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REVIEW ARTICLE

Cloud Computing : Goals, Issues, SOA, Integrated Technologies and Future -scope

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Key words: Cloud Architecture, Business Intelligence, Mobile cloud, Cloud Storage, Services

Abstract

The expansion of networking infrastructure has provided a novel way to store and access resources in a reliable, convenient and affordable means of technology called the Cloud. The cloud has become so popular and established its dominance in many recent world innovations and has highly influenced the trend of the Business process Management with the advantage of shared resources. The ability to remain disaster tolerant, on-demand scalability, flexible deployment and cost effectiveness has made the future world technologies like Internet of Things, to determine the cloud as their data and processing center. However, along with the implementation of cloud based technologies, we must also address the issues involved in its realization. This paper is a review on the advancements, scopes and issues involved in realizing a secured cloud powered environments.

Introduction:

The increasing levels of trust on cloud-oriented technologies are proved by the mass migration of the small and medium-sized (SME) business process and recent world technologies to the cloud Infrastructure This is due to the promising scalable, reliable and affordable nature of the cloud technology. The cloud technologies are very cost efficient in terms of maintenance The Hardware and software technologies are well utilized by the shared resource pooling mechanism, where the user pays for the service based on the metered usage or in some cases the service is offered free of cost. The cloud technologies are disaster resistant. The worst disaster has affected Chennai in the months of November and December 2015. The unexpected, abnormal and over poured rainfall has affected the city of IT with severe floods. In spite of such a calamity, the IT industries were able to continue their business without any hurdles. This facility to store, retrieve, process and handle data anywhere and anytime is only because of the emergence of cloud computing technology (Ahmed *et al.,* 2015; Oliveira *et al.,* 2014; Jula *et al.,* 2014; Zhan *et al.*, 2015). The NIST (Mell & Grance, 2011) describes the cloud as a ubiquitous computing model with shared and reliable resources. The resources in a cloud could be a hardware, software or data that is pooled for access. The ENISA describes cloud computing as a novel method of delivering technology. This shows it is not a recently emerged technology. The cloud computing finds it roots in early 1950's. The cloud architecture should possess the ability to be scalable, flexible, highly abstract, reliable, on-demand, remote handling, and metered usage and secure (Marston *et al.,* 2011; Whaiduzzaman *et al.,* 2014). The cloud is a service that has three branches popularly called **IaaS** model, **PaaS** model and **SaaS** model (Buyya *et al.,* 2008;2009; Oliveira *et al.,* 2014; Jula *et al.*, 2014).

IaaS: The Infrastructure as a service includes Virtual Machines to access the remote hardware or to access the operating system services hosted in the cloud environment. This is facilitated by the means of an Application Programming Interface. The Infrastructure as a service includes Database as a service, Data as a service, Privacy as a service, Information as a service and Firmware as a service (Marston *et al.*, 2011; Bruneo, 2014).

PaaS: Platform is a medium that provides facilities to the client to make efficient use of the cloud technologies. The Client could develop his own applications and deploy in the cloud using the Cloud platform. The PaaS provides Simulation and testing of the user programs as a service.

SaaS: The Software is the integrated program that is meant to provide service and interface between the user

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end and the service provider end. These are developed and hosted by third parties, which can be accessed by the means of billed usage or for free. Cloud business insight was basically the area of startup merchants offering Software as a Service (SaaS) Cloud BI's potential advantages are like those offered by distributed computing innovation when all is said in done.decreased server farm and IT administration costs, quicker arrangement times, expanded adaptability as business needs change. By and large, however, cloud BI organizations are still moderately low-end in nature

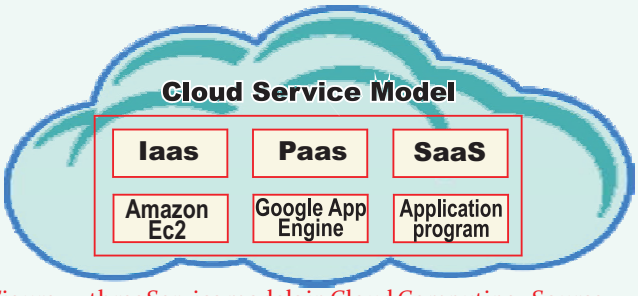

Figure-1: three Service models in Cloud Computing. Source: Branch et al., 2014

All these service models are developed to stand as an interface between the Service provider and client end. The high speed reliable Internet infrastructure counts to its performance. The Four Deployment models are

1. Public Cloud with open access to all
2. Private Cloud with restricted access to an authorized individual organization/person
3. Hybrid Cloud with the combination of distinct clouds facilitates the load balancing mechanism.
4. Community Cloud with restricted use among a group of people who belong to an authorized community.

