Best practices in synchronizing IP-based packet broadcasting networks

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Need for Timing in broadcasting

- Consistent time synchronization is absolutely critical in a media and broadcast facility. Without equipment locked to the same timing source, multiple issues occur affecting media services.

- In the baseband world, devices lock to a reference such as black/Tri-level Sync, DARS, Timecode or genlock.

- With the adoption of IP, standards have been developed under the SMPTE-2110 umbrella, which define a different mechanism of providing timing using IEEE-1588/PTP

- There are 2 PTP profiles utilized in the broadcasting industry: AES67 and SMPTE 2059-2

SMPTE 2059 timing & AES 67 audio

SMPTE 2059

- SMPTE ST 2059-1: generates & aligns interface signals to the SMPTE epoch (methodology)
- SMPTE ST 2059-2: uses PTP profile per IEEE-1588 precise time protocol

- Utilizes PTP to transport time reference signals (time, frequency, phase) over IP for timing recovery in slave devices
- Enables audio, video & metadata content to be PTP-aligned over IP networks (mostly asynchronous)

AES 67

- Developed prior to SMPTE 2110 standards for audio over IP
- Later adopted under 2110-30

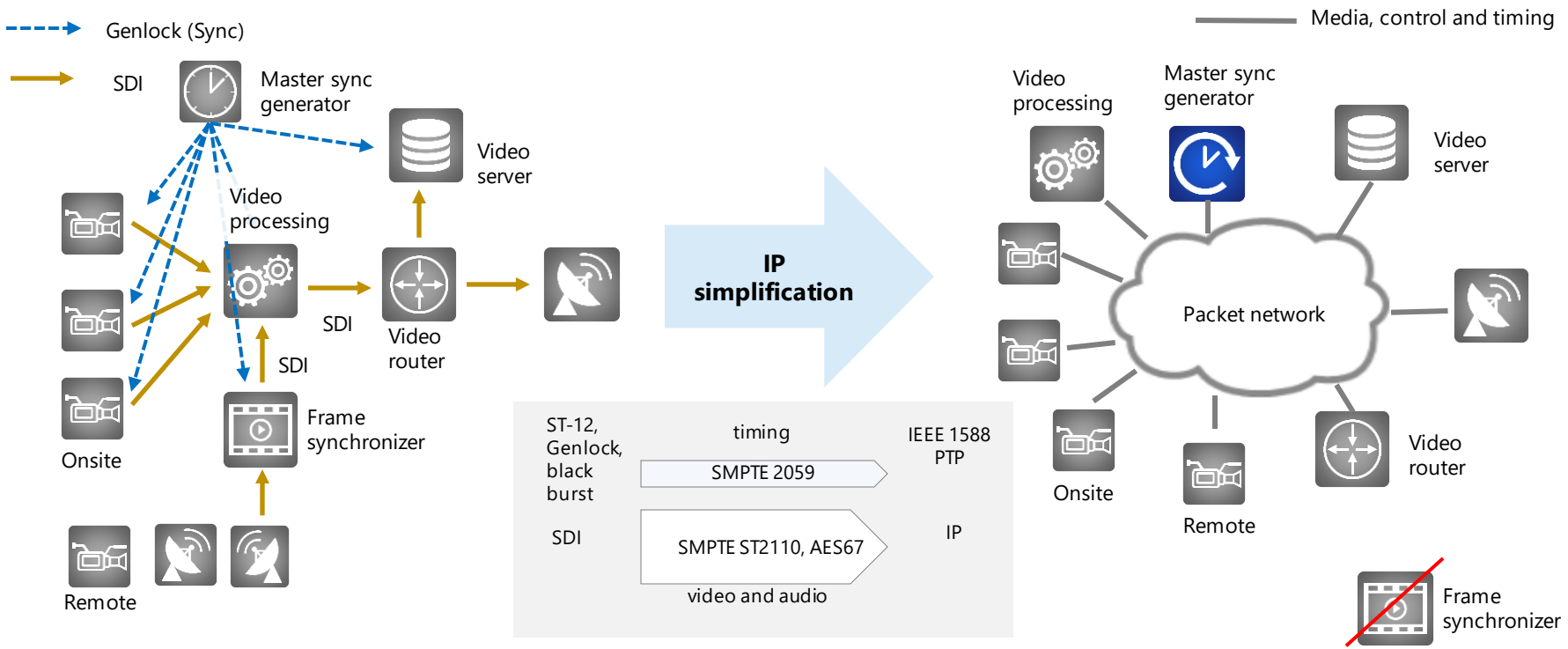
SMPTE 2059 & AES 67 profiles are very similar but not identical

