Cloud Computing an Era in the World

V. Vijayalakshmi, S. Thamizharasan, P. Mahalakshmi

***Abstract*— The term "Cloud Computing" has been mentioned for just under two years in relation to services or infrastructural resources, which can be contracted over a network. Thus, the idea of renting instead of buying IT is nothing new. And so, Cloud Computing has many antecedents and equally as many attempts to define it. The players in the large world of clouds are Software as Service providers, outsourcing and hosting providers, network and IT infrastructure providers and, above all, the companies whose names are closely linked with the Internet's commercial boom. But, all these services in combination outline the complete package known as Cloud Computing – depending on the source with the appropriate focus. That which long ago established itself in the private environment of the Internet is now, noticeably, coming to the attention of businesses too. Not only developers and startups but also large companies with international activities recognize that there is more to Cloud Computing than just marketing hype. Cloud Computing offers the opportunity to access IT resources and services with appreciable convenience and speed. Behind this primarily, is a solution that provides users with services that can be drawn upon on demand and invoiced as and when used. Suppliers of cloud services, in turn, benefit as their IT resources are used more fully and eventually achieve additional economies of scale. Cloud Computing offers flexibility whilst simultaneously reducing costs – with the positive side effect of sustainability.**

***Index Terms*—Cloud, Security, Encryption, Privacy, Resource**

I. INTRODUCTION

Supercomputers today are used mainly by the military, government intelligence agencies, universities and research labs, and large companies to tackle enormously complex calculations for such tasks as simulating nuclear explosions, predicting climate change, designing airplanes, and analyzing which proteins in the body are likely to bind with potential new drugs. Cloud computing aims to apply that kind of power measured in the tens of trillions of computations per second—to .problems like analyzing risk in financial portfolios, delivering personalized medical information, even powering immersive computer games, in a way that users can tap through the Web. It does that by networking large groups of servers that often use low-cost consumer PC technology, with specialized connections to spread data-processing chores across them. By contrast, the newest and most powerful desktop PCs process only about 3 billion computations a second. Let's say you're an executive at a large corporation. Your particular responsibilities include making sure that all of your employees have the right hardware and software they need to do their jobs. Buying computers for everyone isn't enough -you also have to purchase software or software licenses to give employees the tools they require. Whenever you have a new hire, you have to buy more software or make sure your current software license allows another user. It's so stressful that you find it difficult to go to sleep on your huge pile of money every night. Installing a suite of software for each computer, you'd only have to load one application. That application would allow workers to log into a Web-based service which hosts all the programs the user would need for his or her job. Remote machines owned by another company would run everything from e-mail to word processing to complex data analysis programs. It's called cloud computing, and it could change the entire computer industry.

