GATESAIRCONNECT VIRTUAL events

CLOUD DELIVERY OF ATSC 3.0 VIA SECURE RELIABLE TRANSPORT

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TELEVISION TRANSMISSION

MOTIVATION (1)

- Evolving to NextGen TV is unlike the NTSC – DTV conversion.
  - Channel sharing with host and guest stations
  - Likely to involve disparate locations of contributors and transmissions
- Many architectures and ideas have been floated regarding delivering NextGen TV to consumers.
  - Classic single transmission site
  - Single Tx augmented with SFN fillers
  - Completely distributed SFN architecture
  - Gap fillers as necessary

MOTIVATION (2)

- The change to shared infrastructure brings opportunity to evolve distribution to transmitter sites.
- Classic “one studio, one transmitter site” paradigm is shifting.
- High speed connectivity is on the rise everywhere.
- Broadcasters are moving to cloud encoding today.
  - OpEx vs. CapEx
  - COTS server hardware today is extremely powerful.

- COVID-19 is teaching us the extent of things we can do with broadband connectivity and accelerating plans of moving to the cloud.

WHY SECURE RELIABLE TRANSPORT (SRT)

- Secure: Encrypts content in accordance with AES 128, 256
- Reliable: Recovers from severe packet loss
- Transport: Dynamically adapts to changing network conditions.

- Designed for high quality, secure, low latency transport of video over public internet via modified UDP based Data Transfer Protocol (UDT).
  - TCP guarantees delivery, but control of latency and buffering are concerns.
  - UDP gives high throughput and low latency but no delivery assurance.
  - SRT incorporates innovative technology to overcome UDP's "best effort" reputation.

- Scalable
- Firewall friendly
- Open Source: Community can extend and enhance.

GATESAIR VIRTUAL events SRT ALLIANCE

Haivision

WOWZA media systems

ADTEC Digital

APT American Public Television

AVIWEST Shaping tomorrow's live video

BOLIN TECHNOLOGY

COMCAST TECHNOLOGY SOLUTIONS

DAZZL.TV live made easy

dtv INNOVATIONS

ENENSYS Networks

EUR(O)VISION SERVICES

GATESAIR

grass valley

harmonic

Imagine COMMUNICATIONS

IQ BROADCAST Total Broadcast Solutions

kamoov HD Mobile Livestreaming

>URRENT

LIVEX

M2A Media

MediaKind everyone. everywhere.