ITU-T profiles are key for effective redundancy and distribution over the network.

Attribute	AES67	SMPTE2059-2
domain	0 to 255	0 to 127
Announce interval	0 to 4	-3 to 1
Sync interval	-4 to 1	-7 to -1
Min delay interval	The configurable range shall be -3 to 5 or Sync Interval to Sync interval + 5, whichever is the most restrictive	Sync Interval to Sync interval + 5
Min Pdelay req interval	0 to 5	Sync Interval to Sync interval + 5
Announce receipt timeout	2 to 10	2 to 10

AES – Audio Engineering Society

Migration from SDI to PTP/SMPTE 2059



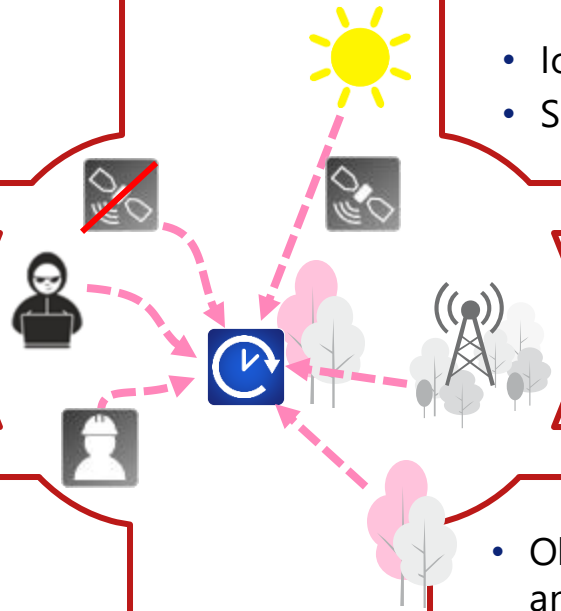
SMPTE 2059 uses PTP IP packets to do the job of traditional SPGs

