

Integration of Cloud Computing With Internet of Things

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Abstract: Cloud computing and Internet of Things (IoT) are two different techniques. It is becoming very difficult to compute power constrained small sensors and other devices which generate the data. Data generated needs to be managed according to its requirements, to create more valuable services. For this purpose, cloud computing must be integrated with Internet of Things is very important. This paper represents use of cloud computing to enable the IoT.

Keywords: Internet of Things; Cloud Computing; Cloud computing services; Generation of data; sensors;

I. INTRODUCTION

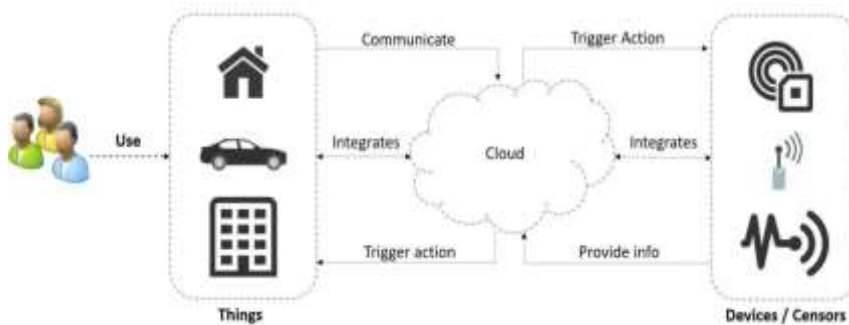
Cloud computing is a type of computing that rely on shared computing resources instead of having local servers or individual devices to handle applications. It means Cloud computing is taking services from different cloud services & moving them outside an organization's database. Cloud computing applications, storage and other services are accessed via the Web. The services are delivered and used over the Internet and are paid for by the cloud customer on an as-needed or pay-per-use business model. The IOT devices generates voluminous amount of data, that's why it puts a huge load on Internet Infrastructure.

As a result, this forces companies to find solutions to minimize the pressure and solve their problem of transferring large amounts of data.[1], Internet of Things represents a concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet. This data can be processed and utilized for various interesting purposes.

II. INTERNET OF THINGS ARCHITECTURE

IoT architecture is treated as a system which can be physical, virtual, or a hybrid of the two, consisting of a collection of numerous active physical things, sensors, actuators, cloud services, specific IoT protocols, communication layers, users, developers, and enterprise layer. Architectures act as an important component of IoT specific infrastructure while facilitating the systematic approach toward different components resulting solutions to related issues.[2] We can define IoT as “a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual ‘Things’ have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network”.

IoT Architecture



III. CLOUD COMPUTING SERVICES WITH DIFFERENT IOT

Cloud computing provides necessary tools and services to create IoT applications. Cloud helps in achieving efficiency, accuracy, speed in implementing IoT applications. Cloud helps IoT application development but IoT is not a cloud computing.



IV. RELATED WORK: INTERNET OF THING INTEGRATES WITH CLOUD COMPUTING

Cloud computing provides required tools and services to create IoT applications. It helps in achieving efficiency, accuracy, and speed in implementing IoT applications. IoT & cloud computing works together to increase efficiency of day to day task & both have complementary relationship. As IoT generates huge data while cloud computing provide services for this data to travel. There are many cloud providers who take advantage of it & provide a pay as you use model.[3]. Many cloud service providers have identified the needs and started giving IOT related services to companies for creation of better IOT solutions. Big companies like Microsoft, Amazon, IBM, and SAP has implemented IOT related components into their cloud platforms. Following are the different cloud computing providers.

- **Private Cloud Services** is a secure cloud that only the specified organization can access. The additional security offered by a private cloud model is ideal for any organization, including enterprise, that needs to store and process private data or carry out sensitive tasks.

- For example, a private cloud service could be utilised by a financial company that is required by regulation to store sensitive data internally and who will still want to benefit from some of the advantages of cloud computing within their business infrastructure, such as on demand resource allocation.[4]
- **Public Cloud Service** is like a Private cloud although the main differentiator is that resources used to process and store data can be shared with other organisations, and data transferred over a public network such as the internet. Third party providers will deliver cloud services over the internet and are normally charged by CPU cycles, storage, or bandwidth that they require.
- **Hybrid Cloud** is a cloud computing environment which uses a mix of on premise, private cloud and third party public cloud services.[5] With the hybrid cloud model, IT decision makers have more control over both the private and public components than using a pre-packaged public cloud platform.[8]

Table 1: Internet of Things integrates with Cloud computing

Attributes	Internet of Things	Cloud computing
Big Data	Generates big data	Manage big data
Storage	Very small or almost none	Large, virtually never ending
Components	Works on hardware components	Works on virtual machines which imitate hardware components
Reachability	Very limited	Wide , far spread
Role of Internet	Source of data convergence	Source of delivering services
Computing capabilities	Limited	Virtually unlimited

Use of IOT is becoming common so that it is important to integrate it with cloud computing. The data generated by IOT requires virtual resources, different services for storage, utilization and to make it possible to create more usefulness from the data generated by IoT's and develop smart applications for the users. Following are some attributes which shows IOT must be integrated with cloud computing.

- Big Data: Cloud computing is a platform for assessing large data generated by IOT.
- Storage: Cloud computing storage is virtual and never ending.
- Components: IOT collects the data by hardware where as Cloud computing works on virtual machines which process the IOT data.
- Reachability: IOT is having limited reachability towards commercial end where as cloud computing spreads widely.
- Role of Internet: In cloud computing internet is a source of delivering services.
- Computing capabilities: Cloud computing capability is virtually unlimited.

V. CONCLUSION

Now a day's cloud computing is a new technological development which has a potential to have great impact on the world. The future Internet is cloud computing which implies that all the efficient activities, making thus an infrastructure network that integrates all types of resources and all types of utility domains. This paper says that the integration of Internet Of Things and cloud computing is the indication of the next big leap in the world of Internet. Different new applications coming from this combination known as IOT Cloud. This combination is the opening a new path for business as well as research.

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