IP SHOWCASE THEATRE™

SMPTE

Case Study: Video Quality With TICO 4K

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TELSTRA

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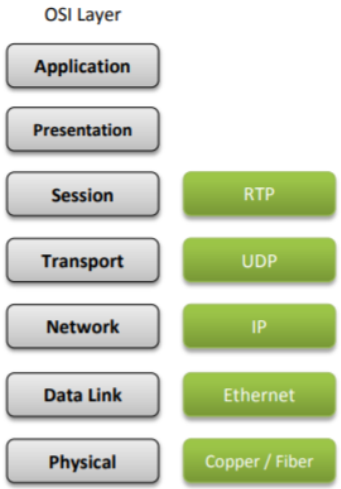
Synopsis

- Telstra's 4K Solution
- Codec Containerization
- Automated Video Quality Assessment
- ST 2110

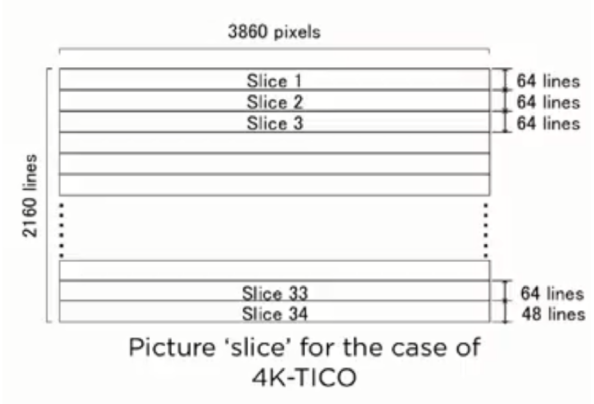
Telstra 4K DPN Solution

- **OB Trucks:** Send Quad 3G-SDI 2SI UHD video
- **Encoder:** Compresses video, and converts Quad 3G-SDI video into a single stream, and adds the 2022-6 RTP header
- RTP includes time information for precise media alignment
- **Network:** Transport One ST 2022-6 stream
  Decoder: RTP Decapsulation to Quad 3G-SDI
  4K Monitor: View 2SI Quad 3G-SDI UHD Video

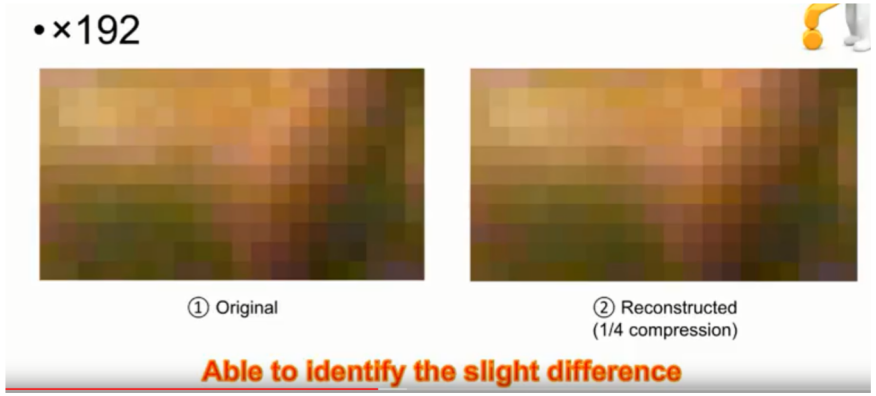


TICO (Tiny Codec) RDD35

- Codec for Live Production: 12G to 3G
- Its compression is very “light” because even after a 4:1 compression, the video quality is excellent !
- Mezzanine compression: Divides the frame into 34 Slices for encoding-decoding.
- Errors in each pixel are minimal and spread over the entire screen, instead of corrupting one block.

