Amazon Kinesis Video Streams: Developer Guide
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## Troubleshooting Producer Library Issues

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What Is Amazon Kinesis Video Streams?

Amazon Kinesis Video Streams is a fully managed AWS service that you can use to stream live video from devices to the AWS Cloud, or build applications for real-time video processing or batch-oriented video analytics.

Kinesis Video Streams isn't just storage for video data. You can use it to watch your video streams in real time as they are received in the cloud. You can either monitor your live streams in the AWS Management Console, or develop your own monitoring application that uses the Kinesis Video Streams API library to display live video.

You can use Kinesis Video Streams to capture massive amounts of live video data from millions of sources, including smartphones, security cameras, webcams, cameras embedded in cars, drones, and other sources. You can also send non-video time-serialized data such as audio data, thermal imagery, depth data, RADAR data, and more. As live video streams from these sources into a Kinesis video stream, you can build applications that can access the data, frame-by-frame, in real time for low-latency processing. Kinesis Video Streams is source-agnostic; you can stream video from a computer's webcam using the GStreamer (p. 135) library, or from a camera on your network using RTSP.

You can also configure your Kinesis video stream to durably store media data for the specified retention period. Kinesis Video Streams automatically stores this data and encrypts it at rest. Additionally, Kinesis Video Streams time-indexes stored data based on both the producer time stamps and ingestion time stamps. You can build applications that periodically batch-process the video data, or you can create applications that require ad hoc access to historical data for different use cases.

Your custom applications, real-time or batch-oriented, can run on Amazon EC2 instances. These applications might process data using open source deep-learning algorithms, or use third-party applications that integrate with Kinesis Video Streams.

Benefits of using Kinesis Video Streams include the following:

- **Connect and stream from millions of devices** – Kinesis Video Streams enables you to connect and stream video, audio, and other data from millions of devices ranging from consumer smartphones, drones, dash cams, and more. You can use the Kinesis Video Streams producer libraries to configure your devices and reliably stream in real time, or as after-the-fact media uploads.

- **Durably store, encrypt, and index data** – You can configure your Kinesis video stream to durably store media data for custom retention periods. Kinesis Video Streams also generates an index over the stored data based on producer-generated or service-side time stamps. Your applications can easily retrieve specified data in a stream using the time-index.

- **Focus on managing applications instead of infrastructure** – Kinesis Video Streams is serverless, so there is no infrastructure to set up or manage. You don't need to worry about the deployment, configuration, or elastic scaling of the underlying infrastructure as your data streams and number of consuming applications grow and shrink. Kinesis Video Streams automatically does all the administration and maintenance required to manage streams, so you can focus on the applications, not the infrastructure.

- **Build real-time and batch applications on data streams** – You can use Kinesis Video Streams to build custom real-time applications that operate on live data streams, and create batch or ad hoc applications that operate on durably persisted data without strict latency requirements. You can build, deploy, and manage custom applications: open source (Apache MXNet, OpenCV), homegrown, or third-party solutions via the AWS Marketplace to process and analyze your streams. Kinesis Video Streams
Are You a First-Time User of Kinesis Video Streams?

If you're a first-time user of Kinesis Video Streams, we recommend that you read the following sections in order:

1. Amazon Kinesis Video Streams: How It Works (p. 5) – To learn about Kinesis Video Streams concepts.
2. Getting Started with Kinesis Video Streams (p. 24) – To set up your account and test Kinesis Video Streams.
4. Kinesis Video Stream Parser Library (p. 127) – To learn about processing incoming data frames in a Kinesis Video Streams consumer application.
5. Amazon Kinesis Video Streams Examples (p. 134) – To see more examples of what you can do with Kinesis Video Streams.
Kinesis Video Streams System Requirements

The following sections contain hardware, software, and storage requirements for Amazon Kinesis Video Streams.

Topics
- Camera Requirements (p. 3)
- SDK Storage Requirements (p. 4)

Camera Requirements

Cameras that are used for running the Kinesis Video Streams Producer SDK and samples have the following memory requirements:

- The SDK content view requires 16 MB of memory.
- The sample application default configuration is 512 MB. This value is appropriate for producers that have good network connectivity and no requirements for additional buffering. If the network connectivity is poor and more buffering is required, you can calculate the memory requirement per second of buffering by multiplying the frame rate per second by the frame memory size. For more information about allocating memory, see StorageInfo (p. 108).

We recommend using USB or RTSP (Real Time Streaming Protocol) cameras that encode data using H.264 because this removes the encoding workload from the CPU.

Currently, the demo application does not support the User Datagram Protocol (UDP) for RTSP streaming. This capability will be added in the future.

The Producer SDK supports the following types of cameras:

- Web cameras.
- USB cameras.
- Cameras with H.264 encoding (preferred).
- Cameras without H.264 encoding.
- Raspberry Pi camera module. This is preferred for Raspberry Pi devices because it connects to the GPU for video data transfer, so there is no overhead for CPU processing.
- RTSP (network) cameras. These cameras are preferred because the video streams are already encoded with H.264.

Tested Cameras

We have tested the following USB cameras with Kinesis Video Streams:

- Logitech 1080p
- Logitech C930
- Logitech C920 (H.264)
• Logitech Brio (4K)
• SVPRO USB Camera 170degree Fisheye Lens Wide Angle 1080P 2mp Sony IMX322 HD H.264 30fps Mini Aluminum USB Webcam Camera

We have tested the following IP cameras with Kinesis Video Streams:
• Vivotek FD9371 – HTV/EHTV
• Vivotek IB9371 – HT
• Hikvision 3MP IP Camera DS-2CD2035FWD-I
• Sricam SP012 IP
• VStarcam 720P WiFi IP Camera (TCP)
• Ipccam Security Surveillance IP Camera 1080P
• AXIS P3354 Fixed Dome Network Camera

Of the cameras that were tested with Kinesis Video Streams, the Vivotek cameras have the most consistent RTSP stream. The Sricam camera has the least consistent RTSP stream.

Tested Operating Systems

We have tested web cameras and RTSP cameras with the following devices and operating systems:
• Mac mini
  • High Sierra
• MacBook Pro laptops
  • Sierra (10.12)
  • El Capitan (10.11)
• HP laptops running Ubuntu 16.04
• Ubuntu 17.10 (Docker container)
• Raspberry Pi 3

SDK Storage Requirements

Installing the Kinesis Video Streams Producer Libraries (p. 46) has a minimum storage requirement of 170 MB and a recommended storage requirement of 512 MB.
Amazon Kinesis Video Streams: How It Works

Topics
- Kinesis Video Streams API and Producer Libraries Support (p. 6)
- Kinesis Video Streams Playback (p. 9)
- Using Streaming Metadata with Kinesis Video Streams (p. 15)
- Kinesis Video Streams Data Model (p. 18)

Amazon Kinesis Video Streams is a fully managed AWS service that enables you to stream live video from devices to the AWS Cloud and durably store it. You can then build your own applications for real-time video processing or perform batch-oriented video analytics.

The following diagram provides an overview of how Kinesis Video Streams works.

The diagram demonstrates the interaction among the following components:
- **Producer** – Any source that puts data into a Kinesis video stream. A producer can be any video-generating device, such as a security camera, a body-worn camera, a smartphone camera, or a...
A producer can also send non-video data, such as audio feeds, images, or RADAR data.

A single producer can generate one or more video streams. For example, a video camera can push video data to one Kinesis video stream and audio data to another.

- **Kinesis Video Streams Producer libraries** – A set of easy-to-use software and libraries that you can install and configure on your devices. These libraries make it easy to securely connect and reliably stream video in different ways, including in real time, after buffering it for a few seconds, or as after-the-fact media uploads.

- **Kinesis video stream** – A resource that enables you to transport live video data, optionally store it, and make the data available for consumption both in real time and on a batch or ad hoc basis. In a typical configuration, a Kinesis video stream has only one producer publishing data into it.

The stream can carry audio, video, and similar time-encoded data streams, such as depth sensing feeds, RADAR feeds, and more. You create a Kinesis video stream using the AWS Management Console or programmatically using the AWS SDKs.

Multiple independent applications can consume a Kinesis video stream in parallel.

- **Consumer** – Gets data, such as fragments and frames, from a Kinesis video stream to view, process, or analyze it. Generally these consumers are called Kinesis Video Streams applications. You can write applications that consume and process data in Kinesis video streams in real time, or after the data is durably stored and time-indexed when low latency processing is not required. You can create these consumer applications to run on Amazon EC2 instances.

- **Kinesis Video Stream Parser Library (p. 127)** – Enables Kinesis Video Streams applications to reliably get media from Kinesis video streams in a low-latency manner. Additionally, it parses the frame boundaries in the media so that applications can focus on processing and analyzing the frames themselves.

## Kinesis Video Streams API and Producer Libraries Support

Kinesis Video Streams provides APIs for you to create and manage streams and read or write media data to and from a stream. The Kinesis Video Streams console, in addition to administration functionality, also supports live and video-on-demand playback. Kinesis Video Streams also provides a set of producer libraries that you can use in your application code to extract data from your media sources and upload to your Kinesis video stream.

### Topics

- Kinesis Video Streams API (p. 6)
- Producer Libraries (p. 8)

## Kinesis Video Streams API

Kinesis Video Streams provides APIs for creating and managing Kinesis video streams. It also provides APIs for reading and writing media data to a stream, as follows:

- **Producer API** – Kinesis Video Streams provides a `PutMedia` API to write media data to a Kinesis video stream. In a `PutMedia` request, the producer sends a stream of media fragments. A *fragment* is a self-contained sequence of frames. The frames belonging to a fragment should have no dependency on any frames from other fragments. For more information, see `PutMedia` (p. 248).
As fragments arrive, Kinesis Video Streams assigns a unique fragment number, in increasing order. It also stores producer-side and server-side time stamps for each fragment, as Kinesis Video Streams-specific metadata.

- **Consumer APIs** – The following APIs enable consumers to get data from a stream:
  - **GetMedia** - When using this API, consumers must identify the starting fragment. The API then returns fragments in the order in which they were added to the stream (in increasing order by fragment number). The media data in the fragments is packed into a structured format such as Matroska (MKV). For more information, see GetMedia (p. 244).

  **Note**
  GetMedia knows where the fragments are (archived in the data store or available in real time). For example, if GetMedia determines that the starting fragment is archived, it starts returning fragments from the data store. When it needs to return newer fragments that are not archived yet, GetMedia switches to reading fragments from an in-memory stream buffer.

This is an example of a continuous consumer, which processes fragments in the order that they are ingested by the stream.

GetMedia enables video-processing applications to fail or fall behind, and then catch up with no additional effort. Using GetMedia, applications can process data that's archived in the data store, and as the application catches up, GetMedia continues to feed media data in real time as it arrives.

- **GetMediaFromFragmentList** (and **ListFragments**) - Batch processing applications are considered offline consumers. Offline consumers might choose to explicitly fetch particular media fragments or ranges of video by combining the ListFragments and GetMediaFromFragmentList APIs. ListFragments and GetMediaFromFragmentList enable an application to identify segments of video for a particular time range or fragment range, and then fetch those fragments either sequentially or in parallel for processing. This approach is suitable for MapReduce application suites, which must quickly process large amounts of data in parallel.

For example, suppose that a consumer wants to process one day's worth of video fragments. The consumer would do the following:

1. Get a list of fragments by calling the ListFragments API and specifying a time range to select the desired collection of fragments.

   The API returns metadata from all the fragments in the specified time range. The metadata provides information such as fragment number, producer-side/server-side time stamps, and so on.

2. Take the fragment metadata list and retrieve fragments, in any order. For example, to process all the fragments for the day, the consumer might choose to split the list into sub-lists and have workers (for example, multiple Amazon EC2 instances) fetch the fragments in parallel using the GetMediaFromFragmentList, and process them in parallel.

The following diagram shows the data flow for fragments and chunks during these API calls.
When a producer sends a PutMedia request, it sends media metadata in the payload, and then sends a sequence of media data fragments. Upon receiving the data, Kinesis Video Streams stores incoming media data as Kinesis Video Streams chunks. Each chunk consists of the following:

- A copy of the media metadata
- A fragment
- Kinesis Video Streams-specific metadata; for example, the fragment number and server-side and producer-side time stamps

When a consumer requests media metadata, Kinesis Video Streams returns a stream of chunks, starting with the fragment number that you specify in the request.

If you enable data persistence for the stream, after receiving a fragment on the stream, Kinesis Video Streams also saves a copy of the fragment to the data store.

**Producer Libraries**

After you create a Kinesis video stream, you can start sending data to the stream. In your application code, you can use these libraries to extract data from your media sources and upload to your Kinesis video stream. For more information about the available producer libraries, see Kinesis Video Streams Producer Libraries (p. 46).
Kinesis Video Streams Playback

You can view a Kinesis video stream using the following methods:

- **GetMedia**: You can use the GetMedia API to build your own applications to process Kinesis video streams. GetMedia is a real-time API with low latency. If you want to create a player that uses GetMedia, you have to build it yourself. For information about how to develop an application that displays a Kinesis video stream using GetMedia, see Stream Parser Library (p. 127).

- **HLS**: HTTP Live Streaming (HLS) is an industry-standard HTTP-based media streaming communications protocol. You can use HLS to view an Amazon Kinesis video stream, either for live playback or to view archived video.

  You can use HLS for live playback. Latency is typically between 3 and 5 seconds, but it can be between 1 and 10 seconds, depending on the use case, player, and network conditions. You can use a third-party player (such as Video.js or Google Shaka Player) to display the video stream by providing the HLS streaming session URL, either programmatically or manually. You can also play back video by typing the HLS streaming session URL in the Location bar of the Apple Safari or Microsoft Edge browsers.

- **MPEG-DASH**: Dynamic Adaptive Streaming over HTTP (DASH), also known as MPEG-DASH, is an adaptive bitrate streaming protocol that enables high quality streaming of media content over the Internet delivered from conventional HTTP web servers.

  You can use MPEG-DASH for live playback. Latency is typically between 3 and 5 seconds, but it can be between 1 and 10 seconds, depending on the use case, player, and network conditions. You can use a third-party player (such as dash.js or Google Shaka Player) to display the video stream by providing the MPEG-DASH streaming session URL, either programmatically or manually.

- **GetClip API**: You can use the GetClip API to download a clip (in an MP4 file) containing the archived, on-demand media from the specified video stream over the specified time range. For more information, see the GetClip API reference.

Topics

- Video Playback with HLS (p. 9)
- Video Playback with MPEG-DASH (p. 12)

Video Playback with HLS

To view a Kinesis video stream using HLS, you first create a streaming session using GetHLSStreamingSessionURL. This action returns a URL (containing a session token) for accessing the HLS session. You can then use the URL in a media player or a standalone application to display the stream.

An Amazon Kinesis video stream has the following requirements for providing video through HLS:

- Data retention must be greater than 0.

- Track 1 of the stream must have a codec ID of V_MPEG/ISO/AVC and contain H.264 encoded media. If there is an audio track (optional), it must be track number 2 and have a codec ID of A_AAC and contain AAC encoded audio.

- The fragments must contain codec private data in the Advanced Video Coding (AVC) for H.264 format (MPEG-4 specification ISO/IEC 14496-15) for the video media. They must also contain codec private data for ACC (AAC specification ISO/IEC 13818-7) for the audio media (if present). For information about adapting stream data to a given format, see NAL Adaptation Flags (p. 107).
Example: Using HLS in HTML and JavaScript

The following example shows how to retrieve an HLS streaming session for a Kinesis video stream and play it back in a webpage. The example shows how to play back video in the following players:

- Video.js
- Google Shaka Player
- hls.js

Topics

- Set Up the Kinesis Video Streams Client for HLS Playback (p. 10)
- Retrieve the Kinesis Video Streams Archived Content Endpoint for HLS Playback (p. 10)
- Retrieve the HLS Streaming Session URL (p. 11)
- Display the Streaming Video with HLS Playback (p. 11)
- Troubleshooting HLS Issues (p. 12)
- Completed Example for HLS Playback (p. 12)

Set Up the Kinesis Video Streams Client for HLS Playback

To access streaming video with HLS, first create and configure the Kinesis Video Streams client (to retrieve the service endpoint) and archived media client (to retrieve the HLS streaming session). The application retrieves the necessary values from input boxes on the HTML page.

```javascript
<script src="https://cdnjs.cloudflare.com/ajax/libs/aws-sdk/2.278.1/aws-sdk.min.js"></script>
...
var protocol = $('#protocol').val();
var streamName = $('#streamName').val();

// Step 1: Configure SDK Clients
var options = {
  accessKeyId: $('#accessKeyId').val(),
  secretAccessKey: $('#secretAccessKey').val(),
  sessionToken: $('#sessionToken').val() || undefined,
  region: $('#region').val(),
  endpoint: $('#endpoint').val() || undefined
}
var kinesisVideo = new AWS.KinesisVideo(options);
var kinesisVideoArchivedContent = new AWS.KinesisVideoArchivedMedia(options);
```

Retrieve the Kinesis Video Streams Archived Content Endpoint for HLS Playback

After the clients are initiated, retrieve the Kinesis Video Streams archived content endpoint to retrieve the HLS streaming session URL:

```javascript
// Step 2: Get a data endpoint for the stream
console.log('Fetching data endpoint');
kinesisVideo.getDataEndpoint({
  StreamName: streamName,
  APIName: "GET_HLS_STREAMING_SESSION_URL"
}, function(err, response) {
  if (err) { return console.error(err); }
  console.log('Data endpoint: ' + response.DataEndpoint);
});
```
Retrieve the HLS Streaming Session URL

When you have the archived content endpoint, call the `GetHLSStreamingSessionURL` API to retrieve the HLS streaming session URL:

```javascript
kinesisVideoArchivedContent.endpoint = new AWS.Endpoint(response.DataEndpoint);

// Step 3: Get a Streaming Session URL
var consoleInfo = 'Fetching ' + protocol + ' Streaming Session URL';
console.log(consoleInfo);
...
else {
    kinesisVideoArchivedContent.getHLSStreamingSessionURL({
        StreamName: streamName,
        PlaybackMode: $('#playbackMode').val(),
        HLSFragmentSelector: {
            FragmentSelectorType: $('#fragmentSelectorType').val(),
            TimestampRange: $('#playbackMode').val() === "LIVE" ? undefined : {
                StartTimestamp: new Date($('#startTimestamp').val()),
                EndTimestamp: new Date($('#endTimestamp').val())
            },
            ContainerFormat: $('#containerFormat').val(),
            DiscontinuityMode: $('#discontinuityMode').val(),
            DisplayFragmentTimestamp: $('#displayFragmentTimestamp').val(),
            MaxMediaPlaylistFragmentResults: parseInt($('#maxResults').val()),
            Expires: parseInt($('#expires').val())
        },
        function(err, response) {
            if (err) { return console.error(err); }
            console.log('HLS Streaming Session URL: ' + response.HLSStreamingSessionURL);
        }
    });
```

Display the Streaming Video with HLS Playback

When you have the HLS streaming session URL, provide it to the video player. The method for providing the URL to the video player is specific to the player used.

The following code example shows how to provide the streaming session URL to a Video.js player:

```javascript
else if (playerName === 'VideoJS') {
    var playerElement = $('#videojs');
    playerElement.show();
    var player = new videojs('videojs');
    console.log('Created VideoJS Player');
    player.src({
        src: response.HLSStreamingSessionURL,
        type: 'application/x-mpegURL'
    });
    console.log('Set player source');
    player.play();
```
console.log('Starting playback');

The following code example shows how to provide the streaming session URL to a **Google Shaka** player:

```javascript
// Shaka Player elements
<video id="shaka" class="player" controls autoplay></video>
<script src="https://cdnjs.cloudflare.com/ajax/libs/shaka-player/2.4.1/shaka-player.compiled.js">
</script>
...
else if (playerName === 'Shaka Player') {
  var playerElement = $('#shaka');
  playerElement.show();
  var player = new shaka.Player(playerElement[0]);
  console.log('Created Shaka Player');
  player.load(response.HLSStreamingSessionURL).then(function() {
    console.log('Starting playback');
  });
  console.log('Set player source');
}
```

The following code example shows how to provide the streaming session URL to an **hls.js** player:

```javascript
// HLS.js elements
<video id="hlsjs" class="player" controls autoplay></video>
<script src="https://cdn.jsdelivr.net/npm/hls.js@latest"></script>
...
var playerName = $('#player').val();
if (playerName == 'HLS.js') {
  var playerElement = $('#hlsjs');
  playerElement.show();
  var player = new Hls();
  console.log('Created HLS.js Player');
  player.loadSource(response.HLSStreamingSessionURL);
  player.attachMedia(playerElement[0]);
  console.log('Set player source');
  player.on(Hls.Events.MANIFEST_PARSED, function() {
    video.play();
    console.log('Starting playback');
  });
}
```

**Troubleshooting HLS Issues**

If the video stream does not play back correctly, see *Troubleshooting HLS Issues* (p. 176).

**Completed Example for HLS Playback**

You can download or view the completed example code.

**Video Playback with MPEG-DASH**

To view a Kinesis video stream using MPEG-DASH, you first create a streaming session using `GetDASHStreamingSessionURL`. This action returns a URL (containing a session token) for accessing the MPEG-DASH session. You can then use the URL in a media player or a standalone application to display the stream.
An Amazon Kinesis video stream has the following requirements for providing video through MPEG-DASH:

- The media must contain h.264 or h.265 encoded video and, optionally, AAC or G.711 encoded audio. Specifically, the codec ID of track 1 should be V_MPEG/ISO/AVC (for h.264) or V_MPEGH/ISO/HEVC (for H.265). Optionally, the codec ID of track 2 should be A_AAC (for AAC) or A_MS/ACM (for G.711).
- Data retention must be greater than 0.
- The video track of each fragment must contain codec private data in the Advanced Video Coding (AVC) for H.264 format and HEVC for H.265 format. For more information, see MPEG-4 specification ISO/IEC 14496-15. For information about adapting stream data to a given format, see NAL Adaptation Flags.
- The audio track (if present) of each fragment must contain codec private data in the AAC format (AAC specification ISO/IEC 13818-7) or the MS Wave format.

Example: Using MPEG-DASH in HTML and JavaScript

The following example shows how to retrieve an MPEG-DASH streaming session for a Kinesis video stream and play it back in a webpage. The example shows how to play back video in the following players:

- Google Shaka Player
- dash.js

Topics

- Set Up the Kinesis Video Streams Client for MPEG-DASH Playback (p. 13)
- Retrieve the Kinesis Video Streams Archived Content Endpoint for MPEG-DASH Playback (p. 13)
- Retrieve the MPEG-DASH Streaming Session URL (p. 14)
- Display the Streaming Video with MPEG-DASH Playback (p. 14)
- Completed Example (p. 15)

Set Up the Kinesis Video Streams Client for MPEG-DASH Playback

To access streaming video with MPEG-DASH, first create and configure the Kinesis Video Streams client (to retrieve the service endpoint) and archived media client (to retrieve the MPEG-DASH streaming session). The application retrieves the necessary values from input boxes on the HTML page.

```javascript
var streamName = $('#streamName').val();

// Step 1: Configure SDK Clients
var options = {
    accessKeyId: $('#accessKeyId').val(),
    secretAccessKey: $('#secretAccessKey').val(),
    sessionToken: ($('#sessionToken').val() || undefined),
    region: ($('#region').val() || undefined),
    endpoint: ($('#endpoint').val() || undefined)
};

var kinesisVideo = new AWS.KinesisVideo(options);
var kinesisVideoArchivedContent = new AWS.KinesisVideoArchivedMedia(options);
```

Retrieve the Kinesis Video Streams Archived Content Endpoint for MPEG-DASH Playback

After the clients are initiated, retrieve the Kinesis Video Streams archived content endpoint so that you can retrieve the MPEG-DASH streaming session URL as follows:
Retrieve the MPEG-DASH Streaming Session URL

When you have the archived content endpoint, call the `GetDASHStreamingSessionURL` API to retrieve the MPEG-DASH streaming session URL as follows:

![Code Snippet]

Display the Streaming Video with MPEG-DASH Playback

When you have the MPEG-DASH streaming session URL, provide it to the video player. The method for providing the URL to the video player is specific to the player that you use.

The following code example shows how to provide the streaming session URL to a Google Shaka player:

![Code Snippet]
Using Streaming Metadata

You can use the Amazon Kinesis Video Streams Producer SDK to embed metadata at the individual fragment level in a Kinesis video stream. Metadata in Kinesis Video Streams is a mutable key-value pair. You can use it to describe the content of the fragment, embed associated sensor readings that need to be transferred along with the actual fragment, or meet other custom needs. The metadata is made available as part of the “GetMedia” (p. 244) or the section called “GetMediaForFragmentList” (p. 274) API operations. It is stored along with the fragments for the entire duration of the stream's retention period. Your consuming applications can read, process, and take action based on the metadata using the Kinesis Video Stream Parser Library (p. 127).

There are two modes in which the metadata can be embedded with fragments in a stream:

- **Nonpersistent**: You can affix metadata on an ad hoc basis to fragments in a stream, based on business-specific criteria that have occurred. An example is a smart camera that detects motion and adds metadata to the corresponding fragments that contain the motion before sending the fragments to its Kinesis video stream. You might apply metadata to the fragment in the following format:

  \[
  \text{Motion} = \text{true}
  \]

---

Completed Example

You can [download or view the completed example code](https://github.com) on GitHub.
• **Persistent**: You can affix metadata to successive, consecutive fragments in a stream based on a continuing need. An example is a smart camera that sends the current latitude and longitude coordinates associated with all fragments that it sends to its Kinesis video stream. You might apply metadata to all the fragments in the following format: Lat = 47.608013N, Long = -122.335167W

You can affix metadata in both of these modes to the same fragment simultaneously, based on your application's needs. The embedded metadata might include objects detected, activity tracked, GPS coordinates, or any other custom data that you want to associate with the fragments in the stream. Metadata is encoded as key-value string pairs.

**Topics**
- Adding Metadata to a Kinesis Video Stream (p. 16)
- Consuming Metadata Embedded in a Kinesis Video Stream (p. 17)
- Streaming Metadata Limitations (p. 18)

**Adding Metadata to a Kinesis Video Stream**

Metadata that you add to a Kinesis video stream is modeled as MKV tags, which are implemented as key-value pairs.

Metadata can either be *transient*, such as to mark an event within the stream, or *persistent*, such as to identify fragments where a given event is taking place. A persistent metadata item remains, and is applied to each consecutive fragment, until it is canceled.

**Note**

The metadata items added using the Producer Libraries (p. 46) are distinct from the stream-level tagging APIs implemented with the section called “TagStream” (p. 227), the section called “UntagStream” (p. 232), and the section called “ListTagsForStream” (p. 222).

**Streaming Metadata API**

You can use the following operations in the Producer SDK to implement streaming metadata.

**PIC**

```c
PUBLIC_API STATUS putKinesisVideoFragmentMetadata(STREAM_HANDLE streamHandle, 
PCHAR name, 
PCHAR value, 
BOOL persistent);
```

**C++ Producer SDK**

```cpp
/**
 * Appends a "tag" or metadata - a key/value string pair into the stream.
 */
bool putFragmentMetadata(const std::string& name, const std::string& value, bool persistent = true);
```

**Java Producer SDK**

Using the Java Producer SDK, you add metadata to a MediaSource using MediaSourceSink.onCodecPrivateData:
void onFragmentMetadata(final @Nonnull String metadataName, final @Nonnull String metadataValue, final boolean persistent) throws KinesisVideoException;

**Persistent and Nonpersistent Metadata**

For nonpersistent metadata, you can add multiple metadata items with the same *name*. The Producer SDK collects the metadata items in the metadata queue until they are prepended to the next fragment. The metadata queue is cleared as the metadata items are applied to the stream. To repeat the metadata, call `putKinesisVideoFragmentMetadata` or `putFragmentMetadata` again.

For persistent metadata, the Producer SDK collects the metadata items in the metadata queue in the same way as for nonpersistent metadata. However, the metadata items are not removed from the queue when they are prepended to the next fragment.

Calling `putKinesisVideoFragmentMetadata` or `putFragmentMetadata` with `persistent` set to `true` has the following behavior:

- Calling the API puts the metadata item in the queue. The metadata is added as an MKV tag to every fragment while the item is in the queue.
- Calling the API with the same *name* and a different *value* as a previously added metadata item overwrites the item.
- Calling the API with an empty *value* removes (cancels) the metadata item from the metadata queue.

**Consuming Metadata Embedded in a Kinesis Video Stream**

To consume the metadata in a Kinesis video stream, use an implementation of `MkvTagProcessor`:

```java
public interface MkvTagProcessor {
    default void process(MkvTag mkvTag, Optional<FragmentMetadata> currentFragmentMetadata) {
        throw new NotImplementedException("Default FragmentMetadataVisitor.MkvTagProcessor");
    }

    default void clear() {
        throw new NotImplementedException("Default FragmentMetadataVisitor.MkvTagProcessor");
    }
}
```

This interface is found in the `FragmentMetadataVisitor` (p. 129) class in the Kinesis Video Stream Parser Library (p. 127).

The `FragmentMetadataVisitor` class contains an implementation of `MkvTagProcessor`:

```java
public static final class BasicMkvTagProcessor implements FragmentMetadataVisitor.MkvTagProcessor {
    @Getter
    private List<MkvTag> tags = new ArrayList<>();

    @Override
    public void process(MkvTag mkvTag, Optional<FragmentMetadata> currentFragmentMetadata) {
        tags.add(mkvTag);
    }
}
```
The `KinesisVideoRendererExample` class contains an example of how to use a `BasicMkvTagProcessor`. In the following example, a `BasicMkvTagProcessor` is added to the `MediaProcessingArguments` of an application:

```java
if (renderFragmentMetadata) {
    getMediaProcessingArguments =
    KinesisVideoRendererExample.GetMediaProcessingArguments.create(
        Optional.of(new FragmentMetadataVisitor.BasicMkvTagProcessor()));
}
```

The `BasicMkvTagProcessor.process` method is called when fragment metadata arrives. You can retrieve the accumulated metadata with `GetTags`. If you want to retrieve a single metadata item, first call `clear` to clear the collected metadata, and then retrieve the metadata items again.

### Streaming Metadata Limitations

The following limitations apply to adding streaming metadata to a Kinesis video stream:

- You can prepend up to 10 metadata items to a fragment.
- A fragment metadata `name` can be up to 128 bytes in length.
- A fragment metadata `value` can be up to 256 bytes in length.
- A fragment metadata `name` cannot begin with the string "AWS". If such a metadata item is added, the `putFragmentMetadata` method in the PIC returns a `STATUS_INVALID_METADATA_NAME` error (error code 0x52000077). Your application can then either ignore the error (the PIC doesn’t add the metadata item), or respond to the error.

### Kinesis Video Streams Data Model

The Producer Libraries (p. 46) and Stream Parser Library (p. 127) send and receive video data in a format that supports embedding information alongside video data. This format is based on the Matroska (MKV) specification.

The MKV format is an open specification for media data. All the libraries and code examples in the Amazon Kinesis Video Streams Developer Guide send or receive data in the MKV format.

The Kinesis Video Streams Producer Libraries (p. 46) use the `StreamDefinition` and `Frame` types to produce MKV stream headers, frame headers, and frame data.

For information about the full MKV specification, see Matroska Specifications.

The following sections describe the components of MKV-formatted data produced by the C++ Producer Library (p. 56).

Topics

- Stream Header Elements (p. 19)
- Stream Track Data (p. 22)
- Frame Header Elements (p. 23)
Stream Header Elements

The following MKV header elements are used by `StreamDefinition` (defined in `StreamDefinition.h`).

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>stream_name</td>
<td>Corresponds to the name of the Kinesis video stream.</td>
<td><code>my-stream</code></td>
</tr>
<tr>
<td>retention_period</td>
<td>The duration that stream data is persisted by Kinesis Video Streams. Specify 0 for a stream that does not retain data.</td>
<td>24</td>
</tr>
<tr>
<td>tags</td>
<td>A key-value collection of user data. This data is displayed in the AWS Management Console and can be read by client applications to filter or get information about a stream.</td>
<td></td>
</tr>
<tr>
<td>kms_key_id</td>
<td>If present, the user-defined AWS KMS master key that is used to encrypt data on the stream. If it is absent, the data is encrypted by the Kinesis-supplied master key (<code>aws/kinesis-video</code>).</td>
<td>01234567-89ab-cdef-0123-456789ab</td>
</tr>
<tr>
<td>streaming_type</td>
<td>Currently, the only valid streaming type is <code>STREAMING_TYPE_REALTIME</code>.</td>
<td><code>STREAMING_TYPE_REALTIME</code></td>
</tr>
<tr>
<td>content_type</td>
<td>The user-defined content type. For streaming video data to play in the console, the content type must be <code>video/h264</code>.</td>
<td><code>video/h264</code></td>
</tr>
<tr>
<td>max_latency</td>
<td>This value is not currently used and should be set to 0.</td>
<td>0</td>
</tr>
<tr>
<td>fragment_duration</td>
<td>The estimate of how long your fragments should be, which is used for optimization. The actual fragment duration is determined by the streaming data.</td>
<td>2</td>
</tr>
<tr>
<td>timecode_scale</td>
<td>Indicates the scale used by frame time stamps. The default is 1 millisecond. Specifying 0 also assigns the default value of 1 millisecond. This value can be between 100 nanoseconds and 1 second.</td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
<td>Typical Values</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>key_frame_fragmentation</td>
<td>If true, the stream starts a new cluster when a keyframe is received.</td>
<td>true</td>
</tr>
<tr>
<td>frame_timecodes</td>
<td>If true, Kinesis Video Streams stamps the frames when they are received. If false, Kinesis Video Streams uses the decode time of the received frames.</td>
<td>true</td>
</tr>
<tr>
<td>absolute_fragment_time</td>
<td>If true, the cluster timecodes are interpreted as using absolute time (for example, from the producer's system clock). If false, the cluster timecodes are interpreted as being relative to the start time of the stream.</td>
<td>true</td>
</tr>
<tr>
<td>fragment_acks</td>
<td>If true, acknowledgements (ACKs) are sent when Kinesis Video Streams receives the data. The ACKs can be received using the KinesisVideoStreamFragmentAck or KinesisVideoStreamParseFragmentAck callbacks.</td>
<td>true</td>
</tr>
<tr>
<td>restart_on_error</td>
<td>Indicates whether the stream should resume transmission after a stream error is raised.</td>
<td>true</td>
</tr>
<tr>
<td>nal_adaptation_flags</td>
<td>Indicates whether NAL (Network Abstraction Layer) adaptation or codec private data is present in the content. Valid flags include NAL_ADAPTATION_ANNEXB_NALS and NAL_ADAPTATION_ANNEXB_CPD_NALS.</td>
<td>NAL_ADAPTATION_ANNEXB_NALS</td>
</tr>
<tr>
<td>frame_rate</td>
<td>An estimate of the content frame rate. This value is used for optimization; the actual frame rate is determined by the rate of incoming data. Specifying 0 assigns the default of 24.</td>
<td>24</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
<td>Typical Values</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>avg_bandwidth_bps</td>
<td>An estimate of the content bandwidth. This value is used for optimization; the actual rate is determined by the bandwidth of incoming data. For example, for a 720p resolution video stream running at 25 FPS, you can expect the average bandwidth to be 5 Mbps.</td>
<td>5</td>
</tr>
<tr>
<td>buffer_duration</td>
<td>The duration that content is to be buffered on the producer. If there is low network latency, this value can be reduced; if network latency is high, increasing this value prevents frames from being dropped before they can be sent, due to allocation failing to put frames into the smaller buffer.</td>
<td></td>
</tr>
<tr>
<td>replay_duration</td>
<td>The amount of time the video data stream is &quot;rewound&quot; in the case of connection loss. This value can be zero if lost frames due to connection loss are not a concern; the value can be increased if the consuming application can eliminate redundant frames. This value should be less than the buffer duration; otherwise the buffer duration is used.</td>
<td></td>
</tr>
<tr>
<td>connection_staleness</td>
<td>The duration that a connection is maintained when no data is received.</td>
<td></td>
</tr>
<tr>
<td>codec_id</td>
<td>The codec used by the content. For more information, see CodecID in the Matroska specification.</td>
<td>V_MPEG2</td>
</tr>
<tr>
<td>track_name</td>
<td>The user-defined name of the track.</td>
<td>my_track</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
<td>Typical Values</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>codecPrivateData</td>
<td>Data provided by the encoder used to decode the frame data, such as the frame width and height in pixels, which is needed by many downstream consumers. In the C++ Producer Library (p. 56), the gMkvTrackVideoBits array in MkvStatics.cpp includes pixel width and height for the frame.</td>
<td></td>
</tr>
<tr>
<td>codecPrivateDataSize</td>
<td>The size of the data in the codecPrivateData parameter.</td>
<td></td>
</tr>
<tr>
<td>track_type</td>
<td>The type of the track for the stream.</td>
<td>MKV_TRACK_INFO_TYPE_AUDIO or MKV_TRACK_INFO_TYPE_VIDEO</td>
</tr>
<tr>
<td>segment_uuid</td>
<td>User-defined segment uuid (16 bytes).</td>
<td></td>
</tr>
<tr>
<td>default_track_id</td>
<td>Unique non-zero number for the track.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Stream Track Data**

The following MKV track elements are used by StreamDefinition (defined in StreamDefinition.h).

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>track_name</td>
<td>User-defined track name. For example, &quot;audio&quot; for the audio track.</td>
<td>audio</td>
</tr>
<tr>
<td>codec_id</td>
<td>Codec id for the track. For example, &quot;A_AAC&quot; for an audio track.</td>
<td>A_AAC</td>
</tr>
<tr>
<td>cpd</td>
<td>Data provided by the encoder used to decode the frame data. This data can include frame width and height in pixels, which is needed by many downstream consumers. In the C++ Producer Library, the gMkvTrackVideoBits array in MkvStatics.cpp includes pixel width and height for the frame.</td>
<td></td>
</tr>
<tr>
<td>cpd_size</td>
<td>The size of the data in the codecPrivateData parameter.</td>
<td></td>
</tr>
<tr>
<td>track_type</td>
<td>The type of the track. For example, you can MKV_TRACK_INFO_TYPE_AUDIO.</td>
<td></td>
</tr>
</tbody>
</table>
Frame Header Elements

The following MKV header elements are used by Frame (defined in the KinesisVideoPic package, in mkvgen/Include.h):

- **Frame Index**: A monotonically increasing value.
- **Flags**: The type of frame. Valid values include the following:
  - FRAME_FLAGS_NONE
  - FRAME_FLAG_KEY_FRAME: If key_frame_fragmentation is set on the stream, key frames start a new fragment.
  - FRAME_FLAG_DISCARDABLE_FRAME: Tells the decoder that it can discard this frame if decoding is slow.
  - FRAME_FLAG_INVISIBLE_FRAME: Duration of this block is 0.
- **Decoding Timestamp**: The time stamp of when this frame was decoded. If previous frames depend on this frame for decoding, this time stamp might be earlier than that of earlier frames. This value is relative to the start of the fragment.
- **Presentation Timestamp**: The time stamp of when this frame is displayed. This value is relative to the start of the fragment.
- **Duration**: The playback duration of the frame.
- **Size**: The size of the frame data in bytes

MKV Frame Data

The data in frame.frameData might contain only media data for the frame, or it might contain further nested header information, depending on the encoding schema used. To be displayed in the AWS Management Console, the data must be encoded in the H.264 codec, but Kinesis Video Streams can receive time-serialized data streams in any format.
Getting Started with Kinesis Video Streams

This section describes how to perform the following tasks in Amazon Kinesis Video Streams:

• Set up your AWS account and create an administrator, if you haven’t already done so.
• Create a Kinesis video stream.
• Send data to the Kinesis video stream from your camera and view the media in the console.

If you are new to Amazon Kinesis Video Streams, we recommend that you read Amazon Kinesis Video Streams: How It Works (p. 5) first.

Note
Following the Getting Started sample will not incur any charges to your AWS account. See Amazon Kinesis Video Streams Pricing for data costs in your region.

Topics
• Step 1: Set Up an AWS Account and Create an Administrator (p. 24)
• Step 2: Create a Kinesis Video Stream (p. 26)
• Step 3: Send Data to a Kinesis Video Stream (p. 26)
• What’s Next? (p. 29)

Step 1: Set Up an AWS Account and Create an Administrator

Before you use Kinesis Video Streams for the first time, complete the following tasks:

1. Sign Up for AWS (p. 24) (unless you already have an account)
2. Create an Administrator IAM User (p. 25)
3. Create an AWS Account Key (p. 25)

Sign Up for AWS

If you already have an AWS account, you can skip this step.

When you sign up for Amazon Web Services (AWS), your AWS account is automatically signed up for all services in AWS, including Kinesis Video Streams. When you use Kinesis Video Streams, you are charged based on the amount of data ingested into, stored by, and consumed from the service. If you are a new AWS customer, you can get started with Kinesis Video Streams for free. For more information, see AWS Free Usage Tier.

To create an AWS account

2. Follow the online instructions.

   Part of the sign-up procedure involves receiving a phone call and entering a verification code on the phone keypad.

Write down your AWS account ID because you need it for the next task.

Create an Administrator IAM User

When you sign up for AWS, you provide an email address and password that is associated with your AWS account. This is your AWS account root user. Its credentials provide complete access to all of your AWS resources.

**Note**

For security reasons, we recommend that you use the root user only to create an administrator, which is an IAM user with full permissions to your AWS account. You can then use this administrator to create other IAM users and roles with limited permissions. For more information, see IAM Best Practices and Creating an Admin User and Group in the IAM User Guide.

**To create an administrator and sign into the console**

1. Create an administrator in your AWS account. For instructions, see Creating Your First IAM User and Administrators Group in the IAM User Guide.
2. As an administrator, you can sign in to the console using a special URL. For more information, see How Users Sign in to Your Account in the IAM User Guide.

The administrator can create more users in the account. IAM users by default don't have any permissions. The administrator can create users and manage their permissions. For more information, see Creating Your First IAM User and Administrators Group.

For more information about IAM, see the following:

- AWS Identity and Access Management (IAM)
- Getting Started
- IAM User Guide

Create an AWS Account Key

You will need an AWS Account Key to access Kinesis Video Streams programmatically.

To create an AWS Account Key, do the following:

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. Choose Users in the navigation bar, and choose the Administrator user.
3. Choose the Security credentials tab, and choose Create access key.
4. Record the Access key ID. Choose Show under Secret access key. Record the Secret access key.

Next Step

Step 2: Create a Kinesis Video Stream (p. 26)
Step 2: Create a Kinesis Video Stream

This section describes how to create a Kinesis video stream.

This section contains the following procedures:

- the section called “Create a Video Stream Using the Console” (p. 26)
- the section called “Create a Video Stream Using the AWS CLI” (p. 26)

Create a Video Stream Using the Console

1. Sign in to the AWS Management Console and open the Kinesis console at https://console.aws.amazon.com/kinesis.
2. On the Video streams page, choose Create video stream.
3. On the Create a new video stream page, type ExampleStream for the stream name. Leave the Default configuration radio button selected.
4. Choose Create video stream.
5. After Kinesis Video Streams creates the stream, review the details on the ExampleStream page.

Create a Video Stream Using the AWS CLI

1. Ensure that you have the AWS CLI installed and configured. For more information, see the AWS Command Line Interface documentation.
2. Run the following Create-Stream command in the AWS CLI:

```
$ aws kinesisvideo create-stream --stream-name "MyKVStream" --data-retention-in-hours "24"
```

The response will look similar to the following:

```
{
}
```

Next Step

Step 3: Send Data to a Kinesis Video Stream (p. 26)

Step 3: Send Data to a Kinesis Video Stream

This section describes how to send media data from a camera to the Kinesis video stream you created in the previous step. This section uses the C++ Producer Library (p. 56) as a GStreamer (p. 135) plugin.

To easily send media from a variety of devices on a variety of operating systems, this tutorial uses GStreamer, an open-source media framework that standardizes access to cameras and other media sources.
The GStreamer example application is supported on the following operating systems:

- Ubuntu
- macOS
- Microsoft Windows
- Raspbian (Raspberry Pi)

For more information about using the GStreamer plugin to stream video from a file or an RTSP stream from a camera, see Example: Kinesis Video Streams Producer SDK GStreamer Plugin (p. 135).

**Download the C++ Producer SDK**

The GStreamer sample is included in the C++ Producer SDK. You can download the C++ Producer SDK from Github using the following Git command:

```
$ git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp
```

For information about SDK prerequisites and downloading, see Step 1: Download and Configure the C++ Producer Library Code (p. 59).

**Compile the GStreamer Example**

You can compile and install the GStreamer sample in the `kinesis-video-native-build` directory using the following commands:

- macOS:
  - Install homebrew
  - Run `brew install pkg-config openssl cmake gstreamer gst-plugins-base gst-plugins-good gst-plugins-bad gst-plugins-ugly log4cplus`
  - Go to `kinesis-video-native-build` directory and run `./min-install-script`
- Ubuntu and Raspbian:
  - Run the following:
    - `$ sudo apt-get update`
    - `$ sudo apt-get install libgstreamer1.0-dev libgstreamer-plugins-base1.0-dev gstreamer1.0-plugins-base-apps`
    - `$ sudo apt-get install gstreamer1.0-plugins-bad gstreamer1.0-plugins-good gstreamer1.0-plugins-ugly gstreamer1.0-tools`
  - If on Raspbian, run `$ sudo apt-get install gstreamer1.0-omx` after running previous commands.
  - Go to `kinesis-video-native-build` directory and run `./min-install-script`
- Windows:
  - Inside mingw32 or mingw64 shell, go to `kinesis-video-native-build` directory and run `./min-install-script`

**Run the GStreamer Example**

The GStreamer application sends media from your camera to the Kinesis Video Streams service. You can run the GStreamer example application for your operating system with the following commands. Run the example application from the `kinesis-video-native-build/downloads/local/bin` directory. Use the following parameters for the command:
• **Access key**: The AWS access key you recorded in the first step of this tutorial.
• **Secret key**: The AWS secret key you recorded in the first step of this tutorial.
• **AWS Region**: A region that supports Kinesis Video Streams. For information on supported regions, see Amazon Kinesis Video Streams Regions.

**Run the GStreamer Example on Ubuntu**

You can run the GStreamer example application on Ubuntu with the following command. Specify your camera device with the `device` parameter.

```
$ gst-launch-1.0 v4l2src device=/dev/video0 ! videoconvert ! video/x-raw,format=I420,width=640,height=480 ! x264enc bframes=0 key-int-max=45 bitrate=512 tune=zerolatency ! h264parse ! video/x-h264,stream-format=avc,alignment=au,profile=baseline ! kvssink stream-name="MyKinesisVideoStream" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

**Run the GStreamer Example on macOS**

You can run the GStreamer example application on MacOS with the following command:

```
$ gst-launch-1.0 autovideosrc ! videoconvert ! video/x-raw,format=I420,width=1280,height=720 ! vtenc_h264_hw allow-frame-reordering=FALSE realtime=TRUE max-keyframe-interval=45 bitrate=512 ! h264parse ! video/x-h264,stream-format=avc,alignment=au,profile=baseline ! kvssink stream-name="MyKinesisVideoStream" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

**Run the GStreamer Example on Windows**

You can run the GStreamer example application on Windows with the following command:

```
$ gst-launch-1.0 ksvideosrc ! videoconvert ! video/x-raw,format=I420,width=640,height=480 ! x264enc bframes=0 key-int-max=45 bitrate=512 tune=zerolatency ! h264parse ! video/x-h264,stream-format=avc,alignment=au,profile=baseline ! kvssink stream-name="MyKinesisVideoStream" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

**Run the GStreamer Example on Raspbian (Raspberry Pi)**

You can run the GStreamer example application on Raspbian with the following command. Specify your camera device with the `device` parameter.

```
$ gst-launch-1.0 v4l2src device=/dev/video0 ! videoconvert ! video/x-raw,format=I420,width=640,height=480 ! omxh264enc control-rate=2 target-bitrate=512000 periodicity-idr=45 inline-header=FALSE ! h264parse ! video/x-h264,stream-format=avc,alignment=au,profile=baseline ! kvssink stream-name="MyKinesisVideoStream" access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

**Consume Media Data**

You can consume media data by either viewing it in the console, or by creating an application that reads media data from a stream using HLS.
View Media Data in the Console

To view the media data sent from your camera in the Kinesis Video Streams console, open the Kinesis Video Streams console at https://console.aws.amazon.com/kinesisvideo/, and choose the MyKinesisVideoStream stream on the Manage Streams page. The video plays in the Video Preview pane.

Consume Media Data using HLS

You can create a client application that consumes data from a Kinesis video stream using Hypertext Live Streaming (HLS). For information about creating an application that consumes media data using HLS, see the section called “Video Playback” (p. 9).

Next Step

What's Next? (p. 29)

What's Next?

See the following topics for further information about Kinesis Video Streams:

- **Producer Libraries (p. 46):** Describes the classes and methods used to send media data to the Kinesis Video Streams service.
- **Stream Parser Library (p. 127):** Describes how to create an application that reads and displays media data from a Kinesis video stream.
- **RTSP and Docker (p. 147):** Describes how to stream video to the Kinesis Video Streams service from a network (RTSP) camera.
Security in Amazon Kinesis Video Streams

Cloud security at AWS is the highest priority. As an AWS customer, you will benefit from a data center and network architecture built to meet the requirements of the most security-sensitive organizations.

Security is a shared responsibility between AWS and you. The shared responsibility model describes this as security of the cloud and security in the cloud:

- **Security of the cloud** – AWS is responsible for protecting the infrastructure that runs AWS services in the AWS Cloud. AWS also provides you with services that you can use securely. The effectiveness of our security is regularly tested and verified by third-party auditors as part of the AWS compliance programs. To learn about the compliance programs that apply to Kinesis Video Streams, see AWS Services in Scope by Compliance Program.
- **Security in the cloud** – Your responsibility is determined by the AWS service that you use. You are also responsible for other factors including the sensitivity of your data, your organization’s requirements, and applicable laws and regulations.

This documentation helps you understand how to apply the shared responsibility model when using Kinesis Video Streams. The following topics show you how to configure Kinesis Video Streams to meet your security and compliance objectives. You’ll also learn how to use other AWS services that can help you to monitor and secure your Kinesis Video Streams resources.

**Topics**
- Data Protection in Kinesis Video Streams (p. 30)
- Controlling Access to Kinesis Video Streams Resources Using IAM (p. 33)
- Controlling Access to Kinesis Video Streams Resources Using AWS IoT (p. 37)
- Monitoring Amazon Kinesis Video Streams (p. 43)
- Compliance Validation for Amazon Kinesis Video Streams (p. 43)
- Resilience in Amazon Kinesis Video Streams (p. 44)
- Infrastructure Security in Kinesis Video Streams (p. 44)
- Security Best Practices for Kinesis Video Streams (p. 44)

Data Protection in Kinesis Video Streams

Server-side encryption using AWS Key Management Service (AWS KMS) keys makes it easier for you to meet strict data management requirements by encrypting your data at rest in Amazon Kinesis Video Streams.

**Topics**
- What Is Server-Side Encryption for Kinesis Video Streams? (p. 31)
- Costs, Regions, and Performance Considerations (p. 31)
- How Do I Get Started with Server-Side Encryption? (p. 31)
- Creating and Using User-Generated AWS KMS Master Keys (p. 32)
- Permissions to Use User-Generated AWS KMS Master Keys (p. 32)
What Is Server-Side Encryption for Kinesis Video Streams?

Server-side encryption is a feature in Kinesis Video Streams that automatically encrypts data before it's at rest by using an AWS KMS customer master key (CMK) that you specify. Data is encrypted before it is written to the Kinesis Video Streams stream storage layer, and it is decrypted after it is retrieved from storage. As a result, your data is always encrypted at rest within the Kinesis Video Streams service.

With server-side encryption, your Kinesis video stream producers and consumers don't need to manage master keys or cryptographic operations. If data retention is enabled, your data is automatically encrypted as it enters and leaves Kinesis Video Streams, so your data at rest is encrypted. AWS KMS provides all the master keys that are used by the server-side encryption feature. AWS KMS makes it easier to use a CMK for Kinesis Video Streams that is managed by AWS, a user-specified AWS KMS CMK, or a master key imported into the AWS KMS service.

Costs, Regions, and Performance Considerations

When you apply server-side encryption, you are subject to AWS KMS API usage and key costs. Unlike custom AWS KMS master keys, the (Default) aws/kinesis-video customer master key (CMK) is offered free of charge. However, you still must pay for the API usage costs that Kinesis Video Streams incurs on your behalf.

API usage costs apply for every CMK, including custom ones. The KMS costs scale with the number of user credentials that you use on your data producers and consumers because each user credential requires a unique API call to AWS KMS.

The following describes the costs by resource:

**Keys**

- The CMK for Kinesis Video Streams that's managed by AWS (alias = aws/kinesis-video) is free.
- User-generated AWS KMS keys are subject to AWS KMS key costs. For more information, see AWS Key Management Service Pricing.

**AWS KMS API Usage**

API requests to generate new data encryption keys or to retrieve existing encryption keys increase as traffic increases, and are subject to AWS KMS usage costs. For more information, see AWS Key Management Service Pricing: Usage.

Kinesis Video Streams generates key requests even when retention is set to 0 (no retention).

**Availability of Server-Side Encryption by Region**

Server-side encryption of Kinesis video streams is available in all the AWS Regions where Kinesis Video Streams is available.

**How Do I Get Started with Server-Side Encryption?**

Server-side encryption is always enabled on Kinesis video streams. If a user-provided key is not specified when the stream is created, the default key (provided by Kinesis Video Streams) is used.

A user-provided AWS KMS master key must be assigned to a Kinesis video stream when it is created. You can't later assign a different key to a stream using the UpdateStream API.

You can assign a user-provided AWS KMS master key to a Kinesis video stream in two ways:
• When creating a Kinesis video stream in the AWS Management Console, specify the AWS KMS master key in the Encryption tab on the Create a new video stream page.
• When creating a Kinesis video stream using the CreateStream API, specify the key ID in the KmsKeyId parameter.

Creating and Using User-Generated AWS KMS Master Keys

This section describes how to create and use your own AWS KMS master keys instead of using the master key administered by Amazon Kinesis Video Streams.

Creating User-Generated AWS KMS Master Keys

For information about how to create your own master keys, see Creating Keys in the AWS Key Management Service Developer Guide. After you create keys for your account, the Kinesis Video Streams service returns these keys in the KMS master key list.

Using User-Generated AWS KMS Master Keys

After the correct permissions are applied to your consumers, producers, and administrators, you can use custom AWS KMS master keys in your own AWS account or another AWS account. All AWS KMS master keys in your account appear in the KMS Master Key list on the console.

To use custom AWS KMS master keys that are located in another account, you must have permissions to use those keys. You must also create the stream using the CreateStream API. You can't use AWS KMS master keys from different accounts in streams created in the console.

Note
The AWS KMS key is not accessed until the PutMedia or GetMedia operation is executed. This has the following results:

• If the key you specify doesn't exist, the CreateStream operation succeeds, but PutMedia and GetMedia operations on the stream fail.
• If you use the provided master key (aws/kinesis-video), the key is not present in your account until the first PutMedia or GetMedia operation is performed.

Permissions to Use User-Generated AWS KMS Master Keys

Before you can use server-side encryption with a user-generated AWS KMS master key, you must configure AWS KMS key policies to allow encryption of streams and encryption and decryption of stream records. For examples and more information about AWS KMS permissions, see AWS KMS API Permissions: Actions and Resources Reference.

Note
The use of the default service key for encryption does not require application of custom IAM permissions.

Before you use user-generated AWS KMS master keys, ensure that your Kinesis video stream producers and consumers (IAM principals) are users in the AWS KMS master key policy. Otherwise, writes and reads from a stream will fail, which could ultimately result in data loss, delayed processing, or hung applications. You can manage permissions for AWS KMS keys using IAM policies. For more information, see Using IAM Policies with AWS KMS.
Example Producer Permissions

Your Kinesis video stream producers must have the `kms:GenerateDataKey` permission:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": ["kms:GenerateDataKey"],
      "Resource": "arn:aws:kms:us-west-2:123456789012:key/1234abcd-12ab-34cd-56ef-1234567890ab"
    },
    {
      "Effect": "Allow",
      "Action": ["kinesis-video:PutMedia"],
      "Resource": "arn:aws:kinesis-video:*:123456789012:MyStream"
    }
  ]
}
```

Example Consumer Permissions

Your Kinesis video stream consumers must have the `kms:Decrypt` permission:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": ["kms:Decrypt"],
      "Resource": "arn:aws:kms:us-west-2:123456789012:key/1234abcd-12ab-34cd-56ef-1234567890ab"
    },
    {
      "Effect": "Allow",
      "Action": ["kinesis-video:GetMedia"],
      "Resource": "arn:aws:kinesis-video:*:123456789012:MyStream"
    }
  ]
}
```

Controlling Access to Kinesis Video Streams Resources Using IAM

By using AWS Identity and Access Management (IAM) with Amazon Kinesis Video Streams, you can control whether users in your organization can perform a task using specific Kinesis Video Streams API operations and whether they can use specific AWS resources.
Policy Syntax

An IAM policy is a JSON document that consists of one or more statements. Each statement is structured as follows:

```json
{
    "Statement": [{
        "Effect": "effect",
        "Action": "action",
        "Resource": "arn",
        "Condition": {
            "condition": {
                "key": "value"
            }
        }
    }]
}
```

There are various elements that make up a statement:

- **Effect**: The effect can be Allow or Deny. By default, IAM users don't have permission to use resources and API actions, so all requests are denied. An explicit allow overrides the default. An explicit deny overrides any allows.

