SUMMARY

As part of creating a VOD pipeline on Google Cloud Platform (GCP), our objective is to process specific videos by transcoding them into multiple resolutions. Additionally, we will generate subtitles from each video’s audio and store them in a designated file for transcription purposes. Each processed video will also have a thumbnail generated, allowing for a visual preview of the video content. This document details the function job-submit-02, one of the cloud functions in our pipeline. The job-submit-02 function on GCP is designed to manage video transcoding tasks. When a video file is uploaded to a designated Cloud Storage bucket, the function is triggered and submits a transcoding job using the Google Cloud Video Transcoder service. This service processes the video into multiple resolutions (SD, HD, and UHD). Once the transcoding job is completed, the function publishes a notification message to a Google Cloud Pub/Sub topic to confirm the successful processing of the video.

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# INTRODUCTION

## I-1 Overview of the Cloud Function's purpose and primary operations

This Cloud Function, job-submit-02, automates the video transcoding process on Google Cloud Platform. When a new video file is uploaded to a specified Cloud Storage bucket, the function triggers the Google Cloud Video Transcoder service to generate multiple video formats (SD, HD, and UHD). Upon job completion, it publishes a notification to a Google Cloud Pub/Sub topic, informing downstream services of the successful transcoding process.

## I-2 Architecture Overview

Une image contenant capture d’écran, texte, Caractère coloré, carré

Description générée automatiquement

Figure 1: Algorithmic diagram of the *job-submit-02* cloud function

**Workflow Explanation:**

* **Trigger Event**: The function is triggered when a file is uploaded to a GCS bucket. The event includes details such as the file name and the source bucket.
* **Video Transcoding**: After extracting the source file details, the function initializes a Transcoder client and submits a transcoding job with specific parameters, including resolution and audio/video streams.
* **Job Response Processing**: The function captures the job response, which includes the job name, then proceeds to the next step to notify job completion.
* **Pub/Sub Notification**: Once the job is completed, the function sends a message to a Pub/Sub topic, notifying that the file has been successfully transcoded and is ready.
* **Error Handling**: If an error occurs during execution, it is logged, and an error message is returned with a failure status.

The function relies on several Google Cloud services (enabled before using them) to achieve its goals:

* Cloud Storage: Stores the source video files and hosts the transcoded output files.
  + Source bucket: “vodunprocessedgcp”
  + Destination bucket: “vodprocessedgcp”
* Google Cloud Video Transcoder: Processes the uploaded video into multiple resolutions.
  + Resolutions are SD, HD, and UHD

**SD**: Refers to video resolution that is generally 480 pixels in height (480p) for standard broadcasts, with a typical resolution of 640x480 pixels or 854x480 pixels. SD is commonly used for older videos and low-resolution streaming.

**HD**: Refers to higher video resolution, typically 720 pixels (720p) or 1080 pixels (1080p) in height. HD resolutions include 1280x720 pixels (720p) and 1920x1080 pixels (1080p), providing a clearer, sharper image than SD, suitable for modern displays and streaming.

**UHD**: Refers to video resolution that is higher than HD, usually at 4K resolution (3840x2160 pixels) or higher. UHD offers even greater detail and clarity, ideal for large screens and high-quality content viewing.

* Google Cloud Pub/Sub: Sends notifications upon the successful completion of transcoding jobs. This section includes a diagram of the data flow from file upload to Pub/Sub notification.
  + Topic name: “verse-dev-433901-topic”

### I-2-1 Function Details

The job-submit-02 cloud function consists of two files which are in the same directory:

* main.py: Contains the main logic for handling events, job submission, and notifications.
* requirements.txt: Lists Python dependencies required for the function to operate.
  + **functions-framework==3.\***

**Role**: *functions-framework* is essential for deploying and testing the Cloud Function locally. It provides a framework that emulates the Google Cloud Function runtime, allowing us to develop and test our function before deploying it to Google Cloud.

**In the Function**: It enables us to define handler as the entry point function and helps manage HTTP and event-based triggers.

* + **google-cloud-storage**

**Role**: Provides access to Google Cloud Storage (GCS), which is the storage service where video files are uploaded and processed. This library enables reading from and writing to GCS buckets.

**In the Function**: It’s used to capture event details (like the bucket name and file path) when a video file is uploaded to trigger the function, and to specify where transcoded files will be stored.

* + **google-cloud-video-transcoder**

**Role:** Manages interactions with the Google Cloud Video Transcoder API, which allows for automated transcoding of video files into different formats and resolutions.

**In the Function:** The core of the function’s logic is here. It initiates a transcoding job, defining video stream configurations (e.g., SD, HD, UHD resolutions), output formats, and locations for transcoded files. This library also provides methods for checking the status of the transcoding job.

* + **google-cloud-pubsub**

**Role:** Supports publishing and receiving messages through Google Cloud Pub/Sub, a messaging service for asynchronous communication between applications and microservices.

**In the Function:** After a successful transcoding job, it publishes a message to a specified Pub/Sub topic to notify other services or users that the transcoding process has been completed. This notification can trigger further downstream processing or alert systems.

**Environment and Configuration**

* **Environment Variables:** Variables for the project ID, location, and any other customizable settings related to the target storage locations and Pub/Sub topics.
  + project\_id: 'verse-dev-433901'
  + Region: us-east4
  + Topic\_name: “verse-dev-433901-topic”
* **Permissions:** The function needs appropriate permissions to interact with the Video Transcoder service, Cloud Storage, and Pub/Sub. Specifically, the function’s service account requires roles such as roles/transcoder.admin, roles/storage.objectViewer, and roles/pubsub.publisher.

