



Audio Video Transport Protocol (AVTP)

Dave Olsen – Chair IEEE 1722a

Harman International



Agenda

- IEEE 1722 Background
- AVTP Basic Concepts
 - Media clock reconstruction
 - Presentation Time
 - Latency normalization
 - Lip Sync
- AVTP Packetization
- MAC Address Acquisition Protocol
- IEEE p1722a Overview

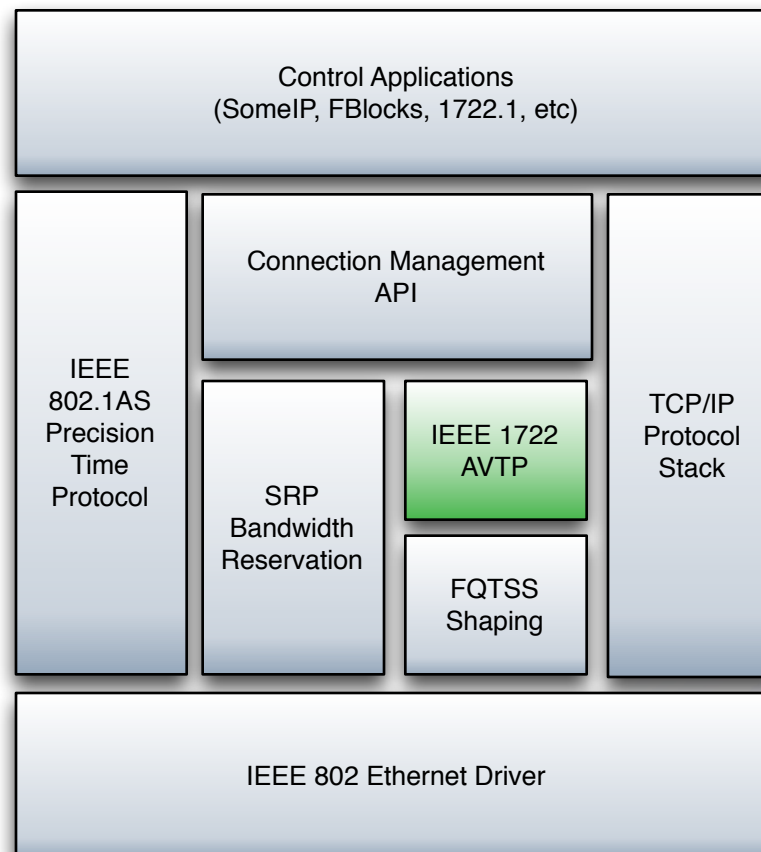


IEEE 1722 - Audio Video Transport Protocol

- **IEEE 1722 enables interoperable streaming by defining:**
 - Media formats and encapsulations
 - Raw & compressed audio/video formats
 - Media synchronization mechanisms
 - Media clock reconstruction/synchronization
 - Latency normalization and optimization
 - Multicast address assignment
 - Assigning AVB Stream ID
 - Reserved pool of addresses



Where does the transport protocol fit?





