IEEE P1722 AVBTP assumptions

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Revision History

Rev	Date	Comments
0.0	2007-006-14	First version for comments, created from previous AVBTP presentations and key assumptions from Don Pannell's AVB assumptions presentation

References:

- Audio Video Bridging (AVB) Assumptions, Version 6 (Don Pannell)
  - http://www.ieee802.org/1/files/public/docs2007/avb-pannell-assumptions-0607-v6.pdf
- AVBTP Presentation Time (Dave Olsen)
  - http://www.avbtp.org/contributions/avbtp-olsen-presentation-time-0507.pdf
- Draft AVBTP over IEEE 802.3 AVB stream data format Version 0.02 (Alan Bartky)
  - http://www.avbtp.org/contributions/avbtp-bartky-proposed-stream-data-format-v0-02-2007-03-27.pdf
- AVB/AVBTP layering, management objects and data transfer processing study Draft 0.01 (Alan Bartky)
  - http://www.avbtp.org/contributions/avb-bartky-end-station-study-0507-v1.pdf

Important Notes from Editor

- **This is version 0.00, so I've done my best to try and collect what I believe to be consensus items collected to date from formal proposals reviewed at our teleconference meetings. I cannot promise I have gotten all them correct.**
- **Please review all consensus items and if you do not consent to them, please let the editor and the rest of the team know (i.e. silence implies consensus). We will use our first formal face to face to formally review all consensus items.**
- **This version has also more detail on Encapsulation than other sections. My intent is to use our next face to face verify all consensus encapsulation items and start editing the details into a draft 0.00 AVBTP specification, removing low level details and then making this document high level only.**

Overview

- This document is to collect high level requirements, ideas, concepts, etc. for Audio/Video Bridging Transport Protocol (AVBTP) for use in:
  - Building and verifying Consensus on key items
  - Documenting those key items for work on the main specification and other documents/contributions
  - Using as a checklist to make sure key items are taken care of.

Overview (continued)

- This document is broken up into major sections as follows:
  - General (leader: Alan Bartky?)
  - Encapsulation (leader: Alan Bartky)
  - Timing and Synchronization (leader: Matt Mora)
  - Session Management (leader: John Fuller)
  - Protocol layering and selected options from other protocols (e.g. 802.1AS, 802.1Qat, 802.1Qav, etc.) (leader: Alan Bartky?)
- For each assumption, it will be identified as a item that is:
  - Approved by Consensus
  - Proposal
  - Question
  - Work Item

General Assumptions

- Approved by Consensus:
  - AVB Class 5 together with AVB Class 4 cannot use more than 75% of a link's bandwidth
    - The Remaining 25% (or more) is used for Legacy (non-AVB) flows
  - Functional Device Type Names
    - AVB will use Talkers, Listeners & Bridges
    - Talker is the source of a Stream, Listener is a receiver of a Stream
    - A Bridge is an 802.1 Bridge
    - Any physical device could be any combination of these
  - An AVBTP stream is between one talker and one or more listeners

General Assumptions

- Proposals:
  - Keep the AVBTP document “simple and pure”. No control/discovery/etc.
  - Keep it simple and close enough to 61883 that bridging to/from the most common forms of 1394 isochronous streams is a straight-forward problem that can easily be done in hardware.
  - AVBTP should be a virtual cable

General Assumptions

- Questions:
  - How much should we work on 1394 to IEEE-802/AVBTP interworking?
  - Will AVBTB have to do any policing or scheduling?
    - Do we need a group to study this, or should we add this to the work of things to do in the Timing/Synchronization team?
- Work Items:
  - *None at this time.*

Timing and Synchronization

- Approved by Consensus:
  - Shall use 802.1AS for global time base
  - Shall be able to react to change in global absolute time (user changing time of day, change in Grandmaster, etc. (see 802.1AS assumptions from AVB document).

Timing and Synchronization

- Proposals:
  - If possible we should have only one format and interpretation for the AVBTP timestamp field for "timestamp valid" for 61883 type encapsulation.
    - Current format proposals are:
      - 0-999,999,999 Sub-seconds in nanoseconds (1588 like)
      - 0-0x3FFFFFFF Sub-seconds in power of 2 fractions of a second (NTP like)
      - 0-0x3FFFFFFF Least significant 30 bits of nanoseconds since epoch
    - Current interpretation proposals:
      - Presentation time (61883 like)
      - Source sample time (RTP like)
      - Application dependent

Timing and Synchronization

- Proposals:
  - Presentation time assumptions/proposals:
    - The Presentation Time has the following purposes:
      - Reconstruction of the media clock
      - Account for link latency
      - Possible Synchronization of streams
      - AVBTP Presentation time is only associated with a single AVBTP stream
      - Presentation time is relative to the 802.1as clock
    - Ingress time is when the sample is sent to the AVBTP layer
      - On an I2S interface this is a 802.1AS timestamp of the word clock transition for the received sample.
    - Egress time is the Ingress time plus a delay constant

