

Internet of Everything (IoE): A New Technology Era will have Impact on Every Facet of our Life

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Abstract—The word internet is changed the way we live, the way we take decisions, the way we think and the way we act etc. Its playing most important in day to day life of humans we can confidently say that Internet is the 4th requirement which is added to our basic survival things like Food, Cloths, Shelter and the Internet In short period of time, the Internet has had an amazing impact on almost everyone's life. With the power of it we are able to get updated information on time; we are able to post new ideas, share information with others, technologies, innovations around the world minute by minute .It evolved a lot from Arpanet to till date and showing impact on many things like business transactions, logistics management, health, industry automobiles, farming, transportation and many more. The most important thing we need to observe here is minute to minute and day to day more number of devices are getting connected to the internet with the help of advanced technologies like Internet of Things (IoT).Internet Of Everything (IoE), Industrial Internet of Things (IIoT), Web of Things(WoT).. The year 1969 we have only four devices with internet, in the year 2012 its increased to 8.7 billion connected devices, 2017 the number is increased to 29 billion connected devices by 2020 according to Cisco this number will be increased to 50 billion devices. These numbers are the just examples how much impact its showing in our day to day life. So the more usage of internet is creating platform for developing new technologies like Internet of Everything. In this paper am giving the overview about what is Internet of Everything (IoE), how its different from IoT, Architecture and its applications.

Index Terms— Data, Things, IoT, IoE, P2P, P2M, M2M, WoT.

I. INTRODUCTION

A day does not start without hearing alarm sound in the smart phone and a day does not go without using smart devices in 20th century. We are living in the era of smart devices. What is smart device?[2] it's a device which is connected to other device with the help of Radio Frequency technologies like Bluetooth ,Zig-Bee, Wi-Fi, Near Field Communication(NFC)[6] and its able to send data, process data and take some decisions accordingly for example Activity Trackers, Google Nest[12], RFID tags[10]. why we are calling device as smart? Consider an example of normal wall clock which is having 3 hands if all hands of it are working properly then only it can show accurate time but it can't track how much time we slept, run because it's not having memory and processing components. If we attach these two components to any normal device or object then it can store and process data. In our example if we attach these two components then normal wall clock also will act as smart wall clock it's the power of smart device.

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Internet of Everything [11] is a network which consists of large number of smart objects, networks and various technologies. These all are capable of sending, receiving, processing data within fraction of seconds for intelligent decision making and control over the applications. So we can say Internet of Everything is a intelligent network with smart devices according to Cisco[3] survey this network will consist of 50 billion smart devices consider the below **figure 1.1** which shows the usage of smart devices from year 2015-2020 in this figure X-axis represents the Years and Y-axis represents the number of smart devices in billions year by year.

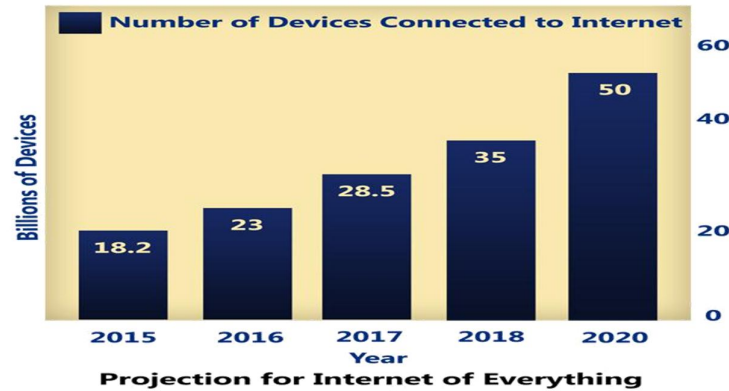


Figure 1.1 Smart Objects Usage Year Wise

The major building blocks of Internet of Everything are People, Process, Data and Things.

People: Connecting all the people with the help of smart objects[7] by sending minute to minute updates in more possible relevant ways[6]. The following **figure 1.2** represents the group of people.



Figure 1.2 People

Process: Sending the right information to right person on time by processing large volume of data with the help of Artificial Intelligence [10], Data Analytics, Deep Learning, Machine Learning and Sensor Fusion technologies[9]. **Things:** These connected to network for intelligent control over the network here all devices are part of the network called Internet of Things (IoT)[1][5]. So Internet of Everything (IoE) is built on the top of IoT. We can connect all living and non-living things to the network for example books, tap, sofa, smart phone, plants, cat etc. The below **figure 1.3** shows the different things which we can use in IoT.



Figure 1.3 Different Things

Data: Information is collected from billions of devices and maintained by using cloud computing and big data technologies [4]. All the devices will uploads huge amount of data to cloud servers[8]. The below **figure 1.4** shows the data uploading to cloud by smart Phones.



Figure 1.4 Data and Cloud

II. INTERNET OF EVERYTHING ARCHITECTURE

The overall architecture of Internet of Everything is divided into two layers

1. **Layer 1(IoT Layer):** it's the bottom layer which consists of all physical things and again it's sub divided into two layers.

a). **People** :People uses different applications to connect with each other and sends data to cloud

b) **Things**: It consists of different sensors [1], things and smart devices upload data to cloud.

The main functionality of this layer is to collect the data from different applications and devices .It acts as interface between cloud and things. It sends the information to those things and people based on their requirement.

2. **Layer 2(Network Layer):** it acts as an interface between IoT and IoE layer. It provides the functionality related to networking like connection establishment, connection release and Session management[13].

3. **Layer 3 (IoE Layer):**

This is the core layer it consists of 4 sub layers it is built on the top of the IoT Layer. It takes all the functionalities of IoT Layer[12] along with it will provide services to Process, Data.