Challenges with satellite-delivered timing

- GNSS outages or temporarily degraded signal quality

- Ionospheric disturbances
- Solar activity

- Jamming: overpowering weak GNSS signals
- Spoofing: fake GNSS signals



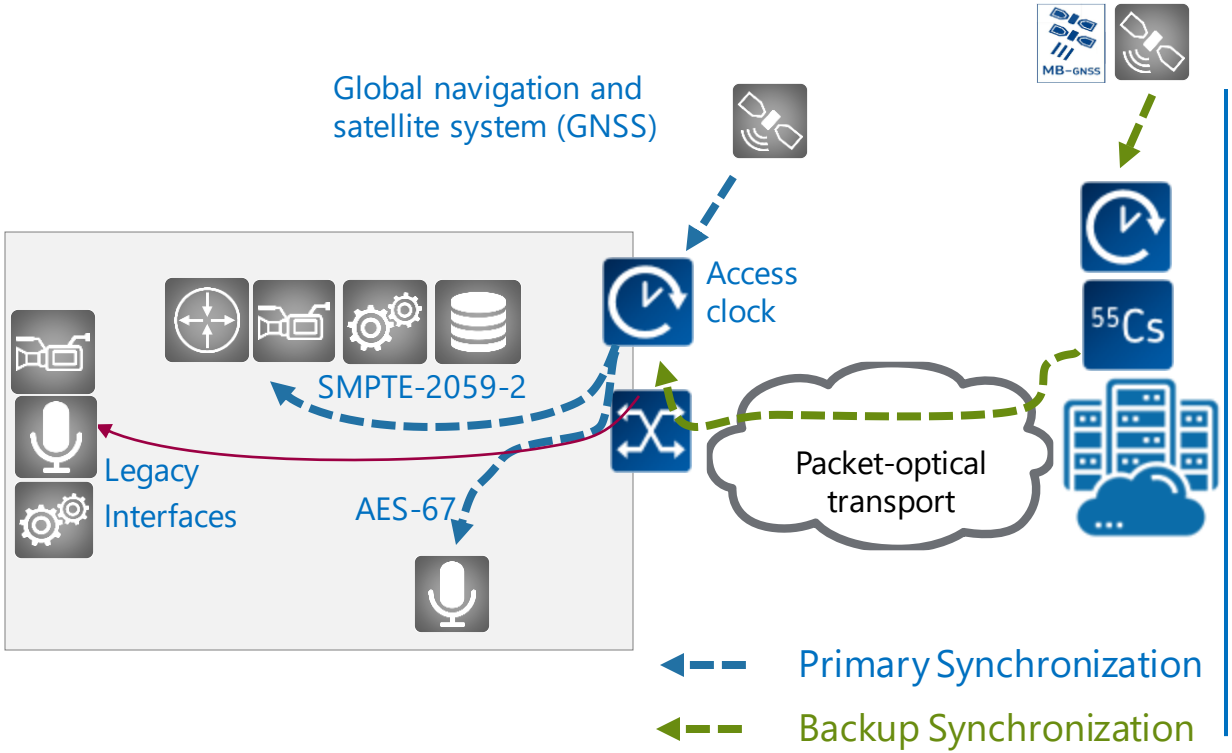
- Interference from high-power RF transmitters such as TV, cellular, radar and µWave

- Antenna construction frequently does not achieve clear sky view

- Obstructions from new buildings and growing trees

Is GNSS your only source for synchronization? You should be scared!

