Live Streaming on AWS with Amazon S3
Implementation Guide
Live Streaming on AWS with Amazon S3: Implementation Guide
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Deliver resilient and secure real-time viewing experiences using AWS Elemental MediaLive and Amazon S3 services

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Amazon Web Services (AWS) helps broadcasters and content owners to automate media supply chains, streamline content distribution, and cost-effectively broadcast live content to a global audience. With AWS, 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.

The Live Streaming on AWS with Amazon S3 solution helps you build highly available live video streaming content using AWS Elemental MediaLive and Amazon Simple Storage Service (Amazon S3) services to deliver resilient and secure real-time viewing experiences to your customers.

This solution is 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.

This solution provides the following features:

- Automatically configures MediaLive and Amazon S3 to encode and originate your content for adaptive bitrate streaming across multiple screens via HTTP Live Streaming (HLS).
- Provides an elastic, highly available, global content delivery network for live video streaming using Amazon CloudFront.
- Supports four input types (RTP_PUSH (p. 20), RTMP_PUSH (p. 20), URL_PULL (p. 19), and INPUT_DEVICE (p. 17)) as the source for your video stream, including a device input so you can use an AWS Elemental Link as the source for the input for your live channel

This implementation guide discusses architectural considerations and configuration steps for deploying the Live Streaming on AWS with Amazon S3 solution in the AWS Cloud. It includes a link to an AWS CloudFormation template that launches and configures 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 in the AWS Cloud.
Live Streaming on AWS with Amazon S3 Implementation Guide
Cost example 1

Cost

You are responsible for the cost of the AWS services used while running this solution. As of March 2022, the cost for running this solution in the US East (N. Virginia) with:

- Approximately 1,000 viewers for a one-hour live event using a standard definition (SD)-540p encoding profile is approximately $1.76 for live encoding and packaging + $67.24 for 791 GB distribution = $69.00 for the one-hour event.
- Approximately 10,000 viewers for a one-hour live event using a high definition (HD)-1080p encoding profile is approximately $3.18 for live encoding and packaging + $1531.49 for 18,017 GB distribution = $1,534.67 for the one-hour event.

These cost estimates depend on many factors, which are detailed in the following cost examples.

**Note**
The examples provided are likely higher than the actual costs of running this solution. The intent was to provide a guide to the pricing that is easily understood. Where assumptions were needed, we used factors that were straightforward to calculate and also likely be more expensive than the actual cost.

For an additional cost example for streaming a live event, refer to the FAQs about live streaming on AWS blog in the AWS Media Blog.

Cost example 1

Cost example 1 covers a use case of approximately 1,000 viewers viewing a live event for about one hour with a SD-540p encoding profile selected in the CloudFormation template. This cost example is based on the following factors:

- Pricing Region: US-East-1, assuming standard pricing (no free-tier or discounts).
- Viewers consume the highest bitrate: While bitrate consumption is a mix of all the streams, we used the highest bitrate in the calculation to show the upper cost range. Additionally, the Quality-Defined Variable Bitrate (QVBR) and variable video complexity can result in an output bandwidth that is 10-50% lower in price than the estimate provided in Table 1.
- 99% cache/hit ratio between the content delivery network (CDN) and Amazon S3.

**Note**
Storage of the test player is not included in this cost estimate.

Table 1 summarizes the total pricing for the live streaming event. Tables 2 through 4 break down the cost for each AWS service.

**Table 1: Cost breakdown for 1,000 viewers for a one-hour live event**

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Function</th>
<th>Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS Elemental MediaLive</td>
<td>Input and outputs for channel</td>
<td>$1.71</td>
</tr>
<tr>
<td>Amazon S3</td>
<td>Storage</td>
<td>$0.01</td>
</tr>
</tbody>
</table>
Live Streaming on AWS with
Amazon S3 Implementation Guide
AWS Elemental MediaLive pricing

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Function</th>
<th>Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requests</td>
<td></td>
<td>$0.04</td>
</tr>
<tr>
<td>Amazon CloudFront</td>
<td>Distribution</td>
<td>$67.24</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>$69.00</strong></td>
</tr>
</tbody>
</table>

**AWS Elemental MediaLive pricing**

Table 2 breaks down the AWS Elemental MediaLive pricing which assumes HD AVC input and SD AVC outputs with less than 10 Mbps bitrate and less than 30 frames per second (fps) frame rate.

