# PHP For Toasters and Everything Else

Robert Cohn
Robert.S.Cohn@intel.com
Intel

# About Me

- Architect for Intel XDK: xdk.intel.com
  - Tools to make apps for iOS, Android, & Windows 8 with HTML & JS. Publish in google play, App Store. Free.
- XDK added support for making IoT Apps
- Taught IoT course at Harvard & Intel

# Where is the Toast?

- Talk will focus on the ‘everything else’
- There will be toast at the end

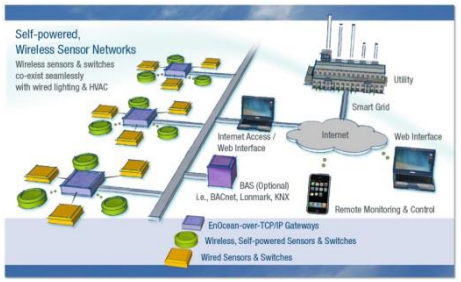
# What is the Internet of Things?

- Internet and Web focused on person-to-person communication, sharing documents
  - Email, chat, images, audio, video, ads, commerce
- Internet of Things (IoT) connects the physical world
  - Observation: sensors
    - Is the door closed?
    - What is the temperature?
  - Analysis
    - Big data: Do we need to provision more power generation?
    - Small data: Am I riding a bike or driving in a car?
  - Actuators
    - Unlock the door
    - Turn on the lights
    - Adjust the temperature

IoT will impact every aspect of our everyday life: comfort, health, safety, environment

