

A Comprehensive Survey of Various Cloud Simulators Required For Deployment of IOT Applications

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Abstract: Cloud Computing is a substantial technological innovation to undertake a large scale and sophisticated computing. Since internet usage is increasing day by day, yet another big area is approaching to utilize internet as a global platform for the purpose of allowing the devices as well as smart objects to communicate, compute and coordinate known as Internet Of Things (IOT). In this paper, empowering platform to IOT applications and cloud simulator are reviewed. Cloud Computing is among the empowering platform to aid IOT applications. Integrating IOT with Cloud represents new paradigm, Cloud-of-Things is termed in current and future internet.

Keywords: Internet of Things (IOT), Cloud computing, Cloud simulator, Cloud-of-Things (COT)

INTRODUCTION

Nowadays, Internet have grown to be the most important thing in people's life. About 2 billion people all over the world make use of internet for the purpose of sending as well as receiving emails, utilizing social networking applications, sharing massive amount of data, playing games and also several other things. Since the utilization of internet is growing day by day, yet another big area is coming up to make use of internet in the form of global

platform for the purpose of allowing the devices as well as smart objects to communicate, compute and also coordinate known as Internet Of Things(IOT)[1].

1.1 IOT

The IOT paradigm is predicated upon sensible as well as self-configuring nodes connected in a very dynamic as well as global system infrastructure. This signifies probably the most troublesome technologies allowing all-pervasive in addition to invasive computing scenarios. IOT is usually recognized by means of real world and small things having restricted storage plus digesting capability, along

with consequential uses relating to reliability, performance/ efficiency, security as well as privacy[2]. IOT is basically a technology in which objects around people is able to connect together (eg device to device) and communicate through the internet. With the growth of this area, it is not mandatory for you to sit at a place and access the internet. Rather internet could be connected to from anywhere you want to and through any kind of device. Obviously internet will continue as a backbone of this new area. IOT can establish a world in which all of the objects referred as smart objects around all of us is usually linked with the internet

which communicate among one another by means of least human involvement.

The inspiration behind IOT is to develop smart city so as to enhance the public resources usage, improve the quality of services provided to individuals and reduce the functional expenses of the services. The ultimate objective would be to generate a much better world intended to humans in which objects in our environment understand what we like, what exactly we wish for, what we require and also take action accordingly without explicit guidelines

The word IOT is used to relate:- (1) The global network which experts claim interconnects sensible items through making use of internet technologies. (2) Group of assisting technologies for example Radio frequency Identifications (RFIDs), machine-to-machine communicating devices, sensor/actuators, etc.(3) lend of application along with services utilizing these technologies intended for enterprise purposes. The IOT is dependent upon 3 building blocks in line with the capability of smart objects to be able to:

- (i) Often be recognizable
- (ii) To communicate
- (iii) To have interaction.

The main objective of IOT is about the data and information instead of point to point communication. The main challenges while developing IOT are:-

1) Heterogeneity of Devices:- Since IOT is all about linking numerous smart devices, so to connect heterogeneous devices is a key concern. These kinds of devices operate on various platforms that make use of distinct protocols in order to contact with each other. Therefore it is important to perform unification of such devices.

2) Scalability:- It is a main challenge since every day on the network multiple devices are getting connected. It includes problems such as addressing, service management, information management etc.

3) Common Information exchange by means of wireless technologies:- Within IOT wireless technologies are employed to link smart devices. This includes problems such as availability, network delays, congestion etc.

4) Energy optimized remedies:- This is certainly significant constraint associated with IOT. A numerous devices are linked by means of networks, energy spent with regard to data communication will

be high. The challenge would be enhance the utilization energy needed for communication among various devices.

5) Capabilities to self-organize:- The smart objects under IOT must sense the environment and respond autonomously to real world conditions, with little interventions.

6) Semantic interoperability and data management:- IOT exchange data among multiple smart objects, so there must be any standardized format with regard to data exchange to ensure the interoperability amongst applications.

7) Mechanisms of Embedded security and preserving privacy:- With IOT security and privacy tend to be the main concern to acquire acceptance from user. IO technology must be secure along with privacy reserving by way of design.[1]

According to survey of IBM, today 3 quintillion (3X10¹⁸) bytes data is being generated everyday in 2012 via means of different sensing devices.

1.2 Common IOT Architecture

IOT stands for connection of networks. It permits people as well as things to be connected any time, any place using anything. The IOT has evolved through the conversions of wireless technologies, Micro electromechanical system and internet. IOT is made up of 3 layers:-

1) Perception layer:- It is the lower layer which is used to collect and send data so that you can understand digital signals using RFID, sensors etc.

