Theory and Practice in IoT 2017 and Future

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Introduction

- Searching Google for “Internet of Things”
  in March 2017,
  about 214 million entries were found.
For example, from Wikipedia [1] and publications by the authors of this paper [2 - 10], Internet of Things (IoT) is the network of all kinds of things embedded with sensors, electronics, software, and so on so forth, connected to the Internet, based on the International Telecommunication Union's Global Standards Initiative" [11].
Kevin Ashton, who was the Executive Director of Auto-ID Center at Massachusetts Institute of Technology (MIT) in the United States said that he coined the term “Internet of Things” to use in the title of the presentation he made to Procter and Gamble (P&G) in the year 1999.
Then in the year 2015, Newsweek named Kevin Ashton “Father of the Internet of Things” [13] as shown in Figure 1. By the way, Srisakdi Charmonman, the senior author of this paper, was named Father of Thai IoT by the International Biographical Centre in Cambridge, England, in the year 2016, as shown in Figure 2.
Kevin Ashton coined the term IoT in 1999 and called “Father of the IoT” in 2015.

Figure 1. Kevin Ashton Coined the Term IoT in 1999 and Called “Father of the IoT” in 2015.
Figure 2. Srisakdi Charmonman named Father of Thai IoT in the year 2016.
Another term for “Internet of Things” is “Internet of Everything” or “IoE”.

Searching Google for “Internet of Everything”, over 40 million entries were found.
For example, the document “Internet of Everything (IoE) Faq” [14] gave answers to nine frequently asked questions (FAQ).

Nine of the FAQ are given below, either in full if they are short, or in summary if they long.
1) What is the Internet of Everything?

The Internet of Everything is the intelligent connection of people, process, data and things.
2) Why is the Internet of Everything important?

The Internet of Everything brings together people, process, data, and things to make networked connections more relevant and valuable than ever before.
IoE turns information into actions that create new capabilities, richer experiences and unprecedented economic opportunity for businesses, individuals and countries.
3) How does the Internet of Everything relate to the Internet of Things?

The “Internet of Everything” builds on the foundation of the "Internet of Things" by adding network intelligence that allows convergence, orchestration and visibility across previously disparate systems.
Introduction (Cont.)

4) Why is the Internet of Everything happening now?

The explosion of new connections joining the Internet of Everything is driven by the development of IP-enabled devices, the increase in global broadband availability and the advent of IPv6 or Internet Protocol Version VI [15].
5) What risks and challenges should be considered in the Internet of Everything?

Some important considerations in the Internet of Everything include privacy, security, energy consumption, and network congestion.
6) What role does the network play in the Internet of Everything?

The network plays a critical role in the Internet of Everything – it must provide an intelligent, manageable, secure infrastructure that can scale to support billions of context-aware devices.
7) How does the Internet of Everything relate to Cisco new brand campaign?

The Internet of Everything represents the business opportunity that the Cisco new brand campaign addresses.
8) Is the Internet of Everything a Cisco architecture or trademark?

The Internet of Everything does not describe a specific architecture and is not solely owned by Cisco.
9) What are the elements of the Internet of Everything?

There are four elements, namely, people, process, things, and data.
This paper presents the introduction to IoT including when the term was coined, the Father of the Internet of Things, the Father of Thai IoT, Nine frequently asked questions about IoT, IoT Theory and Concepts, IoT Practices and Applications, and Expected Number of IoT Devices.
2. IoT Theory and Concepts

- Searching Google for “IoT Theory”, 688,000 results were found.
- From the document “IoT Theory and Concepts” [16], the followings are given.
  1) World will need 300,000 IOT developers by year 2017.
  2) Anything we buy that costs over $100 will be IoT enabled by 2018.
3) Software, electronics and industrial professionals, entrepreneurs and students will need a head start to ride the BIGGEST wave hitting the industry soon with technologies, business verticals, regulations, IoT platforms,
- Alliances, Consortiums and business opportunities;

4) Entrepreneurs should be given opportunity to get started with and learn about:

4.1) Building their own IoT Device and Solutions supported by full access to IoT laboratories.

