A Survey on Cloud Computing

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Abstract— **Cloud Computing is a very recent term which is mainly based on distributed computing, virtualization, utility computing, networking and web and software services. This kind of service oriented architecture reduces information technology overhead for end user, total cost of ownership, supports flexibility and on-demand services.**

Keywords- Cloud Computing, Grid Computing, IaaS, PaaS, SaaS.

I. INTRODUCTION

Cloud [1] is basically a metaphor for internet depending how it is depicted in computer network and is an abstraction for complex infrastructures. The basic principle behind cloud computing is that it assigns the computing resources in the great number of distributed computers rather than local computers or remote servers. This is advantageous as it provides secure, quick, convenient data storage and the net computing service is centered by internet. So, the deployment, allocation, reallocation and monitoring of computing resources are all dynamically handled. The user needs not to care about how to buy software, servers, solutions etc. All the things are available through internet and are on-demand. The main advantage of this kind of computing is pay-per-use model, i.e. users have to pay only for what they have used. Hence it's becoming cost effective. Rajkumar Buyyaa, Chee Shin Yeoa, Srikumar Venugopala, James Broberga and Ivona Brandic [2] described about emerging IT technologies on cloud computing. They elaborate the scenario regarding market-oriented cloud architecture and resource management strategies for market-oriented Clouds. Here the following figure logically describes the basic cloud computing scenario.

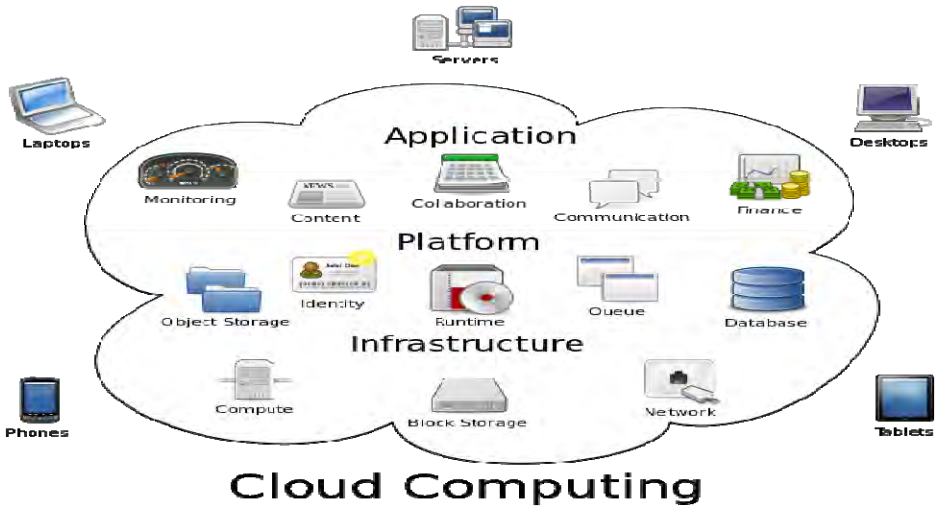

Figure 1. Cloud Computing Logical Diagram [10]

II. LITERATURE REVIEW

R. Buyya et al. [3] defines Cloud Computing according to its utility to end users. They put it like that the cloud computing is a market oriented distributed computing which consists of collection of interconnected and virtualized machines that can be dynamically presented as one or more unified computing resources depending

upon Service Level Agreement (SLA) established between provider and consumer through some negotiation.

According to National Institute of Standards and Technology (NIST) [3] cloud computing is the new kind of computing model which can enable convenient, on-demand access to the shared resources like network, server, storage, application, service form the resources pool which can be rapidly released and deserves minimal management effort or service provider interaction.

