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OVERVIEW OF CLOUD COMPUTING AND CURRENT RESEARCH ISSUES

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Abstract

Cloud computing is like a group of computer services that people can use over the internet. These services are really flexible so you can use more or less of them as you need to. Cloud computing is great because it means you do not have to spend a lot of money on computer equipment and stuff. This is especially good for businesses that need a lot of computer power. Usually cloud computing services are provided by companies that own all the equipment. The cloud computing system is really flexible. Can be used on the Internet with small devices that are easy to carry. This means that the new and existing software can do a lot things and handle more work. Because the pay-per-use model is so good, where you only pay for what you use like computer power, number of transactions, internet speed, amount of data sent and storage space many industries like banking, healthcare and education are moving to cloud computing. Cloud computing is making it possible for these industries to do more with less. Many people are using it because it is convenient and cost effective. Cloud computing is the way for many industries including banking, healthcare and education. They are worried, about security and some other problems. The main thing that is stopping cloud computing from getting bigger is security. This research paper is going to tell us what cloud computing is. It will also talk about the cloud models and give us a general idea of what the cloud computing architecture looks like.

Keywords: Cloud computing, platforms as a service (PaaS), software as a service (SaaS), infrastructure as a service (IaaS), mobile cloud computing (MCC), cloud architecture.

Introduction

The Internet has helped to create new technologies. One of these is computing. Cloud computing is something that a lot of people talk about. It helps users and providers save money and find ways to do business. Over the few years people have started to use cloud computing more and more. It is now a part of the information technology industry [23]. The use of cloud computing has a lot of things about it. Cloud computing also lets people use it from anywhere in the world. And it is very flexible so companies do not

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have to worry about things like updating software. This is because cloud computing does all of these things automatically.Companies, like Google, IBM, Microsoft and Amazon are starting to use cloud computing. Cloud computing is a way that companies are setting up and taking care of software.

The people who make computer systems have made a test versions of platforms and applications like the Elastic Computing Platform, Google App Engine, Amazon Cloud and IBM Blue Cloud infrastructure [42].

Cloud computing is really useful for things like Web Application Development and Mobile Technology.* Web Application Development* Mobile Technology can benefit from using cloud computing.

Cloud Computing Overview

The idea of cloud computing is to make it easy for people to store their data online so they can use cloud computing to do that because they are more flexible.They can handle lots of tasks at the time and they can get bigger or smaller as needed..One good thing about cloud computing is that it helps reduce costs. This is because companies do not have to spend a lot of money on hardware.This helps the company to always be working well and to be able to handle a lot of users at the time.

Cloud computing is very good at dealing with changes, in demand and traffic. So multi-tenancy is really good because it lets many users or organizations use the infrastructure. This is done in a secure and efficient way.

Cloud providers can do a lot more than the way of using one machine for one thing. They can use something called virtualization. This means one real server can be turned into virtual machines. Cloud computing is really great because you only have to pay for what you use and it is very flexible.

Building Blocks for Cloud Computing

Deployment Models

Cloud deployment models are like networking and storage and platforms and software. These are things that you can get as services. The good thing about these services is that you can make them bigger or smaller to meet the demand for Cloud deployment models. This means that Cloud deployment models can give you what you need when you need it.

Cloud

A private cloud is like a special computer system that a company uses just for itself. It does the things that big cloud computing systems do but it is inside the company's own network. The company is in charge of all the resources and applications on the cloud. It is like a special internet that only the company can use but it can still grow and get bigger when the company needs it to.

Because only the company and the people it says are okay can use the cloud it is usually safer than the public cloud. The private cloud is safer because not anyone can

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get to it. Private clouds are a choice, for companies that want to use cloud computing but also want to keep their information safe and private.

The Public Cloud is like the way of doing cloud computing. This is where you get services from companies over the internet. They share the resources with a lot of people and you only pay for what you use like when you buy prepaid phone time. The Public Cloud is good because companies can get resources when they need them.. There is a problem with the Public Cloud. Because the companies do not keep their stuff on their computers the Public Cloud is not as safe as it could be. The Public Cloud has security problems than the Private Cloud.