**Table 2: MediaLive pricing**

<table>
<thead>
<tr>
<th>Input / output</th>
<th>Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD Input (AVC 10-20Mbps)</td>
<td>$0.294</td>
</tr>
<tr>
<td>Output 1 SD (512x288, 400k)</td>
<td>$0.354</td>
</tr>
<tr>
<td>Output 2 SD (640x360, 800k)</td>
<td>$0.354</td>
</tr>
<tr>
<td>Output 3 SD (768x432, 1,200k)</td>
<td>$0.354</td>
</tr>
<tr>
<td>Output 4 SD (960x540, 1,800k)</td>
<td>$0.354</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>$1.71</strong></td>
</tr>
</tbody>
</table>

**Amazon S3 pricing**

Amazon S3 charges $0.023 per Gigabyte (GB) per month for the first 50 Terabytes (TB) stored in the bucket. The volume of storage billed in a month is based on the average storage used throughout the month. This can be determined by size of objects and how long they are stored. For this example, 21 segments for 4 bitrates are stored at all times. The cost of storage per hour is as follows:

1. Add the bitrate of all streams in Kbps:
   - 400k + 800k + 1,200k + 1,800k = 4,200 Kbps
2. Calculate size of four-second segment (for all bitrates combined):
   - 4,200 Kbps * 4 seconds = 16,800 Kb
3. Total size of segments stored at a time:
   - 16,800 Kb * 21 segments = 352,800 Kb
4. Total Kb-hour usage:
   - 352,800 Kb * 1 hour storage = 352,800 Kb-hours
5. Convert to GB-months:
   - 352,800 Kb-hours / 8 bits per byte / 1,000,000 Kb per GB / 744 hours in month = 0.00006 GB-months

   \[
   0.00006 \text{ GB-months} \times \$0.023 = \$0.000001 \text{ per hour of storage}
   \]

The cost will continue to accumulate per hour as long as the objects are not removed from the bucket. Cost of storage is billed monthly.
Live Streaming on AWS with Amazon S3 Implementation Guide

Viewer traffic pricing

Table 3: Amazon S3 storage pricing

<table>
<thead>
<tr>
<th>Input / output</th>
<th>Kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 1 SD (512x288, 400k)</td>
<td>400</td>
</tr>
<tr>
<td>Output 2 SD (640x360, 800k)</td>
<td>800</td>
</tr>
<tr>
<td>Output 3 SD (768x432, 1,200k)</td>
<td>1,200</td>
</tr>
<tr>
<td>Output 4 SD (960x540, 1,800k)</td>
<td>1,800</td>
</tr>
<tr>
<td><strong>Total Kbps:</strong></td>
<td><strong>4,200</strong></td>
</tr>
</tbody>
</table>

Compute total Kb stored

4,200 kbps * 4 seconds * 21 segments = 352,800 Kb

GB-month usage for one hour

0.00006 GB

Cost (GB/hour * $0.023) = $0.000001/hour

Amazon S3 charges $0.005 per 1,000 requests for PUT, COPY, POST, and LIST requests. This example has four input streams, so the number of requests can be approximated by the following:

1. Calculate the number of segments:
   • 3,600 seconds of content / 4 second segments = 900 segments
   • 900 segments * 4 input streams = 3,600 segments
2. Calculate the number of manifest updates:
   • 4 input streams * 3,600 seconds of content / updates every 4 seconds = 3,600 manifest updates
3. Add total segments to total manifest updates to get the number of PUT requests:
   • 3,600 + 3,600 = 7,200 PUT requests per hour

Table 4: Amazon S3 request pricing

<table>
<thead>
<tr>
<th>Request</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUT ts segments</td>
<td>3,600</td>
</tr>
<tr>
<td>PUT manifest files</td>
<td>3,600</td>
</tr>
<tr>
<td><strong>Total requests:</strong></td>
<td><strong>7,200</strong></td>
</tr>
</tbody>
</table>

Cost (total requests/1000 * $0.005) = $0.036/hour

Data transfers from S3 to Amazon CloudFront are free of charge.

**Viewer traffic pricing**

The cost estimate for viewer traffic assumes that all viewers get the highest bitrate for the one-hour live streaming event.