# IMPLEMENTATION OF THE MAIN.PY FUNCTION

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Description générée automatiquement

Figure 2: Importing Libraries and Initial Setup

* **Function**: Imports necessary modules to handle video file processing and integration with Google Cloud services, including Pub/Sub, Transcoder, and Speech.
* **Log Configuration**: Enables capturing essential information at each processing stage, aiding in debugging and monitoring.



Figure 3: Defining the Main handler Function

* **Function**: The handler function serves as the entry point of this Cloud Function. It takes an event parameter, which contains information about the triggering event (here, a new file added in the Cloud Storage bucket).
* **Event Logging**: Logs the received event, allowing verification of the information transmitted at the trigger moment.

Une image contenant texte, capture d’écran, Police, nombre

Description générée automatiquement

Figure 4: Extracting Source File Information

* **Function**: Extracts the bucket name and file name from the trigger event. The complete path source\_gcs is generated to represent the file’s location in Google Cloud Storage.
* **Logging**: Logs the source file path to ensure that the correct file is being processed.

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Description générée automatiquement

Figure 5: Initializes the TranscoderServiceClient

* **Function**: Initializes the TranscoderServiceClient to interact with the Google Cloud Video Transcoder service. The parent is set to identify the project and the region in which the transcoding job will be executed.

Une image contenant texte, Police, capture d’écran, ligne

Description générée automatiquement

Figure 6: Configuring the Transcoding Job

* **Job Configuration**: Specifies the transcoding job parameters, including the source file path (input\_uri) and the destination bucket path (output\_uri).
* **Transcoding Parameters**: Defines the different video (SD, HD, UHD) and audio streams with their resolutions, bitrates, and output containers.

Une image contenant texte, capture d’écran, Police, ligne

Description générée automatiquement

Figure 7: Submitting the Transcoding Job

* **Function**: Submits the job configuration to Google Cloud Transcoder to initiate the transcoding process. job\_name holds the unique job ID, used for tracking.
* **Response Logging**: Logs the API response to confirm that the job has been successfully created.

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Description générée automatiquement

Figure 8: Job Completion Notification (Commented Out)

* **Function**: Currently commented out. This code block would periodically check (poll) the job status to determine if it is complete. If complete, it would publish a success message; if failed, it would log an error.
* **Polling**: This would keep the function active until the job is complete, helpful in workflows requiring real-time response.



Figure 9: Calling the *job\_completed* Notification Function

* **Function**: Once the transcoding job is complete, calls the *job\_completed* function to publish a message on Pub/Sub, signaling that the transcoded file is ready in the destination bucket.

Une image contenant texte, Police, capture d’écran

Description générée automatiquement

Figure 10: Error Handling

* **Function**: If an error occurs during the transcoding job creation process, captures the exception and logs the error message while returning a 500 status code to indicate failure.

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Description générée automatiquement

Figure 11: Publishing Pub/Sub Message with *job\_completed*

* **Function**: Creates a message notifying of the transcoding completion and publishes it to a specific Pub/Sub topic. The message contains the name of the transcoded file, facilitating notification for other services or teams.
* **Error Handling**: Catches potential errors during message publishing, logs the error, and returns None if publishing fails.

# TESTING AND VALIDATION

**Processing Steps**:

* Extracts event details.
* Configures and submits a transcoding job.
* Monitors job status (currently commented out in the code).
* Publishes a Pub/Sub notification when the job is completed.

**Unit Tests**: To be implemented to test different **processing steps**, particularly job creation and Pub/Sub publishing.

**Validation Criteria**: Verify that transcoded files are created in the destination bucket and that Pub/Sub messages are published.

# REFERENCES AND EXTERNAL DOCUMENTATION

* Google Cloud Video Transcoder documentation : [https://cloud.google.com/transcoder/docs/concepts/config-examples?\_gl=1\*1pfwenf\*\_ga\*ODAwNzc2OTM2LjE3MTM3NDEzMjA.\*\_ga\_WH2QY8WWF5\*MTczMTYzNzE4Ni4xMjEuMS4xNzMxNjM3MzY3LjU0LjAuMA..](https://cloud.google.com/transcoder/docs/concepts/config-examples?_gl=1*1pfwenf*_ga*ODAwNzc2OTM2LjE3MTM3NDEzMjA.*_ga_WH2QY8WWF5*MTczMTYzNzE4Ni4xMjEuMS4xNzMxNjM3MzY3LjU0LjAuMA..)
* Google Cloud Pub/Sub documentation : [https://cloud.google.com/pubsub/docs/create-topic?hl=en\_GB&\_gl=1\*vy80lz\*\_ga\*ODAwNzc2OTM2LjE3MTM3NDEzMjA.\*\_ga\_WH2QY8WWF5\*MTczMTYzNzE4Ni4xMjEuMC4xNzMxNjM3MTg3LjU5LjAuMA](https://cloud.google.com/pubsub/docs/create-topic?hl=en_GB&_gl=1*vy80lz*_ga*ODAwNzc2OTM2LjE3MTM3NDEzMjA.*_ga_WH2QY8WWF5*MTczMTYzNzE4Ni4xMjEuMC4xNzMxNjM3MTg3LjU5LjAuMA)..

# GLOSSARY

VOD : Video-On-Demand

GCP : Google Cloud Platform

SD : Standard Definition

HD : High Definition

UHD : Ultra High Definition

API : Application Programming Interface

GCS : Google Cloud Storage

HTTP : HyperText Transfer Protocol