

# Supporting the Transition to SMPTE ST-2110 – The Importance of Legacy Timing Signals

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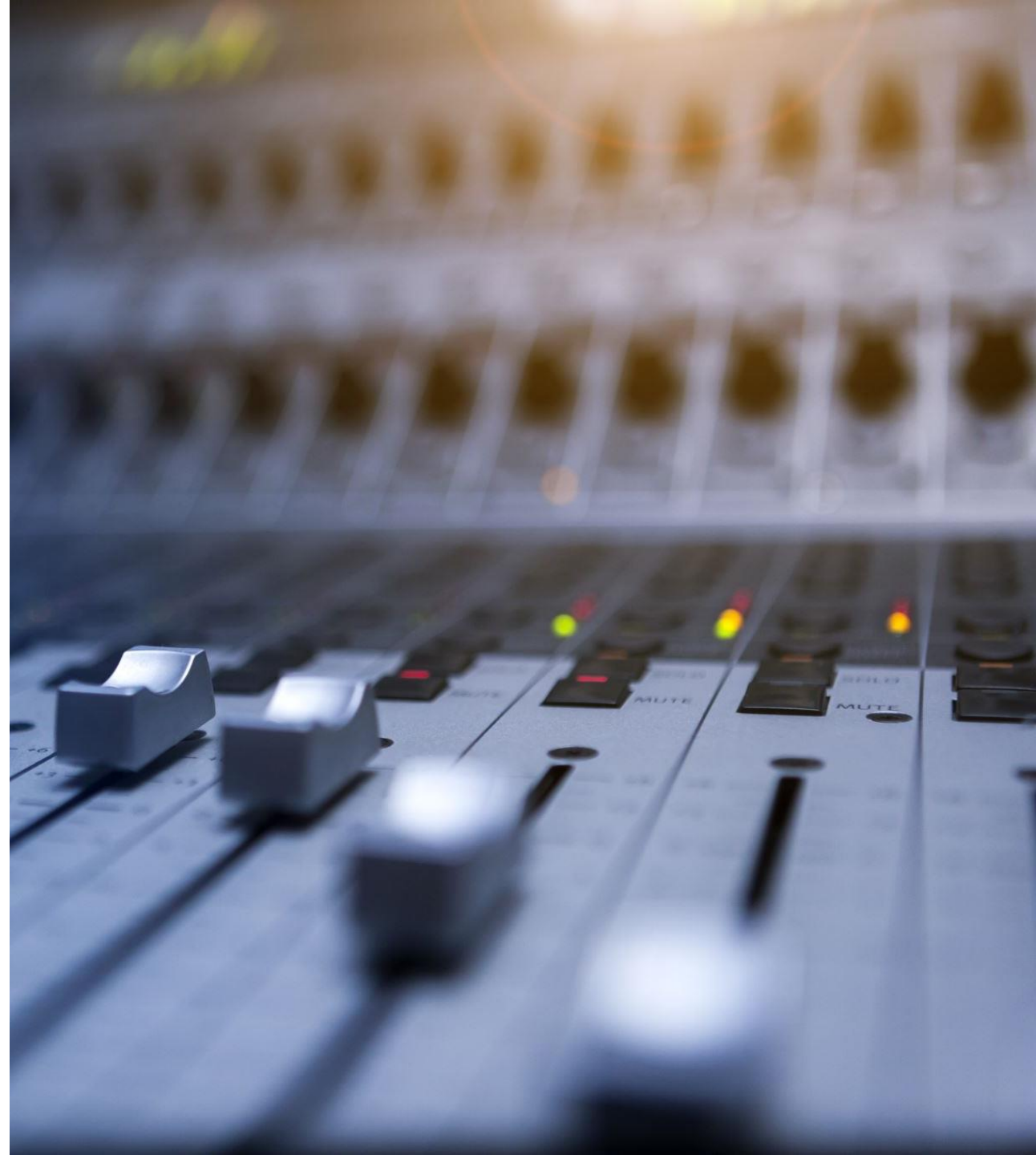
The logo for Meinberg, featuring the word "MEINBERG" in a stylized, italicized, blue font with a white outline, set against a white rounded rectangular background.

The Synchronization Experts.

