

Cloud Computing and Internet of Things: Towards a Smarter World

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Abstract— M2M communication has been revamped after the designing and implementation of networks. Internet has changed the world scenario by connecting people. P2P computing has become pervasive and has influenced the life of people in a great magnitude. A common man is able to compute in a small way and is able to communicate easily than it used to be some ten years back. On the next level, the society has moved from P2P and M2M to P2M due to the explosion of the use of internet and the mobile devices. The economic feasibility of these devices are so easy that even a device a device with basic communication and computing facility is available for INR.250. The mobile devices have almost replaced the conventional computing devices. All these devices are technologically enabled to be connected in the network and can become smart objects. The new idea of the internet of things and internet of everything stems from this background of network and devices. Now there is a vision of connecting everything in the world. The paper explores the basic ideas related to the internet of Things and Internet of everything.

Index Terms— internet of things Internet of Everything, RFID, M2M, P2p, Pervasive Computing

I. INTRODUCTION

‘I think therefore I am’, is the famous philosophical confirmation of on3’s existence. ‘I communicate therefore I am’, might be the new definition given for our existence today. Inter connectivity is going to be our way of life tomorrow. The scene of the movie Avatar where every animate and inanimate things are connected through a system of common network protocols, where all in network can communicate or talk to one another through a common network language will soon become feasible. Internet of things is going to be the way of life in the near future. IPv6 has paved the way for every device on the Internet to have its own IP address. M2M communication is on the rise, enabling devices to exchange and act upon information without a person ever being involved. It has been predicted that the number of connected devices will sir[ass 15 billion nodes by 2015 and reach over 50 billion by 2020. Table 1 presents the current scenario of connections in the world.

Region	M2M%total connections(2013)	M2M CAGR Connections(2010-2013)	CAGR(2010-2013)
Africa	1.0%	41.3%	15.0%
Asia	2.1%	55.0%	10.4%
Europe	5.1%	28.6%	2.4%
Latin America	2.1%	43.7%	7.8%
Northern America	9.3%	22.5%	3.6%
Oceania	5.1%	25.8%	5.5%
Global	2.8%	37.6%	8.8%

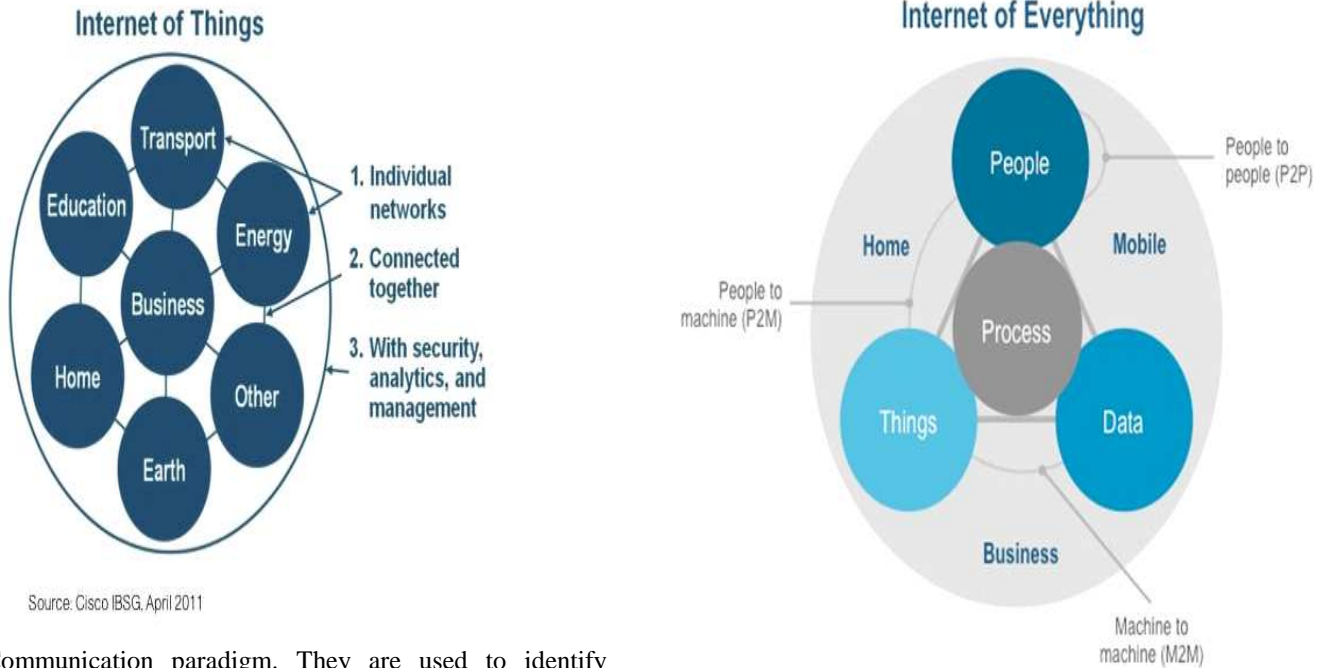
INTERNET OF THINGS AND INTERNET OF EVERYTHING

