A review of emerging technologies under Internet Of Things

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Abstract - This paper presents Internet of Things in in terms of different technologies. Main enabling factor of this concept is the integration of various technologies. According to industry analyst firm IDC, the installed base for the Internet of Things will grow to approximately 212 billion devices by 2020, a number that includes 30 billion connected devices .In this paper, we describe the key technologies involved in the implementation of Internet of Things and the major application domain where the Internet of Things will play a vital role..

Key Words: *Internet, Internet of Things*

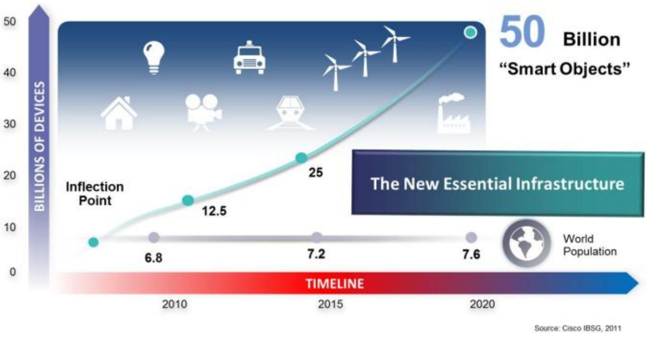
1. INTRODUCTION

The vision of the internet of things is that individual objects of everyday life such as cars, roadways, pacemakers, wirelessly connected pill-shaped cameras in digestive tracks, smart billboards which adjust to the passersby, refrigerators, or even cattle can be equipped with sensors, which can track useful information about these objects. Furthermore, if the objects are uniquely addressable and connected to the internet, then the information about them can flow through the same protocol that connects our computers to the internet. Since these objects can sense the environment and communicate, they have become tools for understanding complexity, and may often enable autonomic responses to challenging scenarios without human intervention. This broader principle is popularly used in IBM's *Smarter Planet* initiative for autonomic computing.

Since the internet of things is built upon the ability to uniquely identify internet-connected objects, the addressable space must be large enough to accommodate the uniquely assigned IP-addresses to the different devices. The original internet protocol IPv4 uses 32-bit addresses, which allows for only about 4.3 billion unique addresses. This was a reasonable design at the time when IPv4 was proposed.

The Internet of Things: A Survey from the Data-Centric Perspective 385 number of internet connected devices was a small fraction of this number. With an increasing number of devices being connected to the internet, and with each requiring its IP-address (for full peer-to-peer communication and functionality), the available IP-addresses are in short supply.As of 2008, the number of internet connected devices exceeded the total number of people on the planet. Fortunately, the new IPv6 protocol which is being adopted has 128-bit addressability, and therefore has an address space of 2128. This is likely to solve the addressability bottleneck being faced by the internet of things phenomenon. It is clear that from a data centric perspective, *scalability*, *distributed processing*, and *real time analytics* will be critical for effective enablement. The large number of devices simultaneously producing data in an automated way will greatly dwarf the information which individuals can enter manually. Humans are constrained by time and physical limits in terms of how much a single human can enter into the system manually, and this constraint is unlikely to change very much over time. On the other hand, the physical limitations on how much data can be effectively collected from embedded sensor devices have steadily been increasing with advances in hardware technology. Furthermore, with increasing numbers of devices which are connected to the internet, the number of such streams also continue to increase in time. Simply speaking, automated sensor data is likely to greatly overwhelm the data which are available from more traditional human-centered sources such as social media. In fact, it is the trend towards ubiquitous and pervasive computing, which is the greatest driving force towards *big data analytics*.

Aside from scalability issues, privacy continues to be a challenge for data collection. Since the individual objects can be tracked, they can also lead to privacy concerns, when these objects are associated with individuals. A common example in the case of RFID technology is one in which a tagged object (such as clothing) is bought by an individual, and then the individual can be tracked because of the presence of the tag on their person. In cases, where such information is available on the internet, the individual can be tracked from almost anywhere, which could lead to unprecedented violations of privacy.



