Presents

Hacking with Embedded Systems

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What’s an embedded system?

INTRODUCTION
Definition

• **Obligatory Wikipedia definition:** “An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints.”

• Basically, a much smaller, less powerful, less featured computer usually built for a specific purpose
• Where are they used?

• **EVERYWHERE**
  
  – Cars (40+!), routers/switches, mp3 players, mobile phones, ereaders, refrigerators, washers, dryers, televisions, aircrafts, etc.
  
  – Found in consumer, cooking, industrial, automotive, medical, commercial and military applications.
What do they look like?

- Embedded system come in many different shapes and sizes
Pogoplug

- Small box that essentially lets you turn any USB hard drive into a network device
- Didn’t disable root access via SSH
- Allowed hackers to strip software and install Linux server (LAMP)
- It costs $10 (used to)
• Instruction Sets
  – CISC: Complex Instruction Set Computer
  – RISC: Reduced Instruction Set Computer

• Memory Types
  – Volatile: Random Access Memory (RAM)
  – Non-volatile: Read Only Memory (ROM)

• Inputs/Outputs
  – Digital (ADC)
  – Analog (DAC, PWM)
  – Communication (UART, I2C, SPI, CAN)
Microcontroller

• A microprocessor with added circuitry.
Popular Microcontrollers

- PIC
- AVR
  - Arduino
- TI MSP430
- ARM
  - BeagleBoard, Raspberry Pi
Arduino

• Open-source platform (hardware + software) used for building electronics projects
• No programmer needed! (boot-loader instead)
• Has an IDE and simple programming language similar to c++
• Huge community with many libraries available
• Many different flavors and shields
Raspberry Pi 🍓

- Credit-card-sized single-board computer
- Runs Linux!
- Has GPU powerful enough for full HD (1080p)
- Basically, a very small computer that has access to i/o pins like a microcontroller
  - can use any language to control (PYTHON!!)
- Has shields too (even some to talk to Arduinos!)
Demo