



Fast Channel Switching

RealNetworks White Paper Series

Applies to:

Helix Server 12

Helix Mobile Server 12

Summary:

Fast Channel Switching is a method of rapid channel switching that is accomplished without having to make client-side changes, including starting new client connection to the server. This is achieved by having the server maintain a connection to the client while switching the channel or input stream on the back end. Channel switch requests are made by the client via an out-of-band HTTP request. After server validates the request and confirms compatibility of requested content, it will perform a switch of content on the same client connection.



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Introduction

This is an introduction and overview of Fast Channel Switching (called further FCS).

Fast Channel Switching

FCS is a new feature included with release of the version 12 of server products. FCS is the ability for the client to choose a different channel to watch or listen to and have the player on the client's machine receive new channel without losing time on starting a new connection and buffering of the new stream. Server does this by interjecting the new media stream source into an already existing client RTSP session after receiving properly formatted out-of-band HTTP request.

Channel

A channel is a stream that can be switched to a different stream (a new channel) within a single RTSP session. This switching capability eliminates the need to set up and tear down a user's RTSP session when the user selects a new stream. As a result, a user can "change channels" without experiencing disruption in playback when a new channel begins. To the user, the succession of streams appears to be a broadcast of user-selected content that ends when a channel finishes streaming and no subsequent channel has been queued.

How it works

FCS operation requires a Helix Server 12 or a Helix Mobile Server 12 (with exception of Helix DNA and Helix Plus versions), one of the supported player versions with RTSP support, at least one of the FCS supported data-types and codecs, and a third party HTTP infrastructure that will provide means to list available content and make properly formed HTTP requests.

The following figure (Figure 1) illustrates a simple channel-switching scenario. Here, the user selects the first channel, "Pop Hits." The user does not make this choice directly through Helix Mobile Server in an RTSP session. Rather, the user interacts with a third-party Web portal that supplies the user's browser with links to the available channels.

Once the user selects the channel, the Web portal sends the channel choice information to Helix Mobile Server as a specially formatted HTTP URL directed toward a secure port. Helix Mobile Server then delivers the media player instructions in an SDP file that enable it to connect to Helix Mobile Server and receive the channel. The channel content may be an on-demand clip, a live broadcast, or a simulated-live broadcast.