Resilient and accurate timing



Availability: Combining satellite- with network-delivered timing

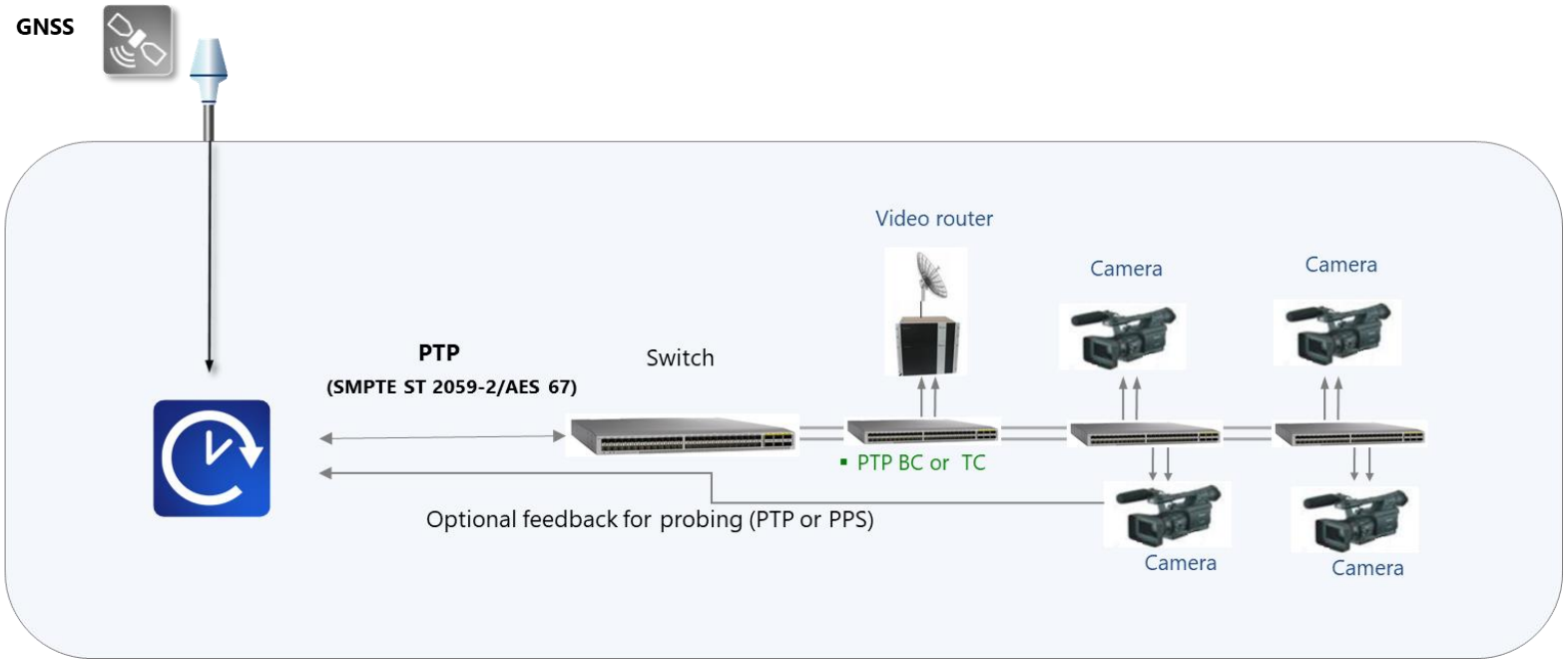
Synchronization interfaces: Legacy Black burst, TLV, DARS, TC, as well as latest PTP featuring SMPTE-2059-2 and AES-67 profile

Best practices: Applying multi-technology devices for seamless migration and resilient operation

Optionally using Multiband or even Cesium clocks for ultimate autonomy & resiliency.

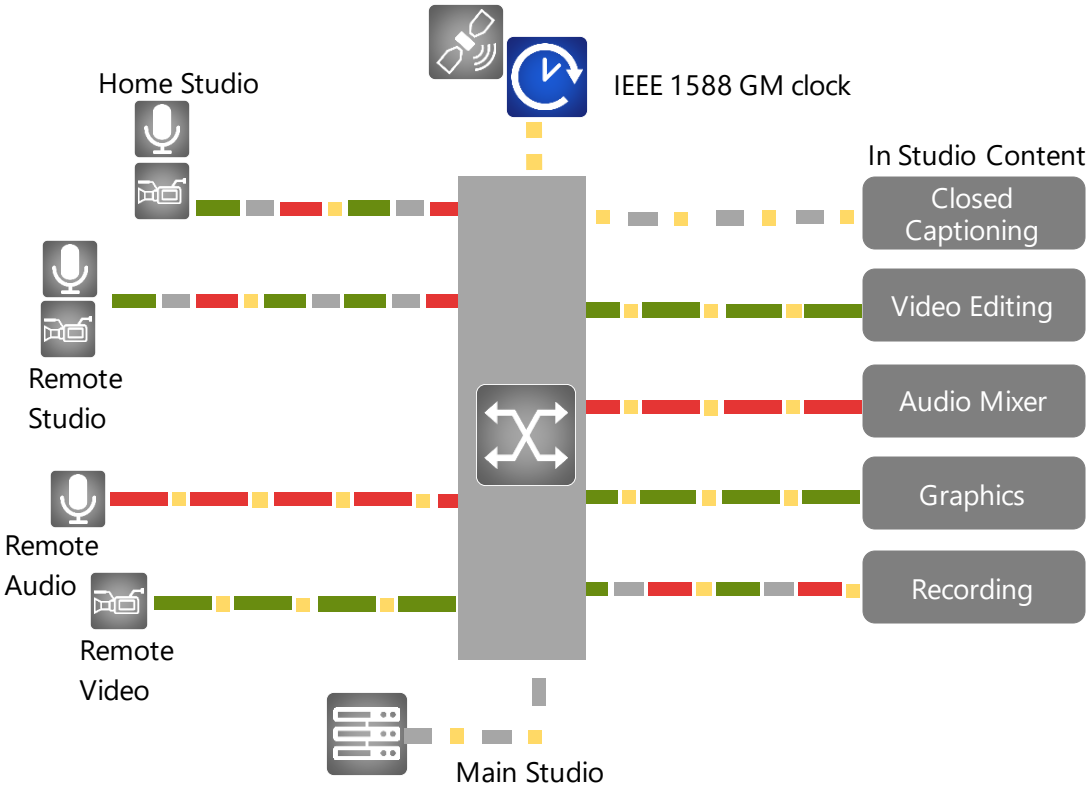
Combining GNSS with network timing for accuracy and resiliency

