

# The Cloud Computing and Internet of Things (IoT)

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## ABSTRACT

The cloud is a huge, interconnected network of powerful servers that performs services for businesses and people. The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT has evolved with the greater generation of data. Internet of Things Cloud Service creates excessive communication between inexpensive sensors in the IoT which means even greater connectivity. Billions of connected devices and machines will soon join human-users. IoT generates lots of data while on the other hand, cloud computing paves way for this data to travel. In this paper we try to focus on cloud providers who take advantage of this to provide a pay-as-you-use model where customers pay for the specific resources used. Also, cloud hosting as a service adds value to IoT startups by providing economies of scale to reduce their overall cost structure.

**Keywords :** Cloud computing, IoT, Future computing.

## I. INTRODUCTION

The IoT is generating an unprecedented amount of data, which in turn puts a tremendous strain on the Internet infrastructure. As a result, companies are working to find ways to alleviate that pressure and solve the data problem. Cloud computing will be a major part of that, especially by making all of the connected devices work together. But there are some significant differences between cloud computing and the Internet of Things that will play out in the coming years as we generate more and more data[1].

Using the cloud is important for aggregating data and drawing insights from that data. For instance, a smart agriculture company would be able to compare soil moisture sensors from Kansas and Colorado after planting the same seeds. Without the cloud, comparing data across wider areas is much more difficult[2]. Using the cloud also allows for high

scalability. When you have hundreds, thousands, or even millions of sensors, putting large amounts of computational power on each sensor would be extremely expensive and energy intensive. Instead, data can be passed to the cloud from all these sensors and processed there in aggregate.

The Internet of Things entered in daily life. For instance, Take smart homing. People can start their cooling devices remotely through their mobile

phones. This earlier used to be possible via an SMS, but today the internet has made it easier. Apart from providing smarter solutions for homes and housing communities, IoT has also been used as a tool in business environments across various industries[3]. However, with the amount of big data that is generated by IoT, a lot of strain is put on the internet infrastructure. This has made businesses and

organizations look for an option that would reduce this load.

Enter cloud computing- an on-demand delivery of computing power, database storage, applications and IT resources. It enables organizations to consume a compute resource, like a virtual machine (VM) instead of building a computing infrastructure on premise. Today, cloud computing has more or less penetrated mainstream IT and its infrastructure. Many tech biggies such as Amazon, Alibaba, Google and Oracle are building machine learning tools with the help of cloud technology to offer a wide range of solutions to businesses worldwide. This article aims to inform you of the role of cloud computing in IoT and why IoT and cloud computing are inseparable.

## II. ROLE OF CLOUD COMPUTING IN IOT

Cloud computing and IoT are work towards increasing the efficiency of everyday tasks and both have a complementary relationship. IoT generates lots of data while on the other hand, cloud computing provides a way for this data to travel. There are many cloud providers who take advantage of this to provide a pay-as-you-use model where customers pay for the specific resources used. Also, cloud hosting as a service adds value to IoT startups by providing economies of scale to reduce their overall cost structure[4]. Cloud computing also enables better collaboration for developers, which is the order of the day in the IoT area. By simplifying developers to store as well as access data remotely, the cloud allows developers to implement projects without delay. Also, by storing data in the cloud, IoT companies can access a huge amount of Big Data.

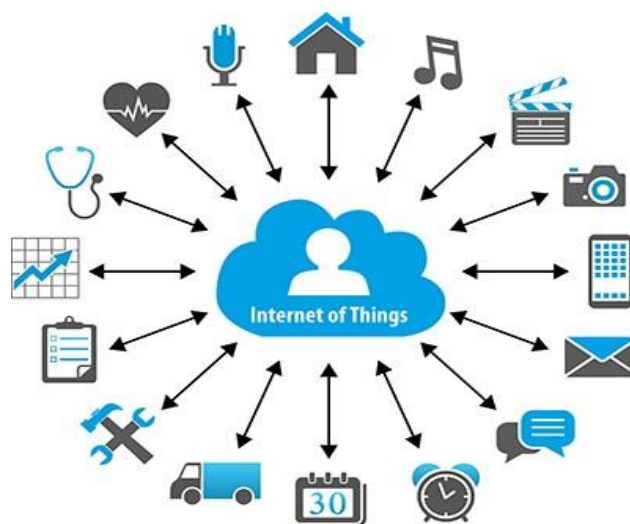


Fig 1: IoT in different environments

When a business uses thousands of sensors for data collection, each of those sensors is loaded with large amounts of computational power<sup>[10]</sup>. This demands huge amount of energy and is costly at the same time. In this situation, data can be passed to the cloud from these sensors and processed there in total. It can be said that the cloud is ‘the brain’ for much of the IoT, as most collected data is after all processed and analysed in the cloud.

