Dissertation on

Media service using Amazon CloudFront of AWS Cloud Computing.

Thesis submitted towards partial fulfilment
of the requirements for the degree of

Master of Technology in IT (Courseware Engineering)

Submitted by
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I hereby declare that this thesis contains literature survey and original research work by the undersigned candidate, as part of his **Master of Technology in IT (Courseware Engineering)** studies.

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I feel extremely glad while presenting this dissertation at School of Education Technology, Jadavpur University, Kolkata, in the partial fulfilment of the requirement for the degree of Master of Technology in IT (Courseware Engineering).

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ABBREVIATIONS

Acronym	Full-Name
AWS	Amazon Web Service
AWS S3	Simple Storage Service
AWS EC2	Elastic Cloud Compute
QoE	Quality of Experience
QoS	Quality of Service
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
CDN	Content Delivery Network
IoT	Internet of Things
AR	Augmented Reality
VR	Virtual Reality
PLR	Packet Loss Ratio

Executive Summary

With the advancement of science and technology our lives have become much easier and comfortable. One of such example of technology is internet. We can use internet for various important reasons, one of them is for entertainment. This entertainment is in the form of multimedia. It can be in the form of text, graphic, audio and video. Out of all of them we prefer video for our entertainment. The genre of video can be different for different people according to their choice. Nowadays with the help of high speed internet we can enjoy videos anytime in anyplace on desktop, laptop or mobile phones. So, there is always a demand for such media service. Service providers find various ways to provide high quality video to the end users. One such way is using Cloud Computing. We can use Amazon Web Service (AWS) service like Simple Storage Service (S3) for media service.

But in this service, we come across various flaws which are not desirable by the service providers. It ranges from security issues to latency issues. So, we are solving the above mentioned problems using AWS CloudFront service. It is a light weight edge computing facility. It helps to provide fast and low-latency experience to the end user. So, this is achieved when we connect this AWS CloudFront with the S3 bucket in which media service website containing videos are hosted. Here, two technologies, Cloud computing and Edge compute facility are combined. As a result, we are able to overcome various challenges and enhance the user experience of video streaming without any compromise.

Chapter 1.0: INTRODUCTION

With the advancement of internet, we are streaming videos of high quality for various personal reasons. It can be for entertainment, education, tutorial etc. Various media service providers are designing platforms to make this process much easier, economical and lag free. Previously, we used to buy domains and servers where we uploaded media service website. But this was very expensive and full of lag.

This problem discussed was solved with the advent of Cloud Computing technology. Cloud computing is a technology where delivery of different kind of services happens through the Internet. These resources include data storage, servers, networking, databases, various software. Cloud computing is named such because the information being accessed is found remotely in cloud or virtual space. Fig.1 shows Cloud Computing Environment overview and its kinds.

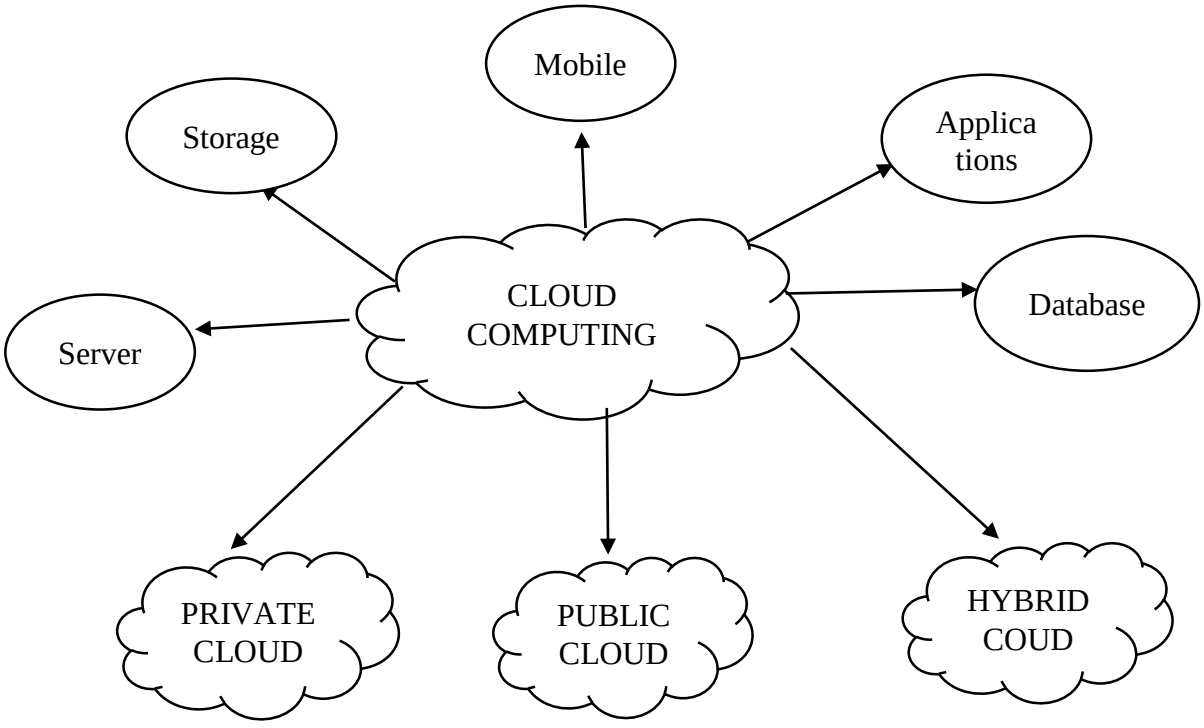

Fig 1: Cloud Computing Environment

There are various service providers across the world which provide cloud computing. Some of them are as follows:

a. Amazon Web Service (AWS)
b. Google Cloud Platform
c. Microsoft Azure
d. IBM Cloud Services
e. Adobe Creative Cloud

Out of these AWS is chosen in our work. AWS provides various services like S3, EC2, AWS Lambda, AWS CloudWatch etc. All these services are useful easy to use and cheaper. These services are pay as you go system. Apart from this, AWS ensures highest levels of availability and security which makes it more attractive to the clients.

1.1 Edge Computing

In spite of so many benefits of using Cloud Computing there lies many flaws which one cannot avoid. There exists a new advanced technology similar to Cloud Computing known as Edge Computing. Edge computing is a distributed information technology architecture where client data is processed at the periphery of the network, close to the originating source as possible. It can be used for Content Delivery Network to deliver media. For this, AWS has a service name AWS CloudFront. The benefits of using AWS CloudFront are as follows:

- It provides security with the help of 'Content Privacy' feature.
- It is less expensive.
- It will cache the content in edge locations and decrease the distance, thus resulting in high availability of applications and ensures low latency and many more.

1.2 Problem Statement

To design and develop a deliver video file using Cloud Computing.

1.3 Objectives

- ❖ To study the process of content delivery by using Cloud Computing.
- ❖ To find out the short comings such as video quality, latency and security of the content delivery process by using Cloud Computing technology.
- ❖ To find out a new age technology to address the above mentioned limitations.

1.4 Assumptions and Scopes

1.4.1 Assumptions

- ✓ The internet bandwidth is assumed to be same in all time.
- ✓ One video taken is of 23.3MB of file size.

1.4.1 Scopes

- ✓ Streaming 8k quality video
- ✓ Playing advances video games on low end devices
- ✓ Self-driving cars

1.5 Organization of the Thesis

Chapter 1 Introduces the research work in brief. It covers problem statement, objectives, assumptions, scopes.

Chapter 2 discuses Literature Survey.

Chapter 3 presents the proposed approach for content delivery.

Chapter 4 includes experimentation details.

Chapter 5 presents Comparative Analysis and Results of the proposed system.

Chapter 6 concludes the research work and indicates future works and further improvements.

References includes all the references used in this research work.

Appendix contains some code snippets of the system.

CHAPTER 2.0: LITERATURE SURVEY

The OTT (Over The Top) video streaming apps like YouTube, Netflix etc. have been dominating the IP traffic throughout the world. This traffic shall continue to grow with the introduction of high quality of video resolution like 4K. Apart from this, internet traffic is also increasing due to emerging of 5G technology applications such as IoT, higher definition videos and Virtual Reality applications. Because of these reasons the service providers need to find out a way to ensure that the content is delivered quickly irrespective of their customer's location. It is seen that more than 50% of OTT video traffic is delivered with the help of CDN that is Content Delivery Network (CDN) [1].

Cloud Computing is a very important technology in the Information Technology sector. It has revolutionised this sector in numerous ways. For example, it has helped in catering the growing demands of IT infrastructure and storage.

The striking ability of Cloud Computing is to provide resources in the form of software and hardware over the network. Cloud Computing provides numerous services which can be hired and used as pay per use basis. We can broadly divide this cloud as follows:

- **Private cloud**: This kind of cloud works for particular business or organization only, not for public access.

- **Public cloud**: This kind of cloud provides services and infrastructure to any organization or public. Here, resources can be shared among large number of people. For example, Google, Microsoft and Amazon
- **Community cloud**: In this kind of cloud, the services and infrastructure are provided to particular organization of same interests.
- **Hybrid cloud**: This kind of cloud is a mixture of both public and private cloud. Though they are mixed together, still it has individual identity therefore providing multiple kinds of deployment [2].

Cloud Computing provide three services named Software as a Service (SaaS), Platform as a Service (PaaS) and finally Infrastructure as a Service (IaaS).

- **Software as a Service (SaaS):** The process of providing software as service over internet is called Software as a Service (SaaS). Instead of installing the software into the user's computer one can simply access the software with the help of internet. It makes it hassle free for users to install the software by following complex steps. Users of SaaS do not need to buy the software or need to install it. One only needs to make sure that there is constant internet access to use the service. For example, Google apps like Gmail and Microsoft Office 365.

- **Platform as a Service (PaaS):** Here, a development environment or platform is provided to the users where they can deploy their software or can do coding. The customer can also run their project or application on this platform. It provides a mixture of

application server, operating system etc. For example, Apache, MySQL etc.