A hybrid cloud is a setup where a private cloud is connected to cloud services outside of it. This whole system is managed from one place. It is like one big system that works inside a safe network. It combines the things about public clouds and private clouds. This way organizations can give people ways to use technology so many users can get to information online but they still have a lot of control over important data and applications. The hybrid cloud is also open which means it can work well with tools and systems that help manage things. Amazon Web Services is a well-known example of how to set up a hybrid cloud.

Community Cloud

A community cloud is a type of infrastructure that several organizations use together. These organizations have the goals and interests. The community cloud can be managed by the organizations that use it or by external service providers. A community cloud is not as common as private clouds. This is because a community cloud is usually set up when related organizations, like banks or universities work together and agree to share it. They do this because they need to collaborate with each other. A community cloud is a way for organizations, like these to share infrastructure and work together on common goals.

The environment can be on your computer at work or on a server that someone else manages. This is really good because a community cloud lets lots of people use the things and still have control over what happens and keep everything safe in a way that works for all of them.

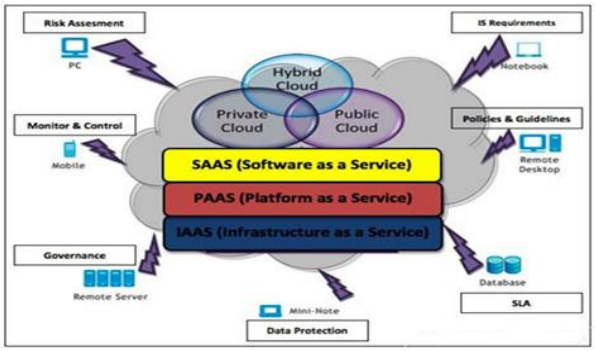

Fig 1: Cloud Deployment Model [1]

The virtual private cloud is an option because it lets companies use the public cloud when they need to but still keep their sensitive operations secure, inside their own infrastructure.

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Mobile Cloud Computing is really important. This thing came up as technologies and fast internet options like 2G, 3G, Wi-Fi and Wi-Max got better. Mobile Cloud Computing combines cloud computing with Mobile Cloud Computing so you can store and work with data, in the cloud and still use it on your smartphones or tablets.

The fact that technologies like HTML5 are getting better has made mobile cloud computing more popular. This has helped more people use mobile cloud computing, which now a big part of what companies do, with cloud computing. Mobile cloud computing is a part of modern cloud strategies.

Service Models

Cloud computing services are usually divided into three layers. These layers are Infrastructure as a Service, Platform as a Service and Software as a Service. Cloud computing services like these are important. Cloud computing services such as Infrastructure as a Service, Platform as a Service and Software as a Service are what people usually talk about. Some people, like Iyer and Henderson and also Han and Mell and Grance wrote about Cloud computing services and these layers in the year 2010.

Infrastructure, as a Service is the layer that gives us the important things we need like servers and storage and networking. Organizations use Infrastructure as a Service to get the computing power and storage they need without having to buy or take care of the hardware. This way they can just use Infrastructure as a Service to get what they want.

Platform as a Service is a type of service that helps people who make software. It gives them a place to build and test their software and then put it out for others to use. This is really helpful because it means the people who make the software do not have to worry about the computers and systems that their software runs on.

Software as a Service, which is also known as SaaS is something that gives people access to software applications when they need it over the internet. SaaS is basically the version of the old way of providing software, which was called the Application Service Provider model. This model makes it possible for people to use software online of having to install it on their own computers.

SaaS uses two kinds of servers: a server that keeps everything consistent and a domain server that does the same thing. These servers work together to make sure the data is consistent and up to date in environments. If the main server fails or gets hacked the whole SaaS environment can be in trouble. It is very important for organizations to protect the SaaS environment and the main server. Protecting SaaS is critical because SaaS is important, for organizations.

Platform as a Service or PaaS is really helpful because it gives you a platform and solution stack as a service. This service is designed for people like developers, IT administrators. End users.You do not have to download or install any software when you use PaaS.PaaS is different from setups. It gives

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you an integrated environment. You can use this environment to build, test and deploy applications in environments. PaaS makes it easy to work with applications, in the cloud.

