

Mile High Video 2019

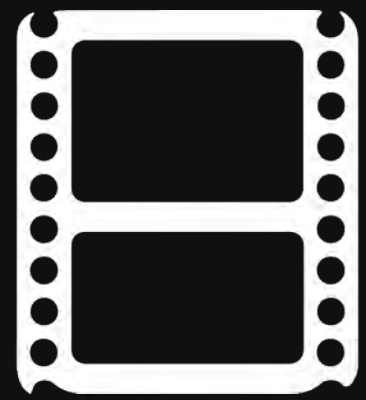
MSO Challenges with Closed Captions

July 31, 2019

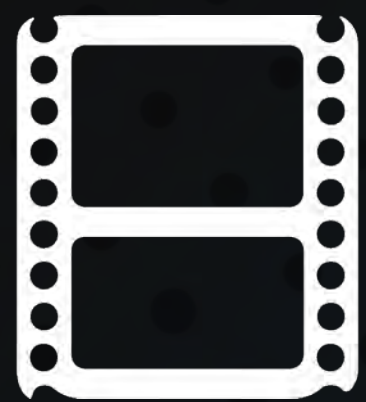


Content Delivery Workflow

Content Provider

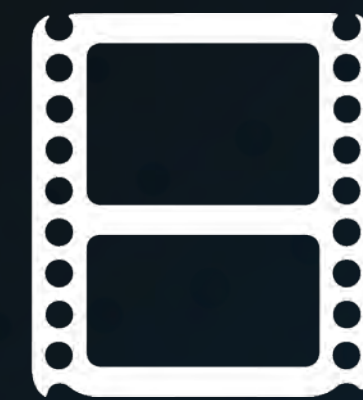
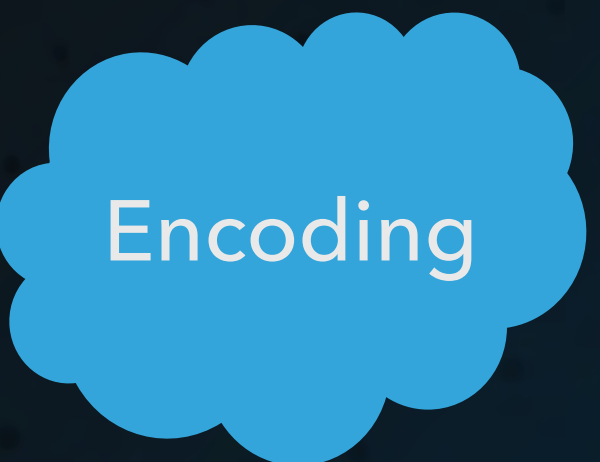
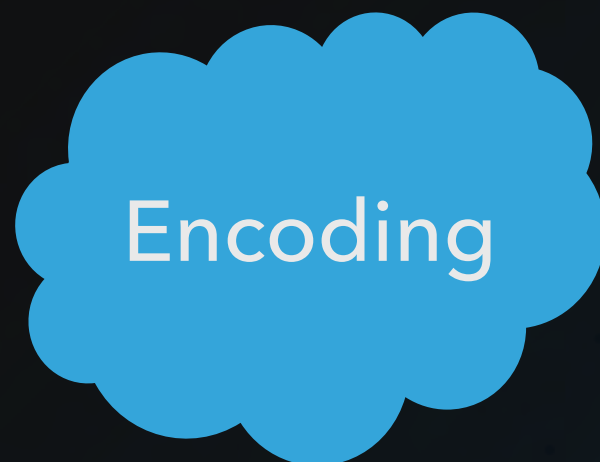


Mezzanine Video Asset
with Sidecar Caption File

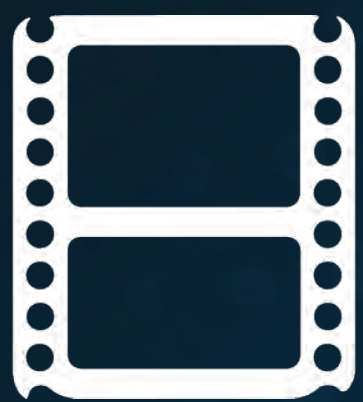


Mezzanine Video Asset
with Embedded Captions

Multiple-System Operator



Video Asset with
Embedded Captions



Video Asset with
Embedded Captions

Video Customers



Closed Caption Problems in the Field

▶ Delayed Captions

- ▶ All captions can be delayed/skewed for up to an hour and then occur at their regular presentation cadence in front of the wrong video position.
- ▶ Individual captions can be delayed in their presentation.

