Making Captions Better

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Introduction

These notes are comments on implementation of SMPTE 430-10 Auxiliary Content Synchronization Protocol and SMPTE 430-11 Auxiliary Resource Presentation List for digital cinema closed captioning. The comments are suggestions to digital cinema server (DCS) developers from the developer of an auxiliary content server (ACS) or closed captioning device. These suggestions are by no means mandatory but, instead, are believed to lead to improved interoperation between a DCS and an ACS. Comments on this document are encouraged.

SMPTE 430-10 Auxiliary Content Synchronization Protocol

1. **Allow for more than one CSP Connection** - SMPTE 430-10 allows for one or more ACS devices. There may be devices other than closed captioning devices connecting to the DCS, so servers should allow for more than one CSP connection on port 4170.
2. **Send RPL URL Early** - Before the ACS receives the RPL URL, it has no idea what is going to be played. Once it receives the RPL URL, the ACS must fetch the RPL, parse it, then fetch and parse the timed text caption file for each language to be displayed. Though we work to make this process as fast as possible, it cannot happen in zero time. Therefore, we suggest sending the RPL URL as soon as the DCS can determine what content is going to be played. For non-scheduled playout, a user often loads a show, then runs it. The RPL URL should be sent when the show is loaded instead of waiting until the show is run. For scheduled playout, send the RPL URL for the next scheduled show when the DCS actually loads the show instead of when playout is started. Testing the IRC-28C and CCE-100 with firmware version 120112, typical content (such as Sintel) is ready for playback within 2 seconds of reception of the RPL URL. Non-typical content (the Fox CC Sync Test, which includes a LOT of data before EntryPoint and after EntryPoint+Duration) is ready for playback about 22 seconds after the RPL URL is received. Note that the system runs more slowly if logging is enabled on the CCE-100 RS232 port or logging is viewed on port 10001. You can check timing by watching CSP traffic with Wire Shark. Filter with tcp.port==4170 to see just the CSP traffic.
3. **Include A Timeout in Wait For ACS** - If, when the user presses play or the scheduled start time has arrived, it is found that the ACS is still processing the data and does not have captions ready, hold off playout for a limited period of time. If a show is loaded immediately prior to start being pressed, there may not have been enough time for the ACS to fetch and parse the required data. The DCS should wait a limited period of time (30 to 60 seconds, or user defined timeout) for the ACS to return that it is ready. This increases the chances of the captions showing from the beginning of the playout in all the languages while not holding off playback indefinitely. Note that even if the ACS reports it is still processing, it may have the first language or two ready for playback. Further, it continues processing the data during playback, so it's possible that all languages will be ready by the time the first caption is to be displayed. However, a limited delay improves our chances. It would be useful to give the user feedback as to why the playback has not started.
4. **Don't Wait For ACS If It's Not There** - The DCS should wait a limited amount of time for the ACS to say that it is ready, but the DCS should not wait at all if the ACS is not there (no content synchronization protocol connection set up). We have seen situations where the ACS was unplugged and the DCS waited for a status ok message that would never arrive. Before entering the wait for ACS loop, check to see if the ACS is actually there.
5. **Set Output Enabled When Playout Starts** - The sample CSP transaction in appendix B of SMPTE 430-10 shows "Set Output Mode Enabled" after the ACS returns a status OK response instead of a status processing response. However, 7.2.5 states "The DCS shall set the output mode to enabled when playing out content that has synchronous auxiliary content." Output mode should always reflect the run/stop status of the DCS. If the DCS starts playout before the ACS has returned status OK, the DCS should still set output mode to enabled to properly reflect the playout status. If the RPL has three languages present, the ACS does not return status OK

until it has fetched and parsed the first reel of the first two languages and fetched and started parsing the first reel of the third language. If playout starts before the ACS reports it is ready, it is better to let the ACS know playout has started so it can start playing the content that it *has* fetched and parsed.

