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Cloud Services

Lab 1 Report: Getting Started with a Public Cloud

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1 Question 1

1.1 What is CDN

As its name states, the content distribution network is composed of distributed network servers across the globe that distribute content to users/customers. These servers and storage replicate services or contents on a large number of proxy systems. CDN servers temporarily store videos, audios, images, js and CSV files and other heavy files. And these cached files are used by customers without any additional travel time to the core server to fetch the data. This approach reduces the waiting time and effectively increases resource utilisation [1].



Figure 1: Geographical Distribution of a CDN [6]

CDN is comprised of two types of servers. The original server and edge servers. When a user requests a service, the edge server lookup their cache, and if the data exist, it is forwarded to the user. But if the data is not in the edge servers, they request the original server, and data is then sent to the user.

CDN system offers better performance, increased reliability, cost savings, and resilience against cyber attacks such as denial of service attacks(DOS) and distributed denial of service (DDOS).[2]

1.2 What is the difference between a traditional CDN and a Cloud-based CDN?

The difference between CDN and CCDN is that CDN relied on third-party providers to deliver their services. Therefore with the increase in the number of customers, there is a need to expand. Hence the need for the geographical availability of third parties to distribute the services is deemed inefficient. This approach is also expensive because hardware needs to be installed in places where the service needs to be scalable.

On the other hand, Cloud CDN uses cloud architecture. When we merge CDN and cloud computing, we can have a robust architecture that enables all the functionality with a virtually infinite compute and storage resources pool with no capital investment in hardware[1]. This allows a wider spread of services and increases scalability because no additional hardware is required.

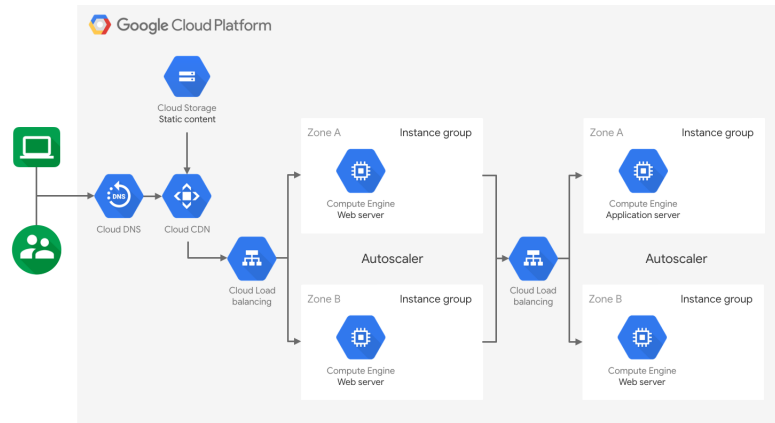


Figure 2: Cloud CDN[2]

2 Question 2

2.1 Biggest CDN Providers in the CDN marketplace

1. G-Core Labs
2. Cloudflare
3. Akamai
4. Fastly
5. MaxCDN
6. Incapsula
7. CacheFly
8. KeyCDN
9. Limelight
10. BunnyCDN
11. CDN 77
12. MetaCDN

2.2 Compare two CDN providers

The comparison between some of the CDN providers is shown in figure 4


CDN Provider	Capacity (Tbps)	Locations	Average response time	Countries	Servers
Akamai	300+	1400+	-	135	325000
G-Core Labs	75+	90+	30ms	31 	-
Limelight	95+	135	-	56	-

Figure 3: First Comparison between some CDN providers












Overall CDN Comparison			
	CLOUDFRONT	AZURE	KEYCDN
General			
Instant Setup			
Transparent Pricing			
Pay As You Go (PAYG)			
No Charges for Requests			
Bandwidth Pricing US&EU	\$0.085	\$0.087/GB	\$0.04/GB \$49 min. / year
Points of Presence	100+	100+	40+

Figure 4: Second Comparison between some CDN providers[8]

3 Exercice 1

We have chosen to deploy the following HTML page because it has many images and icons placed in CloudFront 5. The size of the web page is 4.39 MB. Source is <http://templatemo.com/>