Shuai Zhang, Shufen Zhang, Xuebin Chen and Xiuzhen Huo [4] in their paper told that Cloud Computing is a new kind of computing model which enables outsourcing of all IT needs like storage, computation, and softwares which are geographically distributed through internet. The various use of cloud computing made this popular and accordingly different agreements have been reached depending upon some basic style of this computing. Its style is as follows:

IaaS (Infrastructure as a Service): It is a way of delivering cloud computing infrastructure- servers, storage, network and operating system, as an on demand service. Rather than purchasing servers, softwares, data center space or network equipment, clients can instead buy those resources as a fully outsourced service on demand. The service provider owns the equipment and is responsible for housing, running and maintaining it. IaaS allows a business to get rid of its locally installed servers and instead use so called virtual machine in other's computer. The end result is the same that the users get the service they require but the organization does not need the space, power or hardware investment.

SaaS (Software as a Service): SaaS is a software distribution model in which application are hosted by vendor or service provider and made available to customers over a network, typically the internet. With SaaS, a provider licenses an application to customer either as a service on demand, through a subscription, in a "pay-as-you-go" model, or at no charge when there is opportunity to generate revenue from streams other than user, such as from advertisement.

PaaS (Platform as a Service): It is the way to rent hardware, operating system, network capacity over the internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing application or developing and testing new ones. PaaS builds on IaaS providing a pre-defined operating system, storage and development tools to allow a customer to develop new application to run on the provider's infrastructure. It can be defined as a computer platform that allows the creation of web applications quickly and easily and without the complexity of building and maintaining the software infrastructure underneath it. PaaS is analogous to SaaS except that, rather than being software delivered over the web, it is the platform for creation of software, delivered over the web.

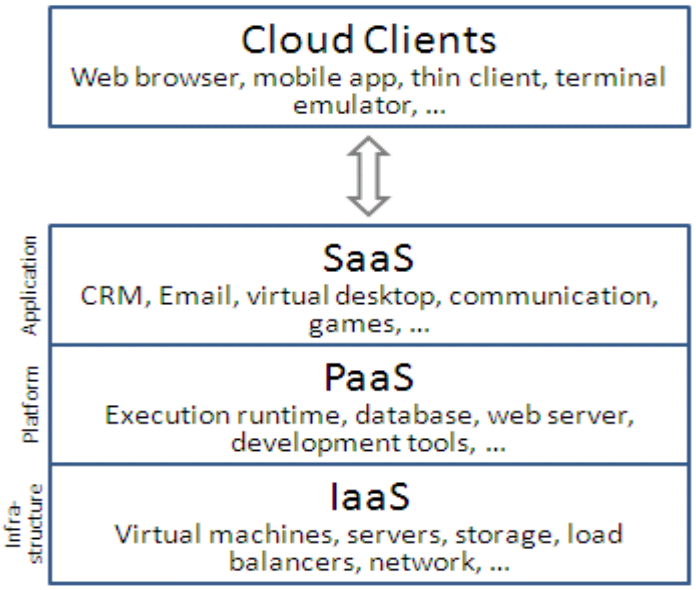

Figure 2. Service Models of Cloud Computing [10]

Shubhasis Sengupta, Vikrant Kaulgud and Vibhu Saujanya Sharma [5] in their paper and Jayant Baliga, Robert W.A. Ayre, Kerry Hinton and Rodney S. Tucker [6] in their paper emphasizes on the cloud computing infrastructure. They sub-divided to into Public, Private and Hybrid Cloud.

Public Cloud: Public cloud is made available to general public by a service provider who hosts the cloud infrastructure. Generally public cloud providers like Amazon AWS, Microsoft and Google own and operate the

infrastructure and offer access over the internet. With this model the customer has no visibility or control over the infrastructure. It is important to note that all the customers on public cloud share the same infrastructure pool with limited configuration, security protection and availability variances.

Public cloud customers benefit from economy of scale, because infrastructure costs are spread across all users, allowing each individual client to operate on low cost, "pay-as-you-go" model. Another advantage is that they are typically larger than an in-house enterprise cloud, which provides clients with seamless, on-demand scalability. This kind of cloud offers the greatest level of efficiency in shared resources, though they are more vulnerable.