2) Network layer:- This is a center layer that gathers the information sent by the layer below it by means of network. It is a gateway, having one interface linked to the network of sensors and the other with the internet.

3) Application layer:- It is the top layer that executes the data presentation. It obtains data through lower layer and gives application with global management representing information. Depending on the consumer requirements, application layer represents data via smart city, healthcare, and other several types of applications.

As outlined by Gartner, there will be 100 to 200 billion devices linked with IOT by 2020. This massive amount of devices linked with internet offers different services which generate big data that should be processed and analyzed for knowledge extraction. To support these kind of IOT applications we require a reliable, flexible

and long time platform such as Cloud Computing [3]

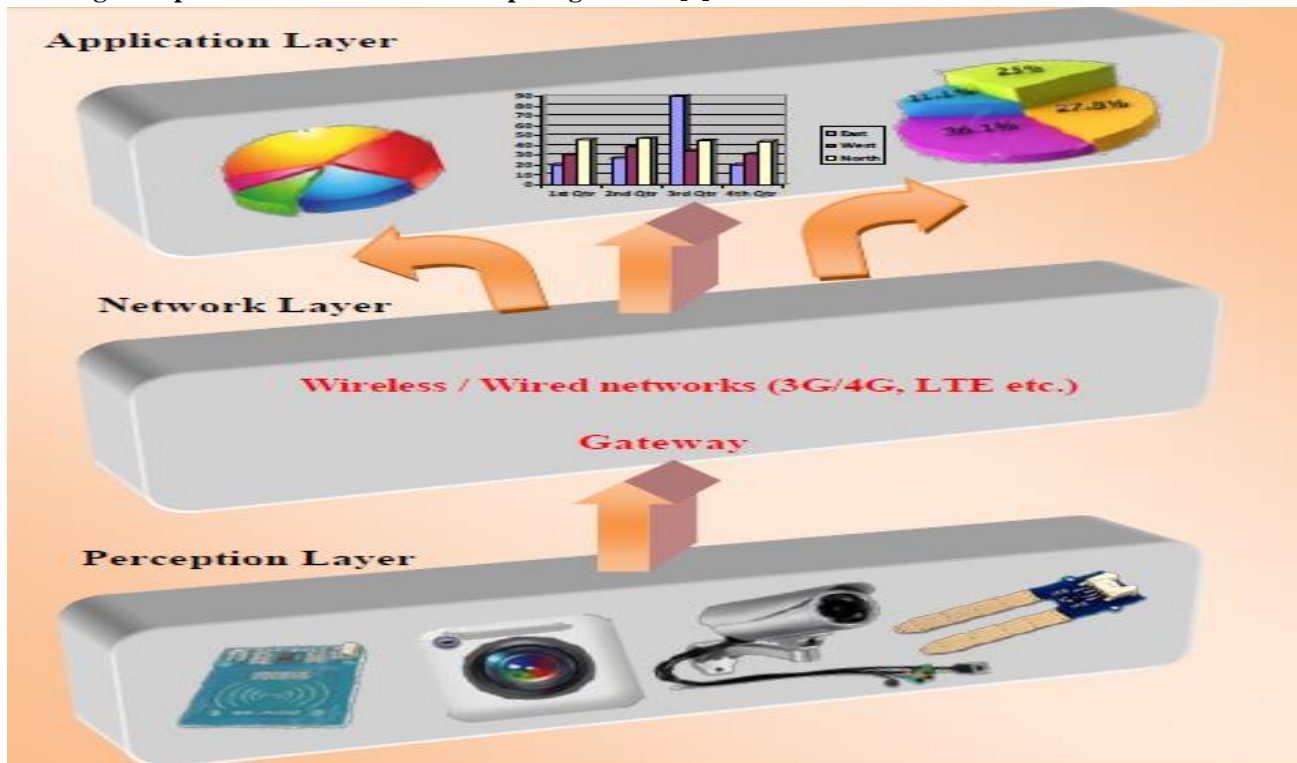


Fig. 1. Three layer Architecture of IOT

1.3 Cloud Computing

Cloud computing is a robust technological innovation to carry out a massive scale and sophisticated computing[4]. It eradicates the necessity to preserve expensive computing software, space, and hardware. Cloud computing has the potential in establishing itself as the part of next generation IT Industry and promises reliable services delivered through data centers[6] Cloud service models include IaaS, SaaS, and PaaS[4].