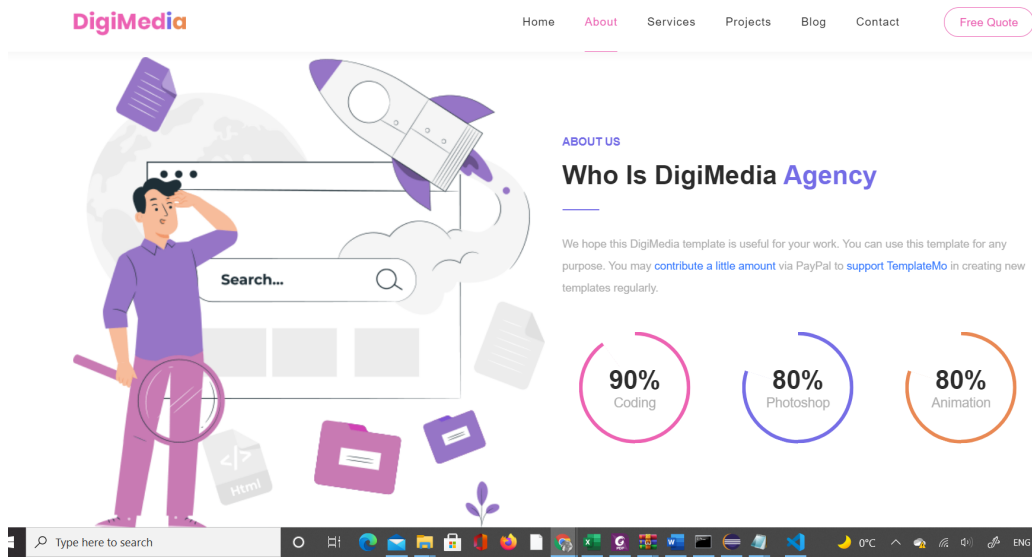


Figure 5: Used webpage

Following the given instructions, we have created the following:

- A bucket named "hununuwus-m7024elab1bucket0" is created and has all the assets and the webpages, this bucket will not use cdn. It is located in US West (N. California) us-west-1. This is a non-CND architecture.
- An Amazon CloudFront console is used to create a new download distribution in which we specify the bucket2. Therefore the contents of the bucket2 would be copied to different edge locations around the globe.
- The second bucket labelled "hununuwus-m7024elab1bucket2 ", which has all the website files but in which the URLs in the web page point to the created CloudFront distribution. This bucket is located in US East (N. Virginia) us-east-1 for a meaningful comparison with bucket0.

Guidelines

After the above configuration there are several steps to be taken in order to make the system functional.

- In addition, they have to be made public in order to be accessed anywhere.
- Enabling Static Website hosting (by going to the bottom options of Properties section of the bucket).

4 Testing the CDN distribution

We have performed two types of tests to observe the network's performance when CDN is used and when it is not. In the first test, we have used curl to monitor the network response time. The second method we have used the “dareboost” website, which allows you to compare websites and give detailed information about the performance. When measuring in dareboost the website is accessed from London and Mexico.

4.1 Curl

Curl is a command-line tool that is used to transfer data. In addition, it also displays network performance in the command line.

We have used the following curl command to observe the network performance when accessing both websites (with CDN and without CDN).

```
CURL:curl -w "@curl-format.txt" -o -s "http://hununuwus-m7024elab1bucket2.s3-website-us-east-1.amazonaws.com" »
```

```
CURL-Format
time_namelookup:  %{time_namelookup}
      time_connect:  %{time_connect}
      time_appconnect:  %{time_appconnect}
      time_pretransfer:  %{time_pretransfer}
      time_redirect:  %{time_redirect}
      time_starttransfer:  %{time_starttransfer}
      -----\n
      time_total:  %{time_total}
```

Therefore to optimise the execution we have written a python code that has a curl function. This python code has a function to run 60 times and displays the total response time.

