METADATA CHALLENGES FOR TODAY'S TV BROADCAST SYSTEMS

Randy Conrod

Harris Corporation Toronto, Canada

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Introduction

- Understanding metadata such as "**audio metadata**" and "**Active Format Description**" (AFD) is a challenge until one understands the transport of video, audio and "extra information" in today's systems.
- Looking back into how extra information has traditionally been moved in **analog NTSC/PAL** and **270 Mb/s** infrastructures allows one to understand how that "extra information" is carried in 1.5 Gb/s and now 3.0 Gb/s infrastructures.
- How to find and view **metadata** using measurement equipment is another challenge as new systems are commissioned.
- Even if all is ideal and metadata is utilized across the system, there still can be issues.

Data, Data and more Data

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- Since all digital signals are considered data, one needs to know how the data is organized.
- The video and audio portions of the signals are called data essence.
- For the sake of simplicity, video essence and audio essence will be used in this paper.
- Metadata is defined as “data about the data” so there is video metadata and audio metadata.
- Examples are AFD, WSS (Wide-Screen Signaling), VI (Video Index) video metadata and Dolby® E (professional) and Dolby® Digital (AC-3) audio metadata.

Data, Data and more Data

- What about other forms of data that is extra information?
- What are they called?
- These other forms of data are called "data essence."
- In defining **metadata** and **data essence**, the lines of definition between them may become "blurry."
- In the following tables (1, 2 and 3), the various metadata and data essence types are listed.
- For the sake of simplicity and brevity, only **video and audio metadata** will be discussed in this paper.

THE FIRST CHALLENGE:

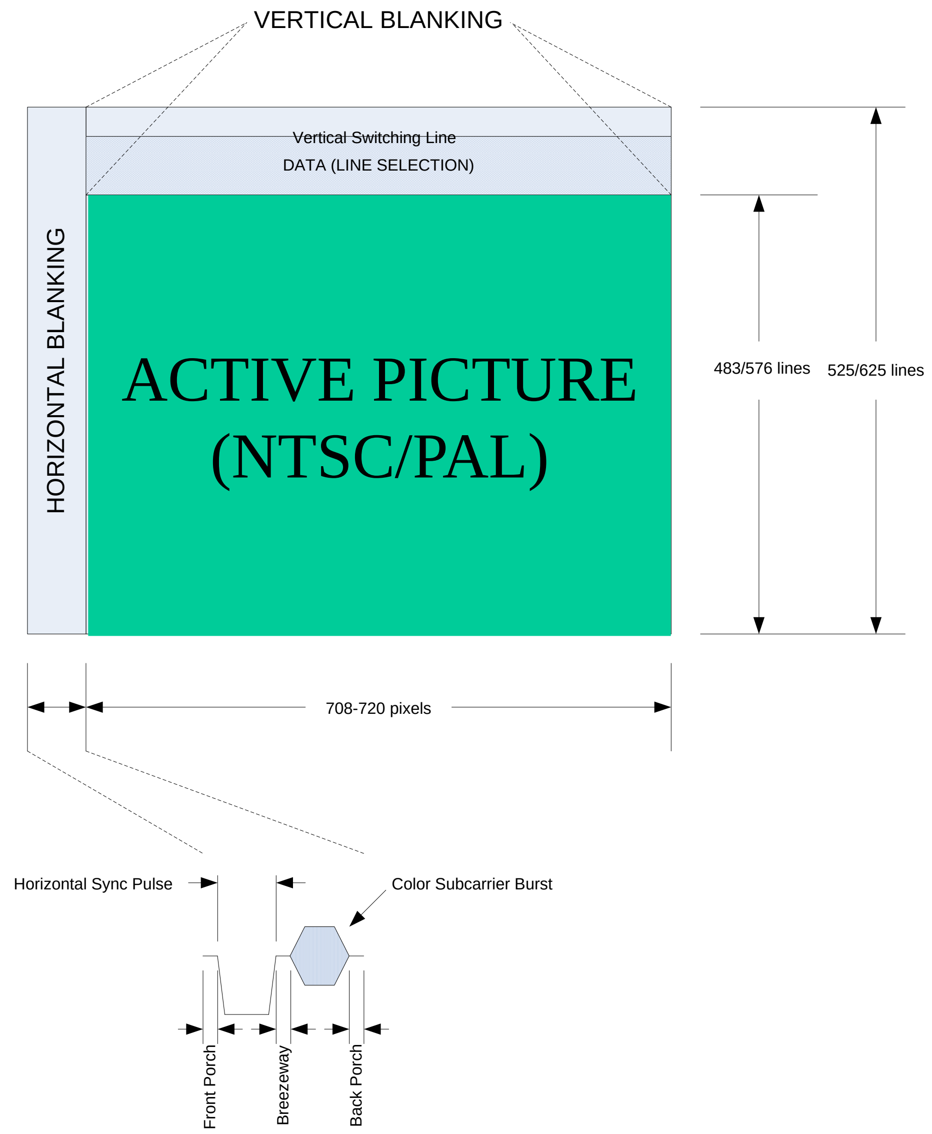
- WHAT IS METADATA AND WHERE CAN IT BE FOUND?

A Historical Perspective — Analog

- A historical perspective provides an understanding of how the television video signal has been utilized to carry extra information.

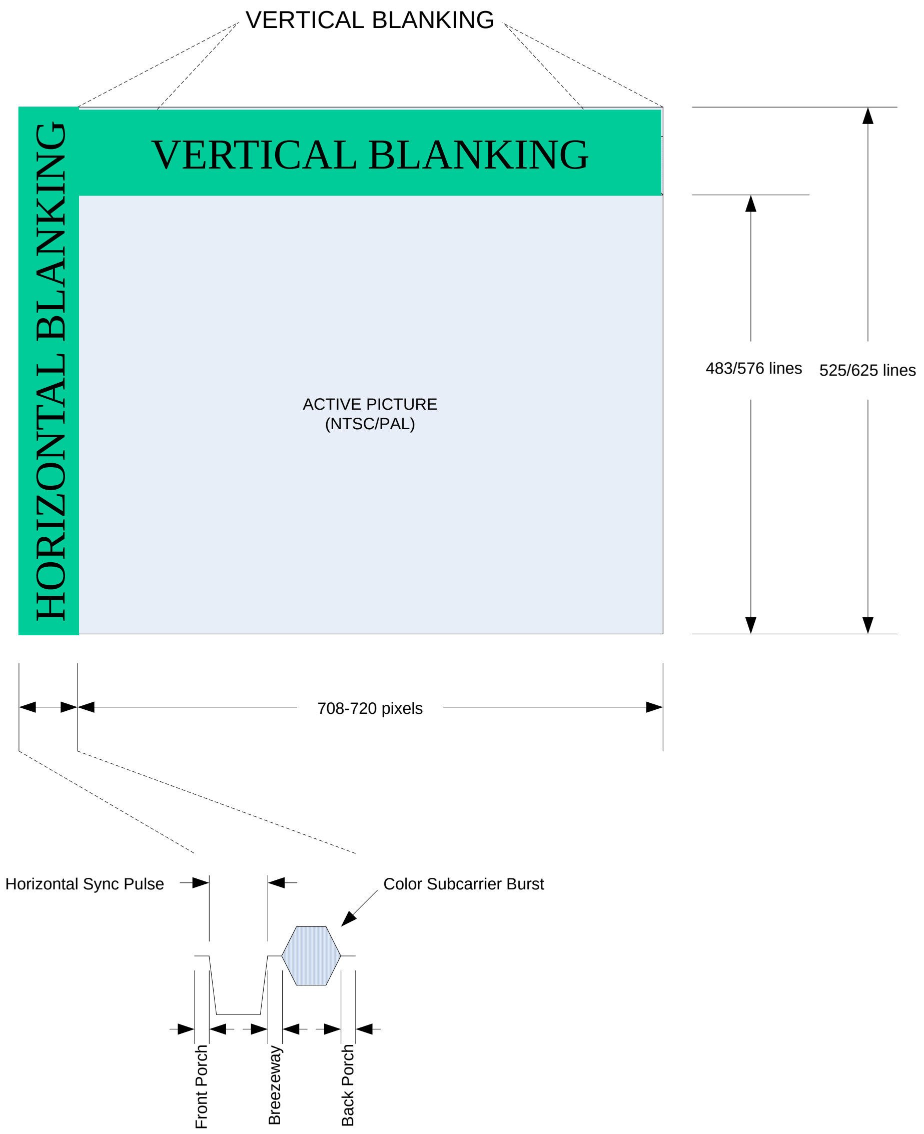
A Historical Perspective — Analog

- For analog, the video signal contains the active picture information



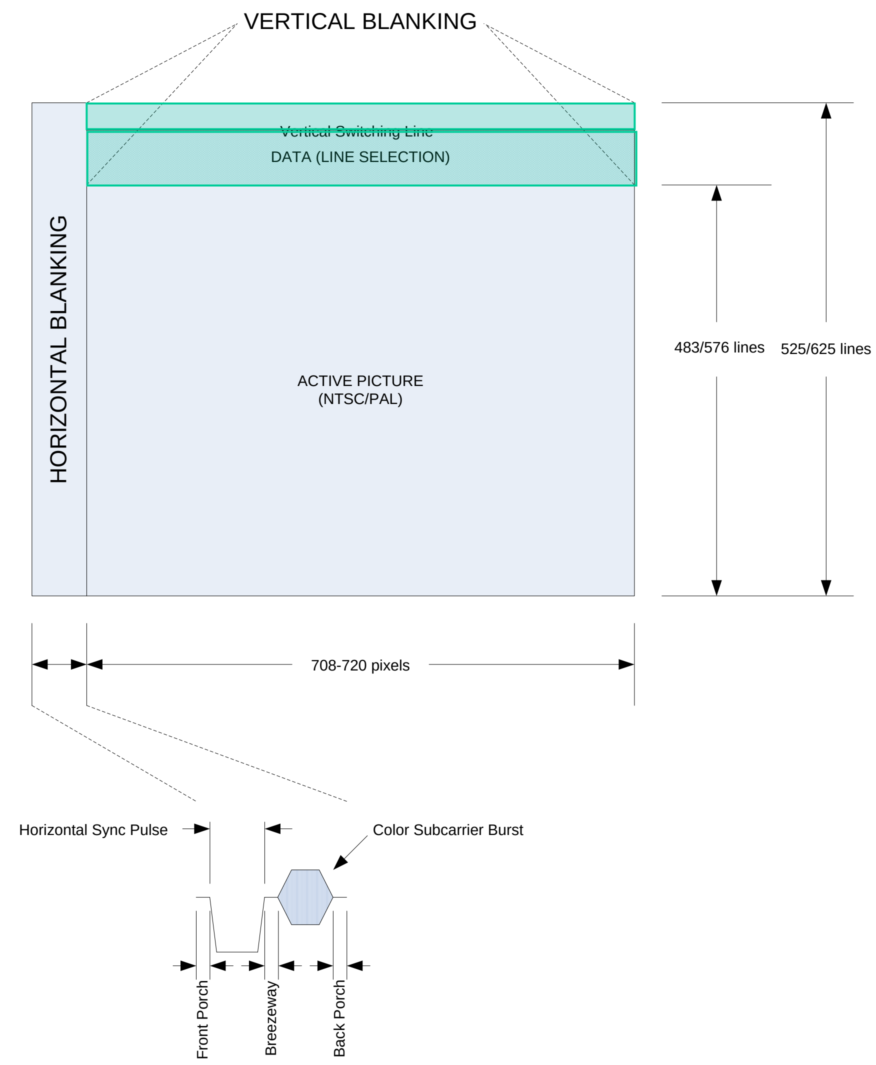
A Historical Perspective — Analog

- and vertical and horizontal blanking intervals (or “blanking”).
- Blanking intervals carry the vertical and horizontal synchronizing information.



