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RESEARCH ARTICLE

THE ERA OF CLOUD COMPUTING: A RECENT SURVEY.

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Abstract

Cloud computing an emerging technology provides various services to the users like infrastructure, hardware, software, storage etc. For working cloud in data security, it is necessary that cloud computing network should always be free from outside attack/ threats. Here in this paper we focused on the cloud computing era needs, applications, issues and challenges and also tried to propose some of the good solutions which can be implemented to resolve them. Authors also tried to discuss different types of cloud and their providers with current scenario of cloud computing which pave the way to forecast its basic way to future.

The service of cloud like IaaS (Infrastructure as a Service) allows an internet trade a way to build up and produce on demand.PaaS (Platform as a Service): It is the client who controls the applications that run in the environment, but does not manage the operating system, hardware on which they are running.

Need of cloud computing is an expertise uses the internet and central remote servers to maintain data and applications. Some reasons are Speedy Elasticity, Measured Service, on-Demand Self-Service etc.

Cloud computing is also known as fifth generation of computing after supercomputer, Personal Computer, Client-Server Computing, and the Web.

One of the issues of cloud computing is data security in which data can be loss or hacked by the attacker, possible solution of this problem by applying encryption techniques on the data. Some challenges are also present in cloud computing like lack of resources in which staff needed new skills or updated knowledge related technology, possible solution is to recruit new staff or give training to the existing ones.

This survey of cloud computing concluded that Cloud computing is increasing part of IT and many gigantic organizations are going to implement cloud computing. In the near future work on data science, artificial intelligence and machine learning service inside cloud provider to protect the customer sensitive data from the intruders attack.

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Introduction:-

The term "cloud computing" may be commonly articulated in businesses all over the world, but its difficult history is less well known. Considering the technology has only accomplished mainstream approval in the last decade or so, it may come as some disclosure to determine that the origins of the cloud are relatively long-standing. Whenever user required accessing any file or application that was not stored locally on your smart phone, tablet or PC then you've benefited from the cloud. But while this technology has become omnipresent today, it is worth recollection that computers themselves have not always been effortlessly available. It may sound noticeable, but for cloud computing to achieve recognition, computers themselves had to penetrate the mainstream. Cloud computing is a centralized controlling system in which minimal resources are offered by the providers, due to which intruder easy gain access to the resources and breach the security. Cloud computing allows the user to take benefit of the technologies. It is used for delivery of its services like-servers, storage, databases, [4] networking, software, analytics and many more. It is agile for the organization in improving the services provided to the user. One of the foremost characteristics of the cloud computing by which it provides flexibility to the user through the reduction of cost. Other one cloud computing services is speed which is provided to self service and on demand large amount of computing resources transfer within a minute without any pressure of capacity planning. Here cloud knew at which time how much amount of power, bandwidth and storage is required according to the geographic conditions [3]. By using on-time data centers in computing productivity gets increases. It becomes more reliable as it secures data, disaster recovery.

Services of Cloud

IaaS (Infrastructure as a Service):

In this IaaS gives industry entrance to essential web architecture, like storage space, servers, and connections, lacking the business require of purchasing and managing this internet infrastructure themselves [27]. IaaS allows an internet trade a way to build up and produce on demand. The user can manage the operating system, storage, deployed applications and probably networking components such as firewalls and load balancers, but not the cloud infrastructure under them. Amazon EC2 and Rackspace Cloud are illustrations of IaaS [28].

PaaS (Platform as a Service):

It is the client who controls the applications that run in the environment, but does not manage the operating system, hardware or network infrastructure on which they are running. The platform is typically an application framework. PaaS allows a set of scalability by design because it is based on cloud computing [28]. Some illustration of a PaaS system include: Mosso, Google App Engine, and Force.com.

SaaS (Software as a Service):

It is the user uses an application, but does not organize the operating system, hardware or network infrastructure on which it's running. Cloud applications allow the cloud to be influence for software architecture, reducing the burdens of maintenance, support, and operations by having the application run on computers belonging to the dealer [27]. Gmail and Salesforce are examples of SaaS run as clouds, but not all SaaS has to be stand in cloud computing.

