

# SE-IOT: Internet of Things



## IOT Introduction and Overview

Derek Kiong  
[dkiong@nus.edu.sg](mailto:dkiong@nus.edu.sg)



© 2016-2018 NUS. The contents contained in this document may not be reproduced in any form or by any means, without the written permission of ISS, NUS other than for the purpose for which it has been supplied.

ATA/SE-IOT/01 Introduction.v3.ppt

Introduction to IOT

Total: 28 pages

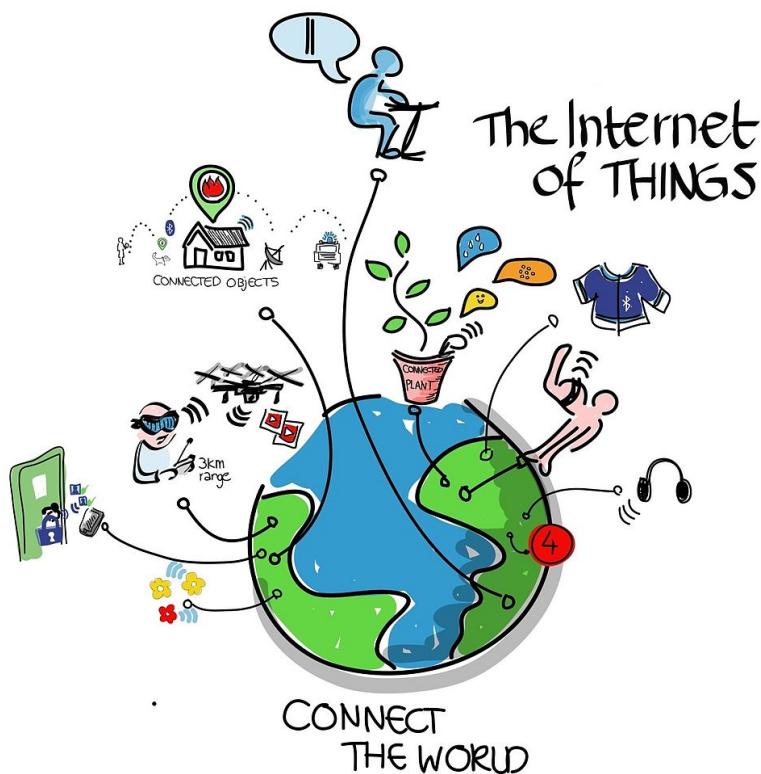


## What is IOT?

- ◆ The Internet of Things (IoT) is the network of physical objects □ devices, vehicles, buildings and other items **embedded** with electronics, software, sensors, and **network connectivity** □ that enables these objects to collect and exchange data.
- ◆ A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