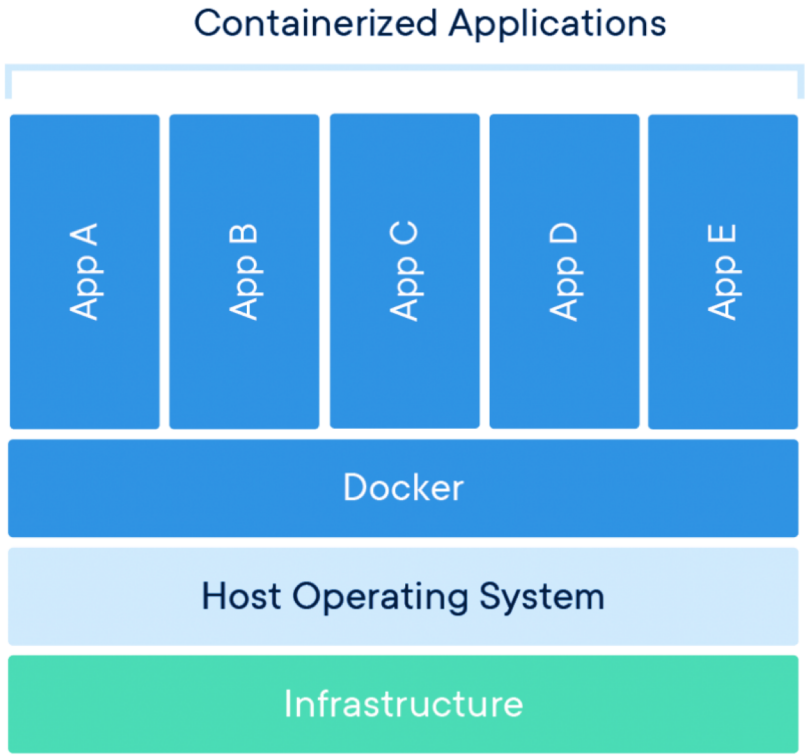


Picture ‘slice’ for the case of 4K-TICO

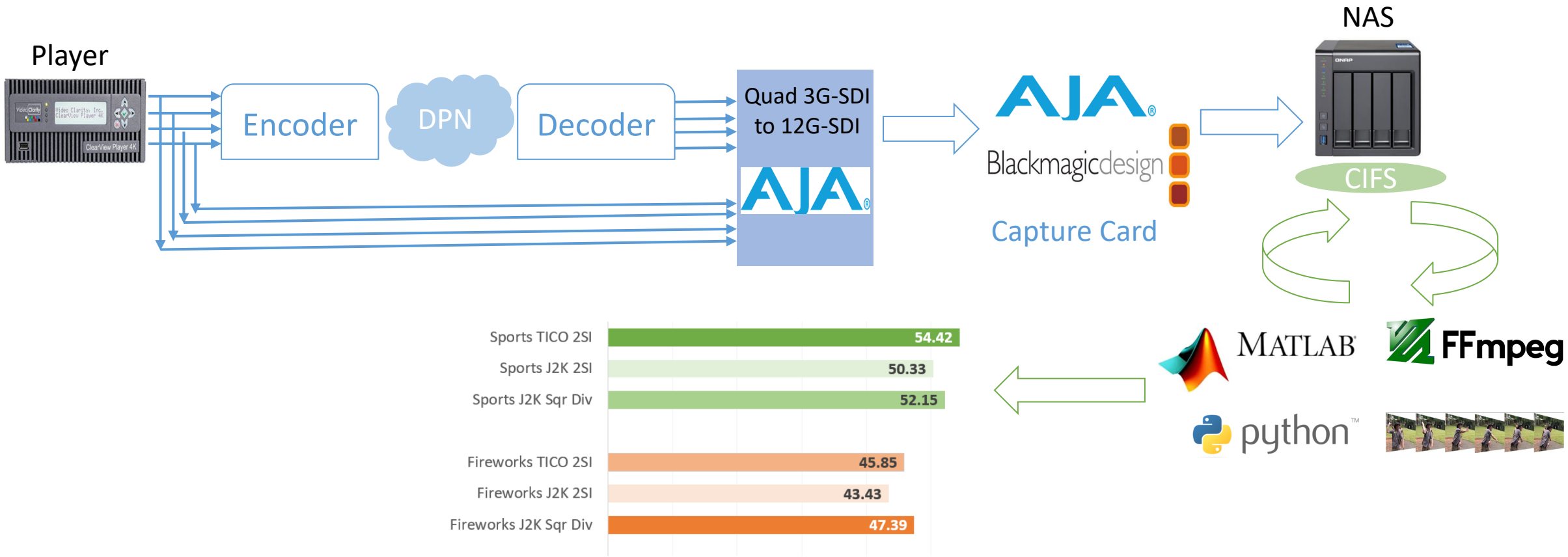


Codec Containerization via Docker

- 5 isolated Containers/Micro servers with 4 I/O SFPs in each available for use
- Push app images (codecs) in docker registry
- Load any codec (TICO v1, TICO v4, J2K, H.264) onto any MS
- RESTful API for automation
- No lengthy process of firmware/logic upgrades, line card removal, etc.

