Available online at www.worldscientificnews.com

World Scientific News

An International Scientific Journal

WSN 41 (2016) 208-213 EISSN 2392-2192

Internet of Things – An Overview

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ABSTRACT

Ubiquitous sensing enabled by Wireless Sensor Network (WSN) technologies cuts across many areas of modern day living. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. The proliferation of these devices in acommunicating – actuating network creates the Internet of Things (IoT), wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (COP). Fuelled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the Internet into a fully integrated Future Internet.

***Keywords*:** Wireless Sensor Network, Internet of Things, Common Operating Picture

1. INTRODUCTION

Internet of Things is the concept of basically connecting any device with an on and off switch to the Internet. This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else. This also applies to components of machines, for example a jet engine of an airplane or the drill of an oil rig. As mentioned earlier, if it has an on and off switch then chances are it can be a part of the IoT.

(Received 01 February 2016; Accepted 10 February 2016; Date of Publication 11 February 2016)

The IoT is a giant network of connected “things” (which also includes people). The relationships in the network will be between people-people, people-things, and things-things.The term Internet of Things was first coined by Kevin Ashtonin 1999 in the context of supply chain management. However, in the past decade, the definition has been more inclusive coveringwide range of applications like healthcare, utilities, transport, etc. Although the definition of ‘Things’ has changed as technologyevolved, the main goal of making a computer sense informationwithout the aid of human intervention remains the same.A radical evolution of the current Internet into a Network of interconnectedobjects that not only harvests information from theenvironment (sensing) and interacts with the physical world (actuation/command/control), but also uses existing Internet standardsto provide services for information transfer, analytics, applications,and communications.

2. SMART OBJECTS

In the Internet of Things (IoT) paradigm, many of the objects that surround us will be on the network in oneform or another. Radio Frequency Identification (RFID) and sensornetwork technologies will rise to meet this new challenge, in whichinformation and communication systems are invisibly embeddedin the environment around us. This results in the generation ofenormous amounts of data which have to be stored, processedand presented in a seamless, efficient, and easily interpretableform. This model will consist of services that are commodities anddelivered in a manner similar to traditional commodities. Cloudcomputing can provide the virtual infrastructure for such utility computing which integrates monitoring devices, storage devices, analytics tools, visualization platforms and client delivery. The costbased model that Cloud computing offers will enable end-to-endservice provisioning for businesses and users to access applicationson demand from anywhere.

3. NETWORK SUPPORT

Smart connectivity with existing networks and context-awarecomputation using network resources is an indispensable part of IoT. With the growing presence of WiFi and 4G-LTE wireless Internetaccess, the evolution towards ubiquitous information and communication networks is already evident. However, for the Internetof Things vision to successfully emerge, the computing paradigmwill need to go beyond traditional mobile computing scenariosthat use smart phones and portables, and evolve into connectingeveryday existing objects and embedding intelligence into ourenvironment.

For technology to disappear from the consciousness of the user, the Internet of Things demands:

- Shared understanding of the situation of its users and their appliances
- Software architectures and pervasive communication networksto process and convey the contextual information to where it is relevant
- Analytics tools in the Internet of Things that aimfor autonomous and smart behaviour.

With these three fundamentalgrounds in place, smart connectivity and context-aware computationcan be accomplished.

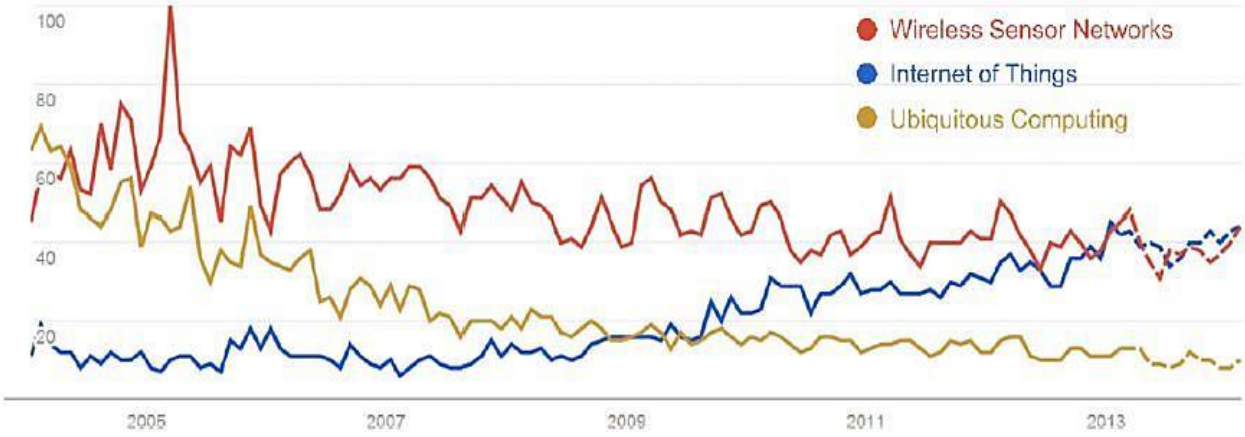

Fig. 1. Google search trends since 2004 for terms Internet of Things, Wireless Sensor Networks, Ubiquitous Computing

Currently, weare in the post-PC era where smart phones and other handheld devicesare changing our environment by making it more interactiveas well as informative. Mark Weiser, the forefather of Ubiquitous Computing (ubicomp), defined a smart environment as "thephysical world that is richly and invisibly interwoven with sensors, actuators, displays, and computational elements, embedded seamlesslyin the everyday objects of our lives, and connected througha continuous network"

4. CLOUD CENTRIC INTERNET OF THINGS

The vision of IoT can be seen from two perspectives — 'Internet'centric and 'Thing' centric. The Internet centric architecture willinvolve internet services being the main focus while data iscontributed by the objects. In the object centric architecture, the smart objects take the centre stage.