With all these features the cloud computing establishes a new paradigm in the era of digitalization. There is no doubt that the future smart cities and smart innovations would have the contribution of cloud computing, to find stability (Mell & Grance, 2011).

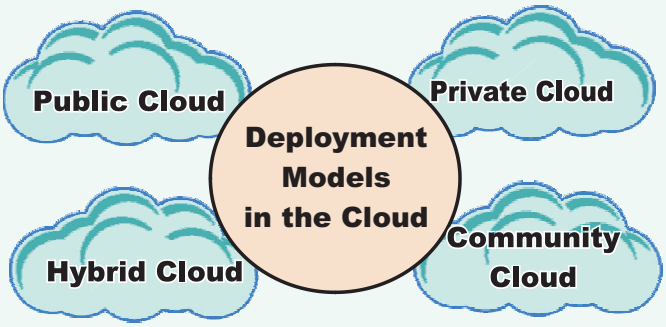

Figure-2: four Deployment models in the cloud computing

Cloud Goals and Characteristics:

The Cloud computing shows a fast growth in the world of technology. The major goals of this well flourished technology lies in the Service oriented Architecture, by the combination of the utility computing, grid computing and distributed computing, to produced increased levels of flexibility and convenience at reduced ownership cost.

The Characteristics of the cloud

1. On-demand Serviceability
2. Broad Network Accessibility
3. Shared Resource Pooling
4. Elasticity
5. Metered Service

On-Demand Serviceability: The cloud has the ability of self-service to the user end with the automation of provisioning resources on demand.

Broad Network Accessibility: Cloud computing is totally based on the Internet Infrastructure. The Internet is the gateway to exploring the world of cloud. A seamless, high-speed and reliable internetworking infrastructure is an essential characteristic to realize a reliable cloud technology. It enables the interoperability among the heterogeneous devices involved in the cloud. The client platform is characterized into two based on the workload as a thin client, which takes a little load and dumps another process to the server and the fat client , which loads the maximum task in itself and approaches the server on requirement with less workload. There are various standard mechanisms introduces to pull almost all devices into the web-based computing. There are mobile phones, tablets, PCs, wearable devices etc., enabled by the Internet Infrastructure. Thus the cloud computing is formed with these devices as the medium of access.

Shared Resource Pooling: The concept of Multi-tenancy is possible due to this characteristic of the cloud technology. A resource at the other end can be accessed from anywhere and anytime with high reliability by multiple users on the shared basis, using the Virtual Machines. The resource could be a data, software or hardware service available at a remote end, accessed on authorization and authentication.

Elasticity: The ability to expand the services and capabilities rapidly, on requirement is termed as Elasticity.

Metered Service: The services offered by the cloud could be metered based on the parameters like Bandwidth, Data Storage, Processing etc. This is a measure to establish transparency between the client and the server on resource consumption. The services offered are in free to use or pay for use .

Challenges in Cloud Computing:

The Workflow Scheduling challenge is characterized as the most critical challenge due to its impact on the System Architecture, Quality of Service and the functionality of the Cloud system. The Cloud based WFS is based on the system model and the service driven model.

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Table-1: Various WFS algorithms and their features