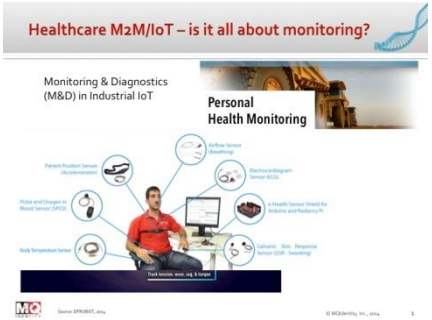
# IoT Applications

Business



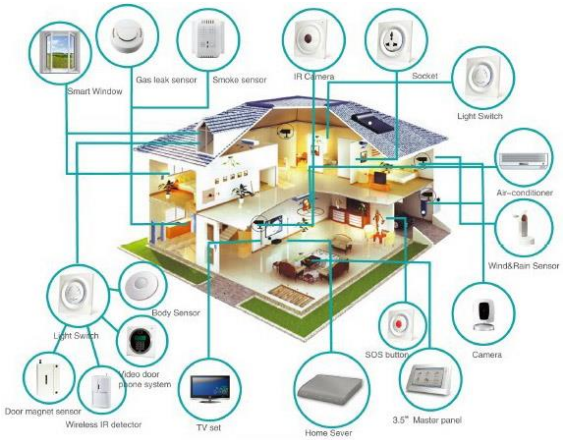

Lighting, HVAC, Energy

Security



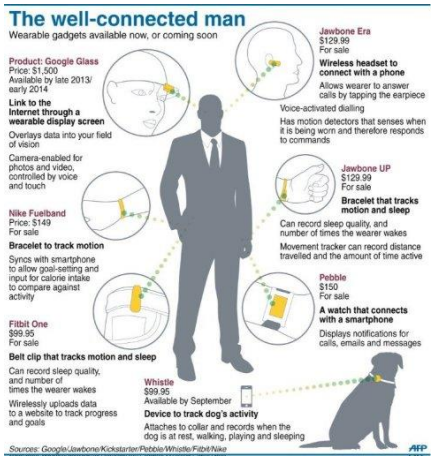

Healthcare

Consumer




Smart Home


Automotive



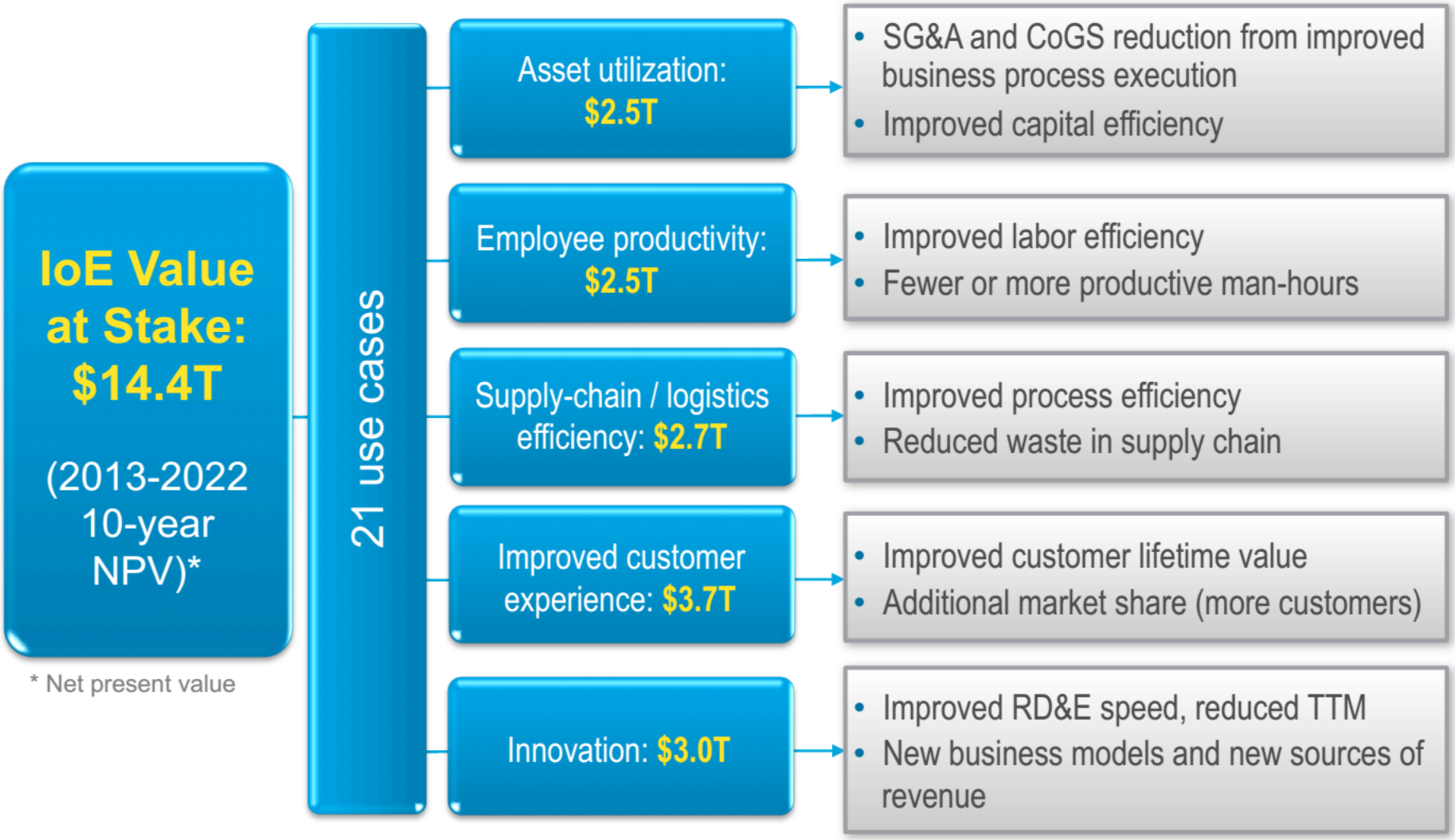

Wearables

# IoT Financial Impact

- Today
  - 7B people
  - 3B internet users
- 2020
  - Gartner:
    - Smartphone/tablet/pc: 7.3B
    - Connected devices: 26B, $300B incremental revenue, $1.9T in value-add sales
  - Cisco: 50B devices, $14.4T NPV
  - Intel, UN, IDC: 200B devices

Every company wants to be a part of IoT

# Internet of Everything:
## How It Delivers Value — and How Much Is at Stake



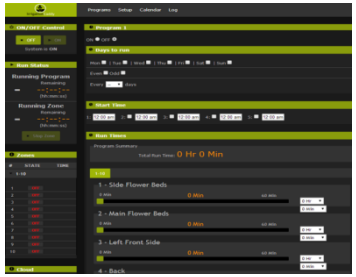
# Nest Story

- Google acquired Nest for $3.2B
- Google monetizes information it collects about you
  - Only knows what you do on the internet
  - Only can reach you while you are connected
- Thermostats and smoke detectors are just the first devices

