



Cloud Based Media Player

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Group (3)

Introduction

- Streaming Is HUGE!
 - The global video streaming market was valued at \$372.07 Billion in 2021
- It's not just video
 - Music, Images, etc.
- Live AND Prerecorded
 - Both live and pre-recorded content is being streamed
 - Fast, reliable access to content is required for customer satisfaction
- I stream, you stream, we all stream
 - Streaming on many media platforms is common-place for most, if not all, people
- Platforms Galore
 - As more streaming services arise, it is imperative to have a platform that provides access to all types of content, both on demand and at scale

Objective

- The goal of our project was to create a Cloud-Based Media Player using Google Cloud Platform Services
 - We wanted our project to be capable of the following:
 - Display / play any type of media
 - Allow users to store their media on the cloud and then access it again
 - Distribute traffic evenly and fairly for optimal user experience
 - Cache content so that the system is not too burdened by repeat requests
 - Be accessible from a single named endpoint

Requirement Analysis

- The primary objectives of this project include:
 - Deploying the multimedia player server using Kubernetes and Docker containers
 - Implementing a MongoDB database for storing media file metadata
 - Archiving infrequently accessed data by implementing Nearline
 - Integrating Google Cloud CDN for content caching and delivery
 - Ensuring high availability and scalability of the solution using Load Balancer
 - Configure Google Cloud DNS for managing domain names and DNS records

It all starts Here

Not Secure | mediaplayertv.com/uploader

Incognito

Upload Media

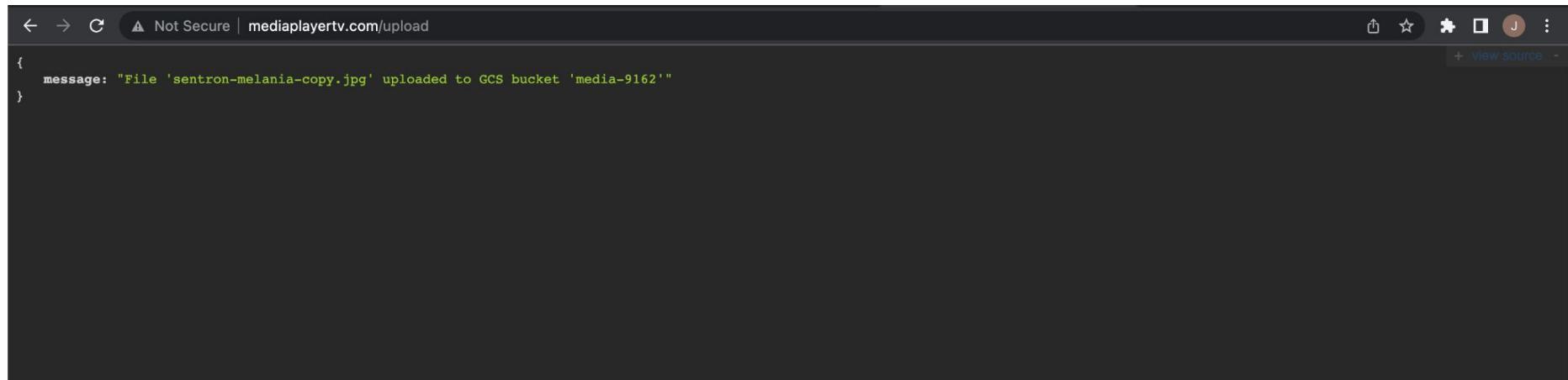
sentron-melania-copy.jpg

Or drag and drop a file here:

Drop file here

Upload!

Response of the Uploader



A screenshot of a web browser window. The address bar shows "Not Secure | mediaplayertv.com/upload". The main content area displays a JSON response:

```
{  
  message: "File 'sentron-melania-copy.jpg' uploaded to GCS bucket 'media-9162'"  
}
```

The browser interface includes standard navigation buttons (back, forward, search) and a toolbar with icons for refresh, stop, and other functions.