Table 5: Viewer traffic pricing
## Cost example 2

Cost example 2 covers a use case of approximately 10,000 viewers viewing a live event for about one hour with an **HD-1080p** encoding profile selected in the CloudFormation template. This cost example is based on the following factors:

- **Pricing Region:** US-East-1, assuming standard pricing (no free-tier or discounts).
- **Viewers consume the highest bitrate:** Note that bitrate consumption is a mix of all the streams, but the highest bitrate is used in the calculation to show the upper cost range. Additionally, the QVBR and variable video complexity can result in an output bandwidth that is 10-50% lower in price than the estimate provided in Table 6.
- **99% cache/hit ratio between the CDN and Amazon S3.**

### Note

Storage of the test player is not included in this cost estimate.

Table 6 summarizes the total pricing for the live streaming event. Tables 7 through 10 break down the cost for each AWS service.

### Table 6: Cost breakdown for 10,000 viewers for a one-hour live event

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Function</th>
<th>Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS Elemental MediaLive</td>
<td>Input and outputs for channel</td>
<td>$3.11</td>
</tr>
<tr>
<td>Amazon S3</td>
<td>Storage</td>
<td>$0.01</td>
</tr>
<tr>
<td></td>
<td>Requests</td>
<td>$0.06</td>
</tr>
<tr>
<td>Amazon CloudFront</td>
<td>Distribution</td>
<td>$1,531.49</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>$1,534.67</strong></td>
</tr>
</tbody>
</table>

## AWS Elemental MediaLive pricing

Table 7 breaks down the AWS Elemental MediaLive pricing which assumes HD AVC input and both SD and HD AVC outputs with less than 10 Mbps bit rate and less than 30 fps frame rate.

### Table 7: MediaLive pricing
Amazon S3 pricing

As detailed in Cost Example 1, Amazon S3 pricing is based on GB of storage per month. Table 8 shows the conversion from Kbps to Mbps to Gbps to GB/hour to get the total GB of storage for the hour-long stream.

<table>
<thead>
<tr>
<th>Input / Output</th>
<th>Kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 1 (512x288_400k)</td>
<td>400</td>
</tr>
<tr>
<td>Output 2 (640x360_800k)</td>
<td>800</td>
</tr>
<tr>
<td>Output 3 (768x432_1,200k)</td>
<td>1,200</td>
</tr>
<tr>
<td>Output 4 (960x540_1,800k)</td>
<td>1,800</td>
</tr>
<tr>
<td>Output 5 (1280x720p_2,700k)</td>
<td>2,700</td>
</tr>
<tr>
<td>Output 6 (1920x1080p_4,100k)</td>
<td>4,100</td>
</tr>
<tr>
<td><strong>Total Kbps:</strong></td>
<td><strong>11,000</strong></td>
</tr>
</tbody>
</table>

Compute total Kb stored

\[
11,000 \text{ Kbps} \times 4 \text{ seconds} \times 21 \text{ segments} = 924,000 \text{ Kb}
\]

GB-month usage for one hour

\[
\frac{924,000 \text{ Kb-hours}}{8 \text{ bits per byte}} \div \frac{1,000,000 \text{ Kb per GB}}{744 \text{ hours}} = 0.0002 \text{ GB/month}
\]

| **Total (GB/hour \times $0.023)** | **$0.000005** |

Table 9: Amazon S3 request pricing
Estimating the viewer traffic

The cost estimate for viewer traffic assumes that all viewers get the highest bitrate for the one-hour live streaming event.

Table 10: Viewer traffic pricing

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Function</th>
<th>Cost per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon CloudFront</td>
<td>Average Mbps per viewer</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Total MB per sec (10,000 x 4.1 / 8)</td>
<td>5,125</td>
</tr>
<tr>
<td></td>
<td>Total Egress per hour (5,125 / 1,024 x 60 x 60)</td>
<td>18,017 GB/hour</td>
</tr>
<tr>
<td></td>
<td>Total (18,017 GB * $0.085):</td>
<td>$1,531.49</td>
</tr>
</tbody>
</table>

Note
Pricing is per minute, with a minimum of 10 minutes. Prices are subject to change.

Amazon CloudWatch metrics cost

Amazon CloudWatch charges $0.30 per metric per month for the first 10,000 metrics. This solution uses 11 metrics, so the cost for an hour-long stream can be determined by:

$0.30 \times \frac{11 \text{ metrics} \times 1 \text{ hour}}{1,080 \text{ hours per month}} = \$0.005$

For more information about metrics, refer to Amazon CloudWatch metrics (p. 21).