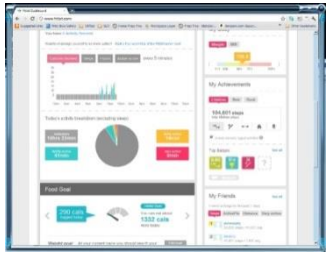
# IoT and PHP

- IoT is built on web technologies
  - HTTP, REST, HTML, web sockets, …

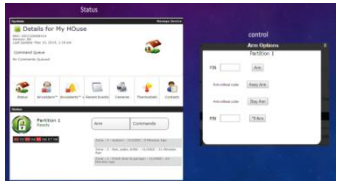
User Interface



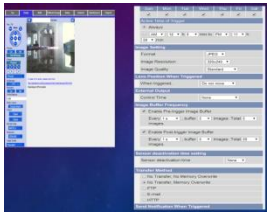
Irrigation



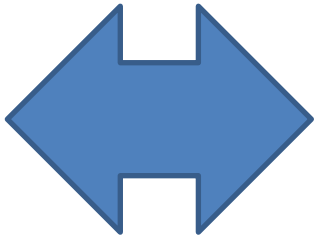
Fitness Device



Burglar Alarm



Security Camera



Web Services

Logging

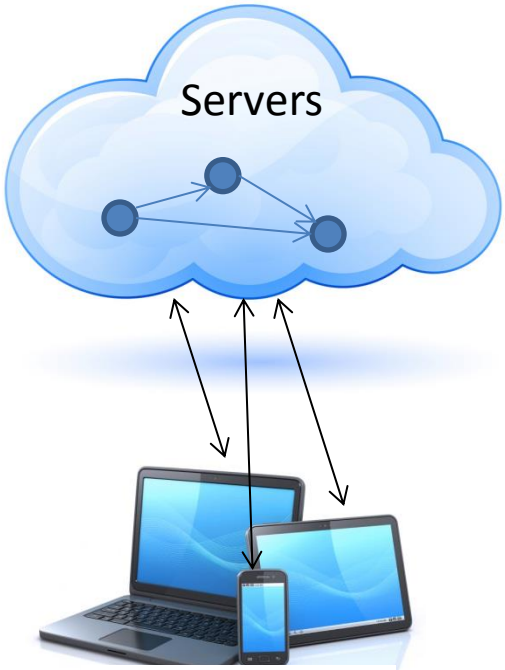
Analytics

Social networking

At a high level, everything looks the same

# What is Different?

**Web**




REST

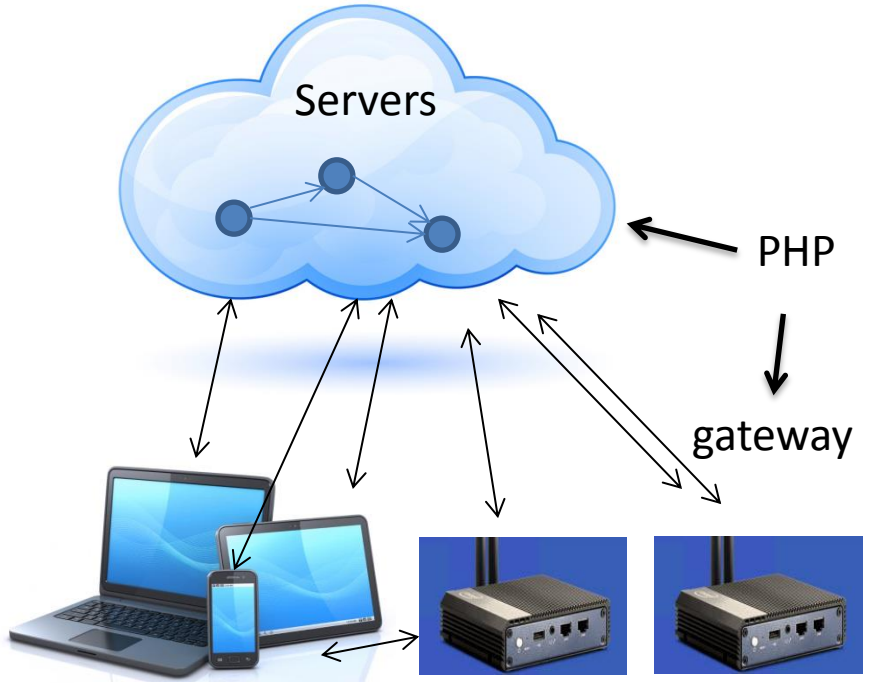
HTTP

TCP

IP

Ethernet/Wifi

**Internet of Things**




REST

HTTP

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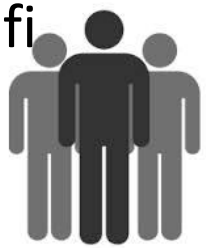
Ethernet/Wifi



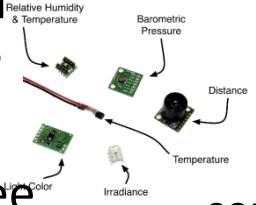
MQTT

COAP

BLE

Zygbee

6LoWPAN




sensors

# Challenges

- UX/UI
- Scale
- Power
- Cost
- Reliability
- Privacy
- Security

# IoT Applications


Device + Companion App

Companion App:
Access data and
control

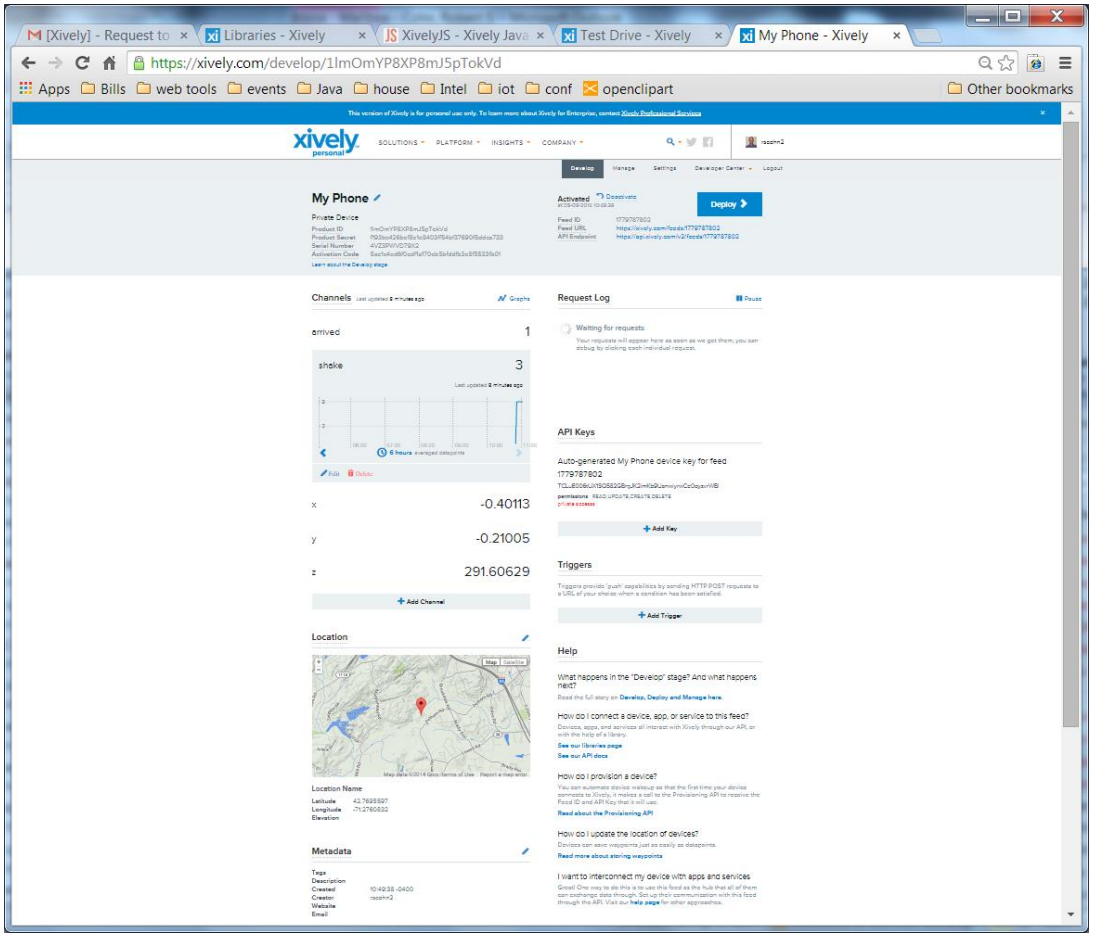

Device + Companion App + Services

# Services

- IoT: collect data, analysis, action
- Services needed to manage data
- Web app to view
- Intel, Microsoft, Oracle, IBM, …
- Integrations: Anypoint Studio/Mulesoft, Temboo