Object in the Bucket

media-9162

Location	Storage class	Public access	Protection
us (multiple regions in United States)	Standard	Subject to object ACLs	None

OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY REPORTS NEW

Buckets > media-9162

UPLOAD FILES UPLOAD FOLDER CREATE FOLDER TRANSFER DATA ▾ MANAGE HOLDS DOWNLOAD DELETE

Filter by name prefix only ▾ Filter objects and folders Show deleted data

	Name	Size	Type	Created	Storage class	Last modified	Public access	Version history	Encr.
<input type="checkbox"/>	1151019.jpg	3.5 MB	image/jpeg	Apr 18, 2023, 10:02:39 PM	Standard	Apr 18, 2023, 10:03:05 PM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	1438209.jpg	310.6 KB	image/jpeg	Apr 24, 2023, 12:30:25 AM	Standard	Apr 24, 2023, 12:31:57 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	Calm-Down.mp3	5.6 MB	audio/mpeg	Apr 23, 2023, 7:32:08 PM	Standard	Apr 24, 2023, 12:52:37 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	EVIL_DEAD_RISE.mp4	7.8 MB	video/mp4	Apr 27, 2023, 1:04:11 AM	Standard	Apr 27, 2023, 1:08:00 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	Turning_Red.mp4	14.3 MB	video/mp4	Apr 27, 2023, 1:04:39 AM	Standard	Apr 27, 2023, 1:08:08 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	WallpaperDog-17018969.jpg	87.6 KB	image/jpeg	Apr 27, 2023, 12:56:12 AM	Standard	Apr 27, 2023, 1:08:17 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	blackpink.pretty_savage.mp3	4.6 MB	audio/mpeg	Apr 27, 2023, 12:58:54 AM	Standard	Apr 27, 2023, 1:08:25 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	mario-trailer.mp4	11.6 MB	video/mp4	Apr 23, 2023, 7:32:42 PM	Standard	Apr 24, 2023, 12:52:29 AM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	sentron-melania-copy.jpg	1 MB	image/jpeg	May 3, 2023, 5:53:06 PM	Standard	May 3, 2023, 5:54:48 PM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	tiesto_10_35.mp3	2.8 MB	audio/mpeg	Apr 25, 2023, 7:55:34 PM	Standard	Apr 25, 2023, 7:55:34 PM	⚠️ Public to internet	Copy URL	—
<input type="checkbox"/>	unsplash.jpg	4.3 MB	image/jpeg	Apr 27, 2023, 12:56:43 AM	Standard	Apr 27, 2023, 1:08:32 AM	⚠️ Public to internet	Copy URL	—

Open object overflow menu

Cloud Function Triggers to Create a Backup in the Nearline Storage

Cloud Functions ← Function details EDIT DELETE COPY LEARN

media-backup 1st gen Version 2, deployed at Apr 25, 2023, 7:52:16 P...

