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## RESEARCH ARTICLE

# STUDY OF CLOUD SERVICES FOR IMPLEMENTING AND INTEGRATING INTERNET OF THINGS

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**ABSTRACT**

Integrating Internet of things with cloud computing having popularity in the recent trends. For adopting cloud services in IoT there are various considerations. Aim of the paper is to present the role of Cloud computing services in IoT implementation and focused on integration of cloud platform also how they are most suitable for Internet of Things concept. It explicitly defines those parameters from the point of view of IoT implementation, Integration and performance.



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## INTRODUCTION

The IoT is defined as the connection made with an object may be living or non-living things. For instance, a vehicle, dustbin, smart phone, anything can be a part of the Internet of Thing. IoT contains things and smart objects. These objects having the ability of computing the tasks and communicate with the internet and humans. The IoT organization has three layers such as perception layer, network layer and application layer (Yen-Kuang Chen, 2012; Gerd Kortuem, 2010; Rafiullah Khan *et al*., 2012). There is advancement in the field of Internet of things (IoT) grown rapidly, in the last decades. To improve the next generation internet, productive research is still in progress. There is a need of integration of IoT with cloud due to the production of Zetta bytes of data from the IoT devices. In the future, the devices connected to internet will be more than the people connected to the internet. Cloud computing is the new era in the recent years. Cloud computing is a paradigm where it can provide any thing as a service. The major services provided by the cloud are infrastructure as a service, software as a service and platform as a service. Cloud computing offers the services with pay-as-you use policy and the users have the flexibility to use any service by renting them. Cloud is the extending platform of parallel and distributed computing. The large industries can utilize cloud services without any installations of high computing devices.

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## INTERNET OF THINGS AND CLOUD COMPUTING:

Internet of Things is the upcoming technology which will completely reform the existing system of technology. According to the definition given by ITU, "The IoT describes a worldwide network of billions or trillions of objects that can be collected from the worldwide physical environment, propagated via the Internet, and transmitted to end-users. Services are available for users to interact with these smart objects over the Internet, query their states, as well as their associated information, and even control their actions" (Lei CHEN *et al*., 2010). Its main principle is to create a large network which consists of different smart devices and networks to facilitate the information sharing of global things from any place and at any time (Su-bin SHEN, 2009). The devices are made smart by using Radio Frequency Identification tags. These devices communicate with the help of networks. The data collected by them are stored and computed on the Cloud services which are location-independent. The cloud service is best suited for this purpose as they provide a convenient way to access resources without having to create expensive infrastructure for it. The services can be availed based on the plans available according to the usage desired.

The use of Cloud in IoT is illustrated in Fig. 1. Cloud computing involves cloud service providers who offer the services to its tenants which in turn use the cloud services through certain contracts with the providers.


**Fig 1. The use of cloud in IoT**

The cloud providers aim to provide sharing of resources between the tenants to meet the dynamic demands. The tenants benefit as they can pay only for the resources they require, thus removing the start-up expenses and being able to quickly scale up or scale down resources during the demand fluctuations. The end-user of a system can interact with a cloud provider directly or indirectly via the tenants. In this paper, we are focusing on the Internet of Things devices' interaction with the cloud services.

**CLOUD COMPUTING TERMINOLOGIES:** For Networks, Services, Servers, Applications, Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources.that can be rapidly provisioned and released with minimal management effort or service provider interaction.The service-providers use three types of service models to provide cloud services, which are explained below. These are Software, Platform and Infrastructure as a Service models.

- Software as a Service (SaaS): Various software applications are provided to the users on a pay-per-use policy
- Platform as a Service (PaaS): Different platforms, tools and other services are provided to theusers.
- Infrastructure as a Service (IaaS): Infrastructure like storage, computing power etc. are made available to the users through virtualization (Yen-Kuang Chen, 2012).

Four types of deployment models are used: Public cloud which is open for access by public; Private cloud which is owned by a private organization; Community cloud which is built for a specific purpose by a community of organizations and Hybrid cloud which is a combination of private and public cloud. There are many parameters which are under concern when we compare the different types of clouds. Generally, using public clouds is a good option for small organizations that seek cost savings and test their software products before they are out in market. Private clouds are better suited for organizations that handle sensitive data and are apprehensive about its confidentiality. Hybrid clouds are appropriate for organizations which want to reap the benefits of both security as well as cost-effectiveness.

**INTEGRATION OF IOT WITH CLOUD SERVICES:** Connected devices to the internet are going to reach the number of 24 billion and this leads to the vast data production (FlavioBonomi *et al*., 2012). Therefore, storage space is needed to honour this data. Cloud computing provides the data storage and data processing for the IoT. These services are provided at rental basis and IoT are integrated with small sensor nodes which are limited in their capacity and storage space. Therefore, cloud computing provides all the needs of IoT. Figure 2 shows the communication architecture of IoT and cloud.

