NaSTA 18 - Talk for Techies-
SMPTE ST 2110 and ST 2069 “IMF” – and jobs!!!

www.smpte.org/uk

SMPTE UK

Peter Weitzel SMPTE fellow
Hon Sec Treasurer UK Section 2012-18
International Membership Director 2015-17
What are SMPTE’s features

- Membership organisation
- International with 1/3 members not in USA
- Not a charity – USA Not For Profit
- Covers all Moving Images Audio and Metadata
- Has members – is run by members not staff
- Delivers Education
- Sets Standards

SMPTE in the UK

serves all who are working with the technology of moving pictures and associated sound & metadata – creatively, practically and innovatively in any format, and on any platform
SMPTE UK USP

Across the UK - with local “clusters”
580+ members – the Third Largest SMPTE Section
5 student chapters – more than 100 Students
Offer all the SMPTE Does
A “members organisation set up to educate”
........ But we also set standards - Which enable interoperability
Cover all Film TV and Digital media
Work to get the younger generation welcomed (not Students alone)
Being Business like ..... In UK and with SMPTE as a whole

How we organise...

Meetings
London plus suggestions to Kindred Societies & BVE, IBC etc.
Clusters – East, South, Around London – well established
Midlands North (Salford) West - developing

Younger Members & Student Chapters
BCU, Ravensbourne, Salford, Solent, Surrey- now +NFTS soon
Plus NaSTA – SMPTE awards £500 to NaSTA Tech award

Webinars
UK Section offers about 6 webinars to SMPTE central each year
What about Weitzel?

- Knew that he wanted to work “behind the camera when 7 years old
- First paid by the BBC when 14 years old (50 years ago)
- Joined BBC in 1976 – and has worked in Projects/Strategy 1978-2010
- Installed first GVG 300 Vision Mixer in PAL (and it had a NEC DVE) costs £800K in 1980
- Designed installed studio with very software controlled Vision mixing system for BBC Sport
- Led teams installing new core systems in BBC Nations and Regions – while also going stereo and about 5 other projects
- Led the international standardisation of Teletext in various forms including the worlds first open standard EPG (& PDC)
- Major author of DVB Subtitle standard
- Developer, Editor and Implementer of Audio Description in the UK
- Co wrote the BBC Technology Business plan
- Working with Video and Audio over IP in 2000
- TDA for BBC broadcast connectivity 20 years
- Consulting for major International broadcasters
- Project Director first international UHD2 transmission (“8k”) 2008 (MPEG over IP)
- Mentored over 200 trainees

And also

- Scripted an entire Blue Peter
- Produced and Directed items for “Tomorrows World”
- Produced wrote directed edited BBC Trailers and Eng. recruitment
- Was a BBC Official spokesperson on Sex and Violence in Programmes
- BBC Exec Producer for Audio Description
- Did the risk assessment for “Otithe Aardvark dressed as nun on skateboard on the ring road!”
- Has qualifications in
  - Electrical Engineering (KCL)
  - Theology (KCL)
  - Management specialising in Corporate Strategy (Uni Of Westminster)
  - Group Psychotherapy (Birkbeck)
- Has been organising meetings for IEE/IET/RTS/SMPTE for 45 years
- Wrote first letter to The Times on “Engineering our Future” in 1980
- Served on Council of IEE and the Board of governors of SMPTE
- SMPTE Fellow 2017
Agenda

- The future is IP
- Video over IP before ST 2110
- ST 2110 – what is it?
- ST 2110 – the extra items PTP and NMOS
- IMF ST 2067 a short look
- Questions
- The Industries and what skill does it need? /Jobs there are!!!
- ..... Comments on Technology in NaSTA

The Future is IP

Internet Protocol is ubiquitous
TCP-IP works fairly well for File transfer
UDP works fairly well for Streaming
The Equipment being mass produced is cheap
Thus lots of COTS kit available
Lots of people would work with IP – thus (cheap??) Staff
Software is everywhere

Broadcasters have some specialist requirements
Files are large and thus needs acceleration to move
Uncompressed video is UDP Multicast at Gbit/sec and requires constant low latency
Thus equipment is COT Top S
Very few people actually underrates at the “every particularly count” level....
There is no place for resend or just delay a bit!
Video over IP before ST 2110

Analogue PAL c 1960 has no pixels and audio is separate except for SiS or SoS
SDI “ITU-R BT 601” 1982 ST259 270 Mbit/sec 720 (702 or 4) pixel/line
Audio can be embedded in HANC ST272
Both carry Teletext (Metadata) in VANC
HD SDI “ITU-R BT 709” 1990 ST 292-1 1.5Gbit/sec 1920 square Pixel/line
Embedded audio in HANC ST291-1 Metadata carried in VANC
HDSGI 3Gbit/sec ST425-1

ST22 family
-1 to -4 FEC and MPEG TS - 5 FEC for ....
ST 2022-6 Wraps HDSDI in IP UDP RFC 768 RTP RFC 3550
Just take HDSDI and drop it in 1376 Octet payloads – can put one sample across two Packets ..... Widely used by Telcos ..... ST2022-7 – hitless switching