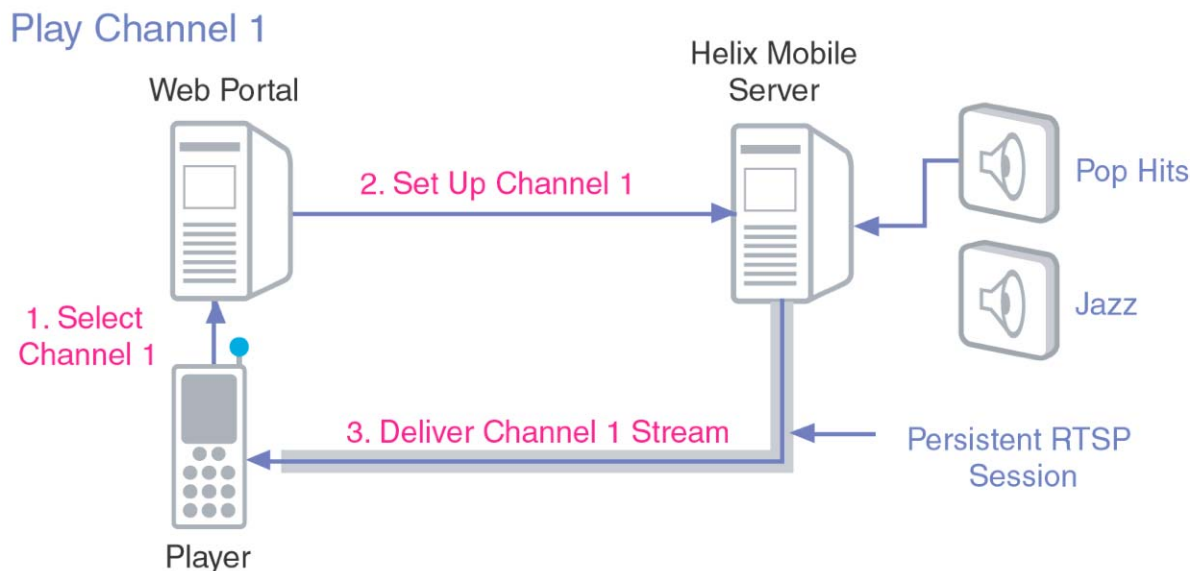


Figure 1

The next figure (Figure 2) shows a user changing the streaming content to a second channel, "Jazz." Again, the user interacts with the Web portal to do this. In this scenario, the change request results from user feedback, such as clicking a link in an on-line guide. However, change requests can occur without user interaction. For example, change requests may result from a predefined playlist that the Web portal manages.

Once the Web portal sends Helix Mobile Server an HTTP command to change the channel, Helix Mobile Server queues the new source. It can switch to the new source immediately, or after the current source has finished playing. When the new channel starts, it streams within the media player's existing RTSP session, providing a seamless switchover between the channel streams.

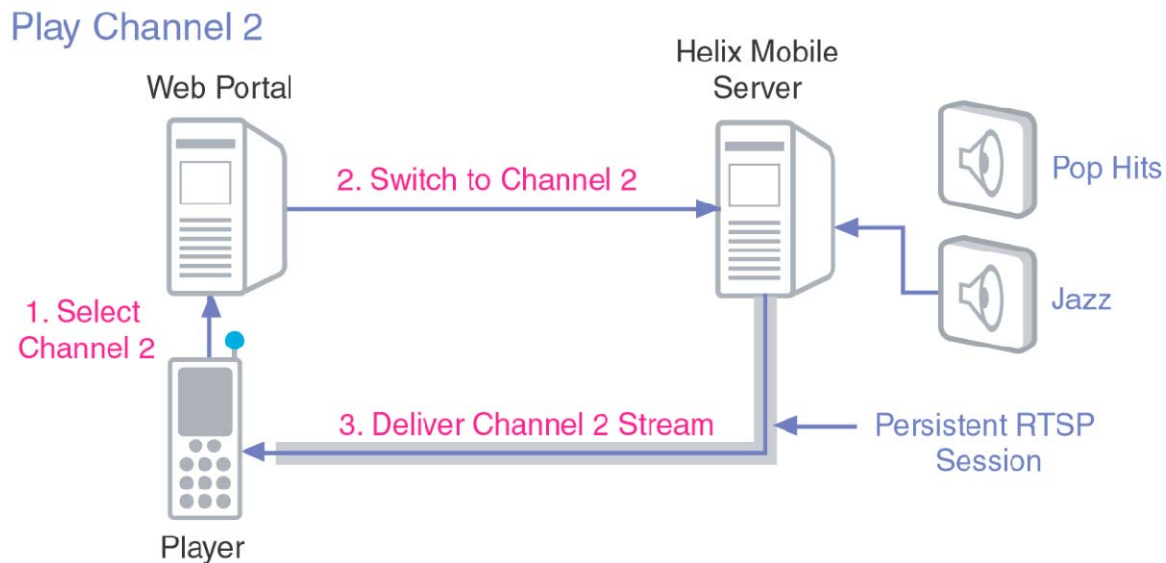


Figure 2

Sample Use Cases

Channel Surfing

The user accesses a Web portal and begins channel surfing. Merriam-Webster Dictionary defines "Channel Surfing" as an "act of surfing through television programs usually by use of a remote control". By having a Web portal configured to allow immediate switching of media streams in the user's RTSP session we can effectively achieve the same result with the Web portal acting as a remote control.