**Research issues in integration of IoT and Cloud:** The integration of IoT with cloud is not a simple issue; the IoT does not allow all the things to integrate and all the resources to avail from the cloud. There are some issues which have to be addressed before the integration. The communication between the IoT and cloud are considered as the major constraint for the integration. Some of the issues are discussed below.

- **QoS Provisioning**: In IoT, the data size produced by the sensor nodes is more, it leads to the unpredictability and quality of service becomes major issue. The sensor nodes produce data at any time and some time it might be an important data. Therefore, cloud should provide prioritization to the data (Nef, 2012). Quality of service is measured in terms of packet loss ratio, bandwidth, jitter and delay (Duan, Ren, 2011).
- **Protocol Design:** In IoT, there are number of devices connected through the internet and the protocol used by these devices is different from one to another. Some devices use Zigbee and some other devices use IEEE 802.11. The gateways present in between the sensor nodes and internet supports some protocols. The protocol support is dependent on the sensor devices and the gateway used in the IoT. So, there is no guarantee of protocol support if any new sensor is added in to the network. Therefore protocol support is also one of the issues to be concerned at the time of communication (Sheng, Zhengguo *et al*., 2013; Zanella, Andrea, 2014).
- **Resource Allocation:** resource allocation is the major issue in the cloud platform. In IoT, the sensor nodes are heterogeneous in nature; there is no idea about the capability of the sensor nodes such as bandwidth and computation power. Therefore, it is difficult to provide the resources to the IoT without knowing the exact utilization (Misra, 2011).
- **Energy Efficiency:** The sensor nodes deployed in the IoT environment must connected to the cloud and it requires lot of data communication and it ultimately leads to the high energy consumption. Allsensor devices are composed of sensing unit, processing unit, transmission unit and power supply unit. Most of the sensor nodes are operated with limited power supply. Therefore, efficient mechanism is needed for efficient utilization of energy for the sensor nodes. Some researchers made contributions to preserve the energy by introducing sleep mode the sensors (Krishna, 2014; Moreno *et al*., 2014).
- **Service discovery**: In the Cloud IoT, the cloud manager takes part of discovering new services to the users. The major issue in the IoT is any node can join in the network or leave the network at any time. Therefore, continuous monitoring is required on the sensor nodes. In larger IoT networks, an IoT manager is also needed to manage the services.

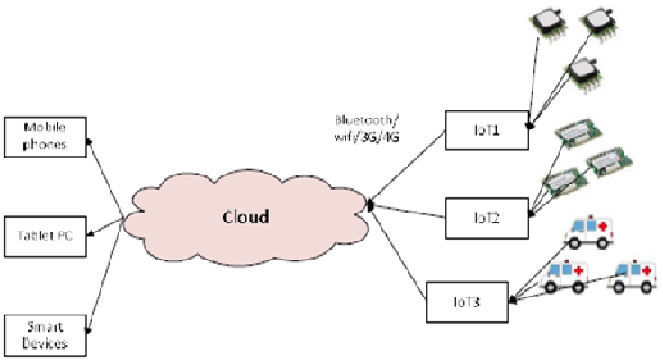


**Figure 2. Communication between IoT and cloud**

- **Privacy and Security:** In both IoT and cloud, privacy and security is the major research issue. In IoT, the data produced by the sensor nodes might be confidential and it requires some security mechanisms to preserve the data (Babar, 2010).

**REASONS: Cloud Services used for IoT:** There are several aspects which suggest the use of Cloud services for Internet of Things (IoT). The below mentioned reasons describe the suitability of cloud services for IoT.

**Always available:** The cloud services are location-independent and always available, which is the prime requirement of Internet of Things technology. The smart devices should be able to interact with each other any time so cloud is the best bet for such necessities.

**Quick scaling up/down:** Cloud services can scale up quickly, so adding any number of devices to the system is made quite easy by Cloud service providers. This helps in effective management of devices during peak hours and otherwise as well. For example in a Smart city, the number of vehicles on the roads may increase during the morning office timings, and hence more number of devices will need to connect to the network to find the parking space.

**Better resource management:** Cloud services can help manage restraints on resources. For example, due to limited power of the batteries and storage space, the computational jobs on smart phones can be moved on to the cloud. It will help lay off the load from such devices on to the cloud servers.

**Cross device functionality:** Cloud services can work across a variety of things or devices. This is one quality of cloud which makes it most appropriate for Internet of Things (Nef *et al*., 2012) which has a large number of devices communicating with each other like sensors, cameras, smart phones etc. The use is best exemplified by Smart cities concept where devices work together to bring about the functionalities like heath care, emergency alerts, traffic management etc.

**Different clouds for different needs:** Cloud services are available in public, private and hybrid models. These can be used for different needs. For example, in Internet of Things model, the health records of patients can be stored on private cloud for use by the doctors. However, the healthcare data like heart-rate, temperature etc. needed for health monitoring can be stored on public clouds.

**Secure data storage:** The use of cloud services for storing data is becoming increasingly popular in IoT. This has ensured that the cloud service providers offer the best data storage plans with maximum security levels being promised. This is necessary for the service providers to manage the market competition and rising demands.