- PaaS, is a framework used for applications and provide platform for the end users[4]. Google's Apps Engine, Microsoft Azure, Force platform, Salesforce.com are some examples of PaaS. The consumer does not manage or control the underlying cloud commercial infrastructure which include systems, servers, network or hard drive, yet provides control over the actual built applications and even settings for the environment of hosting applications.
- SaaS, refers to applications provided through web that can run directly through Internet[4].

Google Docs, Gmail, Salesforce.com, and Online Payroll are examples of SaaS. The consumer doesn't control or manage the root cloud infrastructure including network, computers, systems, storage space, or maybe person request functions, by using the possible difference connected with reduced consumer unique request setup settings.

- IaaS is a self- service model that offers highly scalable resources, where the third party will provide the infrastructure components for end users on on-demand basis[4]. Uses have to pay on pay per use basis. The client doesn't control or manage the underlying cloud commercial infrastructure but offers control over systems, storage, and also deployed software and even restricted power over select social networking components. Amazon Web Services and Flexiscale are the examples of IaaS.

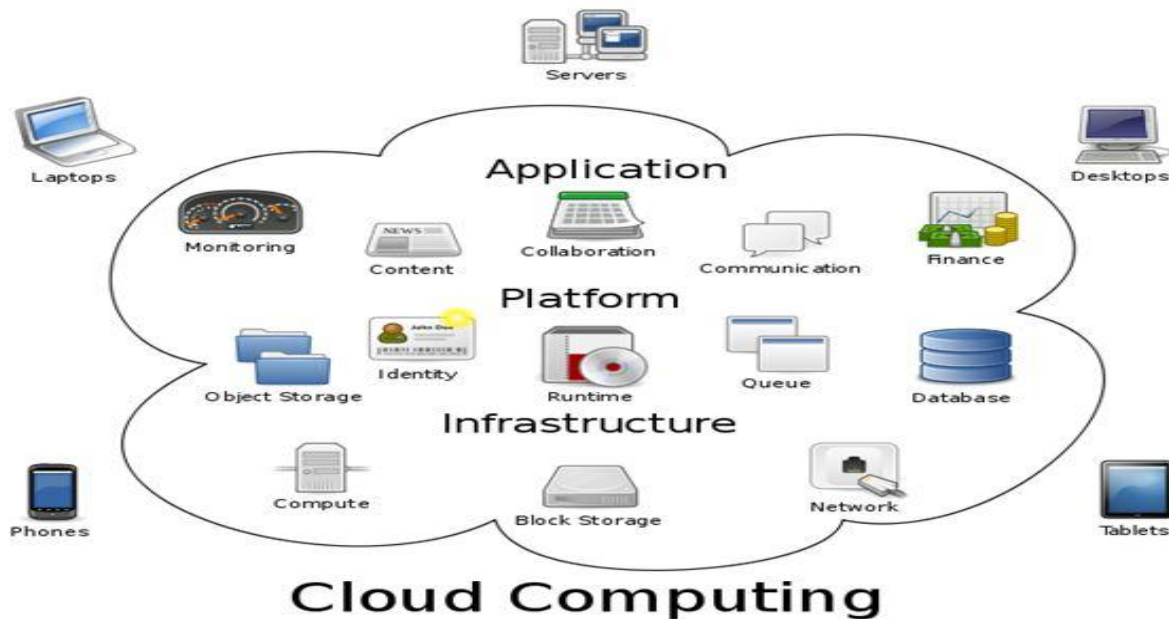


Fig. 2. The Cloud Computing Environment

Security, reliability, parallel processing, and manageability are some advantages of cloud computing. It not only reduces cost but also offers infrastructure and reduce its cost of maintenance and provide effective management to users[5]. Cloud applications of mobile like Gmail, Google drive, iCloud, Onedrive, Dropboxetcimprove mobile cloud performance

1.4 Cloud Simulators

Some of the cloud simulators used for design and simulate the distributed systems are given below:-

- 1) **Peer-to-peer network** models for example structured and unstructured overlay networks have been simulated with PlanetSim[12]. Within a study[13], Planet Sim had been incorporated together with Grid Sim to analyse the performance of distributed scheduling of applications throughout several computational aspects like supercomputer etc.
- 2) **Grid Computing**:- Some of the simulators of Grid Computing are GangSim[7], SimGrid[8], OporSim[9], MicroGrid[10], GridSim[11], .
- 3) **Cloud Computing model** have been simulated with GreenCloud[14], icanCloud[15], CloudSim[16] and its different versions (EMUSIM[17], MDCSim[18],NetworkCloudSim[19],CloudAnalyst[20]) have been described and also compared

-**Green cloud** is a packet level simulator that can model behaviors of network links,

gateways,switchesas well as other hardware resources like storageand CPU inside a data center of cloud. The objective is to make the performance tests easier associated with energy efficient scheduling algorithms. GreenCloud needs additional space of memory and processing power for creating and transferring packet throughout simulation entities.