Advertising

The user accesses Web portal and clicks on a link to see a movie. When the user's media player receives the stream, the user sees an ad. After the ad ends the user sees the requested movie. With proper configuration ad insertion is available Pre-roll and Post-roll or combined for on-demand or for live. This is possible with use of the Queuing Indicator command option for the out-of-band HTTP request. For example:



Pre-Roll

1. User makes a request on the Web portal
2. Web portal generates a request to the server for a switchable session to play an on-demand ad clip
3. Web portal immediately follows up with the second request to the server containing asking for the requested content and including Queuing Indicator command set to "switch at the end of playback".
4. Server received second request, waits for the ad to finish streaming and inserts requested content into user's RTSP session

Post-Roll

1. User makes a request on the Web portal
2. Web portal generates a request to the Helix Server for a switchable session, receives SDP file from the server and forwards it to user
3. Web portal also generates a switch request to the Helix Server for an ad and includes Queuing Indicator command set to "switch at the end of playback"
4. After the original content plays out, user's RTSP session will receive an ad from the server and after that playback will stop

To support post-roll the portal needs to ensure the stream has started playback on the user's player. This can be done by monitoring access logs with the target stream name and unique session ID on the Helix Server or by creating a logging template to notify the portal of new tracks for a given session ID.

Requirements

Codecs and File Formats

The player cannot change decoding methodology used in a single RTSP session, thus all the content used with FCS must be encoded with the same codecs and bitrates. The following codecs are supported:

- RealVideo and RealAudio v8-v10
- H.264
- H.263
- MPEG-4 video
- AAC, AAC+, or Enhanced AAC+ audio
- AMR-NB or AMR-WB audio

Supported file formats are RealMedia (.ra, .rv, .rm), 3GPP (.3gp), and QuickTime (.mov). Windows Media file format is not supported.



Protocols and Transports

Channel switching works only with RTSP-based streams. This includes RTSP streams cloaked as HTTP. MMS and HTTP download are not supported. The network protocol can be either UDP or TCP. You can use the RealNetworks RDT transport protocol, or the standards-based RTP transport protocol.

Third-Party Components

Certain components are necessary for channel switching. These components are not part of the Helix Server offering. The following provides details about the requirements for such components:

Web Portal

A Web portal is a third-party application that provides the user with information about available channels and submits channel requests to Helix Server.

User Browser

Each user must have a browser or a rich media client to be able to access and interact with the Web portal. There are no specific requirements for the browser by the FCS.

User Media Player

User must have an RTSP capable media player that supports codecs and file formats listed above. There are no non-standard RTSP commands used by the FCS system and most RTSP compliant players can be used.

Configuration

Server

To configure server using Helix Administrator:

1. Click **Server Setup** > **Ports** and verify that the channel control port is set to the port value you wish to use (default is 8008)
2. Click **Content Management** > **Channel Switching**
3. Choose "Yes" from the pull-down menu for **Enable Fast Channel Switching**
4. In the pull-down menu for **SDP Mount Point**, select the mount point used to generate SDP files (typically /sdpgen/)
5. Click **Apply**



To prevent unauthorized channel switching or the possibility of DOS-type attacks, ensure that only authorized Web portals and HTTP proxies can issue HTTP commands to Helix Mobile Server on its controller port. Media users should not have direct access to the controller port. You can restrict port access by configuring your firewall appropriately, or defining an access rule (Chapter 15 of the Administration Guide).

Web Portal

The specific Web portal configuration is beyond the scope of this paper, however, the following information lists all of the requirements needed to fulfill channel switching requests that are sent to the Helix Server.

The Web portal must be able to issue commands to the channel controller on the Helix Server. Commands consist of HTTP requests directed to the channel controller port and include parameter and value pairs separated from the main URL by standard query string syntax ("?" and "&"). The following example illustrates the command syntax:
`http://helixserver:controller_port/stream.ext?param1=value1¶m2=value2...`

The following table lists out the parameters included in the HTTP GET request toward the Helix Server's controller port. The last two columns indicate if the attribute is required in the initial request that sets up the channel session or in the channel switch request, or both.



