

#### The future backbone of our industry

#### ETHERNET WILL ALWAYS WIN, BUT WHAT VERSION WILL WE USE?

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# Our precious broadcast industry



## Why again did we want to abandon SDI in favor of IT equipment?



### It looks like the introduction of Ethernet is causing a mess

#### The main reasons to abandon SDI?

- COTS Commercial Of The Shelf (no propriety model)
  - Lower cost ......  $\checkmark$
  - Lower cost of ownership ......???
- We want more flexibility
  - Like a single network for all data .....???
  - Distributed routing ......  $\checkmark$
- We want a backbone that is agnostic to all current and future formats
  - 4K, 8K, HDR ..... these standards are not ideal to run over a dedicated wire like SDI

# Ethernet should meet these requirements

Even though Ethernet in its basic form doesn't work for this application Why Ethernet doesn't work right out of the box

- Best-Effort Delivery Strategy
  - The data will arrive but don't ask me when
- Non-Deterministic
  - Ethernet is random
- No Concept of Isochronous Delivery
  - There is no sense of time and timing
- Is Not Content-Aware
  - All data is treated equally

### Ethernet will always win

We just need to enhance Ethernet with a protocol that will allow the above features to work

#### How difficult can this be?



# So what has our industry come up with so far?

#### Technologies that are offered:

- AVB (with future TSN on Layer 3)
- ST2022-6 (Sony with 2022-6 (?) GV with 2022-6)
- VSF-TR03
- VSF-TR04 (not part of this presentation)
- VSF-TR05 (not part of this presentation)
- The Advanced Media Workflow Association (AMWA NMI project)
- ASPEN by Evertz (how open is this?)
- Dante
- Ravenna
- AES67

	Protocol		ol Timing and S		nd Sync Essence			ice (						
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	V	v	V	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
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				RTP								optional Session		
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VSF TR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
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														Aspen uses a MPEG2 TS data wrapper (multiple
Acnon	10/12	DTD	1588 (PTP)		00037	CT202	V	672020	- (	CDN	NIA	NIA	NIA	188 byte chuncks in one Ethernet packet =
Aspen	IP/L3	RIP	SI2059	DTD	RDD37	51302	X	512038	V	SDN	NA	NA	NA	more overnead)
GV	ID/I 2	DTD	1588 (PTP) \$72050	KIP timostamn	ST 2022 6	omboddod	v		2/	SDN	multiple	proprietary and	NIA	PEC2100 for intercom /Timocodo in SDI
01	IF/L3		312035	timestamp	31 2022-0	embedded	^		v	SDN	options	DNS	NA	At time of writing Sony remains yague on the
Sonv	IP/I 3	RTP	ST20592		nronrietary	nronrietary		nronrietary	nronrietary	SDN				used standards and protocols
	11723		512055.		proprietary	proprietary		proprietary	proprietary	<u>55N</u>				A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	v	V	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

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		DTD	1588 (PTP)	RTP	- <del></del> 2022 C					CDN	multiple	proprietary and		
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## 

### Audio Video Bridging IEEE802.1

### Open IT Standard

#### Self Management

#### QoS included

#### **DEC** included

## AVB still is a superior technology compared to all other offerings



#### THE DEAD HORSE THEORY

The tribal wisdom of the Dakota Indians passed on from generation to generation says:

When you discover that you are riding a dead horse the best strategy is to dismount

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Sony	IP/L3	RTP	ST2059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
Douto	15 /1 0		4500							5.00				A proprietary system with many Audio adopters
Dante	IP/L3	RIP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	V	proprietary	and AES67 included
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AFS67	15/10	0.00		timestamp		RFC3351 (16				D.100	multiple			AES67 may involve a patent owned by
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#### Brad Gilmer of VSF;

## "The VSF developed SMPTE 2022 for long-haul video transport over IP networks,"

#### "It quickly found its way inside facilities, which is not what the inventors of 2022 intended"



## We said so .....
### ST-2022 takes SDI in its entirety over IP/RTP as a single stream

ST-2022 tells nothing about timing but there is a tendency to use ST-2059

Unfortunately ST-2059 timing fights with AES67 in the same port (this needs to be solved)

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### VSF has corrected their design, rethinking the applications and came up TRO3

Definitely a step in the right direction and VSF-TR03 seems like a powerful alternative

TR-03 proposes the time-related essence (video, audio and ancillary data, aka Payload) to be carried over an IP network as separate elementary RTP streams.

