

# AN ANALOGY OF CLOUD COMPUTING WITH IoT

K.SHANTHI<sup>1</sup>, R.MARUTHI<sup>2</sup>

<sup>1</sup> Research Scholar, PRIST University, Thanjavur;

<sup>1</sup> Assistant Professor, Shri Krishnaswamy college for Women, Chennai

<sup>2</sup> Associate Professor, Hindustan Institute of Technology and Science, Chennai

**ABSTRACT:** Cloud computing and Internet of Things (IoT) are two very different technologies that are both already part of our life. The Internet of Things (IoT) is becoming the next Internet-related revolution. It allows billions of devices to be connected and communicate with each other to share information that improves the quality of our daily lives. On the other hand, Cloud Computing provides on-demand, convenient and scalable network access which makes it possible to share computing resources. Their adoption and use are expected to be more and more pervasive, making them important components of the Future Internet. A novel paradigm where Cloud and IoT are merged together is foreseen as disruptive and as an enabler of a large number of application scenarios. In this paper, we focus our attention on the integration of Cloud and IoT, which is called the Cloud-IoT paradigm. Internet of Things (sensors, machines, and devices) generates a huge amount of data per second. Cloud computing helps in the storage and analysis of the data so that enterprise can get the maximum benefit of an IoT infrastructure. IoT solution should connect and allow communication between things, people, and process, and cloud computing plays a very important role in this collaboration to create a high visibility. IoT is just not restricted to functions of systems connectivity, data gathering, storage, and analytics alone. It helps in modernizing the operations by connecting the legacy and smart devices, machines to the internet, and reducing the barriers between IT and OT teams with a unified view of the systems and data. With cloud computing, organizations do not have to deploy extensive hardware, configure and manage networks & infrastructure in IoT deployments. Cloud computing also enables enterprises to scale up the infrastructure, depending on their needs, without setting up an additional hardware and infrastructure. This not only helps speed up the development process, but can also cut down on development costs. Enterprises won't have to spend money to purchase and provision servers and other infrastructure since they only pay for the consumed resources. There are several cloud services and platforms that play different roles in the IoT ecosystem. Some of the platforms also come with inbuilt capabilities like machine learning, business intelligence tools, and SQL query engines to perform complex analytics. In this paper, we will analyze the factors how these cloud services and platforms benefit an IoT ecosystem.

*Keywords: Internet of Things (IoT), Cloud Computing.*

## I. INTRODUCTION:

**Cloud computing** enables companies to store, manage and process data over cloud-enabled platforms providing flexibility, scalability and connectivity. Different models of cloud computing when implemented correctly help businesses with digital transformation, efficiency and growth. However, when connected with IoT, the cloud enables things that are never seen before making business thrive at a faster rate.