- **Action**: The action is the specific API action for which you are granting or denying permission.

- **Resource**: The resource that's affected by the action. To specify a resource in the statement, you need to use its Amazon Resource Name (ARN).

- **Condition**: Conditions are optional. They can be used to control when your policy is in effect.

As you create and manage IAM policies, you might want to use the IAM Policy Generator and the IAM Policy Simulator.

Actions for Kinesis Video Streams

In an IAM policy statement, you can specify any API action from any service that supports IAM. For Kinesis Video Streams, use the following prefix with the name of the API action: kinesisvideo:. For example: kinesisvideo:CreateStream, kinesisvideo:ListStreams, and kinesisvideo:DescribeStream.

To specify multiple actions in a single statement, separate them with commas as follows:
You can also specify multiple actions using wildcards. For example, you can specify all actions whose name begins with the word "Get" as follows:

```
"Action": "kinesisvideo:Get*"
```

To specify all Kinesis Video Streams operations, use the asterisk (*) wildcard as follows:

```
"Action": "kinesisvideo:*"
```

For the complete list of Kinesis Video Streams API actions, see the Kinesis Video Streams API reference.

### Amazon Resource Names (ARNs) for Kinesis Video Streams

Each IAM policy statement applies to the resources that you specify using their ARNs.

Use the following ARN resource format for Kinesis Video Streams:

```
```

For example:

```
```

You can get the ARN of a stream using DescribeStream.

### Granting Other IAM Accounts Access to a Kinesis Video Stream

You might need to grant permission to other IAM accounts to perform operations on Kinesis video streams. The following overview describes the general steps to grant access to video streams across accounts:

1. Get the 12-digit account ID of the account that you want to grant permissions to perform operations on your stream (for example, 111111111111).
2. Create a managed policy on the account that owns the stream that allows the level of access that you want to grant. For example policies for Kinesis Video Streams resources, see Example Policies (p. 36) in the next section.
3. Create a role, specifying the account to which you are granting permissions, and attach the policy that you created in the previous step.
4. Create a managed policy that allows the AssumeRole action on the role you created in the previous step. For example, the role might look like the following:

```json
{
    "Version": "2012-10-17",
    "Statement": {
        "Effect": "Allow",
        "Action": "sts:AssumeRole",
        "Resource": "arn:aws:iam::123456789012:role/CustomRole"
    }
}
```
Example Policies for Kinesis Video Streams

The following example policies demonstrate how you can control user access to your Kinesis video streams.

**Example 1: Allow users to get data from any Kinesis video stream**

This policy allows a user or group to perform the `DescribeStream`, `GetDataEndpoint`, `GetMedia`, `ListStreams`, and `ListTagsForStream` operations on any Kinesis video stream. This policy is appropriate for users who can get data from any video stream.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "kinesisvideo:Describe*",
        "kinesisvideo:Get*",
        "kinesisvideo:List*"
      ],
      "Resource": "*"
    }
  ]
}
```

**Example 2: Allow a user to create a Kinesis video stream and write data to it**

This policy allows a user or group to perform the `CreateStream` and `PutMedia` operations. This policy is appropriate for a security camera that can create a video stream and send data to it.

```json
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "kinesisvideo:CreateStream",
        "kinesisvideo:PutMedia"
      ],
      "Resource": "*"
    }
  ]
}
```

**Example 3: Allow a user full access to all Kinesis Video Streams resources**

This policy allows a user or group to perform any Kinesis Video Streams operation on any resource. This policy is appropriate for administrators.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    
```
Controlling Access to Kinesis Video Streams Resources Using AWS IoT

This section describes how to enable a device (for example, a camera) to send audio/video data to one particular Kinesis video stream only. You can do this by using the AWS IoT credentials provider and an AWS Identity and Access Management (IAM) role.

Devices can use X.509 certificates to connect to AWS IoT using TLS mutual authentication protocols. Other AWS services (for example, Kinesis Video Streams) do not support certificate-based authentication, but they can be called using AWS credentials in AWS Signature Version 4 format. The Signature Version 4 algorithm normally requires the caller to have an access key ID and a secret access key. AWS IoT has a credentials provider that allows you to use the built-in X.509 certificate as the unique device identity to authenticate AWS requests (for example, requests to Kinesis Video Streams). This eliminates the need to store an access key ID and a secret access key on your device.

The credentials provider authenticates a client (in this case, a Kinesis Video Streams SDK that is running on the camera from which you want to send data to a video stream) using an X.509 certificate and issues a temporary, limited-privilege security token. The token can be used to sign and authenticate any AWS request (in this case, a call to the Kinesis Video Streams). For more information, see Authorizing Direct Calls to AWS Services.

This way of authenticating your camera's requests to Kinesis Video Streams requires you to create and configure an IAM role and attach appropriate IAM policies to the role so that the IoT credentials provider can assume the role on your behalf.

For more information about AWS IoT, see AWS IoT Core Documentation. For more information about IAM, see AWS Identity and Access Management (IAM).

Topics
- IoT ThingName as Stream Name (p. 38)
- IoT CertificateId as Stream Name (p. 42)
IoT ThingName as Stream Name

Topics

- Step 1: Create an IoT Thing Type and an IoT Thing (p. 38)
- Step 2: Create an IAM Role to be Assumed by IoT (p. 38)
- Step 3: Create and Configure the X.509 Certificate (p. 40)
- Step 4: Test the IoT Credentials with Your Kinesis Video Stream (p. 41)
- Step 5: Deploying IoT Certificates and Credentials on Your Camera's File System and Streaming Data to Your Video Stream (p. 41)

Step 1: Create an IoT Thing Type and an IoT Thing

In IoT, a thing is a representation of a specific device or logical entity. In this case, an IoT thing represents your Kinesis video stream for which you want to configure resource-level access control. In order to create a thing, first, you must create an IoT thing type. IoT thing types enable you to store description and configuration information that is common to all things associated with the same thing type.

1. The following example command creates a thing type kvs_example_camera:

   ```
   aws --profile default iot create-thing-type --thing-type-name kvs_example_camera > iot-thing-type.json
   ```

2. And this example command creates the kvs_example_camera_stream thing of the kvs_example_camera thing type:

   ```
   aws --profile default iot create-thing --thing-name kvs_example_camera_stream --thing-type-name kvs_example_camera > iot-thing.json
   ```

Step 2: Create an IAM Role to be Assumed by IoT

IAM roles are similar to IAM users, in that a role is an AWS identity with permission policies that determine what the identity can and cannot do in AWS. A role can be assumed by anyone who needs it. When you assume a role, it provides you with temporary security credentials for your role session.

The role that you create in this step can be assumed by IoT in order to obtain temporary credentials from the security token service (STS) when performing credential authorization requests from the client. In this case, the client is the Kinesis Video Streams SDK that is running on your camera.

Perform the following steps to create and configure this IAM role:

1. Create an IAM role.

   The following example command creates an IAM role called KVSCameraCertificateBasedIAMRole:

   ```
   aws --profile default iam create-role --role-name KVSCameraCertificateBasedIAMRole --assume-role-policy-document 'file://iam-policy-document.json' > iam-role.json
   ```
You can use the following trust policy JSON for the `iam-policy-document.json`:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "credentials.iot.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

2. Next, you must attach a permissions policy to the IAM role you created above. This permissions policy allows selective access control (a subset of supported operations) for an AWS resource. In this case, the AWS resource is the video stream to which you want your camera to send data. In other words, once all the configuration steps are complete, this camera will be able to send data only to this video stream.

```
aws --profile default iam put-role-policy --role-name KVSCameraCertificateBasedIAMRole --policy-name KVSCameraIAMPolicy --policy-document 'file://iam-permission-document.json'
```

You can use the following IAM policy JSON for the `iam-permission-document.json`:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "kinesisvideo:DescribeStream",
        "kinesisvideo:PutMedia",
        "kinesisvideo:TagStream",
        "kinesisvideo:GetDataEndpoint"
      ],
      "Resource": "arn:aws:kinesisvideo:*:*:stream/${credentials-iot:ThingName}/*"
    }
  ]
}
```

Note that this policy authorizes the specified actions only on a video stream (AWS resource) that is specified by the placeholder (`${credentials-iot:ThingName}`). This placeholder takes on the value of the IoT thing attribute `ThingName` when the IoT credentials provider sends the video stream name in the request.

3. Next, create a Role Alias for your IAM Role. Role alias is an alternate data model that points to the IAM role. An IoT credentials provider request must include a role-alias to indicate which IAM role to assume in order to obtain the temporary credentials from the STS.

The following sample command creates a role alias called `KvsCameraIoTRoleAlias`,

```
aws --profile default iam create-role-alias --alias KVSCameraIoTRoleAlias --role-name KVSCameraCertificateBasedIAMRole
```
aws --profile default iot create-role-alias --role-alias KvsCameraIoTRoleAlias --role-arn $(jq --raw-output '.Role.Arn' iam-role.json) --credential-duration-seconds 3600 > iot-role-alias.json

4. Now you can create the policy that will enable IoT to assume role with the certificate (once it is attached) using the role alias.

The following sample command creates a policy for IoT called KvsCameraIoTPolicy.

aws --profile default iot create-policy --policy-name KvsCameraIoTPolicy --policy-document 'file://iot-policy-document.json'

You can use the following command to create the iot-policy-document.json document JSON:

cat > iot-policy-document.json <<EOF
{
    "Version":"2012-10-17",
    "Statement":[
    {
        "Effect":"Allow",
        "Action":[
            "iot:Connect"
        ],
        "Resource":"$(jq --raw-output '.roleAliasArn' iot-role-alias.json)"
    },
    {
        "Effect":"Allow",
        "Action":[
            "iot:AssumeRoleWithCertificate"
        ],
        "Resource":"$(jq --raw-output '.roleAliasArn' iot-role-alias.json)"
    }
]
} EOF

Step 3: Create and Configure the X.509 Certificate

Communication between a device (your video stream) and AWS IoT is protected through the use of X.509 certificates.

1. Create the certificate to which you must attach the policy for IoT that you created above.

aws --profile default iot create-keys-and-certificate --set-as-active --certificate-pem-outfile certificate.pem --public-key-outfile public.pem.key --private-key-outfile private.pem.key > certificate

2. Attach the policy for IoT (KvsCameraIoTPolicy created above) to this certificate.

aws --profile default iot attach-policy --policy-name KvsCameraIoTPolicy --target $(jq --raw-output '.certificateArn' certificate)
3. Attach your IoT thing (kvs_example_camera_stream) to the certificate you just created:

```
aws --profile default  iot attach-thing-principal --thing-name kvs_example_camera_stream --principal $(jq --raw-output '.certificateArn' certificate)
```

4. In order to authorize requests through the IoT credentials provider, you need the IoT credentials endpoint which is unique to your AWS account ID. You can use the following command to get the IoT credentials endpoint.

```
aws --profile default  iot describe-endpoint --endpoint-type iot:CredentialProvider --output text > iot-credential-provider.txt
```

5. In addition to the X.509 certificate created above, you must also have a CA certificate to establish trust with the back-end service through TLS. You can get the CA certificate using the following command:

```
curl --silent 'https://www.amazontrust.com/repository/SFSRootCAG2.pem' --output cacert.pem
```

**Step 4: Test the IoT Credentials with Your Kinesis Video Stream**

Now you can test the IoT credentials that you've set up so far.

1. First, create a Kinesis video stream that you want to test this configuration with.

   **Important**
   
   Create a video stream with a name that is identical to the IoT thing name that you created in the previous step (kvs_example_camera_stream).

```
aws kinesisvideo create-stream  --data-retention-in-hours 24 --stream-name kvs_example_camera_stream
```

2. Next, call the IoT credentials provider to get the temporary credentials:

```
curl --silent -H "x-amzn-iot-thingname:kvs_example_camera_stream" --cert certificate.pem --key private.pem.key https://IOT_GET_CREDENTIAL_ENDPOINT/role-aliases/KvsCameraIoTRoleAlias/credentials --cacert ./cacert.pem > token.json
```

   **Note**
   
   You can use the following command to get the IOT_GET_CREDENTIAL_ENDPOINT:
   
   ```
   IOT_GET_CREDENTIAL_ENDPOINT=`cat iot-credential-provider.txt`
   ```

   The output JSON contains the accessKey, secretKey, and the sessionToken which you can use it for accessing the Kinesis Video Streams.
3. Now, for your test, you can use these credentials to invoke the Kinesis Video Streams DescribeStream API for the sample kvs_example_camera_stream video stream.

```bash
AWS_ACCESS_KEY_ID=$(jq --raw-output '.credentials.accessKeyId' token.json)
AWS_SECRET_ACCESS_KEY=$(jq --raw-output '.credentials.secretAccessKey' token.json)
AWS_SESSION_TOKEN=$(jq --raw-output '.credentials.sessionToken' token.json) aws kinesisvideo describe-stream --stream-name kvs_example_camera_stream
```

Step 5: Deploying IoT Certificates and Credentials on Your Camera's File System and Streaming Data to Your Video Stream

**Note**
The steps in this section describe sending media to a Kinesis video stream from a camera that is using the C++ Producer Library.

1. Copy the X.509 certificate, the private key, and the CA certificate generated in the steps above to your camera's file system. You need to specify the paths for where these files are stored, the role alias name, and the IOT credentials endpoint for running the gst-launch-1.0 command or your sample application.

2. The following sample command uses IoT certificate authorization to send video to Kinesis Video Streams:

```bash
# gst-launch-1.0 rtspsrc location=rtsp://YourCameraRtspUrl short-header=TRUE !
rtp2h264depay ! video/x-h264, format=avc,alignment=au !
h264parse ! kvssink stream-name="kvs_example_camera_stream" iot-certificate="iot-
certificate,endpoint=iot-credential-endpoint-host-name,cert-path=/path/to/
certificate.pem,key-path=/path/to/private.pem.key,ca-path=/path/to/cacert.pem,role-
aliases=KvsCameraIoTRoleAlias"
```

**IoT Certificateld as Stream Name**

If you want to represent your device (for example, your camera) through an IoT thing but authorize a different stream name, then you can use the IoT certificateId attribute as your stream name and provide Kinesis Video Streams permissions on the stream using IoT. The steps for accomplishing this are similar to the ones outlined above, with a few changes.

- Modify the permissions policy to your IAM role (iam-permission-document.json) as follows:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "kinesisvideo:DescribeStream",
        "kinesisvideo:PutMedia",
        "kinesisvideo:TagStream",
        "kinesisvideo:GetDataEndpoint"
      ],
      "Resource": "arn:aws:kinesisvideo:::${credentials-iot:AwsCertificateId}/*"
    }
  ]
}
```
Note
The resource ARN uses certificate ID as the placeholder for the stream name. The IAM permission will work when you use the certificate id as the stream name. Get the certificate ID from the certificate so that we can use that as stream name in the following describe stream api call.

```
export CERTIFICATE_ID=`cat certificate | jq --raw-output '.certificateId'
```

- Verify this change using the Kinesis Video Streams describe-stream CLI command:

```
AWS_ACCESS_KEY_ID=$(jq --raw-output '.credentials.accessKeyId' token.json)
AWS_SECRET_ACCESS_KEY=$(jq --raw-output '.credentials.secretAccessKey' token.json)
AWS_SESSION_TOKEN=$(jq --raw-output '.credentials.sessionToken' token.json)
aws kinesisvideo describe-stream --stream-name ${CERTIFICATE_ID}
```

- Pass the certificatId to the IoT credentials provider in the sample application in the Kinesis Video Streams C++ SDK:

```cpp
credential_provider = make_unique<IotCertCredentialProvider>(iot_get_credential_endpoint,
cert_path,
private_key_path,
role_alias,
ca_cert_path,
certificateId);
```

Note
Note that you are passing the thingname to the IoT credentials provider. You can use getenv to pass the thingname to the demo application similar to passing the other IoT attributes. Use the certificate ID as the stream name in the command line parameters when you are running the sample application.

Monitoring Amazon Kinesis Video Streams

Kinesis Video Streams provides monitoring functionality for your delivery streams. For more information, see Monitoring (p. 156).

Compliance Validation for Amazon Kinesis Video Streams

Third-party auditors assess the security and compliance of Amazon Kinesis Video Streams as part of multiple AWS compliance programs. These include SOC, PCI, HIPAA, and others.
Resilience in Amazon Kinesis Video Streams

The AWS global infrastructure is built around AWS Regions and Availability Zones. AWS Regions provide multiple physically separated and isolated Availability Zones, which are connected with low-latency, high-throughput, and highly redundant networking. With Availability Zones, you can design and operate applications and databases that automatically fail over between Availability Zones without interruption. Availability Zones are more highly available, fault tolerant, and scalable than traditional single or multiple data center infrastructures.

For more information about AWS Regions and Availability Zones, see AWS Global Infrastructure.

Infrastructure Security in Kinesis Video Streams

As a managed service, Amazon Kinesis Video Streams is protected by the AWS global network security procedures that are described in the Amazon Web Services: Overview of Security Processes whitepaper.

You use AWS published API calls to access Kinesis Video Streams through the network. Clients must support Transport Layer Security (TLS) 1.0. We recommend TLS 1.2 or later. Clients must also support cipher suites with perfect forward secrecy (PFS) such as Ephemeral Diffie-Hellman (DHE) or Elliptic Curve Ephemeral Diffie-Hellman (ECDHE). Most modern systems such as Java 7 and later support these modes.

Additionally, requests must be signed by using an access key ID and a secret access key that is associated with an IAM principal. Or you can use the AWS Security Token Service (AWS STS) to generate temporary security credentials to sign requests.

Security Best Practices for Kinesis Video Streams

Amazon Kinesis Video Streams provides a number of security features to consider as you develop and implement your own security policies. The following best practices are general guidelines and
Implement least privilege access

When granting permissions, you decide who is getting what permissions to which Kinesis Video Streams resources. You enable specific actions that you want to allow on those resources. Therefore you should grant only the permissions that are required to perform a task. Implementing least privilege access is fundamental in reducing security risk and the impact that could result from errors or malicious intent.

For example, a producer that sends data to Kinesis Video Streams requires only `PutMedia`, `GetStreamingEndpoint`, and `DescribeStream`. Do not grant producer applications permissions for all actions (*), or for other actions such as `GetMedia`.

For more information, see What Is Least Privilege & Why Do You Need It?

Use IAM roles

Producer and client applications must have valid credentials to access Kinesis video streams. You should not store AWS credentials directly in a client application or in an Amazon S3 bucket. These are long-term credentials that are not automatically rotated and could have a significant business impact if they are compromised.

Instead, you should use an IAM role to manage temporary credentials for your producer and client applications to access Kinesis video streams. When you use a role, you don’t have to use long-term credentials (such as a user name and password or access keys) to access other resources.

For more information, see the following topics in the IAM User Guide:

- IAM Roles
- Common Scenarios for Roles: Users, Applications, and Services

Use CloudTrail to Monitor API Calls

Kinesis Video Streams is integrated with AWS CloudTrail, a service that provides a record of actions taken by a user, role, or an AWS service in Kinesis Video Streams.

Using the information collected by CloudTrail, you can determine the request that was made to Kinesis Video Streams, the IP address from which the request was made, who made the request, when it was made, and additional details.

For more information, see the section called “Logging API Calls with CloudTrail” (p. 166).
Kinesis Video Streams Producer Libraries

The Amazon Kinesis Video Streams Producer libraries are a set of easy-to-use libraries that are part of the Kinesis Video Streams Producer SDK. The client uses the libraries and SDK to build the on-device application for securely connecting to Kinesis Video Streams and streaming video and other media data that can be viewed in the console or client applications in real time.

Media data can be streamed in the following ways:

- Streaming media data in real time
- Streaming media data after buffering it for a few seconds
- Streaming after-the-fact media uploads

After you create a Kinesis Video Streams stream, you can start sending data to the stream. You can use the SDK to create application code that extracts the video data (frames) from the media source and uploads it to Kinesis Video Streams. These applications are also referred to as producer applications.

The Producer libraries contain the following components:

- Kinesis Video Streams Producer Client (p. 46)
- Kinesis Video Streams Producer Library (p. 47)

Kinesis Video Streams Producer Client

The Kinesis Video Streams Producer Client includes a single KinesisVideoClient class. This class manages media sources, receives data from the sources, and manages the stream lifecycle as data flows from a media source to Kinesis Video Streams. Furthermore, it provides a MediaSource interface for defining the interaction between Kinesis Video Streams and your proprietary hardware and software.

A media source can be almost anything. For example, you can use a camera media source or a microphone media source. Media sources are not limited to audio and video sources only. For example, data logs might be text files, but they can still be sent as a stream of data. You could also have multiple cameras on your phone that stream data simultaneously.

To get data from any of these sources, you can implement the MediaSource interface. This interface enables additional scenarios for which we don't provide built-in support. For example, you might choose to send the following to Kinesis Video Streams:

- A diagnostic data stream (for example, application logs and events)
- Data from infrared cameras, RADARs, or depth cameras

Kinesis Video Streams does not provide built-in implementations for media-producing devices such as cameras. To extract data from these devices, you must implement code, thus creating your own custom media source implementation. You can then explicitly register your custom media sources with KinesisVideoClient, which uploads the data to Kinesis Video Streams.
The Kinesis Video Streams Producer Client is available for Java and Android applications. For more information, see Using the Java Producer Library (p. 47) and Using the Android Producer Library (p. 51).

Kinesis Video Streams Producer Library

The Kinesis Video Streams Producer Library is contained within the Kinesis Video Streams Producer Client. The library is also available to use directly for those who want a deeper integration with Kinesis Video Streams. It enables integration from devices with proprietary operating systems, network stacks, or limited on-device resources.

The Kinesis Video Streams Producer Library implements the state machine for streaming to Kinesis Video Streams. It provides callback hooks, which require that you provide your own transport implementation and explicitly handle each message going to and from the service.

You might choose to use the Kinesis Video Streams Producer Library directly for the following reasons:

- The device on which you want to run the application doesn't have a Java virtual machine.
- You want to write application code in languages other than Java.
- You might have Java on the device, but you want to reduce the amount of overhead in your code and limit it to the bare minimum level of abstraction, due to limitations such as memory and processing power.

Currently, the Kinesis Video Streams Producer Library is available for C++ applications. For more information, see Using the C++ Producer Library (p. 56).

Related Topics

Using the Java Producer Library (p. 47)
Using the Android Producer Library (p. 51)
Using the C++ Producer Library (p. 56)
???(p. 75)

Using the Java Producer Library

Amazon Kinesis Video Streams provides the Java Producer Library, which you can use to write application code, with minimal configuration, to send media data from a device to a Kinesis video stream.

You must perform the following steps to integrate your code with Kinesis Video Streams, so that your application can start streaming data to your Kinesis video stream:

1. Create an instance of the KinesisVideoClient object.
2. Create a MediaSource object by providing media source information. For example, when creating a camera media source, you provide information such as identifying the camera and specifying the encoding the camera uses.

When you want to start streaming, you must create a custom media source.
3. Register the media source with `KinesisVideoClient`.

After you register the media source with `KinesisVideoClient`, whenever the data becomes available with the media source, it calls `KinesisVideoClient` with the data.

**Procedure: Using the Java Producer SDK**

This procedure demonstrates how to use the Kinesis Video Streams Java Producer Client in your Java application to send data to your Kinesis video stream.

These steps don't require you to have a media source, such as a camera or microphone. Instead, for testing purposes, the code generates sample frames that consist of a series of bytes. You can use the same coding pattern when you send media data from real sources such as cameras and microphones.

The procedure includes the following steps:

- Download and Configure the Code
- Write and Examine the Code
- Run and Verify the Code

**Prerequisites**

- In the sample code, you provide credentials by specifying a profile that you set up in your AWS credentials profile file. If you haven't already done so, first set up your credentials profile. For more information, see Set up AWS Credentials and Region for Development in the AWS SDK for Java.
  
  **Note**
  The Java example uses a `SystemPropertiesCredentialsProvider` object to obtain your AWS credentials. The provider retrieves these credentials from the `aws.accessKeyId` and `aws.secretKey` Java system properties. You set these system properties in your Java development environment. For information about how to set Java system properties, see the documentation for your particular integrated development environment (IDE).

- Your `NativeLibraryPath` must contain your `KinesisVideoProducerJNI` file, available at https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp. The file name extension for this file depends on your operating system:
  - `KinesisVideoProducerJNI.so` for Linux
  - `KinesisVideoProducerJNI.dylib` for macOS
  - `KinesisVideoProducerJNI.dll` for Windows
  
  **Note**

**Step 1: Download and Configure the Java Producer Library Code**

In this section of the Java Producer Library procedure, you download the Java example code, import the project into your Java IDE, and configure the library locations.

For prerequisites and other details about this example, see Using the Java Producer Library.

1. Create a directory, and then clone the example source code from the GitHub repository.
Step 2: Write and Examine the Code

2. Open the Java integrated development environment (IDE) that you use (for example, Eclipse or JetBrains IntelliJ IDEA), and import the Apache Maven project that you downloaded:

   • In IntelliJ IDEA: Choose Import. Navigate to the `pom.xml` file in the root of the downloaded package.
   • In Eclipse: Choose File, Import, Maven, Existing Maven Projects. Then navigate to the `kinesis-video-java-demo` directory.

   For more information, see the documentation for your IDE.

3. The Java example code uses the current AWS credentials. To use a different credentials profile, locate the following code in `DemoAppMain.java`:

   ```java
   final KinesisVideoClient kinesisVideoClient = KinesisVideoJavaClientFactory.createKinesisVideoClient(
       Regions.US_WEST_2,
       AuthHelper.getSystemPropertiesCredentialsProvider());
   ```

   Change the code to the following:

   ```java
   final KinesisVideoClient kinesisVideoClient = KinesisVideoJavaClientFactory.createKinesisVideoClient(
       Regions.US_WEST_2,
       new ProfileCredentialsProvider("credentials-profile-name"));
   ```

   For more information, see `ProfileCredentialsProvider` in the `AWS SDK for Java` reference.

Next Step

the section called “Step 2: Write and Examine the Code” (p. 49)

Step 2: Write and Examine the Code

In this section of the Java Producer Library procedure, you write and examine the Java example code you downloaded in the previous section.

The Java test application (`DemoAppMain`) shows the following coding pattern:

- Create an instance of `KinesisVideoClient`.
- Create an instance of `MediaSource`.
- Register the `MediaSource` with the client.
- Start streaming. That is, start the `MediaSource`, and it starts sending data to the client.

The following sections provide details.

Creating an Instance of `KinesisVideoClient`

You create the `KinesisVideoClient` object by calling the `createKinesisVideoClient` operation.

```java
final KinesisVideoClient kinesisVideoClient = KinesisVideoJavaClientFactory.createKinesisVideoClient(

```
Creating an Instance of MediaSource

To send bytes to your Kinesis video stream, you need to produce the data. Amazon Kinesis Video Streams provides the `MediaSource` interface, which represents the data source.

For example, the Kinesis Video Streams Java library provides the `ImageFileMediaSource` implementation of the `MediaSource` interface. This class only reads data from a series of media files rather than a Kinesis video stream, but you can use it for testing the code.

```java
final MediaSource bytesMediaSource = createImageFileMediaSource();
```

Registering the MediaSource with the Client

Register the media source that you created with the `KinesisVideoClient` so that it knows about the client (and can then send data to the client).

```java
kinesisVideoClient.registerMediaSource(STREAM_NAME, bytesMediaSource);
```

Starting the Media Source

Start the media source so that it can begin generating data and sending it to the client.

```java
bytesMediaSource.start();
```

Next Step

the section called “Step 3: Run and Verify the Code” (p. 50)

Step 3: Run and Verify the Code

To run the Java test harness for the Java Producer library, do the following.

1. Choose `DemoAppMain`.
2. Choose `Run, Run 'DemoAppMain'`.
3. Add your credentials to the JVM arguments for the application:
   - **For non-temporary AWS credentials:** `-Daws.accessKeyId={YourAwsAccessKey} -Daws.secretKey={YourAwsSecretKey} -Djava.library.path={NativeLibraryPath}`
   - **For temporary AWS credentials:** `-Daws.accessKeyId={YourAwsAccessKey} -Daws.secretKey={YourAwsSecretKey} -Daws.sessionToken={YourAwsSessionToken} -Djava.library.path={NativeLibraryPath}`
4. Sign in to the AWS Management Console and open the Kinesis Video Streams console.
On the Manage Streams page, choose your stream.

5. The sample video will play in the embedded player. You might need to wait a short time (up to ten seconds under typical bandwidth and processor conditions) while the frames accumulate before the video appears.

The code example creates a stream. As the MediaSource in the code starts, it begins sending sample frames to the KinesisVideoClient. The client then sends the data to your Kinesis video stream.

Using the Android Producer Library

Amazon Kinesis Video Streams provides the Android Producer Library, which you can use to write application code, with minimal configuration, to send media data from an Android device to a Kinesis video stream.

You must perform the following steps to integrate your code with Kinesis Video Streams so that your application can start streaming data to your Kinesis video stream:

1. Create an instance of the KinesisVideoClient object.
2. Create a MediaSource object by providing media source information. For example, when creating a camera media source, you provide information such as identifying the camera and specifying the encoding the camera uses.

When you want to start streaming, you must create a custom media source.

Procedure: Using the Android Producer SDK

This procedure demonstrates how to use the Kinesis Video Streams Android Producer Client in your Android application to send data to your Kinesis video stream.

The procedure includes the following steps:

- Download and Configure the Code
- Examine the Code
- Run and Verify the Code

Prerequisites

- We recommend Android Studio for examining, editing, and running the application code. We recommend at least version 3.0.0, released October 2017.
- In the sample code, you provide Amazon Cognito credentials. Follow these procedures to set up an Amazon Cognito user pool and identity pool:

  To set up a user pool

  1. Sign in to the Amazon Cognito console.
  2. Choose Manage your User Pools.
  3. Choose Create a user pool.
  4. Type a value for Pool name; for example, `<username>_android_user_pool`.
  5. Choose Review defaults.
  6. Choose Create pool.
7. Copy and save the Pool Id value. You will need this value when you configure the example application.
8. On the page for your pool, choose App clients.
9. Choose Add an app client.
10. Type a value for App client name; for example, <username>_android_app_client.
11. Choose Create app client.
12. Choose Show Details, and copy and save the App client ID and App client secret. You will need these values when you configure the example application.

To set up an identity pool

1. Open the Amazon Cognito console.
2. Choose Manage Identity Pools.
3. Choose Create new identity pool.
4. Type a value for Identity pool name; for example, <username>_android_identity_pool.
5. Expand the Authentication providers section. On the Cognito tab, add the values for the User Pool ID and App client ID from the previous procedure.
6. Choose Create pool.
7. On the next page, expand the Show Details section.
8. In the section that has a value for Role name that ends in Auth_Role, choose View Policy Document.
9. Choose Edit, and confirm the Edit Policy dialog box that appears. Then copy the following JSON and paste it into the editor:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "cognito-identity:*",
        "kinesisvideo:*"
      ],
      "Resource": [
        "*"
      ]
    }
  ]
}
```
10. Choose Allow.
11. On the next page, copy and save the Identity pool ID value from the Get AWS Credentials code snippet. You will need this value when you configure the example application.

Step 1: Download and Configure the Android Producer Library Code

In this section of the Android Producer Library procedure, you download the Android example code and open the project in Android Studio.

For prerequisites and other details about this example, see Using the Android Producer Library.

1. Create a directory, and then clone the AWS Android SDK from the GitHub repository.
Step 1: Download and Configure the Code

2. Open Android Studio.
3. In the opening screen, choose Open an existing Android Studio project.
4. Navigate to the aws-sdk-android-samples/AmazonKinesisVideoDemoApp directory, and choose OK.

In the CredentialsProvider node, provide the identity pool ID from the To set up an identity pool procedure in the Prerequisites section, and provide your AWS Region (for example, us-west-2).

In the CognitoUserPool node, provide the App client secret, App client ID, and Pool ID from the To set up a user pool procedure in the Prerequisites section, and provide your AWS Region (for example, us-west-2).

6. Your awsconfiguration.json file will look similar to the following:

   ```json
   {
     "Version": "1.0",
     "CredentialsProvider": {
       "CognitoIdentity": {
         "Default": {
           "PoolId": "us-west-2:01234567-89ab-cdef-0123-456789abcdef",
           "Region": "us-west-2"
         }
       }
     },
     "IdentityManager": {
       "Default": {}
     },
     "CognitoUserPool": {
       "Default": {
         "AppClientSecret": "abcdefghijklmnopqrstuvwxyz0123456789abcdefghijklmno",
         "AppClientId": "0123456789abcdefgijklmnopqrstuvwxyz0123456789abcdefgijklmno",
         "PoolId": "us-west-2_qRsTuVwXy",
         "Region": "us-west-2"
       }
     }
   }
   ```

7. Update the AmazonKinesisVideoDemoApp/src/main/java/com/amazonaws/kinesisvideo/demoapp/KinesisVideoDemoApp.java with your region (in the sample below, it's set to US_WEST_2):

   ```java
   public class KinesisVideoDemoApp extends Application {
       public static final String TAG = KinesisVideoDemoApp.class.getSimpleName();
       public static Regions KINESIS_VIDEO_REGION = Regions.US_WEST_2;
   }
   ```

   For AWS region constants, see Regions.

   **Next Step**

   the section called “Step 2: Examine the Code” (p. 54)
Step 2: Examine the Code

In this section of the Android Producer Library procedure, you examine the example code.

The Android test application (AmazonKinesisVideoDemoApp) shows the following coding pattern:

- Create an instance of KinesisVideoClient.
- Create an instance of MediaSource.
- Start streaming—that is, start the MediaSource, and it starts sending data to the client.

The following sections provide details.

Creating an Instance of KinesisVideoClient

You create the KinesisVideoClient object by calling the createKinesisVideoClient operation.

```java
mKinesisVideoClient = KinesisVideoAndroidClientFactory.createKinesisVideoClient(
    getActivity(),
    AmazonKinesisVideoDemoApp.KINESIS_VIDEO_REGION,
    AmazonKinesisVideoDemoApp.getCredentialsProvider());
```

For KinesisVideoClient to make network calls, it needs credentials to authenticate. You pass in an instance of AWSCredentialsProvider, which reads your Amazon Cognito credentials from the awsconfiguration.json file that you modified in the previous section.

Creating an Instance of MediaSource

To send bytes to your Kinesis video stream, you must produce the data. Amazon Kinesis Video Streams provides the MediaSource interface, which represents the data source.

For example, the Kinesis Video Streams Android library provides the AndroidCameraMediaSource implementation of the MediaSource interface. This class reads data from one of the device’s cameras.

In the following code example (from the fragment/StreamConfigurationFragment.java file), the configuration for the media source is created:

```java
private AndroidCameraMediaSourceConfiguration getCurrentConfiguration() {
    return new AndroidCameraMediaSourceConfiguration(
        AndroidCameraMediaSourceConfiguration.builder()
            .withCameraId(mCamerasDropdown.getSelectedItem().getCameraId())
            .withEncodingMimeType(mMimeTypeDropdown.getSelectedItem().getMimeType())
            .withHorizontalResolution(mResolutionDropdown.getSelectedItem().getWidth())
            .withVerticalResolution(mResolutionDropdown.getSelectedItem().getHeight())
            .withCameraFacing(mCamerasDropdown.getSelectedItem().getCameraFacing())
            .withIsEncoderHardwareAccelerated(mCamerasDropdown.getSelectedItem().isEndcoderHardwareAccelerated())
            .withFrameRate(FRAMERATE_20)
            .withRetentionPeriodInHours(RETENTION_PERIOD_48_HOURS)
            .withEncodingBitRate(BITRATE_384_KBPS)
            .withCameraOrientation(-mCamerasDropdown.getSelectedItem().getCameraOrientation())
            .withNalAdaptationFlags(StreamInfo.NalAdaptationFlags.NAL_ADAPTATION_ANNEXB_CPD_AND_FRAME_NALS)
            .withIsAbsoluteTimecode(false));
}
```
In the following code example (from the fragment/StreamingFragment.java file), the media source is created:

```java
mCameraMediaSource = (AndroidCameraMediaSource) mKinesisVideoClient
    .createMediaSource(mStreamName, mConfiguration);
```

### Starting the Media Source

Start the media source so that it can begin generating data and sending it to the client. The following code example is from the fragment/StreamingFragment.java file:

```java
mCameraMediaSource.start();
```

### Next Step

the section called “Step 3: Run and Verify the Code” (p. 55)

### Step 3: Run and Verify the Code

To run the Android example application for the Android Producer Library, do the following.

1. Connect to an Android device.
2. Choose Run, Run..., and choose Edit configurations....
3. Choose +, Android App. In the Name field, enter AmazonKinesisVideoDemoApp. In the Module pulldown, choose AmazonKinesisVideoDemoApp. Choose OK.
5. In the Select Deployment Target screen, choose your connected device, and choose OK.
6. In the AWSKinesisVideoDemoApp application on the device, choose Create new account.
7. Enter values for USERNAME, Password, Given name, Email address, and Phone number, and then choose Sign up.

**Note**

These values have the following constraints:

- **Password**: Must contain uppercase and lowercase letters, numbers, and special characters. You can change these constraints in your User pool page on the Amazon Cognito console.
- **Email address**: Must be a valid address so that you can receive a confirmation code.
- **Phone number**: Must be in the following format: `+<Country code><Number>`, for example, `+12065551212`.
8. Enter the code you receive by email, and choose Confirm. Choose Ok.
9. On the next page, leave the default values, and choose Stream.
10. Sign in to the AWS Management Console and open the Kinesis Video Streams console at https://console.aws.amazon.com/kinesisvideo/ in the US West (Oregon) Region.

On the Manage Streams page, choose demo-stream.

11. The streaming video plays in the embedded player. You might need to wait a short time (up to ten seconds under typical bandwidth and processor conditions) while the frames accumulate before the video appears.

**Note**

If the device's screen rotates (for example, from portrait to landscape), the application stops streaming video.
The code example creates a stream. As the MediaSource in the code starts, it begins sending frames from the camera to the KinesisVideoClient. The client then sends the data to a Kinesis video stream named demo-stream.

Using the C++ Producer Library

Amazon Kinesis Video Streams provides the C++ Producer Library, which you can use to write application code to send media data from a device to a Kinesis video stream.

Object Model

The C++ library provides the following objects to manage sending data to a Kinesis video stream:

- **KinesisVideoProducer**: Contains information about your media source and AWS credentials, and maintains callbacks to report on Kinesis Video Streams events.
- **KinesisVideoStream**: Represents the Kinesis video stream. Contains information about the video stream's parameters, such as name, data retention period, media content type, and so on.

Putting Media into the Stream

The C++ library provides methods (for example, PutFrame) that you can use to put data into the KinesisVideoStream object. The library then manages the internal state of the data, which can include the following tasks:

- Performing authentication.
- Watching for network latency. If the latency is too high, the library might choose to drop frames.
- Tracking status of streaming in progress.

Callback Interfaces

This layer exposes a set of callback interfaces, which enable it to talk to the application layer. These callback interfaces include the following:

- Service callbacks interface (CallbackProvider): The library invokes events obtained through this interface when it creates a stream, obtains a stream description, deletes a stream, and so on.
- Client-ready state or low storage events interface (ClientCallbackProvider): The library invokes events on this interface when the client is ready, or when it detects that it might run out of available storage or memory.
- Stream events callback interface (StreamCallbackProvider): The library invokes events on this interface when stream events occur, such as the stream entering the ready state, dropped frames, or stream errors.

Kinesis Video Streams provides default implementations for these interfaces. You can also provide your own custom implementation—for example, if you need custom networking logic or you want to expose a low storage condition to the user interface.

For more information about callbacks in the Producer Libraries, see Producer SDK Callbacks (p. 121).
Procedure: Using the C++ Producer SDK

This procedure demonstrates how to use the Kinesis Video Streams client and media sources in a C++ application to send data to your Kinesis video stream.

Note
The C++ library includes a sample build script for macOS. To use the C++ Producer Library on Microsoft Windows, see Using the C++ Producer SDK on Windows (p. 65).
To use the C++ Producer Library on a Raspberry Pi device, see Using the C++ Producer SDK on Raspberry Pi (p. 69).

The procedure includes the following steps:

• Step 1: Download and Configure the Code
• Step 2: Write and Examine the Code
• Step 3: Run and Verify the Code

Prerequisites

• **Credentials:** In the sample code, you provide credentials by specifying a profile that you set up in your AWS credentials profile file. If you haven’t already done so, first set up your credentials profile.
For more information, see Set up AWS Credentials and Region for Development.

• **Certificate store integration:** The Kinesis Video Streams Producer Library must establish trust with the service it calls. This is done through validating the certification authorities (CAs) in the public certificate store. On Linux-based models, this store is located in the `/etc/ssl/` directory.
Download the certificate from the following location to your certificate store:
https://www.amazontrust.com/repository/SFSRootCAG2.pem

• Install the following build dependencies for macOS:
  • Autoconf 2.69 (License GPLv3+/Autoconf: GNU GPL version 3 or later)
  • CMake 3.7 or 3.8
  • Pkg-Config
  • Flex 2.5.35 Apple (flex-31) or later
  • Bison 2.4 (GNU License)
  • Automake 1.15.1 (GNU License)
  • GNU Libtool (Apple Inc. version cctools-898)
  • xCode (macOS) / clang / gcc (xcode-select version 2347)
  • Java Development Kit (JDK) (for Java JNI compilation)
  • Lib-Pkg

• Install the following build dependencies for Ubuntu (responses to version commands are truncated):
  • Install Git: `sudo apt-get install git`
    ```
    $ git --version
    git version 2.14.1
    ```
  • Install CMake: `sudo apt-get install cmake`
    ```
    $ cmake --version
    cmake version 3.9.1
    ```
  • Install Libtool: `sudo apt-get install libtool`
2.4.6-2

- Install `libtool-bin`: `sudo apt-get install libtool-bin`

  ```
  $ libtool --version
  libtool (GNU libtool) 2.4.6
  Written by Gordon Matzigkeit, 1996
  ```

- Install GNU Automake: `sudo apt-get install automake`

  ```
  $ automake --version
  automake (GNU automake) 1.15
  ```

- Install GNU Bison: `sudo apt-get install bison`

  ```
  $ bison -V
  bison (GNU Bison) 3.0.4
  ```

- Install G++: `sudo apt-get install g++`

  ```
  g++ --version
  g++ (Ubuntu 7.2.0-8ubuntu3) 7.2.0
  ```

- Install curl: `sudo apt-get install curl`

  ```
  $ curl --version
  curl 7.55.1 (x86_64-pc-linux-gnu) libcurl/7.55.1 OpenSSL/1.0.2g zlib/1.2.11
  libidn2/2.0.2 libpsl/0.18.0 (+libidn2/2.0.2) librtmp/2.3
  ```

- Install pkg-config: `sudo apt-get install pkg-config`

  ```
  $ pkg-config --version
  0.29.1
  ```

- Install Flex: `sudo apt-get install flex`

  ```
  $ flex --version
  flex 2.6.1
  ```

- Install OpenJDK: `sudo apt-get install openjdk-8-jdk`

  ```
  $ java --version
  openjdk version "1.8.0_171"
  ```

- Set the `JAVA_HOME` environment variable: `export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64/`

- Run the build script: `./install-script`

**Next Step**

Step 1: Download and Configure the C++ Producer Library Code
Step 1: Download and Configure the C++ Producer Library Code

In this section, you download the low-level libraries and configure the application to use your AWS credentials.

For prerequisites and other details about this example, see Using the C++ Producer Library.

1. Create a directory, and then clone the example source code from the GitHub repository.

   ```bash
   $ git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp
   ```

2. Open the code in the integrated development environment (IDE) of your choice (for example, Eclipse).

3. At the command line, set the `ACCESS_KEY_ENV_VAR` and `SECRET_KEY_ENV_VAR` environment variables to your AWS credentials. Alternatively, you can hardcode your AWS credentials in the following lines of `ProducerTestFixture.h`:

   ```cpp
   if (nullptr == (accessKey = getenv(ACCESS_KEY_ENV_VAR))) {
     accessKey = "AccessKey";
   }
   if (nullptr == (secretKey = getenv(SECRET_KEY_ENV_VAR))) {
     secretKey = "SecretKey";
   }
   ```

4. In `tst/ProducerTestFixture.h`, find the call to `CreateStream`. Change the name of the stream definition from `ScaryTestStream2` to a unique name:

   ```cpp
   shared_ptr<KinesisVideoStream> CreateTestStream(int index) {
     char stream_name[MAX_STREAM_NAME_LEN];
     sprintf(stream_name, "ScaryTestStream_%d", index);
   }
   ```

Next Step

Step 2: Write and Examine the Code (p. 59)

Step 2: Write and Examine the Code

In this section of the C++ Producer Library procedure, you examine the code in the C++ test harness (`tst/ProducerTestFixture.h` and other files). You downloaded this code in the previous section.

The Platform Independent C++ example shows the following coding pattern:

- Create an instance of `KinesisVideoProducer` to access Kinesis Video Streams.
- Create an instance of `KinesisVideoStream`. This creates a Kinesis video stream in your AWS account if a stream of the same name doesn't already exist.
- Call `putFrame` on the `KinesisVideoStream` for every frame of data, as it becomes available, to send it to the stream.

The following sections provide details:
Creating an Instance of KinesisVideoProducer

You create the KinesisVideoProducer object by calling the KinesisVideoProducer::createSync method. The following example creates the KinesisVideoProducer in the ProducerTestFixture.h file:

```cpp
kinesis_video_producer_ = KinesisVideoProducer::createSync(move(device_provider_),
    move(client_callback_provider_),
    move(stream_callback_provider_),
    move(credential_provider_),
    defaultRegion_);
```

The `createSync` method takes the following parameters:

- A `DeviceInfoProvider` object, which returns a `DeviceInfo` object containing information about the device or storage configuration.

  **Note**
  You configure your content store size using the `DeviceInfo.storageInfo.storageSize` parameter. Your content streams share the content store. To determine your storage size requirement, multiply the average frame size by the number of frames stored for the max duration for all the streams. Then multiply by 1.2 to account for defragmentation. For example, suppose that your application has the following configuration:
  - Three streams
  - 3 minutes of maximum duration
  - Each stream is 30 frames per second (FPS)
  - Each frame is 10,000 KB in size
  The content store requirement for this application is $3 \text{ (streams)} \times 3 \text{ (minutes)} \times 60 \text{ (seconds in a minute)} \times 10000 \text{ (kb)} \times 1.2 \text{ (defragmentation allowance)} = 194.4 \text{ Mb} \sim 200\text{Mb}$.

- A `ClientCallbackProvider` object, which returns function pointers that report client-specific events.

- A `StreamCallbackProvider` object, which returns function pointers that are called back when stream-specific events occur.

- A `CredentialProvider` object, which provides access to AWS credential environment variables.

- The AWS Region ("us-west-2"). The service endpoint is determined from the Region.

Creating an Instance of KinesisVideoStream

You create the KinesisVideoStream object by calling the KinesisVideoProducer::CreateStream method with a `StreamDefinition` parameter. The example creates the KinesisVideoStream in the ProducerTestFixture.h file with the track type as video, and with track id as 1:

```cpp
auto stream_definition = make_unique<StreamDefinition>(stream_name,
    hours(2),
    tags,
    ",",
    STREAMING_TYPE_REALTIME,
    "video/h264",
    milliseconds::zero(),
    seconds(2),
    milliseconds(1),
    true,
    true,
    true);
```
The `StreamDefinition` object has the following fields:

- Stream name.
- Data retention period.
- Tags for the stream. These tags can be used by consumer applications to find the correct stream, or to get more information about the stream. The tags can also be viewed in the AWS Management Console.
- AWS KMS encryption key for the stream. For more information, see Using Server-Side Encryption with Kinesis Video Streams.
- Streaming type. Currently, the only valid value is `STREAMING_TYPE_REALTIME`.
- Media content type.
- Media latency. This value is not currently used, and should be set to 0.
- Playback duration of each fragment.
- Media timecode scale.
- Whether the media uses key frame fragmentation.
- Whether the media uses timecodes.
- Whether the media uses absolute fragment times.

Adding an audio track to the Kinesis Video Stream

You can add audio track details to a video track stream definition by using the `addTrack` method of the `StreamDefinition`:

```
stream_definition->addTrack(DEFAULT_AUDIO_TRACKID, DEFAULT_AUDIO_TRACK_NAME,
    DEFAULT_AUDIO_CODEC_ID, MKV_TRACK_INFO_TYPE_AUDIO);
```

The `addTrack` method requires the following parameters:

- Track id (as 1 for audio). This should be unique and non-zero value.
- User-defined track name (e.g. "audio" for the audio track).
- Codec id for this track (e.g. for audio track "A_AAC").
- Track type (e.g. use the enum value of `MKV_TRACK_INFO_TYPE_AUDIO` for audio).

If you have codec private data for the audio track, then you can pass it when calling the `addTrack` function. You can also send the codec private data after creating the `KinesisVideoStream` object while calling the `start` method in `KinesisVideoStream`.

Putting a Frame into the Kinesis Video Stream

You put media into the Kinesis video stream using `KinesisVideoStream::putFrame`, passing in a `Frame` object that contains the header and media data. The example calls `putFrame` in the `ProducerApiTest.cpp` file:

```cpp
frame.duration = FRAME_DURATION_IN_MICROS * HUNDREDS_OF_NANOS_IN_A_MICROSECOND;
frame.size = SIZEOF(frameBuffer_);
frame.frameData = frameBuffer_;
MEMSET(frame.frameData, 0x55, frame.size);

while (!stop_producer_) {
    // Produce frames
    timestamp = std::chrono::duration_cast<std::chrono::nanoseconds>(
        return kinesis_video_producer_)->createStream(move(stream_definition));
```
std::chrono::system_clock::now().time_since_epoch().count() / DEFAULT_TIME_UNIT_IN_NANOS;
frame.index = index++;
frame.decodingTs = timestamp;
frame.presentationTs = timestamp;

// Key frame every 50th
frame.flags = (frame.index % 50 == 0) ? FRAME_FLAG_KEY_FRAME : FRAME_FLAG_NONE;
...
EXPECT_TRUE(kinesis_video_stream->putFrame(frame));

**Note**
The preceding C++ Producer example sends a buffer of test data. In a real-world application, you should obtain the frame buffer and size from the frame data from a media source (such as a camera).

The Frame object has the following fields:

- Frame index. This should be a monotonically incrementing value.
- Flags associated with the frame. For example, if the encoder were configured to produce a key frame, this frame would be assigned the FRAME_FLAG_KEY_FRAME flag.
- Decoding time stamp.
- Presentation time stamp.
- Duration of the frame (to 100 ns units).
- Size of the frame in bytes.
- Frame data.

For more information about the format of the frame, see [Kinesis Video Streams Data Model](#).

**Putting a KinesisVideoFrame into a specific track of KinesisVideoStream**

You can use the PutFrameHelper class to put frame data into a specific track. First, call the getFrameDataBuffer to get a pointer to one of the pre-allocated buffers to fill in the KinesisVideoFrame data. Then, you can call the putFrameMultiTrack to send the KinesisVideoFrame along with the boolean value to indicate the type of frame data. Use true if it’s a video data or false if the frame contains audio data. The putFrameMultiTrack method uses a queueing mechanism to ensure that the MKV Fragments maintain monotonically increasing frame time stamps and any two fragments do not overlap. For example, MKV timestamp of the first frame of a fragment should always be greater than the MKV timestamp of the last frame of the previous fragment.

The PutFrameHelper has the following fields:

- Maximum number of audio frames in the queue
- Maximum number of video frames in the queue
- Size to allocate for a single audio frame
- Size to allocate for a single video frame

**Metrics and Metric Logging**

The C++ Producer SDK includes functionality for metrics and metric logging.

You can use the `getKinesisVideoMetrics` and `getKinesisVideoStreamMetrics` API operations to retrieve information about Kinesis Video Streams and your active streams.
The following code is from the kinesis-video-pic/src/client/include/com/amazonaws/kinesis/video/client/Include.h file.