-**icanCloud**:- It is used for simulation involving variety of Cloud Computing systems along with their architectures. It is able to design as well as simulate large environments and applications over distributed network using a customized detail.

-**CloudSim**:- It is the popular discrete event simulation frameworks. Since it is extremely flexible as well as extensible, it offers designs for all hardware resources that include storage and networks (network contention or network delays), CPU inside various data centers. CloudSim possesses substantial assistance with regard to application (example:- web hosting applications) scheduling level simulations, since it gives cloud exchange (for federated data center resource pooling) cloud broker entities[3]

1.5 Need For Integrating Cloud And IOT

IoT is characterized by small objects of real world, distributed widely having limited storage and processing capabilities while cloud computing has unlimited storage and processing capabilities. In

Agriculture field also, IoT procuresses large non-structured, semi-structured and structured data. Cloud is most convenient solution for collecting, accessing, processing of data [21].

As discussed in earlier section, devices using IoT, have limited processing resources that limits on-site data processing. In this case, data collected by these devices is transmitted from node to node in wireless sensor network which are then upload it on cloud. Real-time processing is performed on cloud. Thus,

Integrating IoT with Cloud represents new paradigm, Cloud-of-Things is termed in current and future internet, in which cloud functions as middle layer between the application and the devices. The relationship between cloud computing and IoT-based applications is shown in Figure 3. Though, IoT is exciting on its own the real innovation and value from IoT can be harnesssed by combining it with cloud computing.

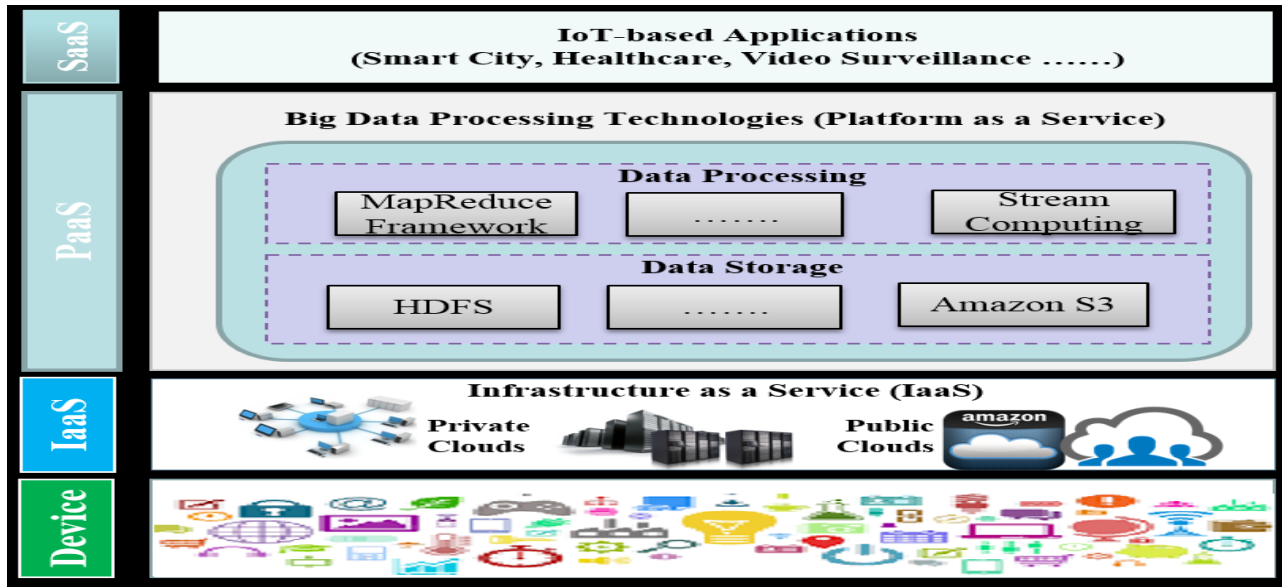


Fig. 3. Relationship between Cloud Computing and IoT-based application

1.6 Cloud Of Things

After knowing basics of IOT as well as Cloud Computing separately we are moving towards actual integration of these two technologies. Many devices will communicate among each other which will generates tremendous amount of data with more internet traffic. Storing this data locally and temporally will be impossible. Again processing and computation must require storage space; which can be obtained from Cloud. IoT and Cloud working with together to form a new platform for all the applications of IoT which is called as Cloud-of-Things.

