



IoT Alive
DIGITAL PRODUCTS FOR
AGRICULTURE

Introduction to the Internet of Things

Partener
principal



Outline

Why?

What is Internet of Things

How did this start

Hardware

Software

Questions

Why?

- We want to receive more data
- We want to control stuff
- We want to automate
- We want to make things faster

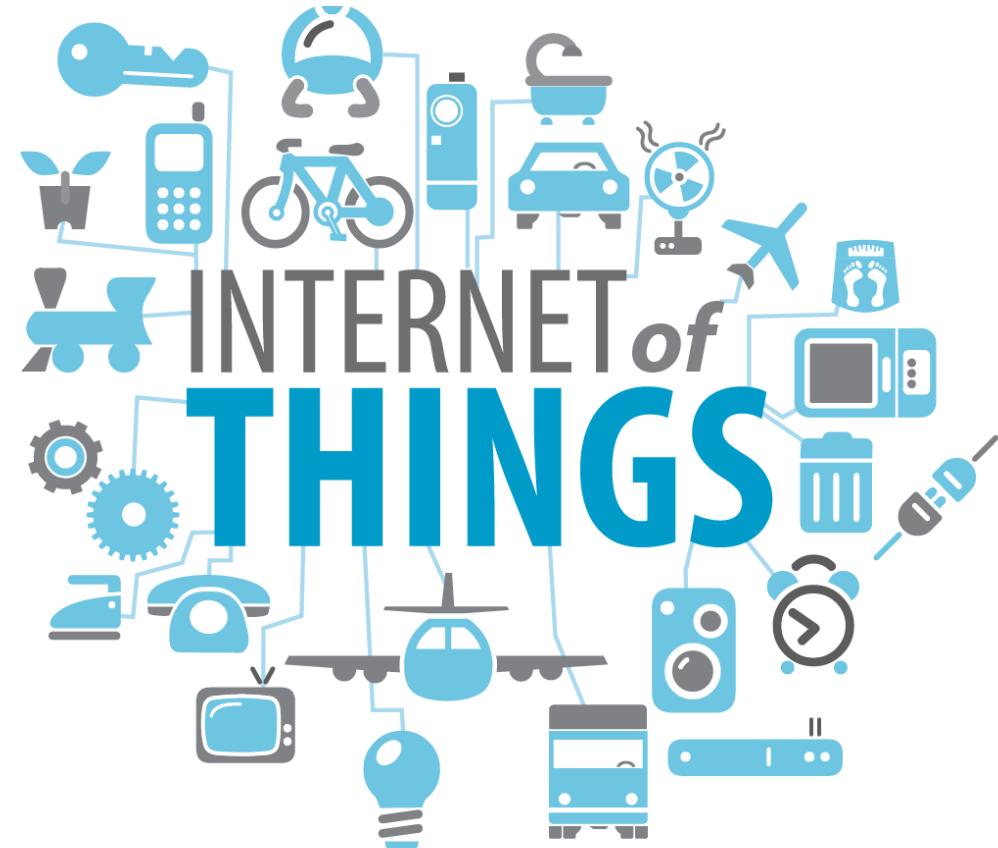


Image from <http://smartdatacollective.com/rick-delgado/285576/scary-security-concerns-in-internet-things>

What is the Internet of Things

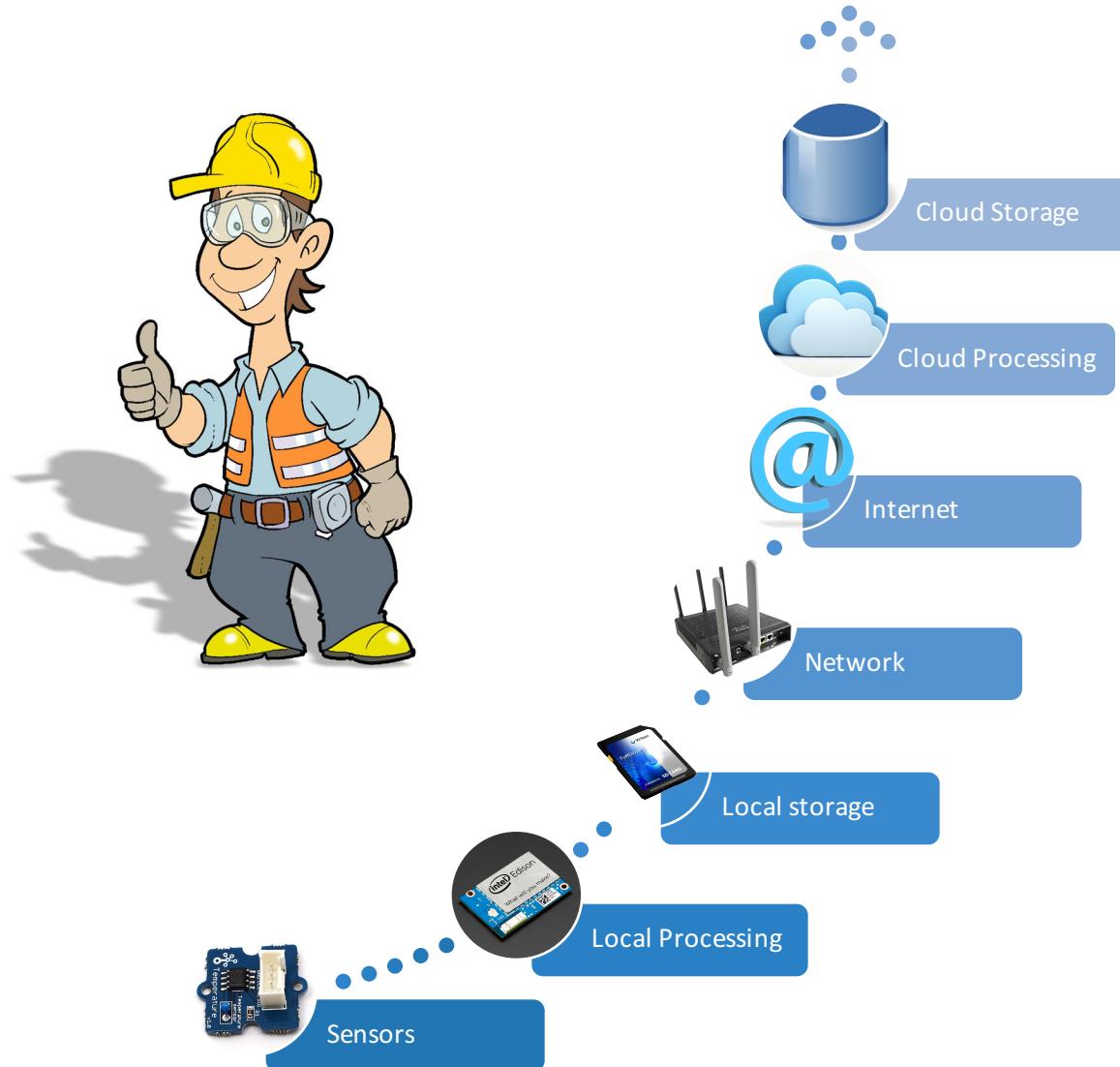


Image from <http://www.cchc.cl/informacion-a-la-comunidad/industria-de-la-construccion/personaje/>

What is Internet of Things?