## III. NEED OF CLOUD FOR IOT

### Sensor networks:

With cloud provides a new opportunity in collecting sensor data it also hinders the progress because of security and privacy issues. Sensor networks have amplified the benefits of IoT. These networks have allowed users to measure, infer and understand delicate indicators from the environment<sup>[5]</sup>. However, timely processing of a large amount of this sensor data has been a major challenge.

### Enables inter-device communication:

Cloud Cache and Dropstr are enabled by cloud communications, allowing easy linking to smartphones. This eases devices to talk to each other and not just us, which essentially is the tenet of IoT

cloud. It would be fair to say that cloud can accelerate the growth of IoT. However, deploying cloud technology also has certain challenges and shortcomings. Not because the cloud is flawed as a technology but the combination of IoT cloud can burden users with some obstacles. If you ever go ahead with an IoT cloud solution, it is better if you know the kind of challenges you may face in advance<sup>[9]</sup>.

### **Remote processing power Provider**

Cloud technology allows IoT to move beyond regular appliances such as air conditioners, refrigerators etc. This is because the cloud has such a vast storage that it takes away dependencies on on-premise infrastructure. With the rise of miniaturization and transition of 4G to higher internet speeds, the cloud will allow developers to offload fast computing processes.

### **Networking and communication protocols:**

Cloud and IoT allows machine-to-machine communications among many different types of devices having various protocols. Managing this kind of a variation could be tough since a majority of application areas do not involve mobility. As of now WiFi and Bluetooth are used as a stop-gap solution to facilitate mobility to a certain extent.

## **IV. IOT AND CLOUD COMPUTING FOR FUTURE**

In the near future, the combination of IoT and Cloud Computing will inevitably boost the growth of the IoT systems and cloud-based services. Most of the industries have understood and accepted the importance of lining up robust cloud services as the backend to many IoT projects. In addition, most of these organisations have already started line up the two technologies and are benefiting from it. IoT and cloud computing has a complementary relationship<sup>[6]</sup>. While IoT generates large amounts of data, many

cloud providers allow data transfer via the internet, that means facilitates a way to navigate the data. In a cloud infrastructure, you can deploy applications to process and analyze data quickly and make decisions as soon as possible.

IoT devices which utilize common APIs and back-end infrastructure can receive important security updates instantly through Cloud as soon as any security breach happens in the infrastructure. This IoT and Cloud computing combined feature is a vital parameter for user security and privacy. Cloud computing helps to collaborate in IoT development. Using Cloud platform, IoT developers can store the data remotely and access easily<sup>[7]</sup>.

IoT in cloud offers public cloud services can easily help the IoT area, by providing third party access to the infrastructure<sup>[8]</sup>. Hence, the integration can help IoT data or computational components operating over IoT devices.

**Increased Scalability:** IoT devices need a lot of storage to share information for valuable purposes. IoT in cloud, like the Cloud Connect to Microsoft Azure can provide customers with greater space which can increase as per the users demand. Helping to resolve the storage needs of customers.

**Increased Performance:** The large amounts of data produced by IoT devices need extreme performance to interact and connect with one another. IoT in cloud provides the connectivity which is necessary to share information between the devices and make meaning from it at a fast pace<sup>[6]</sup>.

**Pay-as-you-go:** Internet Cloud Computing infrastructures help IoT to give meaning to the greater amount of data generated. Users have no worry of buying greater or less storage. They can easily scale the storage as the data generated increases and pay for the amount of storage they consume with Internet Cloud Computing.

## V. CONCLUSION

The Internet of Things is a broad field and includes an incredible variety of applications. The cloud infrastructure is a good architectural fit for IoT, . IoT can benefit from the unlimited capabilities and resources of cloud computing, as cloud has the scalable capacities. There is no one-size-fits-all solution so IoT companies need to consider their specific application when deciding whether the cloud makes sense for them. Moreover, the cloud infrastructure can be accessed anytime and anywhere, and has lower capital expenditure and operational expenditure. Finally we conclude that Internet of things, big data and cloud computing leverage a new horizon of decision support system. And also the combination of the IoT, big data and cloud computing can provide new opportunities and applications in all the sectors.

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