
IOT

- Why?
- How?
- What is RIOT?

Why a software platform for IoT?

- Linux, Android… bare-metal?

Memory ~ 32kB

Memory ~ 8kB

- But as IoT software evolves…
  - more complex pieces, e.g. an IP network stack
  - evolution of application logic

- … non-portable IoT software slows innovation

  90% of IoT soft. should be hardware-independent

  → this is achievable with a good software platform
  (but not if you develop bare-metal)

Goals for an IoT software platform

- ✓ faster innovation by spreading IoT software dev. costs
- ✓ long-term IoT software robustness & security
- ✓ trust, transparency & protection of IoT users' privacy
- ✓ less garbage with less IoT device lock-down

- Why?
- How?
- What is RIOT?

How to achieve our goals?

- Experience (e.g. with Linux) points towards:
  - **open source**
  - **free core**
  - **driven by a grassroots community**

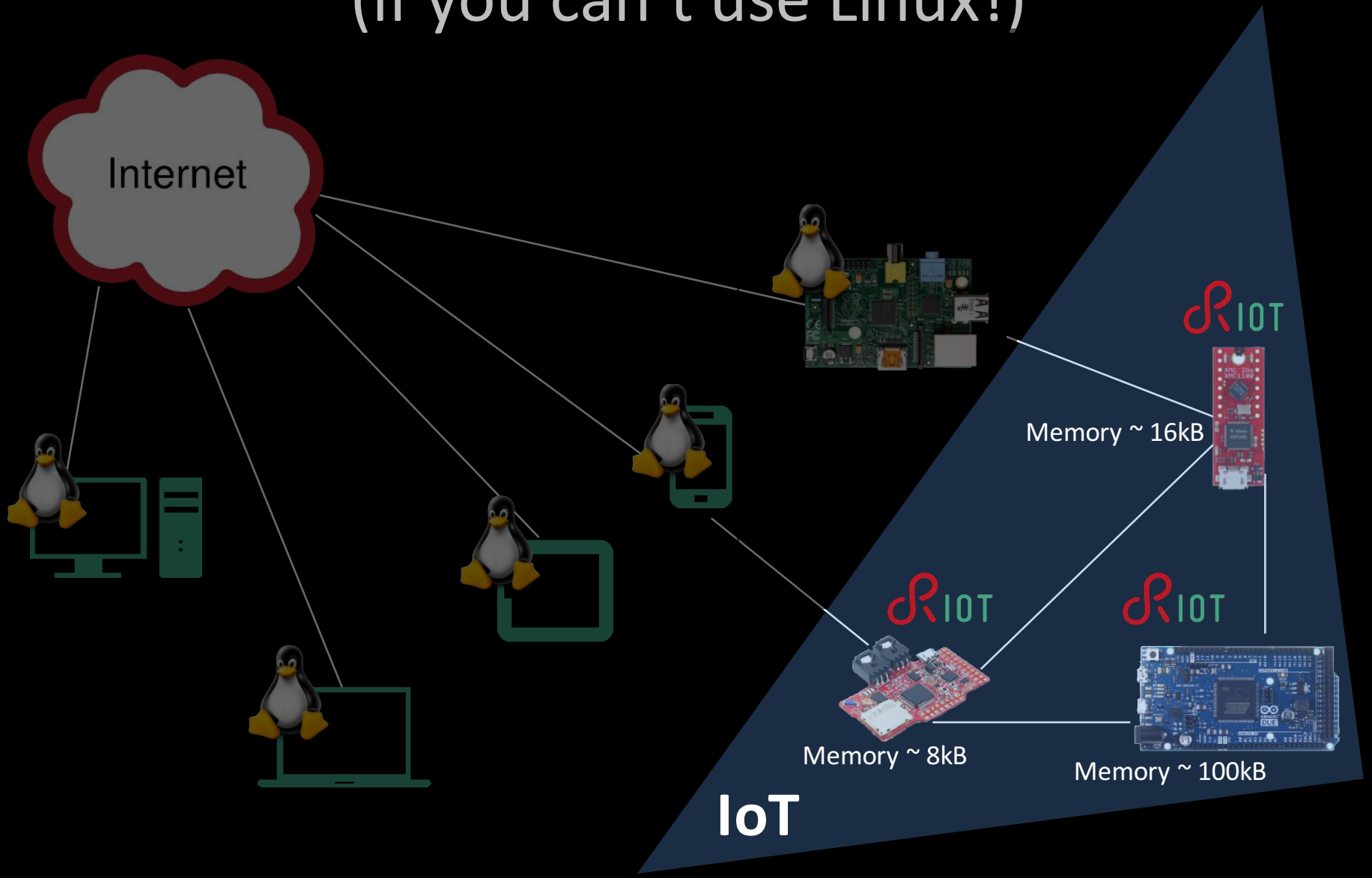
Indirect business models

Geopolitical neutrality

- Why?
- How?
- What is RIOT?

RIOT : an OS that fits IoT devices

(if you can't use Linux!)