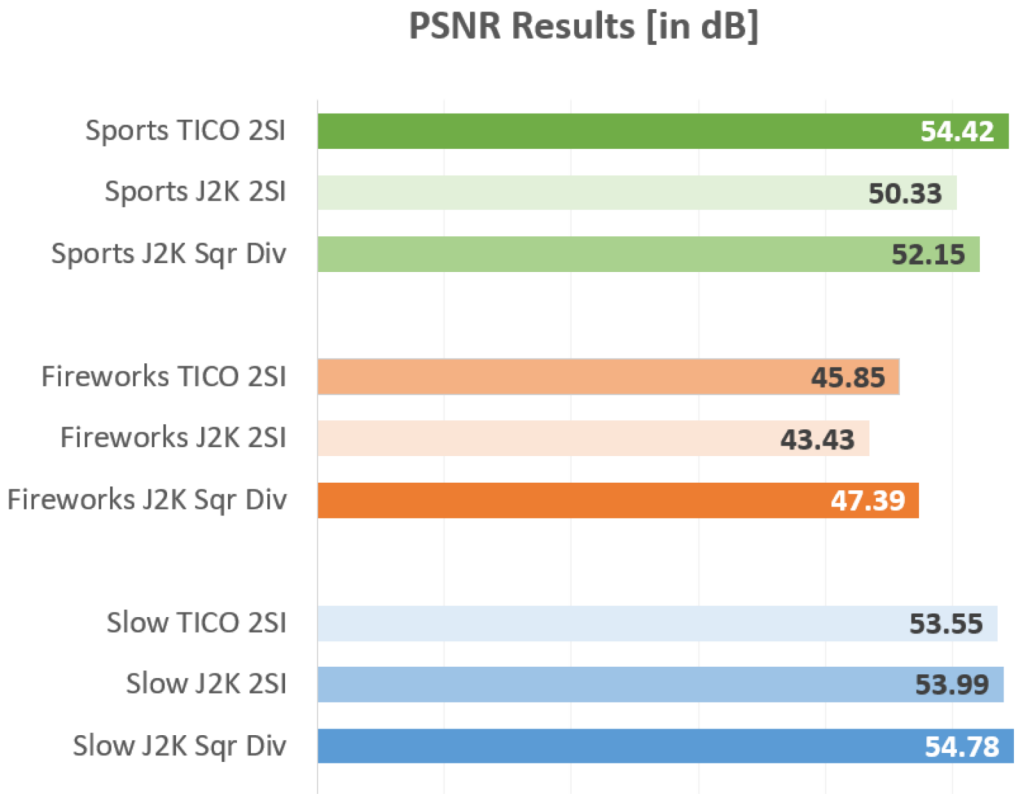


Automated Video Quality Assessment

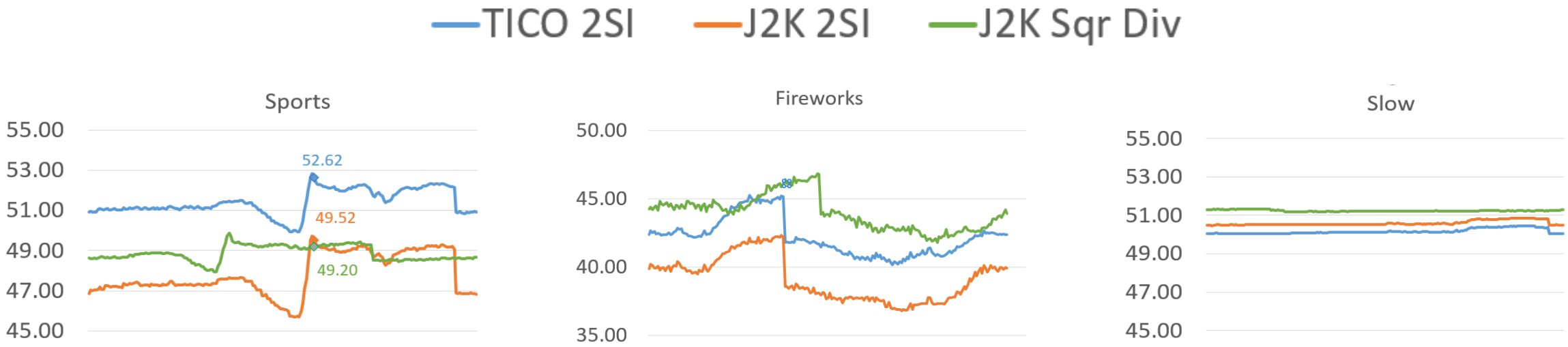


PSNR: Motion Based

- PSNR is an **Objective/Quantitative** video quality assessment model.
- PSNR measures the quality of the image reconstruction by the decoder.
- Higher compression requires higher filtering, which can corrupt the pixel colour information by adding noise.
- Higher the PSNR, better is the video quality.
- Video quality considered to be good when:
  - ❑ 8K > 55 dB
  - ❑ 4K > 45 dB
  - ❑ HD > 37dB
  - ❑ Uncompressed = infinity (no quality loss between input and output)

