IoT
Moving from Hobbies to the Real World
(an embedded view)

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IoT - Definition

Sensor network	➡	Embedded
Control Devices	➡	Soft-Embedded
Platform	➡	Performance Software
Analytics	➡	Distributed Computing Software
Application	➡	GP/Web Software
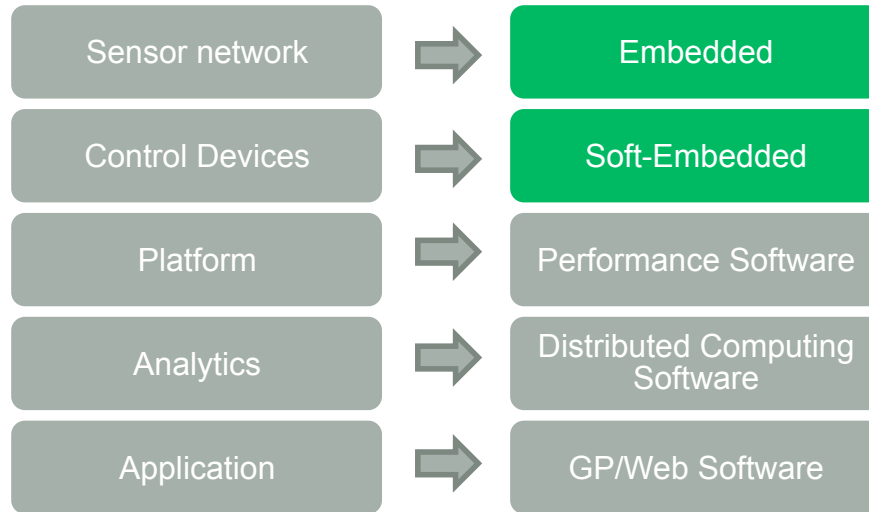
Software Stack that we are familiar with

- Linux distributions customized for Raspberry Pi:
  - Raspbian (Debian GNU/Linux for Raspberry Pi).
  - Raspbmc (XBMC for Raspberry Pi).
  - Arch Linux ARM.
  - Many more distributions in development.
- Python, Ruby, C, Bash Shell available by default.
- Most software from Debian ecosystem is available for download and installation on Raspbian.

Javascript –
      johnny-five.io
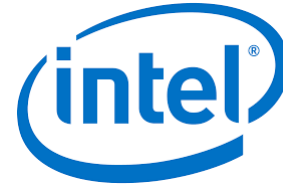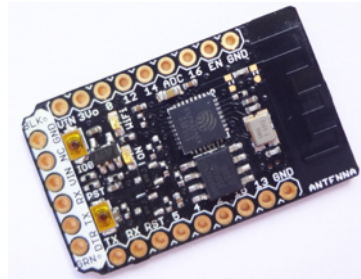   cylon.js
      …

Open hardware platforms for IoT

Some Quick Examples...

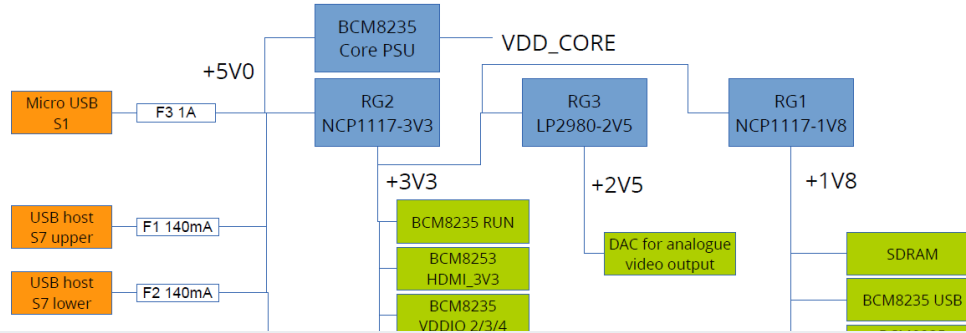Do you recognize this devices? See how they can be easily connected to the new Internet of Things

Is this good for 6.5Billion connected things?