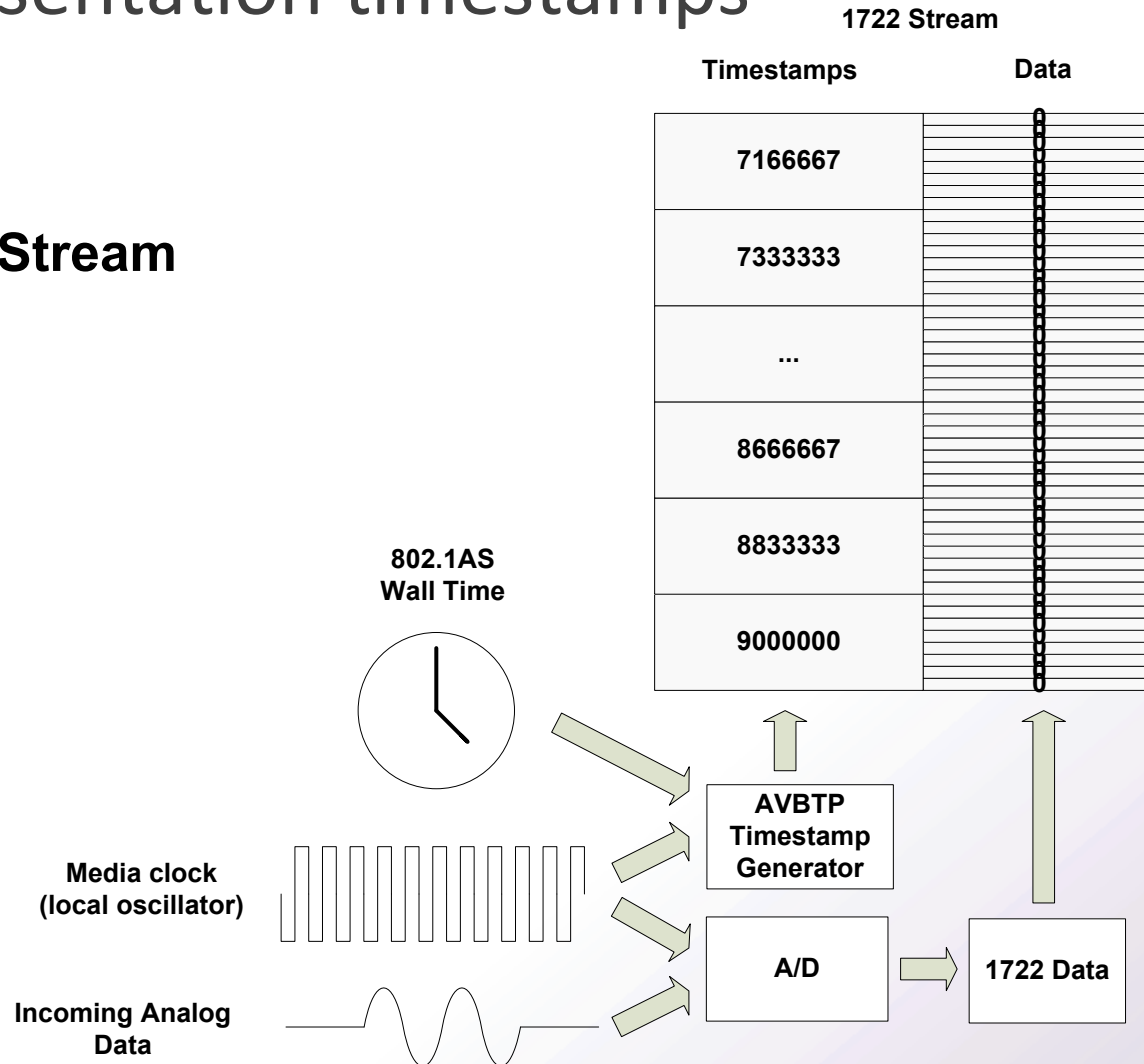
AVTP Basic Concepts

- Media clock reconstruction
- Presentation Time
- Latency normalization
- Lip Sync



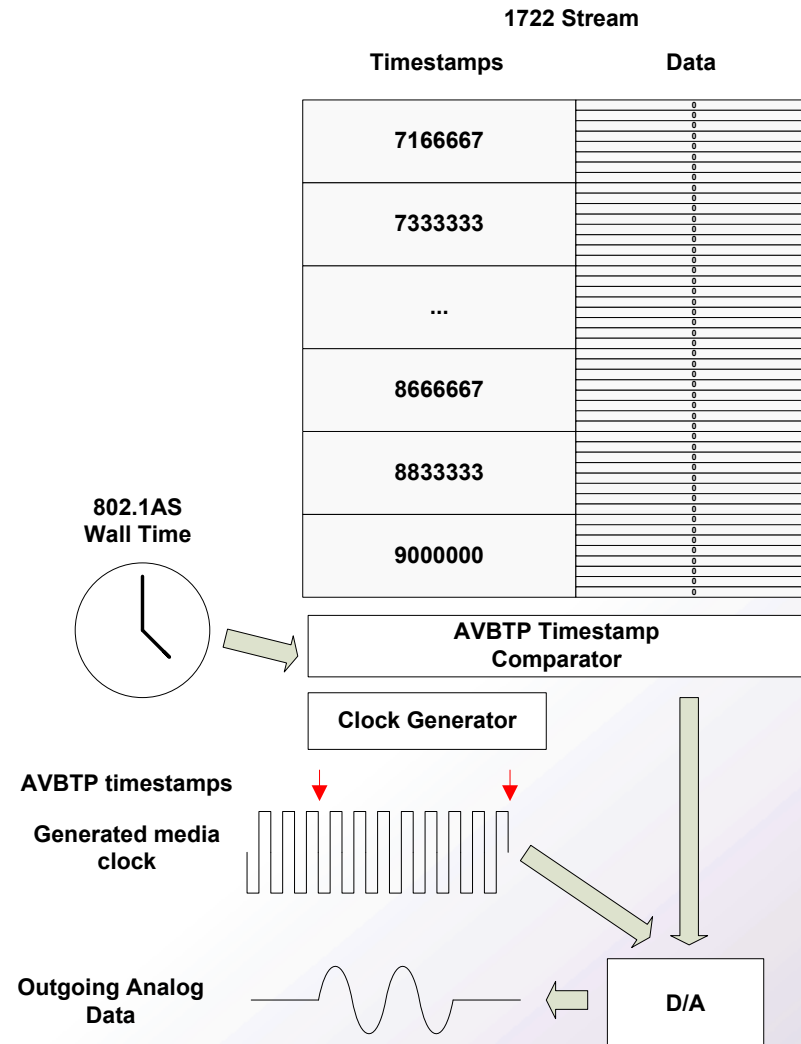
Media clock info embedded in talker's presentation timestamps