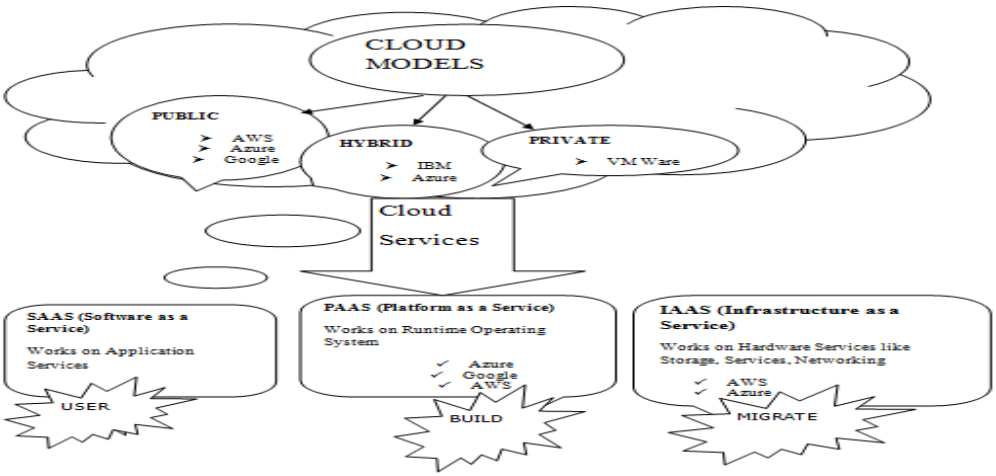

Figure1:-Shows the Cloud Models and Cloud Services with respective Cloud providers according to their usage.

Need of Cloud Computing

The cloud is just a symbol for the Internet. Cloud Computing is an expertise uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access [23]. It was mainly used for dedicated point to point data transfer that is Virtual Private Network (VPN) services. It is now one of the largest emerging computing technologies [24].

Some reason to use cloud services are as follows:-

1. Speedy Elasticity
2. Measured Service
3. On-Demand Self-Service
4. Ubiquitous Network Access
5. Resource Pooling
6. Cost efficiency
7. High Speed
8. Excellent accessibility
9. Manageability
10. Back-up and restore data

Cloud Computing Generations

Cloud computing is a new essence of computing where our style of using Internet changes. It is the prospect of Internet. It is also known as fifth generation of computing after supercomputer, Personal Computer, Client-Server Computing, and the Web. Cloud Computing can be the solution of these questions. Supercomputers started the initiation of computing era. These computers are before time computers, also called big iron, used by huge organizations to process volume data [6]. They have big cabinet to abode CPUs and memory to work. But they are not economically viable for an individual person. The troubles of mainframe computers can be determined by personal computers which decrease the cost of computing and started the novel period of computing. Personal computers are of minute size, which focuses on folks. Individual doesn't be concerned about special training or worker to operate them. . A personal computer may be a desktop computer, a laptop, a tablet PC, or a handheld PC. This makes the execution complex and less manageable. Client-Server Computing resolves such implementation difficulty [7]. In client server computing, server and client are unlike entities and they are connected through a network. Database is executed on server and application interface is on the client machine. Such computing connected with various profit like compact cost of computing, amplified performance, less maintenance, scalable, high availability and less efforts required applying applications. Client- Server cannot be practical on the whole world to share information and offer information in effective and efficient manner [6]. Such fourth generation's restrictions gave birth to fifth generation of computing which is named as Cloud Computing. Cloud computing doesn't restricted to grid, parallel and distributed computing. Grid Computing grant resources to the user when user requires. Parallel computing accomplishes the instruction in parallel for fast reaction to complete user assigned mission. Parallel computing gives only fast response neither storage nor memory as a resource [7]. In distributed computing information or data is distributed in the servers placed at dissimilar geographical areas.

Cloud provider host and manages the application, underlying infrastructure and handle maintenance too. Cloud computing is a model for enabling omnipresent, 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[20]. There are four deployment models to deploy cloud computing:

Types of Cloud-

Public Cloud:

In simple terms, public cloud services are characterized as being accessible to clients from a third party service provider through the Internet. The term "public" does not always mean free, even though it can be free or fairly inexpensive to use [22]. A public cloud does not mean that a user's data is publically visible; public cloud vendors typically provide an access control mechanism for their users. Public clouds provide an elastic, cost effective means to arrange solutions. Examples are AWS (Amazon) cloud, Microsoft Azure cloud.

