The Internet of Things, MQTT, and OpenVMS

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September 2014

Abstract

The Internet of Things is difficult to define, but it essentially refers to the ever-growing network of physical objects that have IP connectivity, allowing them to connect to the internet (or other network), and the communication that occurs between these objects and other internet-enabled devices and systems. In this talk, the speaker will introduce the Internet of Things (IoT) and will discuss some of the key technologies associated with the creation of IoT solutions and services. Particular attention will be given to the Message Queuing Telemetry Protocol (MQTT), which is gaining acceptance as a preferred protocol for use by IoT - based solutions to efficiently and reliably move data between connected objects and other systems. An overview of the MQTT protocol will be given and how MQTT might be used with OpenVMS to implement secure, fault-tolerant, and scalable IoT solutions will be discussed.

About me

Brett Cameron currently works as a senior architect with HP's corporate Cloud Services group, focusing on the design and implementation of message queuing and related integration services for customers and for internal use. Brett lives in Christchurch, New Zealand, and has worked in the software industry for some 22 years. In that time he has gained experience in a wide range of technologies, many of which have long since been retired to the software scrapheap of dubious ideas. In recent years Brett has specialized in systems integration, and the design and implementation of large distributed systems for HP's enterprise customers. This work has seen Brett get involved in the research and development of low-latency and highly scalable messaging solutions for the Financial Services sector running on HP platforms, and as a consequence of this work, Brett has been involved in several interesting Open Source projects, and he has been responsible (or should that be irresponsible) for porting various pieces of Open Source software to the HP OpenVMS platform. Brett holds a doctorate in chemical physics from the University of Canterbury, and still maintains close links with the University, working as a part time lecturer in the Computer Science and Electronic and Computer Engineering departments. In his spare time, Brett enjoys listening to music, playing the guitar, and drinking beer.

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AGENDA

- **Introduction and IoT overview**
- MQTT
- MQTT, IoT, and OpenVMS
- Summary
- Questions and discussion

Introduction

The creation of the Internet was a significant shift in the way people acquire information, interact with each other, and make decisions. Now, the Internet is expanding its reach to a range of devices that can gather and analyze physical data and react to that data in a variety of applications that we've never seen before. This "Internet of Things" marks another dynamic shift in the history of technology.

Andreea Borcea, "*An early mover's guide to IoT*", http://library.dzone.com/assets/request/whitepaper/173147

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More things are being connected…

- Home/daily-life devices
- Business and public infrastructure
- Healthcare
- …
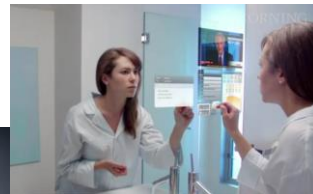
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Adapted from http://personal.ee.surrey.ac.uk/Personal/P.Barnaghi/teaching/EEEM048/EEEM048_Lecture1_Introduction_Part_1.pdf

Defining *Things*

- Technologies and solutions that enable integration of real-world data and services into current information networking technologies
  - *Technology that connects devices over wired or wireless networks*
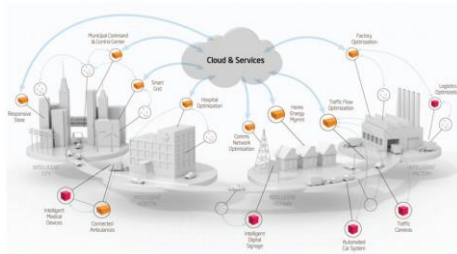
- A system falls under the Internet of Things definition if it meets the following criteria:
  - It must connect
    - To the physical world around itself collecting information
    - To other things in order to interact with them effectively
    - To the internet or a network
    - …
  - It must compute
    - By processing the inputs it receives in some way and making them meaningful to other systems
  - It must communicate
    - With the network, with other things, with users if necessary, …

That's a pretty broad set of criteria!