Talker Stream





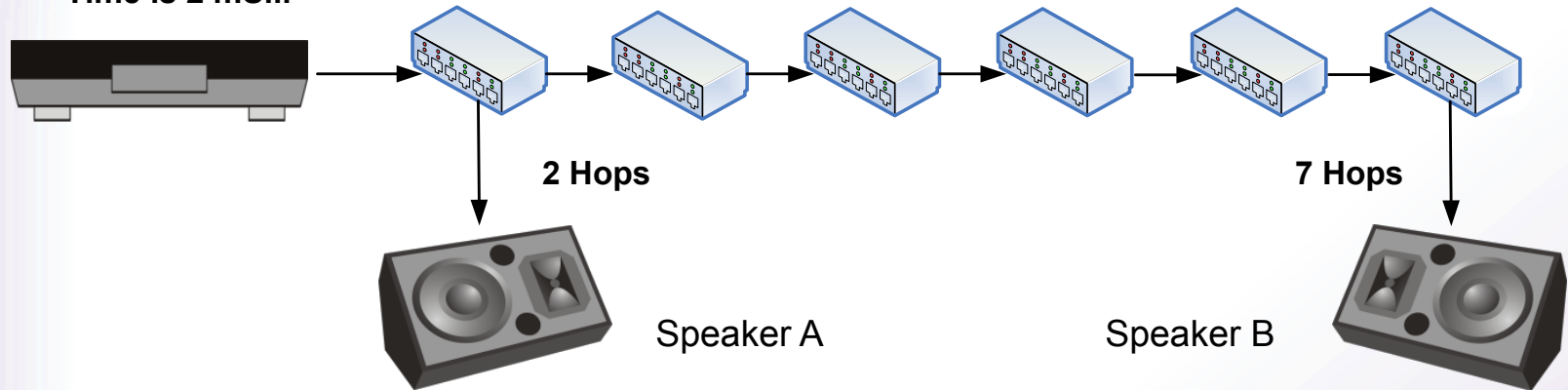
Listener Stream





Latency Normalization

**Default Presentation
Time is 2 mS...**

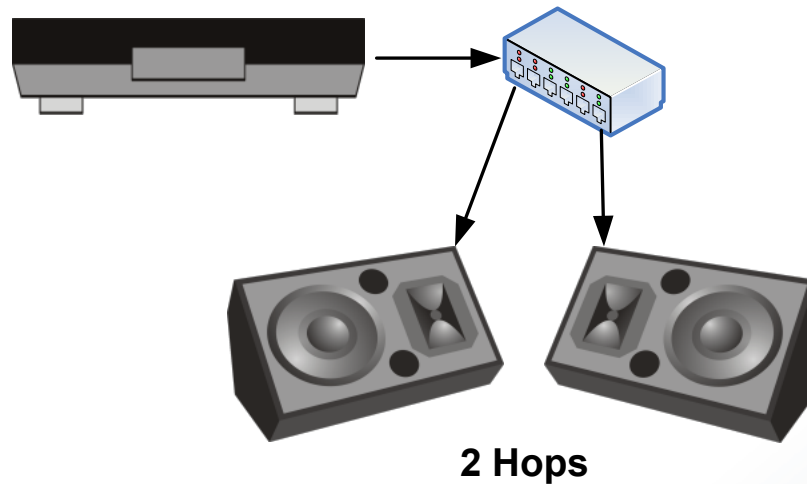


Speaker A buffers audio until Speaker B receives audio and presentation time is reached



Default Presentation Time is 2 ms...

... but Presentation Time
can be dialed down

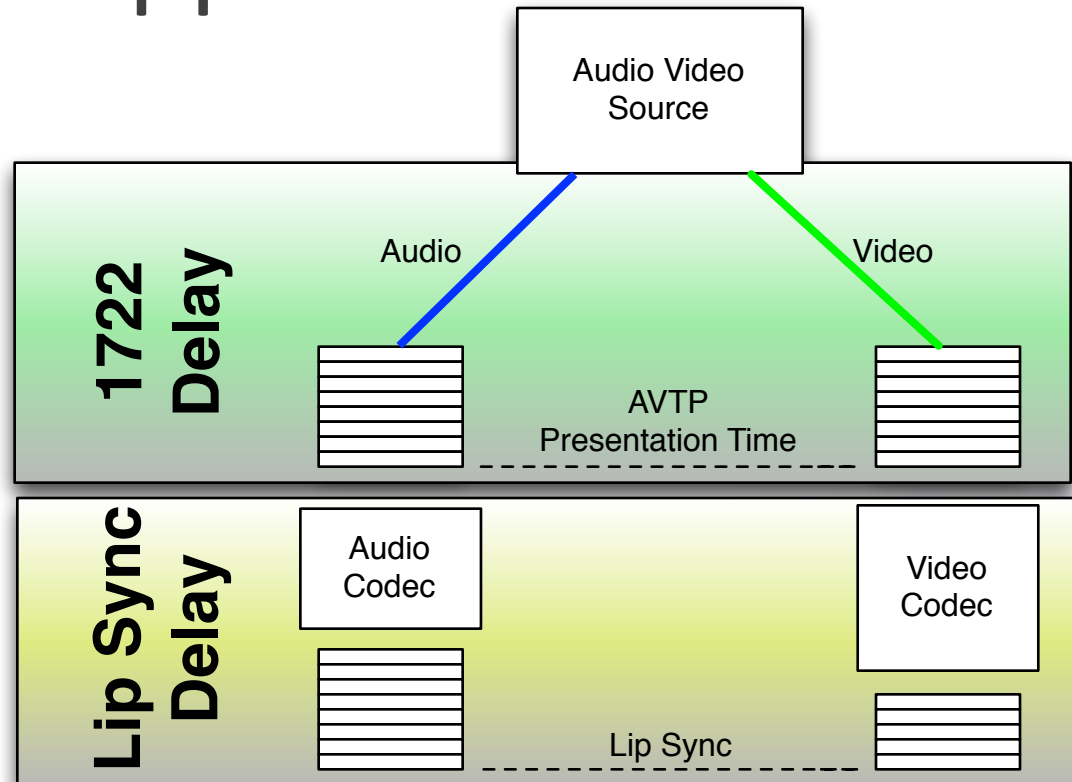


Talker is responsible for setting delay...



Lip Sync Support

- AVTP provides a baseline for Lip Sync
- AVTP does not include codec and other Lip Sync related delays



