IoT Experimentation

Methodological Issues

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Internet of Terror

"An IoT device is nothing more than an embedded system with a TCP/IP stack."

-gnn

This statement defines a model of IoT.

In a ***security article*** from a top tier publication (CACM).

Yet the ***inaccuracy of the model has a direct impact on how we think about security*** for IoT.

viewpoints

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George V. Neville-Neil

Kode Vicious

IoT: The Internet of Terror

If it seems like the sky is falling, that's because it is.

Dear KV,

We are deploying a consumer IoT (Internet of Things) device, with each device connected to a cloud service that acts as the platform from which it will be controlled. The device itself is not dangerous: it is a simple, slimmed-down tablet to be used in hotel chains to replace an alarm clock and TV remote, and to provide access to room service. The device is battery operated, rechargeable, and cheap enough that hopefully no one will want to steal it. Guests cannot load any information into it, and—unlike a typical tablet—it does not serve as a Web browser.

We have an engineer who seems

IoT Experimentation

Core Issues From A Testbed Builder's Perspective

- Modeling experiments
  - What do we need to represent?
  - How do we express models?
- Materialization
  - Good virtualization for all.

Modeling

What's in the box?

- IoT networks
  - Home & Office
  - Industrial Control
  - Medical Facilities
  - Critical Infrastructure
- Classical networks
  - Cloud services
  - Enterprise IT
  - Wide Area Networks
- Human networks
  - Biometric sensing
  - HMI
- Physical systems
  - Sensors
  - Actuators
  - Computer Controllers

Don't think about IoT in isolation!

Modeling

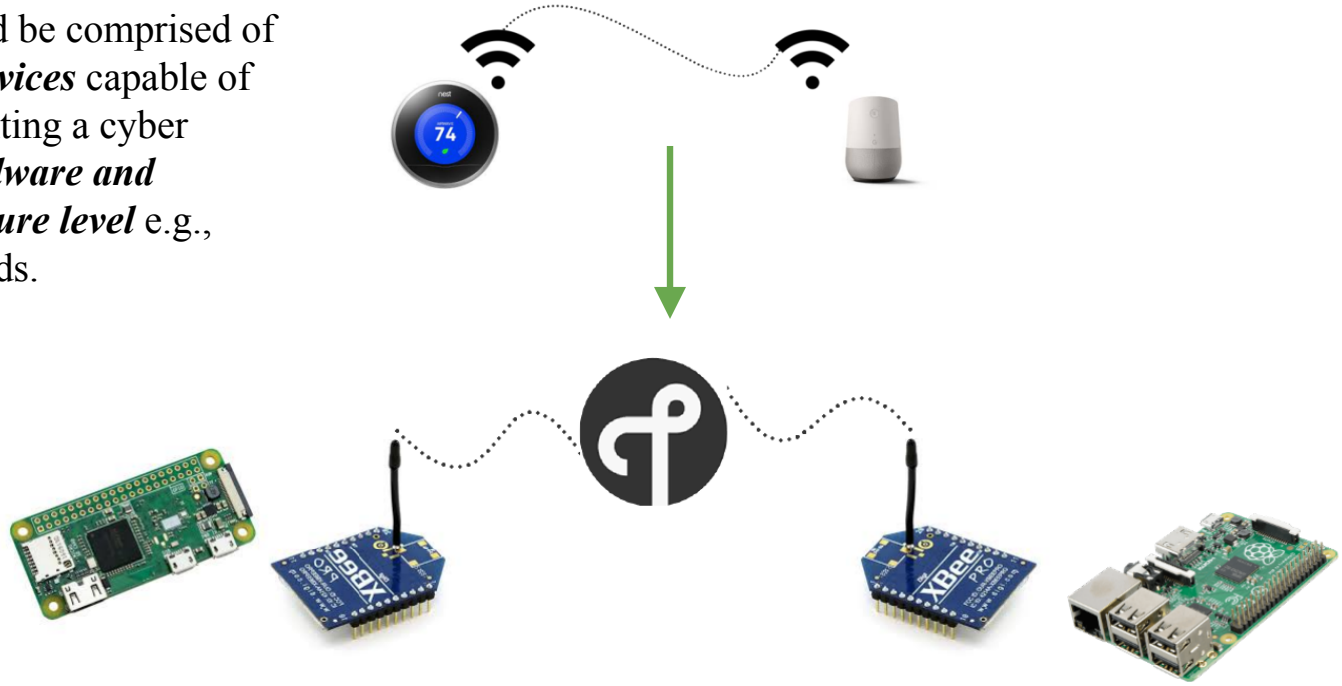
What's in the IoT box?

- Device Classes
  - What
    - Processor architecture
      - Arm, Risc-V, TI, TBD
    - Supported system level software
      - Linux, Riot, TBD
    - Communications hardware & drivers
      - IEEE-802.11.14, XBee, Thread, TBD
    - Sensor hardware & drivers
      - Too many to list, TBD
- Communications Stacks
  - 6LowPan
  - XBee, Zigbee
  - Zwave
  - Thread
  - LTE
  - TBD

Modeling

What we are not modeling.

The testbed should be comprised of ***programmable devices*** capable of faithfully representing a cyber system at the ***hardware and network architecture level*** e.g., development boards.



Materialization

Good Virtualization For All

At a certain point of complexity and scale, you lose the ability to have a faithful pure hardware representation of a system

- Not enough hardware scale
- Not enough hardware variety
- Not enough isolated network segments / network environment too noisy

E2E IoT Virtualization

Getting Here

- QEMU device implementations
- Device drivers
- Chisel hardware models
- Protocol stack emulators (P4)