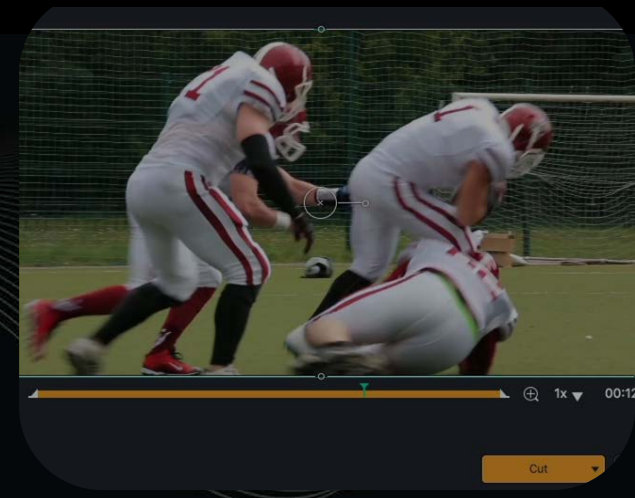# SMPTE 2110
The Good, The Bad,
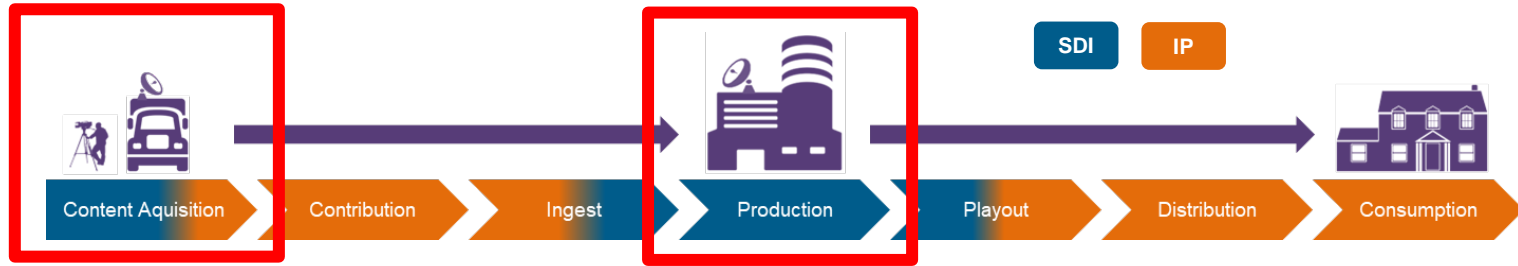# The Ugly

Presented By: Ken Stiver

A Brief Refresher...

...or an Introduction

ST 2110 Transition – where and why?
The drivers behind the transition

IP technologies are widely used through the broadcast chain. Content acquisition and production facilities are the last bastions of SDI. ST 2110 is now the technology of choice for new builds or major refurbishments

SDI

- Point to Point coax cable network
- Uni-directional signal flow
- Well understood and works well
- Higher resolutions require re-cabling and new infrastructure

ST 2110

- IP Network that takes advantage of IT technology and development cycles
- Enables flexible, scalable and more robust infrastructures
- Visibility of what is happening on the network a challenge

ST 2110 Technology Overview
The language of ST 2110 to help identify the opportunity

SMPTE 2110 is specified in several parts – become familiar with the "dashes"

System

ST 2110-10	System architecture and synchronization: essences, RTP, SDP and PTP

Video

ST 2110-20	Uncompressed video transport, based on SMPTE 2022-6
ST 2110-21	Traffic shaping and network delivery timing
ST 2110-22	Constant Bit-Rate Compressed Video transport

Audio

ST 2110-30	Audio transport, based on AES67
ST 2110-31	Transport of AES3 formatted audio

Data

ST 2110-40	Transport of ancillary data
ST 2110-43	Transport of Timed Text Markup Language for captions and subtitles in systems conforming to SMPTE ST 2110-10

