



The Importance of Teaching the Internet of Things

... and how to do it efficiently

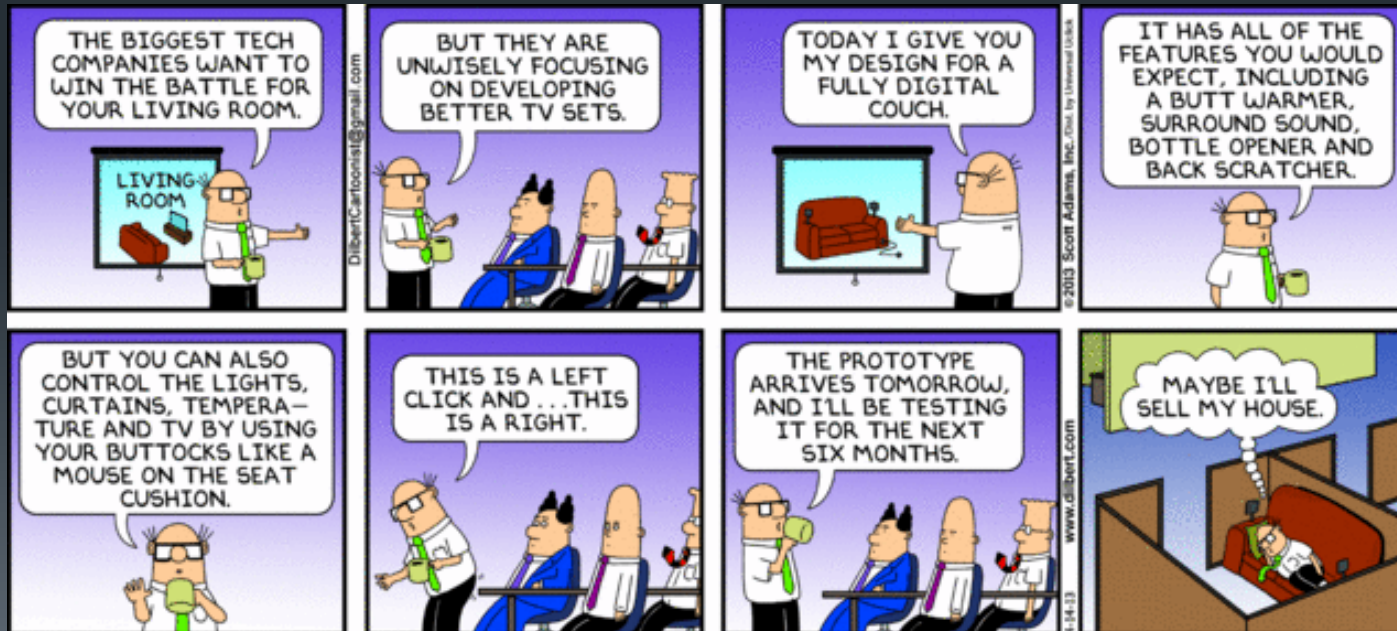
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Perspectives on The Internet of Things