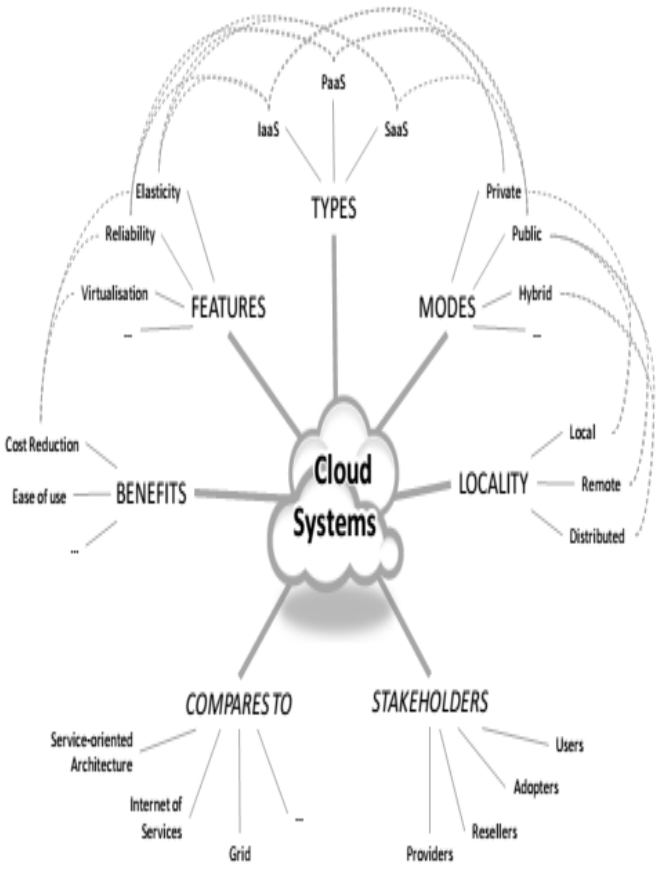

Fig. 1 Cloud Architecture

***V. Vijayalakshmi**, Assistant Professor, CSE Department, Christ College of engineering and technology, Pondicherry University, Pondicherry, India,*
***S. Thamizharasan**, Student M.Tech, CSE Department, Christ College of engineering and technology, Pondicherry University, Pondicherry, India,*
***P. Mahalakshmi**, Student M.Tech, CSE Department, Christ College of engineering and technology, Pondicherry University, Pondicherry, India,*

In a cloud computing system, there's a significant workload shift. Local computers no longer have to do all the heavy lifting when it comes to running applications. The network of computers that make up the cloud handles them instead. Hardware and software demands on the user's side decrease. The only thing the user's computer needs to be able to run is the cloud computing system's interface software, which can be as simple as a Web browser, and the cloud's network takes care of the rest. Instead of running an e-mail program on your computer, you log in to a Web e-mail account remotely. The software and storage for your account doesn't exist on your computer --it's on the service's computer cloud. According to NIST, National Institute of Standards and Technology, Cloud Computing is: "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

II. Deployment Models

There are different models that you can subscribe to depending on your needs. As a home user or small business owner, you will most likely use public cloud services.

A. Private Cloud

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Undertaking a private cloud project requires a significant level and degree of engagement to virtualized the business environment, and requires the organization to reevaluate decisions about existing resources. When done right, it can improve business, but every step in the project raises security issues that must be addressed to prevent serious vulnerabilities.

B. Public Cloud

A cloud is called a 'Public cloud' when the services are rendered over a network that is open for public use. Technically there may be little or no difference between public and private cloud architecture, however, security consideration may be substantially different for services (applications, storage, and other resources) that are made available by a service provider for a public audience and when communication is effected over a non-trusted network. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access only via Internet.

C. Hybrid Cloud

Hybrid cloud is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models. Such composition expands deployment options for cloud services, allowing IT organizations to use public cloud computing resources to meet temporary needs. This capability enables hybrid clouds to employ cloud bursting for scaling across clouds.

D. Community Cloud

Typically cloud systems are restricted to the local infrastructure, i.e. providers of public clouds offer their own infrastructure to customers. Though the provider could actually resell the infrastructure of another provider, clouds do not aggregate infrastructures to build up larger, cross-boundary structures. In particular smaller SMEs could profit from community clouds to which different entities contribute with their respective (smaller) infrastructure.