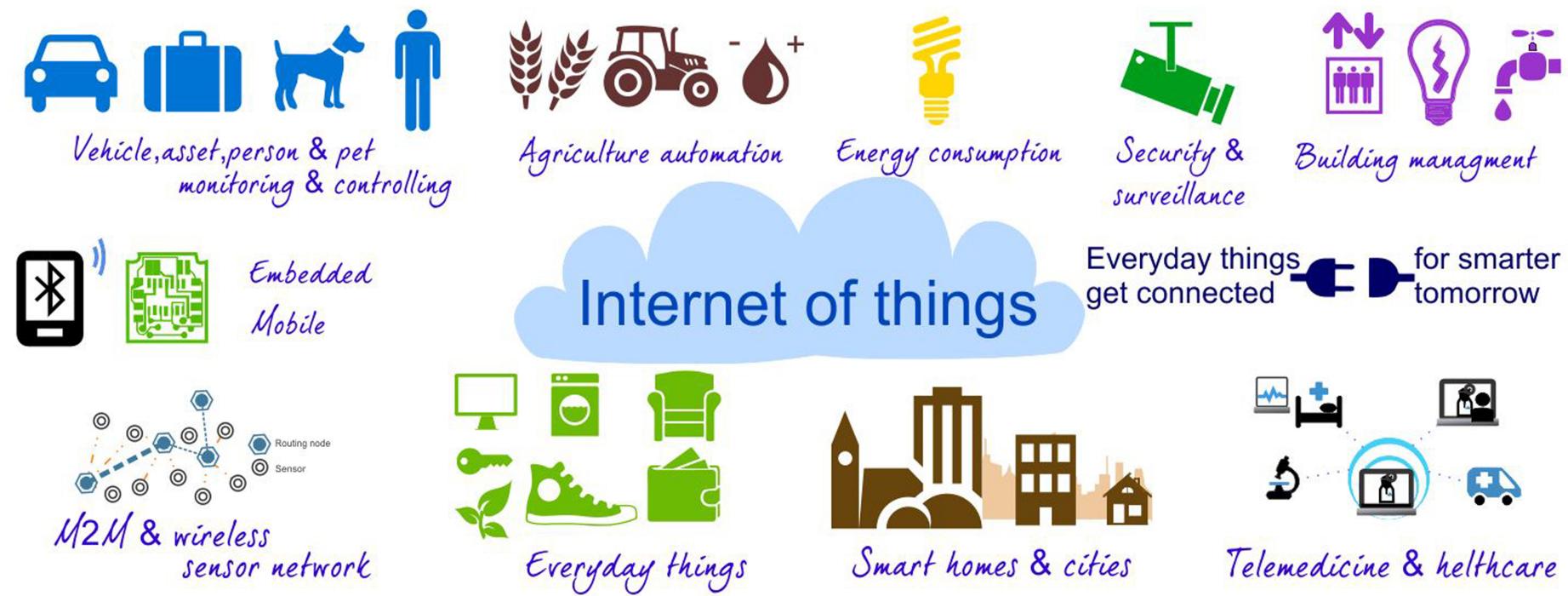


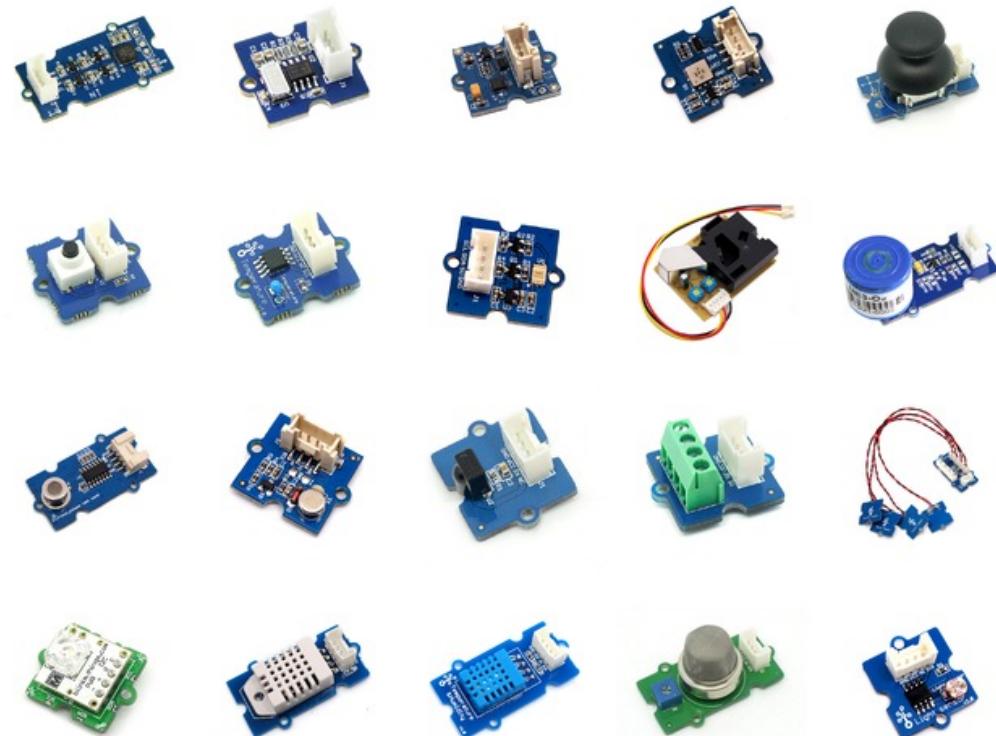
Image from <https://inventrom.wordpress.com/2014/11/27/the-thing-in-internet-of-things/>