# Xively (LogMeIn)

- Try out the test drive
- Workflows
  - Provisioning: registering a device, secure connection
  - Data feeds and visualization
  - Triggers



# Getting Started

- Make something!
- It’s fun
- Solve a problem that connects to your everyday life
  - Home, recreation, social
- Work with a partner: co-worker, friend, son/daughter
- Touch something real

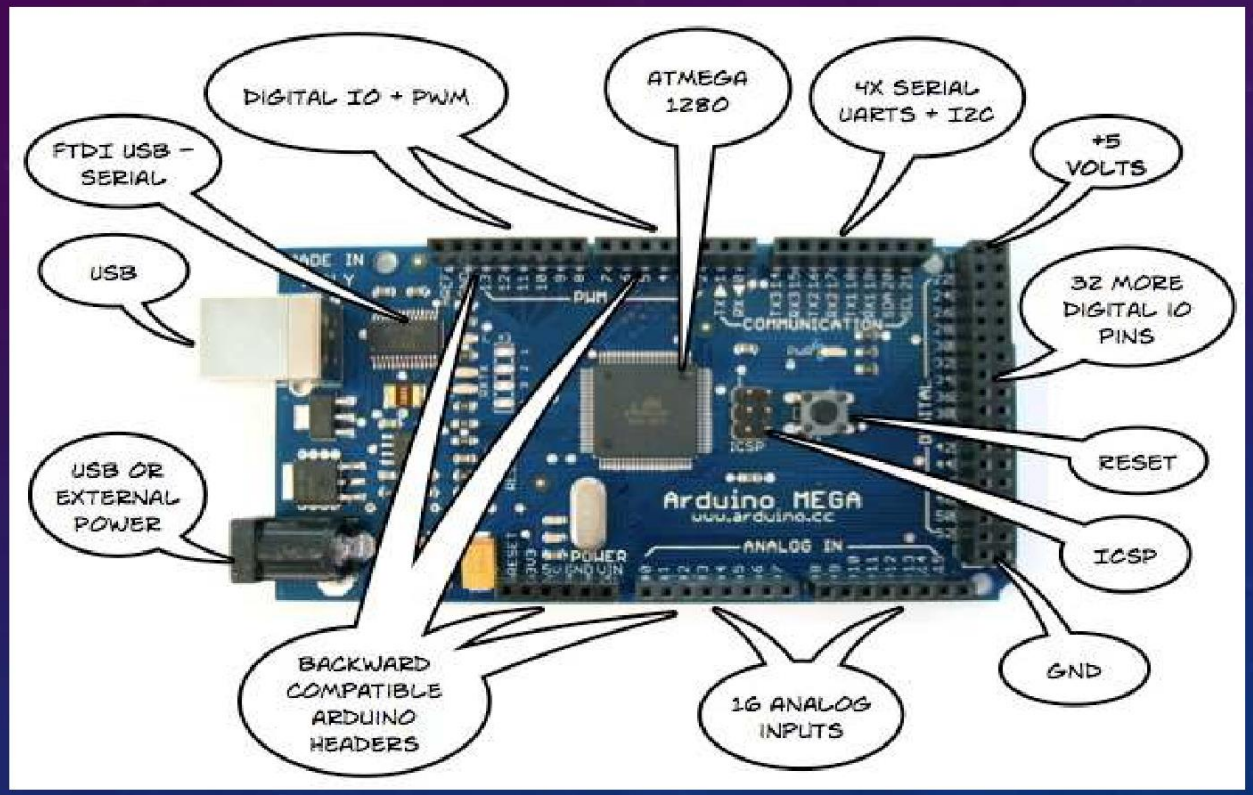
# Prototyping Tools

- Hardware
- Software

# Hardware

- Cheap and accessible, thanks to maker community
- Community knowledge
- Microcontroller and single board computer kits
- Electronic components
- Circuit board manufacturing
- 3D printing
- CNC