▶ Early Captions

- ▶ Individual captions can appear on the screen before they were expected or intended to appear.

▶ Missing Captions

- ▶ Individual captions can simply be missing, removing some dialog.

Caption Problem: Partial Captions



Premier Stalin, I am not sure tha

Caption Problem: Garbled Captions

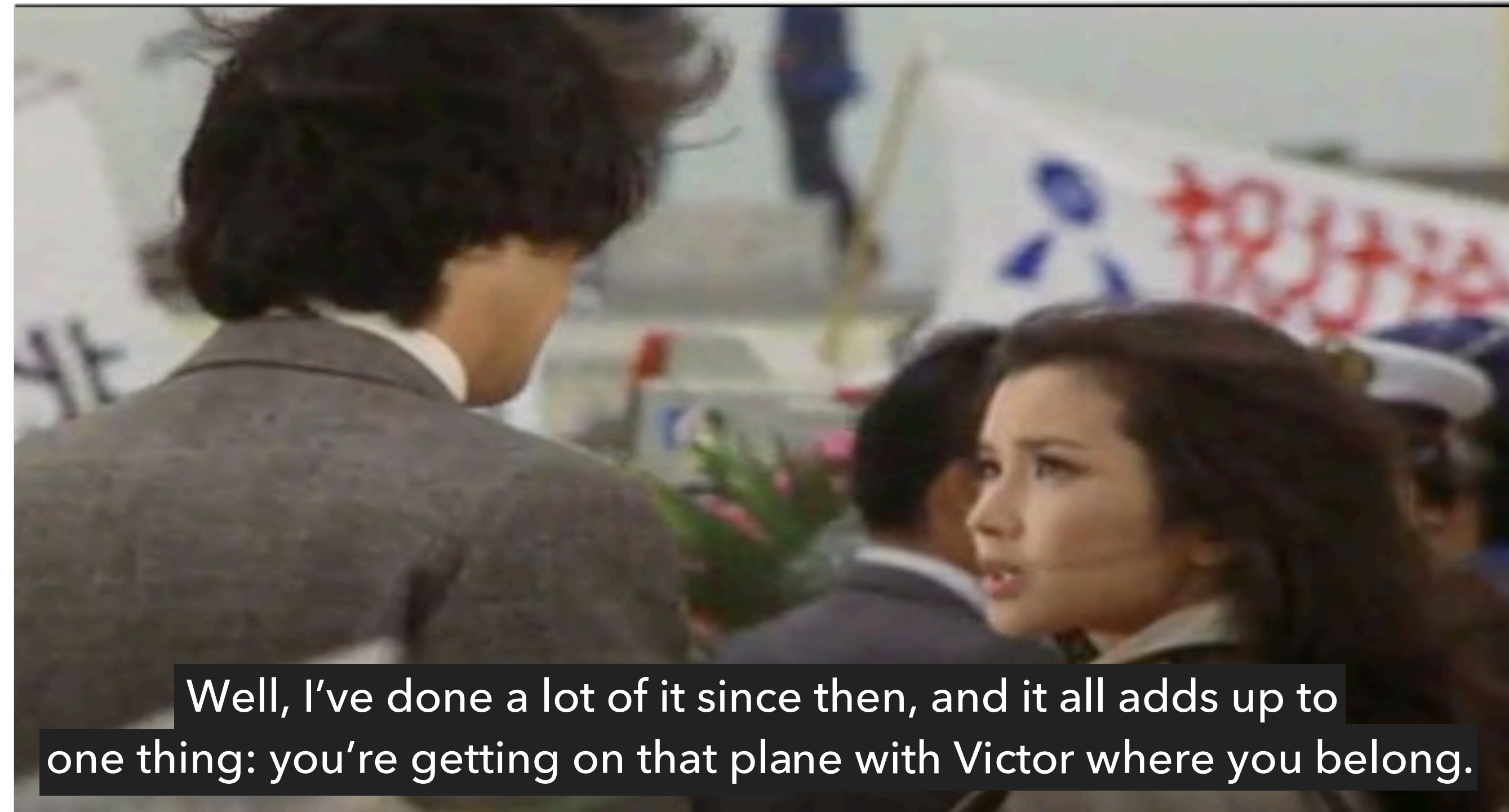


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Caption Problem: Fast Captions



Caption Problem: Letter By Letter Captions



CEA-608 “Line 21” Closed Captions

- ▶ The standard was developed in the 70s and first used in the 80s.
- ▶ Used today for both QAM and IP delivery, and also for DVD.
- ▶ Two Fields of Data, which support 4 Separate Channels of Captions.
- ▶ Three styles of Captions: Pop-On, Roll-Up, and Paint-On.
- ▶ Supports 7 Foreground Colors and 8 Background Colors.
- ▶ Closed Caption Data is carried by two byte pairs.
- ▶ Comprised of Text Characters and Control Commands.
 - ▶ Control Commands: Global Control Codes, Preamble Access Codes, Tab Control Codes, and Mid-Row Control Codes.