METRICS	DETAILS	SOURCE	VARIABLES	TRIGGER	PERMISSIONS	LOGS	TESTING
Logs Severity Default Filter Search all fields and values							
SEVERITY	TIMESTAMP	SUMMARY					
> *	2023-04-27 00:56:17.127 EDT	media-backup	9jlp7r419mvh	FUNCTION execution started			
> *	2023-04-27 00:56:17.129 EDT	media-backup	9jlp7r419mvh	File WallpaperDog-17018969.jpg backedup to WallpaperDog-17018969.jpg in uploader9168			
> *	2023-04-27 00:56:17.120 EDT	media-backup	9jlp7r419mvh	Function execution took 3609 ms, finished with status: 'ok'			
> *	2023-04-27 00:56:45.170 EDT	media-backup	9jlp7w3dtbw5	FUNCTION execution started			
> *	2023-04-27 00:56:46.756 EDT	media-backup	9jlp7w3dtbw5	File unsplash.jpg backedup to unsplash.jpg in uploader9168			
> *	2023-04-27 00:56:46.760 EDT	media-backup	9jlp7w3dtbw5	Function execution took 1590 ms, finished with status: 'ok'			
> *	2023-04-27 00:58:55.416 EDT	media-backup	9jlpjzn1qf1	FUNCTION execution started			
> *	2023-04-27 00:58:57.227 EDT	media-backup	9jlpjzn1qf1	File blackpink.pretty_savage.mp3 backedup to blackpink.pretty_savage.mp3 in uploader9168			
> *	2023-04-27 00:58:57.232 EDT	media-backup	9jlpjzn1qf1	Function execution took 1815 ms, finished with status: 'ok'			
> *	2023-04-27 01:04:12.494 EDT	media-backup	9jlpmeuf58gy	FUNCTION execution started			
> *	2023-04-27 01:04:15.336 EDT	media-backup	9jlpmeuf58gy	File EVIL_DEAD_RISE.mp4 backedup to EVIL_DEAD_RISE.mp4 in uploader9168			
> *	2023-04-27 01:04:15.339 EDT	media-backup	9jlpmeuf58gy	Function execution took 2845 ms, finished with status: 'ok'			
> *	2023-04-27 01:04:40.816 EDT	media-backup	9jlpdhsonyqo	FUNCTION execution started			
> *	2023-04-27 01:04:45.332 EDT	media-backup	9jlpdhsonyqo	File Turning_Red.mp4 backedup to Turning_Red.mp4 in uploader9168			
> *	2023-04-27 01:04:45.335 EDT	media-backup	9jlpdhsonyqo	Function execution took 4519 ms, finished with status: 'ok'			
> *	2023-05-03 17:53:08.176 EDT	media-backup	y01bnwnpth9u3	FUNCTION execution started			
> *	2023-05-03 17:53:11.755 EDT	media-backup	y01bnwnpth9u3	File sentron-melania-copy.jpg backedup to sentron-melania-copy.jpg in uploader9168			
> *	2023-05-03 17:53:11.759 EDT	media-backup	y01bnwnpth9u3	Function execution took 3583 ms, finished with status: 'ok'			

Backup in Nearline Storage

Bucket details

REFRESH HELP ASSISTANT LEARN

uploader9168

Location	Storage class	Public access	Protection
us-east4 (Northern Virginia)	Nearline	Not public	None

OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY REPORTS NEW

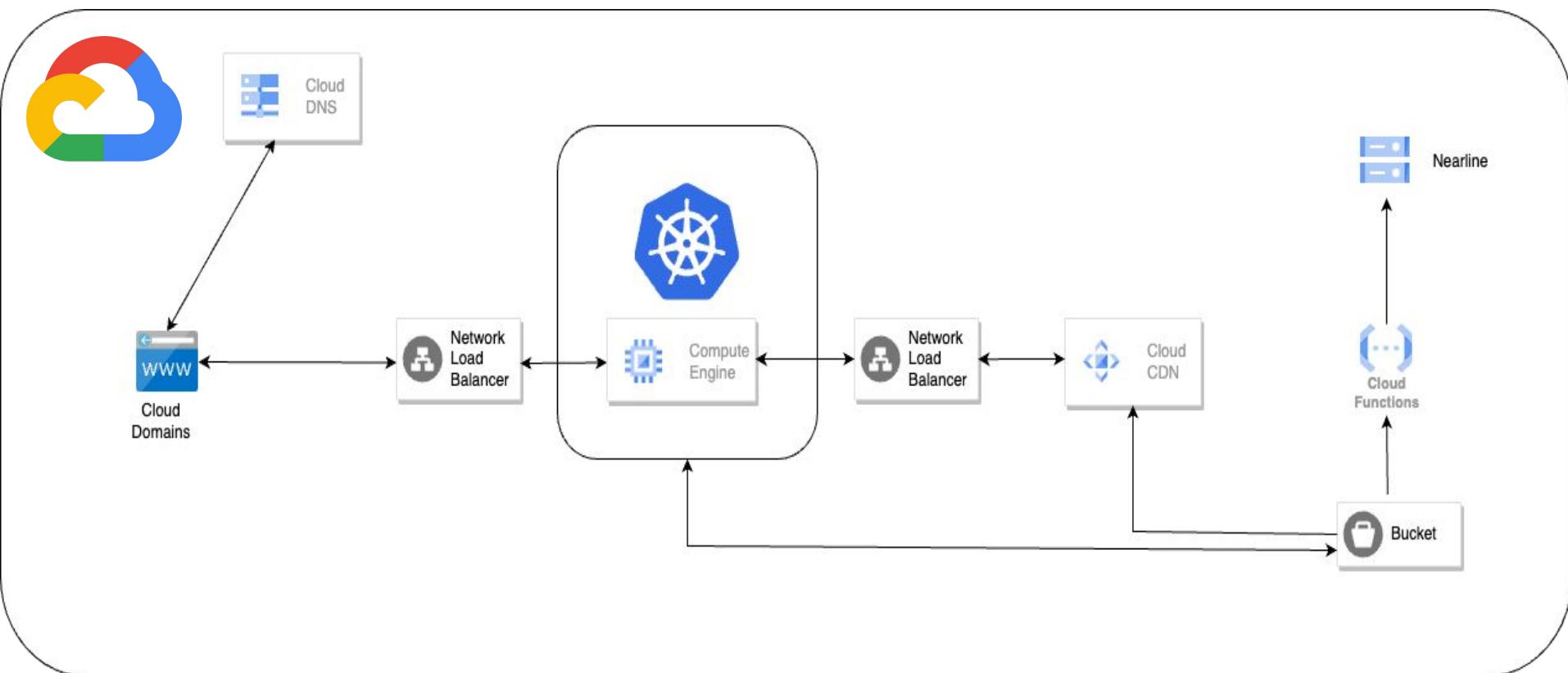
Buckets > uploader9168

UPLOAD FILES UPLOAD FOLDER CREATE FOLDER TRANSFER DATA MANAGE HOLDS DOWNLOAD DELETE

Filter by name prefix only ▾ Filter objects and folders Show deleted data

Name	Size	Type	Created	Storage class	Last modified	Public access	Version history	Encryption
1610496.jpg	396.8 KB	application/octet-stream	Apr 26, 2023, 11:24:37 PM	Nearline	Apr 26, 2023, 11:24:37 PM	Not public	—	Google-
EVIL_DEAD_RISE.mp4	7.8 MB	application/octet-stream	Apr 27, 2023, 1:04:15 AM	Nearline	Apr 27, 2023, 1:04:15 AM	Not public	—	Google-
Profile.pdf	55.6 KB	application/octet-stream	Apr 3, 2023, 2:33:25 AM	Nearline	Apr 3, 2023, 2:33:25 AM	Not public	—	Google-
TLOU.jpeg	217 KB	application/octet-stream	Apr 3, 2023, 11:34:31 PM	Nearline	Apr 3, 2023, 11:34:31 PM	Not public	—	Google-
Turning_Red.mp4	14.3 MB	application/octet-stream	Apr 27, 2023, 1:04:45 AM	Nearline	Apr 27, 2023, 1:04:45 AM	Not public	—	Google-
WallpaperDog-17018969.jpg	87.6 KB	application/octet-stream	Apr 27, 2023, 12:56:17 AM	Nearline	Apr 27, 2023, 12:56:17 AM	Not public	—	Google-
blackpink.pretty_savage.mp3	4.6 MB	application/octet-stream	Apr 27, 2023, 12:58:57 AM	Nearline	Apr 27, 2023, 12:58:57 AM	Not public	—	Google-
jitendra_reddy_resume.pdf	143.8 KB	application/octet-stream	Apr 3, 2023, 8:43:32 PM	Nearline	Apr 3, 2023, 8:43:32 PM	Not public	—	Google-
sentron-melania-copy.jpg	1 MB	application/octet-stream	May 3, 2023, 5:53:11 PM	Nearline	May 3, 2023, 5:53:11 PM	Not public	—	Google-
tiesto_10_35.mp3	2.8 MB	audio/mpeg	Apr 25, 2023, 7:55:36 PM	Nearline	Apr 25, 2023, 7:55:36 PM	Not public	—	Google-
unplash.jpg	4.3 MB	application/octet-stream	Apr 27, 2023, 12:56:46 AM	Nearline	Apr 27, 2023, 12:56:46 AM	Not public	—	Google-

