

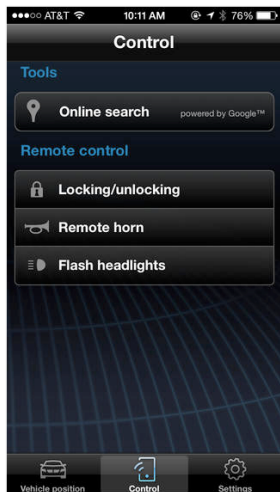
Tock Operating System

Amit Levy^a, Niklas Adolfsson^c, Bradford Campbell^b, Paul Crews^a, Mateo Garcia^a, Branden Ghenab^b, Daniel Giffin^a, Shane Leonard^a, Pat Pannuto^b, Hubert Teo^a, Prabal Dutta^b, Philip Levis^a

SenSys Tutorial
November 5, 2017

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The Internet of Things (IoT)



A Security Disaster

The Economist

World politics

Business & finance

Economics

Science & technology

Culture

Cyber-security

The internet of things (to be hacked)

Hooking up gadgets to the web promises huge benefits. But security must not be an afterthought

Jul 12th 2014 | From the print edition



217



594

How the Internet of Things Could Kill You

By Fahmida Y. Rashid JULY 18, 2014 7:30 AM - Source: Tom's Guide US | 5 COMMENTS

Hacking the Fridge: Internet of Things Has Security Vulnerabilities

JESS SCANLON | MORE ARTICLES

JUNE 28, 2014

Philips Hue LED smart lights hacked, home blacked out by security researcher

By Sal Cangeloso on August 15, 2013 at 11:45 am | 7 Comments

- HP conducted a security analysis of IoT devices¹
 - ▶ 80% had privacy concerns
 - ▶ 80% had poor passwords
 - ▶ 70% lacked encryption
 - ▶ 60% had vulnerabilities in UI
 - ▶ 60% had insecure updates

¹http://fortifyprotect.com/HP_IoT_Research_Study.pdf

A Secure Embedded Operating System for Research and Use

But the World is Changing...

“An embedded system is a computerized system that
is purpose-built for its application.”

Elicia White
Making Embedded Systems, O'Reilly

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THE MUST-HAVE PEBBLE TIME APPS, WATCH FACES, AND GAMES FOR YOUR WRIST

By Joshua Sherman — April 25, 2017 6:34 AM

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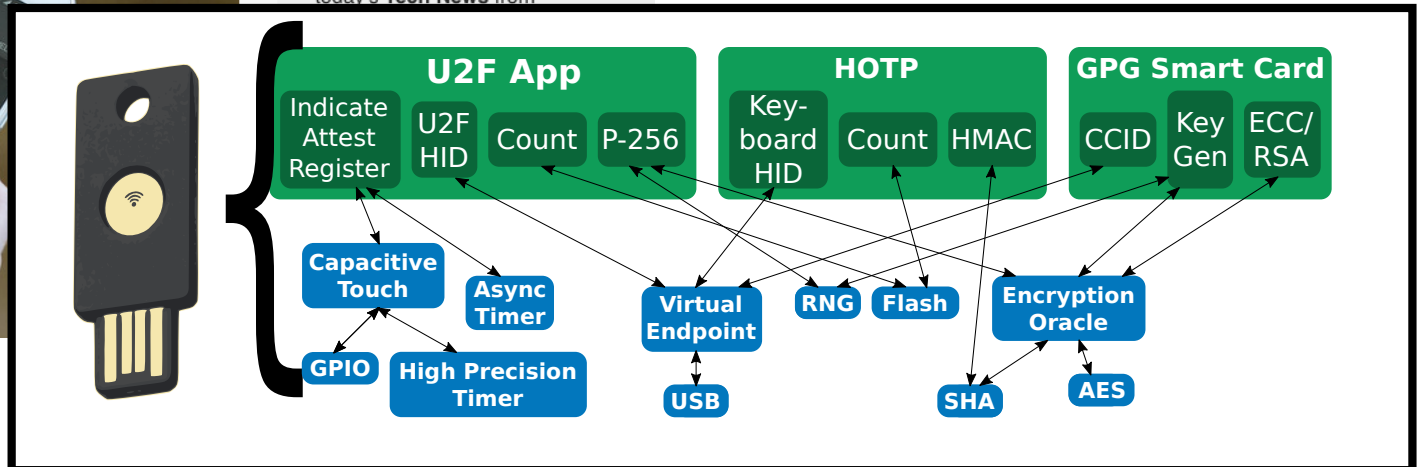