The Internet of Things is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment and the confluence of efficient wireless protocols, improved sensors, cheaper processors, and a bevy of start-ups and established companies developing the necessary management and application software has finally made the concept of the Internet of Things mainstream. The number of Internet-connected devices surpassed the number of human beings on the planet in 2011, and by 2020, Internet-connected devices are expected to number between 26 billion and 50 billion. For every Internet-connected PC or handset there will be 5–10 other types of devices sold with native Internet connectivity

2.TECHNOLOGIES INVOLVED

There are several technologies that can be used to implement the concept of Internet of
Things. In this paper, we discussed the following technologies:

_ Radio Frequency Identification (RFID)
_ Near Field Communication (NFC)
_ Machine-to-Machine Communication (M2M)
_ Vehicle-to-Vehicle Communication (V2V)

2.1Radio frequency identification (RFID)

RFID system is composed of one or more reader(s) and several RFID tags. Tags are characterized by a specific address and are applied to objects. Tags uses radio-frequency electromagnetic fields to transfer data attached to an object. The tags contained electronically stored information which can be read by the RFID reader when the object came in the proximity of the reader (WIKIPEDIA, 2013). RFID allows to monitor objects in real-time, without the need of being in line-of-sight.
From the physical point of view RFID tag or label is a tiny microchip combined with an antenna in a compact package. The tag's antenna picks up signals from an RFID reader and then returns the signal, usually with some additional information. Hitachi has developed a tag with dimensions 0.4*0.4*0.15 mm
MIT Media Lab has designed a build-your-own bag for people who tend to forget keys, mobile phone etc. when leaving home. The bag is made from computerized fabric patches with the radio receiver and antenna, which communicate through signals from RFID tags attached to a mobile phone, a key ring or a wallet.
A sensor built in the bag's handle will detect the moment when it is picked up, indicating that the owner is about to leave and will check the content of the bag and confirm whether the owner has put all the tagged things into the bag or not. If one of the things is missing, the sensor triggers the voice synthesizer, which will announce: "Mobile phone: yes. Wallet: Yes. Keys: No". Owners can customize the bag adding other functions, for instance, through an option to remind their owners to take an umbrella. The bag downloads weather reports from the internet via Bluetooth. The system will alert the owner to take an umbrella when rain is forecast.

Build your own smart purse

2.2Near field communication (NFC)

NFC is quite similar to RFID, or it can be looked as an integration of RFID reader into a mobile phone, which makes NFC customer-oriented as mobile phone is the most popular personal device worldwide (VILMOS; MEDAGLIA; MORONI, 2011). NFC can also be seen as a type of radio communication between NFC enabled mobile devices by touching them together or bring close in the proximity of the other phone. From the technical point of view, NFC operates within the unlicensed Radio Frequency band of 13.56 MHz (MEDAGLIA, 2011); the typical operating range of NFC device is 20 cm.
The operating range is directly depended on the size of the antenna in the device.

2.3Machine-to-machine communication (M2M)

Machine-to-Machine (M2M) refers to the communications between computers, embedded processors, smart sensors, actuators and mobile devices (DYE, 2008). The use of M2M communication is increasing in the scenario at a fast pace. For instance, researchers predicted that, by 2014, there

will be 1.5 billion wirelessly connected devices excluding mobile phones.
There are four components of M2M which are sensing, heterogeneous access, information processing,
application and services

2.4Vehicle-to-vehicle (V2V) communication

V2V Communication is a new concept in which lots of research has to be done. In this, vehicles act as a node in a network and communicate with each other with the use of sensors connected in an ad-hoc network. The infrastructure of V2V network is a bit complicated as there is no fixed topology to be followed as vehicles are moving from one place to another all the time. Applications for vehicular networks can be divided into four broad categories, namely safety and collision avoidance, traffic infrastructure management, vehicle telematics, and entertainment services and Internet connectivity Vehicles communicate with each other within a range of 1000 m. Two types of communication are possible; first one is vehicle-to-vehicle and the other one is the vehicle with the road-side infrastructure. Vehicular communication system is developed as a part of Intelligent Transport System (ITS). From a network architecture point of view, focus is initially placed on routing protocols; Physical layer (PHY), Medium Access Control (MAC) layer, and broadcasting

3APPLICATION

Ample of application is there where Internet of Things is playing a vital role. In the near future, there will be even more applications using Internet of Things. As the world is going through a technological revolution, more and more objects will use the technology of RFID, NFC, M2M communication and V2V communication for automation
Transportation and logistic domain

3.1 Smart parking

The new Smart Parking sensor's to be buried in parking spaces to detect the arrival and departure of vehicles. The Smart parking provides extensive parking management solutions which helps motorists save time and fuel (LIBELIUM, 2013). A significant contribution to congestion arises from motorists searching for accessible parking spaces. Providing accurate information about parking spaces helps traffic flow better, and this will also allow the deployment of application to book parking spaces directly from the vehicle. This will help to reduce CO2 emissions and to minimize traffic jams

3.2 Healthcare domain

3.2.1 Health tracking

We can track health of a person with the help of combination of RFID and NFC technology together. With the use of sensors and the technology stated above we can track the person's body temperature, heart beat rate, blood pressure, etc. In case of emergency, the individual and their personal doctor will be notified with all the data collected by the sensors.