CEA-608: Control Codes

- ▶ **Global Control Codes** – Affect the start and stop of captions, etc.
 - ▶ Examples: RCL – Resume Caption Loading; EOC – End of Caption
- ▶ **Preamble Access Codes** – Can be either Address PACs or Style PACs.
 - ▶ Address PACs - Describe the position of text inside of the caption field.
 - ▶ Style PACs - Describe the caption color and style for individual text.
- ▶ **Tab Control Codes** – Used for positioning the cursor in the caption field.
- ▶ **Mid-Row Control Codes** – Used to temporarily modify the text color or style for a specific row of text.

CEA-608 : Pop-On Captions



- ▶ Captions are written into an offscreen buffer and then presented on screen all at once.

Control Code and Text Data Ordering

- ▶ RCL – Resume Caption Loading (To select Pop-On)
- ▶ ENM – Erase Non-Displayed Memory (Optionally to clear offscreen memory for new captions)
- ▶ Address/Style PAC – (To set position and color elements for new captions)
- ▶ Text for the current caption line.
- ▶ Address/Style PAC – (To set position and color)
- ▶ Text for the current caption line.
(Repeated for all Caption Lines)
- ▶ EDM – Erase Displayed Memory (Optionally to clear any currently visible captions)
- ▶ EOC – End of Caption (To display the caption which was just received)

(Repeated)

CEA-608 : Roll-Up Captions



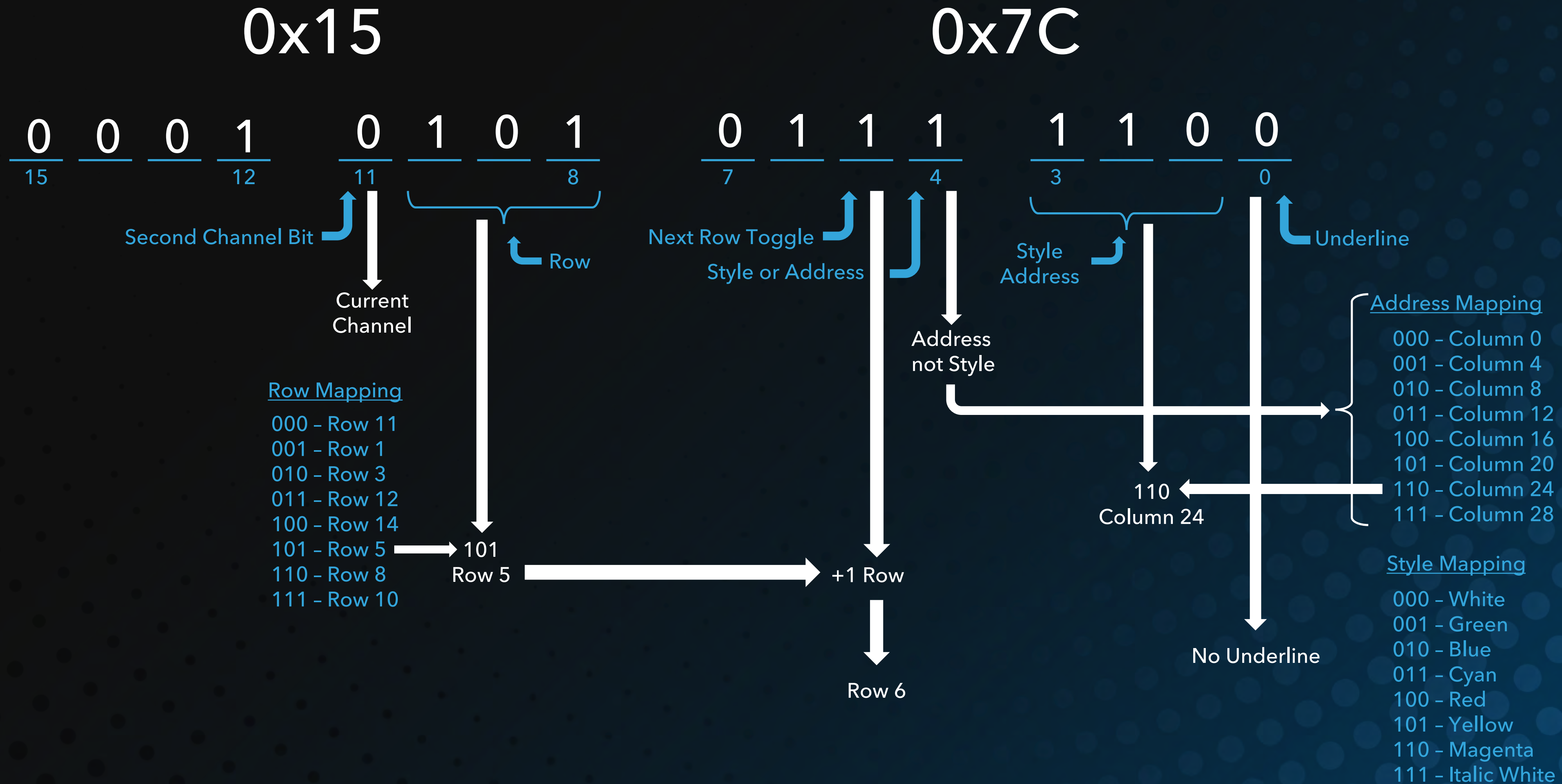
- ▶ Captions are written until the end of line, then rolled up to make room for the next line.
- ▶ Used primarily where there is not predetermined text, such as news or sports.