For More Thomas Edwards SMPTE Webcast

ST 2110 – Component Essence

It handle videos audios and metadata’s as separated flows over IP "No embedding"
Grouping is by SDP RFC4566
Synchronisation is by PTP (ST 2059) and RTP RFC3550
Picture is Only active video No blanking
Image size up to 32k*32k
Y'Cr'Cb', RGB, XYZ, I'Ct'Cp'
4:2:2/10 4:2:2 /12 4:4:4:4 /16 and More
HDR both PQ and HLG

More see SMPTE webcast John Mailhot
The Raster ST2110 Active Picture

As the signal is 1.485 Gbit/sec
In 1080i/50
Active video is 1.037 Gbit/sec
The ANC is 448Mbit/sec
= 30% Wasted!

VANC Line # and CRC
HANC audio
Syncs

ST2110 – lets use existing standards

• Video Flows
  – RFC 4175 (uncompressed)
  – RFC 5371 (J2K)
  – RFC 6184 (H.264 I-frame)
• Audio Flows
  – RFC 3190 (AES67) 24 LPCM
• Ancillary Data
  – New ANC RTP payload
• Clock Distribution
  – IEEE 1588 PTP
  – SMPTE ST 2059-2 Profile
• Synchronization
  – RTP Clock source Signalling in SDP
  – RTCP Sender Reports RFC3550
• Flow Association
  – Session Description Protocol (SDP) RFC4556
• Identity (UUIDs)
  – Sources: RTCP SDES CNAME
  – Flows & Bundles: SDP URI
• Discovery
  – Multicast DNS-SD
ST2110 its parts

Professional Media Over Managed IP Networks (Approved Sept 2017)
- ST2110-10: System Timing and Definitions
- ST2110-20: Uncompressed Active Video
- ST2210-21: Traffic shaping and delivery timing
- ST2110-30: PCM Digital Audio
- ST2110-40: Ancillary Data (end of april 2018)
- ST2110-31: Full AES-3 Transport (future)
- ST2110-50: 2022-6 transport (future)

ST 2057 “PTP” the new Genlock

In an SDI world Analogue signals are still used
- Black and Burst (SD) and Tri-sync (HD) from the Olden days
In the IP world – use IEEE 1588 -2008 Precision Time Protocol
With a tweaks like 1ns resolution – and a “Fast genlock mode” to form ST 2057
By synchronising all equipment to the same time via the network
- this also holds frequency
What this does is to define when the start of a frame (audio sample) is
assuming that the start of a frame / first sample was at the start of the epoch 1 Jan 1970
With 50 Hz this is quite easy

- not so easy with a 60 *1000/1001 Hz
(there is not an integral number of frames in a day!)
What doesn’t it do???

SMPTE ST 2110 Replaces the SDI cable and the equipment either end “point to point”
With (timed) Flows (V A M) over an IP Network to which the equipment is connected ....
So
Where is the equipment each end?
How does the signals know where to go?
Has the network got enough capacity?

Where is the equipment?

*In the Olden days – that was is physical position in the rack – and you just cabled between two units*
In the IP world the equipment has an IP address
And can be anywhere
So –
How is that IP Address defined?
And is the address you want on the network?
“Discovery and Registration” - AMWA NMOS IS04
How do the signals know where to go?

*In the Olden days we had run out sheets – Source Connector ID, Type of cable, Run number Destination Connector ID and you just plugged things up!*

Now the source device needs to have a IP address to identify the output flow – for Media Essence this is usually Multicast – so the Destination needs to know what flow to listen out for. (for Unicast the destination IP address has to be known by the source)

AND

the Fabric has to route it

And is the Fabric the right size

*In the olden days – the limit was often just “Holes in the wall for cables” – because you added more ...*

With IP there are many signals flows capable of going over one link .... Is there enough bit rate?

For error free operation you need to manage it!!!

Hence some form of Software Defined Network SDN

and thus can be dynamic as you can switch Flows in the fabric!

AMWA (IS5) IS6
The architecture should be different

*Current SDI architecture is around a central router*  
(It was not always like this!!!)

What should be the architecture for IP?

Perhaps not a single central router -  
But perhaps a Leaf spine / Top of Rack (TOR) ???  
And often a duplicated infrastructure - may be with different equipment?

*Perhaps like this*

![Diagram of proposed architecture](image)
These are the challenges you will solve !!!!!

Wetzel's Three rules of IP
1. Every packet counts
2. ALL it needs is JUST best practise
3. It is complicated by all the interactions between flows etc. etc.

Questions??