We recommend creating a budget through AWS Cost Explorer to help manage costs. Prices are subject to change. For full details, refer to the pricing webpages for each AWS service used in this solution.
Architecture overview

Deploying this solution with the default parameters builds the following environment in the AWS Cloud.

**Figure 1: Live Streaming on AWS with Amazon S3 architecture**

The AWS CloudFormation template launches the AWS products and services necessary to ingest, transcode, and deliver live streaming video.

1. **AWS Elemental MediaLive** ingests an input feed and transcodes your content into one adaptive bitrate (ABR) HTTP Live Streaming (HLS) stream as output.
2. **Amazon Simple Storage Service** (Amazon S3) provides a scalable highly-available storage bucket to host the encoded segments.
3. An **Amazon CloudFront** distribution is configured to use the Amazon S3 custom endpoints as its origin. The CloudFront distribution delivers your live stream to viewers with low latency and high transfer speeds.
4. An Amazon S3 bucket stores the CloudFront logs.

You can configure this solution to ingest Real-Time Transport Protocol (RTP), Real-Time Messaging Protocol (RTMP), HTTP Live Streaming (HLS) content, or live video from an AWS Elemental Link device. This solution also includes three encoding profiles (p. 10).

**Note**

AWS CloudFormation resources are created from Amazon CDK constructs.
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 AWS Cloud Security.

IAM roles

AWS Identity and Access Management (IAM) roles allow customers to assign granular access policies and permissions to services and users in the AWS Cloud. This solution creates IAM roles that grants the AWS Lambda function access to the other AWS services used in this solution.

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.
Deployment considerations

Encoding profiles

The Live Streaming on AWS with Amazon S3 solution configures AWS Elemental MediaLive with one of three progressive, 30 frames per second encoding profiles. Choose one of the following encoding profiles.

- **HD-1080p profile:** 1920x1080, 1280x720, 960x540, 768x432, 640x360, 512x288
- **HD-720p profile:** 1280x720, 960x540, 768x432, 640x360, 512x288
- **SD-540p profile:** 960x540, 768x432, 640x360, 512x288

Demo content

The solution includes a link to a demo HTTP Live Streaming (HLS) stream hosted in an Amazon S3 bucket, which lets you test the solution without having to set up and configure a live stream. Deploying the solution with default parameters, launches the demo.

Solution updates

To continue using this solution with the latest features and improvements, you must deploy the latest version of the AWS CloudFormation template as a new stack. This solution does not support updating an existing stack. For information to deploy the latest AWS CloudFormation template as a new stack, refer to Launch the stack (p. 13). After the new stack completes deployment, we recommend uninstalling the previous version (p. 23) to save on costs.

Regional deployment

This solution uses AWS Elemental MediaLive, which is currently available in specific AWS Regions only. Therefore, you must launch this solution in an AWS Region where these services are available. For the most current service availability by Region, refer to the AWS Regional Services List.

To use an AWS Elemental Link device as an input, you must launch this solution in the AWS Region where the device is configured.

Supported deployment Regions

Live Streaming on AWS with Amazon S3 is supported in the following AWS Regions:

<table>
<thead>
<tr>
<th>Region name</th>
<th>Region ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>US East (N. Virginia)</td>
<td>us-east-1</td>
</tr>
<tr>
<td>US East (Ohio)</td>
<td>us-east-2</td>
</tr>
</tbody>
</table>
Live Streaming on AWS with Amazon S3 Implementation Guide
Supported deployment Regions

<table>
<thead>
<tr>
<th>Region name</th>
<th>Region ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>US West (Northern California)</td>
<td>us-west-1</td>
</tr>
<tr>
<td>US West (Oregon)</td>
<td>us-west-2</td>
</tr>
<tr>
<td>Asia Pacific (Mumbai)</td>
<td>ap-south-1</td>
</tr>
<tr>
<td>Asia Pacific (Seoul)</td>
<td>ap-northeast-2</td>
</tr>
<tr>
<td>Asia Pacific (Singapore)</td>
<td>ap-southeast-1</td>
</tr>
<tr>
<td>Asia Pacific (Sydney)</td>
<td>ap-southeast-2</td>
</tr>
<tr>
<td>Asia Pacific (Tokyo)</td>
<td>ap-northeast-1</td>
</tr>
<tr>
<td>Europe (Frankfurt)</td>
<td>eu-central-1</td>
</tr>
<tr>
<td>Europe (Ireland)</td>
<td>eu-west-1</td>
</tr>
<tr>
<td>Europe (London)</td>
<td>eu-west-2</td>
</tr>
<tr>
<td>Europe (Paris)</td>
<td>eu-west-3</td>
</tr>
<tr>
<td>Europe (Stockholm)</td>
<td>eu-north-1</td>
</tr>
<tr>
<td>South America (Sao Paulo)</td>
<td>sa-east-1</td>
</tr>
</tbody>
</table>
AWS CloudFormation template