Sensors

Measure values

Send raw data

Low power



Local Processing and Local Storage

Get data from sensors

Process

Send some data to

Edge/Fog Computing



Network and Internet

IoT Gateway

Gathers data from sensors

Gateway Protocols

- 6LoPAN
- LoRaWAN
- BLE

Internet Protocols

- CoAP
- MQTT
- HTTP
- XMPP



Cloud Processing and Storage

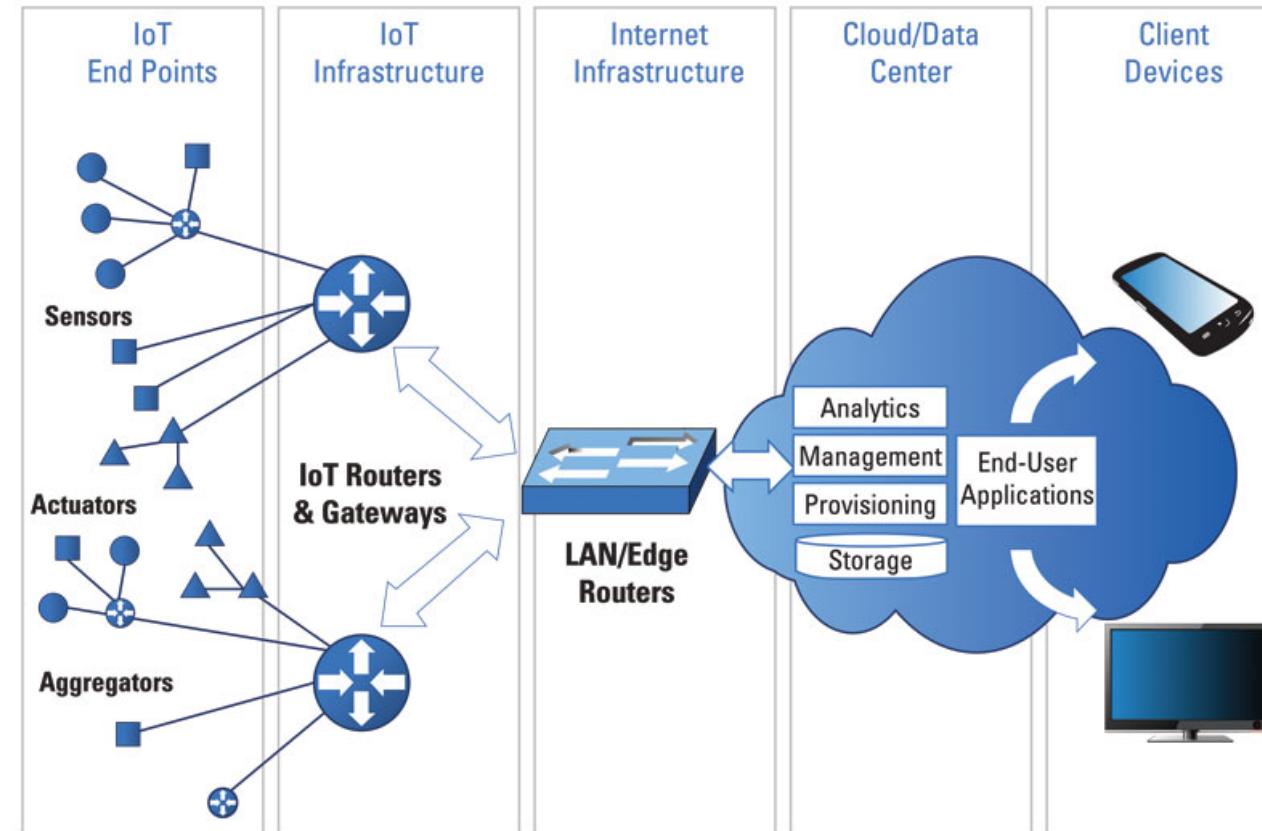
Aggregate Data

Storage

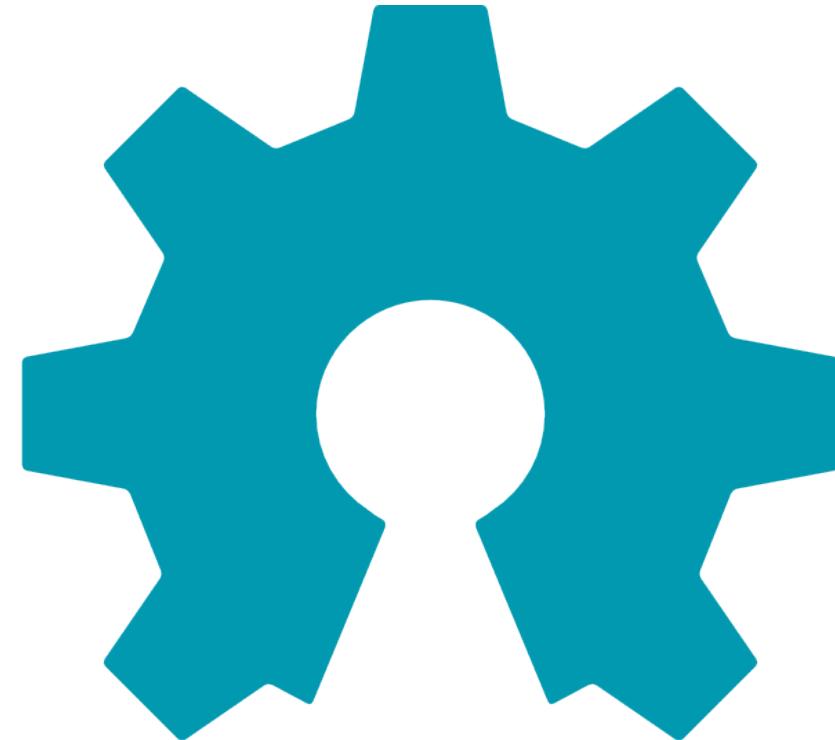
Inferences



IoT Network



How did it start

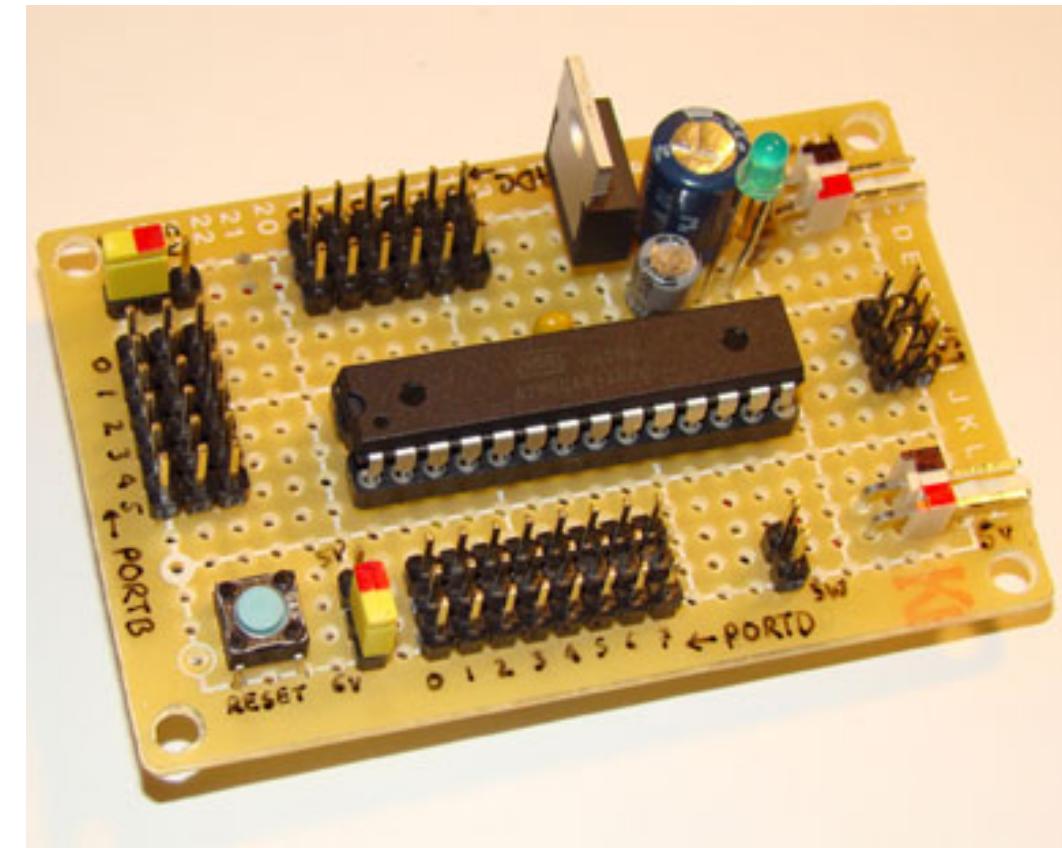