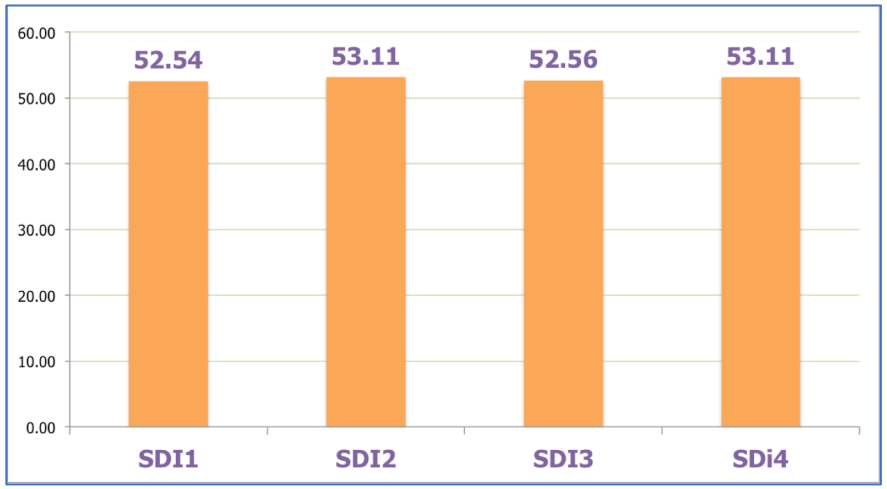


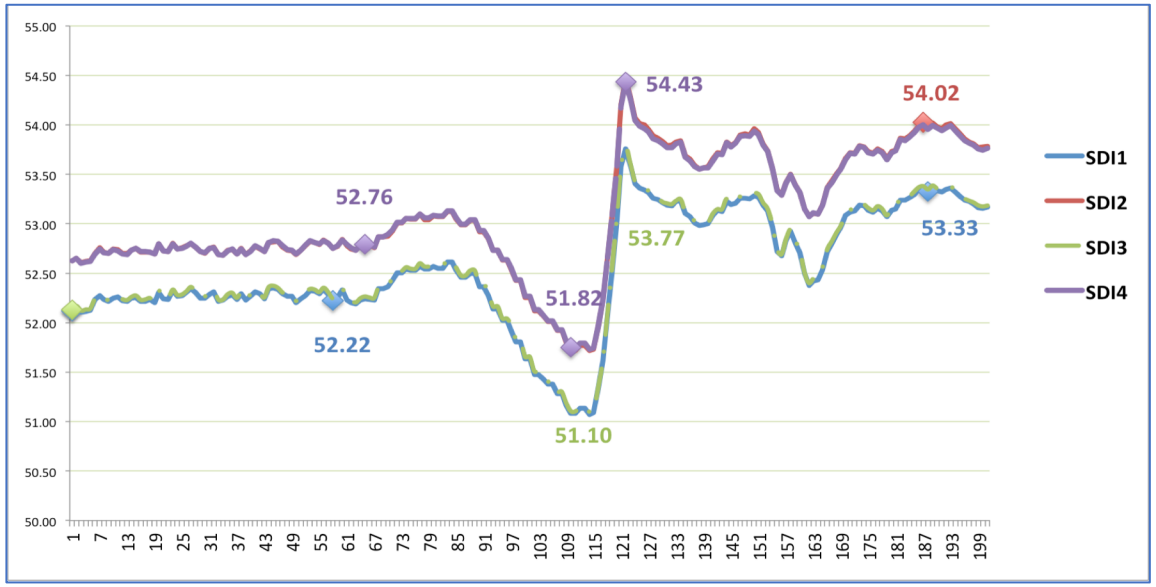
PSNR: Per Frame



PSNR: Per SDI Lane

- PSNR per 3G-SDI is around 1-2dB lower than a 12G-SDI signal
- PSNR for SDI1 = SDI3 and SDI2=SDI4