Micro-Controller Unit's

http://embedded-computing.com/27279-an-iot-development-kit-comparison/#

Raspberry Pi Architecture

BCM8235
Core PSU

VDD_CORE

+5V0

Micro USB
S1

F3 1A

RG2
NCP1117-3V3

RG3
LP2980-2V5

RG1
NCP1117-1V8

+3V3

+2V5

+1V8

USB host
S7 upper

F1 140mA

BCM8235 RUN

USB host
S7 lower

F2 140mA

BCM8253
HDMI_3V3

BCM8235
VDDIO 2/3/4

DAC for analogue
video output

SDRAM

BCM8235 USB
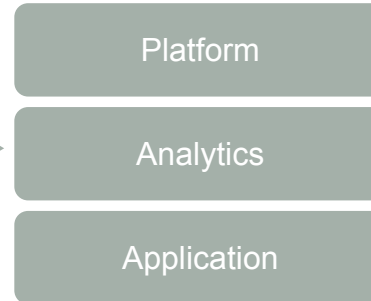
Regulator

Electronics

LAN9512 USB hub
and Ethernet

Camera conn
S5

GPIO
P1

Chris Jones, Martin Jones Technology Ltd
23 February 2014
http://www.martin-jones.com/

Raspberry Pi is a General Purpose Computer

MCU – Comparison parameters

- Compute
- Memory
- I/O Peripherals
- Sensors
- Wireless
- Tools
- Cloud Support
- *Cost*

| Platform |
| Analytics |
| Application |

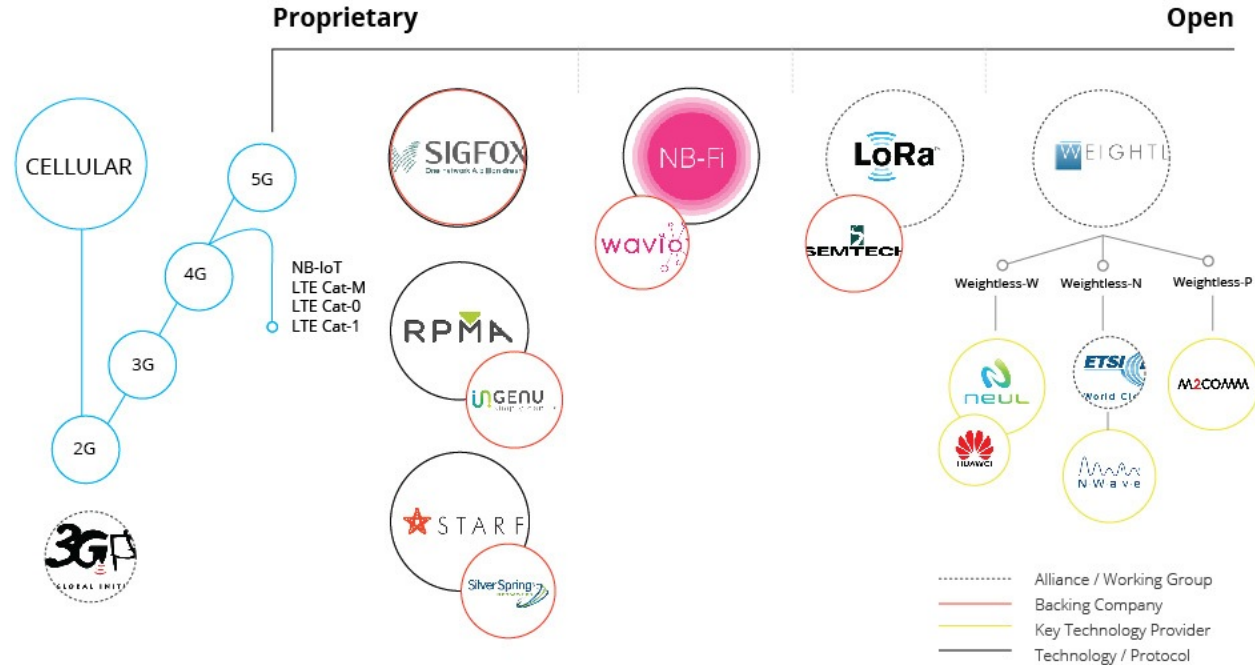http://embedded-computing.com/27279-an-iot-development-kit-comparison/#