6. **Use Unique Playout IDs** - Each time the ACS receives a Set RPL Location request, it queues the URL to fetch and parse the RPL. The Set RPL Location request includes a playout ID that, according to 7.2.4.1, is to be unique. The ACS associates the playout ID in the Set RPL Location request to the RPL that is actually fetched and parsed, then associates it with each of the timed text files that are fetched and parsed, then, finally associates it with each of the captions that are to be displayed. The ACS plays captions in the order they are processed for each language stream. The first en-us file in the RPL is played first, then the second, etc. If, when it's time to play the captions, the playout ID in the timeline update message does not match the playout ID in the next caption to play, the caption is discarded. This continues until there is a playout ID match and the timeline time matches the calculated TimeIn of the caption (calculated based on offset and entry point from the RPL, and the start time in the timed text file). If a playout ID is not unique, the ACS may not play the appropriate captions. Do not send a Set RPL Location with a playout ID that has been previously used (unless a terminate lease has been sent, which erases all knowledge of previous information).
7. **Unroll Loops, if possible** - If a program loops, the ACS has an easier time if the DCS unrolls the loop into either a long RPL or a series of RPLs. When the timeline steps backwards with the same playout ID, the ACS may need to refetch data. If, instead, the data playout appears to be a linear stream of content, the ACS can prefetch the data.
8. **Joining A Show In Process** - If the ACS connects to the DCS while a show is playing, the DCS should immediately report the current playback status. This can be in the form of a few DCS requests to the ACS. These are what is suggested:
    1. Update Timeline - Sending this before the Set RPL Location allows the ACS to skip fetching timed text files that will not be used since we are already past that point in the playout.
    2. Set Output Mode Enabled - Let the ACS know that the movie is playing and that its clock should be advancing.
    3. Set RPL Location - Let the ACS know where the RPL is so it can start fetching the required data.
9. **Handling Noncaptioned Content** - The caption standards do not tell us what to do when there are no captions. We suggest the following:
    1. **Do not send an RPL URL to a non-existent RPL.** The captioning equipment will keep trying to get the RPL multiple times before giving up. If there is no captioned content in the current playout, either do not send a RPL URL in the CSP, or send the URL of an "empty" RPL. An Empty RPL would have the ReelResources element, but not the ReelResource element.
    2. **Set Output Enabled When Playout Starts.** We suggest sending a timeline update message prior to playout start, then an output enabled message when playout starts. Regular timeline update messages should be sent during playout. While not a serious issue, we use the state of playout to determine whether the "offline text" should be displayed. This is text that is shown when a show is not running. During a show, the display is blank except for when a caption is to be displayed. Not sending output enabled when playing non-captioned content results in the offline text being shown continuously during the show. This may be distracting to the audience if a Rear Window display is used, since it will remain lit for the entire show.
10. **Avoid Short Lease Times** - We suggest a lease time in the 60 second area. We've seen 5 second lease requests. If something is delayed slightly, the lease may expire, deleting all content from the captioning equipment.

SMPTE 430-11 Auxiliary Resource Presentation List

1. **No Empty ReelResource Elements** - We have seen situations where an RPL contains a ReelResource element but does not include a ResourceFile element within it. As I read the standard, the ResourceFile element is not optional. We currently associate a language with a caption stream based on the language attribute in the ReelResource element. If there is no ResourceFile element, we never get any captions for this allocated language and will continue to report the status as processing as we continue to fetch and parse files in the hopes of eventually finding captions for this language.
2. **No Bad RPL URLs** - We have seen cases where an RPL URL points to a file that does not exist. This seems to occur most often when the content has no captions. If the content has no captions, either no RPL URL should be sent or an empty RPL should be created.
3. **Use Standard Language Codes** - Since the RPL language attribute is derived from the CPL language attribute, DCS manufacturers have little control over this. We have seen language attributes of "English" instead

of "en". We do our best to handle non-standard language attributes, but use of the standard codes would improve the chances of proper playout. See **USL Captioning Language Codes**.

- SMPTE 429-7-2006 - Composition Playlists
  - 8.6.1 specifies that language element in subtitles shall be xs:language, which states that language codes shall be based on RFC3066, which specifies use of codes in ISO 639. A language element consists of a language code optionally followed by a dash and a region code. For example, en is English. en-us is English as spoken in the US. A list of language codes and region codes is at http://www.langtag.net/registries.html .

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