Control Code and Text Data Ordering

- ▶ RU2, RU3 or RU4 (To set roll-up style and depth)
- ▶ Text for the current line.
- ▶ CR (Carriage Return to roll the display up one row)
- ▶ Address PAC (To set the indent of the base row)
- ▶ Text for the current line.
- ▶ CR (Carriage Return to roll the display up one row)

(Repeated)

CEA-608: Example Control Command Decode



Address PAC: Set Cursor Position to Row 6, Column 24 and do Not Underline

CEA-708 DTV Closed Captions

- ▶ The standard was developed as a follow-up for CEA-608 in the 90s.
- ▶ Had better layering of the data, which allowed for more complex commands and more channels/services.
- ▶ Accommodated carrying 608 in the payload and migration from 608 to 708.
- ▶ Supported up to 16 Closed Captioning Services.
- ▶ Allowed for 8 separate windows per Closed Captioning Service.
- ▶ Allowed for more foreground/background colors using discreet RGB values.
- ▶ Variable length Caption Commands allow for more complex actions and behaviors.
- ▶ Apparently not as widely used, even today, as CEA-608.

CEA-708: Caption Command Codes

- ▶ **Delay {DLY}** in 100ms - Delay suspends all processing of the current service, except for Delay Cancel and Reset scanning.
- ▶ **Delay Cancel {DLC}** – Terminates any active delay and resumes normal command processing
- ▶ **Reset {RST}** - Reset deletes all windows, cancels any active delay, and clears the buffer before the Reset command.
- ▶ **Clear Windows {CLW}** – Clears all specified windows (1 – 8).
- ▶ **Display Windows {DSW}** – Displays all specified windows (1 – 8).
- ▶ **Hide Windows {HDW}** – Hides all specified windows (1 – 8).
- ▶ **Toggle Windows {TGW}** – For specified windows (1 – 8) it hides all displayed windows, and displays all hidden windows.
- ▶ **Delete Windows {DLW}** – Delete all specified windows (1 - 8).
- ▶ **Define Window {DFWx}** – Creates one of eight windows for use by the caption decoder.
- ▶ **Set Current Window {CWx}** – Determines which window the following commands describe: SWA, SPA, SPC, and SPL.
- ▶ **Set Window Attributes {SWA}** – Sets attributes of the current window. (e.g. Border Type, Color, Scroll Direction, Effect Speed)
- ▶ **Set Pen Attributes {SPA}** -Specifies how certain attributes of subsequent characters are to be rendered in the current window.
- ▶ **Set Pen Color {SPC}** – Sets the foreground, background, and edge color for the subsequent characters.
- ▶ **Set Pen Location {SPL}** – Sets the location of for the next bit of appended text in the current window.

