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Why the Cloud is Useful and How ItWorks

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I. HOW DO WEBSITES WORK?

We have a server somewhere, and as a web browser, we want to be able to access thatserver in order to view webpages.
As a client, we will employ the utilisation of a network.
We have a network between us and the server.
The client will discover the network and make use of it to get the data and packets into theserver. The server will then respond to us.
We'll get a response, and we'll be able to look ata website.

Obviously, that is a simplified version.
However, this provides you an idea.
Now it's up to the clients to locate the server as well as the server's task of locating the clients IP addresses are required. As a result, IP addresses are assigned to clients. An IP address is also assigned to a server. As a result, when you utilise an IP address, the notion is that You can submit a request to anyone or anywhere. to the server of your choice, and the server will be able to locate you. This is quite similar to when you're in high school. composing some notes to afriend!
For example, you would write a letter, and that would be your data, and you would be the client,then when you send the letter you put it in your mailbox, and then the network will be the network of the post office, then the post office will use network and the address you put on the letter to route your letter to the destination, which is, in this case, the server, and then if yourcorrespondent wants to reply you back, they can use the address you put on the back of the envelope to write you back, and again, use the same network to get the letter back to you. So, servers are just like the network of your mail.
Hopefully that's a good analogy.

II. WHAT IS IN A SERVER?

A server is going to contain a CPU, and aCPU is a little piece that will be doing some computations, it will be very helpful to do some calculations and find results, and then, your server also needs RAM, or memory. This is going to be very, very fast memory, which will allow us to store information and retrieve it very quickly. So, when we have a CPU and a memorybar, what do we get? Well, we get a brain. Thinkof your brain. When you are thinking, you are actually making computations, very complicatedones, but they are computations, but then you need to retain some information, and again, we have memories and these memories are in our brain, so if we think of the CPU and the RAM together, they sort of look like a brain. Now we also need to have some more long-term storage of data. Obviously, it's still in our brain as humans, but in computers, we have included some special storage to store data, for example, files, and then if we want to store the data in a more structured way, we're going to use a database, and a database is going to be data formatted in a way that we can easily search it and query it.
Finally in the server, we're also going to have some networking aspect. So, there's going to be the routers, switch, DNS servers, and don't worry, all these terms, we'll be seeing them later on in this course. So, in the server, we an aspect of compute, memory, storage, maybe your serversometimes is a database, and we have a networking aspect. All these things are going to super important going forward because the cloudis going to be giving these things for us on demand. So, if we just want to define a little bit of IT terminology before we get started, the network is a bunch of cables, routers, and serversthat are going to be connected with each other, and the router is a specific device that will forward the data packets between computer in the networks, and they will know where to send your packets on the internet, just like your post delivery service. Now when we have a packet and it arrives as a destination, there's a switch, and the switch will send the packet to the correctclients on your network. So, if we put all these things together, it looks like this. Our client will send the data to a router, the router will find its way all the way to a switch, and the switch will know to which computer in your network to sendthe data to. So why do I introduce all these things?
Well, let's go back to traditional IT. When people used to start websites or companiesbefore, they used to do it in their home or their garage, and so they would literally go to the store, buy a server, and they put the server in their home. You may have seen TV shows, you may have read some documentation on the internet that describes on how Google was made.

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You know, Google was started in a garage. Now, as your website grows, you need to add more and more servers to serve that demand, and so your home starts to be filled with servers. So this bad right, but your company is getting bigger, you're generating some money, so you're going to move to your own office, and you decide to allocate a special room which is going to be called a data center. In a data center, you're going to have, again, your servers, and you're going to be able to scale them by adding and purchasing more and more servers. Now this worked, and this worked for so many years, but there are a few problems with this approach.

Number one is that when you have a datacenter or your own home, you're going to have to pay your rent, then you're going to have to add power supply, cooling, and maintenance because it does require some electricity to run your servers, it does require some cooling because the servers do get hot, and sometimes they break down, so you need someone to do the maintenance. On top of it, if you want to add or replace servers, it will take a lot of time because you have to order them, and then you have to hook them up in your center. Scaling is limited. If tomorrow you're getting 10 times bigger, you're going to need 10 times more servers, but you may not have the time or the space to do so. You also need to hire a team that is going to be there all the time, 24/7 to monitor the infrastructure in case something goes wrong.

And what if there is a disaster, what if there is an earthquake, what if there's a power shutdown, or even a fire? That would be bad, right? So, can we externalize all this? And the answer is yes, and that will be the cloud.