This solution uses AWS CloudFormation to automate the deployment of the Live Streaming on AWS with MediaStore solution on the AWS Cloud. It includes the following AWS CloudFormation template, which you can download before deployment:

live-streaming-on-aws-with-amazon-s3.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, Amazon CloudFront distributions, and Amazon S3 buckets, but you can customize the template to meet your specific needs.
Automated deployment

Before you launch the automated deployment, review the 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 five minutes

Launch the stack

Important
This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution and related services and products. AWS owns the data gathered through this survey. Data collection is subject to the AWS Privacy Policy.

To opt out of this feature, download the template, modify the AWS CloudFormation mapping section, and then use the AWS CloudFormation console to upload your template and deploy the solution. For more information, refer to the Collection of operational metrics (p. 24) section of this guide.

This automated AWS CloudFormation template deploys the Live Streaming on AWS with Amazon S3 solution on the AWS Cloud.

Note
You are responsible for the cost of the AWS services used while running this solution. Refer to the Cost (p. 2) section for more details. For full details, refer to the pricing webpage for each AWS service you use in this solution.

1. Log in to the AWS Management Console and select the button to launch the live-streaming-on-aws-with-amazon-s3.template AWS CloudFormation template.

You can also download the template as a starting point for your own implementation.

2. The template launches 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.

Note
This solution uses the AWS Elemental MediaLive and Amazon S3 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. For the most current service availability by Region, refer to the AWS Regional Services List.

3. On the Create stack page, verify that the correct template shows in the Amazon S3 URL text box and choose Next.

4. On the Specify stack details page, assign a name to your solution stack.

5. Under Parameters, review the parameters for the template, and modify them as necessary. This solution uses the following default values.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Input Type</td>
<td>URL_PULL</td>
<td>Specify the input type for MediaLive: RTP_PUSH, RTMP_PUSH, URL_PULL (HLS), or INPUT_DEVICE (AWS Elemental Link). Detailed instructions for each input type can be found in the appendix.</td>
</tr>
<tr>
<td>Source URL</td>
<td>&lt;Optional input&gt;</td>
<td>If you selected URL_PULL for Source Input Type, enter the URL for your source stream. By default, this parameter contains the primary demo source URL.</td>
</tr>
<tr>
<td>Source Username</td>
<td>&lt;Optional input&gt;</td>
<td>If you selected URL_PULL for Source Input Type, enter the username for your source stream if using authentication. This value will be stored securely in AWS Systems Manager Parameter Store.</td>
</tr>
<tr>
<td>Source Password</td>
<td>&lt;Optional input&gt;</td>
<td>If you selected URL_PULL for Source Input Type, enter the password for your source stream if using authentication. This value will be stored securely in AWS Systems Manager Parameter Store.</td>
</tr>
<tr>
<td>Input Security Group CIDR Block</td>
<td>&lt;Optional input&gt;</td>
<td>For RTP_PUSH and RTMP_PUSH input types, specify the CIDR block to restrict access to the MediaLive input endpoint. This should be the IP or IP range of your source stream location/network.</td>
</tr>
</tbody>
</table>

Live Streaming on AWS with Amazon S3 Implementation Guide
Launch the stack
Live Streaming on AWS with Amazon S3 Implementation Guide
Launch the stack

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoding Profile</td>
<td>HD-720</td>
<td>Specify the encoding profile to use with MediaLive.</td>
</tr>
<tr>
<td>Start MediaLive Channel</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 AWS Identity and Access Management (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 receive a CREATE_COMPLETE status in approximately five minutes.