```c
/**
 * Gets information about the storage availability.
 * @param 1 CLIENT_HANDLE - the client object handle.
 * @param 2 PKinesisVideoMetrics - OUT - Kinesis Video metrics to be filled.
 * @return Status of the function call.
 */
PUBLIC_API STATUS getKinesisVideoMetrics(CLIENT_HANDLE, PKinesisVideoMetrics);

/**
 * Gets information about the stream content view.
 * @param 1 STREAM_HANDLE - the stream object handle.
 * @param 2 PStreamMetrics - Stream metrics to fill.
 * @return Status of the function call.
 */
PUBLIC_API STATUS getKinesisVideoStreamMetrics(STREAM_HANDLE, PStreamMetrics);
```

The PClientMetrics object filled by `getKinesisVideoMetrics` contains the following information:

- **contentStoreSize**: The overall size in bytes of the content store (the memory used to store streaming data).
- **contentStoreAvailableSize**: The free memory in the content store, in bytes.
- **contentStoreAllocatedSize**: The allocated memory in the content store.
- **totalContentViewsSize**: The total memory used for the content view. (The content view is a series of indices of information in the content store.)
- **totalFrameRate**: The aggregate number of frames per second across all active streams.
- **totalTransferRate**: The total bits per second (bps) being sent in all streams.

The PStreamMetrics object filled by `getKinesisVideoStreamMetrics` contains the following information:

- **currentViewDuration**: The difference in 100 ns units between the head of the content view (when frames are encoded) and the current position (when frame data is being sent to Kinesis Video Streams).
- **overallViewDuration**: The difference in 100 ns units between the head of the content view (when frames are encoded) to the tail (when frames are flushed from memory, either because the total allocated space for the content view is exceeded, or because a PersistedAck message is received from Kinesis Video Streams, and frames known to be persisted are flushed).
- **currentViewSize**: The size in bytes of the content view from the head (when frames are encoded) to the current position (when frames are sent to Kinesis Video Streams).
- **overallViewSize**: The total size in bytes of the content view.
- **currentFrameRate**: The last measured rate of the stream, in frames per second.
- **currentTransferRate**: The last measured rate of the stream, in bytes per second.

**Teardown**

If you want to send the remaining bytes in a buffer and wait for the ACK, you can use `stopSync`:
Step 3: Run and Verify the Code

To run and verify the code for the C++ Producer Library procedure, do the following:

1. See Prerequisites for credential, certificate, and build requirements.
2. Build the project by using the /kinesis-video-native-build/install-script script. Running the install script installs the following open source dependencies:
   - curl lib
   - openssl (crypto and ssl)
   - log4cplus
   - jsoncpp

   **Note**
   To configure log4cplus, set the following value in PlatformUtils.h to point to your logging function:

   ```
   #define __LOG(p1, p2, p3, ...)     printf(p3, ##__VA_ARGS__)
   ```

3. The executable is built in kinesis-video-native-build/start. Launch it to run the unit test and kick off dummy frame streaming.
4. To enable verbose logs, define the HEAP_DEBUG and LOG_STREAMING C-defines by uncommenting the appropriate lines in CMakeList.txt.

You can monitor the progress of the test suite in the debug output in your IDE. You can also monitor the traffic on your stream by watching the metrics that are associated with your stream in the Amazon CloudWatch console, such as PutMedia.IncomingBytes.

   **Note**
   Because the test harness only sends frames of empty bytes, the console doesn't display the data as a video stream.
Using the C++ Producer SDK as a GStreamer Plugin

GStreamer is a popular media framework used by a multitude of cameras and video sources to create custom media pipelines by combining modular plugins. The Kinesis Video Streams GStreamer plugin greatly simplifies the integration of your existing GStreamer media pipeline with Kinesis Video Streams.

For information about using the C++ Producer SDK as a GStreamer plugin, see Example: Kinesis Video Streams Producer SDK GStreamer Plugin (p. 135).

Using the C++ Producer SDK as a GStreamer Plugin in a Docker Container

In addition, using Docker to create the GStreamer pipeline standardizes the operating environment for Kinesis Video Streams, which greatly simplifies building and executing the application.

For information about using the C++ Producer SDK as a GStreamer plugin in a Docker container, see Run the GStreamer Element in a Docker Container (p. 139).

Using the C++ Producer SDK on Windows

This tutorial demonstrates how to build and run the Producer Libraries (p. 46) on Microsoft Windows. You can then stream video to Kinesis Video Streams from sources such as webcams, USB cameras, or RTSP (Real Time Streaming Protocol) cameras. When you start streaming from your media source to a Kinesis video stream, you can view the video in the Kinesis Video Streams console. You can also build applications that operate on the streaming video that is available in your Kinesis video stream.

Topics

- Building and Running the Producer SDK: Minimalist GNU for Windows (MinGW) (p. 65)
- Building and Running the Producer SDK: Microsoft Visual C++ Compiler (MSVC) (p. 67)

Building and Running the Producer SDK: Minimalist GNU for Windows (MinGW)

Minimalist GNU for Windows (MinGW) is an open-source programming toolchain for developing native Windows applications. You can use MinGW to build the Kinesis Video Streams Producer SDK for Windows and then run one of the sample applications to start streaming video.

This section describes prerequisites and steps needed to build the Amazon Kinesis Video Streams Producer SDK using the MinGW compiler.

Prerequisites

Before you start, ensure that you have the following:

- Download and install the MSYS2 version for your specific Windows platform. MSYS2 provides all the tools to build native Windows applications using MinGW toolchains.
Building the Producer SDK Using MinGW

Follow these steps to use the MinGW runtime environment to compile the Kinesis Video Streams Producer SDK on Windows.

1. Launch the MinGW shell (mingw64.exe) from the C:\msys32 or C:\msys64 directory. Make sure that you are opening the mingw64.exe or mingw32.exe based on your platform, and not the MSYS2 application. The MSYS2 application is the default application that is opened after you finish installing MSYS2.

2. Install Git by running the following command in the MinGW shell:

   ```
   pacman -S git
   ```

3. Download the Kinesis Video Streams Producer SDK from GitHub:

   ```
   git clone --recursive https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp.git
   ```

4. Navigate to the amazon-kinesis-video-streams-producer-sdk-cpp/kinesis-video-native-build directory, and run the following install script to build the Producer SDK:

   ```
   ./min-install-script
   ```

   **Note**
   - Accept all of the prompts when the script runs.
   - Log4cplus is compiled from source, but all other components are downloaded as pre-built binaries.

Running the Producer SDK to Send Video to Kinesis Video Streams

After compiling the Kinesis Video Streams Producer SDK using MinGW, follow these steps to run it:

**Step 1: Set Environment Variables**

- In the MinGW shell, set the following environment variables:

  ```
  export AWS_ACCESS_KEY_ID=YOUR_ACCESS_KEY
  export AWS_SECRET_ACCESS_KEY=YOUR_SECRET_ACCESS_KEY
  export GST_PLUGIN_PATH=$PWD
  ```

  **Note**
  
  YOUR_ACCESS_KEY and YOUR_SECRET_ACCESS_KEY are the access keys for your AWS account used for signing programmatic requests that you make to AWS. For more information, see Managing Access Keys for IAM Users.

**Step 2: Run the Sample Application for Your Media Source**

1. To stream video from your PC webcam, run the sample application from the kinesis-video-native-build directory using the following command:

   ```
   kinesis_video_gstreamer_sample_app.exe my-stream-name
   ```
2. To stream video from your PC webcam using a custom configuration, such as a specific bitrate or resolution, run the Kinesis Video Streams Producer SDK GStreamer plugin using the `gst-launch-1.0` command:

```
gst-launch-1.0 ksvideosrc do-timestamp=TRUE ! video/x-raw,width=640,height=480,framerate=30/1 ! videoconvert ! x264enc bframes=0 key-int-max=45 bitrate=512 ! video/x-h264,profile=baseline,stream-format=avc,alignment=au,width=640,height=480,framerate=30/1 ! kvssink stream-name="your-stream-name" access-key=your_accesskey_id secret-key=your_secret_access_key
```

For information about how to determine the parameters for the `gst-launch-1.0` command, see GStreamer Element Parameter Reference (p. 141).

**Note**
If you are using IoT credentials instead of your access key and secret key to authenticate, you can supply IoT credentials as parameters to the `gst-launch-1.0` command.

The following example demonstrates using IoT parameters to stream video from an RTSP camera:

```
gst-launch-1.0 rtspsrc location=rtsp://YourCameraRtspUrl short-header=TRUE ! rtph264depay ! video/x-h264, format=avc,alignment=au ! kvssink stream-name="your-iot-stream" iot-certificate="iot-certificate,endpoint=endpoint,cert-path=/path/to/certificate,key-path=/path/to/private/key,ca-path=/path/to/ca-cert,role-aliases=role-aliases"
```

3. To stream video from an RTSP (network) camera, run the sample application from the `kinesis-video-native-build` directory using the following command:

```
kinesis_video_gstreamer_sample_rtsp_app.exe RTSP-camera-URL my-test-rtsp-stream
```

### Building and Running the Producer SDK: Microsoft Visual C++ Compiler (MSVC)

The Microsoft Visual C++ Compiler (MSVC) is the compiler for Microsoft Visual Studio. The following sections include the prerequisites and steps that are required to build the Kinesis Video Streams Producer SDK using MSVC.

**Prerequisites**

Before you start, ensure that you have the following:

- Microsoft Windows version 7 or later.
- Microsoft .NET Framework version 4.6.1 or later.
- Git. In the Adjusting your PATH environment installation step, choose Use Git from the Windows Command Prompt.

**Building the Producer SDK Using MSVC**

Follow these steps to use MSVC to compile the Producer SDK on Windows.

**Note**
If you previously installed the Producer SDK for Windows using MinGW, do the following cleanup steps before building the SDK using MSVC.
• Delete the files in the kinesis-video-native-build/downloads directory.
• Remove the CMakeFiles directory and the CMakeCachedList.txt file in the kinesis-video-native-build directory.

1. Open a Windows command prompt as an administrator.
2. Download the Producer SDK:
   ```
   git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp.git
   ```
3. After the download is complete, change to the kinesis-video-native-build directory within the downloaded project.
4. Run the Visual Studio build tools install script:
   ```
   vs-buildtools-install.bat
   ```
5. After the install script completes, if you are using Windows 10 or Windows 7, reboot your computer. Then re-open a Windows command prompt as an administrator.
6. In the kinesis-video-native-build directory, run windows-install.bat, specifying your system's bit width (32 or 64):
   ```
   windows-install.bat 32
   or
   windows-install.bat 64
   ```

   **Note**
   This script builds the following components:
   - The C++ Producer Library (p. 56) libraries.
   - The C++ Producer SDK GStreamer (p. 135) (kvssink).
   - The RTSP and Docker (p. 147) demo, which shows how to stream data from an RTSP (network) camera.

Running the Producer SDK to Send Video to Kinesis Video Streams

After compiling the Kinesis Video Streams Producer SDK using MSVC, follow these steps to run it as a GStreamer plugin.

You have several options for starting the SDK. We recommend that you use the GStreamer (p. 135), which you can run using the example executables available in the kinesis-video-native-build/start directory.

1. Add the following directories to your path (specify the location for the Producer SDK, including the drive):
   ```
   set PATH=%PATH%;install directory\amazon-kinesis-video-streams-producer-sdk-cpp\kinesis-video-native-build\downloads\gstreamer\1.0\x86_64\bin;
   ```
2. Set the following environment variables (replace install directory with the location for the Producer SDK, including the drive):
   ```
   set GST_PLUGIN_PATH=install directory\amazon-kinesis-video-streams-producer-sdk-cpp\kinesis-video-native-build\Release
   set GST_PLUGIN_SYSTEM_PATH=install directory\amazon-kinesis-video-streams-producer-sdk-cpp\kinesis-video-native-build\downloads\gstreamer\1.0\x86_64\lib\gstreamer-1.0
   ```
3. Stream video from the webcam on the PC to the Kinesis Video Streams service using the `gst-launch-1.0` command:

```bash
gst-launch-1.0 ksvideosrc do-timestamp=TRUE ! video/x-raw,width=640,height=480,framerate=30/1 ! videoconvert ! x264enc bframes=0 key-int-max=45 bitrate=512 ! video/x-h264,profile=baseline,stream-format=avc,alignment=au,width=640,height=480,framerate=30/1 ! kvssink stream-name="your-stream-name" access-key=your_accesskey_id secret-key=your_secret_access_key
```

For information about how to determine the parameters for the `gst-launch-1.0` command, see [GStreamer Element Parameter Reference](p. 141).

**Note**

If you are using IoT credentials instead of your access key and secret key, you can supply them as parameters to the `gst-launch-1.0` command. The following example demonstrates using IoT parameters to stream video from an RTSP camera:

```bash
gst-launch-1.0 rtspsrc location=rtsp://YourCameraRtspUrl short-header=TRUE ! rtph264depay ! video/x-h264, format=avc,alignment=au ! kvssink stream-name="your-iot-stream" iot-certificate=iot-certificate,endpoint=endpoint,cert-path=/path/to/certificate,key-path=/path/to/private/key,ca-path=/path/to/ca-cert,role-aliases=role-aliases"
```

4. Alternatively, you can set the following environment variables and use one of our pre-build sample applications.

```bash
export AWS_ACCESS_KEY_ID=YOUR_ACCESS_KEY
export AWS_SECRET_ACCESS_KEY=YOUR_SECRET_ACCESS_KEY
```

5. To stream video from a PC webcam, run the sample application from the `kinesis-video-native-build\Release` directory using the following command:

```bash
kinesis_video_gstreamer_sample_app.exe my-stream-name
```

6. To stream video from an RTSP (network) camera, run the sample application from the `kinesis-video-native-build\Release` directory using the following command:

```bash
kinesis_video_gstreamer_sample_rtsp_app.exe RTSP-camera-URL my-test-rtsp-stream
```

## Using the C++ Producer SDK on Raspberry Pi

The Raspberry Pi is a small, inexpensive computer that can be used to teach and learn basic computer programming skills. This tutorial describes how you can set up and use the Amazon Kinesis Video Streams C++ Producer SDK on a Raspberry Pi device. The steps also include how to verify the installation using the GStreamer demo application.

**Topics**

- [Prerequisites](p. 70)
- [Create an IAM User with Permission to Write to Kinesis Video Streams](p. 70)
- [Join Your Raspberry Pi to Your Wi-Fi Network](p. 71)
- [Connect Remotely to Your Raspberry Pi](p. 71)
- [Configure the Raspberry Pi Camera](p. 72)
- [Install Software Prerequisites](p. 73)
- [Download and Build the Kinesis Video Streams C++ Producer SDK](p. 73)
Prerequisites

Before you set up the C++ Producer SDK on your Raspberry Pi, ensure that you have the following prerequisites:

- A Raspberry Pi device with the following configuration:
  - Board version: 3 Model B or later.
  - A connected camera module.
  - An SD card with a capacity of at least 8 GB.
  - The Raspbian operating system (kernel version 4.9 or later) installed. You can download the latest Raspbian image from the Raspberry Pi Foundation website. Follow the Raspberry Pi instructions to install the downloaded image on an SD card.
- An AWS account with a Kinesis video stream. For more information, see Getting Started with Kinesis Video Streams.

Note

The C++ Producer SDK uses the US West (Oregon) (us-west-2) Region by default. To use the default AWS Region, create your Kinesis video stream in the US West (Oregon) Region. To use a different Region for your Kinesis video stream, do one of the following:

- Set the following environment variable to your Region (for example, us-east-1):

```bash
export AWS_DEFAULT_REGION=us-east-1
```

Create an IAM User with Permission to Write to Kinesis Video Streams

If you haven't already done so, set up an AWS Identity and Access Management (IAM) user with permissions to write to a Kinesis video stream.

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. In the navigation menu on the left, choose Users.
3. To create a new user, choose Add user.
4. Provide a descriptive User name for the user, such as kinesis-video-raspberry-pi-producer.
5. Under Access type, choose Programmatic access.
6. Choose Next: Permissions.
7. Under Set permissions for kinesis-video-raspberry-pi-producer, choose Attach existing policies directly.
9. Choose the JSON tab.
10. Copy the following JSON policy and paste it into the text area. This policy gives your user permission to create and write data to Kinesis video streams.

```json
{
    "Version": "2012-10-17",
    "Statement": [{
        "Effect": "Allow",
        "Action": [
            "kinesisvideo:DescribeStream",
            "kinesisvideo:PutMedia"
        ],
    }
}
```
11. Choose **Review policy**.
12. Provide a **Name** for your policy, such as `kinesis-video-stream-write-policy`.
13. Choose **Create policy**.
14. Return to the **Add user** tab in your browser, and choose **Refresh**.
15. In the search box, type the name of the policy you created.
16. Select the check box next to your new policy in the list.
17. Choose **Next: Review**.
18. Choose **Create user**.
19. The console displays the **Access key ID** for your new user. Choose **Show** to display the **Secret access key**. Record these values; they are required when you configure the application.

### Join Your Raspberry Pi to Your Wi-Fi Network

You can use the Raspberry Pi in **headless** mode, that is, without an attached keyboard, monitor, or network cable. If you are using an attached monitor and keyboard, proceed to **Configure the Raspberry Pi Camera (p. 72)**.

1. On your computer, create a file named `wpa_supplicant.conf`.
2. Copy the following text and paste it into the `wpa_supplicant.conf` file:

   ```
country=US
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

network={
  ssid="<YOUR_WIFI_SSID>"
  scan_ssid=1
  key_mgmt=WPA-PSK
  psk="<YOUR_WIFI_PASSWORD>"
}
```

Replace the `ssid` and `psk` values with the information for your Wi-Fi network.
3. Copy the `wpa_supplicant.conf` file to the SD card. It must be copied to the root of the boot volume.
4. Insert the SD card into the Raspberry Pi, and power the device. It joins your Wi-Fi network, and SSH is enabled.

### Connect Remotely to Your Raspberry Pi

You can connect remotely to your Raspberry Pi in **headless** mode. If you are using your Raspberry Pi with a connected monitor and keyboard, proceed to **Configure the Raspberry Pi Camera (p. 72)**.

1. Before connecting to your Raspberry Pi device remotely, do one of the following to determine its IP address:
• If you have access to your network's Wi-Fi router, look at the connected Wi-Fi devices. Find the device named *Raspberry Pi* to find your device's IP address.

• If you don't have access to your network's Wi-Fi router, you can use other software to find devices on your network. *Fing* is a popular application that is available for both Android and iOS devices. You can use the free version of this application to find the IP addresses of devices on your network.

2. When you know the IP address of the Raspberry Pi device, you can use any terminal application to connect.

• On macOS or Linux, use `ssh`:

```bash
$ ssh pi@<IP address>
```

• On Windows, use PuTTY, a free SSH client for Windows.

For a new installation of Raspbian, the user name is *pi*, and the password is *raspberry*. We recommend that you change the default password.

### Configure the Raspberry Pi Camera

Follow these steps to configure the Raspberry Pi camera to send video from the device to a Kinesis video stream.

1. Open an editor to update the `modules` file with the following command:

```bash
$ sudo nano /etc/modules
```

2. Add the following line to the end of the file, if it's not already there:

```bash
bcm2835-v4l2
```

3. Save the file and exit the editor (Ctrl-X).

4. Reboot the Raspberry Pi:

```bash
# sudo reboot
```

5. When the device reboots, connect to it again through your terminal application if you are connecting remotely.

6. Open `raspi-config`:

```bash
# sudo raspi-config
```

7. Choose **Interfacing Options, Camera**. Enable the camera if it's not already enabled, and reboot if prompted.

8. Verify that the camera is working by typing the following command:

```bash
# raspistill -v -o test.jpg
```

The display shows a five-second preview from the camera, takes a picture (saved to `test.jpg`), and displays informational messages.
Install Software Prerequisites

The C++ Producer SDK requires that you install the following software prerequisites on Raspberry Pi.

1. Install Git:

   ```
   $ sudo apt-get update
   $ sudo apt-get install git
   ```

2. Install Yacc, Lex, and OpenJDK (Open Java Development Kit):

   ```
   $ sudo apt-get install byacc flex
   $ sudo apt-get install openjdk-8-jdk
   ```

3. Set the `JAVA_HOME` environment variable:

   ```
   $ export JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-armhf/
   ```

   **Note**
   If you reboot the device before building the SDK, you must repeat this step. You can also set this environment variable in your `~/.profile` file.

4. CMake is used to build the SDK. Install CMake with the following command:

   ```
   $ sudo apt-get install cmake
   ```

5. Copy the following PEM file to `/etc/ssl/cert.pem`:

   ```
   https://www.amazontrust.com/repository/SFSRootCAG2.pem
   ```

Download and Build the Kinesis Video Streams C++ Producer SDK

**Important**
For a faster build time, you can use Package manager to install the open source dependencies and the build tools for the Kinesis Video Streams C++ Producer SDK. For more information, see https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp/blob/master/install-instructions-linux.md#install-steps-for-ubuntu-17x-and-raspbian-stretch-using-apt-get.

You can also download and build the Kinesis Video Streams C++ Producer SDK using the following procedure. This approach takes longer time to build, depending on network connectivity and processor speed.

1. Install the C++ Producer SDK:

   ```
   $ git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp
   ```

2. Change your current working directory to the install directory:

   ```
   $ cd amazon-kinesis-video-streams-producer-sdk-cpp/kinesis-video-native-build
   ```

3. Make the install script executable:

   ```
   $ chmod +x install-script
   ```
4. Run the install script. The script downloads the source and builds several open-source projects. It might take several hours to run the first time it is executed:

```
$ ./install-script
```

5. Type `Y` to verify. Then the build script runs.

Stream Video to Your Kinesis Video Stream and View the Live Stream

1. To run the sample application, you need the following information:
   - The name of the stream you created in the Prerequisites (p. 70) section.
   - The account credentials (access key ID and secret access key) that you created in Create an IAM User with Permission to Write to Kinesis Video Streams (p. 70).

2. Run the sample application using the following command:

```
$ export AWS_ACCESS_KEY_ID=<Access Key ID>
export AWS_SECRET_ACCESS_KEY=<Secret Access Key>
./kinesis_video_gstreamer_sample_app Stream Name
```

3. You can specify the image size, framerate, and bitrate as follows:

```
$ export AWS_ACCESS_KEY_ID=<Access Key ID>
export AWS_SECRET_ACCESS_KEY=<Secret Access Key>
./kinesis_video_gstreamer_sample_app -w <width> -h <height> -f < framerate> -b <bitrateInKBPS> Stream Name
```

4. If the sample application exits with a library not found error, type the following commands to verify that the project is correctly linked to its open-source dependencies:

```
$ rm -rf ./kinesis-video-native-build/CMakeCache.txt ./kinesis-video-native-build/CMakeFiles
$ ./kinesis-video-native-build/install-script
```

5. Open the Kinesis Video Streams console at https://console.aws.amazon.com/kinesisvideo/.

6. Choose the **Stream name** of the stream you created.

The video stream that is sent from the Raspberry Pi appears in the console.

When the stream is playing, you can experiment with the following features of the Kinesis Video Streams console:

- In the **Video preview** section, use the navigation controls to rewind or fast-forward the stream.
- In the **Stream info** section, notice the codec, resolution, and bitrate of the stream. The resolution and bitrate values are set purposefully low on the Raspberry Pi to minimize bandwidth usage for this tutorial. To view the Amazon CloudWatch metrics that are being created for your stream, choose **View stream metrics in CloudWatch**.
- Under **Data retention period**, notice that the video stream is retained for one day. You can edit this value and set it to **No data retention**, or set a value from one day to several years.

Under server-side encryption, notice that your data is being encrypted at rest using a key maintained by the AWS Key Management Service (AWS KMS).
Using Logging with the C++ Producer SDK

You configure logging for C++ Producer SDK applications in the `kvs_log_configuration` file in the `kinesis-video-native-build` folder.

The following example shows the first line of the default configuration file, which configures the application to write `DEBUG`-level log entries to the AWS Management Console:

```
log4cplus.rootLogger=DEBUG, KvsConsoleAppender
```

You can set the logging level to `INFO` for less verbose logging.

To configure the application to also write log entries to a log file, update the first line in the file to the following:

```
log4cplus.rootLogger=DEBUG, KvsConsoleAppender, KvsFileAppender
```

This configures the application to write log entries to `kvs.log` in the `kinesis-video-native-build/log` folder.

To change the log file location, update the following line with the new path:

```
log4cplus.appender.KvsFileAppender.File=./log/kvs.log
```

**Note**

If `DEBUG`-level logging is written to a file, the log file can use up the available storage space on the device quickly.

Using the C Producer Library

Amazon Kinesis Video Streams provides the C Producer Library, which you can use to write application code to send media data from a device to a Kinesis video stream.

Object Model

The Kinesis Video Streams C producer library is based on a common component called Platform Independent Codebase (PIC), which is available on GitHub at https://github.com/awslabs/amazon-kinesis-video-streams-pic/. The PIC contains platform-independent business logic for the low-levels. The Kinesis Video Streams C producer library wraps PIC with additional layer of API that allows scenario- and platform-specific callbacks and events. The Kinesis Video Streams C producer library has the following components built on top of PIC:

- **Device info providers** – Exposes the `DeviceInfo` structure that can be directly supplied to the PIC API. There is a set of easy-to-configure providers, including application scenario-optimized provider that can optimize the content store based on the number and types of streams that your application handles and the amount of required buffering configured based on the amount of available RAM.

- **Stream info provider** – Exposes the `StreamInfo` structure that can be directly supplied to the PIC API. There is a set of easy-to-configure providers which are specific to the application types and the common types of streaming scenarios. These include providers such as video, audio, audio/video multitrack, etc. Each of these scenarios has defaults that you can customize according to your application's requirements.

- **Callback provider** – Exposes the `ClientCallbacks` structure that can be directly supplied to the PIC API. This includes a set of easy-to-configure callback providers for networking (CURL-based API callbacks), authorization (AWS credentials API), retry streaming on errors callbacks, etc. The Callback providers...
Provider API takes a number of arguments to configure, such as the AWS Region and authorization information (via IoT certificates or through AWS AccessKeyId, SecretKey, SessionToken). You can enhance Callback Provider with custom callbacks if your application needs further processing of a particular callback to achieve some application-specific logic.

- **FrameOrderCoordinator** – Helps handle audio and video synchronization for multi-track scenarios. It has default behavior which you can customize to handle your application's specific logic. It also simplifies the frame metadata packaging in PIC Frame structure before submitting it to the lower-layer PIC API. For non-multitrack scenarios, this component is a pass-through to PIC putFrame API.

The C library provides the following objects to manage sending data to a Kinesis video stream:

- **KinesisVideoClient** – Contains information about your device information and maintains callbacks to report on Kinesis Video Streams events.
- **KinesisVideoStream** – Represents information about the video stream's parameters, such as name, data retention period, media content type, and so on.

### Putting Media Into the Stream

The C library provides methods (for example, `PutKinesisVideoFrame`) that you can use to put data into the `KinesisVideoStream` object. The library then manages the internal state of the data, which can include the following tasks:

- Performing authentication.
- Watching for network latency. If the latency is too high, the library might choose to drop frames.
- Tracking status of streaming in progress.

### Procedure: Using the C Producer SDK

This procedure demonstrates how to use the Kinesis Video Streams client and media sources in a C application to send H.264-encoded video frames to your Kinesis video stream.

The procedure includes the following steps:

- **Step 1: Download the C Producer Library Code** (p. 78)
- **Step 2: Write and Examine the Code** (p. 78)
- **Step 3: Run and Verify the Code** (p. 80)

### Prerequisites

- **Credentials** – In the sample code, you provide credentials by specifying a profile that you set up in your AWS credentials profile file. If you haven't already done so, first set up your credentials profile.

  For more information, see [Set up AWS Credentials and Region for Development](#).

- **Certificate store integration** – The Kinesis Video Streams Producer Library must establish trust with the service it calls. This is done through validating the certification authorities (CAs) in the public certificate store. On Linux-based models, this store is located in the `/etc/ssl/` directory.

  Download the certificate from the following location to your certificate store:

  ```plaintext
  https://www.amazontrust.com/repository/SFSRootCAG2.pem
  ```

  Install the following build dependencies for macOS:

  - **Autoconf 2.69** (License GPLv3+/Autoconf: GNU GPL version 3 or later)
### Procedure: Using the C Producer SDK

- **CMake 3.7 or 3.8**
- **Pkg-Config**
- **Flex 2.5.35 Apple (flex-31) or later**
- **Bison 2.4 (GNU License)**
- **Automake 1.15.1 (GNU License)**
- **GNU Libtool (Apple Inc. version cctools-898)**
- **xCode (macOS) / clang / gcc (xcode-select version 2347)**
- **Java Development Kit (JDK) (for Java JNI compilation)**
- **Lib-Pkg**

Install the following build dependencies for Ubuntu (responses to version commands are truncated):

- **Install Git:**
  ```
  $ git --version
  git version 2.14.1
  ```

- **Install CMake:**
  ```
  $ cmake --version
  cmake version 3.9.1
  ```

- **Install Libtool:**
  ```
  $ libtool --version
  libtool (GNU libtool) 2.4.6
  Written by Gordon Matzigkeit, 1996
  ```

- **Install Libtool-bin:**
  ```
  $ libtool-bin --version
  ```

- **Install GNU Automake:**
  ```
  $ automake --version
  automake (GNU automake) 1.15
  ```

- **Install GNU Bison:**
  ```
  $ bison --version
  bison (GNU Bison) 3.0.4
  ```

- **Install G++:**
  ```
  g++ --version
  g++ (Ubuntu 7.2.0-8ubuntu3) 7.2.0
  ```

- **Install curl:**
  ```
  $ curl --version
  curl 7.55.1 (x86_64-pc-linux-gnu) libcurl/7.55.1 OpenSSL/1.0.2g zlib/1.2.11
  libidn2/2.0.2 libpsl/0.18.0 (+libidn2/2.0.2) librtdmp/2.3
  ```

- **Install pkg-config:**
  ```
  $ pkg-config --version
  0.29.1
  ```
Step 1: Download the Code

1. **Install Flex:**
   ```sh
   sudo apt-get install flex
   # flex --version
   flex 2.6.1
   ```

2. **Install OpenJDK:**
   ```sh
   sudo apt-get install openjdk-8-jdk
   $ java -version
   openjdk version "1.8.0_171"
   ```

3. **Set the JAVA_HOME environment variable:**
   ```sh
   export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64/
   ```

4. **Run the build script:**
   ```sh
   ./install-script
   ```

**Next Step**

Step 1: Download the C Producer Library Code (p. 78)

### Step 1: Download the C Producer Library Code

In this section, you download the low-level libraries. For prerequisites and other details about this example, see Using the C Producer Library.

1. Create a directory, and then clone the example source code from the GitHub repository.

   ```sh
   $ git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp
   ```


2. Open the code in the integrated development environment (IDE) of your choice (for example, Eclipse).

**Next Step**

Step 2: Write and Examine the Code (p. 78)

### Step 2: Write and Examine the Code

In this section, you examine the code of the sample application `KvsVideoOnlyStreamingSample.c` in the kinesis-video-c-producer/samples folder of the https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp repo on GitHub. You downloaded this code in the previous step. This sample demonstrates how to use the C producer library to send H.264-encoded video frames inside the folder kinesis-video-c-producer/samples/h264SampleFrames to your Kinesis video stream.

This sample application has three sections:

- **Initialization and configuration:**
  - Initializing and configuring the platform-specific media pipeline.
  - Initializing and configuring KinesisVideoClient and KinesisVideoStream for the pipeline, setting the callbacks, integrating scenario-specific authentication, extracting and submitting codec private data, and getting the stream to READY state.

- **Main loop:**
  - Getting the frame from the media pipeline with the timestamps and flags.
• Submitting the frame to the KinesisVideoStream.

• Teardown:
  • Stopping (sync) KinesisVideoStream, freeing KinesisVideoStream, freeing KinesisVideoClient.

This sample application completes the following tasks:

• Call the `createDefaultDeviceInfo` API to create the `deviceInfo` object that contains information about the device or storage configuration.

  ```c
  // default storage size is 128MB. Use setDeviceInfoStorageSize after create to change storage size.
  CHK_STATUS(createDefaultDeviceInfo(&pDeviceInfo));
  // adjust members of pDeviceInfo here if needed
  pDeviceInfo->clientInfo.loggerLogLevel = LOG_LEVEL_DEBUG;
  ```

• Call the `createRealtimeVideoStreamInfoProvider` API to create the `StreamInfo` object.

  ```c
  CHK_STATUS(createRealtimeVideoStreamInfoProvider(streamName, DEFAULT_RETENTION_PERIOD, DEFAULT_BUFFER_DURATION, &pStreamInfo));
  // adjust members of pStreamInfo here if needed
  ```

• Call the `createDefaultCallbacksProviderWithAwsCredentials` API to create the default callbacks provider based on static AWS credentials.

  ```c
  CHK_STATUS(createDefaultCallbacksProviderWithAwsCredentials(accessKey, secretKey, sessionToken, MAX_UINT64, region, cacertPath, NULL, NULL, FALSE, &pClientCallbacks));
  ```

• Call the `createKinesisVideoClient` API to create the `KinesisVideoClient` object that contains information about your device storage and maintains callbacks to report on Kinesis Video Streams events.

  ```c
  CHK_STATUS(createKinesisVideoClient(pDeviceInfo, pClientCallbacks, &clientHandle));
  ```

• Call the `createKinesisVideoStreamSync` API to create the `KinesisVideoStream` object.

  ```c
  CHK_STATUS(createKinesisVideoStreamSync(clientHandle, pStreamInfo, &streamHandle));
  ```

• Set up a sample frame and call `PutKinesisVideoFrame` API to send that frame to the `KinesisVideoStream` object.
Step 3: Run and Verify the Code

To run and verify the code for the Producer Library procedure, do the following:

1. Verify that the Prerequisites for credential, certificate, and build requirements are set up.
2. Build the project by using the `/kinesis-video-native-build/install-script` script. Running the install script installs the following open source dependencies:
   - curl lib
   - jsmn
   - openssl (crypto and ssl)
   - Google Test
3. The sample application `kinesis_video_cproducer_video_only_sample` sends h.264-encoded video frames inside the folder `kinesis-video-c-producer/samples/h264SampleFrames` to Kinesis Video Streams. The following command sends the video frames in a loop for ten seconds to Kinesis Video Streams:

```c
// setup sample frame
MEMSET(frameBuffer, 0x00, frameSize);
frame.frameData = frameBuffer;
frame.version = FRAME_CURRENT_VERSION;
frame.trackId = DEFAULT_VIDEO_TRACK_ID;
frame.duration = HUNDREDS_OF_NANOS_IN_A_SECOND / DEFAULT_FPS_VALUE;
frame.decodingTs = defaultGetTime(); // current time
frame.presentationTs = frame.decodingTs;

while(defaultGetTime() > streamStopTime) {
    frame.index = frameIndex;
    frame.flags = fileIndex % DEFAULT_KEY_FRAME_INTERVAL == 0 ? FRAME_FLAG_KEY_FRAME : FRAME_FLAG_NONE;
    frame.size = SIZEOF(frameBuffer);
    CHK_STATUS(readFrameData(&frame, frameFilePath));
    CHK_STATUS(putKinesisVideoFrame(streamHandle, &frame));
    defaultThreadSleep(frame.duration);
    frame.decodingTs += frame.duration;
    frame.presentationTs = frame.decodingTs;
    frameIndex++;
    fileIndex++;
    fileIndex = fileIndex % NUMBER_OF_FRAME_FILES;
}

• Teardown:

