

# A Comprehensive Pathway from Internet of Things to Internet of Everything

**Mr. Rajesh Yadav**

V. K. Krishna Menon College, Bhandup, Mumbai, Maharashtra, India  
rajeshy2808@gmail.com

**Abstract:** The use of internet has great effect or we can say utmost impact in our lives. There is a huge dependency on it in such a way that little things we use in our daily lives now a days has become a broad communication part and has led everyone to move into a new era of Internet of Things (IoT). Here I have tried to incorporate a discussion about the transitional pathway from Internet of Things-IoT to Internet of Everything-IoE. This transitional change is not an instant process there is a gradual change to achieve this. Also there is need of this transition to make human lives comfortable. But this can be made possible only by adaption of technologies. Considering current scenario, both technologies are the interesting topic in the interconnection networking community. Here, I have tried to manifest the progress from IoT--->to IoE, requirement of IoE over IoT, the similarities, the differences, pillars of IoT and IoE, Application of IoE. The aim of this paper is to present a complete overview of IoE in context to today's world.

**Keywords:** Internet of Thing (IoT), Internet of Everything (IoE), Objects, Process, Decentralization.

## I. INTRODUCTION

The IoE as a concept has setup a basis on the descry of over-all connectivity, intelligence and cognition. Simply it means that smart/internet correspondences are not limited by any computers, tablets and Smartphone's. Digital features can be outfitted to any object that are connected within same network of other objects, people and processes with the mapping to generate significant information, exchanges and relevant decision-making.

## II. NEED OF IOE OVER IOT AND M2M

1. M2M: As the name proposes, M2M only deals with machine to machine interaction. Each and every communication happens between machines only. This thus limits the usage up to machine only.
2. IOT: As the name proposes, Internet of things deals with things and internet. Each and every communication happens between Internets and objects only. There is no direct human involvement.
3. IOE: It deals with people, process, data and anything to make the networked connections more insightful by converting information's into action we can imagine now.

From above points it is clear that IoE has more efficiency in terms of communication with other related objects. Hence we can say it is more preferable over IOT and M2M.

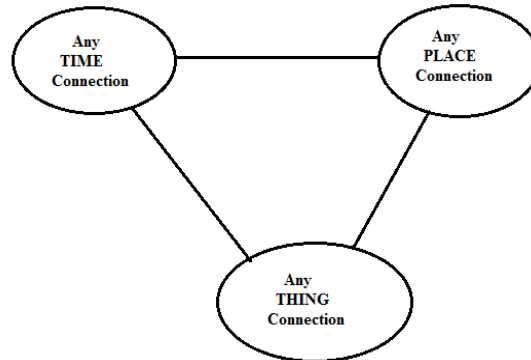
### 2.1 Internet of Things

An interconnected network of all physical objects that are accessed through the Internet is termed as IoT. These objects includes within (embedded) technology to have an interaction with internal states/ external environment. In simple words, whenever objects sense and communicate, there is a change in how, who and where of decisions.

IoT is a technological progression which is creating boom all over the world. IoT act as a network among the individual networks. IoT uses Machine To Machine communication (M2M) technology to connect all the devices through internet.

Concept of IoT focuses on to attach each and everything-any device on the earth with each other with the help of Internet. The term IoT and internet are not similar from each other with the aspect of communication system. Internet

contains only two dimensions -Time and Place as a communication system. Whereas IoT contains things as third dimension, the ultimate goal of IoT is to connect/attach thing in any form on Place of any location at any Time or duration.



**Figure 2:** Dimensions of IOT

As per these conceptual definitions, an IoT is network of the devices that is intelligent and enables these devices to communicate the data and information by connecting them with the help of Internet via information sensing devices.

## 2.2 Pillars of IoT

IoT is a broad technology that depends upon different factors and networks. However it mainly depends on four pillars:

1. Sensors
2. Communication
3. Computers
4. Analysis

### A. Sensors

They are the "eyes and ears" of the IoT interconnected networks. The process of IoT depends upon precise measurement using sensors; no precise sensing can give negative result for a system. They convert physical or non electrical signals into electrical signals. Hence, it is most important to choose sensors that proceed as in idealistic way for a particular task.

### B. Communication

The key technology behind IoT is M2M. Any values that are sensed through sensors are required to be passed on to network for the computing. In ubiquitous wireless communication, it is very easy to create communication among the different networks. Higher the flow of data, more are the chances of corruption of data. Hence, there are requirements to use standard protocols of communication, to avoid problems like data leaks.