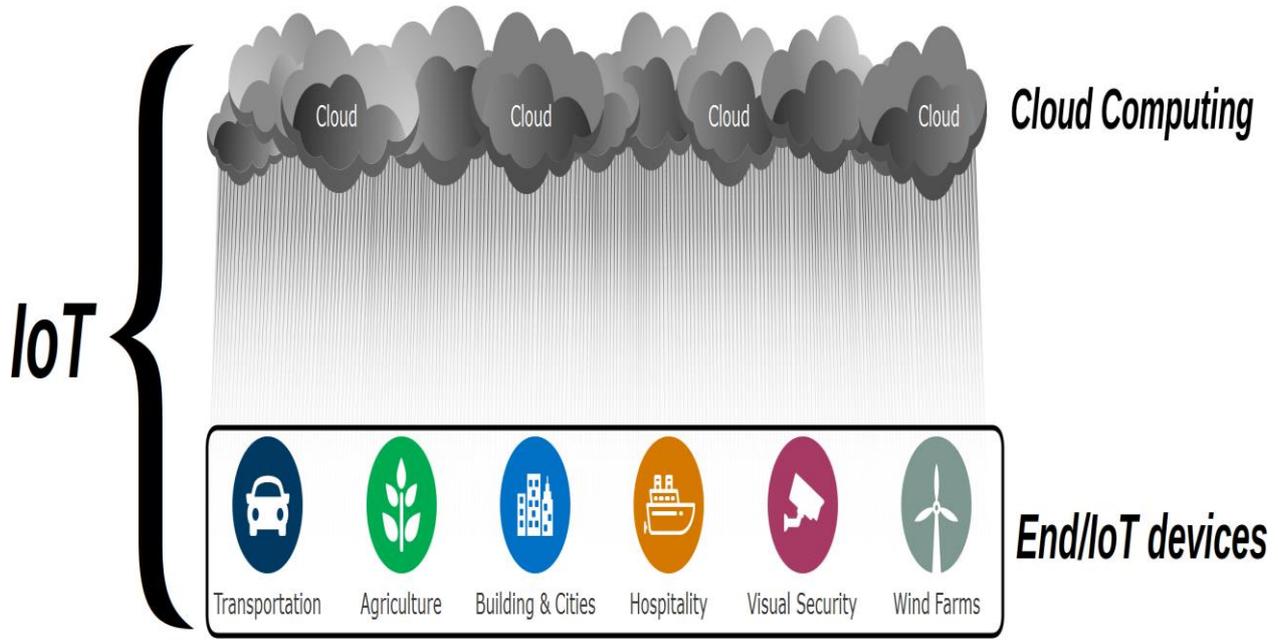
Regardless of the kind of service, cloud computing services provide users with a series of functions including:

- Email
- Storage, backup, and data retrieval
- Creating and testing apps
- Analyzing data
- Audio and video streaming
- Delivering software on demand

Cloud computing is still a fairly new service but is being used by a number of different organizations from big corporations to small businesses, nonprofits to government agencies, and even individual consumers.

There are several cloud services & solutions playing numerous roles in an IoT environment. Some of the cloud computing services have inbuilt capabilities of machine learning, business intelligence tools and SQL engines to perform complex tasks required of IoT

## II. ROLE OF CLOUD COMPUTING IN IoT



### 1. Enables remote computing capabilities:

With a large storage capacity, IoT eliminates the dependencies on on-site infrastructure. With continued development and internet-based tech development such as the internet and devices supporting advanced cloud solutions, cloud technology has become mainstream. Packed with IoT, cloud solutions provides enterprises with the capability to access remote computing services with a single click or command.

### 2. Security & Privacy:

Tasks can be handled automatically with cloud tech & IoT, organizations are able to reduce security threats by a considerable amount. A cloud tech-enabled with IoT is a solution that provides preventive, detective and corrective control. With effective authentication and encryption protocols, it also provides users with strong security measures. Protocols such as biometrics in IoT products help manage as well as safeguard user identities along with data.

### 3. Data Integration:

Current tech developments have not only integrated IoT and cloud smoothly but also provide real-time connectivity and communication. This in turn makes the extraction of real-time information about key business processes and performing on-spot data integration with 24/7 connectivity easy. Cloud-based solutions with powerful data integration capabilities are able to handle a large amount of data generated from multiple sources along with its centralized storage, processing and analysis.

### 4. Minimal Hardware Dependency:

Presently, several IoT solutions offer plug-and-play hosting services that are enabled by integrating the cloud with the IoT. With cloud-enabled, IoT hosting providers need not rely on any kind of hardware or equipment to support the agility required by IoT devices. It has become easy for organizations to implement large scale IoT strategies seamlessly across platforms and move to omnichannel communication.

### 5. Business Continuity:

Known for their agility and reliability, cloud computing solutions are able to provide business continuity in case of any emergency, data loss or disaster. Cloud services operate via a network of data servers located in multiple geographical locations storing multiple copies of data backup. In case of any emergency, IoT based operations continue to work and data recovery becomes easy.

### 6. Communication Between Multiple Devices & Touchpoint:

IoT devices and services need to connect with each other and communicate to perform tasks that are enabled using cloud solutions. By supporting several robust APIs, cloud & IoT is able to interact amongst themselves and connected devices. Having a cloud supported communication helps fasten the interaction happen seamlessly.