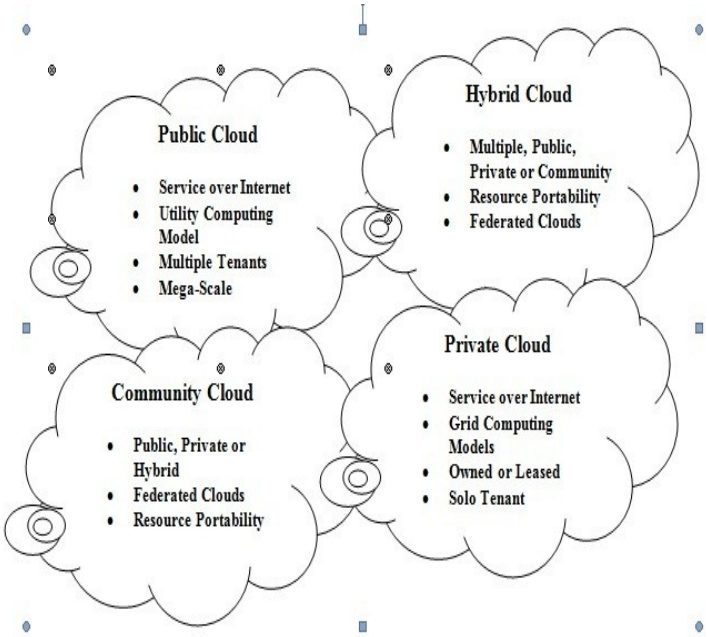

Fig. 2 Types of Cloud

III. Cloud Provider

Each provider serves a specific function, giving users more or less control over their cloud depending on the type. When you choose a provider, compare your needs to the cloud services available. Your cloud needs will vary depending on how you intend to use the space and resources associated with the cloud. If it will be for personal home use, you will need a different cloud type and provider than if you will be using the cloud for business. Keep in mind that your cloud provider will be pay-as-you-go, meaning that if your technological needs change at any point you can purchase more storage space (or less for that matter) from your cloud provider.

There are three types of cloud providers that you can subscribe to: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). These three types differ in the amount of control that you have over your information, and conversely, how much you can expect your provider to do for you. Briefly, here is what you can expect from each type.

A. Software as a Service

A SaaS provider gives subscribers access to both resources and applications. SaaS makes it unnecessary for you to have a physical copy of software to install on your devices. SaaS also makes it easier to have the same software on all of your devices at once by accessing it on the cloud. In a SaaS agreement, you have the least control over the cloud.

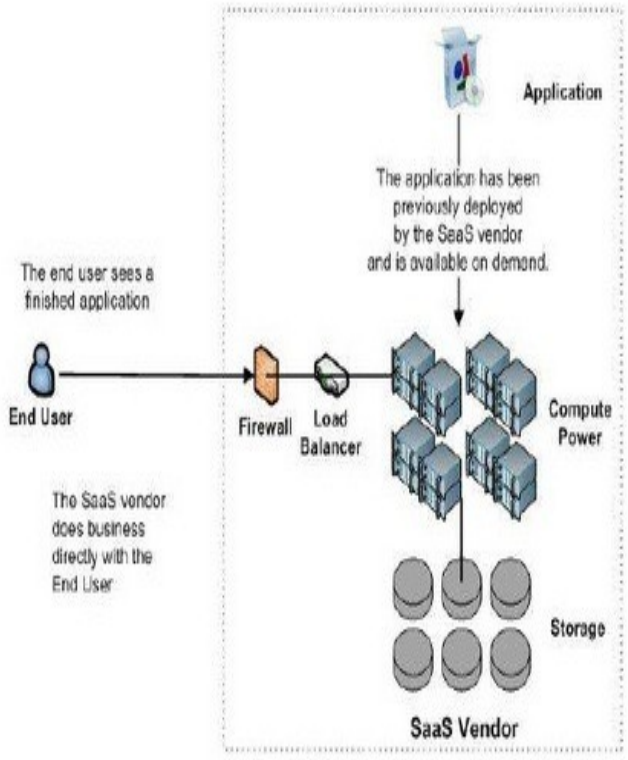

Fig. 3 SaaS

In the business model using software as a service (SaaS), users are provided access to application software and databases. Cloud providers manage the infrastructure and platforms that run the applications. SaaS is sometimes referred to as "on-demand software" and is usually priced on a pay-per-use basis. SaaS providers generally price applications using a subscription fee. In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. Cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support. Cloud applications are different from other applications in their scalability, which can be achieved by cloning tasks onto multiple virtual machines at run-time to meet changing work demand. Load balancers distribute the work over the set of virtual machines. This process is transparent to the cloud user, who sees only a single access point. To accommodate a large number of cloud users, cloud applications can be multitenant, that is, any machine serves more than one cloud user organization. It is common to refer to special types of cloud based application software with a similar naming convention: desktop as a service, business process as a service, test environment as a service, communication as a service. The pricing model for SaaS applications is typically a monthly or yearly flat fee per user, so price is scalable and adjustable if users are added or removed at any point. Proponents claim SaaS allows a business the potential to reduce IT operational costs by outsourcing hardware and software maintenance and support to the cloud provider. This enables the business to reallocate IT operations costs away from hardware/software spending and personnel expenses, towards meeting other goals. In addition, with applications hosted centrally, updates can be released without the need for users to install new software. One drawback of SaaS is that the users' data are stored on the cloud provider's server. As a result, there could be unauthorized access to the data.