*ITU definition*

## Drawing by Wilgengebroed (Esther Emmely Gons)



## ATM ☐early IoT



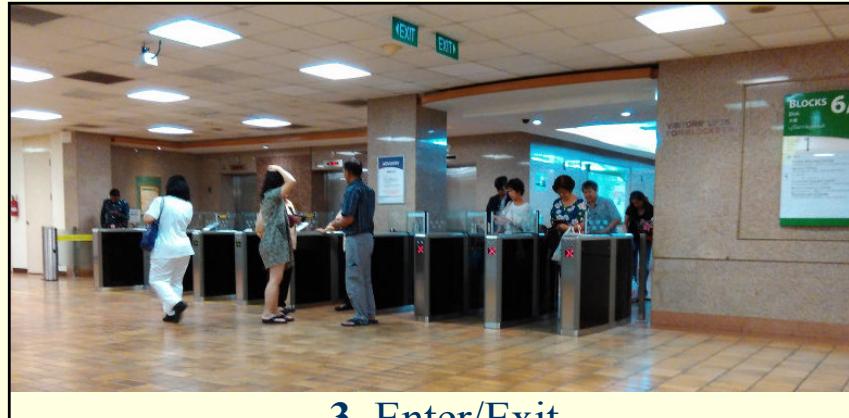
# Visitor Registration/Control system



1. Registration

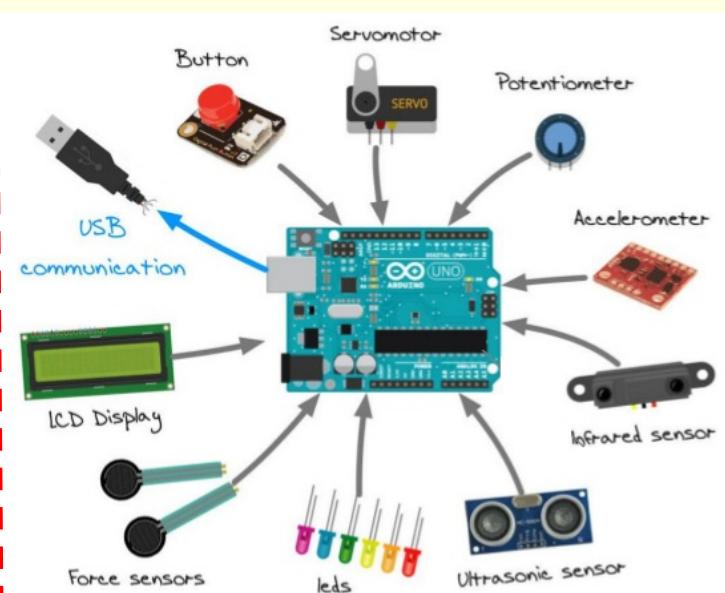


2. Scan



3. Enter/Exit

## Desktop vs Sensor/Pervasive/Embedded Computing



# Pervasive computing + Networking

- ◆ Pervasive computing (also called ubiquitous computing) is the growing trend towards **embedding** microprocessors in everyday objects so they can communicate information.
  - ◆ the words pervasive and ubiquitous mean **existing everywhere**
  - ◆ when computers don't look like computers
- ◆ Network connectivity allows harnessing network resources

# Embedded Systems

- ◆ Hiding computers in machines/applications
  - Microwave
  - DVD/MP3 player
  - Anti-lock brakes
  - Hard-disk component
- ◆ Replacing traditional keyboard/monitor with sensors/actuators
  - Air-conditioner temperature sensor
  - Wheel sensor

# Canon EOS-M □camera or computer?



# Xiaomi Yi action camera



Camera with

- ◆ WI-FI connectivity
- ◆ built-in access point
- ◆ embedded http server
- ◆ remote control/download via network protocols

## Power of the Net

# Toshiba FlashAir



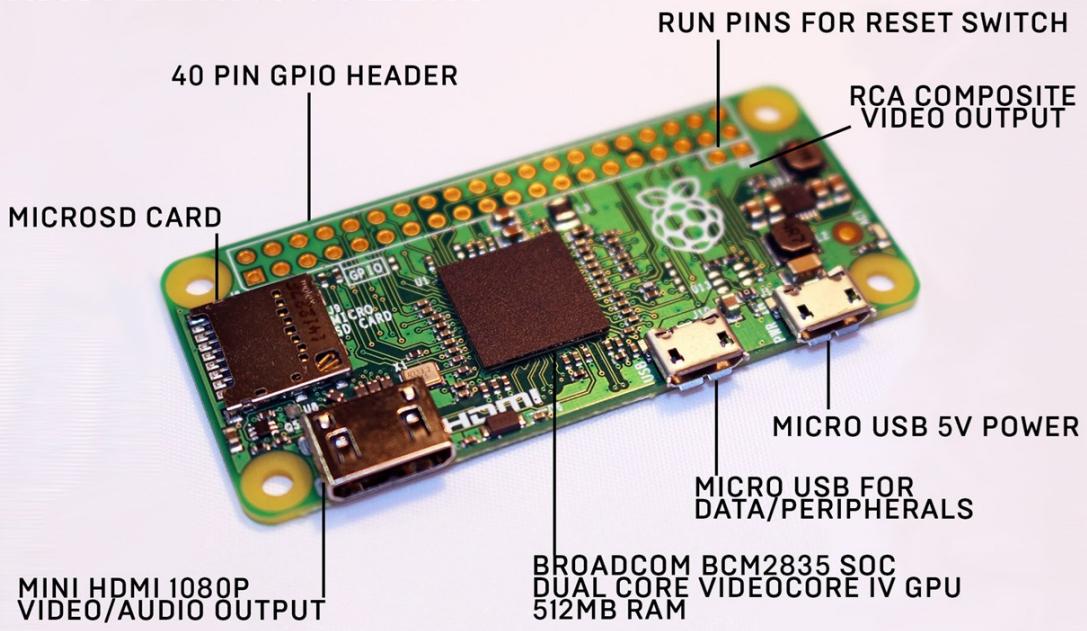
- ◆ WiFi enabled
- ◆ SD card
- ◆ Optional Hotspot/  
Wireless client
- ◆ Access to file system  
via embedded httpd