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Things connecting to things
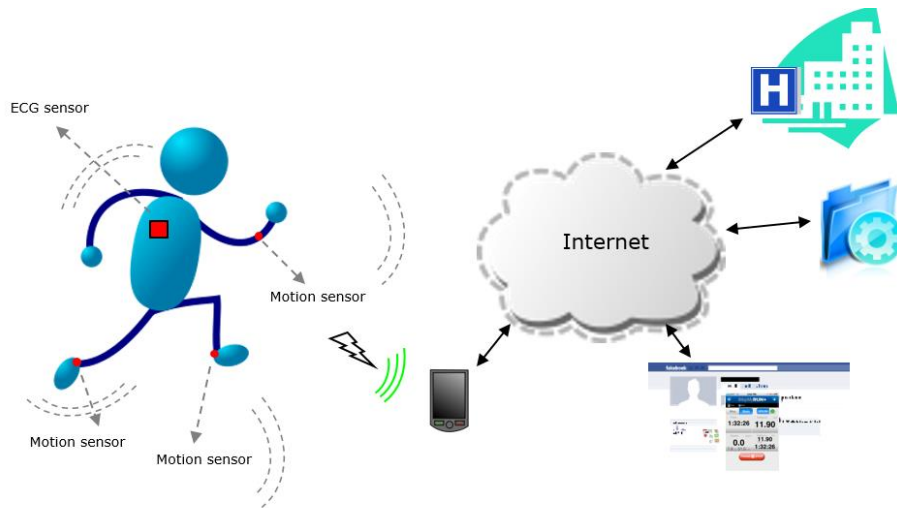
Complex and heterogeneous resources and networks

"*Volvo launches telematics as standard across U.S. lineup*", 1 September 2014, http://analysis.telematicsupdate.com/fleet-and-asset-management/weekly-brief-volvo-launches-telematics-standard-across-us-lineup

8   Images adapted from http://www.satiztpm.it/internet-things

People connecting to things…

ECG sensor

Motion sensor

Motion sensor

Motion sensor

Internet

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# Sensor devices are becoming widely available

- Programmable devices
- Off-the-shelf gadgets and tools
- …


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Wireless Sensor Networks (WSN)

A Wireless Sensor Network (WSN) consists of small, low-cost, and low-energy sensor nodes that cooperatively monitor physical quantities and control actuators. A network may consist of thousands of randomly-deployed self-configurable nodes that operate autonomously to form a multi-hop topology, passing their data through the network to a main location. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.
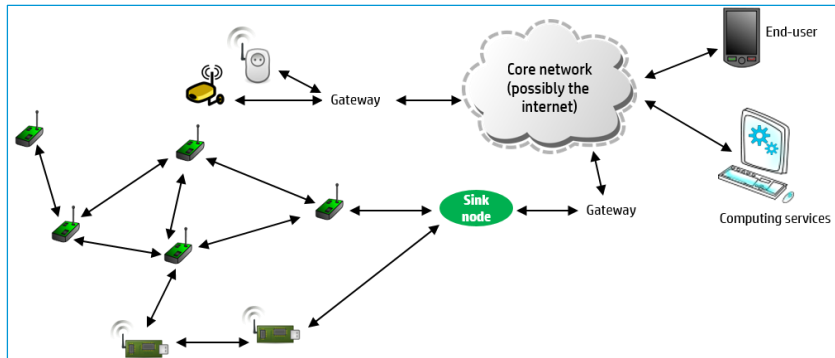
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Future networks