### C. Computers

There have been transformations of Computer into tiny chips. Normally Single chip computers are called microcontrollers. Micro-controller unit works at the speed of Giga Hertz(GHz), that uses a huge amount of power. Computing is responsible for the most of the power consumption. Hence the main issue here is power source or battery hence opting for less power consuming and preferably high frequency microcontroller unit is essential for IoT applications.

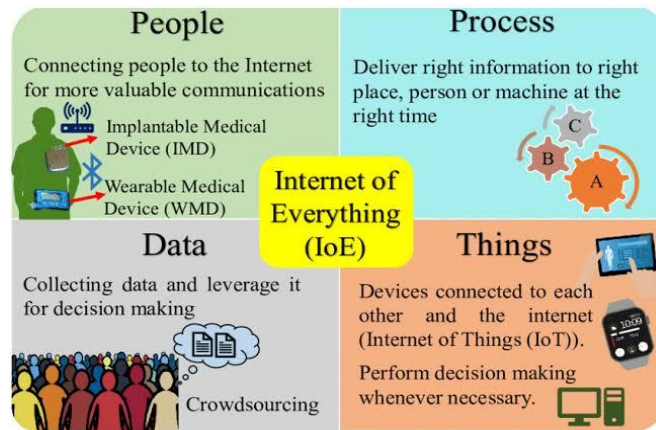
### D. Analysis Data

Use of billions of sensors will generate huge amount of data. Concept of Cloud computing is needed here to store the data, but the hard or we can say difficult part is to analyse big data and observing useful information from them.

There is a need for up gradation of tools and processes in techniques used and develop intelligent algorithms to perceive useful information at real time.

**2.3 Internet of Everything and its Pillars Element**

Rightly framed IOE is -"A technological way of gathering things, data, process, and people to create a interconnection in terms of network which proves more relevant and valuable as compared to turning-before information in verse of actions that will create new opportunative-capabilities, extensive experiences , and non-precedented pecuniary scope for individuals, businesses and countries."Services, Hardware, Software are basic key components of the IoE. As for **pillars elements of the IoE**, there are four pillars as given below:



**Figure 3: Pillars of IoE**

**A. People**

The foremost pillar indicates Connecting people into relevant, significant ways. They provide their personal experience, views, insights through web, applications/ connected devices they use like social mediated networks, sensors in medical fields etc; Artificial intelligence algorithms and other smartly interesting technologies does analysis of this data in order to “perceive and understand” human issues and provide relevant content as per their personal or business interests which helps them solve issues or do decisions quickly.

**B. Data**

It indicates the conversion of data into intelligence for better decisions. As it’s quite known that raw data generally, is of no value unless it is processed one. In other words when raw data is summarized, classified and analyzed with proper techniques gets converted into valuable information that can possess the ability to control systems and solutions that are intelligently unique.

**C. Process**

It indicates the deliverance of the correct information to the correct person /machine at the proper time. Use of different processes based on Artificial intelligence (AI), machine learning(ML), social media network or any other technologies guarantees that the proper information is availed to correct individual at the proper time. The ultimate goal is to make certainly the best possible usage of huge information.

**D. Things**

It includes all substantial devices connected to the Internet for modeling decision insightfully; termed as Internet of Things-(IoT).An authentic IoT concept is encountered here. Sensors and actuators embedded in various physical item generate data and send them to required destination all across the network.

**2.4 Similarities between IoE and IoT**

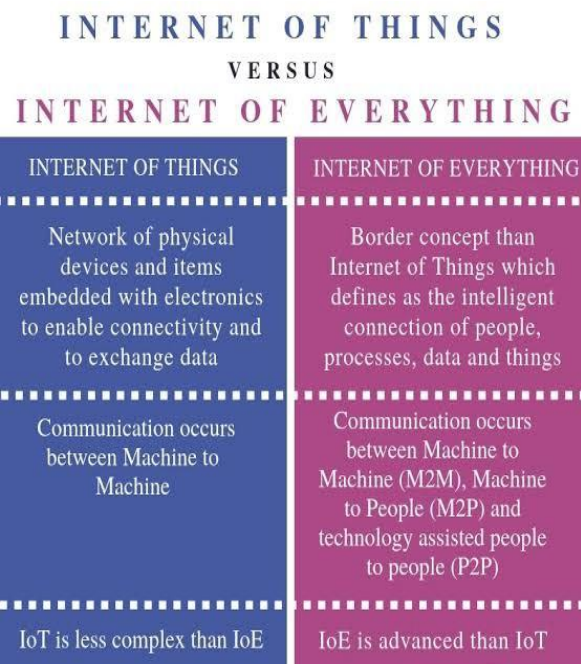
1. Decentralization: Both IoT and IoE incorporates the similarities in such a way that both are distributed and doesn't possess a single center; where node act as a small management center to effectuate certain tasks independently.
2. Security Concerns: Both distributed technologies are suspected to cyber attacks and penetration; in conditional way more connection of devices to the network, the majorly they are vulnerable to contravention.