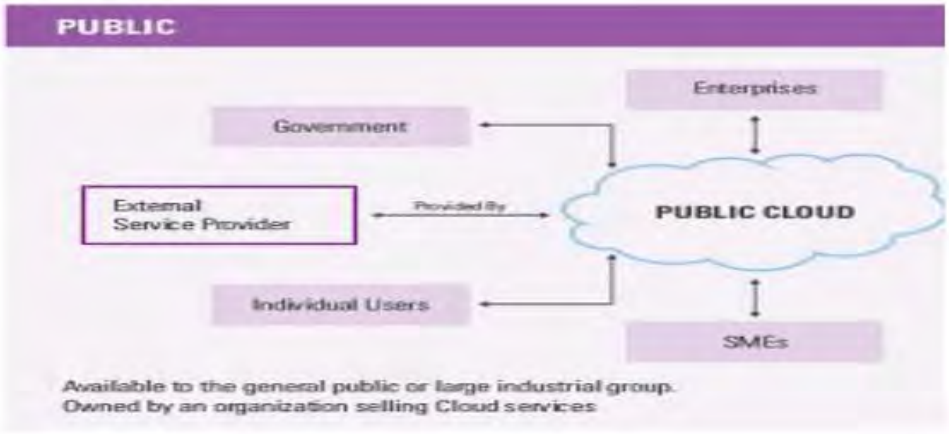

Figure 3. Public Cloud Computing Delivery Model [11]

Private Cloud: This cloud infrastructure is defined to a particular organization. Private clouds allow business to host application in the cloud, while addressing concerns regarding data security and control. It is not shared with other organization, whether managed internally or by third-party and can be hosted internally or externally. There are two variations of private cloud:

(i) *On-Premise Private Cloud*: This type of cloud is hosted within an organization's own facility. A business IT department would incur the capital and operational costs for the physical resources with this model. It is best used for application that requires complete control and configurability of the infrastructure and security.

(ii) *Externally Hosted Private Cloud*: This type of clouds are also exclusively used by one organization, but are hosted by a third party specializing in cloud infrastructure. The service provider facilitates an exclusive cloud environment with full guarantee of privacy. This format is recommended for organizations that prefer not to use public cloud infrastructure due to the risks associated with the sharing of physical resources.

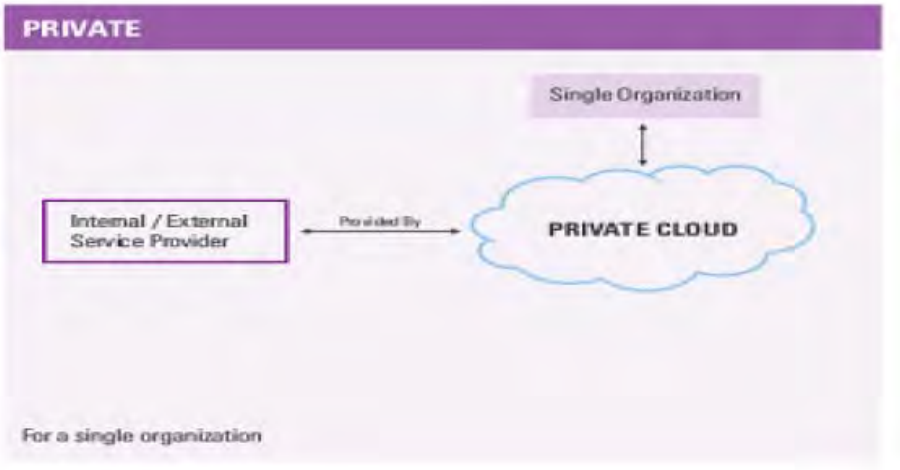

Figure 4. Private Cloud Computing Delivery Model [11]

Hybrid Cloud: These kinds of clouds are composition of two or more clouds (private and/or public), that remain unique entities but are bound together offering the advantages of multiple deployment models. In a hybrid cloud, an organization can leverage third party cloud providers in either a full or partial manner,

increasing the flexibility of computing. This kind of architecture requires both on-premise resources and off-site server based cloud infrastructure. But an organization has to keep track of multiple cloud security platforms and ensure that all aspects of business can communicate with each other.

