How to Explain ST 2110 to a Six-Year-Old

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IP SHOWCASE

Audio Engineering Society · AIMS Alliance for IP Media Solutions · AMWA Networked Media. Working. · EBU · SMPTE · VSF Video Services Forum

Company Introduction

- Company specialising in software-based encoders and decoders for Sport, News and Channel contribution (B2B)
- Based in Central London
- Build everything in house
  - Hardware, firmware, software
- Not to be confused with:

Open Broadcaster Software

What is ST 2110

“If you can't explain it to a six year old, you don't understand it yourself.”

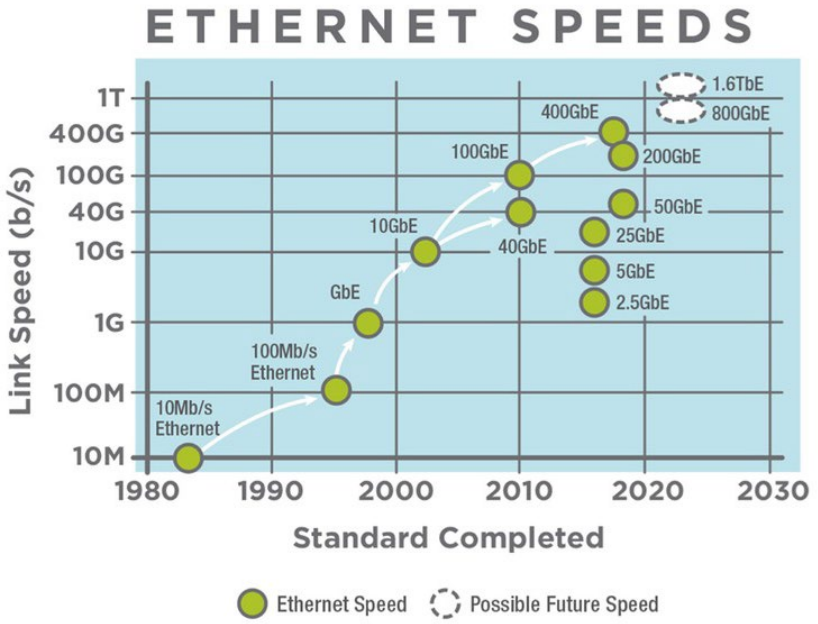
- Never seen any webinars/papers etc. get close to a half-decent explanation
  - Way too detailed or way too handwavy
  - Often very full of jargon
  - No explanation of why things are being done
- Let’s simplify years of work into 15 minutes!

Where things are

- Live production (sports, news etc.) uses Serial Digital Interface cables
- Old fashioned Electrical Signal transmitting what was a very large amount of data when it was invented (gigabit/s). Nowadays not so much.
- One TV signal (pictures + sound) in one cable
- And other historical signals
- Expensive equipment to switch between signals
- Specific to the television industry, huge mess of cabling

Where things are

- Don’t want to use old-fashioned cabling
- Internet growing very quickly
- Youtube, Netflix, Social Media, Big Data
- We can use Internet technology (but not the internet itself) to send pictures and sound around a facility. Known as Internet Protocol “IP” technology.
- Chop up a television picture and sounds into thousands of little pieces (“packets”) and send over a wired network
- Hundreds of television signals in a cable. Cheaper equipment from much bigger industry



About Time (1)

- Set the time of two clocks and check them after a day
- For example a microwave and an oven
- They won’t be the same
- Clocks have their own time source inside that have small differences
- Could be dependent on heat, location (e.g altitude), manufacturer of the clock
- Nowadays, phone connects to the Internet to set its time

About Time (2)

- Television pictures and sound are generated from a clock on the camera or microphone. In Europe, 25 still pictures a second
- Hard to cut between two camera angles if the clocks do not match

1

2

About Time (3)

- An old fashioned signal to keep them together, yet another cable
- Note: on the web, Zoom, webcasts etc., don’t do this

1

2

About Time (4)