open source
hardware

Microcontroller

Small programmable device

Easy connectable



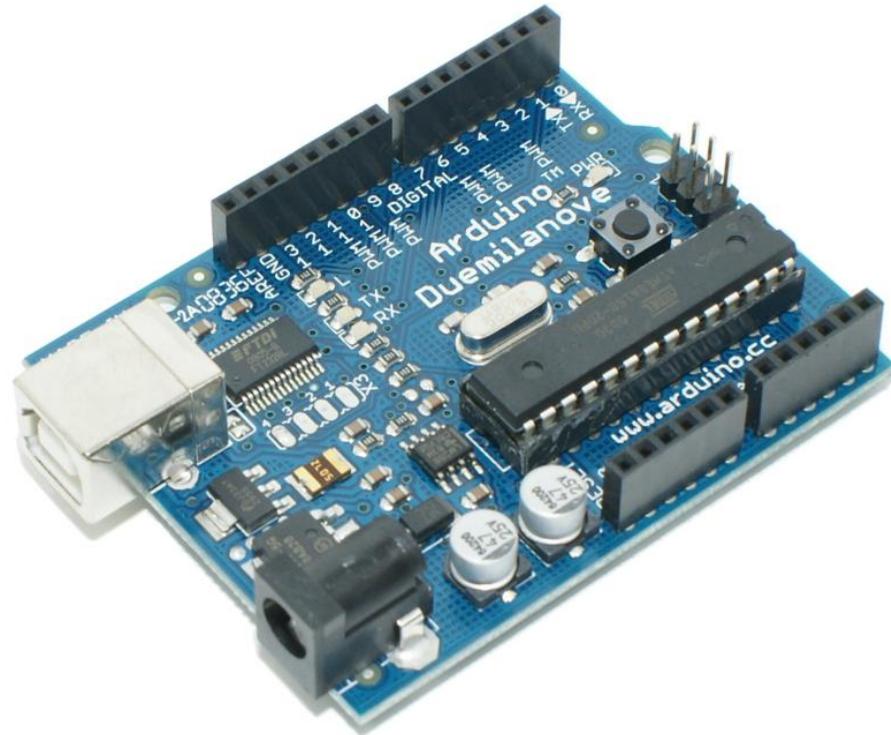
Arduino

Small programmable device

Easy connectable

Is open source

Has a simple to use software



Arduino Ethernet

Small programmable device

Easy connectable

Is open source

Has a simple to use software

Only around 4 simultaneous networking connections



waihu

Raspberry Pi

Computer

Runs Linux

More software oriented programming

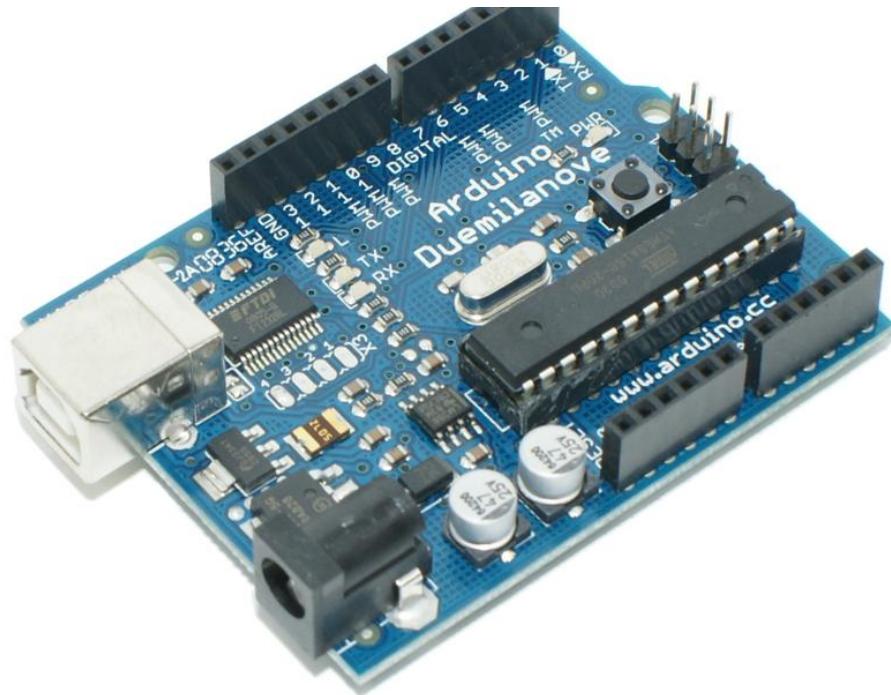
Full Networking System