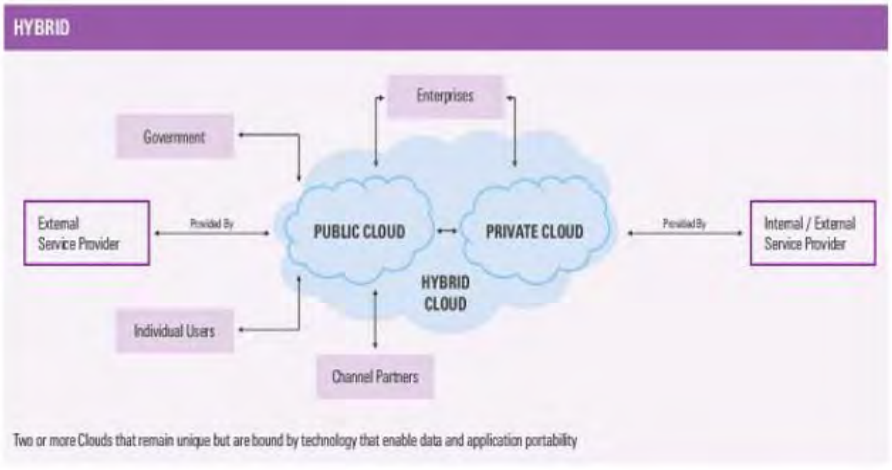

Figure 5. Hybrid Cloud Computing Delivery Model [11]

Shuai Zhang, Shufen Zhang, Xuebin Chen and Xiuzhen Huo [7] in their paper highlight the differences between Cloud Computing and Grid Computing. Cloud computing evolves from grid computing and provides on-demand resource provisioning. Grid computing may or may not be in the cloud depending on what type of users are using it. If the users are systems administrators and integrators, they care how things are maintained in the cloud. They upgrade, install, and virtualize servers and applications. If the users are consumers, they do not care how things are run in the system. Grid computing requires the use of software that can divide and farm out pieces of a program as one large system image to several thousand computers. One concern about grid is that if one piece of the software on a node fails, other pieces of the software on other nodes may fail. This is alleviated if that component has a failover component on another node, but problems can still arise if components rely on other pieces of software to accomplish one or more grid computing tasks. Large system images and associated hardware to operate and maintain them can contribute to large capital and operating expenses. Whereas with cloud computing, companies can scale up to massive capacities in an instant without having to invest in new infrastructure, train new personnel, or license new software. Cloud computing is of particular benefit to small and medium-sized businesses who wish to completely outsource their data-center infrastructure, or large companies who wish to get peak load capacity without incurring the higher cost of building larger data centers internally. In both instances, service consumers use what they need on the Internet and pay only for what they use. The service consumer no longer has to be at a PC, use an application from the PC, or purchase a specific version that's configured for smartphones, and other devices. The consumer does not own the infrastructure, software, or platform in the cloud. He has lower upfront costs, capital expenses, and operating expenses. He does not care about how servers and networks are maintained in the cloud. The consumer can access multiple servers anywhere on the globe without knowing which ones and where they are located.

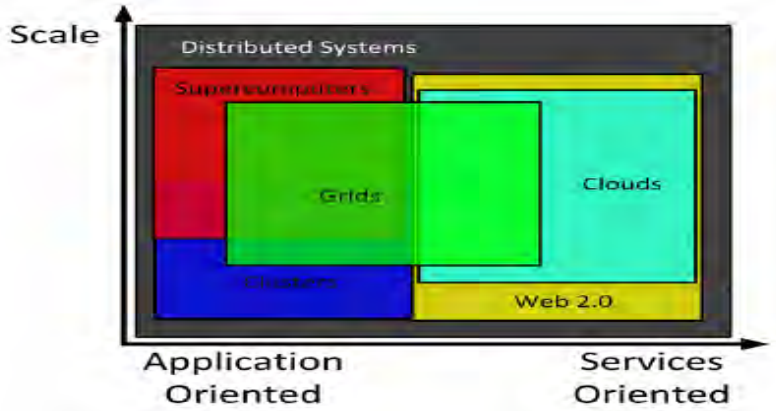

Figure 6. Grid and Cloud Overview

Ian Foster, Yong Zhao, Ioan Raicu and Shiyong Lu [8] also in their paper elaborates the basic differences between cloud and grid computing. According to them, advanced virtualization and grid computing operations