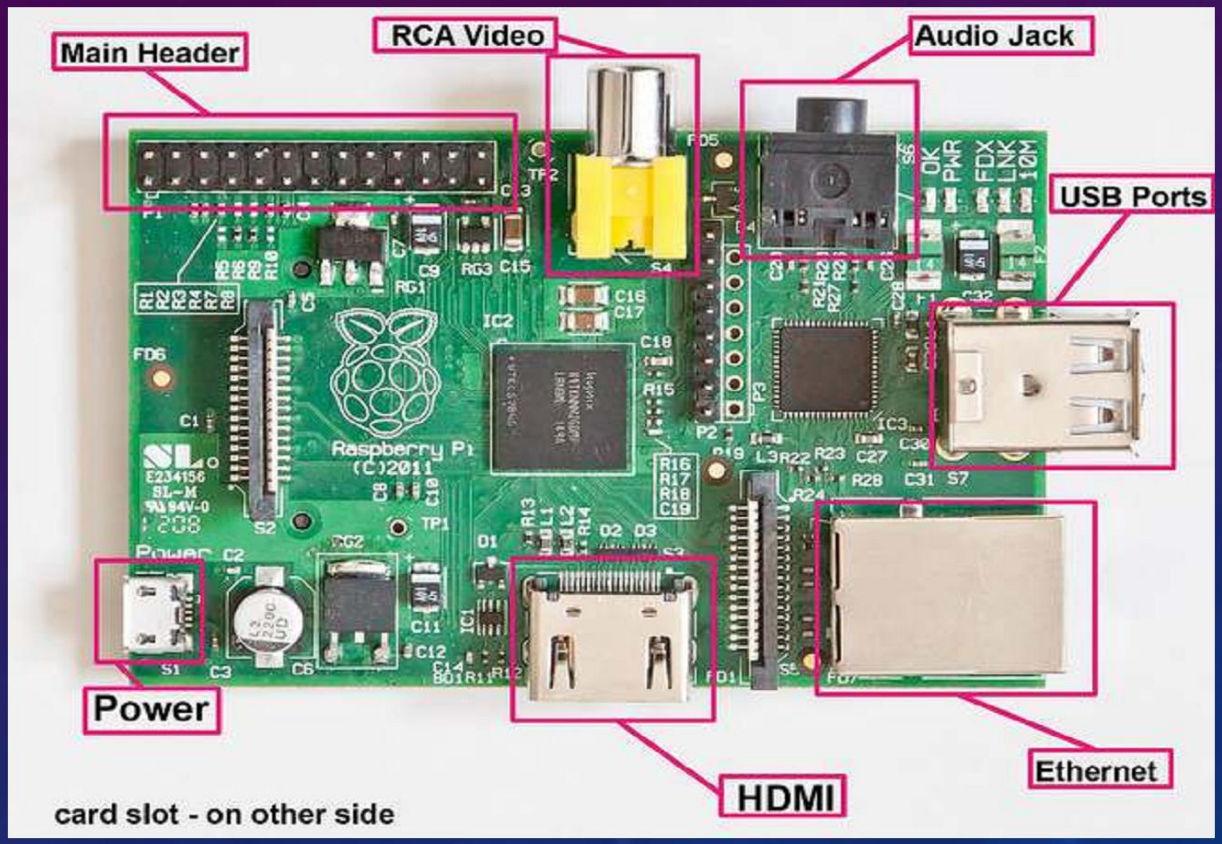
# ARDUINO MEGA




$10-$45
Connector/interfaces to plug in wide variety of components
Program in Wiring (C-like) with Arduino IDE
Battery powered

