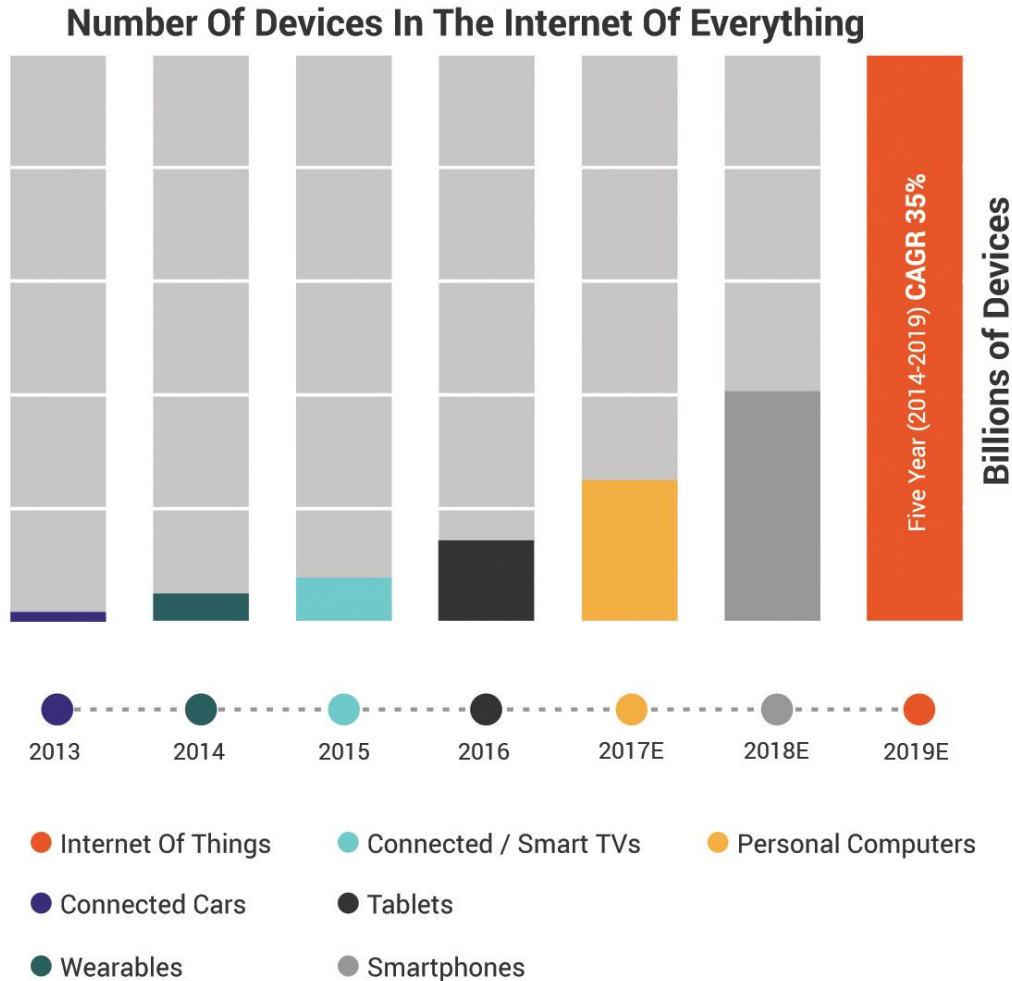


## INTRODUCTION TO IOT FOR BEGINNERS (INTERNET OF THINGS)

### Introduction to Internet of Things:

**What is IoT or Internet of Things:** The Internet of things (IoT) is an ecosystem of *connected physical devices/objects* that are accessible through the internet. IoT is *a system of interrelated devices, digital products, objects, people or animals* that are **provided with unique identifiers (UIDs)**. It has the ability to transfer data over a network without requiring any human interaction. *The idea of this blog post* is to *provide introduction to Internet of Things as well as expose readers with market potential, high level architecture and sample explain IoT use cases*, for Beginners to get a practical and real perspective of IoT today.

IoT is **big and real** in terms of everything. However technologies and standards are still evolving. It's expecting to change more in the coming years. IoT will connect **4 billion people** on the planet through multiple devices and applications. By connecting "things", IoT will make our lives easier. The new wave of connectivity is going beyond smartphones and laptops by thriving towards connected cars, smart homes, wearable's, health care, smart cities, and many more. IoT helps these devices to **bridge the gap between physical and digital worlds** to improve the quality and productivity of industries, society and life. Here we have given a graph that represents the number of devices in the internet of things in the past 5 years.