- **Infrastructure as a Service (IaaS):** Computing services provided by IaaS includes network, storage, operating system on demand. IaaS users can avail these services using wide area network such as internet. For example, users can use Virtual Machines using IaaS platforms [3].

For media streaming, cloud is used. So, AWS is used to serve the purpose. By using AWS, performance of video streaming is increased in many ways. Apart from that AWS has numerous benefits:

a. Scalability: In AWS we can increase the number of servers when the demand for server increases.
b. No upfront investment: There is no cost for creating a media server.
c. Flexible capacity: When we increase the number of servers we need to increase number of memory resources. This can be done in easier ways.
d. Security: Various features are there to ensure security.
e. Speed and agility: Speed is always high as the AWS components have high speed network connections [4].

In order to maintain storage, we have S3 (Simple Storage Service) from AWS. This kind storage comes under block storage. S3 bucket provides unlimited storage and this can be accessed by using URL. Here in the bucket files are uploaded. Global unique name can be assigned as it has universal namespace. Its bucket consists of access control list and policies to control the logs [5].

Amazon S3 pricing model is based on four primary factors. They are number of uploads (PUT requests), downloads (GET requests), amount of data that gets out of cloud and amount of spaces used. LIST and PUT requests are more expensive here. Still AWS is economical [6].

Table 1: S3 pricing model [6]

Amazon S3 Cost (US-West-2)	
Storage	**Cost per GB**
First 50 TB/ month	$0.023
Next 450 TB/month	$0.022
Over 500 TB/ month	$0.021
PUT Requests	Cost per 1000 requests
	$0.005
GET Requests	Cost per 10000 requests
	$0.004
Data Transfer OUT	Cost per GB
First GB/ month	$-
Up to 10TB/ month	$0.090
Next 40TB/ month	$0.085
Next 100TB/ month	$0.070
Next 350TB/ month	$0.050

Some of the advantages of Amazon Web Service S3 are discussed below:

I. Creating Buckets: Here, buckets are the main container for storing required information in Amazon S3. Buckets should have unique name so that we can create DNS handle.
II. Storing data in different buckets: We can store endless information in the buckets. We can import the files many number of times we like. Objects which are saved should have unique key.
III. Security: Amazon S3 provides range of security tools to protect from fraudulent people accessing the files.
IV. Permissions: There is an authentication system in S3 which permits or restricts people for accessing or sharing from S3.
V. Downloading data: The data can be accessed by the authorised user anytime and anyplace from S3 [7].

With Edge computing, there is a paradigm change in the way workloads and processing moving away from cloud. This is because people need to interact and work in real time rather than waiting on data centers located in very far places. Edge Computing is gradually shifting Cloud Computing applications from centralized nodes to the nodes at the edge of the network.

Unlike Cloud Computing, the processing of data and the decisions are taken at the edge of networks in Edge Computing model. As a result, it optimizes cloud computing systems by performing tasks nearest to the users. According to the reports available, it is seen that mobile edge computing market will become a worth of 838.6 million US dollars within 2022 and edge analytics market shall be of worth around 7.96 Billion US Dollars in 2021 [8].

In the paper [9], we found that edge servers provide lower latency to 92% users than cloud computing. According to the experiment, negative values indicate that when a cloud provider location is closer to end users than the edge. In Fig 3, the value of (-100, -10) refers to end users for which latency of edge server which is closest is 10 to 100 ms which is greater than latency of the closest Cloud service provider location. It is observed that edge servers provide latency of 92% to 97% of end-users compared to different cloud providers which is lower. For majority of end-users, edge servers are closer compared to cloud service providers with a latency of 10 to 100 ms [9].

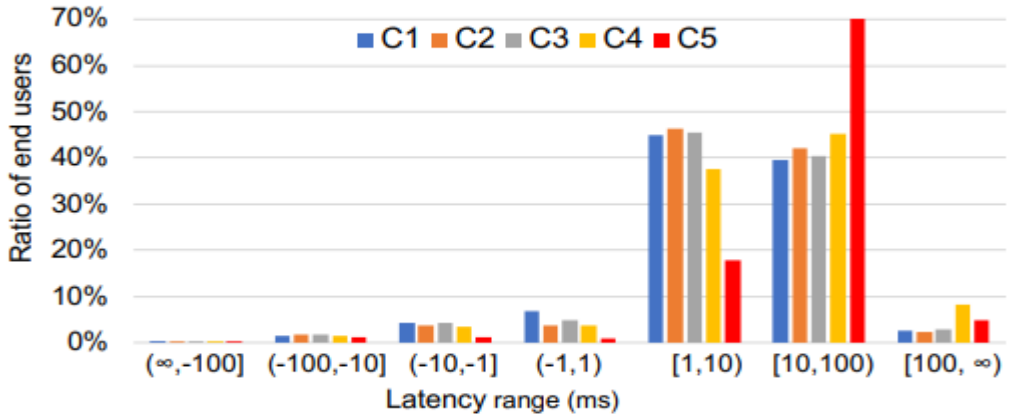

Fig 2: Latency difference of end user between cloud and edge [9]

Amazon CloudFront is a content delivery network (CDN) used for the faster delivery of data. This service works with other components of Amazon Web Service to do content distribution easily.

Amazon CloudFront can be used to deliver media by using global network at edge location so that latency becomes low. Here, the contents are routed automatically to the nearest edge locations to decrease the loading time of the users. It can be used with the

combination of AWS S3 or AWS EC2 (Elastic Cloud Compute). The operational cost of this service is also low [10].

In CDN, as these are distributed in different geographical regions it helps in decreasing execution time. Apart from this when there is huge traffic it prevents the system to crash by distributing traffic to other geographical regions. CloudFront also plays a vital role in ensuring high Quality of Service (QoS) So this CDN plays a very important role in internet ecosystem and serving the end users without any problem [11].

Here, study has been done on three Clouds providing CDN services.

Microsoft Azure along with Verizon offers CDN service. Google Cloud CDN use Google's globally distributed edge to cache HTTP(S) load balanced content. Finally, comes Amazon CloudFront, they manage their infrastructures on their own.

The (QoE) based monitoring and the insights are obtained from video streaming service. In the experiment, it was found that Google Cloud CDN and Amazon CloudFront provide same kind of QoE for end users. Amazon CloudFront offers better QoE for testing users. Overall, both of them offers better QoE than Azure Verizon CDN [12].

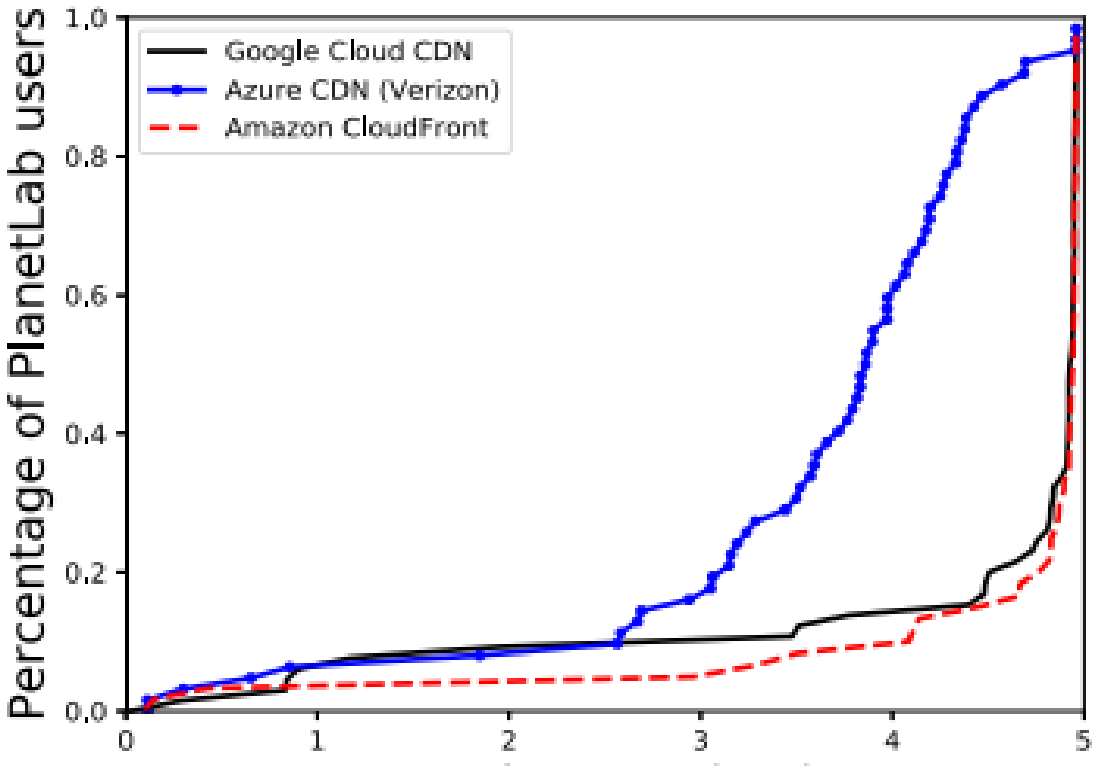

Fig 3: Comparison among three Cloud CDNs [12].

In the experiment performed in [13], where comparison of packet loss ratio is done with and without using CDN:

Table 2: Packet loss ratio when using CDN [13]

Assessment Scenario	**PLR (%)**
Observation-1	0.01
Observation-2	0.01
Observation-3	0.01

Observation-4	0.01
Observation-5	0.01
Observation-6	0
Observation-7	0.1
Observation-8	0
Observation-9	0.1
Observation-10	0.1
Average	0.08

Table 3: Packet loss ratio without using CDN [13]

Assessment Scenario	**PLR (%)**
Observation-1	0.1
Observation-2	0.3
Observation-3	0.3
Observation-4	0.5
Observation-5	0.4
Observation-6	0.2
Observation-7	0.3
Observation-8	0.3

Observation-9	0.5
Observation-10	0.4
Average	0.33

It is found that when CDN infrastructure is used, the result of packet loss ratio gives lower value than the result of the packet loss ratio when CDN infrastructure is not used. Video streaming with CDN provides 0.08% for average packet loss ratio. On other hand, video streaming without using CDN gives 0.33% for average packet loss ratio [13].

