AWS Elemental MediaConvert for Video Editing

*A Project Based Learning Report Submitted in partial fulfilment of the requirements for the award of the degree*

*of*

**Bachelor of Technology**

**in the Department of Computer Science & Engineering**

**Cloud Based AI/ML Speciality (22SDCS07A)**

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March - 2025.

**1. Introduction**

**Overview of the Project**

Cloud-based video editing provides a scalable and cost-effective way to process, edit, and deliver high-quality video content. This project involves the development of a cloud-based video processing platform based on AWS Elemental MediaConvert and other AWS services such as S3, Lambda, and Step Functions. The platform enables users to upload raw video files, which are transcoded into various formats, resolutions, and bitrates for smooth playback on devices. With the use of AWS, this solution does away with on-premises hardware needs, lowers processing time, and has guaranteed high availability. The project is geared towards applications such as content development, live streaming, and business video production.

**AWS Services Being Used and Justification**

1. Amazon S3 – This service acts as the primary storage for video processing, securely storing raw input videos and processed output files.
2. AWS Lambda – This service is used to automate the process by triggering MediaConvert when a new file is uploaded. It eliminates manual intervention and ensures a fully serverless execution model, optimizing resource usage.
3. Step Functions – It coordinates or orchestrates the whole workflow, it ensures smooth processing, error handling making video processing workflows more efficient and reliable.
4. CloudFront – Distributes processed videos with low latency and high availability, ensuring fast and secure playback for end users, regardless of their location.

These services offers a fully managed, serverless, and scalable platform for video editing without the requirement for expensive hardware and human intervention.

**Project Purpose and Expected Outcome**

The purpose of this project is to develop an automated, cloud-computing based video processing system capable of transcoding, processing, and optimizing videos for various platforms. The outcome is expected to be as a very scalable, effective, and inexpensive system that allows seamless video editing, storage, and delivery for applications such as media streaming, education, and corporate training.

**2. Methodology**

**Architecture and Workflow**

* The process begins when a user uploads a video file to an Amazon S3 bucket.
* S3 invokes an AWS Lambda function, which extracts metadata like format, resolution, and duration.
* Lambda calls AWS Step Functions, which orchestrates the execution of the workflow.
* Step Functions invokes AWS Elemental MediaConvert, which processes the video such as format conversion, resolution scaling, noise reduction, and subtitle insertion to improve video quality.
* The processed video is stored in Amazon S3.
* AWS CloudFront distributes it worldwide with low latency and security improvements.

This design provides scalability, automation, and cost-effectiveness, minimizing human intervention and optimizing video delivery. With the use of AWS services, companies can automate video workflows without having to manage infrastructure.

**Explanation of AWS Services Interaction**

The video processing workflow in the cloud is built on smooth cooperation among AWS services to facilitate efficiency and automation.

1. Amazon S3 is the central storage for source and processed videos. Videos uploaded to an S3 bucket initialize the processing chain.
2. AWS Lambda controls workflow activation through automatic extraction of metadata (video format, video resolution) and initiating AWS Step Functions to manage execution.
3. AWS Step Functions automate video processing through the coordination of multiple AWS services without human involvement to ensure seamless operation.
4. AWS Elemental MediaConvert transcoding does video transcoding, bitrate modification, format change, resolution scaling, noise reduction, and subtitle embedding for optimal playback on devices.
5. Amazon CloudFront is a global content delivery network (CDN) that delivers processed videos at low latencies with increased security.

All these AWS services together form saclable, automated, and effective video processing pipeline, removing the need for infrastructure management while ensuring high-quality media delivery.

**Justification for AWS Service Selection**

AWS offers a serverless, fully managed infrastructure that does away with on-premises hardware. MediaConvert for video transcoding guarantees high-quality output with adaptive streaming. Lambda and Step Functions automate the workflow, minimizing operational complexity, while CloudFront guarantees fast delivery of content. This is a cost-effective and scalable solution.

**3. Implementation Steps**

**AWS Infrastructure Setup**

To set up the cloud-based video editing platform:

1. Amazon S3 - Create an S3 Bucket to store input and output videos.
2. AWS Lambda – Configure Lambda functions to trigger workflows when a new video is uploaded to S3. Lambda extracts metadata and initiates processing.
3. AWS Step Functions - Configure Step Functions to manage workflow execution and seamless video processing automation.
4. AWS Elemental MediaConvert - Set up AWS Elemental MediaConvert to configure job settings (video format, resolution, bitrate).
5. Amazon CloudFront – Deploy a Content Delivery Network (CDN) to efficiently distribute processed videos with low latency and high security.

By integrating these services, the system ensures scalability, automation, and fast content delivery, eliminating the need for manual intervention in video processing.

**Security Policies, IAM Roles, and Access Controls**

Security is critical in cloud video processing. The following security practices are adopted:

1. IAM Roles and Policies

* Create a MediaConvert IAM role to allow the service to access Amazon S3 for input/output video files.
* Assign Lambda permissions to trigger MediaConvert jobs and manage metadata in DynamoDB.
* Restrict MediaConvert role permissions to prevent unauthorized modifications to video processing workflows.

1. S3 Bucket Policies

* Prevent public access.

3. Data Encryption

* Enable server-side encryption (SSE-S3) to protect raw and processed video files in Amazon S3.
* Use AWS Key Management Service (KMS) to encrypt MediaConvert job configurations and metadata.
* Enforce HTTPS (TLS encryption) for all video file transfers to prevent data interception.

These security policies ensure secure, encrypted and manageable video editing and processing workflows using AWS MediaConvert.

**Automation and CI/CD Pipeline**

To automate deployment and updates:

* AWS CodePipeline – Automates infrastructure updates.
* AWS CodeBuild – Compiles and tests changes before deployment.
* AWS Lambda Triggers – Automates video processing workflows.

This setup ensures continuous integration, automated deployment, and minimal downtime.