Timing and Synchronization

- Proposals:
  - Presentation time assumptions/proposals:
    - Possible Presentation Time Formats
      - Egress Time (30-64 bits)
      - Ingress Time (64 bits) + offset (30 bits?)
      - Ingress Time (64 bits)
      - Requires some negotiated or default delta between ingress and egress
      - Additional setup information required to be defined

Timing and Synchronization

- Questions:
  - Should this team also work on queuing, policing and scheduling topics?
  - Will we work on a MIB/Management interface definition for this?
- Work Items:
  - Define what is or isn't done by transport layer (i.e. what is done by applications versus the transport layer itself)
  - Design and specify timing/synchronization methods, protocols, formats, etc.
  - Design Timing/Synchronization service interface.

Session Management

- Approved by Consensus:
  - Shall use LLDP(802.1AB), SRP(802.1Qat) as protocols of the Session management protocols and procedures.
- Proposals:
  - Define a simple discovery/control method that can be used if there is no higher layer available. Just steal the 1394 AV/C
  - Provide interface to Zeroconf

Session Management

- Questions:
  - Are there other protocols needed at lower layers?
  - Are there other protocols we should provide a service interface to?
  - Will we work on a MIB/Management interface definition for this?
- Work Items:
  - Protocol
  - State Machine
  - Service Interface

Protocol layering/options

- Approved by Consensus:
  - Shall directly interface with the following protocols
    - LLDP(802.1AB)
    - SRP(802.1Qat)
    - LLC (802.2), Ethertype option only (no length/DSAP/SSAP/etc. support).
  - Shall require use in the AVBTP end station of:
    - PTP(802.1AS)
    - 802.1Qav (queuing and scheduling)
- Proposals:
  - *None at this time.*

Protocol layering/options

- Questions:
  - Will we define any interface to use PTP via a system time interface (or will all PTP time aspects be outside of the scope of the transport layer and instead part of the application layer)?
- Work Items:
  - Ensure all service interfaces are defined for all layers needed by AVBTP either in the AVBTP document or in other documents.

Encapsulation Assumptions

- Approved by Consensus:
  - For AVBTP over AVB, MAC Destination Addresses shall always be multicast addresses and shall be unique for the Layer 2 network. This address shall be used for stream identification.
  - For AVBTP, the sender shall always send frames with 1st Ethertype field set to 0x8100 for 802.1 P/Q type.
  - Priority Code Point (PCP), 3 bits:
    - For data streams, AVBTP shall always specify class 5 or class 4 traffic.
  - Canonical Format Indicator (CFI), 1 bit
    - AVBTP will only support CFI of zero.

Encapsulation Assumptions

- Approved by Consensus:
  - VLAN Identifier (VID), 12 bits:
    - The VID is a VLAN and not a Stream Identifier
    - AVBTP stations must support VLAN ID of zero to send or receive.
    - AVBTP stations are recommended to support other VLAN IDs, but it is not required.
    - Receiving AVBTP stations not supporting or configured for a given VLAN shall discard any frames for which it is not a member of the specified VLAN.
  - AVBTP Shall use a unique Ethertype following the 802.1P/Q Ethertype and Data to identify an AVBTP stream.
    - Value of the Ethertype shall be specified at the proper time per IEEE procedures.

Encapsulation Assumptions

- Approved by Consensus:
  - AVBTP subtype field (8 bits):
    - 0x00: “61883 stream type data” (Editor’s note: placeholder name, suggestions welcome)
    - 0x01: “61883 stream type control” (Editor’s note: placeholder name, suggestions welcome)
  - AVBTP “other” field (8 bits):
    - This field is an 8 bit field reserved for use by AVBTP for additional data
  - AVBTP timestamp field (32 bits, 2 bit Time Qualifier, 30 bits Data)
    - Time Qualifier value of 11 binary shall be used to indicate “No data”
      - Other Values to be defined
    - Data field shall express time related to the 802.1AS Global Clock
  - 61883 type Length Field 16 bits
    - Same as used in 1394/61883 CIP header

Encapsulation Assumptions

- Approved by Consensus:
  - 61883 type Length Field 16 bits
    - Same as used in 1394/61883 CIP header
  - Isochronous Data Format (tag) field, 2 bits:
    - Supported by AVBTP:
      - 00 binary, “data field unformatted” (used by Instrumentation & Industrial Digital Camera (IIDC) 1394 trade association specification)
      - 01 binary, CIP header is present
    - Not supported by AVBTP:
      - 10 binary: Reserved by IEEE 1394
      - 11 binary: Global asynchronous stream packet (GASP) format
        - » Used in 1394 for Serial Bus to Serial Bus bridges
  - Type code (tcode), 4 bits:
    - For AVBTP, Shall be fixed value of 1010 binary (same as 1394 Isochronous packet format)

Encapsulation Assumptions

- Approved by Consensus:
  - CIP header 1st quadlet indicator, 2 bits
    - Fixed at 00 binary
  - Data Block Size (DBS), 8 bits
    - Same definition as currently in 61883, size of Data Blocks in Quadlets
      - 0: 256 quadlets
      - 1-255: 1-255 quadlets
  - Quadlet Padding Count (QPC), 3 bits
    - For all types of 61883 as defined today, this field is always zero.