1.7 Data Communicaion IOT And Cloud

IoT provides the modified communication technique using heterogeneous networks and devices. These networks and devices generates tremendous amount

of sensed data from agriculture fields. Farmer demands are unique in nature and can be fulfilled by scalable network access of cloud. Below Fig. 4. represent the functioning of IoT-Cloud communication IoT layer consist of different types of Sensors (pH, Moisture, Humidity etc.), Wireless underground sensor nodes, on ground sensor nodes, RFID and Sensor gateway. All the nodes communicate and stores sensory data to sensor gateway hop-by-hop manner. Sensor gateway further upload data to cloud using advance capable communication technologies like 3G, 4G, wifi, zigbee etc. For uploading sensory data to cloud require specific hardware requirements such as Arduino kit or raspberry-pi with wifi module.

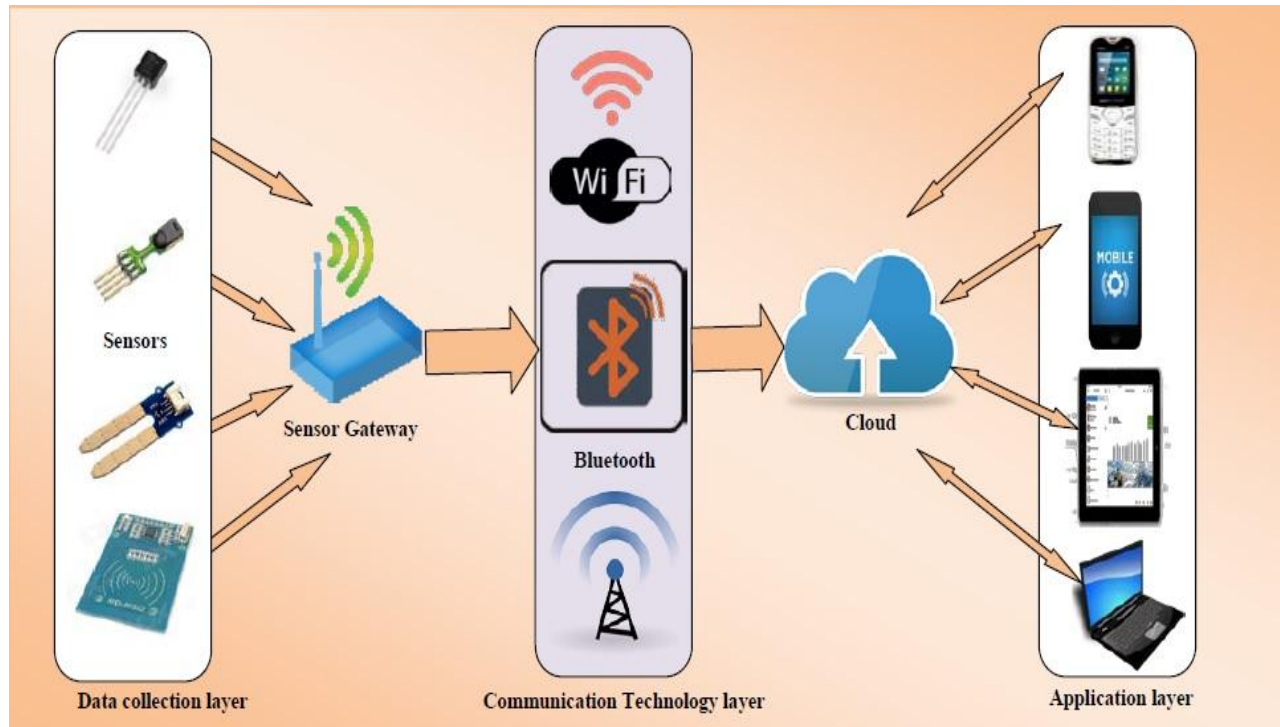


Fig. 4. Data Communication between IOT And Cloud

2 LITERATURE SURVEY

S.No	Authors	Year	Ref No.	Parameters	Technique	Strengths	Limitations
1.	DimitriMazmanov	2013 (ACM Conference)	[22]	Location, availability, reliability, minimum throughput, delay, processing, power	For deployment of service, distributed cloud orchestration manager technique is utilized	It is constant with the philosophy of cloud of employing standard software as well as hardware components for cost minimization	It assumes that the services always have high level performance description
2.	Stefan Nastic	2013 (IEEE)	[23]	Backward compatibility, flexibility	Intent, Intent Scope, and runtime mechanisms set	It offers its own programming model for IoT applications development to be deployed in the cloud	Policy based automation of data-quality and security aspects of cloud-scale IoT applications not applied
3.	Jiehan Zhou	2013 (IEEE)	[24]	Process planning, process generation, process execution, & monitor, service discovery, Reasoning engine service	Constrained Application Protocol (CoAP), Representational State Transfer (REST), IPv6-based Low Power WAN	This platform includes IaaS, PaaS, and SaaS to develop, deploy, run, and compose Things applications	Not very much efficient

4.	Matthias Kovatsch	2014 (conference on IOT)	[25]	Congestion Control, performance and scalability	Constrained Application Protocol (CoAP)	CoAP architecture displays “33 to 64” times throughput more than “HTTP Web servers” of high performance.	Security aspects are not considered
5.	Hong, Sang Gi, NaeSoo Kim, and TaewookHeo	2015 (IEEE)	[26]	Software updating module, communication module as well as sensor processing module	Bluetooth, BLE and UART updating.	Software updating technology, depending on an integrated application package along with a modular hardware Offering reprogramming of IoT devices	Not supported on all environments