Microsoft

NAVER

NETZEAL

OOYALA

PERFORM SPORTS CONTENT & MEDIA

RED BEE PART OF ERICSSON

sencore

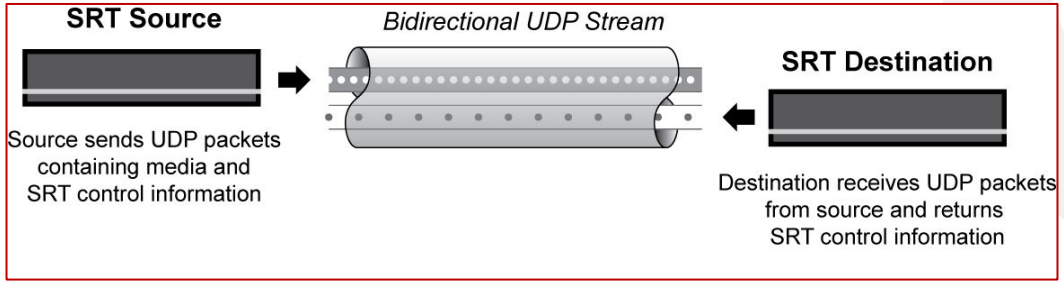
STREAM REPUBLIC

televideo OUTSIDE BROADCASTS & PRODUCTION

TELVUE

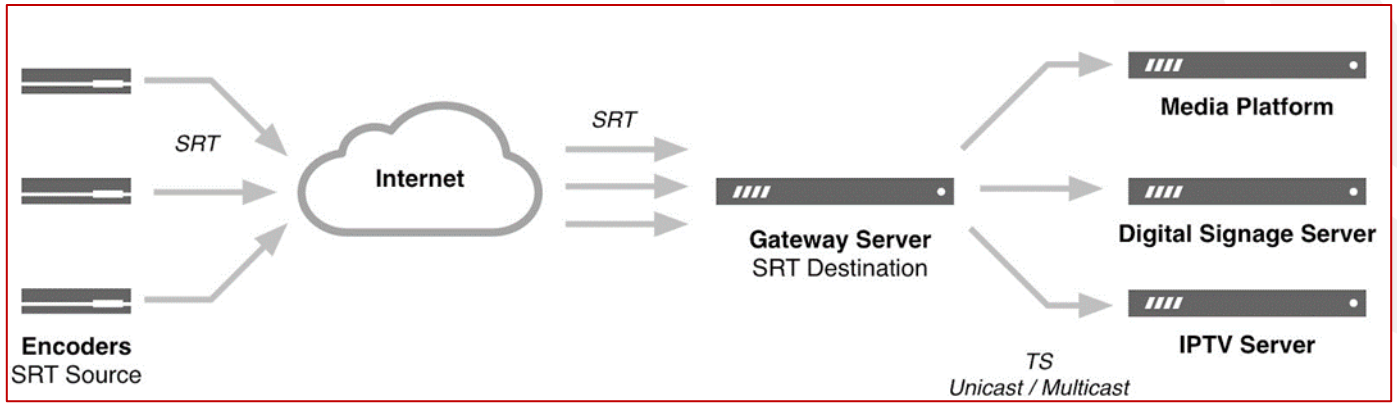
United Teleports

SRT BACKGROUND

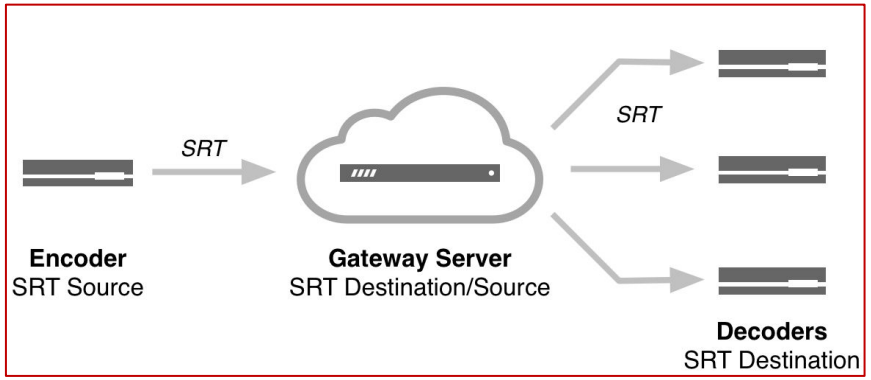


