A Journey from IoT to IoE

Dipti Chauhan, Jay Kumar Jain

Abstract*: The usage is internet is so much affected in our lives that we are depend on it in such a way that even the things we use in our day today lives is now a days part of communication and this need led us to move in a new era of Internet of Things (IoT). This paper discusses about the transition phase from Internet of Things (IoT) to Internet of Everything (IoE). This transition is not an overnight process it takes place gradually. This is very important to adapt to this transition to make our lives comfortable and the devices be able to communicate with one another. However this can be made possible by the people by adapting and understanding technologies and make them able to use it as per their needs. IoT and IoE are the talk of town now a days in the internetworking community. Here in this paper I have made an attempt to show the growth from IoT and to IoE and also make the differences between both the technologies. Also I have discussed about the importance of next generation of internet protocol IPv6 in context of IoT.

Keywords* : *IoT, IoE, IPv6, Objects, Process.

I. INTRODUCTION

Internet is a vast global interconnection of connected computers, servers, mobiles, tablets etc. which is governed by standard protocols for communications system. The usage of Internet enables sending, receiving, or communication of information with remote servers, clouds and analytics platforms. IoT is basically an interconnection of network of physical things (objects) capable of sending and receiving information through internet or other technologies and networks just as computers, servers etc. We all have been discussing about the Internet of Things for a long time, however what are the things we are discussing in this field. According to Gartner, 25 billion devices will be associated with the internet by the year 2020 and those associations will encourage the utilized information to examine, preplan, manage, and settle on insightful choices independently [1]. The “things" which are associated with the devices may appear in many different forms, factors, patterns of use and locations. Consistently we are making many more tools and applications that are connected with the internet in a lot of ways. In this Era an ever increasing number of companies and experts are discussing about "Internet of Everything "(IoE). In fact the terms IoT and IoE are the two faces of a coin. When we moving ahead from "things" to "everything" then we include people, processes and data. It's just a lot bigger than IoT, all the included ecosystem is a good one!

And we all the users are very excited to be the part of this expanded, connected ecosystem. And when we are talking about consumers, the excitement is about being able to interact with smart refrigerators, smart lights, smart cars, smart watches, smart beds, smart toothbrushes, and this list goes is far off beyond the reach. For every enterprise or company worldwide adopting IoE, this is chance to make economic value from this connected ecosystem. Be that as it may, how does this occur? The answer of this question lies in this data which is generated by connected devices. IOE additionally incorporates data about people and processes that have been captured in various applications like CRM and ERP, and stored it in the cloud, or very large data sources and other data repositories. Organizations need to use that data related to things, people and processes, how well the end devices are working, whether the devices are working optimal, even if all their employees are maximally optimal. Regardless of their determination, each process is implemented and the way it works is intended to benefit from this reaction. Education, enterprise services business decided that additional revenue may be generated and also to save cost and time. The future is implemented through IoT the future where real world physical and digital identities are connected and information is communicated through a whole an era of a new class of applications and services [2].

It is not possible to attain the IoT and IoE solutions with the usage of IPv4 address space as it is almost depleted and very few addresses are left. The current IPv4 solutions for device identification and management does not seem fit to address problems of this growing global IoT device space. Consequently, there is a dire need for IPv6. IPv6 is the next-generation Internet protocol that will replace IPv4. IPv6 is acknowledged to provide more address space, better address design, and greater security [4]. Despite of various advantages that IPv6 offers over IPv4 its adoption rate of IPv6 is very slow. As per the google statistics about IPv6 adoption in the Internet on an ongoing basis. The following figure 1 shows the information about the percentage of users that access Google over IPv6 as on July 2019 [5]

II. IOT VS IOE

The Internet of Things (IoT) is another interconnection of innovative technology. It is being proclaimed as the following industrial revolution. The Internet of Things is an expansion of existing associations. These associations are among individuals and PCs to incorporate carefully associated "things". The Internet of Everything was recorded as one of the top patterns of 2015 by Gartner .The term Internet of Everything (IoE) is a genuinely new term, and there is a ton disarray about the distinction between the Internet of Everything (IoE) and the Internet of Things (IoT). In this section we are presenting the difference between IoT and IoE.

Revised Manuscript Received on September 03, 2019

***** Correspondence Author

Dipti Chauhan*, Assistant Professor, School of Computer Science & IT, Symbiosis University of Applied Sciences, Indore, India.

Jay Kumar Jain, Associate Professor, Department of Information Technology, Sagar Institute of Research & Technology, Bhopal, India.