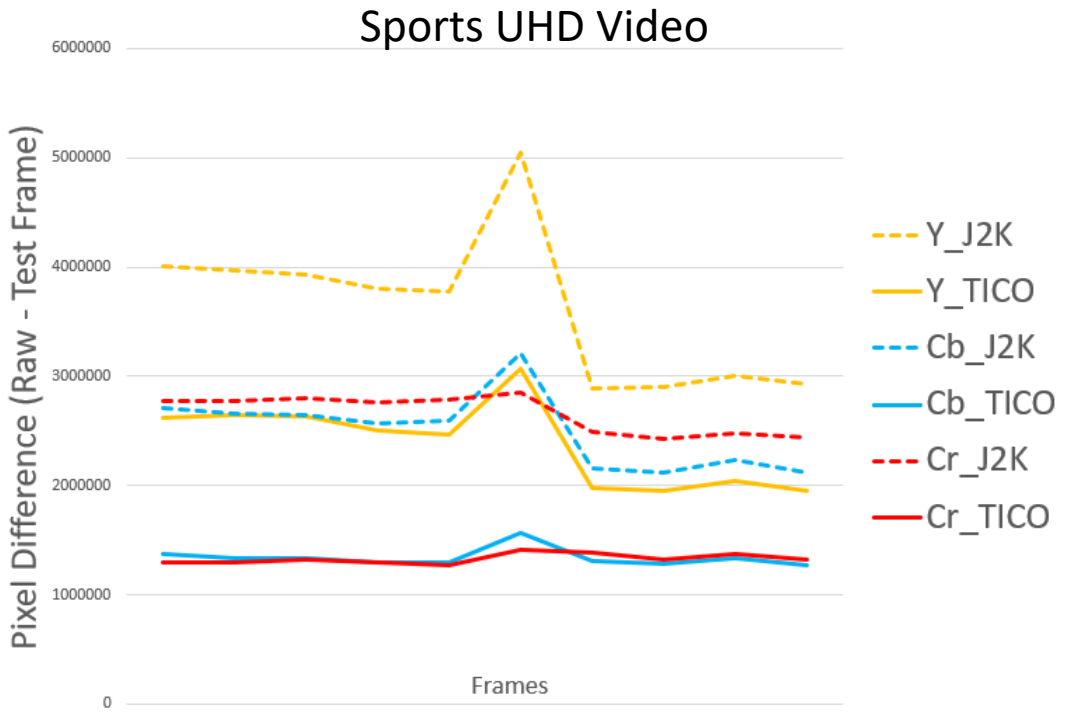




TICO Sports 2SI Quad 3G-SDI UHD Video

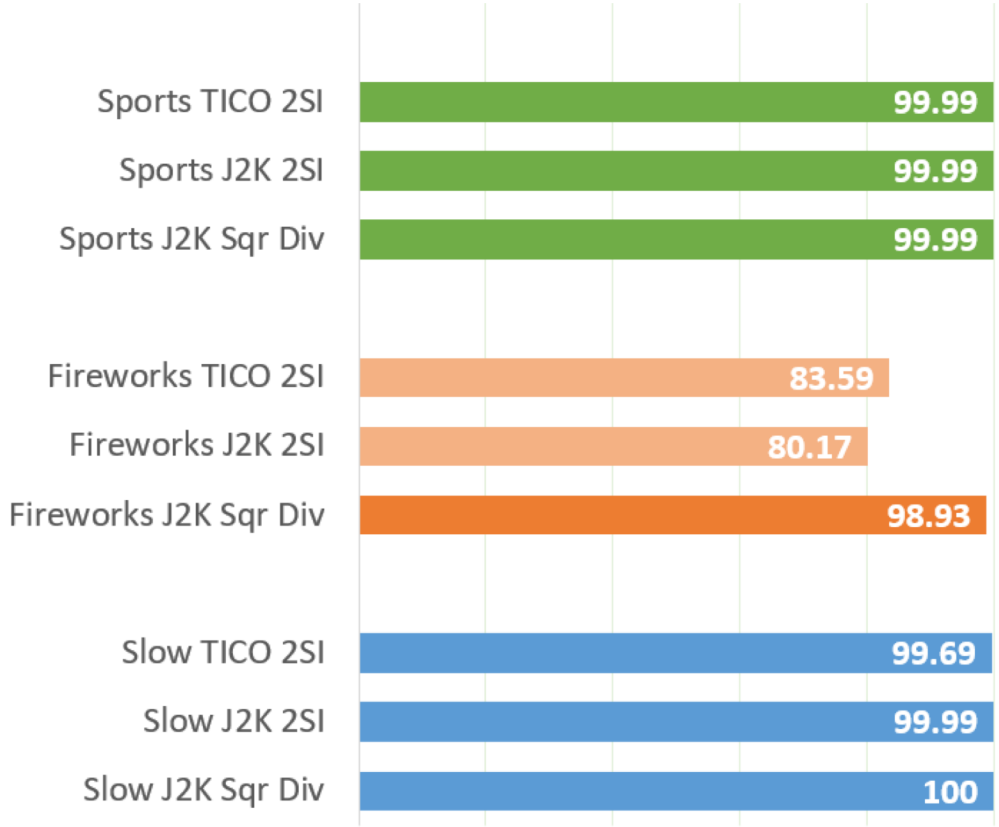
YCbCr

- This model helps you understand how a codec handles colours.
- Chroma Subsampling: 4:2:2
- YUV (Analog) = YCbCr (Digital)
  - ❑ Y = Luma
  - ❑ Cb = Blue Chroma
  - ❑ Cr = Red Chroma
- Extract colour information from test pixel, split into Y-Cb-Cr, and compare with the raw pixel



