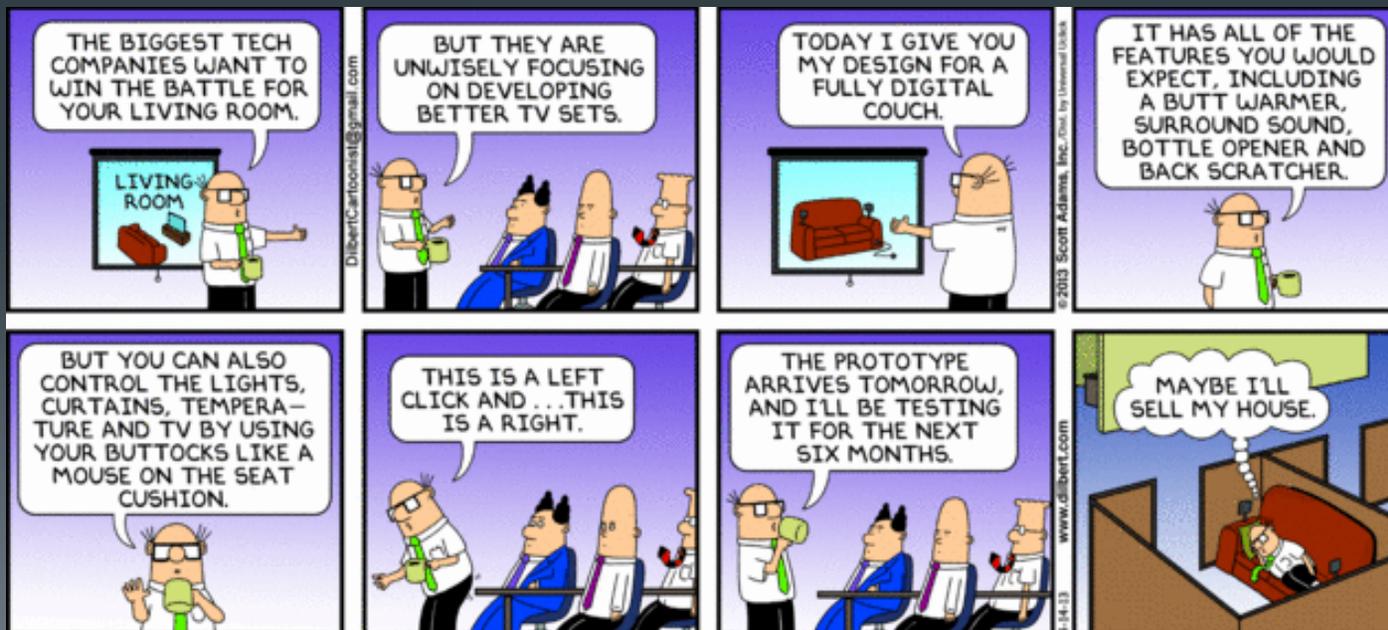# Teaching the Internet of Things Through Device Integration

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Perspectives on The Internet of Things

EVEN MORE

Why the Internet of Things Is Important to Teach

- The IoT Industry is advancing at a faster rate than anyone else has envisioned.
  - There are dozens of new devices being released all the time
  - The leveraging of "standard" protocols has been accelerated
  - The security issues STILL have not been addressed
    - In fact the more devices that are deployed, the more vulnerable we are
  - The "human" elements that IoT technologies influence are being ignored

More and More Players Are Joining the Party

- Traditional IT Companies
  - Cisco
    - Has just introduced a new class into the Networking Academy curriculum
    - Packet Tracer v7 has incorporated a whole cadre of IoT devices
  - Microsoft
  - Apple
    - We think Apple has evolved to something beyond a traditional IT company
- Newer, smaller (more nimble??) IT Companies
  - TPLINK
  - DLink
  - Belkin (they even have a whole line … WeMo)
  - Nest (well, it was bought by Google … we may NOT want to talk about it)
  - Orvibo
  - There are literally hundreds of small company's making s*** using the same chipsets
    - What they all have in common … "Works with Alexia"

More and More Players Are Joining the Party

- Thingy Manufactures
  - Samsung
  - GE
  - Sylvania
  - Amazon
  - Google
  - Honeywell
  - Philips
  - Siemens Technologies
  - Allen Bradley
  - Leviton Lighting
  - Lutron Lighting
  - Carrier HVAC
  - Ecobee HVAC
  - Bose Audio
  - Logitech AV Controls
  - Schlage Locks
  - Kwikset Locks
  - … and many, many more

The IoT Landscape Has Changed

- 1st Generation
  - Discrete IoT Components controlling a limited set of devices
  - Even though common protocols were used (TCP/IP, Ethernet, Wifi, Bluetooth, Zigbee and ZWave) there were little to no interoperability.
    - Example … Phillips Hue lighting system still prefers to use their own controller
- 2nd Generation (today)
  - Manufactures, such as Samsung, are developing multiple device controllers using a common set of APIs to encourage development of integrated components using common communications and networking protcols.
- 3rd Generation (future prognostication on my part)
  - Common controller protocols and languages will enable true interoperabiliy

Challenges in Teaching
The Internet of Things

- You will need lots of "things"
  - The pieces are small, and individually, not expensive
  - However, you will need multiples of the "things"
- You will need specialized labs for the "things"
  - Because there are so many "things", it makes it difficult to setup/teardown labs for every class
- Students can come in from other programs with little to no networking background or experience
- "Buy-in" from the programs who would be using the "things"
- Instructors will need to have knowledge of the "things"
  - For example:
    - Thermostats – knowledge of HVAC
    - Media Distribution – knowledge of Audio/Video technologies
    - Lighting Controls – knowledge of electrical wiring and lighting design
    - VoIP – knowledge of the public switched telephone network
    - Home Security – knowledge of legal issues

Challenges in Teaching
The Internet of Things

- And the number one challenge …

SECURITY

- Both knowledge and teaching

Practicum …
Create an Integrated IoT Activity

- The heart of IoT is the interconnection between devices
  - Referred to as "Sensors ←→ Actuators"
- There needs to be something in the middle to manage these interactions …
  - This is the "Microcontroller"
    - Until recently, it was a Tower of Bable ... everything is proprietary
      - Insteon, Control4, Crestron, etc
    - NOW … we have been transitioning to STANDARDS
      - TCP/IP
      - Ethernet & WiFi
      - Zigbee & Z-Wave

Practicum …
Create an Integrated IoT Activity

- One of the newest players, Samsung, has created a Microcontroller that can support almost any IoT device
  - But … Samsung DID NOT want to write all of the device drivers and the activities
  - So … they created a developer platform and are encouraging the development and dissemination of devices and activities
- Today we are going to try to develop our own first activity