No OS
Limited programming tools
Processing power of 1985 PC

# RASPBERRY PI

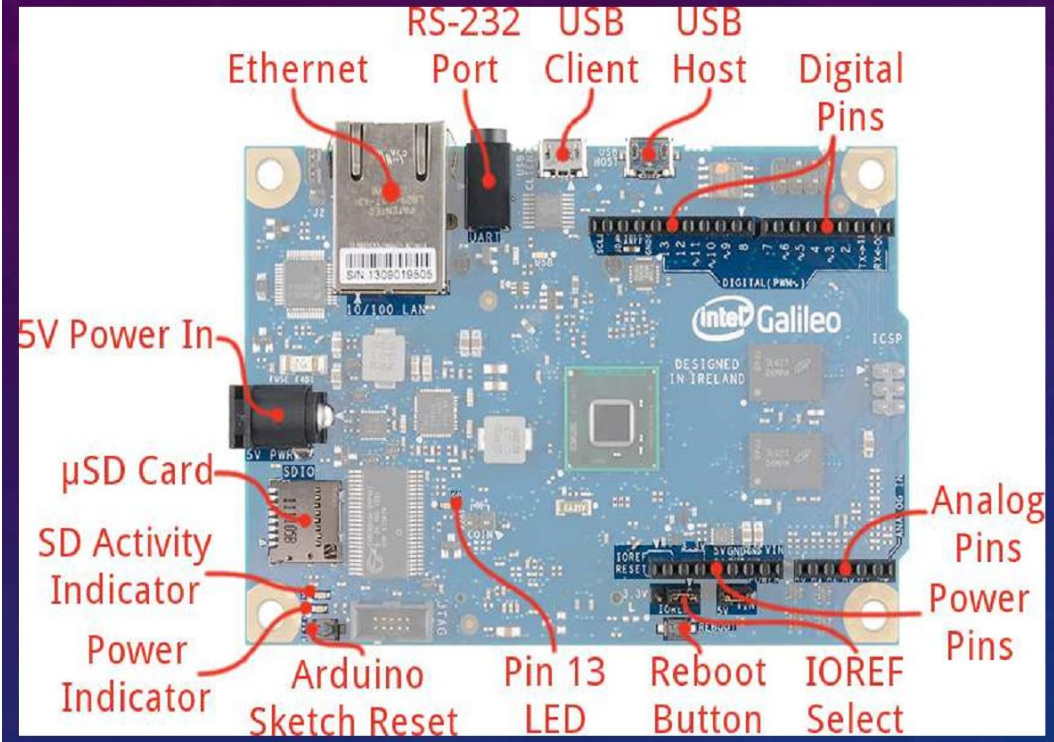


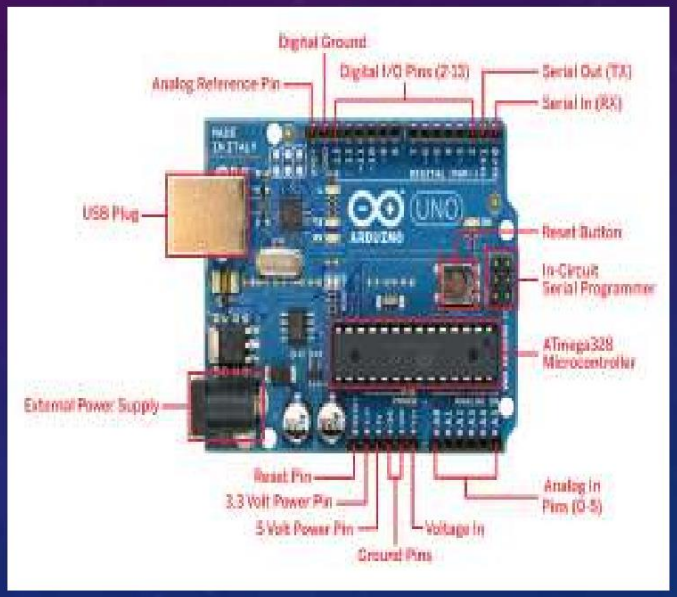

| | | | |
|---|---|---|---|
| 3.3V | 1 | 2 | 5V |
| I2C0 SDA | 3 | 4 | DNC |
| I2C0 SCL | 5 | 6 | GROUND |
| GPIO4 | 7 | 8 | UART TXD |
| DNC | 9 | 10 | UART RXD |
| GPIO 17 | 11 | 12 | GPIO 18 |
| GPIO 21 | 13 | 14 | DNC |
| GPIO 22 | 15 | 16 | GPIO 23 |
| DNC | 17 | 18 | GPIO 24 |
| SP10 MOSI | 19 | 20 | DNC |
| SP10 MISO | 21 | 22 | GPIO 25 |
| SP10 SCLK | 23 | 24 | SP10 CE0 N |
| DNC | 25 | 26 | SP10 CE1 N |

$35-$45
May need extra parts to connect sensors
Program in Python, C, PHP, JavaScript, no Arduino

Linux
Video/keyboard/ethernet connectors
Processing power of 1995 PC

# INTEL GALILEO




$60

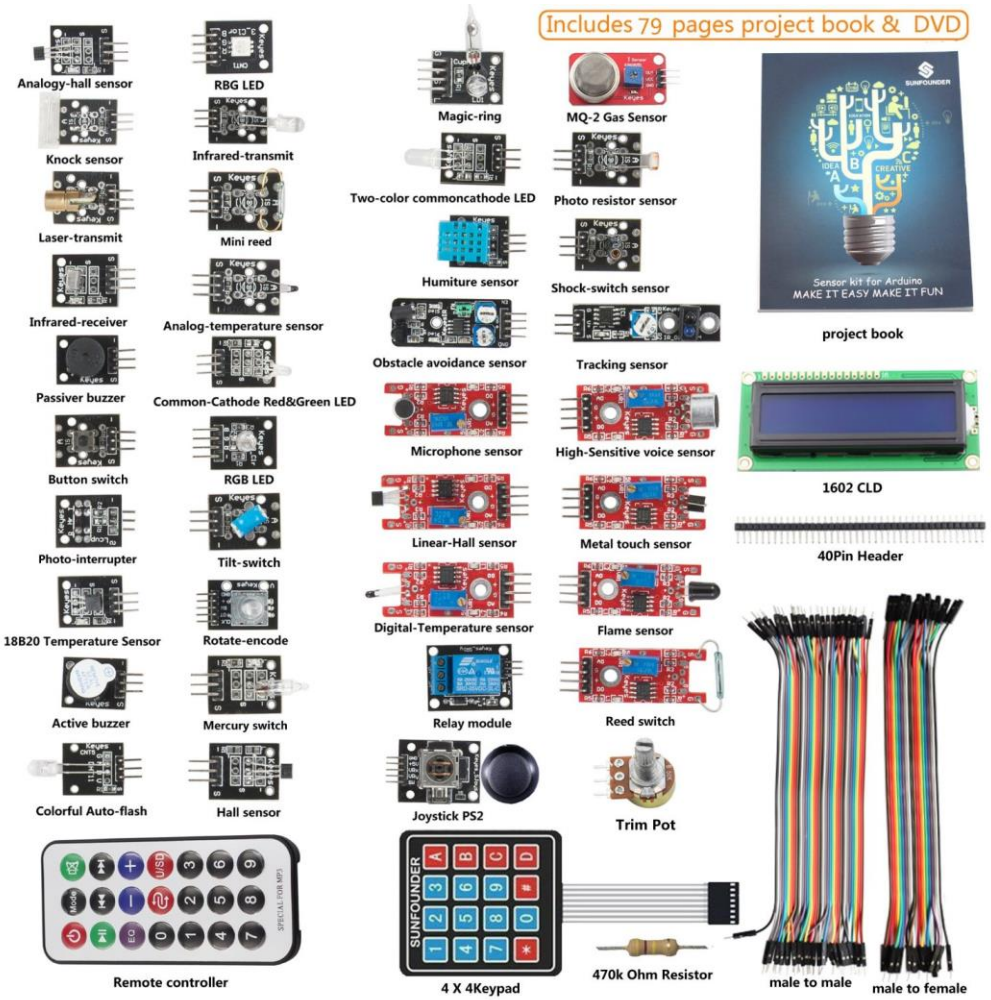
Arduino compatible, software and hardware

