



When automation is introduced, dealing with closed captioning often requires extra manual processes for extraction, editing, and embedding captions into media that is ready to air

This paper discusses the various requirements, pitfalls, and options available to make use of more automated workflows for dealing with captioned media.

- ## Delivery of proxy files to captioners

1. Create the compressed proxy .mp4 video from a video editing system
2. Upload and share the proxy video to an FTP site or file sharing service

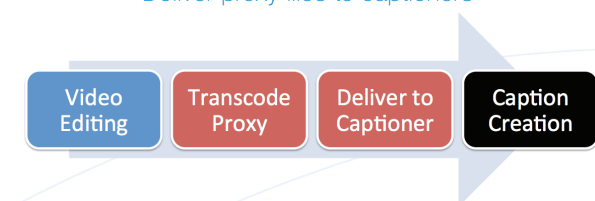
3. Notify captioning department of order and required turnaround time
4. Receive captioning file via e-mail and transcode with media
5. Verify captioning presence during quality control before delivery

The manual workflow above can vary if a video production studio has an in-house captioning department or sends the video to a third-party service provider.

The practice of creating of proxy files for captioning comes from several hurdles which make it undesirable to send large full-resolution master videos to the captioner. These include the use of captioning software systems that only support specific video formats in order to create a project, as well as the use of simple desktop computers, which are not optimized to playback and edit large, high bit rate video files. Proxy video files can be watermarked or downgraded to reduce the risk of pre-release leaks or unintentional spread of classified information. Finally, using a proxy prevents the possibility of unintentional changes that could affect the final master file.

In order to automate the delivery of proxy video files to a caption service department, a workflow to transcode, deliver, and notify can be designed for the post-production staff to remove all the manual steps that are required to work with the captioner.

Deliver proxy files to captioners

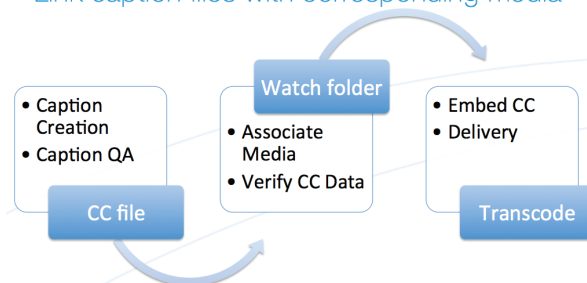


Link caption files with media

Once a service department has completed a captioning project, a compatible caption file such as an .SCC (Scenarist Closed Caption file) document is delivered to the customer. It is common for completed caption files to be sent back and forth via e-mail. Problems with email attachments can cause unintentional, but hard to detect changes to the caption document unless additional manual steps are taken. However, the biggest issue that video professionals have to tangle with is how to take the caption file and associate that with the video file for transcoding for digital file based delivery. There is very little information regarding that process and generally it can be hit or miss for a first time captioning customer.

What is optimal for captioning in a post-production environment is a way to automatically associate captioning files from the service department with the master video file for transcoding. This can be accomplished using consistent naming conventions for the video files and a watch folder that can associate the captioning data file with the media. Once these two files are associated, then a transcoding workflow can deliver the final digital master file such as .MXF, MPEG-2, LXF, GXF, etc.

Link caption files with corresponding media



Embed closed captions into media

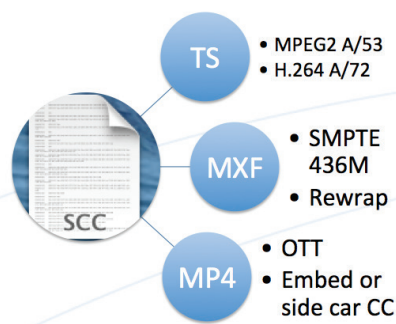
Adding caption data into a video file can sometimes be challenging. There are many different ways to add CEA-608 and CEA-708 data to media. Furthermore, each TV station may require a different type of video file with a specific formatting of 608/708 data. Generally speaking a video editor or post-production manager may be caught in a web of codecs, caption files, editing systems, and difficult ways to perform quality control once captioning is embedded into a video file. This can be discouraging for a video professional that simply needs to deliver a captioned program on time.