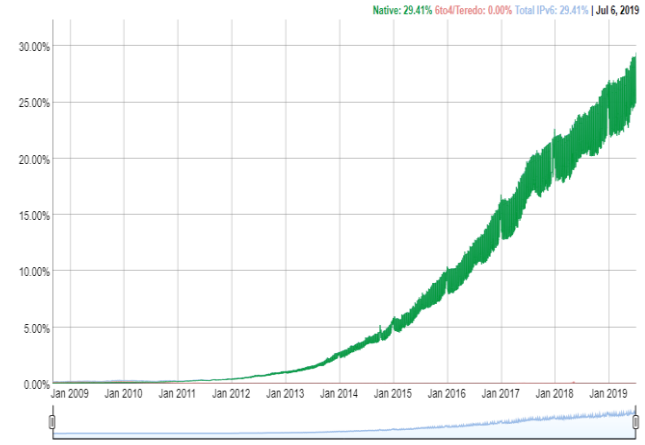

Fig.1. Access of Google users over IPv6 in Percentage

IoT is concerned about things i.e. the system of physical devices and items accessed through the Internet. These objects may contain embedded technology to interact with interior states or the outside condition. In another words, when objects can sense and convey, it changes how and where choices are made, and who makes them. However IoE laid the foundation over IoT and is concerned with bringing together people, process, data, and things to make networked connections more relevant and valuable than ever before-turning information into actions that create new capabilities, better experiences, and unprecedented economic opportunity for businesses, individuals, and countries [6]. IoE depicts an existence where billions of items have sensors to distinguish measure and evaluate their status; all associated over open or private systems utilizing standard and exclusive conventions. The Internet of Everything will re-concoct enterprises at three levels: business process, plan of action, and business minute. There are tremendous values in IoE adjustment over the globe. Basically, IoE attempts to give a start to finish environment of availability that comprises of innovations, procedures, and ideas utilized over all network use-cases. The following figure: 2 demonstrate the mainstays of Internet of Everything (IoE). Four Pillars exposed to Internet of Everything are People, Process, Data and Things.

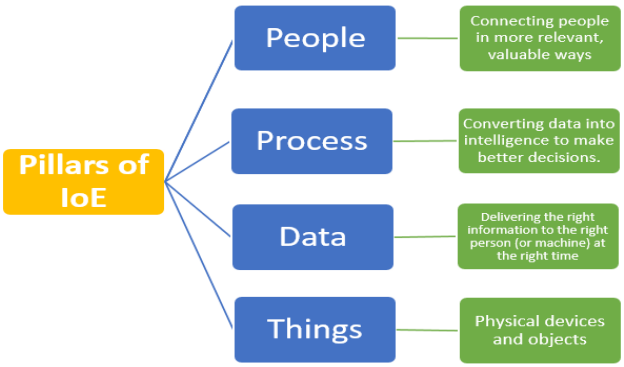

Fig.2. Pillars of IoE

III. CHALLENGES FOR INTERNET OF THINGS

The exponential reception of IoT will drive down sensor and procurement costs, empowering increasingly more reasonable business cases that have recently been excessively costly. A huge amount of data is generated through the communication from IoT. And this data generated from IoT devices only changes to value if it becomes subject to analysis, which brings data analytics in the picture. Data analytics is a process, which is used to check large and small data sets with different data properties to derive meaningful conclusions and actionable insights. Internet of Things is another insurgency of the Internet. The challenges of the Internet of Things will be complex and sweeping. We will attempt here to distinguish a portion of these difficulties by thinking about the viewpoints of Government, Privacy and Legal Regulatory and Rights issues.

Government and IoT- A lot of challenges is faced by the government regarding the security issues for the usage of IoT. IoT will rely upon both open and private interchanges arranges, and will utilize different wireline and remote modes, including satellite, frequently in blend or on a related premise. The requirement for consistent availability will require strong broadband and foundation for interconnecting gadgets. How would governments be able to address this difficulty?

Privacy Issues: The likelihood of tracking and reconnaissance of individuals by government and private organizations increases as the devices are always associated with the internet. These devices gather client information without their authorization, examine them for purposes just known to the parent organization. The social grasp of the IoT devices leads individuals to confide in these devices with gathering of their own information without understanding the future ramifications.

Legal Regulatory and Rights issues-There are no solid laws present which incorporates the different layers of IoT over the world. The range of devices and objects associated with one another raises numerous security issues and no current legitimate laws address such issues. The problem arises in whether current risk laws will expand their arm for devices which are associated with the web all the time on the grounds that such gadgets have complex responsibility issues.

