Bachelor Project – RIOT in the Internet of Things

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TODAY

(1) RIOT Introduction

(2) Setup Work Environment

(3) Project Introduction

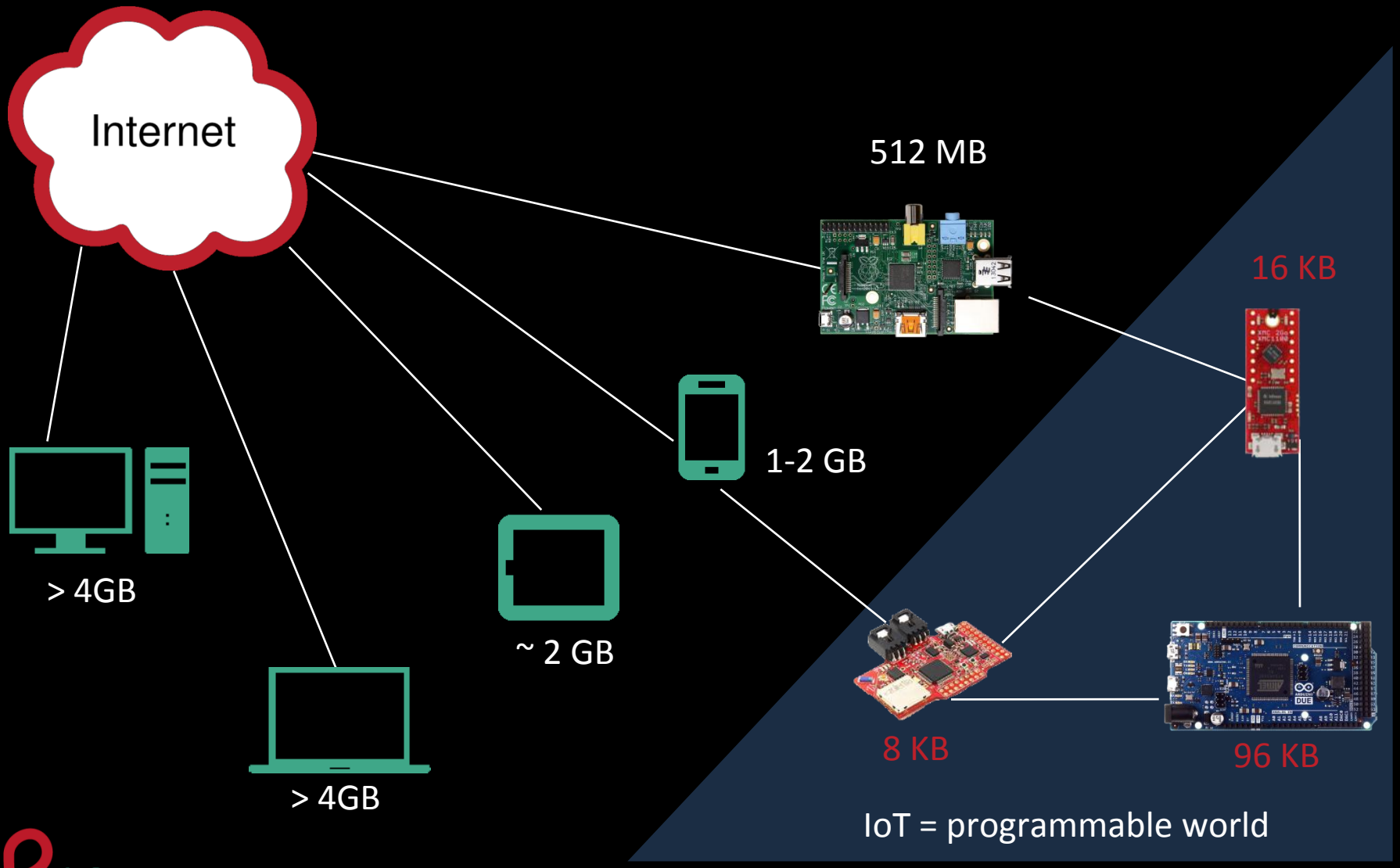
