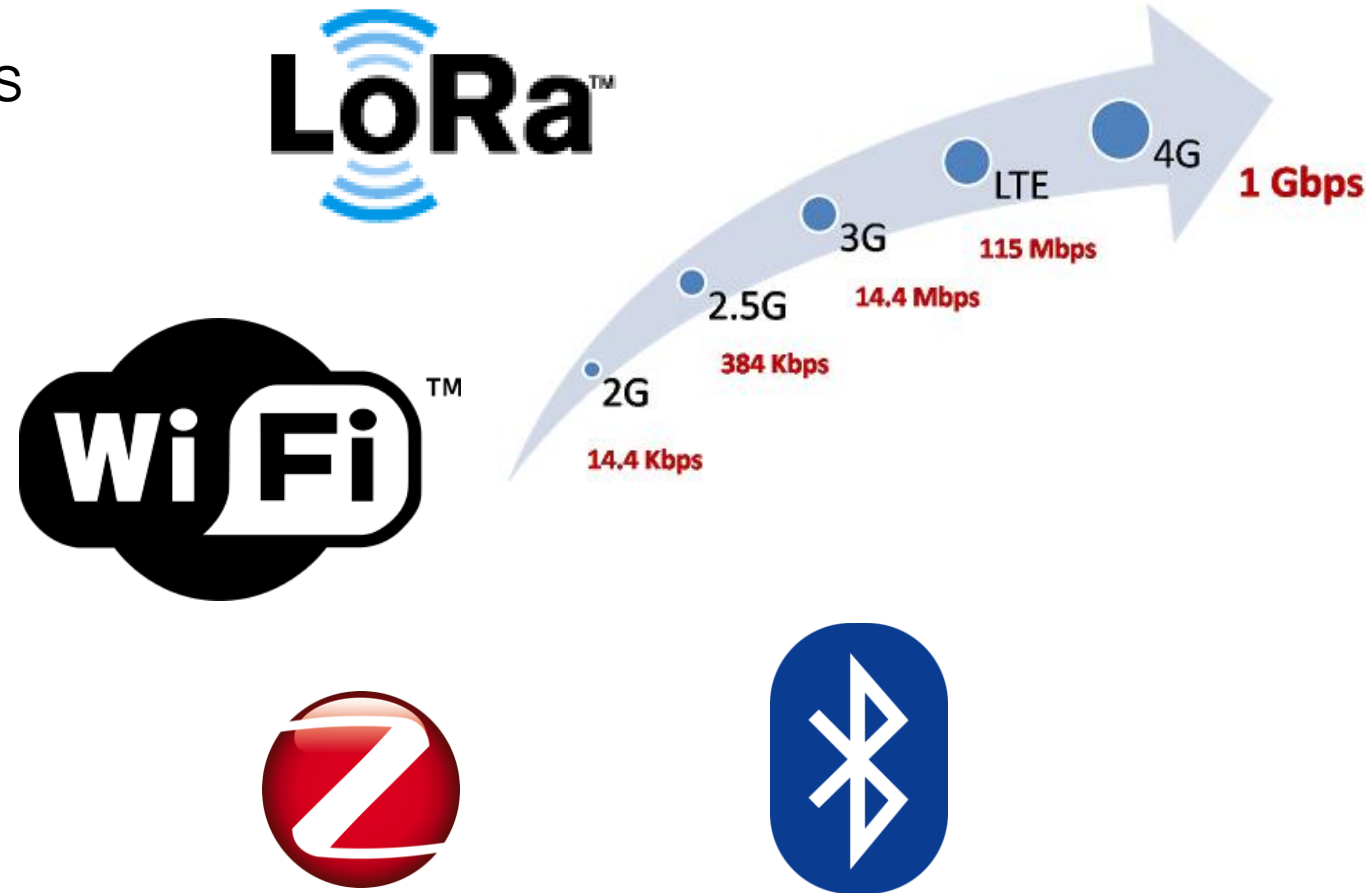
- ZigBee, WiFi

Short range

- Bluetooth, 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

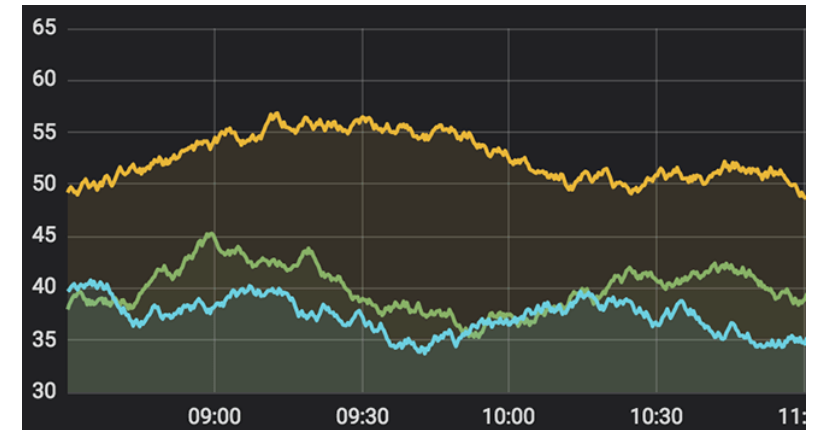
- Batteries, sleep modes ...

Security & Device management

- Authentication, Onboarding ...
- Monitoring

Data management

- Data transport & storage
- Processing and visualization





Thank you