Source : Bi Intelligence Estimates

Graph

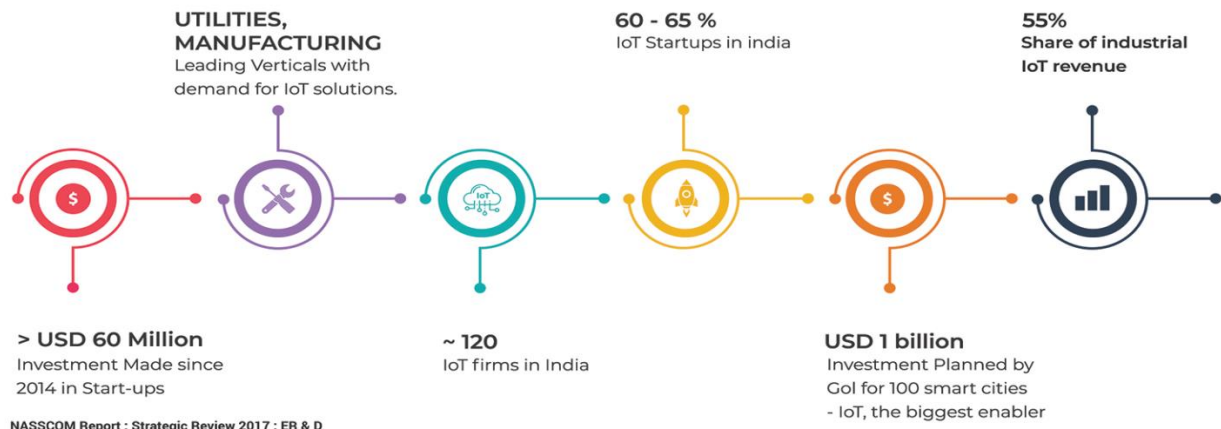
representing number of devices in IoT.

### The Growth of IoT:

Firstly, let's discuss how IoT or Internet of Things has gained a lot of importance in the past few years. Moreover, here are some of the key statistics with respect to India specific IoT market.

1. Demand for IoT has gone up by **more than 300%** in the last few years.
2. More than **10 million jobs** will be created in the next few years.
3. More than **60 million USD** have been invested in startups since 2014.
4. By 2020 IoT market in India is poised to reach **15 billion USD**
5. There are tremendous opportunities for further growth with nearly **120 IoT firms in India**, offering solutions in the IoT segment.

That's not alone! There is an increase in about **65% of IoT Startups** in India. Utilities and Manufacturing are the leading verticals with demand for IoT solutions. USD 1 billion has been invested as planned by GoI for **100 smart cities** which is enabled using IoT. These numbers clearly provide an indication of growth of IoT now and moving forward.



## Growth of IoT

### How IoT works?

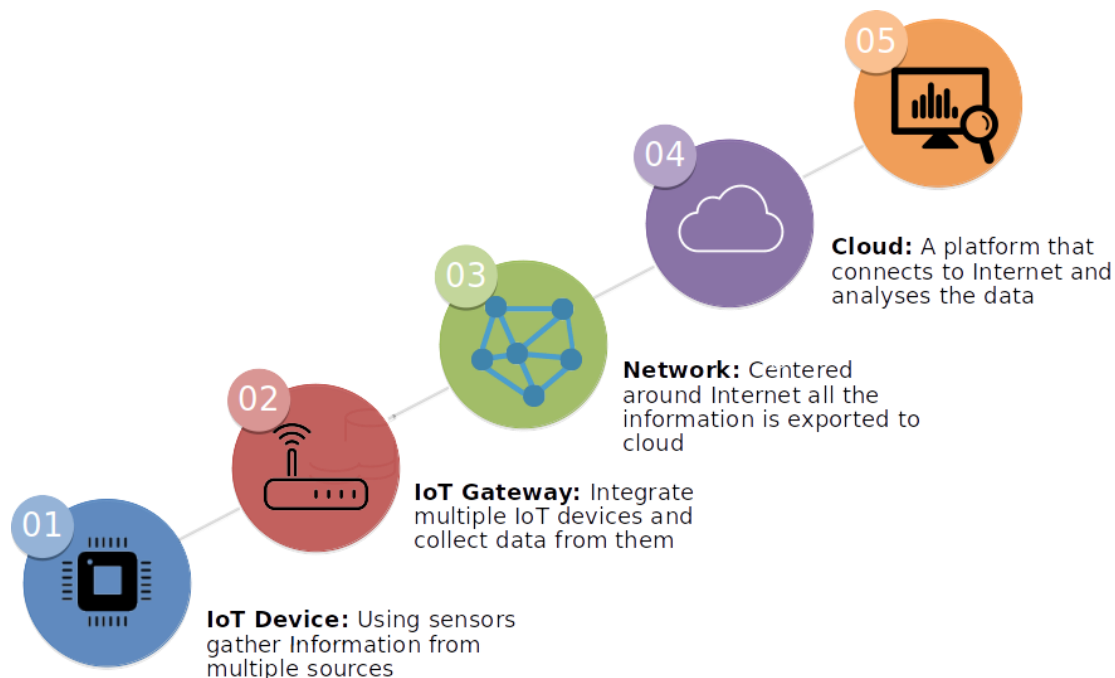
Secondly, the IoT gives us access to so many things but have you ever thought **how does it work?** IoT has been changing so many things around us. It has very much changed our lifestyle too knowingly or unknowingly. In and around our surroundings **each device is embedded with so many sensors and chips.** These sensors and chips transmit data and this data is valuable to us. There are large amounts of data which gives some meaningful solutions for common problems faced by a common man