**Comment:**

1. The former serves an advantages to both systems, since the entire system doesn't degenerate even if problem is induced in a couple of nodes.
2. The later one causes disadvantages in the form of security.

**2.5 Differences between IoE and IoT**

The basic difference lies in pillars of both IoE and IoT. Internet of Everything (IoE) includes 4 pillars- people, process, data, and things whereas the Internet of Things (IoT) has one pillar: things in general but it depends on four other pillars i.e sensors, Communication, Computers and Analysis IoE induces the strength of the Internet for improvising business and industry outcomes/results, and make people's learning and lives better by adding to the progress of IoT. In an essence, an IoT, is the inter-connectivity of various physical objects that is used to send and receive data, whereas an IoE is broad term that, apart from IoT, indulge both technologies and people as part of end-nodes.



**Figure 4:** Differences between IoT and IoE

**Examples**

As a glimpse of practical experience, each commercial measured organization can seek the Internet of Everything model into its processes and benefit from it.

**Some Assorted Examples:**

1. Electricity Meter and Smart Water System for locale as well as industrial measured organizations to monitor usage rates and make conclusion with reference to economy can be implemented by Municipality systems.
2. Sensors for computing maintenance into production to observe equipment segments that needs to be fixed or substituted by the manufacturing industry. This helps in exclusion of downtime and lessening the fixing costs.

3. Smart Devices and Sensors on trucks to optimize delivery conditions and possible routing can be introduced by logistics and delivery companies.

Comprehensively, the scope of IoE devices is flourishing day by day, and commercials are changing perforceably.

### 2.6 Security and Privacy Challenges in the IoE

The Internet of Everything is employed in multi-domain circumstances. It consists of a huge number of devices and services that are connected to each other for exchanging information. Every domain aspects infers and applies its own privacy, trust and security requirements. Below are few challenges in IoE Securities:

#### A. Privacy of User and Data Hedge in IoE

In IoE one of important issue to be focus on is its privacy or seclusion. Privacy of user is a very sensitive concept in many researches works. Data collection privacy, Data Sharing, Data Management, and Data Surveillance is required in IOE network in terms of things, process, data and people.

#### B. Computing and Identity Management

In IoE, an amalgamation of processes and technologies are utilized in form of Computing and Identity. The purpose is to head up and secure admittance to information and resources.

#### C. Policy integration and Trust Management

As the enormous amount of things does communication in IoE, trust serve a major role in creation of safer and secured communication between varied things. There should be mechanism that will commit efficiently in IoE environment.


#### D. Access control and Authorization

Authorization is process of locating the access permission to use resource, if the person or object, is identified. Access is equipped to particular object or entities, by checking the access grants or rights. By utilizing control on access, authorization is effectuated.

#### E. End-to-End security

An important security trial is to have security at the endpoints between devices and Internet hosts connected in IoE network. Algorithmic Functions and Session keys must be securely contrived for comprehensive End-to-End security.

### 2.7 Application Areas of IoE

Application	Description
 <p data-bbox="258 1767 411 1794"><b>Smart Home</b></p>	<p data-bbox="512 1554 1410 1688">A classification of the numerous IOE applications across all channels is smart homes. It is includes both control and automation. It foreshows an apartment that has various household appliances that communicate with each other and controlled remotely or, scheduled.</p>



 <p><b>Smart City</b></p>	<p>A smart cities usessensor machine, to collect and analyze data. Cities use this data to improvise infrastructure, utilities and services. The solutions incorporated in IOE model of the Smart City address a wide range of urban problems, including traffic, reduce air and noise pollution, and help make cities safer.</p>
 <p><b>Smart Network</b></p>	<p>Smart networks with use of network of transmission lines, smart meters, and distribution automation remotely monitor and control everything from lighting, traffic signs, traffic jams, parking lots, road warnings to early detection of things like energy flows from earthquakes and tsunamis.</p>
 <p><b>Smart Trading</b></p>	<p>IOE enables retail stores to become smart stores that receive real-time data on customer tastes, needs and habits. In this way, retailers can predict customer behavior and offers the needed client services</p>
 <p><b>Smart supply chain</b></p>	<p>An IOE can process workflows and change device settings to optimize performance, troubleshooting issues such as tracking items on the move or in transit, or helping suppliers share inventory information.</p>
 <p><b>Smart Geonics</b></p>	<p>The numeral figure of farms is conventionally outlying and an inordinate number of farmers can be monitored via the Internet. “Everything” can revolutionize the daily work of farmers.</p>