When you look at the three service models, which are Software as a Service, Platform as a Service and Infrastructure as a Service and you combine them with different ways to set up cloud computing you get a complete idea of what cloud computing is. Like you can see in Fig 2 the cloud computing system is surrounded by lots of devices that are connected to each other. There are also concerns about security with Software as a Service, Platform as a Service and Infrastructure, as a Service.

Cloud-Based Services Include Things like This:

They are on the internet Cloud-based services are used by a lot of people because Cloud-based services are easy to use and you can get to them from anywhere.

You can use Cloud-based services to store your files and Cloud-based services can help you work with people.The main thing, about Cloud-based services is that you do not need to have equipment to use Cloud-based services.Virtualized infrastructure (servers, storage, networking)Virtualized physical resources (hardware abstracted for flexible use) Virtualized middleware platforms (tools and environments for application development)Virtualized business applications (software delivered as services) Security is very important, for everyone. The providers and clients must share this responsibility to protect the data, applications and infrastructure.

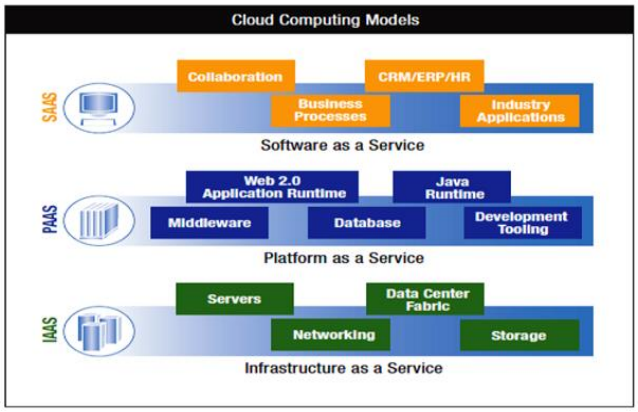

Fig. 2 Models for Delivering Cloud Computing Services [26]

Cloud Computing Architecture: Overview

Cloud computing is basically made up of two things: the people who use it and the cloud itself. Usually people get to the cloud services over the Internet. Some companies also set up their own private clouds, where people can get in through the company's own network.

Figure 3 is about Cloud Architecture. At the heart of Cloud Architecture is a server. This main server is in charge of how the system works and it does things that an operating system does for the cloud. The main server is also called middleware. It helps get things done by making sure users and cloud services can talk to each other. Cloud Architecture relies on this middleware to handle jobs make sure everything gets done fairly and keep everything running well. Cloud Architecture uses middleware to

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manage workloads and balance requests so that Cloud Architecture can be efficient.

There are some good examples of cloud platforms that use this kind of architecture. Amazon EC2 and Google App Engine.

Cloud Computing Entities

Cloud computing entities are made up of a lot of people and companies. The cloud computing system has a main players.The two main groups: cloud providers and cloud consumers. There are some new roles, like cloud service brokers and cloud resellers are important, to the cloud computing entities.

Cloud Providers are companies that can be internet service providers or big telephone companies. Some are large firms that do work for other companies.

Cloud Providers offer things like SaaS and PaaS and IaaS to their customers and, to people who sell things and to retailers. Cloud Service Brokers are like middlemen. They are, between the people who provide the cloud services and the people who use them.

Although Cloud Service Brokers do not own the equipment or run the systems they talk to the providers. Work out deals. They also add services to what the providers offer. This way they can make cloud environments for their clients.

Cloud Resellers are very important when cloud providers want to work with people around the world. Cloud providers can work with companies that help people with computers or other Cloud Resellers to sell cloud services in certain areas.

Cloud consumers are the people who use cloud services. These are the end users. Cloud brokers and resellers are also cloud consumers. They buy cloud services from providers so they can sell them to others. So anyone who uses cloud resources is a consumer.

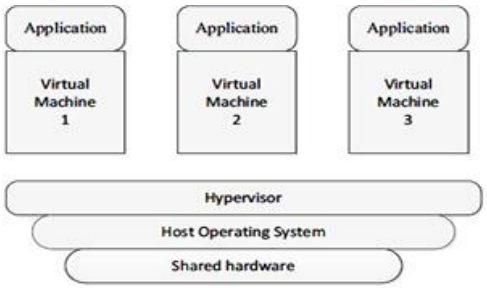

Fig 3: Cloud Architecture [10]

Research Difficulties in Cloud Computing

Cloud computing research addresses the difficulties of enabling applications and development platforms to benefit from cloud computing, as well as the challenges of satisfying the demands of next-generation private, public, and hybrid cloud computing architectures.. The following list includes some of the most difficult cloud computing research problems [31, 41].