RASPBERRY

Raspberry Pi and Arduino

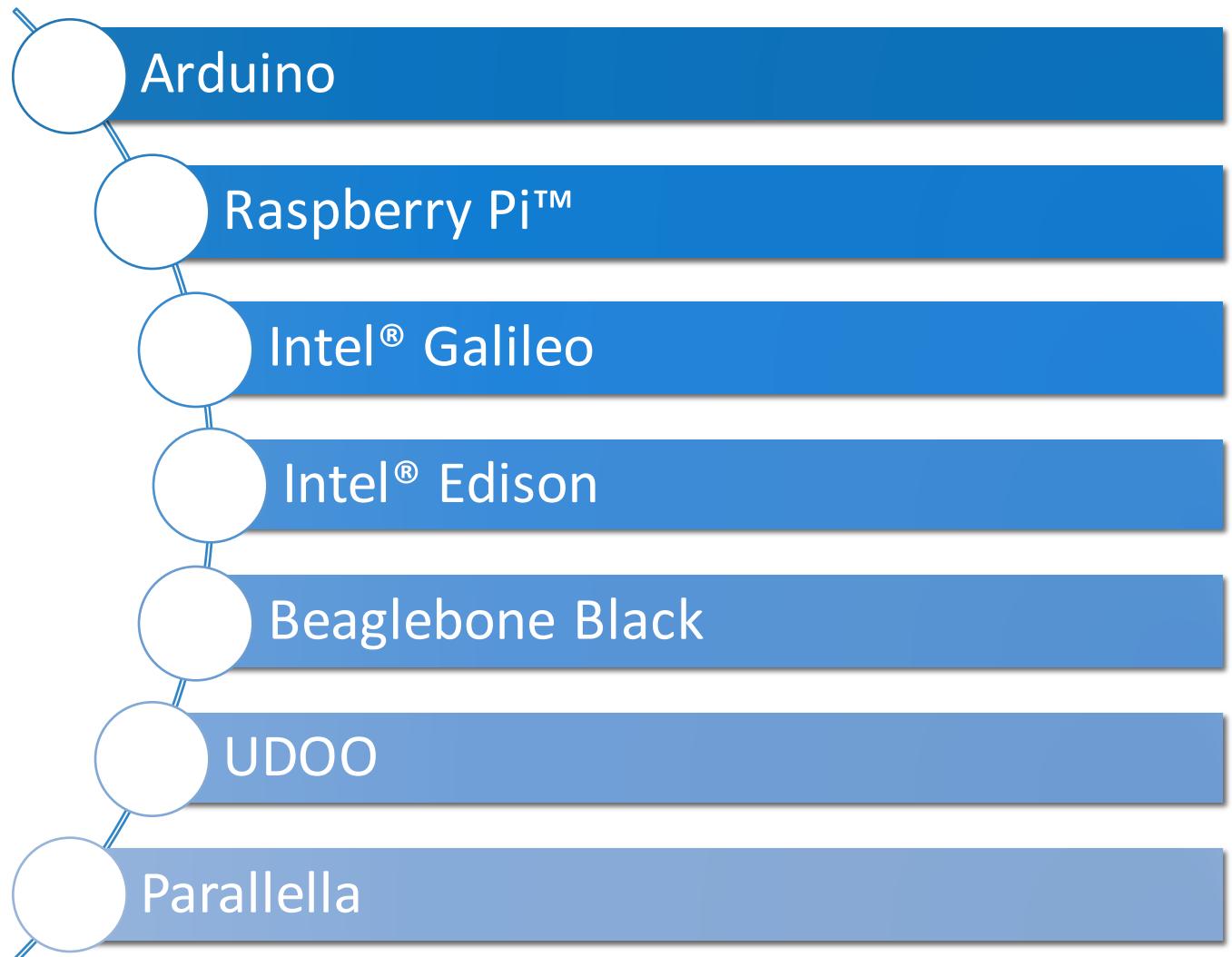
HARDWARE



SOFTWARE AND NETWORKING SYSTEM



Hardware



Good for sensors



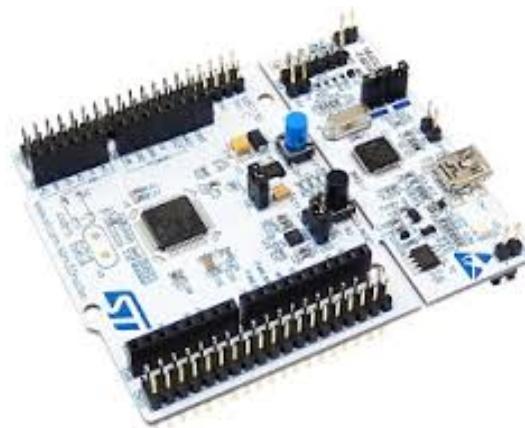
Arduino
\$25
ATmega328

ChipKIT
\$30
PIC

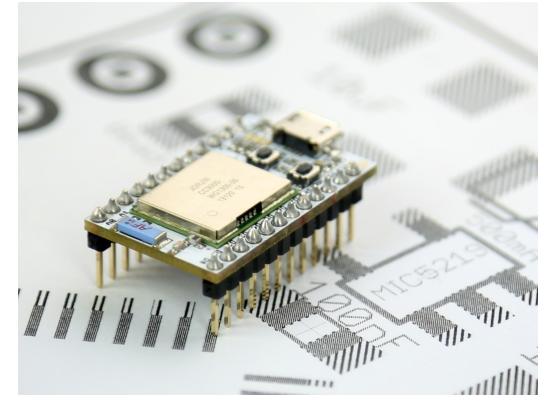


LaunchPad
\$4
MSP430

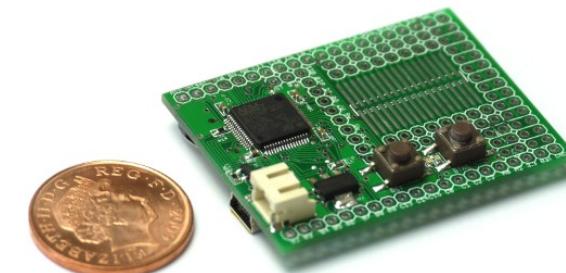
Good for some sensors and processing



STM32
\$30
ARM Cortex M0,
M3, M4



Particle
\$35
ARM
WiFi Internet



Espruino
\$30
ARM
Javascript

Good for processing and network



Raspberry Pi