RIOT : an OS that fits IoT devices

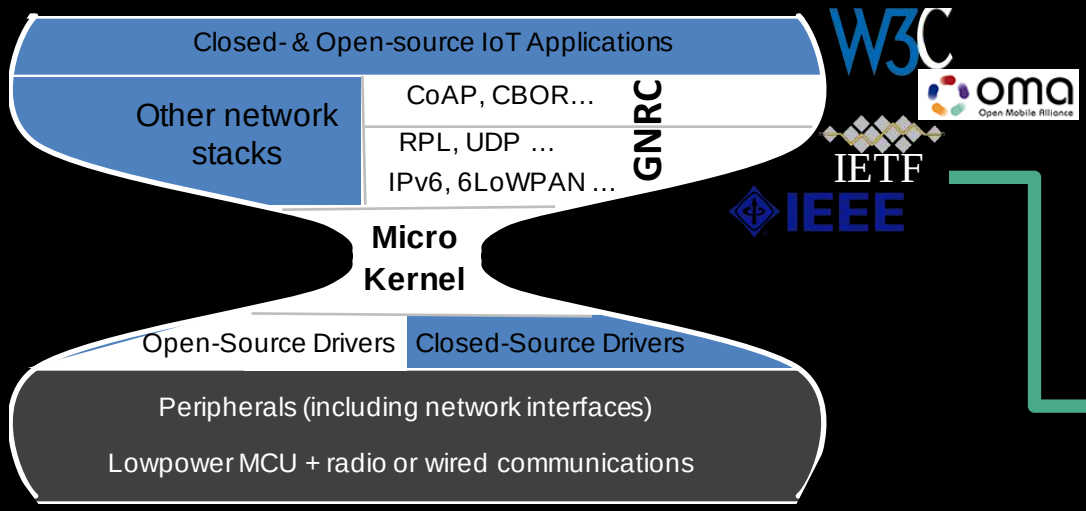
- RIOT is the combination of:

  - ❑ memory & energy efficient design to fit IoT devices

  - ❑ functionalities of a full-fledged operating system

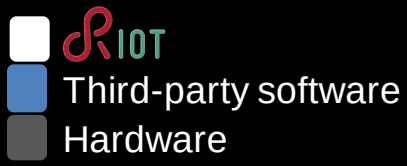
    - ✓Advanced, consistent APIs across 32-bit, 16-bit, 8-bit hardware
    - ✓Full-featured, extensible network stacks
    - ✓Well-known dev. tools, standard C and C++ programming
    - ✓Easy integration of third-party software packages

RIOT in one slide



RIOT = a plaftorm for **portable IoT software** based on:

- open-source
- open-access protocol specs
- community-driven development



Hardware Independent IoT Code

RAM/ROM usage on a Cortex-M IoT device

	Hardware Specific				
Configuration	**Platform**	**Drivers**	**Kernel**	**Net**	**Σ**
ROM					
minimal	1,754	0	854	0	2,816
WSN default	4,684	6,183	2,233	4,105	37,002
gnrc_minimal	2,732	4106	2,140	12,298	27,524
gnrc	3,675	4138	2,700	30,985	74,752
RAM					
minimal	656	0	2,022	0	2,880
WSN default	681	0	2,022	2,066	6,344
gnrc_minimal	676	0	2,022	2,990	7,016
gnrc	676	0	2,022	15,815	20,828

With a simple application over a IPv6/6LoWPAN stack in RIOT, 95% of the code is hardware-independent and/or reusable (and appplication code is completely portable).

Third-party IoT code & tools

- Packages (similar to BSD ports) for third-party open source code
  - ✓ Use code not initially developed for RIOT
  - ✓ Use code not even initially developed for IoT!

Package	Overall Diff Size	Relative Diff Size
libcoap	639 lines	6.3 %
libfixmath	34 lines	0.2 %
lwip	767 lines	1.3 %
micro-ecc	14 lines	0.8 %
relic	24 lines	<0.1 %

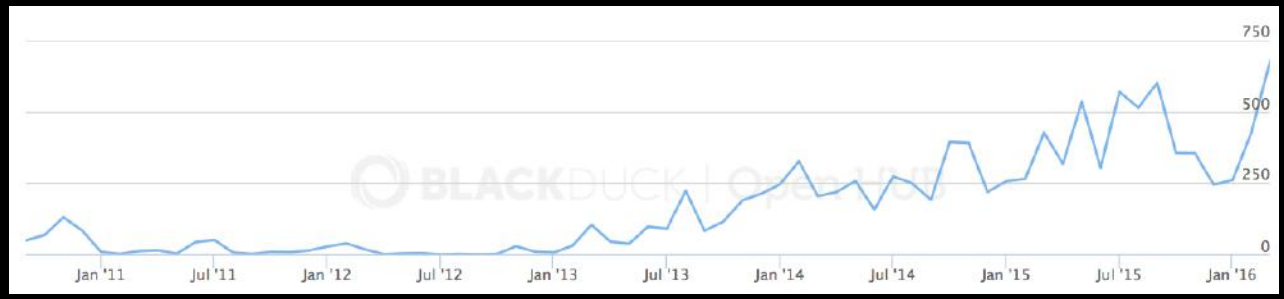
→ Only small porting effort needed! (negligible % LoC)

- Interoperates with common systems standards
  - ✓ Run & debug as native process in Linux
  - ✓ Use of well-known debug tools enabled
  - → Shorter development life-cycles


GDB
The GNU Project Debugger
Valgrind
WIRESHARK
OpenOCD

RIOT Today

- 115+ contributors from all around the world
- Contributions from industry academia, makers/tinkerers



RIOT Commits/Month. Source: BlackDuck OpenHUB

- 60+ boards: various CPU architectures, radios, sensors…