

# An Evolutionary Development from IoT (Internet of Things) to IoE (Internet of Everything)

Sumit Purohit<sup>1</sup>, Shailendra Purohit<sup>2</sup>, Dr. Ajay Mathur<sup>3</sup>

<sup>1</sup>Asst. Professor, Department of Computer Science, Aishwarya College of Education, Jodhpur, (Raj), India

<sup>2</sup>Asst. Professor, Department of Computer Science, Aishwarya College of Education, Jodhpur, (Raj), India

<sup>3</sup>Professor, Computer Science Department, Govt. Polytechnic College, Jodhpur, (Raj.), India

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**Abstract** – In today's scenario we people are very much dependent on Internet, as Internet is an important part of our daily routine. As we know Internet is a medium of communication & because of such routine of accessing Internet that creates a new horizon of Internet of Thing (IoT). Our paper shares the overview of transformation of Internet of Thing (IoT) to Internet of Everything (IoE). This is the fact that every evolution takes time to grow hence this evolution also growing according to phases and also following the slogan "Necessity is the mother of Invention". This transformational development is an important aspect because through this our technological environment and also our routine will be more comfortable. Every proposal of new ones will have requirement analysis & on behalves of those needs new system appears. Through this comfortable technology, devices and user can met their compatibility about to achieve goal of invention. As IoT & IoE both are upcoming interests for internet world hence our paper is focused on such evolutionary development.

**Key Words:** IoT, IoE, Object, Interconnected devices, Process, People, Network

## 1. INTRODUCTION

Our today's world is very much dependent on Internet. The life without Internet is difficult to imagine. As every ones routine is dependent on it, we have variety of electrical & electronic devices which are connected with Internet. Initially this internet connectivity was with personal computers. After that this connectivity enhanced regarding to people & thereafter requirements move towards more developed concept of Internet of Things. In current era due to continuous development of industrialization, the research is on peak about to search the concept of Internet of Everything (IoE). So we can say Internet of Things (IoT) & Internet of Everything (IoE) both are basically two sides of the same thing. When we move from 'things' to 'everything' then other then network and things we have people, process & data too. So IoE is an extension of IoT. We people are very curious about to become part of this advanced world of interconnected system.

## 2. IoT (Internet of Things)

### 2.1 Definition

Whenever we are trying to define the term Internet of Things (IoT) for this no universal definition has been declared, one conceptual definition for IoT is that it is an umbrella term which has a broad range of technologies, applications and variety of interconnected electrical or electronic devices. This broad range of devices which is actually having unique IP addresses & can hold, transmit & receive data about to resolve their objectives. IoT can be defined as a network of interconnected devices with unique identification through IP addresses & also having technologies that can enable them to sense, gather data & interact with surroundings in which they reside.

### 2.2 IoT: Features

The most concerned features of regarding to IoT, are as follows:

- a) **Connectivity:** IoT enabled devices can have connectivity via Bluetooth, Wi-Fi, Li-Fi & radio waves etc. Such connectivity can get possible through various protocols in order to maximize efficiency & establishment of generic connectivity across IoT systems & relevant industries.
- b) **Sensing:** we people can recognize & analyze our states which are based on our past experiences likewise in IoT we need to read the analog signals & convert it about to get meaningful insight out of it. For this we can use GPS, electrochemical pressure, RFID, gyroscope, light sensors etc.
- c) **Active involvements:** IoT enabled devices can connect different types of products, cross platform technologies and services work together to construct an active involvement between all of them.
- d) **Resizing:** IoT devices should be planned in such a way so that they can be resizing easily on demand. Resizing term over here is synonymously known as scale.

- e) **Dynamic nature:** about to take pure decisions, IoT devices have to collect and convert data in dynamic manner. In such process various IoT components need to be transforming their state dynamically.
- f) **Intelligence:** every IoT enabled device used data to finalize important business insights and drive associated decisions. To obtain valuable insights we develop Machine Learning (ML) / Deep Learning (DL) models. In this sequence the analog signals are preprocessed and get convert to a particular format on which machine models are trained. As per business needs, we require to keep the proper data infrastructure.
- g) **Energy:** a lot of energy is demanding for interconnected devices and associated analytics. We have to finalize such design methodology so that low energy consumption will be there.
- h) **Safety:** the important feature for every IoT system is security. As our entire interconnection of IoT enabled modules will have sensitive information which will pass from end to end. At the time of finalizing design methodology we need to focus about proper safety, security measures & firewall about to prevent unauthenticated access.
- i) **Integration:** about to enhance user experience IoT integrates with different types of cross domain models.