B. Platform as a Service

It is a category of cloud computing services that provides a computing platform and a solution stack as a service. Along with software as a service (SaaS) and infrastructure as a service (IaaS), it is a service model of cloud computing. In this model, the consumer creates the software using tools and/or libraries from the provider. The consumer also controls software deployment and configuration settings. The provider provides the networks, servers, storage, and other services. PaaS offerings facilitate the deployment of applications without the cost and complexity of buying and managing the underlying hardware and software and provisioning hosting capabilities. There are various types of PaaS vendors; however, all offer application hosting and a deployment environment, along with various integrated services. Services offer varying levels of scalability and maintenance.

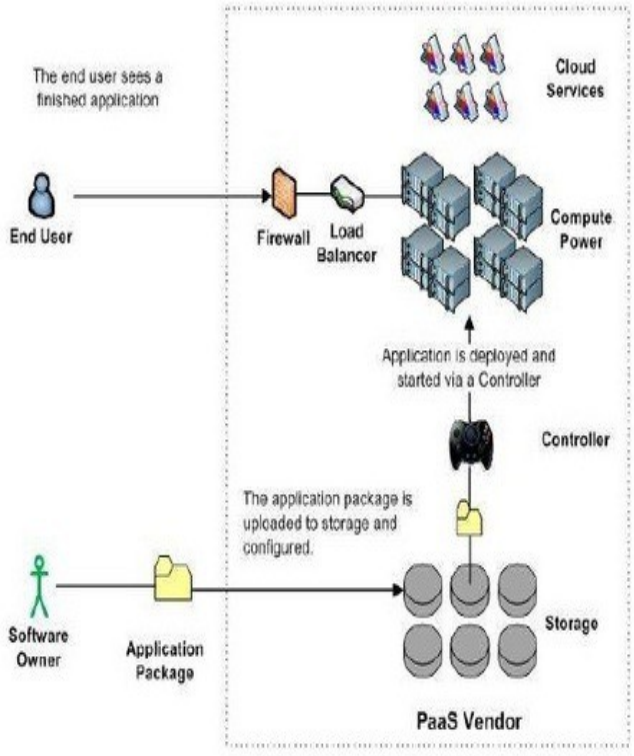

Fig. 4 PaaS

PaaS offerings may also include facilities for application design, application development, testing, and deployment as well as services such as team collaboration, web service integration, and marshalling, database integration, security, scalability, storage, persistence, state management, application versioning, application instrumentation, and developer community facilitation.

C. *Infrastructure as a Service*

In the most basic cloud-service model, providers of IaaS offer computers, physical or (more often) virtual machines - and other resources. (Ahypervisor, such as Xen or KVM, runs the virtual machines as guests. Pools of hypervisors within the cloud operational support-system can support large numbers of virtual machines and the ability to scale services up and down according to customers' varying requirements.)