- SRT is a connection-oriented protocol.
- Provides transport of media and control messages.
- Caller, Listener, Rendezvous modes to establish handshake
  - Independent of Source and Destination

SRT FLEXIBILITY / SCALABILITY



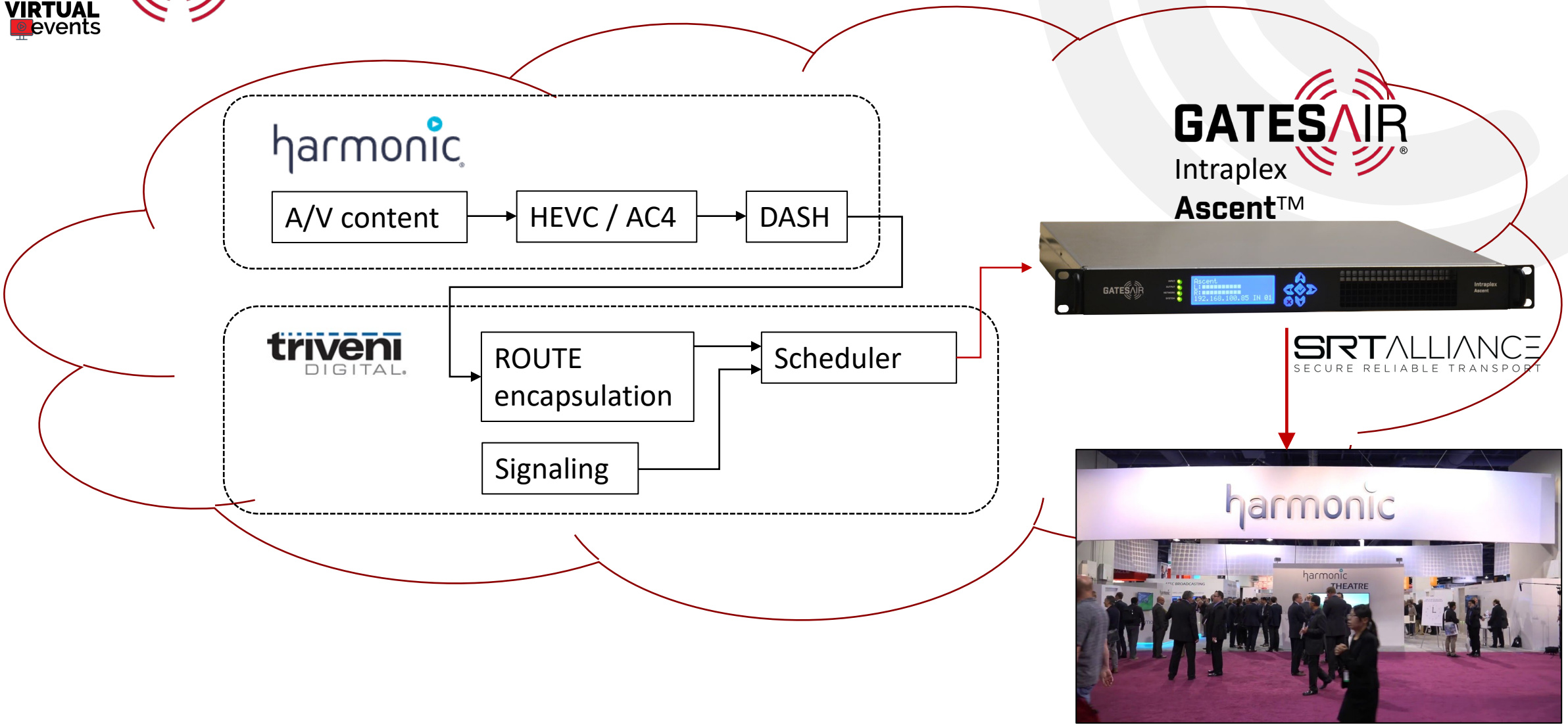
- Multiple sources
- Multiple destinations