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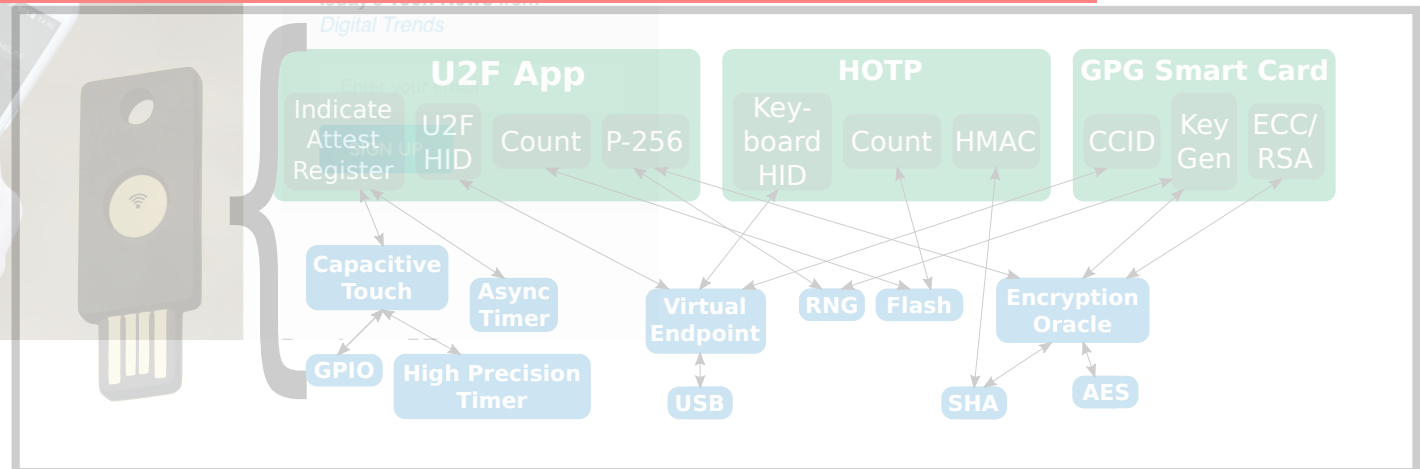
Making Embedded Systems, O'Reilly



But the World is Changing...