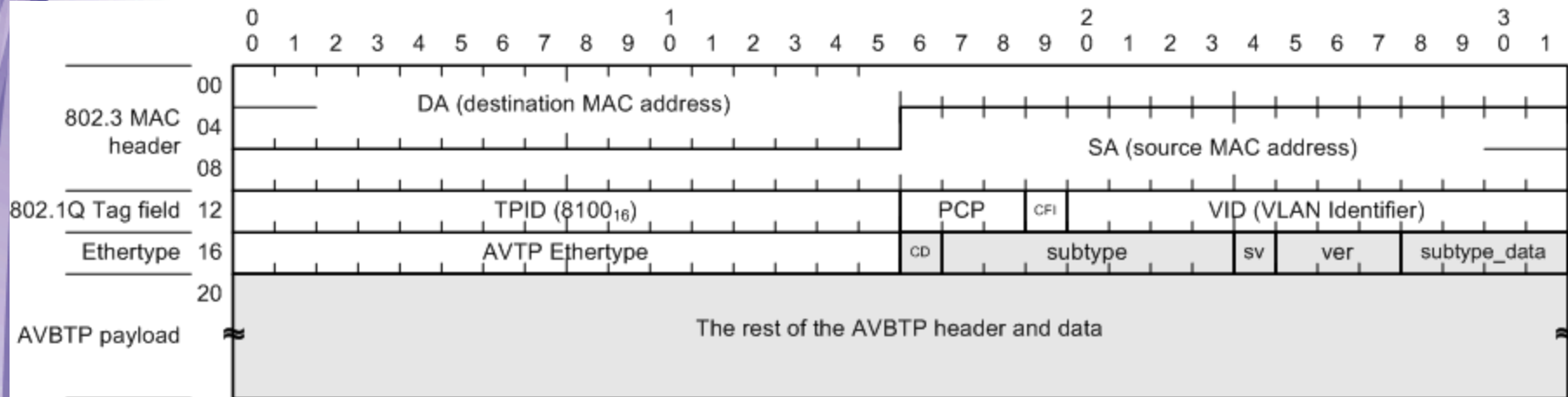


AVTP packet components

- Ethernet header
 - plus
- Common frame header
 - Control frames
 - Common control frame header
 - Protocol-specific headers & payload
 - or
 - Streaming frames
 - Common stream data header
 - Streaming data headers & payload



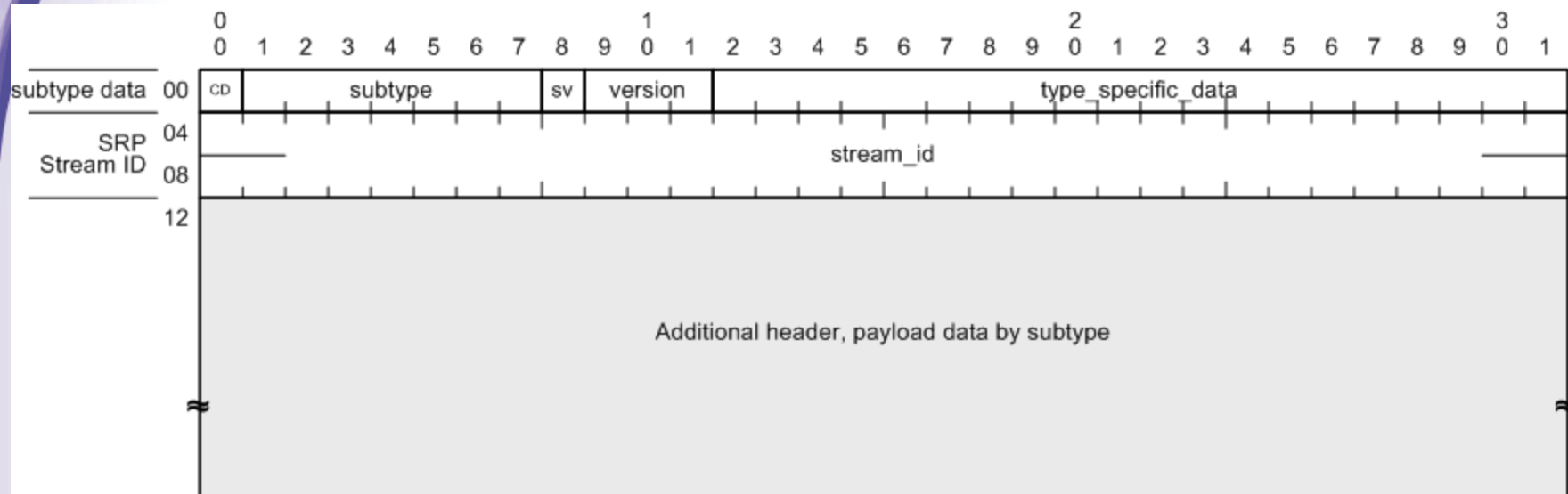
AVTP packets encapsulated within Ethernet header



AVTP Frames are identified by a unique Ethertype



AVTP frame common header fields



cd: control or data packet

subtype: protocol type

sv: stream_id valid

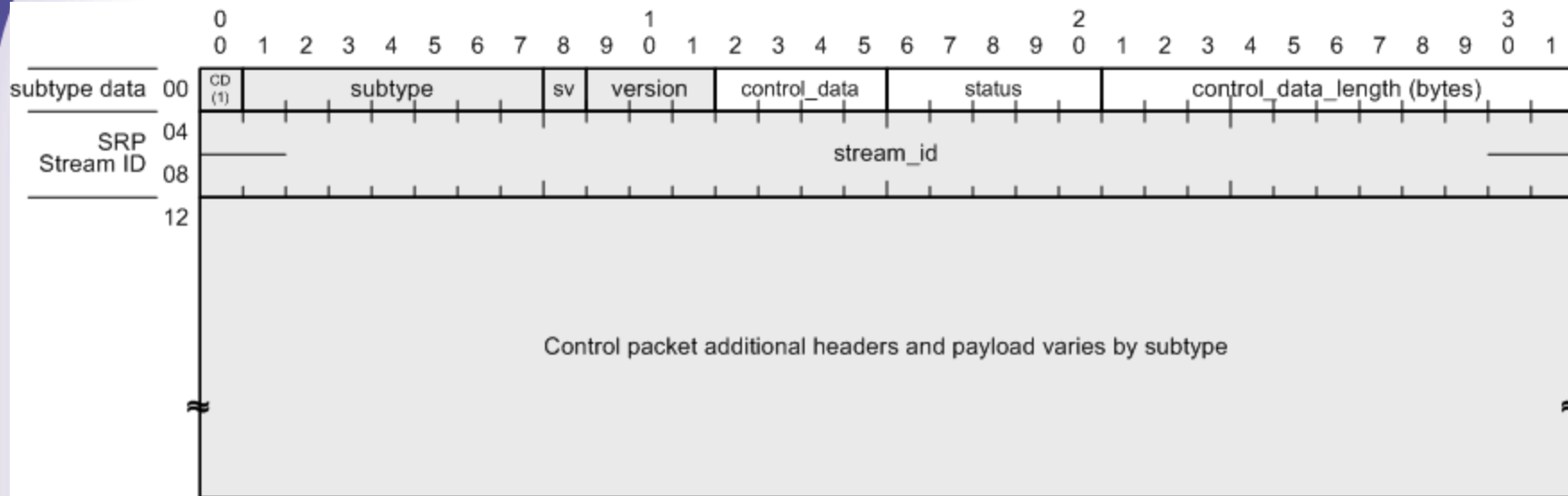
version: revision of 1722 standard

type_specific_data: protocol specific info

stream_id: IEEE 802.1Qat stream ID



Command/control packet header (cd=1)