Private Cloud:
A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based [23]. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might required. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and the networks used are restricted and designated.

Community Cloud:
A community cloud is controlled and used by a group of organizations that have shared interests, such as specific security requirements or a common mission. It works as private cloud also. The members of the community share access to the data and applications in the cloud [24].

Hybrid Cloud:
A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non-business critical information and processing to the public cloud, while keeping business-critical services and data in their control. Example Google cloud provider [22].

Virtualization is the new technology of the cloud computing. This technology divided physical computers into virtual devices by which they can easily manage the task. Generally cloud provider is using traditional security system to avoid authorized access of the resources. Virtualization is a key point in the cloud system that provides multiple virtual instance of a physical resource and if a single instance of a resource susceptible then connected clients are affected [8].

Related Work
G.E.Blonder,1996[1],Dhamija et.al2000[2], and X. Suo et.al2005[3] proposed a recognition-based graphical password system that authenticates users by choosing portfolios among decoy portfolios. He has discussed here many graphical password schemes have been proposed till now for securing data.

Paul. A.J, et.al 2007 [4] has presented security in cloud computing environment mostly uses right now infrastructure as a service for the research.

Joshi Ashay Mukundrao, et.al 2011[5],Hwan-Seok Yang, 2013[9],Muhammet Baykara, et.al 2015[13] explained that Cloud computing and Intrusion Detection and Prevention Systems are one such measure to lessen these attacks. Hybrid Intrusion Detection System (HIDS) that combines the positive features of two different detection methodologies. He has given many research projects from the past have built intrusion detection systems and honeypot architectures based on virtual machine introspection (VMI) are discussed.

Muhammad Baqer Mollah, et.al 2012 [7], Sameer Rajan,et.al 2011 [6], Bhise 2013[11] given the proposed In this paper, author have evaluated and highlighted the various aspects of Cloud Computing to find the reality of the fifth generation computing in the form of cloud computing. There are numerous layers in present cloud computing architecture, service models, platforms, issues i.e. security, privacy, reliability, open standard and types. This paper explain all about the capable cloud computing technology i.e. its architecture, advantages, platforms, issues and challenges, applications, future and research selection of cloud computing. Here in this paper author explain the issue of how cloud consumers can make resourceprovisioning plan for their calculation. He tries to resolve number of instances mandatory to execute workload so as to attain optimization goal based on the uniqueness of workload and purchasing plans provided by Amazon EC2 which can considerably reduce the total cost acquire to customer.

Sultan Aldossary, et.al 2016[14] and Gagan,et.al2016 [15] explained that Cloud computing change the entire world as necessity grows day by day by moving the data into cloud. Data stored in the cloud which is in virtual machine use to share resources in cloud. Yunfei CI, et.al 2017[16], Liangxuan Zhang, et.al 2017[17] explained that cryptography gives assurance to network and information security. In cryptography, attribute based encryption (ABE) is one of the technique to protect the data.

Lynn 2017[18] and Apurva Saxena et.al 2018[19-20] Here in this paper various models are proposed for honey pot to solve the problem of industries and that is used to captures the activities of attackers and maintains a log for

providing better security to the cloud network. An author proposed an algorithm to resolve some of the issues of network security**.** This paper presents the concept of production and research Honeypot as a service in cloud environment by implementing the benefits of Kerberos Authentication system, which distinguishes between hackers and users, and to provide overall security to the data/network.

In another paper offer an overview and multi-level feature analysis of seven enterprise server less computing platforms. The evaluation extant research on these platforms and identifies the surfacing of AWS Lambda as a de facto base platform for research on enterprise server less cloud computing.