- Cloud Data Management & Security
- Cloud Data Management & Security
- Data Encryption
- Migration of Virtual Machines
- Interoperability
- Access Controls
- Energy Management
- Service Level Agreements:

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Service Level Agreements are very important for cloud management. They let you make copies of the same application on other servers if you need to. The cloud uses a priority system to decide what to do. If needed the cloud can. Reduce the use of less important applications. Cloud clients have to be careful when they look at the Service Level Agreements of cloud vendors, like Amazon or Google. One big thing to consider in an SLA is uptime which means how often the service will be working. For example will it be working 99.9 percent of the time or 99.99 percent of the time. This is a deal because it affects how well the Service Level Agreement or SLA works for the customers.

The cloud service provider can only change the security settings from away even for private clouds that are just for their company. They have no way of knowing if these settings are actually being used by the Cloud data. The Cloud data is still at risk because of this. When we are talking about the infrastructure provider they have to do things like make sure everything is safe and private. The infrastructure provider can use something called attestation to check if the security settings of an application have been changed. The infrastructure provider can also use cryptographic protocols to make sure that the infrastructure provider can check the security settings of an application. However virtual machines can move around a lot in a place, like the cloud. The main purpose of software like Map-reduce and Hadoop is to spread out the work of handling amounts of data. These software systems usually work with file systems like GFS and HDFS that are used on the internet.

Migration of Virtual Machines

Migration of Virtual Machines is really useful. Virtual Machines can run lots of programs. They do not need specific hardware to work. This is because of Virtualization. Virtualization is great for cloud computing. It helps move Virtual Machines to make sure the workload is spread out in a data center. This means data centers can provide services that are reliable and really fast.

The idea of moving processes led to the development of Virtual Machine migration. Virtual Machine migration is based on this idea. Virtual Machines can be moved to places. Xen and VMware have come up with something called "virtual machine migration. This means that the virtual machines can be moved from one place to another with short outages. The problem is that it is hard to find out where the hotspots are and start the migration process.

This process is not flexible enough to handle changes in the workload. When we move the machines we need to make sure that the in-memory state is transferred correctly and efficiently. We have to think about the resources of both the servers and the applications. Interoperability is the capacity of two or more systems to cooperate, share, and utilize information effectively. Many public cloud networks are set up as closed systems that are not intended to communicate with each other.

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People are working to fix this problem. The Open Grid Forum, which is a group of companies, is making something called the Open Cloud Computing Interface. This interface has an API that helps control cloud systems. Controlling cloud systems is still a challenge.

Energy Resource Management

Companies that run data centers can save a lot of money on energy without affecting the agreements they have with their customers, which is also really good, for the environment. It has been calculated that 53% of the overall operating expenses of data centers are used for powering and cooling them. In addition to reducing data center energy costs, the objective is to comply with environmental and governmental regulations in the field. Recently, there has been a significant focus on designing data centers that use less energy.

Various approaches can be used to address this issue. For instance, it is now typical to use energy-efficient hardware architecture that permits the reduction of CPU speeds and the shutdown of partial hardware components. Two other strategies to lower power consumption by shutting off underutilized machines are server consolidation and energy-conscious workload scheduling. The study of energy-efficient network protocols and infrastructure has just begun. A major obstacle in all of the aforementioned approaches is achieving a reasonable balance between application performance and energy savings.

The Global Energy Management Center helps businesses understand their energy usage. To save energy businesses can look at their energy usage patterns to see how energy they are using how much it is costing them and how much carbon they are producing. By implementing a Remote Control Unit with the ability to connect to a cloud-based architecture, the center is in a unique position to serve clients worldwide [13].

Multi-tenancy

Multi-tenancy is when people can use kinds of cloud applications over the Internet. These cloud applications can be things like widgets on the Internet or big software applications that companies use. The software vendor stores the data for these cloud applications on their systems. This means that people can get to these applications from anywhere as long as they have the Internet. The cloud applications can be very simple or very complicated, with a lot of security to keep the data safe. Multi-tenancy is what makes it possible for people to use these cloud applications.