are essential elements of Cloud Computing environment. PaaS, which is commonly associated with cloud computing is a service offered within the scope of grid computing. Computing as a service, Storage as a service, Network as a service are also grid services. Cloud computing should not focus on underlying middleware, hardware, storage or network resources. Those resources are hidden from the consumer of cloud services. SaaS is generally associated with cloud computing and currently the primary cloud service offering. The only significant difference between grid and cloud computing pertains to what services are offered and how customers use those services. It has to do with level of abstraction, because the basic architectural requirements for grid and cloud are the same.

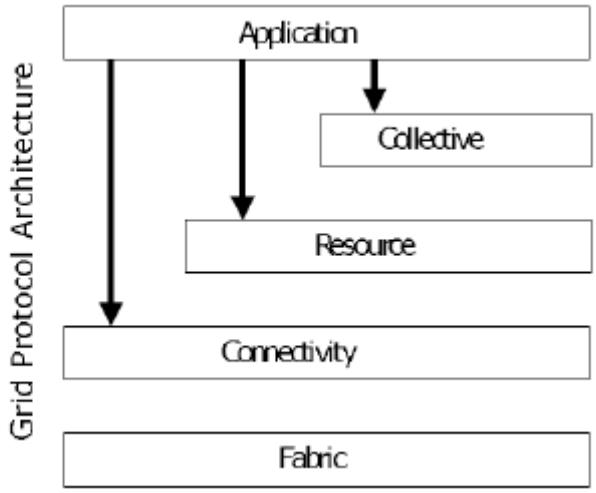

Figure 7. Grid Protocol Architecture

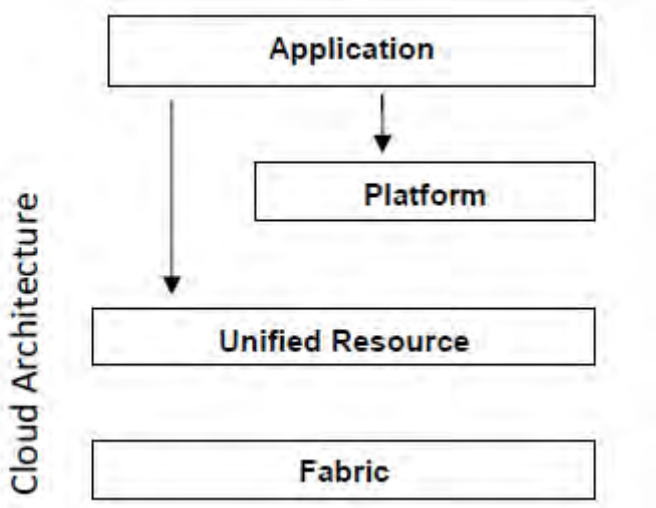

Figure 8. Cloud Architecture

Naidila Sadashiv and S.M Dilip Kumar [9] in their paper gave a detail comparison between cluster, grid and cloud computing. According to their view, all three systems are distributed and share similar characteristics. The similarities relate to resource pooling and broad network access – two criteria that are fulfilled by all systems. Network access to cluster and grid computing systems usually takes place within a corporate network, while the services of a cloud computing system can also be accessed through public network, i.e. the Internet. The differences between cloud computing systems on the one hand and grid and cluster computing systems on the other are attributable to the system dynamics. Resources in grid and cluster environments are generally pre-reserved, while cloud computing systems are demand driven, i.e. operation of these systems is geared to consumers' actual needs. Another difference concerns the rapid elasticity criterion, which forms an integral part of cloud computing systems but is not normally supported by cluster or grid systems. Service usage only tends to be accurately measured in grid and cloud computing systems, whereas the majority of cluster environments simply provision rudimentary metering functions.