(4) Recent and future RIOT Projects

(5) RIOT Tutorial

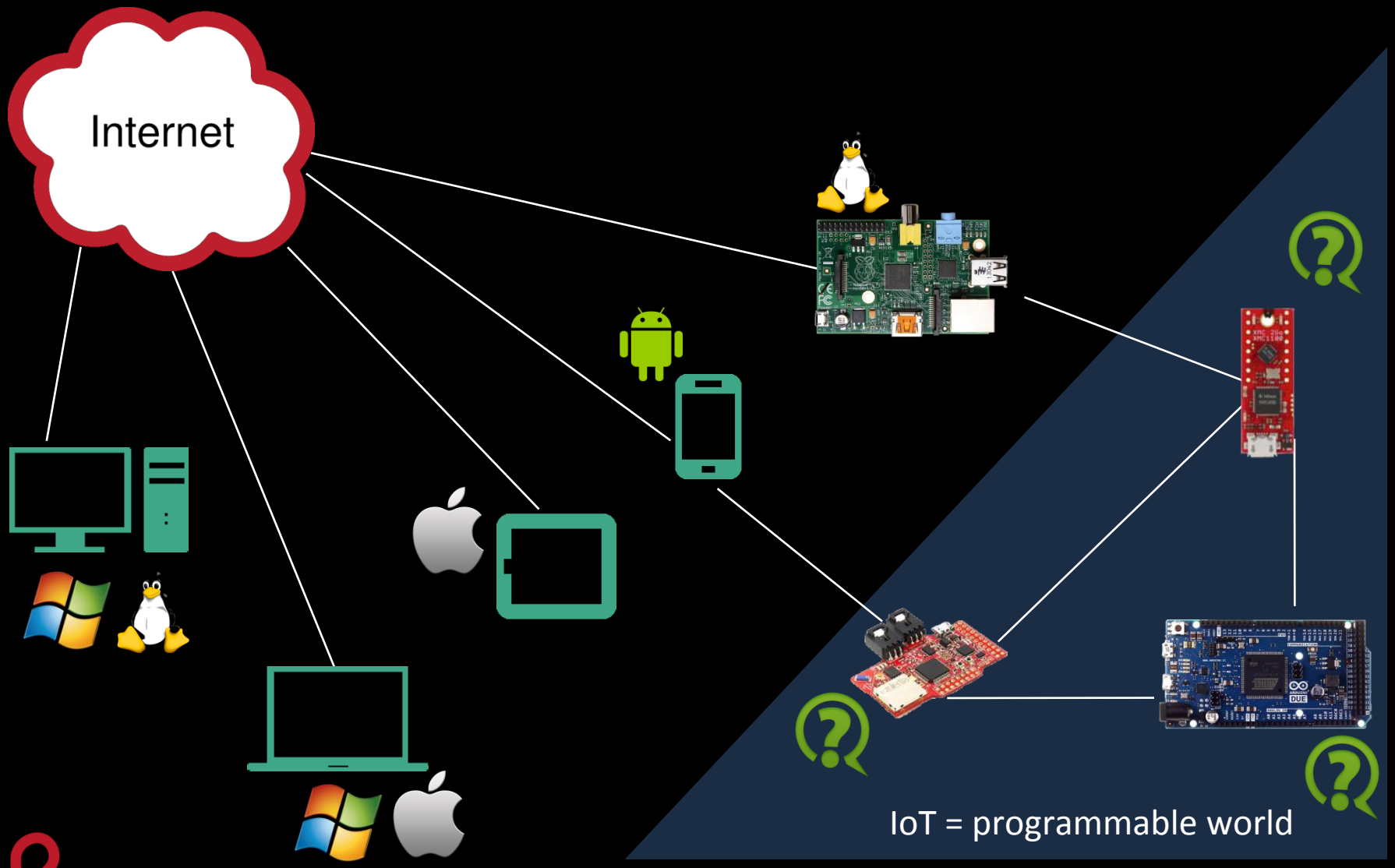
AGENDA

- Internet of Things: Which OS?
- RIOT in a nutshell
- RIOT user and developer evolution
- Roadmap

