

Live Streaming with AWS Elemental Cloud

AWS Implementation Guide

Tom Nightingale

Usman Shakeel

Scott Malkie

Konstantin Wilms

November 2016

Last updated: April 2017 (see [revisions](#))



Copyright (c) 2017 by Amazon.com, Inc. or its affiliates.

Live Streaming with Elemental Cloud is licensed under the terms of the Amazon Software License available at

<https://aws.amazon.com/asl/>

Contents

| | |
|--|----|
| Overview | 3 |
| Cost..... | 3 |
| Architecture Overview | 4 |
| AWS Elemental Cloud Platform..... | 4 |
| AWS Cloud Architecture | 5 |
| Deployment Considerations..... | 5 |
| Regional Deployment..... | 5 |
| AWS CloudFormation Templates | 6 |
| Automated Deployment | 6 |
| Prerequisites | 6 |
| Launch the Stack..... | 7 |
| Security | 9 |
| Additional Resources | 10 |
| Appendix A: AWS Elemental Cloud Parameters | 11 |
| Appendix B: Collection of Anonymous Data | 12 |
| Send Us Feedback | 12 |
| Document Revisions..... | 13 |

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 Elemental Cloud](#), a service that enables customers to rapidly deploy multiscreen offerings for live and on-demand content, with Elastic Load Balancing, Auto Scaling, and Amazon CloudFront to build a highly resilient and secure architecture that delivers an exceptional real-time viewing experience.

The live streaming solution automatically configures your existing AWS Elemental Cloud¹ deployment to encode and package your content for adaptive bitrate streaming across multiple screens via HTTP live streaming (HLS) and Dynamic Adaptive Streaming over HTTP (DASH). The solution also deploys a fleet of Amazon Elastic Compute Cloud (Amazon EC2) instances in an Auto Scaling group, for Nginx caching, and uses Amazon CloudFront to deliver an elastic, highly available, global solution 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 which also deletes the AWS Elemental Cloud configuration, to help ensure that you only pay for the infrastructure you use.

Cost

You are responsible for the cost of the AWS Elemental and other AWS services used while running this live streaming solution. As of the date of publication, the cost for running this solution with default settings in the US East (N. Virginia) Region is approximately **\$2 per hour** for the AWS services. Prices are subject to change. For full details, see the pricing webpage for each AWS service you will be using in this solution. The hourly cost does not include the data transfer fees, which will vary depending on the number of users, or the costs associated with AWS Elemental Cloud. For more details on AWS Elemental Cloud pricing, please contact cloudsales@elementaltechnologies.com.

¹ To use this solution, you must have access to AWS Elemental Cloud services. For more information, contact cloudsales@elementaltechnologies.com.