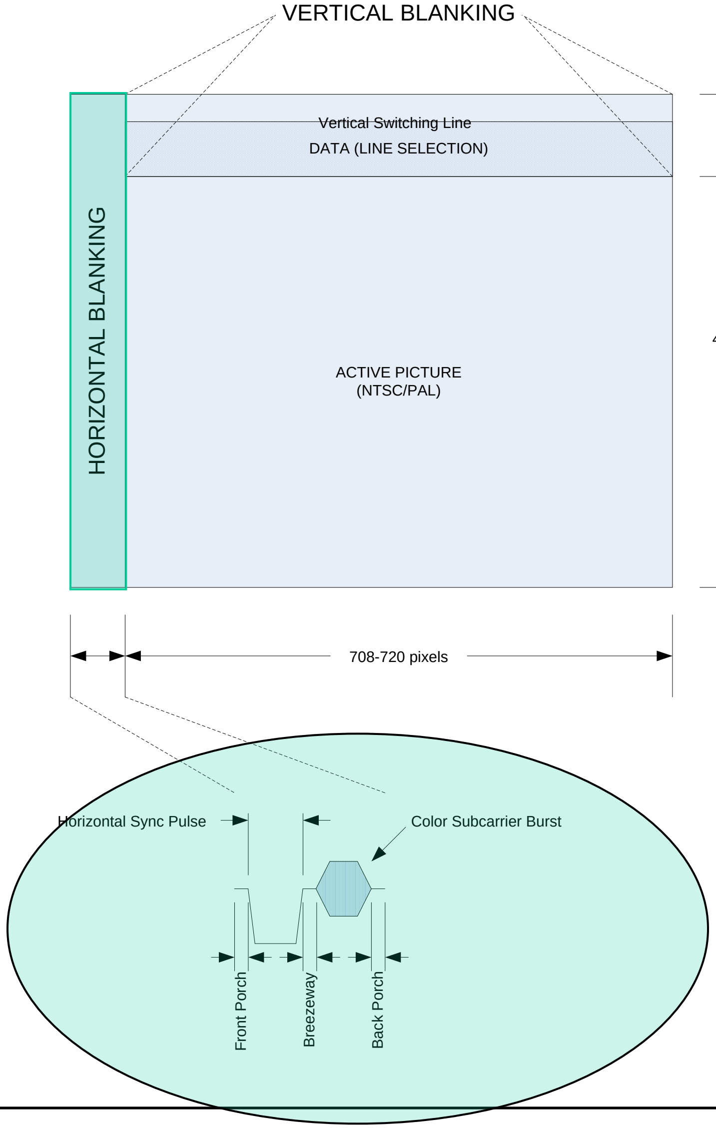
A Historical Perspective — Analog

- The vertical blanking interval contains the vertical synchronizing pulses and “unused” lines of video.



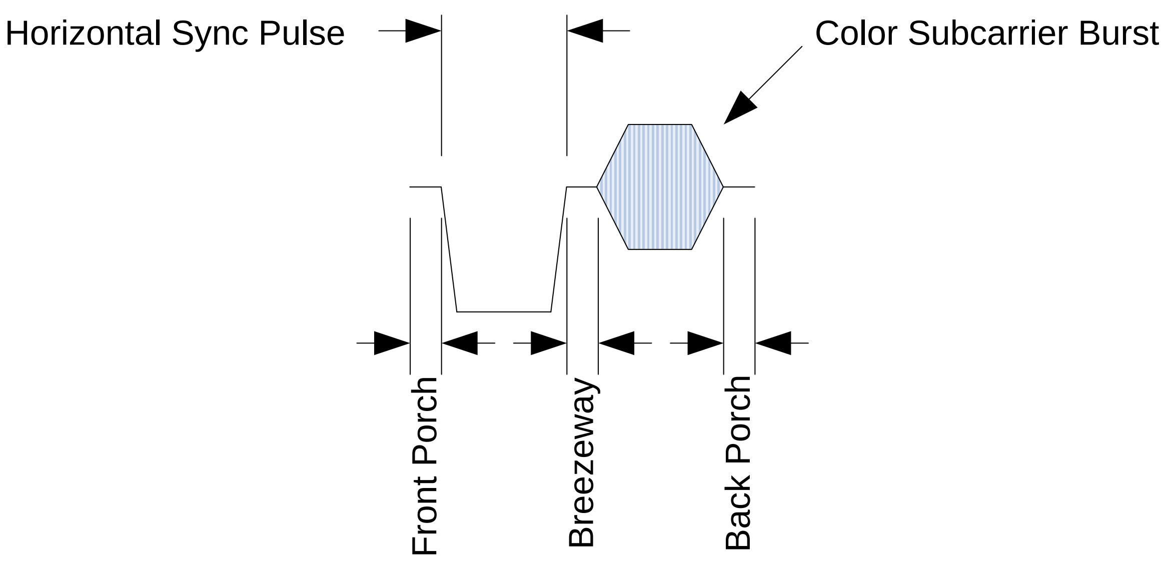
A Historical Perspective — Analog

- The horizontal blanking interval is made up of the front porch, horizontal synchronizing pulse, the breezeway, the color subcarrier "burst" and the back porch.



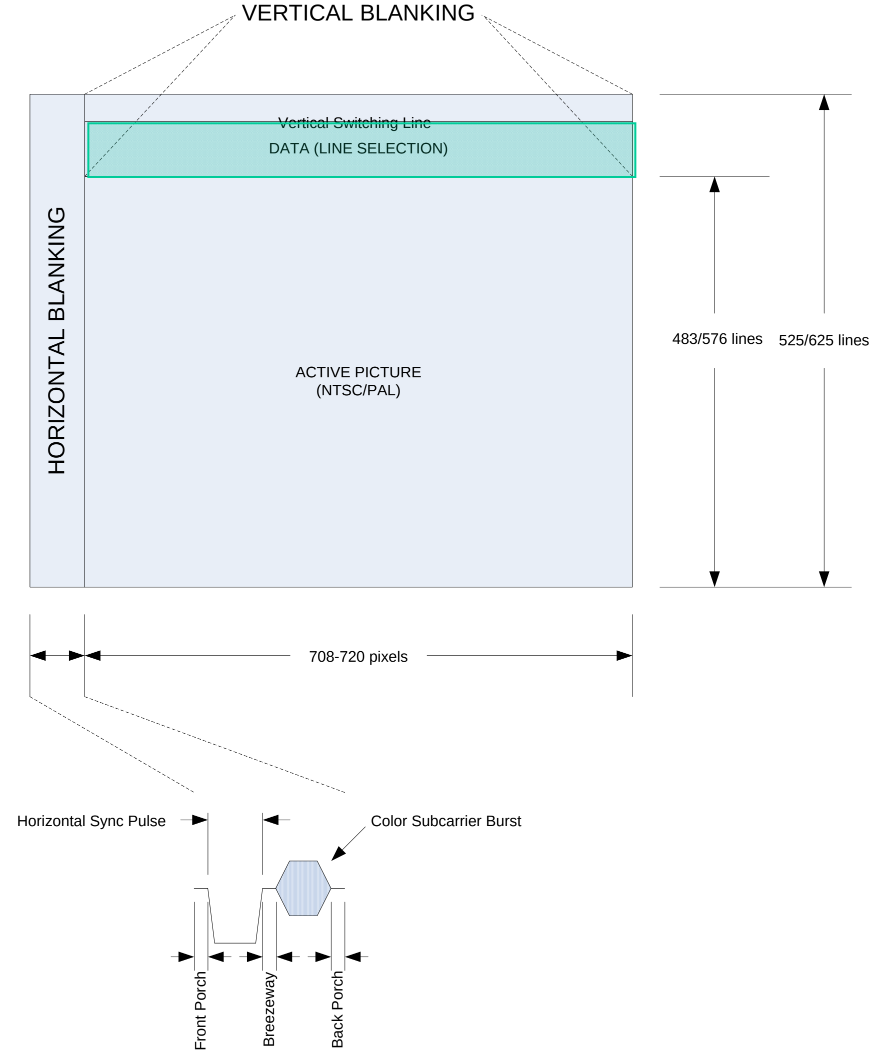
A Historical Perspective — Analog

- The horizontal blanking interval is made up of the front porch, horizontal synchronizing pulse, the breezeway, the color subcarrier "burst" and the back porch.



A Historical Perspective — Analog

- In earlier analog systems, the opportunity for utilizing the “unused” lines in the vertical blanking interval existed to carry “extra information”.



A Historical Perspective — Analog

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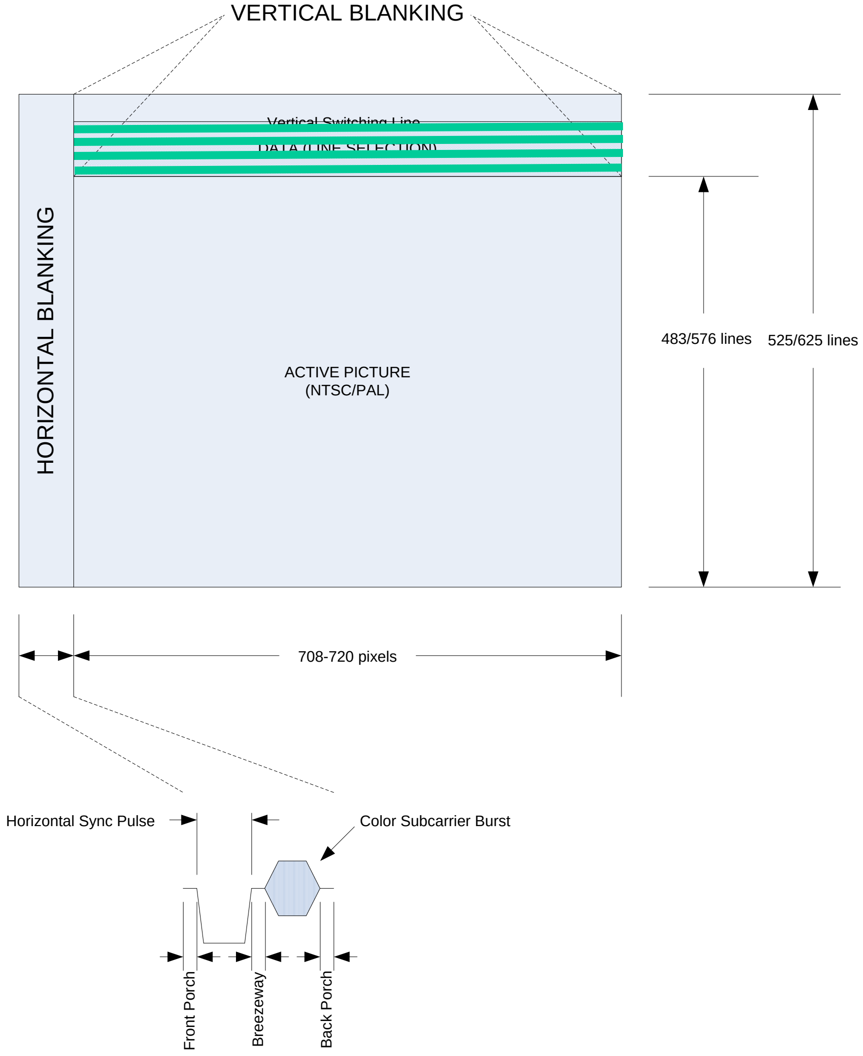
- This situation enabled applications such as closed captioning for the hearing impaired and news/sports/weather/other “teletext” extra visual information.
- For production applications, time code in the vertical blanking interval enhanced video tape edit decisions.
- Other applications such as signaling downstream equipment to perform certain tasks were also possible.

