

Live Streaming on AWS

AWS Implementation Guide

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November 2016

Last updated: March 2019 (see [revisions](#))



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About This Guide

This implementation guide discusses architectural considerations and configuration steps for deploying the live streaming solution on Amazon Web Services (AWS). It includes links to [AWS CloudFormation](#) templates that launch and configure the AWS services required to deploy this solution using AWS best practices for security and availability.

The guide is intended for IT infrastructure architects, administrators, and DevOps professionals who have practical experience with video streaming and architecting on the AWS Cloud.

Overview

Amazon Web Services (AWS) enables broadcasters and content owners to automate media supply chains, streamline content distribution, and cost-effectively broadcast live content to

a global audience. With the AWS Cloud, you can seamlessly scale your infrastructure to meet demand, and pay only for what you use, helping you build highly available and cost-effective solutions for live video streaming.

AWS offers several options for delivering live streaming content on the cloud that enable you to automatically provision and dynamically scale any combination of video processing, delivery, and storage services. Customers can combine [AWS Media Services](#) with Amazon CloudFront to build a highly resilient and secure architecture that delivers an exceptional real-time viewing experience.

The live streaming solution automatically configures AWS Elemental MediaLive and AWS Elemental MediaPackage to encode and package your content for adaptive bitrate streaming across multiple screens via HTTP live streaming (HLS), Dynamic Adaptive Streaming over HTTP (DASH), Microsoft Smooth Streaming (MSS), and Common Media Application Format (CMAF). The solution also uses Amazon CloudFront to provide an elastic, highly available, global content delivery network for live video streaming. The solution is easy to deploy and used only during the live event. When you finish streaming, you can delete the solution's stack to help ensure that you only pay for the infrastructure you use.

Cost

You are responsible for the cost of the AWS services used while running this live streaming solution. As of the date of publication, the cost for running this solution in the US East (N. Virginia) Region is shown in the table below. The cost depends on the encoding profile you choose, and does not include data transfer fees, the cost for the demo HTML preview player, or Amazon CloudFront and AWS Elemental MediaPackage costs, which will vary depending on the number of users and the types of end user devices.

Encoding Profile	Total Cost/Hour
1080 (8 encodes)	\$5.00
720 (7 encodes)	\$4.00
540 (5 encodes)	\$2.25

Note that pricing is per minute, with a minimum of 10 minutes. Prices are subject to change. For full details, see the pricing webpage for each AWS service you will be using in this solution.

Architecture Overview

Deploying this solution builds the following environment in the AWS Cloud.