Architecture



Some Cloud Objects Used: Load Balancers

Load balancing

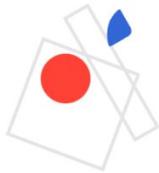
+ CREATE LOAD BALANCER

REFRESH

DELETE

HELP ASSISTANT

LEARN



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X

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- ✓ Diagnose and prevent connectivity issues
- ✓ View packet loss and latency metrics
- ✓ Keep your firewall rules strict and efficient

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REMIND ME LATER

LOAD BALANCERS

BACKENDS

FRONTENDS

ⓘ Faster web performance and improved web protection with Cloud CDN and Cloud Armor. [Learn more](#) DISMISS

Filter Enter property name or value

? ☰

<input type="checkbox"/>	Name	Load balancer type	Protocols	Region	Backends	
<input type="checkbox"/>	my-front-lb	HTTP(S)	HTTP		✓ 1 backend service (1 instance group, 0 network endpoint groups)	⋮
<input type="checkbox"/>	streeamer-9162	HTTP(S)	HTTP		✓ 1 backend bucket	⋮

CDN

Cloud CDN [ADD ORIGIN](#) [REFRESH](#) [REMOVE](#)

[Filter](#) Enter property name or value



<input type="checkbox"/>	<input checked="" type="radio"/>	Origin name	Cache mode	Associated load balancers	Cache hit ratio
<input type="checkbox"/>	<input checked="" type="radio"/>	stream-9162	Cache static content	streamer-9162	No data

Compute

VM instances [CREATE INSTANCE](#) [IMPORT VM](#) [REFRESH](#)

[HELP ASSISTANT](#)

[LEARN](#)

[**INSTANCES**](#) OBSERVABILITY INSTANCE SCHEDULES

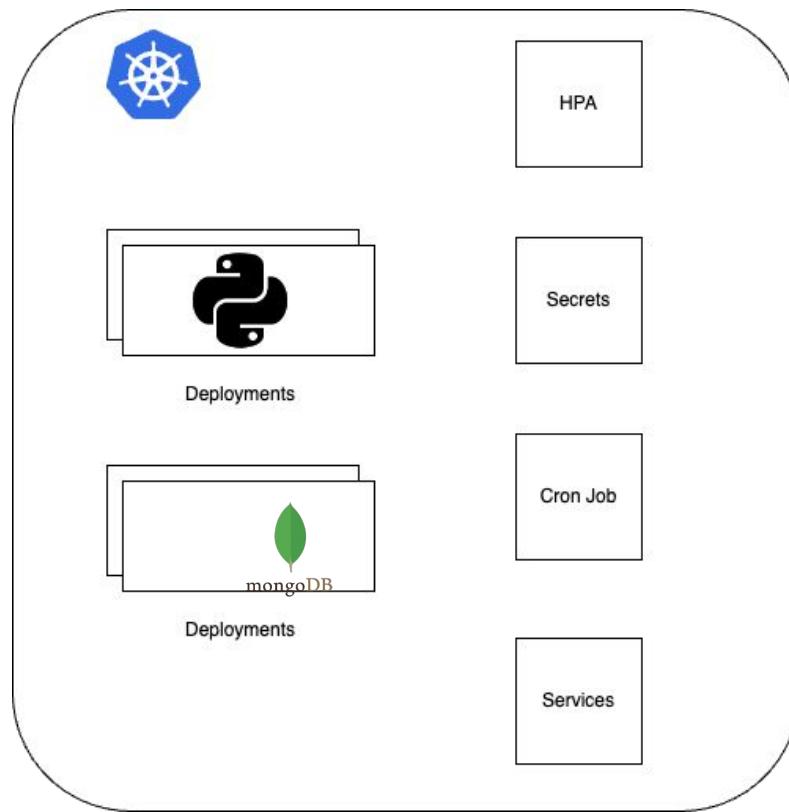
VM instances

[Filter](#) Enter property name or value



<input type="checkbox"/>	Status	Name	Zone	Connect	
<input type="checkbox"/>	<input checked="" type="radio"/>	master	us-central1-a	SSH	
<input type="checkbox"/>	<input checked="" type="radio"/>	worker-1	us-central1-a	SSH	