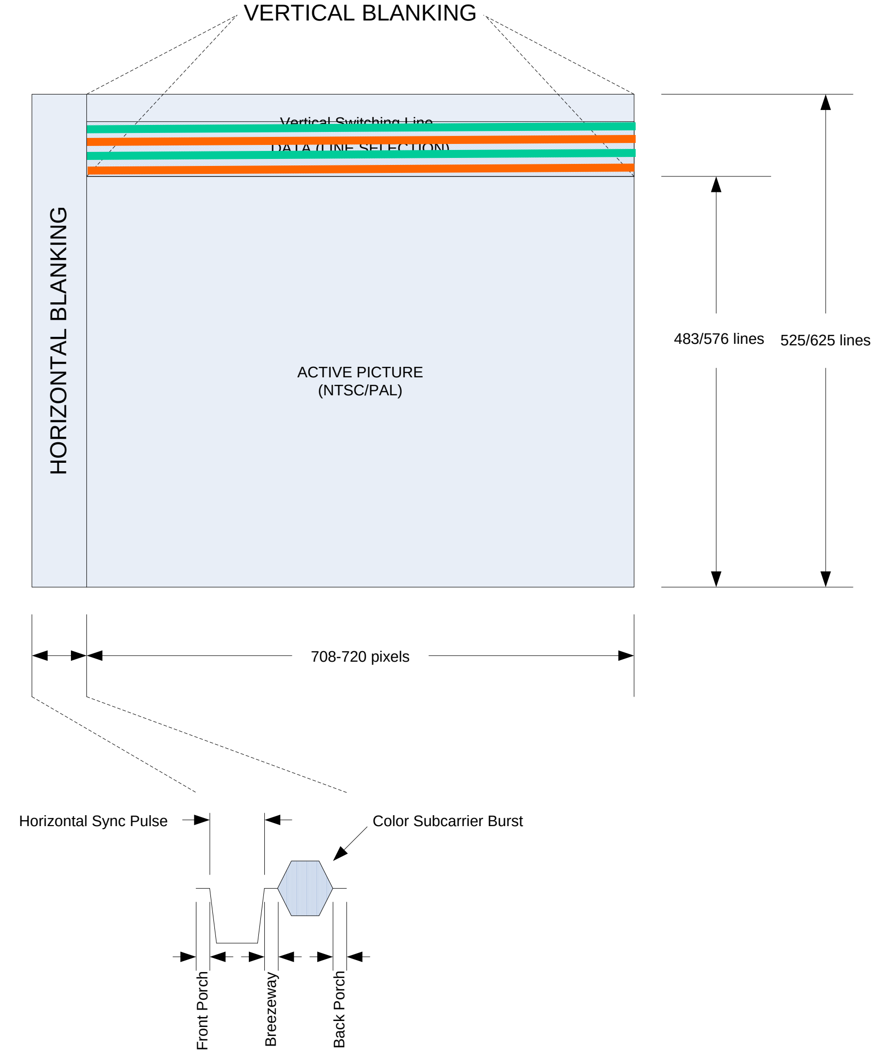
A Historical Perspective — Analog

- As the vertical blanking interval is divided into lines, the data is added line by line — a process that is commonly known as "line selection."



A Historical Perspective — Analog

- Due to the video signal being interlaced with odd and even lines, as a line is selected, there are the field 1 and field 2 selections.



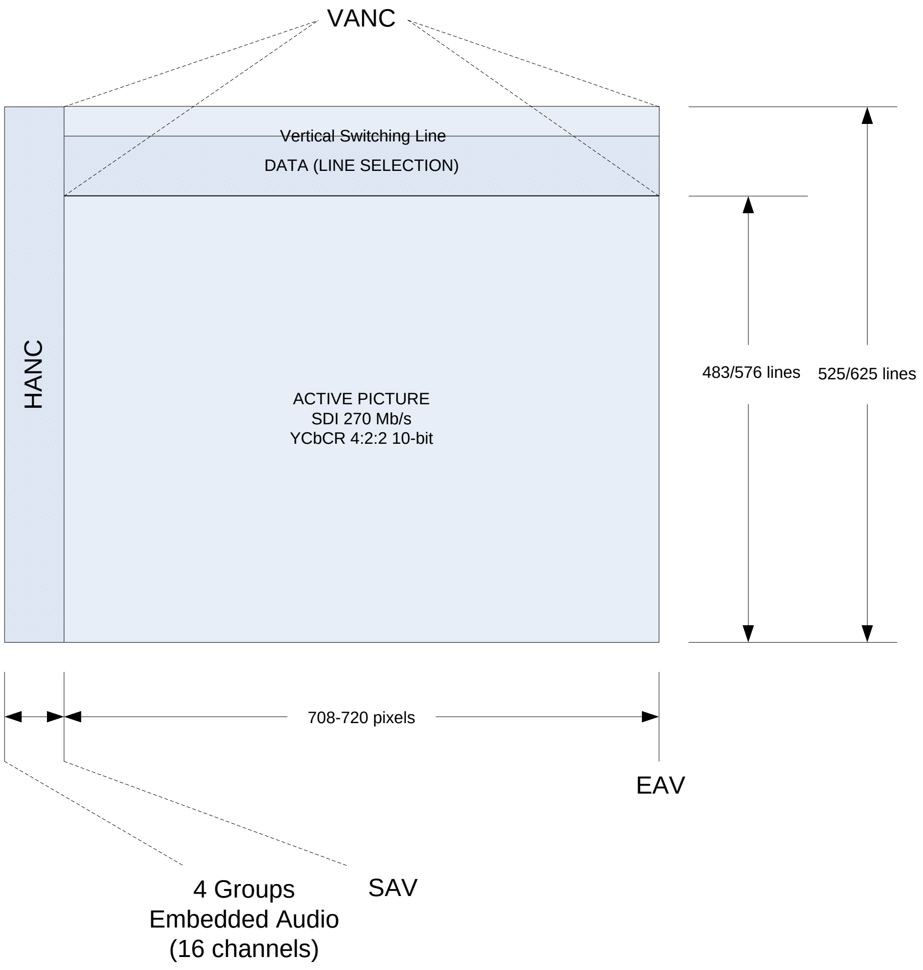
- In Table 1, metadata and data essence are shown with locations and the given standard for analog video signals.

NTSC/PAL VBI Data	525 NTSC	625 PAL/SECAM	Notes	Standards
Teletext WST Syst. A	NA	Lines 7 to 22		ITU-R BT.653-3
Teletext WST Syst. B	NA	Lines 7 to 22		ITU-R BT.653-3
Teletext NABTS	Lines 11 to 20	NA	US-Can.	EIA-516
Teletext WST Syst. D	Lines 11 to 20	NA	Japan	ITU-R BT.653-3
VITC	Lines 10 to 20	Lines 6 to 22	2 lines	SMPTE 12M
VITS	Lines 17 and 18	Lines	Note 1	CCIR Rec. 569
VIRS	Line 19/282	NA	Note 2	EIA TVSB1
GCR	Lines 19/282	Line 318	Note 3	ITU-R BT.1124-1 ATSC A/49
Closed Captions/V-chip/Source ID/TSID	Line 21/284 (CEA-608)	In Teletext pages Line 6 to 22	Note 4:	CEA-608 EIA-744
WSS	Line 22/285	Line 23	Note 5	BT.1119-2
10-field sequence	Line 15/278	NA		SMPTE 318M
AMOL (Nielsen)	Line 20/283-22/285	NA	Note 6	ACN-4031122 & 4031193 CEA-2020
Aspect ratio data	Line 20/283	NA	Note 7	IEC-61880
PDC (Program Distrib. Contr.)	NA	Line 16	Note 8	ETS 300 231 ITU-R BT.809
NTSC IP & Trigger Binding	Line 21/284	NA	Note 12	SMPTE 361M

Table 1 (notes can be found at the end of the paper)

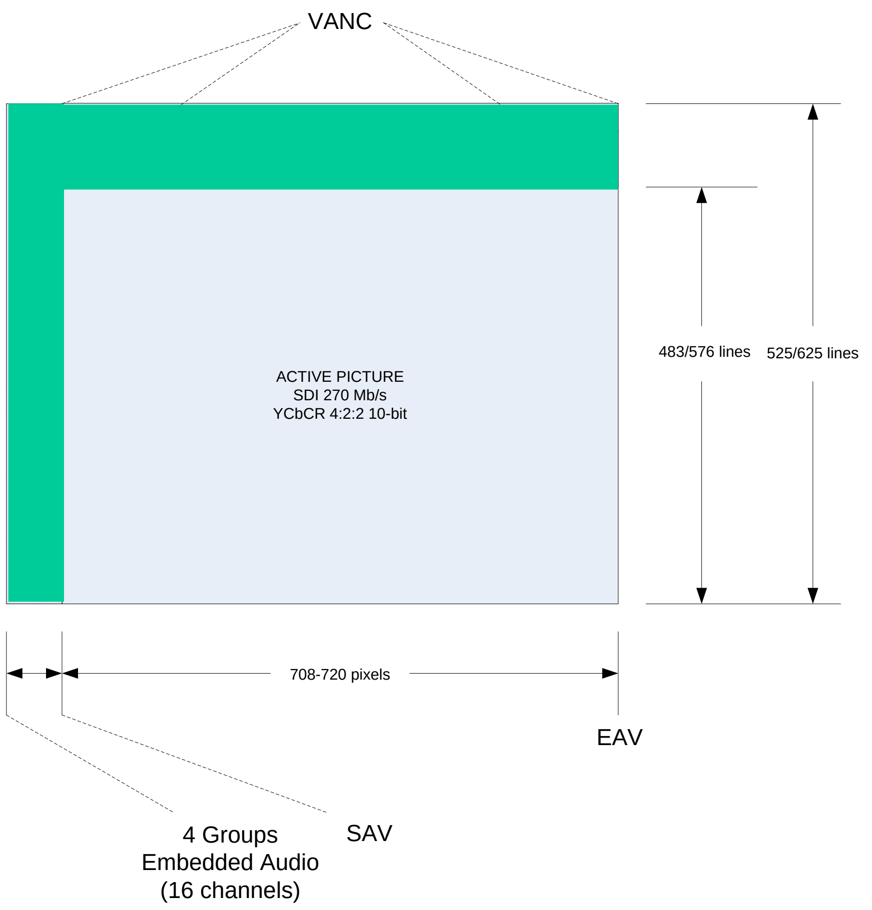
A Historical Perspective — Digital

- The move to digital video enabled more data to be added.