HTTP Attributes for Channel Controller Requests

Attribute	Function	Example	Initial Request	Channel Switch
Switching Allowed Marker	Indicates that the requested stream is a channel that can be switched	hxs=1	required	required
Session ID	Identifies the user's RTSP session	guid=ID	required	required
Rate Control Flag	Enables rate control: 0 - rate control disabled (default) 1 - rate control enabled	mdp=1	optional	not used
Queuing Indicator	Specifies when the next channel starts to play: 0 - switch immediately (default) 1 - switch at end of playback	queue=1	not used	optional
SDP File on Error	Generates an SDP file on an error: 0 - no new SDP on error 1 - new SDP on error (default)	sdp=0	optional	optional

Switching Allowed Marker

The switching marker is the required parameter that instructs Helix Server to monitor this session and allow channel switching. The value for this parameter is immaterial and can be user-selected.

Session ID

Session ID is the unique value that the Web portal is responsible for generating for each user. The value should be between 8 and 32 characters in length and may contain all alphanumeric characters and "-" (hyphen). The Session ID is used by the Helix Server to identify each user's RTSP session.



Rate Control Flag

Setting rate control flag to 1 in the initial request will enable Helix Server to use its rate control feature if network conditions are favorable.

Queuing Indicator

By default, Helix Server will perform channel switch immediately upon receiving the switch request. Adding the parameter `queue=1` to the query string informs Server to queue the new channel, and not to start delivering it after the current clip ends.

SDP file on Error

By default, Helix Server will return an SDP file for the requested channel if the channel switch request fails. After setting this parameter to 0, Helix Server will only return HTTP error code.

Sample Workflow

Initial Channel Request

1. The user selects a channel using information provided by Web portal.
2. The Web portal then requests that channel SDP file from the Helix Server using an HTTP GET request with added channel controller parameters. For example here is the URL for an on-demand channel:
`http://helixserver.example.com:8008/station5.3gp?hxs=1&mdp=1&guid=a5230cgj321`
3. Helix Server after receiving a request with `hxs=1` in the URL accepts it as a channel switching session request and checks for existing session ID value. If there are none, server returns an SDP file for the channel back to the Web portal.
4. Web portal delivers SDP file to the user identifying the stream with the SDP MIME type, `application/sdp`.
5. User's media player initiates the RTSP session by contacting Helix Server using the channel URL with included session ID embedded in the SDP file.
6. Helix Server begins to stream the channel and registers it under the session ID supplied in the URL.



Switch to a New Channel

1. The user selects a new channel in the information provided by Web portal.
2. Web portal then requests that channel from the Helix Server using an HTTP GET request with added channel switch parameters. Using the previous session ID example URL, the new URL would look like this:
`http://helixserver.example.com:8008/station9.3gp?hxs=1&sdp=0&guid=a5230cgj321`
3. Helix Server checks that a session ID is still used by an active session, verifies that the new channel exists, determines if the current and new channels are compatible. If there are no errors in any of the checks, Helix Server stops reading from the original media source and starts reading the new one, effectively switching the stream within the RTSP session to the new channel.
 - a. For on-demand, packets from the new source are delivered to the client immediately. There is no need to wait because a key frame is immediately available (first frame in the file) and the old stream need not wait for a closing key frame.
 - b. For live, server starts reading from the most recent key frame of the small buffer it keeps for every inbound live stream. Thus, source is switched immediately as with on-demand sources.
 - c. If, however, Helix Server determines that there are errors in any of the checks performed, it returns an HTTP error code and, optionally, an SDP file with the new channel, to the Web portal
 - i. Optionally, Web portal delivers error response to the user, or provides user with the new SDP file (assuming it has been configured to do so).
4. The user's media player begins to play the new channel stream as soon as all buffered data for the previous channel is consumed (generally about 4 seconds, but could be longer).
 - a. Mechanisms for flushing the client's buffer and playing new audio/video source upon receipt of the first packet are planned for a future release that will support 3GPP Release 7 support for server-side channel switching.

Additional Information

Additional information about usage and configuration can be found in the *Helix (Mobile) Server Administration Guide* and *Helix (Mobile) Server Configuration and Registry Reference*.