ATSC 3.0 TRANSPORT

- ATSC A/324 STL standard was originally multicast-only
- Recent update added unicast to accommodate for smaller internet providers that may have difficulty in properly provisioning for multicast traffic.
- Security of A/324 transport is evolving, however it is rooted in norms of the broadcaster having physical presence at each end of the STL.
  - Not necessarily cloud friendly
  - Authentication, not encryption.

NAB 2020 PLANNED DEMO

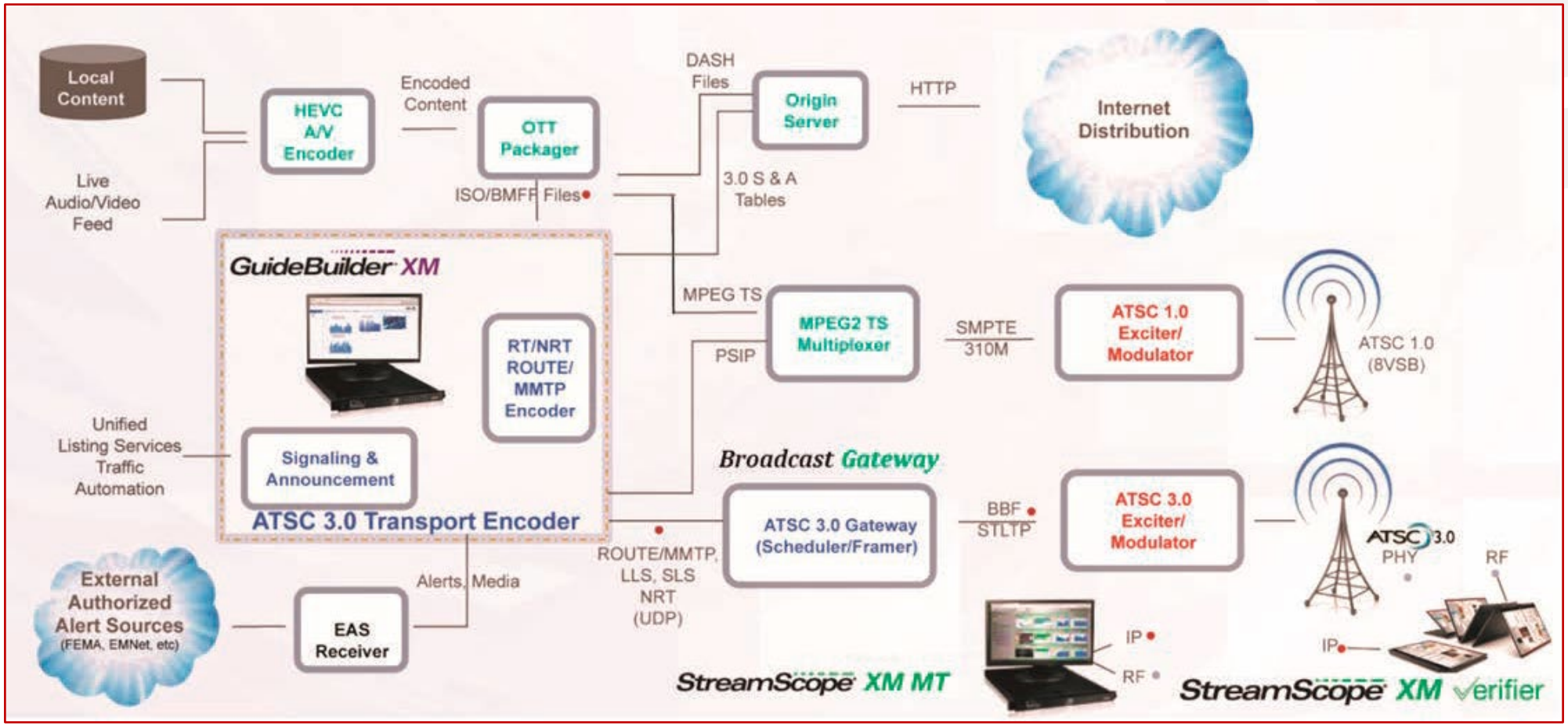


NAB 2020 PLANNED DEMO

Inter-booth IP links

ALTERNATIVE TO NAB IMPLEMENTATION

triveni DIGITAL



TRIAL IMPLEMENTATION

Princeton, NJ

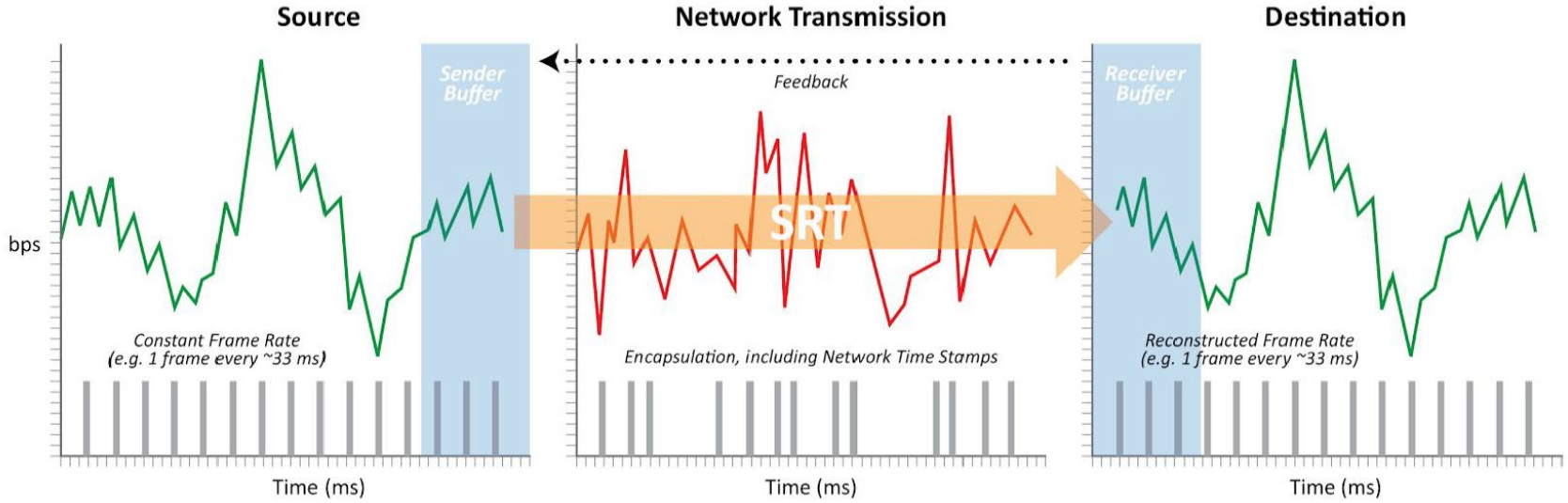
Mason, Ohio

MITIGATING NETWORK IMPERFECTIONS

- Secure Reliable Transport
- SMPTE-2022 Forward Error Correction
- Network Diversity