The python code is as follows.

```

import csv
import subprocess
import numpy as np
#text_file = open("without cdn.txt", "r")
#lines = text_file.readlines()
numpara = 7
numcalls = 200
npmath = np.zeros((numcalls,numpara))

for i in range(numcalls):
    sp = subprocess.Popen(["curl -w "@curl-format.txt" -o NUL -s "http://hununuwus-m7024elab1bucket0.amazon.com"', shell=True, stdout=subprocess.PIPE])
    sp_return = sp.stdout.read()
    lines = sp_return.decode("utf-8")
    C= lines.split(",")
    res = []
    for j in range(len(C)):
        res.append(float(C[j]))
    npvect = np.array(res)
    npmath[i] = npvect

avg = np.mean(npmat,0)
print(avg)

```

Figure 6: Curl Python Code

Therefore the result obtained from this experiment can be observed in figures 8 and 9. The network used is Skeria student accommodation public wifi. Its characteristics can be seen in figure 7.

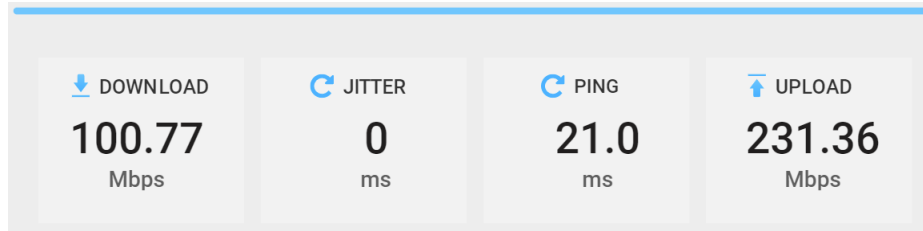


Figure 7: Skeria Network Speed

After running the python code the averaged result obtained are as follows

Origin server : (US)		
Parameters	CDN(s)	Non-CDN(s)
time_namelookup	0.01805698	0.01859625
time_connect	0.15845145	0.16596973
time_appconnect	0.	0.
time_pretransfer	0.15859905	0.16612797
time_redirect	0.	0.
time_starttransfer	0.3510129	0.36342435
time_total	0.35119133	0.36362465

Figure 8: Skelleftea Response Time

Origin server : (US)		
Parameters	CDN(s)	Non-CDN(s)
time_namelookup	0.06515257	0.01716162
time_connect	0.27987947	0.12912212
time_appconnect	0.	0.
time_pretransfer	0.28002997	0.12927477
time_redirect	0.	0.
time_starttransfer	0.41949458	0.3900104
time_total	0.41971585	0.39021217

Figure 9: Finland Response Time

The result we have obtained showed that the response time when accessing the servers from Skelleftea, was better for bucket2 (With CDN) than bucket0 (non-CDN). But when accessing the servers from a location in Finland, the performance of bucket0 (Without CDN) was a bit better than bucket2 (with CDN).

4.2 Uptrends

We employed the well known website Uptrends for another test of the loading time. We conducted tests from two locations, namely Amsterdam and New York. The results can be seen in figures 10, 11, 12 and 13.