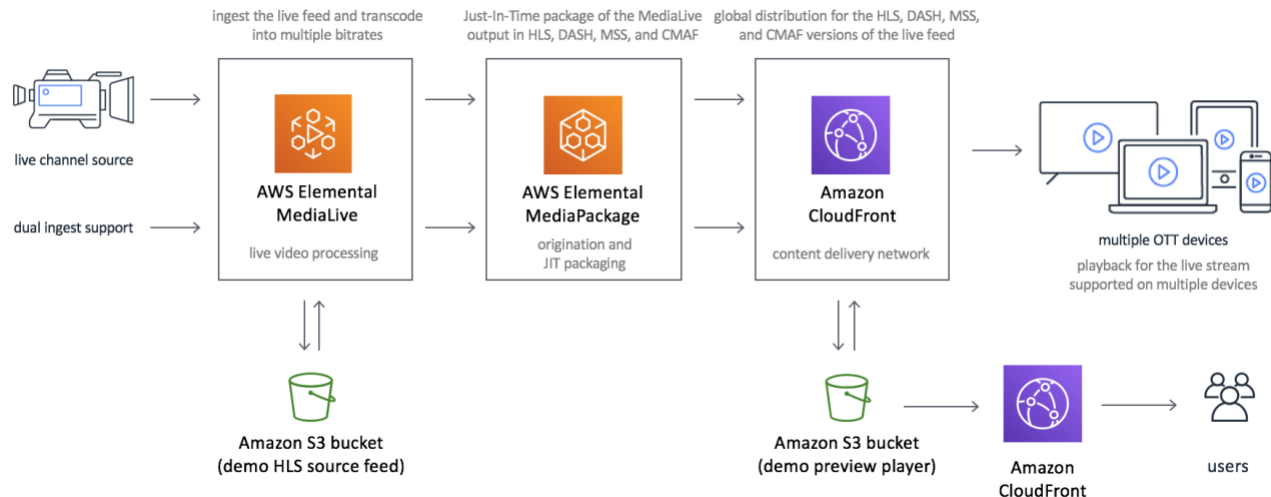


Figure 1: Live Streaming on AWS solution architecture

The solution's AWS CloudFormation template launches the AWS products and services necessary to ingest, transcode, and deliver live streaming video. AWS Elemental MediaLive ingests two input feeds and transcodes your content into two adaptive bitrate (ABR) HTTP Live Streaming (HLS) streams as output. AWS Elemental MediaPackage ingests the MediaLive output and packages the live stream into HLS, Dynamic Adaptive Streaming over HTTP (DASH), Microsoft Smooth Streaming (MSS), and Common Media Application Format (CMAF) formats that are delivered to four MediaPackage custom endpoints.

An Amazon CloudFront distribution is configured to use the MediaPackage custom endpoints as its origin. The CloudFront distribution delivers your live stream to viewers with low latency and high transfer speeds.

You can configure the solution to ingest Real-Time Transport Protocol (RTP), Real-Time Messaging Protocol (RTMP), HTTP Live Streaming (HLS), or AWS Elemental MediaConnect flows. The solution also includes three encoding profiles, which are ABR stream sets ranging in output resolution from 270p to 1080p, that you can set during initial configuration.

The solution also deploys a demo HTML preview player that you can use to test the solution. The player is a static website [hosted](#) in an Amazon Simple Storage Service (Amazon S3) bucket. Amazon CloudFront is used to restrict access to the solution's website bucket contents.

Deployment Considerations

Encoding Profiles

The Live Streaming on AWS solution configures AWS Elemental MediaLive with one of three encoding profiles. Choose one of the following encoding profiles.

- **1080p profile:** 1080p@6500kbps, 720p@5000kbps, 720p@3300kbps, 540p@2000kbps, 432p@1200kbps, 360p@800kbps, 270p@400kbps, 234p@200kbps
- **720p profile:** 720p@5000kbps, 720p@3300kbps, 540p@2000kbps, 432p@1200kbps, 360p@800kbps, 270p@400kbps, 234p@200kbps
- **540p profile:** 540p@2000kbps, 432p@1200kbps, 360p@800kbps, 270p@400kbps, 234p@200kbps

Regional Deployment

This solution uses AWS Elemental MediaLive, MediaPackage, and MediaConnect which are currently available in specific AWS Regions only. Therefore, you must launch this solution in an AWS Region where these services are available.¹ If you use MediaConnect as input, you must deploy this solution in the same region as your MediaConnect flows.

AWS CloudFormation Template

This solution uses AWS CloudFormation to automate the deployment of this live streaming solution on the AWS Cloud. It includes the following AWS CloudFormation template, which you can download before deployment:

[View template](#)

live-streaming-on-aws.template: Use this template to launch the solution and all associated components. The default configuration deploys an AWS Lambda function, an AWS Elemental MediaLive input and channel, an AWS Elemental MediaPackage channel, two Amazon CloudFront distributions, and an Amazon Simple Storage Service (Amazon S3) bucket for the demo HTML preview player but you can also customize the template based on your specific needs.

¹ For the most current service availability by region, see <https://aws.amazon.com/about-aws/global-infrastructure/regional-product-services/>

Automated Deployment

Before you launch the automated deployment, please review the architecture, configuration, network security, and other considerations discussed in this guide. Follow the step-by-step instructions in this section to configure and deploy the solution into your account.

Time to deploy: Approximately 20 minutes

Launch the Stack

This automated AWS CloudFormation template deploys the live streaming solution on the AWS Cloud.