To automate this process, transcoding of caption data must also be introduced into a video transcoding workflow. For example, an .SCC only contains CEA-608 data and is intended for 29.97 standard definition video. To be able to deliver a TV broadcast video file with captions in many formats, an automated transcoding workflow can be designed to translate the caption data found in the .SCC file to include CEA-708. In addition, the data must be embedded in the correct space of the video file. There are three general methods for inserting caption data into a video file:

1. VBI (Vertical Blanking Interval) for Standard Definition
2. Closed Caption Track inside of the video wrapper (.MOV, .MXF)
3. User data inside the video essence (MPEG-2, SEI H.264, DV25,50,100)

It is imperative that an automated transcoding solution has the ability to insert caption data in the these three categories for file-based delivery.

Embed CC into Media



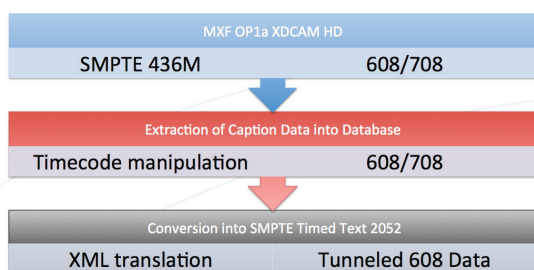
Extract caption data for repurposing and Internet media

Related to the ability to embed caption data into media files, there is also a need to repurpose existing captioned media files, which are captured live, stored on a video server, or pulled from tape or file archives.

The need to repurpose TV caption data for Internet delivery is driven by legislation, which requires TV broadcasters to also caption Internet videos. (See CVAA from FCC.gov.)

In addition, standard definition media files that only contain CEA-608 data may need to be transcoded to HD media files, which require both CEA-608 and CEA-708 data.

Extract caption data for repurposing and Internet CC



Automate generation of open captioned proxy for Quality Control

Clients' management, legal, or other departments often request a media file for approval before final delivery. When captioning is introduced to a file-based delivery workflow, a customer must also sign off on the quality of the captioning. Simply checking the text file is not sufficient, for example, due to new FCC requirements on caption timing, synchronicity, and visual positioning.

Therefore, transcoding should also automatically generate an open captioned proxy for QC. The open captioned proxy must visually represent the same look and feel to simulate the end viewing experience.

Open captioning means that the closed caption data is burned into the video image and cannot be turned off. This is done to make sure that the viewing of captioning formatting and timing is guaranteed to represent the final result, and not dependent on the playback mechanism which may require a menu setting to access the captioning or may not render the captioning identically to the end users' display devices.

Since high definition broadcast masters contain the same caption data in two different formats (CEA-608 and CEA-708), it is ideal to be able to preview both types of captions to ensure both formats contain the correct information. Additionally, if additional languages such as French or Spanish are detected in the captioning, then multiple open captioned proxies should be generated for proper quality control.

Automatically create open captioned proxy for QC



Transcode and delivery of closed captioned media

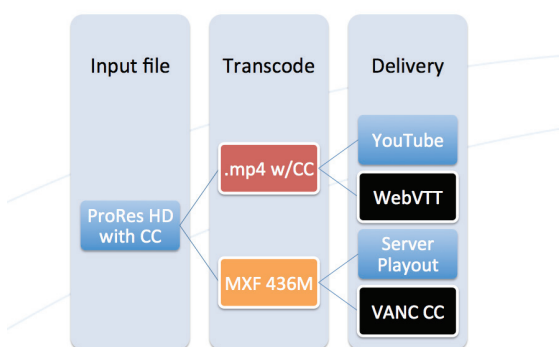
One of the biggest captioning challenges for TV broadcasters is to convert a captioned media file into a completely different flavor of media file and preserve the caption data. Transcoding a video file is essentially a compression process that is designed to convey the original image and audio into a different format. Captions must also be treated as a primary media type by the transcoder, and may require translation of the caption data into different specifications and formats.

There are two categories of consideration that play a part in this workflow. The first is to be able to read the caption data from the source file in order to re-apply the captions to whatever output format is needed. In the case of HD video file formats for TV, the output needs to contain both CEA-608 and 708 caption data. Because there are multiple ways that a media file can contain captions, the transcoding engine may not always be able to read the captioning data from the source file. This can result in a stumbling block in the automated workflow. Manual steps then need to be taken to find out how to read the captions from a source clip for the caption data to be included in the final transcoded media file.

The second category of consideration is to determine which captioning data format is compatible with the playout mechanism such as a TV broadcast server or Internet video player. For example, an XDCAM .MXF file can contain the same captioning data in two different locations: as A/53 user data in the essence video, and/or as a SMPTE 436M track in the .MXF wrapper. Some video playout servers may only be able to see captions from one type or the other. Therefore even if the file is determined to contain the proper captions, these captions might not work on the specific video server used by the broadcaster. The video deliverable has to meet the specification requirements of the broadcaster, or the file could be rejected or possibly aired without captioning, which could result in FCC fines.