### 7. Response Time & Data Processing:

Edge computing combined with IoT solutions usually shortens response time and speeds up data processing capabilities. It requires the deployment of IoT with cloud computing and edge computing solutions for maximum utilization. Though cloud computing services can accelerate the growth of IoT, there are certain challenges in deploying these services successfully. The combination of IoT and cloud presents a few obstacles that need to be handled beforehand.

## III. CHALLENGES THAT CLOUD & IOT BRINGS TOGETHER:

### 1. Large Amount of Data:

Processing a large amount of data can be tiring and overwhelming, especially with countless devices working at multiple touch points. This can threaten the overall performance of the application. Therefore constant monitoring of the system and data backup is advised.

### 2. Network and Communication Protocol:

Cloud and IoT devices involve multiple touch point communication using numerous protocols. Since it is an internet-dependent service, it is difficult to manage the change sometimes. Internet accessibility using Wi-Fi and mobile Internet can help resolve any challenges faced due to connectivity issues in such situations.

### 3. Sensor Network:

Sensor network allows users to process and understand the IoT environment and amplifies the benefit of IoT. But, processing larger chunks of data regularly is a major challenge faced by these networks.

## IV. BEHAVIORS THROUGH WITH CLOUD PLATFORMS ENABLE IOT APPLICATIONS:

Cloud computing and IoT enables portability and interoperability in developing IoT application across the network of different cloud setups. Not to mention, these are the intercloud benefits that businesses can take advantage of. Such intercloud solutions possess SDKs, which enterprises can use to create their application without worrying about the backend processes. Besides, the cloud enables application hosting, deployment, and update of IoT applications.

Furthermore, Fog computing is considered to be an appropriate platform for the Internet of Things (IoT) use cases such as Connected Vehicle, Smart Grid, Smart Cities, Wireless Sensors and Actuators Networks (WSANs). Here, you can innovate network structure efficiently and faster. Using Fog computing, one can directly leverage the “things,” and here no need to introduce new boxes in the network. However, the backend activities are performed using SDK, which allows URL wrapping, location tracking, content tagging, and behavior monitoring.

Additionally, cloud computing makes IoT systems fault-tolerant. Device shadowing or digital twins is another benefit that cloud computing facilitates to IoT systems. In this process, developers can create the backup of devices and running applications in the cloud, making it fault-tolerant. Furthermore, they can take statistics offline. Simultaneously, organizations can also set up virtual servers, create applications, and launch a database to help run their IoT solution.

## V. IOT — ADVANTAGES AND DISADVANTAGES OF CLOUD COMPUTING:



### Advantages of Cloud Computing:

#### 1) Back-up and restore data:

- Once the data is stored in the cloud, it is easier to get back-up and restore that data using the cloud.

#### 2) Improved collaboration:

- Cloud applications improve collaboration by allowing groups of people to quickly and easily share information in the cloud via shared storage.

- If your business has two employees or more, then you should be making collaboration a top priority. After all, there isn't much point to having a team if it is unable to work like a team. Cloud computing makes collaboration a simple process.
- Team members can view and share information easily and securely across a cloud-based platform.
- Some cloud-based services even provide collaborative social spaces to connect employees across your organization, therefore increasing interest and engagement. Collaboration may be possible without a cloud-computing solution, but it will never be as easy, or as effective.

### 3) Excellent accessibility:

- Cloud allows us to quickly and easily access store information anywhere, anytime in the whole world, using an internet connection.
- An internet cloud infrastructure increases organization productivity and efficiency by ensuring that our data is always accessible.
- Cloud computing offers simplified and enhanced IT maintenance and management capacities by agreements backed by SLA, central resource administration and managed infrastructure.
- You get to enjoy a basic user interface without any requirement for installation.
- Plus you are assured guaranteed and timely management, maintenance, and delivery of the IT services.

### 4) Low maintenance cost:

- Cloud computing reduces both hardware and software maintenance costs for organizations. The services are free from capital expenditure. There are no huge costs of hardware in cloud computing. You just have to pay as you operate it and enjoy the model based on your subscription plan.

