Transporting ST2110 over WAN
VSF Technical Recommendation
Activity Group

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To enable effective transport of ST2110 media flows and associated control data across Wide Area Networks in an interoperable manner.

Key Activity Group Objective & timings

Phase 1: NAB 2019
Phase 2: IBC 2019
Activity Group Team represents:

- Vendors: Nevion, Imagine, GV, Evertz, Netinsight, Matrox, Medialinks, Mellanox, Packetstorm, Intopix, Sony, Artel
- Users: Disney DTCI, (BT), BBC, ESPN, AT&T, Century Link, Zayo, IRT
Key user scenarios:
Event remote production connectivity
Inter-company facilities connectivity
Intra-company facilities connectivity
ST2110 over WAN for inter-facility & OBs

- Flow protection ✓
- Flow trunking ✓
- Essence alignment ✓
- Low latency handling
- Format conversion
- Compression ✓
- Protection of other data flows ✓
- Security
- PTP trunking
- Wan timing
- Associated control (NMOS) filtering and border proxying
What we are talking about:

- LAN side
  - Video essences
  - Audio essences
  - Other essences
  - Control (IS04/5)
  - Campus PTP
  - Other IP data

- WAN side
  - Monitoring
    - Protection termination
    - Address translation
    - Transcapsulation
    - IS-0x reg/disc/ctl filter/proxy
    - Essence timing re-alignment
  - Other IP data

Composite or essence media

This is what we are defining

- Incoming flow time alignment
- -21 pacing/reshaping

(conforming incoming from WAN?)
Flow protection #1
- SMPTE2022-7 based
ST2110-WAN: Protection

• Dual path protection will use ST2022-7
• FEC on individual essence flows (all media types) will use bounded ST2022-5
  – Receivers shall support a matrix product of at least 100
  – Transmitters shall be configurable to use a matrix whose product is 100 or less
• Single FEC - 2D column-only (as opposed to 1D which is inherently row based)
• FEC on trunk (the GRE over RTP option) will use the same restrictions as above
• Aim to keep latency as low as possible (important for low bit rate flows)
• RIST for OTT transport could be explored later
Flow protection #2
FEC – ST2022-5 based
constrained to LxD product of 100 maximum
Trunking essences

2110-20
2110-30
2110-30
2110-40
OTHER STUFF

TRUNK
ST2110-WAN: Flow trunking

- Basic trunking option using GRE over UDP (RFC8086) as-is
  - This is to be used in cases when protection of the trunk is not required
  - Protection of the essences (2022-7 RTP merge and 2022-5 FEC) can be applied
  - Mandate use of the 32-bit SN for trunk integrity monitoring
  - Note that key switch vendors appear to NOT currently support this

- Trunking using GRE (RFC2784) over RTP (RFC3550) with 2110-style SN extension
  - Use for cases where protection is needed at the trunk layer
  - This needs to be defined (see proposal in subsequent slide)
  - Use 2022-7 for RTP merge and (constrained) 2022-5 for FEC (as per previous slide)
  - Consideration for RFC submission (not necessary – precedent exists)
Trunking encapsulation

Original packet

The original IP packet with GRE over UDP header

The original IP packet with GRE over RTP header

The original Ethernet packet with GRE over RTP header
2022-7 protection at essence or trunk
GRE over RTP

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<th>RTP TSP</th>
<th>RTP SSRC</th>
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<th>GRE HDR</th>
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<th>Payload (IP or Ethernet)</th>
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Protection of other data
ST2110-WAN: Protection of other data

- Service providers and broadcasters have desire to trunk other IP data (TCP or UDP) with similar protection (specifically 2022-7 style)
- The GRE over RTP defined previously would allow both RTP merge and FEC to be applied if desired
- Differentiation of non-RTP traffic recommended so it protects optimally i.e. existing 2022-7 dual RTP flow best transported on two independent tunnels
- Broadcasters have other ‘stuff’ to carry in tunnel – not necessarily ST2110
Reconciling essence timings for WAN
• Essence realignment refers to the temporal realignment of the individual essence flows that constitute a wholistic media signal to ensure they are temporally in synchronization.

• Essence alignment consideration:
  – On transit off-campus
  – On transit on-campus

• Signals may be carried as native 2110 or in some other format on WAN

• Alignment is essential when converting to composite flow (e.g. ST2022-6)

• Alignment is optional when transiting WAN as ST2110 essence

• Statement on relative timing of essences being essential .... NEEDS MORE WORK
  – Production intent
  – Presentation time (actual vs presentation)

• RTP should be preserved within WAN transport, to allow for far-end re-alignment

• Look to further work on carrying origination time that may be of use....
Compression

LAN uncompressed

WAN compressed
• Recognize that long-haul WAN connectivity can be too costly to use uncompressed in some scenarios

• Define compression type, profile and bit-rate range to be used
  – TR-01 100-200Mbps for 1080i/720p, 150-300Mbps for 1080P
  – TR-01 already has maximum and minimum rates recommended – should they be narrowed?
  – AT&T (Nick) - expand up to 500Mbps for 1080P?

• Do we want to specify TR-01 2018 ULL for some use cases?

• Consideration that JPEG-XS may well be a good candidate for recommendation within the next 12 months
MTU/fragmentation

- GRE over UDP already addresses fragmentation
- The GRE over RTP should adopt the same text/recommendations as GRE over UDP
- Recommend that controllable media flow sources ensure packet lengths sufficiently small to avoid risk of reaching max MTU/fragmentation when wrapped
- For generic TCP data sources industry best practice (e.g. MSS clamping) should be used to minimize likelihood of fragmentation
- Other data sources (e.g. VPN data) may well default to max MTU and will be the likely area of unavoidable fragmentation
Discovery & control - filtering & proxy
IS-0X discovery/reg/control transport proxy

Campus facility 1

Campus facility 2
Other topics - Transcapsulation

ST 2110

ST 2022-6 or ST 2110
Other topics - Security

Connectivity Security

Will reference other work on best practice

Content Security
Other consideration - PTP trunking
Timing domains

- ST 2110 LAN
- ST2110 or ST2022-6 or ST2022-8
- PTP
Thank you to those who have been involved
There is still time for other input

vsf.tv

http://vsf.tv/SMPTE_ST_2110_over_WAN.shtml
Thank You
Do come and see us SU5510
We do a nice cup of tea!

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