\$35

900 MHz ARM, GPU

1 GB RAM

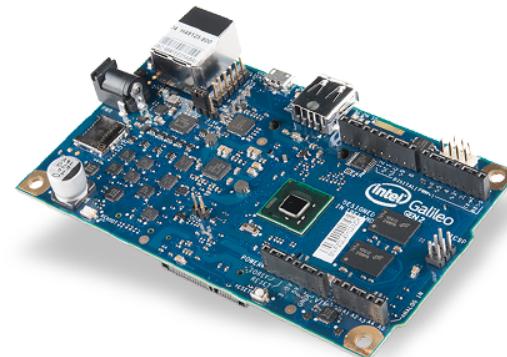
Compute Module

Intel® Galileo

\$50

400 MHz Quark x86

256 MB RAM



Intel® Edison

\$70

1 GHz Dual Core Atom x86

1 GB RAM

WiFi

BLE

4 GB Flash

Good for processing and network



Beaglebone Black
\$45
1 GHz ARM, GPU
512 MB RAM
4 GB Flash

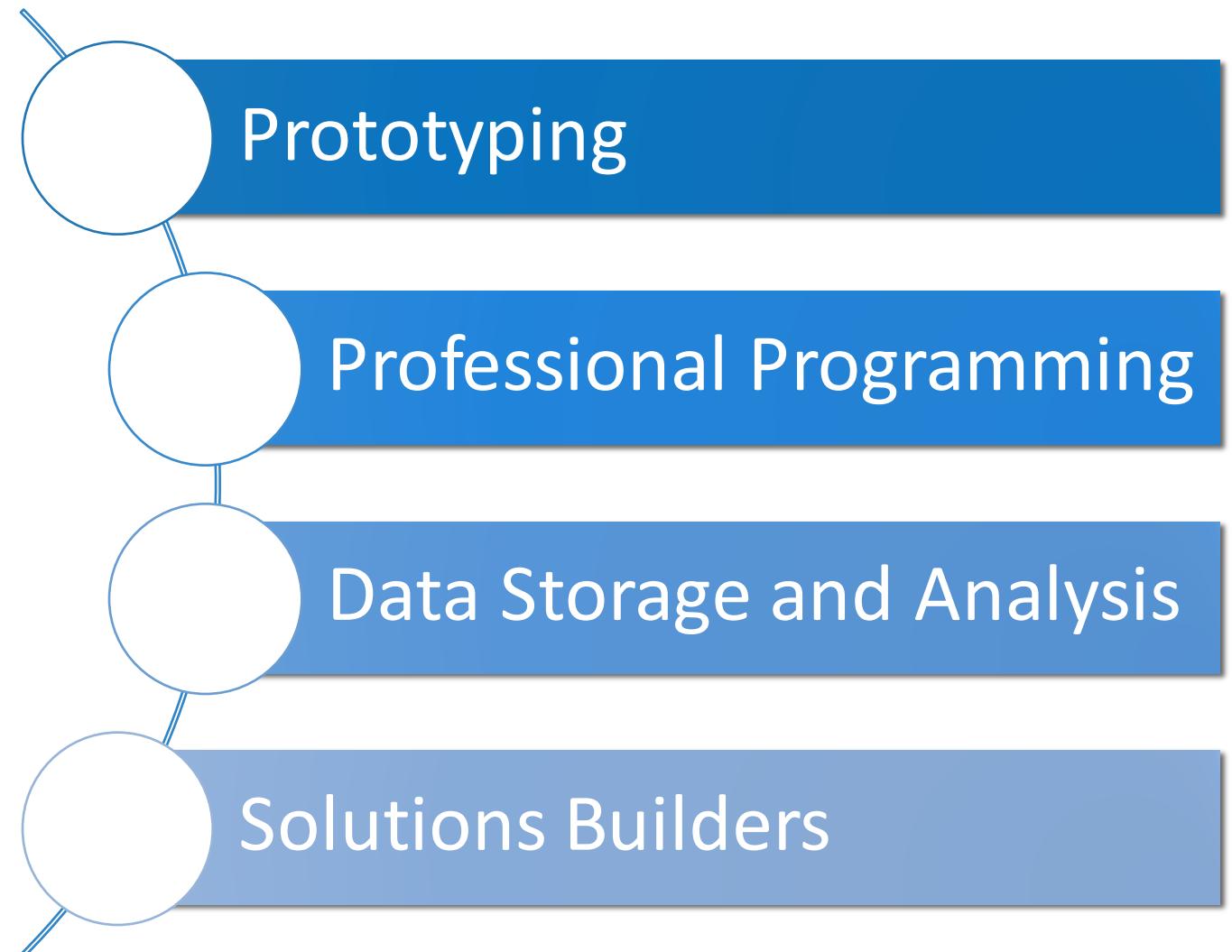


UDOO Neo
\$50
i.MX 6 Solo ARM, GPU
ARM M4
512 MB or 1 GB RAM



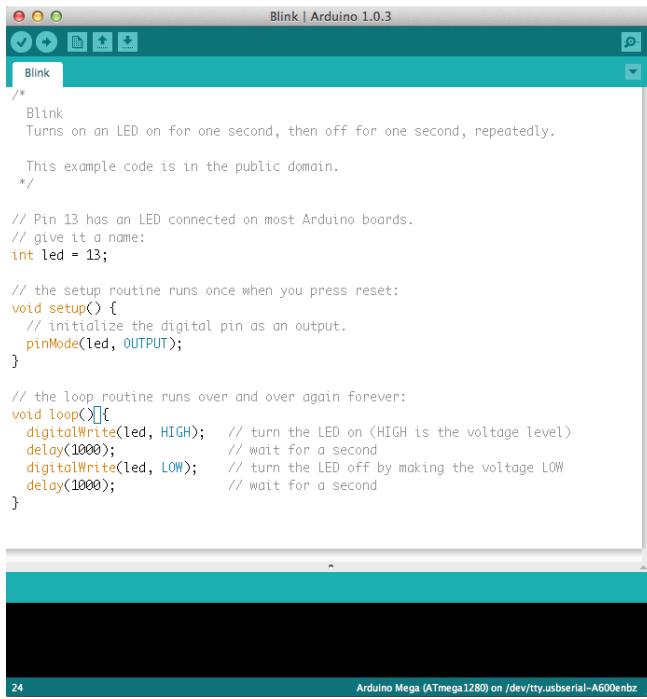
Parallella
\$99
1 GHz Dual Core Zynq ARM
16 or 64 Epiphany CPUs