### 5) Mobility:

- Cloud computing allows us to easily access all cloud data via mobile.
- Cloud computing allows mobile access to corporate data via smart phones and devices, which, considering over 2.6 billion smart phones are being used globally today, is a great way to ensure that no one is ever left out of the loop.
- Staff with busy schedules, or who live a long way away from the corporate office, can use this feature to keep instantly up to date with clients and co-worker. Through the cloud, you can offer conveniently accessible information to sales staff who travel, freelance employees, or remote employees, for better work-life balance.
- Therefore, it's not surprising to see that organizations with employee satisfaction listed as a priority are up to 24% more likely to expand cloud usage.

### 6) I-Services in the pay-per-use model:

- Cloud computing offers Application Programming Interfaces (APIs) to the users for access services on the cloud and pays the charges as per the usage of service.

### 7) Unlimited storage capacity:

- Cloud offers us a huge amount of storing capacity for storing our important data such as documents, images, audio, video, etc. in one place.

### 8) Data security:

- Data security is one of the biggest advantages of cloud computing. Cloud offers many advanced features related to security and ensures that data is securely stored and handled
- .A cloud host's full-time job is to carefully monitor security, which is significantly more efficient than a conventional in-house system, where an organization must divide its efforts between a myriad of IT concerns, with security being only one of them.
- And while most businesses don't like to openly consider the possibility of internal data theft, the truth is that a staggeringly high percentage of data thefts occur internally and are perpetrated by employees.

**Disadvantages of Cloud Computing:**A list of the disadvantage of cloud computing is given below -



**1) Internet Connectivity:**

- As you know, in cloud computing, every data (image, audio, video, etc.) is stored on the cloud, and we access these data through the cloud by using the internet connection. If you do not have good internet connectivity, you cannot access these data. However, we have no any other way to access data from the cloud

**2) Vendor lock-in:**

- Vendor lock-in is the biggest disadvantage of cloud computing. Organizations may face problems when transferring their services from one vendor to another. As different vendors provide different platforms, that can cause difficulty moving from one cloud to another.

**3) Vulnerability to attacks:**

- Storing data in the cloud may pose serious challenges of information theft since in the cloud every data of a company is online. Security breach is something that even the best organizations have suffered from and it's a potential risk in the cloud as well. Although advanced security measures are deployed on the cloud, still storing confidential data in the cloud can be a risky affair.

**4) Network connectivity dependency:**

- Cloud Computing is entirely dependent on the Internet. This direct tie-up with the Internet means that a company needs to have reliable and consistent Internet service as well as a fast connection and bandwidth to reap the benefits of Cloud Computing.

**5) Downtime:**

- Downtime is considered as one of the biggest potential downsides of using Cloud Computing. The cloud providers may sometimes face technical outages that can happen due to various reasons, such as loss of power, low Internet connectivity, data centers going out of.

**6) Limited Control:**

- As we know, cloud infrastructure is completely owned, managed, and monitored by the service provider, so the cloud users have less control over the function and execution of services within a cloud infrastructure.

**7) Security:**

- Although cloud service providers implement the best security standards to store important information. But, before adopting cloud technology, you should be aware that you will be sending all your organization's sensitive information to a third party, i.e., a cloud computing service provider. While sending the data on the cloud, there may be a chance that your organization's information is hacked by Hackers.

**CONCLUSION:**

Integration of IoT and cloud computing solutions is the future of the internet and is currently solving several business obstacles along with opening new avenues in business & research. New applications and services are being developed at each step to resolve the existing challenges. Cloud and IoT have a long road to cover to unlock their true potential in the future.

**References:**

1. [The Role Of Cloud Computing In Internet Of Things \(IoT\) \(rapyder.com\)](https://www.rapyder.com)
2. [What is the role of Cloud computing in IoT - Tech Blogger \(contenteratechspace.com\)](https://contenteratechspace.com)
3. IoT — Advantages and Disadvantages of Cloud Computing | by Mohamed Wasim Akram
4. <https://www.einfochips.com/blog/importance-of-cloud-computing-for-large-scale-iot-solutions/>