3.**2.2 Pharmaceutical products**

Safety of pharmaceutical product is of utmost importance to prevent the health of patients.
Attaching smart labels to drugs, tracking them through the supply chain and monitoring their status with sensors has benefits like items require specific storing conditions so they can be monitored whether their requirements are fulfilled or not. We can also track the expiry of drugs with the use of sensors; this will prevent the transferring of expired drugs to the patient.

3.3 Smart environments domain

3.3.1 Smart water supply

Smart cities must monitor water supply to ensure that there is adequate access for resident and business need. Wireless Sensor Networks provide the technology for cities to monitor their water piping systems more accurately and discover their greatest water loss risks. Cities that are addressing water leakage problem with sensor technology are producing high savings from their investment. Tokyo, for example, has calculated they save $170 million each year by detecting water leakage problems early (LIBELIUM, 2013). The system can report pipe flow measurement data regularly, as well as send automatic alerts if water use is outside of an estimated normal range. This allows a smart city to determine the location of leaking pipes and prioritize repairs based on the amount of water loss that could be prevented

3.3.2 Food sustainability

Food that we eat has to go through various stages before they arrive in the refrigerators. They are bound in a strict food cycle: production, harvesting, transportation and distribution.
With the use of appropriate sensors, we can prevent the food from climatic damages by keeping a good eye on temperature, humidity, light, healt etc. Sensors can measure these variations precisely and notify the concerned person. Monitoring helps in prevention of possible plant

3.4 M2M and V2V communication domain

3.4.1 Industrial maintenance

The sensors fit in the machinery are used to monitor the temperature and vibration in industrial motors, and also warn when irregular operation is detected. Industrial maintenance is
the term for the task of keeping the equipment running at peak efficiency in a factory. It includes scheduled cleaning, parts replacement and lubrication and repairs. The field of industrial maintenance does not involve just the repair of already existing malfunctions (LIBELIUM, 2013), but preventive maintenance typically is also a vital part of the field. Companies waste billions due to inefficient maintenance management. This will help Companies to save money and time.

3.4.2 Smart cars

Machine to machine (M2M) communications, and especially Smart Cars, could help to improve accident prevention. A pilot to operate remote control car in order to minimize car accident and reduce human error was developed by McGill University (SANTORELLI; MORAWSKI; LE-NGOC, 2011). These driverless cars will provide functioning more than just safety such as they can save valuable time, reduce stress of driving etc.

3.5 NFC application domain

3.5.1 Travelling

NFC can enhance the travelling experience to a greater extent: it can help us to minimize the check in time during the stay in hotels. When the room is booked in a hotel, a secure digital key is sent to the traveler. One can use that digital ticket, with the NFC enabled locks, and directly enter into the room without wasting any time in check-in lounges.

3.5.2 Health

NFC can be useful in monitoring personal health. It can gather information about health and send the collective data to health monitoring center. These centers can, therefore, analyze health and provide the valuable report and information to the individual

4 OPEN ISSUES

In scenario, the effect of IoT can be seen in all technical areas. It helps in smart communication between objects but several issues are there to be addressed before the worldwide implementation of IoT. In this section, we identify some important issues related to addressing, routing protocol, security and privacy, standardization issue and congestion and overload issue.

4.1 Addressing and networking issue

Each and every device connected in the network has a unique address by which it can be identified. As the IoT is gaining grounds in scenario, the demand for these unique address increases at a very fast rate. There are very limited number of address available in IPv4 addressing and will soon reach zero as it identifies each node through a 4-byte address.

5.CONCLUSION

The internet has drastically changed the way we lived, as in scenario all the interaction is done over the internet. The IoT has the potential to add a new dimension to this process by enabling communication between smart objects. IoT should be considered as a part of future internet as everything is going to be connected in a network so that objects can interact with each other, but still there are lots of issues which are to be solved to make this a reality. Lot of research is required in this field, once implemented successfully, the quality of life is improved because of the reduction of the effort made by humans on unimportant things.

In this paper, we presented the technologies and its specification that can be used to make Internet of Things a reality. After that, we state some good examples where Internet of Things is of great use, and at last we discuss some open issues which are still to be solved before the wide acceptance of this technology.

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