Architecture Overview

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

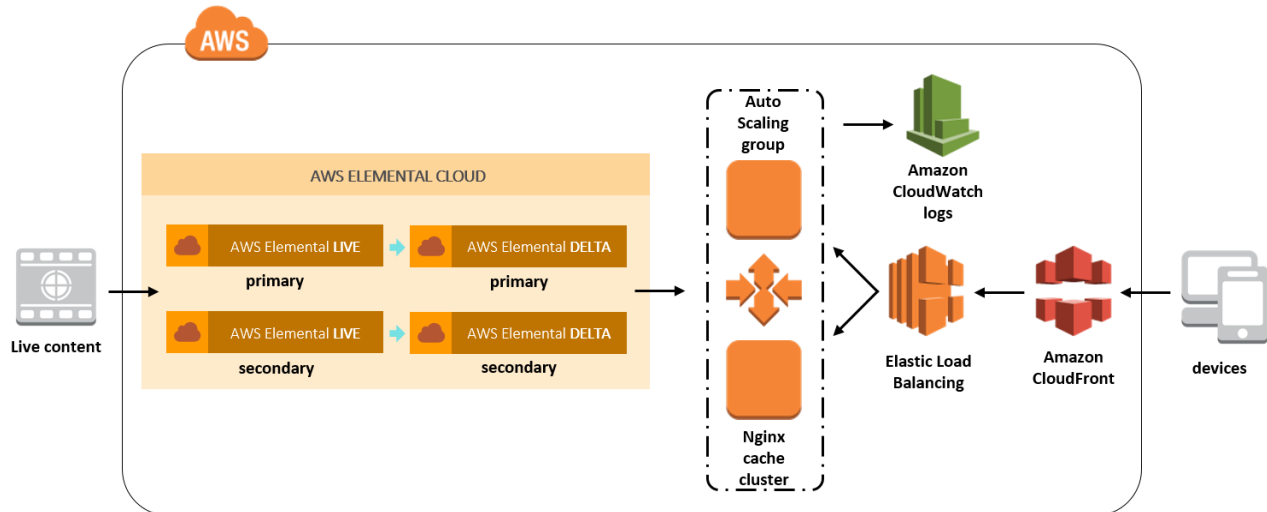


Figure 1: Live streaming solution (with AWS Elemental Cloud) architecture on AWS

Before you launch this live streaming solution, you must have an existing AWS Elemental Cloud deployment with running AWS Elemental Live and AWS Elemental Delta services in the same AWS Region where you deploy this live streaming solution. For more information, see the [Prerequisites](#) section.

The primary solution AWS CloudFormation template launches an AWS Lambda function that configures your running AWS Elemental Live nodes for encoding to multiple adaptive bitrate resolutions, and AWS Elemental Delta nodes for just-in-time packaging, using .xml templates. These templates can be customized to meet your needs.

For customers who want to deploy this solution in an AWS Region that does not support AWS Lambda, this solution includes a secondary template that uses a Python script, hosted on an Amazon Elastic Compute Cloud (Amazon EC2) instance, to configure the AWS Elemental Cloud services. See [Regional Deployment](#) for more information.

AWS Elemental Cloud Platform

For this solution, the AWS Elemental Cloud platform consists of two AWS Elemental Live nodes and two AWS Elemental Delta nodes. Each AWS Elemental Live node has a corresponding AWS Elemental Delta node downstream. This provides a separate stream of the original source for high availability. AWS Elemental Live encodes the incoming stream and creates five adaptive bitrate (ABR) resolutions that are pushed to AWS Elemental Delta. AWS Elemental Delta packages the five resolutions and delivers them, as requested

by clients, to Apple HLS, MPEG DASH, or Microsoft Smooth ABR packages. Optionally, customers can configure a third set of AWS Elemental Live and AWS Elemental Delta nodes to provide a sample video feed for testing purposes.

AWS Cloud Architecture

The AWS architecture consists of Nginx across a cluster of Amazon Elastic Compute Cloud (Amazon EC2) instances that cache content from the primary AWS Elemental Delta and fail over to the secondary AWS Elemental Delta, if necessary. The Amazon EC2 instances also send cache logs to Amazon CloudWatch. The Nginx cluster uses Auto Scaling to provide a scalable cache layer between AWS Elemental Cloud and Amazon CloudFront. CloudFront is used to provide video delivery worldwide. This approach provides two highly scalable cache tiers to offload video distribution to end users while optimizing their viewing experience.

When the live streaming event is complete, customers can delete the AWS CloudFormation stack which deletes the AWS resources and the AWS Elemental Cloud configuration.

Deployment Considerations

Regional Deployment

This live streaming solution includes two AWS CloudFormation templates for deployment. The primary solution template (*live-streaming.template*) uses AWS Lambda, which is currently available in specific AWS Regions only. For the best performance, we recommend deploying the AWS resources and the AWS Elemental Cloud resources in the same AWS Region. To use the primary template, you must launch this solution in an AWS Region where Lambda and AWS Elemental Cloud are available.²

The secondary solution template (*live-streaming-ec2.template*) uses a Python script to configure the AWS Elemental Cloud resources for encoding and packaging. It does not use Lambda. Use this template to deploy this live streaming solution in an AWS Region where Lambda is not available.

Important: AWS Lambda is used to delete the AWS Elemental Cloud configuration, which includes the AWS Elemental Live events and the AWS Elemental Delta input and output filters, when you finish streaming. If you use the secondary solution template, you must manually delete the AWS Elemental Live and AWS Elemental Delta configuration.

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

AWS CloudFormation Templates

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

View template

live-streaming.template: Use this template to launch the solution and all associated components. The default configuration deploys an AWS Lambda function, an Nginx cache cluster, Elastic Load Balancing, an Amazon CloudFront distribution, and Amazon CloudWatch Logs, but you can also customize the template based on your specific needs.