No	WFS method	Functionality	Type of Approach	Environment	Features
1	Market Oriented Hierarchical Scheduling Strategy MOHSS	Assurance of Suitable workflow QoS for user-presented WFS functions. Robust optimization procedures to reduce the cost of the systems running cloud work -flow methods.	Cloud	Meta-Heuristic	QoS requirement is satisfied at low cost of WFS
2	Multiple QoS of Multi-Workflows (MQMW)	Multiple workflows are scheduled which are initiated at any time by considering the QoS requirements.	Cloud,	Heuristic	Scheduling success rates are prominently enhanced. It is designed for several workflows with various QoS requirements
3	Business Grid Quality of Service (BGQS)	Matching QoS of business applications with characteristics of heterogeneous grid resources and adjusting if necessary during execution to maintain agreed service levels	Grid	Business Oriented	Directed to mainstream business-oriented applications, key features include: the facility to allow the Grid Resource Consumer (GRC) to request QoS at varying levels, e.g. time, cost, CPU or RAM; dynamically calculated metrics for measuring QoS such as reliability; matchmaking and monitoring to establish whether Grid Resource Providers (GRP) can deliver a suitable level of QoS to the GRC; and reallocation of resource during execution
4	Cost optimization and time optimization scheduling policies (COTOSP)	The Gridbus broker is employed, which acts as a broker at the user-level, hires resources from Amazon Elastic Compute Cloud (EC2), as the provider of IaaS.	Cloud	Market Oriented	The computational capability of local resources is enhanced by obtaining resources from IaaS providers to attain the deadline within the budgetary constraints.
5	DAG-LOSS & DAG-GAIN	A fundamental framework is used for workflow applications modeled like DAGs, and heuristics that enable scheduling of DAG nodes or workflow tasks onto the resources are examined.	Grid	Heuristic	Budget constraints are satisfied while time in general is optimized.
6	Multiple QoS based Resource Scheduling Algorithm (MQRS)	Cost is incurred when a task is executed by breaking down the cost of the task into two parts: (i) computation resource cost; and (ii) bandwidth resource cost.	Grid	Computational economy-based framework	Acceptable scheduling is provided for real-world workflows in three dimensions: (i) cost; (ii) deadlines; and (iii) reliability.
7	Mixed-Integer Non-Linear Programming (MINLP)	Individual application details are abstracted but the global cost optimi-zation problem and scheduling of the entire grid workload are focused on.	Grid	HoltWinters method	Workflow deadlines are satisfied at lower cost and higher utilization of underlying grid resources to improve failure rates and turnaround times.
8	Optimized Resource Scheduling Algorithm (ORSA)	Scheduling Parameters Speed,Resource Utilization & Request allocation problem	Cloud	Multiple instances	Speed of the IGA is almost twice the traditional GA 2.The utilization rate of resources is high.
9	Innovative transaction intensive cost-constraint scheduling algorithm (ITICCSA)	Execution cost and time Workflow with large number of instances	Cloud	Batch Mode	1.To minimize the cost under certain user-designated Deadlines. 2. Enables the compromises of execution cost and time.
10	Particle Swarm Optimization-based Heuristic for Scheduling (PSBHS)	Resource utilization, time Group of tasks	Cloud	Dependency mode	1. it is used for three times cost savings as compared to BRS 2.It is used for good distribution.
11	Time and cost-constrained scheduling strategy (TCCSS)	Dynamic, shared and autonomous resources are adopted in grids.	Grid	Extended critical activity	Less completion time and lower cost meet requirements in practical applications, which can effectively meet users' needs.

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WFS Metrics:

The Quality of Service of the various algorithms is studied based on the three categories system functionalities and the System architecture. The scheduling of the Cloud workflow involves the cost aware approach that considers the profitability level of the consumers and the service providers. The QoS deals with the budget, Deadline, Reliability, Availability, makespan, SLA, and Security. There will be interaction among the various QoS factors to decide the cost of the cloud-based systems.

Budget: It is the threshold of the amount spent on a system.

Deadline: It is the threshold of the time for Work Flow completion.

Reliability: The ability of the system to be readily available on demand for independent allocation of the cloud resources.

Availability: The Availability improves the maintainability of the resources. This has an impact on the ability to test the resources in a workflow scheduling environment.

Makespan: It defines the overall time taken for the completion of a workflow Schedule in the Cloud Environment.

SLA: It is a legal agreement, mutually accepted by the client and the service providers that define the parameters of Quality, Payment, and limitations. Security: It deals with the level of trustworthiness of a cloud-based service. The confidentially is also a part of security which should ensure highly confidential execution of the workflow.

These factors of the QoS have a direct impact on the three service models of the cloud and the service-driven architecture. The service-driven architecture includes the Client and utility provider. The System architecture of a WFS includes the hardware and the intensiveness of the system. The Hardware-aware WFS deals with the multiple core awareness models of WFS whereas the System intensive models concentrate on the object, data, communication and the ability for multiple workflows .The System functionality includes the time complexity, rescheduling, resource utilization, resource allocation, load balancing and task estimation challenges.