Note
To test the live stream playback, navigate to the AWS CloudFormation stack Outputs tab, copy the Amazon CloudFront URL, and open the URL in any player compatible with HTTP Live Streaming (HLS). For more details, refer to Amazon CloudWatch metrics (p. 21).
Additional resources

- AWS CloudFormation
- AWS Elemental MediaLive
- AWS Elemental Link
- Amazon Simple Storage Service
- Amazon CloudWatch
- AWS Lambda
- AWS Identity and Access Management
AWS Elemental Link input configuration

This solution includes support for the AWS Elemental Link device as a source for live streaming content. AWS Elemental Link offers a configuration-free, cost-efficient way to securely and reliably transfer video to AWS Elemental MediaLive. For more details on the device, refer to the AWS Elemental Link product page.

To configure this solution to use an AWS Elemental Link device you need the following:

- A Link device powered on and connected to the internet.
- The Link device ID. To find the device ID, sign in to the AWS MediaLive console and navigate to MediaLive Devices in the AWS Region where your device is registered. The device is listed with the Link device ID.
- Launch the solution in the same Region as the Link device with the following parameters:
  - **Source Input Type**: INPUT DEVICE
  - **AWS Elemental Link Input Device ID**: The ID of the Link device from the AWS Elemental MediaLive console. You can only attach a Link device to one input at a time. If the Link device is already attached to an input, you cannot create a new input using that device.
  - **Encoding Profile**: Select the profile that best matches your source resolution.
  - **Start MediaLive Channel**: If your device is ready to stream, select true. Otherwise, select false—you can start the MediaLive channel through the AWS MediaLive console when you’re ready to stream.

**Note**
For a full list of input types and configuration details, refer to the Creating an input topic in the AWS Elemental MediaLive User Guide.
Figure 2: AWS Elemental Link input configuration
URL Pull (HLS) input configuration

URL Pull provides the option to ingest an HLS stream over HTTP or HTTPS. The following parameters are required to configure the solution to ingest an HLS stream:

- **Solution Input Type:** URL_PULL
- **Source URL:** The HTTP(s) link to the HLS stream manifest file. The default value is a demo stream from AWS.
- **Source Username:** Only required if you have basic authentication setup on your source HLS stream.
- **Source Password:** Only required if you have basic authentication setup on your source HLS stream.
- **Encoding Profile:** Select the profile that best matches your source resolution.
- **Start MediaLive Channel:** If your device is ready to stream, select true. Otherwise, select false—you can start the MediaLive channel through the AWS console when you're ready to stream.

**Note**
For a full list of input types and configuration details, refer to the Creating an input topic in the AWS Elemental MediaLive User Guide.

![Parameters](image)

**Figure 3: URL Pull (HLS) input configuration**
RTMP Push and RTP Push input configuration

RTP and RTMP Push provide the option to push a transport stream (TS) to AWS Elemental MediaLive. In both options, the following parameters are required to configure the solution:

- **Solution Input Type:** RTP_PUSH / RTMP_PUSH
- **Input Security Group CIDR Block:** A valid CIDR block used to create a security group to restrict access to the MediaLive input.
- **Encoding Profile:** Select the profile that best matches your source resolution.
- **Start MediaLive Channel:** If your device is ready to stream, select true. Otherwise, select false—you can start the MediaLive channel through the AWS console when you’re ready to stream.

**Note**
For a full list of input types and configuration details, refer to the Creating an input topic in the AWS Elemental MediaLive User Guide.

![Figure 4: RTMP Push and RTP Push input configuration](image)
Amazon CloudWatch metrics

The Live Streaming on AWS with Amazon S3 solution activates Amazon CloudWatch metrics to monitor Amazon S3 requests made to the live stream distribution bucket. Out of the 16 metrics available for Amazon S3 requests, the following metrics are used for this solution:

- All requests
- PUT requests
- DELETE requests
- HEAD requests
- LIST requests
- Bytes downloaded
- Bytes uploaded
- 4xx errors
- 5xx errors
- First byte latency
- Total request latency

To deactivate CloudWatch metrics for the live stream distribution bucket, remove the metrics filter:

1. Sign in to the AWS CloudFormation console.
2. On the Stacks page, select the solution stack.
3. Select the Outputs tab.
4. View bucket metrics by selecting the hyperlink for the BucketMetrics output.
5. Choose Manage filters then select the filter.
6. Choose Delete.
Update the solution

If you have previously deployed the solution, use the following instructions to upgrade your solution to the latest version:

1. Uninstall the previously deployed solution. Refer to *Uninstall the solution (p. 23).*
2. Launch the latest template. Refer to *Deployment (p. 13).*
Uninstall the solution

You can uninstall the Live Streaming on AWS with MediaStore solution from the AWS Management Console, or by using the AWS Command Line Interface (AWS CLI). You must manually delete the Amazon Simple Storage Service (Amazon S3) buckets created by this solution. AWS Solutions Implementations do not automatically delete these resources in case you have stored data that you wish to retain.