SRT MITIGATIONS

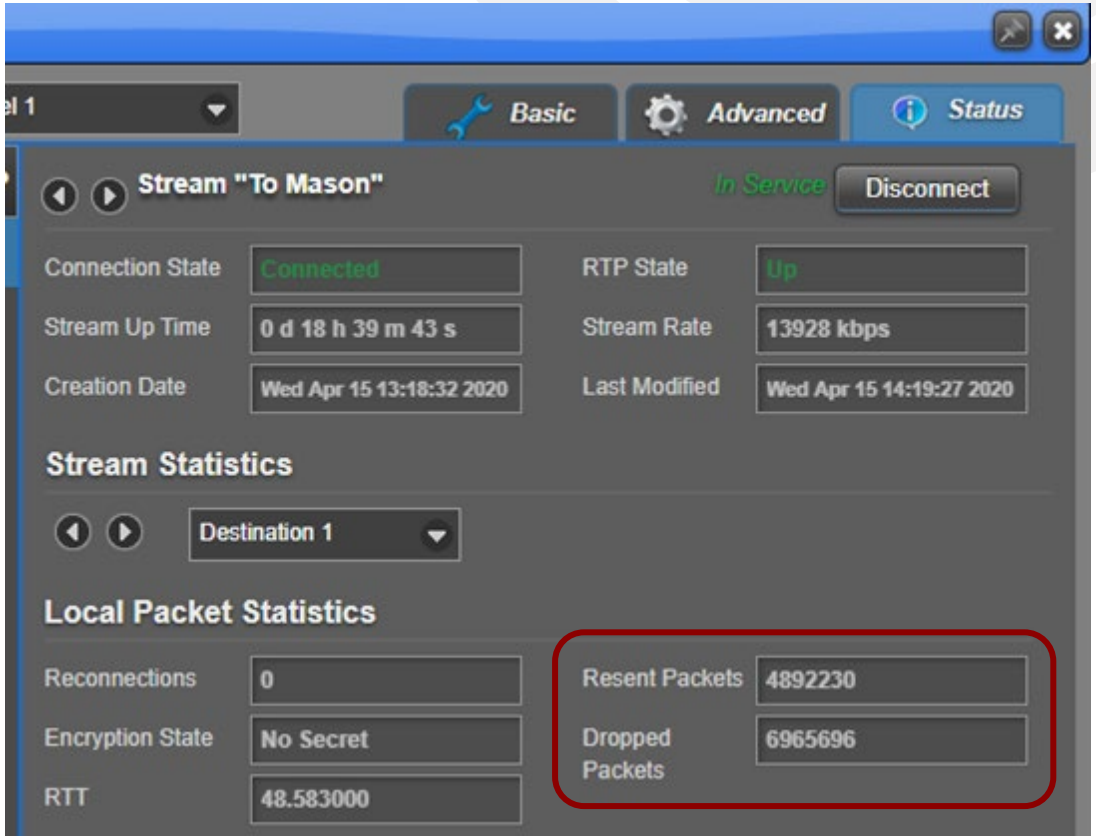
- Within SRT's algorithms are measures to mitigate the effects of delays, jitter and packet loss.
- Large buffers help, but at the expense of latency.
- SRT implements a mechanism that recreates the input signal characteristics on the receive side, which serves to reduce the need for buffering.



SOME SRT TERMINOLOGY: TRANSMIT SIDE

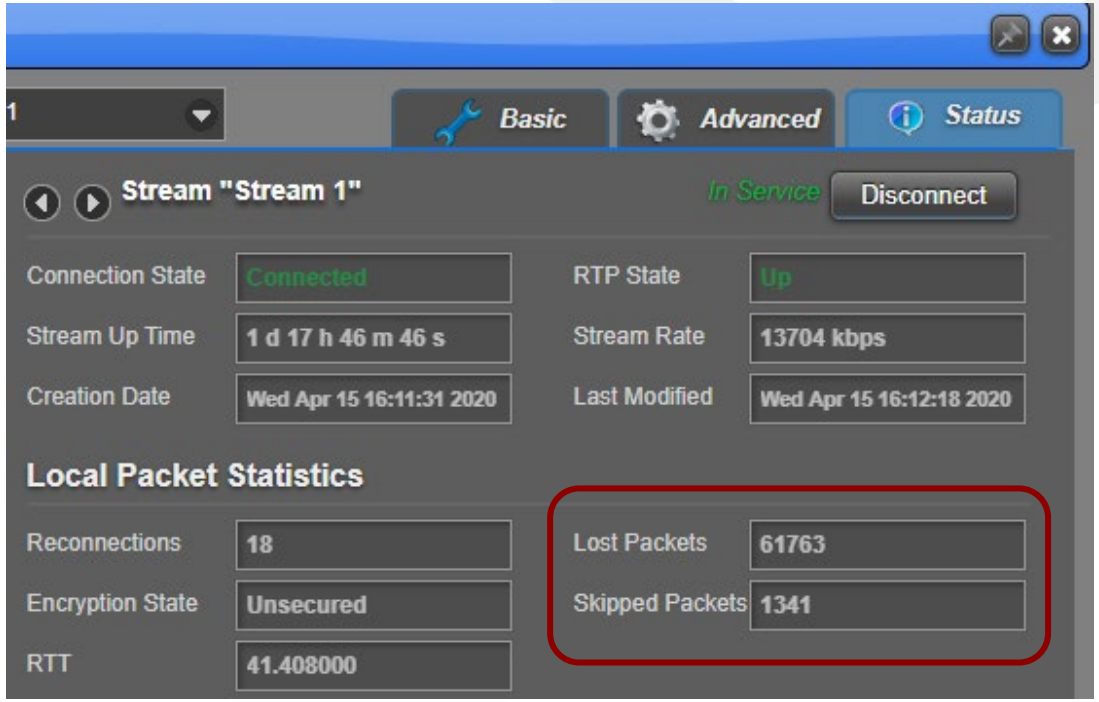
- Resent Packets: Number of packets retransmitted based on reports from the destination device.

- Dropped Packets: Number of Packets reported missing by the destination device. (Raw number dropped by the network.) These may be recovered by retransmission by the source. In the SRT streaming paradigm, these do not necessarily result in video artifacts.