The system is compatible with Flash and HTML5 mode, and it automatically detects whether the browser can support Flash, and if it does not support Flash, then it will automatically use HTML5 player.

HTML5 supports multimedia on any kind of mobile devices. New syntax features are also introduced to support video, audio etc. HTML5 has also introduced another new features that can change the way end users interact with different documents. HTML5 provides web pages better meaning and structure.

Different tags will make data driven Web that is valuable to programs as well as users. Local storage feature like S3, HTML5 based web apps has shorter starting time and faster networking speed. The unified platform totally supports all kinds of playback platforms, such as Personal Computers, mobile phones, etc. Without installing playback plug-ins, the system will directly use the browser to play online video player [14].

In the system proposed in [15], a video file of size 23.3 MB and .mp4 file format is used. Transcoding was done on the video file. When the video is played on this player, the time in which the first frame is displayed is shown. It is observed that if small size of .ts file is used then the time after which the first frame of the video start playing is much lesser than time duration for larger .ts file.

So this shows that if we use smaller .ts files then buffering will be less than the larger file.

Table 4: Playing the video file [15]

Length of video	**Length of TS files (in seconds)**	**Time after which the first frame of video starts playing**
05:19 s/23.3MB	10	00:04.6 s
05:19 s/23.3MB	30	00:04.93 s
05:19 s/23.3MB	60	00:04.94 s

CHAPTER 3.0: Proposed Approach

Media streaming using Cloud Computing has been proposed in various research papers. There will be downgrade of video file as the video is transcoded from .mp4 to .ts file format to reduce the size of the file. Then the security provide here is of HTTP which is not desirable as it is not secure because it does not encrypt the data from a Web Page when that data is in transit.

In the proposed research work, AWS CloudFront is used for content delivery. At first, a demo media service website has been made. Few videos files are uploaded in the website. This website is created using HTML, CSS and jQuery.

Then we need to host this website. For this we have taking the help of Cloud Computing in the form of Amazon Web Service. We have chosen AWS S3 service for the hosting purpose. Then we go through the configurations of policies of the bucket for the access purposes.

Then along with these components we are including a service named AWS CloudFront. It provides edge networking facility to make sure that the media is sent to end user with very low latency. Apart from that the costing is very minimal amount. We also have admin power of content delivery and enhanced security policies.

Combining all these components we get a robust effective Content Delivery Network for carrying out media service of videos of high quality at any place and at any time without any hassle.

3.1 Proposed architecture

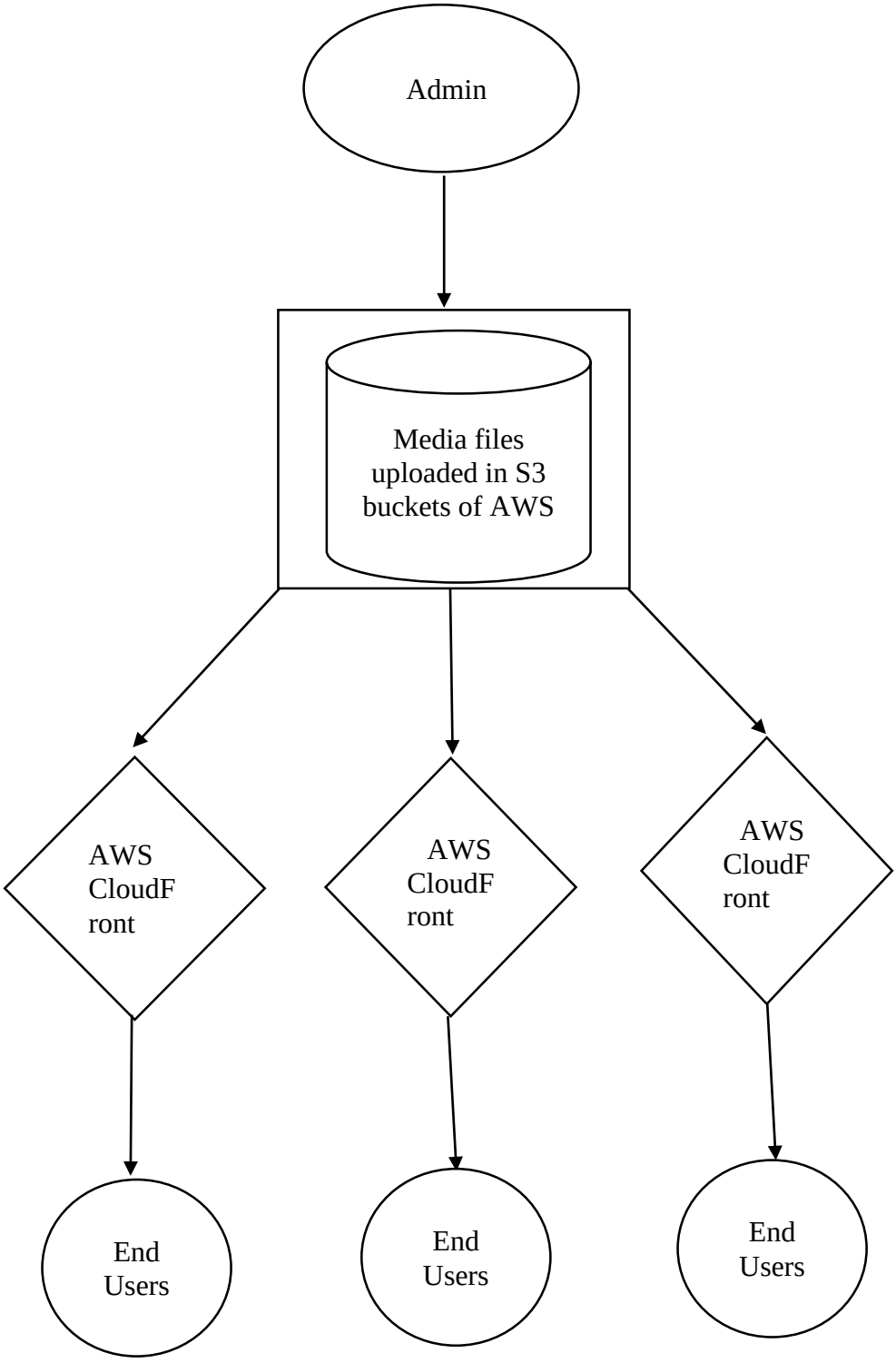

Fig 4: The components of proposed Content Delivery Network

3.2 Description

The system design is shown in block diagram in the fig 4. Here admin has total power and authorization over this system. He can make changes in the website. He can also add or remove videos.

The whole website along with video files are hosted with the help of AWS S3 bucket. For content delivery AWS CloudFront is used along with S3.

Now, the CloudFront will create cacheable files at edge locations. So, as a result the latency will decrease as the requested files are close to end user.

So this is the proposed system for content delivery made with the help of Cloud Computing.

CHAPTER 4.0: Experimentations and Results

The following steps to be followed to create the project and to perform the desired tasks.

STEP 1

At first we need to create a demo website for media service. Very few videos are present in the website.

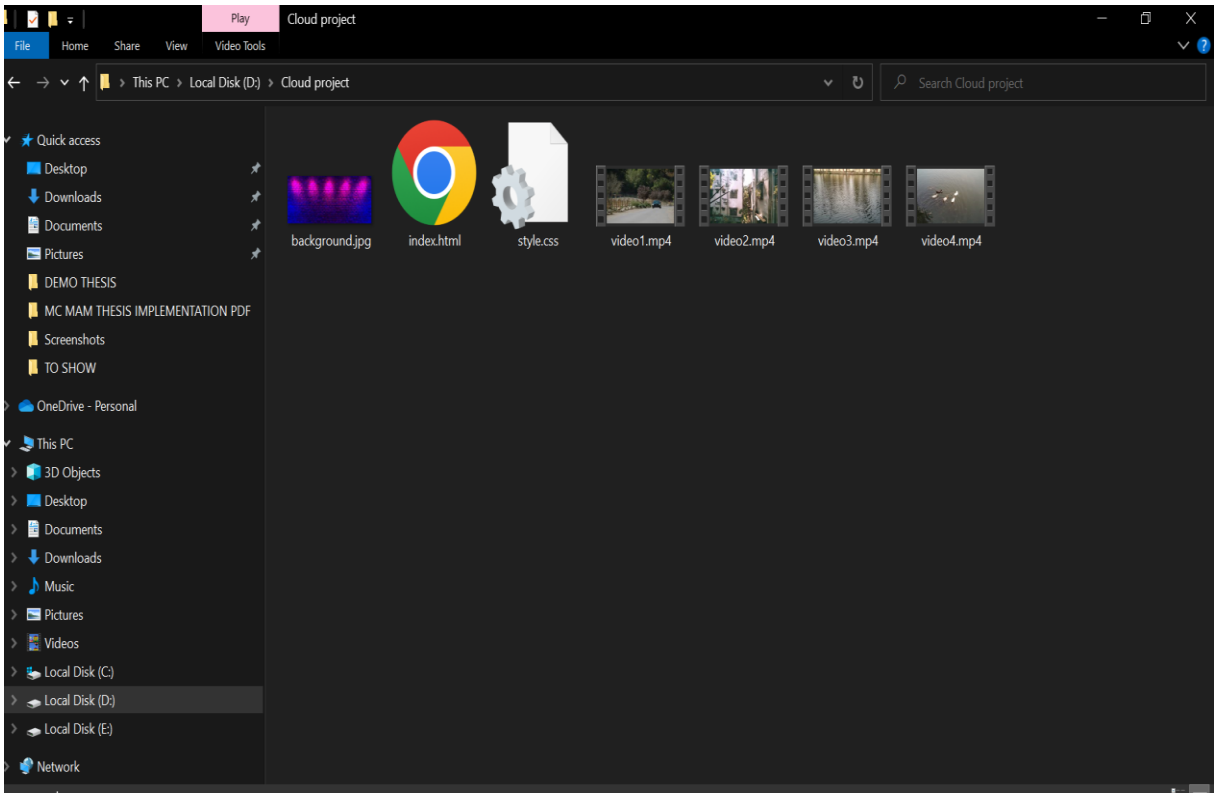

Fig 5: Project files

The project files are ready to be uploaded so that we can do the hosting. Then only users can access the website.