4.2) IoT definition and use cases of IoT for different domains.
4.3) IoT Applications in different domains.
4.4) IoT Market in different domains.
4.5) IoT Architecture.
4.6) Sensors and Actuators.
4.7) IOT industry.
4.8) IoT standards.
4.9) Multiple IOT software and cloud platform.
4.10) IoT communication architecture.
4.11) IoT protocols.
4.12) Benefits of cloud for IoT.
4.13) Big Data and Big data technologies and IoT.
4.14) IoT securities.
3. IoT Practices and Applications

From the document

“10-internet-of-things-applications” [17],
the top ten IoT applications are:
1) Smart Home. There are over 256 IoT companies and startups providing services for IoT applications in homes.
The total amount of funding for Smart Home startups currently exceeds US$2.5 billions.

This list includes prominent startup names such as Nest or AlertMe as well as a number of multinational corporations like Philips, Haier, or Belkin.
2) Wearables. The most popular IoT wearable is Apple’s smart watch in April 2015.

- There are a lot of other wearable innovations to be excited about, such as:
  2.1) Sony Smart B Trainer,
  2.2) Myo gesture control,
  2.3) LookSee bracelet.
Of all the IoT startups, wearables maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars.
3) Smart City. Many cities in the world have been declared to be Smart Cities with applications of IoT such as traffic management, water distribution, waste management, urban security and environmental monitoring.
4) Smart grids. Smart grid promises to use information about the behaviors of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity.
5) Industrial internet. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently does not reach the masses like smart home or wearables do.
6) Connected car. The connected car is coming up slowly.

- One of the reasons is that the development cycles in the automotive industry take 2-4 years.
- Most large auto makers as well as some brave startups are working on connected car solutions.
- Google, Microsoft, and Apple have all announced connected car platforms.
7) Connected Health or Digital health or Telehealth or Telemedicine.

- The concept of a connected health care system and smart medical devices bears enormous potential not just for companies but also for the well-being of people in general.
8) Smart retail. Proximity-based advertising as a subset of smart retail is starting to take off.

- But the popularity ranking shows that it is still a niche segment.
9) Smart supply chain.

- Supply chains have been getting smarter for some years already.
- Solutions for tracking goods while they are on the road, or getting suppliers to exchange inventory information have been on the market for years.
10) Smart farming. Due to the remoteness of farming operations and the large number of livestock that could be monitored, the Internet of Things could revolutionize the way farmers work.

- Smart farming will become the important application field in the predominantly agricultural-product exporting countries.
4. Expected Number of IoT Devices

- With IoT becoming more and more popular.
- The number of devices connected to IoT are expected to be very large.
- From the document “Reality Check: 50B IoT devices connected by 2020 - beyond the hype and into reality” [18], the following predictions for the year 2020 were made:
1) Prediction made in the year 2011, Ericsson’s CEO Hans Vestberg: “50 billion connected devices”.

2) Prediction made in the year 2013, Cisco: “50 billion things will be connected”.

3) Prediction made in the year 2013, ABI Research report: “30 billion”. 
4) Prediction made in the year 2013, Morgan Stanley report: “75 billion devices”.

5) Prediction made in the year 2014, an Intel Infographic: “31 billion devices”.

Expected Number of IoT Devices (Cont.)
6) Prediction made in the year 2014, ABI Research updated report: “41 billion”.

7) Prediction made in the year 2015, Gartner Research: “20.8 billion”.

Expected Number of IoT Devices (Cont.)
The predictions made in the years 2011 to 2015 of the number of devices connected to IoT by the year 2020 were from 20.8 billion devices to 50 billion devices.

However, the number of 50 billion devices seemed to be more popularly cited.
5. Concluding Remarks

- Searching Google for “Internet of Things”, over 214 million entries were found.
- Internet of Things (IoT) is the network of all kinds of things embedded with sensors, electronics, software, and so on so forth, connected to the Internet.
This paper presented the introduction to IoT including when the term was coined, the Father of the Internet of Things, the Father of Thai IoT, Nine frequently asked questions about IoT, IoT Theory and Concepts, IoT Practices and Applications, and Expected Number of IoT Devices.
Since new papers on IoT are appearing very often, all parties concerned should search Google from time to time to study and decide whether or not to use the new information for the benefits of themselves, their organizations and their countries.
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