Note: You are responsible for the cost of the AWS services used while running this solution. See the [Cost](#) section for more details. For full details, see the pricing webpage for each AWS service you will be using in this solution.

1. Log in to the AWS Management Console and click the button to the right to launch the `live-streaming-on-aws` AWS CloudFormation template. You can also [download the template](#) as a starting point for your own implementation.
2. The template is launched in the US East (N. Virginia) Region by default. To launch this solution in a different AWS Region, use the region selector in the console navigation bar.

A blue rectangular button with the text "Launch Solution" in white, sans-serif font.

Note: This solution uses the AWS Elemental MediaLive, MediaPackage, and MediaConnect services, which are currently available in specific AWS Regions only. Therefore, you must launch this solution in an AWS Region where these services are available.²

3. On the **Select Template** page, verify that you selected the correct template and choose **Next**.
4. On the **Specify Details** page, assign a name to your live streaming solution stack.
5. Under **Parameters**, review the parameters for the template and modify them as necessary.

This solution uses the following default values.

² For the most current service availability by region, see <https://aws.amazon.com/about-aws/global-infrastructure/regional-product-services/>.

Parameter	Default	Description
Deployment Options		
Source Code	<Requires input>	Choose whether to deploy the solution using NodeJS or Python source code for the AWS Lambda-backed custom resource
Demo Console	True	Choose whether to deploy the preview player
Live Streaming Source		
Source Input Type	URL_PULL	Specify the input type for AWS Elemental MediaLive: RTP_PUSH, RTMP_PUSH, RTMP_PULL, URL_PULL, or MEDIACONNECT
Source Codec	AVC	Specify the codec for the source stream for MediaLive: AVC, HEVC, or MPEG2
Encoding Profile	720	Specify the encoding profile to use with MediaLive
Start MediaLive Channel	True	Choose whether to start the MediaLive channel when the solution is created. We recommend starting the channel if you will use the demo preview player.
PUSH Source Input Types		
Input CIDR Block	<Requires input>	Specify the CIDR block for the MediaLive security group for PUSH Input Types
PULL Source Input Types		
Primary Source URL	https://d15an60oaeed9r.cloudfront.net/live_stream_v2/sports_reel_with_markers.m3u8	The primary source URL for the live feed. By default, this parameter contains the primary demo source URL.
Primary Source Username	<Optional input>	If authentication is required to access the source, enter the username
Primary Source Password	<Optional input>	If authentication is required to access the source, enter the password
Secondary Source URL	https://d3h5srgm8b0t83.cloudfront.net/live_stream_v2/sports_reel_with_markers.m3u8	The secondary (backup) source URL for the live feed. By default, this parameter contains the secondary demo source URL.
Secondary Source Username	<Optional input>	If authentication is required to access the secondary source, enter the username
Secondary Source Password	<Optional input>	If authentication is required to access the secondary source, enter the password
MediaConnect Source Input Types		

Parameter	Default	Description
Primary MediaConnect Flow ARN	<Optional input>	The primary source MediaConnect flow for the live feed. You can create the flow in the MediaConnect console. To provide redundancy, create the primary and secondary flows in different Availability Zones.
Secondary MediaConnect Flow ARN	<Optional input>	The secondary source MediaConnect flow for the live feed. You can create the flow in the MediaConnect console. To provide redundancy, create the primary and secondary flows in different Availability Zones.

6. Choose **Next**.
7. On the **Options** page, choose **Next**.
8. On the **Review** page, review and confirm the settings. Be sure to check the box acknowledging that the template will create IAM resources.
9. Choose **Create** to deploy the stack.

You can view the status of the stack in the AWS CloudFormation Console in the **Status** column. You should see a status of **CREATE_COMPLETE** in roughly 20 minutes.

To test the live stream playback, navigate to the AWS CloudFormation stack **Outputs** tab, select the **Demo Console URL** from the **Value** column.

Note: In addition to the primary AWS Lambda function, this solution includes the `solution-helper` Lambda function, which runs only during initial configuration or when resources are updated or deleted.