STEP 2

Now we have to log into the Amazon Web Service portal by giving login Id and password. Then, we need to find the S3 bucket for our work.

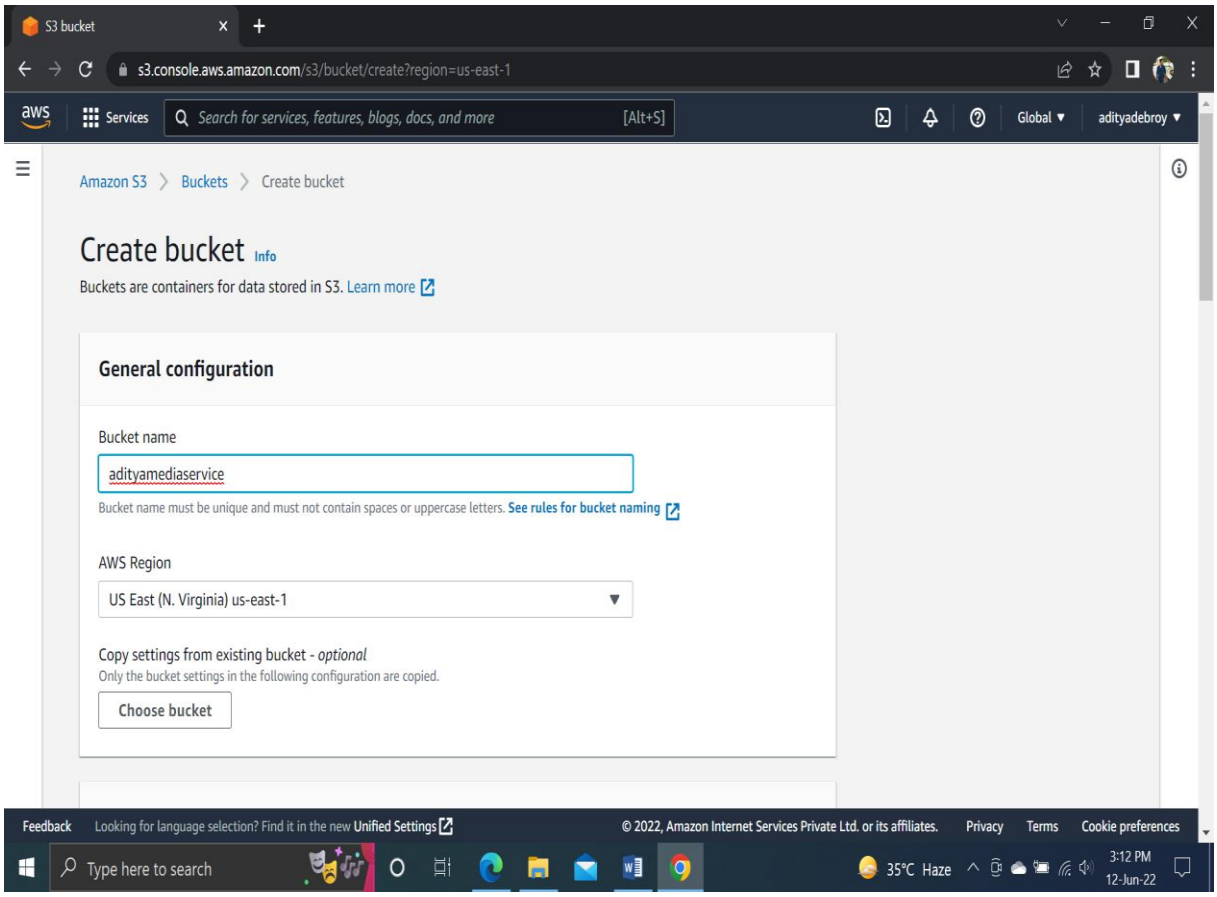

Fig 6: S3 Bucket

Here we have to provide bucket name and the AWS region where it will be created. Then apart from that we have to do configuration of users then create the bucket.

STEP 3

Now we have to make some changes to the bucket polices so that users can access our services after hosting the website

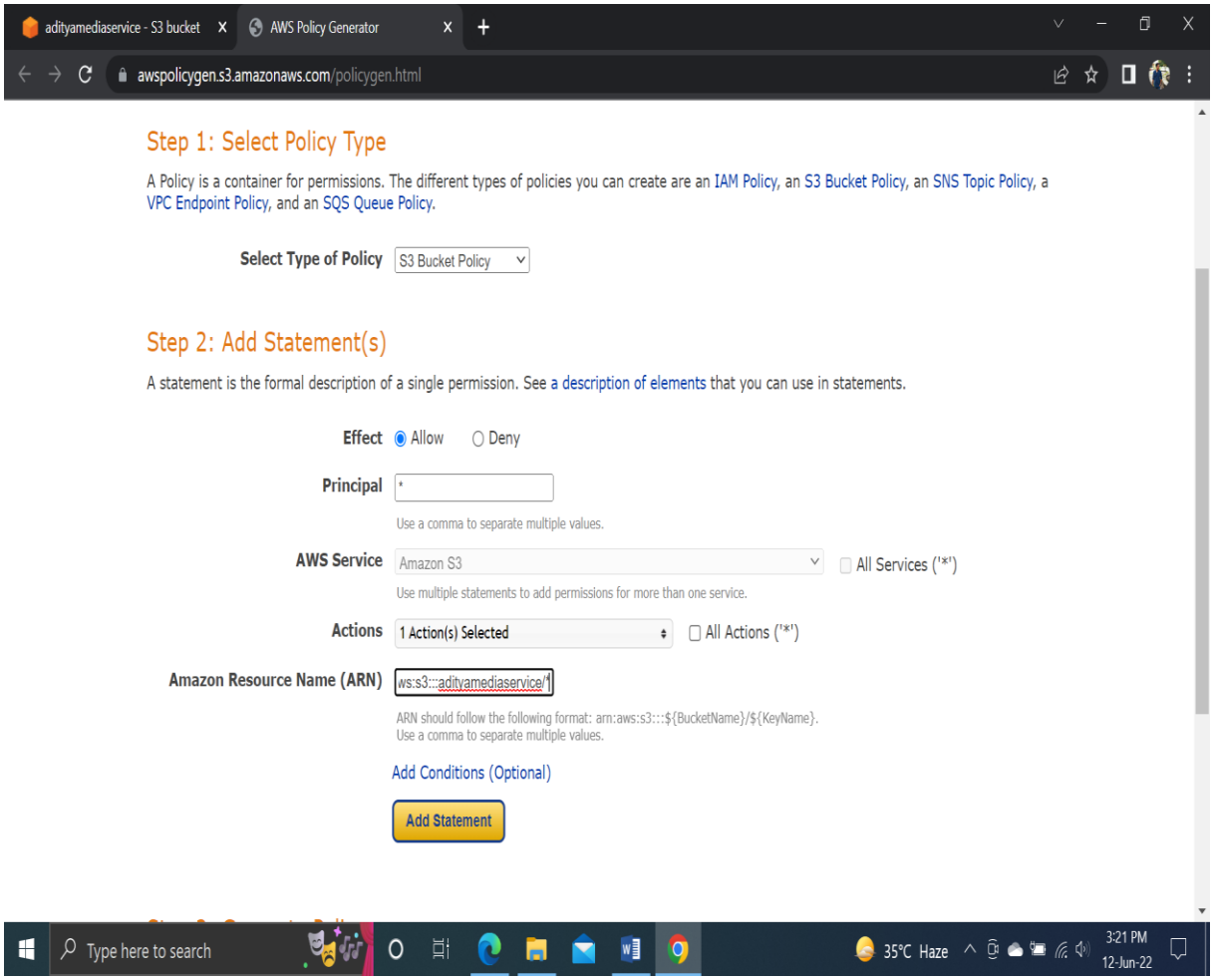

Fig 7: Bucket policies

Here we have made the changes in the polices and action for getting the desired output. For that we have also provided a JSON code scripts for making the changes. That code shall be added in the appendix part.