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			312033:		proprietary	proprietary				358				A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	V	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

Transport Protocol for Layer 2 media devices
Real Time Transport Protocol - Describes how to transport real time data over layer 3 Ethernet as timing, payload (audio/video/data)
Precision Time Protocol - Base for all timing protocols defined by multiple profiles
SMPTE timing profile of 1588 (PTP)
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SMPTE AES3 Digital Audio Interface, SMPTE Extensions payload description
Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream

### 

### Advanced Media Workflow Association

### Working on NMI (Networked Media Incubator)

The technical goals of the group will be guided by the Reference Architecture (RA) published by the Joint Task Force on Networked Media. JT-NM (EBU/SMPTE/VSF)

### AMWA will use a slightly modified/enhanced VSF-TR03 standard

	Prot	ocol	Timing a	and Sync		Esse	ence		Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	$\checkmark$	v	$\checkmark$	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
AVB	L2	IEEE 1722	(802as)		IEEE 1722	IEEE 1722	IEEE 1722	IEEE 1722	Optional	Self managed	IEEE 1722.1	IEEE 1722.1	IEEE 1722.1	(A/V Consumer, automotive)
				RTP										
SMPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
			1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
VSF TR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
			1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique		basically based on VSF-TR03 with defined
AMWA	IP/L3	RTP	ST2059	(RFC7273)	extensions	extensions	extensions	extensions	√ (VC2 ?)	SDN	HTTP-based	ID (UUID) based	NA	Discovery and Identity
														Aspen uses a MPEG2 TS data wrapper (multiple
			1588 (PTP)											188 byte chunks in one Ethernet packet = more
Aspen	IP/L3	RTP	ST2059		RDD37	ST302	X	<u>ST2038</u>		<u>SDN</u>	NA	NA	NA	overhead)
		070	1588 (PTP)	RTP						CDN	multiple	proprietary and		
GV	IP/L3	RIP	ST2059	timestamp	ST 2022-6	embedded	X		V	SDN	options	DNS	NA	RFC3190 for intercom / limecode in SDI
Conv		DTD	CT 20F 02							CDN				At time of writing Sony remains vague on the
Sony	IP/L3	RIP	\$12059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
Danto	un /i 2	DTD	1500		NA	propriotony	NA		NA	DiffConv			propriotory	A proprietary system with many Audio adopters
Dante	IP/L5	KIP	1300			Accorts		NA		DiffServ			proprietary	allu AESO7 Includeu Pavonna acts as a framowork far multipla typos
Ravenna	ID/I 2	PTD	1588		ΝΔ	Accepts	NA	ΝΔ	NA	DiffServ				of PTD transport (AES67 is one of them)
Navenna	IF/L3		1300		NA					Dilliserv				Fights with surront version of ST20E0 (Caution
				KIP timostamn		DEC2251 /16			/		multiplo			AFS67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

IEEE 1722	Transport Protocol for Layer 2 media devices
RTP	Real Time Transport Protocol - Describes how to transport real time data over layer 3 Ethernet as timing, payload (audio/video/data)
1588 (PTP)	Precision Time Protocol - Base for all timing protocols defined by multiple profiles
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ST302	SMPTE AES3 Digital Audio Interface, SMPTE Extensions payload description
ST2038	Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream



ASPEN is an encapsulation format that takes uncompressed SD, HD, 3G and Ultra HD signals and packetizes them into an MPEG-2 Transport Stream