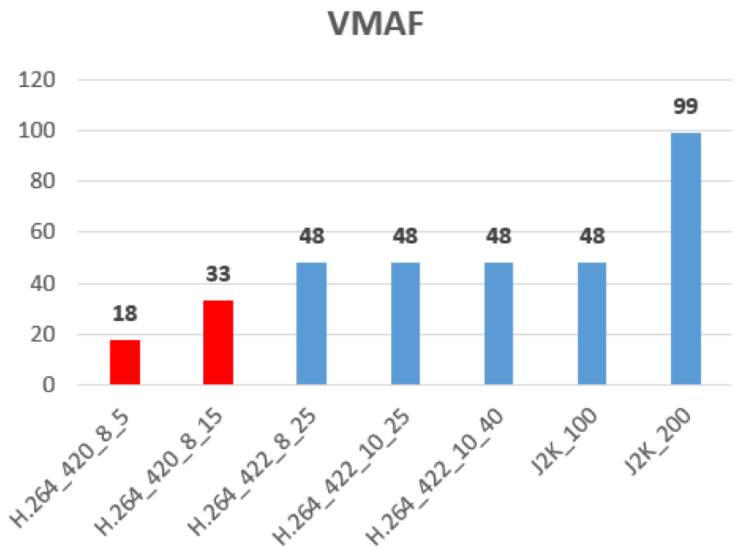
VMAF

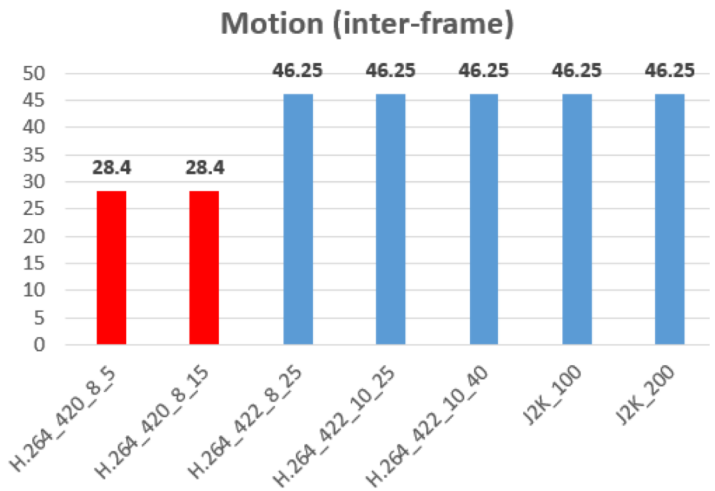
- VMAF is an automated model to predict **Subjective/Qualitative/Perceived** video quality by humans, developed by Netflix.
- It is highly dependent on the perceived video quality from the SMPTE recommended viewing distance and height for HD and 4K videos.