	Clusters	*Grids*	*Clouds*
SLA	Limited	Yes	Yes
Allocation	Centralized	Decentralized	Both
Resource Handling	Centralized	Distributed	Both
Loose coupling	No	Both	Yes
Protocols/API	MPI, Parallel Virtual	MPI,MPICH-G, GIS,GRAM	TCP/IP,SOAP, REST,AJAX
Reliability	No	Half	Full
Security	Yes	Half	No
User friendliness	No	half	Yes
Virtualization	Half	Half	Yes
Interoperability	Yes	Yes	Half
Standardized	Yes	Yes	No
Business Model	No	No	Yes
Task Size	Single large	Single large	Small & medium
SOA	No	Yes	Yes
Multitenancy	No	Yes	Yes
System Performance	Improves	Improves	Improves
Self service	No	Yes	Yes
Computation service	Computing	Max. Computing	On demand
Heterogeneity	No	Yes	Yes
Scalable	No	Half	Yes
Inexpensive	No	No	Yes
Data Locality Exploited	No	No	Yes
Application	HPC,HTC	HPC, HTC, Batch	SME interactive apps.
Switching cost	Low	Low	High
Value Added Services	No	Half	Yes

Table 1. Comparison of Cluster, Grid and Cloud Computing

III. CONCLUSION

Here we have mainly discussed about the recent trends on the very new concept Cloud Computing including its computing style and architecture. But there is another very important concept which should be taken care of, i.e. security aspect of cloud computing. It is quite a difficult situation to handle as the resources are geographically distributed and because of virtualization. So, it should be a very good area for future work.

REFERENCES

[1] Michael Miller, Cloud computing: web based applications that change the way you work and collaborate online (Pearson Education).

[2] R. Buyya, C.S. Yeo, S. Venugopal, J. Broberg and I. Brandic, "Cloud Computing and Emerging IT Platforms: Vision, Hype, and reality for delivering computing as the 5th utility", Future Generation Computer System, 25(6), pp. 599-616, 2009.

[3] Saurabh Kumar Garg and Rajkumar Buyya, "Green Cloud computing and Environmental Sustainability".

[4] Shuai Zhang, Shufen Zhang, Xuebin Chen and Xiuzhen Huo, " Cloud Computing Research and Development Trend", 2010, Second International Conference on Future Networks, pp. 93-97.

[5] Subhashis Sengupta, Vikrant Kaulgud and Vibhu Saujanya Sharma, "Cloud Computing Security- Trends and Research Directions", 2011, IEEE World Congress on Services, pp. 524-525.

[6] Jayant Baliga, Robert W. A. Ayre, Kerry Hinton, and Rodney S. Tucker, Fellow IEEE, "Green Cloud Computing: Balancing Energy in Processing, Storage, and Transport".

[7] Shuai Zhang, Shufen Zhang, Xuebin Chen and Xiuzhen Huo, "The Comparison Between Cloud Computing and Grid Computing", International Conference on Computer Application and System Modeling (ICCASM), IEEE 2010, pp. 72-75.

[8] Ian Foster, Yong Zhao, Ioan Raicu and Shiyong Lu, "Cloud Computing and Grid Computing 360-Degree Compared".

[9] Naidila Sadashiv and S.M Dilip Kumar, "Cluster, Grid and Cloud Computing: A Detailed Comparison", 6th International Conference on Computer Science & Education (ICCSE), 2011, IEEE, pp. 477-482.

[10] www.wikipedia.com

[11] www.ibm.com

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Poulami Dalapati completed her B.Tech in Computer Science and Engineering from West Bengal University of Technology, Calcutta, India in the year of 2011. Now she is persuing her M.Tech in Computer Science from Birla Institute of Technology, Mesra, Ranchi, India. Presently she is working on Cloud Computing as her thesis work. Her reseach interest includes Cloud Computing, Parallel and Distributed Computing.

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