### ASPEN is fully compatible with SMPTE ST 2059 PTP-based synchronization

	Prot	ocol	Timing a	and Sync		Ess	ence		Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	V	v	V	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
AVB	L2	IEEE 1722	(802as)		IEEE 1722	IEEE 1722	IEEE 1722	IEEE 1722	Optional	Self managed	IEEE 1722.1	IEEE 1722.1	IEEE 1722.1	(A/V Consumer, automotive)
	4			RTP		-								
SIVIPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
			1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
VSF TR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
			1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique		basically based on VSF-TR03 with defined
AMWA	IP/L3	RTP	ST2059	(RFC7273)	extensions	extensions	extensions	extensions	√ (VC2 ?)	SDN	HTTP-based	ID (UUID) based	NA	Discovery and Identity
														Aspen uses a MPEG2 TS data wrapper (multiple
			1588 (PTP)											188 byte chunks in one Ethernet packet = more
Aspen	IP/L3	RTP	ST2059		RDD37	ST302	Х	ST2038	V	SDN	NA	NA	NA	overhead)
			1588 (PTP)	RTP							multiple			
GV	IP/L3	RTP	ST2059	timestamp	ST 2022-6	embedded	Х		V	SDN	options	DNS	NA	RFC3190 for intercom /Timecode in SDI
														At time of writing Sony remains vague on the
Sony	IP/L3	RTP	ST2059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
														A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	V	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
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	Prot	ocol	Timing a	nd Sync		Esse	ence		Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	V	v	V	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
AVB	L2	IEEE 1722	(802as)		IEEE 1722	IEEE 1722	IEEE 1722	IEEE 1722	Optional	Self managed	IEEE 1722.1	IEEE 1722.1	IEEE 1722.1	(A/V Consumer, automotive)
				RTP										
SMPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
			1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
VSF TR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
			1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique		basically based on VSF-TR03 with defined
AMWA	IP/L3	RTP	ST2059	(RFC7273)	extensions	extensions	extensions	extensions	√ (VC2 ?)	SDN	HTTP-based	ID (UUID) based	NA	Discovery and Identity
														Aspen uses a MPEG2 TS data wrapper (multiple
			1588 (PTP)											188 byte chunks in one Ethernet packet = more
Aspen	IP/L3	RTP	ST2059		RDD37	ST302	X	ST2038	V	SDN	NA	NA	NA	overhead)
			1588 (PTP)	RTP							multiple	proprietary and		
GV	IP/L3	RTP	ST2059	timestamp	ST 2022-6	embedded	Х		V	SDN	options	DNS	NA	RFC3190 for intercom /Timecode in SDI
														At time of writing Sony remains vague on the
Sony	IP/L3	RTP	ST2059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
														A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ		√	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

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ST302	SMPTE AES3 Digital Audio Interface, SMPTE Extensions payload description
ST2038	Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream





### Dante (by <u>Audinate</u>) is a well established audio over IP network system with many compatible manufacturers

	Prot	ocol	Timing a	ind Sync		Esse	ence		Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	$\checkmark$	v	V	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
AVB	L2	IEEE 1722	(802as)		IEEE 1722	IEEE 1722	IEEE 1722	IEEE 1722	Optional	Self managed	IEEE 1722.1	IEEE 1722.1	IEEE 1722.1	(A/V Consumer, automotive)
				RTP										
SMPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
	<b>1</b> -		1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
VSF IR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
A B // W/ A		DTD	1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique	NLA	basically based on VSF-TR03 with defined
AIVIVA	IP/L3	RIP	512059	(RFC/2/3)	extensions	extensions	extensions	extensions	V (VC2 ?)	SDN	HITP-based	ID (UUID) based	NA	Discovery and identity
														Aspen uses a MPEG2 IS data wrapper (multiple
Asnen	ID/I 3	RTD	1588 (PTP) ST2059			ST302	x	572038	٧	SDN	NΔ	NΔ	NΔ	188 byte churks in one Ethernet packet = more
	11763		1588 (DTD)	RTD	NBB37	51502	X	312030	v v	301	multinle	nronrietary and		overneady
GV	IP/L3	RTP	ST2059	timestamp	ST 2022-6	embedded	х		v	SDN	options	DNS	NA	RFC3190 for intercom /Timecode in SDI
	, =											-		At time of writing Sony remains vague on the
Sony	IP/L3	RTP	ST2059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
														A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	V	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
45003				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

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ST302	SMPTE AES3 Digital Audio Interface, SMPTE Extensions payload description
ST2038	Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream

### Ravenna



#### Ravenna is also an audio network protocol developed by Lawo

	Protocol		Timing and Sync		Essence				Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	v	$\checkmark$	v	V	NA	Self managed	NA	NA	NA	
														Fully standardized and based on an IEEE
			1588											protocol not specifically designed for broadcast
AVB	L2	IEEE 1722	(802as)		IEEE 1722	IEEE 1722	IEEE 1722	IEEE 1722	Optional	Self managed	IEEE 1722.1	IEEE 1722.1	IEEE 1722.1	(A/V Consumer, automotive)
				RTP										
SMPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
			1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
VSF TR3	IP/L3	RTP	ST2059	(RFC7273)	RFC4175	RFC3190	ST291	ST291	NA	SDN	options	Protocol (SAP)	NA	shortcomings in ST 2022-6 protocol
				RTP	RFC4175 +	RFC3190+	ST291 +	ST291 +			mDNS			
			1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique		basically based on VSF-TR03 with defined
AMWA	IP/L3	RTP	ST2059	(RFC7273)	extensions	extensions	extensions	extensions	√ (VC2 ?)	SDN	HTTP-based	ID (UUID) based	NA	Discovery and Identity
														Aspen uses a MPEG2 TS data wrapper (multiple
A ano 10		00	1588 (PTP)			c <del></del> 2002	N/	c <del>.</del>	,	(D)				188 byte chunks in one Ethernet packet = more
Aspen	IP/L3	RIP	ST2059		RDD37	\$1302	X	512038	ν	SDN	NA	NA	NA	overnead)
CV	10/12	DTD	1588 (PTP)	RTP	CT 2022 C		V		-1	CDN	multiple	proprietary and	NLA	
GV	IP/L3	RIP	512059	timestamp	51 2022-6	empedded	X		V	SDN	options	DINS	NA	RFC3190 for intercom / Timecode in SDI
Sonv	כו/חו	ртр	CTODEO2		propriotory	propriotory		propriotory	propriotory	SDN				At time of writing Sony remains vague on the
Johy	IP/L5	NIP	512059!		proprietary	proprietary		proprietary	proprietary	3010				A proprietory system with many Audia adoptors
Dante	IP/I 3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	v	proprietary	and AFS67 included
	, 20					Accepts							proprietary	Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

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### AES67

### AES67 is a standard for audio over IP interoperability developed by the



## AES67 patent claim on the technology by <u>*Audinate*</u>.

This makes implementing AES67 a bit tricky (If you license Dante you get AES67 for free)

#### Dante, Ravenna and AES67 audio standards use DiffServ as the QoS method

# Timing &

Latency

Timing is a challenge in IP networks but enough has been developed and tested that in the future this should be no problem

Audio, video and data locking is also a challenge but with individual timestamps a correct sync is easier than before

All timing based on IEEE 1588 has the option to use a defined starting point (Jan 1, 1970)
# Latency is as much a challenge as it is in current SDI systems

# Seam ess switching

## Seamless switching is important in our industry

## ST 2022-7 seamless Protected Switching of 2022 IP datagrams

A way to send two matching streams of packets from a source to a destination over different paths, and have the receiver switch seamless between them.

We call this "destination switching" and is not a difficult method "source switching" on the other hand is quite difficult and can only be managed in a tightly controlled environment of hard and software



## There will be some: VC2 (Dirac) Tico LLVC

 $\bullet \bullet \bullet \bullet$ 

Is it worth it ... ?