SOA in Cloud Computing:

Cloud Computing comprises of a Service-oriented Architecture than an application oriented Architecture. The distributed Computing has laid the foundation for this advancement in the cloud [11]. The RPC is the first SoA in the network based systems. The key concept of Service-oriented architecture is a component based approach. In service oriented Architecture, the client requests and the server offer the service on demand. The SoA determines the workflows. The service is provided as soon as the request is received or in some cases, it could be processed in allotted time. The fault tolerance, audit, data aware and process aware service delivery are the characteristics of a SoA architecture. Characterizes the Component-based approach by this given factors- i)Ability to reuse, ii) Ability to replace or substitute, iii) Ability to extend, iv) Ability to scale, v) Ability to customize features, vi) Ability to Compose functional solutions, vii) Ability to be reliable and available, viii) Ability to provide security, ix) Cost of services.

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Table- 2: Analysis of QoS challenges in WFS on various algorithms

		I	II	III	IV	V	VI	VII
1	MOHSS	X	X	X	X	-	X	X
2	MQMW	X	X	X	X	-	X	X
3	BGQS	-	-	-	-		-	X
4	COTOSP	-	-	X	X	-	X	X
5	DAG-LOSS &DAG-GAIN	-	X	X	X	-	X	X
6	MQRS	-	-	-	X	-	X	X
7	MINLP	X	-	X	X	X	X	X
8	ORSA	X	X	-	X	X	X	X
9	ITICCSA	-	-	X	X	X	X	X
10	PSBHS	-	-	X	X	X	X	X
11	TCCSS	-	-	X	X	X	X	-

Abbreviations: I-Budget; **II**-Deadline, **III**-Reliability, **IV**-Availability, **V**-Makespan, **VI**-SLA **VII**-Security

Table-3: Qos based on System functionality of various algorithms

		I	II	III	IV	V	VI
1	MOHSS	-	X	X	-	X	Client
2	MQMW Provider	X	X	X	X	-	Service
3	BGQS	X	X	X	X	-	Client
4	COTOSP	X	X	-	X	X	Client
5	DAG-LOSS & DAG-GAIN	-	X	-	X	X	Client
6	MQRS provider	X	X	X	X	-	Service
7	MINLP provider	-	X	-	-	X	Service
8	ORSA	-	-	X	X	X	Client
9	ITICCSA	-	X	X	X	X	X
10	PSBHS	-	-	X	X	X	Client
11	TCCSS provider	X	-	-	X	X	Service

Abbreviations: I-Time Complexity, **II** Resource utilization, **III**-Resource allocation, **IV**-Load balancing, **V**-Task estimation, **VI**-Profitability

Table-4: the Frequencies of the Qos Challenges are calculated and they are tabulated as follows

	Frequency(in %)	Challenge
Budget	15	QoS
Deadline	27	QoS
Reliability	7	QoS
Availability	5	QoS
makespan	31	QoS
SLA	6	QoS
Security	9	QoS
Object intensive	16	System Functionality
Data intensive	37	System Functionality
Communication intensive	16	System Functionality
Multicore aware	21	System Functionality
Multiple workflow	10	System Functionality
Time complexity	28	System Architecture
Rescheduling	18	System Architecture
Resource utilization	16	System Architecture
Resource Allocation	16	System Architecture
Load Balancing	10	System Architecture
Task estimation	12	System Architecture

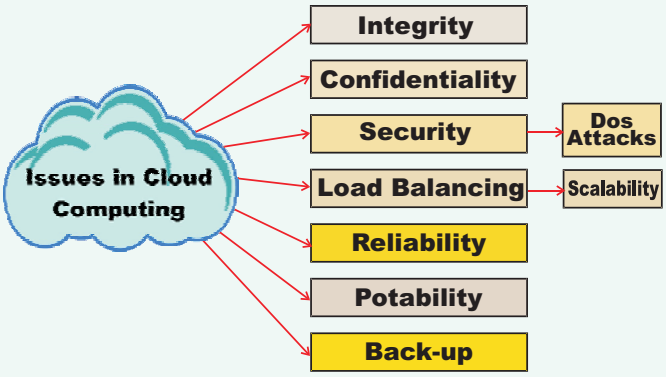

Figure- 3: the main issues in Cloud computing

The workflow scheduling is always represented using a DAG (Directed Acyclic Graph) that connects the components that are loosely coupled with the components that are tightly coupled (Abrishami *et al.*, 2013; Jain *et al.*, 2014). Virtualization is also a part of the SoA that provides the portability between the higher and lower ends of computing. IBM mainframe stands as the pioneer for the concept of virtualization that has been widely deployed in all forms of the computing (Buyya *et al.*, 2008; Zhan *et al.*, 2015).

