



Study and Implementation of Simple Storage Service on Cloud

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ABSTRACT

In the past few years, cloud computing has become a crucial part of most of the organizations as it enables the business to access services on the Internet. Cloud computing is rapidly growing technology that provides a safer way of storing and sharing information. With traditional computing, the end user needs to purchase server space, has limited access to the storage, and data centers are located locally. Whereas in cloud computing, there is a concept of renting than owning and can be done on a pay-per-use paradigm. In this paper, we study about cloud computing technology from various aspects such as definition, vital characteristics, cloud models and use Amazon Web Services to implement the file storage service on cloud.

Key words: Amazon Web Services, Cloud Computing, Elastic Compute Cloud, Simple Storage Service.

1. INTRODUCTION

Cloud computing is changing our everyday life in many ways. In today's world, cloud technology is trending among business environments. Cloud technology impact our lives on many levels such as social impact, health, development, education and many more. Basically, Cloud is a metaphor for the Internet. Cloud computing is a growing technology where anybody or any organization can opt the services as a platform, infrastructure and software. While opting the cloud services, one can store their data and access it via the Internet instead of using a computer hard drive. It enables a customer to store and share information to remote locations. It provides system software and hardware in the data centers and applications as services over the Internet in a pay-as-you-go manner.

In this paper, our objective is to come up with the concept of Cloud Computing: definition, key characteristics, deployment models, service models, and file storage service on Amazon Web Services (AWS). The remainder of this paper is structured as follows: the concept of cloud computing is discussed in Section 2. Section 3 presents the of Cloud Computing features. Section 4 reviews cloud models i.e., deployment models and service models. Section 5 illustrates the usage of AWS services for downloading files, uploading files and hosting a website using Amazon S3. Also, the

security rules for the authorized data access. Section 6 concludes the whole paper.

2. DEFINITION OF CLOUD COMPUTING

In the 1960s, John McCarthy proposed that cloud computing facilities would be organized as a public utility [3]. Only the services they use must be paid by a customer. Cloud computing is used for remote server data storage, server data processing and access data via the Internet. It offers servers, online data storage, applications, and infrastructure.

The NIST Definition of Cloud Computing “Cloud Computing is a model for enabling ubiquitous, 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 [1].”

Some cloud providers are Amazon Web Services, IBM Cloud, Google Cloud Platform, Microsoft Azure, DigitalOcean and terremark.

Figure 1 shows the NIST definition of cloud computing that includes essential characteristics, service and deployment models as given below:

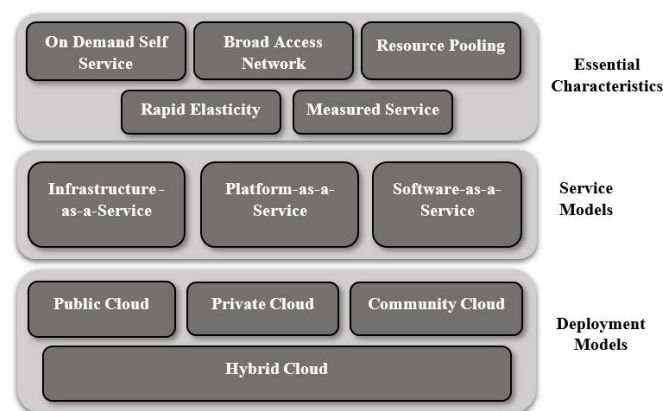


Figure 1: The NIST Definition of Cloud Computing

3. CHARACTERISTICS OF CLOUD COMPUTING

On Demand Self Service. Cloud Computing provides resources (e.g., storage, applications, server time) on demand, i.e., when the user needs it [2], which can be done with minimal human assistance. The user can request and be provided with access to the offered service automatically by the cloud infrastructure.

Broad Network Access. The cloud environment is entirely network-based, it can be accessed from any place and at any time. Resources are available over the Internet and the consumer can access cloud services via any device with the Internet connectivity such as laptops, smartphones, PDA or tablets.

Resource Pooling. The cloud service provider offers a pool of computing and storage resources to assist multiple users using multi-tenancy, with resources assigned dynamically. For instance, one can share a single physical instance of hardware, software, processing, database, network bandwidth, and basic infrastructure.

Rapid Elasticity. Cloud Computing resources can be provisioned automatically and rapidly. Resources can easily be scaled horizontally or vertically at any time based on increasing or decreasing service demand and user load. Elasticity boosts the utilization of cloud capabilities.

Measured Service. The cloud computing vendor provides the resources (e.g., processing, amount of storage space used, bandwidth, number of network I/O requests, etc.) to the consumer on a pay-per-use basis. It works for both providers and consumers to monitor, control and report the utilized service.

4. CLOUD MODELS

Deployment Models

Public Cloud. The services are available through a network that is easy for the general public to access. An organization that sells cloud services may own it. Amazon is the largest public cloud provider [2].