    CHK_STATUS(stopKinesisVideoStreamSync(streamHandle));
    CHK_STATUS(freeKinesisVideoStream(&streamHandle));
    CHK_STATUS(freeKinesisVideoClient(&clientHandle));
```

Next Step

Step 3: Run and Verify the Code (p. 80)
If you want to send H.264-encoded frames from another folder (for example, MyH264FramesFolder), you can run the sample with the following arguments:

./kinesis_video_cproducer_video_only_sample YourStreamName 10 MyH264FramesFolder

4. To enable verbose logs, define the HEAP_DEBUG and LOG_STREAMING C-defines by uncommenting the appropriate lines in CMakeList.txt.

You can monitor the progress of the test suite in the debug output in your IDE. You can also monitor the traffic on your stream by watching the metrics that are associated with your stream in the Amazon CloudWatch console, such as PutMedia.IncomingBytes.

**Note**
The console doesn't display the data as a video stream because the test harness only sends frames of empty bytes.

## Producer SDK Reference

This section contains limits, error codes, and other reference information for the Kinesis Video Streams Producer Libraries (p. 46).

### Topics
- Producer SDK Limits (p. 81)
- Error Code Reference (p. 83)
- Network Abstraction Layer (NAL) Adaptation Flag Reference (p. 107)
- Producer SDK Structures (p. 107)
- Kinesis Video Stream Structures (p. 109)
- Producer SDK Callbacks (p. 121)

## Producer SDK Limits

The following table contains the current limits for values in the Producer Libraries (p. 46).

**Note**
Before setting these values, you must validate your inputs. The SDK doesn't validate these limits, and a runtime error occurs if the limits are exceeded.

<table>
<thead>
<tr>
<th>Value</th>
<th>Limit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max stream count</td>
<td>128</td>
<td>The maximum number of streams that a producer object can create. This is a soft limit (you can request an increase). It ensures that the producer doesn't accidentally create streams recursively.</td>
</tr>
<tr>
<td>Max device name length</td>
<td>128 characters</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Limit</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Max tag count</td>
<td>50 per stream</td>
<td></td>
</tr>
<tr>
<td>Max stream name length</td>
<td>256 characters</td>
<td></td>
</tr>
<tr>
<td>Min storage size</td>
<td>10 MiB = 10 * 1024 * 1024 bytes</td>
<td></td>
</tr>
<tr>
<td>Max storage size</td>
<td>10 GiB = 10 * 1024 * 1024 * 1024 bytes</td>
<td></td>
</tr>
<tr>
<td>Max root directory path length</td>
<td>4,096 characters</td>
<td></td>
</tr>
<tr>
<td>Max auth info length</td>
<td>10,000 bytes</td>
<td></td>
</tr>
<tr>
<td>Max URI string length</td>
<td>10,000 characters</td>
<td></td>
</tr>
<tr>
<td>Max tag name length</td>
<td>128 characters</td>
<td></td>
</tr>
<tr>
<td>Max tag value length</td>
<td>1,024 characters</td>
<td></td>
</tr>
<tr>
<td>Min security token period</td>
<td>30 seconds</td>
<td></td>
</tr>
<tr>
<td>Security token grace period</td>
<td>40 minutes</td>
<td>If the specified duration is longer, it is limited to this value.</td>
</tr>
<tr>
<td>Retention period</td>
<td>0 or greater than one hour</td>
<td>0 indicates no retention.</td>
</tr>
<tr>
<td>Min cluster duration</td>
<td>1 second</td>
<td>The value is specified in 100 ns units, which is the SDK standard.</td>
</tr>
<tr>
<td>Max cluster duration</td>
<td>30 seconds</td>
<td>The value is specified in 100 ns units, which is the SDK standard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The backend API may enforce a shorter cluster duration.</td>
</tr>
<tr>
<td>Max fragment size</td>
<td>50 MB</td>
<td>For more information, see Kinesis Video Streams Limits (p. 170).</td>
</tr>
<tr>
<td>Max fragment duration</td>
<td>10 seconds</td>
<td>For more information, see Kinesis Video Streams Limits (p. 170).</td>
</tr>
<tr>
<td>Max connection duration</td>
<td>45 minutes</td>
<td>The backend closes the connection after this time. The SDK rotates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the token and establishes a new connection within this time.</td>
</tr>
<tr>
<td>Max ACK segment length</td>
<td>1,024 characters</td>
<td>Maximum segment length of the acknowledgement sent to the ACK parser</td>
</tr>
<tr>
<td>Max content type string length</td>
<td>128 characters</td>
<td></td>
</tr>
<tr>
<td>Max codec ID string length</td>
<td>32 characters</td>
<td></td>
</tr>
<tr>
<td>Max track name string length</td>
<td>32 characters</td>
<td></td>
</tr>
<tr>
<td>Max codec private data length</td>
<td>1 MiB = 1 * 1024 * 1024 bytes</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Limit</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Min timecode scale value length</td>
<td>100 ns</td>
<td>The minimum timecode scale value to represent the frame timestamps in the resulting MKV cluster. The value is specified in increments of 100 ns, which is the SDK standard.</td>
</tr>
<tr>
<td>Max timecode scale value length</td>
<td>1 second</td>
<td>The maximum timecode scale value to represent the frame timestamps in the resulting MKV cluster. The value is specified in increments of 100 ns, which is the SDK standard.</td>
</tr>
<tr>
<td>Min content view item count</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Min buffer duration</td>
<td>20 seconds</td>
<td>The value is specified in increments of 100 ns, which is the SDK standard.</td>
</tr>
<tr>
<td>Max update version length</td>
<td>128 characters</td>
<td></td>
</tr>
<tr>
<td>Max ARN length</td>
<td>1024 characters</td>
<td></td>
</tr>
<tr>
<td>Max fragment sequence length</td>
<td>128 characters</td>
<td></td>
</tr>
<tr>
<td>Max retention period</td>
<td>10 years</td>
<td></td>
</tr>
</tbody>
</table>

## Error Code Reference

This section contains error and status code information for the [Producer Libraries](#) (p. 46).

For information about solutions to common issues, see [Troubleshooting Kinesis Video Streams](#) (p. 174).

### Topics

- Errors and Status Codes Returned by PutFrame Callbacks - Platform Independent Code (PIT) (p. 83)
- Errors and Status Codes Returned by PutFrame Callbacks - C Producer Library (p. 105)

### Errors and Status Codes Returned by PutFrame Callbacks - Platform Independent Code (PIT)

The following sections contain error and status information that is returned by callbacks for the PutFrame operation within the Platform Independent Codebase (PIT).

### Topics

- Error and Status Codes Returned by the Client Library (p. 84)
- Error and Status Codes Returned by the Duration Library (p. 97)
- Error and Status Codes Returned by the Common Library (p. 97)
- Error and Status Codes Returned by the Heap Library (p. 98)
- Error and Status Codes Returned by the MKVGen Library (p. 99)
- Error and Status Codes Returned by the Trace Library (p. 103)
Error and Status Codes Returned by the Client Library

The following table contains error and status information that is returned by methods in the Kinesis Video Streams Client library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x52000001</td>
<td>STATUS_MAX_STREAM_COUNT</td>
<td>The maximum stream count was reached.</td>
<td>Specify a larger max stream count in DeviceInfo as specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x52000002</td>
<td>STATUS_MIN_STREAM_COUNT</td>
<td>Minimum stream count error.</td>
<td>Specify the max number of streams greater than 0 in DeviceInfo.</td>
</tr>
<tr>
<td>0x52000003</td>
<td>STATUS_INVALID_DEVICE_NAME_LENGTH</td>
<td>invalid device name length.</td>
<td>Refer to the max device name length in characters that is specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x52000004</td>
<td>STATUS_INVALID_DEVICE_INFO_VERSION</td>
<td>invalid DeviceInfo structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x52000005</td>
<td>STATUS_MAX_TAG_COUNT</td>
<td>The maximum tag count was reached.</td>
<td>Refer to the current max tag count that is specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x52000006</td>
<td>STATUS_DEVICE_FINGERPRINT_LENGTH</td>
<td>invalid DeviceInfo structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x52000007</td>
<td>STATUS_INVALID_CALLBACKS_VERSION</td>
<td>invalid Callbacks structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x52000008</td>
<td>STATUS_INVALID_STREAM_INFO_VERSION</td>
<td>invalid StreamInfo structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x52000009</td>
<td>STATUS_INVALID_STREAM_NAME_LENGTH</td>
<td>invalid stream name length.</td>
<td>Refer to the max stream name length in characters that is specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200000a</td>
<td>STATUS_INVALID_STORAGE_SIZE</td>
<td>invalid storage size was specified.</td>
<td>The storage size in bytes must be within the limits specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200000b</td>
<td>STATUS_INVALID_ROOT_DIRECTORY_LENGTH</td>
<td>invalid directory string length.</td>
<td>Refer to the max root directory path length that is specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200000c</td>
<td>STATUS_INVALID_SPILL_RATIO</td>
<td>invalid spill ratio.</td>
<td>Express the spill ratio as a percentage from 0 to 100.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x5200000d</td>
<td>STATUS_INVALID_STORAGE_INFO_VERSION</td>
<td>Invalid StorageInfo structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x5200000e</td>
<td>STATUS_INVALID_STREAM_STATE</td>
<td>The stream is in a state that doesn't permit the current operation.</td>
<td>Most commonly, this error occurs when the SDK fails to reach the state that it needs to perform the requested operation. For example, it occurs if the GetStreamingEndpoint API call fails, and the client application ignores it and continues putting frames into the stream.</td>
</tr>
<tr>
<td>0x5200000f</td>
<td>STATUS_SERVICE_CALL_CALLBACKS_MISSING</td>
<td>The Callbacks structure has missing function entry points for some mandatory functions.</td>
<td>Ensure that the mandatory callbacks are implemented in the client application. This error is exposed only to PIC (Platform Independent Code) clients. C++ and other higher-level wrappers satisfy these calls.</td>
</tr>
<tr>
<td>0x52000010</td>
<td>STATUS_SERVICE_CALL_NOT_AUTHORIZED_ERROR</td>
<td>Unauthorized.</td>
<td>Verify the security token/certificate/security token integration/expiration. Ensure that the token has the correct associated rights with it. For the Kinesis Video Streams sample applications, ensure that the environment variable is set correctly.</td>
</tr>
<tr>
<td>0x52000011</td>
<td>STATUS_DESCRIBE_STREAM_CALL_FAILED</td>
<td>DescribeStream API failure.</td>
<td>This error is returned after the DescribeStream API retry failure. The PIC client returns this error after it gives up retrying.</td>
</tr>
<tr>
<td>0x52000012</td>
<td>STATUS_INVALID_DESCRIBE_STREAM_RESPONSE</td>
<td>The DescribeStreamResponse structure.</td>
<td>The structure that was passed to the DescribeStreamResultEvent is either null or contains invalid items like a null Amazon Resource Name (ARN).</td>
</tr>
<tr>
<td>0x52000013</td>
<td>STATUS_STREAM_IS_BEING_DELETED</td>
<td>The stream is being deleted.</td>
<td>An API failure was caused by the stream being deleted. Ensure that no other processes are trying to delete the stream while the stream is in use.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x52000014</td>
<td>STATUS_SERVICE_CALL_INVALID_ARG_ERROR</td>
<td>Invalid arguments were specified for the service call.</td>
<td>The backend returns this error when a service call argument is not valid or when the SDK encounters an error that it can't interpret.</td>
</tr>
<tr>
<td>0x52000015</td>
<td>STATUS_SERVICE_CALL_DEVICE_NOT_FOUND_ERROR</td>
<td>The device was not found.</td>
<td>Ensure that the device is not deleted while in use.</td>
</tr>
<tr>
<td>0x52000016</td>
<td>STATUS_SERVICE_CALL_DEVICE_NOT_PROVISIONED_ERROR</td>
<td>The device was not provisioned.</td>
<td>Ensure that the device has been provisioned.</td>
</tr>
<tr>
<td>0x52000017</td>
<td>STATUS_SERVICE_CALL_RESOURCE_NOT_FOUND_ERROR</td>
<td>Generic resource not found returned from the service.</td>
<td>This error occurs when the service can't locate the resource (for example, a stream). It might mean different things in different contexts, but the likely cause is the usage of APIs before the stream is created. Using the SDK ensures that the stream is created first.</td>
</tr>
<tr>
<td>0x52000018</td>
<td>STATUS_INVALID_AUTH_LEN</td>
<td>Invalid auth info length.</td>
<td>Refer to the current values that are specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x52000019</td>
<td>STATUS_CREATE_STREAM_CALL_FAILED</td>
<td>The CreateStream API call failed.</td>
<td>Refer to the error string for more detailed information about why the operation failed.</td>
</tr>
<tr>
<td>0x5200002a</td>
<td>STATUS_GET_STREAMING_TOKEN_CALL_FAILED</td>
<td>GetStreamingToken call failed.</td>
<td>Refer to the error string for more detailed information about why the operation failed.</td>
</tr>
<tr>
<td>0x5200002b</td>
<td>STATUS_GET_STREAMING_ENDPOINT_CALL_FAILED</td>
<td>GetStreamingEndpoint call failed.</td>
<td>Refer to the error string for more detailed information about why the operation failed.</td>
</tr>
<tr>
<td>0x5200002c</td>
<td>STATUS_INVALID_URI_LEN</td>
<td>An invalid URI string length was returned from the GetStreamingEndpoint API.</td>
<td>Refer to the current maximum values that are specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200002d</td>
<td>STATUS_PUT_STREAM_CALL_FAILED</td>
<td>The PutMedia API call failed.</td>
<td>Refer to the error string for more detailed information about why the operation failed.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x5200002e</td>
<td>STATUS_STORE_OUT_OF_MEMORY</td>
<td>The content store is out of memory.</td>
<td>The content store is shared between the streams and should have enough capacity to store the maximum durations for all the streams + ~20% (accounting for the defragmentation). It's important to not overflow the storage. Choose values for the maximum duration per stream that correspond to the cumulative storage size and the latency tolerances. It's better to drop the frames as they fall out of the content view window versus just being put (content store memory pressure). This is because dropping the frames triggers the stream pressure notification callbacks. Then the application can adjust the upstream media components (like the encoder) to thin the bitrate, drop frames, or act accordingly.</td>
</tr>
<tr>
<td>0x5200002f</td>
<td>STATUS_NO_MORE_DATA_AVAILABLE</td>
<td>No more data is available currently for a stream.</td>
<td>This is a potential valid result when the media pipeline produces more slowly than the networking thread consumes the frames to be sent to the service. Higher-level clients (for example, C++, Java, or Android) do not see this warning because it's handled internally.</td>
</tr>
<tr>
<td>0x52000030</td>
<td>STATUS_INVALID_TAG_VERSION</td>
<td>Invalid Tag structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x52000031</td>
<td>STATUS_SERVICE_CALL_UNKNOWN_ERROR</td>
<td>Generic error was returned from the networking stack.</td>
<td>See the logs for more detailed information.</td>
</tr>
<tr>
<td>0x52000032</td>
<td>STATUS_SERVICE_CALL_RESOURCE_IN_USE_ERROR</td>
<td>Returned from the service. For more information, see the Kinesis Video Streams API Reference.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x52000033</td>
<td>STATUS_SERVICE_CALL_CLIENT_LIMIT_ERROR</td>
<td>Client limit.</td>
<td>Returned from the service. For more information, see the Kinesis Video Streams API Reference.</td>
</tr>
<tr>
<td>0x52000034</td>
<td>STATUS_SERVICE_CALL_DEVICE_LIMIT_ERROR</td>
<td>Device limit.</td>
<td>Returned from the service. For more information, see the Kinesis Video Streams API Reference.</td>
</tr>
<tr>
<td>0x52000035</td>
<td>STATUS_SERVICE_CALL_STREAM_LIMIT_ERROR</td>
<td>Stream limit.</td>
<td>Returned from the service. For more information, see the Kinesis Video Streams API Reference.</td>
</tr>
<tr>
<td>0x52000036</td>
<td>STATUS_SERVICE_CALL_RESOURCE_DELETED_ERROR</td>
<td>Resource deleted or is being deleted.</td>
<td>Returned from the service. For more information, see the Kinesis Video Streams API Reference.</td>
</tr>
<tr>
<td>0x52000037</td>
<td>STATUS_SERVICE_CALL_TIMEOUT_ERROR</td>
<td>The service call timed out.</td>
<td>Calling a particular service API resulted in a timeout. Ensure that you have a valid network connection. The PIC will retry the operation automatically.</td>
</tr>
<tr>
<td>0x52000038</td>
<td>STATUS_STREAM_READY_CALLBACK_FAILED</td>
<td>Stream ready notification.</td>
<td>This notification is sent from the PIC to the client indicating that the async stream has been created.</td>
</tr>
<tr>
<td>0x52000039</td>
<td>STATUS_DEVICE_TAGS_COUNT_NON_ZERO_TAGS_NULL</td>
<td>Invalid tags were specified.</td>
<td>Ensure that the tags are specified or the count is zero.</td>
</tr>
<tr>
<td>0x5200003a</td>
<td>STATUS_INVALID_STREAM_DESCRIPTION_VERSION</td>
<td>Invalid StreamDescription structure version.</td>
<td>Specify the correct current version of the structure.</td>
</tr>
<tr>
<td>0x5200003b</td>
<td>STATUS_INVALID_TAG_NAME_LENGTH</td>
<td>Invalid tag name length.</td>
<td>Refer to the limits for the tag name that are specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200003c</td>
<td>STATUS_INVALID_TAG_VALUE_LENGTH</td>
<td>Invalid tag value length.</td>
<td>Refer to the limits for the tag value that are specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200003d</td>
<td>STATUS_TAG_STREAM_CALL_FAILED</td>
<td>The TagResource API call failed.</td>
<td>The TagResource API call failed. Check for a valid network connection. See the logs for more information about the failure.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x5200003e</td>
<td>STATUS_INVALID_CUSTOM_DATA</td>
<td>Invalid custom data has been specified in a call to the PIC APIs.</td>
<td>In the clients that only use PIC.</td>
</tr>
<tr>
<td>0x5200003f</td>
<td>STATUS_INVALID_CREATE_STREAM_RESPONSE</td>
<td>The structure or its member fields are invalid (that is, the ARN is null or larger than what's specified in Producer SDK Limits (p. 81)).</td>
<td></td>
</tr>
<tr>
<td>0x52000040</td>
<td>STATUS_CLIENT_AUTH_CALL_FAILED</td>
<td>The PIC failed to get proper auth information (that is, AccessKeyId or SecretAccessKey) after a number of retries. Check the authentication integration. The sample applications use environment variables to pass in credential information to the C++ Producer Library.</td>
<td></td>
</tr>
<tr>
<td>0x52000041</td>
<td>STATUS_GET_CLIENT_TOKEN_CALL_FAILED</td>
<td>This situation can occur for clients that use PIC directly. After a number of retries, the call fails with this error.</td>
<td></td>
</tr>
<tr>
<td>0x52000042</td>
<td>STATUS_CLIENT_PROVISION_CALL_FAILED</td>
<td>Provisioning is not implemented.</td>
<td></td>
</tr>
<tr>
<td>0x52000043</td>
<td>STATUS_CREATE_CLIENT_CALL_FAILED</td>
<td>A generic error returned by the PIC after a number of retries when the client creation fails.</td>
<td></td>
</tr>
<tr>
<td>0x52000044</td>
<td>STATUS_CLIENT_READY_CALL_FAILED</td>
<td>Returned by the PIC state machine if the PIC fails to move to the READY state. See the logs for more information about the root cause.</td>
<td></td>
</tr>
<tr>
<td>0x52000045</td>
<td>STATUS_TAG_CLIENT_CALL_FAILED</td>
<td>The TagResource API call failed for the producer client.</td>
<td>The logs for more information about the root cause.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>--------------</td>
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<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x52000046</td>
<td>STATUS_INVALID_CREATE_DEVICE_RESPONSE</td>
<td>Device/producer creation failed.</td>
<td>The higher-level SDKs (for example, C++ or Java) don't implement the device/producer creation API yet. Clients that use PIC directly can indicate a failure using the result notification.</td>
</tr>
<tr>
<td>0x52000047</td>
<td>STATUS_ACK_TIMESTAMP_NOT_IN_VIEW_WINDOW</td>
<td>The timestamp of the received ACK is not in the view.</td>
<td>This error occurs if the frame corresponding to the received ACK falls out of the content view window. Generally, this occurs if the ACK delivery is slow. It can be interpreted as a warning and an indication that the downlink is slow.</td>
</tr>
<tr>
<td>0x52000048</td>
<td>STATUS_INVALID_FRAGMENT_ACK_VERSION</td>
<td>Invalid FragmentAck structure version.</td>
<td>Specify the correct current version of the FragmentAck structure.</td>
</tr>
<tr>
<td>0x52000049</td>
<td>STATUS_INVALID_TOKEN_EXPIRATION</td>
<td>Invalid security token expiration.</td>
<td>The security token expiration should have an absolute timestamp in the future that is greater than the current timestamp, with a grace period. For the limits for the grace period, see the Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x5200004a</td>
<td>STATUS_END_OF_STREAM</td>
<td>End of stream (EOS) indicator.</td>
<td>In the GetStreamData API call, indicates that the current upload handle session has ended. This occurs if the session ends or errors, or if the session token has expired and the session is being rotated.</td>
</tr>
<tr>
<td>0x5200004b</td>
<td>STATUS_DUPLICATE_STREAM_NAME</td>
<td>Duplicate stream name.</td>
<td>Multiple streams can't have the same stream name. Choose a unique name for the stream.</td>
</tr>
<tr>
<td>0x5200004c</td>
<td>STATUS_INVALID_RETENTION_PERIOD</td>
<td>Invalid retention period.</td>
<td>An invalid retention period is specified in the StreamInfo structure. For information about the valid range of values for the retention period, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>------------------</td>
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<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x5200004d</td>
<td>STATUS_INVALID_ACK_KEY_START</td>
<td>Failed to parse the fragment ACK string. Invalid key start indicator. The fragment ACK string might be damaged. It can self-correct and this error can be treated as a warning.</td>
<td></td>
</tr>
<tr>
<td>0x5200004e</td>
<td>STATUS_INVALID_ACK_DUPLICATE_KEY_NAME</td>
<td>Failed to parse the fragment ACK string. Multiple keys have the same name. The fragment ACK string might be damaged. It can self-correct and this error can be treated as a warning.</td>
<td></td>
</tr>
<tr>
<td>0x5200004f</td>
<td>STATUS_INVALID_ACK_INVALID_VALUE_START</td>
<td>Failed to parse the fragment ACK string because of an invalid key value start indicator. The fragment ACK string might be damaged. It can self-correct, and this error can be treated as a warning.</td>
<td></td>
</tr>
<tr>
<td>0x52000050</td>
<td>STATUS_INVALID_ACK_INVALID_VALUE_END</td>
<td>Failed to parse the fragment ACK string because of an invalid key value end indicator. The fragment ACK string might be damaged. It can self-correct and this error can be treated as a warning.</td>
<td></td>
</tr>
<tr>
<td>0x52000051</td>
<td>STATUS_INVALID_PARSED_ACK_TYPE</td>
<td>Failed to parse the fragment ACK string because an invalid ACK type was specified.</td>
<td></td>
</tr>
<tr>
<td>0x52000052</td>
<td>STATUS_STREAM_HAS_BEEN_STOPPED</td>
<td>The stream has been stopped, but a frame is still being put into the stream.</td>
<td></td>
</tr>
<tr>
<td>0x52000053</td>
<td>STATUS_INVALID_STREAM_METRICS_VERSION</td>
<td>Specify the correct current version of the StreamMetrics structure.</td>
<td></td>
</tr>
<tr>
<td>0x52000054</td>
<td>STATUS_INVALID_CLIENT_METRICS_VERSION</td>
<td>Specify the correct current version of the ClientMetrics structure.</td>
<td></td>
</tr>
<tr>
<td>0x52000055</td>
<td>STATUS_INVALID_CLIENT_READY_STATE</td>
<td>Failed to reach the READY state during the producer client initialization. See the logs for more information.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>-------------------</td>
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<td>--------------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>0x52000056</td>
<td>STATUS_STATE_MACHINE_STATE_NOT_FOUND</td>
<td>Internal state machine error.</td>
<td>Not a publicly visible error.</td>
</tr>
<tr>
<td>0x52000057</td>
<td>STATUS_INVALID_FRAGMENT_ACK_TYPE</td>
<td>Invalid ACK type is specified in the FragmentAck structure.</td>
<td>The FragmentAck structure should contain ACK types defined in the public header.</td>
</tr>
<tr>
<td>0x52000058</td>
<td>STATUS_INVALID_STREAM_READY_STATE</td>
<td>Internal state machine transition error.</td>
<td>Not a publicly visible error.</td>
</tr>
<tr>
<td>0x52000059</td>
<td>STATUS_CLIENT_FREED_BEFORE_STREAM</td>
<td>The stream object was freed after the producer was freed.</td>
<td>There was an attempt to free a stream object after the producer object was freed. This can only occur in clients that directly use PIC.</td>
</tr>
<tr>
<td>0x5200005a</td>
<td>STATUS_ALLOCATION_SIZE_SMALLER_THAN_REQUESTED</td>
<td>Internal error indicating that the actual allocation size from the content store is smaller than the size of the packaged frame/fragment.</td>
<td></td>
</tr>
<tr>
<td>0x5200005b</td>
<td>STATUS_VIEW_ITEM_SIZE_GREATER_THAN_ALLOCATION</td>
<td>The stored size of the allocation in the content view is greater than the allocation size in the content store.</td>
<td></td>
</tr>
<tr>
<td>0x5200005c</td>
<td>STATUS_ACK_ERR_STREAM_READ_ACK_ERROR</td>
<td>Stream read error ACK.</td>
<td>An error that the ACK returned from the backend indicating a stream read/parsing error. This generally occurs when the backend fails to retrieve the stream. Auto-restreaming can usually correct this error.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>------------</td>
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<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x5200005d</td>
<td>STATUS_ACK_ERR_FRAGMENT_SIZE_REACHED</td>
<td>The maximum fragment size was reached.</td>
<td>The max fragment size in bytes is defined in Producer SDK Limits (p. 81). This error indicates that there are either very large frames, or there are no key frames to create manageable size fragments. Check the encoder settings and ensure that key frames are being produced properly. For streams that have very high density, configure the encoder to produce fragments at smaller durations to manage the maximum size.</td>
</tr>
<tr>
<td>0x5200005e</td>
<td>STATUS_ACK_ERR_FRAGMENT_DURATION_REACHED</td>
<td>The maximum fragment duration was reached.</td>
<td>The max fragment duration is defined in Producer SDK Limits (p. 81). This error indicates that there are either very low frames per second or there are no key frames to create manageable duration fragments. Check the encoder settings and ensure that key frames are being produced properly at the regular intervals.</td>
</tr>
<tr>
<td>0x5200005f</td>
<td>STATUS_ACK_ERR_CONNECTION_DURATION_REACHED</td>
<td>The maximum connection duration was reached.</td>
<td>Kinesis Video Streams enforces the max connection duration as specified in the Producer SDK Limits (p. 81). The Producer SDK automatically rotates the stream/token before the maximum is reached, and so clients using the SDK should not receive this error.</td>
</tr>
<tr>
<td>0x52000060</td>
<td>STATUS_ACK_ERR_FRAGMENT_TIMECODE_NOT_MONOTONIC</td>
<td>Timecodes are not monotonically increasing.</td>
<td>The Producer SDK enforces timestamps, so clients using the SDK should not receive this error.</td>
</tr>
<tr>
<td>0x52000061</td>
<td>STATUS_ACK_ERR_MULTI_TRACK_MKV</td>
<td>Multiple tracks in the MKV.</td>
<td>The Producer SDK enforces single track streams, so clients using the SDK should not receive this error.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
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</tr>
<tr>
<td>0x52000062</td>
<td>STATUS_ACK_ERR_INVALID_MKV_DATA</td>
<td>Invalid MKV data.</td>
<td>The backend MKV parser encountered an error parsing the stream. Clients using the SDK might encounter this error if the stream is corrupted in the transition or if the buffer pressures force the SDK to drop tail frames that are partially transmitted. In the latter case, we recommend that you either reduce the FPS/resolution, increase the compression ratio, or (in the case of a &quot;bursty&quot; network) allow for larger content store and buffer duration to accommodate for the temporary pressures.</td>
</tr>
<tr>
<td>0x52000063</td>
<td>STATUS_ACK_ERR_INVALID_PRODUCER_TIMESTAMP</td>
<td>Invalid producer timestamp.</td>
<td>The service returns this error ACK if the producer clock has a large drift into the future. Higher-level SDKs (for example, Java or C++) use some version of the system clock to satisfy the current time callback from PIC. Ensure that the system clock is set properly. Clients using the PIC directly should ensure that their callback functions return the correct timestamp.</td>
</tr>
<tr>
<td>0x52000064</td>
<td>STATUS_ACK_ERR_STREAM_NOT_ACTIVE</td>
<td>Inactive stream.</td>
<td>A call to a backend API was made while the stream was not in an &quot;Active&quot; state. This occurs when the client creates the stream and immediately continues to push frames into it. The SDK handles this scenario through the state machine and recovery mechanism.</td>
</tr>
<tr>
<td>0x52000065</td>
<td>STATUS_ACK_ERR_KMS_KEY_ACCESS_DENIED</td>
<td>AWS KMS access denied error.</td>
<td>Returned when the account has no access to the specified key.</td>
</tr>
<tr>
<td>0x52000066</td>
<td>STATUS_ACK_ERR_KMS_KEY_DISABLED</td>
<td>AWS KMS key is disabled</td>
<td>The specified key has been disabled.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
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</tr>
<tr>
<td>0x52000067</td>
<td>STATUS_ACK_ERR_KMS_KEY</td>
<td>AWS KMS key validation error.</td>
<td>Generic validation error. For more information, see the AWS Key Management Service API Reference.</td>
</tr>
<tr>
<td>0x52000068</td>
<td>STATUS_ACK_ERR_KMS_KEY</td>
<td>AWS KMS key unavailable.</td>
<td>The key is unavailable. For more information, see the AWS Key Management Service API Reference.</td>
</tr>
<tr>
<td>0x52000069</td>
<td>STATUS_ACK_ERR_KMS_KEY</td>
<td>AWS KMS key invalid use of AWS KMS key.</td>
<td>The AWS KMS key is not configured to be used in this context. For more information, see the AWS Key Management Service API Reference.</td>
</tr>
<tr>
<td>0x5200006a</td>
<td>STATUS_ACK_ERR_KMS_INVALID_STATE</td>
<td>The AWS KMS key is invalid state.</td>
<td>For more information, see the AWS Key Management Service API Reference.</td>
</tr>
<tr>
<td>0x5200006b</td>
<td>STATUS_ACK_ERR_KMS_KEY</td>
<td>AWS KMS key not found.</td>
<td>The key was not found. For more information, see the AWS Key Management Service API Reference.</td>
</tr>
<tr>
<td>0x5200006c</td>
<td>STATUS_ACK_ERR_STREAM</td>
<td>The stream has been or is being deleted.</td>
<td>The stream is being deleted by another application or through the AWS Management Console.</td>
</tr>
<tr>
<td>0x5200006d</td>
<td>STATUS_ACK_ERR_ACK_ID</td>
<td>Unknown error.</td>
<td>Generic service internal error.</td>
</tr>
<tr>
<td>0x5200006e</td>
<td>STATUS_ACK_ERR_FRAGMENT</td>
<td>Fragment archival error.</td>
<td>Returned when the service fails to durably persist and index the fragment. Although it's rare, it can occur for various reasons. By default, the SDK retries sending the fragment.</td>
</tr>
<tr>
<td>0x5200006f</td>
<td>STATUS_ACK_ERR_UNKNOWN</td>
<td>Unknown error.</td>
<td>The service returned an unknown error.</td>
</tr>
<tr>
<td>0x52000070</td>
<td>STATUS_MISSING_ERR_ACK</td>
<td>Missing ACK information.</td>
<td>The ACK parser completed parsing, but the FragmentAck information is missing.</td>
</tr>
<tr>
<td>0x52000071</td>
<td>STATUS_INVALID_ACK_SEGMENT_LENGTH</td>
<td>Invalid ACK segment length.</td>
<td>An ACK segment string with an invalid length was specified to the ACK parser. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
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<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x52000074</td>
<td>STATUS_MAX_FRAGMENT_METADATA_COUNT</td>
<td>The maximum number of metadata items has been added to a fragment.</td>
<td>A Kinesis video stream can add up to 10 metadata items to a fragment, either by adding a nonpersistent item to a fragment, or by adding a persistent item to the metadata queue. For more information, see Using Streaming Metadata with Kinesis Video Streams (p. 15).</td>
</tr>
<tr>
<td>0x52000075</td>
<td>STATUS_ACK_ERR_FRAGMENT_METADATA_LIMIT_REACHED</td>
<td>A limit (maximum metadata count, metadata name length, or metadata value length) has been reached.</td>
<td>The Producer SDK limits the number and size of metadata items. This error does not occur unless the limits in the Producer SDK code are changed. For more information, see Using Streaming Metadata with Kinesis Video Streams (p. 15).</td>
</tr>
<tr>
<td>0x52000076</td>
<td>STATUS_BLOCKING_PUT_INTERRUPTED_STREAM_TERMINATED</td>
<td>Not implemented.</td>
<td></td>
</tr>
<tr>
<td>0x52000077</td>
<td>STATUS_INVALID_METADATA_NAME</td>
<td>The metadata name is not valid.</td>
<td>The metadata name cannot start with the string “AWS”. If this error occurs, the metadata item is not added to the fragment or metadata queue. For more information, see Using Streaming Metadata with Kinesis Video Streams (p. 15).</td>
</tr>
<tr>
<td>0x52000078</td>
<td>STATUS_END_OF_FRAGMENT_FRAME_INVALID_STATE</td>
<td>The end of fragment frame is in an invalid state.</td>
<td>The end of fragment should not be sent in a non-key-frame fragmented stream.</td>
</tr>
<tr>
<td>0x52000079</td>
<td>STATUS_TRACK_INFO_MISSING</td>
<td>Track information is missing.</td>
<td>The track number must be greater than 0 and it must match the track id.</td>
</tr>
<tr>
<td>0x5200007a</td>
<td>STATUS_MAX_TRACK_COUNT</td>
<td>Track count is exceeded.</td>
<td>You can have a maximum of 3 tracks per stream.</td>
</tr>
<tr>
<td>0x5200007b</td>
<td>STATUS_OFFLINE_MODE_WRITE</td>
<td>The offline streaming mode retention time is set to zero.</td>
<td>The offline streaming mode retention time should not be set to zero.</td>
</tr>
<tr>
<td>0x5200007c</td>
<td>STATUS_ACK_ERR_TRACK_NUMBER_MISMATCH</td>
<td>The track number of the error ACK is mismatched.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>--------------</td>
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<td>------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>0x5200007d</td>
<td>STATUS_ACK_ERR_FRAMES_MISSING_FOR_TRACK</td>
<td>Frames missing for a track.</td>
<td></td>
</tr>
<tr>
<td>0x5200007e</td>
<td>STATUS_ACK_ERR_MORE_THAN_ALLOWED_TRACKS_FOUND</td>
<td>Maximum allowed number of tracks is exceeded.</td>
<td></td>
</tr>
<tr>
<td>0x5200007f</td>
<td>STATUS_UPLOAD_HANDLE_ABORTED</td>
<td>Upload handle is aborted.</td>
<td></td>
</tr>
<tr>
<td>0x52000080</td>
<td>STATUS INVALID_CERTIFICATE_PATH_LENGTH</td>
<td>Invalid certificate path length.</td>
<td></td>
</tr>
<tr>
<td>0x52000081</td>
<td>STATUS DUPPLICATE_TRACK_ID_FOUND</td>
<td>Duplicate track ID found.</td>
<td></td>
</tr>
</tbody>
</table>

**Error and Status Codes Returned by the Duration Library**

The following table contains error and status information that is returned by methods in the Duration library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xFFFFFFFFFFFFFFFF</td>
<td>INVALID_DURATION_VALUE</td>
</tr>
</tbody>
</table>

**Error and Status Codes Returned by the Common Library**

The following table contains error and status information that is returned by methods in the Common library.

*Note*

These error and status information codes are common to many APIs.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00000001</td>
<td>STATUS NULL_ARG</td>
<td>NULL was passed for a mandatory argument.</td>
</tr>
<tr>
<td>0x00000002</td>
<td>STATUS INVALID_ARG</td>
<td>An invalid value was specified for an argument.</td>
</tr>
<tr>
<td>0x00000003</td>
<td>STATUS INVALID_ARG_LEN</td>
<td>An invalid argument length was specified.</td>
</tr>
<tr>
<td>0x00000004</td>
<td>STATUS NOT_ENOUGH_MEMORY</td>
<td>Could not allocate enough memory.</td>
</tr>
<tr>
<td>0x00000005</td>
<td>STATUS_BUFFER_TOO_SMALL</td>
<td>The specified buffer size is too small.</td>
</tr>
<tr>
<td>0x00000006</td>
<td>STATUS UNEXPECTED_EOF</td>
<td>An unexpected end of file was reached.</td>
</tr>
<tr>
<td>0x00000007</td>
<td>STATUS FORMAT_ERROR</td>
<td>An invalid format was encountered.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x00000008</td>
<td>STATUS_INVALID_HANDLE_ERROR</td>
<td>Invalid handle value.</td>
</tr>
<tr>
<td>0x00000009</td>
<td>STATUS_OPEN_FILE_FAILED</td>
<td>Failed to open a file.</td>
</tr>
<tr>
<td>0x0000000a</td>
<td>STATUS_READ_FILE_FAILED</td>
<td>Failed to read from a file.</td>
</tr>
<tr>
<td>0x0000000b</td>
<td>STATUS_WRITE_TO_FILE_FAILED</td>
<td>Failed to write to a file.</td>
</tr>
<tr>
<td>0x0000000c</td>
<td>STATUS_INTERNAL_ERROR</td>
<td>An internal error that normally doesn't occur and might indicate an SDK or service API bug.</td>
</tr>
<tr>
<td>0x0000000d</td>
<td>STATUS_INVALID_OPERATION</td>
<td>There was an invalid operation, or the operation is not permitted.</td>
</tr>
<tr>
<td>0x0000000e</td>
<td>STATUS_NOT_IMPLEMENTED</td>
<td>The feature is not implemented.</td>
</tr>
<tr>
<td>0x0000000f</td>
<td>STATUS_OPERATION_TIMED_OUT</td>
<td>The operation timed out.</td>
</tr>
<tr>
<td>0x00000010</td>
<td>STATUS_NOT_FOUND</td>
<td>A required resource was not found.</td>
</tr>
</tbody>
</table>

**Error and Status Codes Returned by the Heap Library**

The following table contains error and status information that is returned by methods in the heap library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x01000001</td>
<td>STATUS_HEAP_FLAGS_ERROR</td>
<td>An invalid combination of flags was specified.</td>
</tr>
<tr>
<td>0x01000002</td>
<td>STATUS_HEAP_NOT_INITIALIZED</td>
<td>An operation was attempted before the heap was initialized.</td>
</tr>
<tr>
<td>0x01000003</td>
<td>STATUS_HEAP_CORRUPTED</td>
<td>The heap was corrupted or the guard band (in debug mode) was overwritten. A buffer overflow in the client code might lead to a heap corruption.</td>
</tr>
<tr>
<td>0x01000004</td>
<td>STATUS_HEAP_VRAM_LIB_MISSING</td>
<td>The VRAM (video RAM) user or kernel mode library cannot be loaded or is missing. Check if the underlying platform supports VRAM allocations.</td>
</tr>
<tr>
<td>0x01000005</td>
<td>STATUS_HEAP_VRAM_LIB_REOPEN</td>
<td>Failed to open the VRAM library.</td>
</tr>
<tr>
<td>0x01000006</td>
<td>STATUS_HEAP_VRAM_INIT_FUNC_SYMBOL</td>
<td>Failed to load the INIT function export.</td>
</tr>
<tr>
<td>0x01000007</td>
<td>STATUS_HEAP_VRAM_ALLOC_FUNC_SYMBOL</td>
<td>Failed to load the ALLOC function export.</td>
</tr>
</tbody>
</table>
Error and Status Codes Returned by the MKVGen Library

The following table contains error and status information that is returned by methods in the MKVGen library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description / Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x32000001</td>
<td>STATUS_MKV_INVALID_FRAME_DATA</td>
<td>Invalid members of the Frame data structure. Ensure that the duration, size, and frame data are valid and are within the limits specified in Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000002</td>
<td>STATUS_MKV_INVALID_FRAME_TIMESTAMP</td>
<td>Invalid frame timestamp. The calculated PTS (presentation timestamp) and DTS (decoding timestamp) are greater or equal to the timestamp of the start frame of the fragment. This is an indication of a</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description / Recommended Action</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x32000003</td>
<td>STATUS_MKV_INVALID_CLUSTER_DURATION</td>
<td>An invalid fragment duration was specified. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000004</td>
<td>STATUS_MKV_INVALID_CONTENT_TYPE_LENGTH</td>
<td>Invalid content type string length. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000005</td>
<td>STATUS_MKV_NUMBER_TOO_BIG</td>
<td>There was an attempt to encode a number that's too large to be represented in EBML (Extensible Binary Meta Language) format. This should not be exposed to the SDK clients.</td>
</tr>
<tr>
<td>0x32000006</td>
<td>STATUS_MKV_INVALID_CODEC_ID_LENGTH</td>
<td>Invalid codec ID string length. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000007</td>
<td>STATUS_MKV_INVALID_TRACK_NAME_LENGTH</td>
<td>Invalid track name string length. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000008</td>
<td>STATUS_MKV_INVALID_CODEC_PRIVATE_DATA_LENGTH</td>
<td>Invalid codec private data length. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x32000009</td>
<td>STATUS_MKV_CODEC_PRIVATE_NULL</td>
<td>The codec private data (CPD) is NULL, whereas the CPD size is greater than 0.</td>
</tr>
<tr>
<td>0x3200000a</td>
<td>STATUS_MKV_INVALID_TIMECODE_SCALE</td>
<td>Invalid timecode scale value. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x3200000b</td>
<td>STATUS_MKV_MAX FRAME TIMECODE</td>
<td>The frame timecode is greater than the maximum. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description / Recommended Action</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>0x3200000c</td>
<td>STATUS_MKV_LARGE_FRAME_TIMECODE</td>
<td>The max frame timecode was reached. The MKV format uses signed 16 bits to represent the relative timecode of the frame to the beginning of the cluster. The error is generated if the frame timecode cannot be represented. This error indicates either a bad timecode scale selection or the cluster duration is too long, so representing the frame timecode overflows the signed 16-bit space.</td>
</tr>
<tr>
<td>0x3200000d</td>
<td>STATUS_MKV_INVALID_ANNEXB_NALU_IN_FRAME_DATA</td>
<td>An invalid Annex-B start code was encountered. For example, the Annex-B adaptation flag was specified and the code encounters an invalid start sequence of more than three zeroes. A valid Annex-B format should have an &quot;emulation prevention&quot; sequence to escape a sequence of three or more zeroes in the bytestream. For more information, see the MPEG specification. For information about this error on Android, see STATUS_MKV_INVALID_ANNEXB_NALU_IN_FRAME_DATA (0x3200000d) error on Android (p. 182).</td>
</tr>
<tr>
<td>0x3200000e</td>
<td>STATUS_MKV_INVALID_AVCC_NALU_IN_FRAME_DATA</td>
<td>Invalid AVCC NALu packaging when the adapting AVCC flag is specified. Ensure that the bytestream is in a valid AVCC format. For more information, see the MPEG specification.</td>
</tr>
<tr>
<td>0x3200000f</td>
<td>STATUS_MKV_BOTH_ANNEXB_AND_AVCC_SPECIFIED</td>
<td>Both adapting AVCC and Annex-B NALs were specified. Specify either one, or specify none.</td>
</tr>
<tr>
<td>0x32000010</td>
<td>STATUS_MKV_INVALID_ANNEXB_NALU_IN_CPD</td>
<td>Invalid Annex-B format of CPD when the adapting Annex-B flag is specified. Ensure that the CPD is in valid Annex-B format. If it is not, then remove the CPD Annex-B adaptation flag.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description / Recommended Action</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>0x32000011</td>
<td>STATUS_MKV_PTS_DTS_ARE_NOT_SAME</td>
<td>Kinesis Video Streams enforces the PTS (presentation timestamp) and DTS (decoding timestamp) to be the same for the fragment start frames. These are the key frames that start the fragment.</td>
</tr>
<tr>
<td>0x32000012</td>
<td>STATUS_MKV_INVALID_H264_H265_CPD</td>
<td>Failed to parse H264/H265 codec private data.</td>
</tr>
<tr>
<td>0x32000013</td>
<td>STATUS_MKV_INVALID_H264_H265_SPS_WIDTH</td>
<td>Failed to extract the width from the codec private data.</td>
</tr>
<tr>
<td>0x32000014</td>
<td>STATUS_MKV_INVALID_H264_H265_SPS_HEIGHT</td>
<td>Failed to extract the height from codec private data.</td>
</tr>
<tr>
<td>0x32000015</td>
<td>STATUS_MKV_INVALID_H264_H265_SPS_NALU</td>
<td>Invalid H264/H265 SPS NALu.</td>
</tr>
<tr>
<td>0x32000016</td>
<td>STATUS_MKV_INVALID_BIH_CPD</td>
<td>Invalid bitmap info header format in the codec private data.</td>
</tr>
<tr>
<td>0x32000017</td>
<td>STATUS_MKV_INVALID_HEVC_NALU</td>
<td>Invalid High Efficiency Video Coding (HEVC) Network Abstraction Layer units (NALU) count.</td>
</tr>
<tr>
<td>0x32000018</td>
<td>STATUS_MKV_INVALID_HEVC_FORMAT</td>
<td>Invalid HEVC format.</td>
</tr>
<tr>
<td>0x32000019</td>
<td>STATUS_MKV_HEVC_SPS_NALU_MISSING</td>
<td>Missing HEVC NALUs in the Sequence Parameter Set (SPS).</td>
</tr>
<tr>
<td>0x3200001a</td>
<td>STATUS_MKV_INVALID_HEVC_SPS_NALU_SIZE</td>
<td>Invalid HEVC SPS NALU size.</td>
</tr>
<tr>
<td>0x3200001b</td>
<td>STATUS_MKV_INVALID_HEVC_SPS_RESERVED</td>
<td>Invalid HEVC reserved SPS.</td>
</tr>
<tr>
<td>0x3200001c</td>
<td>STATUS_MKV_INVALID_HEVC_SPS_RESERVED</td>
<td>Invalid HEVC reserved SPS.</td>
</tr>
<tr>
<td>0x3200001d</td>
<td>STATUS_MKV_MIN_ANNEX_B_CPD</td>
<td>Minimum Annex-b codec private beta value size. For H264, this value must be equal to or greater that 11. For H265, this value must be equal to or greater than 15.</td>
</tr>
<tr>
<td>0x3200001e</td>
<td>STATUS_MKV_ANNEXB_CPD_MISSING</td>
<td>Missing codec private data in Annex-B NALUs.</td>
</tr>
<tr>
<td>0x3200001f</td>
<td>STATUS_MKV_INVALID_ANNEXB_CPD</td>
<td>Invalid codec private beta in Annex-B NALUs.</td>
</tr>
<tr>
<td>0x32000020</td>
<td>STATUS_MKV_INVALID_TAG_NAME</td>
<td>Invalid tag name length. Valid value is greater than zero and less than 128.</td>
</tr>
</tbody>
</table>
### Error Code Reference

The following table contains error and status information that is returned by methods in the Trace library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x10100001</td>
<td>STATUS_MIN_PROFILER_BUFFER</td>
</tr>
</tbody>
</table>

### Error and Status Codes Returned by the Utils Library

The following table contains error and status information that is returned by methods in the Utils library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x40000001</td>
<td>STATUS_INVALID_BASE64_ENCODE</td>
</tr>
<tr>
<td>0x40000002</td>
<td>STATUS_INVALID_BASE</td>
</tr>
<tr>
<td>0x40000003</td>
<td>STATUS_INVALID_DIGIT</td>
</tr>
<tr>
<td>0x40000004</td>
<td>STATUS_INT_OVERFLOW</td>
</tr>
<tr>
<td>0x40000005</td>
<td>STATUS_EMPTY_STRING</td>
</tr>
<tr>
<td>0x40000006</td>
<td>STATUS_DIRECTORY_OPEN_FAILED</td>
</tr>
<tr>
<td>0x40000007</td>
<td>STATUS_PATH_TOO_LONG</td>
</tr>
<tr>
<td>0x40000008</td>
<td>STATUS_UNKNOWN_DIR_ENTRY_TYPE</td>
</tr>
<tr>
<td>0x40000009</td>
<td>STATUS_REMOVE_DIRECTORY_FAILED</td>
</tr>
<tr>
<td>0x4000000a</td>
<td>STATUS_REMOVE_FILE_FAILED</td>
</tr>
</tbody>
</table>
Error and Status Codes Returned by the View Library

The following table contains error and status information that is returned by methods in the View library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x30000001</td>
<td>STATUS_MIN_CONTENT_VIEW_ITEM_COUNT</td>
<td>An invalid content view item count was specified. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x30000002</td>
<td>STATUS_INVALID_CONTENT_VIEW_DURATION</td>
<td>An invalid content view duration was specified. For more information, see Producer SDK Limits (p. 81).</td>
</tr>
<tr>
<td>0x30000003</td>
<td>STATUS_CONTENT_VIEW_NO_MORE_ITEMS</td>
<td>An attempt was made to get past the head position.</td>
</tr>
<tr>
<td>0x30000004</td>
<td>STATUS_CONTENT_VIEW_INVALID_INDEX</td>
<td>An invalid index is specified.</td>
</tr>
<tr>
<td>0x30000005</td>
<td>STATUS_CONTENT_VIEW_INVALID_TIMESTAMP</td>
<td>An invalid timestamp overlap. The frame decoding timestamp should be greater or equal to the previous frame timestamp, plus the previous frame duration: ( DTS(n) \geq DTS(n-1) + Duration(n-1) ). This error often indicates an &quot;unstable&quot; encoder. The encoder produces a burst of encoded frames, and their timestamps are smaller than the intra-frame durations. Or the stream is configured to use SDK timestamps, and the frames are sent faster than the frame durations. To help with some &quot;jitter&quot; in the encoder, specify a smaller frame duration in the StreamInfo.StreamCaps structure. For example, if the stream is 25FPS, each frame's duration is 40 ms. However, to</td>
</tr>
</tbody>
</table>
handle the encoder jitter, we recommend that you use half of that frame duration (20 ms). Some streams require more precise control over the timing for error detection.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x30000006</td>
<td>STATUS_INVALID_CONTENT_VIEW_LENGTH</td>
<td>Invalid content view item data length was specified.</td>
</tr>
</tbody>
</table>

**Errors and Status Codes Returned by PutFrame Callbacks - C Producer Library**

The following section contains error and status information that is returned by callbacks for the PutFrame operation within the C producer library.

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x15000001</td>
<td>STATUS_STOP_CALLBACK_CHAIN</td>
<td>The callback chain has stopped.</td>
</tr>
<tr>
<td>0x15000002</td>
<td>STATUS_MAX_CALLBACK_CHAIN</td>
<td>The maximum callback chain was reached.</td>
</tr>
<tr>
<td>0x15000003</td>
<td>STATUS_INVALID_PLATFORM_CALLBACKS_VERSION</td>
<td>Invalid PlatformCallbacks structure version.</td>
</tr>
<tr>
<td>0x15000004</td>
<td>STATUS_INVALID_PRODUCER_CALLBACKS_VERSION</td>
<td>Invalid ProducerCallbacks structure version.</td>
</tr>
<tr>
<td>0x15000005</td>
<td>STATUS_INVALID_STREAM_CALLBACKS_VERSION</td>
<td>Invalid StreamCallbacks structure version.</td>
</tr>
<tr>
<td>0x15000006</td>
<td>STATUS_INVALID_AUTH_CALLBACKS_VERSION</td>
<td>Invalid AuthCallbacks structure version.</td>
</tr>
<tr>
<td>0x15000007</td>
<td>STATUS_INVALID_API_CALLBACKS_VERSION</td>
<td>Invalid ApiCallbacks structure version.</td>
</tr>
<tr>
<td>0x15000008</td>
<td>STATUS_INVALID_AWS_CREDENTIALS_VERSION</td>
<td>Invalid AwsCredentials structure version.</td>
</tr>
<tr>
<td>0x15000009</td>
<td>STATUS_MAX_REQUEST_HEADER_COUNT</td>
<td>The maximum request header count was reached.</td>
</tr>
<tr>
<td>Code</td>
<td>Message</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>0x1500000a</td>
<td>STATUS_MAX_REQUEST_HEADER_NAME_LEN</td>
<td>The maximum request header name length was reached.</td>
</tr>
<tr>
<td>0x1500000b</td>
<td>STATUS_MAX_REQUEST_HEADER_VALUE_LEN</td>
<td>The maximum request header value length was reached.</td>
</tr>
<tr>
<td>0x1500000c</td>
<td>STATUS_INVALID_API_CALL_RETURN_JSON</td>
<td>Invalid return JSON for an API call.</td>
</tr>
<tr>
<td>0x1500000d</td>
<td>STATUS_CURLE_INIT_FAILED</td>
<td>Curl initialization failed.</td>
</tr>
<tr>
<td>0x1500000e</td>
<td>STATUS_CURLE_LIBRARY_INIT_FAILED</td>
<td>Curl lib initialization failed.</td>
</tr>
<tr>
<td>0x1500000f</td>
<td>STATUS_INVALID_DESCRIBE_STREAM_RETURN_JSON</td>
<td>Invalid return JSON for DescribeStream.</td>
</tr>
<tr>
<td>0x15000010</td>
<td>STATUS_HMAC_GENERATION_ERROR</td>
<td>HMAC generation error.</td>
</tr>
<tr>
<td>0x15000011</td>
<td>STATUS_IOT_FAILED</td>
<td>IOT authorization failed.</td>
</tr>
<tr>
<td>0x15000012</td>
<td>STATUS_MAX_ROLE_ALIAS_LEN_EXCEEDED</td>
<td>The maximum role alias length was reached.</td>
</tr>
<tr>
<td>0x15000013</td>
<td>STATUS_MAX_USER_AGENT_NAME_POSTFIX_LEN_EXCEEDED</td>
<td>The maximum user agent name postfix length was reached.</td>
</tr>
<tr>
<td>0x15000014</td>
<td>STATUS_MAX_CUSTOM_USER_AGENT_LEN_EXCEEDED</td>
<td>The maximum customer user agent length was reached.</td>
</tr>
<tr>
<td>0x15000015</td>
<td>STATUS_INVALID_USER_AGENT_LENGTH</td>
<td>The maximum user agent length.</td>
</tr>
<tr>
<td>0x15000016</td>
<td>STATUS_INVALID_ENDPOINT_CACHING_PERIOD</td>
<td>Invalid endpoint caching period.</td>
</tr>
<tr>
<td>0x15000017</td>
<td>STATUS_IOT_EXPIRATION_PARSING_FAILED</td>
<td>The IOT expiration parsing has failed.</td>
</tr>
<tr>
<td>0x15000018</td>
<td>STATUS_IOT_EXPIRATION_TIMESTAMP</td>
<td>IOT expiration timestamp occurs in the past.</td>
</tr>
</tbody>
</table>
Network Abstraction Layer (NAL) Adaptation Flag

Reference

This section contains information about available flags for the StreamInfo.NalAdaptationFlags enumeration.

The elementary stream in an application can be in either Annex-B or AVCC format:

- The Annex-B format delimits NALUs (Network Abstraction Layer units) with two bytes of zeroes, followed by one or three bytes of zeroes, followed by the number 1 (called a start code, for example, 00000001).
- The AVCC format also wraps NALUs, but each NALU is preceded by a value that indicates the size of the NALU (usually four bytes).

Many encoders produce the Annex-B bitstream format. Some higher-level bitstream processors (such as a playback engine or the Media Source Extensions (MSE) player in the AWS Management Console) use the AVCC format for their frames.

The codec private data (CPD), which is SPS/PPS (Sequence Parameter Set/Picture Parameter Set) for the H.264 codec, can also be in Annex-B or AVCC format. However, for the CPD, the formats are different from those described previously.

The flags tell the SDK to adapt the NALUs to AVCC or Annex-B for frame data and CPD as follows:

<table>
<thead>
<tr>
<th>Flag</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAL_ADAPTATION_FLAG_NONE</td>
<td>No adaptation</td>
</tr>
<tr>
<td>NAL_ADAPTATION_ANNEXB_NALS</td>
<td>Adapt Annex-B NALUs to AVCC NALUs</td>
</tr>
<tr>
<td>NAL_ADAPTATION_AVCC_NALS</td>
<td>Adapt AVCC NALUs to Annex-B NALUs</td>
</tr>
<tr>
<td>NAL_ADAPTATION_ANNEXB_CPD</td>
<td>Adapt Annex-B NALUs for the codec private data to AVCC format NALUs</td>
</tr>
<tr>
<td>NAL_ADAPTATION_ANNEXB_CPD</td>
<td>Adapt Annex-B NALUs for the codec and frame private data to AVCC format NALUs</td>
</tr>
</tbody>
</table>

For more information about NALU types, see Section 1.3: Network Abstraction Layer Unit Types in RFC 3984.

Producer SDK Structures

This section includes information about structures that you can use to provide data to the Kinesis Video Streams Producer object.

Topics

- DeviceInfo/DefaultDeviceInfoProvider (p. 108)
- StorageInfo (p. 108)
DeviceInfo/DefaultDeviceInfoProvider

The **DeviceInfo** and **DefaultDeviceInfoProvider** objects control the behavior of the Kinesis Video Streams Producer object.

**Member Fields**

- **version**: An integer value used to ensure that the correct version of the structure is used with the current version of the code base. The current version is specified using the `DEVICE_INFO_CURRENT_VERSION` macro.
- **name**: The human-readable name for the device.
- **tagCount/tags**: Not currently used.
- **streamCount**: The maximum number of streams that the device can handle. This pre-allocates the storage for pointers to the stream objects initially, but the actual stream objects are created later. The default is 16 streams, but you can change this number in the `DefaultDeviceInfoProvider.cpp` file.
- **storageInfo**: An object that describes the main storage configuration. For more information, see StorageInfo (p. 108).

**StorageInfo**

Specifies the configuration of the main storage for Kinesis Video Streams.

The default implementation is based on a low-fragmentation fast heap implementation, which is optimized for streaming. It uses the `MEMALLOC` allocator, which can be overwritten on a given platform. Some platforms have virtual memory allocation without backing the allocation with physical pages. As the memory is used, the virtual pages are backed by the physical pages. This results in low-memory pressure on the overall system when storage is underused.

Calculate the default storage size based on the following formula. The `DefragmentationFactor` should be set to 1.2 (20 percent).

\[
\text{Size} = \text{NumberOfStreams} \times \text{AverageFrameSize} \times \text{FramesPerSecond} \times \text{BufferDurationInSeconds} \times \text{DefragmentationFactor}
\]

In the following example, a device has audio and video streams. The audio stream has 512 samples per second, with an average sample of 100 bytes. The video stream has 25 frames per second, with an average of 10,000 bytes. Each stream has 3 minutes of buffer duration.

\[
\text{Size} = (512 \times 100 \times (3 \times 60) + 25 \times 10000 \times (3 \times 60)) \times 1.2 = (9216000 + 45000000) \times 1.2 = 65059200 = \approx 66\text{MB}.
\]

If the device has more available memory, it is recommended that you add more memory to storage to avoid severe fragmentation.

Ensure that the storage size is adequate to accommodate the full buffers for all streams at high encoding complexity (when the frame size is larger due to high motion) or when the bandwidth is low. If the producer hits memory pressure, it emits storage overflow pressure callbacks (`StorageOverflowPressureFunc`). However, when no memory is available in the content store, it drops the frame that's being pushed into Kinesis Video Streams with an error (`STATUS_STORE_OUT_OF_MEMORY = 0x5200002e`). For more information, see Error and Status Codes Returned by the Client Library (p. 84). This can also happen if the application acknowledgements (ACKs) are not available, or the persisted ACKs are delayed. In this case, the buffers fill to the "buffer duration" capacity before the older frames start dropping out.
Member Fields

- **version**: An integer value used to ensure that the correct version of the structure is used with the current version of the code base.

- **storageType**: A `DEVICE_STORAGE_TYPE` enumeration that specifies the underlying backing/implementation of the storage. Currently the only supported value is `DEVICE_STORAGE_TYPE_IN_MEM`. A future implementation will support `DEVICE_STORAGE_TYPE_HYBRID_FILE`, indicating that storage falls back to the file-backed content store.

- **storageSize**: The storage size in bytes to preallocate. The minimum allocation is 10 MB, and the maximum allocation is 10 GB. (This will change with the future implementation of the file-backed content store.)

- **spillRatio**: An integer value that represents the percentage of the storage to be allocated from the direct memory storage type (RAM), as opposed to the secondary overflow storage (file storage). Not currently used.

- **rootDirectory**: The path to the directory where the file-backed content store is located. Not currently used.

Kinesis Video Stream Structures

You can use the following structures to provide data to an instance of a Kinesis video stream.

**Topics**

- StreamDefinition/ StreamInfo (p. 109)
- ClientMetrics (p. 119)
- StreamMetrics (p. 120)

StreamDefinition/ StreamInfo

The `StreamDefinition` object in the C++ layer wraps the `StreamInfo` object in the platform-independent code, and provides some default values in the constructor.

**Member Fields**

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>stream_name</td>
<td>string</td>
<td>An optional stream name. For more information about the length of the stream name, see [Producer SDK Limits](p. 81). Each stream should have a unique name.</td>
<td>If no name is specified, a name is generated randomly.</td>
</tr>
<tr>
<td>retention_period</td>
<td>duration&lt;uint64_t, ratio&lt;3600&gt;&gt;</td>
<td>The retention period for the stream, in seconds. Specifying 0 indicates no retention.</td>
<td>3600 (One hour)</td>
</tr>
<tr>
<td>tags</td>
<td>const map&lt;string, string&gt;*</td>
<td>A map of key-value pairs that contain user information. If the</td>
<td>No tags</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
<td>Default Value</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>stream already has a set of tags, the new tags are appended to the existing set of tags.</td>
<td></td>
</tr>
<tr>
<td><strong>kms_key_id</strong></td>
<td>string</td>
<td>The AWS KMS key ID to be used for encrypting the stream. For more information, see Data Protection in Kinesis Video Streams (p. 30).</td>
<td>The default KMS key (aws/kinesis-video).</td>
</tr>
<tr>
<td><strong>streaming_type</strong></td>
<td>STREAMING_TYPE enumeration</td>
<td>The only supported value is STREAMING_TYPE_REALTIME.</td>
<td></td>
</tr>
<tr>
<td><strong>content_type</strong></td>
<td>string</td>
<td>The content format of the stream. The Kinesis Video Streams console can play back content in the video/h264 format.</td>
<td>video/h264</td>
</tr>
<tr>
<td><strong>max_latency</strong></td>
<td>duration&lt;uint64_t, milli&gt;</td>
<td>The maximum latency in milliseconds for the stream. The stream latency pressure callback (if specified) is called when the buffer duration exceeds this amount of time. Specifying 0 indicates that no stream latency pressure callback will be called.</td>
<td>milliseconds::zero()</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
<td>Default Value</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>fragment_duration</td>
<td>duration&lt;uint64_t&gt;</td>
<td>The fragment duration that you want, in seconds. This value is used in combination with the key_frame_fragmentation value. If this value is false, Kinesis Video Streams generates fragments on a key frame after this duration elapses. For example, an Advanced Audio Coding (AAC) audio stream has each frame as a key frame. Specifying key_frame_fragmentation = false causes fragmentation to happen on a key frame after this duration expires, resulting in 2-second fragments.</td>
<td>2</td>
</tr>
</tbody>
</table>
### Stream Structures

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>timecode_scale</strong></td>
<td>duration&lt;uint64_t, milli&gt;</td>
<td>The MKV timecode scale in milliseconds, which specifies the granularity of the timecodes for the frames within the MKV cluster. The MKV frame timecode is always relative to the start of the cluster. MKV uses a signed 16-bit value (0-32767) to represent the timecode within the cluster (fragment). Therefore, you should ensure that the frame timecode can be represented with the given timecode scale. The default timecode scale value of 1 ms ensures that the largest frame that can be represented is 32767 ms ≈ 32 seconds. This is over the maximum fragment duration that is specified in Kinesis Video Streams Limits (p. 170), which is 10 seconds.</td>
<td>1</td>
</tr>
<tr>
<td><strong>key_frame_fragmentation</strong></td>
<td>bool</td>
<td>Whether to produce fragments on a key frame. If true, the SDK produces a start of the fragment every time there is a key frame. If false, Kinesis Video Streams waits for at least fragment_duration and produces a new fragment on the key frame following it.</td>
<td>true</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
<td>Default Value</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>frame_timecodes</td>
<td>bool</td>
<td>Whether to use frame timecodes or generate timestamps using the current time callback. Many encoders don’t produce timestamps with the frames. So specifying <code>false</code> for this parameter ensures that the frames are timestamped as they are put into Kinesis Video Streams.</td>
<td>true</td>
</tr>
<tr>
<td>absolute_fragment_times</td>
<td>bool</td>
<td>Kinesis Video Streams uses MKV as its underlying packaging mechanism. The MKV specification is strict about frame timecodes being relative to the beginning of the cluster (fragment). However, the cluster timecodes can be either absolute or relative to the starting time for the stream. If the timestamps are relative, the <code>PutMedia</code> service API call uses the optional stream start timestamp and adjust the cluster timestamps. The service always stores the fragments with their absolute timestamps.</td>
<td>true</td>
</tr>
<tr>
<td>fragment_acks</td>
<td>bool</td>
<td>Whether to receive application level fragment ACKs (acknowledgements) or not.</td>
<td>true, meaning that the SDK will receive the ACKs and act accordingly.</td>
</tr>
<tr>
<td>restart_on_error</td>
<td>bool</td>
<td>Whether to restart on specific errors.</td>
<td>true, meaning that the SDK tries to restart the streaming if any errors occur.</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
<td>Default Value</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>recalculate_metrics</td>
<td>bool</td>
<td>Whether to recalculate the metrics. Each call to retrieve the metrics can recalculate those to get the latest &quot;running&quot; value, which might create a small CPU impact. You might need to set this to false on extremely low-power/footprint devices to spare the CPU cycles. Otherwise, it's not advised to use false for this value.</td>
<td>true</td>
</tr>
</tbody>
</table>
### Field

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>nal_adaptation_flags</td>
<td>uint32_t</td>
<td>Specifies the Network Abstraction Layer unit (NALU) adaptation flags. If the bitstream is H.264 encoded, it can then be processed as raw or packaged in NALUs. Those are either in the Annex-B or AVCC format. Most of the elementary stream producers/consumers (read encoders/decoders) use the Annex-B format because it has some advantages, such as error recovery. Higher-level systems use the AVCC format, which is the default format for MPEG, HLS, DASH, and so on. The console playback uses the browser's MSE (media source extensions) to decode and play back the stream that uses the AVCC format. For H.264 (and for M-JPEG and H.265), the SDK provides adaptation capabilities. Many elementary streams are in the following format. In this example, Ab is the Annex-B start code (001 or 0001).</td>
<td>The default is to adapt Annex-B format to AVCC format for both the frame data and for the codec private data.</td>
</tr>
</tbody>
</table>

In the case of H.264, the codec private data (CPD) is in the SPS (sequence parameter set) and PPS (picture parameter set) parameters, and it can:

\[
\text{Ab(Sps)Ab(Pps)Ab(I-frame)Ab(P/B-frame)Ab(P/B-frame)\ldots}
\]

### Example

- In the case of H.264, the codec private data (CPD) is in the SPS (sequence parameter set) and PPS (picture parameter set) parameters, and it can...
<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Rate</td>
<td>uint32_t</td>
<td>The expected frame rate. This value is used to better calculate buffering needs.</td>
<td>25</td>
</tr>
<tr>
<td>Avg Bandwidth BPS</td>
<td>uint32_t</td>
<td>The expected average bandwidth for the stream. This value is used to better calculate buffering needs.</td>
<td>4 * 1024 * 1024</td>
</tr>
</tbody>
</table>
### Field Structures

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
</table>
| buffer_duration | duration<
<p>| duration&lt;uint64_t&gt; | The stream buffer duration, in seconds. The SDK keeps the frames in the content store for up to the buffer_duration, after which the older frames are dropped as the window moves forward. If the frame that is being dropped has not been sent to the backend, the dropped frame callback is called. If the current buffer duration is greater than max_latency, then the stream latency pressure callback is called. The buffer is trimmed to the next fragment start when the fragment persisted ACK is received. This indicates that the content has been durably persisted in the cloud, so storing the content on the local device is no longer needed. | 120           |</p>
<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>replay_duration</td>
<td>duration&lt;uint64_t&gt;</td>
<td>The duration to roll the current reader backward to replay during an error if restarting is enabled, in seconds. The rollback stops at the buffer start (in case it has just started streaming or the persisted ACK has come along). The rollback tries to land on a key frame that indicates a fragment start. If the error that is causing the restart is not indicative of a dead host (that is, the host is still alive and contains the frame data in its internal buffers), the rollback stops at the last received ACK frame. It then rolls forward to the next key frame, because the entire fragment is already stored in the host memory.</td>
<td>40</td>
</tr>
<tr>
<td>connection_staleness</td>
<td>duration&lt;uint64_t&gt;</td>
<td>The time, in seconds, after which the stream staleness callback is called if the SDK does not receive the buffering ACK. It indicates that the frames are being sent from the device, but the backend is not acknowledging them. This condition indicates a severed connection at the intermediate hop or at the load balancer.</td>
<td>30</td>
</tr>
<tr>
<td>codec_id</td>
<td>string</td>
<td>The codec ID for the MKV track.</td>
<td>V_MPEG4/ISO/AVC</td>
</tr>
<tr>
<td>track_name</td>
<td>string</td>
<td>The MKV track name.</td>
<td>kinesis_video</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
<td>Default Value</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>codecPrivateData</td>
<td>unsigned char*</td>
<td>The codec private data (CPD) buffer. If the media pipeline has the information about the CPD before the stream starts, it can be set in StreamDefinition.codecPrivateData. The bits are copied, and the buffer can be reused or freed after the call to create the stream. However, if the data is not available when the stream is created, it can be set in one of the overloads of the KinesisVideoStream.start(cpd) function.</td>
<td>null</td>
</tr>
<tr>
<td>codecPrivateDataSize</td>
<td>uint32_t</td>
<td>The codec private data buffer size.</td>
<td>0</td>
</tr>
</tbody>
</table>

**ClientMetrics**

The **ClientMetrics** object is filled by calling getKinesisVideoMetrics.

**Member Fields**

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>version</td>
<td>UINT32</td>
<td>The version of the structure, defined in the CLIENT_METRICS_CURRENT_VERSION macro.</td>
</tr>
<tr>
<td>contentStoreSize</td>
<td>UINT64</td>
<td>The overall content store size in bytes. This is the value specified in DeviceInfo.StorageInfo.storageSize.</td>
</tr>
<tr>
<td>contentStoreAvailableSize</td>
<td>UINT64</td>
<td>Currently available storage size in bytes.</td>
</tr>
<tr>
<td>contentStoreAllocatedSize</td>
<td>UINT64</td>
<td>Currently allocated size. The allocated plus the available sizes should be slightly smaller than the overall storage size, due to the internal bookkeeping and the implementation of the content store.</td>
</tr>
<tr>
<td>totalContentViewsSize</td>
<td>UINT64</td>
<td>The size of the memory allocated for all content views</td>
</tr>
</tbody>
</table>
**Field** | **Data Type** | **Description**
--- | --- | ---
| | | for all streams. This is not counted against the storage size. This memory is allocated using the MEMALLOC macro, which can be overwritten to provide a custom allocator.

| totalFrameRate | UINT64 | The total observed frame rate across all the streams.
| totalTransferRate | UINT64 | The total observed stream rate in bytes per second across all the streams.

**StreamMetrics**

The **StreamMetrics** object is filled by calling `getKinesisVideoMetrics`.

**Member Fields**

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>version</td>
<td>UINT32</td>
<td>The version of the structure, defined in the STREAM_METRICS_CURRENT_VERSION macro.</td>
</tr>
<tr>
<td>currentViewDuration</td>
<td>UINT64</td>
<td>The duration of the accumulated frames. In the fast networking case, this duration is either 0 or the frame duration (as the frame is being transmitted). If the duration becomes longer than the max_latency specified in the StreamDefinition, the stream latency callback is called if it is specified. The duration is specified in 100 ns units, which is the default time unit for the PIC layer.</td>
</tr>
<tr>
<td>overallViewDuration</td>
<td>UINT64</td>
<td>The overall view duration. If the stream is configured with no ACKs or persistence, this value grows as the frames are put into the Kinesis video stream and becomes equal to the buffer_duration in the StreamDefinition. When ACKs are enabled and the persisted ACK is received, the buffer is trimmed to the next key frame, because the ACK timestamp indicates</td>
</tr>
</tbody>
</table>
### Field Data Type Description

<table>
<thead>
<tr>
<th>Field</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>the beginning of the entire fragment. The duration is specified in 100-ns units, which is the default time unit for the PIC layer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>currentViewSize</td>
<td>UINT64</td>
<td>The size in bytes of the current buffer.</td>
</tr>
<tr>
<td>overallViewSize</td>
<td>UINT64</td>
<td>The overall view size in bytes.</td>
</tr>
<tr>
<td>currentFrameRate</td>
<td>UINT64</td>
<td>The observed frame rate for the current stream.</td>
</tr>
<tr>
<td>currentTransferRate</td>
<td>UINT64</td>
<td>The observed transfer rate in bytes per second for the current stream.</td>
</tr>
</tbody>
</table>

### Producer SDK Callbacks

The classes and methods in the Amazon Kinesis Video Streams Producer SDK do not maintain their own processes. Instead, they use the incoming function calls and events to schedule callbacks to communicate with the application.

There are two callback patterns that the application can use to interact with the SDK:

- **CallbackProvider**: This object exposes every callback from the platform-independent code (PIC) component to the application. This pattern allows full functionality, but it also means that the implementation must handle all of the public API methods and signatures in the C++ layer.
- **StreamCallbackProvider (p. 122) and ClientCallbackProvider (p. 122)**: These objects expose the stream-specific and client-specific callbacks, and the C++ layer of the SDK exposes the rest of the callbacks. This is the preferred callback pattern for interacting with the Producer SDK.

The following diagram illustrates the object model of the callback objects:

![Object Model Diagram]

In the preceding diagram, DefaultCallbackProvider derives from CallbackProvider (which exposes all of the callbacks in the PIC) and contains StreamCallbackProvider and ClientCallbackProvider.

**This topic contains the following sections:**

- [ClientCallbackProvider (p. 122)]
- [StreamCallbackProvider (p. 122)]
ClientCallbackProvider

The ClientCallbackProvider object exposes client-level callback functions. The details of the functions are described in the ClientCallbacks (p. 122) section.

Callback methods:

- getClientReadyCallback: Reports a ready state for the client.
- getStorageOverflowPressureCallback: Reports storage overflow or pressure. This callback is called when the storage utilization drops below the STORAGE_PRESSURE_NOTIFICATION_THRESHOLD value, which is 5 percent of the overall storage size. For more information, see StorageInfo (p. 108).

StreamCallbackProvider

The StreamCallbackProvider object exposes stream-level callback functions.

Callback methods:

- getDroppedFragmentReportCallback: Reports a dropped fragment.
- getDroppedFrameReportCallback: Reports a dropped frame.
- getFragmentAckReceivedCallback: Reports that a fragment ACK is received for the stream.
- getStreamClosedCallback: Reports a stream closed condition.
- getStreamConnectionStaleCallback: Reports a stale connection condition. In this condition, the producer is sending data to the service but is not receiving acknowledgements.
- getStreamDataAvailableCallback: Reports that data is available in the stream.
- getStreamErrorReportCallback: Reports a stream error condition.
- getStreamLatencyPressureCallback: Reports a stream latency condition, which is when the accumulated buffer size is larger than the max_latency value. For more information, see StreamDefinition/ StreamInfo (p. 109).
- getStreamReadyCallback: Reports a stream ready condition.
- getStreamUnderflowReportCallback: Reports a stream underflow condition. This function is not currently used and is reserved for future use.

For the source code for StreamCallbackProvider, see StreamCallbackProvider.h.

ClientCallbacks Structure

The ClientCallbacks structure contains the callback function entry points that the PIC calls when specific events occur. The structure also contains version information in the CALLBACKS_CURRENT_VERSION field, and a customData field for user-defined data that is returned with the individual callback functions.

The client application can use a this pointer for the custom_data field to map member functions to the static ClientCallback functions at runtime, as shown in the following code example:

```c
STATUS TestStreamCallbackProvider::streamClosedHandler(UINT64 custom_data, STREAM_HANDLE stream_handle, UINT64 stream_upload_handle) {
    LOG_INFO("Reporting stream stopped.");
}
```
TestStreamCallbackProvider* streamCallbackProvider =
reinterpret_cast<TestStreamCallbackProvider*>(custom_data);
streamCallbackProvider->streamClosedHandler(...);

## Events

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreateDeviceFunc</td>
<td>Not currently implemented on the backend. This call fails when called from Java or C++. Other clients perform platform-specific initialization.</td>
<td>Backend API</td>
</tr>
<tr>
<td>CreateStreamFunc</td>
<td>Called when the stream is created.</td>
<td>Backend API</td>
</tr>
<tr>
<td>DescribeStreamFunc</td>
<td>Called when DescribeStream is called.</td>
<td>Backend API</td>
</tr>
<tr>
<td>GetStreamingEndpointFunc</td>
<td>Called when GetStreamingEndpoint is called.</td>
<td>Backend API</td>
</tr>
<tr>
<td>GetStreamingTokenFunc</td>
<td>Called when GetStreamingToken is called.</td>
<td>Backend API</td>
</tr>
<tr>
<td>PutStreamFunc</td>
<td>Called when PutStream is called.</td>
<td>Backend API</td>
</tr>
<tr>
<td>TagResourceFunc</td>
<td>Called when TagResource is called.</td>
<td>Backend API</td>
</tr>
<tr>
<td>CreateMutexFunc</td>
<td>Creates a synchronization mutex.</td>
<td>Synchronization</td>
</tr>
<tr>
<td>FreeMutexFunc</td>
<td>Frees the mutex.</td>
<td>Synchronization</td>
</tr>
<tr>
<td>LockMutexFunc</td>
<td>Locks the synchronization mutex.</td>
<td>Synchronization</td>
</tr>
<tr>
<td>TryLockMutexFunc</td>
<td>Tries to lock the mutex. Not currently implemented.</td>
<td>Synchronization</td>
</tr>
<tr>
<td>UnlockMutexFunc</td>
<td>Unlocks the mutex.</td>
<td>Synchronization</td>
</tr>
<tr>
<td>ClientReadyFunc</td>
<td>Called when the client enters a ready state.</td>
<td>Notification</td>
</tr>
<tr>
<td>DroppedFrameReportFunc</td>
<td>Reports when a frame is dropped.</td>
<td>Notification</td>
</tr>
<tr>
<td>DroppedFragmentReportFunc</td>
<td>Reports when a fragment is dropped. This function is not currently used and is reserved for future use.</td>
<td>Notification</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
<td>Type</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>FragmentAckReceivedFunc</td>
<td>Called when a fragment ACK (buffering, received, persisted, and error) is received.</td>
<td>Notification</td>
</tr>
<tr>
<td>StorageOverflowPressureFunc</td>
<td>Called when the storage utilization drops below the STORAGE_PRESSURE_NOTIFICATION_THRESHOLD value, which is defined as 5 percent of the overall storage size.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamClosedFunc</td>
<td>Called when the last bits of the remaining frames are streamed.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamConnectionStaleFunc</td>
<td>Called when the stream enters a stale connection state. In this condition, the producer is sending data to the service but is not receiving acknowledgements.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamDataAvailableFunc</td>
<td>Called when stream data is available.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamErrorReportFunc</td>
<td>Called when a stream error occurs. The PIC automatically closes the stream under this condition.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamLatencyPressureFunc</td>
<td>Called when the stream enters a latency condition, which is when the accumulated buffer size is larger than the max_latency value. For more information, see StreamDefinition/StreamInfo (p. 109).</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamReadyFunc</td>
<td>Called when the stream enters the ready state.</td>
<td>Notification</td>
</tr>
<tr>
<td>StreamUnderflowReportFunc</td>
<td>This function is not currently used and is reserved for future use.</td>
<td>Notification</td>
</tr>
<tr>
<td>DeviceCertToTokenFunc</td>
<td>Returns the connection certificate as a token.</td>
<td>Platform integration</td>
</tr>
<tr>
<td>GetCurrentTimeFunc</td>
<td>Returns the current time.</td>
<td>Platform integration</td>
</tr>
<tr>
<td>GetDeviceCertificateFunc</td>
<td>Returns the device certificate. This function is not currently used and is reserved for future use.</td>
<td>Platform integration</td>
</tr>
</tbody>
</table>
### Callback Implementations to Retry Streaming

The Kinesis Video Producer SDK provides the status of streaming through callback functions. It is recommended that you implement the following callback mechanisms to recover from any momentary network issues encountered during streaming.

- **Stream latency pressure callback** - this callback mechanism gets triggered when the SDK encounters a stream latency condition. This happens when the accumulated buffer size is larger than the MAX_LATENCY value. When the stream is created, the streaming application sets MAX_LATENCY to the default value of 60 seconds. The typical implementation for this callback is to reset the connection. You can use the sample implementation at https://github.com/awslabs/amazon-
• **Stream staleness callback** - this callback gets triggered when the producer can send data to the AWS KVS service (uplink) but it's not able to get the acknowledgements (buffered ACK) back in time (default is 60 seconds). Depending on the network settings, either the stream latency pressure callback or the stream staleness callback, or both can get triggered. Similar to the stream latency pressure callback retry implementation, the typical implementation is to reset the connection and start a new connection for streaming. You can use the sample implementation at [https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp/blob/master/kinesis-video-gst-demo/kinesis_video_gstreamer_sample_app.cpp#L1023](https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp/blob/master/kinesis-video-gst-demo/kinesis_video_gstreamer_sample_app.cpp#L1023) as needed.

• **Stream error callback** - this callback gets triggered when the SDK encounters a timeout on the network connection or other errors during the call to the KVS API service calls. To recover from network timeout errors, you can refer to and use the sample implementation for recreating the stream at [https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp/blob/master/kinesis-video-gst-demo/kinesis_video_gstreamer_sample_app.cpp#L1023](https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-cpp/blob/master/kinesis-video-gst-demo/kinesis_video_gstreamer_sample_app.cpp#L1023)

• **Dropped frame callback** - this callback gets triggered when the storage size is full either due to slow network speed or a stream error. If the network speed results in dropped frames, then you can either increase the storage size, reduce the video frame size or frame rate to match the network speed.
Kinesis Video Stream Parser Library

The Kinesis Video Stream Parser Library is an easy-to-use set of tools you can use in Java applications to consume the MKV data in a Kinesis video stream.

The library includes the following tools:

- **StreamingMkvReader (p. 128):** This class reads specified MKV elements from a video stream.
- **FragmentMetadataVisitor (p. 129):** This class retrieves metadata for fragments (media elements) and tracks (individual data streams containing media information, such as audio or subtitles).
- **OutputSegmentMerger (p. 130):** This class merges consecutive fragments or chunks in a video stream.
- **KinesisVideoExample (p. 131):** This is a sample application that shows how to use the Kinesis Video Stream Parser Library.

The library also includes tests that show how the tools are used.

Procedure: Using the Kinesis Video Stream Parser Library

This procedure includes the following steps:

- the section called “Step 1: Download and Configure the Code” (p. 128)
- the section called “Step 2: Write and Examine the Code” (p. 128)
- the section called “Step 3: Run and Verify the Code” (p. 133)

Prerequisites

You must have the following to examine and use the Kinesis Video Stream Parser Library:

- An Amazon Web Services (AWS) account. If you don't already have an AWS account, do the following:
  - Open [https://aws.amazon.com/](https://aws.amazon.com/), and then choose Create an AWS Account.
  - Note: This might be unavailable in your browser if you previously signed in to the AWS Management Console. In that case, choose Sign In to the Console, and then choose Create a new AWS account.
  - Follow the online instructions.
  - Part of the sign-up procedure involves receiving a phone call and entering a PIN using the phone keypad.
  - Note your AWS account ID because you need it for configuring programmatic access to Kinesis video streams.
• A Java integrated development environment (IDE), such as Eclipse Java Neon or JetBrains IntelliJ Idea.

Step 1: Download and Configure the Code

In this section, you download the Java library and test code, and import the project into your Java IDE.

For prerequisites and other details about this procedure, see Stream Parser Library (p. 127).

1. Create a directory and clone the library source code from the GitHub repository (https://github.com/aws/amazon-kinesis-video-streams-parser-library).

   
   # git clone https://github.com/aws/amazon-kinesis-video-streams-parser-library

2. Open the Java IDE that you are using (for example, Eclipse or IntelliJ IDEA) and import the Apache Maven project that you downloaded:

   • In Eclipse: Choose File, Import, Maven, Existing Maven Projects, and navigate to the kinesis-video-streams-parser-lib folder.
   • In IntelliJ Idea: Choose Import. Navigate to the pom.xml file in the root of the downloaded package.

   For more information, see the related IDE documentation.

   Next Step

   the section called “Step 2: Write and Examine the Code” (p. 128)

Step 2: Write and Examine the Code

In this section, you examine the Java library and test code, and learn how to use the tools from the library in your own code.

The Kinesis Video Stream Parser Library contains the following tools:

• StreamingMkvReader (p. 128)
• FragmentMetadataVisitor (p. 129)
• OutputSegmentMerger (p. 130)
• KinesisVideoExample (p. 131)

StreamingMkvReader

This class reads specified MKV elements from a stream in a non-blocking way.

The following code example (from FragmentMetadataVisitorTest) shows how to create and use a Streaming MkvReader to retrieve MkvElement objects from an input stream called inputStream:

```java
StreamingMkvReader mkvStreamReader = StreamingMkvReader.createDefault(new InputStreamParserByteSource(inputStream));
```
while (mkvStreamReader.mightHaveNext()) {
    Optional<MkvElement> mkvElement = mkvStreamReader.nextIfAvailable();
    if (mkvElement.isPresent()) {
        mkvElement.get().accept(fragmentVisitor);
        ...
    }
}

FragmentMetadataVisitor

This class retrieves metadata for fragments (media elements) and tracks (individual data streams
containing media information, such as codec private data, pixel width, or pixel height).

The following code example (from the FragmentMetadataVisitorTest file) shows how to use
FragmentMetadataVisitor to retrieve data from a MkvElement object:

```java
FragmentMetadataVisitor fragmentVisitor = FragmentMetadataVisitor.create();
StreamingMkvReader mkvStreamReader =
    StreamingMkvReader.createDefault(new InputStreamParserByteSource(in));
int segmentCount = 0;
while(mkvStreamReader.mightHaveNext()) {
    Optional<MkvElement> mkvElement = mkvStreamReader.nextIfAvailable();
    if (mkvElement.isPresent()) {
        mkvElement.get().accept(fragmentVisitor);
        if (MkvTypeInfos.SIMPLEBLOCK.equals(mkvElement.get().getElementMetaData().getTypeInfo())) {
            MkvDataElement dataElement = (MkvDataElement) mkvElement.get();
            Frame frame = ((MkvValue<Frame>)dataElement.getValueCopy()).getVal();
            MkvTrackMetadata trackMetadata =
                fragmentVisitor.getMkvTrackMetadata(frame.getTrackNumber());
            assertTrackAndFragmentInfo(fragmentVisitor, frame, trackMetadata);
        }
        if (MkvTypeInfos.SEGMENT.equals(mkvElement.get().getElementMetaData().getTypeInfo())) {
            if (mkvElement.get() instanceof MkvEndMasterElement) {
                if (segmentCount < continuationTokens.size()) {
                    Optional<String> continuationToken =
                        fragmentVisitor.getContinuationToken();
                    Assert.assertTrue(continuationToken.isPresent());
                    Assert.assertEquals(continuationTokens.get(segmentCount),
                                continuationToken.get());
                    segmentCount++;
                }
            }
        }
    }
}
```

The preceding example shows the following coding pattern:

- Create a FragmentMetadataVisitor to parse the data, and a StreamingMkvReader (p. 128) to
  provide the data.
- For each MkvElement in the stream, test if its metadata is of type SIMPLEBLOCK.
- If it is, retrieve the MkvDataElement from the MkvElement.
- Retrieve the Frame (media data) from the MkvDataElement.
- Retrieve the MkvTrackMetadata for the Frame from the FragmentMetadataVisitor.
- Retrieve and verify the following data from the Frame and MkvTrackMetadata objects:
• The track number.
• The frame's pixel height.
• The frame's pixel width.
• The codec ID for the codec used to encode the frame.
• That this frame arrived in order. That is, verify that the track number of the previous frame, if present, is less than that of the current frame.

To use FragmentMetadataVisitor in your project, pass MkvElement objects to the visitor using their accept method:

```java
mkvElement.get().accept(fragmentVisitor);
```

### OutputSegmentMerger

This class merges metadata from different tracks in the stream into a stream with a single segment.

The following code example (from the FragmentMetadataVisitorTest file) shows how to use OutputSegmentMerger to merge track metadata from a byte array called `inputBytes`:

```java
FragmentMetadataVisitor fragmentVisitor = FragmentMetadataVisitor.create();
ByteArrayOutputStream outputStream = new ByteArrayOutputStream();
OutputSegmentMerger outputSegmentMerger =
    OutputSegmentMerger.createDefault(outputStream);
CompositeMkvElementVisitor compositeVisitor =
    new TestCompositeVisitor(fragmentVisitor, outputSegmentMerger);
final InputStream in = TestResourceUtil.getTestInputStream("output_get_media.mkv");
StreamingMkvReader mkvStreamReader =
    StreamingMkvReader.createDefault(new InputStreamParserByteSource(in));
while (mkvStreamReader.mightHaveNext()) {
    Optional<MkvElement> mkvElement = mkvStreamReader.nextIfAvailable();
    if (mkvElement.isPresent()) {
        mkvElement.get().accept(compositeVisitor);
        if (MkvTypeInfos.SIMPLEBLOCK.equals(mkvElement.get().getElementMetaData().getTypeInfo())) {
            MkvDataElement dataElement = (MkvDataElement) mkvElement.get();
            Frame frame = ((MkvValue<Frame>) dataElement.getValueCopy()).getVal();
            Assert.assertTrue(frame.getFrameData().limit() > 0);
            MkvTrackMetadata trackMetadata =
                fragmentVisitor.getMkvTrackMetadata(frame.getTrackNumber());
            assertTrackAndFragmentInfo(fragmentVisitor, frame, trackMetadata);
        }
    }
}
```

The preceding example shows the following coding pattern:

• Create a FragmentMetadataVisitor (p. 129) to retrieve the metadata from the stream.
• Create an output stream to receive the merged metadata.
• Create an OutputSegmentMerger, passing in the ByteArrayOutputStream.
• Create a CompositeMkvElementVisitor that contains the two visitors.
• Create an InputStream that points to the specified file.
• Merge each element in the input data into the output stream.

KinesisVideoExample

This is a sample application that shows how to use the Kinesis Video Stream Parser Library.

This class performs the following operations:

• Creates a Kinesis video stream. If a stream with the given name already exists, the stream is deleted and recreated.
• Calls PutMedia to stream video fragments to the Kinesis video stream.
• Calls GetMedia to stream video fragments out of the Kinesis video stream.
• Uses a StreamingMkvReader (p. 128) to parse the returned fragments on the stream, and uses a FragmentMetadataVisitor (p. 129) to log the fragments.

Delete and recreate the stream

The following code example (from the StreamOps.java file) deletes a given Kinesis video stream:

```java
//Delete the stream
amazonKinesisVideo.deleteStream(new DeleteStreamRequest().withStreamARN(streamInfo.get().getStreamARN()));
```

The following code example (from the StreamOps.java file) creates a Kinesis video stream with the specified name:

```java
amazonKinesisVideo.createStream(new CreateStreamRequest().withStreamName(streamName)
    .withDataRetentionInHours(DATA_RETENTION_IN_HOURS)
    .withMediaType("video/h264"));
```

Call PutMedia

The following code example (from the PutMediaWorker.java file) calls PutMedia on the stream:

```java
putMedia.putMedia(new PutMediaRequest().withStreamName(streamName)
    .withFragmentTimecodeType(FragmentTimecodeType.RELATIVE)
    .withProducerStartTimestamp(new Date())
    .withPayload(inputStream), new PutMediaAckResponseHandler() {
    ...
});
```

Call GetMedia

The following code example (from the GetMediaWorker.java file) calls GetMedia on the stream:

```java
GetMediaResult result = videoMedia.getMedia(new GetMediaRequest().withStreamName(streamName).withStartSelector(startSelector));
```

Parse the GetMedia result

This section describes how to use StreamingMkvReader (p. 128), FragmentMetadataVisitor (p. 129) and CompositeMkvElementVisitor to parse, save to file, and log the data returned from GetMedia.
Read the output of GetMedia with StreamingMkvReader

The following code example (from the GetMediaWorker.java file) creates a StreamingMkvReader (p. 128) and uses it to parse the result from the GetMedia operation:

```java
StreamingMkvReader mkvStreamReader = StreamingMkvReader.createDefault(new
    InputStreamParserByteSource(result.getPayload()));
log.info("StreamingMkvReader created for stream {} ", streamName);
try {
    mkvStreamReader.apply(this.elementVisitor);
} catch (MkvElementVisitException e) {
    log.error("Exception while accepting visitor ", e);
}
```

In the preceding code example, the StreamingMkvReader (p. 128) retrieves MKVElement objects from the payload of the GetMedia result. In the next section, the elements are passed to a FragmentMetadataVisitor (p. 129).

Retrieve Fragments with FragmentMetadataVisitor

The following code examples (from the KinesisVideoExample.java and StreamingMkvReader.java files) create a FragmentMetadataVisitor (p. 129). The MkvElement objects iterated by the StreamingMkvReader (p. 128) are then passed to the visitor using the accept method.

```java
FragmentMetadataVisitor fragmentMetadataVisitor = FragmentMetadataVisitor.create();
```

```java
if (mkvElementOptional.isPresent()) {
    //Apply the MkvElement to the visitor
    mkvElementOptional.get().accept(elementVisitor);
}
```

Log the elements and write them to a file

The following code example (from the KinesisVideoExample.java file) creates the following objects and returns them as part of the return value of the GetMediaProcessingArguments function:

- A LogVisitor (an extension of MkvElementVisitor) that writes to the system log.
- An OutputStream that writes the incoming data to an MKV file.
- A BufferedOutputStream that buffers data bound for the OutputStream.
- An the section called “OutputSegmentMerger” (p. 130) that merges consecutive elements in the GetMedia result with the same track and EBML data.
- A CompositeMkvElementVisitor that composes the FragmentMetadataVisitor (p. 129), the section called “OutputSegmentMerger” (p. 130), and LogVisitor into a single element visitor

```java
//A visitor used to log as the GetMedia stream is processed.
LogVisitor logVisitor = new LogVisitor(fragmentMetadataVisitor);
```
// An OutputSegmentMerger to combine multiple segments that share track and ebml
// metadata into one
OutputStream fileOutputStream =
Files.newOutputStream(Paths.get("kinesis_video_example_merged_output2.mkv"),
    StandardOpenOption.WRITE, StandardOpenOption.CREATE);
BufferedOutputStream outputStream = new BufferedOutputStream(fileOutputStream);
OutputSegmentMerger outputSegmentMerger =
OutputSegmentMerger.createDefault(outputStream);

// A composite visitor to encapsulate the three visitors.
CompositeMkvElementVisitor mkvElementVisitor =
    new CompositeMkvElementVisitor(fragmentMetadataVisitor, outputSegmentMerger,
        logVisitor);
return new GetMediaProcessingArguments(outputStream, logVisitor, mkvElementVisitor);

The media processing arguments are then passed into the GetMediaWorker, which is in turn passed to
the ExecutorService which executes the worker on a separate thread:

GetMediaWorker getMediaWorker = GetMediaWorker.create(getRegion(),
    getCredentialsProvider(),
    getStreamName(),
    new StartSelector().withStartSelectorType(StartSelectorType.EARLIEST),
    amazonKinesisVideo,
    getMediaProcessingArgumentsLocal.getMkvElementVisitor());
executorService.submit(getMediaWorker);
Amazon Kinesis Video Streams Examples

The following code examples demonstrate how to work with the Kinesis Video Streams API:

Examples: Sending Data to Kinesis Video Streams

- **Example: Kinesis Video Streams Producer SDK GStreamer Plugin (p. 135):** Shows how to build the Kinesis Video Streams Producer SDK to use as a GStreamer destination.
- **Run the GStreamer Element in a Docker Container (p. 139):** Shows how to use a pre-built Docker image for sending RTSP video from an IP camera to Kinesis Video Streams.
- **Example: Streaming from an RTSP Source (p. 147):** Shows how to build your own Docker image and send RTSP video from an IP camera to Kinesis Video Streams.
- **Example: Sending Data to Kinesis Video Streams Using the PutMedia API (p. 144):** Shows how to use the Using the Java Producer Library (p. 47) to send data to Kinesis Video Streams that is already in a container format (MKV) using the PutMedia API.

Examples: Retrieving Data from Kinesis Video Streams

- **KinesisVideoExample (p. 131):** Shows how to parse and log video fragments using the Kinesis Video Streams Parser Library.
- **Example: Parsing and Rendering Kinesis Video Streams Fragments (p. 148):** Shows how to parse and render Kinesis video stream fragments using JCodec and JFrame.
- **the section called “Amazon SageMaker” (p. 150):** Demonstrates a solution that uses Amazon SageMaker to determine when certain objects appear in a video stream.

Examples: Playing Back Video Data

- **Example: Using HLS in HTML and JavaScript (p. 10):** Shows how to retrieve an HLS streaming session for a Kinesis video stream and play it back in a webpage.

Prerequisites

- In the sample code, you provide credentials by specifying a profile that you set in your AWS credentials profile file, or by providing credentials in the Java system properties of your integrated development environment (IDE). So if you haven't already done so, first set up your credentials. For more information, see Set up AWS Credentials and Region for Development.
- We recommend that you use a Java IDE to view and run the code, such as one of the following:
  - Eclipse Java Neon
Example: Kinesis Video Streams Producer SDK GStreamer Plugin

This topic shows how to build the Amazon Kinesis Video Streams Producer SDK to use as a GStreamer plugin.

Topics
- Download, Build, and Configure the GStreamer Element (p. 136)
- Run the GStreamer Element (p. 136)
- Example GStreamer Launch Commands (p. 137)
- Run the GStreamer Element in a Docker Container (p. 139)
- GStreamer Element Parameter Reference (p. 141)

GStreamer is a popular media framework used by a multitude of cameras and video sources to create custom media pipelines by combining modular plugins. The Kinesis Video Streams GStreamer plugin greatly simplifies the integration of your existing GStreamer media pipeline with Kinesis Video Streams. After integrating GStreamer, you can get started with streaming video from a webcam or RTSP (Real Time Streaming Protocol) camera to Kinesis Video Streams for real-time or later playback, storage, and further analysis.

The GStreamer plugin automatically manages the transfer of your video stream to Kinesis Video Streams by encapsulating the functionality provided by the Kinesis Video Streams Producer SDK in a GStreamer sink element, kvssink. The GStreamer framework provides a standard managed environment for constructing media flow from a device such as a camera or other video source for further processing, rendering, or storage.

The GStreamer pipeline typically consists of the link between a source (video camera) and the sink element (either a player to render the video, or storage for offline retrieval). In this example, you use the Producer SDK element as a sink, or media destination, for your video source (webcam or IP camera). The plugin element that encapsulates the SDK then manages sending the video stream to Kinesis Video Streams.

This topic shows how to construct a GStreamer media pipeline capable of streaming video from a video source, such as a web camera or RTSP stream, typically connected through intermediate encoding stages (using H.264 encoding) to Kinesis Video Streams. When your video stream is available as a Kinesis video stream, you can use the Kinesis Video Stream Parser Library for further processing, playback, storage, or analysis of your video stream.
Download, Build, and Configure the GStreamer Element

The GStreamer Plugin example is included with the Kinesis Video Streams C++ Producer SDK. For information about SDK prerequisites and downloading, see Step 1: Download and Configure the C++ Producer Library Code (p. 59).

To build the Producer SDK GStreamer sink as a dynamic library on macOS, Ubuntu, Raspberry Pi, or Windows, execute the following command in the kinesis-video-native-build directory:

```bash
./gstreamer-plugin-install-script
```

After the sink is built, you can execute `gst-launch-1.0` from the following directory:

```bash
<YourSdkFolderPath>/kinesis-video-native-build/downloads/local/bin
```

You can either run `gst-launch-1.0` from this directory, or add it to the `PATH` environment variable:

```bash
$ export PATH=<YourSdkFolderPath>/kinesis-video-native-build/downloads/local/bin:$PATH
```

Add the library directory to your path so that the GStreamer plugin can be found:

```bash
export GST_PLUGIN_PATH=<YourSdkFolderPath>/kinesis-video-native-build/downloads/local/lib:
#GST_PLUGIN_PATH
```

Set the library path for the SDK:

```bash
export LD_LIBRARY_PATH=<YourSdkFolderPath>/kinesis-video-native-build/downloads/local/lib
```

Run the GStreamer Element

To run GStreamer with the Kinesis Video Streams Producer SDK element as a sink, execute the `gst-launch-1.0` command. Use settings that are appropriate for the GStreamer plugin to use—for example, `v4l2src` for v4l2 devices on Linux systems, or `rtspsrc` for RTSP devices. Specify `kvssink` as the sink (final destination of the pipeline) to send video to the Producer SDK.

The `kvssink` element has the following required parameters:

- **stream-name**: The name of the destination Kinesis video stream.
- **storage-size**: The storage size of the device in kilobytes. For information about configuring device storage, see StoragentInfo (p. 108).
- **access-key**: The AWS access key that is used to access Kinesis Video Streams. You must provide either this parameter or `credential-path`.
- **secret-key**: The AWS secret key that is used to access Kinesis Video Streams. You must provide either this parameter or `credential-path`.
- **credential-path**: A path to a file containing your credentials for accessing Kinesis Video Streams. For example credential files, see Sample Static Credential and Sample Rotating Credential. For more information on rotating credentials, see Managing Access Keys for IAM Users. You must provide either this parameter or `access-key` and `secret-key`.

For information about `kvssink` optional parameters, see GStreamer Element Parameter Reference (p. 141).
For the latest information about GStreamer plugins and parameters, see GStreamer Plugins, or execute the following command to list options:

```
gst-inspect-1.0 kvssink
```

### Example GStreamer Launch Commands

These examples demonstrate how to use a GStreamer plugin to stream video from different types of devices.

#### Example 1: Stream Video from an RTSP Camera on Ubuntu

The following command creates a GStreamer pipeline on Ubuntu that streams from a network RTSP camera, using the `rtspsrc` GStreamer plugin:

```
$ gst-launch-1.0 rtspsrc location="rtsp://YourCameraRtspUrl" short-header=TRUE ! rtph264depay ! video/x-h264, format=avc,alignment=au ! kvssink stream-name="YourStreamName" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

#### Example 2: Encode and Stream Video from a USB Camera on Ubuntu

The following command creates a GStreamer pipeline on Ubuntu that encodes the stream from a USB camera in H.264 format, and streams it to Kinesis Video Streams. This example uses the `v4l2src` GStreamer plugin.

```
$ gst-launch-1.0 v4l2src do-timestamp=TRUE device=/dev/video0 ! videoconvert ! video/x-raw,format=I420,width=640,height=480,framerate=30/1 ! x264enc bframes=0 key-int-max=45 bitrate=500 ! video/x-h264,stream-format=avc,alignment=au,profile=baseline ! kvssink stream-name="YourStreamName" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

#### Example 3: Stream Pre-Encoded Video from a USB Camera on Ubuntu

The following command creates a GStreamer pipeline on Ubuntu that streams video that the camera has already encoded in H.264 format to Kinesis Video Streams. This example uses the `v4l2src` GStreamer plugin.

```
$ gst-launch-1.0 v4l2src do-timestamp=TRUE device=/dev/video0 ! h264parse ! video/x-h264,stream-format=avc,alignment=au ! kvssink stream-name="plugin" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

#### Example 4: Stream Video from a Network Camera on macOS

The following command creates a GStreamer pipeline on macOS that streams video to Kinesis Video Streams from a network camera. This example uses the `rtspsrc` GStreamer plugin.

```
$ gst-launch-1.0 rtspsrc location="rtsp://YourCameraRtspUrl" short-header=TRUE ! rtph264depay ! video/x-h264, format=avc,alignment=au ! kvssink stream-
```
name="YourStreamName" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"

Example 5: Stream Video from a Network Camera on Windows

The following command creates a GStreamer pipeline on Windows that streams video to Kinesis Video Streams from a network camera. This example uses the rtspsrc GStreamer plugin.

```
$ gst-launch-1.0 rtspsrc location="rtsp://YourCameraRtspUrl" short-header=TRUE ! rtph264depay ! video/x-h264, format=avc,alignment=au ! kvssink stream-name="YourStreamName" storage-size=512 access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

Example 6: Stream Video from a Camera on Raspberry Pi

The following command creates a GStreamer pipeline on Raspberry Pi that streams video to Kinesis Video Streams. This example uses the v4l2src GStreamer plugin.

```
$ gst-launch-1.0 v4l2src do-timestamp=TRUE device=/dev/video0 ! videoconvert ! video/x-raw,format=I420,width=640,height=480,framerate=30/1 ! omxh264enc control-rate=1 target-bitrate=5120000 periodicity-idr=45 inline-header=FALSE ! h264parse ! video/x-h264,stream-format=avc,alignment=au,width=640,height=480,framerate=30/1,profile=baseline ! kvssink stream-name="YourStreamName" frame-timestamp=dts-only access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

Example 7: Stream Video from a Camera on Raspberry Pi and Specify Region

The following command creates a GStreamer pipeline on Raspberry Pi that streams video to Kinesis Video Streams in the US East (N. Virginia) region. This example uses the v4l2src GStreamer plugin.

```
$ gst-launch-1.0 v4l2src do-timestamp=TRUE device=/dev/video0 ! videoconvert ! video/x-raw,format=I420,width=640,height=480,framerate=30/1 ! omxh264enc control-rate=1 target-bitrate=5120000 periodicity-idr=45 inline-header=FALSE ! h264parse ! video/x-h264,stream-format=avc,alignment=au,width=640,height=480,framerate=30/1,profile=baseline ! kvssink stream-name="YourStreamName" frame-timestamp=dts-only access-key="YourAccessKey" secret-key="YourSecretKey" aws-region="YourAWSRegion"
```

Example 8: Stream both audio and video in Raspberry-PI and Ubuntu

See how to run the gst-launch-1.0 command to start streaming both audio and video in Raspberry-PI and Ubuntu.

Example 9: Stream both audio and video in MacOS

See how to run the gst-launch-1.0 command to start streaming both audio and video in MacOS.

Example 10: Stream both audio and video in Windows using MSVC

See how to run the gst-launch-1.0 command to start streaming both audio and video in Windows using MSVC.
Example 11: Stream both audio and video in Windows using MSYS2

See how to run the gst-launch-1.0 command to start streaming both audio and video in Windows using MSYS2.

Run the GStreamer Element in a Docker Container

Docker is a platform for developing, deploying, and running applications using containers. Using Docker to create the GStreamer pipeline standardizes the operating environment for Kinesis Video Streams, which greatly simplifies building and executing the application.

To install and configure Docker, see the following:

- Docker download instructions
- Getting started with Docker

After installing Docker, you can download the Kinesis Video Streams C++ Producer SDK (and GStreamer plugin) from Amazon Elastic Container Registry using the `docker pull` command.

To run GStreamer with the Kinesis Video Streams Producer SDK element as a sink in a Docker container, do the following:

**Topics**

- Authenticate your Docker Client (p. 139)
- Download the Docker Image for Ubuntu, macOS, Windows, or Raspberry Pi (p. 139)
- Run the Docker Image (p. 140)

Authenticate your Docker Client

Authenticate your Docker client to the Amazon ECR registry that you intend to pull your image from. You must get authentication tokens for each registry used, and the tokens are valid for 12 hours. For more information, see Registry Authentication in the Amazon Elastic Container Registry User Guide.

**Example: Authenticate with Amazon ECR**

```
aws ecr get-login --no-includes-email --region us-west-2 --registry-ids 546150905175
```

The preceding command produces output similar to the following:

```
docker login -u AWS -p <Password> https://YourAccountId.dkr.ecr.us-west-2.amazonaws.com
```

The resulting output is a Docker login command that you use to authenticate your Docker client to your Amazon ECR registry.

Download the Docker Image for Ubuntu, macOS, Windows, or Raspberry Pi

Download the Docker image to your Docker environment using one of the following commands, depending on your operating system:
Download the Docker Image for Ubuntu

```bash
```

Download the Docker Image for macOS

```bash
```

Download the Docker Image for Windows

```bash
```

Download the Docker Image for Raspberry Pi

```bash
```

To verify that the image was successfully added, use the following command:

```bash
docker images
```

Run the Docker Image

Use one of the following commands to run the Docker image, depending on your operating system:

Run the Docker Image on Ubuntu

```bash
sudo docker run -it --network="host" --device=/dev/video0 546150905175.dkr.ecr.us-west-2.amazonaws.com/kinesis-video-producer-sdk-cpp-amazon-linux /bin/bash
```

Run the Docker Image on macOS

```bash
sudo docker run -it --network="host" 546150905175.dkr.ecr.us-west-2.amazonaws.com/kinesis-video-producer-sdk-cpp-amazon-linux /bin/bash
```

Run the Docker Image on Windows

```bash
docker run -it 546150905175.dkr.ecr.us-west-2.amazonaws.com/kinesis-video-producer-sdk-cpp-windows <AWS_ACCESS_KEY_ID> <AWS_SECRET_ACCESS_KEY> <RTSP_URL> <STREAM_NAME>
```

Run the Docker Image on Raspberry Pi

```bash
sudo docker run -it --device=/dev/video0 --device=/dev/vchiq -v /opt/vc:/opt/vc 546150905175.dkr.ecr.us-west-2.amazonaws.com/kinesis-video-producer-sdk-cpp-raspberry-pi /bin/bash
```

Docker launches the container, and presents you with a command prompt for executing commands within the container.

In the container, set the environment variables using the following command:
Start streaming from the camera using the `gst-launch-1.0` command that is appropriate for your device.

**Note**
On macOS, you can only stream video from a network camera when running GStreamer in a Docker container. Streaming video from a USB camera on macOS in a Docker container is not supported.

For examples of using the `gst-launch-1.0` command to connect to a local web camera or a network RTSP camera, see Launch Commands (p. 137).

**GStreamer Element Parameter Reference**

To send video to the Amazon Kinesis Video Streams Producer SDK, you specify `kvssink` as the `sink`, or final destination of the pipeline. This reference provides information about `kvssink` required and optional parameters. For more information, see the section called “GStreamer” (p. 135).

The `kvssink` element has the following required parameters:

- **stream-name**: The name of the destination Kinesis video stream.
  
  **Note**
  When using IoT authorization, the value of stream-name must be identical to the value of iot-thingname (in IoT provisioning). For more information, see "Invalid thing name passed" error when using IoT authorization (p. 182).

- **storage-size**: The storage size of the device in kilobytes. For information about configuring device storage, see Storagelnfo (p. 108).

- **access-key**: The AWS access key that is used to access Kinesis Video Streams. You must provide either this parameter or credential-path.

- **secret-key**: The AWS secret key that is used to access Kinesis Video Streams. You must provide either this parameter or credential-path.

- **credential-path**: A path to a file containing your credentials for accessing Kinesis Video Streams. For example credential files, see Sample Static Credential and Sample Rotating Credential. You must provide either this parameter or access-key and secret-key.

The `kvssink` element has the following optional parameters. For more information about these parameters, see Kinesis Video Stream Structures (p. 109).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Unit/ Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>absolute-fragment-times</td>
<td>Whether to use absolute fragment times.</td>
<td>Boolean</td>
<td>true</td>
</tr>
<tr>
<td>avg-bandwidth-bps</td>
<td>The expected average bandwidth for the stream.</td>
<td>Bytes per second</td>
<td>4194304</td>
</tr>
<tr>
<td>aws-region</td>
<td>The AWS region to use.</td>
<td>String</td>
<td>us-west-2</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Unit/ Type</td>
<td>Default</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>buffer-duration</td>
<td>The stream buffer duration.</td>
<td>Seconds</td>
<td>180</td>
</tr>
<tr>
<td>codec-id</td>
<td>The codec ID of the stream.</td>
<td>String</td>
<td>&quot;V_MPEG4/ISO/AVC&quot;</td>
</tr>
<tr>
<td>connection-staleness</td>
<td>The time after which the stream staleness callback is called.</td>
<td>Seconds</td>
<td>60</td>
</tr>
<tr>
<td>content-type</td>
<td>The content type of the stream.</td>
<td>String</td>
<td>&quot;video/h264&quot;</td>
</tr>
<tr>
<td>fragment-acks</td>
<td>Whether to use fragment ACKs.</td>
<td>Boolean</td>
<td>true</td>
</tr>
<tr>
<td>fragment-duration</td>
<td>The fragment duration that you want.</td>
<td>Milliseconds</td>
<td>2000</td>
</tr>
<tr>
<td>framerate</td>
<td>The expected frame rate.</td>
<td>Frames per second</td>
<td>25</td>
</tr>
<tr>
<td>frame-timecodes</td>
<td>Whether to use frame timecodes or generate timestamps using the current time callback.</td>
<td>Boolean</td>
<td>true</td>
</tr>
</tbody>
</table>
| frame-timestamp        | • (0): pts-only: Set the decoding timestamp (DTS) equal to the presentation timestamp (PTS) for every frame sent to Kinesis Video Streams.  
  • (1): dts-only: Set PTS equal to DTS for every frame sent to Kinesis Video Streams.  
  • (2): default-timestamp: Try to use both PTS and DTS. If one is not available, then use the other. | Enum          | default-timestamp | GstKvsSinkFrameTimestampType |
<p>| key-frame-fragmentation| Whether to produce fragments on a key frame.          | Boolean        | true      |
| log-config             | The log configuration path.                           | String         | &quot;./kvs_log_configuration&quot; |
| max-latency            | The maximum latency for the stream.                   | Seconds        | 60        |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Unit/ Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>recalculate-metrics</td>
<td>Whether to recalculate the metrics.</td>
<td>Boolean</td>
<td>true</td>
</tr>
<tr>
<td>replay-duration</td>
<td>The duration to roll the current reader backward to replay during an error if restarting is enabled.</td>
<td>Seconds</td>
<td>40</td>
</tr>
<tr>
<td>restart-on-error</td>
<td>Whether to restart when an error occurs.</td>
<td>Boolean</td>
<td>true</td>
</tr>
<tr>
<td>retention-period</td>
<td>The length of time the stream is preserved.</td>
<td>Hours</td>
<td>2</td>
</tr>
<tr>
<td>rotation-period</td>
<td>The key rotation period. For more information, see Rotating Customer Master Keys.</td>
<td>Seconds</td>
<td>2400</td>
</tr>
<tr>
<td>streaming-type</td>
<td>The streaming type. Valid values include: • 0: real time • 1: near real time (not currently supported) • 2: offline (not currently supported)</td>
<td>Enum</td>
<td>0: real time</td>
</tr>
<tr>
<td>timecode-scale</td>
<td>The MKV timecode scale.</td>
<td>Milliseconds</td>
<td>1</td>
</tr>
<tr>
<td>track-name</td>
<td>The MKV track name.</td>
<td>String</td>
<td>&quot;kinesis_video&quot;</td>
</tr>
<tr>
<td>iot-certificate</td>
<td>IoT credentials to be used in the kvssink element. Accepts the following keys and values: • endpoint=iotcredentialsproviderendpoint • cert-path=/localdirectorypath/to/certificate • key-path=/localdirectorypath/to/private/key • ca-path=/localdirectorypath/to/ca-cert • role-aliases=role-aliases</td>
<td>String</td>
<td>None</td>
</tr>
</tbody>
</table>
Example: Sending Data to Kinesis Video Streams Using the PutMedia API

This example demonstrates how to use the PutMedia API. It shows how to send data that is already in a container format (MKV). If your data needs to be assembled into a container format before sending (for example, if you are assembling camera video data into frames), see Kinesis Video Streams Producer Libraries (p. 46).

Note
The PutMedia operation is available only in the C++ and Java SDKs, due to the full-duplex management of connections, data flow, and acknowledgements. It is not supported in other languages.

This example includes the following steps:
- Step 1: Download and Configure the Code (p. 144)
- Step 2: Write and Examine the Code (p. 145)
- Step 3: Run and Verify the Code (p. 146)

Step 1: Download and Configure the Code

In this section, you download the Java example code, import the project into your Java IDE, configure the library locations, and configure the code to use your AWS credentials.

1. Create a directory and clone the example source code from the GitHub repository. The PutMedia example is part of the Java Producer Library (p. 47).

   $ git clone https://github.com/awslabs/amazon-kinesis-video-streams-producer-sdk-java

2. Open the Java IDE that you are using (for example, Eclipse or IntelliJ IDEA), and import the Apache Maven project that you downloaded:
   - In Eclipse: Choose File, Import, Maven, Existing Maven Projects, and navigate to the root of the downloaded package. Select the pom.xml file.
   - In IntelliJ IDEA: Choose Import. Navigate to the pom.xml file in the root of the downloaded package.

   For more information, see the related IDE documentation.

3. Update the project so that the IDE can find the libraries that you imported.
   - For IntelliJ IDEA, do the following:
     a. Open the context (right-click) menu for the project's lib directory, and choose Add as library.
     b. Choose File, Project Structure.
     c. Under Project Settings, choose Modules.
     d. In the Sources tab, set Language Level to 7 or higher.
   - For Eclipse, do the following:
     a. Open the context (right-click) menu for the project, and choose Properties, Java Build Path, Source. Then do the following:
       1. On the Source tab, double-click Native library location.
2. In the **Native Library Folder Configuration** wizard, choose **Workspace**.
3. In the **Native Library Folder** selection, choose the **lib** directory in the project.
b. Open the context (right-click) menu for the project, and choose **Properties**. Then do the following:
1. On the **Libraries** tab, choose **Add Jars**.
2. In the **JAR selection** wizard, choose all the .jars in the project's lib directory.

### Step 2: Write and Examine the Code

The **PutMedia** API example (**PutMediaDemo**) shows the following coding pattern:

**Topics**
- Create the **PutMediaClient** (p. 145)
- Stream Media and Pause the Thread (p. 146)

The code examples in this section are from the **PutMediaDemo** class.

### Create the **PutMediaClient**

Creating the **PutMediaClient** object takes the following parameters:

- The URI for the **PutMedia** endpoint.
- An **InputStream** pointing to the MKV file to stream.
- The stream name. This example uses the stream that was created in the Using the Java Producer Library (p. 47) (**my-stream**). To use a different stream, change the following parameter:

```java
private static final String STREAM_NAME="my-stream";
```

**Note**
The **PutMedia** API example does not create a stream. You must create a stream either by using the test application for the Using the Java Producer Library (p. 47), by using the Kinesis Video Streams console, or by using the AWS CLI.

- The current timestamp.
- The time code type. The example uses **RELATIVE**, indicating that the timestamp is relative to the start of the container.
- An **AWSKinesisVideoV4Signer** object that verifies that the received packets were sent by the authorized sender.
- The maximum upstream bandwidth in Kbps.
- An **AckConsumer** object to receive packet received acknowledgements.

The following code creates the **PutMediaClient** object:

```java
/* actually URI to send PutMedia request */
final URI uri = URI.create(KINESIS_VIDEO_DATA_ENDPOINT + PUT_MEDIA_API);

/* input stream for sample MKV file */
final InputStream inputStream = new FileInputStream(MKV_FILE_PATH);

/* use a latch for main thread to wait for response to complete */
```
Step 3: Run and Verify the Code

To run the PutMedia API example, do the following:

1. Create a stream named `my-stream` in the Kinesis Video Streams console or by using the AWS CLI.
2. Change your working directory to the Java producer SDK directory:

   ```bash
   $ cd /<YOUR_FOLDER_PATH_WHERE_SDK_IS_DOWNLOADED>/amazon-kinesis-video-streams-producer-sdk-java/
   ```

3. Compile the Java SDK and demo application:

   ```bash
   mvn package
   ```

4. Create a temporary filename in the `/tmp` directory:

   ```bash
   $ jar_files=$(mktemp)
   ```

5. Create a classpath string of dependencies from the local repository to a file:

   ```bash
   $ mvn -Dmdep.outputFile=$jar_files dependency:build-classpath
   ```

6. Set the value of the `LD_LIBRARY_PATH` environment variable as follows:

Stream Media and Pause the Thread

After the client is created, the sample starts asynchronous streaming with `putMediaInBackground`. The main thread is then paused with `latch.await` until the `AckConsumer` returns, at which point the client is closed.

```java
/* start streaming video in a background thread */
client.putMediaInBackground();

/* wait for request/response to complete */
latch.await();

/* close the client */
client.close();
```
7. Run the demo from the command line as follows, providing your AWS credentials:

```bash
$ export LD_LIBRARY_PATH=/<YOUR_FOLDER_PATH_WHERE_SDK_IS_DOWNLOADED>/amazon-kinesis-
    video-streams-producer-sdk-cpp/kinesis-video-native-build/downloads/local/lib:
    $LD_LIBRARY_PATH
$ classpath_values=$(cat $jar_files)
```

8. Open the Kinesis Video Streams console at https://console.aws.amazon.com/kinesisvideo/, and
choose your stream on the Manage Streams page. The video plays in the Video Preview pane.

---

**Example: Streaming from an RTSP Source**

The C++ Producer Library (p. 56) contains a definition for a Docker container that connects to an RTSP
(Real Time Streaming Protocol) network camera. Using Docker standardizes the operating environment
for Kinesis Video Streams, which greatly simplifies building and executing the application.

To use the RTSP demo application, first install and build the C++ Producer Library (p. 56).

The following procedure demonstrates how to set up and use the RTSP demo application.

**Topics**

- Prerequisites (p. 147)
- Build the Docker Image (p. 147)
- Run the RTSP Example Application (p. 148)

**Prerequisites**

To run the Kinesis Video Streams RTSP example application, you must have the following:

- **Docker:** For information about installing and using Docker, see the following links:
  - Docker download instructions
  - Getting started with Docker
- **RTSP network camera source:** For information about recommended cameras, see System
  Requirements (p. 3).

**Build the Docker Image**

First, you build the Docker image that the demo application will run inside.

1. Create a new directory and copy the following files from the docker_native_scripts directory
to the new directory:
   - Dockerfile
   - start_rtsp_in_docker.sh
2. Change to the directory that you created in the previous step.
3. Build the Docker image using the following command. This command creates the image and tags it as `rtspdockertest`.

```
docker build -t rtspdockertest .
```

4. Record the image ID that was returned in the previous step (for example, `54f0d65f69b2`).

### Run the RTSP Example Application

Start the Kinesis Video Streams Docker container using the following command. Provide the image ID from the previous step, your AWS credentials, the URL of your RTSP network camera, and the name of the Kinesis video stream to send the data.

```
$ docker run -it <IMAGE_ID> <AWS_ACCESS_KEY_ID> <AWS_SECRET_ACCESS_KEY> <RTSP_URL> <STREAM_NAME>
```

To customize the application, comment or remove the `ENTRYPOINT` command in `Dockerfile`, and launch the container using the following command:

```
docker run -it <IMAGE_ID> bash
```

You are then prompted inside the Docker container to customize the sample application and start streaming.

### Example: Parsing and Rendering Kinesis Video Streams Fragments

The [Stream Parser Library](#) contains a demo application named `KinesisVideoRendererExample` that demonstrates parsing and rendering Amazon Kinesis video stream fragments. The example uses JCodec to decode the H.264 encoded frames that are ingested using the [Example: Kinesis Video Streams Producer SDK GStreamer Plugin](#) application. After the frame is decoded using JCodec, the visible image is rendered using JFrame.

This example shows how to do the following:

- Retrieve frames from a Kinesis video stream using the `GetMedia` API and render the stream for viewing.
- View the video content of streams in a custom application instead of using the Kinesis Video Streams console.

You can also use the classes in this example to view Kinesis video stream content that isn't encoded as H.264, such as a stream of JPEG files that don't require decoding before being displayed.

The following procedure demonstrates how to set up and use the Renderer demo application.

### Prerequisites

To examine and use the Renderer example library, you must have the following:
Running the Renderer Example

1. Create a directory, and then clone the example source code from the GitHub repository.

```
$ git clone https://github.com/aws/amazon-kinesis-video-streams-parser-library
```

2. Open the Java IDE that you are using (for example, Eclipse or IntelliJ IDEA), and import the Apache Maven project that you downloaded:

- **In Eclipse:** Choose File, Import, Maven, Existing Maven Projects. Navigate to the kinesis-video-streams-parser-lib directory.
- **In IntelliJ IDEA:** Choose Import. Navigate to the pom.xml file in the root of the downloaded package.

   **Note**
   If IntelliJ can't find your dependencies, you might have to do the following:
   - **Build clean:** Choose File, Settings, Build, Execution, Deployment, Compiler. Ensure that Clear output directory on rebuild is selected, and then choose Build, Build Project.
   - **Reimport the project:** Open the context (right-click) menu for the project, and choose Maven, Reimport.

   For more information, see the related IDE documentation.

3. From your Java IDE, open src/test/java/com.amazonaws.kinesisvideo.parser/examples/KinesisVideoRendererExampleTest.

4. Remove the @Ignore directive from the file.

5. Update the .stream parameter with the name of your Kinesis video stream.

6. Run the KinesisVideoRendererExample test.

How It Works

The example application demonstrates the following:

- Sending MKV data (p. 149)
- Parsing MKV Fragments into Frames (p. 150)
- Decoding and Displaying the Frame (p. 150)

Sending MKV data

The example sends sample MKV data from the rendering_example_video.mkv file, using PutMedia to send video data to a stream named render-example-stream.

The application creates a PutMediaWorker:
For information about the PutMediaWorker class, see Call PutMedia (p. 131) in the Stream Parser Library (p. 127) documentation.

### Parsing MKV Fragments into Frames

The example then retrieves and parses the MKV fragments from the stream using a GetMediaWorker:

```java
GetMediaWorker getMediaWorker = GetMediaWorker.create(getRegion(),
    getCredentialsProvider(),
    getStreamName(),
    new StartSelector().withStartSelectorType(StartSelectorType.EARLIEST),
    streamOps.amazonKinesisVideo,
    getMediaProcessingArgumentsLocal.getFrameVisitor());
executorService.submit(getMediaWorker);
```

For more information about the GetMediaWorker class, see Call GetMedia (p. 131) in the Stream Parser Library (p. 127) documentation.

### Decoding and Displaying the Frame

The example then decodes and displays the frame using JFrame.

The following code example is from the KinesisVideoFrameViewer class, which extends JFrame:

```java
public void setImage(BufferedImage bufferedImage) {
    image = bufferedImage;
    repaint();
}
```

The image is displayed as an instance of java.awt.image.BufferedImage. For examples that show how to work with BufferedImage, see Reading/Loading an Image.

### Example: Identifying Objects in Video Streams Using Amazon SageMaker

This example demonstrates how to create a solution that uses Amazon SageMaker to identify when certain objects appear in an Amazon Kinesis video stream. Amazon SageMaker is the managed platform for developers and data scientists to build, train, and deploy machine learning models quickly and easily.

The example consists of a Docker container that includes the application functionality, and an AWS CloudFormation template that automates the deployment of the application's AWS resources.

The AWS CloudFormation template creates the following resources:

- An Amazon Elastic Container Service (Amazon ECS) cluster that uses the AWS Fargate compute engine that runs the library software.
- An Amazon DynamoDB table that maintains checkpoints and related state across workers that run on Fargate tasks.
• A **Kinesis data stream** that captures the inference outputs generated from Amazon SageMaker.
• An **AWS Lambda function** that parses the output from Amazon SageMaker.
• **AWS Identity and Access Management (IAM)** resources for providing access across services.
• **Amazon CloudWatch** resources for monitoring the application.

The application is compatible with any Amazon SageMaker endpoint that processes data. This example contains instructions for creating an Amazon SageMaker endpoint that uses a sample object identification algorithm template. You can modify or replace the algorithm based on your application's use cases and requirements.

**Topics**

- Prerequisites (p. 151)
- Creating the Application (p. 152)
- Monitoring the Application (p. 153)
- Extending the Application (p. 154)
- Cleaning up the Application (p. 155)

**Prerequisites**

The example application has the following prerequisites:

- **Amazon SageMaker** (p. 151)
- **Kinesis Video Stream** (p. 151)
- **Service-Linked Role** (p. 151)

**Amazon SageMaker**

This example requires an Amazon SageMaker notebook. For information about creating a notebook, see Creating a Notebook Instance in the *Amazon SageMaker Developer Guide*. Note the following when creating your notebook:

- Add the `object_detection_image_json_format.ipynb` example (from the Introduction to Amazon Algorithms section in the SageMaker Examples tab of the Jupyter console) to the notebook.
- Create an Amazon Simple Storage Service (Amazon S3) bucket, and provide its name in the Prerequisites step when adding the example.
- After you create the notebook, choose **Endpoint configuration** on the Amazon SageMaker console, and make a note of the **Endpoint name**.

**Kinesis Video Stream**

This example requires one or more Kinesis video streams that have live video data. For information about creating a Kinesis video stream and sending data to it from a camera, see **GStreamer** (p. 135). Make a note of your Kinesis video stream name.

**Service-Linked Role**

This example requires that your account have a service-linked role for AWS Fargate operation. New AWS accounts have this role enabled by default. If you see the following error when creating the application, you must enable the service-linked role:
Creating the Application

To create the sample application, you use AWS CloudFormation and the templates that are provided.

**To use AWS CloudFormation to create the application**

1. Sign in to the AWS Management Console and open the AWS CloudFormation console using one of the following links for your AWS Region. The link launches the correct stack for your Region:
   - Launch in Asia Pacific (Sydney) Region (ap-southeast-2)
   - Launch in Asia Pacific (Tokyo) Region (ap-northeast-1)
   - Launch in Europe (Frankfurt) Region (eu-central-1)
   - Launch in Europe (Ireland) Region (eu-west-1)
   - Launch in US East (N. Virginia) Region (us-east-1)
   - Launch in US West (Oregon) Region (us-west-2)

2. On the **Create Stack** page, provide the following values:
   - Give the stack a unique name (for example, `username-KVS-SageMaker`).
   - Provide the Amazon SageMaker endpoint name (not the endpoint ARN) that you created in the previous section.
   - Provide the name of your Kinesis video stream. If you have more than one Kinesis video stream, provide the stream names in quotation marks and separated by commas.
   - Keep the rest of the settings as they are.

   Choose **Next**.

3. On the **Options** page, keep the settings as they are.

4. Select the I **acknowledge that AWS CloudFormation might create IAM resources** check box. Choose **Next**.

AWS CloudFormation creates the application.

The following table lists several parameters used by the Docker container when you create a stack using this AWS CloudFormation template. Their values are predefined in the SSM resource in the template, but you can customize them as needed.

<table>
<thead>
<tr>
<th><strong>Resource name</strong></th>
<th><strong>Default value</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>inferenceInterval</td>
<td>6</td>
<td>The sampling ratio for video frames that are sent to the SageMaker endpoint.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The sampling ratio is 1 out of every 6 I-Frames is sent to the SageMaker endpoint.</td>
</tr>
<tr>
<td>sageMakerTaskQueueSize</td>
<td>5000</td>
<td>The size of the queue that maintains the pending requests to the SageMaker endpoint.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The size of the queue is affected by ‘sageMakerTaskTimeoutInMilli’. If sagemaker inference takes longer, requests are buffered in this queue.</td>
</tr>
<tr>
<td>sageMakerTaskThreadPoolSize</td>
<td>20</td>
<td>Number of threads that is used to concurrently execute SageMaker requests.</td>
</tr>
</tbody>
</table>
Monitoring the Application

The application created by the AWS CloudFormation template includes an Amazon CloudWatch dashboard and a CloudWatch log stream that you use to monitor application metrics and events.

Application Dashboard

The application includes a CloudWatch dashboard for monitoring application metrics. To view the application dashboard, open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/ and choose Dashboards in the left navigation bar.

Choose the KVS-SageMaker-Driver-KvsSageMakerIntegration-aws-region dashboard. The dashboard shows the following information:

- **Frame Metrics**: Metrics for processing the video stream, sending frames to the Amazon SageMaker endpoint, and writing to the Kinesis data stream that connects the Amazon SageMaker notebook with the AWS Lambda function that processes Amazon SageMaker inference output results.
- **IngestToProcessLatency**: The time difference between when a video frame is ingested into the Kinesis Video Streams service and when the application receives the frame.
- **Current Lease Total**: The application is granted permissions to read from the Kinesis video stream using a lease. This metric shows the number of active leases. The application uses one lease per Kinesis video stream, and one lease for synchronization between streams.
- **Lease Sync Metrics**: The frequency and duration of permission lease synchronization.
- **LeaseCount per Worker**: The distribution of leases among the Amazon SageMaker worker threads.
- **Number of Workers**: The number of Amazon SageMaker workers processing streams. Each task in an Amazon ECS cluster has one worker running. One worker can process more than one stream.
- **ECS Service Utilization**: Usage metrics for the Amazon ECS cluster.
- **KinesisDataStream**: Usage metrics of the Kinesis data stream.
• **SageMaker**: Operations performed by the Amazon SageMaker notebook.
• **Lambda**: Number and duration of the Lambda function that processes the output from the Amazon SageMaker notebook.

If any of the information in these graphs indicates an operational issue (such as a value steadily increasing rather than being stable), see the following section about how to read the application logs to determine the issue.

**CloudWatch Logs**

The application includes two CloudWatch logs:

**Topics**
- The Application Log (p. 154)
- The Lambda Function Log (p. 154)

**The Application Log**

You can use the application log to monitor application events and error conditions. This log is helpful if you need to contact product support with an issue.

**To read the Application Log**

1. Open the Amazon ECS console at https://console.aws.amazon.com/ecs.
2. Choose the KVS-Sagemaker-Driver cluster.
3. Choose the stack-name-SageMakerDriverService service in the Services tab.
4. Choose the Logs tab.

The application log shows events such as initialization, configuration, and lease activity.

**The Lambda Function Log**

You can use the Lambda function log to track successful object identifications.

**To read the Lambda log**

2. Choose the Lambda function for your application. The Lambda function name is in the following format:

   ```
   ```

3. Choose the Monitoring panel.
4. Choose View logs in CloudWatch.

The CloudWatch log for the application shows successful identifications of objects in the Kinesis video stream and other application events.

**Extending the Application**

You can add custom functionality to your application by modifying the values that you provide in the AWS CloudFormation template window as follows:
• **EndPointAcceptContentType**: You can change this value if your Amazon SageMaker endpoint does not accept frames in JPG format. The following formats are supported:
  • image/jpg
  • image/png
  • image/bmp
  • image/gif
  • application/x-image

• **LambdaFunctionBucket, LambdaFunctionKey**: The provided settings use an AWS Lambda function that processes the Amazon SageMaker output and writes it to CloudWatch Logs. If you want to send the Amazon SageMaker output elsewhere, you can provide your own Lambda function.

• **Tag Filters**: If you have streams that are tagged using the the section called “TagStream” (p. 227) action, you can specify the tags of streams that you want to process. For example, if you have two streams that have the **Location** key with the values **Front** and **Parking**, you would filter to only use those streams using the following entry:

  ```json
  {"key":"Location","values":["Front","Parking"]}
  ```

### Cleaning up the Application

After you've finished with the application that you created for this tutorial, we recommend that you delete any resources that you don't want to keep, to avoid incurring any ongoing charges.

1. **Amazon SageMaker endpoint**: If you created the Amazon SageMaker endpoint for this tutorial rather than using an existing endpoint, delete the endpoint. In the Amazon SageMaker control panel, choose Endpoint configurations. Choose the endpoint you created, and choose Actions, Delete. Confirm the deletion.

2. **Amazon SageMaker notebook**: On the Amazon SageMaker console, choose Notebook instances. Choose the notebook that you created, and choose Actions, Stop. When the notebook shows that its Status is Stopped, choose Actions, Delete. Confirm the deletion.

   **Note**
   For more information on cleaning up Amazon SageMaker resources, see Clean up in the Amazon SageMaker developer guide.

3. **Amazon SageMaker execution policy**: On the IAM console, in the navigation pane, choose Policies. Choose the policy that you created for this tutorial. The name of the policy is similar to the following: AmazonSageMaker-ExecutionPolicy-timestamp

   Choose Policy actions, Delete. Confirm the deletion.

4. **Amazon SageMaker execution role**: On the IAM console, in the navigation pane, choose Roles. Choose the role that you created for this tutorial. The name of the role is similar to the following: AmazonSageMaker-ExecutionRole-timestamp

   Choose Delete role. Confirm the deletion.

5. **AWS CloudFormation stack**: On the AWS CloudFormation console, choose the stack that you created for this tutorial. Choose Actions, Delete Stack. Confirm the deletion.

6. **Amazon S3 bucket**: On the Amazon S3 console, choose the bucket that you created to store the Amazon SageMaker assets. Choose Delete. Enter the name of the bucket and choose Confirm to confirm deletion.

7. **Kinesis video stream**: On the Kinesis Video Streams console, choose the video stream that you created for the application. Choose Delete. Confirm the deletion.
Monitoring Kinesis Video Streams

Monitoring is an important part of maintaining the reliability, availability, and performance of Kinesis Video Streams and your AWS solutions. You should collect monitoring data from all of the parts of your AWS solution so that you can more easily debug a multi-point failure if one occurs. Before you start monitoring Kinesis Video Streams, however, you should create a monitoring plan that includes answers to the following questions:

- What are your monitoring goals?
- What resources will you monitor?
- How often will you monitor these resources?
- What monitoring tools will you use?
- Who will perform the monitoring tasks?
- Who should be notified when something goes wrong?

After you have defined your monitoring goals and have created your monitoring plan, the next step is to establish a baseline for normal Kinesis Video Streams performance in your environment. You should measure Kinesis Video Streams performance at various times and under different load conditions. As you monitor Kinesis Video Streams, you should store a history of monitoring data that you've collected. You can compare current Kinesis Video Streams performance to this historical data to help you to identify normal performance patterns and performance anomalies, and devise methods to address issues that may arise.

Topics
- Monitoring Kinesis Video Streams Metrics with CloudWatch (p. 156)
- Logging Kinesis Video Streams API Calls with AWS CloudTrail (p. 166)

Monitoring Kinesis Video Streams Metrics with CloudWatch

You can monitor a Kinesis video stream using Amazon CloudWatch, which collects and processes raw data from Kinesis Video Streams into readable, near real-time metrics. These statistics are recorded for a period of 15 months, so that you can access historical information and gain a better perspective on how your web application or service is performing.

