IEEE 1588/802.1AS Synchronisation for RTP Streams
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Abstract

Specification of an RTP header extension for carrying in-band synchronization metadata provided by the IEEE1588/802.1AS Precision Time Protocols.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

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1. Introduction

Synchronisation between RTP flows and between devices rendering RTP flows is currently facilitated by means of NTP format timestamps taken with respect to a shared reference clock. In professional AV applications, the NTP clock synchronisation protocol does not meet the time alignment and synchronisation speed requirements of many systems.

Like NTP, the IEEE1588 family of clock synchronisation protocols provide a shared reference clock in a network - typically a LAN. IEEE1588 provides sub-microsecond synchronisation between devices on a LAN and typically locks within seconds at startup rather than minutes. With support from Ethernet switches, IEEE1588 protocols can achieve nanosecond timing accuracy in LANs. Network interface chips and cards supporting hardware time-stamping of timing critical protocol messages are also available.

When using IEEE1588 clock synchronisation, networked AV systems can achieve sub 1 microsecond time alignment accuracy when rendering rendering of AV signals and can support latencies less than 1ms through a gigabit LAN.

Two main flavours of IEEE1588 are in use today:

- IEEE 1588-2008: the second version of the "Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems". This is a revised version of the original IEEE1588-2002 standard and is often called IEEE1588v2 or PTPv2.

- IEEE 802.1AS: "Timing and Synchronization for Time Sensitive Applications in Bridged Local Area Networks". This is a Layer-2 only profile of IEEE 1588-2008 for use in Audio/Video Bridged LANs.

By using an IEEE 1588 derived reference clock, synchronisation of RTP streams and devices in LANs can be considerably improved.

2. Timestamp formats

A global IEEE 1588/802.1AS timestamp is 80 bits in total, divided into two parts:

- AS_sec: 48 bits seconds since epoch
- AS_nsec: 32 bits nanoseconds
A shorter 32 bit timestamp is defined for use in streaming media protocols in the following way:

\[
\text{as\_timestamp} = (\text{AS\_sec} \times 10^9 + \text{AS\_nsec}) \mod 2^{32}
\]

The shorter as\_timestamp field covers just over 4 seconds of time.

3. Header Extension

IEEE 1588/802.1AS Synchronisation Header Extension

The fields are defined as follows:

- **subtype**: IEEE 1733 RTCP subtype field, see Section 4.
- **as\_timestamp**: a 32 bit IEEE 1588/802.1AS timestamp as defined in Section 4.
- **reserved**: as this specification evolves, additional fields are expected to be included in this header.

4. IEEE 1733 / RTCP

IEEE 1733 defines an RTCP header extension which also includes 802.1AS timestamp information. The IEEE 1733 RTCP extension signals information in addition to timestamps, including:
subtype an RTCP subtype

gmIdentity an 80 bit field uniquely identifying the current 802.1AS
grand master clock for the network

stream_id a 64 bit number identifying the 802.1Qav stream associated
with this RTP flow

as_timestamp the 32 bit 802.1AS timestamp (Section 2) associated
with the RTP timestamp carried in this packet

rtp_timestamp the RTP timestamp of a media packet

5. IANA Considerations

TBD: A URN will be required to signal the presence of this header
extension, such as:

urn:ietf:params:rtp-hdrext:avb-sync

6. Acknowledgements

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate

7.2. Informative References


Appendix A. An Appendix
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