IV. APPLICATIONS OF IOT

Obviously that the present publicity around the Internet of Things (IoT) is enormous. It appears each day another organization reports some IoT enabled product. Furthermore, with it a few (one-sided) expectation of where the market is going. Rather than making one more one-sided forecast, we gauged what the extremely prominent Internet of Things applications are at the present time. Following are the few Applications of IoT.

1. Smart Cities: This is one of the main applications of IoT which includes the usage of ICT to increase operational efficiency and enables information sharing with the public and improve both the quality of government services and citizen welfare. The Government of India has started Smart City Mission with the mission to develop 100 cities across the country making them citizen friendly and sustainable [7]. Smart city consists of different areas to be covered under IoT. Figure 3 represents the smart city application of IoT [8].

Fig.3. Smart City

2. Smart Environment: Smart Environments are the physical worlds and needs which are daily encountered in human day to day life, and can be seamlessly embedded with smart devices equipped with sensors, actuators and computational elements [9]. They have the potential to allow users to engage and interact seamlessly with their immediate surroundings. This has been made conceivable by the presentation of insightful innovations, combined with programming based administrations. It is obvious that innovative advances have given another time to both detecting innovation and computational handling to encourage the vision of brilliant conditions. Despite the fact that various difficulties exist in their deployment, various large scale projects are trying to advance their take-up further. The Smart Environments typically include different components which are listed in figure 4.

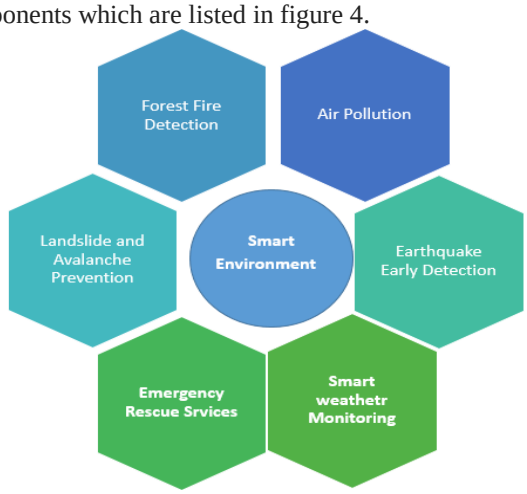

Fig.4. Smart Environment

3. Smart Water: Water is the vital resource for everyone and smart water application of IoT enables it to consider it in every part of the water cycle—from sourcing to treatment to delivery to consumption to reclamation. Water Quality, Water Leakages and River floods are the applications of Smart water. A lot research is being made in this area.

4. Smart Meter: Smart metering is concerned with the benefits and utilities by improving customer satisfaction with faster interaction, while giving consumers more control of their energy usage to save money and reduce carbon emissions. This application deals with monitoring & measurement of Smart grids, Tank level, Photovoltaic Installations, Water flow and Stock Calculations.

5. Security & Emergencies: Protections and crisis incorporates Explosive and Hazardous Gases which identify gas levels and spillages in modern conditions, surroundings of synthetic industrial facilities and inside mines, Perimeter Access Control incorporates access control to confined territories and location of individuals in non-approved zones, Liquid Presence which incorporates fluid discovery in warehouses, data centres and sensitive building grounds to avert break downs and erosion and Radiation Levels which incorporates Distributed estimation of radiation levels in atomic power stations surroundings to produce spillage alarms.

6. Logistics: This IoT application includes Quality of Shipment Conditions, Item Location, Storage Incompatibility Detection, Fleet Tracking etc.

7. eHealth: This incorporates Fall Detection: Assistance for old or impaired individuals living autonomous.
Therapeutic Fridges: Control of conditions inside coolers putting away immunizations, drugs and natural components.
Sportsmen Care: Vital signs observing in superior focuses and fields.
Patients Surveillance: Monitoring of states of patients inside clinics and in elderly folks individuals' home.
UV Radiation: Measurement of Ultraviolet sun beams to caution individuals not to be uncovered in specific hours.

