What happened to the "things"?

Thoughts and Considerations on the Internet of Things.

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Agenda

• Why are we here?
• What is the Internet of Things?
• Standards?
• Market?
• Benefits?
• Where?
• How?
What is the IoT - Definitions

• ISO/IEC JTC 1/SWG 05 collected 42 definitions for IoT, M2M, Cyber Physical Systems, and Machine Type Communications
What is the Internet of Things?

• “An infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the virtual world and react.”

  – ISO/IEC JTC 1/SWG 05 – November 2014
What does it mean?

• **RAIN RFID MISSION**

• To enable businesses and consumers to identify, locate, authenticate and engage items in our everyday world.
Where did the IoT Start?

• Kevin Ashton (then with Procter & Gamble) coined the phrase in 1999
• Talking about lipstick
• So what does it mean now?
The IoT and Standards

- New Committee in ISO/IEC JTC 1/WG 10 replaced SWG 5
- Report of work done so far in SWG 5 can be found at www.jtc1.org
- Work included some mind maps to show the extent of the IoT as well as marketing and standards work
Understanding the IoT

Technologies
- Auto Configuration
- Scalable
- Discoverable
- Heterogeneous Devices
- Unique Names/Addresses
- Usability
- Standardized Interfaces
- Networked
- Timely
- Location-Aware
- Modular
- Robust/Reliable/Resilient
- Secure
- Confidentiality of Information
- Green
- Low Cost

Application Domains and Use Cases
- Users
  - Transporters
  - Distributors
  - Others
- Network Providers
- Service Providers
- Manufacturers
- Privacy Advocates
- Government Agencies
- Regulatory Agencies
- Standards Developing Organizations (SDOs)
- Academia / Research Labs
- Testing / Certification Vendors

Stakeholders

Requirements

Other Considerations
- Sustainability
- Ethics
- Accessibility

Standards (See work done by ISO/IEC JTC 1/SWG 5/Ad Hoc Group 3.)
IoT Applications Areas

Healthcare
- Remote diagnostics and examinations
- Remote patient monitoring, tracking, and telemetry
- Remote treatment and surgery
- Patient prescription management
- Medical asset tracking (e.g., ambulances, and pharmaceuticals)
- Connected and up to date medical records

Information and Communication Technologies (ICT)
- Network device tracking, inventory, automation, and remote predictive management
- Physical security and monitoring (e.g., fences, gates, sensors, junctions, access control, backup power supplies, and access control)
- Process monitoring and management
- Equipment monitoring and management
- Health and safety monitoring and management
- Inventory management
- Shipping tracking

Manufacturing and Heavy Industry
- Proactive service and warranty (e.g., factory-located vehicles for on-site service)
- Product recall management
- Preventive maintenance

Retail and Hospitality
- Field and pasture sensors indicating chemical and environmental conditions to producers
- Monitoring of poultry, livestock, and processed foods for quality and detect management, spoilage, and expiry
- Tracking of livestock variables at the risk of being lost
- Access control and monitoring without processing facilities
- Automation of existing services and billing
- Automation of delivery processes and accounting
- Smart trucks, planes, automobiles, boats, and spacecraft
- Traffic signals that respond to traffic conditions

Public Safety and Military
- Financial and Banking
- Fire and Farming
- Transportation
- Home automation
- Home security and monitoring
- Smart appliances
- Food and Farming
- Retail and Hospitality
- Government
- Education
- Energy
- Entertainment and Sports
- IoT Application Domains and Use Cases

- Financial and Banking
- Retail and Hospitality
- Government
- Education
- Energy
- Entertainment and Sports

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RFID | barcode
AIDC consultation service
Standards

• There are already many existing standards that will affect the IoT
• SWG 05 identified over 400 and WG 10 is currently at 572
• WG 10 is working on a Reference Architecture for IoT
• Other groups are looking at “Identification Standards”
Market Size

• The IoT Market will be $290 billion by 2017, and growing at 30 percent per year to $828 billion (MarketsandMarkets 5/13)

• 31 billion internet-connected devices will exist by 2020 (Intel)

• A family of four will move from having 10 connected devices in 2012 to 25 in 2017 to 50 in 2022 (Intel)

• And this is only half the story:
  – At least that many objects will not be directly connected, but will communicate with a network connected device.
RAIN RFID Delivers the Internet of “Things”

Internet of “Things” is a superset of Internet of powered devices

- Personal Care
- Apparel
- Healthcare
- Fresh Food
- Logistics
- Pharmaceuticals
- Liquor
- Electronics
- Location

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The Internet of Things

2020:
- 1.9 Bn IP nodes
  - $24Bn value

2020:
- 30 Bn RAIN tags
  - $2.1Bn value (tags alone)

**Internet of Things with IP address**
Ubiquitous smart objects sense and communicate over the internet with no human interaction.

**Other ID and Sensor systems (Internet of Things without IP address)**
Dedicated systems for connected things. Proprietary or standardized RFID, Active RFID, Real Time Location Systems, Mesh Sensor Networks.

**Consumer Applications**
- Wearable technology
- Home automation
- Healthcare, fitness, assisted living
- Consumer services and infotainment
- Vehicles

**Component Trends**
- IC - low power
- Device - open source hardware
- Gateway - hardware agnostic
- Software - proprietary
- System Supply - targeted to a need

**Key**
- Larger circle size indicates larger unit volume potential (not to scale)

**Industrial & government applications**
Driver: Governments or specific niche problems
- Infrastructure monitoring/smart cities
- Lighting
- Transportation monitoring
- Energy monitoring/smart grid
- Process automation
- Security
- Agriculture

Source: IDTechEx
Today, 60% of the RAIN RFID tags go on retail items.