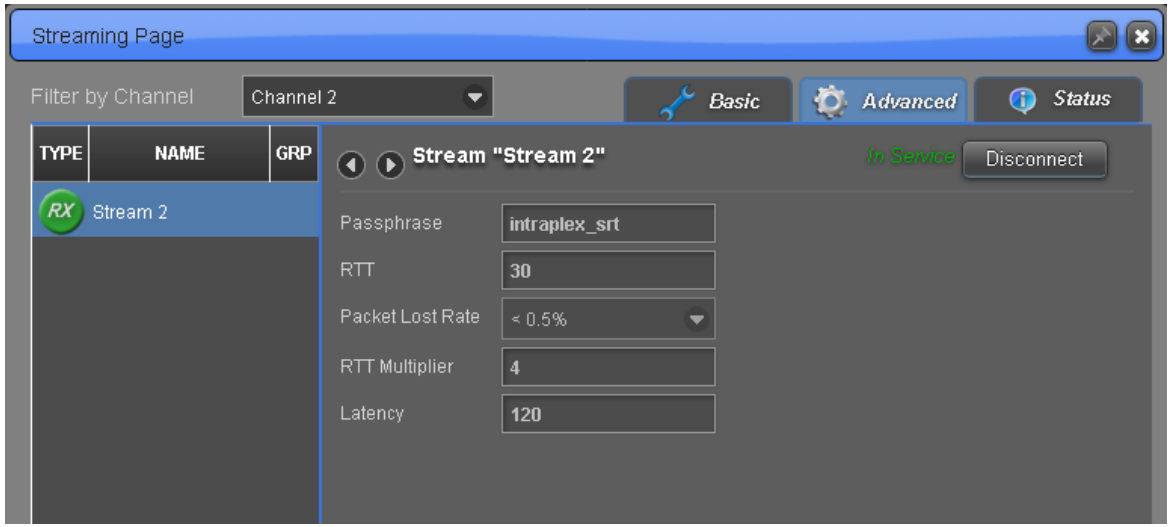


SOME SRT TERMINOLOGY: RECEIVE SIDE

- Lost Packets: Number of packets reported missing by the decoder.
- Skipped Packets: Packets that have arrived at the receive side too late or never at all.
  - If the time_to_play a packet has passed
    - Not at the decoder yet
    - Content it is associated with already played
  - Reported as skipped.
  - In SRT paradigm of video streaming, results in video artifact.



SRT LINK TUNING



- Passphrase: Used for AES encryption.
- RTT: Round Trip Time for packets on the link.
- RTT Multiplier: Controls stream latency factor, can be set with an estimated packet loss rate for the link.
- Latency: Determines how long to keep packets for retransmission.

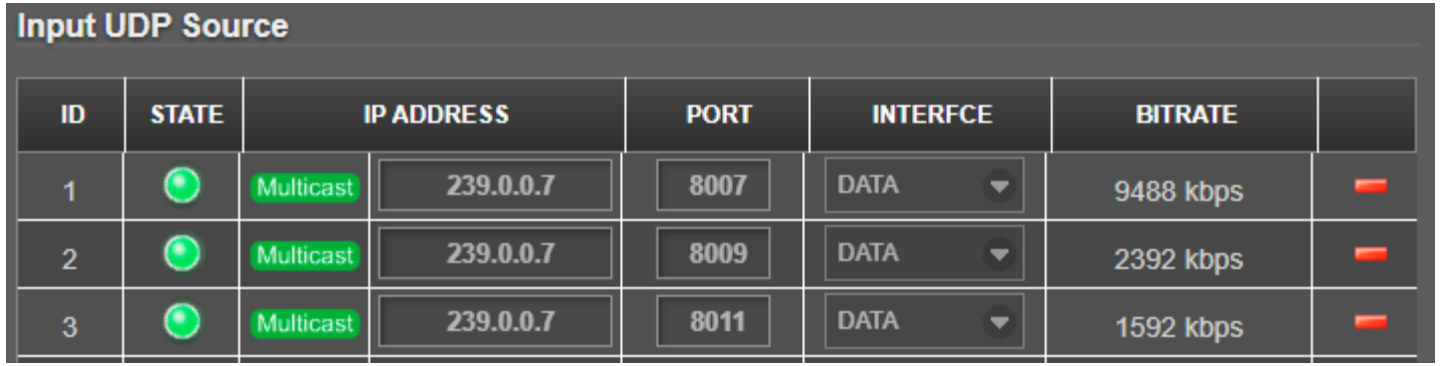
SRT LINK TUNING

- SRT's paradigm for streaming video involves managing factors of RTT, Latency, link bandwidth / dynamics as well as encoder rates.
  - This works well with streaming video.
  - SRT guides implementers on how to use ping or other network tool to help with RTT, packet loss rate, latency, etc. to set up buffers appropriately to achieve desired link performance.

- ATSC 3 A/324 STL link is:
  - Constant bit rate, set by physical layer parameters set up in the Scheduler
    - Good news: We know what it is and can lock down QoS and desired overhead with provider, etc.
  - Intolerant to packet loss.