**No extra cost of infrastructure:** The use of cloud for IoT also provides a cost benefit which is the most lucrative of all its features. There is no extra cost for resources and infrastructure. The cloud infrastructure can be used by paying small costs according to the plans of service providers.

## Conclusion

This paper presented the architecture for integration of IoT with cloud services and the research issues which need to be addressed at the time of integration. The Internet of Things technology is a promising new field in Information and Communications technology (ICT). It can induce the smart factor into the functionalities of diverse fields. The applications of IoT range from Smart cities to Agriculture, Tourism, and Healthcare etc. The implementation of IoT needs the coordination of various technologies like Wireless networks, Cloud computing and networks. This paper presented the role of Cloud services in IoT. A comprehensive reasoning of the various factors was done which suggest the appropriateness of Cloud for IoT. The always-on feature of Cloud services among many others is best suited for the Internet of Things (IoT).

## REFERENCES

Abdelwahab, S., Hamdaoui, B., Guizani, M. and Rayes, A. 2014. “Enabling Smart Cloud Services Through Remote Sensing: An Internet of Everything Enabler,” *Internet of Things Journal*, vol. 1, no. 3, pp. 276–288.

Babar, Sachin, Parikshit Mahalle, Antonietta Stango, Neeli Prasad, and Ramjee Prasad. 2010. "Proposed security model and threat taxonomy for the Internet of Things (IoT)." In *International Conference on Network Security and Applications*, pp. 420-429. Springer Berlin Heidelberg.

Duan, Ren, Xiaojiang Chen, and Tianzhang Xing. 2011. "A QoS architecture for IOT." In *Internet of Things (iThings/CPSCom), 2011 International Conference on and 4th International Conference on Cyber, Physical and Social Computing*, pp. 717-720. IEEE.

Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, 2012. "Fog Computing and Its Role in the Internet of Things", in the proceedings of ACM SIGCOMM, August 17, Helsinki, Finland.

Gerd Kortuem, Fahim Kawsar, Daniel Fitton, and Vasughi Sundramoorthi, 2010. “Smart Objects and Building Blocks of Internet of Things”, *IEEE Internet Computing Journal, volume 14,* issue 1, pp. 44-51, Jan.-Feb.

Karandeep Kaur, 2016. ”A study of the role of Cloud services in the implementation of Internet of Things (IoT)”International Journal of Recent Trends in Engineering & Research (IJRTER) *Volume 02, April.*

Krishna, P. Venkata, *et al*., 2014. "Secure socket layer certificate verification: a learning automata approach." *Security and Communication Networks* 7.11: 1712-1718.

Lei CHEN, Mitchell TSENG, Xiang LIAN. 2010. Development of foundation models for Internet of Things. Front. Comput. Sci. China, 4(3): 376–385.

Misra, S., Krishna, P. V., Agarwal, H., Saxena, A.,&Obaidat, M. S. 2011. A learning automata based solution for

preventing distributed denial of service in Internet of things. In *Internet of Things (iThings/CPSCom), 2011 International Conference on and 4th International Conference on Cyber, Physical and Social Computing* (pp. 114-122). IEEE.

Moreno, M., Úbeda, B., Skarmeta, A.F. and Zamora, M.A., 2014. How can we tackle energy efficiency in iot based smart buildings?. *Sensors*, *14*(6), pp.9582- 9614.

Nef, M.A., Perlepes, L., Karagiorgou, S., Stamoulis, G.I. and Kikiras, P.K., 2012. Enabling qos in the internet of things. In *Proc. of the 5th Int. Conf. on Commun., Theory, Reliability, and Quality of Service (CTRQ 2012)* (pp. 33-38).

Rafiullah Khan, Sarmad Ullah Khan, Rifaqat Zaheer, and Shahid Khan, 2012. "Future Internet: The Internet of Things Architecture, Possible Applications and Key Challenges", in the proceedings of 10thInternational Conference on Frontiers of Information Technology, Islamabad, Pakistan, 17-19 December.

Sheng, Zhengguo, Shusen Yang, Yifan Yu, Athanasios V. Vasilakos, Julie A. McCann, and Kin K. Leung. 2013. "A survey on the ietf protocol suite for the internet of things: Standards, challenges, and opportunities." *IEEE Wireless Communications* 20,no. 6: 91-98.

Su-bin SHEN, Qu-li FAN, Ping ZONG. 2009. Study on the Architecture and Associated Technologies for Internet of Things. Journal of Nanjing University of Posts and Telecommunications (Natural Science). 29(6):1-11.

Yen-Kuang Chen, 2012. "Challenges and Opportunities of Internet of Things",in the proceedings of 17th Asia and South Pacific Design Automation Conference, 30 Jan. – 02 Feb., Santa Clara, CA, USA.

Zanella, Andrea, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, and Michele Zorzi. 2014. "Internet of things for smart cities." *IEEE Internet of Things Journal* 1, no. 1: 22-32.

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