control_data: protocol-specific data

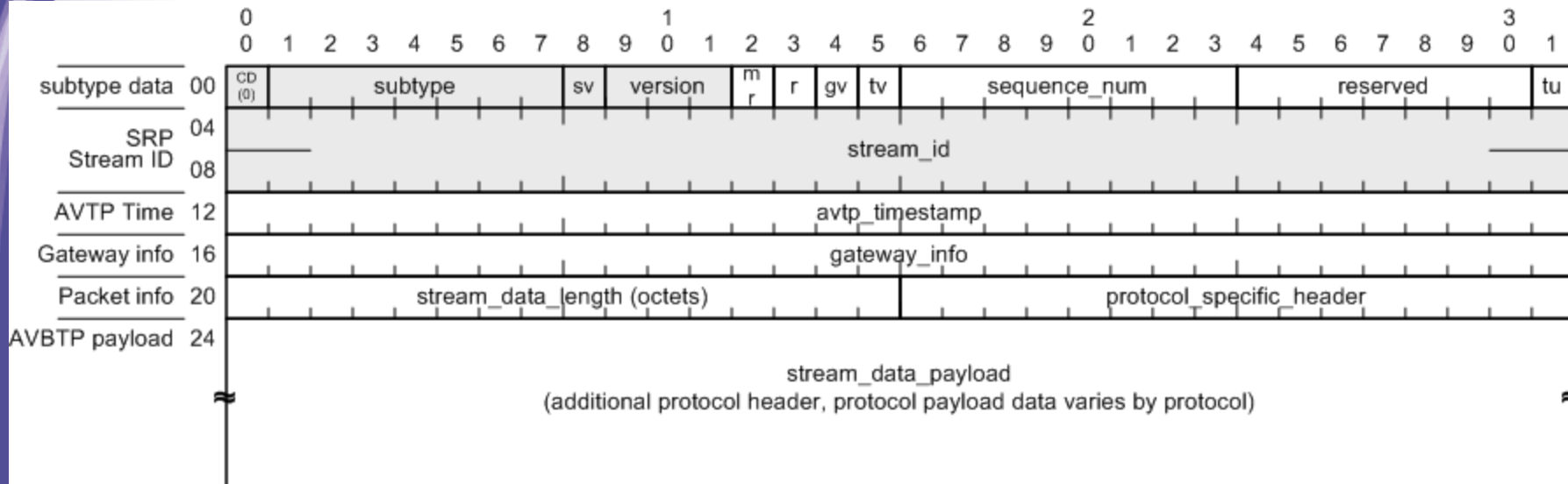
status: status flags, values, etc

control_data_length: length in bytes of control payload

AVTP Control packets used in IEEE P1722.1



AVTP common stream data header



mr: media clock restart
r: reserved
gv: gateway_info field valid
tv: avtp timestamp valid
sequence_number: sequence number
tu: timestamp uncertainty

AVTP Stream packets require an SRP reservation



AVTP subtype field specifies streaming protocol

Value	Function	Meaning
00 ₁₆	61883_IIDC	IEC 61883/IIDC over AVTP
01 ₁₆	MMA	MMA payload over AVTP
02 ₁₆ – 7D ₁₆	-	Reserved for future protocols
7E ₁₆	MAC address acquisition protocol	MAAP
7F ₁₆	Experimental	Experimental



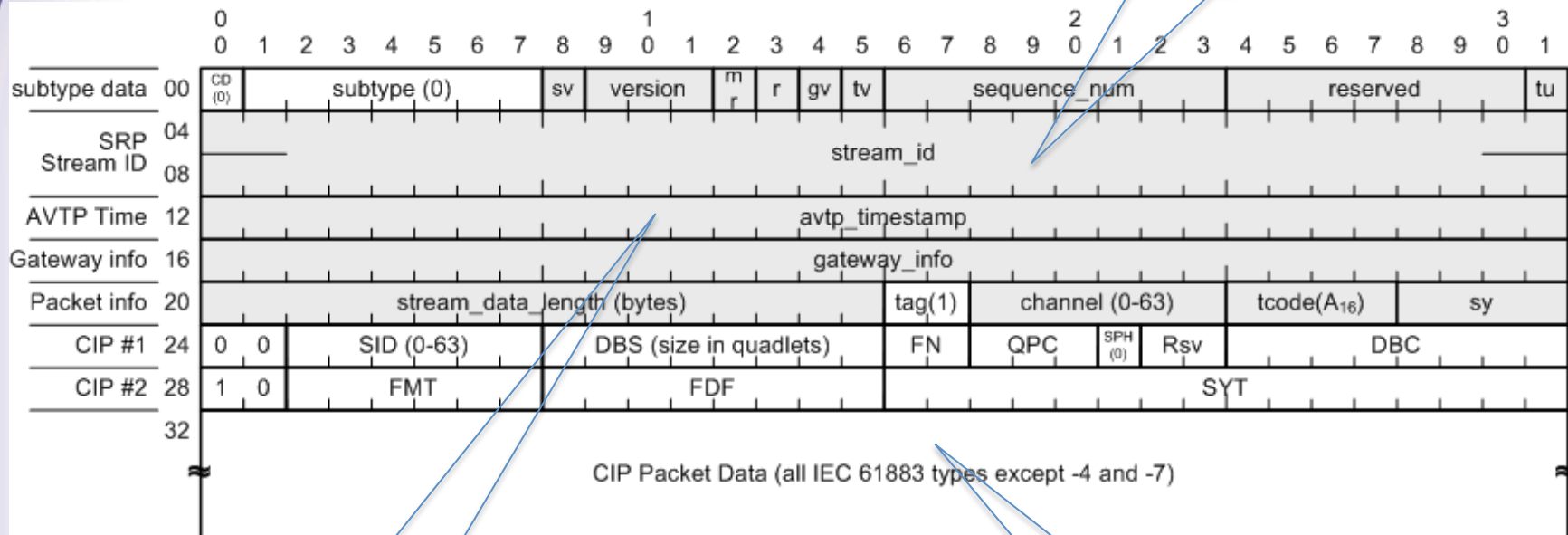
Support for raw & compressed audio/video

