

CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: Separation of Cloud Generated Audio Streams	
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Project Overview:

The United States Coast Guard (USCG) plans to modernize their Search and Rescue Operational system. This involves moving the Operator Audio Console application from an on-premises local workstation to the Cloud. This Capstone will explore the feasibility of a web-based Operator Console.

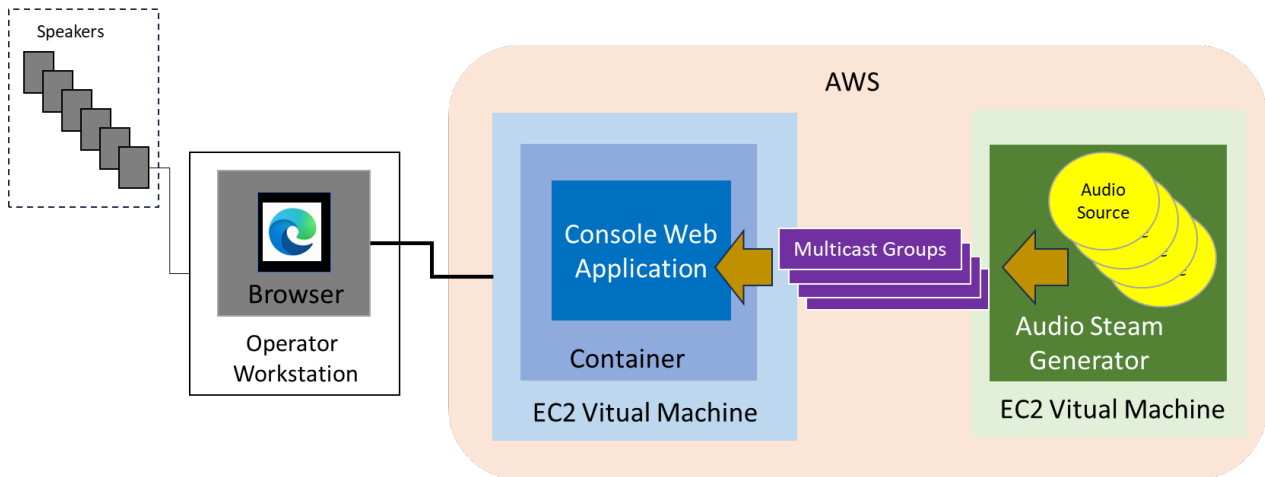
If we can distinguish four audio streams on two speakers, operators could use a browser-based application on a standard computer. This would support access of the system anywhere by anyone with the proper authentication. Moving to a cloud hosted Console would significantly reduce hardware, real estate, and personnel costs.

Accordingly, the purpose of this capstone project is to create a secure Amazon Web Services (AWS) Web-based Audio Console that can receive multiple concurrent audio streams and play them on the browser's local desktop computer speakers or USB-connected headset.

The audio streams are to be played in a way that each voice stream is distinguishable. Distinguishable voice stream audio should be demonstrable by (1) a multiple speaker configuration; and (2) using "spatial audio" processing techniques.

The proposed concept is shown in Figure 1.

Console Web Application



- Audio is generated by the Audio Stream Generator and flows to the console
 - up to 10 audio streams may be generated
- Each Audio stream is sent into a unique multicast group
- The Console listens on all multicast groups
- The Console mixes and renders the audio streams on local speakers or headset

Figure 1. Console Web Application

- The student will learn how to build AWS cloud-based applications using:
 - modern development tools such as Visual Studio Code
 - cloud programming languages such as JavaScript, Java, Python
 - server-side runtime environments such as Node
 - web based data formats for storing and transferring data such as JSON
 - aspects of Zero Trust Security
 - document databases such as Mongo
 - automated testing methods such as mocha, chai, supertest
- The student will learn how audio voice streams are manipulated by:
 - routing audio streams over the cloud
 - mixing audio streams
 - rendering audio streams to speakers
 - rendering spatial audio streams to speakers

Knowledge, skills, and expertise required for this project:

- basic understanding of the AWS cloud architecture
- programming skills in Java and/or JavaScript
- web server development experience in Node, Express
- knowledge of audio voice encoding and streaming techniques

Equipment Requirements:

- The project will require:
 - access to AWS GovCloud and procurement of cloud resources (e.g., EC2)
 - hardware device that enables the attachment of up to 10 speakers
- The project may require:
 - licensing of software to mix and separate audio streams

Software and other Deliverables:

Project deliverables are phased through the two-semester sequence and include:

- high level architecture
- block diagram of the web server
- containerized web server
- automated test environment
- audio stream simulator (generator)
- recommendation for separating audio voice streams

Other Requirements

U.S. Citizenship is required.