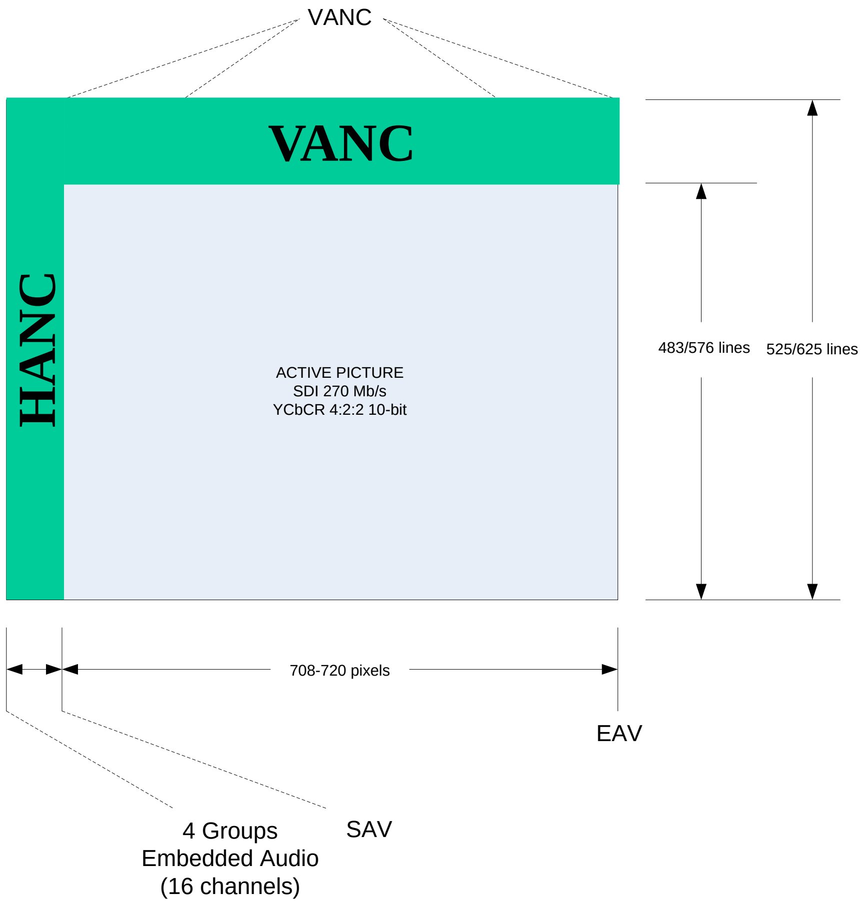
A Historical Perspective — Digital

- The "blanking intervals" in analog video signals are analogous to "ancillary data spaces" in digital video signals.



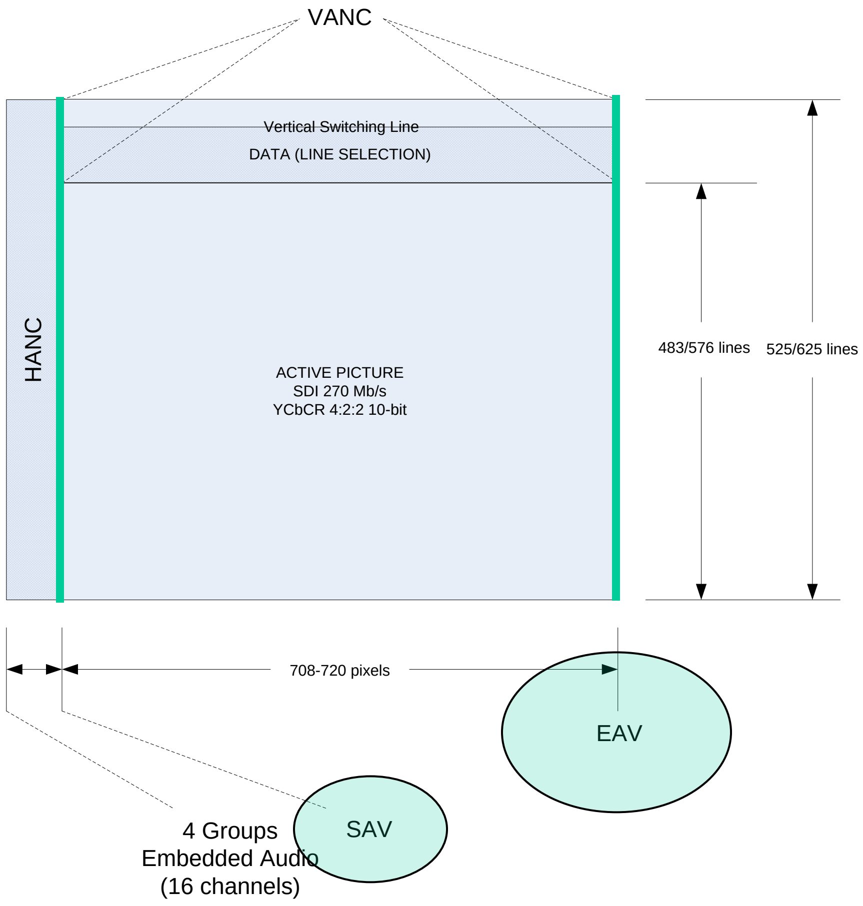
A Historical Perspective — Digital

- There is a vertical ancillary data space (VANC) and horizontal ancillary data space (HANC).



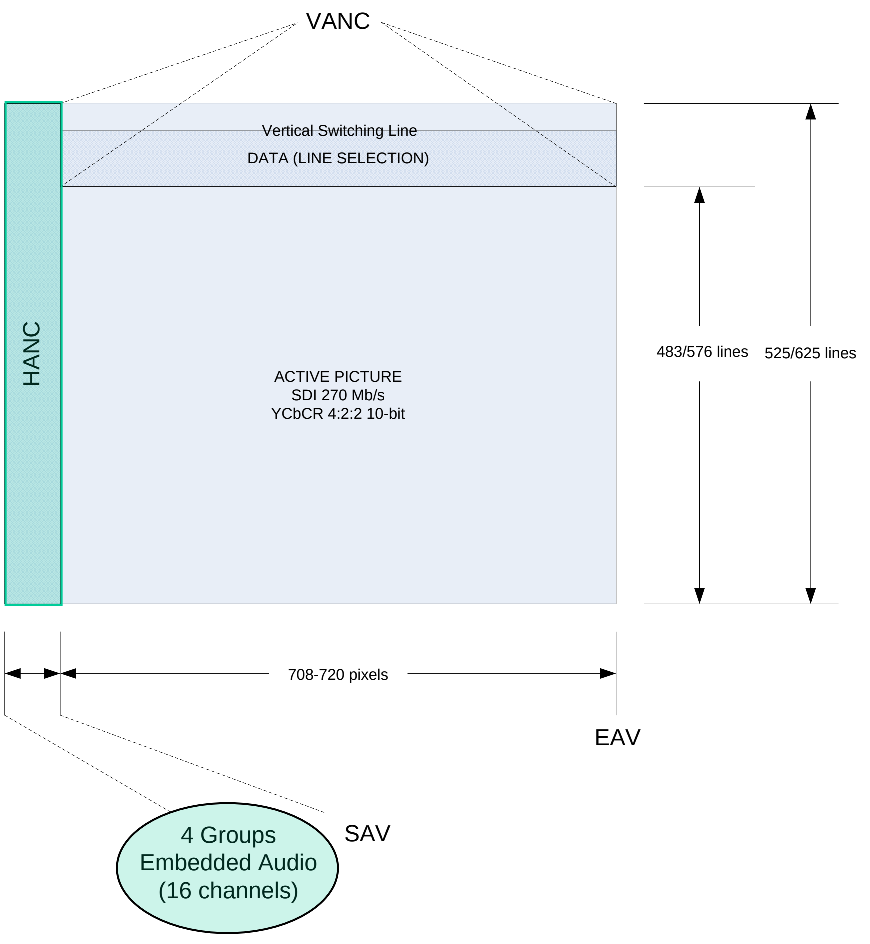
A Historical Perspective — Digital

- Vertical and horizontal synchronizing pulses are now represented by the data word SAV for "start of active video" and EAV for "end of active video."



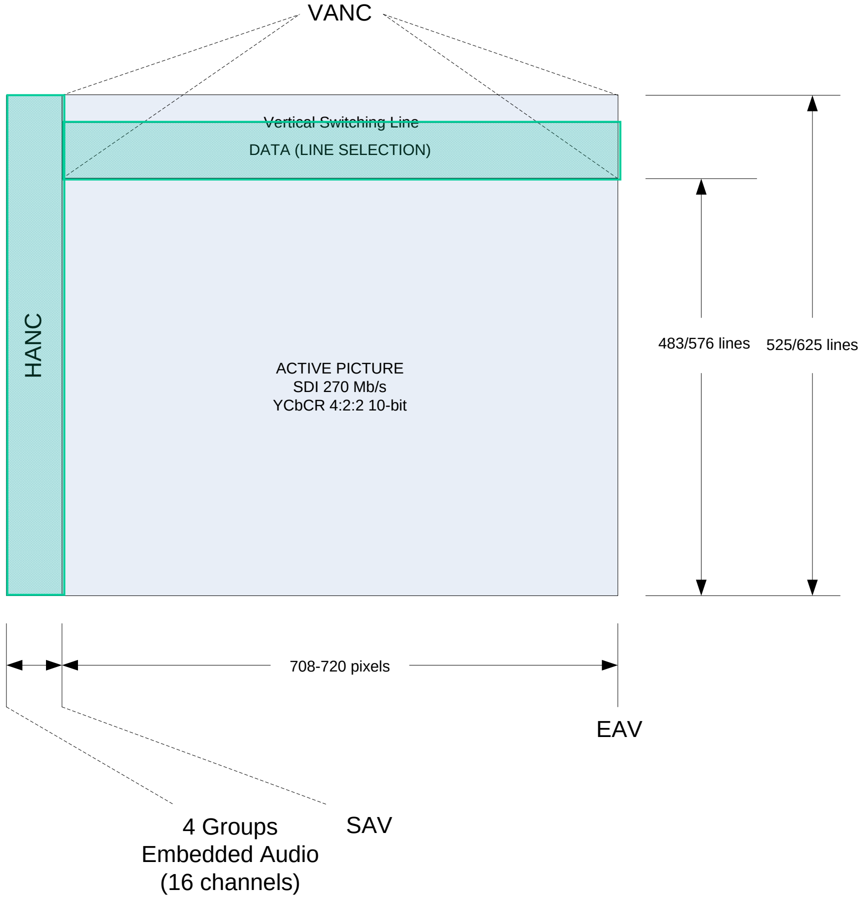
A Historical Perspective — Digital

- The amount of “data” increased so that 16 channels of digital audio could be carried, along with the digital video signal, with any other “additional data.”



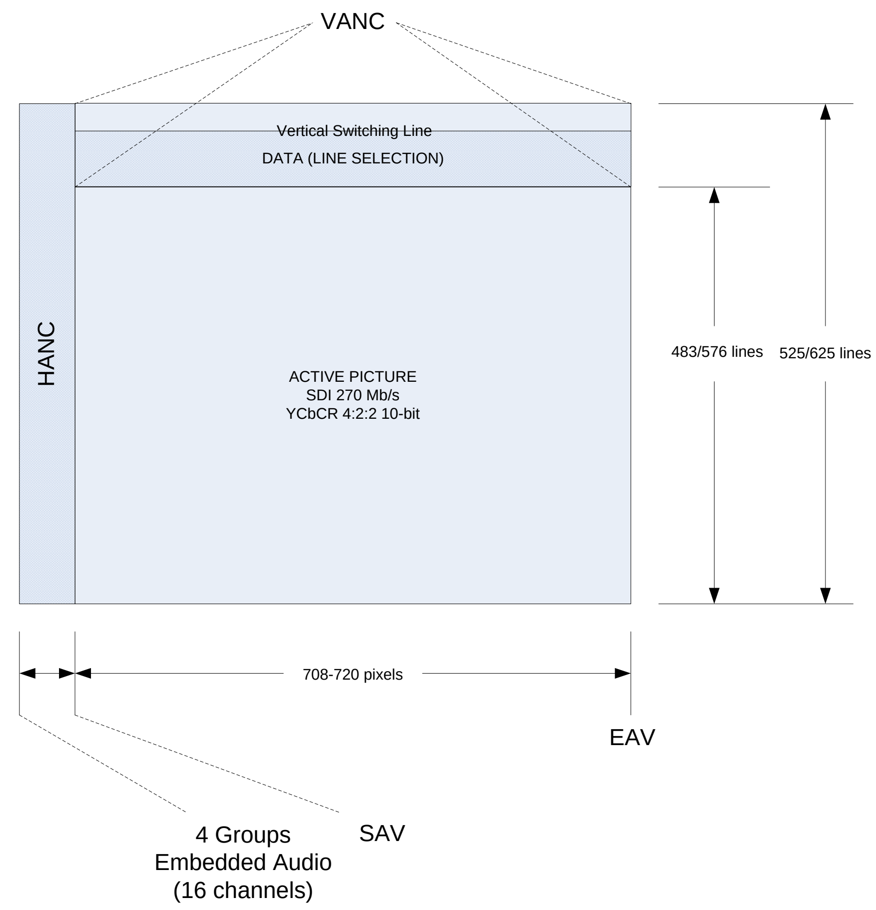
A Historical Perspective — Digital

- This is known as embedding the audio and data signals into the video signal.



