Teaching the Internet of Things Through Device Integration

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Perspectives on
The Internet of Things

WEAR THIS BIOSensor
SO MANAGEMENT CAN
MONITOR YOUR HEALTH
DURING THE DAY.

WOW. I DIDN'T KNOW
YOU CARE SO MUCH
ABOUT MY HEALTH.

OH, I DO.

EMPLOYEE 479
DON'T HAVE SHALLOW
BREATHING. YOU CAN
GIVE THAT ONE SOME
MORE WORK.

THE BIGGEST TECH
COMPANIES WANT TO
WIN THE BATTLE FOR
YOUR LIVING ROOM.

BUT THEY ARE
UNWISELY FOCUSING
ON DEVELOPING
BETTER TV SETS.

TODAY I GIVE YOU
MY DESIGN FOR A
FULLY DIGITAL
COUCH.

IT HAS ALL OF THE
FEATURES YOU WOULD
EXPECT, INCLUDING
A BUTT WARMER,
SURROUND SOUND,
BOTTLE OPENER AND
BACK SCRATCHER.

BUT YOU CAN ALSO
CONTROL THE LIGHTS,
CURTAINS, TEMPERa-
TURE AND TV BY USING
YOUR BUTTOCKS LIKE A
MOUSE ON THE SEAT
CUSHION.

THIS IS A LEFT
CLICK AND... THIS
IS A RIGHT.

THE PROTOTYPE
ARRIVES TOMORROW,
AND I'LL BE TESTING
IT FOR THE NEXT
SIX MONTHS.

MAYBE I'LL
SELL MY HOUSE.
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 protocols.

- 3rd Generation (future prognostication on my part)
  - Common controller protocols and languages will enable true interoperability
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 …

- 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