### 2.3 IoT: Components

Various components are there about to develop an IoT system. Some of them are as follows:

- a) **Sensors:** Sensors are important component which capture analog signals. As per requirements & domains, various sensors like light sensors, gas sensors, temperature sensors etc are used. Regarding to requirements of sensors various parameters which are actually based on these sensors should be keep in mind. These parameters are like accuracy towards inputted data, reliable input and purpose etc.
- b) **Network:** Signals are transmitted which are retrieved by interconnected sensors over the network and then forward to various components of network like routers, bridges & also to varied lengthy networks like LAN, MAN & WAN etc. Through different technologies like WiFi, Bluetooth, Ethernet & LiFi we can connect different parts of network to the sensors.
- c) **Standards:** The aggregation of all activities of handling, processing & storing the data collected from the sensors, depends upon the use of various

standards which are again depended on IoT applications which is used. Standards can be technological (Wi-Fi / HTTP/Extraction, Transformation, Loading (ETL)) & Regulatory standards.

- d) **Intelligent analysis and actions:** This analysis is run by cognitive technologies & the associated models that facilitate the use of cognitive technology. These cognitive technologies have ability to process diversified information, vision & voice. Intelligent actions can be defined as Machine to Machine (M2M) and Machine to Human (M2H) interfaces.

## 3. IoE (Internet of Everything)

### 3.1 Definition

IoE is an updated term & is a concept which is having idea of complete connectivity, intelligence & cognition. IoE is the interconnection between people, things, data & processes. The aim of it is to improve experiences & create smart decisions.

### 3.2 IoE: Features

IoE has various features like:

- a) Centralization of data is actually converted into the distributed modes.
- b) External data taking as an input & given back to other components of the network.
- c) IoE is having relation with the every technology in the process of digital transformation. These technologies can be AI, ML, Bigdata, IoT etc.

### 3.3 IoE: Components

Whenever we people study the concept of Internet of Everything (IoE) then it is essential to understand the basic components of it. These are:

- a) **Things**
- b) **People**
- c) **Data**
- d) **Process**

- a) **Things:** It is the basic component of IoT as well as IoE. Here 'Things' are considered as connected objects which are gathering information through sensors and also share respective information with each other on internet. The number of interconnected things is growing day by day. In IoT, interconnected things can be various physical items embedded with sensors and actuators

generate data on their status & send it to the needed destination across the network.

- b) **People:** People are those components which are basically integral to IoE and also no intelligent connection can get possible without them. In more general, IoE is actually made by people & for the people. Human beings use interconnected devices every day, relevant analysis of data & equip the potential of data insights. People after get connected themselves; they play an important role in People to Machine (P2M) & People to People (P2P) interaction. People provide their respective insights through applications, websites or via interconnected devices which are relevantly used.
- c) **Data:** We know initially data is considered as a raw fact which is generated by devices & having no values. But after proper analyze, summarized & classified itself it turns into complete meaningful information that will have control towards various integrated systems & capable of taking smart decisions. As the data sources & relative volume grow then the data management & analysis become more vital as compare to the previous one.
- d) **Process:** It is the major component which determines in what manner every component which we have discussed with the rest to provide maximum value in the world of digital. The process is considered to be a successful if connected things retrieved right data & transmit it to the right person probably in a right time. The process is an important component for IoE interconnection which allows new juncture across today's market.

One of the important components for IoE is the network which may be wired or wireless. Through this network various devices can get connected.

#### 4. COMPARISON BETWEEN IOT AND IOE

The term Internet of Things has come to represent interconnection of electronic or electrical devices & technology through internet. In future, IoT will generate a great impact of the internet with more pervasiveness & intimate towards personal in our routine.

IoT devices are not having strong standardization regarding to the connectivity with the internet. IoT will be employed with management & authorized features to connect in application like home environmental aspects, telephone network & domestic utility services.