CEA-708: Example Caption Command Decode

0x90

1 0 0 1 0 0 0 0
23 16

Set Pen Attributes {SPA}

Text Tag Mapping

- 0 - Dialog
- 1 - Source or Speaker ID
- 2 - Electronically Reproduced Voice
- 3 - Dialog in other Language
- 4 - Voiceover
- 5 - Audible Translation
- 6 - Subtitle Translation
- 7 - Voice Quality Description
- 8 - Song Lyrics
- 9 - Sound Effect Description
- 10 - Musical Score Description
- 11 - Oath
- 12 - Undefined
- 13 - Undefined
- 14 - Invisible

0x36

0 0 1 1 0 1 1 0
15 8

Text Tag

Offset

Pen Size

3 - Dialog in other Language

Offset Mapping

- 0 - Subscript
- 1 - Normal
- 2 - Superscript

0xAD

0 1 0 1 1 1 0 1
7 0

Italic

Underline

Edge Type

Font Tag

Not Italic Underlined

Pen Size Mapping

- 0 - Small
- 1 - Standard
- 2 - Large

2 - Large

Edge Type Mapping

- 0 - None
- 1 - Raised
- 2 - Depressed
- 3 - Uniform
- 4 - Left Drop Shadow
- 5 - Right Drop Shadow

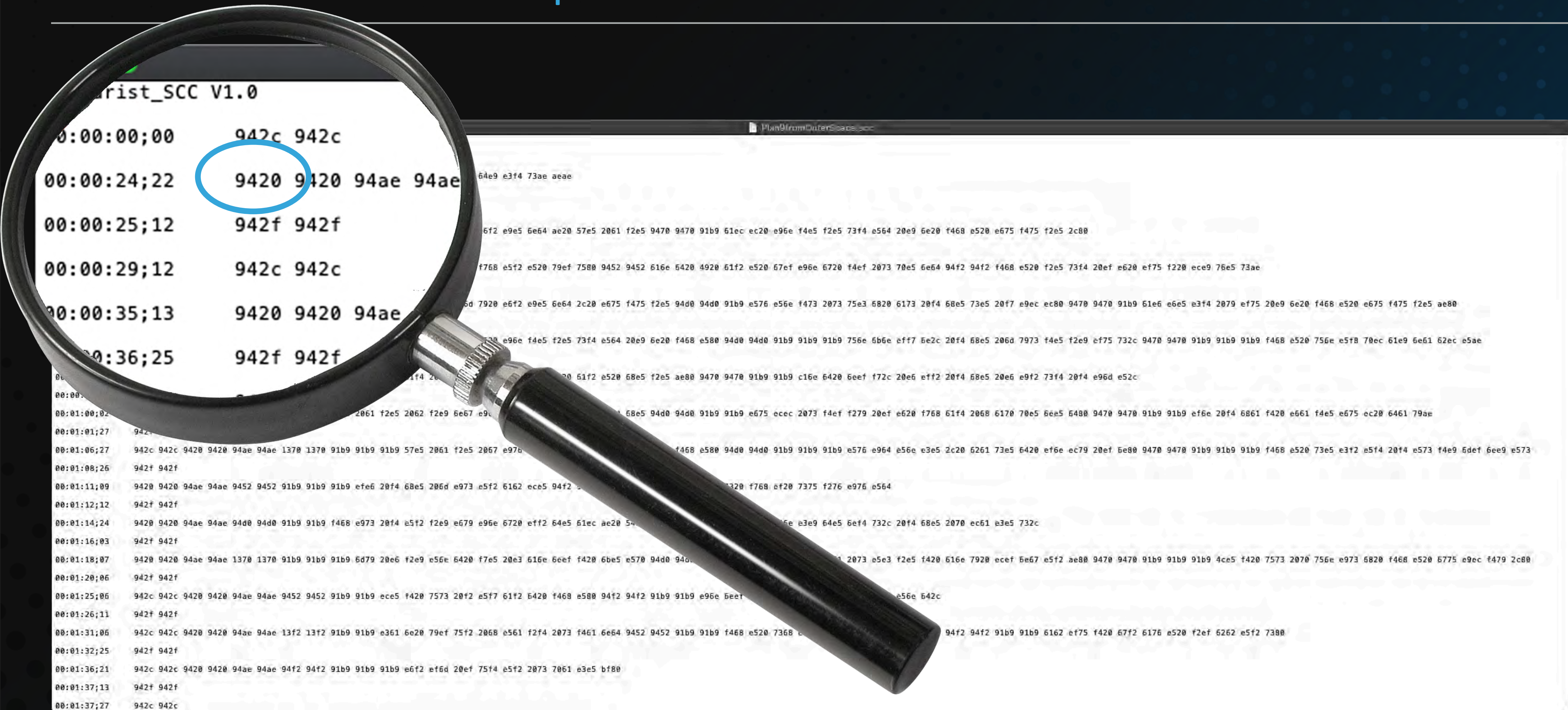
Font Tag Mapping

- 0 - Default
- 1 - Monospaced Serif
- 2 - Proportional Serif
- 3 - Monospaced Sanserif
- 4 - Proportional Sanserif
- 5 - Casual
- 6 - Cursive
- 7 - Small Caps