STEP 4

Once we are done in creating the bucket in AWS S3 successfully then we can upload the required files for hosting onto the internet

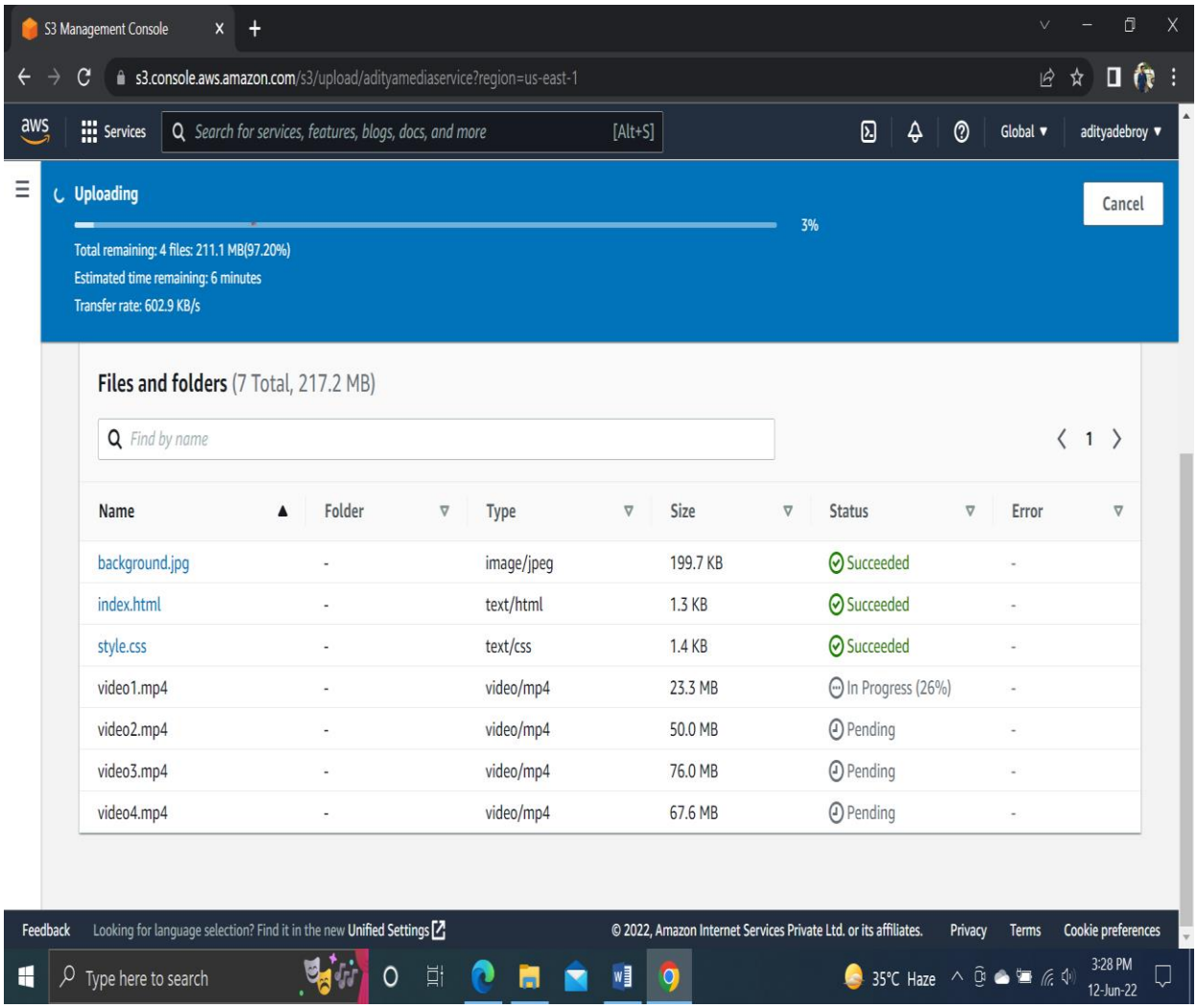

Fig 8: Uploading project files

Here the videos and files are in queue so that they can be uploaded inside the bucket. The index.html and style.css contain the required codes which shall be discussed in the Appendix section.

STEP 5

After completion of above step we are able to see our website. We have http://adityamediaservice.s3-website-us-east1.amazonaws.com as the URL. On clicking it we can see the following:

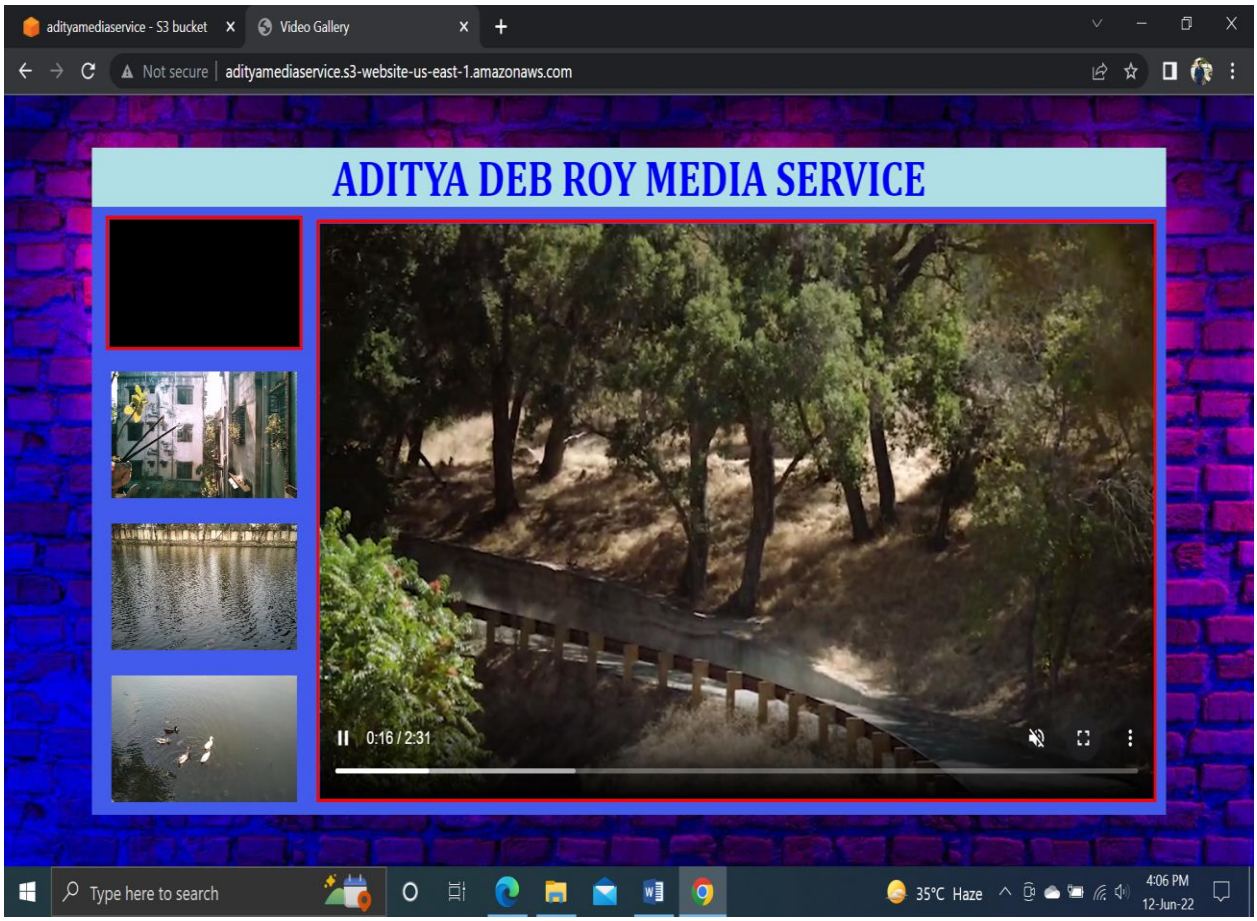

Fig 9: Demo media service website

Fig 9 shows our website for media service purpose. While playing the video we are experiencing some buffering. Apart from that we are also be not able to get proper security.

STEP 6

In order to overcome disadvantages mentioned earlier we are opting for AWS CloudFront service of media distribution. Fig 10 shows AWS CloudFront configurations.

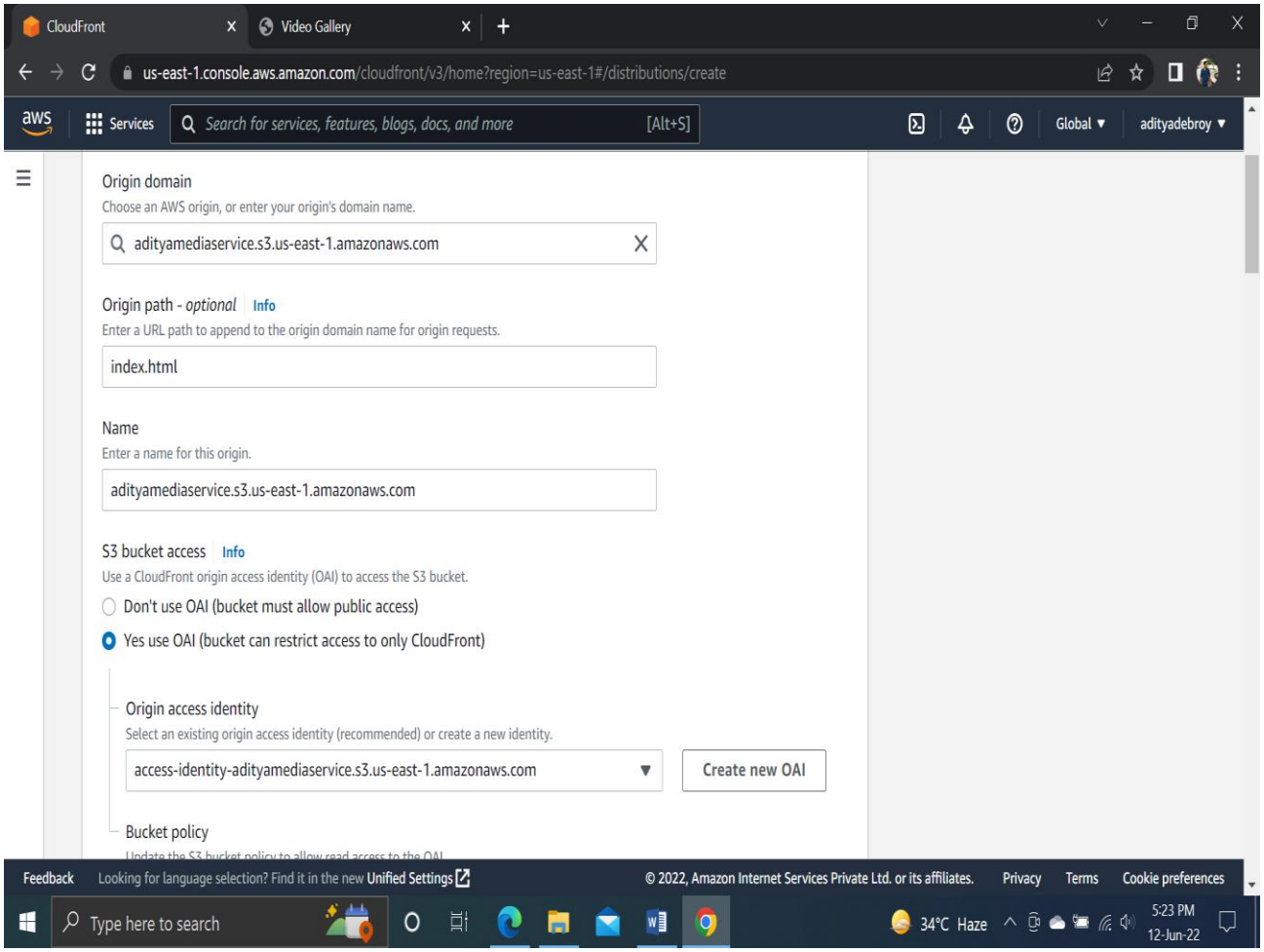

Fig 10: AWS CloudFront configurations

We need to follow the required steps to initialize the process of creating this service.

