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From Wireless Badgers to Hacked Light Bulbs

Dr George Oikonomou

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Outline

- Wireless badgers…
- The Contiki OS
- … hacked light bulbs
- Security for IoT Applications
- Research at Bristol

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From Wireless Badgers…

- Overground: Easy
- Underground???
  - GPS won't work…

- Oxford Univ. 2010
- Tunnel structure revealed
- Hardware
  - Custom wireless embedded device
  - Custom antenna
- Software: Contiki!

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The Contiki OS – Early

- 8bit Micro, 32-128 KB Storage, 8-10KB RAM

- A. Dunkels, “Full TCP/IP for 8-bit architectures,” 2003
- uIP ➔ Contiki OS
- uIPv6 (embedded TCP/IPv6)
- Embedded Firmware Size < 128 KB
- RAM Usage < 8 KB

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The Contiki OS – Now

- 32-bit Arm CM3
- 16-32 KB RAM
- 256 – 512 KB Flash

- Dozens of supported platforms (official & unofficial)

Contiki at CES 2014
Thermostats, Lightbulbs and Demos

- http://contiki-os.blogspot.co.uk/2014/01/contiki-products-at-ces-2014.html
- https://www.youtube.com/watch?feature=player_detailpage&v=7qJEQvcu-cQ

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8 July 2014 Last updated at 13:52

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Smart LED light bulbs leak wi-fi passwords

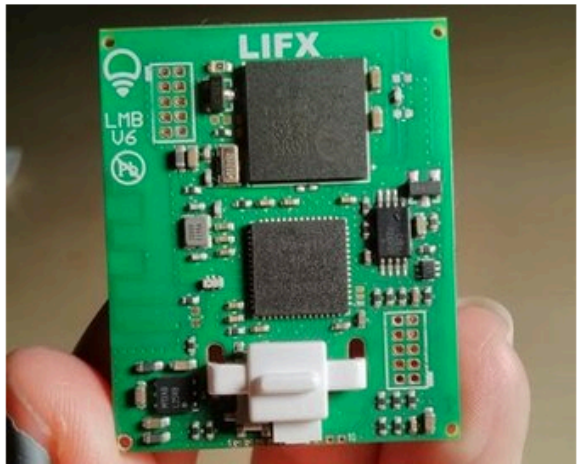
By Jane Wakefield
Technology reporter

Security experts have demonstrated how easy it is to hack network-enabled LED light bulbs.

Context Security released details about how it was able to hack into the wi-fi network of one brand of network-enabled bulb, and control the lights remotely.

The LIFX light bulb, which is available to buy in the UK, has network connectivity to let people turn it on and off with their smartphones.

The firm behind the bulbs has since fixed



http://www.bbc.co.uk/news/technology-28208905

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So, Security? Privacy???

- Location tracking for humans
- Can I hack your window open?

- Crypto?
- 2048 RSA certificate in 32 KB RAM…
- Elliptic Curves (ECDH, ECDSA)

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IoT Research at Bristol

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Bristol researcher instrumental to the success of IoT applications

Press release issued: 1 July 2014

The Internet of Things (IoT), a network of interconnected internet-enabled gadgets, could change the way people live in the future. A University of Bristol researcher is instrumental to the success of Contiki, an open source operating system for the IoT.

Contiki, which connects tiny low-cost, low-power microcontrollers to the internet, has been well-known to the IoT community for a long time. However, it has gained greater visibility following demonstrations of Contiki-powered products at the largest event in the consumer electronics industry, the Consumer Electronics Show (CES 2014), earlier this year.

Dr George Oikonomou, Research Associate in Security for the Internet of Things

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ForToo

- Digital forensics for emerging technologies
- Smartphones
- Social networks
- Internet of Things

This work has been supported by the European Union's Prevention of and Fight against Crime Programme "Illegal Use of Internet" - ISEC 2010 Action Grants, grant ref. HOME/2010/ISEC/AG/INT-002.