Be aware of requests for ST 2022-6 (a packetized SDI stream that combines the Audio, Video and Data together) and ST 2022-7 which defines a redundancy mechanism for seamless protection switching.
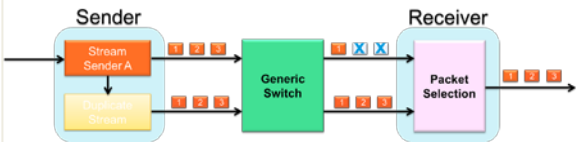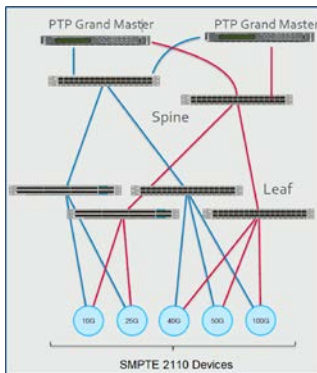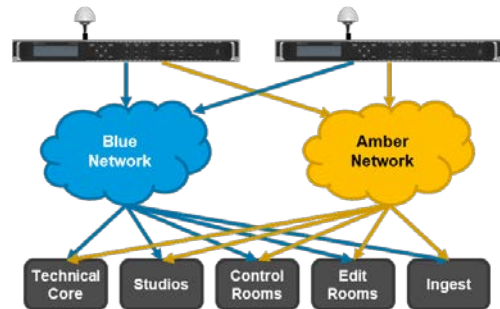.

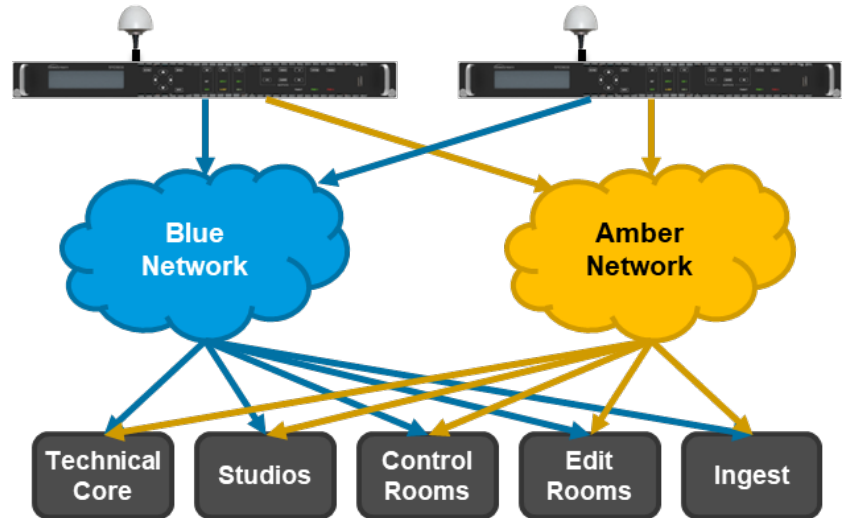# The Three R's

Existing Standards & Continued Learning

The Three R's: Redundancy, Robustness and Reliability.

Redundancy	Robustness	Reliability
● Use of SMPTE 2022-07 allows for a "hot-hot" production environment with two disparate networks delivering packets to the receiver. This allows the receiver to choose on a packet by packet basis	● Need more ports or higher bandwidth? 　○ Add another Switch. ● Tired of running 8 firmwares back because you can't find a window to take down a 24/7 service? ● Redundant networks allows for easier scheduling of maintenance windows for upgrades and hot fixes.	● While we may have new applications of the technologies, the principles remain the same ● SMPTE 2110 uses off the shelf equipment for managing routing and connection

SMPTE 2110 is built upon existing IT technologies

- SDP files are used in information technology to describe multimedia session parameters, including media types, codecs, and network addresses, facilitating session negotiation between endpoints.
  - Common uses: VoIP, video conferencing, and streaming media applications.

- PTP synchronizes distributed systems with high precision, benefiting financial, automotive, and manufacturing sectors.
  - Common Uses: Accurate transaction timestamping; Synchronized control systems in autonomous vehicles; Precise process coordination, enhancing efficiency and quality control in manufacturing

Spine-and-leaf architecture and high-bandwidth equipment meets the demands of modern computing providing scalable, high-performance connectivity between devices, ensuring efficient data transfer and low-latency communication.

The Bad:

Knowledge Gaps & Troubleshooting

New World? New Troubleshooting Tools

- What signals are actually on this physical port?

- Is my network operating normally?