COMCAST

SCC – Scenarist Closed Captions File



MCC – MacCaptions File

```
File Format=MacCaption_MCC V1.0
/////////////////////////////////////////////////////////////////
// Telestream, LLC
// Ancillary Data Packet Transfer File
//
// Permission to generate this format is granted provided that
// 1. This ANC Transfer file format is used on an as-is basis and no warranty is given, and
// 2. This entire descriptive information text is included in a generated .mcc file.
//
// General file format:
// HH:MM:SS:FF(tab)[Hexadecimal ANC data in groups of 2 characters]
// Hexadecimal data starts with the Ancillary Data Packet DID (Data ID defined in S291M)
// and concludes with the Check Sum following the User Data Words.
// Each time code line must contain at most one complete ancillary data packet.
// To transfer additional ANC Data successive lines may contain identical time code.
// Time Code Rate=[24, 25, 30, 30DF, 50, 60, 60DF]
//
// ANC data bytes may be represented by one ASCII character according to the following schema:
// G FAh 00h 00h
// H 2 x (FAh 00h 00h)
// I 3 x (FAh 00h 00h)
// J 4 x (FAh 00h 00h)
// K 5 x (FAh 00h 00h)
// L 6 x (FAh 00h 00h)
// M 7 x (FAh 00h 00h)
// N 8 x (FAh 00h 00h)
// O 9 x (FAh 00h 00h)
// P FBh 80h 80h
// Q FCh 80h 80h
// R FDh 80h 80h
// S 96h 69h
// T 61h 01h
// U E1h 00h 00h 00h
// Q FCh 80h 80h
// Q FCh 80h 80h
// Z 00h
//
/////////////////////////////////////////////////////////////////
UUID=547E3D64-59EF-4B3F-9357-1EB136020B16
Creation Program=Caption Inspector
Creation Date=Wednesday, May 29, 2019
Creation Time=15:02:12
Time Code Rate=24

00:00:00:00 T575572F432Z72F9FC942CR00K74ZZ8F
00:00:00:01 T575572F43Z0172F9FC942CR00K74Z0191
00:00:00:02 T575572F43Z0272F9QR00K74Z02D3
00:00:00:03 T575572F43Z0372F9QR00K74Z03D5
00:00:00:04 T575572F43Z0472F9QR00K74Z04D7
00:00:00:05 T575572F43Z0572F9QR00K74Z05D9
00:00:00:06 T575572F43Z0672F9QR00K74Z06D8
00:00:00:07 T575572F43Z0772F9QR00K74Z07D0
00:00:00:08 T575572F43Z0872F9QR00K74Z08DF
00:00:00:09 T575572F43Z0972F9QR00K74Z09E1
00:00:00:10 T575572F43Z0A72F9QR00K74Z0AE3
00:00:00:11 T575572F43Z0B72F9QR00K74Z0BE5
00:00:00:12 T575572F43Z0C72F9QR00K74Z0CE7
00:00:00:13 T575572F43Z0D72F9QR00K74Z0DE9
00:00:00:14 T575572F43Z0E72F9QR00K74Z0EEB
00:00:00:15 T575572F43Z0F72F9QR00K74Z0FED
00:00:00:16 T575572F43Z272F9QR00K74ZZCF
00:00:00:17 T575572F43Z0172F9QR00K74Z01D1
00:00:00:18 T575572F43Z0272F9QR00K74Z02D3
00:00:00:19 T575572F43Z0372F9QR00K74Z03D5
00:00:00:20 T575572F43Z0472F9QR00K74Z04D7
00:00:00:21 T575572F43Z0572F9QR00K74Z05D9
```