Encapsulation Assumptions

- Approved by Consensus:
  - Source Packet Header (SPH) indicator, 1 bit
    - If one
      - Then AVBTP packet contains 61883-4 or 61883-7 (or future) source packets.
      - AVBTP timestamp at offset 24 shall be ignored and instead, timestamps with the source packet(s) shall be used instead.
    - If zero
      - Then AVBTP packet does not contain source packets (contains Data Blocks)
      - AVBTP timestamp field shall be parsed and processed

Encapsulation Assumptions

- Approved by Consensus:
  - Source Packet Header (SPH) indicator, 1 bit
    - If one
      - Then AVBTP packet contains 61883-4 or 61883-7 (or future) source packets.
      - AVBTP timestamp field in AVBTP header shall be ignored and instead, timestamps with the source packet(s) shall be used instead.
    - If zero
      - Then AVBTP packet does not contain source packets (contains integer number of Data Blocks)
      - AVBTP timestamp in the AVBTP header shall be parsed and processed.
  - Reserved (Rsv), 2 bits
    - Reserved (not used by 61883), set to zero
  - Data Block Count, 8 bits
    - Sequence number of 1st Data Block in the packet
    - Same meaning as in 61883 over 1394

Encapsulation Assumptions

- Approved by Consensus:
  - CIP header 2nd quadlet indicator, 2 bits
    - Fixed at 10 binary
  - Stream Format, 6 bits
    - Same values as currently defined for 61883
  - Format Dependent Field (FDF), 8 bits if SPH=0, 24 bits if SPH=1
    - Same values as currently defined for 61883
  - SYT field (1394 cycle time based presentation time)
    - Not mandatory for use by AVBTP end stations
    - Can be used by 1394 to AVB interworking units

Encapsulation Assumptions

- Proposals:
  - For all class 5 traffic, limit maximum transmission unit size in order to limit total transmission time on and 802.3 100 megabit (including preamble and inter-frame gap to 75% of 125µs)
  - For all 61883 type traffic, limit maximum data payload to 256 quadlets (1024 bytes)
  - If possible we should have only one format and interpretation for the AVBTP timestamp field for “timestamp valid” for 61883 type encapsulation.
    - Current format proposals are:
      - 0-999,999,999 Sub-seconds in nanoseconds (1588 like)
      - 0-0x3FFFFFFF Sub-seconds in power of 2 fractions of a second (NTP like)
      - 0-0x3FFFFFFF Least significant 30 bits of nanoseconds since epoch
    - Current interpretation proposals:
      - Presentation time (61883 like)
      - Source sample time (RTP like)
      - Application dependent

Encapsulation Assumptions

- Proposals:
  - For 61883-4 and 61883-7 traffic (packets that use Source Packet Header (SPH) option to carry MPEG compressed video data)
    - Change format and interpretation of presentation time field in the source packets from from 1394 cycle time to 802.1AS Global time.
    - Do not support fragmentation (if needed, that traffic can run using class 4 on non 8 KHz intervals).
    - Change Data Block Size from fragment size to entire MPEG packet payload .