Process: This layer is responsible for applying different algorithms on the collected data to take intelligent decisions on time.

Data: Billions of devices will generate large volume of real time data [14] so this layer is responsible for storing and handling this data into cloud or Fog.



Internet of Everything Architecture

Figure 2.1 IoE Architecture with Layers

III. IoE COMMUNICATION TYPES

IoE will exchange data between people and things by following 3 communication types.

1. **People to people (P2P):** connected people can interact with each other to exchange the information [10][11]. Ex: mobile communication

2. **People to Machine (P2M):** people can interact with machine by sending command (People-Things)[10]. Ex: A person can Control the things at home by sending command like ON/OFF.

3. **Machine to Machine (M2M):** Two machines can communicate with each other (Things-Data)[13][14]. Ex: uploading data to server.



Figure 3.1 IoE communication

IV. HOW IOE DIFFERENT FORM IOT?

When we are thinking about the Internet of Everything vs Internet of Things, is that “Things” are physical objects. Which has a real life presence, such as a computers, mobiles and sensors, can be regarded as a “Smart Thing.”[1] IoT or IoE reads data from all those devices for example instead of changing the temperature in the home automation based on commands; it will send a message to a user either by email or message whenever a certain temperature is reached. The Internet we know it isn’t just made of different devices. Example, the world’s biggest search engine, “Google”, [6] can’t be considered to be a single technology. It exists somewhere on the network. This is true for services that we might use every day life, such as Face book, whatsapp and instagram[7].

This is the first update to the Internet of Everything: services that you can’t point and say “That exists in this real world.”But the Internet is also made up of many things than just the online services that are used. The fact is that we need to consider an Internet made up of data streams passing between networks [10]. Internet also contains all of the people that are connected to it.

The Internet of Everything connects up all of these separate concepts into one cohesive whole. It’s not just about allowing devices to talk to each other; it’s about allowing everything to talk about each other. In some ways, you can see the Internet of Things as the equivalent of a rail road line, including the tracks and the connections [5], whereas the Internet of Everything is all of that, and the trains, ticket machines, staff, customers, weather conditions, signals.

A. Major Differences with Examples

Difference between IoE & IoT is in IoT all the smart devices we are connecting, data and services are not connected but where as in IOE all the data and Process is also connected to understand these difference check out the following examples.

1. Example :(Home Automation)

In IoT home automation all the smart devices are like Refrigerator, oven connected through wireless technologies and they will update information to cloud related to temperature[12] we know it but when coming to IoE it will cover all the devices more importantly it will monitor the data like how many units of power consumed, at what time machine is switched on/off etc details so in IoT.It will only cover the mobiles, TV’s, ovens[13] but where as in IoE along with all these it will cover Taps, Tables, Chairs even Floor condition.

2. Example :(Health Sector)

Monitoring the patient digestive system with the help of smart pill. This smart pill will send the continuous data to the doctor in the right time when there is any problem in the digestive system and the person also can know his problem finally I wanted to say is we can track any kind of information from anywhere with the help of IoE[3]. In this example if we use IoT the user has to send the message to his doctor if we make use of IoE smart pill will automatically sends the data to doctor so here connecting digestive system will comes under IoE application[2].

In the above two examples data and processes are connected with the help new technology called Web Of Things(WOT)[4] which takes IoE to next level So,IoT will cover only few things but where as in IOE it will cover everything.

V. APPLICATIONS

Internet Of Everything will be used in Business, Health care ,transportation, traffic, banking, wearable's, home appliances, farming, Govt. sectors, E-commerce, retail, robotics, weather forecasting, vending machines, IT & Networks, industrial, Energy, Security, Public Safety, and many more applications in this paper am going to explain few applications with an examples[10][12][14] .

Dynamic Pricing: In the future, everything has dynamic pricing where supply and demand drives pricing. Ola already knows when demand is high, or when we are stuck in traffic charges more.

Retail: stores will monitor your eye gaze, knowing what you glanced at what you picked up and considered, and put back on the shelf. Dynamic pricing will entice you to pick it up again.

City Traffic: Cars looking for parking cause 40% of traffic in city centers. Parking sensors will tell your car where to find an open spot. Streetlights and house lights will only turn on when you're nearby.

Transportation: Self-driving cars and IoE will make ALL traffic a thing of the past.

Healthcare: Wearable's will be tracking your vitals constantly, allowing you and others to make better health decisions.

Smart Farming: IoE enables farmers to monitor the exact condition (temperature, humidity, sun) of every crop and recommend optimal harvest times. IoE can follow details of fermentation and even assure perfect handling through distribution and sale to the consumer at the market.

Banking/Insurance: Research shows that if you exercise and eat healthy, you're more likely to repay your loan. Imagine a variable interest rate (or lower insurance rate) depending on exercise patterns and eating habits?

Forests: With connected sensors placed on trees, you can make urban forests healthier and better able to withstand -- and even take advantage of the effects of climate change

Furniture: Software and sensors embedded in office furniture are being used to improve office productivity, ergonomics and employee health.

VI. CONCLUSION AND FUTURE SCOPE

Internet of Everything (IoE) is coming of age with a vengeance. We have reached that special place where the numbers of connected and potentially connected devices is so large, the ease and cost of connection is so low, and the surrounding technologies of data, analytics, AI, Machine Learning and sensor fusion are sufficiently advanced that companies are moving fast towards IoE to address the issues that leading companies face integrating and acting on the Internet of Everything it leads to the creating a multi-year, multi-client platform it has two themes: defining the linkage between business purpose and strategy and the opportunities presented by IoE finally am concluding the IoE will have more scope in the future.

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