Monitoring



Constant monitoring enables preventive detection of degradation

Use Case: Remote Collaboration



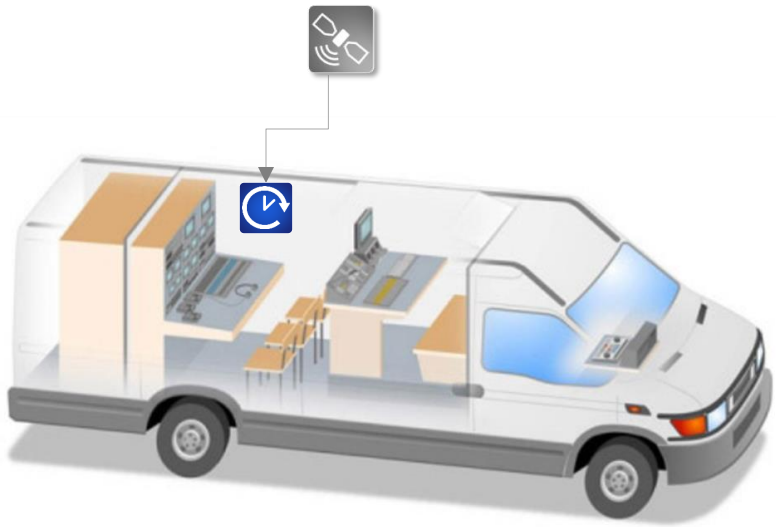
Video RTP packet
Audio RTP packet
Control/Metadata packet
ST 2059/ AES 67 packet

Given high accuracy timestamping of audio and video, additional information (Metadata) such as subtitles and languages can more easily be added to content streams.

Editing & production also is facilitated given all video and audio can be synchronized at the production facility now that all content at the packet level is timestamped with SMTPE 2059 and/or AES 67.

Given all content is packetized and synchronized, production now can happen anywhere

Use Cases: Simple mobile applications



A Master clock source can be added to a mobile unit easily to provide timing to all equipment used to capture audio and video in the field.