View template

live-streaming-ec2.template: Use this template to launch the solution and all associated components in an AWS Region that does not support AWS Lambda. The default configuration deploys an Nginx cache cluster, Elastic Load Balancing, an Amazon CloudFront distribution, and Amazon CloudWatch Logs, but you can also customize the template based on your specific needs. It does not deploy AWS Lambda.

Important: AWS Lambda is used to delete the AWS Elemental Cloud configuration, which includes the AWS Elemental Live events and the AWS Elemental Delta input and output filters, when you finish streaming. If you use the secondary solution template, you must manually delete the AWS Elemental Cloud configuration.

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

Prerequisites

Before you launch this live streaming solution, you must have an existing AWS Elemental Cloud deployment. The AWS Elemental Cloud deployment should include the following:

- AWS Elemental Live with two running nodes using version 2.9.3 or later. If you plan to use the sample video stream as your source, you must have three running nodes.
- AWS Elemental Delta with two running nodes and the origin service pack enabled.

- A valid username and API key with access to the AWS Elemental Cloud deployment.

For more information on AWS Elemental Cloud, or for any configuration questions, visit <http://www.elemental.com/products/aws-elemental-cloud> or contact cloudsales@elementaltechnologies.com.

To get your content into AWS Elemental Live, you must configure your contribution encoder to point to the public IP address of the two AWS Elemental Live nodes. For example, `rtp://54.54.54.54:5001` and `rtp://52.52.52.52:5001`.

Note: Make sure that your ground controller has outbound access to the public IP addresses of the AWS Elemental Live nodes on port 5000 and port 5001.

Launch the Stack

This automated AWS CloudFormation template deploys the live streaming solution on the AWS Cloud. Please make sure that you have a running AWS Elemental Cloud deployment before launching the stack. See [Prerequisites](#) for configuration details.

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* 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.

Launch
Solution

Note: This solution uses the AWS Lambda service, which is currently available in specific AWS Regions only. Therefore, you must launch this solution in an AWS Region where Lambda and AWS Elemental Cloud are available.³ To launch the solution in a region that does not support Lambda, use the *live-streaming-ec2* template.

3. On the **Select Template** page, verify that you selected the correct template and choose **Next**.

³ For the most current AWS Lambda availability by region, see <https://aws.amazon.com/about-aws/global-infrastructure/regional-product-services/>

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.

Important: To successfully launch the live streaming solution stack, you need to enter parameters from your existing AWS Elemental Cloud deployment. See [Appendix A](#) for steps to find each AWS Elemental Cloud parameter value.

This solution uses the following default values.

| Parameter | Default | Description |
|----------------------------------|------------------|--|
| Elemental User | <Requires input> | The AWS Elemental username with admin access to the AWS Elemental Cloud deployment |
| Elemental API Key | <Requires input> | The API key associated with the AWS Elemental user account |
| Elemental Live | <Requires input> | The FQDN of the AWS Elemental Conductor service that is used to configure AWS Elemental Live nodes Important: Do not include https://. |
| Elemental Live Version | <Requires input> | AWS Elemental Live server version; valid options are 2.9 or 2.10 |
| Elemental Delta 1 | <Requires input> | The FQDN of the primary AWS Elemental Delta server that is used to configure the content filters Important: Do not include https://. |
| Elemental Delta 2 | <Requires input> | The FQDN of the secondary AWS Elemental Delta server that is used to configure content filters Important: Do not include https://. |
| Live Nodes | <Requires input> | Comma-delimited list of AWS Elemental Live node IDs Note: To use the sample video feed, you must provide IDs for three nodes. |
| Source Stream | Demo | The UDP or RTP source video stream. Include the port and protocol. For example, rtp://10.0.0.1:5001 Note: To use the sample video feed, use the default value: Demo. |
| Send Anonymous Usage Data | Yes | Send anonymous data to AWS to help us understand usage across our customer base as a whole. To opt out of this feature, choose No. For more information, see Appendix B . |

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, copy the Amazon CloudFront URL from the **Value** column for the applicable stream and paste it into an online DASH or HLS test player, such as [Bitmovin](#).

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](#).