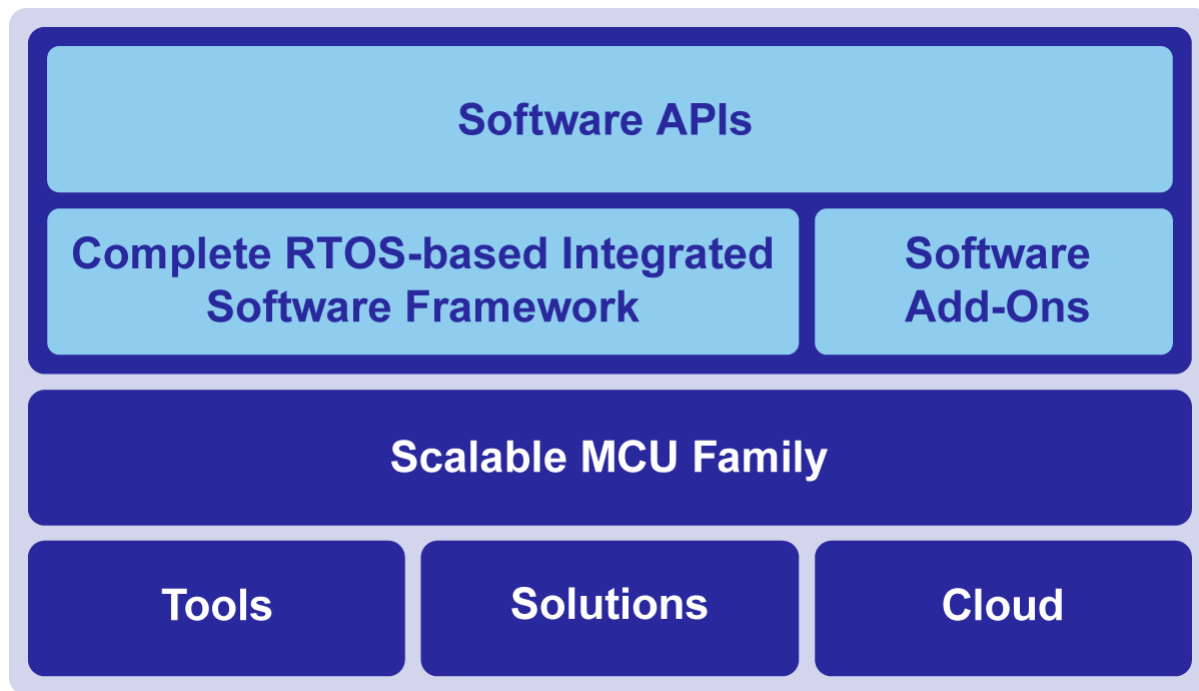|	Compute	Memory	I/O & Peripherals	Wireless	Tools	Cloud	Cost
Atmel SAM W25 Xplained Pro[2]	48 MHz ARM Cortex-M0+ MCU	• 8 MB Serial Flash	• Atmel Data Gateway Interface • GPIO • I2C • UART • USB • SPI • Virtual COM	• 802.11 b/g/n Wi-Fi	• Atmel Studio • Embedded Debugger	• Arrayent • Exosite • Proximetry • PubNub • wot.io • Zatar	$42.65
Imagination Creator Ci40[3]	550 MHz dual-core, dual-threaded MIPS32 InterAptiv CPU	• 256 MB DDR3 SDRAM • 512 MB NAND Flash	• ADC • EJTAG • GPIO • I2C • mikroBUS • PWM • Raspberry Pi B+ • SPI • UART	• 2x2 802.11 b/g/n/ac Wi-Fi • 802.15.4 (6LoWPAN) • Bluetooth 4.1	• FlowCloud SDK	• FlowCloud	$52
Marvell EZ-Connect MW302[4]	200 MHz Cortex-M4F MCU	• 512 KB SRAM • External QSPI Flash	• ADC • DAC • GPIO • I2C • I2S • JTAG • PWM • SPI • UART • USB 2.0	• 1x1 802.11 b/g/n Wi-Fi	• Marvell AWS IoT Starter SDK • Eclipse • ARM GNU Compiler/ Debugger • OpenOCD	• AWS IoT • Arrayent • Ayla • Evrythng • Xively	$49
Texas Instruments Simple-Link Wi-Fi CC3200 LaunchPad[5]	80 MHz ARM Cortex-M4 MCU	• 256 KB RAM • External SPI Flash • ROM Bootl-oader • 32-chan-nel μDMA	• ADC • I2C • I2S • Parallel Camera • PWM • SDMMC • SPI • UART	• 802.11 b/g/n Wi-Fi	• Code Composer Studio • GNU Com-piler/De bugger • OpenOCD • IAR Embed-ded Work-bench	• AWS IoT • Arrayent • Exosite • IBM IoT Cloud • Xively	$29.99