### 

## Self Management

### The broadcast industry tends to put QoS and management in the hands of an SDN!

### And ..... There are many flavors of SDN

## An alternative is TSN (Time Sensitive Networks) aka AVB2

## TSN is the future of big networks according to the IT industry

	Protocol		Timing and Sync		Essence				Optional					
Flavor	Transport	Payload	Clock Sync	Payload Sync	Video	Audio	Time Code	ANC/Metadata	Compression	QOS	Discovery	Identity	Control	Notes
SDI	SDI	baseband	Synchron	TRS	٧	V	v	V	NA	Self managed	NA	NA	NA	
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				RTP										
SMPTE 2022-6	IP/L3	RTP	NA	timestamp		S	DI		2022-2	SDN	NA	NA	NA	can use ST2059 as reference
				RTP								optional Session		
			1588 (PTP)	timestamp							multiple	Anouncement		next generation VSF based proposal to correct
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				RTP	RFC4175 +	RFC3190 +	ST291 +	ST291 +			mDNS			
A B 43A/A	15 /1 0		1588 (PTP)	timestamp	header	header	header	header			DNS-SD	Universal Unique		basically based on VSF-TR03 with defined
AIVIWA	IP/L3	RTP	ST2059	(RFC7273)	extensions	extensions	extensions	extensions	√ (VC2 ?)	SDN	HTTP-based	ID (UUID) based	NA	Discovery and Identity
														Aspen uses a MPEG2 TS data wrapper (multiple
Aspon	ר ו/ חו	DTD	1588 (PTP)		00027	CT202	V	672020		CDN	NIA	NIA	NIA	188 byte chuncks in one Ethernet packet =
Aspen	IP/L3	KIP	312039 4500 (DTD)		RDD37	51302	~	512038	V	SDN		NA	NA	more overnead)
GV	ID/I 3	RTP	1588 (PTP) ST2059	KIP timestamn	ST 2022-6	embedded	x		٧/	SDN	ontions		NΔ	REC3190 for intercom /Timecode in SDI
<u>.</u>	IF/LJ	NTF	312033	timestamp	51 2022-0	embedded	A		v	3011	Options	DNS		At time of writing Sony remains vague on the
Sony	IP/L3	RTP	ST2059?		proprietary	proprietary		proprietary	proprietary	SDN				used standards and protocols
	,==				pi e pi cesi y									A proprietary system with many Audio adopters
Dante	IP/L3	RTP	1588		NA	proprietary	NA	NA	NA	DiffServ	V	$\checkmark$	proprietary	and AES67 included
						Accepts								Ravenna acts as a framework for multiple types
Ravenna	IP/L3	RTP	1588		NA	multiple RFC's	NA	NA	NA	DiffServ				of RTP transport (AES67 is one of them)
				RTP										Fights with current version of ST2059 (Caution
				timestamp		RFC3351 (16					multiple			AES67 may involve a patent owned by
AES67	IP/L3	RTP	1588	(RFC7273)	NA	bit) RFC3190	NA	NA	NA	DiffServ	options			Audinate/Dante)

IEEE 1722	Transport Protocol for Layer 2 media devices						
RTP	Real Time Transport Protocol - Describes how to transport real time data over layer 3 Ethernet as timing, payload (audio/video/data)						
1588 (PTP)	Precision Time Protocol - Base for all timing protocols defined by multiple profiles						
ST2059	SMPTE timing profile of 1588 (PTP)						
RFC7273	(Request for Comments IETF) Describes the relation between 1588 and RTP						
RFC4175	(Request for Comments IETF) Describes how uncompressed active video (elementry stream) is packetized specifically linked to RTP						
RFC3190	(Request for Comments IETF) Describes how uncompressed audio (elementry stream) is packetized specifically linked to RTP						
ST291	SMPTE description of the header used to packetize ANC data						
RDD37	Registered Disclosure Document - Aspen - desribes uncompressed active video (elementry stream) in an MPEG-2 Transport Stream which is encapulated in ST2022-2						
ST302	SMPTE AES3 Digital Audio Interface, SMPTE Extensions payload description						
ST2038	Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream						



#### So where does this leave you as an end-user

- Too many choices
- Poor interoperability
- An SDN for all offerings (except AVB)
- To compress or not to compress TiCo/VC2/LLVC?
- Do I invest in this now?



#### And where does that leave us manufacturers?

- Too many choices
- Every flavor costs time and money
- You can waste quite a bit of both

## The Future?

?

# If you need to built something now ....

## Use SDI. (and be very happy with it)

# If you need to built something now on IP ....

## Use ST 2022-6 (and be sure you will need to change soon)

# If you need to built something in the future ....

## Use VSF-TRO3 (or TR04 or TR05 or ....)

If you need to built something soon on IP, and be ready for anything that might come .... Use a vendor that will follow

all future formats





## No 3<sup>rd</sup> party IP cores

We are adapting our core to all above proposals and become agnostic on the used encapsulation format

#### THANK YOU

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