- Connected
  - Any place, any time, any thing
 - To be honest, I think we're almost there
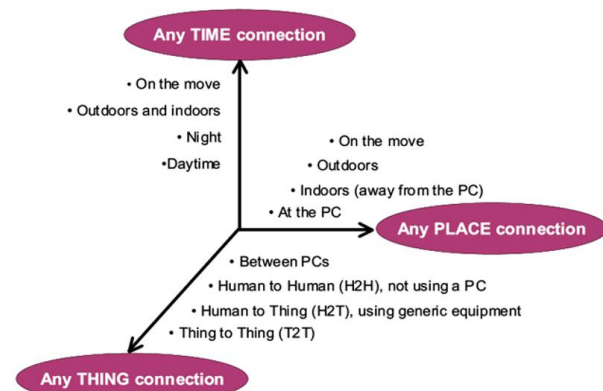
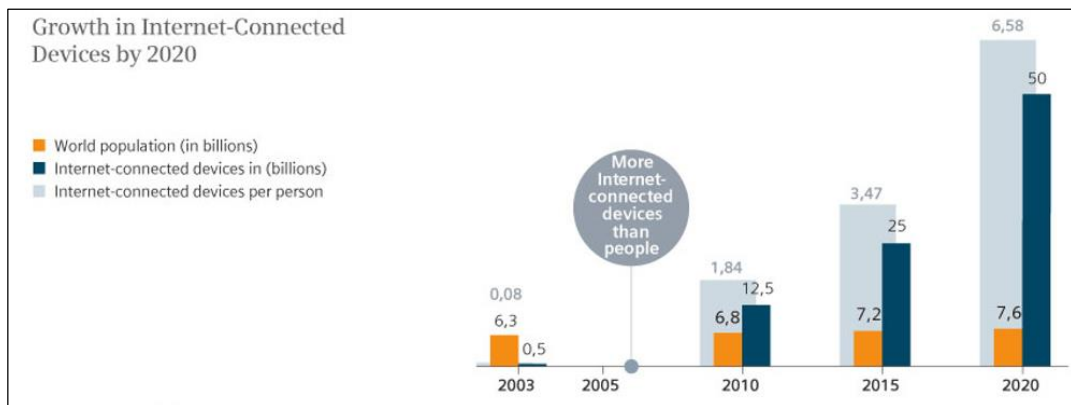Source: ITU adapted from Nomura Research Institute

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Number of things connected to the internet...

- During 2008 (possibly earlier, depending on who you ask), the number of *things* connected to the internet exceeded the number of *people* on earth
- By 2020 it is predicted that there will be 50 billion internet-connected devices of some form or another

2003   **2010**   **2015**   **2020**
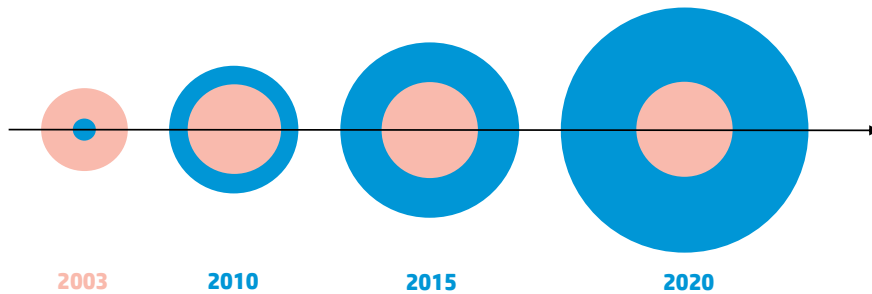
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Numbers of Internet-connected devices

Growth in Internet-Connected Devices by 2020

- World population (in billions)
- Internet-connected devices in (billions)
- Internet-connected devices per person

More Internet-connected devices than people

6,58
50
3,47
25
1,84
12,5
6,8
7,2
7,6
0,08
6,3
0,5

2003   2005   2010   2015   2020

Source: Cisco IBSG, April 2011

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This is getting a bit scary...

http://blog.trentonsystems.com/internet-of-things-crosses-business-personal-boundaries/

Global data generation

Source: Cisco VNI Mobile, 2012

According to various sources, every day around 20 quintillion (10^18) bytes of data are produced (this figure includes enterprise data, social media, and sensor data). Much of this data is probably junk, and some of it probably gets discarded, but the fact remains: *we generate a lot of data*!