- Formats based on IEC 61883 parts 1-8¹
 - **61883-2 SD-DVCR**
 - **61883-4 MPEG2-TS Compressed Video**
 - **61883-6 Uncompressed Audio**
 - **61883-7 Satellite TV MPEG**
 - **61883-8 Bt.601/656 Video**
 - **IIDC Uncompressed Industrial Cameras**



61883-*n* header/streams encapsulated in 1722 packets

What Stream?



When to Play?

What to Play?



IEEE 1722 packet format for 61883-6/AM824 (Multi-bit linear audio) 48kHz stereo stream

802.3 MAC header	DA (MAC destination address)																			
	DA (MAC destination address)								SA (MAC source address)											
VLAN Tag field	SA (MAC source address)																			
	TPID (802.1Q = 8100 ₁₆)								PCP		CFI	VID (VLAN Identifier)								
AVTP type	EtherType (AVBTP = 22F0 ₁₆)								CD (0)	subtype (0)				sv	version		m	r	gv	tv
SRP Stream ID	sequence_num				reserved				tu	stream_id										
	stream_id																			
AVTP Timestamp	stream_id								avtp_timestamp											
	avtp_timestamp								gateway_info											
gateway_info	gateway_info								stream_data_length (bytes)											
61883 CIP header	tag(1)	channel (0-63)			tcode(A ₁₆)			sy		0	0	SID (0-63)				DBS (size in quadlets)				
	FN	QPC	SPH (0)	Rsv	DBC				1	0	FMT				FDF					
61883/AM824 Audio samples	SYT								label				24-bit audio sample #1							
	24-bit audio sample #1								label				24-bit audio sample #2							
	24-bit audio sample #2								label				24-bit audio sample #3							
	24-bit audio sample #3								label				24-bit audio sample #4							
	24-bit audio sample #4								label				24-bit audio sample #5							
	24-bit audio sample #5								label				24-bit audio sample #6							
	24-bit audio sample #6																			



802.3 MAC header	DA (MAC destination address)																																	
	DA (MAC destination address)												SA (MAC source address)																					
	SA (MAC source address)																																	
VLAN Tag field	TPID (802.1Q = 8100 ₁₆)												PCP		CFI		VID (VLAN Identifier)																	
AVTP type	EtherType (AVBTP = 22F0 ₁₆)												CD (0)		subtype (0)						sv		version				m _r		r		gv		tv	
SRP Stream ID	sequence_num						reserved						tu		stream_id																			
	stream_id																																	
AVTP Timestamp	stream_id												avtp_timestamp																					
	avtp_timestamp												gateway_info																					
gateway_info	gateway_info												stream_data_length (bytes)																					
61883 CIP header	tag(1)		channel (0-63)						tcode(A ₁₆)				sy		0 0		SID (0-63)						DBS (size in quadlets)											
	FN		QPC		SPH (0)		Rsv		DBC						1 0		FMT						FDF											
	SYT												VDSPC						sol		sav		line number											
61883-8 Source Packet Data Video samples	line number						r		Ver		Type		byte 1 video data						byte 2 video data															
	byte 3 video data						byte 4 video data						byte 5 video data						byte 6 video data															
															
	byte 715 video data						byte 716 video data						byte 717 video data						byte 718 video data															
	byte 719 video data						byte 720 video data																											