A Historical Perspective — Digital

- By definition, a digital video signal is made of the video essence, the audio essence and any additional data essence or metadata.
- The VANC and HANC are shown for what is known as standard-definition video or referred to as SD-SDI standard definition (480i, 576i) — Serial Digital Interface at a data rate of 270 Mb/s.
- One frame of VANC and HANC are shown.



A Historical Perspective — Digital

- Data Identifiers, (DIDs) and Secondary Data Identifiers (SDIDs) describe the data essence and metadata that are embedded into the HD digital video signal.
- The idea of utilizing the VANC as “lines of video” was a simple means of identifying data essence and metadata when digital signals were implemented.
- The VANC was divided up into “lines,” and any data essence or metadata is line-selected as in analog systems (aka line identifier).
- It is possible to place more than one type of data essence or metadata in one line of video.

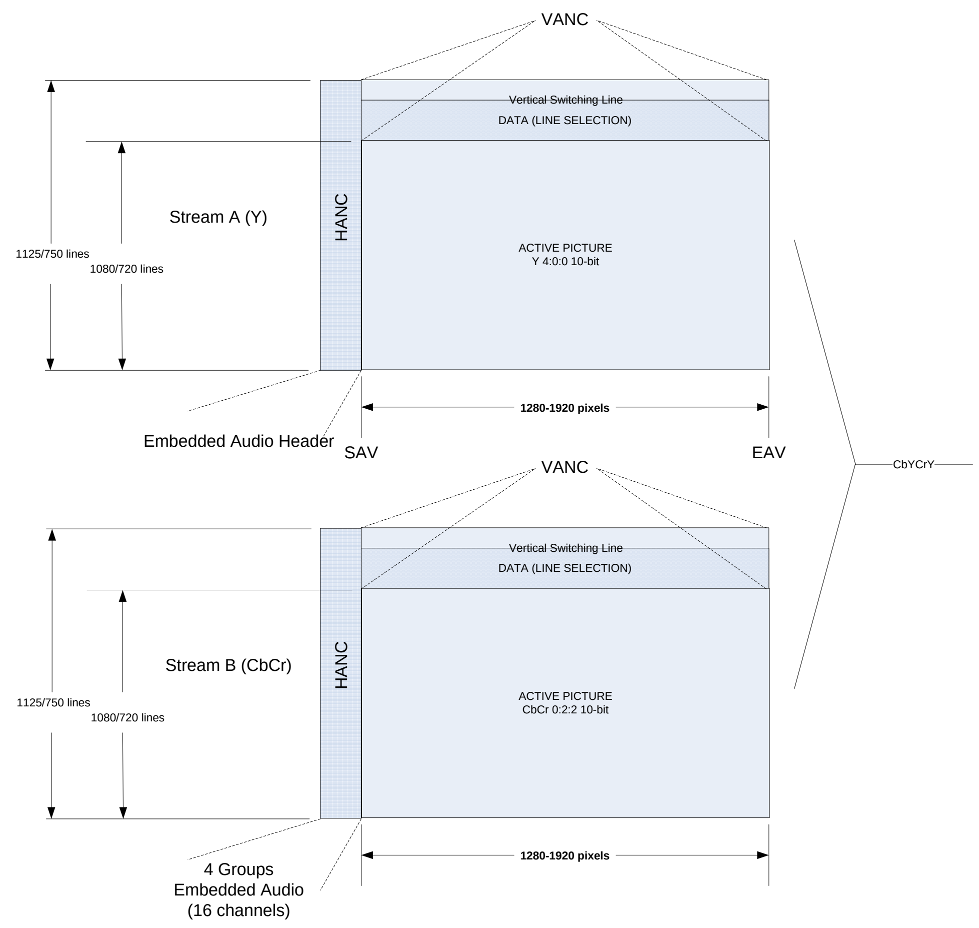
A Historical Perspective — Digital

SDI VBI Data – 270 Mb/s	525	625		
Digital Audio channels	All lines except the line after the switching point	All lines except the line after the switching point	HANC	SMPTE 272M
DVITC	Line 14/277 Optional line 16/279 (Y samples)	Line 19/332 Optional line 21/334 (Y samples)	In SDI VANC	SMPTE 266M SMPTE 125M
Video Index	Line 14/277 (Cr, Cb samples)	Line 11/324 (Cr, Cb samples)	In SDI VANC	RP-186+ SMPTE 125M
Ancillary Time Code (ATC)	One VBI line LTC: every frame VITC: every field	One VBI line LTC: every frame VITC: every field	VANC	RP-188 SMPTE 12M-2
Closed Captions	Line 21/284 (digitized) And/or One VBI line First field only	Line 22/335 (digitized) And/or One VBI line First field only	SDI-VANC Note 9	CEA-608 CEA-708 SMPTE SMPTE 334-1/-2 ETSI TR 101 233
Dolby-E Audio metadata	One VBI line First field only	One VBI line First field only	VANC	SMPTE 2020-1 SMPTE 2020-2/-3
VBI Data Services	One VBI line First field only	One VBI line First field only	VANC Note 10	RP-208/ SMPTE 334-1
DTV Prog. Descrip.	One VBI line First field only	One VBI line First field only	VANC	RP-207/ SMPTE 334-1
AFD and P&S Data	One VBI line Both fields	One VBI line Both fields	VANC	SMPTE 2016-1/-3 SMPTE 2016-2/-4
UMID + Prog. ID	One VBI line First field only	One VBI line First field only	VANC	RP 223
ANC Metadata	HANC Multiple VBI lines Both fields	HANC Multiple VBI lines Both fields	HANC VANC	RP-214
ANC Mole	HANC/VANC Both fields	HANC/VANC Both fields		SMPTE 353
Payload ID	Line 13/276	Line 9/322	HANC	SMPTE 352
Film transfer codes	One VBI line First field only	One VBI line First field only	VANC	RP-215
SCTE 104 messages	One VBI line First field only	One VBI line First field only	VANC	RP-2010
DVB/SCTE VBI data	One VBI line	One VBI line	VANC	RP-2031
Equipment and self-checking purposes	NA	Lines 20/333	VANC	EBU Tech 3267. See Note 11 below.
ABC Cue data	NA	One VBI line	VANC	Australia - proprietary
ABC Brandnet data	One VBI line	NA	VANC	US - proprietary
ARIB Control data	HANC/VANC			ARIB STD-B39
CBS Lidia	Line 18	NA	VANC	CBS document. See Note 13 below.

Table 2 (notes can be found at the end of the paper)

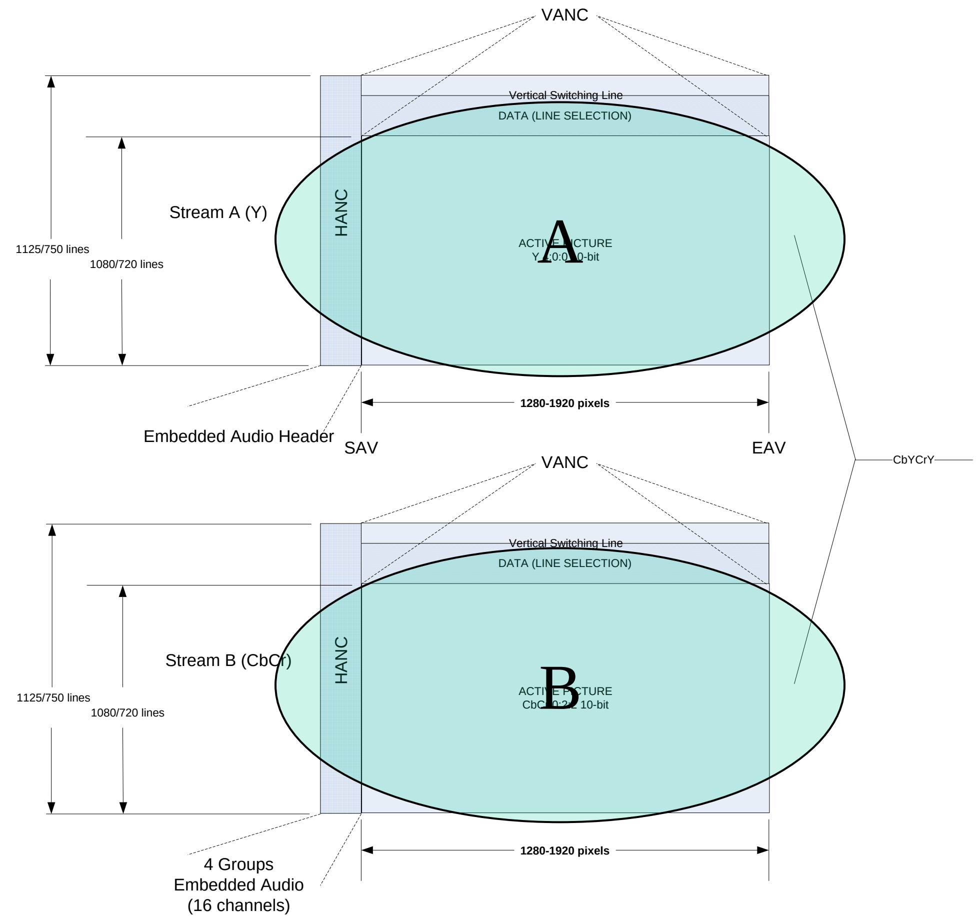
A Historical Perspective — Higher Definition

- When moving to a higher-definition video signal with a higher data rate and more complexity regarding the “ancillary data spaces”.