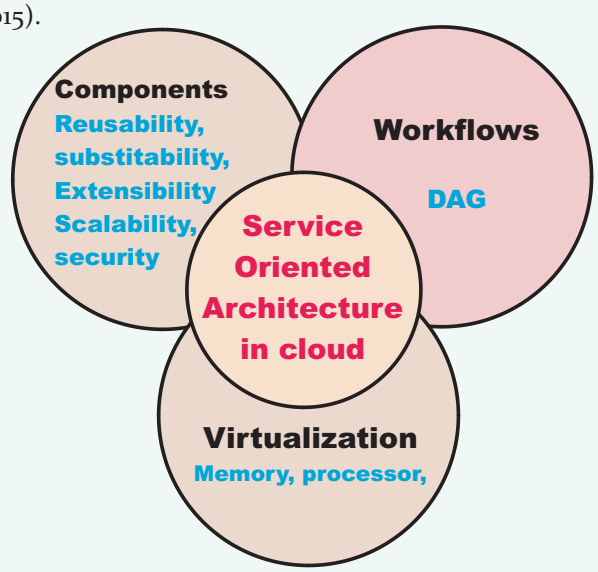

Figure-4: Service oriented Architecture in cloud computing.

Adoption of Cloud Computing in Emerging Technologies:

'Push all in Cloud and Access with Internet' is the trend set by the cloud computing Technology. The cloud computing is described as the realization of the cyberinfrastructure along with Virtualization, Grid Computing, Distributed Computing and Utility computing. Data is the basic element in the world of Internetworking (Abolfazli *et al.*, 2015). The Data protection, processing, and storage are the most concentrated areas of research in today's world. The Data storage devices face several drawbacks (Bruneo, 2014; Dong *et al.*, 2014). The processing of large amounts of data

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accounting to petabytes could not be solved by an ordinary physical machine. Hence, there is born an idea to migrate these important tasks to the cloud. The term big data was introduced, and the three important milestones namely Protection, Processing and Protection are achieved. The advancement in Digital Electronics has also laid a path to the technology, which is estimated as the Technology of future with its enormous growth and extensive application. The Internet of Things is a combination of the embedded systems, integrated networking technologies, mobile computing, ubiquitous computing, data Processing and storage (Wang *et al.,* 2014; Aazam *et al.,* 2014). The mobile computing technology has also integrated with cloud and it gave birth to the technology called MCC (Mobile Cloud Computing) with offloading facilities (Ahmed *et al.,* 2015). Let us discuss a few emerging technologies and how they are integrated with the cloud to offer a wide range of services.

The technologies will integrate and diffuse at a stage to form a powerful integrated Technology. Internet of Things is expected to become the super powerful technology of the world in forthcoming decades. This ability is possible only because of the cloud computing. The Table (1) clearly shows the dominance of the cloud computing in the emerging technologies. Many of these technologies still remain in their infancy due to the security, load balancing, cost of computing, fault tolerance and reliability issues (Wei *et al.,* 2014). We can expect these riddles to be solved by the experts in the future. Coming to the Internet of Things, the structural technologies involved are embedded systems, networking protocols and infrastructure, cloud computing and big data analytics. However, the research issues involved in these technologies are effectiveness in security, load balancing, scalable and interoperable environment development.

Conclusion:

The cloud and the integrated technologies are facing a lot of issues in spite of its effective application. The security, integrity and confidentiality triangle is considered as the basic quality for any medium that involves data communication (Bacon *et al.,* 2014). Hence, a secured cloud principle should be designed with a ability to check any present issue. We insist on the development of cloud security, because all the future world technologies have adopted cloud as their medium of storage and processing, due to its provisions like scalability, fault tolerance, flexibility and utility model. We predict the cloud computing will dominate the future world of computing with increased ability, powered by the upcoming high speed internet technologies. We predict there would be maximum migration of technologies to cloud Environment. Hence, the cloud will bloom and partner with all the technologies, because the Internet of Things has itself adapted to cloud environment. As long as these integrated technologies are widespread, the cloud remains stable and established.