Software



Prototyping

ARDUINO



```

Blink | Arduino 1.0.3

/*
Blink
Turns on an LED on for one second, then off for one second, repeatedly.

This example code is in the public domain.

*/
// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

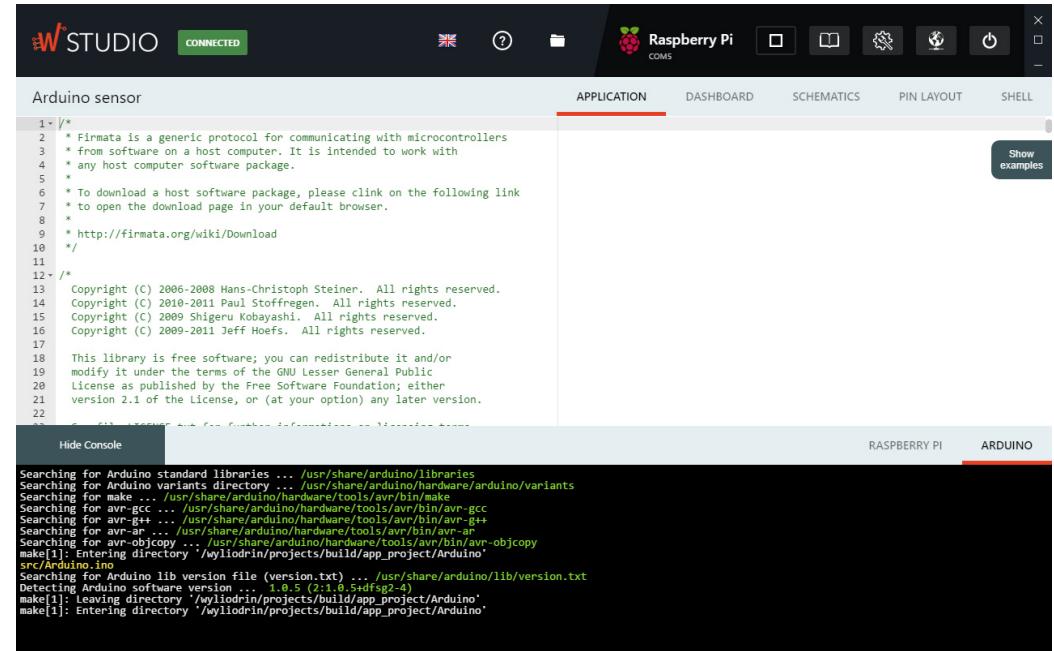
// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output:
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop(){
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000); // wait for a second
  digitalWrite(led, LOW); // turn the LED off by making the voltage LOW
  delay(1000); // wait for a second
}

  
```

24 Arduino Mega (ATmega1280) on /dev/tty.usbserial-A600enbz

WYLIODRIN STUDIO



W STUDIO CONNECTED

Raspberry Pi COMS

APPLICATION DASHBOARD SCHEMATICS PIN LAYOUT SHELL

Show examples

Arduino sensor

```

1 /*
2  * Firmata is a generic protocol for communicating with microcontrollers
3  * from software on a host computer. It is intended to work with
4  * any host computer software package.
5
6  * To download a host software package, please click on the following link
7  * to open the download page in your default browser.
8  *
9  * http://firmata.org/wiki/Download
10 */
11
12 /*
13 Copyright (C) 2006-2008 Hans-Christoph Steiner. All rights reserved.
14 Copyright (C) 2010-2011 Paul Stoffregen. All rights reserved.
15 Copyright (C) 2009 Shigeru Kobayashi. All rights reserved.
16 Copyright (C) 2009-2011 Jeff Hoefs. All rights reserved.
17
18 This library is free software; you can redistribute it and/or
19 modify it under the terms of the GNU Lesser General Public
20 License as published by the Free Software Foundation; either
21 version 2.1 of the License, or (at your option) any later version.
22
23
  
```

RASPBERRY PI ARDUINO

Hide Console

```

Searching for Arduino standard libraries ... /usr/share/arduino/libraries
Searching for Arduino variants directory ... /usr/share/arduino/hardware/arduino/variants
Searching for make ... /usr/share/arduino/hardware/tools/avr/bin/make
Searching for avr-gcc ... /usr/share/arduino/hardware/tools/avr/bin/avr-gcc
Searching for avr-g++ ... /usr/share/arduino/hardware/tools/avr/bin/avr-g++
Searching for avr-objcopy ... /usr/share/arduino/hardware/tools/avr/bin/avr-objcopy
make[1]: Entering directory '/wyliodrin/projects/build/app_project/Arduino'
src/Arduino.ino
Searching for Arduino lib version file (version.txt) ... /usr/share/arduino/lib/version.txt
Detecting Arduino software version ... 1.0.3 (/2.3.1.5+dfsg2-4)
make[1]: Leaving directory '/wyliodrin/projects/build/app_project/Arduino'
make[1]: Entering directory '/wyliodrin/projects/build/app_project/Arduino'
  
```

Professional Programming

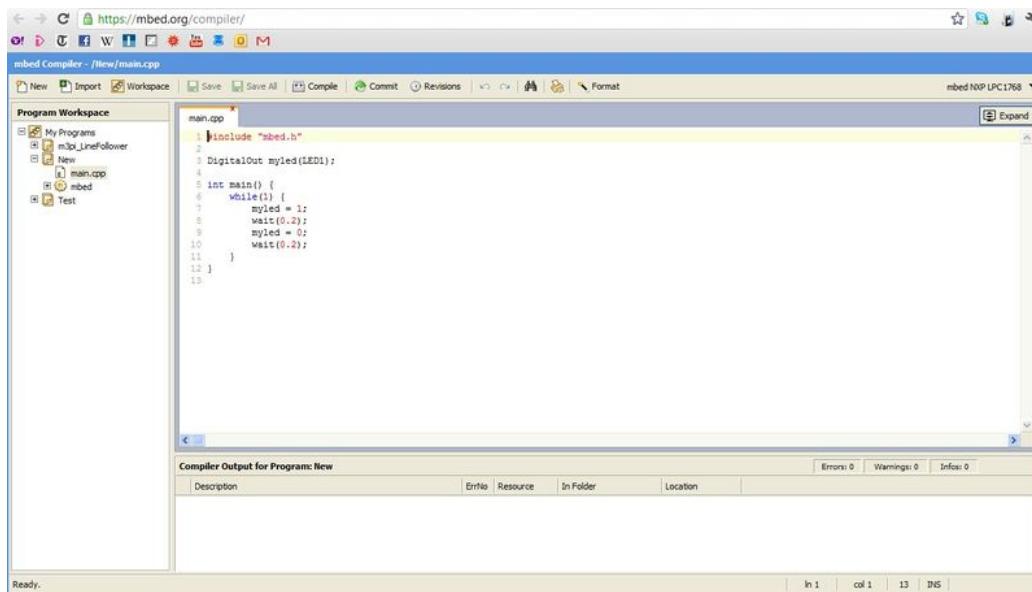
ECLIPSE

The screenshot shows the Eclipse C/C++ IDE interface. The top menu bar includes File, Edit, Source, Refactor, Navigate, Search, Run, Project, Window, Help, and a C/C++ specific tab. The left sidebar is the Project Explorer, displaying the project structure with files like power.c, main.c, fpga.c, spi_wrapper.c, install.txt, and main.c. The main workspace shows the content of main.c, which includes various header files and defines for the NanoMind3 board. The bottom right corner shows the Task List view, listing tasks such as stdlib.h, stdio.h, stdint.h, dev/uart.h, dev/arm/cpu_pm.h, util/console.h, supervisor/supervisor.h, csp/csp.h, csp/interfaces/csp_if_can.h, csp_extra/csp_if_i2c.h, csp_extra/csp_if_kiss.h, csp/interfaces/csp_if_i2c.h, csp_extra/csp_console.h, freertos/FreeRTOS.h, freertos/task.h, F_CPU, F_OSC, F_USART, vTaskServer(void*), vTaskUserRx(void*), vTaskInit(void*), handle_server:xTaskHandle, handle_console:xTaskHandle, and main(void): int.