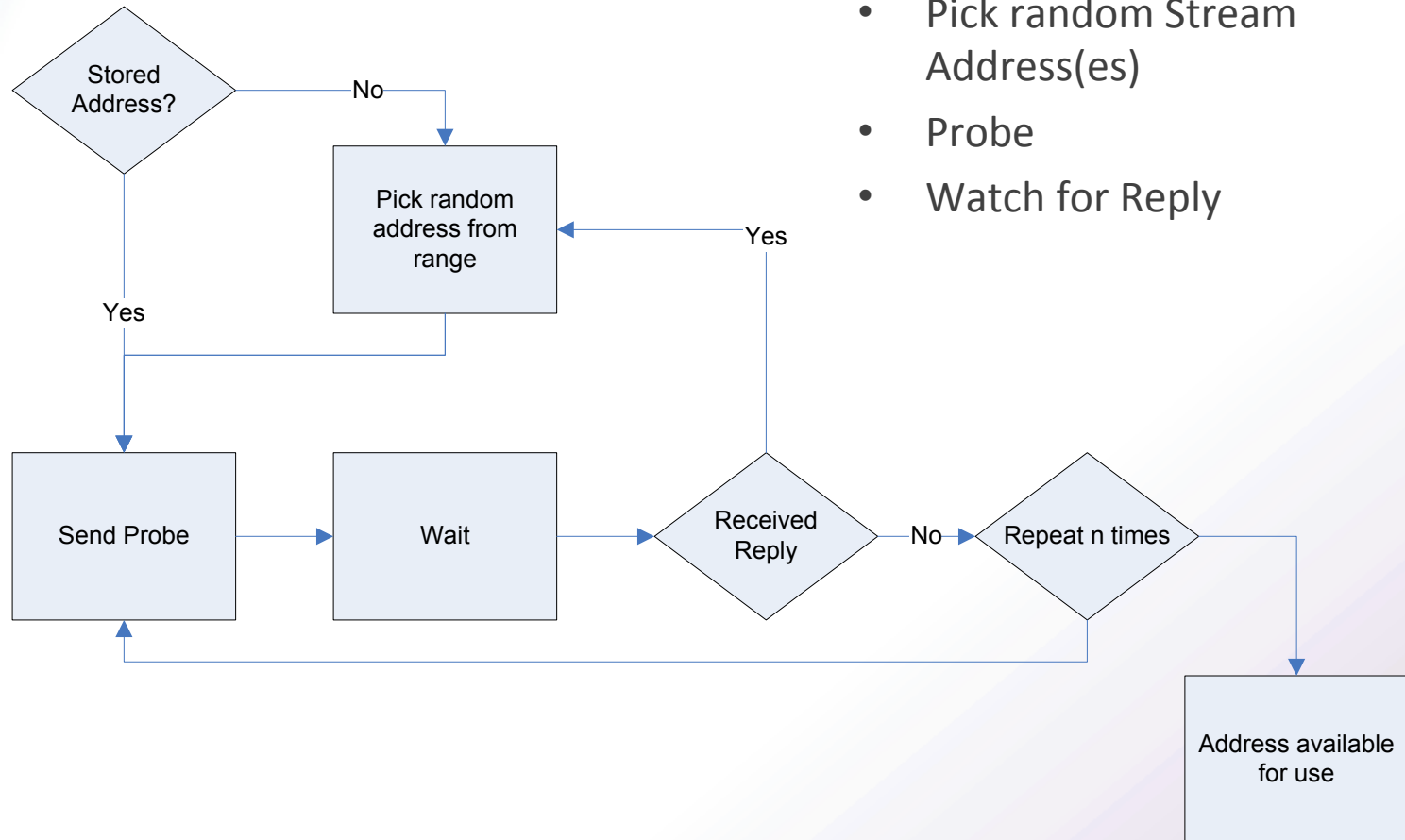
MAC Address Allocation Protocol

- Stream DA Addresses must be unique
- Method for dynamic address allocation
- Allocate addresses individually or in blocks
- Reserved set of MAC addresses for use by MAAP
- No need for vendors to assign multiple MAC addresses to a device that supports multiple streams