Table- 5: list of emerging technologies integrated with the cloud computing

No	Technology/ Sector	Proposed by	Major area(s) of Influence	ApplicationKey Methos	Features	Integrated Technology
1	Mobile Cloud Computing	Ahmed *et al.,* 2015 Khan *et al.,* 2014 Abolfazli *et al.,* 2014 Yegui *et al.,* 2014 Chen *et al.,* 2015 Aminzadeh *et al.,* 2015	Data and Network Centric Performance analysis, Decision making in migration of Application, heterogeneity	OMNet++, 5G, emotion aware computing	Application Migration in runtime, offloading, considers various network parameters for Analysis. Overcomes the issues faced by Application Execution Frameworks	Mobile Computing and Cloud computing
2	Manufacturing & Service Sectors	Buyya *et al.,* 2019 Marston *et al.,* 2011	Diffusion of Innovation (DOI) Technology Organization Environment (TOI)	Factor Analysis, conceptual Analysis, Multiple Regression analysis	SME (small and Medium Enterprises)	SME and Cloud Computing
3	Bigdata Analytics	Marston *et al.,* 2011 Branch *et al.,* 2014 Sookhaka *et al.,* 2015 Mehdi & Singhal, 2015	Ubiquitous Computing, Virtualization of Storage & Processing the data	No Sql based Data Access	Exascale analytics, Audit	Scientific and business data analysis, with cloud computing
4	Vehicular Cloud Computing	Whaiduzzaman *et al.,* 2014 Bitam *et al.,* 2015	General Computing for vehicles	VANET and MCC	Smart and Safe vehicles.	MCC, CC and embedded systems
5	Healthcare Technologies	Jula *et al.,* 2014 Chen *et al.,* 2015 Sultan, 2014	Healthcare	Wearable and implanted sensors	Ability to monitor health time to time. Alert mechanism. Reliable healthcare	Wireless Sensors, Cloud Computing, IoT
6	File Management	Gupta, 2015	Private, Public and community basis	Amazon EC2 cloud	Provision to store data, Cloud based VPS, FTP	Cloud Storage

7	Internet of Things	Wang *et al.*, 2014 Aazam *et al.*, 2014	Automation, Monitoring & controlling from remote end	Sensors, actuators and embedded system	Establish inter-operability, remote monitoring, communication and aut omation of devices with internet	Wireless sensors, Knowledge base, Protocols, actuators, Cloud computing, big data analytics, etc.,