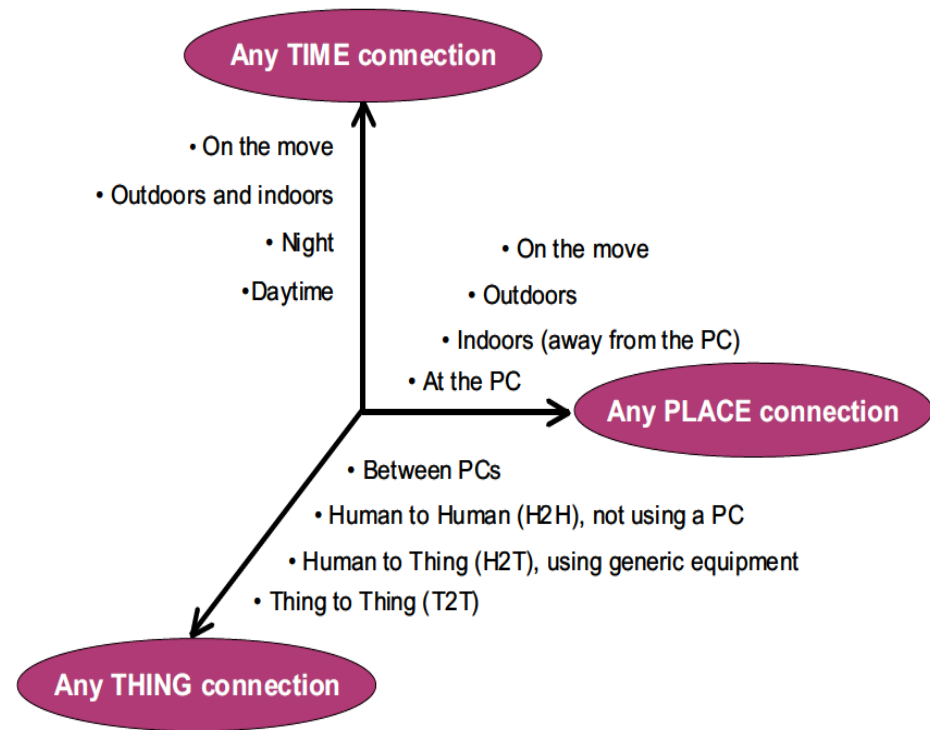
So ... What is The Internet of Things

- Let's start with the first "go to" source ... Wikipedia
 - The **Internet of Things (IoT)** is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.
- In 2005 the World Summit on Information Society posited ...
 - By embedding short-range mobile transceivers into a wide array of additional gadgets and everyday items, [we are] enabling new forms of communication between people and things, and between things themselves.
- At the Internet of Things conference held in Zurich in 2008 (yeah, there are now whole conferences on the topic) it was stated ...
 - The term "Internet of Things" has come to describe a number of technologies and research disciplines that enable the Internet to reach out into the real world of physical objects.

The Internet of Things Paradigm Shift

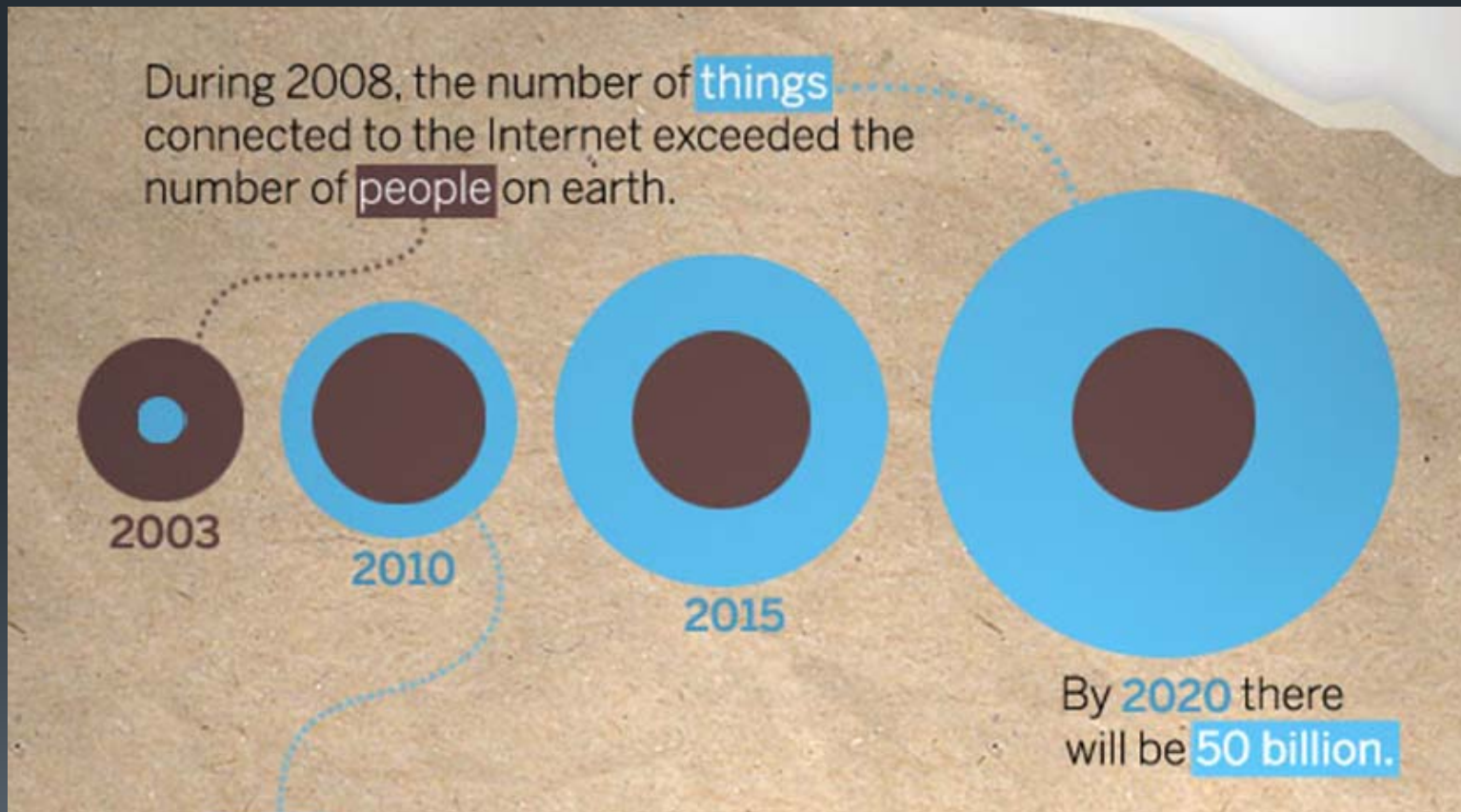
The ITU has published this chart showing how the Internet of Things' idea of *Any Time / Any Place / Any Thing* connections will change the way we view and use the Internet.