There are several reasons for this. The main reason is the cost. When a lot of users use the databases and application servers and hardware it can affect how fast other customers get a response.. For example when a lot of people are using the service at the time it can take longer to get a response but it does not always mean that the computer is working harder.

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Server Consolidation

The cloud offers improved resource utilization and decreased power and cooling needs, made possible by server consolidation. In the context of cloud computing, server consolidation is a useful strategy for optimizing resource utilization and reducing energy consumption. Live virtual machine migration technology is frequently used to move virtual machines (VMs) from several underutilized servers to a single server, allowing the remaining servers to be placed in an energy-saving mode.

A variation of the vector bin-packing problem, an NP-hard optimization problem, is frequently used to define the problem of optimally consolidating computers in a data center. Several heuristics have been proposed to address this issue. Dependencies between virtual machines (VMs), such as communication requirements, have also been considered recently.

This is really important for things that multiple virtual machines share, like bandwidth, memory cache and disk I/O. So it is very important to keep an eye on how machine footprints change and use this information to consolidate servers in a smart way. We need to track changes, in machine footprints and use this data to do server consolidation efficiently with virtual machine footprints. Finally, when resource congestion occurs, the system must respond quickly.

Service Availability and Reliability

Service Availability and Reliability is very important. We need to make sure that cloud services are always available. When we use software as a service from cloud providers we have to be able to get to it all the time. It does not matter if our internet connection is bad or good we still need to be able to use the software. So the software has to be good and work well all the time. This is a problem. For example Apples MobileMe cloud service had some issues. This service is used to store and synchronize data on devices. Service Availability and Reliability of cloud services, like Apples MobileMe is crucial. A lot of customers had trouble getting to their mail and making sure their data was up to date, which made for a start to the service. To stop this from happening providers use things, like Google Gears, Adobe AIR and Curl. Google Gears, Adobe AIR and Curl are important because they help cloud-based applications work on your computer even when you are not connected to the internet.

Common Cloud Standards

Security is a deal when it comes to cloud computing. There are three things that need to be looked at: the technology, the people and how things are run.To get the okay from known groups like ISO (International Standard Organization) there are some rules that need to be followed. For the parts that make things work we can look at an options. We can change the ISO 27001 standard. Use it as the main way to measure things in the SAS 704 framework.

The main problem is that a lot of groups are trying to figure out how to accredit cloud services but no one group is in charge of

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all of them. Another big problem is that we need one organization to be in charge of saying which cloud services are good enough.

The security experts and the Institute for Information Security Professionals and the cloud services all have to work to make this happen. The Institute for Information Security Professionals is very important in this process because they are already working with security experts. We have to make sure the cloud services are safe and the Institute, for Information Security Professionals can help with that. Platform Management is a job.

Platform Management:

The cloud platform is very useful for developers. They can make applications that run on the cloud and use cloud services at the time. Such as platform as a service or PaaS and on-demand platforms. Managing a platform, like this is a challenge because the platform has to be able to change size and grow as needed. This is what makes cloud platforms so special they are elastic, scalable. This new approach to application support is promising. Most of the requirements for an on-premises application, which operates inside an organization, are already present when the development team produces it. While other computers in the ecosystem provide services such as remote storage, an operating system offers fundamental support for running applications, interfacing with storage, and other functions.

Conclusion

Cloud computing is the way to go for companies now. It is what people think will be the big thing, in how businesses use computers. A lot of companies are starting to use cloud computing. This trend is going to keep going. Companies that want to stay of the game can really benefit from using the cloud.

New technologies like internet connections and mobile devices are getting better and better and this gives us new chances to do things but it also makes us worry about keeping our information safe and private. Cloud computing has the issues so companies that provide cloud computing services need to be honest with their clients, about how safe their information really is. Safeguarding sensitive information and maintaining trust are essential for the continued growth and adoption of cloud services.

Cloud computing is really going to be big in the future. It is a safe and affordable way to do things with computers.. Cloud computing is going to be very important, for companies. The way they use technology. Cloud computing will help companies come up with ideas and find new ways to do things.

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