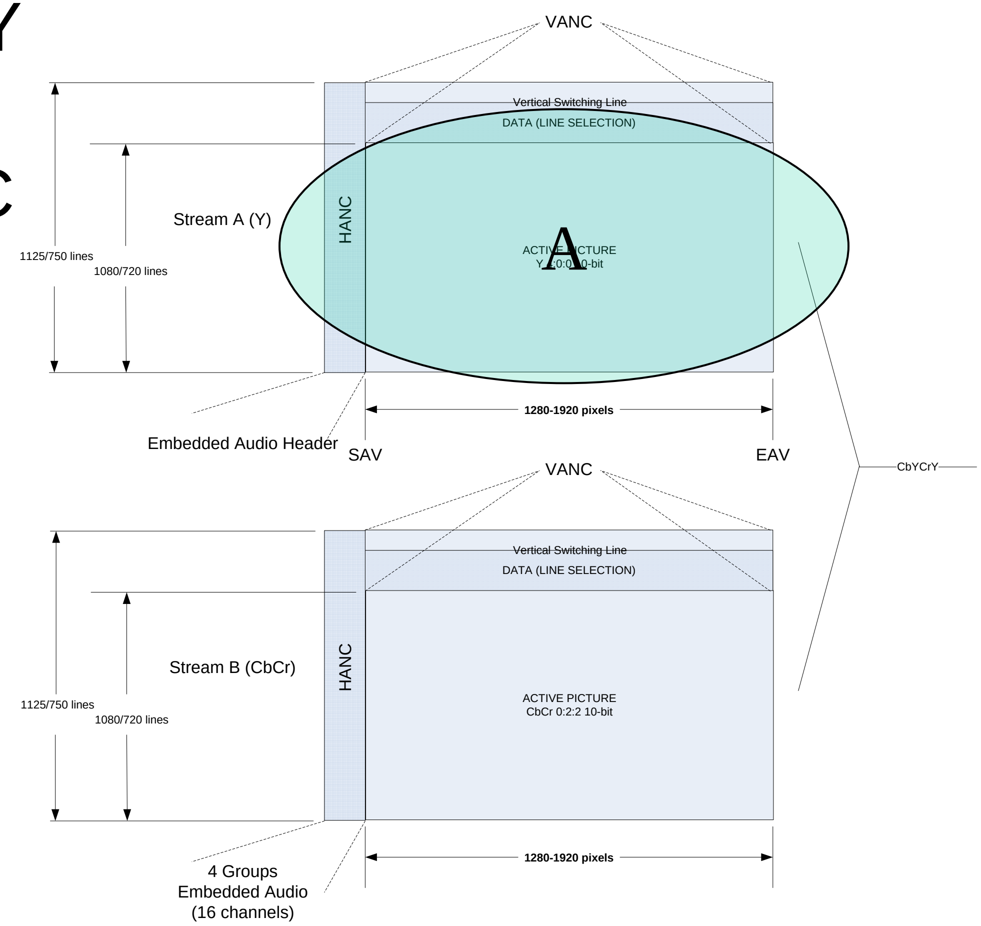


A Historical Perspective — Higher Definition

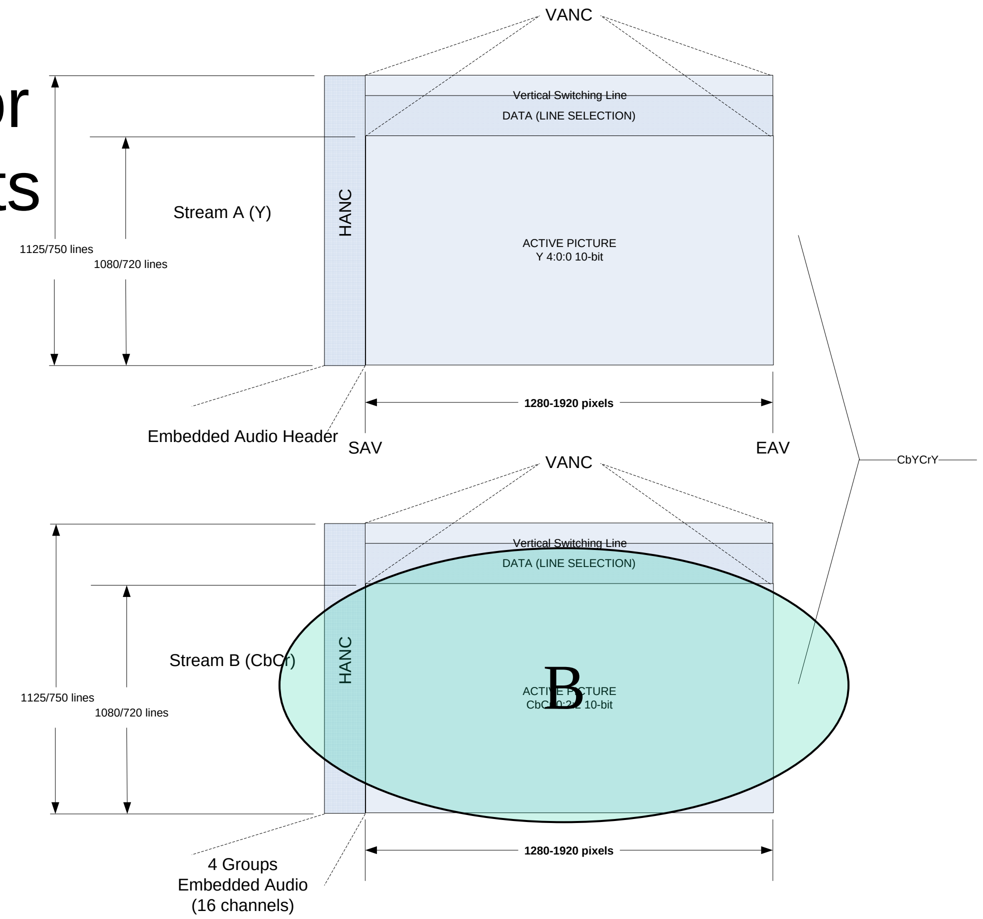
- The video is carried in two streams (A and B).



- Stream A contains the Y or luminance portion of the signal with its VANC and HANC

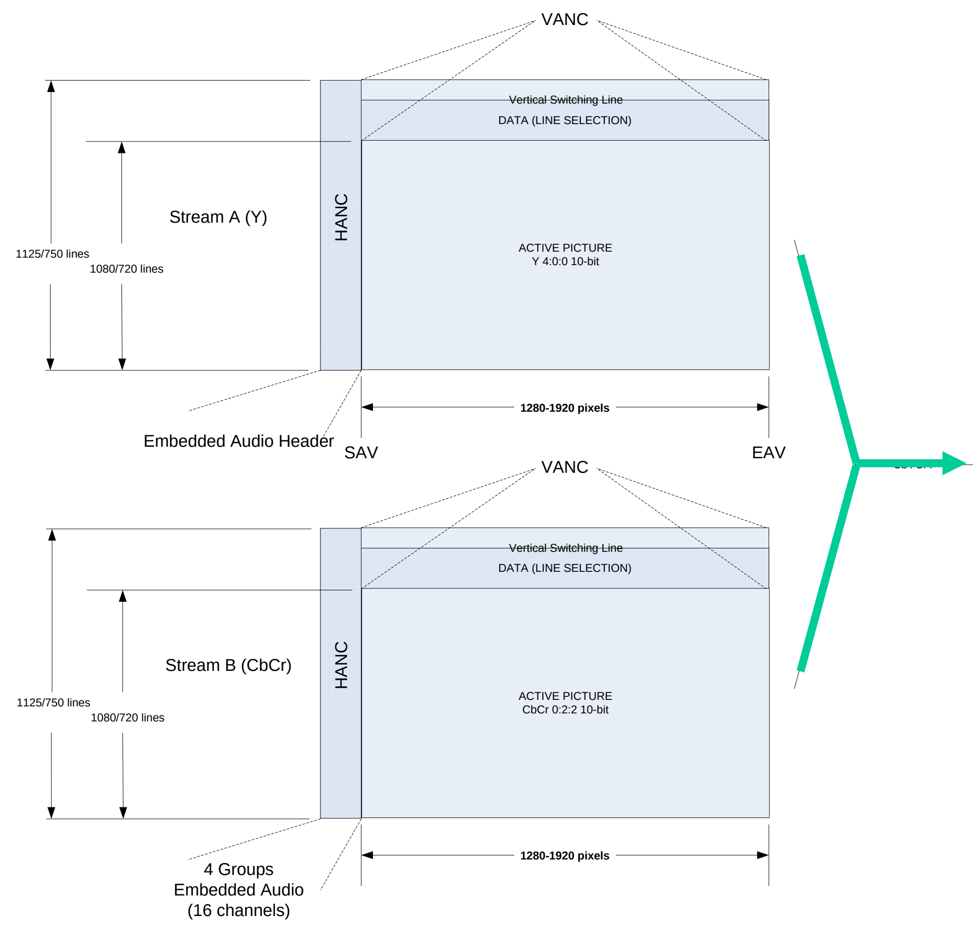


- and the B stream that carries the CbCr or color difference portion with its own VANC and HANC.



A Historical Perspective — Higher Definition

- The two streams (A and B) are multiplexed into the serial data stream as CbYCrY.
- The drawing depicts the data organization for what is known today as “high-definition” video or referred to as HD-SDI high definition — Serial Digital Interface (720p, 1080i) at a data rate of 1.5 Gb/s.
- One frame of VANC and HANC are shown.



A Historical Perspective — Higher Definition

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HD-SDI VBI Data - 1.5 Gb/s	720p60	720p50		
Digital Audio channels	All lines except the line after the switching point. Audio data in C-stream. Audio control packet in Y-stream.	All lines except the line after the switching point. Audio data in C-stream. Audio control packet in Y-stream.	HANC	SMPTE 299M
Ancillary Time Code (ATC)	One VBI line LTC and VITC Y-stream only	One VBI line LTC and VITC Y-stream only	VANC	RP-188 SMPTE 12M-2
Closed Captions	One VBI line Y-stream only	One VBI line Y-stream only	HD-SDI VANC Note 9	CEA-608 CEA-708 SMPTE SMPTE 334-1/-2 ETSI TR 101 233
Dolby-E Audio metadata	One VBI line Y-stream only	One VBI line Y-stream only	VANC	SMPTE 2020-1 SMPTE 2020-2/-3
VBI Data Services	One VBI line Y-stream only	One VBI line Y-stream only	VANC Note 10	RP-208/ SMPTE 334-1
DTV Prog. Descrip.	One VBI line Y-stream only	One VBI line Y-stream only	VANC	RP-207/ SMPTE 334-1
AFD and P&S Data	One VBI line Y-stream only	One VBI line Y-stream only	VANC	SMPTE 2016-1/-3 SMPTE 2016-2/-4
UMID + Prog. ID	One VBI line	One VBI line	VANC	RP 223
ANC Metadata	HANC Multiple VBI lines	HANC Multiple VBI lines	HANC VANC	RP-214
Payload ID	Line 10 Y-stream only	Line 10 Y-stream only	HANC	SMPTE 352
Film transfer codes	One VBI line Y-stream only	One VBI line Y-stream only	VANC	RP-215
SCTE 104 messages	One VBI line Y-stream only	One VBI line Y-stream only	VANC	RP-2010
DVB/SCTE VBI data	One VBI line	One VBI line	VANC	RP-2031
ABC Cue data	NA	One VBI line	VANC	Australia - proprietary
ABC Brandnet data	VBI line 10	NA	VANC	US - proprietary

A Historical Perspective — Higher Definition

HD-SDI VBI Data - 1.5 Gbps	1080i60	1080i50		
Digital Audio channels	All lines except the line after the switching point. Audio data in C-stream. Audio control packet in Y-stream.	All lines except the line after the switching point. Audio data in C-stream. Audio control packet in Y-stream.	HANC	SMPTE 299M
Ancillary Time Code (ATC)	One VBI line LTC: every frame VITC: every field Y-stream only	One VBI line LTC: every frame VITC: every field Y-stream only	VANC	RP-188 SMPTE 12M-2
Closed Captions	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	HD-SDI VANC Note 9	CEA-608 CEA-708 SMPTE 334M-1 ETSI TR 101 233
Dolby-E Audio metadata	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	VANC	SMPTE 2020-1 SMPTE 2020-2/-3
VBI Data Services	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	VANC Note 10	RP-208/SMPTE 334M
DTV Prog. Descrip.	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	VANC	RP-207/SMPTE 334M
AFD and P&S Data	One VBI line Both fields Y-stream only	One VBI line Both fields Y-stream only	VANC	SMPTE 2016-1/-3 SMPTE 2016-2/-4
UMID + Prog. ID	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	VANC	RP 223
ANC Metadata	HANC Multiple VBI lines Both fields	HANC Multiple VBI lines Both fields	HANC VANC	RP-214
Payload ID	Line 10/572 Y-stream only	Line 10/572 Y-stream only	HANC	SMPTE 352
Film transfer codes	One VBI line First field only Y-stream only	One VBI line First field only Y-stream only	VANC	RP-215
SCTE 104 messages	One VBI line First field only	One VBI line First field only	VANC	RP-2010
DVB/SCTE VBI data	One VBI line	One VBI line	VANC	RP-2031
ABC Cue data	NA	One VBI line	VANC	Australia - proprietary
ARIB Control data	HANC/VANC			ARIB STD-B39
CBS Lidia	Line 9	NA	VANC	CBS document. See Note 13 below.