## IoT □ Why now?

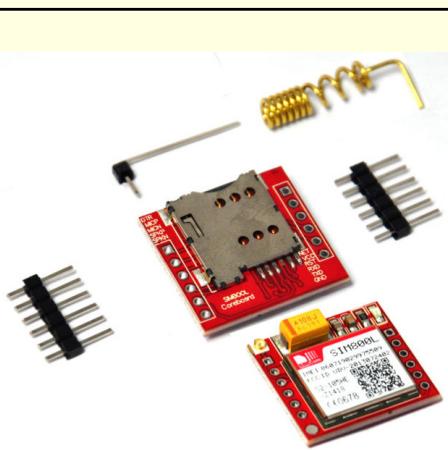
- ◆ Cost effective hardware and manufacturing
- ◆ Cost effective devices
- ◆ Cost effective communication infrastructure
- ◆ Business automation and process efficiency
- ◆ Market competition (eg real-time analytics)

# Raspberry Pi Zero -- USD\$5

## RASPBERRY PI ZERO



## Communication modules



GSM module

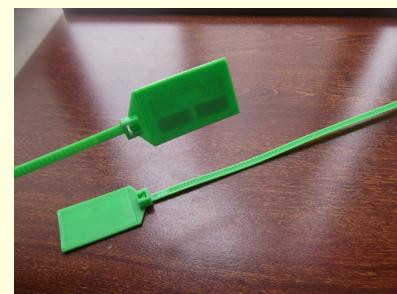


Wi-Fi/bluetooth module



USB Wi-Fi

# Sensor technology for automation



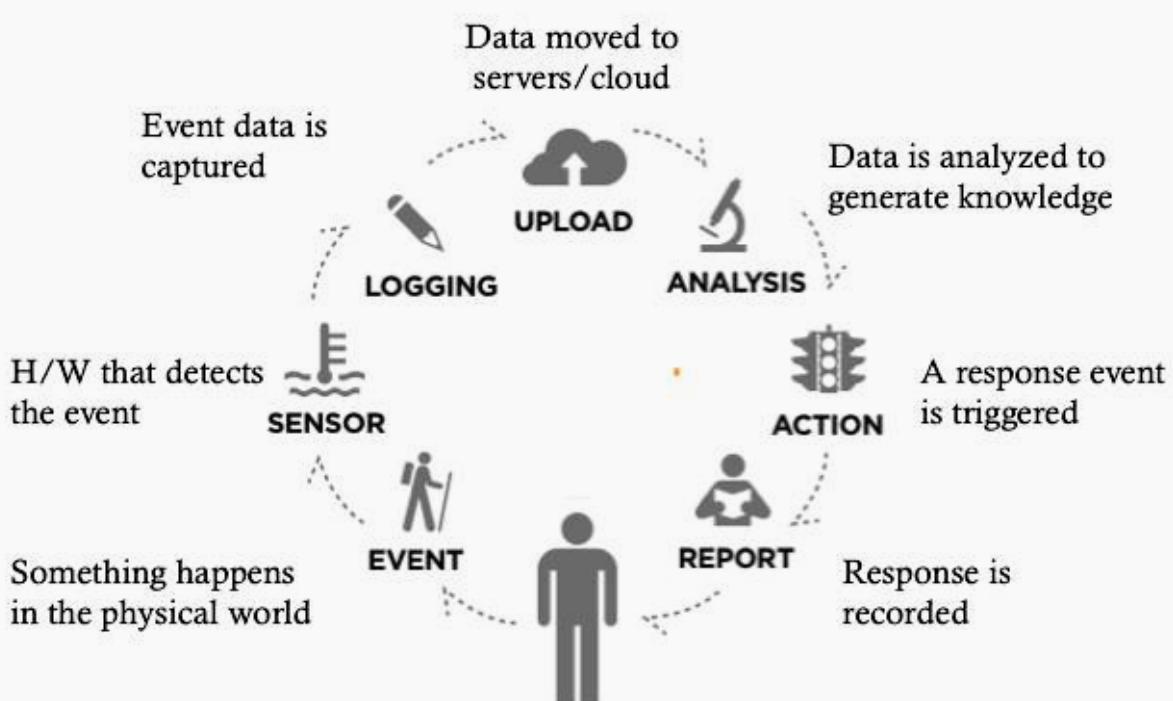
## Increased Adoption



# IoT Possible applications

- ◆ Supply chain
  - Tag, Track, Trace
- ◆ Retail, CRM, ERP
  - Inventory/Product information
  - Customer loyalty
- ◆ Healthcare
  - Patient monitoring
- ◆ Transportation
  - Accident avoidance, Monitoring
- ◆ Energy management
- ◆ Public services
  - Crowd control
  - Traffic management
  - Street lighting

## Supply chain management



# IoT Questions

- ◆ What additional value might IoT contribute?