For instance –

- Providing city residents real time updates on where to park vehicles
- Provide individuals and his doctors with personal health information and predictive alerts
- Making a greener world by helping residents with effective use of electrical / electronic devices
- Providing solutions for home safety and security

### Components of IoT:

Now that you have a brief idea about how IoT works at high level, let us start building architectural understanding. Certainly, here is the diagram to give you a high level view



## Components of IoT

IoT architecture is a structure of numerous elements. In simple words, IoT architecture has five major components. Here is a description of the components

### 1. IoT device:

IoT device can be wireless sensors, software, actuators and computer devices. They are fixed to a specific object that runs through internet. These devices **enable the transfer of data** among objects or people automatically without any interference of human resources. For example, **Fit bit** is an IoT device which communicates with an app via internet and provides us so many insights about our health condition.

### 2. IoT Gateway:

IoT gateway is a device or a software program that serves as a connection point between cloud and multiple IoT devices. All the information moving to cloud or vice versa has to pass through IoT gateway. IoT gateway provides extra security for the IoT network and the data that is being transported.

An array of IoT devices connect with IoT gateway via **low-range protocols** (ex: Bluetooth Low Energy or **BLE**). The gateway in turn uses **web-scale protocols** (ex: Message Queue Telemetry Transport or **MQTT**) to access the internet.

### 3. Network:

Network is the bridging element that connect an array of IoT gateways to the Cloud platform by traditional **TCP/IP network**. It is been existing over years connected with a bunch of protocols.

Now the same network has additional meaning of “glue” that bridges everything. The network has a series of protocols (some of them are given below) which makes the communication happen in a seamless way. Overall IoT protocols can be summarized as mentioned in the image below.

### Current Internet Protocols

### Expected IOT Protocols

HTTP FTP,SMTP,IMAP	Application	MQTT COAP,AMQP
TCP and UDP	Transport	UDP and TCP
IPv4 and IPv6	Networking	IPv6 and IPv4
Ethernet,Wi-Fi, GSM	Data Link	Ethernet,Wi-Fi, GSM, LTE-M, Lora, SigFox
Protocol Level TCP/IP Model		

## IOT and Internet Protocols

Network Protocols

### 4. Cloud:

**Cloud is a platform** which takes massive volumes of data generated. They receive them via IoT gateways which in turn has tons of by devices behind them. Since the amount of data handling is very significant it will have following characteristics.

1. Web services – Ability to handle incoming client request and response
2. Scalability – Ability to scale-up or scale-down depending on the data / network traffic
3. Distributed – Inherently support distributed computing to handle resources
4. Business Intelligence / Analytics – By analyzing big data and derive analysis
5. Cost optimization – Provide facilities to customer to achieve results in optimized way

Today almost all the major giants like **Google, Amazon, Microsoft, IBM** are offering their own IoT platforms. All of them provide key features mentioned above and much more.

### 5. Applications:

The synthesized data for the end user to derive meaningful insights. The application typically provides an **User Interface (UI)** which the user can get the final insights (ex: Home devices status) or even trigger some action (ex: Switch ON / OFF). Again this interface can be anything ranging from a **mobile application, custom dashboards on panels or simply a web interface.**

### IoT Use Case : Smart Home

In today's world everyone wants a comfortable lifestyle. IoT makes our lives simpler and more convenient. A smart home is everyone's dream home. Wouldn't you love it if you could switch on the air conditioner before reaching home or turn off the lights even after leaving home? Everyone is so busy in catching up with their work that they might miss out on a few things at home in a hurry. Here IoT helps us wonderfully in **connecting us with the devices and notifying us about everything at home even when we are at work or anywhere else.** Not only that, IoT helps you to manage your home smarter. You can water your garden by sitting in office with just one tap in your mobile application. .