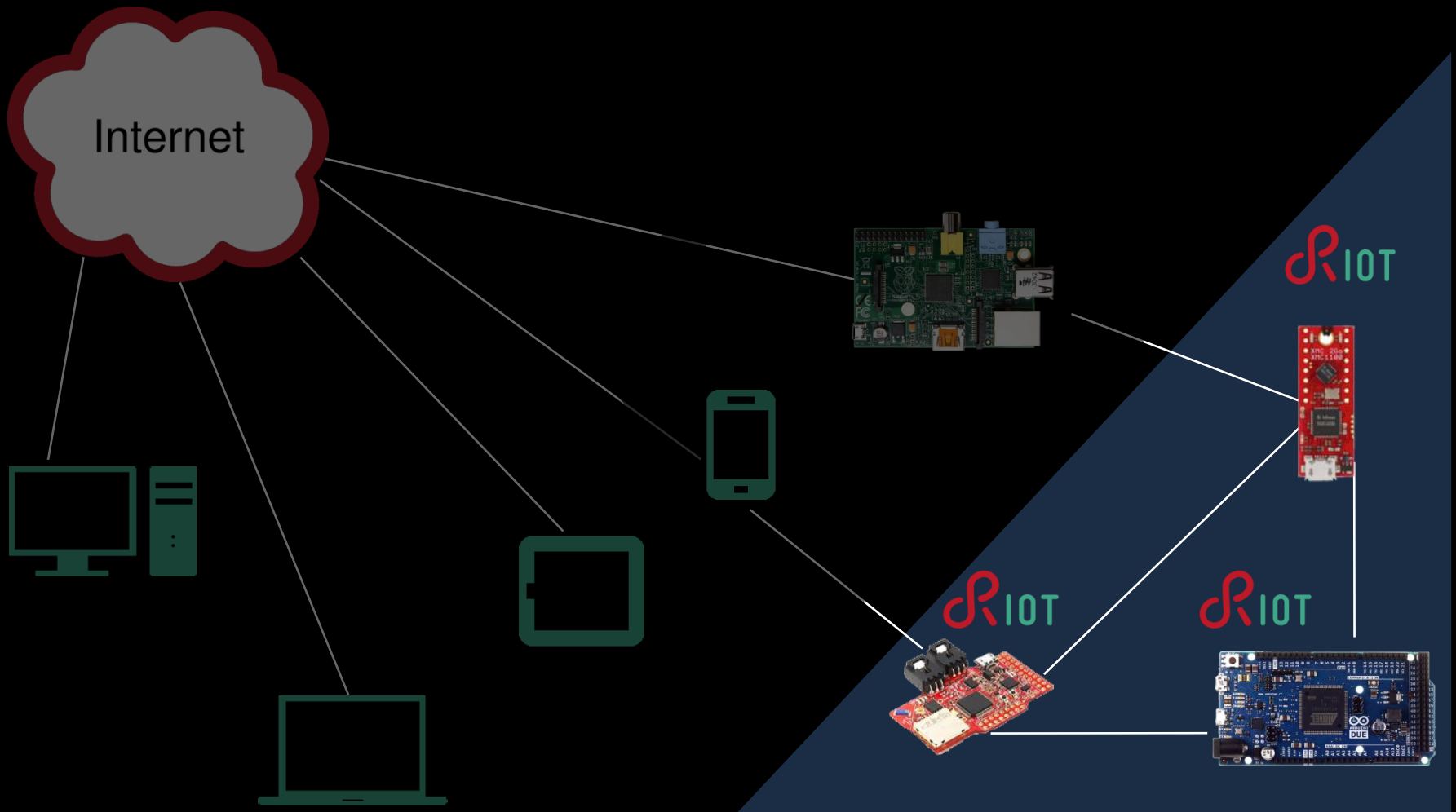
The Internet of Things (IoT)



IoT: The operating system question



RIOT: The friendly IoT operating system



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RIOT: Positioning

"If your IoT device cannot run Linux, then run RIOT!"

- RIOT requires only a few kB of RAM/ROM, and small CPU
- With RIOT, code once & run heterogeneous IoT hardware
  - 8bit hardware (e.g. AVR)
  - 16bit hardware (e.g. MSP430)
  - 32bit hardware (e.g. ARM Cortex-M)