Private Cloud. The infrastructure allows the services to be accessible within a single organization which is why it is also called the internal cloud. It can be administered internally or by a third party. Because of its private nature it is extremely secured.

Community Cloud. A group of organizations share the cloud services that have similar computing concerns forming a community. A third-party or internal / external service supplier may provide it.

Hybrid Cloud. Integration of two or more cloud infrastructures, i.e., private, public or community cloud. The non-critical tasks are performed using the public cloud, while the critical activities are performed using a private cloud.

Service Models

Infrastructure-as-a-Service (IaaS). The name speaks for itself, as this service provides cloud infrastructure such as virtual storage, virtual machines, networking resources and servers on the charge-per-use paradigm. Major IaaS suppliers are Amazon EC2 [3], Linode and GoGrid [6].

Platform-as-a-Service (PaaS). This service provides the user (i.e., software developer) with the platform including runtime environment for developing, testing, deploying and managing applications. Major PaaS suppliers are Windows Azure [5], Google App Engine [3] and Heroku.

Software-as-a-Service (SaaS). A software application is hosted as a service and delivered to the end user over the Internet using a web browser or a program interface on a pay-as-you-go basis [7]. Major SaaS suppliers are Salesforce.com, Microsoft and SAP.

5. FILE STORAGE SERVICE ON CLOUD

“A cloud file storage is a method for storing data in the cloud that provides servers and applications access to data through shared file systems [4].”

Amazon Web Services - Amazon Web Services (AWS) is a secure cloud service platform providing computing power, database storage, content delivery and other functionalities to assist, scale and develop companies. It offers a broad variety of services from which we focus on compute, storage and security, identity, & compliance services.

5.1 Amazon Elastic Compute Cloud

Amazon Elastic Compute Cloud (EC2) provides several virtual computers, each with various operating systems [12].

To create an EC2 Instance:

- (a) **Choose AMI** - Amazon Machine Image is a template containing the configuration of the software necessary to launch your instance.
- (b) **Choose Instance Type** - Instances are virtual servers capable of running applications. They have different combinations of storage, memory, CPU and networking capabilities, and offer you the flexibility to choose the right combination of resources for your applications.
- (c) **Configure Instance** - You can launch various instances from the same AMI, request Spot instances to take advantage of the reduced pricing, assign the instance a function of access management, and more.
- (d) **Add Storage** - You can add extra EBS volumes to your instance and instance store volumes, or edit the root volume settings.
- (e) **Add Tags** - A tag is a case-sensitive pair of key-value. Tags for all instances and volumes will be implemented.
- (f) **Configure Security Group** - A security group for your instance is a set of firewall standards that regulate the traffic. To enable particular traffic to reach your instance, you can add rules. You can generate or pick from a current security group.
- (g) **Review** - Please review the information of the launch of your instance. For each section, you can go back to editing modifications. Click Launch to assign your instance to a key pair and finish the launch process.

5.2 Amazon Simple Storage Service

Amazon Simple Storage Service (S3) enables customers to store big quantities of high-availability information [12]. User can create a bucket and store data objects in the following bucket. For example, a web page having an image can be found at

`https://s3.ap-south-1.amazonaws.com/bucketthesis/NIST.png`
The bucket with key *bucketthesis* contains an object with the key *NIST.png*. Slashes shows an arbitrary depth hierarchy.

To create a S3 Bucket:

- (a) **Name and region** - Create a bucket by providing a unique name across all the existing buckets and the AWS region where the bucket is created.
- (b) **Configure options** - Amazon S3 supports sub-resources for storing and managing bucket configuration information such as versioning, tags, server access logging, and default encryption.
- (c) **Set permissions** - Amazon S3 allows user with additional permissions to perform any other bucket operations.
- (d) **Review** - Please check the details of your bucket creation. For each section, you can go back to edit changes.

5.3 PuTTY

PuTTY is an open source application and a free secure shell client for Windows [8]. It is used to connect from the Windows to the Linux instance.

After launching an instance, there are following conditions that needs to be completed before connecting to the Linux instance using PuTTY. They are as follows [8]:

1. General requirements should be verified for connecting to the instance.
2. On the local computer, install PuTTY.
3. By using PuTTYgen, convert the private key.

Once we are connected to the instance, we can login using the following user names as [8]:

1. ubuntu is the username for an Ubuntu AMI.
2. ec2-user is the username for the Linux AMI.

Connecting to the Linux Instance using PuTTY

1. Start PuTTY.
2. Select Session and copy the Public DNS (IPv4) in the Host Name (or IP address) in the Category panel.
3. Expand Connection, in the Category panel, expand SSH, and then select Auth.
4. Select Browse and select the .ppk file you created for your key pair, and then select Open to begin the PuTTY session.
5. Choose Yes for a security alert dialog box. A window will open and you will be connected to your instance.