Using the AWS Management Console

1. Sign in to the AWS CloudFormation console.
2. On the Stacks page, select the solution stack.
3. Choose Delete.

Using AWS Command Line Interface

Verify that the AWS Command Line Interface (AWS CLI) is available in your environment. For installation instructions, refer to What Is the AWS Command Line Interface in the AWS CLI User Guide. After confirming the AWS CLI is available, run the following command.

```
$ aws cloudformation delete-stack --stack-name <your-stack-name>
```

Replace `<your-stack-name>` with the name of your CloudFormation stack.

Deleting the Amazon S3 buckets

This solution is configured to retain the Amazon S3 buckets if you decide to delete the AWS CloudFormation stack to prevent against accidental data loss. After uninstalling the solution, you can manually delete the S3 buckets if you do not need to retain the data. Follow these steps to delete the Amazon S3 buckets.

1. Sign in to the Amazon S3 console.
2. Choose Buckets from the left navigation pane.
3. Locate the `<stack-name>` S3 buckets.
4. Select one of the S3 buckets and choose Delete.

Repeat the steps until you have deleted all the `<stack-name>` S3 buckets.

To delete the S3 buckets using AWS CLI, run the following command:

```
$ aws s3 rb s3://<bucket-name> --force
```

Alternatively, you can configure the AWS CloudFormation template to delete the Amazon S3 buckets automatically. Before deleting the stack, change the deletion behavior in the AWS CloudFormation DeletionPolicy attribute.
Collection of operational metrics

This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution to improve the services and products. When activated, the following information is collected and sent to AWS:

- **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 selected at launch
- **Encoding Profile**: The encoding profile selected at launch
- **ChannelStart**: The option to start the MediaLive channel selected at launch

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, complete the following steps before launching the AWS CloudFormation template:

1. Download the AWS CloudFormation template to your local hard drive.
2. Open the AWS CloudFormation template with a text editor.
3. Modify the AWS CloudFormation template mapping section as follows:

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

   to:

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

4. Sign in to the AWS CloudFormation console.
5. Select Create stack.
6. On the Create stack page, Specify template section, select Upload a template file.
7. Under Upload a template file, choose Choose file and select the edited template from your local drive.
8. Choose Next and follow the steps in Launch the stack (p. 13) in the Automated deployment section of this guide.
Source code

Visit our GitHub repository to download the templates and scripts for this solution, and to share your customizations with others. The Live Streaming on AWS with Amazon S3 template is generated using the AWS Cloud Development Kit (CDK). Refer to the README.md file for additional information.
## Revisions

<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2020</td>
<td>Initial release</td>
</tr>
<tr>
<td>June 2020</td>
<td>Release v1.1.0: Added support for AWS Elemental Link.</td>
</tr>
<tr>
<td>December 2020</td>
<td>Release v1.2.0: Updated the AWS CloudFormation template. For more information, refer to the CHANGELOG.md file in the GitHub repository.</td>
</tr>
<tr>
<td>July 2021</td>
<td>Release v1.2.1: bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository. Documentation updates: Expanded the cost estimates to provide more granular information, clarified the collection of operational metrics information, and updated guide organization to improve readability.</td>
</tr>
<tr>
<td>September 2021</td>
<td>Release v2.0.0: bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository.</td>
</tr>
<tr>
<td>November 2021</td>
<td>Release v2.1.0: bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository.</td>
</tr>
<tr>
<td>January 2022</td>
<td>Release v2.1.1: bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository.</td>
</tr>
<tr>
<td>March 2022</td>
<td>Release v3.0.0: Updated to use Amazon S3 rather than AWS Elemental MediaStore as live streaming origin. For more information, refer to the CHANGELOG.md file in the GitHub repository.</td>
</tr>
</tbody>
</table>
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Notices

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AWS glossary

For the latest AWS terminology, see the AWS glossary in the AWS General Reference.