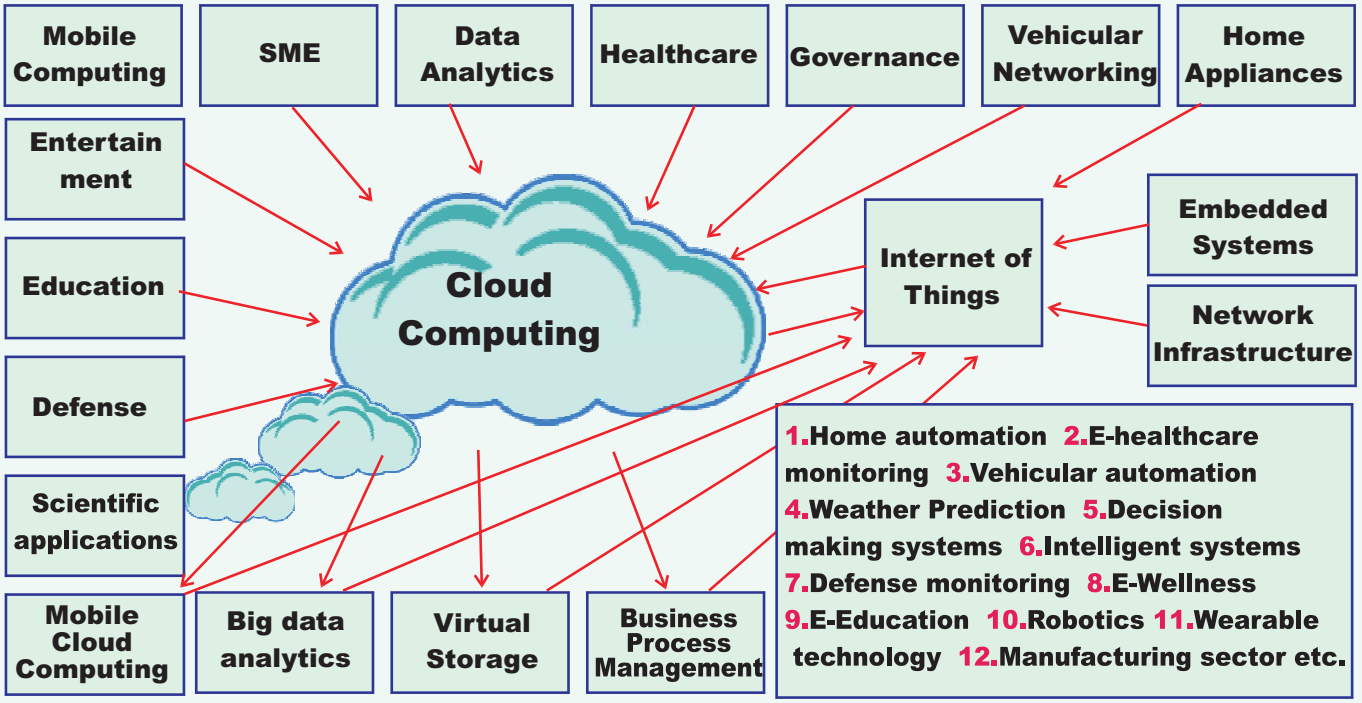

Figure- 5: cloud computing and Integrated technologies

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References:

Aazam, M., Khan, I., Alsaffar, A.A. & Huh, E. (2014): Cloud of Things: Integrating Internet of Things and cloud computing and the issues involved." Proceedings of Applied Sciences and Technology (IBCAST), 2014 11th International Bhurban Conference on. IEEE, p. 414-419.

Abrishami, S., Naghibzadeh, M. & Epema, D.H.J. (2013): Deadline-constrained workflow scheduling algorithms for Infrastructure as a Service Clouds. *Fut. Gener. Comp. Sy.* 29(1):158-169.

Abolfazli, S., Sanaei, Z., Ahmed, E., Gani, A. & Buyya, R. (2014):. Cloud-based Augmentation for Mobile devices: Motivation, Taxonomies, and Open Challenges. *IEEE Commun.Surv. Tut.*, 16(1):337-368

Abolfazli, S., Sanaei, Z., Tabassi, A., Rosen, S., Xchanging, Gani, A. & Khan, S.U. (2015): Cloud Adoption in Malaysia: Trends, Opportunities, and Challenges. *Cloud Comp. IEEE.*, 2.1: 60-68

Ahmed, E., Akhunzada, A., Whaiduzzaman, Md., Gani, A., Hamid, S.H.A. & Buyya, R. (2015): Network-centric performance analysis of runtime application migration in mobile cloud computing. *Simul. Model. Prac.Th.*, 50: 42-56.

Aminzadeh, N., Sanaei, Z. & Hamid, S.H.A. (2015): Mobile storage augmentation in mobile cloud computing: Taxonomy, approaches, and open issues. *Simul.Model.Prac.Th.*, 50: 96-108.

Aminzadeh, N., Sanaei, Z. & Hamid, S.H.A. (2015): Mobile storage augmentation in mobile cloud computing: Taxonomy, approaches, and open issues. *Simul. Model. Prac.Th.*, 50: 96-108.

Bacon, J., Eyers, D. Pasquier, T., Singh, J., Papagiannis, I. & Pietzuch, P. (2014): Information flow control for secure cloud computing. *Net. Ser. Manag., IEEE Transac.*, 11(1): 76-89.

Bitam, S., Mellouk, A. & Zeadally, S. "VANET-cloud: a generic cloud computing model for vehicular Ad Hoc networks." *Wirel. Comm. IEEE*, 22(1): 96-102.