5.4 Download and Upload Files

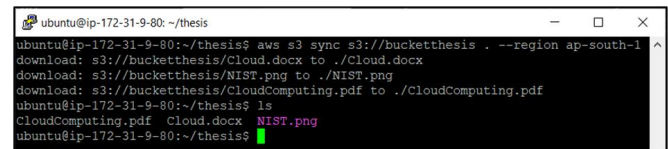
Once a bucket has been created, we can upload different types of files i.e., .html, .png, .txt, .docx, .pdf and many more in it. The bucket should be publicly accessible so that we can upload and download file to and from Amazon S3 through the AWS command line interface over the Internet.

To Download a File

To download a file from Amazon S3 through a command line interface, the AWS command is:

aws s3 sync s3://bucketname .

Figure 2 shows the Amazon Web Services command line interface to download the files as given below:



```
ubuntu@ip-172-31-9-80: ~/thesis
ubuntu@ip-172-31-9-80:~/thesis$ aws s3 sync s3://bucketthesis . --region ap-south-1
download: s3://bucketthesis/Cloud.docx to ./Cloud.docx
download: s3://bucketthesis/NIST.png to ./NIST.png
ubuntu@ip-172-31-9-80:~/thesis$ ls
CloudComputing.pdf  Cloud.docx  NIST.png
ubuntu@ip-172-31-9-80:~/thesis$
```

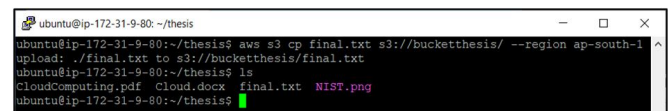
Figure 2: AWS CLI to download files

To Upload a File

To upload a file to Amazon S3 through a command line interface, the AWS command is:

aws s3 cp filename s3://bucketname/

Figure 3 shows the Amazon Web Services command line interface to upload the files as given below:



```
ubuntu@ip-172-31-9-80: ~/thesis
ubuntu@ip-172-31-9-80:~/thesis$ aws s3 cp final.txt s3://bucketthesis/ --region ap-south-1
upload: ./final.txt to s3://bucketthesis/final.txt
ubuntu@ip-172-31-9-80:~/thesis$ ls
CloudComputing.pdf  Cloud.docx  final.txt  NIST.png
ubuntu@ip-172-31-9-80:~/thesis$
```

Figure 3: AWS CLI to upload files

5.5 Host a Static Website

AWS offers solutions for cloud web hosting. Static websites deliver images, HTML, JavaScript, videos and other files and are used to deliver personal or marketing sites [11].

To host a static website, perform the following steps [9]:

1. Configure the S3 bucket to host a website.
2. Upload the content of the website to the bucket.
3. Make the bucket public read access.
4. The website is then available at the bucket endpoints specific to the AWS region.

5.6 Security Rule – Bucket Policy and IAM Policy

Bucket Policy

Bucket policy is an AWS Identity and Access Management resource-based policy. We can add a bucket policy to grant access permissions for the bucket and the objects in it to other AWS accounts or IAM users [10].

Use bucket policy generator that uses JSON-based access policy language for creating a bucket policy for a specific bucket. An AWS Policy Generator is a tool for creating policies that control access to the products and resources from AWS.

To create bucket policy:

- (a) **Select Policy Type** - Select the type of policy.
- (b) **Add Statements** - A statement is the formal description of a single permissions. Enter the values for the following: Effect, Principal, AWS Service, Actions and ARN.
- (c) **Generate Policy** - A policy is a document that acts as a container for one or more statements. We get a code that uses JSON-based access policy language.

IAM Policy

Identity and Access Management is a service from AWS which uses the concept of access management and allows you to give it to your users who are going to use your account. You can give permissions to different users who are using the same AWS account that you have created. You can have one AWS account on which a number of people can work.

Components of IAM

- (a) **Users** – Create IAM users to grant people or applications access to your AWS account.
- (b) **Groups** – Create groups to manage access for multiple IAM users.
- (c) **Roles** – Create roles to grant AWS services and external identities access to your AWS account.
- (d) **Policies** – Use policies to define permissions for IAM users, groups, and roles.

6. CONCLUSION

The cloud technology has the potential to provide access the applications as a utility over the web and helps business owners to take better decisions. Cloud computing helps users to reduce management responsibilities, reduce costs and configure the applications online any time.

In this paper, we have studied about cloud computing, covering its concepts, characteristics and successfully implemented the AWS services for (a) downloading and uploading files using an Amazon EC2 instance through AWS command line interface; (b) hosting a website using Amazon S3; and (c) applying Amazon S3 Bucket Policy and IAM Policy for the authorized users to access the data. As part of our future work, our focus will be on implementing other AWS services and policies.

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