STEP 7

Next we need to provide some time for deployment process as it creates different edge locations. Fig 11 shows deployment of AWS CloudFront.

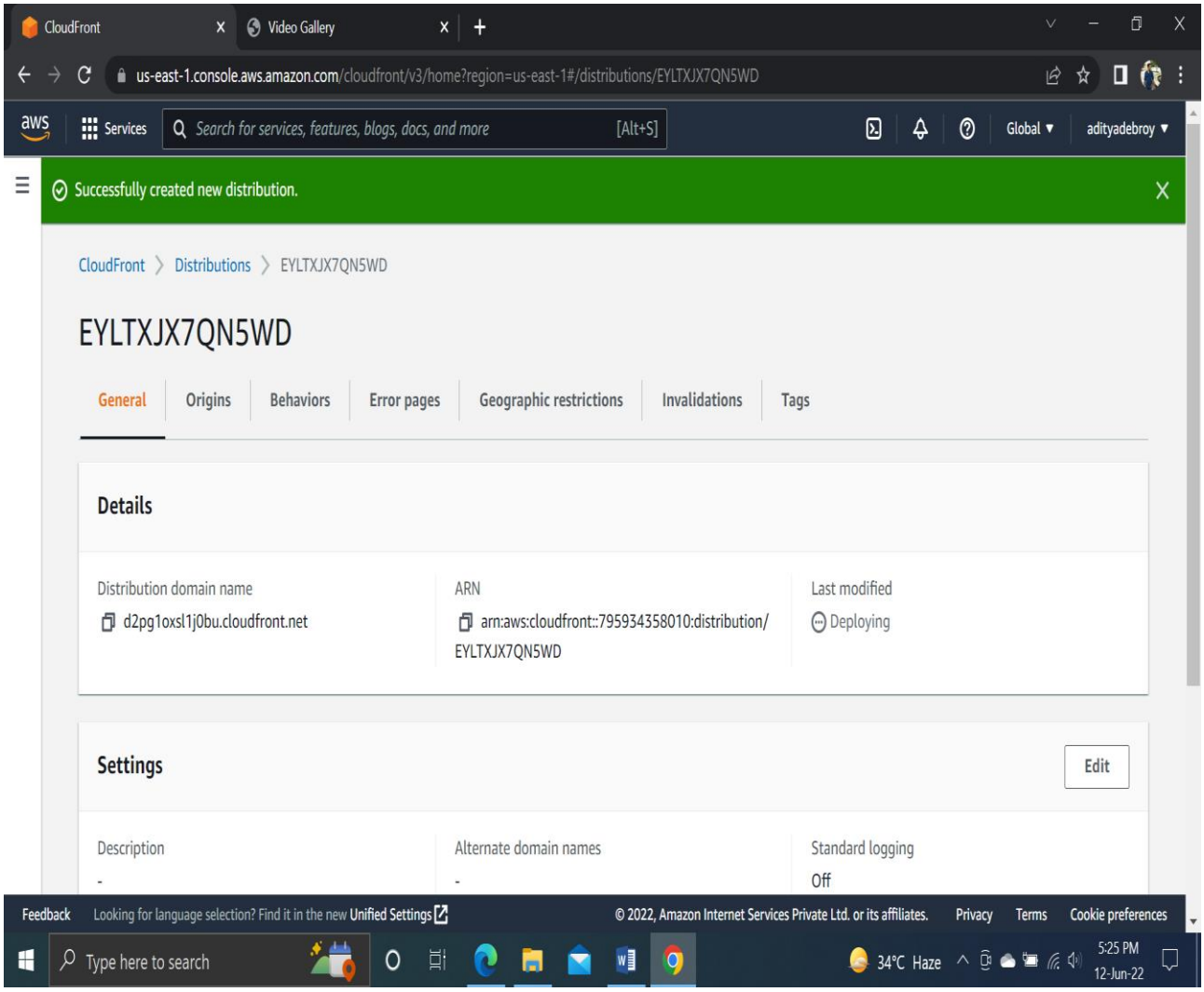

Fig 11: Deployment of AWS CloudFront

STEP 8

Finally, AWS CloudFront service is ready to be used. Now the website containing the videos has loaded with help of CloudFront. The URL is https://d2pg1oxsl1j0bu.cloudfront.net . Fig 12 shows demo website running with AWS CloudFront.

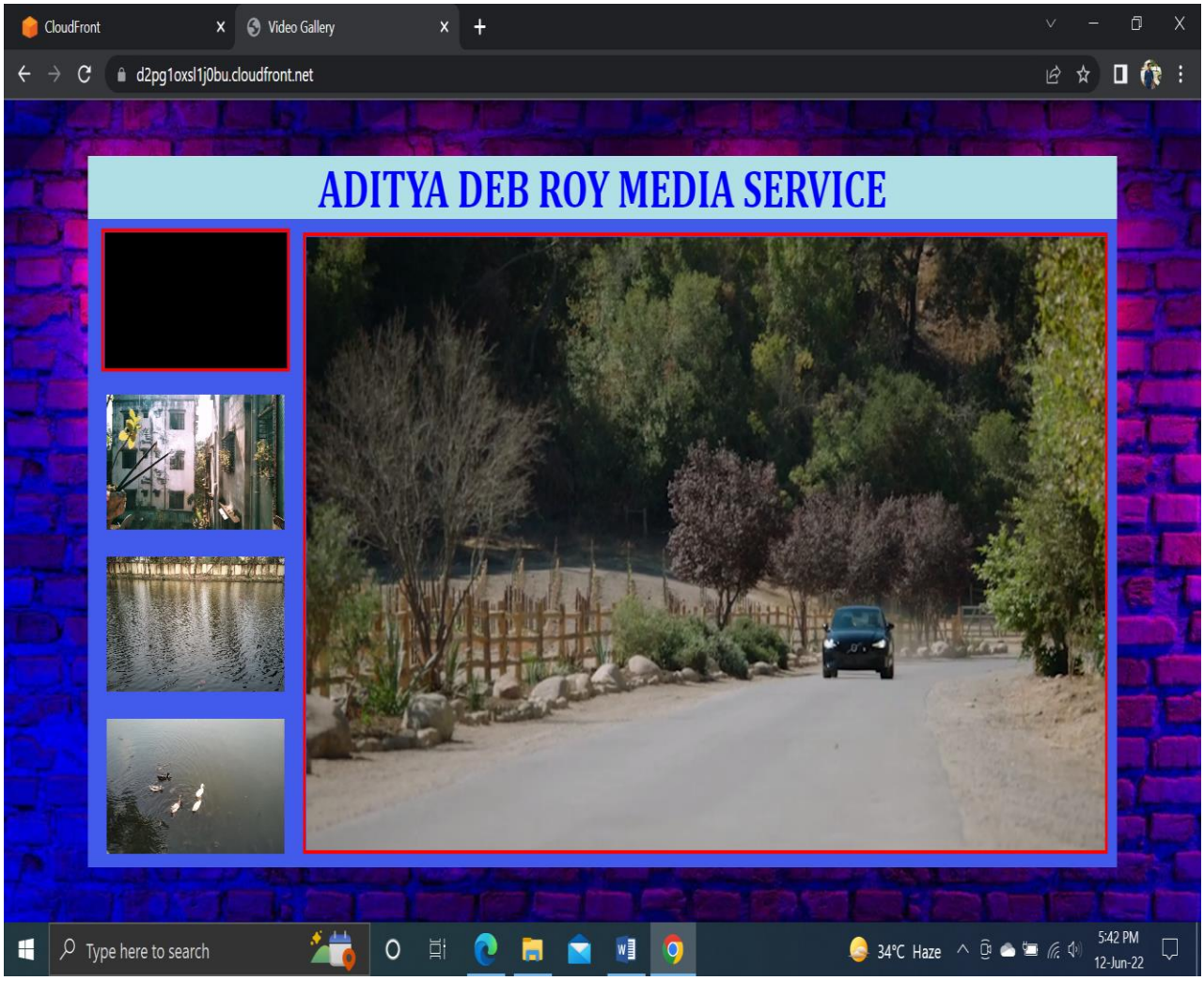

Fig 12: Demo website running with AWS CloudFront

Apparently, the website loaded faster than before and video playing without any buffering.

4.1 Results

For experiment purpose we have used a video file of size 23.3 MB in .mp4 format. In this work, the video is named as video1. Fig 13 shows the networking data.