Program in Python, C, PHP, JavaScript, Wiring

Linux

Processing power of 1995 PC

# Sensors


Includes 79 pages project book & DVD
Analogy-hall sensor
RBG LED
Knock sensor
Infrared-transmit
Laser-transmit
Mini reed
Infrared-receiver
Analog-temperature sensor
Passiver buzzer
Common-Cathode Red&Green LED
Button switch
RGB LED
Photo-interrupter
Tilt-switch
18B20 Temperature Sensor
Rotate-encode
Active buzzer
Mercury switch
Colorful Auto-flash
Hall sensor
Remote controller
Magic-ring
MQ-2 Gas Sensor
Two-color commoncathode LED
Photo resistor sensor
Humiture sensor
Shock-switch sensor
Obstacle avoidance sensor
Tracking sensor
Microphone sensor
High-Sensitive voice sensor
Linear-Hall sensor
Metal touch sensor
Digital-Temperature sensor
Flame sensor
Relay module
Reed switch
Joystick PS2
Trim Pot
4 X 4Keypad
470k Ohm Resistor
Sensor kit for Arduino
MAKE IT EASY MAKE IT FUN
project book
1602 CLD
40Pin Header
male to male
male to female

# Actuators

# Connecting Controller with Sensors & Actuators

- Hardware
  - Digital output: Turn on LED
  - Digital input: Is switch on?
  - Analog input: Voltage indicates temperature
  - Analog output: Voltage determines brightness of LED, position of servo (analog comes from PWM)
- Software
  - Libraries to read and write pins

# WHERE TO BUY STUFF

| | Notes |
|---|---|
| amazon.com | Can get lot of stuff here shipped very quickly |
| adafruit.com | Lot of cool info about arduino, rpi, educational material, kits, components |
| makershed.com | Maker community, kits, educational material |
| raspberrypi.org | All info about raspberrypi |
| maker.intel.com | Info about galileo board |
| dexterindustries.com | Robotics for raspberrypi and lego |
| Sparkfun.com | Lot of sensors and kits for arduino, rpi |
| Coocox.org | More peripherals and boards |
| Freetronics.com | Lot of arduino compatible stuff |
| Sainsmart.com | Lot of peripherals and sensors for arduino |
| Codeduino | Lot of info about arduino and projects |
| Avnet.com, digikey.com, mouser.com, frys, RS | Lot of electronic peripherals |

Check Shieldlist.org for a complete list

# Programming Tools

**Micro-controller**

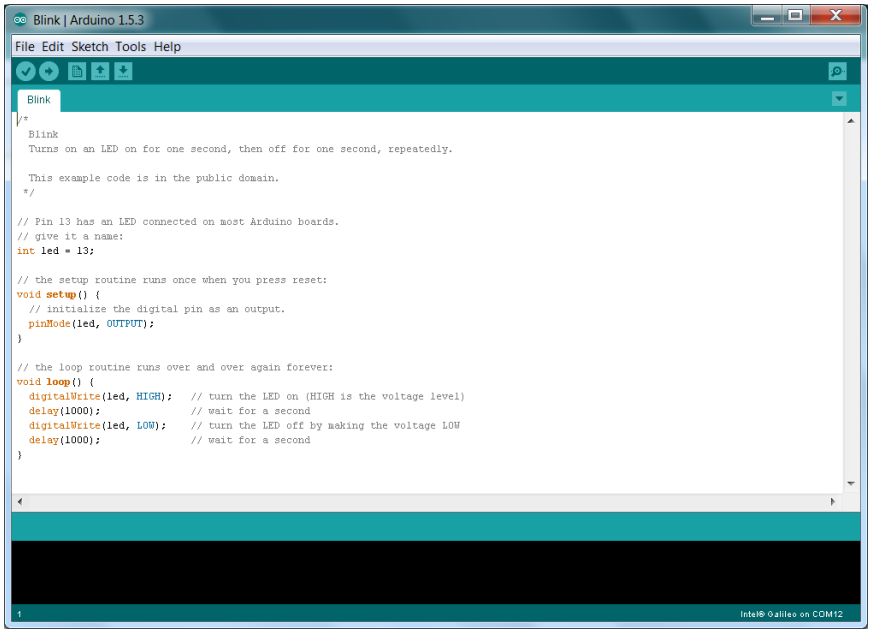
- Arduino: Wiring (C-like)
- Netduino: C#
- Tessel:  Javascript

**Single Board Computer**

- Raspberry Pi
- Intel Gallileo

# Arduino IDE

- Arduino/Galileo
- Wiring/C
- Write code on laptop, push & run on arduino
- Simple, easy to use
- Many code examples and libraries
  - LED to web server
- Limited software tools
  - No debuggers
- Good enough when not much software