Encapsulation Assumptions

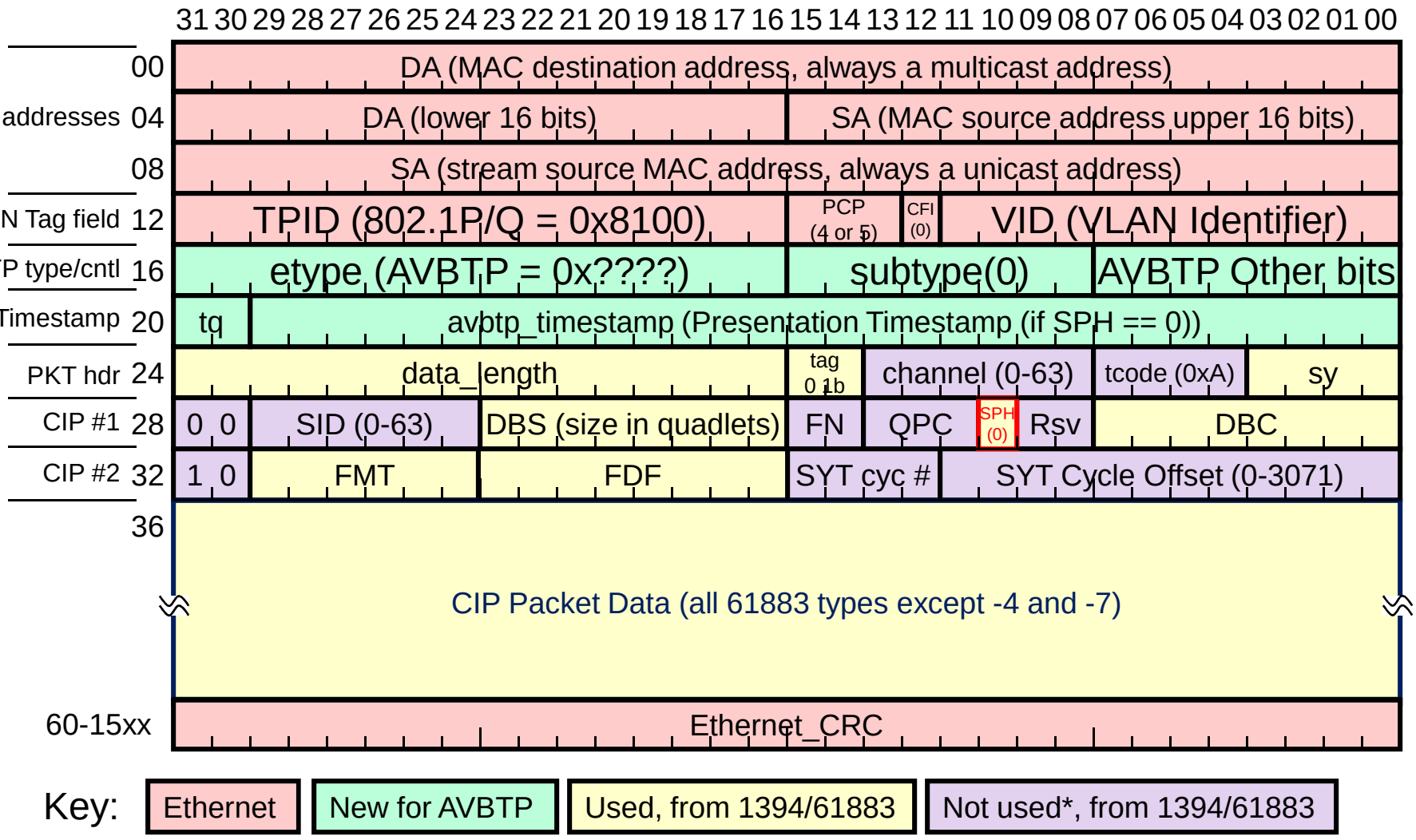
- Questions:
  - Should we standardize the length field for all AVBTP formats?
  - Is there other control traffic that will need other encapsulation options?
    - If so, do we also need to have any unicast of non-AVB stream multicast messages (such as RTCP or AV/C)?