- ◆ What additional data can make the system run better?
- ◆ How can that data be made available?
- ◆ What actuators may be automated?

## IOT Strategy -- Business Value

- ◆ Make existing processes more efficient
  - minimizing downtime
  - improving information accessibility
- ◆ Enhance existing business processes with new information and features
  - Supply chain example
- ◆ Enable new business models
  - Tiered electrical charges for auto-on equipment?

# Reduce cost/Increase revenue



## Amazon Key

- ♦ New Amazon Key Will Allow Package Delivery Inside Your Home

or

- ♦ Amazon Key: The Smart Delivery Solution That No One Wants?

# Security

- ◆ Pervasive computing applications increases dependence and likelihood of errors & attacks
  - Technology
  - Process
- ◆ IoT Security paramount for reliability and integrity of system

## Technology Gone Wrong

Can Hackers Hijack Wi-Fi Barbie Doll to Spy On Your Kids?



The Mattel corporation has introduced the Hello Barbie™ interactive doll that not only talks, it listens. And records your kid's conversation with her. And connects to Wi-Fi so her recordings can be analyzed by the ToyTalk™ voice-recognition software, and the information shared with parents or ... who knows. What could possibly go wrong?

# Traditional Locks better?

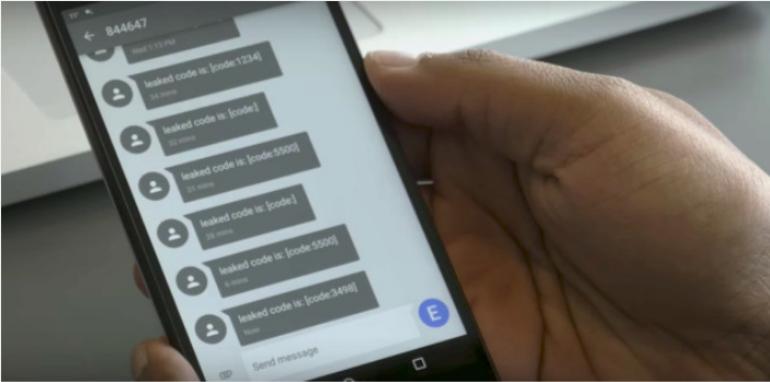
**ars TECHNICA**

RISK ASSESSMENT —

## Samsung Smart Home flaws let hackers make keys to front door

Don't rely on SmartThings for anything security related, researchers warn.

DAN GOODIN - 5/3/2016, 2:31 AM



[Enlarge](#)

Computer scientists have discovered vulnerabilities in Samsung's Smart Home automation system that allowed them to carry out a host of remote attacks, including digitally picking connected door locks from anywhere in the world.

# Security

**The Straits Times**

12 mins ·

Like Page

Provision store owner [REDACTED] printed out his own barcode stickers and stuck it on tins of milk powder at Cold Storage and Giant. He then scanned the items at the self-checkout counter to get them at cheaper prices.

In one instance, he paid \$10 for \$630 worth of items.



### Man who printed fake barcode stickers to cheat supermarkets sentenced to 6 months' jail

SINGAPORE - A provision store owner printed his own barcode stickers and fixed them on various items in supermarkets to obtain them at lower prices a court...

# Summary

- ◆ Computing with things which don't look like a computer
  - hidden/embedded processor
  - non-traditional keyboard/mouse input
  - non-traditional monitor display
- ◆ Power of the network/collaboration
- ◆ Facilitate automation
- ◆ Unlock business value
  - <http://deloitte.wsj.com/cfo/2014/08/29/internet-of-things-unlocking-the-business-value-of-connected-devices/>

## Course Assignment (40%)

<i>End of Week 1</i>	Choose team of 2 members. Select potential use-case involving IoT. How does it add business value?
<i>Week 2 -- 5</i>	Proof of concept/prototype/simulate selected use-case using equipment provide and/or additional sensors etc
<i>Week 5</i>	Book 20 min presentation/demo slot
<i>Week 6</i>	Present/demo