SMPTE-2022 FORWARD ERROR CORRECTION

- ATSC A/324 specifies SMPTE-2022-1 Forward Error Correction
- ST-2022 FEC can be added to the SRT tunnel via *UDP Multiplexing* to be used by the ATSC 3 exciter.



SMPTE-2022 TUNNELING

Ascent SRT Sender:

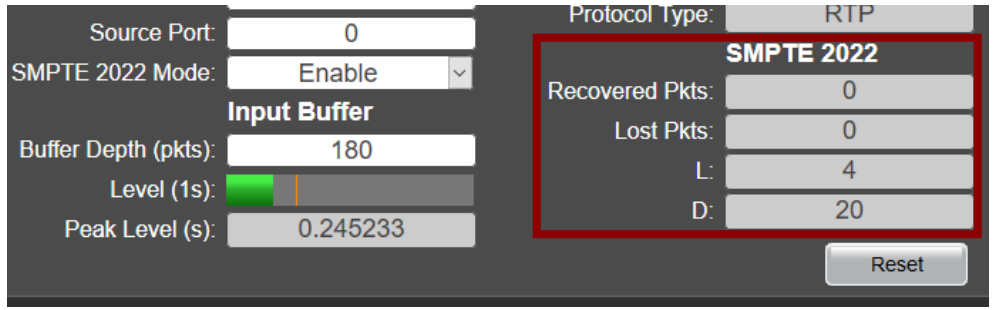
Input UDP Source

ID	STATE	IP ADDRESS		PORT	INTERFCE	BITRATE	
1		Multicast	239.0.0.7	8007	DATA	9488 kbps	
2		Multicast	239.0.0.7	8009	DATA	2392 kbps	
3		Multicast	239.0.0.7	8011	DATA	1592 kbps	

Ascent SRT Receiver:

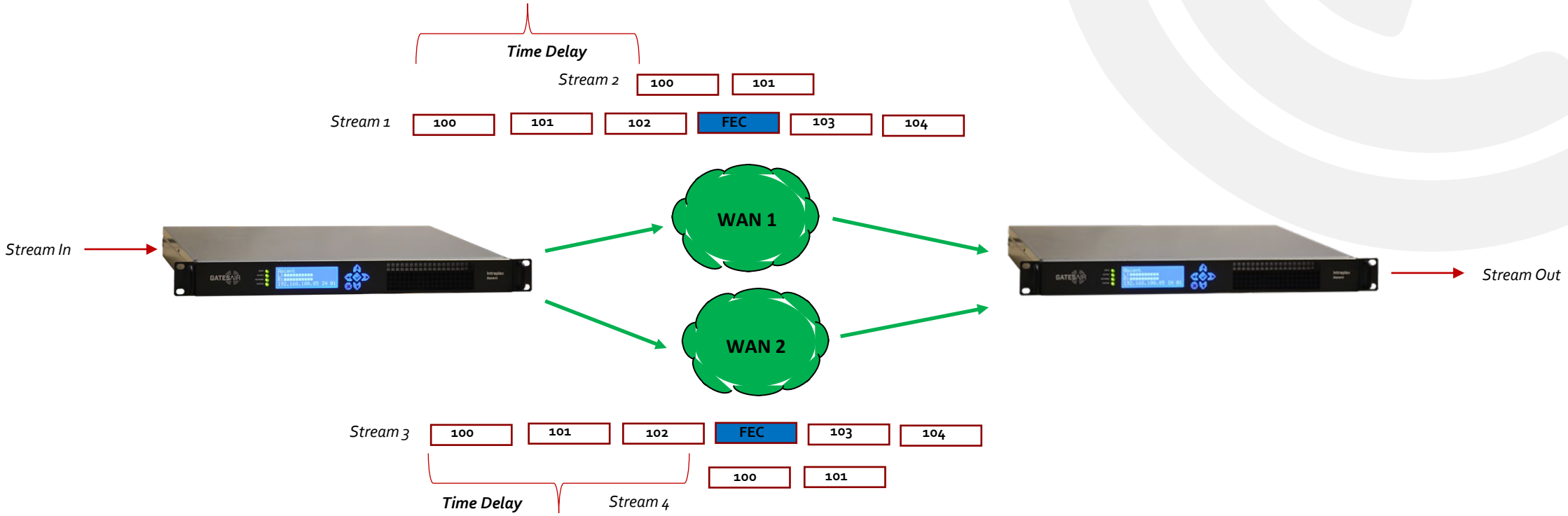
Output UDP Destinations

ID	STATE	IP ADDRESS		PORT	INTERFCE	BITRATE	
1		Multicast	239.255.151.1	50151	WAN1	9504 kbps	
2		Multicast	239.255.151.1	50153	WAN1	2392 kbps	
3		Multicast	239.255.151.1	50155	WAN1	1592 kbps	