Encapsulation Assumptions

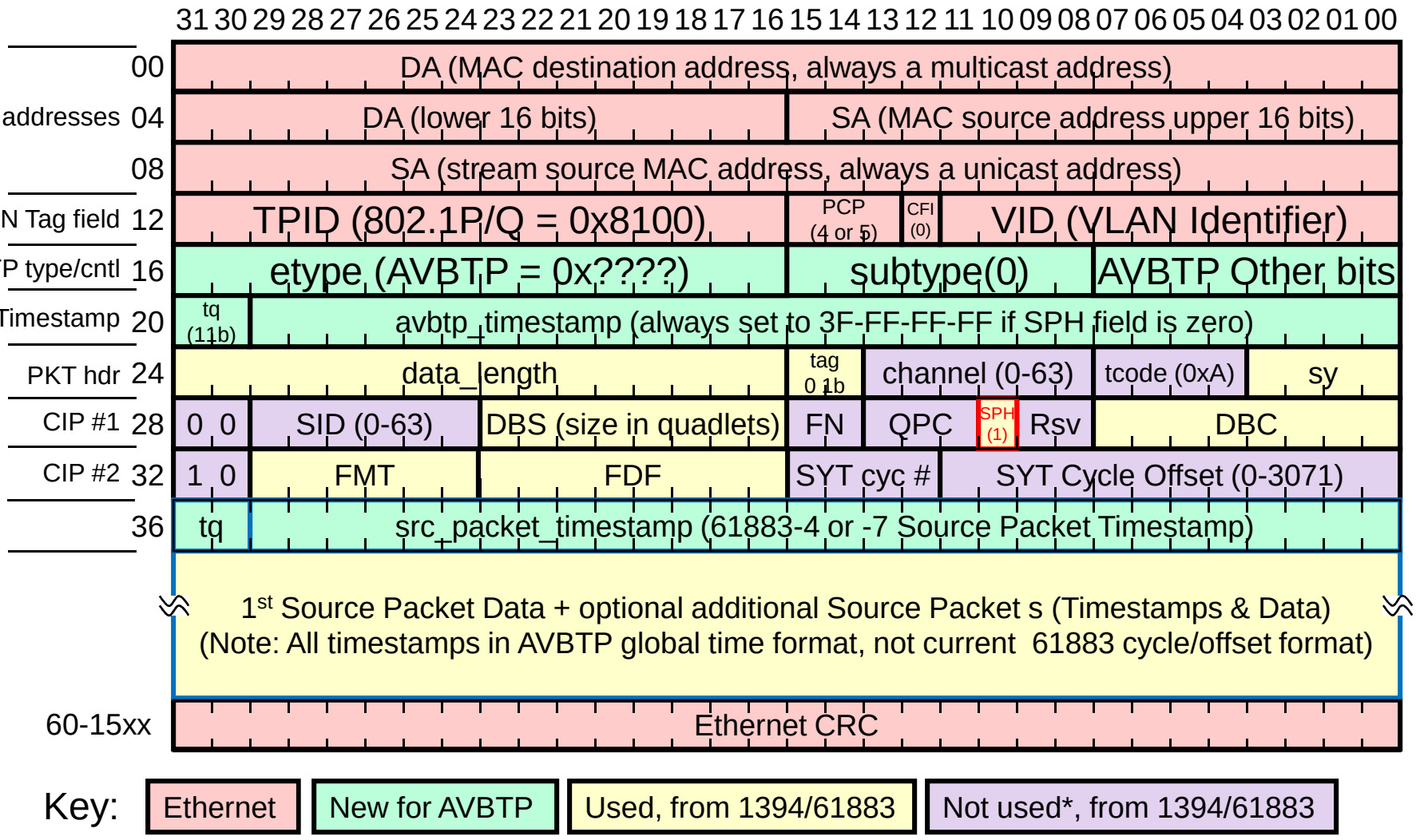
- Work Items:
  - Need to come up with format to allow proprietary encapsulations (define subtype and any fields we deem necessary to ensure consistency)
  - Need to define if/how the following 1394/CIP/61883 fields are to be defined and used (or not):
    - Channel ID (0-63)
    - Source ID (0-63)
    - Reserved (2 bits)
    - “sy” field (4 bits) (currently used by 1394 for Digital rights management).

Backup

Draft AVBTP CIP Stream Data packet, SPH(0)