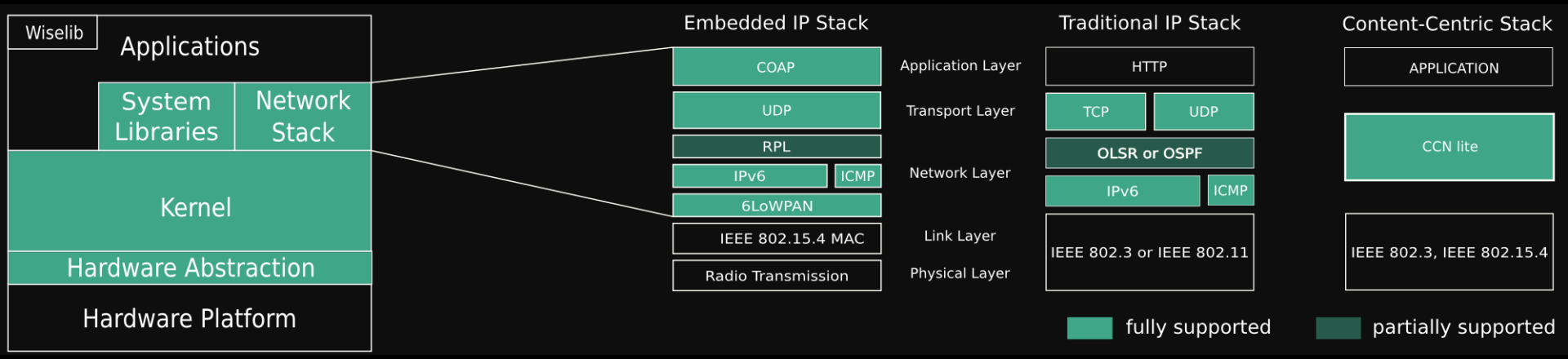
RIOT: Fact sheet

- µ-kernel-like architecture(for robustness)
- Modular design (for adaptivity)
- Tickless scheduler (for energy efficiency)
- Deterministic O(1) scheduling (for real-time)
- Low latency interrupt handling (for reactivity)
- Preemptive multi-threading & powerful IPC
- Efficient hardware abstraction
- Full featured, extendable network-stacks

RIOT: IoT development made easy

- Open source, community-driven
- Write your code in ANSI-C or C++
- Compliant to the most widely used POSIX features such as pthreads and sockets
- No IoT hardware needed for debugging
  - Run & debug RIOT as native process in Linux

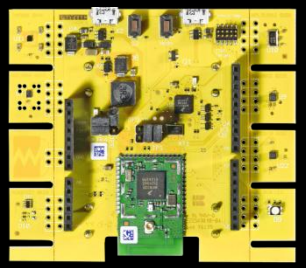
RIOT: Built to connect



- RIOT supports several network stacks
- Open-access protocol specs by the IETF/IRTF
  - e.g. 6LoWPAN, IPv6, CoAP

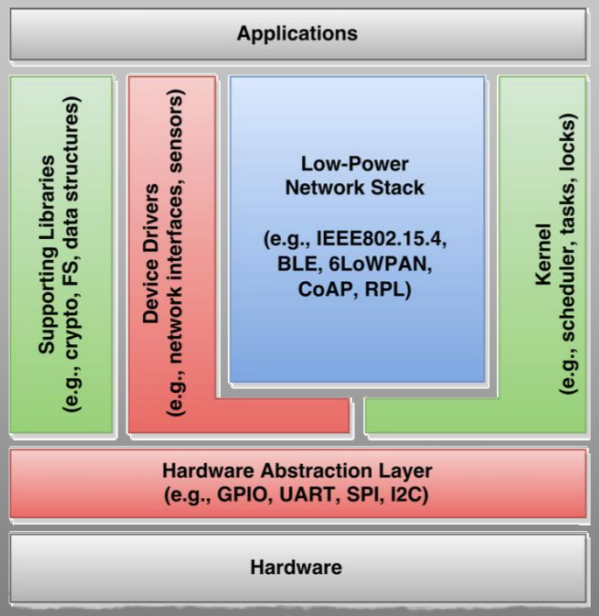
RIOT already runs on a wide range of IoT hardware

Support for > 70 boards, various CPUs, different architectures, radios, sensors, …