**WORKSHOP**  
ON  
**SYNCHRONIZATION**  
AND  
**TIMING SYSTEMS**

# Agenda

- Need for timing in Broadcast/media networks
- Legacy broadcast timing
- PTP for Broadcast
- Supporting legacy equipment in a broadcast IP network
- Summary



# Why Time is Essential in Broadcast and Media

- Multiple audio and video files captured on separate equipment
  - Must be recombined for broadcast or steaming based on audio/visual file timestamps
  - Need smooth transitions among cameras, playback devices and other audio-visual sources
  - Color accuracy
  - Prevent jitter and artifacts
- Timing requirements
  - For video and mono audio:  $\sim 10$  ms
  - For stereo audio:  $\sim 10$   $\mu$ s
  - Error budgeted to network time distribution is typically  $1$   $\mu$ s.



NBC Nightly News. Photo by Jeff Maurone

# Legacy Broadcast Timing Signals

- Video Signals
  - Black Burst
  - Tri-Level Sync
- Audio Signals
  - Word Clock
  - Digital Audio Reference Signal (DARS)
- Linear Time Code
  - Used to insert timestamps in captured media

# Black Burst / Black and Burst / Bi-Level Sync

- Pulse based sync signal for SD video.
- A black signal of -40 IRE followed by a 10 cycle burst of the color video subcarrier (where chrominance information is). The start of the Black indicates the start of the new line.
- The pulse is based on FPS x Number of horizontal Pixels. BB on a standard def 480p resolution has an approx. frequency of 16MHz.
- This is an active video signal but does not contain any functional video information beyond timing sync.
- May be daisy chained.



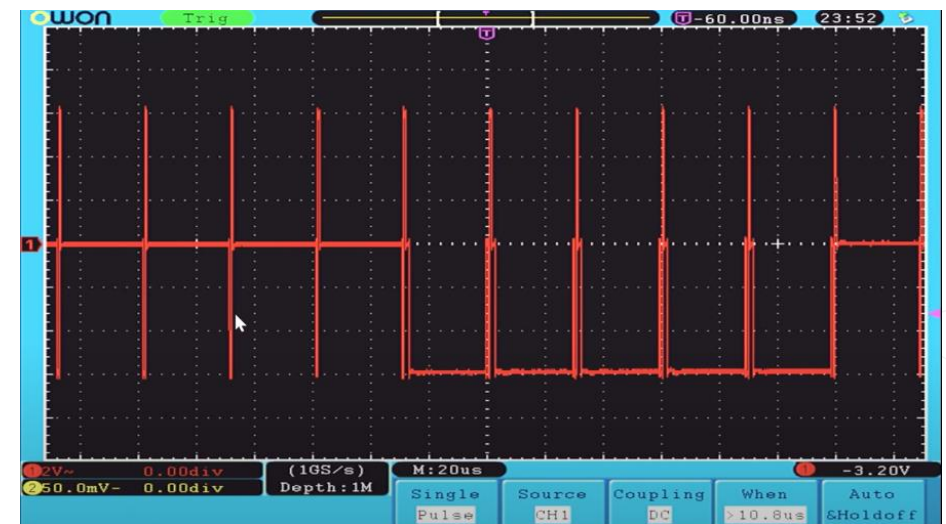
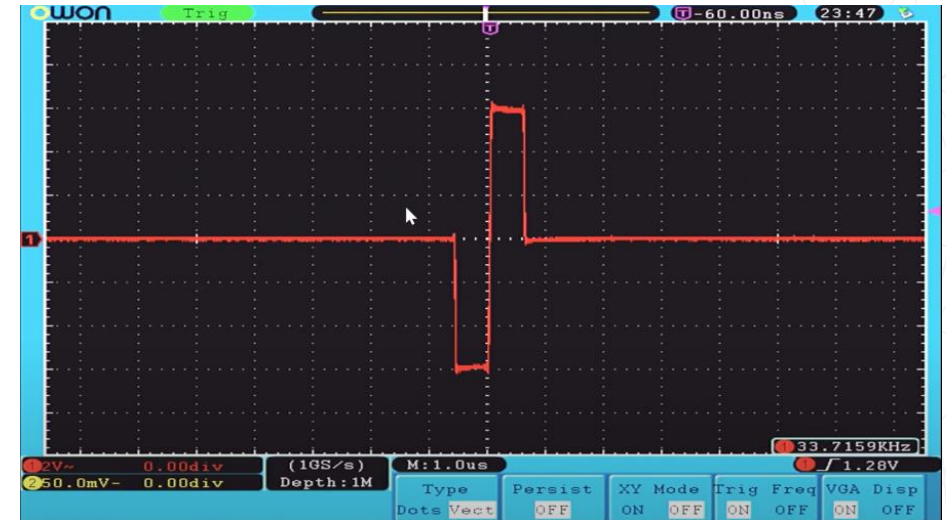
Image from Doug Johnson Productions

\*May be used for HD, but not ideal due to HD video running at a higher frequency. Jitter / tearing is more likely to occur.