III. WHAT IS CLOUD COMPUTING?

Cloud computing is defined as the distribution of computational power, database storage, applications, and other IT resources on demand. The phrase "on-demand" is crucial in this context. You receive it when you require it. After that, using a cloud service platform, you'll be charged on a pay-as-you-go basis. That means you'll just have to pay once. for what you asked for when you asked for it, and while you're using it, and after you've finished using it, you won't be paying any longer. Isn't this a significant shift?

After that, there's cloud computing. As a result, we'll be able to provide exactly the proper type. and the amount of computer power you'll need.

Do you need a big server? We have that for you. Do you want a small one? We have that too. Do you want 10? Yes. Do you want two tomorrow? Of course. The cloud really allows you to adapt to the type and size you need. Then you can access all these resources, not with 24-hour notice, not with two hours of notice, but instantly, you don't need to order things in advance. When you want a server, and you'll see this in this course, you'll have it within seconds. Then the cloud will also give you a really nice interface so, you can easily access your servers, your storage, databases, and a set of application services.

Something about the cloud, but in specific AWS, which is Amazon Web Services own's and maintains the network-connected hardware required for these application services while you provision and use what you need via a web application. So, with this interface, we'll make all these things a reality. Now, let's go back to our traditional IT. So, we're changing. We have our office or our garage, but now instead of building our own data center we're going to use the cloud, and in the cloud, which is also a data center, is just not our data center, we're going to have servers one, two, three, as we need and as we go and we're just going to pay for exactly what we're using.

So, you have actually been using the cloud without even knowing it because it is omnipresent, but not necessarily visible. So, if you use a web client such as Gmail, well, for example, it's an email cloud service and you're going to pay only for the emails you stored.

You're not provisioning servers when you use Gmail, you just use it. Maybe you've stored some data on the cloud, maybe through Dropbox, Google Drive, Google Photos, iCloud, I don't know. But with Dropbox, for example, it's a cloud store service, you're going to put your files on Dropbox. And originally, fun fact, Dropbox was built on AWS. So, we've been using a cloud storage service as well without knowing it. And Netflix, it's huge. It is built entirely on AWS and it provides you a cloud service, which is to get video on-demand.

Now, obviously these cloud services are very different from AWS, but we'll learn what it goes behind these services and how AWS can help you build these kinds of cloud services. So, let's go one step further.

There are different kinds of clouds out there.

The first one is called a Private Cloud and the provider is, could be Rackspace. This is cloud services used by a single organization, they're not exposed to the public, So, you get your own private cloud, your own private data center, it's just managed by someone else. You still have complete control over it and you have more security for a sensitive application, which may need some specific business needs.

Now the Public Cloud is more interesting. So, three famous cloud providers thatare public, are Microsoft Azure, Google Cloud, and Amazon Web Services. So, in this case, the cloud resources own and operated by a third-party cloud service provider and they're delivered over the Internet and we'll see the sixadvantages of using cloud computing.
So in this instance, that means that from AWS,we'll be able to request what we need when wewant it.
The last one is Hybrid Cloud; we're actually getting the mix of private and public. We're going to keep some servers on premises and we'll extend some of the capabilities we need into the cloud. That means that we'll have ahybrid of our own infrastructure and the AWS cloud. We'll have control over sensitive assets in your private infrastructure, but we'll have the flexibility and the cost effectiveness of using thepublic cloud.

IV. CHARACTERISTICS OF CLOUDCOMPUTING

1) *On-demand self-Service:* Users can provision resources and use themwithout human interaction from the service provider
2) *Broad network Access:* Resources available over the network, and canbe accessed by diverse client platforms
3) *Multi-tenancy and Resource Pooling:* Multiple customers can share the same infrastructure and applications with security and privacy Multiple customers are serviced from the samephysical resources
4) *Rapid elasticity and Scalability:* Automatically and quickly acquire and disposeresources when needed Quickly and easily scale based on demand
5) *Measured Service:* Usage is measured, users pay correctly for whatthey have used

V. ADVANTAGES OF CLOUD COMPUTING

Trade capital expense (CAPEX) for operationalexpense (OPEX) Pay On-Demand: don't own hardwareReduced Total Cost of Ownership (TCO)&Operational Expense (OPEX)
Benefit from massive economies of scale Prices are reduced as AWS is more efficient due to large scale
Stop guessing capacity Scale based on actual measured usage
Increase speed and agility Stop spending money running and maintainingdata centers
Go global in minutes: leverage the AWS global infrastructure

VI. PROBLEMS SOLVED BY THE CLOUD

Flexibility: change resource types when neededCost-Effectiveness: pay as you go, for what youuse
Scalability: accommodate larger loads bymaking hardware stronger or adding additional nodes
Elasticity: ability to scale out and scale-in whenneeded
High-availability and fault-tolerance: buildacross data centers
Agility: rapidly develop, test and launchsoftware applications