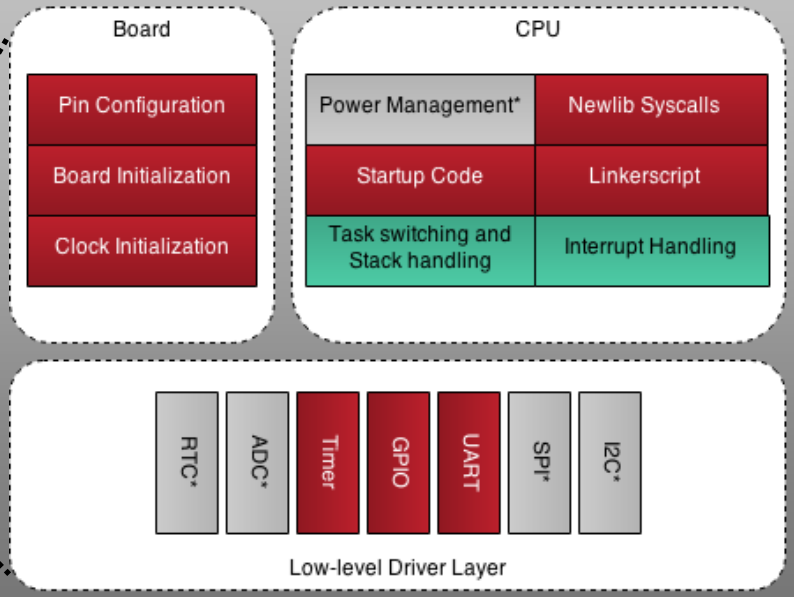


ARDUINO

Minimized Hardware-Dependent Code



Zoom on Board & CPU



Red: must have

Green: must have but shared by all ports with same architecture

Grey: optional for initial porting

RIOT

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RIOT Origins

History

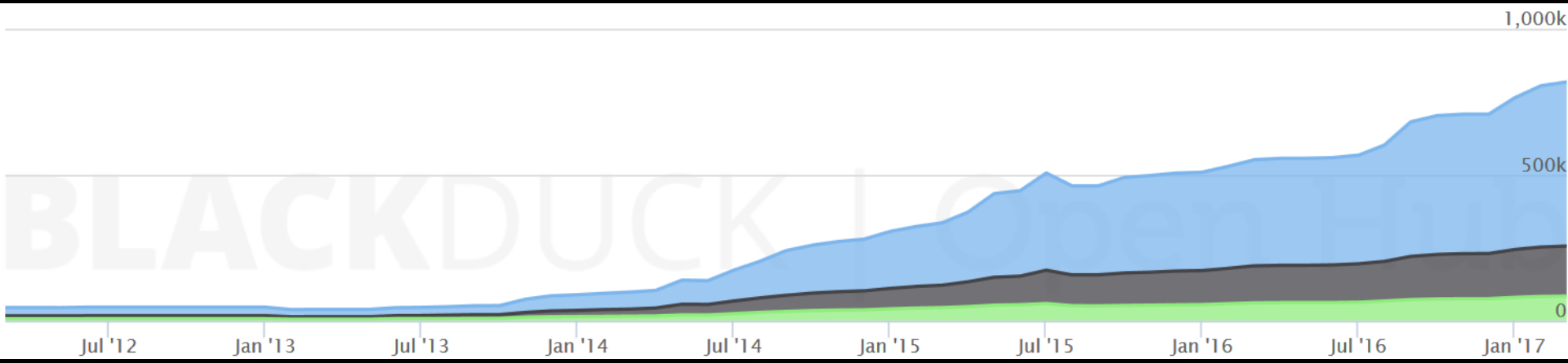
- 2008 – Project roots:
  The kernel was started
  as part of a research project
- 2010 – Towards the IoT:
  Implementation of 6LoWPAN
  and RPL was initiated
- 2013 – RIOT goes public:
  Branding of RIOT started,
  source code moved to Github

Founding institutions

RIOT stats

194 contributors, 90 active in last 12 months

from industry, academia and makers scene-



Estimated cost: $8.5M, 154 person-years [1]

[1] source: www.openhub.net/p/RIOT-OS estimate using the basic COCOMO Model

Join the RIOT

- World-wide, open source community
- ~ 730 forks on GitHub
  https://github.com/RIOT-OS/RIOT
- Hundreds on the developer mailing list: devel@riot-os.org
- Developers from Asia, Europe, North America, South America
- Support & discussions on IRC:
  irc.freenode.org #riot-os

Some Active Supporters

Embedded World 2015, 2016, 2017

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Roadmap 2017

- Network stack developments
  - Optimization, BLE support, new ICN features …
  - Application layer protocols (MQTT, Rest, …)
- Deployment tools
  - Over-the-air application updates, over-the-air OS update...
- More development tools
  - Advanced test-framework, including distributed testing
  - Distributed application framework
- Cloud interface and integration

RIOT

https://github.com/RIOT-OS/Tutorials