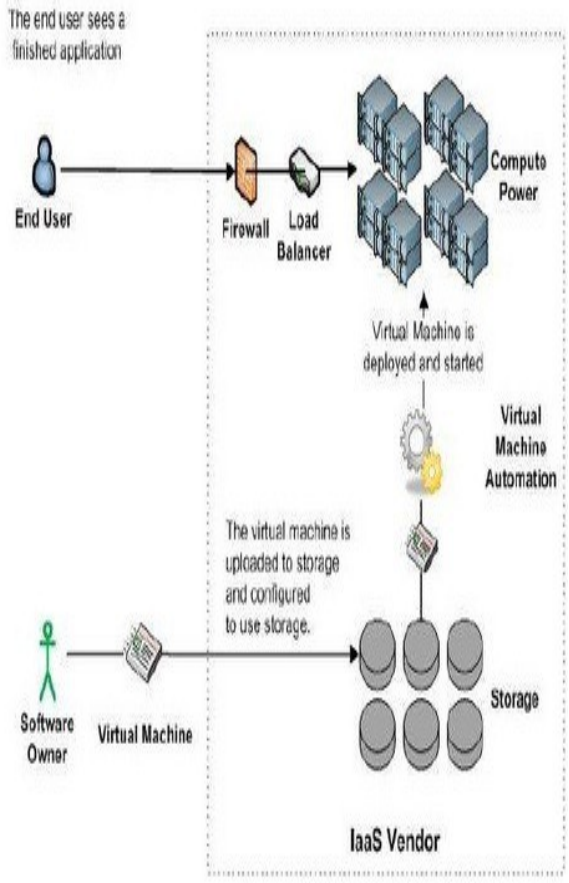

Fig. 5 IaaS

IaaS clouds often offer additional resources such as a virtual-machine image library, raw (block) and file-based storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles. IaaS-cloud providers supply these resources on-demand from their large pools installed in data centers. For wide-area connectivity, customers can use either the Internet or carrier clouds (dedicated virtual private networks). Cloud communications and cloud telephony, rather than replacing local computing infrastructure, replace local telecommunications infrastructure with Voice over IP and other off-site Internet services.

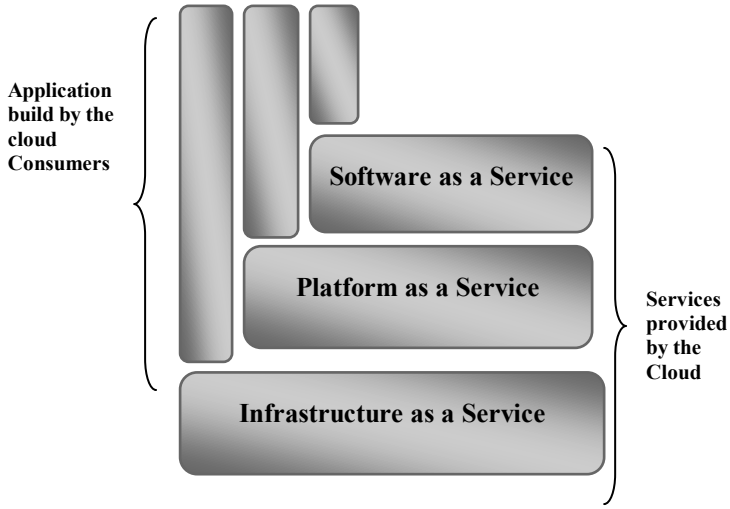

Fig. 6 Cloud Services

IV. TECHNOLOGICAL ASPECTS

The main technological challenges that can be identified and that are commonly associated with cloud systems are

A. *Virtualization*

It is an essential technological characteristic of clouds which hides the technological complexity from the user and enables enhanced flexibility (through aggregation, routing and translation). More concretely, virtualization supports the following features.

- **Ease of use:** through hiding the complexity of the infrastructure (including management, configuration etc.) virtualization can make it easier for the user to develop new applications, as well as reduces the overhead for controlling the system.

- **Infrastructure independency:** in principle, virtualization allows for higher interoperability by making the code platform independent.

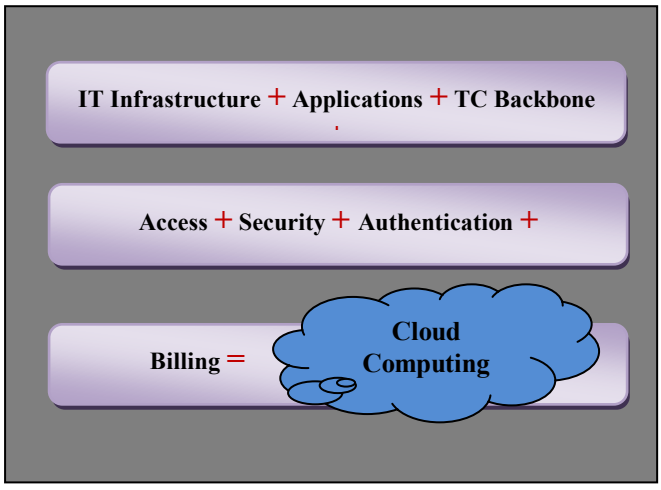

Fig. 7 Technical aspects of Cloud

- **Flexibility and Adaptability:** by exposing a virtual execution environment, the underlying infrastructure can change more flexible according to different conditions and requirements (assigning more resources, etc.).