- HD and 4K VMAF models are different.

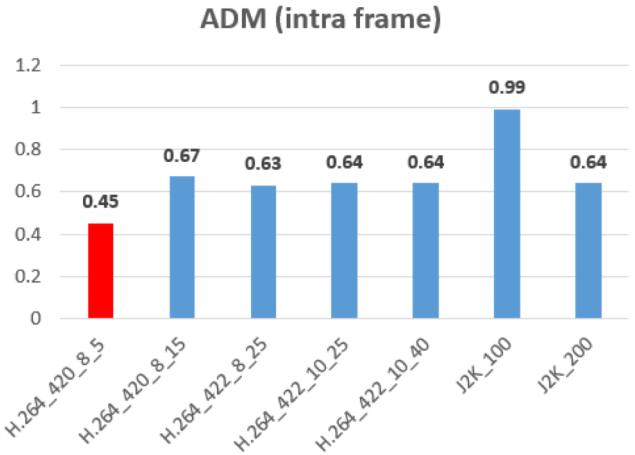


VMAF for H.264

VMAF great for predicting Inter-frame and Intra-frame defects for some codecs.

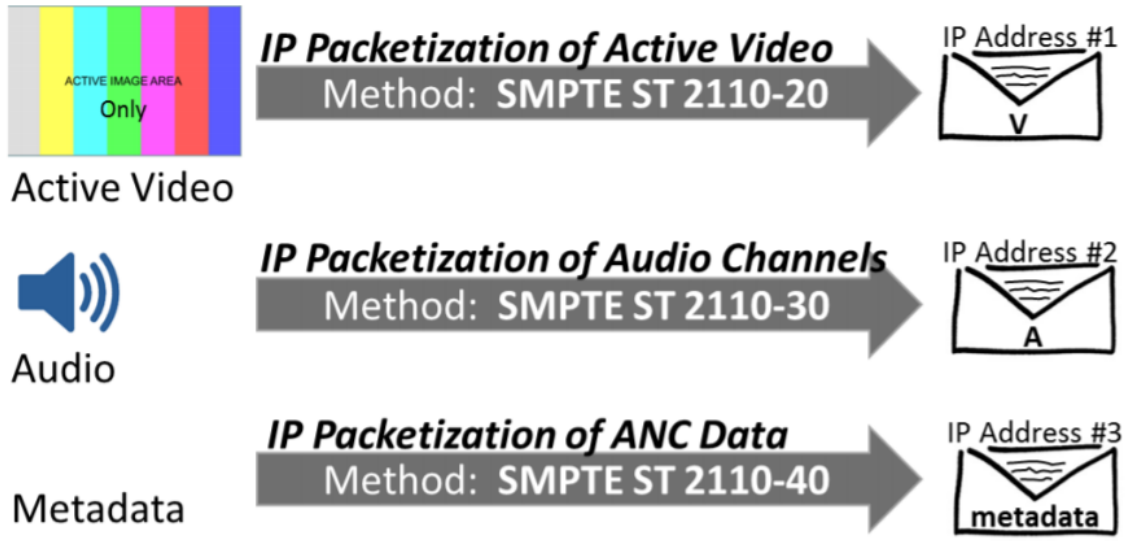




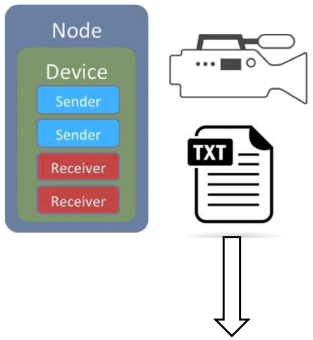


Next-in-Line Solution for 4K/8K: ST 2110-22 (TICO XS)