Inside K8s Cluster on Compute



K8s Objects on the cluster

ssh.cloud.google.com/v2/ssh/projects/alpha-161809/zones/us-central1-a/instances/master?authuser=0&hl=en_US&projectNu...

SSH-in-browser

UPLOAD FILE

DOWNLOAD FILE



```
jitendra_ben10@k8-master:~$ kubectl get deployments
```

NAME	READY	UP-TO-DATE	AVAILABLE	AGE
media-player-deployment	3/3	3	3	6d19h
mongodb-deployment	1/1	1	1	8d

```
jitendra_ben10@k8-master:~$ kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
media-player-deployment-5b67c5b7b-lvfrp	1/1	Running	3 (40m ago)	6d18h
media-player-deployment-5b67c5b7b-ntbwp	1/1	Running	0	20s
media-player-deployment-5b67c5b7b-qmczh	1/1	Running	0	20s
mongodb-deployment-59cc877ffd-txz5m	1/1	Running	5 (40m ago)	8d
puller-28052530-96bz9	0/1	Completed	0	20m
puller-28052540-scmx7	0/1	Completed	0	10m
puller-28052550-8xxpp	0/1	Completed	0	37s

```
jitendra_ben10@k8-master:~$ kubectl get svc
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT (S)	AGE
kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	62d
media-player-svc	LoadBalancer	10.97.235.85	<pending>	6000:30557/TCP	8d
mongo	ClusterIP	10.108.56.14	<none>	27017/TCP	8d

```
jitendra_ben10@k8-master:~$ kubectl get secrets
```

NAME	TYPE	DATA	AGE
gcp-creds	Opaque	1	29d

```
jitendra_ben10@k8-master:~$ kubectl get cronjobs
```

NAME	SCHEDULE	SUSPEND	ACTIVE	LAST SCHEDULE	AGE
puller	*/10 * * * *	False	0	58s	8d

```
jitendra_ben10@k8-master:~$ kubectl get hpa
```

NAME	REFERENCE	TARGETS	MINPODS	MAXPODS	REPLICAS	AGE
media-player-hpa	Deployment/media-player-deployment	<unknown>/80%	1	5	3	6d17h

```
jitendra_ben10@k8-master:~$
```