- **Location independence:** services can be accessed independent of the physical location of the user and the resource.

B. Multi-tenancy

It is a highly essential issue in cloud systems, where the location of code and / or data is principally unknown and the same resource may be assigned to multiple users (potentially at the same time). This affects infrastructure resources as well as data / applications / services that are hosted on shared resources but need to be made available in multiple isolated instances. Classically, all information is maintained in separate databases or tables, yet in more complicated cases information may be concurrently altered, even though maintained for isolated tenants. Multi tenancy implies a lot of potential issues, ranging from data protection to legislator issue.

C. Security, Privacy and Compliance

It is obviously essential in all systems dealing with potentially sensitive data and code.

D. Data Management

It is an essential aspect in particular for storage clouds, where data is flexibly distributed across multiple resources. Implicitly, data consistency needs to be maintained over a wide distribution of replicated data sources. At the same time, the system always needs to be aware of the data location (when replicating across data centers) taking latencies and particularly workload into consideration. As size of data may change at any time, data management addresses both horizontal and vertical aspects of scalability. Another crucial aspect of data management is the provided consistency guarantees.

E. APIs and / or Programming Enhancements

They are essential to exploit the cloud features: common programming models require that the developer takes care of the scalability and autonomic capabilities him- / herself, whilst a cloud environment provides the features in a fashion that allows the user to leave such management to the system.

F. Metering

It of any kind of resource and service consumption is essential in order to offer elastic pricing, charging and billing. It is therefore a pre-condition for the elasticity of clouds.

V. SECURITY REQUIREMENTS OF CLOUD COMPUTING

A. Robust security

Meeting the first requirement providing robust security means moving beyond a traditional perimeter-based approach to a layered model that ensures the proper isolation of data, even in a shared, multitenant cloud. This includes content protection at different layers in the cloud infrastructure, such as at the storage, hypervisor, virtual machine and database layers. It also requires mechanisms to provide confidentiality and access control. These may include encryption, obfuscation and key management, as well as isolation and containment, robust log management and an audit infrastructure

B. Trust and assurance

To meet the second requirement providing trust or assurance the company needs to have confidence in the integrity of the complete cloud environment. This includes the physical data centers, hardware, software, people and processes employed by the provider. The service provider needs to establish an evidence-based trust architecture and control of the cloud environment, through adequate monitoring and reporting capabilities to ensure the customer of transparency around security vulnerabilities and events. This should include audit trails that help the customer meet internal and external demands for provable security, as well as automated notification and alerts that support the customer's existing problem or incident management protocols so it can manage its total security profile..