In the Kinesis Video Streams Management Console, you can view CloudWatch metrics for a Kinesis video stream in two ways:

- In the Dashboard page, choose the Video streams tab in the Account-level metrics for Current Region section.
- Choose the Monitoring tab in the video stream’s details page.

Kinesis Video Streams provides the following metrics:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PutMedia.Requests</td>
<td>Number of PutMedia API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PutMedia.IncomingBytes</td>
<td>Number of bytes received as part of PutMedia for the stream. Unit: Bytes</td>
</tr>
<tr>
<td>PutMedia.IncomingFragments</td>
<td>Number of complete fragments received as part of PutMedia for the stream. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.IncomingFrames</td>
<td>Number of complete frames received as part of PutMedia for the stream. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.ActiveConnections</td>
<td>The total number of connections to the service host. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.ConnectionErrors</td>
<td>Errors while establishing PutMedia connection for the stream. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.FragmentIngestionLatency</td>
<td>Time difference between when the first and last bytes of a fragment are received by Kinesis Video Streams. Unit: Milliseconds</td>
</tr>
<tr>
<td>PutMedia.FragmentPersistLatency</td>
<td>Time taken from when the complete fragment data is received and archived. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.Latency</td>
<td>Time difference between the request and the HTTP response from InletService while establishing the connection. Unit: Count</td>
</tr>
<tr>
<td>PutMedia.BufferingAckLatency</td>
<td>Time difference between when the first byte of a new fragment is received by Kinesis Video Streams and when the Buffering ACK is sent for the fragment. Unit: Milliseconds</td>
</tr>
<tr>
<td>PutMedia.ReceivedAckLatency</td>
<td>Time difference between when the last byte of a new fragment is received by Kinesis Video Streams and when the Received ACK is sent for the fragment. Unit: Milliseconds</td>
</tr>
<tr>
<td>PutMedia.PersistedAckLatency</td>
<td>Time difference between when the last byte of a new fragment is received by Kinesis Video Streams and when the Persisted ACK is sent for the fragment. Unit: Milliseconds</td>
</tr>
</tbody>
</table>
### Metric

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PutMedia.ErrorAckCount</td>
<td>Number of Error ACKs sent while doing PutMedia for the stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>PutMedia.Success</td>
<td>1 for each fragment successfully written; 0 for every failed fragment. The average value of this metric indicates how many complete, valid fragments are sent.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMedia.Requests</td>
<td>Number of GetMedia API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMedia.OutgoingBytes</td>
<td>Total number of bytes sent out from the service as part of the GetMedia API for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Bytes</td>
</tr>
<tr>
<td>GetMedia.OutgoingFragments</td>
<td>Number of fragments sent while doing GetMedia for the stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMedia.OutgoingFrames</td>
<td>Number of frames sent during GetMedia on the given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMedia.MillisBehindNow</td>
<td>Time difference between the current server timestamp and the server timestamp of the last fragment sent.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetMedia.ConnectionErrors</td>
<td>The number of connections that were not successfully established.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMedia.Success</td>
<td>1 for every fragment successfully sent; 0 for every failure. The average value indicates the rate of success.</td>
</tr>
</tbody>
</table>
|                                             | **Note**
<p>|                                             | Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging. |
|                                             | Units: Count                                                               |
| GetMediaForFragmentList.OutgoingBytes       | Total number of bytes sent out from the service as part of the GetMediaForFragmentList API for a given stream. |
|                                             | Units: Bytes                                                               |</p>
<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GetMediaForFragmentList.OutgoingFrames</strong></td>
<td>Total number of frames sent out from the service as part of the GetMediaForFragmentList API for a given stream. Units: Count</td>
</tr>
<tr>
<td><strong>GetMediaForFragmentList.Requests</strong></td>
<td>Number of GetMediaForFragmentList API requests for a given stream. Units: Count</td>
</tr>
<tr>
<td><strong>GetMediaForFragmentList.Success</strong></td>
<td>1 for every fragment successfully sent; 0 for every failure. The average value indicates the rate of success. <strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see <a href="#">Request/Response Summary Logging</a>. Units: Count</td>
</tr>
<tr>
<td><strong>ListFragments.Latency</strong></td>
<td>Latency of the ListFragments API calls for the given stream name. Units: Milliseconds</td>
</tr>
<tr>
<td><strong>GetHLSStreamingSessionURL.Latency</strong></td>
<td>Latency of the GetHLSStreamingSessionURL API calls for the given stream name. Units: Milliseconds</td>
</tr>
<tr>
<td><strong>GetHLSStreamingSessionURL.Requests</strong></td>
<td>Number of GetHLSStreamingSessionURL API requests for a given stream. Units: Count</td>
</tr>
<tr>
<td><strong>GetHLSStreamingSessionURL.Success</strong></td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success. <strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see <a href="#">Request/Response Summary Logging</a>. Units: Count</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GetHLSMasterPlaylist.Latency</td>
<td>Latency of the GetHLSMasterPlaylist API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetHLSMasterPlaylist.Requests</td>
<td>Number of GetHLSMasterPlaylist API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetHLSMasterPlaylist.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetHLSMediaPlaylist.Latency</td>
<td>Latency of the GetHLSMediaPlaylist API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetHLSMediaPlaylist.Requests</td>
<td>Number of GetHLSMediaPlaylist API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetHLSMediaPlaylist.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMP4InitFragment.Latency</td>
<td>Latency of the GetMP4InitFragment API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetMP4InitFragment.Requests</td>
<td>Number of GetMP4InitFragment API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GetMP4InitFragment.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success. <strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMP4MediaFragment.Latency</td>
<td>Latency of the GetMP4MediaFragment API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetMP4MediaFragment.Requests</td>
<td>Number of GetMP4MediaFragment API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMP4MediaFragment.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success. <strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetMP4MediaFragment.OutgoingBytes</td>
<td>Total number of bytes sent out from the service as part of the GetMP4MediaFragment API for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Bytes</td>
</tr>
<tr>
<td>GetTSFragment.Latency</td>
<td>Latency of the GetTSFragment API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetTSFragment.Requests</td>
<td>Number of GetTSFragment API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>Metric</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GetTSFragment.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetTSFragment.OutgoingBytes</td>
<td>Total number of bytes sent out from the service as part of the GetTSFragment API for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Bytes</td>
</tr>
<tr>
<td>GetDASHStreamingSessionURL.Latency</td>
<td>Latency of the GetDASHStreamingSessionURL API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetDASHStreamingSessionURL.Requests</td>
<td>Number of GetDASHStreamingSessionURL API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetDASHStreamingSessionURL.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
<tr>
<td>GetDASHManifest.Latency</td>
<td>Latency of the GetDASHManifest API calls for the given stream name.</td>
</tr>
<tr>
<td></td>
<td>Units: Milliseconds</td>
</tr>
<tr>
<td>GetDASHManifest.Requests</td>
<td>Number of GetDASHManifest API requests for a given stream.</td>
</tr>
<tr>
<td></td>
<td>Units: Count</td>
</tr>
</tbody>
</table>
### CloudWatch Metrics Guidance

CloudWatch metrics can be useful for finding answers to the following questions:

**Topics**
- Is data reaching the Kinesis Video Streams service? (p. 164)
- Why is data not being successfully ingested by the Kinesis Video Streams service? (p. 164)
- Why can’t the data be read from the Kinesis Video Streams service at the same rate as it’s being sent from the producer? (p. 164)
- Why is there no video in the console, or why is the video being played with a delay? (p. 164)
- What is the delay in reading real-time data, and why is the client lagging behind the head of the stream? (p. 165)
- Is the client reading data out of the Kinesis video stream, and at what rate? (p. 165)
- Why can’t the client read data out of the Kinesis video stream? (p. 166)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GetDASHManifest.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.<strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging. Units: Count</td>
</tr>
<tr>
<td>GetClip.Latency</td>
<td>Latency of the GetClip API calls for the given video stream name. Units: Miliseconds</td>
</tr>
<tr>
<td>GetClip.Requests</td>
<td>Number of GetClip API requests for a given video stream. Units: Count</td>
</tr>
<tr>
<td>GetClip.Success</td>
<td>1 for every successful request; 0 for every failure. The average value indicates the rate of success.<strong>Note</strong> Failures include both 400 (user) errors and 500 (system) errors. For more information about enabling a summary of requests and responses, including AWS request IDs, see Request/Response Summary Logging. Units: Count</td>
</tr>
<tr>
<td>GetClip.OutgoingBytes</td>
<td>Total number of bytes sent out from the service as part of the GetClip API for a given video stream. Units: Bytes</td>
</tr>
</tbody>
</table>
Is data reaching the Kinesis Video Streams service?

Relevant metrics:
- PutMedia.IncomingBytes
- PutMedia.IncomingFragments
- PutMedia.IncomingFrames

Action items:
- If there is a drop in these metrics, check if your application is still sending data to the service.
- Check the network bandwidth. If your network bandwidth is insufficient, it could be slowing down the rate the service is receiving the data.

Why is data not being successfully ingested by the Kinesis Video Streams service?

Relevant metrics:
- PutMedia.Requests
- PutMedia.ConnectionErrors
- PutMedia.Success
- PutMedia.ErrorAckCount

Action items:
- If there is an increase in PutMedia.ConnectionErrors, look at the HTTP response/error codes received by the producer client to see what errors are occurring while establishing the connection.
- If there is a drop in PutMedia.Success or increase in PutMedia.ErrorAckCount, look at the ack error code in the ack responses sent by the service to see why ingestion of data is failing. For more information, see AckErrorCode.Values.

Why can't the data be read from the Kinesis Video Streams service at the same rate as it's being sent from the producer?

Relevant metrics:
- PutMedia.FragmentIngestionLatency
- PutMedia.IncomingBytes

Action items:
- If there is a drop in these metrics, check the network bandwidth of your connections. Low-bandwidth connections could cause the data to reach the service at a lower rate.

Why is there no video in the console, or why is the video being played with a delay?

Relevant metrics:
• PutMedia.FragmentIngestionLatency
• PutMedia.FragmentPersistLatency
• PutMedia.Success
• ListFragments.Latency
• PutMedia.IncomingFragments

Action items:
• If there is an increase in PutMedia.FragmentIngestionLatency or a drop in PutMedia.IncomingFragments, check the network bandwidth and whether the data is still being sent.
• If there is a drop in PutMedia.Success, check the ack error codes. For more information, see AckErrorCode.Values.
• If there is an increase in PutMedia.FragmentPersistLatency or ListFragments.Latency, you are most likely experiencing a service issue. If the condition persists for an extended period of time, check with your customer service contact to see if there is an issue with your service.

What is the delay in reading real-time data, and why is the client lagging behind the head of the stream?

Relevant metrics:
• GetMedia.MillisBehindNow
• GetMedia.ConnectionErrors
• GetMedia.Success

Action items:
• If there is an increase in GetMedia.ConnectionErrors, then the consumer might be falling behind in reading the stream, due to frequent attempts to re-connect to the stream. Look at the HTTP response/error codes returned for the GetMedia request.
• If there is a drop in GetMedia.Success, then it's likely due to the service being unable to send the data to the consumer, which would result in dropped connection, and reconnects from consumers, which would result in the consumer lagging behind the head of the stream.
• If there is an increase in GetMedia.MillisBehindNow, look at your bandwidth limits to see if you are receiving the data at a slower rate because of lower bandwidth.

Is the client reading data out of the Kinesis video stream, and at what rate?

Relevant metrics:
• GetMedia.OutgoingBytes
• GetMedia.OutgoingFragments
• GetMedia.OutgoingFrames
• GetMediaForFragmentList.OutgoingBytes
• GetMediaForFragmentList.OutgoingFragments
• GetMediaForFragmentList.OutgoingFrames
Action items:

- These metrics indicate what rate real-time and archived data is being read.

Why can't the client read data out of the Kinesis video stream?

Relevant metrics:

- GetMedia.ConnectionErrors
- GetMedia.Success
- GetMediaForFragmentList.Success
- PutMedia.IncomingBytes

Action items:

- If there is an increase in GetMedia.ConnectionErrors, look at the HTTP response/error codes returned by the GetMedia request. For more information, see AckErrorCode.Values.
- If you are trying to read the latest/live data, check PutMedia.IncomingBytes to see if there is data coming into the stream for the service to send to the consumers.
- If there is a drop in GetMedia.Success or GetMediaForFragmentList.Success, it's likely due to the service being unable to send the data to the consumer. If the condition persists for an extended period of time, check with your customer service contact to see if there is an issue with your service.

Logging Kinesis Video Streams API Calls with AWS CloudTrail

Amazon Kinesis Video Streams is integrated with AWS CloudTrail, a service that provides a record of actions taken by a user, role, or an AWS service in Amazon Kinesis Video Streams. CloudTrail captures all API calls for Amazon Kinesis Video Streams as events. The calls captured include calls from the Amazon Kinesis Video Streams console and code calls to the Amazon Kinesis Video Streams API operations. If you create a trail, you can enable continuous delivery of CloudTrail events to an Amazon S3 bucket, including events for Amazon Kinesis Video Streams. If you don't configure a trail, you can still view the most recent events in the CloudTrail console in Event history. Using the information collected by CloudTrail, you can determine the request that was made to Amazon Kinesis Video Streams, the IP address from which the request was made, who made the request, when it was made, and additional details.

To learn more about CloudTrail, including how to configure and enable it, see the AWS CloudTrail User Guide.

Kinesis Video Streams and CloudTrail

CloudTrail is enabled on your AWS account when you create the account. When supported event activity occurs in Amazon Kinesis Video Streams, that activity is recorded in a CloudTrail event along with other AWS service events in Event history. You can view, search, and download recent events in your AWS account. For more information, see Viewing Events with CloudTrail Event History.

For an ongoing record of events in your AWS account, including events for Amazon Kinesis Video Streams, create a trail. A trail enables CloudTrail to deliver log files to an Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all AWS Regions. The trail logs events from all Regions in the AWS partition and delivers the log files to the Amazon S3 bucket that you specify. Additionally, you can configure other AWS services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see the following:
Amazon Kinesis Video Streams supports logging the following actions as events in CloudTrail log files:

- CreateStream
- DeleteStream
- DescribeStream
- GetDataEndpoint
- ListStreams
- ListTagsForStream
- TagStream
- UntagStream
- UpdateDataRetention
- UpdateStream

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root or AWS Identity and Access Management (IAM) user credentials.
- Whether the request was made with temporary security credentials for a role or federated user.
- Whether the request was made by another AWS service.

For more information, see the CloudTrail userIdentity Element.

**Example: Amazon Kinesis Video Streams Log File Entries**

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files aren’t an ordered stack trace of the public API calls, so they don’t appear in any specific order.

The following example shows a CloudTrail log entry that demonstrates the CreateStream action.

```json
{
  "Records": [
    {
      "eventVersion": "1.05",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
      },

      "eventTime": "2021-12-31T23:59:59Z",
      "eventSource": "kinesisvideo.amazonaws.com",
      "awsRegion": "us-west-2",
      "eventName": "CreateStream",
      "requestParameters": {
        "streamName": "my-stream"
      }
    }
  ]
}
```
"eventTime": "2018-05-25T00:16:31Z",
"eventSource": " kinesisvideo.amazonaws.com",
"eventName": "CreateStream",
"awsRegion": "us-east-1",
"sourceIPAddress": "127.0.0.1",
"userAgent": "aws-sdk-java/unknown-version Linux/x.xx",
"requestParameters": {
  "streamName": "VideoStream",
  "dataRetentionInHours": 2,
  "mediaType": "mediaType",
  "kmsKeyId": "arn:aws:kms::us-east-1:123456789012:alias",
  "deviceName": "my-device"
},
"responseElements": {
  "requestID": "f0944dab-c757-11e3-9a63-4e1-c4e8d420d9b",
  "eventID": "b7acfc076-6ca9-4d1b-a3d7-c4e8d420d9b"
},
"eventVersion": "1.05",
"userIdentity": {
  "type": "IAMUser",
  "principalId": "EX_PRINCIPAL_ID",
  "arn": "arn:aws:iam::123456789012:user/Alice",
  "accountId": "123456789012",
  "accessKeyId": "EXAMPLE_KEY_ID",
  "userName": "Alice"
},
"eventTime": "2018-05-25T17:06Z",
"eventSource": " kinesisvideo.amazonaws.com",
"eventName": "DeleteStream",
"awsRegion": "us-east-1",
"sourceIPAddress": "127.0.0.1",
"userAgent": "aws-sdk-java/unknown-version Linux/x.xx",
"requestParameters": {
  "currentVersion": "keqrgekj9"
},
"responseElements": null,
"requestID": "f0944d86-c757-11e3-2b4e-25654b1b3136",
"eventID": "0b2f1396-88af-4561-b16f-398f8eaa596"
},
"eventVersion": "1.05",
"userIdentity": {
  "type": "IAMUser",
  "principalId": "EX_PRINCIPAL_ID",
  "arn": "arn:aws:iam::123456789012:user/Alice",
  "accountId": "123456789012",
  "accessKeyId": "EXAMPLE_KEY_ID",
  "userName": "Alice"
},
"eventTime": "2014-04-19T00:15:02Z",
"eventSource": " kinesisvideo.amazonaws.com",
"eventName": "DescribeStream",
"awsRegion": "us-east-1",
"sourceIPAddress": "127.0.0.1",
"userAgent": "aws-sdk-java/unknown-version Linux/x.xx",
"requestParameters": {
  "streamName": "VideoStream"
},
"responseElements": null,
"requestID": "a68541ca-c757-11e3-901b-cbcfe5b367a",
"eventID": "22a5fb8f-4e61-4bee-a8ad-3b72046b4c4d"
Example: Amazon Kinesis Video Streams Log File Entries

```
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "EX_PRINCIPAL_ID",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accountId": "123456789012",
    "accessKeyId": "EXAMPLE_KEY_ID",
    "userName": "Alice"
  },
  "eventTime": "2014-04-19T00:15:03Z",
  "eventSource": "kinesisvideo.amazonaws.com",
  "eventName": "GetDataEndpoint",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "127.0.0.1",
  "userAgent": "aws-sdk-java/unknown-version Linux/x.xx",
  "requestParameters": {
    "streamName": "VideoStream",
    "APIName": "LIST_FRAGMENTS"
  },
  "responseElements": null,
  "requestID": "a6e6e9cd-c757-11e3-901b-cbcfe5b3677a",
  "eventID": "dcd2126f-c8d2-4186-b32a-192dd48d7e33"
},
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "EX_PRINCIPAL_ID",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accountId": "123456789012",
    "accessKeyId": "EXAMPLE_KEY_ID",
    "userName": "Alice"
  },
  "eventTime": "2018-05-25T00:16:56Z",
  "eventSource": "kinesisvideo.amazonaws.com",
  "eventName": "ListStreams",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "127.0.0.1",
  "userAgent": "aws-sdk-java/unknown-version Linux/x.xx",
  "requestParameters": {
    "maxResults": 100,
    "streamNameCondition": {
      "comparisonValue": "MyVideoStream",
      "comparisonOperator": "BEGINS WITH"
    }
  },
  "responseElements": null,
  "requestID": "e9f9c8eb-c757-11e3-bf1d-6948db3cd570",
  "eventID": "77cf0d06-ce90-42da-9576-71986fec411f"
}
```

Kinesis Video Streams Limits

Kinesis Video Streams has the following limits:

The limits below are either soft [s], which can be upgraded by submitting a support ticket, or hard [h], which cannot be increased.

Control Plane API limits

The following section describes limits for Control Plane APIs.

When an account-level Request limit is reached, a ClientLimitExceededException is thrown.

When an account-level Streams limit is reached, or a stream-level limit is reached, a StreamLimitExceededException is thrown.

Control Plane API limits

<table>
<thead>
<tr>
<th>API</th>
<th>Account Limit: Request</th>
<th>Account Limit: Streams</th>
<th>Stream-level limit</th>
<th>Relevant Exceptions and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreateStream</td>
<td>50 TPS [s]</td>
<td>2500 streams per account [s] in US East (N. Virginia) and US West (Oregon) regions. 1000 streams per account [s] in all other supported regions.</td>
<td></td>
<td>Devices, CLIs, SDK-driven access, and the console can all invoke this API. Only one API call succeeds if the stream doesn't already exist.</td>
</tr>
<tr>
<td>API</td>
<td>Account Limit: Request</td>
<td>Account Limit: Streams</td>
<td>Stream-level limit</td>
<td>Relevant Exceptions and Notes</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DescribeStream</td>
<td>300 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td>Console at <a href="https://console.aws.amazon.com/">https://console.aws.amazon.com/</a> and submit a service limit increase case for Kinesis Video Streams to request an increase of this limit.</td>
</tr>
<tr>
<td>UpdateStream</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>ListStreams</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>DeleteStream</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>GetDataEndpoint</td>
<td>500 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td>Called every 45 minutes to refresh the streaming token for most PutMedia/GetMedia use cases. Caching data endpoints is safe if the application reloads them on failure.</td>
</tr>
<tr>
<td>UpdateDataRetention</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>TagStream</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>UntagStream</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
<tr>
<td>ListTagsForStream</td>
<td>50 TPS [h]</td>
<td>N/A</td>
<td>5 TPS [h]</td>
<td></td>
</tr>
</tbody>
</table>

### Media and Archived Media API limits

The following section describes limits for Media and Archived Media APIs.

When a stream-level limit is exceeded, a StreamLimitExceeded Exception is thrown.

When a connection-level limit is reached, a ConnectionLimitExceeded Exception is thrown.

The following errors or acks are thrown when a fragment-level limit is reached:
- A **MIN_FRAGMENT_DURATION_REACHED** ack is returned for a fragment below the minimum duration.
- A **MAX_FRAGMENT_DURATION_REACHED** ack is returned for a fragment above the maximum duration.
- A **MAX_FRAGMENT_SIZE** ack is returned for a fragment above the maximum data size.
- A **FragmentLimitExceeded** exception is thrown if a fragment limit is reached in a `GetMediaForFragmentList` operation.

**Data Plane API limits**

<table>
<thead>
<tr>
<th>API</th>
<th>Stream-level limit</th>
<th>Connection-level limit</th>
<th>Bandwidth limit</th>
<th>Fragment-level limit</th>
<th>Relevant Exceptions and Notes</th>
</tr>
</thead>
</table>
| **PutMedia** | 5 TPS [h]          | 1 [s]                  | 12.5 MB/second, or 100 Mbps [s] | • Minimum fragment duration: 1 second [h]  
• Maximum fragment duration: 10 seconds [h]  
• Maximum fragment size: 50 MB [h]  
• Maximum number of tracks: 3 [s] | A typical PutMedia request contains data for several seconds, resulting in a lower TPS per stream. In the case of multiple concurrent connections that exceed limits, the last connection is accepted. |
| **GetHLSStreamingSessionURL** | N/A               | N/A                    | N/A                       | Only 10 sessions per stream can be active at a time [h]. After the limit has been reached, the oldest session is revoked when a new session is created. |
| **GetDASHStreamingSessionURL** | N/A               | N/A                    | N/A                       | Only 10 sessions per stream can be active at a time [h]. After the limit has been reached, the oldest session is revoked when a new session is created. |
| **GetMedia** | 5 TPS [h]          | 3 [s]                  | 25 MB/s or 200 Mbps [s]   | N/A                                                                                   | Only three clients can concurrently receive content from the media stream at any moment of time. Further client connections are rejected. A unique consuming client shouldn’t need more than 2 or 3 TPS because after the connection is established, we anticipate... |
### Media and Archived Media API limits

<table>
<thead>
<tr>
<th>API</th>
<th>Stream-level limit</th>
<th>Connection-level limit</th>
<th>Bandwidth limit</th>
<th>Fragment-level limit</th>
<th>Relevant Exceptions and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ListFragments</td>
<td>5 TPS [h]</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>that the application will read continuously.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If a typical fragment is approximately 5 MB, this limit means ~75 MB/ sec per Kinesis video stream. Such a stream would have an outgoing bitrate of 2x the streams’ maximum incoming bitrate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>API</th>
<th>Stream-level limit</th>
<th>Connection-level limit</th>
<th>Bandwidth limit</th>
<th>Fragment-level limit</th>
<th>Relevant Exceptions and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>GetMediaForFragmentList</td>
<td>5 [s]</td>
<td>25 MB/s or 200 MbpsA [s]</td>
<td>Maximum number of fragments: 1000 [h]</td>
<td>Five fragment-based consuming applications can concurrently get media. Further connections are rejected.</td>
<td></td>
</tr>
<tr>
<td>GetClip</td>
<td>1 TPS [h]</td>
<td>N/A</td>
<td>100 MB size limit [h]</td>
<td>Maximum number of fragments: 200 [h]</td>
<td>There’s a 25 transactions per second (TPS) account-level limit [s] for this API.</td>
</tr>
</tbody>
</table>

### Video Playback Protocol API limits

<table>
<thead>
<tr>
<th>API</th>
<th>Session-level limit</th>
<th>Fragment-level limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GetDASHManifestPlaylist</td>
<td>5 TPS [h]</td>
<td>Maximum number of fragments per playlist: 1000 [h]</td>
</tr>
<tr>
<td>GetHLSMasterPlaylist</td>
<td>5 TPS [h]</td>
<td>N/A</td>
</tr>
<tr>
<td>GetHLSMediaPlaylist</td>
<td>5 TPS [h]</td>
<td>Maximum number of fragments per playlist: 1000 [h]</td>
</tr>
<tr>
<td>GetMP4InitFragment</td>
<td>5 TPS [h]</td>
<td>N/A</td>
</tr>
<tr>
<td>GetMP4MediaFragment</td>
<td>10 TPS [h]</td>
<td>N/A</td>
</tr>
<tr>
<td>GetTSFragment</td>
<td>10 TPS [h]</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Troubleshooting Kinesis Video Streams

Use the following information to troubleshoot common issues encountered with Amazon Kinesis Video Streams.

Topics
- Troubleshooting General Issues (p. 174)
- Troubleshooting API Issues (p. 174)
- Troubleshooting HLS Issues (p. 176)
- Troubleshooting Java Issues (p. 177)
- Troubleshooting Producer Library Issues (p. 178)
- Troubleshooting Stream Parser Library Issues (p. 183)

Troubleshooting General Issues

This section describes general issues that you might encounter when working with Kinesis Video Streams.

Issues
- Latency too high (p. 174)

Latency too high

Latency might be caused by the duration of fragments that are sent to the Kinesis Video Streams service. One way to reduce the latency between the producer and the service is to configure the media pipeline to produce shorter fragment durations.

To reduce the number of frames sent in each fragment, and thus reduce the amount of time for each fragment, reduce the following value in `kinesis_video_gstreamer_sample_app.cpp`:

```c
g_object_set(G_OBJECT (data.encoder), "bframes", 0, "key-int-max", 45, "bitrate", 512, NULL);
```

Note
- Latencies are higher in the Mozilla Firefox browser due to the internal implementation of video rendering.

Troubleshooting API Issues

This section describes API issues that you might encounter when working with Kinesis Video Streams.

Issues
- Error: "Unknown options" (p. 175)
- Error: "Unable to determine service/operation name to be authorized" (p. 175)
- Error: "Failed to put a frame in the stream" (p. 175)
• Error: "Service closed connection before final AckEvent was received" (p. 175)
• Error: "STATUS_STORE_OUT_OF_MEMORY" (p. 176)

Error: "Unknown options"

GetMedia and GetMediaForFragmentList can fail with the following error:

Unknown options: <filename>.mkv

This error occurs if you configured the AWS CLI with an output type of `json`. Reconfigure the AWS CLI with the default output type (`none`). For information about configuring the AWS CLI, see `configure` in the AWS CLI Command Reference.

Error: "Unable to determine service/operation name to be authorized"

GetMedia can fail with the following error:

Unable to determine service/operation name to be authorized

This error might occur if the endpoint is not properly specified. When you are getting the endpoint, be sure to include the following parameter in the `GetDataEndpoint` call, depending on the API to be called:

--api-name GET_MEDIA
--api-name PUT_MEDIA
--api-name GET_MEDIA_FOR_FRAGMENT_LIST
--api-name LIST_FRAGMENTS

Error: "Failed to put a frame in the stream"

PutMedia can fail with the following error:

Failed to put a frame in the stream

This error might occur if connectivity or permissions are not available to the service. Run the following in the AWS CLI, and verify that the stream information can be retrieved:

```
aws kinesisvideo describe-stream --stream-name StreamName --endpoint https://ServiceEndpoint.kinesisvideo.region.amazonaws.com
```

If the call fails, see Troubleshooting AWS CLI Errors for more information.

Error: "Service closed connection before final AckEvent was received"

PutMedia can fail with the following error:

com.amazonaws.SdkClientException: Service closed connection before final AckEvent was received
This error might occur if PushbackInputStream is improperly implemented. Ensure that the unread() methods are correctly implemented.

Error: "STATUS_STORE_OUT_OF_MEMORY"

PutMedia can fail with the following error:

| The content store is out of memory. |

This error occurs when the content store is not allocated with sufficient size. To increase the size of the content store, increase the value of StorageInfo.storageSize. For more information, see StorageInfo (p. 108).

Troubleshooting HLS Issues

This section describes issues that you might encounter when using HTTP Live Streaming (HLS) with Kinesis Video Streams.

Issues
- Retrieving HLS streaming session URL succeeds, but playback fails in video player (p. 176)
- Latency too high between producer and player (p. 177)

Retrieving HLS streaming session URL succeeds, but playback fails in video player

This situation occurs when you can successfully retrieve an HLS streaming session URL using GetHLSStreamingSessionURL, but the video fails to play back when the URL is provided to a video player.

To troubleshoot this situation, try the following:

- Determine whether the video stream plays back in the Kinesis Video Streams console. Consider any errors that the console shows.
- If the fragment duration is less than one second, increase it to one second. If the fragment duration is too short, the service might throttle the player because it is making requests for video fragments too frequently.
- Verify that each HLS streaming session URL is being used by only one player. If more than one player is using a single HLS streaming session URL, the service might receive too many requests and throttle them.
- Verify that your player supports all of the options that you are specifying for the HLS streaming session. Try different combinations of values for the following parameters:
  - ContainerFormat
  - PlaybackMode
  - FragmentSelectorType
  - DiscontinuityMode
  - MaxMediaPlaylistFragmentResults

Some media players (like HTML5 and mobile players) typically only support HLS with the fMP4 container format. Other media players (like Flash and custom players) may only support HLS with the
MPEG TS container format. Experimenting with the `ContainerFormat` parameter is a good place to start troubleshooting.

- Verify that each fragment has a consistent number of tracks. Verify that fragments in the stream are not changing between having both an audio and video track and just a video track. Also verify that the encoder settings (resolution, frame rate, etc) are not changing between fragments in each track.

**Latency too high between producer and player**

This situation occurs when the latency is too high from when the video is captured to when it is played in the video player.

Video is played back through HLS on a per-fragment basis. Therefore, latency can't be less than fragment duration. Latency also includes the time needed for buffering and transferring data. If your solution requires latency of less than one second, consider using the `GetMedia` API instead.

You can adjust the following parameters to reduce the overall latency, but adjusting these parameters might also reduce the video quality or increase the rebuffering rate.

- **Fragment duration**: The fragment duration is the amount of video between divisions in the stream as controlled by the frequency of keyframes generated by the video encoder. The recommended value is one second. Having a shorter fragment duration means that less time is spent waiting for the fragment to complete before transmitting the video data to the service. Shorter fragments are also faster for the service to process. However, if the fragment duration is too short, the probability increases that the player will run out of content and have to stop and buffer content. If the fragment duration is less than 500 milliseconds, the producer might create too many requests, causing the service to throttle them.

- **Bitrate**: A video stream with a lower bitrate takes less time to read, write, and transmit. However, a video stream with a lower bitrate usually has a lower video quality.

- **Fragment count in media playlists**: A latency-sensitive player should only load the newest fragments in a media playlist. Most players start at the oldest fragment instead. By reducing the number of fragments in the playlist, you reduce the time separation between the old and new fragments. With a smaller playlist size, it is possible for a fragment to be skipped during playback, if there is a delay in adding new fragments to the playlist, or if there is a delay in the player getting an updated playlist. We recommend using 3–5 fragments, and to use a player that is configured to load only the newest fragments from a playlist.

- **Player buffer size**: Most video players have a configurable minimum buffer duration, usually with a 10-second default. For the lowest latency, you can set this value to 0 seconds. However, doing so means that the player rebuffers if there is any delay producing fragments because the player will have no buffer for absorbing the delay.

- **Player "catch up"**: Video players typically don't automatically catch playback up to the front of the video buffer if the buffer fills up, such as when a delayed fragment causes a backlog of fragments to play. A custom player can avoid this by either dropping frames, or increasing the playback speed (for example, to 1.1x) to catch up to the front of the buffer. This causes playback to be choppy or increase in speed as the player catches up, and rebuffering might be more frequent as the buffer size is kept short.

**Troubleshooting Java Issues**

This section describes how to troubleshoot common Java issues encountered when working with Kinesis Video Streams.

**Issues**

- **Enabling Java logs**
Enabling Java logs

To troubleshoot issues with Java samples and libraries, it is helpful to enable and examine the debug logs. To enable debug logs, do the following:

1. Add log4j to the pom.xml file, in the dependencies node:

   ```xml
   <dependency>
     <groupId>log4j</groupId>
     <artifactId>log4j</artifactId>
     <version>1.2.17</version>
   </dependency>
   ```

2. In the target/classes directory, create a file named log4j.properties with the following contents:

   ```properties
   # Root logger option
   log4j.rootLogger=DEBUG, stdout
   # Redirect log messages to console
   log4j.appender.stdout=org.apache.log4j.ConsoleAppender
   log4j.appender.stdout.target=System.out
   log4j.appender.stdout.layout=org.apache.log4j.PatternLayout
   log4j.appender.stdout.layout.ConversionPattern=%d{yyyy-MM-dd HH:mm:ss} %-5p %c{1}:%L - %m%n
   log4j.logger.org.apache.http.wire=DEBUG
   ```

   The debug logs then print to the IDE console.

Troubleshooting Producer Library Issues

This section describes issues that you might encounter when using the Producer Libraries (p. 46).

Issues

- Cannot compile the Producer SDK (p. 179)
- Video stream does not appear in the console (p. 179)
- Error: "Security token included in the request is invalid" when streaming data using the GStreamer demo application (p. 179)
- Error: "Failed to submit frame to Kinesis Video client" (p. 179)
- GStreamer application stops with "streaming stopped, reason not-negotiated" message on OS X (p. 180)
- Error: "Failed to allocate heap" when creating Kinesis Video Client in GStreamer demo on Raspberry Pi (p. 180)
- Error: "Illegal Instruction" when running GStreamer demo on Raspberry Pi (p. 180)
- Camera fails to load on Raspberry Pi (p. 180)
- Camera can't be found on macOS High Sierra (p. 181)
- jni.h file not found when compiling on macOS High Sierra (p. 181)
- Curl errors when running the GStreamer demo application (p. 181)
- Timestamp/range assertion at runtime on Raspberry Pi (p. 181)
- Assertion on gst_value_set_fraction_range_full on Raspberry Pi (p. 182)
- STATUS_MKV_INVALID_ANNEXB_NALU_IN_FRAME_DATA (0x3200000d) error on Android (p. 182)
Cannot compile the Producer SDK

Verify that the required libraries are in your path. To verify this, use the following command:

```
$ env | grep LD_LIBRARY_PATH
```

Video stream does not appear in the console

To display your video stream in the console, it must be encoded using H.264 in AvCC format. If your stream is not displayed, verify the following:

- Your NAL Adaptation Flags (p. 107) are set to NAL_ADAPTATION_ANNEXB_NALS | NAL_ADAPTATION_ANNEXB_CPD_NALS if the original stream is in Annex-B format. This is the default value in the StreamDefinition constructor.
- You are providing the codec private data correctly. For H.264, this is the sequence parameter set (SPS) and picture parameter set (PPS). Depending on your media source, this data may be retrieved from the media source separately or encoded into the frame.

Many elementary streams are in the following format, where Ab is the Annex-B start code (001 or 0001):

```
Ab(Sps)Ab(Pps)Ab(I-frame)Ab(P/B-frame) Ab(P/B-frame) Ab(P/B-frame) Ab(P/B-frame) Ab(P/B-frame) Ab(P/B-frame)
```

The CPD (Codec Private Data) which in the case of H.264 is in the stream as SPS and PPS, can be adapted to the AvCC format. Unless the media pipeline gives the CPD separately, the application can extract the CPD from the frame by looking for the first Idr frame (which should contain the SPS/PPS), extract the two NALUs [which will be Ab(Sps)Ab(Pps)] and set it in the CPD in StreamDefinition.

Error: "Security token included in the request is invalid" when streaming data using the GStreamer demo application

If this error occurs, there is an issue with your credentials. Verify the following:

- If you are using temporary credentials, you must specify the session token.
- Verify that your temporary credentials are not expired.
- Verify that you have the proper rights set up.
- On macOS, verify that you do not have credentials cached in Keychain.

Error: "Failed to submit frame to Kinesis Video client"

If this error occurs, the timestamps are not properly set in the source stream. Try the following:
• Use the latest SDK sample, which might have an update that fixes your issue.
• Set the high-quality stream to a higher bit rate, and fix any jitter in the source stream if the camera supports doing so.

GStreamer application stops with "streaming stopped, reason not-negotiated" message on OS X

Streaming may stop on OS X with the following message:

```
```

A possible workaround for this is to remove the framerate parameters from the `gst_caps_new_simple` call in `kinesis_video_gstreamer_sample_app.cpp`:

```c
GstCaps *h264_caps = gst_caps_new_simple("video/x-h264",
  "profile", G_TYPE_STRING, "baseline",
  "stream-format", G_TYPE_STRING, "avc",
  "alignment", G_TYPE_STRING, "au",
  "width", GST_TYPE_INT_RANGE, 320, 1920,
  "height", GST_TYPE_INT_RANGE, 240, 1080,
  "framerate", GST_TYPE_FRACTION_RANGE, 0, 1,
  30, 1,
  NULL);
```

Error: "Failed to allocate heap" when creating Kinesis Video Client in GStreamer demo on Raspberry Pi

The GStreamer sample application tries to allocate 512 MB of RAM, which might not be available on your system. You can reduce this allocation by reducing the following value in `KinesisVideoProducer.cpp`:

```c
device_info.storageInfo.storageSize = 512 * 1024 * 1024;
```

Error: "Illegal Instruction" when running GStreamer demo on Raspberry Pi

If you encounter the following error when executing the GStreamer demo, ensure that you have compiled the application for the correct version of your device. (For example, ensure that you are not compiling for Raspberry Pi 3 when you are running on Raspberry Pi 2.)

```
INFO - Initializing curl.
Illegal instruction
```

Camera fails to load on Raspberry Pi

To check whether the camera is loaded, run the following:
Camera can't be found on macOS High Sierra

On macOS High Sierra, the demo application can't find the camera if more than one camera is available.

jni.h file not found when compiling on macOS High Sierra

To resolve this error, update your installation of Xcode to the latest version.

Curl errors when running the GStreamer demo application

To resolve curl errors when you run the GStreamer demo application, copy this certificate file to /etc/ssl/cert.pem.

Timestamp/range assertion at runtime on Raspberry Pi

If a timestamp range assertion occurs at runtime, update the firmware and restart the device:

```
$ sudo rpi-update
$ sudo reboot
```
Assertion on `gst_value_set_fraction_range_full` on Raspberry Pi

The following assertion appears if the `uv4l` service is running:

```c
gst_util_fraction_compare (numerator_start, denominator_start, numerator_end, denominator_end) < 0' failed
```

If this occurs, stop the `uv4l` service and restart the application.

**STATUS_MKV_INVALID_ANNEXB_NALU_IN_FRAME_DATA (0x3200000d) error on Android**

The following error appears if the NAL Adaptation Flags (p. 107) are incorrect for the media stream:

```java
putKinesisVideoFrame(): Failed to put a frame with status code 0x3200000d
```

If this error occurs, provide the correct `.withNalAdaptationFlags` flag for your media (for example, `NAL_ADAPTATION_ANNEXB_CP_D_NALS`). Provide this flag in the following line of the Android Producer Library (p. 51):


**Maximum Fragment Duration Was Reached Error**

This error occurs when a media fragment in a stream exceeds the maximum fragment duration limit. By default, Kinesis Video Streams sets a stream's maximum fragment duration to 10 seconds.

To resolve this issue, try the following:

- If you are using a webcam/USB camera, do one of the following:
  - If the you are using key frame-based fragmentation, then set the encoder to provide key frames within 10 seconds.
  - If you are not using key frame-based fragmentation, then when defining the stream in Step 2: Write and Examine the Code (p. 59), set the maximum fragment duration limit to a value that's less than 10 seconds.
  - If you are using software encoders (like x264) in the Gstemer pipeline, you can set the key-int-max attribute to a value within 10 seconds (for example, set key-int-max to 60, with fps set to 30, to enable key frames every 2 seconds).
  - If you are using an RPI camera, set the keyframe-interval attribute to be less than 10 seconds.
  - If you are using an IP (RTSP) camera, set the GOP size to 60.

"Invalid thing name passed" error when using IoT authorization

To avoid this error (`HTTP Error 403: Response: {"message":"Invalid thing name passed"}`) when you're using IoT credentials for authorization, make sure that the value of `stream-name` (a required parameter of the `kvssink` element) is identical to the value of `iot-thingname`. For more information, see GStreamer Element Parameter Reference (p. 141).
Troubleshooting Stream Parser Library Issues

This section describes issues that you might encounter when using the Stream Parser Library (p. 127).

Issues

- Cannot access a single frame from the stream (p. 183)
- Fragment decoding error (p. 183)

Cannot access a single frame from the stream

To access a single frame from a streaming source in your consumer application, ensure that your stream contains the correct codec private data. For information about the format of the data in a stream, see Data Model (p. 18).

To learn how to use codec private data to access a frame, see the following test file on the GitHub website: KinesisVideoRendererExampleTest.java

Fragment decoding error

If your fragments are not properly encoded in an H.264 format and level that the browser supports, you might see the following error when playing your stream in the console:

<table>
<thead>
<tr>
<th>Fragment Decoding Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>There was an error decoding the video data. Verify that the stream contains valid H.264 content</td>
</tr>
</tbody>
</table>

If this occurs, verify the following:

- The resolution of the frames matches the resolution specified in the Codec Private Data.
- The H.264 profile and level of the encoded frames matches the profile and level specified in the Codec Private Data.
- The browser supports the profile/level combination. Most current browsers support all profile and level combinations.
- The timestamps are accurate and in the correct order, and no duplicate timestamps are being created.
- Your application is encoding the frame data using the H.264 format.
# Document History for Amazon Kinesis Video Streams

The following table describes the important changes to the documentation since the last release of Amazon Kinesis Video Streams.

- **Latest API version:** 2017-11-29
- **Latest documentation update:** January 21, 2019

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting Started: Send Data to a Kinesis video stream</td>
<td>Basic tutorial for sending media data from a camera to a Kinesis video stream. For more information, see [Step 3: Send Data to a Kinesis Video Stream](p. 26).</td>
<td>January 21, 2019</td>
</tr>
<tr>
<td>Library template for integration with Amazon SageMaker</td>
<td>Sample application for Kinesis Video Streams that uses Amazon SageMaker to identify when certain objects appear in an Amazon Kinesis video stream. For more information, see [Amazon SageMaker](p. 150).</td>
<td>November 19, 2018</td>
</tr>
<tr>
<td>Streaming metadata</td>
<td>You can use the Producer SDK to embed metadata in a Kinesis video stream. For more information, see [Using Streaming Metadata with Kinesis Video Streams](p. 15).</td>
<td>September 28, 2018</td>
</tr>
<tr>
<td>C++ Producer SDK for Windows</td>
<td>The C++ Producer SDK is now available for Microsoft Windows. For more information, see [Using the C++ Producer SDK on Windows](p. 65).</td>
<td>August 30, 2018</td>
</tr>
<tr>
<td>C++ Producer SDK logging</td>
<td>You can configure logging for C++ Producer SDK applications. For more information, see [Using Logging with the C++ Producer SDK](p. 75).</td>
<td>July 18, 2018</td>
</tr>
<tr>
<td>HLS video streaming</td>
<td>You can now view a Kinesis video stream using HTTP Live Streaming. For more information, see [Kinesis Video Streams Playback](p. 9).</td>
<td>July 13, 2018</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Streaming from an RTSP source</td>
<td>Sample application for Kinesis Video Streams that runs in a Docker container and streams video from an RTSP source. For more information, see RTSP and Docker (p. 147).</td>
<td>June 20, 2018</td>
</tr>
<tr>
<td>C++ Producer SDK GStreamer Plugin</td>
<td>Shows how to build the C++ Producer Library (p. 56) to use as a GStreamer destination. For more information, see GStreamer (p. 135).</td>
<td>June 15, 2018</td>
</tr>
<tr>
<td>Producer SDK callbacks reference documentation</td>
<td>Reference documentation for the callbacks used by the Kinesis Video Streams Producer Libraries (p. 46). For more information, see Producer SDK Callbacks (p. 121).</td>
<td>June 12, 2018</td>
</tr>
<tr>
<td>System requirements</td>
<td>Documentation for memory and storage requirements for producer devices and SDK. For more information, see Kinesis Video Streams System Requirements (p. 3).</td>
<td>May 30, 2018</td>
</tr>
<tr>
<td>CloudTrail support</td>
<td>Documentation for using CloudTrail to monitor API usage. For more information, see Logging Kinesis Video Streams API Calls with AWS CloudTrail (p. 166).</td>
<td>May 24, 2018</td>
</tr>
<tr>
<td>Producer SDK structures reference documentation</td>
<td>Reference documentation for the structures used by the Kinesis Video Streams Producer Libraries (p. 46). For more information, see Producer SDK Structures (p. 107) and Kinesis Video Stream Structures (p. 109).</td>
<td>May 7, 2018</td>
</tr>
<tr>
<td>Renderer example documentation</td>
<td>Documentation for the Renderer example application, which shows how to decode and display frames from a Kinesis video stream. For more information, see Example: Parsing and Rendering Kinesis Video Streams Fragments (p. 148).</td>
<td>March 15, 2018</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Producer SDK Limits reference documentation</td>
<td>Information about limits for operations in the C++ Producer Library (p. 56). For more information, see Producer SDK Limits (p. 81).</td>
<td>March 13, 2018</td>
</tr>
<tr>
<td>C++ Producer SDK for Raspberry Pi</td>
<td>Procedure for setting up and running the C++ Producer Library (p. 56) on a Raspberry Pi device. For more information, see Using the C++ Producer SDK on Raspberry Pi (p. 69).</td>
<td>March 13, 2018</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Information about monitoring Kinesis Video Streams metrics and API calls using Amazon CloudWatch and AWS CloudTrail. For more information, see Monitoring Kinesis Video Streams (p. 156).</td>
<td>February 5, 2018</td>
</tr>
<tr>
<td>Network Abstraction Layer (NAL) adaptation flag reference</td>
<td>Information about setting NAL adaptation flags when consuming streaming video. For more information, see NAL Adaptation Flags (p. 107).</td>
<td>January 15, 2018</td>
</tr>
<tr>
<td>Android support for streaming video</td>
<td>Kinesis Video Streams now supports streaming video from Android devices. For more information, see Android Producer Library (p. 51).</td>
<td>January 12, 2018</td>
</tr>
<tr>
<td>Kinesis Video example documentation</td>
<td>Documentation for the Kinesis Video example application, which shows how to use the Kinesis Video Stream Parser Library (p. 127) in an application. For more information, see KinesisVideoExample (p. 131).</td>
<td>January 9, 2018</td>
</tr>
<tr>
<td>Kinesis Video Streams documentation released</td>
<td>This is the initial release of the Amazon Kinesis Video Streams Developer Guide.</td>
<td>November 29, 2017</td>
</tr>
</tbody>
</table>
API Reference

This section contains the API Reference documentation.

Actions

The following actions are supported by Amazon Kinesis Video Streams:

- CreateSignalingChannel (p. 189)
- CreateStream (p. 192)
- DeleteSignalingChannel (p. 196)
- DeleteStream (p. 198)
- DescribeSignalingChannel (p. 201)
- DescribeStream (p. 204)
- GetDataEndpoint (p. 207)
- GetSignalingChannelEndpoint (p. 210)
- ListSignalingChannels (p. 213)
- ListStreams (p. 216)
- ListTagsForResource (p. 219)
- ListTagsForStream (p. 222)
- TagResource (p. 225)
- TagStream (p. 227)
- UntagResource (p. 230)
- UntagStream (p. 232)
- UpdateDataRetention (p. 235)
- UpdateSignalingChannel (p. 238)
- UpdateStream (p. 241)

The following actions are supported by Amazon Kinesis Video Streams Media:

- GetMedia (p. 244)
- PutMedia (p. 248)

The following actions are supported by Amazon Kinesis Video Streams Archived Media:

- GetClip (p. 255)
- GetDASHStreamingSessionURL (p. 259)
- GetHLSStreamingSessionURL (p. 266)
- GetMediaForFragmentList (p. 274)
- ListFragments (p. 277)

The following actions are supported by Amazon Kinesis Video Signaling Channels:

- GetIceServerConfig (p. 281)
Amazon Kinesis Video Streams

The following actions are supported by Amazon Kinesis Video Streams:

- CreateSignalingChannel (p. 189)
- CreateStream (p. 192)
- DeleteSignalingChannel (p. 196)
- DeleteStream (p. 198)
- DescribeSignalingChannel (p. 201)
- DescribeStream (p. 204)
- GetDataEndpoint (p. 207)
- GetSignalingChannelEndpoint (p. 210)
- ListSignalingChannels (p. 213)
- ListStreams (p. 216)
- ListTagsForResource (p. 219)
- ListTagsForStream (p. 222)
- TagResource (p. 225)
- TagStream (p. 227)
- UntagResource (p. 230)
- UntagStream (p. 232)
- UpdateDataRetention (p. 235)
- UpdateSignalingChannel (p. 238)
- UpdateStream (p. 241)
**CreateSignalingChannel**  
Service: Amazon Kinesis Video Streams

CreateSignalingChannel creates a signaling channel.

CreateSignalingChannel is an asynchronous operation.

**Request Syntax**

```
POST /createSignalingChannel HTTP/1.1
Content-type: application/json

{
    "ChannelName": "string",
    "ChannelType": "string",
    "SingleMasterConfiguration": {
        "MessageTtlSeconds": number
    },
    "Tags": [
        { 
            "Key": "string",
            "Value": "string"
        }
    ]
}
```

**URI Request Parameters**

The request does not use any URI parameters.

**Request Body**

The request accepts the following data in JSON format.

**ChannelName (p. 189)**

A name for the signaling channel that you are creating. It must be unique for each AWS account and AWS Region.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+

Required: Yes

**ChannelType (p. 189)**

A type of the signaling channel that you are creating. Currently, SINGLE_MASTER is the only supported channel type.

Type: String

Valid Values: SINGLE_MASTER

Required: No

**SingleMasterConfiguration (p. 189)**

A structure containing the configuration for the SINGLE_MASTER channel type.
Type: `SingleMasterConfiguration` (p. 293) object

Required: No

**Tags (p. 189)**

A set of tags (key-value pairs) that you want to associate with this channel.

Type: Array of `Tag` (p. 297) objects

Array Members: Minimum number of 0 items. Maximum number of 50 items.

Required: No

**Response Syntax**

```
HTTP/1.1 200
Content-type: application/json
{
    "ChannelARN": "string"
}
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

**ChannelARN (p. 190)**

The Amazon Resource Name (ARN) of the created channel.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+`

**Errors**

For information about the errors that are common to all actions, see `Common Errors (p. 310)`.

**AccessDeniedException**

You do not have required permissions to perform this operation.

HTTP Status Code: 401

**AccountChannelLimitExceededException**

You have reached the maximum limit of active signaling channels for this AWS account in this region.

HTTP Status Code: 400

**ClientLimitExceeded**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.
HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceInUseException

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

TagsPerResourceExceededLimitException

You have exceeded the limit of tags that you can associate with the resource. Kinesis video streams support up to 50 tags.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
CreateStream
Service: Amazon Kinesis Video Streams

Creates a new Kinesis video stream.

When you create a new stream, Kinesis Video Streams assigns it a version number. When you change the stream's metadata, Kinesis Video Streams updates the version.

CreateStream is an asynchronous operation.

For information about how the service works, see How it Works.

You must have permissions for the KinesisVideo:CreateStream action.

Request Syntax

POST /createStream HTTP/1.1
Content-type: application/json

{
   "DataRetentionInHours": number,
   "DeviceName": "string",
   "KmsKeyId": "string",
   "MediaType": "string",
   "StreamName": "string",
   "Tags": {
      "string" : "string"
   }
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

DataRetentionInHours (p. 192)

The number of hours that you want to retain the data in the stream. Kinesis Video Streams retains the data in a data store that is associated with the stream.

The default value is 0, indicating that the stream does not persist data.

When the DataRetentionInHours value is 0, consumers can still consume the fragments that remain in the service host buffer, which has a retention time limit of 5 minutes and a retention memory limit of 200 MB. Fragments are removed from the buffer when either limit is reached.

Type: Integer

Valid Range: Minimum value of 0.

Required: No

DeviceName (p. 192)

The name of the device that is writing to the stream.

Note
In the current implementation, Kinesis Video Streams does not use this name.
Type: String
Pattern: [a-zA-Z0-9.-]+
Required: No

**KmsKeyId (p. 192)**

The ID of the AWS Key Management Service (AWS KMS) key that you want Kinesis Video Streams to use to encrypt stream data.

If no key ID is specified, the default, Kinesis Video-managed key (aws/kinesisvideo) is used.

For more information, see DescribeKey.

Type: String
Length Constraints: Minimum length of 1. Maximum length of 2048.
Pattern: .+
Required: No

**MediaType (p. 192)**

The media type of the stream. Consumers of the stream can use this information when processing the stream. For more information about media types, see Media Types. If you choose to specify the MediaType, see Naming Requirements for guidelines.

Example valid values include "video/h264" and "video/h264,audio/aac".

This parameter is optional; the default value is null (or empty in JSON).

Type: String
Required: No

**StreamName (p. 192)**

A name for the stream that you are creating.

The stream name is an identifier for the stream, and must be unique for each account and region.

Type: String
Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: [a-zA-Z0-9.-]+
Required: Yes

**Tags (p. 192)**

A list of tags to associate with the specified stream. Each tag is a key-value pair (the value is optional).

Type: String to string map
Key Length Constraints: Minimum length of 1. Maximum length of 128.
Key Pattern: ^([^/\p{L}\p{Z}\p{N}_.:=/\-@]*\$)
Value Length Constraints: Minimum length of 0. Maximum length of 256.
Value Pattern: [\p{L}\p{Z}\p{N}_.:=/\-@]*
Required: No

Response Syntax

HTTP/1.1 200
Content-type: application/json

{
  "StreamARN": "string"
}

Response Elements

If the action is successful, the service sends back an HTTP 200 response.
The following data is returned in JSON format by the service.

StreamARN (p. 194)
  The Amazon Resource Name (ARN) of the stream.
  Type: String
  Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccountStreamLimitExceededException
  The number of streams created for the account is too high.
  HTTP Status Code: 400

ClientLimitExceededException
  Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.
  HTTP Status Code: 400

DeviceStreamLimitExceededException
  Not implemented.
  HTTP Status Code: 400

InvalidArgumentException
  The value for this input parameter is invalid.
  HTTP Status Code: 400
InvalidDeviceException
Not implemented.
HTTP Status Code: 400

ResourceInUseException
The signaling channel is currently not available for this operation.
HTTP Status Code: 400

TagsPerResourceExceededLimitException
You have exceeded the limit of tags that you can associate with the resource. Kinesis video streams support up to 50 tags.
HTTP Status Code: 400

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
DeleteSignalingChannel
Service: Amazon Kinesis Video Streams

Deletes a specified signaling channel. DeleteSignalingChannel is an asynchronous operation. If you don't specify the channel's current version, the most recent version is deleted.

Request Syntax

POST /deleteSignalingChannel HTTP/1.1
Content-type: application/json

{    "ChannelARN": "string",    "CurrentVersion": "string" }

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

ChannelARN (p. 196)

The Amazon Resource Name (ARN) of the signaling channel that you want to delete.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+

Required: Yes

CurrentVersion (p. 196)

The current version of the signaling channel that you want to delete. You can obtain the current version by invoking the DescribeSignalingChannel or ListSignalingChannels API operations.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: [a-zA-Z0-9-]+

Required: No

Response Syntax

HTTP/1.1 200

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.
Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceeded Exception

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceInUseException

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

VersionMismatchException

The stream version that you specified is not the latest version. To get the latest version, use the DescribeStream API.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
DeleteStream
Service: Amazon Kinesis Video Streams

Deletes a Kinesis video stream and the data contained in the stream.

This method marks the stream for deletion, and makes the data in the stream inaccessible immediately.

To ensure that you have the latest version of the stream before deleting it, you can specify the stream version. Kinesis Video Streams assigns a version to each stream. When you update a stream, Kinesis Video Streams assigns a new version number. To get the latest stream version, use the DescribeStream API.

This operation requires permission for the KinesisVideo:DeleteStream action.

Request Syntax

```
POST /deleteStream HTTP/1.1
Content-type: application/json
{
  "CurrentVersion": "string",
  "StreamARN": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

CurrentVersion (p. 198)

Optional: The version of the stream that you want to delete.