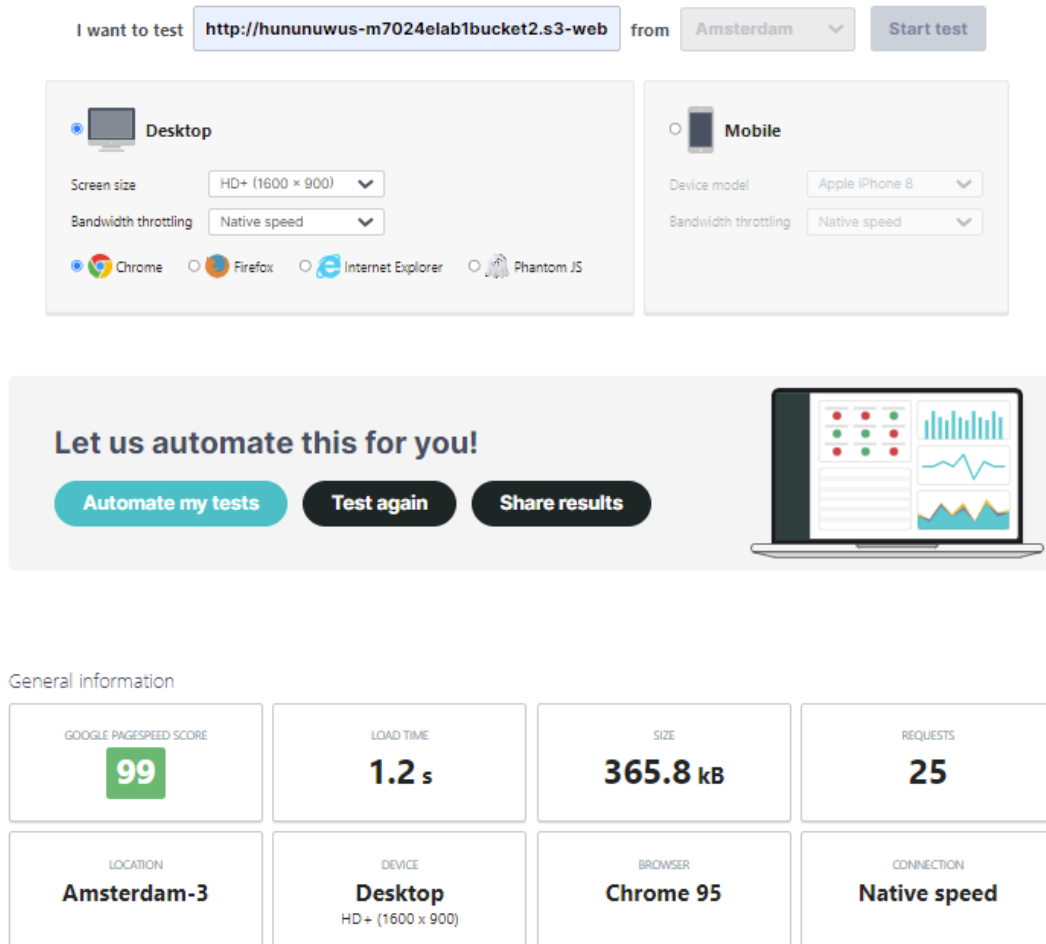


Figure 10: Bucket2 : Accessed from Amsterdam

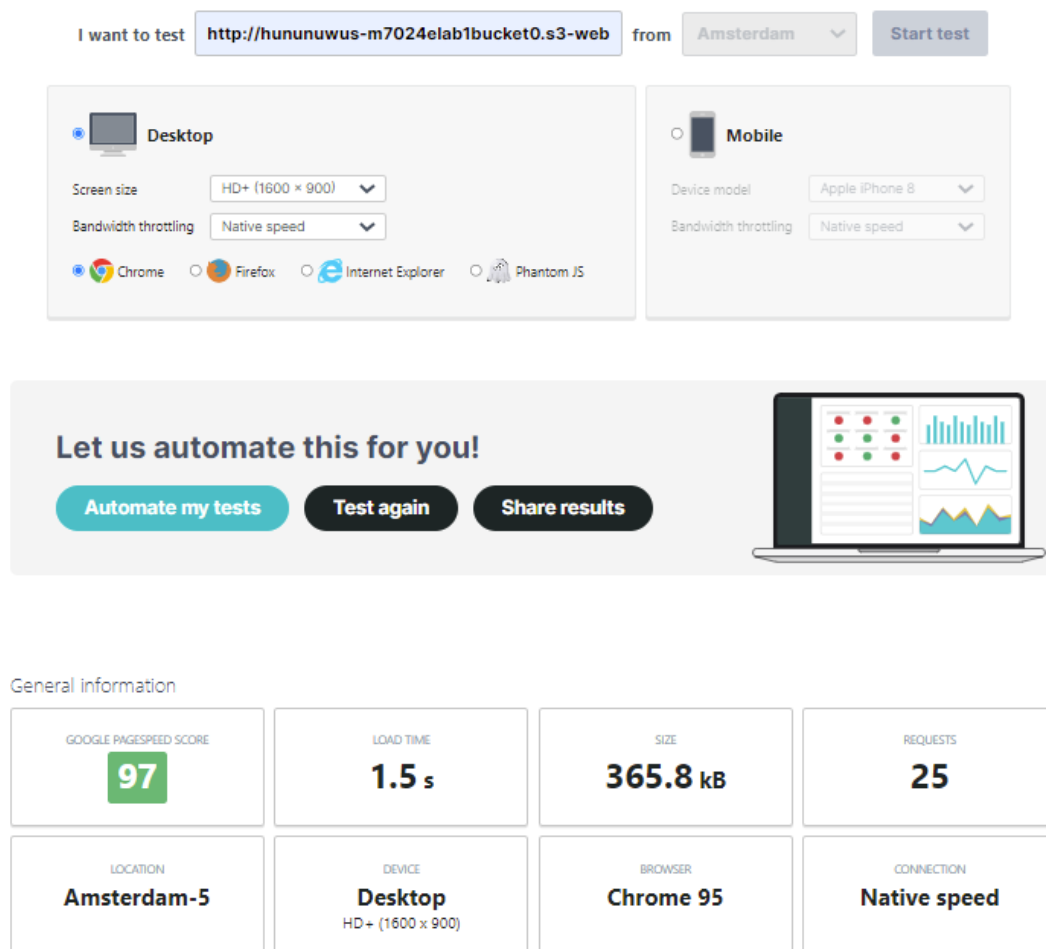


Figure 11: Bucket0 : Accessed from Amsterdam

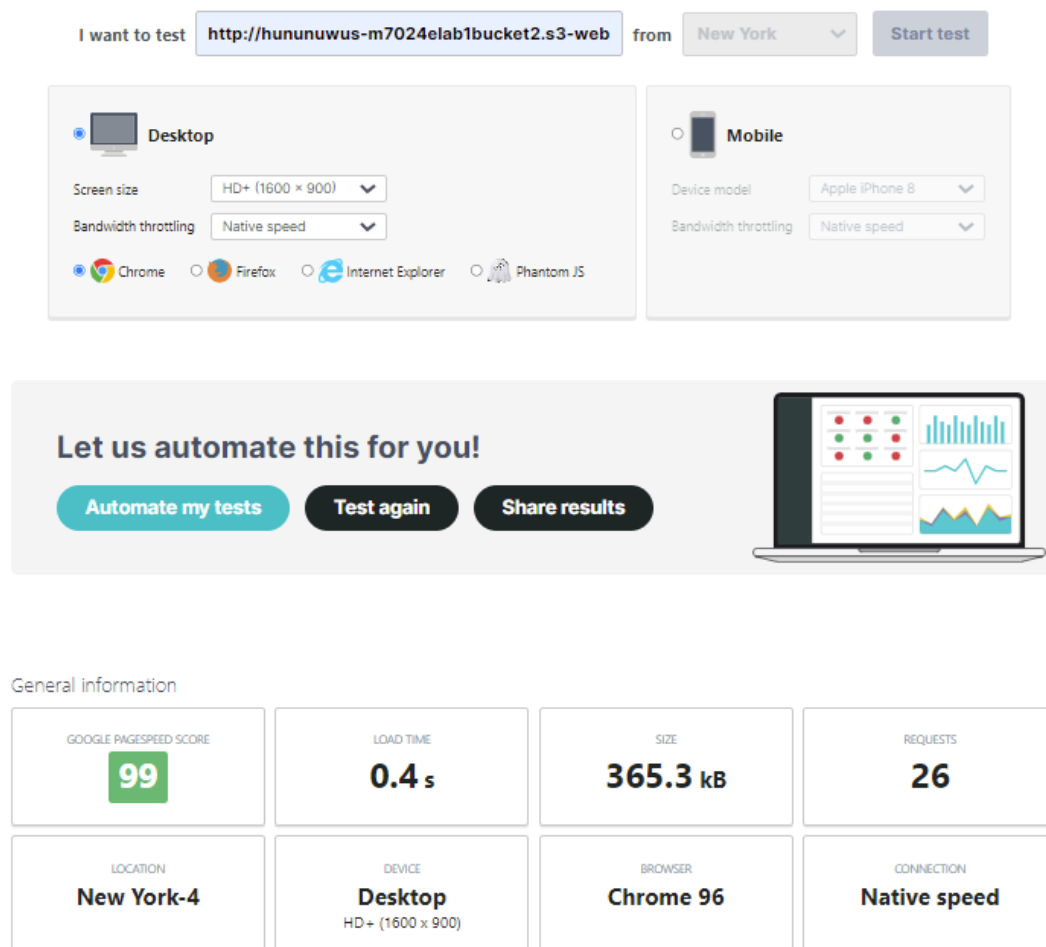