A bit more on wireless support

LPWAN IoT Market
(Low-Power Wide Area Network)

Proprietary   Open

CELLULAR — 5G, 4G, 3G, 2G

NB-IoT
LTE Cat-M
LTE Cat-0
LTE Cat-1

3GPP GLOBAL INITIATIVE

SIGFOX — The network is the answer

RPMA — INGENU

STARF — Silver Spring

NB-Fi — wavio

LoRa — SEMTECH

WEIGHTLESS — Weightless-W, Weightless-N, Weightless-P

neul — Huawei

ETSI World Class — NWave

M2COMM

Legend:
- Alliance / Working Group
- Backing Company
- Key Technology Provider
- Technology / Protocol

Renesas Stack (as an example) - Yesterday

Beyond the silicon…
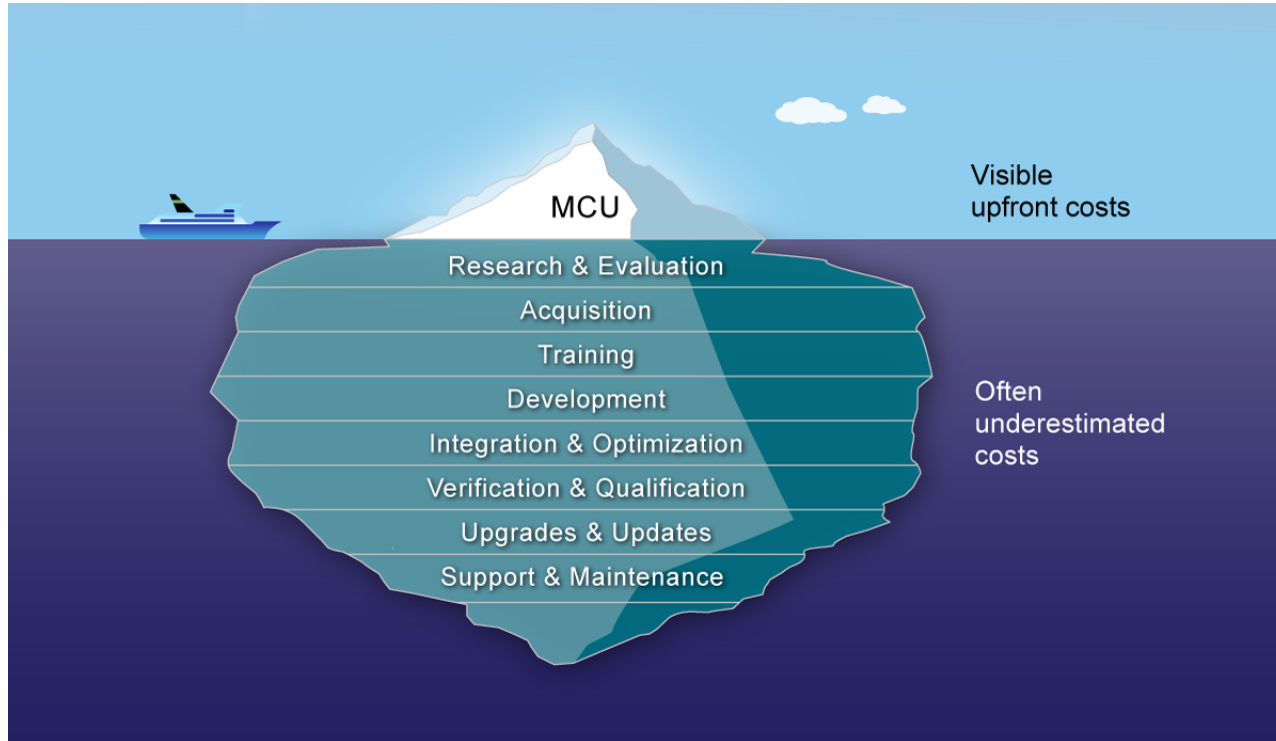
Renesas Synergy (as an example) - Today

Approach to get into real-world

Proof of Concept
- Cost doesn't matter
- Raspberry Pi, Arduino or anything at your disposal

Prototype
- Go as close to product as possible (98% is good)
- Usability designs are important (in B2B, serviceability)

Build
- Endless nights, and masala chai

Benchmark
- Understand your key implementation parameters
- Compare and contrast technical considerations

Cycle
- Go back with learnings until remaining 2% is perfect

satisfaction

solution cost

Thank you

Choose your problem

Choose your platform

Solve