A smart home

Let us talk about one such aspects, turning on and off lighting's at home which is generally called as **smart lighting**. Smart lighting generally uses mesh networking where each device i.e a smart bulbs(that includes a WiFi connection to it) is wirelessly connected to its nearest neighbor. This network is controlled by a hub that plugs into your router which enables the other networked devices such as a smartphone, tablet which eventually communicates with the bulbs.

When we are away from home also we can control the lighting's by turning on or off the lights with just one tap. This data gets saved in the cloud from there we can access it on our



smartphones. We can check from our smartphones, if any lights are on, if so we can turn it off from where ever we are. In the same way we can also turn on the lights for any particular area. Smart lighting's come with additional features such as dimming the light or changing the color of the light based on our requirements. This helps us to optimize our usage of power and we can save a lot of electricity.

### *Working of Smart Home*

Many devices or sensors (**1 -> IoT device**) connects to a main processor which is the gateway (**2 -> IoT gateway**). The gateways perform many important functions such as device connectivity, security, protocol translation, data filtering, management and many more. The network or router (**3 -> Network**) connects the gateway to the cloud using various protocols. The data of the lighting's in the house is saved in a cloud (**4-> cloud**). With the help of an application in a smartphone (**5-> Application**) one can see the data present on the cloud and keep a check on the home.

### **Benefits of IoT:**

#### **1. Automation:**

In today's context, automation is the key to everything we do – be it home or office or industry. Automation, in the past few years has evolved as the primary factor to efficient mass production and mitigate human errors as well as saving time and reducing cost factors. Automation helps us to manage everything from a place. We don't have to go to the location. It keeps all the devices connected through a single interface which is massive. Automation gives us the comfort and convenience to perform everything from a one place.

#### **2. Improved customer engagement:**

Customer experience is very important for any company or product. IoT helps us to get the maximum customer engagement. It helps us to provide better customer experience. For example IoT can improve customer satisfaction by monitoring equipment. The customers can stay connected to their products and devices from anywhere.

#### **3. Efficient:**

The Internet of things has taken the world by a storm. It has gained momentum in the business world and successfully managed to do what technology aims to do such as automate process and drive efficiency remotely. Moreover, sensors can be deployed almost anywhere to track about anything that provides useful data. IoT is very efficient in many fields such as home automation, smart industry, automobiles, retail, agriculture and many more.

#### **4. Derive meaningful insights & prediction:**

The Internet of things helps us to make better decisions about everything even about the way we trade goods and health care to building smart cities. The internet has connected millions of people across the globe. No one had anticipated this a decade ago. There are a countless interactions between humans and machines that occur over these networks are producing data about almost everything that we do. It's not just people that are being connected but a vast network of electronic devices and sensors are constantly transmitting huge amount of data concerning everything we do.

## 5. IoT used in various domains:

Certainly, it's needless to say that the hype for IoT has been increasing immensely. IoT is a very huge domain. It is implemented in various Here are a few applications of the various IoT verticals

IoT Verticals	Applications
Industrial	Energy networks, Aerospace, Futuristic Farming, Drones, Smart Dust, Smart Robotics, Smart Logistics Management, Power Management, etc.
Automotive	In vehicle infotainment, predictive maintenance, security, surveillance, safety, data analytics and dashboard reporting, real time monitoring, etc.
Smart Home	Remote monitoring, energy saving, communication, automation, data analytics, etc.
Health Care	Tracking and alerts, remote medical assistance, data assortment and analysis, end to end connectivity, simultaneous reporting and monitoring, etc.
Retail	Predictive equipment maintenance, smart transportation, demand aware warehouse, connected consumer, smart store, etc.
Logistics	Location management systems, inventory tracking and warehousing, IoT technology and predictive analytics, blockchain for supply chain management, etc.
Agriculture	Precision farming, agricultural drones, livestock monitoring, smart greenhouses, etc.
Education	Attendance monitoring system, smart boards, superior safety features, learning at



	anytime anywhere, poster boards into IoT enabled boards, etc.
Smart City	Smart parking, road traffic, public transport, utilities, street lighting, waste management, environment, public safety, etc.
Environment	Environmental sensors, smart farming, energy efficiency, energy requirements, etc.