# Tri-Level Sync

- Pulse based sync signal for HD video.
- Higher Frequency than Black Burst.
- The pulse is based on FPS x Number of horizontal Pixels. Tri-Level on a 1080p @ 30fps resolution has an approx. frequency of 33MHz
- This is an active video signal but does not contain any functional video information beyond timing sync.
- 5 pulses of black indicate the start of a new frame.
- May be daisy chained.



# Linear Time Code (LTC)

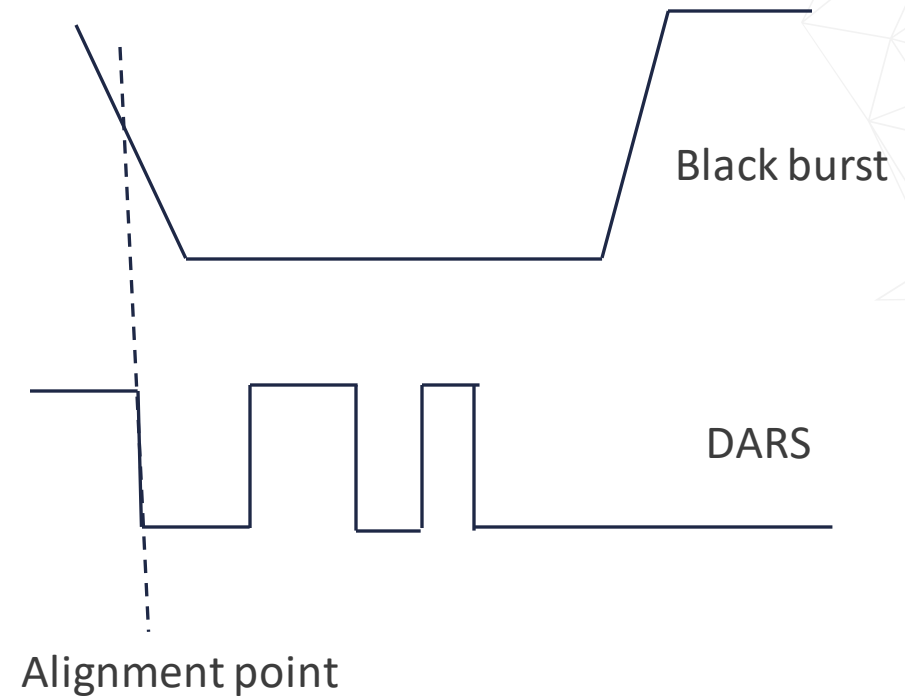


Images from Doug Johnson Productions

- Video sync signal – does not synchronize cameras, it is a reference metadata.
- Production Metadata; A clock that counts the number of frames per second.
- Each frame is assigned a specific timecode. Extremely helpful in post-production to line up multiple recordings/sources that were synced up to the same time code.
- Audio based signal utilizing bi-phase mark code. 0 bit has a single transition, 1 bit has two transitions.