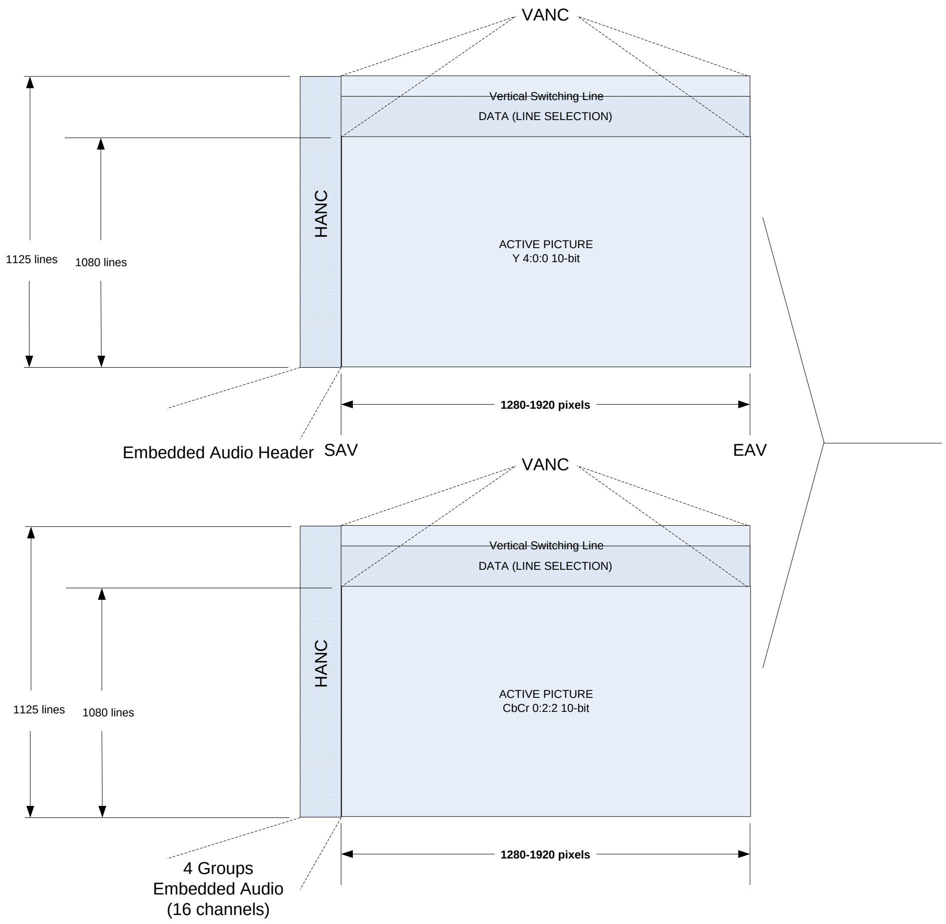
Table 3 (notes can be found at the end of the paper)

The Future – 1080p, 3 Gb/s

- Today's systems support analog, digital 270 Mb/s and 1.5 Gb/s with their associated data essence and video and audio metadata.
- When designing a new system, there is now also 3 Gb/s to contend with and another layer of complexity to be understood.
- Within the new 3 Gb/s infrastructure, there are different methods of data organization called Level A and Level B.
- Level A (YCbCr 4:2:2, 10 bit) and Level B (YCbCr 4:2:2, 10 bit) are utilized by broadcasters, and other formats within Level B support formats utilized for production

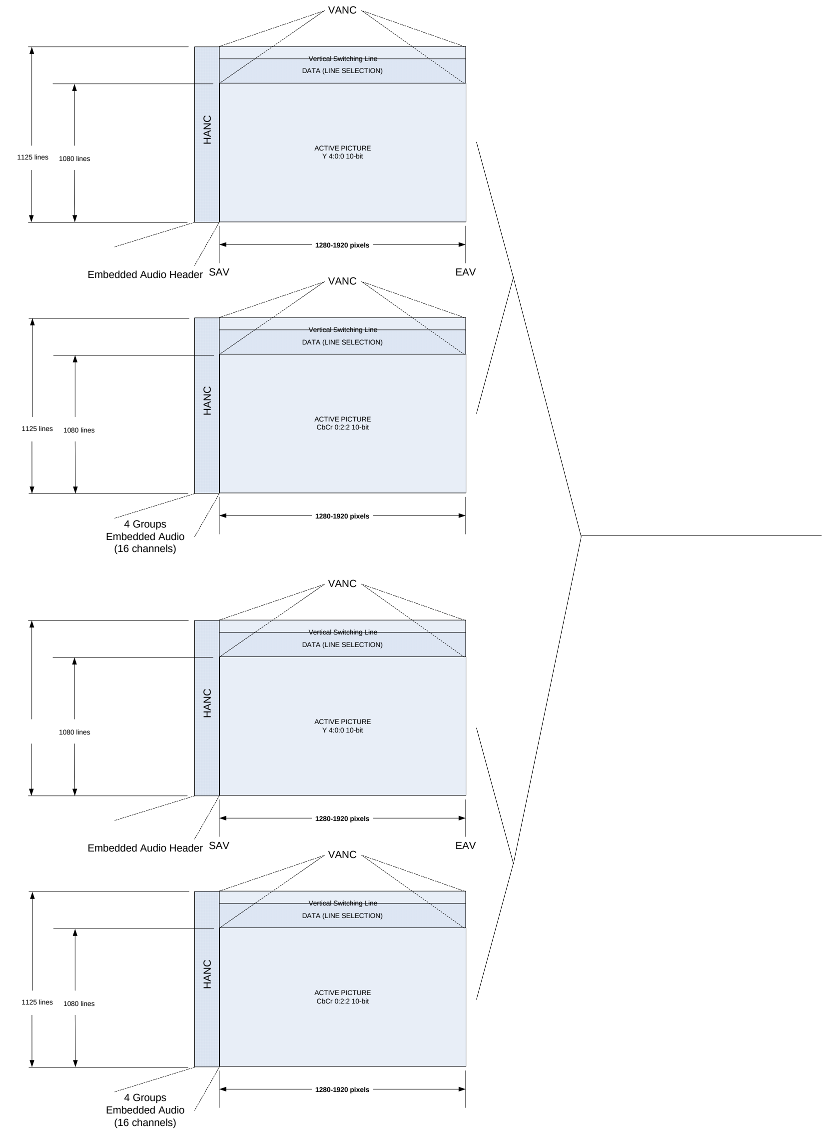
The Future – 1080p, 3 Gb/s

- Level A follows the same stream format (YCbCr) as 1.5 Gb/s with the exception of supporting 1080p



The Future – 1080p, 3 Gb/s

- Level B supports “dual link”.
- Dual link can be two 270 Mb/s, two 720p or two 1080i video signals that are the same standard and phase aligned.
- As well, Level B supports dual-link production formats.
- This can be utilized for “Left Eye/Right Eye” for 3D TV.



The Future – 1080p, 3 Gb/s

HD-SDI VBI Data - 3 Gb/s – Level B	1080p60	1080p50		
Digital Audio channels – First 16 channels:	All lines except the line after the switching point. Audio data and Audio control packet in Link A.	All lines except the line after the switching point. Audio data and Audio control packet in Link A.	HANC	SMPTE 299M
Digital Audio channels – Above 16 channels:	All lines except the line after the switching point. Audio data and Audio control packet in Link B.	All lines except the line after the switching point. Audio data and Audio control packet in Link B.	HANC	SMPTE 299M
Ancillary Time Code (ATC)	One VBI line LTC and VITC In Data stream 1 first	One VBI line LTC and VITC In Data stream 1 first	VANC	RP-188 SMPTE 12M-2
Closed Captions	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	HD-SDI VANC Note 9	CEA-608 CEA-708 SMPTE SMPTE 334-1/-2.ETSI TR 101 233
Dolby-E Audio metadata	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	SMPTE 2020-1 SMPTE 2020-2/-3
VBI Data Services	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC Note 10	RP-208/SMPTE 334M
DTV Prog. Descrip.	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	RP-207/SMPTE 334M
AFD and P&S Data	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	SMPTE 2016-1/-3 SMPTE 2016-2/-4
UMID + Prog. ID	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	RP 223
ANC Metadata	HANC Multiple VBI lines In Data stream 1 first	HANC Multiple VBI lines In Data stream 1 first	HANC VANC	RP-214
Payload ID	Line 10 Data stream 1 and 2	Line 10 Data stream 1 and 2	HANC	SMPTE 352 SMPTE 425
Film transfer codes	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	RP-215
SCTE 104 messages	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	RP-2010
DVB/SCTE VBI data	One VBI line In Data stream 1 first	One VBI line In Data stream 1 first	VANC	RP-2031
ABC Cue data	NA	One VBI line In Data stream 1 first	VANC	Australia – proprietary
ARIB Control data	HANC/VANC In Data stream 1 first			ARIB STD-B39
CBS Lidia	Line 9 In Data stream 1 first	NA	VANC	CBS document. See Note 13 below.

Table 4 (notes can be found at the end of the paper)

The Challenge Continues

- Now that we know where the metadata and other data essence are found and which standards they adhere to, the next step is to understand how we see this when we analyze the signal.
- For historical reasons, a video line is typically used to describe where metadata may be found.
- It is important to note that any metadata or data essence should not be embedded into the vertical switching line or in the line after.

The Challenge Continues

- The 525, 625, 720 and 1080 formats may use different lines to embed the same metadata when converting between formats
- And more than one form of metadata or data essence may be found on a given line.
- Using video lines to describe where to find the metadata and data essence can be confusing.
- It is essential to utilize DID/SDID for many types of ancillary data, as some data packets may not be assigned line numbers

The Challenge Continues

- The following table shows the DID/SDID for AFD and audio metadata:

Services	Data Position	DID	SDID
Ancillary Data (=291M)			
Metadata packets		2F0h	
Dolby-E audio Metadata	Y VANC (the second line after switching line)	145h	
Active Format Description and Bar Data	Both fields	141h	105h

Table 5

The Challenge Continues

- As well, when converting between interlace and progressive formats, metadata may or may not exist on adjacent fields (for interlace) and frames (for progressive).
- This may cause issues in interfacing equipment.

What Works Well for Metadata?

- Europe rolled out WSS (Wide Screen Signaling) in the distribution channel many years ago to provide information on the aspect ratio, enabling the home receiver to react to the information and optimize the display.
- This works well and may be applied in other parts of the world looking to roll out a similar means of optimizing displays.
- Recently, AFD has been employed further up the chain in the production domain to assist in automatic aspect ratio conversion when up- and down-converting.
- This also works well, as aspect ratio changes are frame accurate and occur with no disturbances if the equipment was designed to do so.
- Set-top boxes and TVs using AFD will start shipping in the fall of 2009.
- When considering audio metadata, the mechanisms exist today to move audio metadata from production through the entire signal chain and into the home.