When running this solution, you will see both Lambda functions in the AWS Lambda console, do not delete the `solution-helper` function as it is necessary to manage associated resources.

Once the live streaming event is complete, terminate the resources created by this solution to help ensure that you don't incur unnecessary AWS charges.

Security

When you build systems on AWS infrastructure, security responsibilities are shared between you and AWS. This shared model can reduce your operational burden as AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the services operate. For more information about security on AWS, visit the [AWS Security Center](#).

Amazon CloudFront

This solution deploys a static website [hosted](#) in an Amazon S3 bucket. To help reduce latency and improve security, this solution includes an Amazon CloudFront distribution with an origin access identity, which is a special CloudFront user that helps restrict access to the solution's website bucket contents. For more information, see [Restricting Access to Amazon S3 Content by Using an Origin Access Identity](#).

Additional Resources

AWS services

- [AWS Elemental MediaLive](#)
- [AWS Elemental MediaPackage](#)
- [AWS Elemental MediaConnect](#)
- [Amazon CloudFront](#)
- [AWS CloudFormation](#)
- [AWS Lambda](#)

AWS Blogs

- [Connecting AWS Elemental Live On-Premises to AWS Media Services in the Cloud](#)
- [Connecting OBS Studio to AWS Media Services in the Cloud](#)
- [Connecting FFmpeg Using RTP to AWS Media Services in the Cloud](#)
- [Connecting FFmpeg Using RTMP to AWS Media Services in the Cloud](#)
- [Connecting VLC Media Playing Using RTP to AWS Media Services in the Cloud](#)

Tutorials and Workshops

- [AWS Live Streaming and Live-to-VOD Workshop](#)
- [Build a Secure Packager and Encoder Key Exchange \(SPEKE\) Reference Server](#)
- [Build a Frame-Accurate Live-to-VOD Workflow with Image Recognition](#)

Appendix: Collection of Anonymous Data

This solution includes an option to send anonymous usage data to AWS. We use this data to better understand how customers use this solution and related products and services. When

enabled, the following information is collected and sent to AWS when the AWS CloudFormation template is launched:

- **Solution ID:** The AWS solution identifier
- **Unique ID (UUID):** Randomly generated, unique identifier for each live streaming solution deployment
- **Timestamp:** Data-collection timestamp
- **Launch Data:** The AWS Region where the stack was launched
- **Source Input Type:** The input type you selected at launch
- **Source Input Codec:** The codec you selected at launch
- **Source Input Resolution:** The resolution you selected at launch
- **Source Code:** The code base you selected at launch
- **Console: Whether or not the preview player was launched**

Note that AWS will own the data gathered via this survey. Data collection will be subject to the [AWS Privacy Policy](#). To opt out of this feature, modify the AWS CloudFormation template mapping section as follows:

```
AnonymousData:  
  SendAnonymousData:  
    Data: Yes
```

to

```
AnonymousData:  
  SendAnonymousData:  
    Data: No
```

Source Code

This solution includes two source code options, NodeJS and Python. Use the **Source Code** AWS CloudFormation parameter to choose the source code you want. You can visit our [GitHub repository](#) to download the templates and scripts for this solution, and to share your customizations with others.

Document Revisions

Date	Change	In sections
November 2016	Initial release	--
March 2017	Added an AWS CloudFormation parameter for the Elemental Live server version	Launch the Stack
April 2017	Changed all Elemental references to AWS Elemental to reflect the new name	Throughout the guide
September 2018	Added information about AWS Elemental MediaLive and MediaPackage functionality, and encoding profiles	Overview ; Architecture Overview ; Deployment Considerations ; AWS CloudFormation Template ; Automated Deployment ; Resources ; Appendix
December 2018	Added information about the Amazon CloudFront distribution for the static website hosted in the Amazon S3 bucket	Security
March 2019	Added information about MediaConnect input and CMAF format functionality	Architecture Overview ; Regional Deployments ; Launch the Stack

Notices

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