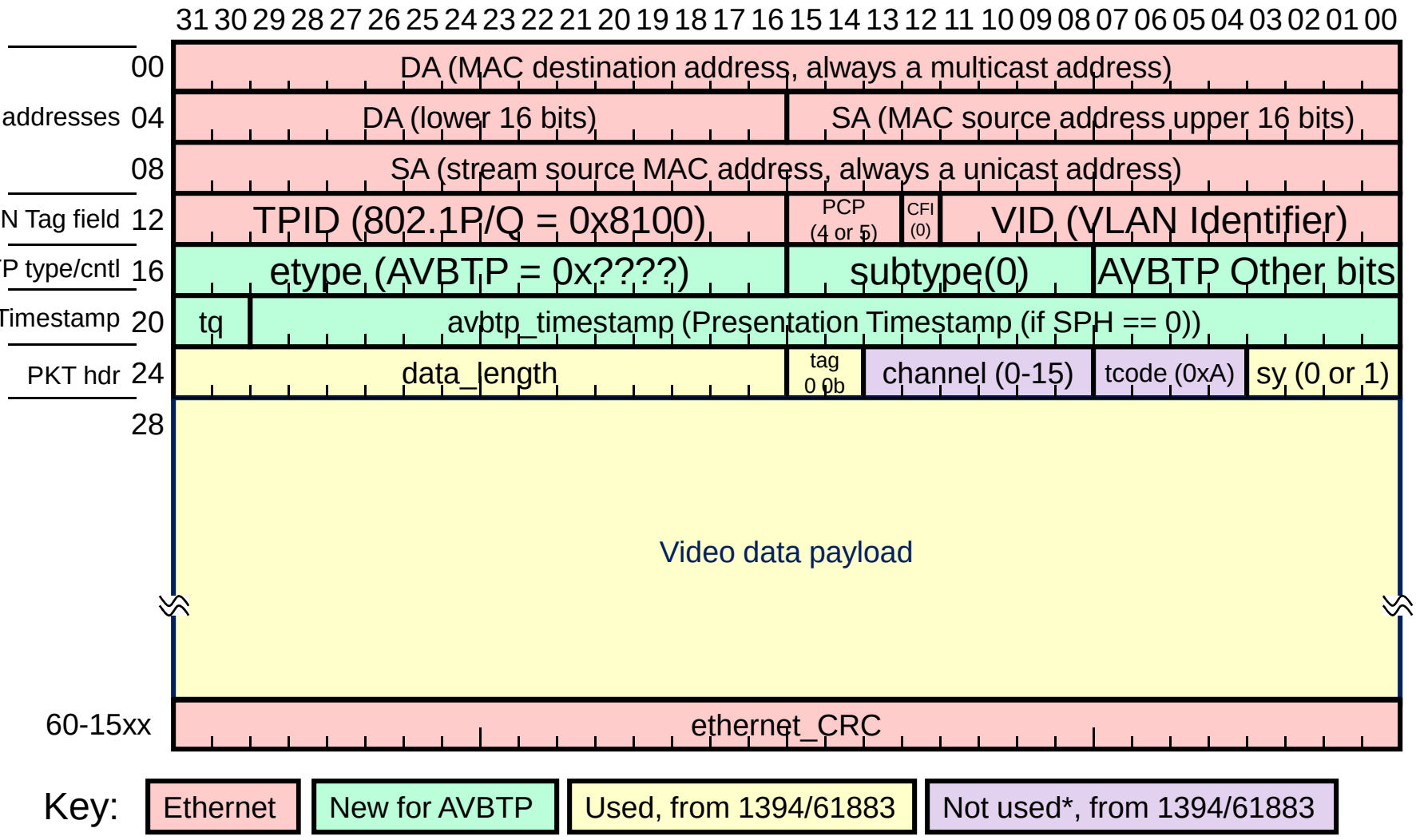


Draft AVBTP CIP Stream Data packet, SPH(1)



Key: Ethernet | New for AVBTP | Used, from 1394/61883 | Not used*, from 1394/61883