IoT and IoE have some differences which are mentioning in following manner:

- IoT is considered as a network of connected physical devices where data collection & exchange of data can get possible without any human intervention whereas IoE is smart interconnection between things, data, people and process which is forming web layout of things in terms of future internet concept.
- As far as objective of IoT is concerned that is to build an interconnected system of devices or in other words about to create things to things interconnection of system. IoE is having objective of transforming information into action, to provide data oriented decision making & enhanced capabilities with greater experience.
- IoT enabled network will have machine to machine interconnection where as IoE interconnection occurs between machine to machine, machine to people & also people to people.
- IoT is having lesser complexity as compared to IoE whereas IoE is comparatively more complex than IoT as IoE includes Internet of Human (NoH), Internet of Digital (IoD) & Internet of Things (IoT) too.
- IoT is focusing on physical things or devices or objects with their interconnected network whereas IoE is focusing on people, process, data & things simultaneously.
- IoT is considered to be earlier generation or subset of IoE whereas IoE is superset of IoT & relevant communication technologies.
- Applications for IoT can be interconnected home appliances, smart security, surveillance & energy management & also wearable fitness monitors etc. IoE applications can be person to person supply chain, connecting roads with hospitals to save more lives, connecting home for comfort living & many more.

#### 5. CONCLUSIONS

In this paper we described an overview for the evolutionary development from IoT to IoE and also comparative study of both new technologies. As far as earlier era of internet is concerned, the devices which were connected in the discipline of interconnection were like personal computer and other static hardware. After that devices which are having mobility like smart phones, were introduced. This consistent development of smart hardware is now days are connected with internet at a

greater extent. In concise manner, IoT is basically cyber enabled physical system that having interconnection of variety of devices & smart things. These objects are associated with various technologies like embedded sensors, smart management, protocols, data storage, data analytics & data processing etc. IoE is known as a superset of IoT. This concept of Internet of Everything welcomes procedures associated with person individual, information & things together to plan organized associations. With such evolutionary development new proposals with greater capacities, enhanced experiences & also with ubiquitous connectivity will be the welcome door for associated organization, people & also for the whole world.

## REFERENCES

- [1] Antar Shaddad Abdul. Qawy, Pramod P. J., E. Magesh, T. Srinivasulu "The internet of Things (IoT): An overview", IJERA, ISSN: 2248-9622, Vo. 5, Issue 12(Part-2), December 2015, PP. 71-82
- [2] Dipti Chauhan, Jay Kumar Jain, "A journey from IoT to IoE", IJITEE, ISSN: 2278-3075, Volume-8, Issue-11, September 2019
- [3] AbdelRahaman H. Hussein, "Internet of Things (IoT): Research challenges & Future applications", IJACSA, Vol. 10, No. 6, 2019
- [4] Zainab H, Ali, Hesham A. Ali, Mahmoud M. Badawy, Mansoura Universities, Egypt, "Internet of Things (IoT): Definition, challenges & Recent Research Directions", IJCA (0975-8887) Volume 128-No.1, October 2015
- [5] Mahdi H. Miraz, Maaruf Ali, "A Review on Internet of Things (IoT), Internet of Everything (IoE) & Internet of Nano Things (IoNT)", IEEE

## BIOGRAPHIES



**Sumit Purohit**, Ph.D. pursuing from Career Point University, Kota, Rajasthan, received the MCA degree From IGNOU, New Delhi and B.Sc degree from Jai Narain Vyas University, Jodhpur in 2005 and 1999, respectively. During 2010-2021, he stayed in Aishwarya College of Education, Jodhpur as an Assistant professor in Department of Computer Science.



**Shailendra Purohit**, received the M.Phil(CS) From Vinayka University, Tamilnadu, MCA degree From GJU, Hissar University in 2008 and 2005, respectively. During 2008-2021, he stayed in Aishwarya College of Education, Jodhpur as an Assistant professor in Department of Computer Science.



**Dr. Ajay Mathur** has secured his B.E., M.Tech. in Computer Science and Ph.D. from JNU, Jodhpur, India. He Joined as a Lecturer (Computer Sc. & Engineering) in Govt. Polytechnic College, Jodhpur in 1991 and currently is working as Head of Department in the Department of Computer Science and Engineering of the same college. His research interests include multi core systems, video compression etc. He has already presented 10 papers in international seminars and has written 11 books related to Computer field with Vardhan Publication, Jaipur.