Specify the version as a safeguard to ensure that your are deleting the correct stream. To get the stream version, use the DescribeStream API.

If not specified, only the CreationTime is checked before deleting the stream.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: [a-zA-Z0-9]+

Required: No

StreamARN (p. 198)

The Amazon Resource Name (ARN) of the stream that you want to delete.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+

Required: Yes
Response Syntax

HTTP/1.1 200

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform this operation.

HTTP Status Code: 401

ResourceInUseException

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

VersionMismatchException

The stream version that you specified is not the latest version. To get the latest version, use the DescribeStream API.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
• AWS SDK for PHP V3
• AWS SDK for Python
• AWS SDK for Ruby V3
DescribeSignalingChannel
Service: Amazon Kinesis Video Streams

Returns the most current information about the signaling channel. You must specify either the name or the Amazon Resource Name (ARN) of the channel that you want to describe.

Request Syntax

POST /describeSignalingChannel HTTP/1.1
Content-type: application/json

{
  "ChannelARN": "string",
  "ChannelName": "string"
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

ChannelARN (p. 201)

The ARN of the signaling channel that you want to describe.
Type: String
Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+
Required: No

ChannelName (p. 201)

The name of the signaling channel that you want to describe.
Type: String
Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: [a-zA-Z0-9-_.-]+
Required: No

Response Syntax

HTTP/1.1 200
Content-type: application/json

{
  "ChannelInfo": {
    "ChannelARN": "string",
    "ChannelName": "string",
    "ChannelStatus": "string",
    "ChannelType": "string",
  
  
  

201
Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

ChannelInfo (p. 201)

A structure that encapsulates the specified signaling channel's metadata and properties.

Type: ChannelInfo (p. 288) object

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceeded

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgument

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
• AWS SDK for PHP V3
• AWS SDK for Python
• AWS SDK for Ruby V3
DescribeStream
Service: Amazon Kinesis Video Streams

Returns the most current information about the specified stream. You must specify either the StreamName or the StreamARN.

Request Syntax

POST /describeStream HTTP/1.1
Content-type: application/json

{
  "StreamARN": "string",
  "StreamName": "string"
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

StreamARN (p. 204)

The Amazon Resource Name (ARN) of the stream.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.]+/[0-9]+

Required: No

StreamName (p. 204)

The name of the stream.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9._-]+

Required: No

Response Syntax

HTTP/1.1 200
Content-type: application/json

{
  "StreamInfo": {
    "CreationTime": number,
    "DataRetentionInHours": number,
    "DeviceName": "string",
    "KmsKeyId": "string",
    "RmsKeyId": "string"}
}
"MediaType": "string",
"Status": "string",
"StreamARN": "string",
"StreamName": "string",
"Version": "string"
}
}

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

StreamInfo (p. 204)

An object that describes the stream.

Type: StreamInfo (p. 294) object

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform this operation.

HTTP Status Code: 401

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
**GetDataEndpoint**

*Service: Amazon Kinesis Video Streams*

Gets an endpoint for a specified stream for either reading or writing. Use this endpoint in your application to read from the specified stream (using the GetMedia or GetMediaForFragmentList operations) or write to it (using the PutMedia operation).

**Note**

The returned endpoint does not have the API name appended. The client needs to add the API name to the returned endpoint.

In the request, specify the stream either by `StreamName` or `StreamARN`.

**Request Syntax**

```
POST /getDataEndpoint HTTP/1.1
Content-type: application/json

{
    "APIName": "string",
    "StreamARN": "string",
    "StreamName": "string"
}
```

**URI Request Parameters**

The request does not use any URI parameters.

**Request Body**

The request accepts the following data in JSON format.

**APIName (p. 207)**

The name of the API action for which to get an endpoint.

*Type: String*

*Valid Values: PUT_MEDIA | GET_MEDIA | LIST_FRAGMENTS | GET_MEDIA_FOR_FRAGMENT_LIST | GET_HLS_STREAMING_SESSION_URL | GET_DASH_STREAMING_SESSION_URL | GET_CLIP*

*Required: Yes*

**StreamARN (p. 207)**

The Amazon Resource Name (ARN) of the stream that you want to get the endpoint for. You must specify either this parameter or a `StreamName` in the request.

*Type: String*


*Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+*

*Required: No*

**StreamName (p. 207)**

The name of the stream that you want to get the endpoint for. You must specify either this parameter or a `StreamARN` in the request.

*Type: String*
Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+ 

Required: No 

Response Syntax

```
HTTP/1.1 200
Content-type: application/json
{
   "DataEndpoint": "string"
}
```

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

**DataEndpoint (p. 208)**

The endpoint value. To read data from the stream or to write data to it, specify this endpoint in your application.

Type: String

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

The value for this input parameter is invalid.

HTTP Status Code: 400

**NotAuthorizedException**

The caller is not authorized to perform this operation.

HTTP Status Code: 401

**ResourceNotFoundException**

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:
- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
GetSignalingChannelEndpoint
Service: Amazon Kinesis Video Streams

Provides an endpoint for the specified signaling channel to send and receive messages. This API uses the SingleMasterChannelEndpointConfiguration input parameter, which consists of the Protocols and Role properties.

Protocols is used to determine the communication mechanism. For example, if you specify WSS as the protocol, this API produces a secure websocket endpoint. If you specify HTTPS as the protocol, this API generates an HTTPS endpoint.

Role determines the messaging permissions. A MASTER role results in this API generating an endpoint that a client can use to communicate with any of the viewers on the channel. A VIEWER role results in this API generating an endpoint that a client can use to communicate only with a MASTER.

Request Syntax

```plaintext
POST /getSignalingChannelEndpoint HTTP/1.1
Content-type: application/json

{
    "ChannelARN": "string",
    "SingleMasterChannelEndpointConfiguration": {
        "Protocols": [ "string" ],
        "Role": "string"
    }
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

ChannelARN (p. 210)

The Amazon Resource Name (ARN) of the signalling channel for which you want to get an endpoint.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+

Required: Yes

SingleMasterChannelEndpointConfiguration (p. 210)

A structure containing the endpoint configuration for the SINGLE_MASTER channel type.

Type: SingleMasterChannelEndpointConfiguration (p. 292) object

Required: No

Response Syntax

```
HTTP/1.1 200
```
Content-type: application/json

```json
{
    "ResourceEndpointList": [
        {
            "Protocol": "string",
            "ResourceEndpoint": "string"
        }
    ]
}
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response. The following data is returned in JSON format by the service.

**ResourceEndpointList (p. 210)**

A list of endpoints for the specified signaling channel.

Type: Array of ResourceEndpointListItem (p. 291) objects

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**AccessDeniedException**

You do not have required permissions to perform this operation.

HTTP Status Code: 401

**ClientLimitExceeded Exception**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

The value for this input parameter is invalid.

HTTP Status Code: 400

**ResourceInUseException**

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

**ResourceNotFoundException**

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
**ListSignalingChannels**  
**Service:** Amazon Kinesis Video Streams

Returns an array of ChannelInfo objects. Each object describes a signaling channel. To retrieve only those channels that satisfy a specific condition, you can specify a ChannelNameCondition.

**Request Syntax**

```plaintext
POST /listSignalingChannels HTTP/1.1  
Content-type: application/json

{
    "ChannelNameCondition": {
        "ComparisonOperator": "string",
        "ComparisonValue": "string"
    },
    "MaxResults": number,
    "NextToken": "string"
}
```

**URI Request Parameters**

The request does not use any URI parameters.

**Request Body**

The request accepts the following data in JSON format.

**ChannelNameCondition (p. 213)**

- Optional: Returns only the channels that satisfy a specific condition.
- Type: ChannelNameCondition (p. 290) object
- Required: No

**MaxResults (p. 213)**

- The maximum number of channels to return in the response. The default is 500.
- Type: Integer
- Valid Range: Minimum value of 1. Maximum value of 10000.
- Required: No

**NextToken (p. 213)**

- If you specify this parameter, when the result of a ListSignalingChannels operation is truncated, the call returns the NextToken in the response. To get another batch of channels, provide this token in your next request.
- Type: String
- Length Constraints: Minimum length of 0. Maximum length of 512.
- Pattern: [a-zA-Z0-9+/=]*
- Required: No
Response Syntax

HTTP/1.1 200
Content-type: application/json

{
   "ChannelInfoList": [
      {
         "ChannelARN": "string",
         "ChannelName": "string",
         "ChannelStatus": "string",
         "ChannelType": "string",
         "CreationTime": number,
         "SingleMasterConfiguration": {
            "MessageTtlSeconds": number
         },
         "Version": "string"
      }],
   "NextToken": "string"
}

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

ChannelInfoList (p. 214)

An array of ChannelInfo objects.

Type: Array of ChannelInfo (p. 288) objects

NextToken (p. 214)

If the response is truncated, the call returns this element with a token. To get the next batch of streams, use this token in your next request.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 512.

Pattern: [a-zA-Z0-9+/=]*

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceeded Exception

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400
InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
**ListStreams**  
*Service: Amazon Kinesis Video Streams*

Returns an array of `StreamInfo` objects. Each object describes a stream. To retrieve only streams that satisfy a specific condition, you can specify a `StreamNameCondition`.

**Request Syntax**

```plaintext
POST /listStreams HTTP/1.1  
Content-type: application/json

{
  "MaxResults": number,
  "NextToken": "string",
  "StreamNameCondition": {
    "ComparisonOperator": "string",
    "ComparisonValue": "string"
  }
}
```

**URI Request Parameters**

The request does not use any URI parameters.

**Request Body**

The request accepts the following data in JSON format.

**MaxResults (p. 216)**

The maximum number of streams to return in the response. The default is 10,000.

- Type: Integer
- Valid Range: Minimum value of 1. Maximum value of 10000.
- Required: No

**NextToken (p. 216)**

If you specify this parameter, when the result of a `ListStreams` operation is truncated, the call returns the `NextToken` in the response. To get another batch of streams, provide this token in your next request.

- Type: String
- Length Constraints: Minimum length of 0. Maximum length of 512.
- Pattern: [a-zA-Z0-9+/=]*
- Required: No

**StreamNameCondition (p. 216)**

Optional: Returns only streams that satisfy a specific condition. Currently, you can specify only the prefix of a stream name as a condition.

- Type: `StreamNameCondition (p. 296)` object
- Required: No
Response Syntax

HTTP/1.1 200
Content-type: application/json

{  
  "NextToken": "string",
  "StreamInfoList": [
    {
      "CreationTime": number,
      "DataRetentionInHours": number,
      "DeviceName": "string",
      "KmsKeyId": "string",
      "MediaType": "string",
      "Status": "string",
      "StreamARN": "string",
      "StreamName": "string",
      "Version": "string"
    }
  ]
}

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

NextToken (p. 217)

If the response is truncated, the call returns this element with a token. To get the next batch of streams, use this token in your next request.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 512.

Pattern: [a-zA-Z0-9+/=]*

StreamInfoList (p. 217)

An array of StreamInfo objects.

Type: Array of StreamInfo (p. 294) objects

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400
See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
ListTagsForResource
Service: Amazon Kinesis Video Streams
Returns a list of tags associated with the specified signaling channel.

Request Syntax

```json
POST /ListTagsForResource HTTP/1.1
Content-type: application/json
{
  "NextToken": "string",
  "ResourceARN": "string"
}
```

URI Request Parameters
The request does not use any URI parameters.

Request Body
The request accepts the following data in JSON format.

```plaintext
NextToken (p. 219)
If you specify this parameter and the result of a ListTagsForResource call is truncated, the response includes a token that you can use in the next request to fetch the next batch of tags.
Type: String
Length Constraints: Minimum length of 0. Maximum length of 512.
Pattern: [a-zA-Z0-9+/=]*
Required: No

ResourceARN (p. 219)
The Amazon Resource Name (ARN) of the signaling channel for which you want to list tags.
Type: String
Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.]+/[0-9]+*
Required: Yes
```

Response Syntax

```json
HTTP/1.1 200
Content-type: application/json
{
  "NextToken": "string",
  "Tags": {
    "string": "string"
  }
}
```
Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

NextToken (p. 219)

If you specify this parameter and the result of a ListTagsForResource call is truncated, the response includes a token that you can use in the next request to fetch the next set of tags.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 512.

Pattern: [a-zA-Z0-9+/=]*

Tags (p. 219)

A map of tag keys and values associated with the specified signaling channel.

Type: String to string map

Key Length Constraints: Minimum length of 1. Maximum length of 128.

Key Pattern: ^([\p{L}\p{Z}\p{N}\._:/=+\@]*)*$

Value Length Constraints: Minimum length of 0. Maximum length of 256.

Value Pattern: [\p{L}\p{Z}\p{N}\._:/=+\@]*

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:
• AWS Command Line Interface
• AWS SDK for .NET
• AWS SDK for C++
• AWS SDK for Go
• AWS SDK for Java
• AWS SDK for JavaScript
• AWS SDK for PHP V3
• AWS SDK for Python
• AWS SDK for Ruby V3
ListTagsForStream
Service: Amazon Kinesis Video Streams

Returns a list of tags associated with the specified stream.

In the request, you must specify either the StreamName or the StreamARN.

Request Syntax

```plaintext
POST /listTagsForStream HTTP/1.1
Content-type: application/json

{
    "NextToken": "string",
    "StreamARN": "string",
    "StreamName": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

NextToken (p. 222)

If you specify this parameter and the result of a ListTagsForStream call is truncated, the response includes a token that you can use in the next request to fetch the next batch of tags.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 512.

Pattern: [a-zA-Z0-9+/=]*

Required: No

StreamARN (p. 222)

The Amazon Resource Name (ARN) of the stream that you want to list tags for.

Type: String


Required: No

StreamName (p. 222)

The name of the stream that you want to list tags for.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+
Required: No

Response Syntax

```json
HTTP/1.1 200
Content-type: application/json
{
    "NextToken": "string",
    "Tags": {
        "string": "string"
    }
}
```

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

NextToken (p. 223)

If you specify this parameter and the result of a ListTags call is truncated, the response includes a token that you can use in the next request to fetch the next set of tags.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 512.

Pattern: [a-zA-Z0-9+/=]*

Tags (p. 223)

A map of tag keys and values associated with the specified stream.

Type: String to string map

Key Length Constraints: Minimum length of 1. Maximum length of 128.

Key Pattern: ^([\p{L}\p{Z}\p{N}_.:/=+@]*$)

Value Length Constraints: Minimum length of 0. Maximum length of 256.

Value Pattern: [\p{L}\p{Z}\p{N}_.:/=+@]*

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400
InvalidResourceFormatException
The format of the StreamARN is invalid.
HTTP Status Code: 400

NotAuthorizedException
The caller is not authorized to perform this operation.
HTTP Status Code: 401

ResourceNotFoundException
Amazon Kinesis Video Streams can't find the stream that you specified.
HTTP Status Code: 404

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
TagResource
Service: Amazon Kinesis Video Streams

Adds one or more tags to a signaling channel. A tag is a key-value pair (the value is optional) that you can define and assign to AWS resources. If you specify a tag that already exists, the tag value is replaced with the value that you specify in the request. For more information, see Using Cost Allocation Tags in the AWS Billing and Cost Management User Guide.

Request Syntax

POST /TagResource HTTP/1.1
Content-type: application/json

{  
  "ResourceARN": "string",
  "Tags": [
    
    {  
      "Key": "string",
      "Value": "string"
    }
  ]
}

URI Request Parameters
The request does not use any URI parameters.

Request Body
The request accepts the following data in JSON format.

ResourceARN (p. 225)
The Amazon Resource Name (ARN) of the signaling channel to which you want to add tags.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+

Required: Yes

Tags (p. 225)
A list of tags to associate with the specified signaling channel. Each tag is a key-value pair.

Type: Array of Tag (p. 297) objects

Array Members: Minimum number of 1 item. Maximum number of 50 items.

Required: Yes

Response Syntax

HTTP/1.1 200

Response Elements
If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.
Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

**AccessDeniedException**

You do not have required permissions to perform this operation.

HTTP Status Code: 401

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

The value for this input parameter is invalid.

HTTP Status Code: 400

**ResourceNotFoundException**

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

**TagsPerResourceExceededLimitException**

You have exceeded the limit of tags that you can associate with the resource. Kinesis video streams support up to 50 tags.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
TagStream
Service: Amazon Kinesis Video Streams

Adds one or more tags to a stream. A tag is a key-value pair (the value is optional) that you can define and assign to AWS resources. If you specify a tag that already exists, the tag value is replaced with the value that you specify in the request. For more information, see Using Cost Allocation Tags in the AWS Billing and Cost Management User Guide.

You must provide either the StreamName or the StreamARN.

This operation requires permission for the KinesisVideo:TagStream action.

Kinesis video streams support up to 50 tags.

Request Syntax

```json
POST /tagStream HTTP/1.1
Content-type: application/json

{
    "StreamARN": "string",
    "StreamName": "string",
    "Tags": {
        "string": "string"
    }
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

StreamARN (p. 227)

The Amazon Resource Name (ARN) of the resource that you want to add the tag or tags to.

Type: String


Required: No

StreamName (p. 227)

The name of the stream that you want to add the tag or tags to.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-_.-]+`

Required: No

Tags (p. 227)

A list of tags to associate with the specified stream. Each tag is a key-value pair (the value is optional).
Type: String to string map

Key Length Constraints: Minimum length of 1. Maximum length of 128.

Key Pattern: ^([\p{L}\p{Z}\p{N}_.:/=+\-@]*)$

Value Length Constraints: Minimum length of 0. Maximum length of 256.

Value Pattern: [\p{L}\p{Z}\p{N}_.:/=+\-@]*

Required: Yes

Response Syntax

<table>
<thead>
<tr>
<th>HTTP/1.1 200</th>
</tr>
</thead>
</table>

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

InvalidResourceFormatException

The format of the StreamARN is invalid.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform this operation.

HTTP Status Code: 401

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

TagsPerResourceExceededLimitException

You have exceeded the limit of tags that you can associate with the resource. Kinesis video streams support up to 50 tags.

HTTP Status Code: 400
See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
UntagResource
Service: Amazon Kinesis Video Streams

Removes one or more tags from a signaling channel. In the request, specify only a tag key or keys; don't specify the value. If you specify a tag key that does not exist, it's ignored.

Request Syntax

POST /UntagResource HTTP/1.1
Content-type: application/json

{
  "ResourceARN": "string",
  "TagKeyList": [ "string" ]
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

ResourceARN (p. 230)

The Amazon Resource Name (ARN) of the signaling channel from which you want to remove tags.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+

Required: Yes

TagKeyList (p. 230)

A list of the keys of the tags that you want to remove.

Type: Array of strings

Array Members: Minimum number of 1 item. Maximum number of 50 items.


Pattern: ^([\p{L}\p{Z}\p{N}_.:/=+\-@]*)$

Required: Yes

Response Syntax

HTTP/1.1 200

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.
Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceeded Exception

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
UntagStream  
Service: Amazon Kinesis Video Streams

Removes one or more tags from a stream. In the request, specify only a tag key or keys; don't specify the value. If you specify a tag key that does not exist, it's ignored.

In the request, you must provide the StreamName or StreamARN.

Request Syntax

```
POST /untagStream HTTP/1.1
Content-type: application/json
{
    "StreamARN": "string",
    "StreamName": "string",
    "TagKeyList": [ "string" ]
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

StreamARN (p. 232)

The Amazon Resource Name (ARN) of the stream that you want to remove tags from.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+`

Required: No

StreamName (p. 232)

The name of the stream that you want to remove tags from.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-_.-]+`

Required: No

TagKeyList (p. 232)

A list of the keys of the tags that you want to remove.

Type: Array of strings

Array Members: Minimum number of 1 item. Maximum number of 50 items.


Pattern: `^\[(\p{L}\p{Z}\p{N}\p{P}\p{N}_\.:=/\+\-@\])*\]$`
Required: Yes

Response Syntax

HTTP/1.1 200

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

InvalidResourceFormatException

The format of the StreamARN is invalid.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform this operation.

HTTP Status Code: 401

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
UpdateDataRetention
Service: Amazon Kinesis Video Streams

Increases or decreases the stream's data retention period by the value that you specify. To indicate whether you want to increase or decrease the data retention period, specify the Operation parameter in the request body. In the request, you must specify either the StreamName or the StreamARN.

Note
The retention period that you specify replaces the current value.

This operation requires permission for the KinesisVideo:UpdateDataRetention action.

Changing the data retention period affects the data in the stream as follows:

- If the data retention period is increased, existing data is retained for the new retention period. For example, if the data retention period is increased from one hour to seven hours, all existing data is retained for seven hours.
- If the data retention period is decreased, existing data is retained for the new retention period. For example, if the data retention period is decreased from seven hours to one hour, all existing data is retained for one hour, and any data older than one hour is deleted immediately.

Request Syntax

```plaintext
POST /updateDataRetention HTTP/1.1
Content-type: application/json

{
  "CurrentVersion": "string",
  "DataRetentionChangeInHours": number,
  "Operation": "string",
  "StreamARN": "string",
  "StreamName": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

CurrentVersion (p. 235)

The version of the stream whose retention period you want to change. To get the version, call either the DescribeStream or the ListStreams API.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: [a-zA-Z0-9]\+

Required: Yes

DataRetentionChangeInHours (p. 235)

The retention period, in hours. The value you specify replaces the current value. The maximum value for this parameter is 87600 (ten years).
Type: Integer
Valid Range: Minimum value of 1.
Required: Yes

**Operation (p. 235)**
Indicates whether you want to increase or decrease the retention period.
Type: String
Valid Values: INCREASE_DATA_RETENTION | DECREASE_DATA_RETENTION
Required: Yes

**StreamARN (p. 235)**
The Amazon Resource Name (ARN) of the stream whose retention period you want to change.
Type: String
Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+`
Required: No

**StreamName (p. 235)**
The name of the stream whose retention period you want to change.
Type: String
Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: `[a-zA-Z0-9-_.-]+`
Required: No

**Response Syntax**

```
HTTP/1.1 200
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgument Exception**

The value for this input parameter is invalid.
HTTP Status Code: 400

**NotAuthorizedException**

The caller is not authorized to perform this operation.

HTTP Status Code: 401

**ResourceInUseException**

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

**ResourceNotFoundException**

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

**VersionMismatchException**

The stream version that you specified is not the latest version. To get the latest version, use the DescribeStream API.

HTTP Status Code: 400

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
UpdateSignalingChannel

Service: Amazon Kinesis Video Streams

Updates the existing signaling channel. This is an asynchronous operation and takes time to complete.

If the `MessageTtlSeconds` value is updated (either increased or reduced), it only applies to new messages sent via this channel after it's been updated. Existing messages are still expired as per the previous `MessageTtlSeconds` value.

**Request Syntax**

```
POST /updateSignalingChannel HTTP/1.1
Content-type: application/json

{
    "ChannelARN": "string",
    "CurrentVersion": "string",
    "SingleMasterConfiguration": {
        "MessageTtlSeconds": number
    }
}
```

**URI Request Parameters**

The request does not use any URI parameters.

**Request Body**

The request accepts the following data in JSON format.

**ChannelARN (p. 238)**

The Amazon Resource Name (ARN) of the signaling channel that you want to update.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+`

Required: Yes

**CurrentVersion (p. 238)**

The current version of the signaling channel that you want to update.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: `[a-zA-Z0-9-]+`

Required: Yes

**SingleMasterConfiguration (p. 238)**

The structure containing the configuration for the SINGLE_MASTER type of the signaling channel that you want to update.

Type: `SingleMasterConfiguration (p. 293)` object

Required: No
Response Syntax

HTTP/1.1 200

Response Elements

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

AccessDeniedException

You do not have required permissions to perform this operation.

HTTP Status Code: 401

ClientLimitExceeded Exception

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

ResourceInUseException

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

VersionMismatchException

The stream version that you specified is not the latest version. To get the latest version, use the DescribeStream API.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
UpdateStream
Service: Amazon Kinesis Video Streams

Updates stream metadata, such as the device name and media type.

You must provide the stream name or the Amazon Resource Name (ARN) of the stream.

To make sure that you have the latest version of the stream before updating it, you can specify the stream version. Kinesis Video Streams assigns a version to each stream. When you update a stream, Kinesis Video Streams assigns a new version number. To get the latest stream version, use the DescribeStream API.

UpdateStream is an asynchronous operation, and takes time to complete.

Request Syntax

POST /updateStream HTTP/1.1
Content-type: application/json

{
  "CurrentVersion": "string",
  "DeviceName": "string",
  "MediaType": "string",
  "StreamARN": "string",
  "StreamName": "string"
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

CurrentVersion (p. 241)

The version of the stream whose metadata you want to update.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: [a-zA-Z0-9-]+

Required: Yes

DeviceName (p. 241)

The name of the device that is writing to the stream.

Note

In the current implementation, Kinesis Video Streams does not use this name.

Type: String


Pattern: [a-zA-Z0-9_.-]+

Required: No
**MediaType (p. 241)**

The stream’s media type. Use `MediaType` to specify the type of content that the stream contains to the consumers of the stream. For more information about media types, see Media Types. If you choose to specify the `MediaType`, see Naming Requirements.

To play video on the console, you must specify the correct video type. For example, if the video in the stream is H.264, specify `video/h264` as the `MediaType`.

Type: String


Pattern: `[\w\-\.\+]+/[\w\-\.\+]+,(\[\w\-\.\+]+/[\w\-\.\+]+)*`

Required: No

**StreamARN (p. 241)**

The ARN of the stream whose metadata you want to update.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+`

Required: No

**StreamName (p. 241)**

The name of the stream whose metadata you want to update.

The stream name is an identifier for the stream, and must be unique for each account and region.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-_.-]+`

Required: No

**Response Syntax**

| HTTP/1.1 200 |

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response with an empty HTTP body.

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400
InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform this operation.

HTTP Status Code: 401

ResourceInUseException

The signaling channel is currently not available for this operation.

HTTP Status Code: 400

ResourceNotFoundException

Amazon Kinesis Video Streams can't find the stream that you specified.

HTTP Status Code: 404

VersionMismatchException

The stream version that you specified is not the latest version. To get the latest version, use the DescribeStream API.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3

Amazon Kinesis Video Streams Media

The following actions are supported by Amazon Kinesis Video Streams Media:

- GetMedia (p. 244)
- PutMedia (p. 248)
GetMedia
Service: Amazon Kinesis Video Streams Media

Use this API to retrieve media content from a Kinesis video stream. In the request, you identify the stream name or stream Amazon Resource Name (ARN), and the starting chunk. Kinesis Video Streams then returns a stream of chunks in order by fragment number.

**Note**
You must first call the GetDataEndpoint API to get an endpoint. Then send the GetMedia requests to this endpoint using the --endpoint-url parameter.

When you put media data (fragments) on a stream, Kinesis Video Streams stores each incoming fragment and related metadata in what is called a "chunk." For more information, see PutMedia. The GetMedia API returns a stream of these chunks starting from the chunk that you specify in the request.

The following limits apply when using the GetMedia API:

- A client can call GetMedia up to five times per second per stream.
- Kinesis Video Streams sends media data at a rate of up to 25 megabytes per second (or 200 megabits per second) during a GetMedia session.

**Note**
If an error is thrown after invoking a Kinesis Video Streams media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

- `x-amz-ErrorType` HTTP header – contains a more specific error type in addition to what the HTTP status code provides.
- `x-amz-RequestId` HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the ErrorType header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

For more information, see the Errors section at the bottom of this topic, as well as Common Errors.

**Request Syntax**

```
POST /getMedia HTTP/1.1
Content-type: application/json

{
    "StartSelector": {
        "AfterFragmentNumber": "string",
        "ContinuationToken": "string",
        "StartSelectorType": "string",
        "StartTimestamp": number
    },
    "StreamARN": "string",
    "StreamName": "string"
}
```

**URI Request Parameters**

The request does not use any URI parameters.
Request Body

The request accepts the following data in JSON format.

**StartSelector (p. 244)**

Identifies the starting chunk to get from the specified stream.

Type: StartSelector (p. 298) object

Required: Yes

**StreamARN (p. 244)**

The ARN of the stream from where you want to get the media content. If you don't specify the streamARN, you must specify the streamName.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-._]+/[0-9]+

Required: No

**StreamName (p. 244)**

The Kinesis video stream name from where you want to get the media content. If you don't specify the streamName, you must specify the streamARN.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9-._]+

Required: No

Response Syntax

HTTP/1.1 200
Content-Type: ContentType

Payload

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response.

The response returns the following HTTP headers.

**ContentType (p. 245)**

The content type of the requested media.


Pattern: ^[a-zA-Z0-9-._\./\-]+$

The response returns the following as the HTTP body.
Payload (p. 245)

The payload Kinesis Video Streams returns is a sequence of chunks from the specified stream. For more information about the chunks, see PutMedia. The chunks that Kinesis Video Streams returns in the GetMedia call also include the following additional Matroska (MKV) tags:

- AWS_KINESISVIDEO_CONTINUATION_TOKEN (UTF-8 string) - In the event your GetMedia call terminates, you can use this continuation token in your next request to get the next chunk where the last request terminated.
- AWS_KINESISVIDEO_MILLIS_BEHIND_NOW (UTF-8 string) - Client applications can use this tag value to determine how far behind the chunk returned in the response is from the latest chunk on the stream.
- AWS_KINESISVIDEO_FRAGMENT_NUMBER - Fragment number returned in the chunk.
- AWS_KINESISVIDEO_SERVER_TIMESTAMP - Server timestamp of the fragment.
- AWS_KINESISVIDEO_PRODUCER_TIMESTAMP - Producer timestamp of the fragment.

The following tags will be present if an error occurs:

- AWS_KINESISVIDEO_ERROR_CODE - String description of an error that caused GetMedia to stop.
- AWS_KINESISVIDEO_ERROR_ID: Integer code of the error.

The error codes are as follows:

- 3002 - Error writing to the stream
- 4000 - Requested fragment is not found
- 4500 - Access denied for the stream's KMS key
- 4501 - Stream's KMS key is disabled
- 4502 - Validation error on the stream's KMS key
- 4503 - KMS key specified in the stream is unavailable
- 4504 - Invalid usage of the KMS key specified in the stream
- 4505 - Invalid state of the KMS key specified in the stream
- 4506 - Unable to find the KMS key specified in the stream
- 5000 - Internal error

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

ConnectionLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client connections.

HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400
InvalidEndpointException

Caller used wrong endpoint to write data to a stream. On receiving such an exception, the user must call GetDataEndpoint with APIName set to PUT_MEDIA and use the endpoint from response to invoke the next PutMedia call.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

ResourceNotFoundException

Status Code: 404, The stream with the given name does not exist.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
**PutMedia**

Service: Amazon Kinesis Video Streams Media

Use this API to send media data to a Kinesis video stream.

**Note**
Before using this API, you must call the GetDataEndpoint API to get an endpoint. You then specify the endpoint in your PutMedia request.

In the request, you use the HTTP headers to provide parameter information, for example, stream name, timestamp, and whether the timestamp value is absolute or relative to when the producer started recording. You use the request body to send the media data. Kinesis Video Streams supports only the Matroska (MKV) container format for sending media data using this API.

You have the following options for sending data using this API:

- Send media data in real time: For example, a security camera can send frames in real time as it generates them. This approach minimizes the latency between the video recording and data sent on the wire. This is referred to as a continuous producer. In this case, a consumer application can read the stream in real time or when needed.

- Send media data offline (in batches): For example, a body camera might record video for hours and store it on the device. Later, when you connect the camera to the docking port, the camera can start a PutMedia session to send data to a Kinesis video stream. In this scenario, latency is not an issue.

When using this API, note the following considerations:

- You must specify either streamName or streamARN, but not both.

- To be able to play the media on the console or via HLS, track 1 of each fragment should contain h.264 encoded video, the CodecID in the fragment metadata should be "V_MPEG/ISO/AVC", and the fragment metadata should include AVCC formatted h.264 codec private data. Optionally, track 2 of each fragment should contain AAC encoded audio, the CodecID in the fragment metadata should be "A_AAC", and the fragment metadata should include AAC codec private data.

- You might find it easier to use a single long-running PutMedia session and send a large number of media data fragments in the payload. For each fragment received, Kinesis Video Streams sends one or more acknowledgements. Potential network considerations might cause you to not get all these acknowledgements as they are generated.

- You might choose multiple consecutive PutMedia sessions, each with fewer fragments to ensure that you get all acknowledgements from the service in real time.

**Note**
If you send data to the same stream on multiple simultaneous PutMedia sessions, the media fragments get interleaved on the stream. You should make sure that this is OK in your application scenario.

The following limits apply when using the PutMedia API:

- A client can call PutMedia up to five times per second per stream.
- A client can send up to five fragments per second per stream.
- Kinesis Video Streams reads media data at a rate of up to 12.5 MB/second, or 100 Mbps during a PutMedia session.

Note the following constraints. In these cases, Kinesis Video Streams sends the Error acknowledgement in the response.
• Fragments that have time codes spanning longer than 10 seconds and that contain more than 50 MB of data are not allowed.

• Fragments containing more than three tracks are not allowed. Each frame in every fragment must have the same track number as one of the tracks defined in the fragment header. Additionally, every fragment must contain at least one frame for each track defined in the fragment header.

• Each fragment must contain at least one frame for each track defined in the fragment metadata.

• The earliest frame timestamp in a fragment must be after the latest frame timestamp in the previous fragment.

• An MKV stream containing more than one MKV segment or containing disallowed MKV elements (like track*) also results in the Error acknowledgement.

Kinesis Video Streams stores each incoming fragment and related metadata in what is called a "chunk." The fragment metadata includes the following:

• The MKV headers provided at the start of the PutMedia request

• The following Kinesis Video Streams-specific metadata for the fragment:
  - server_timestamp - Timestamp when Kinesis Video Streams started receiving the fragment.
  - producer_timestamp - Timestamp, when the producer started recording the fragment. Kinesis Video Streams uses three pieces of information received in the request to calculate this value.
    - The fragment timecode value received in the request body along with the fragment.
    - Two request headers: producerStartTimestamp (when the producer started recording) and fragmentTimeCodeType (whether the fragment timecode in the payload is absolute or relative).

Kinesis Video Streams then computes the producer_timestamp for the fragment as follows:

If fragmentTimeCodeType is relative, then

\[
\text{producer_timestamp} = \text{producerStartTimestamp} + \text{fragment timecode}
\]

If fragmentTimeCodeType is absolute, then

\[
\text{producer_timestamp} = \text{fragment timecode (converted to milliseconds)}
\]

• Unique fragment number assigned by Kinesis Video Streams.

Note
When you make the GetMedia request, Kinesis Video Streams returns a stream of these chunks. The client can process the metadata as needed.

Note
This operation is only available for the AWS SDK for Java. It is not supported in AWS SDKs for other languages.

Note
Kinesis Video Streams does not parse and validate the codec private data during ingestion and archival via the PutMedia API. KVS extracts and validates the necessary information from the codec private data for MPEG-TS and MP4 fragment packaging when consuming the stream via the HLS APIs.

Note
If an error is thrown after invoking a Kinesis Video Streams media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

• x-amz-ErrorType HTTP header – contains a more specific error type in addition to what the HTTP status code provides.
• `x-amz-Request-Id` HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the `ErrorType` header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

For more information, see the Errors section at the bottom of this topic, as well as Common Errors.

**Request Syntax**

```plaintext
POST /putMedia HTTP/1.1
x-amzn-stream-name: StreamName
x-amzn-stream-arn: StreamARN
x-amzn-fragment-timecode-type: FragmentTimecodeType
x-amzn-producer-start-timestamp: ProducerStartTimestamp

Payload
```

**URI Request Parameters**

The request requires the following URI parameters.

**FragmentTimecodeType (p. 250)**

You pass this value as the `x-amzn-fragment-timecode-type` HTTP header.

Indicates whether timecodes in the fragments (payload, HTTP request body) are absolute or relative to `producerStartTimestamp`. Kinesis Video Streams uses this information to compute the `producer_timestamp` for the fragment received in the request, as described in the API overview.

Valid Values: ABSOLUTE | RELATIVE

**ProducerStartTimestamp (p. 250)**

You pass this value as the `x-amzn-producer-start-timestamp` HTTP header.

This is the producer timestamp at which the producer started recording the media (not the timestamp of the specific fragments in the request).

**StreamARN (p. 250)**

You pass this value as the `x-amzn-stream-arn` HTTP header.

Amazon Resource Name (ARN) of the Kinesis video stream where you want to write the media content. If you don’t specify the `streamARN`, you must specify the `streamName`.


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+`

**StreamName (p. 250)**

You pass this value as the `x-amzn-stream-name` HTTP header.

Name of the Kinesis video stream where you want to write the media content. If you don’t specify the `streamName`, you must specify the `streamARN`.

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-_\.]+`
Request Body

The request accepts the following binary data.

Payload (p. 250)

The media content to write to the Kinesis video stream. In the current implementation, Kinesis Video Streams supports only the Matroska (MKV) container format with a single MKV segment. A segment can contain one or more clusters.

Note
Each MKV cluster maps to a Kinesis video stream fragment. Whatever cluster duration you choose becomes the fragment duration.

Response Syntax

HTTP/1.1 200

Payload

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The response returns the following as the HTTP body.

Payload (p. 251)

After Kinesis Video Streams successfully receives a PutMedia request, the service validates the request headers. The service then starts reading the payload and first sends an HTTP 200 response.

The service then returns a stream containing a series of JSON objects (Acknowledgement objects) separated by newlines. The acknowledgements are received on the same connection on which the media data is sent. There can be many acknowledgements for a PutMedia request. Each Acknowledgement consists of the following key-value pairs:

- **AckEventType** - Event type the acknowledgement represents.
  - **Buffering**: Kinesis Video Streams has started receiving the fragment. Kinesis Video Streams sends the first Buffering acknowledgement when the first byte of fragment data is received.
  - **Received**: Kinesis Video Streams received the entire fragment. If you did not configure the stream to persist the data, the producer can stop buffering the fragment upon receiving this acknowledgement.
  - **Persisted**: Kinesis Video Streams has persisted the fragment (for example, to Amazon S3). You get this acknowledgement if you configured the stream to persist the data. After you receive this acknowledgement, the producer can stop buffering the fragment.
  - **Error**: Kinesis Video Streams ran into an error while processing the fragment. You can review the error code and determine the next course of action.
  - **Idle**: The PutMedia session is in-progress. However, Kinesis Video Streams is currently not receiving data. Kinesis Video Streams sends this acknowledgement periodically for up to 30 seconds after the last received data. If no data is received within the 30 seconds, Kinesis Video Streams closes the request.

  Note
  This acknowledgement can help a producer determine if the PutMedia connection is alive, even if it is not sending any data.

- **FragmentTimeCode** - Fragment timecode for which acknowledgement is sent.
The element can be missing if the AckEventType is Idle.

- **FragmentNumber** - Kinesis Video Streams-generated fragment number for which the acknowledgement is sent.
- **ErrorId and ErrorCode** - If the AckEventType is ErrorId, this field provides corresponding error code. The following is the list of error codes:
  - 4000 - Error reading the data stream.
  - 4001 - Fragment size is greater than maximum limit, 50 MB, allowed.
  - 4002 - Fragment duration is greater than maximum limit, 10 seconds, allowed.
  - 4003 - Connection duration is greater than maximum allowed threshold.
  - 4004 - Fragment timecode is less than the timecode previous time code (within a PutMedia call, you cannot send fragments out of order).
  - 4005 - More than one track is found in MKV. (deprecated)
  - 4006 - Failed to parse the input stream as valid MKV format.
  - 4007 - Invalid producer timestamp.
  - 4008 - Stream no longer exists (deleted).
  - 4009 - Fragment metadata limit reached.
  - 4010 - The track number in an MKV frame did not match the tracks in the MKV header.
  - 4011 - The fragment did not contain any frames for at least one of the tracks in the MKV header.
  - 4012 - More than the allowed number of tracks found in the input MKV.
  - 4500 - Access to the stream's specified KMS key is denied.
  - 4501 - The stream's specified KMS key is disabled.
  - 4502 - The stream's specified KMS key failed validation.
  - 4503 - The stream's specified KMS key is unavailable.
  - 4504 - Invalid usage of the stream's specified KMS key.
  - 4505 - The stream's specified KMS key is in an invalid state.
  - 4506 - The stream's specified KMS key is not found.
  - 5000 - Internal service error
  - 5001 - Kinesis Video Streams failed to persist fragments to the data store.

**Note**
The producer, while sending the payload for a long running PutMedia request, should read the response for acknowledgements. A producer might receive chunks of acknowledgements at the same time, due to buffering on an intermediate proxy server. A producer that wants to receive timely acknowledgements can send fewer fragments in each PutMedia request.

**Errors**
For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**
Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**ConnectionLimitExceededException**
Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client connections.
HTTP Status Code: 400

InvalidArgumentException

The value for this input parameter is invalid.

HTTP Status Code: 400

InvalidEndpointException

Caller used wrong endpoint to write data to a stream. On receiving such an exception, the user must call GetDataEndpoint with APIName set to PUT_MEDIA and use the endpoint from response to invoke the next PutMedia call.

HTTP Status Code: 400

NotAuthorizedException

The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

ResourceNotFoundException

Status Code: 404, The stream with the given name does not exist.

HTTP Status Code: 404

Example

Acknowledgement Format

The format of the acknowledgement is as follows:

```json
{
    Acknowledgement : {
        "EventType": enum,
        "FragmentTimecode": Long,
        "FragmentNumber": Long,
        "ErrorId" : String
    }
}
```

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
Amazon Kinesis Video Streams Archived Media

The following actions are supported by Amazon Kinesis Video Streams Archived Media:

- GetClip (p. 255)
- GetDASHStreamingSessionURL (p. 259)
- GetHLSStreamingSessionURL (p. 266)
- GetMediaForFragmentList (p. 274)
- ListFragments (p. 277)
GetClip
Service: Amazon Kinesis Video Streams Archived Media

Downloads an MP4 file (clip) containing the archived, on-demand media from the specified video stream over the specified time range.

Both the StreamName and the StreamARN parameters are optional, but you must specify either the StreamName or the StreamARN when invoking this API operation.

As a prerequisite to using GetClip API, you must obtain an endpoint using GetDataEndpoint, specifying GET_CLIP for the APIName parameter.

An Amazon Kinesis video stream has the following requirements for providing data through MP4:

- The media must contain h.264 or h.265 encoded video and, optionally, AAC or G.711 encoded audio. Specifically, the codec ID of track 1 should be V_MPEG/ISO/AVC (for h.264) or V_MPEGH/ISO/HEVC (for H.265). Optionally, the codec ID of track 2 should be A_AAC (for AAC) or A_MS/ACM (for G.711).
- Data retention must be greater than 0.
- The video track of each fragment must contain codec private data in the Advanced Video Coding (AVC) for H.264 format and HEVC for H.265 format. For more information, see MPEG-4 specification ISO/IEC 14496-15. For information about adapting stream data to a given format, see NAL Adaptation Flags.
- The audio track (if present) of each fragment must contain codec private data in the AAC format (AAC specification ISO/IEC 13818-7) or the MS Wave format.

You can monitor the amount of outgoing data by monitoring the GetClip.OutgoingBytes Amazon CloudWatch metric. For information about using CloudWatch to monitor Kinesis Video Streams, see Monitoring Kinesis Video Streams. For pricing information, see Amazon Kinesis Video Streams Pricing and AWS Pricing. Charges for outgoing AWS data apply.

Request Syntax

```
POST /getClip HTTP/1.1
Content-type: application/json

{
  "ClipFragmentSelector": {
    "FragmentSelectorType": "string",
    "TimestampRange": {
      "EndTimestamp": number,
      "StartTimestamp": number
    }
  },
  "StreamARN": "string",
  "StreamName": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

**ClipFragmentSelector (p. 255)**

The time range of the requested clip and the source of the timestamps.
Type: ClipFragmentSelector (p. 300) object

Required: Yes

StreamARN (p. 255)

The Amazon Resource Name (ARN) of the stream for which to retrieve the media clip.

You must specify either the StreamName or the StreamARN.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+

Required: No

StreamName (p. 255)

The name of the stream for which to retrieve the media clip.

You must specify either the StreamName or the StreamARN.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9-_.-]+

Required: No

Response Syntax

HTTP/1.1 200
Content-Type: ContentType

Payload

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The response returns the following HTTP headers.

ContentType (p. 256)

The content type of the media in the requested clip.


Pattern: ^[a-zA-Z0-9_\.-]+$

The response returns the following as the HTTP body.

Payload (p. 256)

Traditional MP4 file that contains the media clip from the specified video stream. The output will contain the first 100 MB or the first 200 fragments from the specified start timestamp. For more information, see Kinesis Video Streams Limits.
Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

A specified parameter exceeds its restrictions, is not supported, or can't be used.

HTTP Status Code: 400

InvalidCodecPrivateDataException

The codec private data in at least one of the tracks of the video stream is not valid for this operation.

HTTP Status Code: 400

InvalidMediaFrameException

One or more frames in the requested clip could not be parsed based on the specified codec.

HTTP Status Code: 400

MissingCodecPrivateDataException

No codec private data was found in at least one of tracks of the video stream.

HTTP Status Code: 400

NoDataRetentionException

A streaming session was requested for a stream that does not retain data (that is, has a DataRetentionInHours of 0).

HTTP Status Code: 400

NotAuthorizedException

Status Code: 403, The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

ResourceNotFoundException

GetMedia throws this error when Kinesis Video Streams can't find the stream that you specified.

GetHLSStreamingSessionURL and GetDASHStreamingSessionURL throw this error if a session with a PlaybackMode of ON_DEMAND or LIVE_REPLAY is requested for a stream that has no fragments within the requested time range, or if a session with a PlaybackMode of LIVE is requested for a stream that has no fragments within the last 30 seconds.

HTTP Status Code: 404

UnsupportedStreamMediaTypeException

The type of the media (for example, h.264 or h.265 video or ACC or G.711 audio) could not be determined from the codec IDs of the tracks in the first fragment for a playback session. The codec ID for track 1 should be V_MPEG/ISO/AVC and, optionally, the codec ID for track 2 should be A_AAC.

HTTP Status Code: 400
See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
GetDASHStreamingSessionURL

Service: Amazon Kinesis Video Streams Archived Media

Retrieves an MPEG Dynamic Adaptive Streaming over HTTP (DASH) URL for the stream. You can then open the URL in a media player to view the stream contents.

Both the StreamName and the StreamARN parameters are optional, but you must specify either the StreamName or the StreamARN when invoking this API operation.

An Amazon Kinesis video stream has the following requirements for providing data through MPEG-DASH:

- The media must contain h.264 or h.265 encoded video and, optionally, AAC or G.711 encoded audio. Specifically, the codec ID of track 1 should be V_MPEG/ISO/AVC (for h.264) or V_MPEGH/ISO/HEVC (for H.265). Optionally, the codec ID of track 2 should be A_AAC (for AAC) or A_MS/ACM (for G.711).
- Data retention must be greater than 0.
- The video track of each fragment must contain codec private data in the Advanced Video Coding (AVC) for H.264 format and HEVC for H.265 format. For more information, see MPEG-4 specification ISO/IEC 14496-15. For information about adapting stream data to a given format, see NAL Adaptation Flags.
- The audio track (if present) of each fragment must contain codec private data in the AAC format (AAC specification ISO/IEC 13818-7) or the MS Wave format.

The following procedure shows how to use MPEG-DASH with Kinesis Video Streams:

1. Get an endpoint using GetDataEndpoint, specifying GET_DASH_STREAMING_SESSION_URL for the APIName parameter.
2. Retrieve the MPEG-DASH URL using GetDASHStreamingSessionURL. Kinesis Video Streams creates an MPEG-DASH streaming session to be used for accessing content in a stream using the MPEG-DASH protocol. GetDASHStreamingSessionURL returns an authenticated URL (that includes an encrypted session token) for the session’s MPEG-DASH manifest (the root resource needed for streaming with MPEG-DASH).

   **Note**
   Don’t share or store this token where an unauthorized entity could access it. The token provides access to the content of the stream. Safeguard the token with the same measures that you would use with your AWS credentials.

   The media that is made available through the manifest consists only of the requested stream, time range, and format. No other media data (such as frames outside the requested window or alternate bitrates) is made available.

3. Provide the URL (containing the encrypted session token) for the MPEG-DASH manifest to a media player that supports the MPEG-DASH protocol. Kinesis Video Streams makes the initialization fragment and media fragments available through the manifest URL. The initialization fragment contains the codec private data for the stream, and other data needed to set up the video or audio decoder and renderer. The media fragments contain encoded video frames or encoded audio samples.

4. The media player receives the authenticated URL and requests stream metadata and media data normally. When the media player requests data, it calls the following actions:

   - **GetDASHManifest**: Retrieves an MPEG DASH manifest, which contains the metadata for the media that you want to playback.
   - **GetMP4InitFragment**: Retrieves the MP4 initialization fragment. The media player typically loads the initialization fragment before loading any media fragments. This fragment contains the ""fytp"" and ""moov"" MP4 atoms, and the child atoms that are needed to initialize the media player decoder. The initialization fragment does not correspond to a fragment in a Kinesis video stream. It contains only the codec private data for the stream and respective track, which the media player needs to decode the media frames.
• GetMP4MediaFragment: Retrieves MP4 media fragments. These fragments contain the "moof" and "mdat" MP4 atoms and their child atoms, containing the encoded fragment's media frames and their timestamps.

   **Note**
   After the first media fragment is made available in a streaming session, any fragments that don't contain the same codec private data cause an error to be returned when those different media fragments are loaded. Therefore, the codec private data should not change between fragments in a session. This also means that the session fails if the fragments in a stream change from having only video to having both audio and video.

Data retrieved with this action is billable. See [Pricing](https://aws.amazon.com/kinesis/video-streams/pricing/) for details.

   **Note**
   The following restrictions apply to MPEG-DASH sessions:

   • A streaming session URL should not be shared between players. The service might throttle a session if multiple media players are sharing it. For connection limits, see [Kinesis Video Streams Limits](https://aws.amazon.com/kinesis/video-streams/limits/).

   • A Kinesis video stream can have a maximum of ten active MPEG-DASH streaming sessions. If a new session is created when the maximum number of sessions is already active, the oldest (earliest created) session is closed. The number of active GetMedia connections on a Kinesis video stream does not count against this limit, and the number of active MPEG-DASH sessions does not count against the active GetMedia connection limit.

   **Note**
   The maximum limits for active HLS and MPEG-DASH streaming sessions are independent of each other.

You can monitor the amount of data that the media player consumes by monitoring the GetMP4MediaFragment.OutgoingBytes Amazon CloudWatch metric. For information about using CloudWatch to monitor Kinesis Video Streams, see [Monitoring Kinesis Video Streams](https://aws.amazon.com/kinesis/video-streams/monitoring/). For pricing information, see [Amazon Kinesis Video Streams Pricing](https://aws.amazon.com/kinesis/video-streams/pricing/) and [AWS Pricing](https://aws.amazon.com/aws-pricing/). Charges for both HLS sessions and outgoing AWS data apply.

For more information about HLS, see [HTTP Live Streaming](https://developer.apple.com/) on the Apple Developer site.

   **Important**
   If an error is thrown after invoking a Kinesis Video Streams archived media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

   • `x-amz-ErrorType` HTTP header – contains a more specific error type in addition to what the HTTP status code provides.

   • `x-amz-RequestId` HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the ErrorType header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

   For more information, see the [Errors](https://aws.amazon.com/kinesis/video-streams/errors/) section at the bottom of this topic, as well as [Common Errors](https://aws.amazon.com/kinesis/video-streams/errors/).

**Request Syntax**

```plaintext
POST /getDASHStreamingSessionURL HTTP/1.1
```
Content-type: application/json

{
    "DASHFragmentSelector": {
        "FragmentSelectorType": "string",
        "TimestampRange": {
            "EndTimestamp": number,
            "StartTimestamp": number
        }
    },
    "DisplayFragmentNumber": "string",
    "DisplayFragmentTimestamp": "string",
    "Expires": number,
    "MaxManifestFragmentResults": number,
    "PlaybackMode": "string",
    "StreamARN": "string",
    "StreamName": "string"
}

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

DASHFragmentSelector (p. 260)

The time range of the requested fragment and the source of the timestamps.

This parameter is required if PlaybackMode is ON_DEMAND or LIVE_REPLAY. This parameter is optional if PlaybackMode is LIVE. If PlaybackMode is LIVE, the FragmentSelectorType can be set, but the TimestampRange should not be set. If PlaybackMode is ON_DEMAND or LIVE_REPLAY, both FragmentSelectorType and TimestampRange must be set.

Type: DASHFragmentSelector (p. 302) object

Required: No

DisplayFragmentNumber (p. 260)

Fragments are identified in the manifest file based on their sequence number in the session. If DisplayFragmentNumber is set to ALWAYS, the Kinesis Video Streams fragment number is added to each S element in the manifest file with the attribute name "kvs:fn". These fragment numbers can be used for logging or for use with other APIs (e.g. GetMedia and GetMediaForFragmentList). A custom MPEG-DASH media player is necessary to leverage these this custom attribute.

The default value is NEVER.

Type: String

Valid Values: ALWAYS | NEVER

Required: No

DisplayFragmentTimestamp (p. 260)

Per the MPEG-DASH specification, the wall-clock time of fragments in the manifest file can be derived using attributes in the manifest itself. However, typically, MPEG-DASH compatible media players do not properly handle gaps in the media timeline. Kinesis Video Streams adjusts the media timeline in the manifest file to enable playback of media with discontinuities. Therefore, the wall-
clock time derived from the manifest file may be inaccurate. If DisplayFragmentTimestamp is set to ALWAYS, the accurate fragment timestamp is added to each S element in the manifest file with the attribute name “kvs:ts”. A custom MPEG-DASH media player is necessary to leverage this custom attribute.

The default value is NEVER. When DASHFragmentSelector (p. 302) is SERVER_TIMESTAMP, the timestamps will be the server start timestamps. Similarly, when DASHFragmentSelector (p. 302) is PRODUCER_TIMESTAMP, the timestamps will be the producer start timestamps.

Type: String

Valid Values: ALWAYS | NEVER

Required: No

Expires (p. 260)

The time in seconds until the requested session expires. This value can be between 300 (5 minutes) and 43200 (12 hours).

When a session expires, no new calls to GetDashManifest, GetMP4InitFragment, or GetMP4MediaFragment can be made for that session.

The default is 300 (5 minutes).

Type: Integer

Valid Range: Minimum value of 300. Maximum value of 43200.

Required: No

MaxManifestFragmentResults (p. 260)

The maximum number of fragments that are returned in the MPEG-DASH manifest.

When the PlaybackMode is LIVE, the most recent fragments are returned up to this value. When the PlaybackMode is ON_DEMAND, the oldest fragments are returned, up to this maximum number.

When there are a higher number of fragments available in a live MPEG-DASH manifest, video players often buffer content before starting playback. Increasing the buffer size increases the playback latency, but it decreases the likelihood that rebuffering will occur during playback. We recommend that a live MPEG-DASH manifest have a minimum of 3 fragments and a maximum of 10 fragments.

The default is 5 fragments if PlaybackMode is LIVE or LIVE_REPLAY, and 1,000 if PlaybackMode is ON_DEMAND.

The maximum value of 1,000 fragments corresponds to more than 16 minutes of video on streams with 1-second fragments, and more than 2 1/2 hours of video on streams with 10-second fragments.

Type: Long

Valid Range: Minimum value of 1. Maximum value of 1000.

Required: No

PlaybackMode (p. 260)

Whether to retrieve live, live replay, or archived, on-demand data.

Features of the three types of sessions include the following:

• **LIVE**: For sessions of this type, the MPEG-DASH manifest is continually updated with the latest fragments as they become available. We recommend that the media player retrieve a new
manifest on a one-second interval. When this type of session is played in a media player, the user interface typically displays a "live" notification, with no scrubber control for choosing the position in the playback window to display.

**Note**

In **LIVE** mode, the newest available fragments are included in an MPEG-DASH manifest, even if there is a gap between fragments (that is, if a fragment is missing). A gap like this might cause a media player to halt or cause a jump in playback. In this mode, fragments are not added to the MPEG-DASH manifest if they are older than the newest fragment in the playlist. If the missing fragment becomes available after a subsequent fragment is added to the manifest, the older fragment is not added, and the gap is not filled.

- **LIVE_REPLAY**: For sessions of this type, the MPEG-DASH manifest is updated similarly to how it is updated for **LIVE** mode except that it starts by including fragments from a given start time. Instead of fragments being added as they are ingested, fragments are added as the duration of the next fragment elapses. For example, if the fragments in the session are two seconds long, then a new fragment is added to the manifest every two seconds. This mode is useful to be able to start playback from when an event is detected and continue live streaming media that has not yet been ingested as of the time of the session creation. This mode is also useful to stream previously archived media without being limited by the 1,000 fragment limit in the **ON_DEMAND** mode.