Figure 12: Bucket2 : Accessed from New York

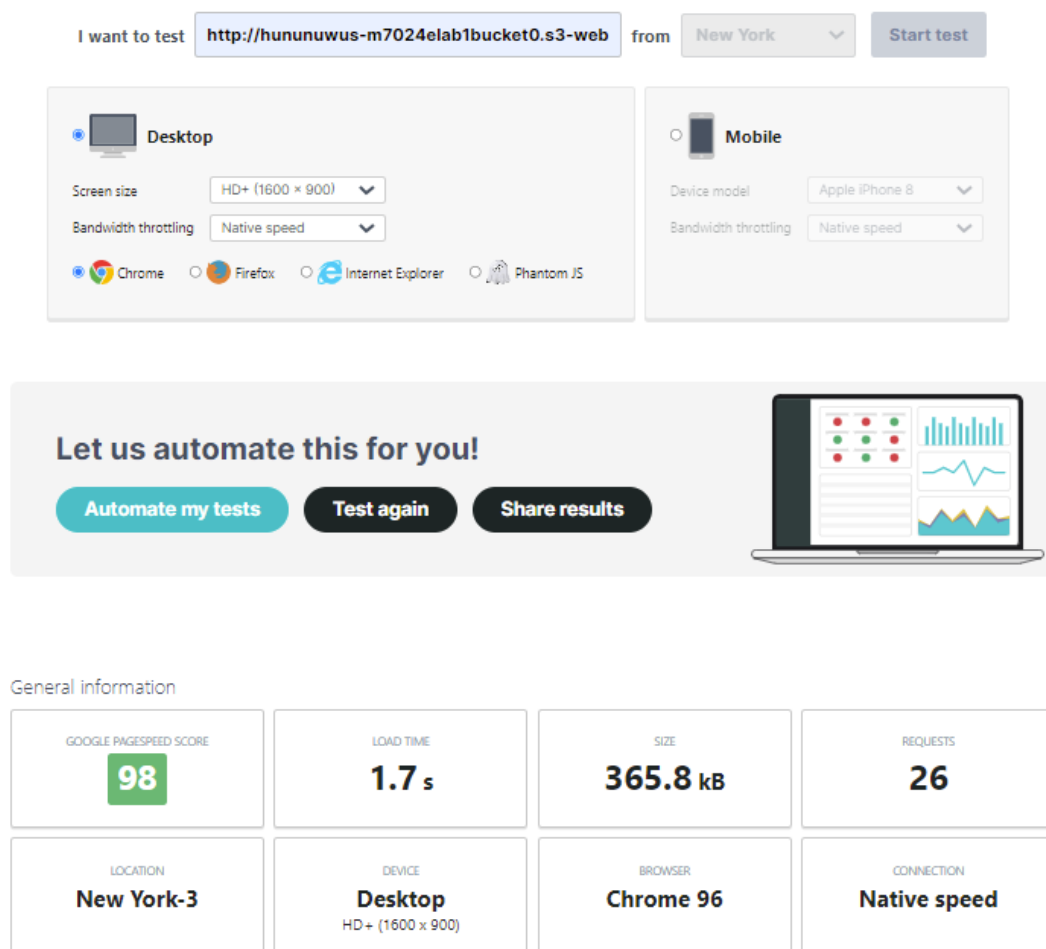


Figure 13: Bucket0 : Accessed from New York

5 Conclusion

The result in both the testing methods curl and Uptrends showed that in the larger cases, a website deployed with a CDN service has a better performance and better response time than the website deployed without CDN.

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