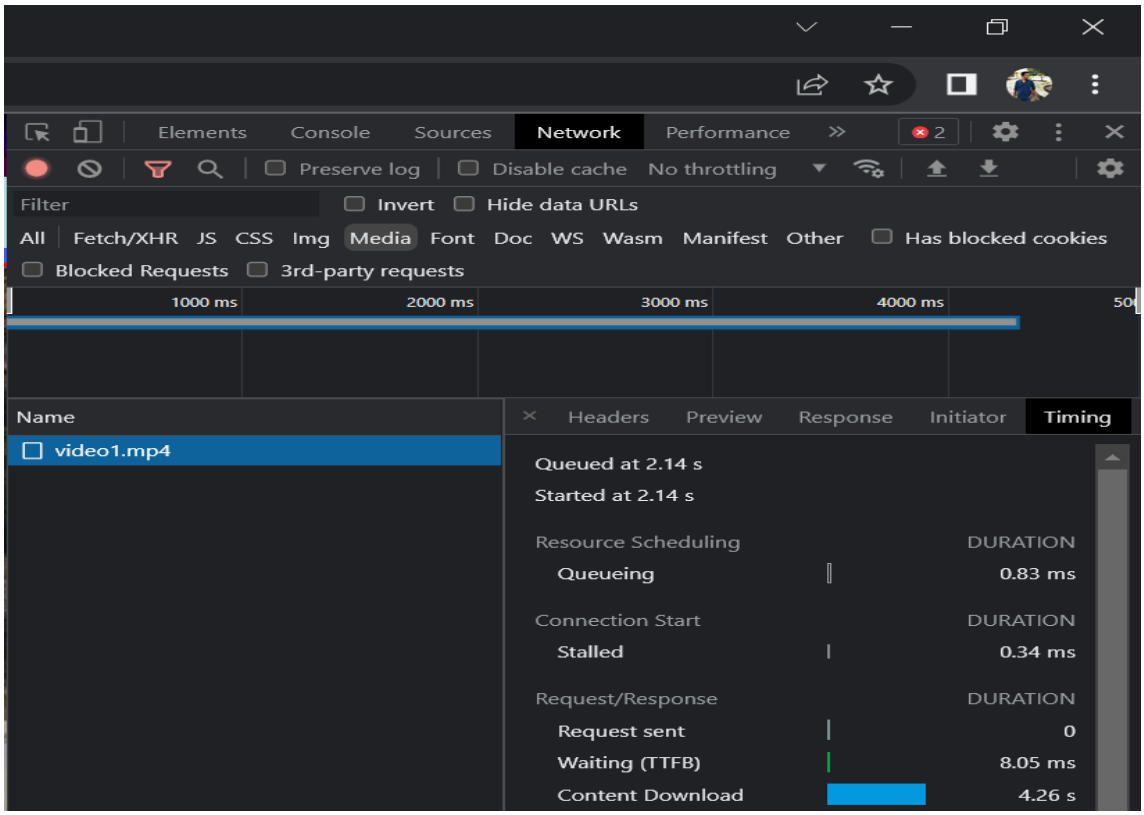

Fig 13: Values on inspection

It was found that the TTFB was always less than 1s (approx. as no stable conditions like bandwidth and internet speed is maintained).

There is no visible lag or buffering in the video while playing. The file is kept in .mp4 format. So, there is no compromise in the video quality.

There has been an enhancement in the security as when we are using CloudFront and we are getting security of HTTPS protocol. Fig 14 displays the security certificate.

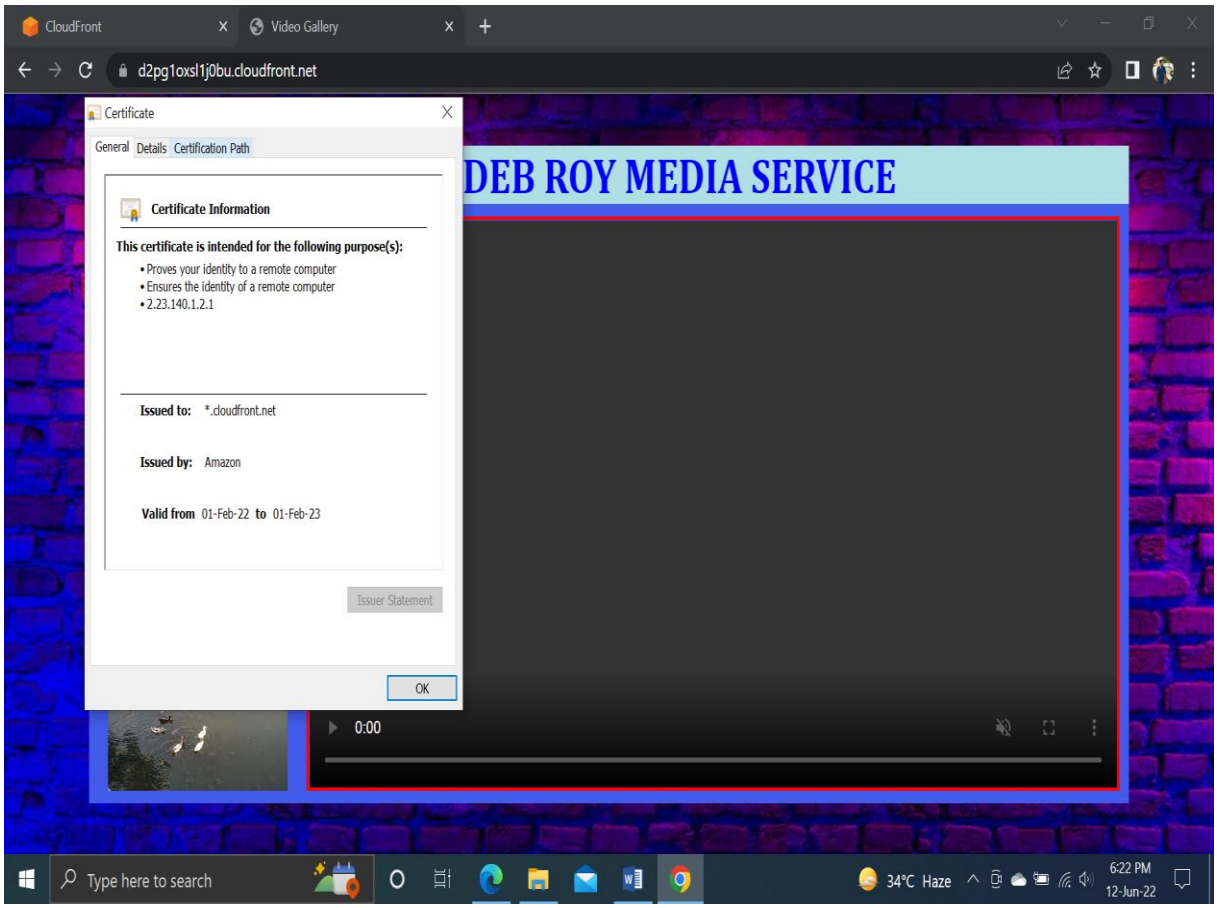

Fig 14: Security certificate

In S3 the security is of HTTP. Therefore it is not secured. But with the help of this Content Delivery Network it is secured and is certified with help of Amazon.

This is one of the biggest importance we found in the experiment as nowadays cybercrime is happening now and then.

Lastly, we can get authorisation power with the help of this service. As a media service owner we can decide to which we can provide our

services and to whom we can restrict our services. This is not possible using S3 service. Fig 15 shows geographic restrictions where users can select which region to restrict.

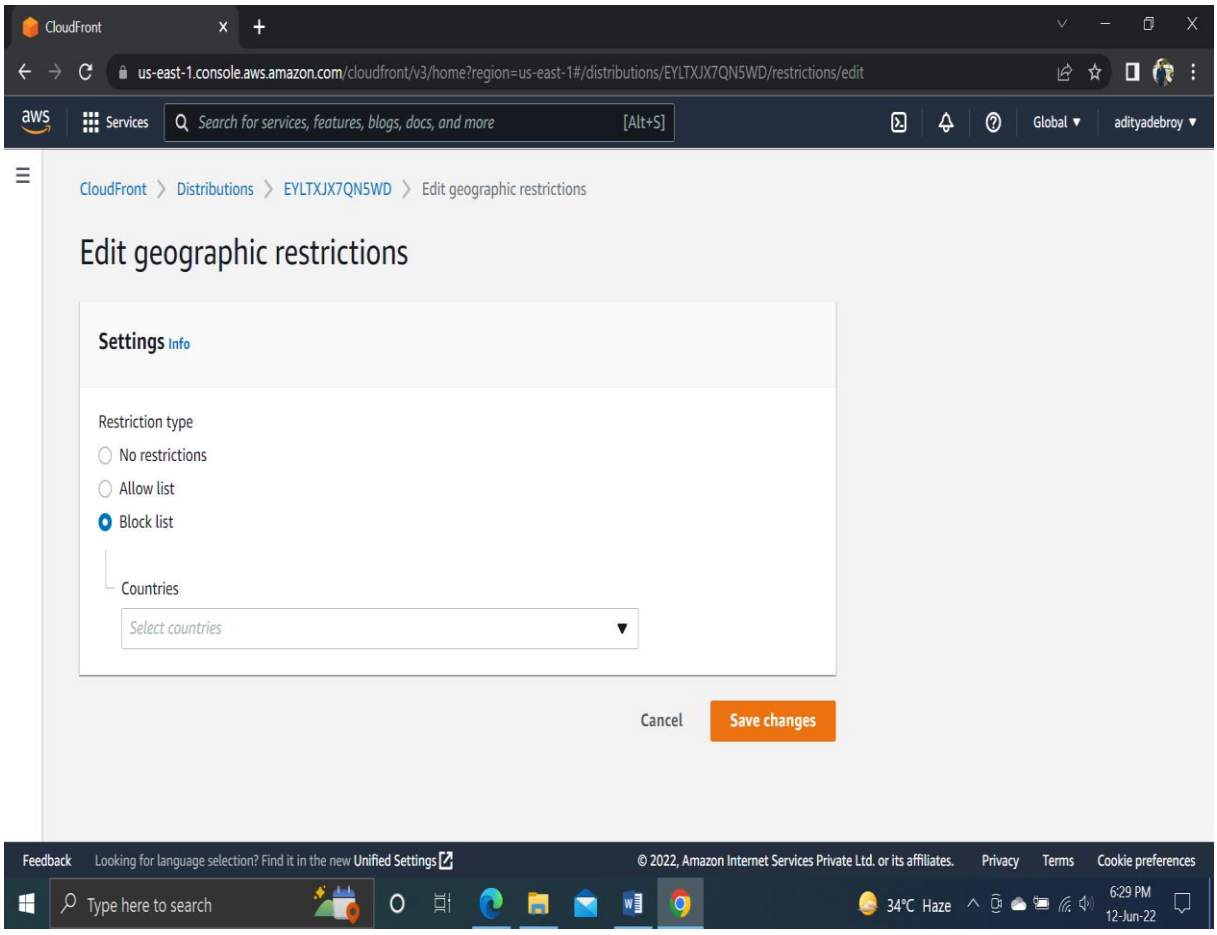

Fig 15: Geographic restriction

Here, we can decide which country to restrict and which country to allow to use our media service. This is another important advantage found during the experimentation.