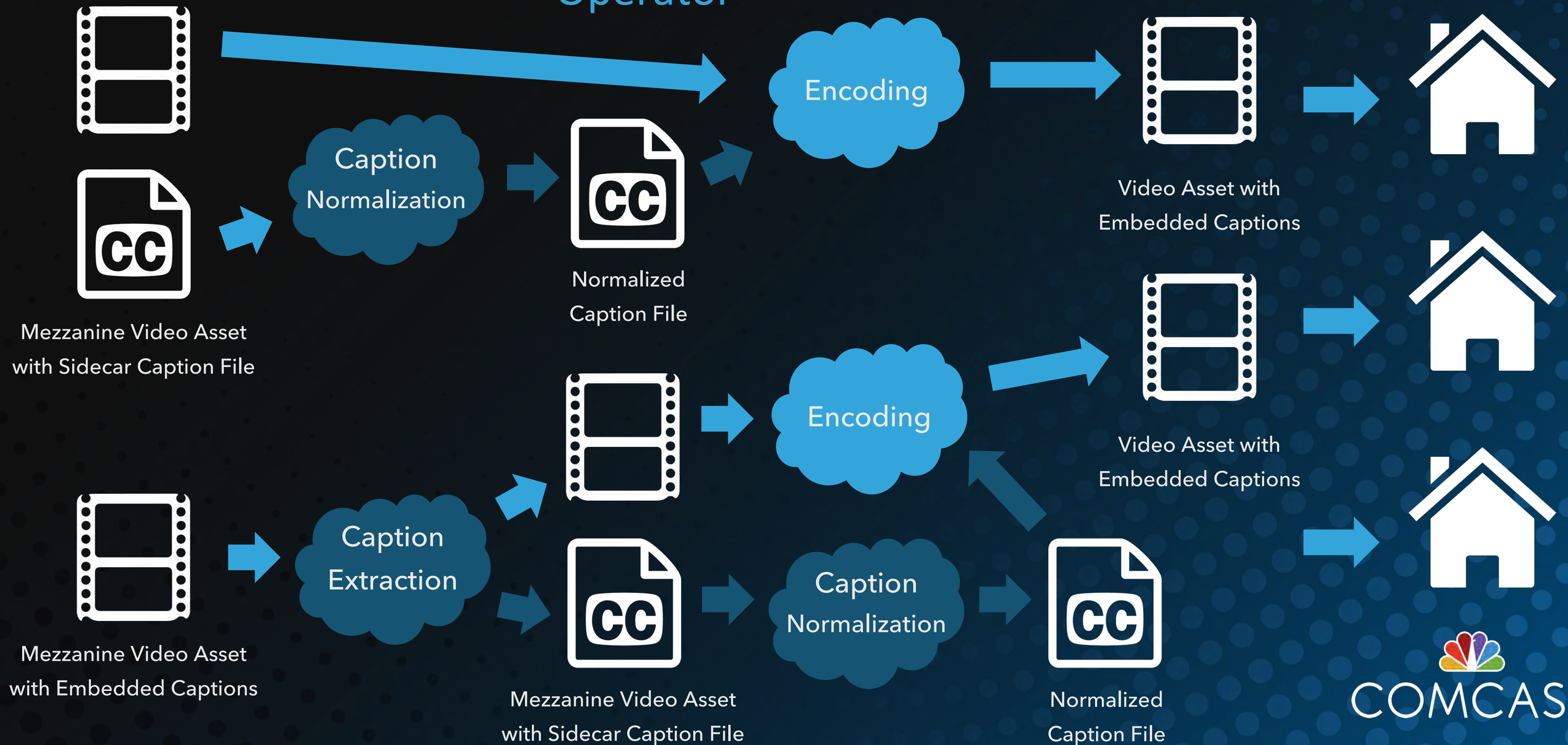
- ▶ Compressed using the replacement table described in the file.
- ▶ One line per frame.
- ▶ Carries both 608 and 708.
- ▶ Can include non-Caption related signaling information.

Content Delivery Workflow with Caption Service

Content Provider

Multiple-System Operator

Video Customers



Underlying Problem: Paint-On Captions

- ▶ **Paint-On Captions are not properly supported on older STBs.**
- ▶ **Manifests itself as follows:**
 - ▶ **Captions will flicker.**
 - ▶ **Captions are truncated.**
 - ▶ **Captions are added letter by letter.**
- ▶ **Resolved by converting Paint-On Captions to Roll-On Captions.**

Underlying Problem: Pop-On Caption Duration

- ▶ When Pop On Captions were authored, not enough time was given between the time when the caption is popped on the screen and when the caption is cleared.
- ▶ Manifests itself with the caption disappearing from screen before the user can speed-read the contents.
- ▶ Resolved by ensuring a minimum onscreen duration of the captions based on the number of words in the caption.

Underlying Problem: Pop-On Caption Buildup

- ▶ If 608 Pop-On Captions are not given enough time to build up before they are popped onto the screen we will get issues once they pop on.
- ▶ Manifests itself as follows:
 - ▶ Captions are truncated.
 - ▶ Captions are late.
- ▶ Resolved by ensuring a minimum duration of caption build up before popping them on the screen.