Branch, R. , Tjeerdsma, H. , Wilson, C. , Hurley, R. & McConnell, S. (2014): Cloud Computing and Big Data: A Review of Current Service Models and Hardware Perspectives. *J. Softw. Eng. Applic.*, 7: 686-693

Bruneo, D. (2014): A stochastic model to investigate data center performance and qos in iaas cloud computing systems. *Parall. Distr. Sy. IEEE Transac.*, 25(3): 560-569.

Buyya, R., Yeo, C.S. & Venugopal, S. (2008): Market-oriented cloud computing: Vision, hype, and reality for delivering it services as computing utilities." High Performance Computing and Communications, 2008. HPCC'08. 10th IEEE International Conference on. Ieee, 2008.

Buyya, R., Yeo, C.S., Venugopal, S., Broberg, J. & Brandic, I. (2009): "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. *Fut.*

Ambient Science, 2016: Vol. 03(2); 04-11
DOI:10.21276/ambi.2016.03.2.rv01

Gener. Com. Sy., 25(6): 599-616.

Chen, M., Y. Zhang, Y. Li, M. & Alamri, H.A. (2015): AIWAC: affective interaction through wearable computing and cloud technology. *Wirel. Commun. IEEE*, 22(1): 20-27.

Chen, .M, Zhang, Y., Li, Y., Mao, S. & Leung, V.C.M. (2015): Emc: Emotion-aware mobile cloud computing in 5g. Netw. IEEE, 29(2): 32-38.

Dong, X., Yu, J., Luo, Y. Chen, U., Xue, G. & Li, M. (2014): Achieving an effective, scalable and privacy-preserving data sharing service in cloud computing. *Comp. Secur.*, 42: 151-164.

Gupta, U. (2015): Survey on security issues in file management in cloud computing environment. *arXiv preprint*, arXiv:1505.00729.

Jain, N., Menache, I., Naor, J. & Yaniv, J. (2014): A truthful mechanism for value-based scheduling in cloud computing. *Th. Compu. Sy.*, 54(3): 388-406.

Jula, A., Sundararajan, E. & Othman, Z. (2014): Cloud computing service composition: A systematic literature review. *Expert Sy. Appl.*, 41(8): 3809-3824.

Khan, A.R., Othman, M., Madani, S.A., & Khan, S.U. (2014): A survey of mobile cloud computing application models. *Commun. Surv. Tut. IEEE*, 16(1): 393-413.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. & Ghalsasi, A. (2011): Cloud computingThe business perspective. *Dec. Supp. Sy.*, 51(1): 176-189.

Mehdi, B. & Singhal, M. (2015): The Role of Cloud Computing Architecture in Big Data; in Pedrycz, W & Chen, S.M ed.- Information Granularity, Big Data, and Computational Intelligence. Springer International Publishing. P. 275-295.

Mell, P. & Grance, T. (2011): The NIST definition of cloud computing. Spl. Publication. 800-145

Oliveira, T., Thomas, M. & Espadanal, M (2014): Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Inform. Manag.*, 51(5): 497-510.

Sookhaka, M., Gani, A., Khanb , M.K., & Buyya, R. (2015): Dynamic remote data auditing for securing big data storage in cloud computing. *Inform. Sci.*, 000:116

Sultan, N (2014): Making use of cloud computing for healthcare provision: Opportunities and challenges. *Int. J. Inform. Manag.*, 34(2): 177-184.

Wang, C., Bi, Z. & Xu, L.D. (2014): IoT and cloud computing in automation of assembly modeling systems. *Indus. Inform., IEEE Transac.*, 10(2): 1426-1434.

Wei, L., Zhu, H., Cao, Z., Dong, X., Jia, W., Chen, Y. & Vasilakos, A.V. (2014): Security and privacy for storage and computation in cloud computing. *Inform. Sci.*, 258: 371-386.

Whaiduzzaman, Md., Sookhak, M., Gani, A. & Buyya, R. (2014): A survey on vehicular cloud computing."*J. Netw. Comp. Appl.*, 40: 325-344.

Yegui, C., Yu, F.R. & Bu, S. (2014): Cloud computing meets mobile wireless communications in next generation cellular networks. *Netw. IEEE*, 28(6): 54-59.

Zhan, Z., Lui, X., Gong, Y. & Zhang, J. (2015): Cloud computing resource scheduling and a survey of its evolutionary approaches. *ACM Comp. Sur.*, (CSUR), 47(4): 63.