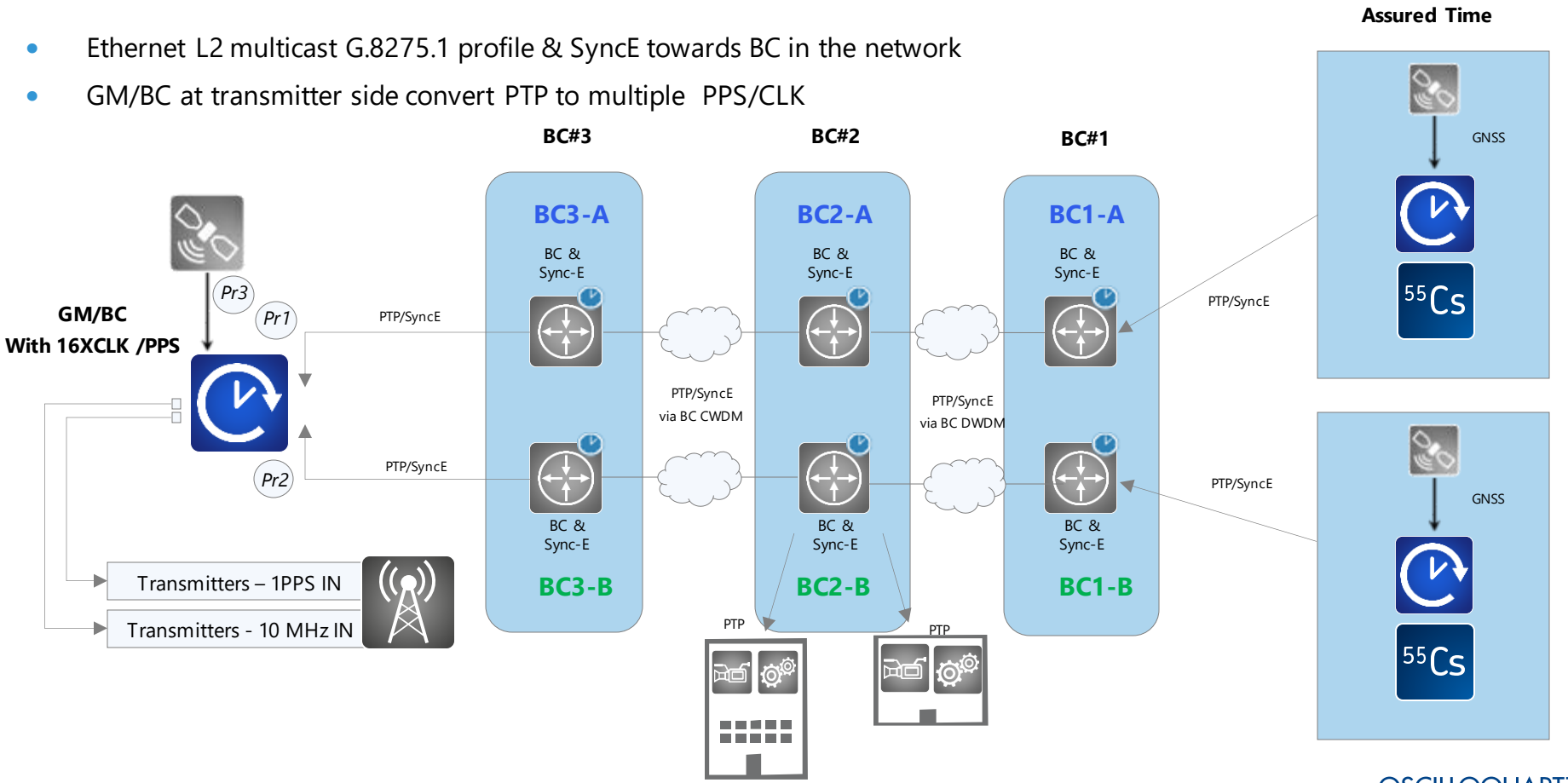
This is a typical scenario for compact Grandmaster clocks that require little or no additional physical space required.

Enable 2110 in mobile units.

Small mobile solutions are key for flexible deployment

Other applications in broadcast

- Ethernet L2 multicast G.8275.1 profile & SyncE towards BC in the network
- GM/BC at transmitter side convert PTP to multiple PPS/CLK



Takeaways

- Next generation broadcast applications are moving to IP to take advantage of lower cost and flexibility offered by IP technology.

- IP delivers higher flexibility for broadcast services but timestamping and network engineering are critical for meeting expected QoS.
  - Audio is also streamed with metadata and these streams must **reliably** align with video when transmitted over asynchronous IP network connections.
  - **Reliable** time sources must be deployed so that all content created in IP, can be produced, edited and transmitted with high resolution content with expected QoS.

- Risks from GNSS reliance must be considered and planned for in order to ensure service availability. Better oscillators, newer technologies & redundancy are key.

Thank you

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