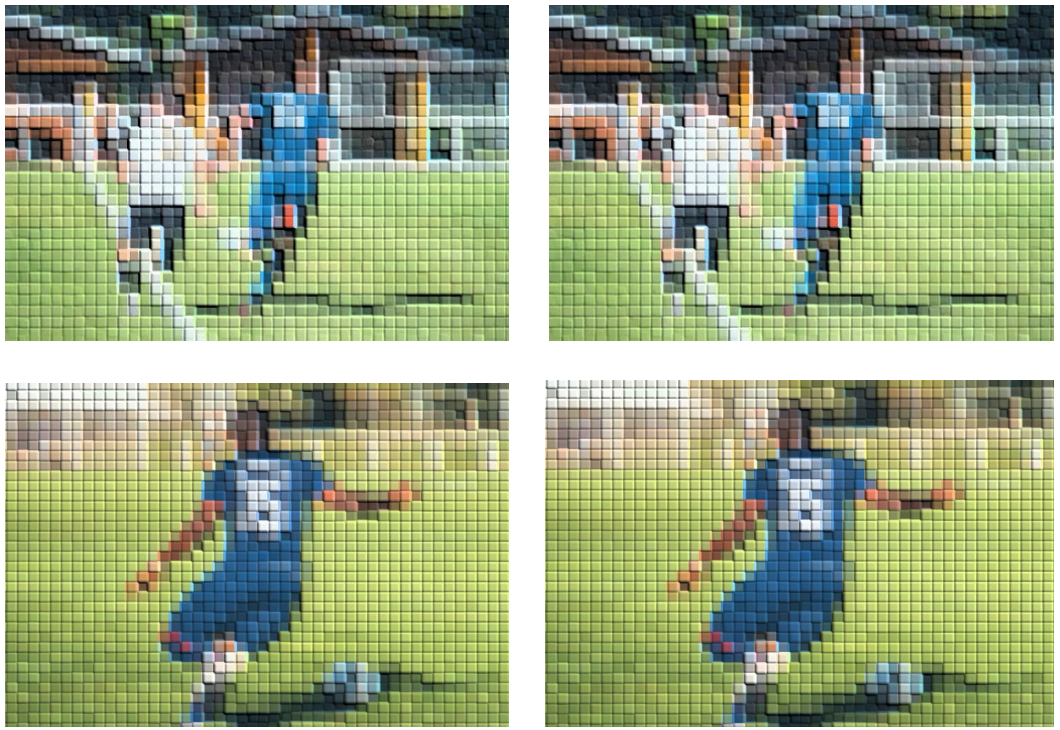
- During a leap year an extra day is added because the Earth doesn't perfectly go round the Sun (365.2422 days)
- Also small adjustments known as "leap seconds" at certain times when the clock strikes New Year's
- Need to make sure time doesn't jump otherwise pictures will glitch when Big Ben strikes midnight
- One of the reasons we can't just use the time sync mechanism like a phone
- Use GPS (satellite navigation) as a time-source, very high quality, has no leap seconds
- Transport this as IP Packets over the Network (Precision Time Protocol – PTP) but much better quality than a normal Internet connected clock

Packets and time (1)

- Split the pictures and sound up into thousands of little packets
- Imagine all television signals started at the same time, and each picture was a “tick”
- Work how many pictures there should be by now and wait to start at the right time

1st January 1970

(PTP epoch)

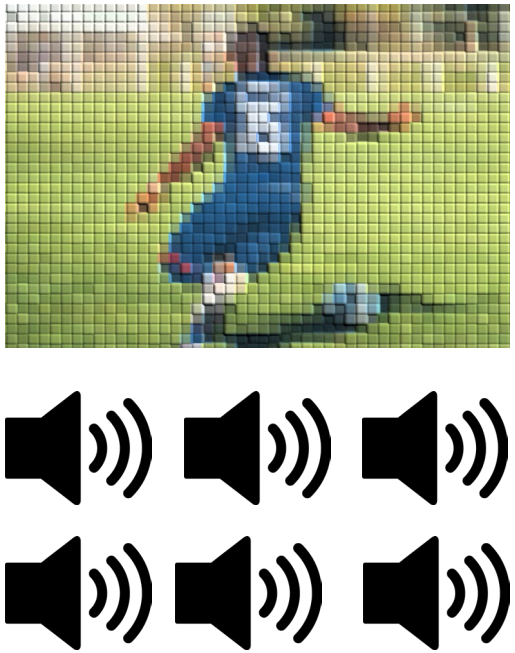


42 years later…

Now

Packets and time (2)

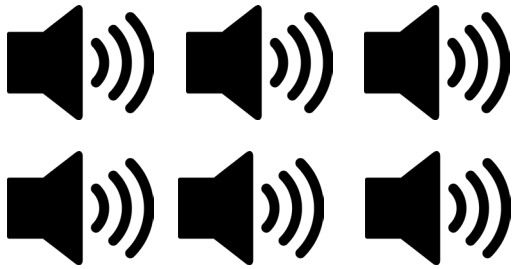
- Lots of pictures and sounds, split into packets and being sent over the network
- Packets given an address (can send to more than one place) – millions per second



- Not everyone needs to receive pictures if they are only using the sound
- When I receive these packets, how do I know when they are from?
- Need to know this so I can make sure they are in sync (when he kicks the ball you get a kicking sound at the right time)
- Attach the time (“timestamp”) to each packet so we can put the puzzle back together

Key points

- We want to use modern IP technology to make live television
- We have agreed on a common time across all the clocks in the broadcast
- We split pictures and sound up into thousands of packets and make sure we send them at the right time, and add a timestamp to each packets
- Anyone who wants to receive these packets uses the timestamps to put them all back together



- **The rest is just jargon, and implementation details**

Any Questions?

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