Figure 1 – A new dimension



Source: ITU adapted from Nomura Research Institute

The Internet of Things Statistics



The Internet of Things Statistics

\$180.3 Billion

The 2017 projection of the Internet of Things market revenue the Smart-Home industry is expected to generate.

This is the leading industry for the IoT.

<http://postscapes.com/what-exactly-is-the-internet-of-things-infographic> / Harbor Research

\$9 Trillion
The Internet of Things will generate nearly in annual sales by 2020
Internet of Things Spending Guide/International Data Corporation [IDC], 2014

212 Billion
Devices will be part of the Internet of Things by 2020

Samsung IFA 2014 / International Data Corporation [IDC], 2014

75%
Three-quarters of companies that are either actively exploring the Internet of Things or are already using it.
The Economist Intelligence Unit / The Internet of Things Business Index, October 2013



Why the Internet of Things Is Important to Teach

- Heavy investments in commercial, residential and industrial use
- The use of IT in OT (Operations Technology)
- Finally reaching the goal of a truly converged network
 - Many Non-Traditional networks are being either replaced by or being bridged into Ethernet
- Because networking curriculum is adding (a lot of) IoT material
 - Cisco is a prime mover in this area



Teaching the Internet of Things Is an Easy Transition

- We are already very familiar with the networking protocols in the OSI model
 - Ethernet, WiFi, DSL and DOCSIS are still the root of communications with IoT technologies
 - TCP/IP is still the basis of the networking and management protocols of IoT



Teaching the Internet of Things Is an Easy Transition

- IoT products and services are easy to understand and are very accessible
 - Commercial and Residential
 - HVAC Systems
 - Lighting Controls
 - Media Distribution
 - Surveillance
 - Access Controls
 - Industrial Devices
 - PLCs (Programmable Logic Controllers)
 - SCADA (Supervisory Control and Data Acquisition)
 - Microcontrollers



Teaching the Internet of Things Is an Easy Transition

- So, What's the new stuff we'll need to teach??
 - New wireless protocols such as Zigbee and Z-Wave
 - Emphasis on UDP and RTP protocols
 - Programming real-time applications
 - IP based sensors and actuators
 - Current non-IT protocols that are being Bridged (i.e. BACnet)



The Internet of Things Will Attract New Students from Diverse Backgrounds

- Students from traditional Computer Science
 - In order to program IoT applications, they **MUST** understand the technology and their protocols
- Students from “Trade” Industries
 - Construction
 - Architecture
 - Plumbing and Electrical
 - Industrial Engineering
 - Aerospace
 - Manufacturing
 - Aviation (*think “Drones”*)



Approaching the Internet of Things In the Classroom

- Add some IoT labs and projects ...
 - Many labs can be virtualized (Netlab)
 - Many labs can use inexpensive “off-the-shelf” parts
 - Many labs can take advantage of hardware and software that has been used in other classes
 - VoIP
 - Wireless
 - Storage
 - Many labs have already been created
 - ... and more are on the way



Approaching the Internet of Things In the Classroom

- Here are some of the classes that would benefit from adding IoT curriculum
 - Comptia A+, Network+ and Security+
 - Cisco Semester 1 (Introduction to Networking)
 - Voice Over IP
 - Ethical Hacking (actually, ALL security classes)
 - Fundamentals of Wireless ← Hyper-Important
- If you had a Digital Home Technology or Residential Networking class it could easily be repurposed for an IoT class

In Conclusion



The **Internet** gave us the opportunity to connect in ways we could never have dreamed possible. The **Internet of Things** will take us beyond connection to become part of a living, moving, **global nervous system.**

Whether you are an individual, technology developer, or adopter of these technologies, the Internet of Things will stretch the boundaries of today's systems. Are you prepared for the changes in the way we will learn, work, and innovate?