A. Definition

IoT is defined as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual)things based on existing and evolving interoperable information and communication technologies. IoT is also defined as the physical objects to the Internet and to each other through small , embedded sensors and wired and wireless technologies, creating and ecosystem of ubiquitous computing. Another definition succinctly calls it as embedded intelligence. The Internet of Things(IoT) describes the phenomenon of everyday devices connecting to the internet through tiny embedded sensors and computing power. Everything that is connected and processes data is an IoT component or a smart object. Smart objects include people, animal and things in the world. The goal of the Internet of Things is to enable things to be connected anytime, anywhere, with anything and anyone ideally using any path/network and any service. In the future computation, storage and communication services will be highly wireless/wired sensors, M2M devices, RFID tags, etc.) will create a highly decentralized common poll of resources interconnected by a dynamic network of networks. The communication language will be based on interoperable protocols, operating in heterogeneous environments and platforms. Thus IoT is about things and people connected through network and in communication of data with capabilities of processing from basic to sophisticated data.

II. IOT ELEMENTS

A Gartner’s IT Hype Cycle has identified IoT as one of the recent emerging technologies in IT. Radio **Frequency Identification(RFID)** is a major breakthrough in embedded



Source: Cisco IBSG, April 2011

Communication paradigm. They are used to identify anything to which it has been attached. The RFID tags can be passive and active. For example, the retail and supply chain management, transportation and access control applications. It is used in processing toll cards and bank cards. IoT is viewed as the network of networks (Fig. 1,1).

Wireless Sensor network (WSN) has also contributed towards the growth of IoT. Low cost, power miniature devices for use in remote sensing applications have facilitated sensing, collection, processing, analysis and dissemination of information. WSN hardware, communication stack, middle-ware, secure data aggregation are some of the challenges. **Addressing schemes** to uniquely identify the 'thing' is critical for the success of IoT. The unique identifier will allow users to control and communicate the billion devices through the internet. The current IPv4 may not support the billion devices we are talking about; but IPv6 may alleviate the device identification problems. Uniform Resource Name system is taken as the fundamental for the development of IoT. The URN with IPv6 can enable WSN to become a framework for IoT. Data storage and analytics is another requirement for IoT due to the huge volume of data that would be created by these interconnected billion devices. Data need to be stored effectively used for smart monitoring and implementation of data intelligently. AI algorithms play a crucial role in these areas of analytics. Algorithms and automated decision making should be used for IoT applications.

III. APPLICATION OF IOT

1) Connected cities:

The population is expected to grow from 3.5 billion in 2010 to 6.2 billion in 2050. Cities are becoming hubs of energy consumption, transportation, and parking.

Figure: key Technological Development in the context of IoT application Domain public safety and urban logistics.

Cities will become smarter due to M2M technologies. Sensors, wireless communication facilitate better energy management, traffic optimization and building automation. Processing information from various data capturing devices in areas such as transportation, population waste management, energy and so on is very powerful which would provide more information and ownership to the citizens.

2) Connected Homes:

Energy management is a big issue in homes. Making homes environment and energy aware becomes easier through IoT. Remotely managing and controlling facilities, devices and equipment's at home is possible. Ultimately connectivity will improve the quality of life and the standard of living.

3) Connected Health:

Another significant area of the application of IoT is healthcare. With growing population and the number of people with chronic diseases, health management has become a major area of concern. IoT enable health monitoring efficient through wearable and attachable smart devices that will transmit data to the health experts regularly for further follow up and monitoring.

4) Connected cars:

Smart cars communicate to another car and to the driver. Modern cars have multiple sensors fixed in them that can automatically control and monitor the parts. Monitoring of tire pressure and climate prediction, prediction of traffic and road condition, etc become feasible through the processing and analysis.

The list is not exhaustive as the IoT is going to connect everything that can be connected. Every object will become smart through the features of data connectivity and communicability.

IV. CONCLUSION AND CHALLENGES:

From the areas of application it is obvious that the issues of security will become a major concern. The three components of IoT. RFID, WSN and cloud are vulnerable to attacks. Cryptographic technique and methods will play a major role in addressing the security issues.

The idea of privacy has been slowly disappearing since the expansion of cyberspace. In cyberspace privacy is not longer a concern. And people are slowly getting used to it and changing their attitude, understanding and behavior according to that.

The technology needed to handle the huge volume of data that IoT is going to produce and communicate over the network. This might lead us to a list of challenges such as data representation, storage and querying. New methods are needed to handle such a huge volume of data. As the heterogeneity of the devices increase the methods of handling the varieties of data would become tough.

IoT is about 'thing' the 'thing' includes even people animals. The existential question of human being considered as a 'thing' may raise several concerns. How would one feel if he or she is equated with another device or animal in terms of data connectivity and processing? Will the machines overtake us it is often depicted in Terminator movies? IoT shall reconstruct the society and the way we live. There are both positive and negative aspects of any new technology. IoT promises to take out lives into the next level of living.

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