For answers - look at www.smpte.org/webcasts
Or come to a SMPTE meeting or read SMPTE Motion Imaging Journal
Also good sources
IMF ST 2067

Interoperable Mastering format
Designed to solve two problems
a) To make versioning/localisation of films easy
b) To provide a way of shipping the required content to and from POST house

What's versioning / Localisation

- Original Version Video (en)
- Original Version Audio (en)
- Let's have a French version
  - Titles (fr)
  - Credits (fr)
- French Audio (fr)
- or French Canadian version
  - Titles (fr)
  - Credits (fr)
- French Canadian Audio (fr)

A typical Feature film has over 700 versions
With various audios
 technically - stereo 5.1. ATMOS
as well as language/market
and subtitles in more languages than the audio!
As well as different cuts of the video to
reflect the local cultural requirements
Let's have a French version or French Canadian version.

Under 12 version

Just have the OV and the differences – plus various Metadata to describe what each “Composition” contains CPL
A List of all that there is Asset map AMP (as the “bits” are storied as objects)
And a packing LIST PKL
(Plus how do you want it output Technically an OPL)
Note what happens if something changes / is replaced!

If I have the OVV and OAV
Then to make a French Canadian version I need a package which is

CPL French Canadian
Plus
Titles (fr) video
Credits (fr) video
Snippets French and Canadian
French Canadian audio

….. A very small set of files
IMF – in digital world aka the pampers advert

We can compose each version of the commercial by using a CPL to take video end slate and right audio ....

As each online platform needs different technical formats – why no output these using different OPLs (Broadcast uses AS11DPP)

And then why not do it "on the fly" for every call for that advert to be served ......

Lots of Metadata

Questions??

For answers - look at www.smpte.org/webcasts
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The Industries and Jobs

Basic Sector grid of the Industries

Notes:
Many Industries - not one!
The large Services sector may be split to cover wide spectrum from "Adverts" VFX via POST = Creative Through OBs to Transmitters (Service Providers) and Systems Integrators = Technical
Note some are “not Media and Entertainment field” But still the “art and science of the moving image” And that engineering skills like numeracy and being organised work anywhere!

See more in "formation of UK Section" in https://www.smpte.org/sections/united-kingdom/events/bill-lovell-memorial-lecture-2017
Skills you need

- Working effectively both individually and collaboratively as part of a team
- Ability to communicate clearly and concisely using appropriate discretion
- Build and maintain positive relationships with colleagues, customers and suppliers
- Demonstrate a passion for the broadcast media industry and its productions
- Display a strong work ethic and commitment... And understand being timely
- Work accurately with a high degree of attention to detail whilst maintaining a wide overview
- Think creatively and logically to solve both technical and creative issues (remember fundamentals)
- Contribute to a process continual improvement of workflow and technique
- Proactively keep up to date with latest developments within the industries
- Uphold ethical and professional standards & Maintain company and customer confidentiality

Non Modo..... Sed etiam

The skills seem to be opposites......
- You need to have a breadth of view and experience - NaSTA is good at this!
- And grow them – Don’t just sit in the corner!

There is a assumption that you will grow / keep up to date
- (advert) So join SMPTE and attend its meetings/ webinars
  and read its Journal AND Contribute to its activities “share your knowledge”

You will move across the industries doing different jobs / roles for many employers (and clients)
- So look beyond the technology space – to the business /wider issues

Enjoy it – Engineering is fun – And Broadcasting even more so!!
NaSTA Tech Awards

Cover a wide range
• Innovations/ Products
• A major programme
• Developing Facilities
• Growing Skills / Learning
Ideally “all of the above”
but the balance may be very different

There is no show reel!!
• Good layout
• Logical story telling
• Appropriate Diagrams/ photos/ URL
• State requirements WHY
• Describe What and How
• Why was it a success (or not)
• What next?

“ A Hand out to sell your abilities”

Join SMPTE Free first year then $10

• Meeting others working in our industries - that what SMPTE meetings are all about
• Receiving the Motion Imaging Journal (not associate members)
• full of the latest techniques and news from SMPTE sections around the World
• Participating the Technology relevant webcasts, at no Charge
• Access our archive - Look back over SMPTEs work over the past 100 years
• Attending events _ and conferences, Courses at member discount rates
– you can easily save your subscription (and it can be offset against tax)
• Getting Preferential booking for UK meetings
• Supporting those joining our industries through the Graduate Initiative
• Taking part in standards work, and directing the way our industries move
• Just being an active member of the world’s largest Members society for those working with the moving image, its audio and metadata- on any platform - Film, Television, Digital media
• And there are special awards for student papers etc. etc.

BUT SMPTE needs you as a graduate and thus be someone changing our industries
What can you do?

Join us
SMPTE UK needs more members to represent
• the wide range of industries
• and roles
• across the UK
So we can better serve the UK
As we grow the SMPTE UK community – and take an even greater role in the UK “media tech” and “other” ecosystems
And in SMPTE developments world wide

Join in
• Attend meetings and activities
• Contribute to meetings etc.
• Run the SMPTE UK Business
• Mentor Younger members
• ....... And more
Like A Conversation with SMPTE Leadership

And your company can support and sponsor SMPTE UK activities in kind and in cash!

www.smpte.org/uk
Look for NaSTA in the sidebar