A conceptual framework integrating the ubiquitous sensing devices and the applications is shown in Fig. 2. In order to realize the full potential of cloud computing as wellas ubiquitous sensing, a combined framework with a cloud at thecentre seems to be most viable.

5. FIELDS OF APPLICATION

The ability to network embedded devices with limited CPU, memory and power resources means that IoT finds applications in nearly every field. Such systems could be in charge of collecting information in settings ranging from natural ecosystems to buildings and factories, thereby finding applications in fields of environmental sensing and urban planning.

On the other hand, IoT systems could also be responsible for performing actions, not just sensing things. Intelligent shopping systems, for example, could monitor specific users' purchasing habits in a store by tracking their specific mobile phones. These users could then be

provided with special offers on their favourite products, or even location of items that they need, which their fridge has automatically conveyed to the phone.Additional examples of sensing and actuating are reflected in applications that deal with heat, electricity and energy management, as well as cruise-assisting transportation systems. Other applications that the Internet of Things can provide is enabling extended home security features and home automation.

The concept of an "internet of living things" has been proposed to describe networks of biological sensors that could use cloud-based analyses to allow users to study DNA or other molecules. All these advances add to the numerous list of IoT applications. Now with IoT, you can control the electrical devices installed in your house while you are sorting out your files in office. Your water will be warm as soon as you get up in the morning for the shower. All credit goes to smart devices which make up the smart home. Everything connected with the help of Internet.

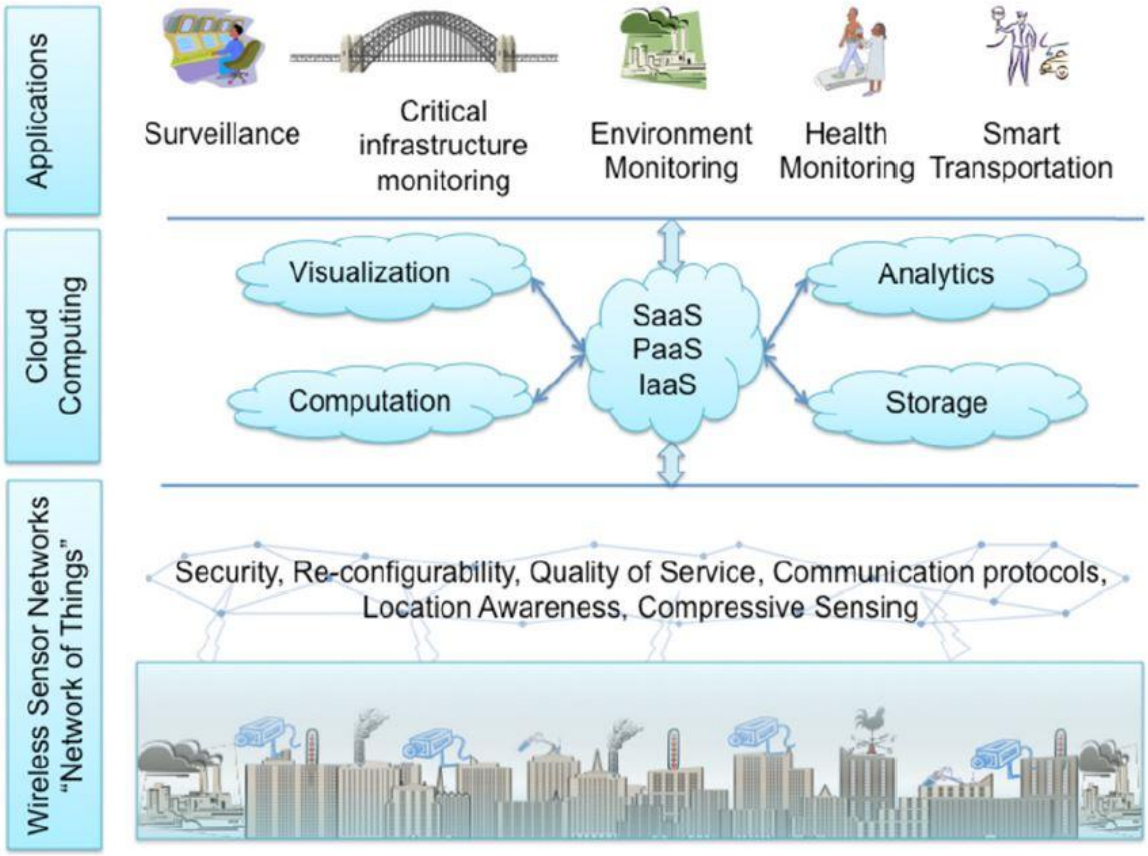

Fig. 2. Conceptual IoT framework with Cloud Computing at the centre

6. SUMMARY AND CONCLUSIONS

The proliferation of devices with communicating–actuatingcapabilities is bringing closer the vision of an Internet of Things, where the sensing and actuation functions seamlessly blend intothe background and new capabilities are made possible throughaccess of rich new

information sources. The evolution of the nextgeneration mobile system will depend on the creativity of the usersin designing new applications. IoT is an ideal emerging technologyto influence this domain by providing new evolving data and therequired computational resources for creating revolutionary apps. The consolidationof international initiatives is quite clearly accelerating progress towards an IoT, providing an overarching view for the integration andfunctional elements that can deliver an operational IoT.

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