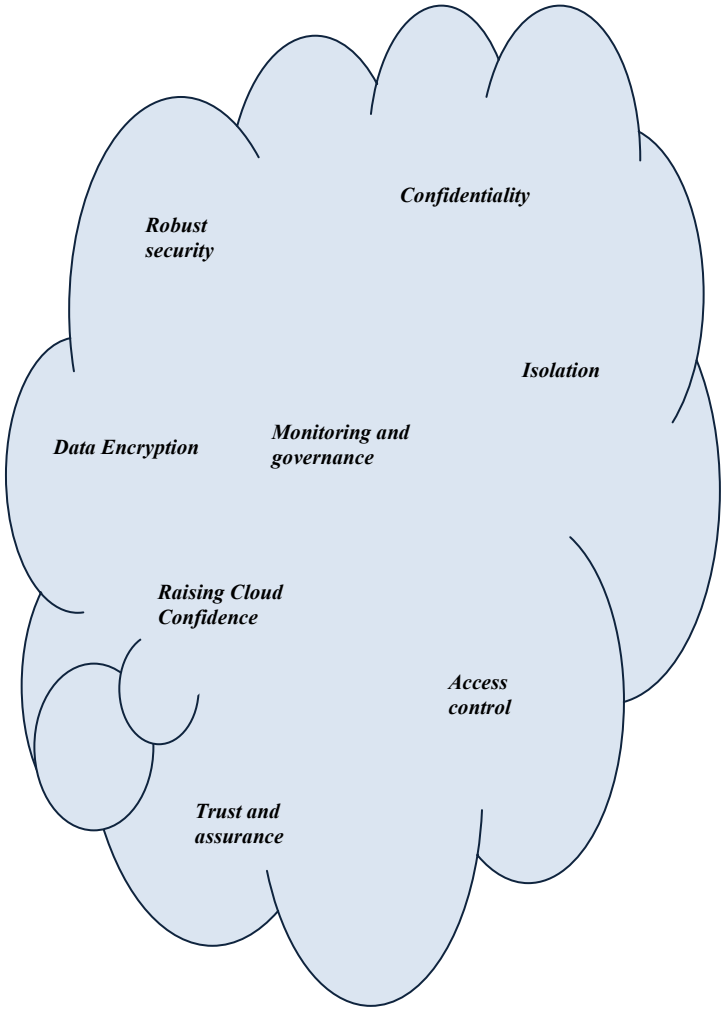

Fig. 8 Cloud Security

C. Monitoring and governance

This is the third requirement cloud governance comes in utilities that allow customers to monitor the environment for security, as well as ensure compliance with other KPIs, such as performance and reliability. Using these utilities, customers should be able to perform these activities almost as well as they could in their own data centers. Just as importantly, these utilities allow customers to take appropriate action based on the security information received from the provider. These actions might include shutting down an application that appears to be under attack or forcing the provider to tighten its procedures if critical updates or patches are not being applied on time.

D. Isolation

To ensure isolation within a multitenant environment, service providers often employ multiple virtual data centers, each on its own virtual LAN, to maintain customer data separation. For further security, each virtual data center can be configured into one or more trust clusters (each including, for example, separate Web servers, application servers and database zones), separated by demilitarized zones (DMZs) and virtual firewalls to ensure multitenancy, security.

E. Confidentiality

Confidentiality is provided by encryption and/or obfuscation based on business requirements. Encryption might seem like the most complete and foolproof protection, but by completely obscuring the characteristics of the data, it can defeat indexing and search capabilities and increase the expense of filtering, querying or consolidation. Obfuscation retains enough properties of the data to allow these operations, as well as any that rely on the semantics of the data, while obscuring the data sufficiently to destroy its value if compromised.

F. Access control

Identity management and provisioning platforms ensure that only authorized users can see the appropriate applications and data. This needs to be backed by compliance and audit and log management, so that customers have a record of which users accessed (which resources, when. In a cloud environment, access and identity management is often provided through federated identity management that allows customers to use their existing IT management systems in the cloud. Authentication, authorization and validation processes also help ensure access and identity control. Providers may also need to ensure the integrity of data and messages through strong authentication or other means to make sure data has not been compromised in transit.

G. Data Encryption

Data encryption adds a layer of protection, even if a system is compromised. Encrypting data in transit is especially important, as that traffic will be traversing a shared network and could potentially be intercepted if an attacker gains access at a critical point in the network. Encrypting the data as it traverses the network makes it much more difficult for an attacker to do anything with intercepted traffic. Encrypting critical data "at rest" within the virtual disk file is also very important. This will protect critical data from "walking off," and will make it much more difficult for an attacker to compromise data, even if they are able to compromise an endpoint.

H. Raising Cloud Confidence

The cost and agility benefits of the cloud will continue to drive organizations to migrate more critical applications and services to these platforms. As they do so, they will choose cloud providers that deliver not only the required security but also the assurance of robust security and the governance capabilities to manage ongoing security needs in a cost-effective way. Companies that choose to work with service providers offering robust security, assurance and governance architectures will have powerful first mover advantage as competitors of all sizes move more of their business to the cloud.