- **ON_DEMAND**: For sessions of this type, the MPEG-DASH manifest contains all the fragments for the session, up to the number that is specified in MaxMediaPlaylistFragmentResults. The manifest must be retrieved only once for each session. When this type of session is played in a media player, the user interface typically displays a scrubber control for choosing the position in the playback window to display.

In all playback modes, if FragmentSelectorType is **PRODUCER_TIMESTAMP**, and if there are multiple fragments with the same start timestamp, the fragment that has the larger fragment number (that is, the newer fragment) is included in the MPEG-DASH manifest. The other fragments are not included. Fragments that have different timestamps but have overlapping durations are still included in the MPEG-DASH manifest. This can lead to unexpected behavior in the media player.

The default is **LIVE**.

**Type**: String

**Valid Values**: **LIVE** | **LIVE_REPLAY** | **ON_DEMAND**

**Required**: No

### **StreamARN (p. 260)**

The Amazon Resource Name (ARN) of the stream for which to retrieve the MPEG-DASH manifest URL.

You must specify either the **StreamName** or the **StreamARN**.

**Type**: String

**Length Constraints**: Minimum length of 1. Maximum length of 1024.

**Pattern**: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9_.-]+/[0-9]+`

**Required**: No

### **StreamName (p. 260)**

The name of the stream for which to retrieve the MPEG-DASH manifest URL.

You must specify either the **StreamName** or the **StreamARN**.

**Type**: String
Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: \[a-zA-Z0-9_.-]+\]

Required: No

**Response Syntax**

```
HTTP/1.1 200
Content-type: application/json

{
  "DASHStreamingSessionURL": "string"
}
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

**DASHStreamingSessionURL (p. 264)**

The URL (containing the session token) that a media player can use to retrieve the MPEG-DASH manifest.

Type: String

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

A specified parameter exceeds its restrictions, is not supported, or can't be used.

HTTP Status Code: 400

**InvalidCodecPrivateDataException**

The codec private data in at least one of the tracks of the video stream is not valid for this operation.

HTTP Status Code: 400

**MissingCodecPrivateDataException**

No codec private data was found in at least one of tracks of the video stream.

HTTP Status Code: 400

**NoDataRetentionException**

A streaming session was requested for a stream that does not retain data (that is, has a DataRetentionInHours of 0).
HTTP Status Code: 400

**NotAuthorizedException**

Status Code: 403, The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

**ResourceNotFoundException**

GetMedia throws this error when Kinesis Video Streams can't find the stream that you specified.

GetHLSStreamingSessionURL and GetDASHStreamingSessionURL throw this error if a session with a PlaybackMode of ON_DEMAND or LIVE_REPLAY is requested for a stream that has no fragments within the requested time range, or if a session with a PlaybackMode of LIVE is requested for a stream that has no fragments within the last 30 seconds.

HTTP Status Code: 404

**UnsupportedStreamMediaTypeException**

The type of the media (for example, h.264 or h.265 video or ACC or G.711 audio) could not be determined from the codec IDs of the tracks in the first fragment for a playback session. The codec ID for track 1 should be V_MPEG/ISO/AVC and, optionally, the codec ID for track 2 should be A_AAC.

HTTP Status Code: 400

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
GetHLSStreamingSessionURL
Service: Amazon Kinesis Video Streams Archived Media

Retrieves an HTTP Live Streaming (HLS) URL for the stream. You can then open the URL in a browser or media player to view the stream contents.

Both the StreamName and the StreamARN parameters are optional, but you must specify either the StreamName or the StreamARN when invoking this API operation.

An Amazon Kinesis video stream has the following requirements for providing data through HLS:

• The media must contain h.264 or h.265 encoded video and, optionally, AAC encoded audio. Specifically, the codec ID of track 1 should be V_MPEG/ISO/AVC (for h.264) or V_MPEG/ISO/HEVC (for h.265). Optionally, the codec ID of track 2 should be A_AAC.
• Data retention must be greater than 0.
• The video track of each fragment must contain codec private data in the Advanced Video Coding (AVC) for H.264 format or HEVC for H.265 format (MPEG-4 specification ISO/IEC 14496-15). For information about adapting stream data to a given format, see NAL Adaptation Flags.
• The audio track (if present) of each fragment must contain codec private data in the AAC format (AAC specification ISO/IEC 13818-7).

Kinesis Video Streams HLS sessions contain fragments in the fragmented MPEG-4 form (also called fMP4 or CMAF) or the MPEG-2 form (also called TS chunks, which the HLS specification also supports). For more information about HLS fragment types, see the HLS specification.

The following procedure shows how to use HLS with Kinesis Video Streams:

1. Get an endpoint using GetDataEndpoint, specifying GET_HLS_STREAMING_SESSION_URL for the APIName parameter.
2. Retrieve the HLS URL using GetHLSStreamingSessionURL. Kinesis Video Streams creates an HLS streaming session to be used for accessing content in a stream using the HLS protocol. GetHLSStreamingSessionURL returns an authenticated URL (that includes an encrypted session token) for the session's HLS master playlist (the root resource needed for streaming with HLS).

   **Note**
   Don't share or store this token where an unauthorized entity could access it. The token provides access to the content of the stream. Safeguard the token with the same measures that you would use with your AWS credentials.

   The media that is made available through the playlist consists only of the requested stream, time range, and format. No other media data (such as frames outside the requested window or alternate bitrates) is made available.

3. Provide the URL (containing the encrypted session token) for the HLS master playlist to a media player that supports the HLS protocol. Kinesis Video Streams makes the HLS media playlist, initialization fragment, and media fragments available through the master playlist URL. The initialization fragment contains the codec private data for the stream, and other data needed to set up the video or audio decoder and renderer. The media fragments contain H.264-encoded video frames or AAC-encoded audio samples.

4. The media player receives the authenticated URL and requests stream metadata and media data normally. When the media player requests data, it calls the following actions:

   - **GetHLSMasterPlaylist**: Retrieves an HLS master playlist, which contains a URL for the GetHLSMediaPlaylist action for each track, and additional metadata for the media player, including estimated bitrate and resolution.
   - **GetHLSMediaPlaylist**: Retrieves an HLS media playlist, which contains a URL to access the MP4 initialization fragment with the GetMP4InitFragment action, and URLs to access the MP4 media fragments.
media fragments with the GetMP4MediaFragment actions. The HLS media playlist also contains metadata about the stream that the player needs to play it, such as whether the PlaybackMode is LIVE or ON_DEMAND. The HLS media playlist is typically static for sessions with a PlaybackType of ON_DEMAND. The HLS media playlist is continually updated with new fragments for sessions with a PlaybackType of LIVE. There is a distinct HLS media playlist for the video track and the audio track (if applicable) that contains MP4 media URLs for the specific track.

- **GetMP4InitFragment**: Retrieves the MP4 initialization fragment. The media player typically loads the initialization fragment before loading any media fragments. This fragment contains the "fym" and "moov" MP4 atoms, and the child atoms that are needed to initialize the media player decoder.

  The initialization fragment does not correspond to a fragment in a Kinesis video stream. It contains only the codec private data for the stream and respective track, which the media player needs to decode the media frames.

- **GetMP4MediaFragment**: Retrieves MP4 media fragments. These fragments contain the "moof" and "mdat" MP4 atoms and their child atoms, containing the encoded fragment's media frames and their timestamps.

  **Note**
  After the first media fragment is made available in a streaming session, any fragments that don’t contain the same codec private data cause an error to be returned when those different media fragments are loaded. Therefore, the codec private data should not change between fragments in a session. This also means that the session fails if the fragments in a stream change from having only video to having both audio and video.

  Data retrieved with this action is billable. See Pricing for details.

- **GetTSFragment**: Retrieves MPEG TS fragments containing both initialization and media data for all tracks in the stream.

  **Note**
  If the ContainerFormat is MPEG_TS, this API is used instead of GetMP4InitFragment and GetMP4MediaFragment to retrieve stream media.

  Data retrieved with this action is billable. For more information, see Kinesis Video Streams pricing.

**Note**
The following restrictions apply to HLS sessions:

- A streaming session URL should not be shared between players. The service might throttle a session if multiple media players are sharing it. For connection limits, see Kinesis Video Streams Limits.

- A Kinesis video stream can have a maximum of ten active HLS streaming sessions. If a new session is created when the maximum number of sessions is already active, the oldest (earliest created) session is closed. The number of active GetMedia connections on a Kinesis video stream does not count against this limit, and the number of active HLS sessions does not count against the active GetMedia connection limit.

  **Note**
  The maximum limits for active HLS and MPEG-DASH streaming sessions are independent of each other.

You can monitor the amount of data that the media player consumes by monitoring the GetMP4MediaFragment.OutgoingBytes Amazon CloudWatch metric. For information about using CloudWatch to monitor Kinesis Video Streams, see Monitoring Kinesis Video Streams. For pricing information, see Amazon Kinesis Video Streams Pricing and AWS Pricing. Charges for both HLS sessions and outgoing AWS data apply.

For more information about HLS, see HTTP Live Streaming on the Apple Developer site.
Important
If an error is thrown after invoking a Kinesis Video Streams archived media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

- `x-amz-ErrorType` HTTP header – contains a more specific error type in addition to what the HTTP status code provides.
- `x-amz-RequestId` HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the ErrorType header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

For more information, see the Errors section at the bottom of this topic, as well as Common Errors.

Request Syntax

```
POST /getHLSStreamingSessionURL HTTP/1.1
Content-type: application/json

{
  "ContainerFormat": "string",
  "DiscontinuityMode": "string",
  "DisplayFragmentTimestamp": "string",
  "Expires": number,
  "HLSFragmentSelector": {
    "FragmentSelectorType": "string",
    "TimestampRange": {
      "EndTimeStamp": number,
      "StartTimeStamp": number
    }
  },
  "MaxMediaPlaylistFragmentResults": number,
  "PlaybackMode": "string",
  "StreamARN": "string",
  "StreamName": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

**ContainerFormat (p. 268)**

Specifies which format should be used for packaging the media. Specifying the `FRAGMENTED_MP4` container format packages the media into MP4 fragments (fMP4 or CMAF). This is the recommended packaging because there is minimal packaging overhead. The other container format option is `MPEG_TS`. HLS has supported MPEG TS chunks since it was released and is sometimes the only supported packaging on older HLS players. MPEG TS typically has a 5–25 percent packaging overhead. This means MPEG TS typically requires 5–25 percent more bandwidth and cost than fMP4.

The default is `FRAGMENTED_MP4`.

Type: String
Valid Values: FRAGMENTED_MP4 | MPEG_TS

Required: No

**DiscontinuityMode (p. 268)**

Specifies when flags marking discontinuities between fragments are added to the media playlists.

Media players typically build a timeline of media content to play, based on the timestamps of each fragment. This means that if there is any overlap or gap between fragments (as is typical if HLSFragmentSelector (p. 306) is set to SERVER_TIMESTAMP), the media player timeline will also have small gaps between fragments in some places, and will overwrite frames in other places. Gaps in the media player timeline can cause playback to stall and overlaps can cause playback to be jittery. When there are discontinuity flags between fragments, the media player is expected to reset the timeline, resulting in the next fragment being played immediately after the previous fragment.

The following modes are supported:

- **ALWAYS**: a discontinuity marker is placed between every fragment in the HLS media playlist. It is recommended to use a value of ALWAYS if the fragment timestamps are not accurate.
- **NEVER**: no discontinuity markers are placed anywhere. It is recommended to use a value of NEVER to ensure the media player timeline most accurately maps to the producer timestamps.
- **ON_DISCONTINUITY**: a discontinuity marker is placed between fragments that have a gap or overlap of more than 50 milliseconds. For most playback scenarios, it is recommended to use a value of ON_DISCONTINUITY so that the media player timeline is only reset when there is a significant issue with the media timeline (e.g. a missing fragment).

The default is ALWAYS when HLSFragmentSelector (p. 306) is set to SERVER_TIMESTAMP, and NEVER when it is set to PRODUCER_TIMESTAMP.

Type: String

Valid Values: ALWAYS | NEVER | ON_DISCONTINUITY

Required: No

**DisplayFragmentTimestamp (p. 268)**

Specifies when the fragment start timestamps should be included in the HLS media playlist. Typically, media players report the playhead position as a time relative to the start of the first fragment in the playback session. However, when the start timestamps are included in the HLS media playlist, some media players might report the current playhead as an absolute time based on the fragment timestamps. This can be useful for creating a playback experience that shows viewers the wall-clock time of the media.

The default is NEVER. When HLSFragmentSelector (p. 306) is SERVER_TIMESTAMP, the timestamps will be the server start timestamps. Similarly, when HLSFragmentSelector (p. 306) is PRODUCER_TIMESTAMP, the timestamps will be the producer start timestamps.

Type: String

Valid Values: ALWAYS | NEVER

Required: No

**Expires (p. 268)**

The time in seconds until the requested session expires. This value can be between 300 (5 minutes) and 43200 (12 hours).

When a session expires, no new calls to GetHLSMasterPlaylist, GetHLSMediaPlaylist, GetMP4InitFragment, GetMP4MediaFragment, or GetTSFragment can be made for that session.
The default is 300 (5 minutes).

Type: Integer

Valid Range: Minimum value of 300. Maximum value of 43200.

Required: No

HLSFragmentSelector (p. 268)

The time range of the requested fragment and the source of the timestamps.

This parameter is required if PlaybackMode is ON_DEMAND or LIVE_REPLAY. This parameter is optional if PlaybackMode is LIVE. If PlaybackMode is LIVE, the FragmentSelectorType can be set, but the TimestampRange should not be set. If PlaybackMode is ON_DEMAND or LIVE_REPLAY, both FragmentSelectorType and TimestampRange must be set.

Type: HLSFragmentSelector (p. 306) object

Required: No

MaxMediaPlaylistFragmentResults (p. 268)

The maximum number of fragments that are returned in the HLS media playlists.

When the PlaybackMode is LIVE, the most recent fragments are returned up to this value. When the PlaybackMode is ON_DEMAND, the oldest fragments are returned, up to this maximum number.

When there are a higher number of fragments available in a live HLS media playlist, video players often buffer content before starting playback. Increasing the buffer size increases the playback latency, but it decreases the likelihood that rebuffering will occur during playback. We recommend that a live HLS media playlist have a minimum of 3 fragments and a maximum of 10 fragments.

The default is 5 fragments if PlaybackMode is LIVE or LIVE_REPLAY, and 1,000 if PlaybackMode is ON_DEMAND.

The maximum value of 1,000 fragments corresponds to more than 16 minutes of video on streams with 1-second fragments, and more than 2 1/2 hours of video on streams with 10-second fragments.

Type: Long

Valid Range: Minimum value of 1. Maximum value of 1000.

Required: No

PlaybackMode (p. 268)

Whether to retrieve live, live replay, or archived, on-demand data.

Features of the three types of sessions include the following:

- **LIVE**: For sessions of this type, the HLS media playlist is continually updated with the latest fragments as they become available. We recommend that the media player retrieve a new playlist on a one-second interval. When this type of session is played in a media player, the user interface typically displays a "live" notification, with no scrubber control for choosing the position in the playback window to display.

**Note**

In LIVE mode, the newest available fragments are included in an HLS media playlist, even if there is a gap between fragments (that is, if a fragment is missing). A gap like this might cause a media player to halt or cause a jump in playback. In this mode, fragments are not added to the HLS media playlist if they are older than the newest fragment in the playlist.
If the missing fragment becomes available after a subsequent fragment is added to the playlist, the older fragment is not added, and the gap is not filled.

- **LIVE_REPLAY**: For sessions of this type, the HLS media playlist is updated similarly to how it is updated for LIVE mode except that it starts by including fragments from a given start time. Instead of fragments being added as they are ingested, fragments are added as the duration of the next fragment elapses. For example, if the fragments in the session are two seconds long, then a new fragment is added to the media playlist every two seconds. This mode is useful to be able to start playback from when an event is detected and continue live streaming media that has not yet been ingested as of the time of the session creation. This mode is also useful to stream previously archived media without being limited by the 1,000 fragment limit in the ON_DEMAND mode.

- **ON_DEMAND**: For sessions of this type, the HLS media playlist contains all the fragments for the session, up to the number that is specified in MaxMediaPlaylistFragmentResults. The playlist must be retrieved only once for each session. When this type of session is played in a media player, the user interface typically displays a scrubber control for choosing the position in the playback window to display.

In all playback modes, if FragmentSelectorType is PRODUCER_TIMESTAMP, and if there are multiple fragments with the same start timestamp, the fragment that has the larger fragment number (that is, the newer fragment) is included in the HLS media playlist. The other fragments are not included. Fragments that have different timestamps but have overlapping durations are still included in the HLS media playlist. This can lead to unexpected behavior in the media player.

The default is **LIVE**.

**Type**: String

**Valid Values**: LIVE | LIVE_REPLAY | ON_DEMAND

**Required**: No

**StreamARN (p. 268)**

The Amazon Resource Name (ARN) of the stream for which to retrieve the HLS master playlist URL.

You must specify either the StreamName or the StreamARN.

**Type**: String

**Length Constraints**: Minimum length of 1. Maximum length of 1024.

**Pattern**: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.]+(/[0-9]+`  

**Required**: No

**StreamName (p. 268)**

The name of the stream for which to retrieve the HLS master playlist URL.

You must specify either the StreamName or the StreamARN.

**Type**: String

**Length Constraints**: Minimum length of 1. Maximum length of 256.

**Pattern**: `[a-zA-Z0-9-_.-]+`  

**Required**: No

**Response Syntax**

HTTP/1.1 200
Content-type: application/json

{
   "HLSStreamingSessionURL": "string"
}

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response. The following data is returned in JSON format by the service.

**HLSStreamingSessionURL (p. 271)**

The URL (containing the session token) that a media player can use to retrieve the HLS master playlist.

Type: String

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

A specified parameter exceeds its restrictions, is not supported, or can't be used.

HTTP Status Code: 400

**InvalidCodecPrivateDataException**

The codec private data in at least one of the tracks of the video stream is not valid for this operation.

HTTP Status Code: 400

**MissingCodecPrivateDataException**

No codec private data was found in at least one of tracks of the video stream.

HTTP Status Code: 400

**NoDataRetentionException**

A streaming session was requested for a stream that does not retain data (that is, has a DataRetentionInHours of 0).

HTTP Status Code: 400

**NotAuthorizedException**

Status Code: 403, The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

**ResourceNotFoundException**

GetMedia throws this error when Kinesis Video Streams can't find the stream that you specified.
GetHLSStreamingSessionURL and GetDASHStreamingSessionURL throw this error if a session with a PlaybackMode of ON_DEMAND or LIVE_REPLAY is requested for a stream that has no fragments within the requested time range, or if a session with a PlaybackMode of LIVE is requested for a stream that has no fragments within the last 30 seconds.

HTTP Status Code: 404

UnsupportedStreamMediaTypeException

The type of the media (for example, h.264 or h.265 video or ACC or G.711 audio) could not be determined from the codec IDs of the tracks in the first fragment for a playback session. The codec ID for track 1 should be V_MPEG/ISO/AVC and, optionally, the codec ID for track 2 should be A_AAC.

HTTP Status Code: 400

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
GetMediaForFragmentList
Service: Amazon Kinesis Video Streams Archived Media

Gets media for a list of fragments (specified by fragment number) from the archived data in an Amazon Kinesis video stream.

Note
You must first call the GetDataEndpoint API to get an endpoint. Then send the GetMediaForFragmentList requests to this endpoint using the --endpoint-url parameter.

The following limits apply when using the GetMediaForFragmentList API:

- A client can call GetMediaForFragmentList up to five times per second per stream.
- Kinesis Video Streams sends media data at a rate of up to 25 megabytes per second (or 200 megabits per second) during a GetMediaForFragmentList session.

Important
If an error is thrown after invoking a Kinesis Video Streams archived media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

- x-amz-ErrorType HTTP header – contains a more specific error type in addition to what the HTTP status code provides.
- x-amz-RequestId HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the ErrorType header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

For more information, see the Errors section at the bottom of this topic, as well as Common Errors.

Request Syntax

```
POST /getMediaForFragmentList HTTP/1.1
Content-type: application/json
{
    "Fragments": [ "string" ],
    "StreamName": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

Fragments (p. 274)

A list of the numbers of fragments for which to retrieve media. You retrieve these values with ListFragments (p. 277).

Type: Array of strings
Array Members: Minimum number of 1 item. Maximum number of 1000 items.
Pattern: ^[0-9]+$  
Required: Yes

**StreamName (p. 274)**
The name of the stream from which to retrieve fragment media.
Type: String
Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: [a-zA-Z0-9_.-]+  
Required: Yes

**Response Syntax**

```
HTTP/1.1 200
Content-Type: ContentType

Payload
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response.
The response returns the following HTTP headers.

**ContentType (p. 275)**
The content type of the requested media.
Pattern: ^[a-zA-Z0-9_.-]+$  

The response returns the following as the HTTP body.

**Payload (p. 275)**
The payload that Kinesis Video Streams returns is a sequence of chunks from the specified stream.
For information about the chunks, see PutMedia. The chunks that Kinesis Video Streams returns in the GetMediaForFragmentList call also include the following additional Matroska (MKV) tags:
- AWS_KINESISVIDEO_FRAGMENT_NUMBER - Fragment number returned in the chunk.
- AWS_KINESISVIDEO_SERVER_SIDE_TIMESTAMP - Server-side timestamp of the fragment.
- AWS_KINESISVIDEO_PRODUCER_SIDE_TIMESTAMP - Producer-side timestamp of the fragment.

The following tags will be included if an exception occurs:
- AWS_KINESISVIDEO_FRAGMENT_NUMBER - The number of the fragment that threw the exception
- AWS_KINESISVIDEO_EXCEPTION_ERROR_CODE - The integer code of the exception
- AWS_KINESISVIDEO_EXCEPTION_MESSAGE - A text description of the exception
Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

InvalidArgumentException

A specified parameter exceeds its restrictions, is not supported, or can't be used.

HTTP Status Code: 400

NotAuthorizedException

Status Code: 403, The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

ResourceNotFoundException

GetMedia throws this error when Kinesis Video Streams can't find the stream that you specified.

GetHLSStreamingSessionURL and GetDASHStreamingSessionURL throw this error if a session with a PlaybackMode of ON_DEMAND or LIVE_REPLAY is requested for a stream that has no fragments within the requested time range, or if a session with a PlaybackMode of LIVE is requested for a stream that has no fragments within the last 30 seconds.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
ListFragments
Service: Amazon Kinesis Video Streams Archived Media

Returns a list of Fragment (p. 304) objects from the specified stream and timestamp range within the archived data.

Listing fragments is eventually consistent. This means that even if the producer receives an acknowledgment that a fragment is persisted, the result might not be returned immediately from a request to ListFragments. However, results are typically available in less than one second.

**Note**
You must first call the GetDataEndpoint API to get an endpoint. Then send the ListFragments requests to this endpoint using the --endpoint-url parameter.

**Important**
If an error is thrown after invoking a Kinesis Video Streams archived media API, in addition to the HTTP status code and the response body, it includes the following pieces of information:

- **x-amz-ErrorType** HTTP header – contains a more specific error type in addition to what the HTTP status code provides.
- **x-amz-RequestId** HTTP header – if you want to report an issue to AWS, the support team can better diagnose the problem if given the Request Id.

Both the HTTP status code and the ErrorType header can be utilized to make programmatic decisions about whether errors are retry-able and under what conditions, as well as provide information on what actions the client programmer might need to take in order to successfully try again.

For more information, see the Errors section at the bottom of this topic, as well as Common Errors.

**Request Syntax**

```
POST /listFragments HTTP/1.1
Content-type: application/json

{
    "FragmentSelector": {
        "FragmentSelectorType": "string",
        "TimestampRange": {
            "EndTimestamp": number,
            "StartTimestamp": number
        }
    },
    "MaxResults": number,
    "NextToken": "string",
    "StreamName": "string"
}
```

**URI Request Parameters**
The request does not use any URI parameters.

**Request Body**
The request accepts the following data in JSON format.

**FragmentSelector (p. 277)**

Describes the timestamp range and timestamp origin for the range of fragments to return.
Type: FragmentSelector (p. 305) object
Required: No

**MaxResults (p. 277)**

The total number of fragments to return. If the total number of fragments available is more than the value specified in max-results, then a ListFragments:NextToken (p. 279) is provided in the output that you can use to resume pagination.

Type: Long

Valid Range: Minimum value of 1. Maximum value of 1000.
Required: No

**NextToken (p. 277)**

A token to specify where to start paginating. This is the ListFragments:NextToken (p. 279) from a previously truncated response.

Type: String

Pattern: \[a-zA-Z0-9+/-]+={0,2}
Required: No

**StreamName (p. 277)**

The name of the stream from which to retrieve a fragment list.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: \[a-zA-Z0-9_.-]+
Required: Yes

**Response Syntax**

HTTP/1.1 200
Content-type: application/json

```
{
    "Fragments": [
        {
            "FragmentLengthInMilliseconds": number,
            "FragmentNumber": "string",
            "FragmentSizeInBytes": number,
            "ProducerTimestamp": number,
            "ServerTimestamp": number
        }
    ],
    "NextToken": "string"
}
```

**Response Elements**

If the action is successful, the service sends back an HTTP 200 response.
The following data is returned in JSON format by the service.

**Fragments (p. 278)**

A list of archived Fragment (p. 304) objects from the stream that meet the selector criteria. Results are in no specific order, even across pages.

Type: Array of Fragment (p. 304) objects

**NextToken (p. 278)**

If the returned list is truncated, the operation returns this token to use to retrieve the next page of results. This value is null when there are no more results to return.

Type: String


Pattern: `[a-zA-Z0-9+/-]+={0,2}

**Errors**

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Kinesis Video Streams has throttled the request because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

A specified parameter exceeds its restrictions, is not supported, or can't be used.

HTTP Status Code: 400

**NotAuthorizedException**

Status Code: 403, The caller is not authorized to perform an operation on the given stream, or the token has expired.

HTTP Status Code: 401

**ResourceNotFoundException**

GetMedia throws this error when Kinesis Video Streams can't find the stream that you specified.

GetHLSStreamingSessionURL and GetDASHStreamingSessionURL throw this error if a session with a PlaybackMode of ON_DEMAND or LIVE_REPLAY is requested for a stream that has no fragments within the requested time range, or if a session with a PlaybackMode of LIVE is requested for a stream that has no fragments within the last 30 seconds.

HTTP Status Code: 404

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
• AWS SDK for C++
• AWS SDK for Go
• AWS SDK for Java
• AWS SDK for JavaScript
• AWS SDK for PHP V3
• AWS SDK for Python
• AWS SDK for Ruby V3

Amazon Kinesis Video Signaling Channels

The following actions are supported by Amazon Kinesis Video Signaling Channels:

• GetIceServerConfig (p. 281)
• SendAlexaOfferToMaster (p. 284)
GetIceServerConfig
Service: Amazon Kinesis Video Signaling Channels

Gets the Interactive Connectivity Establishment (ICE) server configuration information, including URIs, user name, and password which can be used to configure the WebRTC connection. The ICE component uses this configuration information to set up the WebRTC connection, including authenticating with the Traversal Using Relays around NAT (TURN) relay server.

TURN is a protocol that is used to improve the connectivity of peer-to-peer applications. By providing a cloud-based relay service, TURN ensures that a connection can be established even when one or more peers are incapable of a direct peer-to-peer connection. For more information, see A REST API For Access To TURN Services.

You can invoke this API to establish a fallback mechanism in case either of the peers is unable to establish a direct peer-to-peer connection over a signaling channel. You must specify the Amazon Resource Name (ARN) of your signaling channel in order to invoke this API.

Request Syntax

```http
POST /v1/get-ice-server-config HTTP/1.1
Content-type: application/json

{
  "ChannelARN": "string",
  "ClientId": "string",
  "Service": "string",
  "Username": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

ChannelARN (p. 281)

The ARN of the signaling channel to be used for the peer-to-peer connection between configured peers.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+`

Required: Yes

ClientId (p. 281)

Unique identifier for the viewer. Must be unique within the signaling channel.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-_.-]+`
Service (p. 281)

Specifies the desired service. Currently, TURN is the only valid value.

Type: String

Valid Values: TURN

Required: No

Username (p. 281)

An optional user ID to be associated with the credentials.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+

Required: No

Response Syntax

HTTP/1.1 200
Content-type: application/json

{  
  "IceServerList": [
    
    {  
      "Password": "string",
      "Ttl": number,
      "Uris": [ "string" ],
      "Username": "string"
    }
  ]
}

Response Elements

If the action is successful, the service sends back an HTTP 200 response.

The following data is returned in JSON format by the service.

IceServerList (p. 282)

The list of ICE server information objects.

Type: Array of IceServer (p. 309) objects

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

ClientLimitExceededException

Your request was throttled because you have exceeded the limit of allowed client calls. Try making the call later.
HTTP Status Code: 400
InvalidArgumentException
The value for this input parameter is invalid.

HTTP Status Code: 400
InvalidClientException
The specified client is invalid.

HTTP Status Code: 400
NotAuthorizedException
The caller is not authorized to perform this operation.

HTTP Status Code: 401
ResourceNotFoundException
The specified resource is not found.

HTTP Status Code: 404
SessionExpiredException
If the client session is expired. Once the client is connected, the session is valid for 45 minutes. Client should reconnect to the channel to continue sending/receiving messages.

HTTP Status Code: 400

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS Command Line Interface
- AWS SDK for .NET
- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for JavaScript
- AWS SDK for PHP V3
- AWS SDK for Python
- AWS SDK for Ruby V3
SendAlexaOfferToMaster
Service: Amazon Kinesis Video Signaling Channels

This API allows you to connect WebRTC-enabled devices with Alexa display devices. When invoked, it sends the Alexa Session Description Protocol (SDP) offer to the master peer. The offer is delivered as soon as the master is connected to the specified signaling channel. This API returns the SDP answer from the connected master. If the master is not connected to the signaling channel, redelivery requests are made until the message expires.

Request Syntax

```
POST /v1/send-alexa-offer-to-master HTTP/1.1
Content-type: application/json

{
  "ChannelARN": "string",
  "MessagePayload": "string",
  "SenderClientId": "string"
}
```

URI Request Parameters

The request does not use any URI parameters.

Request Body

The request accepts the following data in JSON format.

**ChannelARN (p. 284)**

The Amazon Resource Name (ARN) of the signaling channel by which Alexa and the master peer communicate.

Type: String


Required: Yes

**MessagePayload (p. 284)**

The base64-encoded SDP offer content.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 10000.

Pattern: `[a-zA-Z0-9-/=]+`

Required: Yes

**SenderClientId (p. 284)**

The unique identifier for the sender client.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.
Pattern: [a-zA-Z0-9_.-]+  
Required: Yes

Response Syntax

```
HTTP/1.1 200
Content-type: application/json
{
    "Answer": "string"
}
```

Response Elements

If the action is successful, the service sends back an HTTP 200 response. The following data is returned in JSON format by the service.

**Answer (p. 285)**

The base64-encoded SDP answer content.

Type: String  
Length Constraints: Minimum length of 1. Maximum length of 10000.

Errors

For information about the errors that are common to all actions, see Common Errors (p. 310).

**ClientLimitExceededException**

Your request was throttled because you have exceeded the limit of allowed client calls. Try making the call later.

HTTP Status Code: 400

**InvalidArgumentException**

The value for this input parameter is invalid.

HTTP Status Code: 400

**NotAuthorizedException**

The caller is not authorized to perform this operation.

HTTP Status Code: 401

**ResourceNotFoundException**

The specified resource is not found.

HTTP Status Code: 404

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:
Data Types

The following data types are supported by Amazon Kinesis Video Streams:

- ChannelInfo (p. 288)
- ChannelNameCondition (p. 290)
- ResourceEndpointListItem (p. 291)
- SingleMasterChannelEndpointConfiguration (p. 292)
- SingleMasterConfiguration (p. 293)
- StreamInfo (p. 294)
- StreamNameCondition (p. 296)
- Tag (p. 297)

The following data types are supported by Amazon Kinesis Video Streams Media:

- StartSelector (p. 298)

The following data types are supported by Amazon Kinesis Video Streams Archived Media:

- ClipFragmentSelector (p. 300)
- ClipTimestampRange (p. 301)
- DASHFragmentSelector (p. 302)
- DASHTimestampRange (p. 303)
- Fragment (p. 304)
- FragmentSelector (p. 305)
- HLSFragmentSelector (p. 306)
- HLSTimestampRange (p. 307)
- TimestampRange (p. 308)

The following data types are supported by Amazon Kinesis Video Signaling Channels:

- IceServer (p. 309)

Amazon Kinesis Video Streams

The following data types are supported by Amazon Kinesis Video Streams:
• ChannelInfo (p. 288)
• ChannelNameCondition (p. 290)
• ResourceEndpointListItem (p. 291)
• SingleMasterChannelEndpointConfiguration (p. 292)
• SingleMasterConfiguration (p. 293)
• StreamInfo (p. 294)
• StreamNameCondition (p. 296)
• Tag (p. 297)
A structure that encapsulates a signaling channel's metadata and properties.

**Contents**

**ChannelARN**

The Amazon Resource Name (ARN) of the signaling channel.

Type: String


Pattern: `arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-.]+/[0-9]+`

Required: No

**ChannelName**

The name of the signaling channel.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: `[a-zA-Z0-9-.]+`

Required: No

**ChannelStatus**

Current status of the signaling channel.

Type: String

Valid Values: CREATING | ACTIVE | UPDATING | DELETING

Required: No

**ChannelType**

The type of the signaling channel.

Type: String

Valid Values: SINGLE_MASTER

Required: No

**CreationTime**

The time at which the signaling channel was created.

Type: Timestamp

Required: No

**SingleMasterConfiguration**

A structure that contains the configuration for the SINGLE_MASTER channel type.

Type: SingleMasterConfiguration (p. 293) object
Required: No

**Version**

The current version of the signaling channel.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: \[a-zA-Z0-9]+\]

Required: No

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
(ChannelNameCondition)
Service: Amazon Kinesis Video Streams

An optional input parameter for the ListSignalingChannels API. When this parameter is specified while invoking ListSignalingChannels, the API returns only the channels that satisfy a condition specified in ChannelNameCondition.

Contents

ComparisonOperator

A comparison operator. Currently, you can only specify the BEGINS_WITH operator, which finds signaling channels whose names begin with a given prefix.

Type: String

Valid Values: BEGINS_WITH

Required: No

ComparisonValue

A value to compare.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
ResourceEndpointListItem
Service: Amazon Kinesis Video Streams

An object that describes the endpoint of the signaling channel returned by the GetSignalingChannelEndpoint API.

Contents

Protocol

The protocol of the signaling channel returned by the GetSignalingChannelEndpoint API.
Type: String
Valid Values: WSS | HTTPS
Required: No

ResourceEndpoint

The endpoint of the signaling channel returned by the GetSignalingChannelEndpoint API.
Type: String
Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
SingleMasterChannelEndpointConfiguration
Service: Amazon Kinesis Video Streams

An object that contains the endpoint configuration for the SINGLE_MASTER channel type.

Contents

Protocols

This property is used to determine the nature of communication over this SINGLE_MASTER signaling channel. If WSS is specified, this API returns a websocket endpoint. If HTTPS is specified, this API returns an HTTPS endpoint.

Type: Array of strings

Array Members: Minimum number of 1 item. Maximum number of 5 items.

Valid Values: WSS | HTTPS

Required: No

Role

This property is used to determine messaging permissions in this SINGLE_MASTER signaling channel. If MASTER is specified, this API returns an endpoint that a client can use to receive offers from and send answers to any of the viewers on this signaling channel. If VIEWER is specified, this API returns an endpoint that a client can use only to send offers to another MASTER client on this signaling channel.

Type: String

Valid Values: MASTER | VIEWER

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
SingleMasterConfiguration
Service: Amazon Kinesis Video Streams

A structure that contains the configuration for the SINGLE_MASTER channel type.

Contents

MessageTtlSeconds
The period of time a signaling channel retains underlivered messages before they are discarded.

Type: Integer

Valid Range: Minimum value of 5. Maximum value of 120.

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
StreamInfo

Service: Amazon Kinesis Video Streams

An object describing a Kinesis video stream.

Contents

CreationTime

A time stamp that indicates when the stream was created.

Type: Timestamp

Required: No

DataRetentionInHours

How long the stream retains data, in hours.

Type: Integer

Valid Range: Minimum value of 0.

Required: No

DeviceName

The name of the device that is associated with the stream.

Type: String


Pattern: \[a-zA-Z0-9_.-]+\]

Required: No

KmsKeyId

The ID of the AWS Key Management Service (AWS KMS) key that Kinesis Video Streams uses to encrypt data on the stream.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 2048.

Pattern: .+

Required: No

MediaType

The MediaType of the stream.

Type: String


Pattern: :\w\-\w\+\+\,\w\-\w\+\+\]/\w\-\w\+\+\)*

Required: No

Status

The status of the stream.
Type: String

Valid Values: CREATING | ACTIVE | UPDATING | DELETING

Required: No

StreamARN

The Amazon Resource Name (ARN) of the stream.

Type: String


Pattern: arn:aws:kinesisvideo:[a-z0-9-]+:[0-9]+:[a-z]+/[a-zA-Z0-9-_.-]+/[0-9]+

Required: No

StreamName

The name of the stream.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9-_.-]+

Required: No

Version

The version of the stream.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 64.

Pattern: [a-zA-Z0-9-]+

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
StreamNameCondition
Service: Amazon Kinesis Video Streams

Specifies the condition that streams must satisfy to be returned when you list streams (see the ListStreams API). A condition has a comparison operation and a value. Currently, you can specify only the BEGINS_WITH operator, which finds streams whose names start with a given prefix.

Contents

ComparisonOperator

A comparison operator. Currently, you can specify only the BEGINS_WITH operator, which finds streams whose names start with a given prefix.

Type: String

Valid Values: BEGINS_WITH

Required: No

ComparisonValue

A value to compare.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: [a-zA-Z0-9_.-]+

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
Tag
Service: Amazon Kinesis Video Streams

A key and value pair that is associated with the specified signaling channel.

Contents

Key

The key of the tag that is associated with the specified signaling channel.

Type: String


Pattern: ^([\p{L}\p{Z}\p{N}_.:/=+-@]*)$

Required: Yes

Value

The value of the tag that is associated with the specified signaling channel.

Type: String

Length Constraints: Minimum length of 0. Maximum length of 256.

Pattern: [\p{L}\p{Z}\p{N}_.:/=+-@]*

Required: Yes

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3

Amazon Kinesis Video Streams Media

The following data types are supported by Amazon Kinesis Video Streams Media:

- StartSelector (p. 298)
StartSelector
Service: Amazon Kinesis Video Streams Media

Identifies the chunk on the Kinesis video stream where you want the GetMedia API to start returning media data. You have the following options to identify the starting chunk:

- Choose the latest (or oldest) chunk.
- Identify a specific chunk. You can identify a specific chunk either by providing a fragment number or timestamp (server or producer).
- Each chunk's metadata includes a continuation token as a Matroska (MKV) tag (AWS_KINESISVIDEO_CONTINUATION_TOKEN). If your previous GetMedia request terminated, you can use this tag value in your next GetMedia request. The API then starts returning chunks starting where the last API ended.

Contents

AfterFragmentNumber

Specifies the fragment number from where you want the GetMedia API to start returning the fragments.

Type: String


Pattern: ^[0-9]+$

Required: No

ContinuationToken

Continuation token that Kinesis Video Streams returned in the previous GetMedia response. The GetMedia API then starts with the chunk identified by the continuation token.

Type: String


Pattern: ^[a-zA-Z0-9_\.-]+$

Required: No

StartSelectorType

Identifies the fragment on the Kinesis video stream where you want to start getting the data from.

- NOW - Start with the latest chunk on the stream.
- EARLIEST - Start with earliest available chunk on the stream.
- FRAGMENT_NUMBER - Start with the chunk after a specific fragment. You must also specify the AfterFragmentNumber parameter.
- PRODUCER_TIMESTAMP or SERVER_TIMESTAMP - Start with the chunk containing a fragment with the specified producer or server timestamp. You specify the timestamp by adding StartTimestamp.
- CONTINUATION_TOKEN - Read using the specified continuation token.

Note

If you choose the NOW, EARLIEST, or CONTINUATION_TOKEN as the startSelectorType, you don't provide any additional information in the startSelector.

Type: String
Valid Values: FRAGMENT_NUMBER | SERVER_TIMESTAMP | PRODUCER_TIMESTAMP | NOW | EARLIEST | CONTINUATION_TOKEN

Required: Yes

StartTimestamp

A timestamp value. This value is required if you choose the PRODUCER_TIMESTAMP or the SERVER_TIMESTAMP as the startSelectorType. The GetMedia API then starts with the chunk containing the fragment that has the specified timestamp.

Type: Timestamp

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3

Amazon Kinesis Video Streams Archived Media

The following data types are supported by Amazon Kinesis Video Streams Archived Media:

- ClipFragmentSelector (p. 300)
- ClipTimestampRange (p. 301)
- DASHFragmentSelector (p. 302)
- DASHTimestampRange (p. 303)
- Fragment (p. 304)
- FragmentSelector (p. 305)
- HLSFragmentSelector (p. 306)
- HLSTimestampRange (p. 307)
- TimestampRange (p. 308)
ClipFragmentSelector
Service: Amazon Kinesis Video Streams Archived Media

Describes the timestamp range and timestamp origin of a range of fragments.

Fragments that have duplicate producer timestamps are deduplicated. This means that if producers are producing a stream of fragments with producer timestamps that are approximately equal to the true clock time, the clip will contain all of the fragments within the requested timestamp range. If some fragments are ingested within the same time range and very different points in time, only the oldest ingested collection of fragments are returned.

Contents

FragmentSelectorType
The origin of the timestamps to use (Server or Producer).
Type: String
Valid Values: PRODUCER_TIMESTAMP | SERVER_TIMESTAMP
Required: Yes

TimestampRange
The range of timestamps to return.
Type: ClipTimestampRange (p. 301) object
Required: Yes

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
ClipTimestampRange
Service: Amazon Kinesis Video Streams Archived Media

The range of timestamps for which to return fragments.

The values in the ClipTimestampRange are inclusive. Fragments that begin before the start time but continue past it, or fragments that begin before the end time but continue past it, are included in the session.

Contents

EndTimestamp

The end of the timestamp range for the requested media.

This value must be within 3 hours of the specified StartTimestamp, and it must be later than the StartTimestamp value. If FragmentSelectorType for the request is SERVER_TIMESTAMP, this value must be in the past.

This value is inclusive. The EndTimestamp is compared to the (starting) timestamp of the fragment. Fragments that start before the EndTimestamp value and continue past it are included in the session.

Type: Timestamp
Required: Yes

StartTimestamp

The starting timestamp in the range of timestamps for which to return fragments.

This value is inclusive. Fragments that start before the StartTimestamp and continue past it are included in the session. If FragmentSelectorType is SERVER_TIMESTAMP, the StartTimestamp must be later than the stream head.

Type: Timestamp
Required: Yes

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
DASHFragmentSelector
Service: Amazon Kinesis Video Streams Archived Media

Contains the range of timestamps for the requested media, and the source of the timestamps.

Contents

FragmentSelectorType

The source of the timestamps for the requested media.

When FragmentSelectorType is set to PRODUCER_TIMESTAMP and
GetDASHStreamingSessionURL:PlaybackMode (p. 262) is ON_DEMAND or LIVE_REPLAY,
the first fragment ingested with a producer timestamp within the specified
FragmentSelector:TimestampRange (p. 305) is included in the media playlist. In addition, the
fragments with producer timestamps within the TimestampRange ingested immediately following
the first fragment (up to the GetDASHStreamingSessionURL:MaxManifestFragmentResults (p. 262)
value) are included.

Fragments that have duplicate producer timestamps are deduplicated. This means that if producers
are producing a stream of fragments with producer timestamps that are approximately equal to
the true clock time, the MPEG-DASH manifest will contain all of the fragments within the requested
timestamp range. If some fragments are ingested within the same time range and very different
points in time, only the oldest ingested collection of fragments are returned.

When FragmentSelectorType is set to PRODUCER_TIMESTAMP and
GetDASHStreamingSessionURL:PlaybackMode (p. 262) is LIVE, the producer timestamps are used in
the MP4 fragments and for deduplication. But the most recently ingested fragments based on server
timestamps are included in the MPEG-DASH manifest. This means that even if fragments ingested in
the past have producer timestamps with values now, they are not included in the HLS media playlist.

The default is SERVER_TIMESTAMP.

Type: String

Valid Values: PRODUCER_TIMESTAMP | SERVER_TIMESTAMP

Required: No

TimestampRange

The start and end of the timestamp range for the requested media.

This value should not be present if PlaybackType is LIVE.

Type: DASHTimestampRange (p. 303) object

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
DASHTimestampRange
Service: Amazon Kinesis Video Streams Archived Media

The start and end of the timestamp range for the requested media.

This value should not be present if PlaybackType is LIVE.

Note
The values in the DASHTimestampRange are inclusive. Fragments that begin before the start time but continue past it, or fragments that begin before the end time but continue past it, are included in the session.

Contents

EndTimestamp
The end of the timestamp range for the requested media. This value must be within 3 hours of the specified StartTimestamp, and it must be later than the StartTimestamp value.

If FragmentSelectorType for the request is SERVER_TIMESTAMP, this value must be in the past.

The EndTimestamp value is required for ON_DEMAND mode, but optional for LIVE_REPLAY mode. If the EndTimestamp is not set for LIVE_REPLAY mode then the session will continue to include newly ingested fragments until the session expires.

Note
This value is inclusive. The EndTimestamp is compared to the (starting) timestamp of the fragment. Fragments that start before the EndTimestamp value and continue past it are included in the session.

Type: Timestamp
Required: No

StartTimestamp
The start of the timestamp range for the requested media.

If the DASHTimestampRange value is specified, the StartTimestamp value is required.

Note
This value is inclusive. Fragments that start before the StartTimestamp and continue past it are included in the session. If FragmentSelectorType is SERVER_TIMESTAMP, the StartTimestamp must be later than the stream head.

Type: Timestamp
Required: No

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
Fragment
Service: Amazon Kinesis Video Streams Archived Media

Represents a segment of video or other time-delimited data.

Contents

**FragmentLengthInMilliseconds**

The playback duration or other time value associated with the fragment.

Type: Long

Required: No

**FragmentNumber**

The unique identifier of the fragment. This value monotonically increases based on the ingestion order.

Type: String


Pattern: `^[0-9]+$`

Required: No

**FragmentSizeInBytes**

The total fragment size, including information about the fragment and contained media data.

Type: Long

Required: No

**ProducerTimestamp**

The timestamp from the producer corresponding to the fragment.

Type: Timestamp

Required: No

**ServerTimestamp**

The timestamp from the AWS server corresponding to the fragment.

Type: Timestamp

Required: No

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
FragmentSelector
Service: Amazon Kinesis Video Streams Archived Media

Describes the timestamp range and timestamp origin of a range of fragments.

Only fragments with a start timestamp greater than or equal to the given start time and less than or equal to the end time are returned. For example, if a stream contains fragments with the following start timestamps:

- 00:00:00
- 00:00:02
- 00:00:04
- 00:00:06

A fragment selector range with a start time of 00:00:01 and end time of 00:00:04 would return the fragments with start times of 00:00:02 and 00:00:04.

Contents

FragmentSelectorType

The origin of the timestamps to use (Server or Producer).

Type: String

Valid Values: PRODUCER_TIMESTAMP | SERVER_TIMESTAMP

Required: Yes

TimestampRange

The range of timestamps to return.

Type: TimestampRange (p. 308) object

Required: Yes

See Also

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
HLSFragmentSelector
Service: Amazon Kinesis Video Streams Archived Media

Contains the range of timestamps for the requested media, and the source of the timestamps.

Contents

FragmentSelectorType
The source of the timestamps for the requested media.

When FragmentSelectorType is set to PRODUCER_TIMESTAMP and GetHLSStreamingSessionURL:PlaybackMode (p. 270) is ON_DEMAND or LIVE_REPLAY, the first fragment ingested with a producer timestamp within the specified FragmentSelector:TimestampRange (p. 305) is included in the media playlist. In addition, the fragments with producer timestamps within the TimestampRange ingested immediately following the first fragment (up to the GetHLSStreamingSessionURL:MaxMediaPlaylistFragmentResults (p. 270) value) are included.

Fragments that have duplicate producer timestamps are deduplicated. This means that if producers are producing a stream of fragments with producer timestamps that are approximately equal to the true clock time, the HLS media playlists will contain all of the fragments within the requested timestamp range. If some fragments are ingested within the same time range and very different points in time, only the oldest ingested collection of fragments are returned.

When FragmentSelectorType is set to PRODUCER_TIMESTAMP and GetHLSStreamingSessionURL:PlaybackMode (p. 270) is LIVE, the producer timestamps are used in the MP4 fragments and for deduplication. But the most recently ingested fragments based on server timestamps are included in the HLS media playlist. This means that even if fragments ingested in the past have producer timestamps with values now, they are not included in the HLS media playlist.

The default is SERVER_TIMESTAMP.

Type: String
Valid Values: PRODUCER_TIMESTAMP | SERVER_TIMESTAMP
Required: No

TimestampRange
The start and end of the timestamp range for the requested media.

This value should not be present if PlaybackType is LIVE.

Type: HLSTimestampRange (p. 307) object
Required: No

See Also
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
HLSTimestampRange
Service: Amazon Kinesis Video Streams Archived Media

The start and end of the timestamp range for the requested media.

This value should not be present if PlaybackType is LIVE.

**Note**
The values in the HLSTimestampRange are inclusive. Fragments that begin before the start time but continue past it, or fragments that begin before the end time but continue past it, are included in the session.

**Contents**

**EndTimestamp**

The end of the timestamp range for the requested media. This value must be within 3 hours of the specified StartTimestamp, and it must be later than the StartTimestamp value.

If FragmentSelectorType for the request is SERVER_TIMESTAMP, this value must be in the past.

The EndTimestamp value is required for ON_DEMAND mode, but optional for LIVE_REPLAY mode. If the EndTimestamp is not set for LIVE_REPLAY mode then the session will continue to include newly ingested fragments until the session expires.

**Note**
This value is inclusive. The EndTimestamp is compared to the (starting) timestamp of the fragment. Fragments that start before the EndTimestamp value and continue past it are included in the session.

Type: Timestamp

Required: No

**StartTimestamp**

The start of the timestamp range for the requested media.

If the HLSTimestampRange value is specified, the StartTimestamp value is required.

**Note**
This value is inclusive. Fragments that start before the StartTimestamp and continue past it are included in the session. If FragmentSelectorType is SERVER_TIMESTAMP, the StartTimestamp must be later than the stream head.

Type: Timestamp

Required: No

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
**TimestampRange**
Service: Amazon Kinesis Video Streams Archived Media

The range of timestamps for which to return fragments.

**Contents**

**EndTimestamp**
The ending timestamp in the range of timestamps for which to return fragments.

Type: Timestamp
Required: Yes

**StartTimestamp**
The starting timestamp in the range of timestamps for which to return fragments.

Type: Timestamp
Required: Yes

**See Also**
For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3

**Amazon Kinesis Video Signaling Channels**
The following data types are supported by Amazon Kinesis Video Signaling Channels:

- IceServer (p. 309)
**IceServer**
Service: Amazon Kinesis Video Signaling Channels

A structure for the ICE server connection data.

**Contents**

**Password**
A password to login to the ICE server.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: \[a-zA-Z0-9_.-]+\]

Required: No

**Ttl**
The period of time, in seconds, during which the user name and password are valid.

Type: Integer


Required: No

**Uris**
An array of URIs, in the form specified in the I-D.petithuguenin-behave-turn-uris spec. These URIs provide the different addresses and/or protocols that can be used to reach the TURN server.

Type: Array of strings

Length Constraints: Minimum length of 1. Maximum length of 256.

Required: No

**Username**
A user name to login to the ICE server.

Type: String

Length Constraints: Minimum length of 1. Maximum length of 256.

Pattern: \[a-zA-Z0-9_.-]+\]

Required: No

**See Also**

For more information about using this API in one of the language-specific AWS SDKs, see the following:

- AWS SDK for C++
- AWS SDK for Go
- AWS SDK for Java
- AWS SDK for Ruby V3
Common Errors

This section lists the errors common to the API actions of all AWS services. For errors specific to an API action for this service, see the topic for that API action.

**AccessDeniedException**
You do not have sufficient access to perform this action.
HTTP Status Code: 400

**IncompleteSignature**
The request signature does not conform to AWS standards.
HTTP Status Code: 400

**InternalFailure**
The request processing has failed because of an unknown error, exception or failure.
HTTP Status Code: 500

**InvalidAction**
The action or operation requested is invalid. Verify that the action is typed correctly.
HTTP Status Code: 400

**InvalidClientTokenId**
The X.509 certificate or AWS access key ID provided does not exist in our records.
HTTP Status Code: 403

**InvalidParameterCombination**
Parameters that must not be used together were used together.
HTTP Status Code: 400

**InvalidParameterValue**
An invalid or out-of-range value was supplied for the input parameter.
HTTP Status Code: 400

**InvalidQueryParameter**
The AWS query string is malformed or does not adhere to AWS standards.
HTTP Status Code: 400

**MalformedQueryString**
The query string contains a syntax error.
HTTP Status Code: 404

**MissingAction**
The request is missing an action or a required parameter.
HTTP Status Code: 400

**MissingAuthenticationToken**
The request must contain either a valid (registered) AWS access key ID or X.509 certificate.
HTTP Status Code: 403
**MissingParameter**
A required parameter for the specified action is not supplied.

HTTP Status Code: 400
**OptInRequired**
The AWS access key ID needs a subscription for the service.

HTTP Status Code: 403
**RequestExpired**
The request reached the service more than 15 minutes after the date stamp on the request or more than 15 minutes after the request expiration date (such as for pre-signed URLs), or the date stamp on the request is more than 15 minutes in the future.

HTTP Status Code: 400
**ServiceUnavailable**
The request has failed due to a temporary failure of the server.

HTTP Status Code: 503
**ThrottlingException**
The request was denied due to request throttling.

HTTP Status Code: 400
**ValidationError**
The input fails to satisfy the constraints specified by an AWS service.

HTTP Status Code: 400

**Common Parameters**

The following list contains the parameters that all actions use for signing Signature Version 4 requests with a query string. Any action-specific parameters are listed in the topic for that action. For more information about Signature Version 4, see Signature Version 4 Signing Process in the Amazon Web Services General Reference.

**Action**
The action to be performed.

- Type: string
- Required: Yes

**Version**
The API version that the request is written for, expressed in the format YYYYY-MM-DD.

- Type: string
- Required: Yes

**X-Amz-Algorithm**
The hash algorithm that you used to create the request signature.
Condition: Specify this parameter when you include authentication information in a query string instead of in the HTTP authorization header.

Type: string

Valid Values: AWS4-HMAC-SHA256

Required: Conditional

**X-Amz-Credential**

The credential scope value, which is a string that includes your access key, the date, the region you are targeting, the service you are requesting, and a termination string (“aws4_request”). The value is expressed in the following format: access_key/YYYYMMDD/region/service/aws4_request.

For more information, see Task 2: Create a String to Sign for Signature Version 4 in the Amazon Web Services General Reference.

Condition: Specify this parameter when you include authentication information in a query string instead of in the HTTP authorization header.

Type: string

Required: Conditional

**X-Amz-Date**

The date that is used to create the signature. The format must be ISO 8601 basic format (YYYYMMDD'T'HHMMSS'Z'). For example, the following date time is a valid X-Amz-Date value: 20120325T120000Z.

Condition: X-Amz-Date is optional for all requests; it can be used to override the date used for signing requests. If the Date header is specified in the ISO 8601 basic format, X-Amz-Date is not required. When X-Amz-Date is used, it always overrides the value of the Date header. For more information, see Handling Dates in Signature Version 4 in the Amazon Web Services General Reference.

Type: string

Required: Conditional

**X-Amz-Security-Token**

The temporary security token that was obtained through a call to AWS Security Token Service (AWS STS). For a list of services that support temporary security credentials from AWS Security Token Service, go to AWS Services That Work with IAM in the IAM User Guide.

Condition: If you’re using temporary security credentials from the AWS Security Token Service, you must include the security token.

Type: string

Required: Conditional

**X-Amz-Signature**

Specifies the hex-encoded signature that was calculated from the string to sign and the derived signing key.

Condition: Specify this parameter when you include authentication information in a query string instead of in the HTTP authorization header.

Type: string
Required: Conditional

**X-Amz-SignedHeaders**

Specifies all the HTTP headers that were included as part of the canonical request. For more information about specifying signed headers, see Task 1: Create a Canonical Request For Signature Version 4 in the Amazon Web Services General Reference.

Condition: Specify this parameter when you include authentication information in a query string instead of in the HTTP authorization header.

Type: string

Required: Conditional