This solution creates security groups that control and isolate network traffic between the Amazon Elastic Compute Cloud (Amazon EC2) instances and the load balancer. But, the Amazon CloudFront endpoints are publicly accessible.

AWS Elemental Cloud offers a number of options for protecting content including traditional AES, SAMPLE-AES, and Fairplay (HLS), PlayReady (HLS, DASH, Smooth Streaming), Adobe Access (HLS, HDS, pHLS, pHDS), and Common Encryption (Widevine, DASH). For more information on the various content protection options within AWS Elemental Cloud, please visit <https://www.elemental.com/products/aws-elemental-cloud/> or contact cloudsales@elementaltechnologies.com.

Additional Resources

AWS services documentation

- [AWS CloudFormation](#)
- [Amazon CloudWatch](#)
- [Amazon EC2 user guide for Linux instances](#)
- [Elastic Load Balancing](#)
- [Auto Scaling](#)
- [AWS Lambda](#)

Other products and documentation

- [AWS Elemental Cloud](#)
- [Nginx](#)

Appendix A: AWS Elemental Cloud Parameters

To successfully launch the solution stack, you need to enter parameters from your existing AWS Elemental Cloud deployment. Use the following steps to find each AWS Elemental Cloud parameter value you will need to complete [Launch the Stack](#). You should already be logged into the AWS CloudFormation console and ready to enter your solution parameters on the **Specify Details** page.

1. Open a separate browser window and log in to <https://cloud.elementaltechnologies.com>.
2. In the upper-right corner of the page, choose your username and select **Profile**.
3. On the **Profile** page, copy the **Login** value.
In the AWS CloudFormation console, paste it into the **Elemental Login** parameter field.
4. On the AWS Elemental Cloud **Profile** page, copy the **API & WebDAV Key** value.
In the AWS CloudFormation console, paste it into the **Elemental API Key** parameter field.
5. In the AWS Elemental Cloud deployment UI, choose the question mark icon next to the AWS Elemental Live service name, copy the **URL** value.
In the AWS CloudFormation console, paste it into the **Elemental Live** parameter field.
6. In the AWS Elemental Cloud deployment UI, choose the question mark icon next to the AWS Elemental Delta service name.
7. Under **Ingest and Egress addresses**, choose **Access Info Tab**.
8. On the **Service Properties** page, copy the **User Interface & API Delta 1** URL.
In the AWS CloudFormation console, paste it into the **Elemental Delta 1** parameter field.
9. On the AWS Elemental Cloud **Service Properties** page, copy the **User Interface & API Delta 2** URL.
In the AWS CloudFormation console, paste it into the parameter **Elemental Delta 2** field.
10. In the AWS Elemental Cloud Conductor UI, choose the **Nodes** tab.
11. Select the magnifying glass icon for each of the three nodes.
The node ID value is the number at the end of the URL. For example, <https://abc123.cloud.elementaltechnologies.com/nodes/2>.

12. In the AWS CloudFormation console, enter those numbers in the **Live Nodes** parameter field as a comma-delimited list. For example, **2, 3, 4**.

For more information on AWS Elemental Cloud, or for any configuration questions, visit <https://www.elemental.com/products/aws-elemental-cloud/> or contact cloudsales@elementaltechnologies.com.

Appendix B: 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 to improve the services and products that we offer. 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 and the type of source video: demo or other

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, set the **Send Anonymous Usage Data** parameter to No.

Send Us Feedback

We welcome your questions and comments. Please post your feedback on the [AWS Solutions Discussion Forum](#).

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 |

© 2017, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Notices

This document is provided for informational purposes only. It represents AWS's current product offerings and practices as of the date of issue of this document, which are subject to change without notice. Customers are responsible for making their own independent assessment of the information in this document and any use of AWS's products or services, each of which is provided "as is" without warranty of any kind, whether express or implied. This document does not create any warranties, representations, contractual commitments, conditions or assurances from AWS, its affiliates, suppliers or licensors. The responsibilities and liabilities of AWS to its customers are controlled by AWS agreements, and this document is not part of, nor does it modify, any agreement between AWS and its customers.

Live Streaming with AWS Elemental Cloud is licensed under the terms of the Amazon Software License available at <https://aws.amazon.com/asl/>.