Draft AVBTP IIDC Stream Data packet

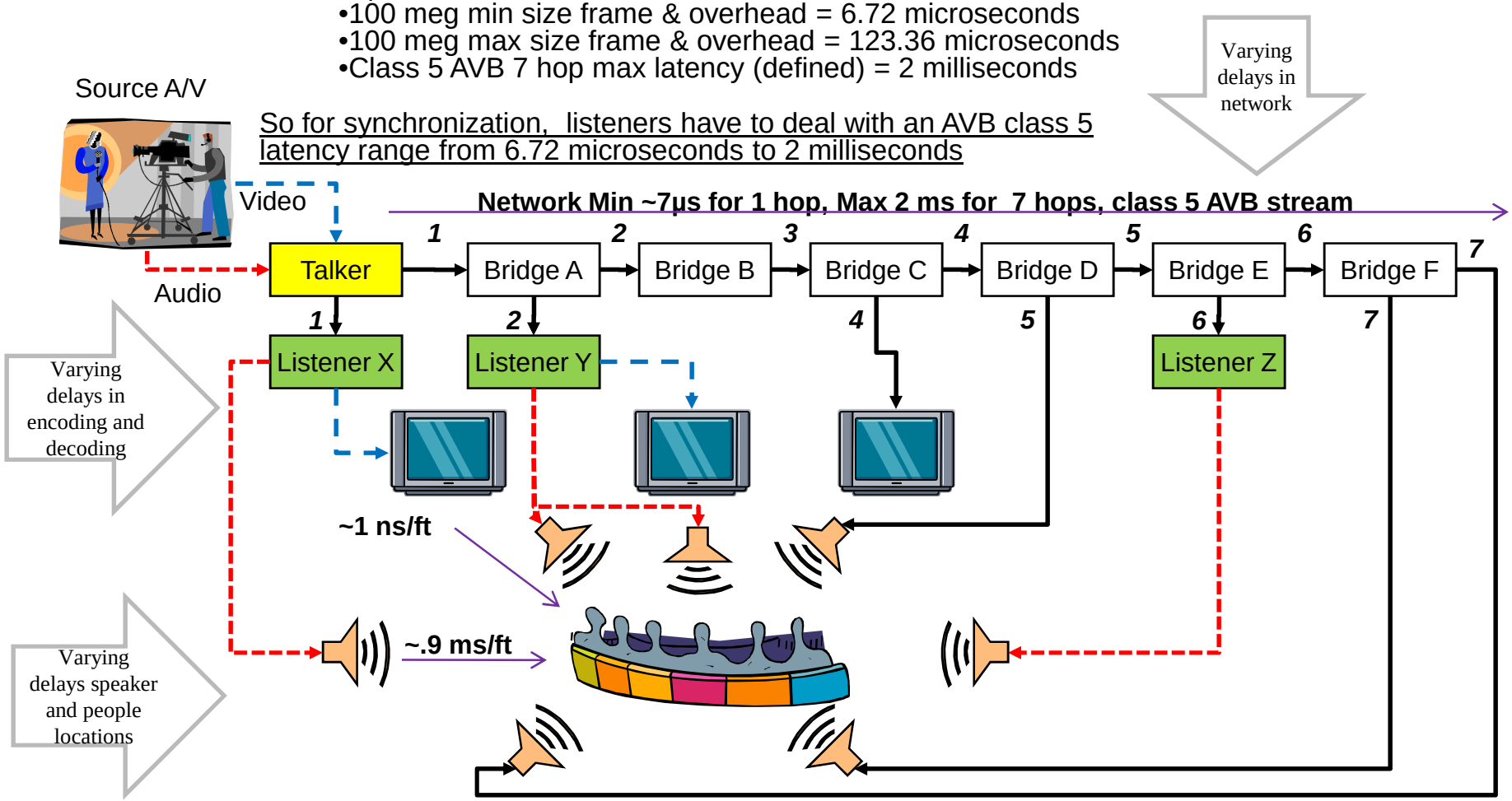


Mixed bridged and P2P AVB

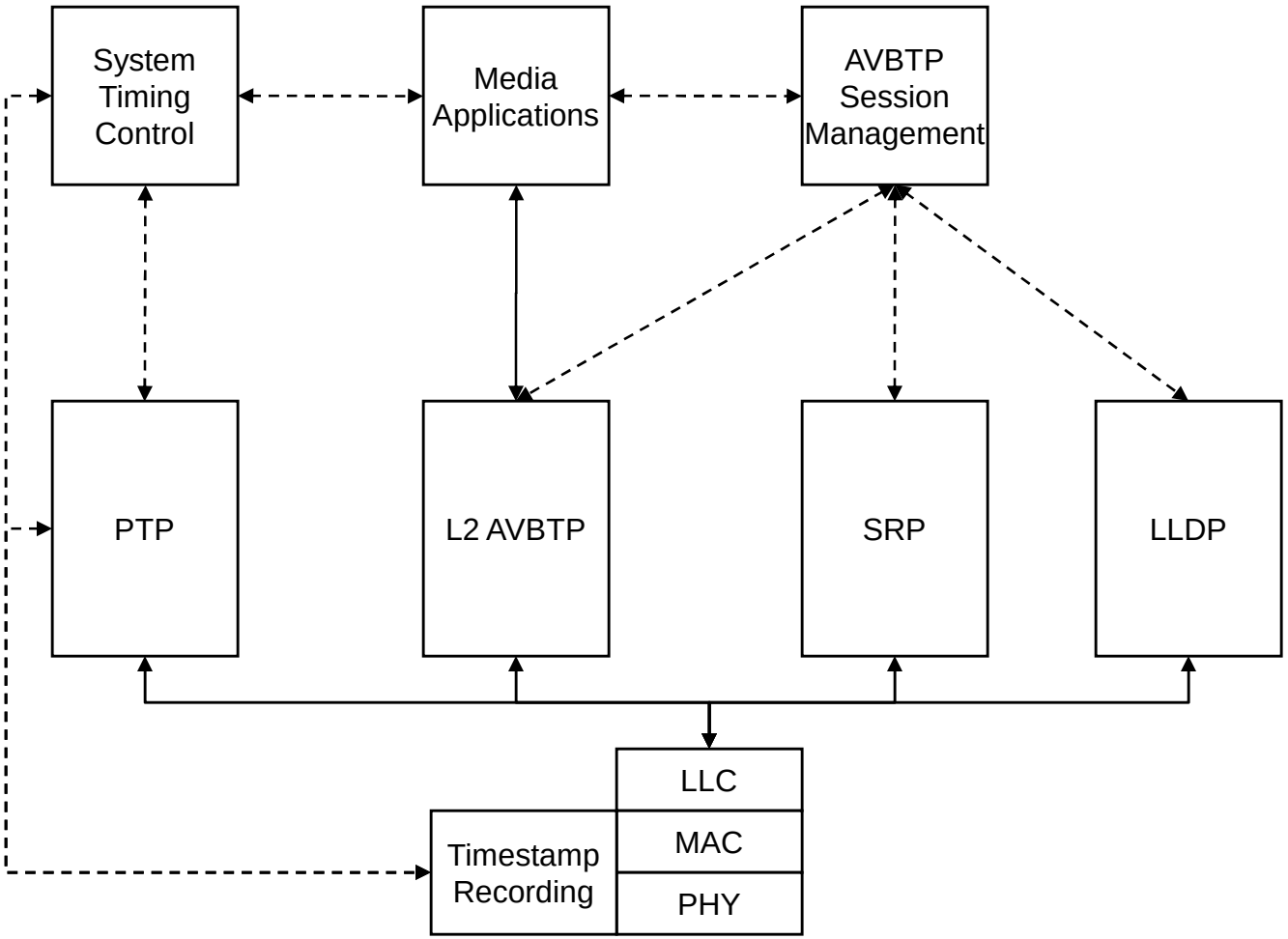
Misc time info:

- Speed of light = ~ 1 nanosecond / foot
- Speed of sound = ~ .9 milliseconds / foot
- 100 meg min size frame & overhead = 6.72 microseconds
- 100 meg max size frame & overhead = 123.36 microseconds
- Class 5 AVB 7 hop max latency (defined) = 2 milliseconds