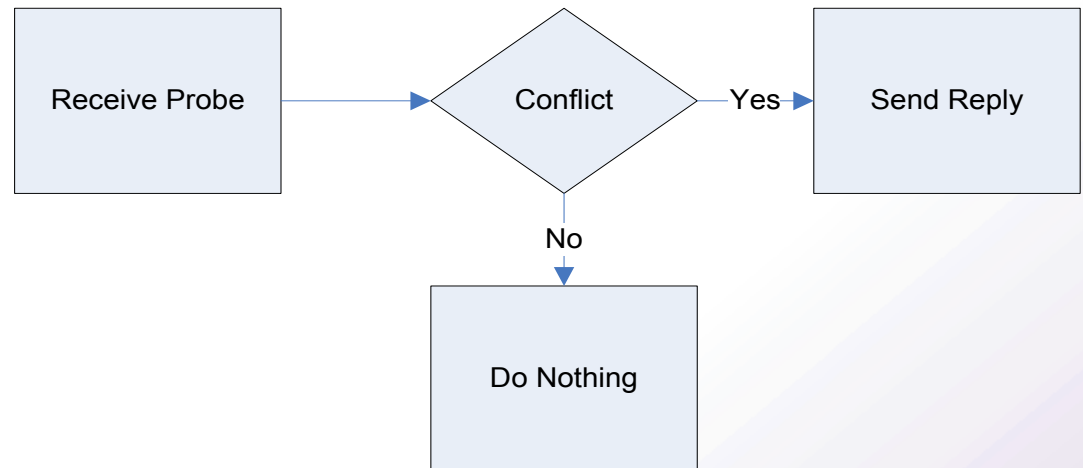
Address Acquisition Algorithm

- Pick random Stream Address(es)
- Probe
- Watch for Reply





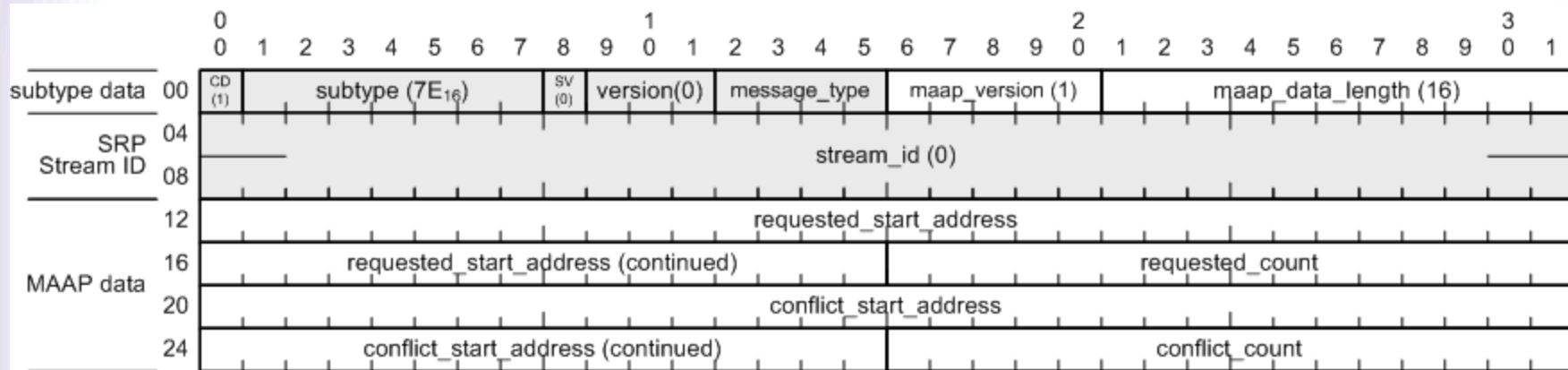
Address Defense Algorithm



- Watch for Probe packets
- If a conflict, send a Reply



MAAP Control Frame





MAAP message types

Value	Function	Meaning
0	--	Reserved
1	MAAP_PROBE	Probe MAC address(es)
2	MAAP_DEFEND	Defend MAC address(es)
3	MAAP_ANNOUNCE	Announce acquired MAC address(es)
4 - 5	--	Reserved



Reserved MAAP MAC addresses

Address Range	Function	Meaning
91:E0:F0:00:00:00– 91:E0:F0:00:FD:FF	MAAP Dynamic Allocation Pool	These addresses are available for dynamic allocation by the MAAP.
91:E0:F0:00:FE:00 – 91:E0:F0:00:FE:FF	MAAP locally administered Pool	These addresses are reserved to be statically allocated.
91:E0:F0:00:FF:00 – 91:E0:F0:00:FF:FF	MAAP Reserved Pool	Reserved



IEEE P1722a – Amendment 1 Extensible Stream Formats

- Program Authorization Request (PAR) approved Sep 2011
- Feature Freeze end of 2012
- Sponsor Ballot mid 2013
- Final Standard end of 2013



IEEE 1722a

- Extensible Audio/Video Formats
 - AVTP Audio
 - AVTP Video
 - AVTP Control Streams
- Media Clock Negotiation Protocol
 - Automatic negotiation of media clock sources
- Diagnostics
 - Common diagnostic variables and counter to aid in detection of network problems



AVTP Audio

- Support for PCM Audio
- High channel counts
 - Less frame overhead
- Simpler data parsing
 - Fixed packet size
 - Single timestamp per packet
- No dependence on 125usec interval



AVTP Video

- Professional Studio quality Video
 - SMPTE 259, 292, 424, etc.
- MJPEG
- H.264
- JPEG 2000

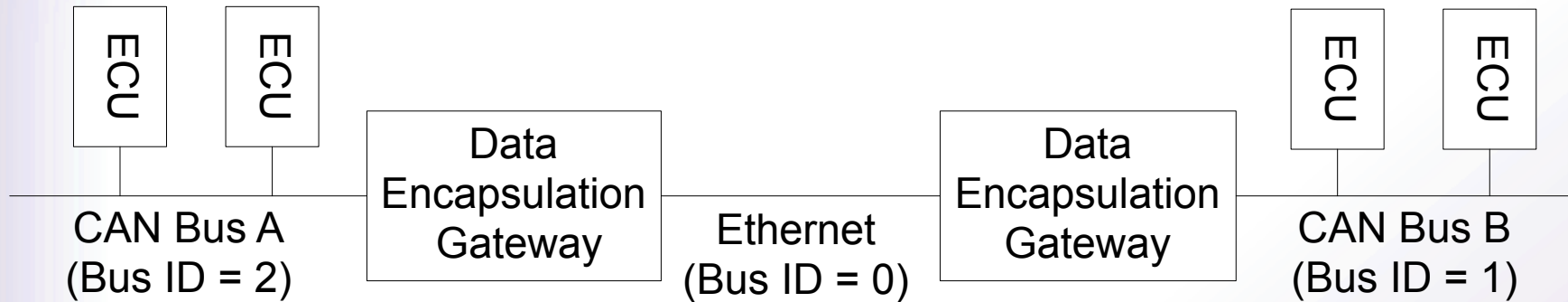


AVTP Control Streams

- Support for Automotive Protocols
 - FlexRay
 - CAN
 - LIN
- Time Sensitive Control Stream
 - Generic format for sending non Audio/Video data in streams
 - Use cases
 - Meter data
 - Time sensitive controls (Lighting cues, etc.)



AVTP Control Streams



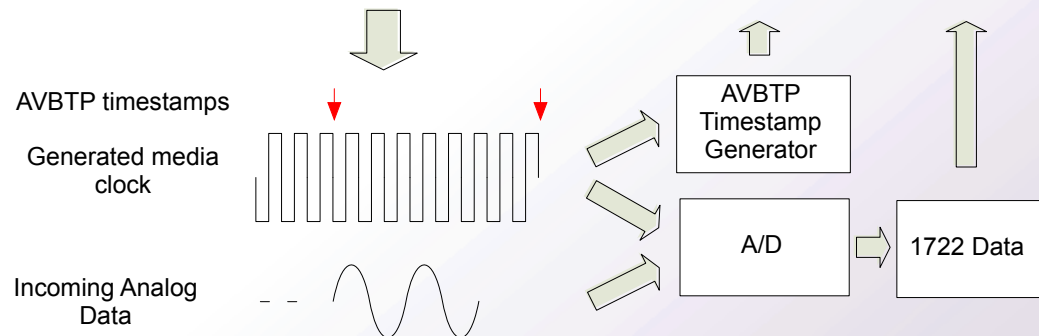


Media Clock Streams

- Ability to synchronize multiple devices to a single media stream
- Reduce the need for Sample Rate Conversion



Talker Stream with Media Clock Stream

[illegible][illegible]



More info...

- Website
 - <http://grouper.ieee.org/groups/1722/>
- Email reflector
 - subscribe avbtp <FirstName> <LastName> to ListServ@ieee.org
- Weekly phone conferences
 - See website for details
- Face-to-face meetings every two months