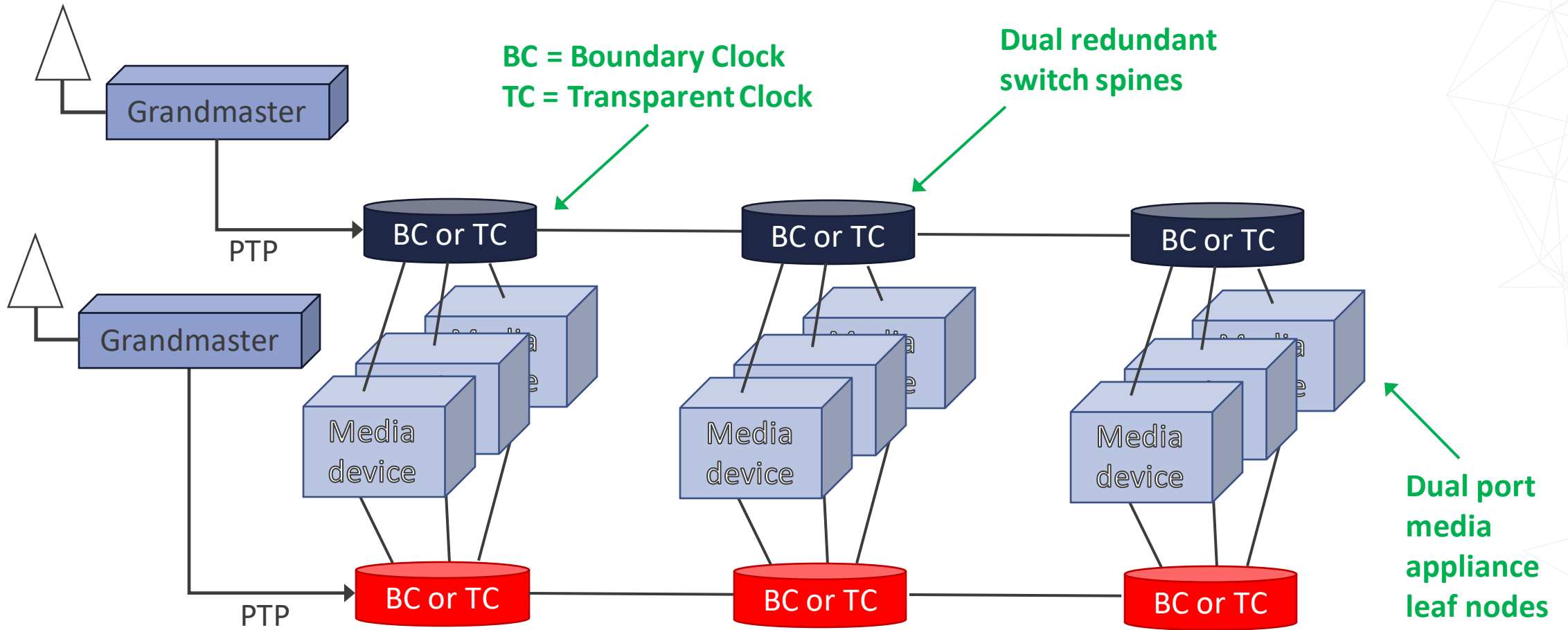
# Audio Sync Signals

- Word Clock
  - Audio "house clock" signal
  - Pulse or square wave based digital audio sync
- DARS
  - Digital Audio Reference Signal
  - AES3 signal with only the preamble active
- Purpose of Word clock and DARS
  - Prevents digital artifacts / distortion
  - Lines up multiple audio devices
  - Often aligned with video sync signal





# Redundant IP Networks



# PTP for Broadcast and Media

## PTP profiles for broadcast and media:

- SMPTE 2059-2
- Audio Engineering Society AES67
- L3, E2E, Multicast

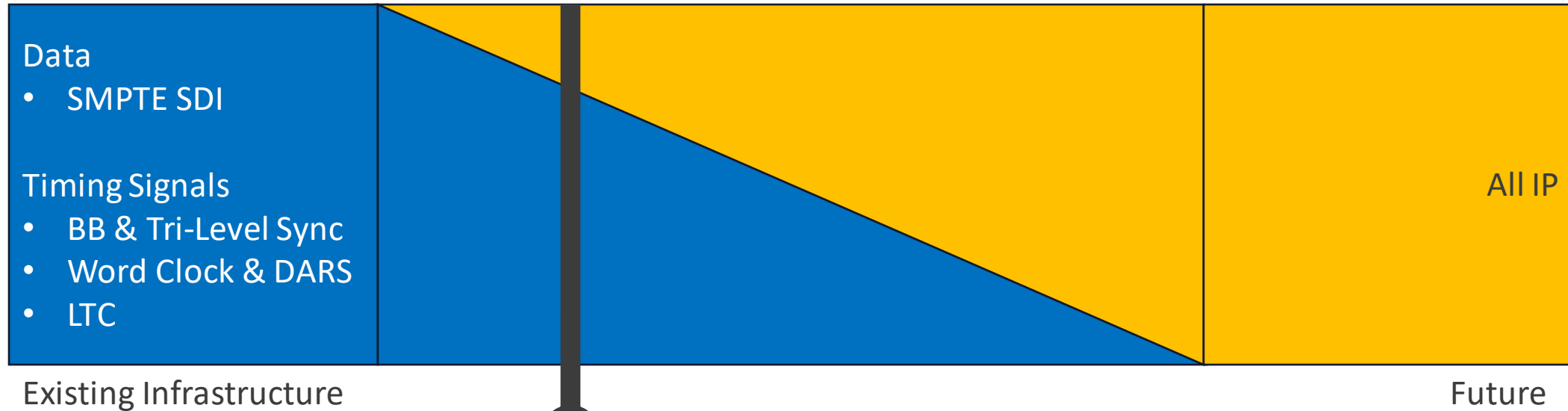
### Management message sent by ports in the Leader state