The Cron Job runs every 10 mins and fetches the metadata of the objects from the bucket and stores it in MongoDB.

```
2023-05-03T21:50:36.326+0000 I CONTROL  [initandlisten]
> show dbs
admin          0.000GB
config         0.000GB
file_metadata  0.000GB
local          0.000GB
> use file_metadata
switched to db file_metadata
> show collections
files
> db.files.find()
[{"_id": ObjectId("644a0601e723179cbd8dcb04"), "name": "1151019.jpg", "size": 3696420, "content_type": "image/jpeg", "url": "http://34.149.205.56/1151019.jpg"}, {"_id": ObjectId("644a0601e723179cbd8dcb05"), "name": "1438209.jpg", "size": 318087, "content_type": "image/jpeg", "url": "http://34.149.205.56/1438209.jpg"}, {"_id": ObjectId("644a0601e723179cbd8dcb07"), "name": "Calm-Down.mp3", "size": 5842075, "content_type": "audio/mpeg", "url": "http://34.149.205.56/Calm-Down.mp3"}, {"_id": ObjectId("644a0601e723179cbd8dcb08"), "name": "EVIL_DEAD_RISE.mp4", "size": 8133173, "content_type": "video/mp4", "url": "http://34.149.205.56/EVIL_DEAD_RISE.mp4"}, {"_id": ObjectId("644a0601e723179cbd8dcb09"), "name": "Turning_Red.mp4", "size": 14969262, "content_type": "video/mp4", "url": "http://34.149.205.56/Turning_Red.mp4"}, {"_id": ObjectId("644a0601e723179cbd8dcb0a"), "name": "WallpaperDog-17018969.jpg", "size": 89668, "content_type": "image/jpeg", "url": "http://34.149.205.56/WallpaperDog-17018969.jpg"}, {"_id": ObjectId("644a0601e723179cbd8dcb0b"), "name": "blackpink.pretty.savage.mp3", "size": 4849210, "content_type": "audio/mpeg", "url": "http://34.149.205.56/blackpink.pretty.savage.mp3"}, {"_id": ObjectId("644a0601e723179cbd8dcb0c"), "name": "mario-trailer.mp4", "size": 12148024, "content_type": "video/mp4", "url": "http://34.149.205.56/mario-trailer.mp4"}, {"_id": ObjectId("644a0601e723179cbd8dcb0d"), "name": "tiesto_10_35.mp3", "size": 2957312, "content_type": "audio/mpeg", "url": "http://34.149.205.56/tiesto_10_35.mp3"}, {"_id": ObjectId("644a0601e723179cbd8dcb0e"), "name": "unplash.jpg", "size": 4509950, "content_type": "image/jpeg", "url": "http://34.149.205.56/unplash.jpg"}, {"_id": ObjectId("6452d9626fa152b1309879af"), "name": "sentron-melania-copy.jpg", "size": 1072166, "content_type": "image/jpeg", "url": "http://34.149.205.56/sentron-melania-copy.jpg"}]
```

Tahdah.. The Media Player Application

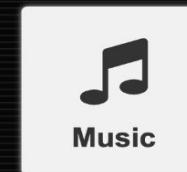
Not Secure | mediaplayertv.com



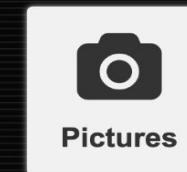
Media Dashboard



Videos



Music



Pictures



EVIL_DEAD_RISE.mp4



Turning_Red.mp4



mario-trailer.mp4





Calm-Down.mp3



blackpink.pretty_savage.mp3



tiesto_10_35.mp3





1151019.jpg



1438209.jpg



WallpaperDog-17018969.jpg



unsplash.jpg



sentron-melani

←

→

C

Not Secure | mediaplayertv.com/play/1438209.jpg



Demo Time

You can Access the Application here:

<http://mediaplayertv.com/>

Problems Faced

- Load Balancer
 - In the proposal, we wanted to utilize a Load Balancer to distribute traffic to our Compute Instances
 - However, to distribute traffic from a Load Balancer, the end point needed to be a Backend Service
 - Solution: Create an Instance Group containing our Compute Instances and route traffic to the Instance Group
- Jellyfin & CDN:
 - In the proposal, we planned to use Jellyfin as the media player
 - However, the biggest problem was that it doesn't support Google Cloud CDN well
 - We have also tried to use similar platforms like jellyfin such as Plex, Emby etc. But, none of them support a CDN well.
 - Solution: Substitute Jellyfin with a simpler player, and deploy MongoDB to store the metadata

- Cloud Functions:
 - The cloud functions gets triggered too fast. Had faced Issues when trying to take backup of the uploaded files
 - Solution: Came up with a wait logic to make the functions wait until the file is actually uploaded
- Enabling Metrics Server for HPA (Horizontal Pod Autoscaling)
 - Metrics server doesn't come inbuilt with the K8s cluster. We were required to enable it.
 - The old documentation and articles are outdated and point to a metrics-server deployment file which doesn't exist.
 - The new metrics server is converted to a Helm chart and we were required to deploy using Helm.

Future Scope

- Add Authentication & Authorization
- Relterate UI Design
- Create Thumbnails for videos using Cloud Functions
- Fetch Album Art for Songs using Album Art APIs

Code Link

- https://github.com/jkovvur1/CS_552_Final_Project

Thank you!