- Reviewing Primary vs Secondary vs SDP

- IP Captures

- Timing in a non-deterministic network routing platform (TCP / IP)
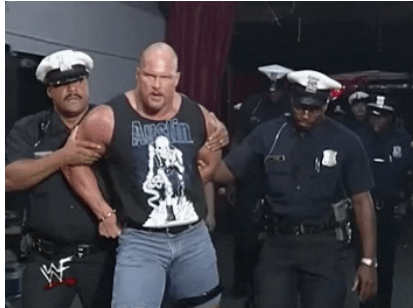
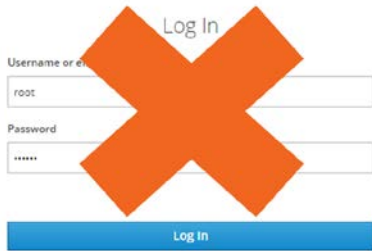# Standard Are Great

That's Why Everyone Has One

Talking with your IT department

Does this product support SSO? Can we add individual users?

Are your devices secured on the network using the principle of "least privileged"?

What is this traffic and why do you need so much bandwidth?

"If you alarm on everything, you alarm on nothing" - a tired broadcast engineer somewhere

- Increasing complexity requires granular toolsets to give precise information in a manner that can be immediately actioned.
  - Monitoring capacity can triple or quadruple depending on how essences and groups are monitored, especially in a 2022-07 environment.

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# Optical Transceivers: Things to Keep in Mind

Transmission Wavelengths

- **Multi-Mode:** Most common wavelength is 850nm. 1300nm is occasionally used.
- **Single-Mode:** Most common wavelengths are 1310nm and 1550nm.
  - 1550nm is typically used for longer distances.
- **Wavelength Division Multiplexing (WDM):** Uses a number of wavelengths dependent on manufacturer. Typically used for channel density on single strands of fiber.

Distances

- **SR (Short Range):** Multimode fiber, typically have a maximum distance of 300 meters
- **LR (Long Range) Transceivers:** Single-mode fiber, can transmit data over distances up to 10 kilometers.
- **ER (Extended Range) Transceivers:** Single-mode fiber, these modules can reach up to 40 kilometers.
- **ZR (Very Long Range) Transceivers:** Single-mode fiber,data transmission over distances of up to 80 kilometers
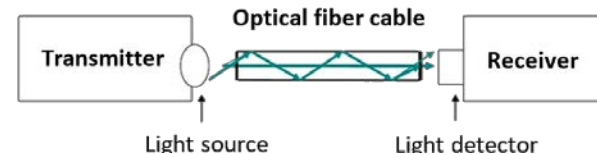
Connector Types and Polish

- LC, SC, ST, FC, MTP, MPO
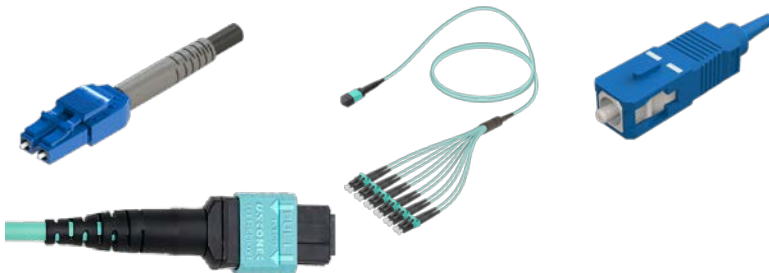
Number of Lanes

- Multiple fiber cores
- NRZ vs PAM
  - Pulse Amplitude Modulation allows for more data on a single wavelength

Summary of ST 2110 Technology

Advantages of using ST 2110

- The broadcast industry can benefit from the use of IT technologies, scaling and faster development timelines
- Enhanced scalability for future growth driven by bandwidth no port counts
- Increased flexibility provided by IP routing and networking vs. SDI routing and networking
- Enables new and agile workflows such as centralized/downstream production
- Easy to adapt to higher resolution formats
- Significant weight savings for cabling and connectivity
- Easier integrations and broader compatibility with modern IT infrastructure

Challenges associated with ST 2110

- IP networks decrease visibility of what you have on your network and what is happening on your network since everything is on the same pipe – requires new tools to address this
- The transition presents a challenge to skill sets of traditional broadcast engineering staff – increased use of third parties and system integrators for new system designs and implementation

Remember ST 2110 is about the physical layer and so for many users their job is unchanged and their connection to IP is invisible. Broadcast and Network Engineers are the ones who need tools to help them with ST 2110 network setup, commissioning and maintenance.