- Master locking status
- Default video frame rate
- Local time zone info
- Previous and next jam sync

### Flags

- Drop frame enabled
- Color frame in use
- Daylight savings time in effect
- Leap second pending

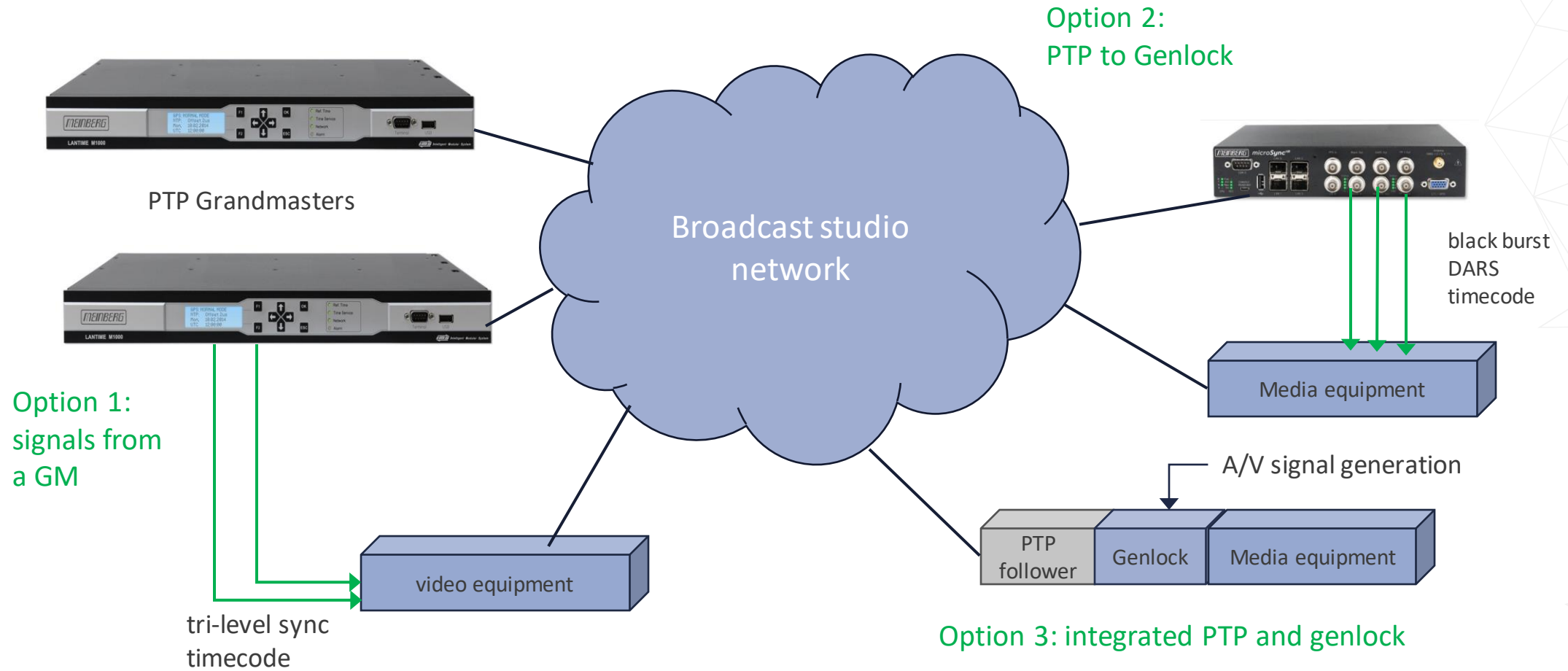
# Transition from Legacy Timing to All IP Future



## Transition to all IP

- It will take a long time, > 10 years
- Streaming & big networks farther along than content capture & production
- Cannot discard existing equipment, like cameras
- Network must continue to support all devices and program feeds

# Broadcast Networks with Legacy Support



# Key Points

- Precise timing is essential in Broadcast/Media networks
- Legacy broadcast signals require support. Transition to IP network will be gradual.
- Timing can be distributed in broadcast IP networks using PTP
- Redundancy increases time transfer resilience and robustness
- Conversion from PTP to legacy signals can happen in media equipment, in the PTP grandmaster, or in dedicated conversion nodes



**Thank You !**

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