# Command Line

- Raspberry Pi/Galileo
- ssh to device
- linux
- vi
- C/python/node/PHP

# ARM Linux Distributions

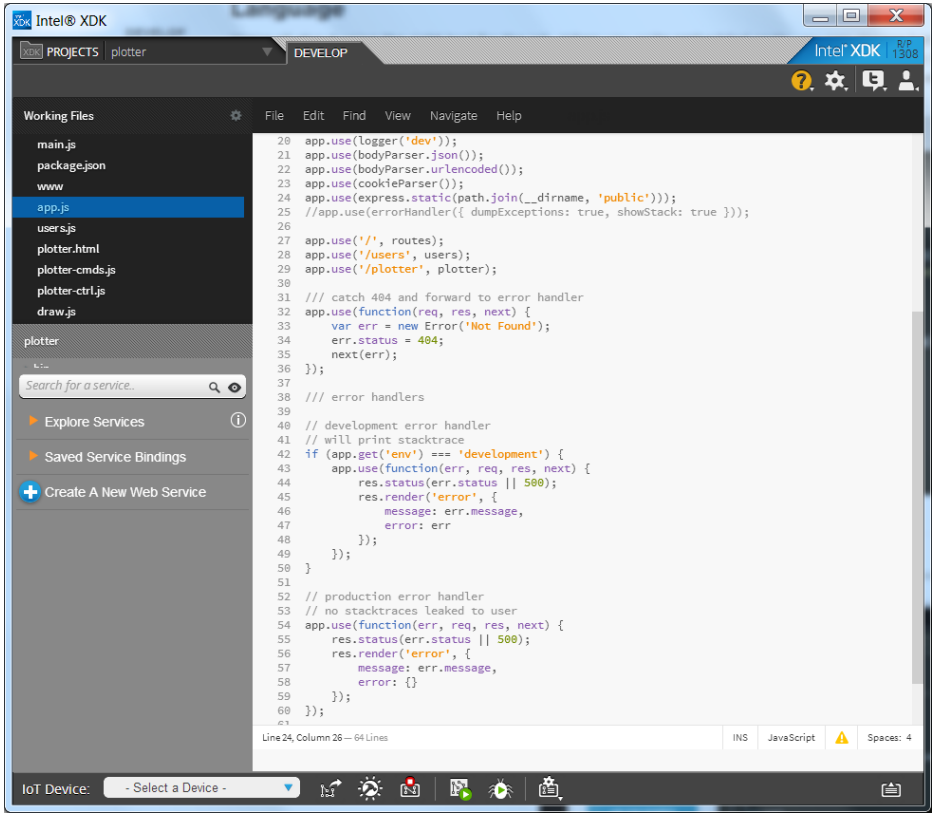
- Raspberry Pi processor not compatible with Debian ARM
- Use Raspbian
- Compile/build on raspberry pi
  - Can be slow (5-10x!)
- Cross-build on desktop
- Nginx instead of Apache + php

# Galileo Linux Distributions

- Debian not compatible with x86 processor in Galileo
- Intel provides minimal linux
- Unofficial package repo: http://alextgalileo.altervista.org/package-repo-configuration-instructions.html
- Apache + php
- Official package repo coming soon

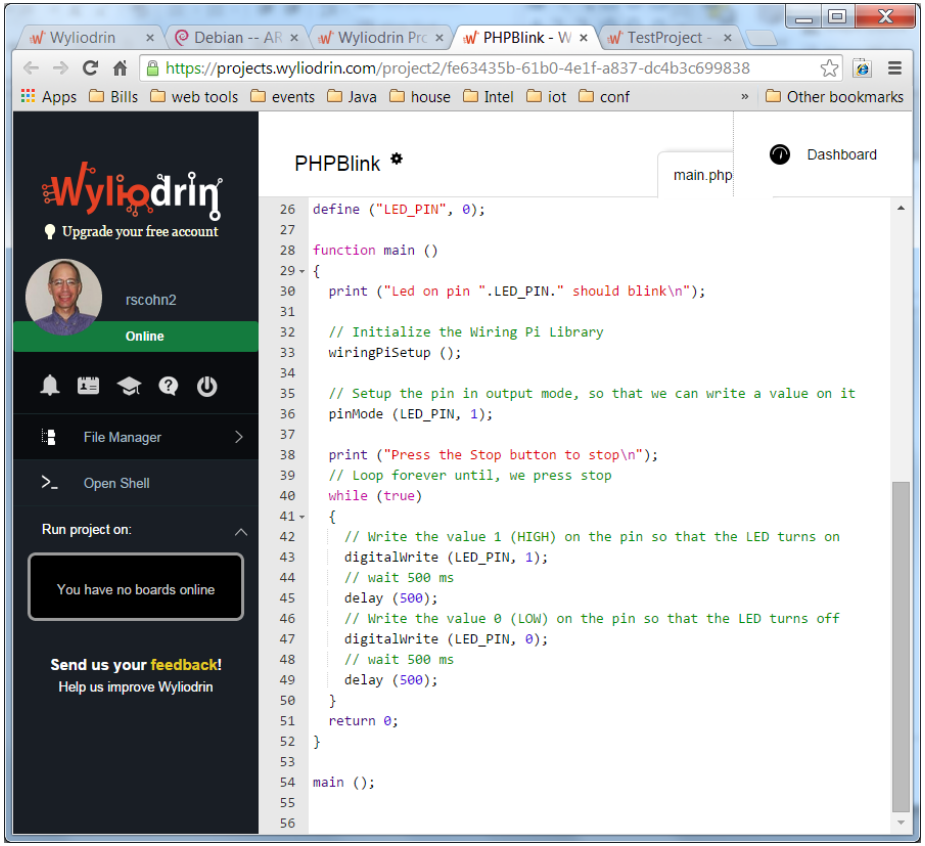
# NodeJS With Intel XDK + Galileo

- Program Galileo with NodeJS
- Add packages to package.json
- Push project to galileo
- NPM install on galileo
- Launch app, see console on desktop
- Remote debugger
- Released on September 30



# Wyliodrin

- Runs in browser-cloud based
- Server push apps to device
- Galileo & Raspberry Pi
- Visual Programming, Python, Javascript, Arduino, Shell Script, C, C++, C#, ObjC, Pascal, Perl, PHP



# IoT Hello World

- Blinking LED
- Browser controlled LED

# Which Language?

- Best support for accessing pins:
  - Wiring (similar to C)
  - Python
  - Javascript
- Best support for making web interface
  - PHP
  - Python
  - Javascript

# Demo: Toaster

- http://youtu.be/XkxyECSDN7Y
- “This is both ridiculous and AMAZING!!!”

# Experiences

- Mechanical aspects can be time consuming
- Electrical is quick
  - Need to be more careful
- Software was easy

# Summary

- IoT will affect every aspect of your life
- Combination of hardware, software, design
- Built on web technologies
  - Everything you already know will be useful
- Fun & easy to experiment & learn