- **ST 2110-22** – Compressed Video, CBR
- TICO XS = JPEG XS: 12G to 1.5G and even less!
- Good for live production
- Essence based encapsulation
- Easy solution for audio and metadata extraction/addition



SDP and NMOS



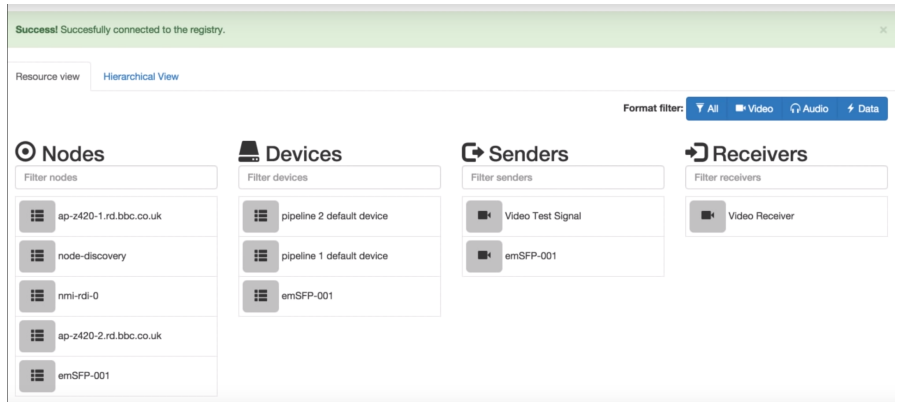
SDP (RFC 4566): Transport file carrying video format, multicast address, time information, sent by the source or management instance (camera or SFP). SDP must synchronize RTP timestamp with PTP.

IS-04: Device registers via POST in the Registration & Discovery

IS-05: Connection Management GETs SDP from devices, patches SDP to the receiver, and receiver subscribes to the sender.

UHD Quad 3G-SDI SDP

```
v=0
o=- 1443716955 1443716955 IN IP4 192.168.39.190
s=st2110 0-0-0
t=0 0
a=group:MULTI-2SI 0 1 2 3
m=video 1000 RTP/AVP 96
c=IN IP4 239.20.45.0/64
a=source-filter: incl IN IP4 239.20.45.0 192.168.39.104
a=rtpmap:96 raw/90000
a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN;
a=mediaclk:direct=0
a=ts-refclk:ptp=IEEE1588-2008:08-00-11-ff-fe-22-91-bb:0
a=mid:0
m=video 1001 RTP/AVP 96
c=IN IP4 239.20.45.1/64
a=source-filter: incl IN IP4 239.20.45.1 192.168.39.104
a=rtpmap:96 raw/90000
a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN;
a=mediaclk:direct=0
a=ts-refclk:ptp=IEEE1588-2008:08-00-11-ff-fe-22-91-bb:0
a=mid:1
m=video 1012 RTP/AVP 96
c=IN IP4 239.20.45.12/64
a=source-filter: incl IN IP4 239.20.45.12 192.168.39.105
a=rtpmap:96 raw/90000
a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN;
a=mediaclk:direct=0
a=ts-refclk:ptp=IEEE1588-2008:08-00-11-ff-fe-22-91-bb:0
a=mid:2
m=video 1013 RTP/AVP 96
c=IN IP4 239.20.45.13/64
a=source-filter: incl IN IP4 239.20.45.13 192.168.39.105
a=rtpmap:96 raw/90000
a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN;
a=mediaclk:direct=0
a=ts-refclk:ptp=IEEE1588-2008:08-00-11-ff-fe-22-91-bb:0
a=mid:3
```



Thankyou