VII. TYPES OF CLOUD COMPUTING INFRASTRUCTURE AS A SERVICE(IAAS)

1) Provide building blocks for cloud IT
2) Provides networking, computers, data storagespace
3) Highest level of flexibility
4) Easy parallel with traditional on-premises IT

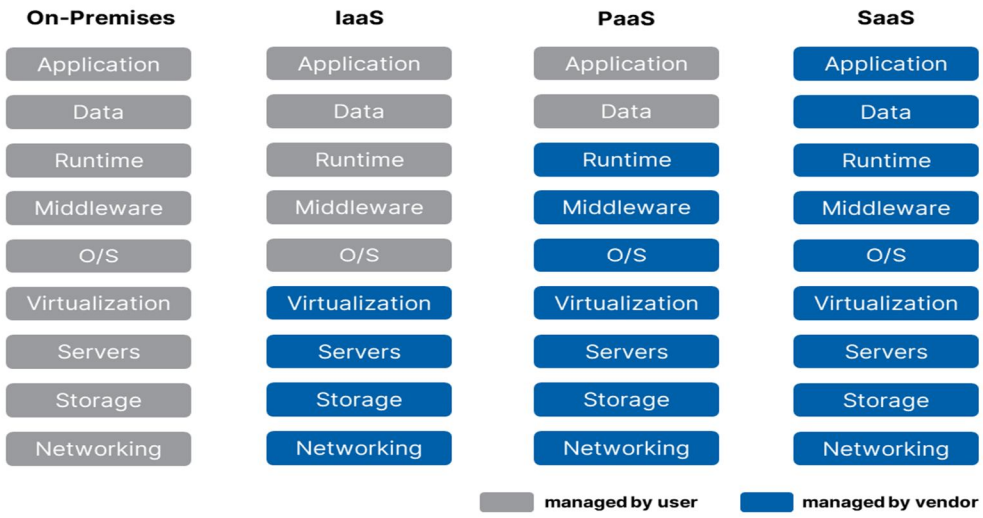
A. Platform as a service (PAAS)

Removes the need for your organization tomanage the underlying infrastructure Focus on the deployment and management ofyour applications

B. Software as Service (SAAS)

Completed product that is run and managed bythe service provider So, if you want to compare all these things, well, let's take an example. On-premise isyou're going to manage everything. So, your applications, your data, your runtime, your middleware, the operating system, virtualization,servers, storage and networking. And that's a lot.With IaaS, Infrastructure as a Service, we're going to manage the application, the data, the runtime, the middleware, and the OS, but all the virtualization, servers, storage and networking, are going to be managed by others. And in our case, AWS. With Platform as a Service, we manage even less. So, everything from the runtime to the networking is managed by AWS.

And the only thing we care about when we use aPlatform as a Service is our application and our data. And finally, well if you're using Software as a Service, everything is going to be managed by AWS.



VIII. EXAMPLE OF CLOUD COMPUTINGTYPES

A. Infrastructure as a Service

1) Amazon EC2(on AWS)

2) GCP, Azure, Rackspace, Digital Ocean, Linode

B. Platform as a Service

1) Elastic Beanstalk (on AWS)

2) Heroku, Google App Engine (GCP), WindowsAzure (Microsoft)

C. Software as a Service

1) Many AWS services (ex: Recognition forMachine Learning)

2) Google Apps(Gmail), Dropbox, Zoom

IX. HISTORY OF CLOUD COMPUTING

Prior to the advent of cloud computing, there was Client/Server computing, which is essentially a centralized storage system in which all software applications, data, and controls are stored on the server side. If a single user has to access specific data or run a programmer, he or she must first connect to the server and get authorized access before proceeding. Following that, distributed computing emerged, in which allcomputers are networked together and share resources as needed. Cloud computing concepts arose as a result of the aforesaid computing and were later implemented.

In a speech at MIT in 1961, John MacCharty proposed that computing be sold as autility, similar to water or electricity. It was a fantastic idea, but like many brilliant ideas, it was ahead of its time, as despite interest in the model, technology was just not ready for it for the following few decades. But, of course, time has gone, and technology has caught up with thatconcept, and after a few years, we can say: In 1999, Salesforce.com started delivering of applications to users using a simple website. Theapplications were delivered to enterprises over the Internet, and this way the dream of computing sold as utility were true.

In 2002, Amazon started Amazon Web Services,providing services like storage, computation andeven human intelligence. However, only startingwith the launch of the Elastic Compute Cloud in2006 a truly commercial service open to everybody existed.