6.	YaserJaraweh	2015 Springer	[27]	SDN, SDSys, SDSStore, SDSecwher SD means Software Defined.	Sensor Network cluster, IoT controller, Data-Base pool Cluster	To control the systems, it offers simple, scalable, flexible, centralized, Programmable solution.	It is not very much efficient and is based on experiments
7.	FarzadKhodadadi	2015 (IEEE)	[28]	Number of data sources available, number of tasks created, QoS	AWS built on Aneka platform	It includes all the interaction among the cloud, data sources with applications within less time and energy	Efficient and scalable algorithms for data filtering, provisioning, and scheduling are not developed
8.	AnuragJaiswal, DomanalShri dhar, and G. Ram Mohana Reddy	2015 (IEEE)	[3]	Execution Time, Speedup factor	Python based cloud simulator	The framework connects cloud, data sources with applications	Expensive hardware, accuracy is not measured, not feasible because of network delay
9.	Sivieri, Alessandro, Luca Mottola, and GianpaoloCugola	2016 (Elsevier)	[29]	Handling different communication, providing extended addressing schemes, and offering access to low-level information from networking stack.	The VM-based execution, Erlang (a programming language),	It provides a development platform which enables developers to integrate localized and Internet-wide interactions.	When compared with C it produces CPU overhead
10.	XuezhiZang	2016 (arXiv.org)	[30]	Execution Time and VM Computing Cost and Network Cost	MapReduce model	Provides a great level of efficiency	Design and implement stream computing model is not studied

3 COMPARISON TABLE

Ref no	Year	Framework/ Tool/Technique	Speedup	Execution time	Makespan	Response time
[3]	2015	Cloud Simulator	✓	✓	×	×
[31]	2016	Divide and conquer	×	✓	×	×
[32]	2010	Sensor-as-a-service	×	×	×	✓
[33]	2009	BlueSky Cloud Framework	✓	×	×	✓
[34]	2011	Inernet on thing and forestry	✓	✓	×	✓
[30]	2016	Cloud based Simulator	×	✓	✓	×
[35]	2008	MapReduce Framework on Graphics Processors	✓	✓	×	✓
[36]	2012	iCanCloud simulator	×	✓	×	✓
[37]	2009	Multi-tier Data Center Simulation Platform	✓	✓	×	✓
[38]	2011	Cloud Simulator	×	✓	✓	✓
[39]	2011	Auto-scaling technique	×	✓	×	✓

4 CONCLUSION

As we have analyzed that the data generation is increasing rapidly in size, speed and nature. So to analyze data effectively in domain applications such as IoT where Cos are generating data anytime and everywhere brings challenges. The Comparison table above shows the various cloud simulators. Among the overall performance of all the cloud simulators it is concluded that Python based cloud simulator provides more speedup and accuracy. It showed an excellent rate of energy efficiency improvement. Since in this review the outcome results show that the existing has been done cloud environment but the search is still not force upon inter-cloud environment. In future the inter-cloud can be used to increase the speed by using more energy efficient algorithm for dealing with the private cloud.

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