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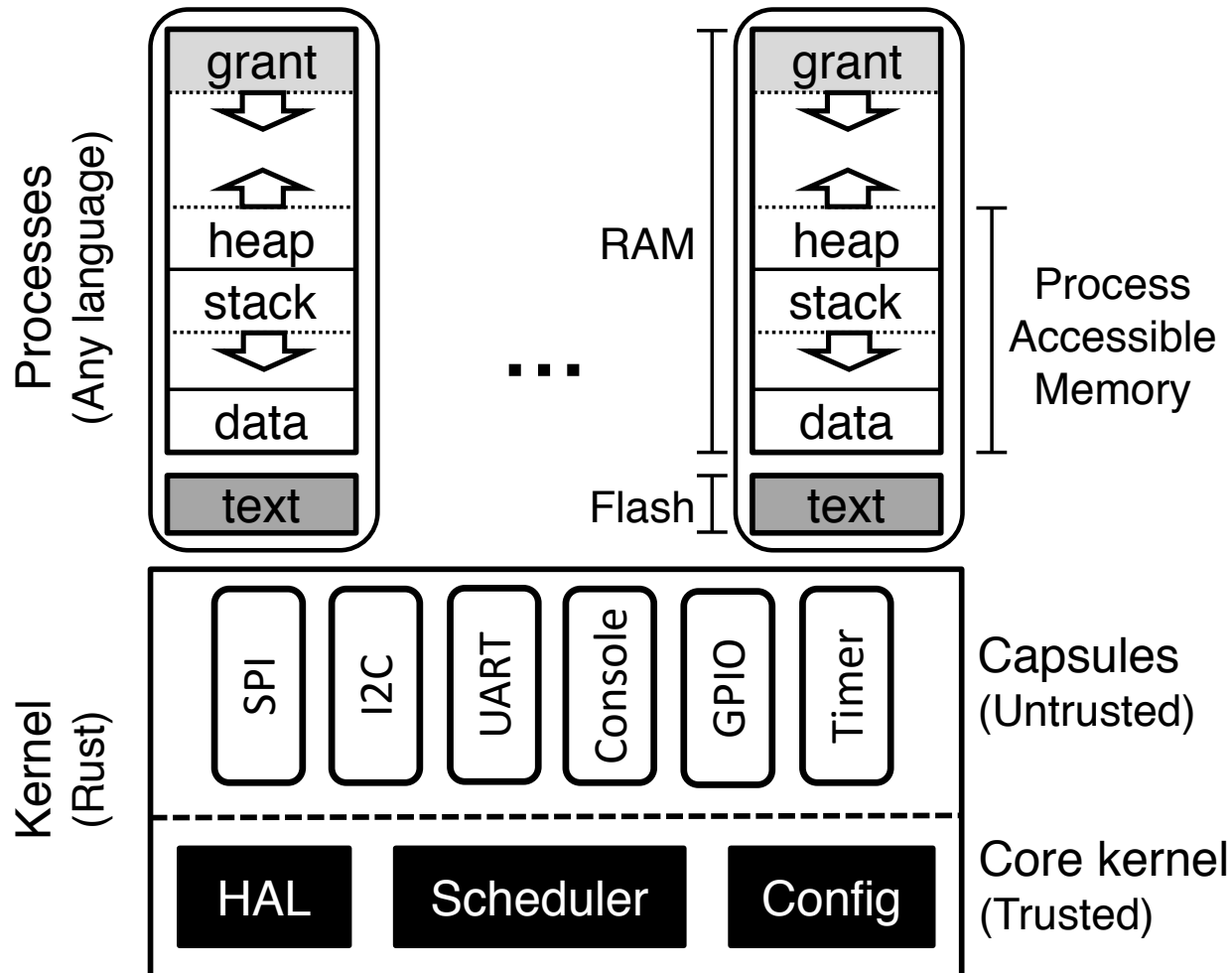
A new class of embedded devices, that act as platforms supporting loadable programs within a particular application domain.



Tock Operating System

- Safe, multi-tasking operating system for memory-constrained devices
- Core kernel written in Rust, a safe systems language
 - Small amount of trusted code (can do unsafe things)
 - Rust bindings for memory-mapped I/O
 - Core scheduler, context switches
- Core kernel can be extended with *capsules*
 - Safe, written in Rust
 - Run inside kernel
- *Processes* can be written in any language (asm, C)
 - Leverage Cortex-M memory protection unit (MPU)
 - User-level, traps to kernel with system calls

Tock Architecture



Tock Operating System

- Safe, multi-tasking operating system for memory-constrained devices
- Core kernel written in Rust, a safe systems language
 - Small amount of trusted code (can do unsafe things)
 - Rust bindings for memory-mapped I/O, core scheduler, context switches
- Many new system design and research challenges
 - Writing a kernel in a type safe, not garbage collected language
 - Memory isolation and allocation
- 4 hardware platforms
 - Strong support for research: hail (applications), imix (systems)
 - Some peripherals available: nRF52, Teensy 3.6
- Learn how to use Tock today!

Thanks!

<https://www.tockos.org/>

Amit Levy <levya@cs.stanford.edu>



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Programmable IoT starts at the edge

An embedded operating system designed for running multiple concurrent, mutually distrustful applications on low-memory and low-power microcontrollers.

We'll be giving tutorials this summer and fall. For registration and details head over to the event pages:

- [RustConf 2017](#) (August 17th, Portland, OR)
- [SenSys 2017](#) (November 5th, Delft, The Netherlands)

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↑ Our fearless leader