What Doesn't Work so Well for Metadata?

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- Although AFD reduces the need for human intervention in both the production and playout chains, if there is no metadata, it must be inserted somewhere in the workflow.
- If all of the content is known, it is simply a matter of an operator identifying the aspect ratio and inserting the correct flag.
- This cannot be done automatically because there are two things that must be considered.
  - If the image contains black bars either at the top and bottom or on the sides, this could be analyzed; however, there are cases when this will not work.
  - Also, considering how logos are placed when branding a program, the logo may be placed in such a way that should an aspect ratio change take place, it could be cut off or appear to be in the wrong place.
  - An additional layer of operator intervention to examine where a logo is placed and how it will look further downstream is required to get it right all of the time.

Other Considerations for AFD

- Once a signal has been identified by an AFD flag, it is very important that this information be propagated through the entire system.
- Once AFD is lost, the entire idea behind AFD falls apart.
- So, if there are no active format description flags in place, they must be added automatically or by an operator.
- The operator must look at the image on a picture monitor and set up the aspect ratio converter properly.
- Today's control environments allow for a remote panel at the operator's location with easy-to-find status for flag presence and pushbuttons for each type of aspect ratio encountered.
- Custom situations will exist and AFD equipment is required to adapt
- A "truth table" allows decisions for the insertion of AFD based on the absence/presence of AFD flags
- What happens if there are two differing flags on two differing lines in the VANC ?
  - Line selection at the input for AFD devices is required

Other Considerations for AFD

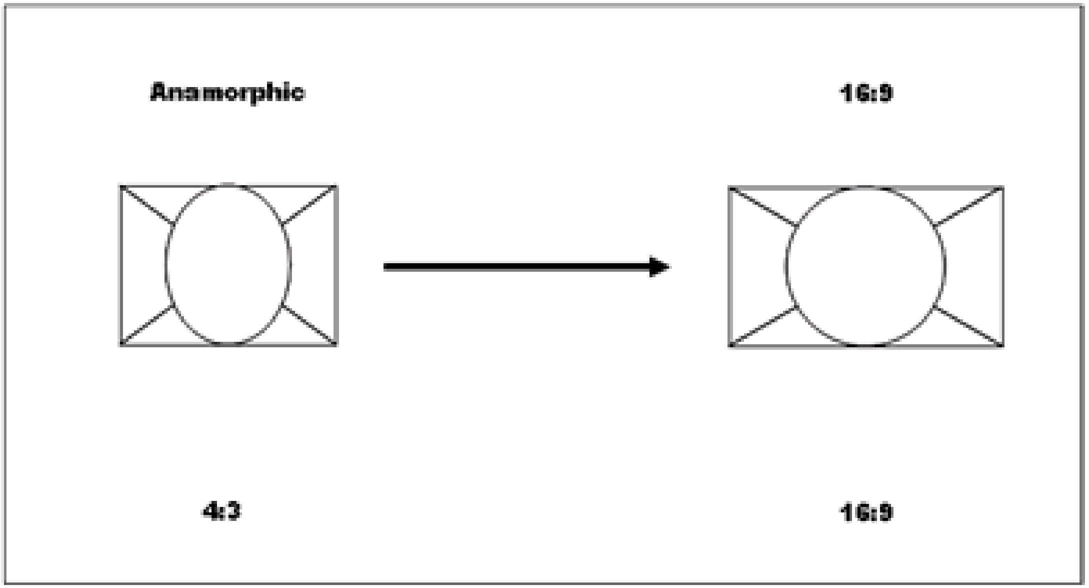
- Monitoring the signal for the presence of the AFD flag will assist the operator.
- When an alarm occurs in the typical waveform / vector / data / metadata monitoring equipment display used today, the operator then chooses the best appropriate of action.
- For equipment that handles AFD, user selection when the flag “disappears” for either remaining at the last known good AFD flag or a user selected default is a requirement.
- As many cable and DBS operators will simply center cut HD for SD distribution, graphics branding will likely continue to be located inside the 4:3 window of a 16:9 image (station logo will be in the middle of the screen); however, if the graphics designer created both a 4:3 and 16:9 graphic and the saved files were called out using AFD, this may be possible by using AFD flags.

Other Considerations for AFD

- A letterbox image in a legacy television set is not acceptable to the viewing public (USA), a cropped center is preferred.
- Broadcasters and content producers will likely still not assume letterbox HD broadcasts inside a SD transmission – choosing to continue to shoot and produce in the cropped center.
- As AFD rolls out, there will be issues that arise.
  - As AFD propagates through some older STBs, AFD interferes with the Closed Captioning information.
  - Some TV sets with AFD do not operate as advertised.
  - Some TV sets identify black bars and make decisions on the aspect ratio to be displayed – this may or may not be the default setting.
  - The ATSC and CEA are standardizing AFD; however, in other parts of the world (DVB), is the same standardization taking place ?
  - One other consideration is who will insert flags for commercials - the producer of the commercial or the broadcaster ?
  - What about Bar Data and how may it be used ?

Other Considerations for AFD

- There is the possibility where the SD 4:3 anamorphic format may need to be flagged; however, there isn't a flag in the AFD standard as this format would not be typically used in the home environment.
- This would be utilized when the STB could process the aspect ratio for 16:9 display when the incoming format to the STB is SD 4:3 anamorphic
- A custom (or incorrect) flag would suffice for a "closed" system such as this so long as the STB knows what to do with the custom flag.



Other Considerations for AFD

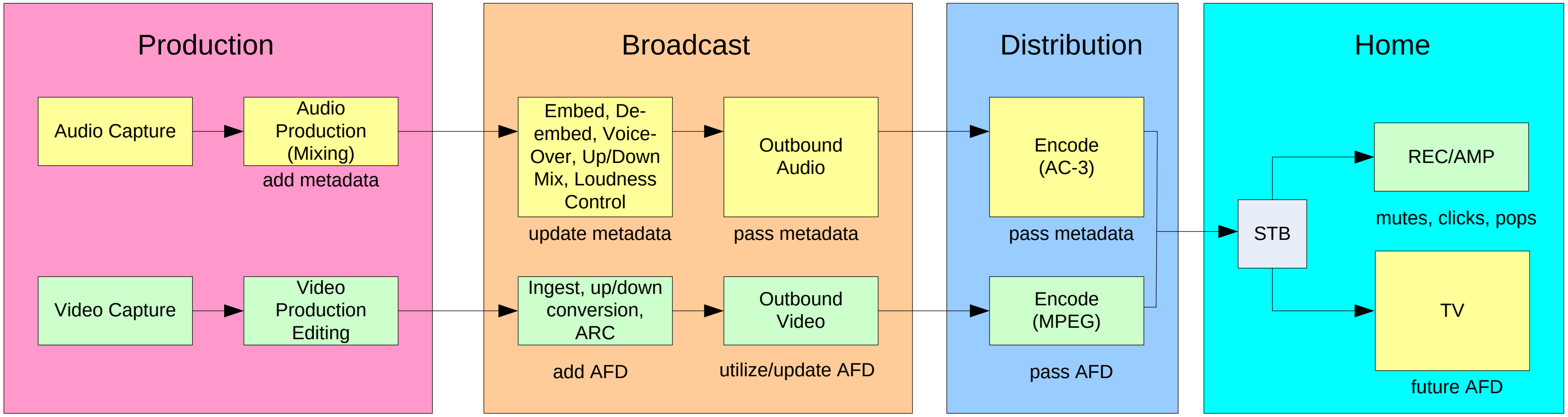
- Because the FCC did not demand AFD be included in the first round of DTV converter boxes, very few have AFD today; however, several available coupon-eligible DTV converter boxes (USA only) do support AFD.
- AFD has been part of the ATSC A/53 for many years, but broadcasters have only recently begun to implement it as equipment with AFD capability is now available.
- The new ATSC A/79 RP covers the use of AFD and other metadata in the conversion process for distribution to NTSC viewers as cable headends.
- AFD will start to appear in TVs around the fall 2009 selling season; it is now part of the standard, but still not mandatory under the FCC rules.

What Doesn't Work so Well for Metadata?

- Regarding audio metadata — even though the mechanism exists to move audio metadata all of the way into the home receiver/amplifier, the design implementation of the home receiver/amplifier may cause issues.
- Signaling stereo and surround sound switching in the home may result in clicks or pops or noticeable muting of the audio during the switch.
- From the July/August 2009 AES Journal:
  - A new bulletin is being devised (CEA-CEB21) that will recommend the response a receiver should make in the presence or absence of audio metadata (www.ce.org/standards)

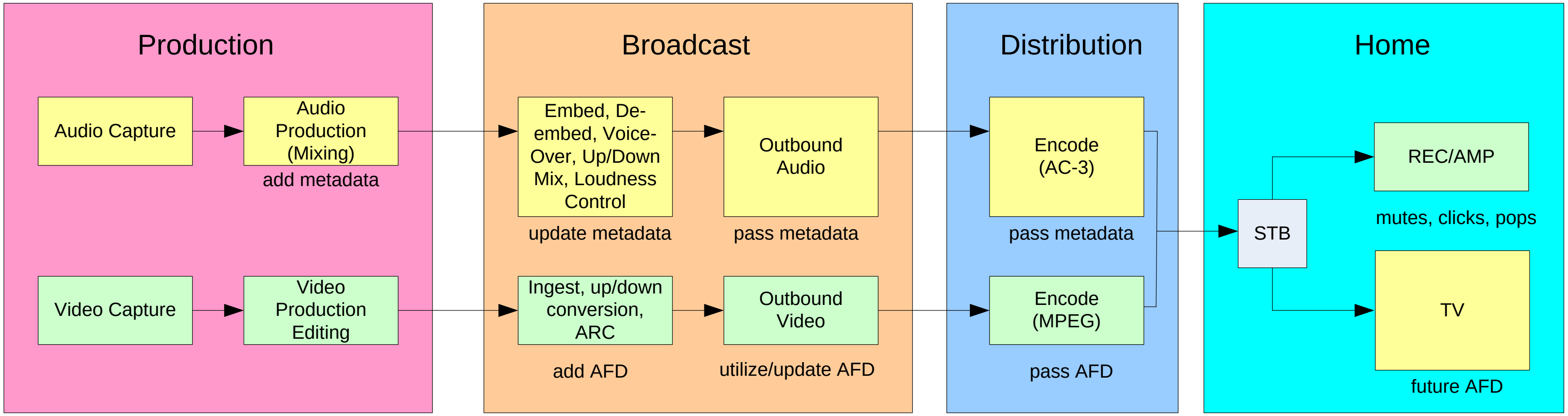
Example of Metadata in Today's Systems

- A simple signal flow for video and audio is shown. For metadata applications, the idea is to add metadata as early as possible and pass it through the chain, updating it appropriately.



Example of Metadata in Today's Systems

- Although today's systems do not yet fully utilize metadata, there are opportunities for simplifying workflow and lessening human intervention in the processing. There are, however, still challenges to achieving an ideal end-to-end implementation with no issues.



Conclusions

- This paper briefly touched on AFD and audio metadata applications in today’s systems, but there will be more utilization of metadata in the future.
- The key to metadata implentation is understanding what it is, how to find it and what it can do to improve workflow.
- Ensuring that the specified equipment meets the appropriate standards goes a long way toward achieving a successful implementation.
- Even though “all is good” when a broadcaster hands off the signal into the distribution chain, there may still be issues at the end point in the home today.