So for synchronization, listeners have to deal with an AVB class 5 latency range from 6.72 microseconds to 2 milliseconds



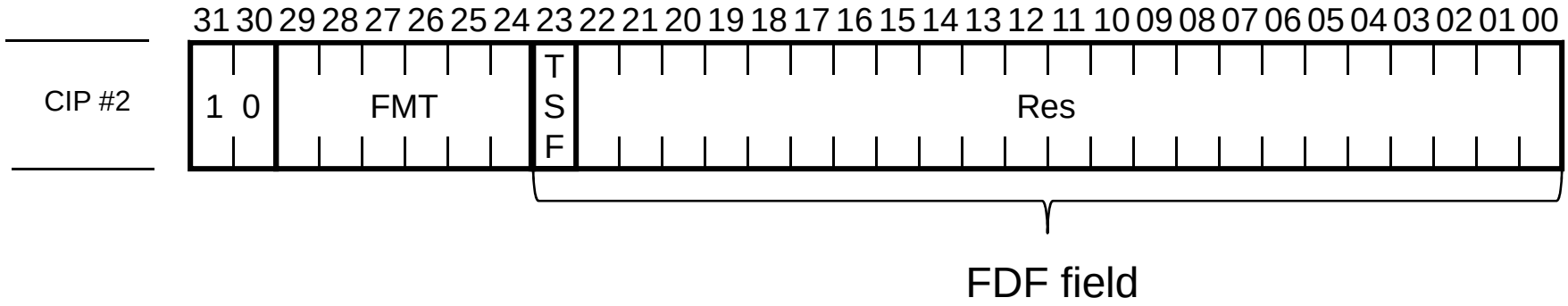
AV end station layering



Data Payload proposal

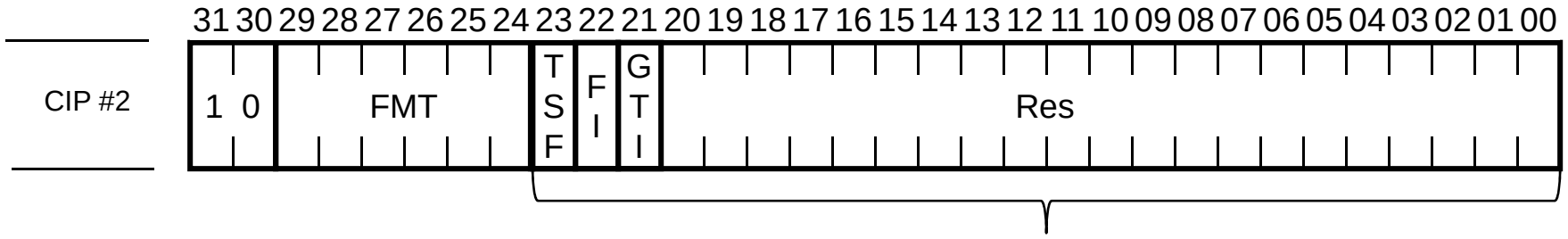
- For AVBTP (IEEE 802 and RTP) All data after the CIP header will be the same 61883 format used for payload except for a new Source Packet Header (1st quadlet of the source packet) will be defined to use 802.1AS timing (global time) instead of 1394 timing (8 kHz cycle and 24.576 MHz cycle offset).
  - For AVBTP same format as used in offset 24
    - 2 Bit Timestamp Qualifier
    - 30 bit Timestamp in Nanoseconds
      - Editor's note: For this case, we will need a full 30 bits if we do nanoseconds to get an equivalent 1 second resolution as is currently used by 1394/61883

Current 61883-4 & -7 FDF field



- FMT field:
  - 100000 binary: 61883-4
  - 100001 binary: 61883-7
- TSF (time shift flag) indicates a time-shifted data stream:
  - 0 = the stream is not time-shifted.
  - 1 = the stream is time-shifted.
- Res: reserved for future extension and shall be zeros.

Proposed new 61883-4 & -7 FDF field



- TSF
  - Same as today
- Fragmentation Indicator (FI)
  - 0: Fragmentation allowed
    - Use DBS of 6 for 61883-4 and 9 for 61883-7 with associated FN and DBC values as currently specified.
  - 1: Fragmentation not allowed
    - Use DBS of 48 for 61883-4 and 36 for 61883-7, FN always 0, DBC counts full source packets including timestamp (192 bytes for -4, 144 bytes for -7)
- Global Time Indicator
  - 0: 1394 local bus type time used
    - Use source packet header as defined in current specification (7 bits reserved, 13 bit 8 kHz cycle, 12 bit 24.576 MHz cycle offset)
  - 1: IEEE 1588 / 802.1AS Global time used
    - New for AVBTP and possible future use by other protocols (2 bit Time Qualifier, 30 bit global time subset in Nanoseconds (1 GHz))
- Res: reserved for future extension and shall be zeros.