In 2009, Google Apps also started to providecloud computing enterprise applications.

Of course, all the big players are present in the cloud computing evolution, some were earlier, some were later. In 2009, Microsoft launched Windows Azure, and companies like Oracle andHP have all joined the game. This proves that today, cloud computing has become mainstream.

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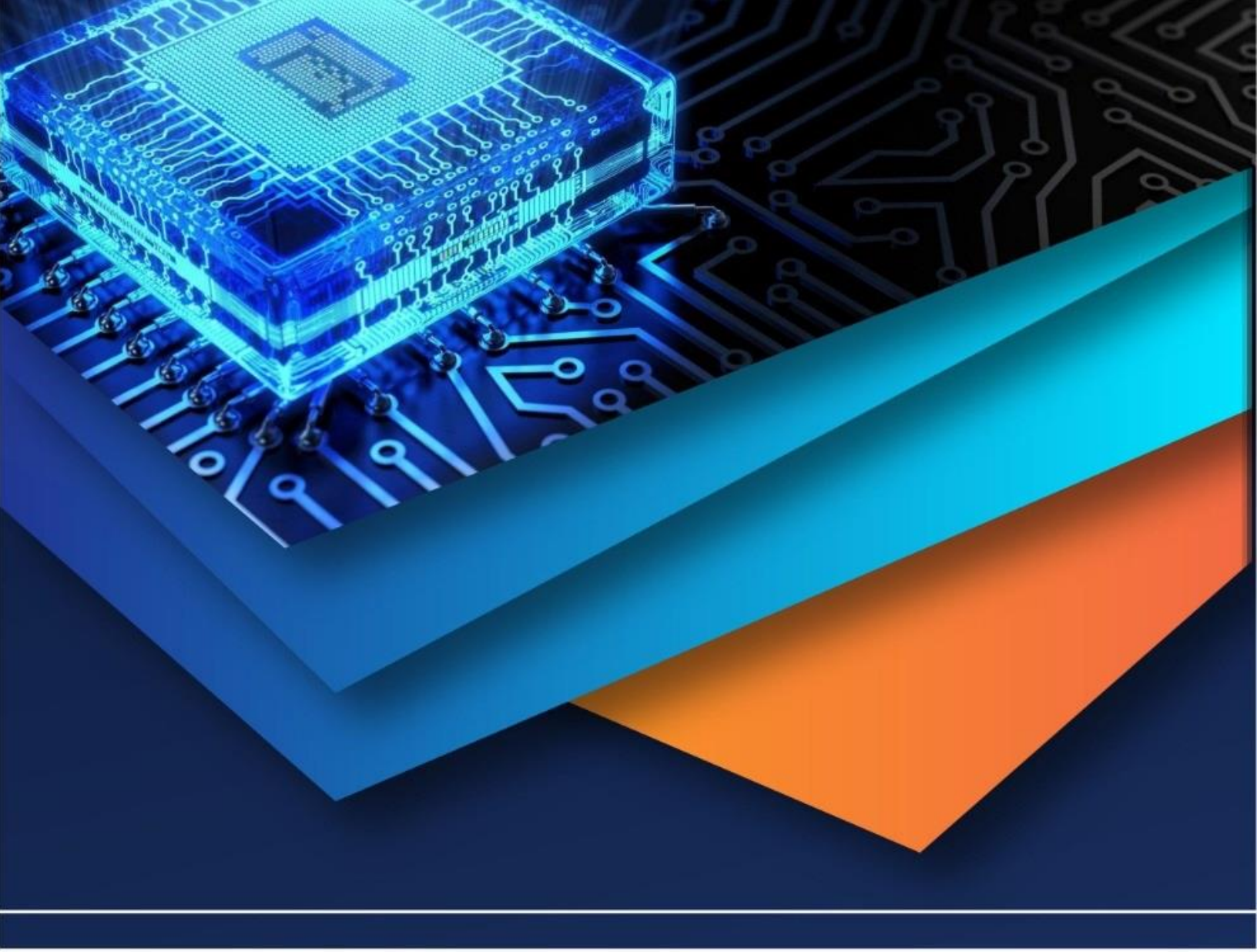
X. CONCLUSION

Cloud computing heralds the start of a new era inthe field of data and communication technology, since it is accompanied by a development paradigm that has the potential to alter the way computing is done. Users are still becoming conscious as a result of this knowledge, and a shift from conformist subtracting to cloud computing will occur, but only gradually. Developers with unique ideas for online serviceswill no longer need to pay big sums of money tostructure their programmers and tools substructure abilities thanks to this technology.

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