CHAPTER 5.0: Comparative Analysis

Let us compare between two systems. One with using AWS CloudFront and another system without using AWS CloudFront. We can do so as we have hosted our media service website with CloudFront service. We have also seen some of its advantages.

Table 5: Comparison between two systems

	With Using AWS CloudFront	Without Using AWS CloudFront
Latency	Low	High
Video Quality	High or same as uploaded by the service provider.	Low
Buffering	Very less.	High.
Security	HTTPS.	HTTP.
Geographic Restriction	Can be done here.	Cannot be done here
Cost	Low	Somewhat high.

CHAPTER 6.0: Conclusions and Future Scopes

We all know Cloud Computing technology is the most important and currently used technology. This has been adopted by various companies to carry out their businesses. Apart from this more and more research is required in Cloud and Edge computing technology. With the help of Edge, we are able to do media services with low latency. We all know there is great scope in this field. If we closely look into it and do further research, then many new technological advances can be done in 5G, IoT, Robotics, AR/VR.

There are many future scopes of this work.

- With the advancement of video quality, people will now stream in 8k videos if robust content delivery network is there.
- Edge computing is the most important key for 5G technology.
- Apart from that there are scope in AR/VR by decreasing more latency of network.
- If the latency is less we can play high end intensive games on our low specification laptop or desktop while using the computing power of Cloud.
- Self-driving cars, Robotics all these technologies can be improved and will make our life smart and more comfortable.

References

1. Abubakr O. Al-Abbasi & Vaneet Aggarwal, “Multi-Tier Caching Analysis in CDN-Based Over-the-Top Video Streaming Systems”, *IEEE/ACM TRANSACTIONS ON NETWORKING*, vol. 27, no. 2, pp. 835 - 847, 2019.

2. Aaqib Rashid & Amit Chaturvedi, “Cloud Computing Characteristics and Services: A Brief Review”, *International Journal of Computer Sciences and Engineering*, vol. 7, no. 2, pp. 421-426, 2019.

3. Priyanshu Srivastava & Rizwan Khan, “A Review Paper on Cloud Computing”, *International Journals of Advanced Research in Computer Science and Software Engineering*, vol. 8, no. 6, pp. 17-20, 2018.

4. V.D. Ambeth Kumar, V.D. Ashok Kumar, H. Divakar & R. Gokul, “Cloud Enabled Media Streaming using Amazon Web Services”, *International Conference on Smart Technologies and Management for Computing, Communication, Controls*, Energy and Materials, vol. 2, no. 4, pp. 195-198, Veltech Dr.RR & Dr.SR University, Chennai, T.N., India, 2 - 4 August 2017.

5. Ambika Gupta, Anjani Mehta, Lakshya Daver & Priya Banga, “Implementation of Storage in Virtual Private Cloud using Simple Storage Service on AWS”, *International Conference on Innovative Mechanisms for Industry Applications***,** pp. 213-217, Bangalore, India, 05-07 March 2020.

6. Yun Tian, Ryan Babcock, Carol Taylor & Yanqing Ji, “A New Live Video Streaming Approach Based on Amazon S3 Pricing Model”, *IEEE Annual Computing and Communication Workshop and Conference*, pp.321-328, Las Vegas, NV, USA, 08-10 January 2018.

7. Aayushi Toshniwal, Kabir Singh Rathore, Avnish Dubey, Priyanka Dhasal & Ritu Maheshwari, “Media Streaming in Cloud with Special Reference to Amazon Web Services: A Comprehensive Review”, *International Conference on Intelligent Computing and Control Systems*, pp.368-372, Madurai, India, 13-15 May 2020.

8. Sachchidanand Singh, “Optimize Cloud Computations using Edge Computing”, International Conference on Big Data, IoT and Data Science, pp.49-53, Pune, India, 20-22 December 2017.

9. Batyr Charyyev, Engin Arslan & Mehmet Hadi Gunes, “Latency Comparison of Cloud Datacenters and Edge Servers”, *IEEE Conference and Exhibition on Global Telecommunications (GLOBECOM)***,** pp. 1-6, Taipei, Taiwan, 07-11 December 2020.

10. Marius Alexandru Dinca, Nicoleta Angelescu, Radu Dragomir, Dan Constantin Puchianu & Ion Caciula, “Digital Media Distribution Platform Using Amazon Web Services”, *11th International Conference on Electronics, Computers*

and Artificial Intelligence (ECAI), pp. 1-4, Pitesti, Romania, 27-29 June 2019.

11. Mythresh Korupolu, Venkata Surendra Kommineni, Srikanth Jannabhatla, Hemanth Kalyanam & Vijaykumar Vasantham, "Video Streaming Platform Using Distributed Environment In Cloud Platform", *7th International Conference on Advanced Computing & Communication Systems (ICACCS)*, pp. 1414-1417, Coimbatore, India, 19-20 March 2021.

12. Chen Wang, Andal Jayaseelan & Hyong Kim, "Comparing Cloud Content Delivery Networks for Adaptive Video Streaming", *IEEE 11th International Conference on Cloud Computing (CLOUD)*, pp. 686-693, San Francisco, CA, USA, 02-07 July 2018.

13. Wella Edli Shabrina, Dodi Wisaksono Sudiharto, Endro Ariyanto & Muhammad Al Makky, "The QoS Improvement Using CDN for Live Video Streaming with HLS", *International Conference on Smart Technology and Applications (ICoSTA)*, pp. 1-5, Surabaya, Indonesia, 20-20 February 2020.

14. Ji-chun Zhao & Jian-xin Guo, "Design of Distance Learning Streaming Media System Based on Cloud Platform", *IEEE 3rd International Conference on Cloud Computing and Big Data Analysis (ICCCBDA)*, pp. 131-134, Chengdu, China, 20-22 April 2018.

15. Nitesh Jain, Harshika Shrivastava & Asmita A. Moghe, “Production-ready environment for HLS Player using FFmpeg with automation on S3 Bucket using Ansible”, *2nd International Conference on Data, Engineering and Applications (IDEA)***,** pp. 1-4, Bhopal, India, 28-29 February 2020.

Appendix-A

User's manual

1.System Requirements:

a. 8GB RAM
b. 500GB ROM
c. Intel i5 processor
d. Graphics Card
e. Internet access
f. HD monitor.

2.Software Requirements:

a. Windows 10 Operating System.
b. Google Chrome.
c. Notepad

3.Installation and settings:

No such installations are required for the work. But one should have AWS account. Then only one can log in with credentials.

Appendix-B

index.html Code

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width,
initial-scale=1.0">
   <link rel="stylesheet" href="style.css">
   <title>Video Gallery</title>

</head>

<body>
<div><h1><B>ADITYA DEB ROY MEDIA
SERVICE</B></h1><div>
   <div class="container">
      <div class="videos">
         <video class="active" src="video1.mp4"
muted></video>
         <video src="video2.mp4" muted></video>
         <video src="video3.mp4" muted></video>
         <video src="video4.mp4" muted></video>

      </div>
      <div class="main-video">
         <video src="videos/video1.mp4" muted controls
autoplay></video>
```

```
      </div>
   </div>

   <!-- jquery cdn link -->
   <script
src="https://cdnjs.cloudflare.com/ajax/libs/jquery/3.6.0/jque
ry.min.js"></script>

   <script>

      $(document).ready(function(){

         $('.videos video').click(function(){


$(this).addClass('active').siblings().removeClass('active');

            var src = $(this).attr('src');
            $('.main-video video').attr('src',src);
         });
      });

   </script>

</body>
</html>
```

style.css code

```
*{
   margin: 0;
   padding: 0;
   box-sizing: border-box;
   font-family: Cambria, Cochin, Georgia, Times, 'Times New Roman', serif;
}

body{
   height: 100vh;
   display: flex;
   align-items: center;
   justify-content: center;
   overflow: hidden;
   background: cornflowerblue;
}


body{

   display: flex;
   align-items: center;
   justify-content: center;
   overflow: hidden;
   background-image: url('background.jpg');
}

h1{
            color:BLUE;
```

```
            text-align:center;
            background-color:powderblue;
            font-size:250%;


        }

.container{
   width: 1100px;
   height: 480px;
   display: flex;
   background: rgb(66, 91, 235);
}

.container .videos{
   width: 20%;
   padding: 10px 10px 10px 10px;
   display: flex;
   flex-direction: column;
   justify-content: space-between;
}

.container .videos video{
   width: 95%;
   height: 100px;
   margin: 10px;
   object-fit: cover;
   cursor: pointer;
   transition: 0.2s;
}
```

```
.container .videos video:nth-child(1){
   margin-top: 0;
}

.container .videos video:hover,
.container .videos .active{
   transform: scale(1.06);
   border: 3px solid red;
}

.container .main-video{
   width: 80%;
   padding: 10px;
}

.container .main-video video{
   width: 100%;
   height: 100%;
   object-fit: cover;
   border: 3px solid red;
}
```

AWS JSON policy document codes

```
{
  "Id": "Policy1655027533078",
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "Stmt1655027478342",
      "Action": [
        "s3:GetObject"
      ],
      "Effect": "Allow",
      "Resource": "arn:aws:s3:::adityamediaservice/*",
      "Principal": "*"
    }
  ]
}
```