VI. CONCLUSION

Much more than the technology that supports it, Cloud Computing is the last plateau of evolution of the IT industrialization process. Looking back at the recent years of the IT industry, it was predictable that something like Cloud Computing would come to revolutionize the IT industry. It seems that for a while, the "tecky" people took over the IT business, always eager to try new technologies, often with little value for the business they were trying to support. Now business is back to claim added value from the IT departments, and Cloud Computing may very well be the answer.

REFERENCES

[1] Mariana Carroll, Paula Kotzé, Alta van der Merwe (2012). "Securing Virtual and Cloud Environments". In I. Ivanov et al. *Cloud Computing and Services Science, Service Science: Research and Innovations in the Service Economy*. Springer Science+Business Media.doi:10.1007/978-1-4614-2326-3.
[2] "Cloud Computing entry". NetLingo. Retrieved 15 January 2014.
[3] Jeff Bezo's Risky Bet, Robert D. Hof, Business Week, November 13, 2006(http://www.businessweek.com/magazine/content/06_46/b4009001.htm).
[4] UniversityofMichiganhttp://it.umich.edu/initiatives/cloud/content/what-cloud. Retrieved 15 January 2014.
[5] Das Konzept und Funktionsweise von Software-as-a-Service (SaaS), Dr. Michael Pauly, WissenHeute, 10/2008, 2008.
[6] Simson Garfinkel (3 October 2011). "The Cloud Imperative". *Technology Review* (MIT). Retrieved 31 May 2013.
[7] Linthicum, David. (2011-04-27) "How to integrate with the cloud", InfoWorld: Cloud Computing, April 27, 2011.
[8] Cloud Computing krempelt den Markt um, Nicolas Zeitler, CIO, 2008 (http://www.cio.de/strategien/methoden/857112/index.html).
[9] Keep an eye on cloud computing, Amy Schurr, Network World, 2008-07-08, citing the Gartner report, "Cloud Computing Confusion Leads to Opportunity". Retrieved 2009-09-11.
[10] "Security of virtualization, cloud computing divides IT and security pros". Network World. 2010-02-22. Retrieved 2010-08-22.
[11] HAMDAQA, Mohammad (2012). *Cloud Computing Uncovered: A Research Landscape*. Elsevier Press. pp. 41–85. ISBN 0-12-396535-7.
[12] King, Rachael (2008-08-04). "Cloud Computing: Small Companies Take Flight". Businessweek. Retrieved 2010-08-22.
[13] "Cloud Certification From Compliance Mandate to Competitive Differentiator". Cloudcor. Retrieved 2011-09-20.
[14] Berl, Andreas, et al., Energy-Efficient Cloud Computing, The Computer Journal, 2010.
[15] Rouse, Margaret. "Definition: Cloudbursting," May 2011. SearchCloudComputing.com.
[16] Linthicum, David. (2011-04-27) "How to integrate with the cloud", InfoWorld: Cloud Computing, April 27, 2011

[17] Voorsluys, William; Broberg, James; Buyya, Rajkumar (February 2011). "Introduction to Cloud Computing". In R. Buyya, J. Broberg, A.Goscinski. *Cloud Computing: Principles and Paradigms*. New York, USA: Wiley Press. pp. 1–44.ISBN 978-0-470-88799-8.

BIOGRAPHY

V.Vijayalakshmi she has completed her MCA from Sri Manakula Vinayagar Engineering College affiliated to Pondicherry University, India the M.Tech Computer Science & Engineering from Sri Manakula Vinayagar Engineering College affiliated to Pondicherry University, India. She has published 8 papers at international journals, 3 International Conferences, and 2 National Conferences. Her research area of interest is Cloud Computing, Web Service and Data Mining.

S.Thamizharasan he has completed his B.Tech in Perunthalaivar Kamarajar Institute of Engineering and Technology affiliated to Pondicherry University, India and currently a final year M.Tech Student at the Computer Science of Christ College of Engineering and Technology affiliated to Pondicherry University, India.

P. Mahalakshmi she has completed her B. Tech in Manakula vinayagar institute of technology affiliated to Pondicherry University, India and currently a final year M.Tech Student at the Computer Science of Christ College of Engineering and Technology affiliated to Pondicherry University, India.