III. CONCLUSION

As per above discussion and points, it can be concluded that

1. Internet of Everything (IoE) has replaced the IoT.
2. It is essential now a days to have securities in IOE. The major challenge in IOE is to maintain privacy and secrecy.
3. There is similarities yet a fine line differences between IoT and IoE.
4. Sectors like Smart City, Home automation, Smart Agriculture etc, can be automated by use of IoE security requirements.
5. If IoE is implemented in future events, then there will huge growth in human status, organizations businesses and country's development status.

**REFERENCES**

- [1]. Suresh P, Daniel JV, Parthasarathy V, Aswathy RH. (2014). A state of the art review on the IoT history, technology and fields of deployment. In the Proceedings of IEEE International Conference on Science, Engineering, Management, Resolution (ICSEMR'14); 1–8.
- [2]. Mzahm AM, Sharifuddin M, Tang AYC. (2013). Agents of Things (AoT): An intelligent operational concept of the IoT. In 3th International Conference on Intelligent Systems Design and Applications (ISDA), 159–64.
- [3]. Corcoran P. (2016).The Internet of Things: Why now, and what's next?. IEEE Consumer Electronics Magazine. Jan; 5(1):63–8.
- [4]. Quandeng GOU, Yihe LIU, Lianshan YAN, Yao LI.( 2013) Construction and strategies in IoT security system. In IEEE International Conference on Green Computing and Communications and IEEE IoT and IEEE Cyber, Physical and Social Computing; 1129–31.
- [5]. Zear A, Singh PK, Singh Y. (2016) .Intelligent transport system: a progressive review. Indian Journal of Science and Technology. 1–8.
- [6]. Farooq, M. Waseem, A. Khairi, and S. Mazhar.( 2015 ).“A Critical Analysis on the Security Concerns of Internet of Things (IoT)”.
- [7]. Roman, P. Najera, & J. Lopez.( 2011 ).vol. 44, 51-58, “Securing the internet of things”.
- [8]. Mahmoud, T.Yousuf, F.Aloul, I.Zualkernan.( 2016). Internet of things (IoT) security: Current status, challenges and prospective measures.10th International Conference for Internet Technology and Secured Transactions, ICITST 2015, pp. 336341..
- [9]. A. Khan, K.Salah. ( 2017) IoT security: Review, block chain solutions, and open challenges. Future Generation Computer Systems, 82, pp. 395411,
- [10]. Moganedi., &J.Mtsweni. (2017)Beyond the convenience of the internet of things: Security and privacy concerns. IST-Africa Week Conference (IST-Africa), pp. 110.
- [11]. U. Farooq, M.Waseem, A.Khairi, S.Mazhar, (2015).A Critical Analysis on the Security Concerns of Internet of Things ( IoT ). International Journal of Computer Applications, 111(7), pp. 16.
- [12]. [https://www.researchgate.net/figure/The-vision-of-Internet-of-Everything-IOE-with-Human-in-the-Loop-driving-serious-need\\_fig1\\_335854956](https://www.researchgate.net/figure/The-vision-of-Internet-of-Everything-IOE-with-Human-in-the-Loop-driving-serious-need_fig1_335854956).
- [13]. <https://www.cloudcredential.org/blog/knowledge-byte-the-differences-between-iot-m2m-and-ioe/>
- [14]. <https://www.polytron.com/blog/the-internet-of-things-and-everything-iotioe/>

**BIOGRAPHY**



Mr. Rajesh Yadav is working as Assistant Professor in V. K. Krishna Menon College with an overall teaching experience of 6 + years having an educational qualification of M.Sc (Computer Science) , NET, UPTET and B.Ed. He has also completed his diploma in machine learning using R Studio. He has participated in more than 250 seminars, webinars (national and international) and workshops all inclusive. He has successfully completed more than 70 faculty development programmes and more than 12 certificate courses. He has participated and presented 11 papers in international and national conferences. He has published 24 research papers in reputed peer reviewed, international journals and conference proceedings and authored two books for computer Science subjects. His research area of interest is Machine Learning, Data science, Computing, Automata, Internet of things.