Issues In Cloud Computing And Recommended Solutions

Virtualization security issues:

Issues

Virtualization [19] of network controllers allows users to combine their networking hardware resources and run multiple virtual machines concurrently on consolidated hardware. Virtualization also provides the user a rich set of features such as I/O sharing, consolidation, isolation and migration, and simplified management with provisions for teaming and failover. Virtualization is not restricted to large enterprises. The Hypervisor sits between hardware and the operating system. Virtualization allows multiple operating systems and applications. Server virtualization, especially when coupled with blade technology, increases computing and storage density while making IT assets more flexible. Virtualization is one of the important component of the cloud computing. It provides an illusion of something like virtual computer, storage device, and network, hardware platform resources [14].

We tried to solve some security issues with their possible solutions, which can be described as:-

1. A Cross Virtual Machine Side-Channel Attacks:-In this attacker attack through side-channel. Through the channel information get leaked by stealing the cryptographic key.

   Possible Solution:- For security of the key if substitution method is applied in the key with two level securities like generate the OTP (One Time Password) [2].
2. VM Image Sharing: - In this, threat is inside the image and forward it to others. By this act data can be leaked or it harm in many ways.

   Possible Solution: - While sharing any image in the network be alert as a sender and provide some security features like apply some cryptographic [1] techniques in encapsulate the image in the form of text and then share it.
3. VM (Virtual machine) Isolation: - In this single machine contains more than one virtual machine has its own guest operating system. If one operating system get fails other start work.

   Possible Solution: - Each VM in a single system has secured independently by anti-virus, so that by sharing hardware resources of the system.
4. VM Escape:-In this VMM (virtual machine manager) manages the data malicious user escape from [14] the manager from which it directly communicate with the host operating system.

   Possible Solution: - Whenever any unauthorized user try to interact with the host operating system the alarm generate to the manager in the form of pop-up message.
5. VM Migration: - Virtual machine migration is the task of moving a virtual machine from one physical hardware surroundings to another. It is part of administration hardware virtualization systems and is something that providers look at as they offer virtualization services [15]. Virtual machine migration is also known as teleportation.

   Possible Solution: - In this solution provides security at each level and when virtual machine migration is in process rest all process should not be idle inside the machine so that attacker must not be benefited.
6. VM Rollback:-This process gives more flexibility to the user. When VM rollback to the previous state but the state is not static, so when user gives the command of rollback they disable the previous state.

   Possible Solution: - In this always check the previous state if it is correct, so try to validate the state.
7. Hypervisor Issues: - Hypervisor or VMM (virtual machine monitor) hardware that creates and runs VM. The hypervisor run on host and having guest operating system [17]. It manages the execution of the operating system and assigning the resources.

   Possible Solution: -Each VMM of the host must have some secure cryptographic techniques so the attacker should not get benefited.

After making system virtualized now the next step is process with cloud computing. On working with various types of cloud as discussed above, here are some of the issues that can be noticed and we tried to propose some of the best solutions that can be implemented to resolve them in a better way.

Cloud Computing Issues and challenges

In cloud computing security is a wide topic [23] to discuss. It is combination of technologies and policies to protect the data, services and infrastructure. This mixture is an objective of all possible attacks. There is plethora of issues and challenges on cloud computing, one most important is reliability on new technology, dependency on cloud services, selecting perfect cloud setup, hacking of brand, recovery of lost data, transparency of service provider and many more. But here we have done research and are working on some issues provided possible solutions which are implemented. On some issues we are trying to get the desired outcome. Furthermore new possible solutions required in cloud computing which can protect the data in an efficient manner. Some issues facing by the cloud computing are as the following:

1. Data security
2. Malicious Insider
3. Denial of Service
4. Service Hijacking
5. Data Location

Table1:-Issues of cloud computing with the possible solutions

S.No.	Issues	Problem	Possible Solution
1.	Virtual Machine	• Security is less effective • Malicious user may able to manages the data • Operating systems are not secure	Generate OTP (One Time Password) or alarm can be created. Pop-up message can be generated. Other process of the machine should not be idle.
2.	VM (Virtual Machine) Isolation	• Data can be leaked /steal	Anti-virus must be installed on the each machine where operation is performed.
3.	VM (Virtual Machine) Migration	• Machine migration is a task	Apply some cryptographic techniques.
4.	Data Security	• Data losses • Hacking of the data	Apply encryption techniques. Tokenization method can be applied.
5.	Malicious Insider	• Can damage the user's sensitive data	Implement the password protection on the instance of cloud provider.
6.	Denial of service	• Attack on server • Interrupt the service by sending the heavy traffic	Alert generate on the dashboard. Mail can be sent to authorized person and service on server stops automatically.
7.	Service Hijacking	• Login credentials get altered, misused, deleted	Use IAM service of the cloud to assign the policy to every user with the limitation in access the services. Another method MFA is another service of the cloud.
8.	Data Location	• Hacker can attack on the data	Apply some encryption technique like SSL (Secure Socket Layer)