Underlying Problem: Specification Violations

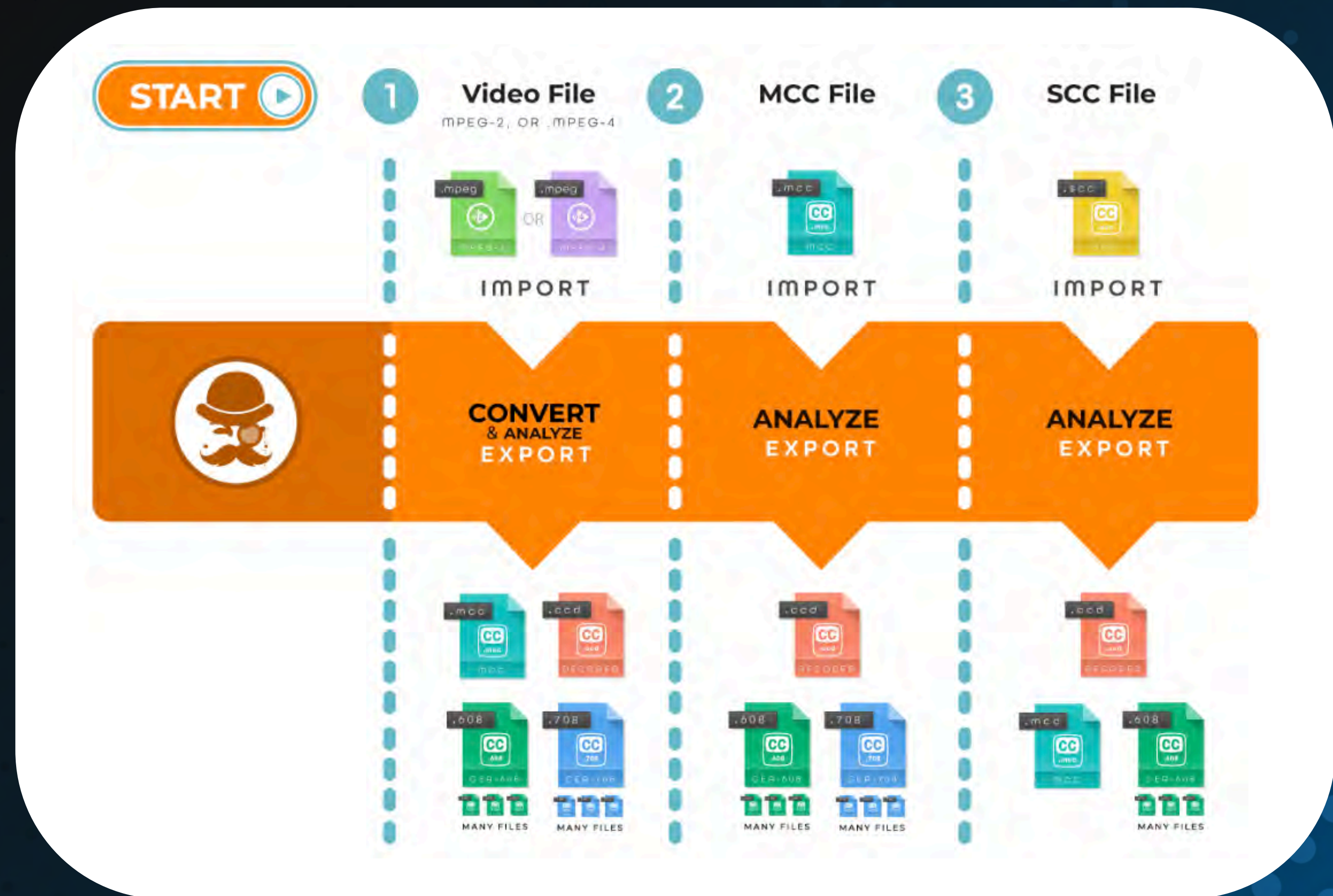
- ▶ When the captions violated the 608 and 708 specifications, we saw a variety of issues.
- ▶ Manifests itself as follows:
 - ▶ Garbled Captions.
 - ▶ Missing Captions.
 - ▶ Phantom Caption Tracks.
- ▶ Resolved by ensuring captions matched the specification and removing data that seemed erroneous.

Caption Inspector Opensource Project



**CAPTION
INSPECTOR**
CLOSED CAPTIONING TOOLS

- ▶ Extracts Embedded Captions from Video Assets.
- ▶ Provides Inline Decode of Captions.
- ▶ Provides Decoded Text and Command Codes for all Channels/Services.
- ▶ Opensource.



<https://github.com/Comcast/caption-inspector>