V. IOT AND IPV6

It is already very clear that with the use of IoT there is a need of lot of IP addresses which cannot be fulfilled by IPv4 internet protocol. Due to limited address capacity of IPv4, the transition towards IPv6 is unavoidable. IPv6 has the address space of 128 bit which results in 340 undecillion (that is 340 trillion trillion trillion) addresses. We can also say that IPv6 is actually a key communication enabler for the future Internet of Things. Without the extensive global adoption and successful deployment of IPv6 as the primary version of the Internet Protocol, the adoption of IoT technology is not be possible. This is due to the fact that IoT needs more address to address devices over the network which is not possible with IPv4. Also adoption of IPv6 will results towards more secure internet as IPv6 is more secure over IPv4. IPv6 over IoT has been researched for a long time and have built up a few working frameworks like Tiny OS and Contiki that are generally very little and bolster the IPv6 convention suites and environments IPv6 is extremely wealthy in potential highlights, these diminished situations have regularly limited cautiously the highlights accessible so as to address IoT issues while reducing the size of the hidden framework and leaving more space for applications. For instance an essential Contiki framework takes under 20KByte, and even one supporting a full IPv6 stack and the other high-level protocols including DTLS can likely fit into 70 Kbyte. Because of auto address design highlight of IPv6 radically decreases IoT configuration effort and deployment cost.

VI. CONCLUSION

In this survey paper we presented a detailed description from Internet of Things (IoT) to Internet of Everything (IoE). This new phase of IoT and IoE is relatively new. If we think back just 20 years ago, the majority of Internet-connected devices were desktop PCs and other immobile hardware. Then, large mobile devices started to be introduced. As we know, this rapidly progressed to smartphones. From here, all types of everyday "things" became, and are becoming, Internet-connected. These gadgets are harmoniously both helped by wise information and help develop AI with the plenty of information that clients are making. These IoT gadgets, for example, vehicles, wearables, apparatuses, and the sky is the limit from there, ended up implanted with sensors, control frameworks, and processors so as to empower level correspondence all through an open, multinode arrange. Today, IoE is considered a superset of IoT. Cisco, which originally instituted the term the Internet of Everything, accepts that this procedure brings individuals, information, and things together to make organized associations increasingly pertinent and important. With this, the objective is to have "new capacities, more extravagant encounters, and extraordinary financial open door for organizations, people, and nations.

REFERENCES

1. Ray, ParthaPratim. "A survey on Internet of Things architectures." Journal of King Saud University-Computer and Information Sciences 30.3 (2018): 291-319.
2. Miorandi, Daniele, et al. "Internet of things: Vision, applications and research challenges." Ad hoc networks 10.7 (2012): 1497-1516.
3. Samad, Fahad, and Z. A. Memon. "The future of internet: IPv6 fulfilling the routing needs in internet of things." International Journal of Future Generation Communication and Networking 11.1 (2018): 13-22.
4. Chauhan, Dipti, and Sanjay Sharma. "A survey on next generation Internet Protocol: IPv6." Int. J. Electron. Ind. Eng.(IJEEE), ISSN 2.2 (2014): 125-128.
5. Weblinkurl:https://www.google.com/intl/en/ipv6/statistics.html.
6. Bojanova, Irena, George Hurlburt, and Jeffrey Voas. "Imagineering an internet of anything." Computer 47.6 (2014): 72-77.
7. Mission Statement and Guidelines - Smart Cities" (PDF). Ministry of Urban Development, GOI. Archived (PDF) from the original on 1 August 2017. Retrieved 1 February 2016.
8. Jain, Jay Kumar. "Secure and Energy-Efficient Route Adjustment Model for Internet of Things." Wireless Personal Communications (2019): 1-25.
9. VimalJerald, A., S. A. Rabara, and T. D. P. Bai. "Internet of things (IoT) based smart environment integrating various business applications." International Journal of Computer Applications 128.128 (2015): 32-37.

AUTHORS PROFILE

Dr. Dipti Chauhan is working as Assistant Professor in the School of Computer Science and information technology at Symbiosis University of Applied Sciences Indore. She did her PhD from Maulana Azad National Institute of Technology Bhopal in 2016. She also did her M. tech in Computer Science and Engineering from University Institute of Technology Bhopal. She is having an overall teaching and research experience of about 13 years. She is also IPv6 certified gold and silver network professional from Universiti Sains Malaysia. Her research interests include wireless networks, advanced computer networks & Internet of Things.

Dr. Jay Kumar Jain is working as Associate Professor in the Department of Information of Technology at Sagar Institute of Research & Technology, Bhopal, India. He did his Ph. D. from Maulana Azad National Institute of Technology Bhopal in 2015. He is having research as well as teaching experience of about 13 years. He has published many research papers in International/National Journal and Conferences. His research interests include Wireless Sensor Networks, Internet of Things and MANETs.