While trying to solve these issues, some of the challenges are generated this can be explained as:

2.2 Cloud computing challenges are as follows:

1. Security
2. Managing cloud Spending
3. Lack of resources
4. Migration
5. Vendor lock-in

Detailed descriptions of challenges with their recommended solutions are given in table 2.

S.No.	Challenges	Problem	Possible Solution
1.	Security	• On higher risk when traffic gets increase	Cloud flare prevents from DDoS attack and provides security
2.	Managing Cloud Spending	• cost increases, • unable to govern the services, • performance	For example cloud health is one of the cloud provider which provides cloud services
3.	Lack of resources	• staff may need to acquire new skills • create or update foundation process	Higher the skilled workers
4.	Migration	• When data is migrated from on-premise to cloud	SMS (Server Migration Service) is an agent less service which makes easier and faster.
5.	Vendor lock-in	• Manage different services of different cloud • How to switch from one cloud to another cloud.	Image of an instance which is launch on cloud provider

Table 2:-Challenges of cloud computing and their possible solutions

IV Present Scenario Of Cloud

There are different cloud providers for example in public, cloud provider such as Amazon AWS, Microsoft Azure and GCP (Google Cloud provider), private has VMware cloud provider and Hybrid cloudcontains different cloud provider which uses these cloud for their self network and open for public use also like IBM, AWS and Azure. If machine learning, data mining, deep learning with cloud computing is used then there will be more applications [26, 29]. The cloud computing has many applications in different services of cloud like it offers:-

1. It provides scalable resources.They move to migrate from in-house data centers to cloud without having to spend in setup and preservation of costly transportation.
2. Chatbots can offer modify solution, messages through cloud provider. Siri, Alexa and Google Assistant are all cloud-based natural-language bright bots [25].
3. For communication cloud uses dissimilar application like skype, whatsApp. In view of efficiency concern, office tools like Microsoft Office 365 are used.
4. For business management applications like customer relationship management (CRM) and enterprise resource planning (ERP) are based on a cloud service provider. Salesforce, Hubspot, Marketo are all relevance of cloud.
5. In Social Media the most accepted and hidden purpose of cloud computing are Facebook, LinkedIn, MySpace, Twitter, and lots of other sites use cloud computing.
6. Cloud computing enables data scientists to strike into any managerial data to investigate it for patterns and insights, find future crisis and help in data backed judgment making. Hadoop,Cassandra, is one of the gears used in cloud computing [25].
7. The cloud can provide an environment to cut operating cost and launch the apps in the market faster. LoadStorm and Blaze Meter are accepted testing tools.
8. The cloud also provides more elasticity in the sense that client can have large storage and on-demand backups [25]. Drop box, Google Drive and Amazon S3 are stylish examples of cloud backup solutions.
9. This can rapidity and simplify the development process. Amazon Lumberyard is a popular mobile game development instrument used in the cloud.
10. Serverless cloud computing presents the chance for researchers in cloud computing from a new viewpoint, interoperability, optimization, virtualization management, fault tolerance, simulation and a lot more.

Conclusion:-

Cloud computing is novel technology that provides easy computing and access to high performance computing, networking, storage and infrastructure through internet. Cloud computing is increasing part of IT and many gigantic organizations are going to implement cloud computing. A number of them provide IaaS, PaaS and some other provides SaaS. Amazon.com, Sun, IBM gives storage service while Google Apps provides software as a service. In the near future working on data science, artificial intelligence and machine learning service inside cloud provider to protect the customer sensitive data such as login credential through encryption techniques and other password

protection technique inside security group, so that we can increase the efficiency and accuracy to makes the data more secure.

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