RAIN will connect 25 billion things a year by 2020 and deliver the identity, location, and authenticity of each.
Is the IoT important?

A new study conducted by Vanson Bourne surveyed 2,000 small business IT professionals across the U.K., U.S., Canada and Australia

- 82 percent of American small business owners believe that IoT will deliver new opportunities for their companies.
- 69 percent said that IoT will help make them more productive.
- 66 percent said that they expect to benefit from faster access to more data
- 65 percent bank on increased access to data.
- 56 percent said the IoT will help deliver improved customer service.
- 51 percent expect IoT to improve profit margins.
- 44 percent of the study's respondents worried that cost would stand as barrier to implementing IoT tech.
- 33 percent of small businesses expect to adopt IoT-enabled tech within two years.
Top 3 IoT Benefits for Companies (in percentage of executives surveyed)

- Employee Productivity
- Asset Optimization
- Cost Cutting

Source: Accenture
Industries Investing in IoT Sensors for Their Businesses

Source: PricewaterhouseCoopers.
Savings from Industrial Internet Efficiencies (IoT) (in billions of dollars)

Source: GE.
Where is the IoT important?

• Look at some of the key areas that IoT already is showing value
Smart Cities

• **Smart Parking**
  – Where is the closest parking slot?

• **Structural Health**
  – Was the bridge damaged when the boat hit it?

• **Traffic Congestion**
  – Early warning and direction advise

• **Smart Lighting**
  – Weather adaptive lighting

• **Waste Management**
  – Monitoring domestic and commercial waste collection
Smart Environment

- **Forest Fire Detection**
  - Early detection and mobilization
- **Air Pollution**
  - Monitoring air quality and initiating
- **Earthquake Early Detection, Landslide and Avalanche Prevention**
  - Alerts and preventative measures
Smart Water

• **Water Quality**
  – Early detection of pollution in water supply

• **Water Leakages**
  – Detection of leaks in transport and storage vessels

• **River Floods**
  – Early detection and mitigation of flood conditions
Security and Emergencies

• Perimeter Access Control
  – Security measures

• Radiation Levels
  – Early alerts and preventative measures

• Explosive and Hazardous Gases
  – Detection of dangerous situations with alerts and possible mitigation
Retail

• **Supply Chain Control**
  – Ability to monitor and respond to local conditions

• **Smart Product Management**
  – Automate re-stocking processes and improve display situations

• **Intelligent Shopping Application**
  – Connect the customer to the store
Logistics

- **Quality of Shipment Conditions**
  - Ensure best shipping conditions

- **Fleet Tracking**
  - Monitor and redirect deliveries as needed

- **Item Location**
  - Where is that widget?
Industrial Control

• M2M Applications
  – Monitor and control of the manufacturing processes

• Indoor Air Quality, Temperature Monitoring, Ozone Presence
  – Ensure the quality of the work environment

• Indoor Location
  – Finding widgets and equipment to smooth the process
Smart Agriculture

• Crop Quality Enhancing
  – Measuring and adjusting the growing conditions

• Green Houses
  – Optimal Temperature, humidity, etc. control

• Compost
  – Creating the right conditions to give the required nutrients
Smart Animal Farming

• Farm to Plate monitoring
  – Where did your meal come from and are there any issues?

• Animal Tracking
  – Ensuring the correct feed and living style for the best quality products
Domestic and Home Automation

- **Energy and Water Use**
  - Need to cut domestic energy use

- **Remote Control Appliances**
  - Ensure the safety of the house and save energy

- **Art and Goods Preservation**
  - Optimum climate conditions to preserve national treasures
eHealth

• Fall Detection
  – Assistance for elderly or infirm people
• Medical Fridges
  – Better storage of medical supplies
• Sportsman Care
  – On and off-field monitoring of athletes
• Patient Surveillance
  – Real time monitoring of medical situations
Examples

Postscapes web page shows many examples:

http://goo.gl/bLnC8D
Six IoT Growth Areas

• **Tracking tools** for pets, cars, offenders, and a variety of assets

• **Power management** and control allow the control of devices from a smartphone e.g. Belkin’s WeMo, Ninja Blocks, and the Revolv hub.

• **Entertainment things**, such as the just-for-fun Bubblino, a device that blows bubbles when certain keywords appear on Twitter
Six IoT Growth Areas

• **Health monitoring devices** and associated online tools, e.g. Jawbone Up, Fitbit for general health monitoring and Corventis, a wireless cardiac monitor

• **Household device monitoring** such as fridges, washing machines, lights, doors etc.

• **Environmental monitoring tools** e.g. the NEST thermostat, or Netatmo weather station for meteorological data
Issues to be resolved

• **Security** - confidentiality, integrity, and availability of both data and services

• **Privacy and surveillance** - Scott McNealy’s position *(Sun Microsystems)* “Privacy is dead. Deal with it.” is not shared by all

• **Meltdown** - impact of system failure
RAIN – Enabling the IoT

• The low cost solution to identification and data collection
• No batteries - lasts forever
• Reads 10m or more
• Reads 1000 tags/second
• Sensor options
• Encryption available
Summary

• The IoT is about **THINGS** not just Devices
• Things will mostly not have IP addresses
• Passive UHF RFID “**RAIN**” will have a major part to play
• We need to better vocalize the importance of the IoT to industry
• The University’s RFID Center of Excellence will help corporations solve their issues
Summary

• How do you fit in this?
• Do you need to be involved?
• How do you get help?
  – Consultants (me!)
  – University of Pittsburgh
Questions?

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