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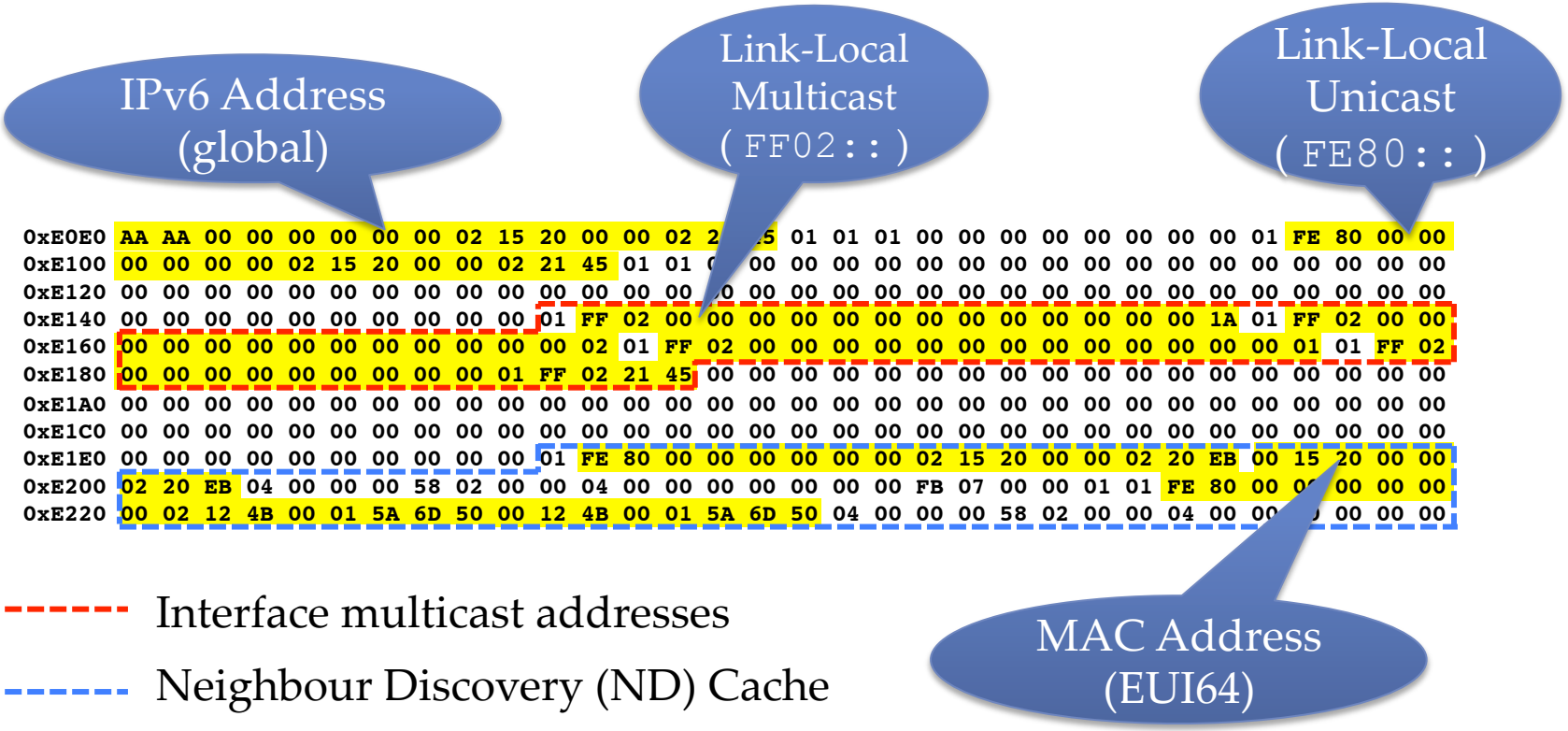
RAM Analysis

RAM Contents of an 8051-based Micro Powered by a Contiki Firmware



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Digital Forensics for the Internet of Things

- Zero-knowledge RAM carving
- Network topology reconstruction

Joint work with V. Kumar, T. Tryfonas, D. Page and I. Phillips

V. Kumar, G. Oikonomou, T. Tryfonas, D. Page, I. Phillips, "Digital Investigations for IPv6-Based Wireless Sensor Networks", Digital Investigation - Special Issue Proc. DFRWS USA 2014, Elsevier, 2014 (in press)

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RERUM

Security, Privacy, Reliability for the IoT

- FP7 STREP: Grant nº 609094
- Start: 1st September 2013
  Duration: 36 months
- Total Cost: €5,196,176.00
- Consortium:
  - 12 partners from 6 countries
  - 2 Local Authorities
- https://ict-rerum.eu

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement nº609094.

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Thank You!

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