Transcoding workflows that are compatible with VBI, user data, and caption tracks must be able to preserve and translate the caption data between the source clip and the variety of different file-based delivery formats and containers.

Transcode and delivery of captioned media

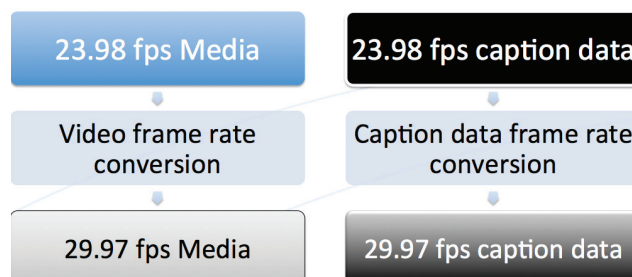


Frame rate conversion of caption data

Digital file delivery workflows can include requirements for the source file and the final delivery to have different frame rates. The same is true for caption data. The challenge is that most captioning is designed for TV broadcast and therefore is typically formatted in 29.97 fps. A caption service company is usually asked to caption the TV master and not the Internet deliverable master which could be in 23.98 fps. In many cases, video providers are expected to repurpose a TV broadcast caption file which was originally created for 29.97fps for use with a VOD or Internet video file at 23.98 fps.

In order to successfully transcode to or from a 23.98 fps media file, the automated engine must now pull the caption data into a separate mechanism to adjust the frame rate to match the deliverable format.

Frame rate conversion of caption data



Automatic video frame rate conversions must introduce a secondary step to convert the frame rate of the caption data to avoid sync issues.

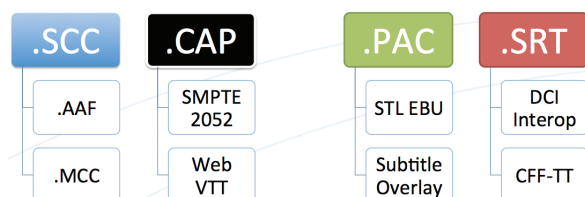
Flip caption documents between various broadcast or Internet types

Most file-based automation and transcoding solutions have support for the .SCC file. However, today's file based delivery requirements call for support for a variety of caption documents. Internet captioning file formats require output of caption files as SMPTE 2052 timed text .XML and WebVTT documents. Broadcasters who have access to older archived caption files such as .CAP, .TDS or .CIN must repurpose these documents for new media delivery requirements.

There is also a need to re-edit existing content that is captioned. This introduces an opportunity to convert a standard caption file such as .SCC into caption format that can be used in a video editing system. For example, in the case of Avid Media Composer systems, a special Avid .AAF caption file containing both CEA-608 and 708 can be created by transcoding from a standard caption file. Once the caption data is imported into the editing timeline as a separate asset, the video editor can add graphics, bumpers, and cuts without negatively affecting the caption data.

Entire archives of old caption files can be converted to a modern caption format that can be used for editing, Internet delivery, and embedding into new, more efficient master file formats that support 4K/Ultra HD resolutions such as ProRes, DNxHD, and H.265 HEVC.

Flip caption documents between various types
(TV and Internet caption files)



Automatic conversion between TV and Internet caption files is imperative to meet delivery requirements.

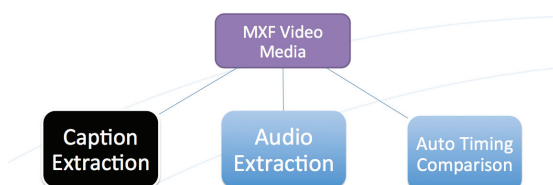
Analysis of video file formats for caption data and timing

Despite strict guidelines for digital video file delivery from production houses to TV and Internet distributors, broadcasters often receive video files that do not transcode or playback properly with closed captioning. Although these can typically be fixed with a re-transcode and closed caption insertion, an automated mechanism can automatically detect issues of missing caption data or synchronization. This can be a huge time saver to help catch problems before they become high priority with limited time to air.

There are automated analysis tools available that can quickly scan both SD and HD broadcast video files for CEA-608, CEA-708, V-chip, XDS, and AFD data information. These tools must be able to scan a variety of protocols of caption data including VBI (vertical blanking intervals), user data A/53, and SMPTE 436M inside MXF wrapped video files.