XTE ATSC 3.0 Exciter

DYNAMIC STREAM SPLICING



- Streams sent across two network paths.
- “Hitless” operation with packet and network losses.
- SMPTE 2022-7

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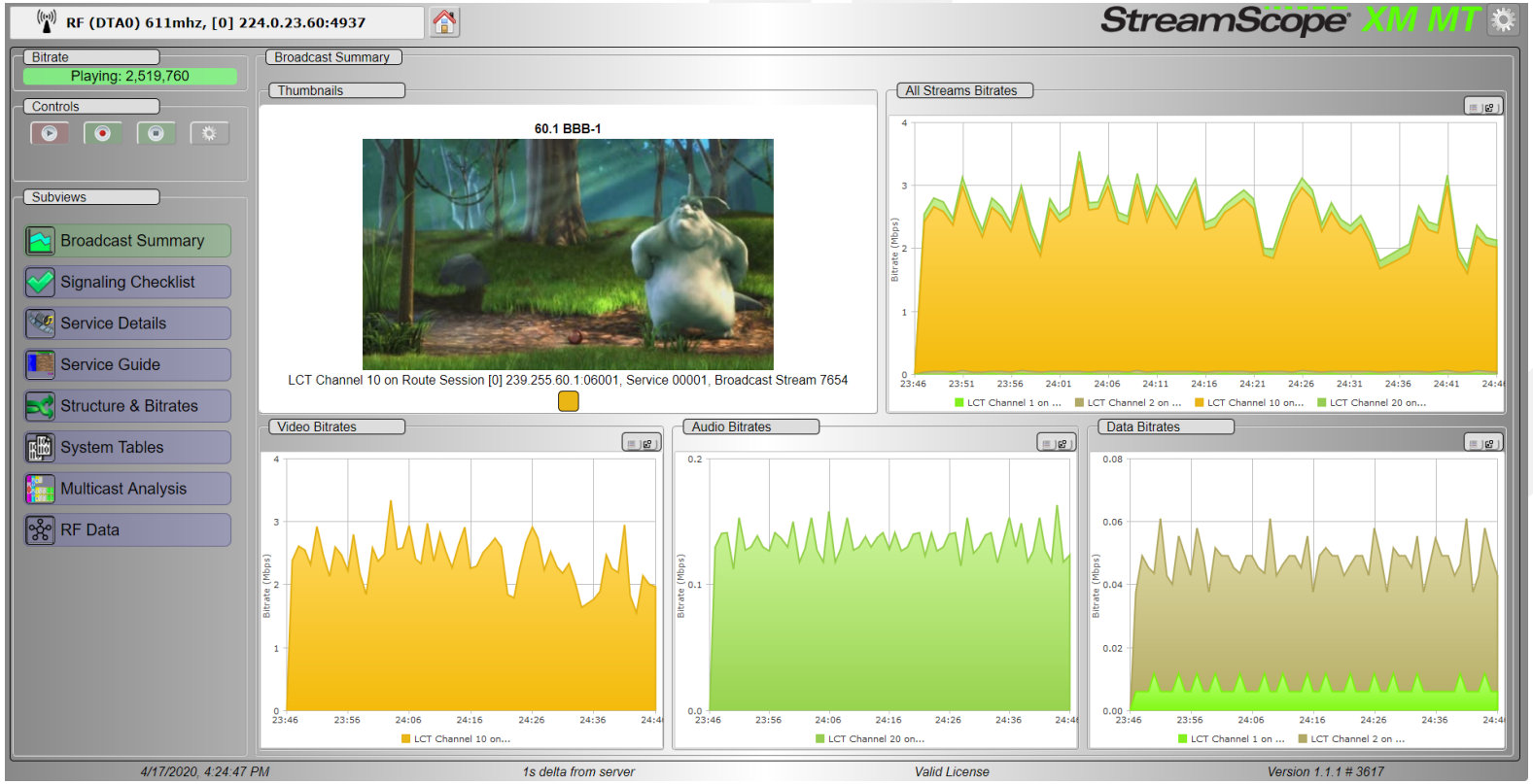

Received on
Triveni StreamScope XM MT

Received on LG TV

CREDITS

- Many thanks…

- Triveni Team:
  - Dave Catapano, Senior Vice President, Engineering
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  - Ralph Bachofen, Senior Vice President, Sales and Marketing

- GatesAir team:
  - Gavin Gundler, Software Engineer
  - Keyur Parikh, Vice President, Intraplex™ Products

- Harmonic:
  - Joel Wilhite, Senior Systems Design Engineer

FURTHER READING

- “Cloud Ingest of Live Video – An open approach to RIST, SRT and retransmission protocols”
  - https://netinsight.net/wp-content/uploads/2019/05/Cloud-Ingest-of-Live-Video-An-open-approach-to-RIST-SRT-and-retransmission-protocols.pdf

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THANK YOU

QUESTIONS?

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