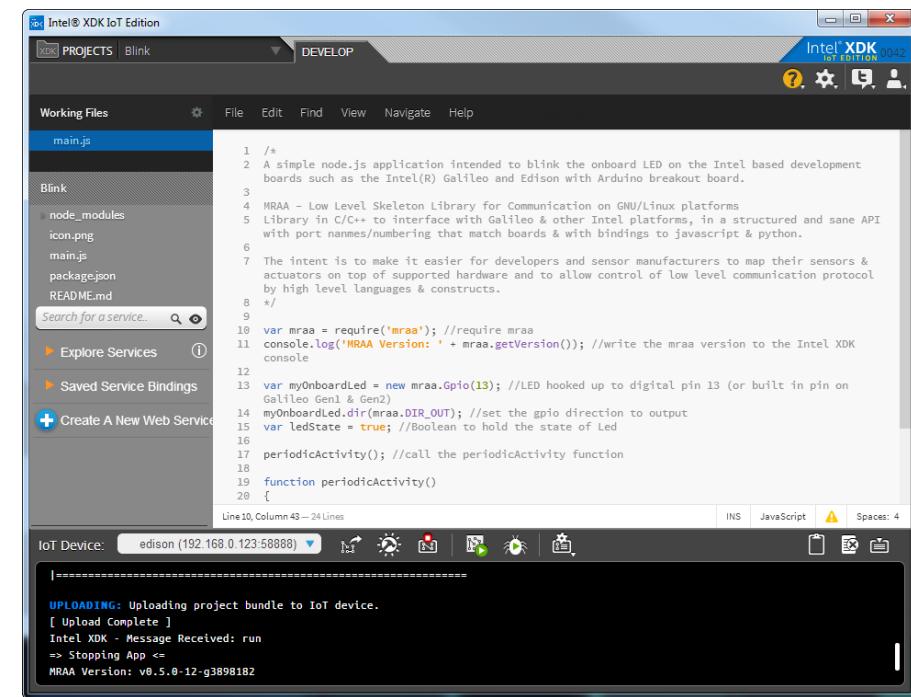
VIM

Professional Programming

MBED (ONLINE)

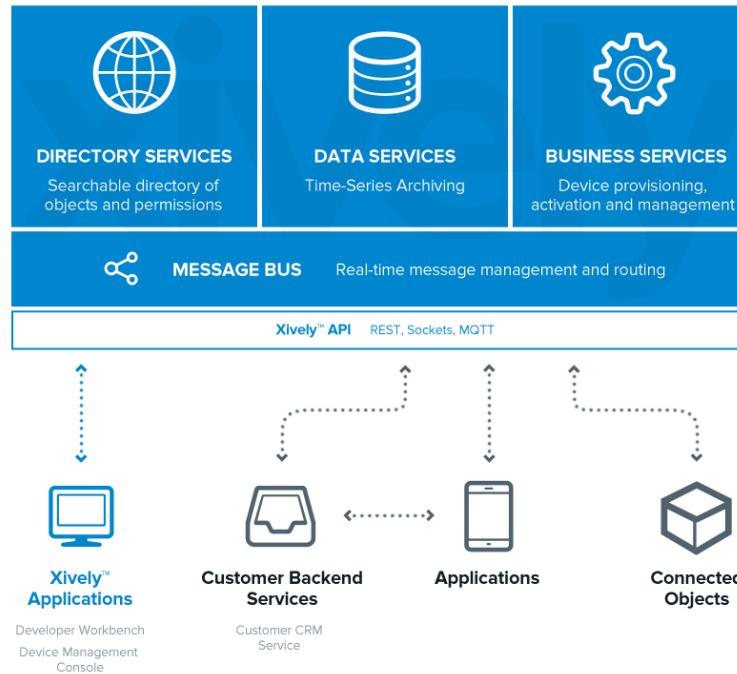


INTEL® XDK

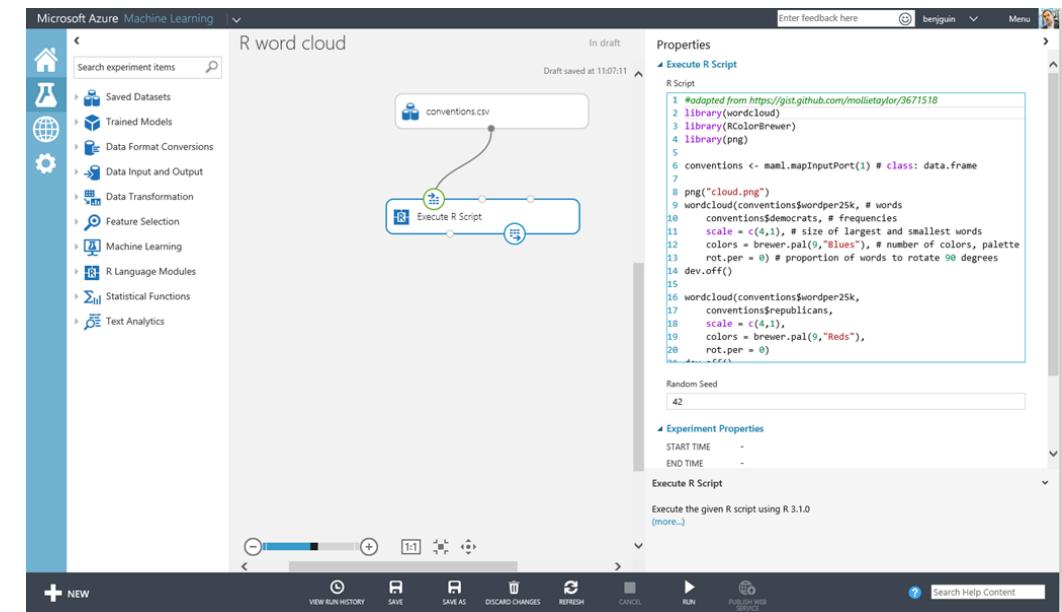


Data Acquisition and Analysis

XIVELY



MICROSOFT AZURE



Questions?