Automated speech indexing technologies can also aid in analyzing the timing of the text to the spoken dialogue within the audio tracks of the input digital video file format. This ability can quickly find caption drifting sync issues that are common in frame rate conversion processes. This is especially important to broadcasters that need to prepare for the new captioning quality guidelines from the FCC.

Analysis of video file formats for caption data and timing



If the 608/708 caption data is extracted, then a filter can automatically analyze the timing of the captions and compare to the spoken word in the audio.

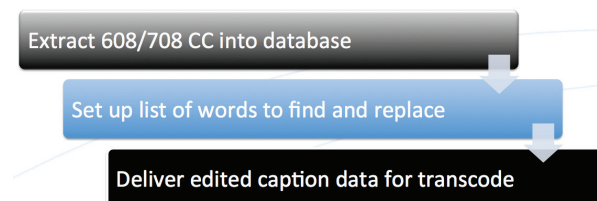
Editing text in automation and bad word filtering (profane words, banned words and prohibited words)

Another possibility within the automated captioning workflow is to make edits to the actual text that is embedded in video file formats or sidecar caption files such as .SCC and .CAP. To do this properly an intermediate step can map the text into a database that is editable. This introduces the option to do simple word processor type of changes such as “find and replace” words that are incorrect within the caption text.

For example, if the name of a character in a film or TV program is misspelled, a task can be scripted to find the incorrect spelling and quickly replace the text with the proper name.

Another application involves setting up a list of prohibited words that should not appear in the captions for delivery to video markets that need to censor foul language. Once the list is defined, a script can search and replace or delete any words that appear in the captioning data.

Editing text in automation and bad word filtering



Once the full caption data is extracted from a media file or caption document, the user can set up a list of words to replace.

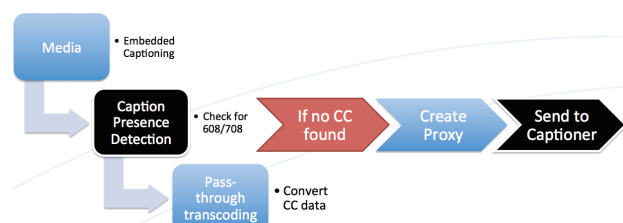
Automate reporting of caption presence in digital file formats

Once the analysis is complete an automated workflow can also create reports to help engineers understand captioning issues with video files that failed to properly transcode and did not contain captioning based on their internal guidelines. These reports can be detailed enough to include what type of data is missing from the captioning as well as any timing issues.

Deployment of these reports can also be automated. A workflow can be designed to populate remote storage with text documents that contain analysis details. In addition, broadcasters can set up automatic e-mails that can be sent to clients, production houses, and internal staff to alert them when a file has trouble with captions.

It may also be necessary to provide these reports to an administrative team in the event of a compliance audit by a legislative body.

Automated reporting of caption presence in video files



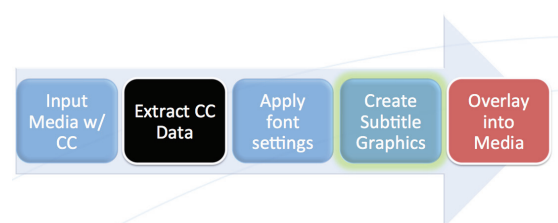
In addition, caption presence detection can help make automated decisions during the file-based workflow. Media can be sorted based on caption presence and deliver non-captioned media directly to a captioning service department.

Convert caption files to burn-in subtitles

Rendering subtitles over video can be a time consuming manual process. This is especially problematic when working with a variety of video file formats and resolutions. Automating the text overlay and rendering within the transcoding workflow essentially takes this time consuming process away from the video editing workflow. Caption files such as STL EBU, PAC, .SCC, .SRT and WebVTT are very small and can be used to create a text graphic image sequence that can be utilized by video transcoding software to burn-in to a variety of video file formats.

Because, the graphics are being generated from a text file, the user can specify the font size, color, outline, and style for subtitling. This is very useful when delivering SD, HD, and OTT content that need burn-in subtitles.

Convert caption files to burn-in subtitles



The original caption data may not have font information. Therefore, the automated task must include font settings to create the desired look for subtitles.

Conclusions

For broadcast engineers who need to make sure content is properly transcoded and aired with closed captioning, automation can be a great time saver and take on much of the manual video file analysis and troubleshooting burden. Tasks that would normally require conference calls, additional software and equipment, can be replaced by an automated workflow that can edit, transcribe, analyze and report closed captioning data related processes.

As regulations for captioning quality control become stricter, broadcast facilities will need to implement automated captioning tasks within the transcoding and delivery workflow.

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