AIMS

Alliance for IP Media Solutions

Interoperability Standards for IP Media Networking

AES67 and SMPTE ST 2110

- Two significant standards have emerged in the past several years to provide wide-ranging interoperability for professional media networking
- This session intends to review the background and objectives behind the creation of each of these standards
- Explain the relationship between the two standards
- Recent developments and the future roadmap for both of these important standards will also be explored

Panelists

- Kevin Gross
- Andreas Hildebrand
- Mike Cronk
- Terry Holton

MNA – Media Networking Alliance

- Established in 2014
- Mission was to promote the AES67 standard
- Also to educate the Pro Audio industry about AES67

AIMS – Alliance for IP Media Solutions

- Established in late 2015
- Focus on promoting the adoption, standardization, development and refinement of open protocols for media over IP
- Initial emphasis at that time on VSF TR-03 and TR-04, SMPTE 2022-6 and AES67

AIMS Mission

To foster the ***adoption*** *of one set of common, ubiquitous,*

standards-based *protocols for* ***interoperability over IP***

in the media and entertainment industry

Interoperability Standards for IP Media Networking

Collaboration

- During 2017, the MNA and AIMS collaborated in sponsoring the very successful IP Showcase events at the NAB and IBC shows

Collaboration

- During 2017, the MNA and AIMS collaborated in sponsoring the very successful IP Showcase events at the NAB and IBC shows
- Through this collaboration, it became clear that the two organizations had very much in common and could more effectively promote open standards for IP interoperability by joining forces

Merger

- This lead to the merger of the MNA into AIMS at the beginning of 2018

Interoperability Standards for IP Media Networking

AIMS – 100 members

- Following the merger with the MNA, AIMS has continued to grow and now has 100 members
- Manufacturers from the Broadcast, Pro Audio and ProAV industries
- End users of media networking technology including many major broadcasters

AIMS Alliance for IP Media Solutions

Members List

100 Members

21ST CENTURY FOX
β3
ADVANTECH Enabling an Intelligent Planet
AJA
ALC NetworX
alteros An Audio-Technica Company
ARCHWAVE audio networking & streaming technologies
ARISTA
Artel
Atos
ATTEROTECH
AVID
AXIS COMMUNICATIONS
AXON THE HEART OF BROADCAST
BBC
BFE
BOSCH
BRIDGE TECHNOLOGIES
broad cast SOLUTIONS
CALREC
Canon
CBC
CBS
CDV 新奥特
CISCO
Clear-Com
COBALT
CHYRONHEGO
DAYANG
DELL EMC
DELTACAST VIDEO SOLUTIONS FOR DEVELOPERS
digigram
DirectOut TECHNOLOGIES
Diversified. IMAGINATION ENGINEERED
embrionix
MediaKind everyone. everywhere.
euro media group
evertz
EVS
FLORICAL SYSTEMS
FITCAN
Focusrite
FVA FUYOH VIDEO
grass valley A BELDEN BRAND
GeFei
GENELEC
GRUPO GLOBO
HARMAN A SAMSUNG COMPANY
harmonic
Ikegami
Imagine COMMUNICATIONS
intoPIX
JUNIPER NETWORKS Engineering Simplicity
LAWO
Leader
LINKER 联汇 ONE LINKER ONE WORLD
Luminex NETWORK INTELLIGENCE
LYNXTechnik AG
MACNICA
matrox
mediaproxy
MEINBERG
Mellanox TECHNOLOGIES
MERGING AUDIO FOR THE NETWORKING AGE
NBCUniversal
NEC Orchestrating a brighter world
netinsight
nevion
NTC National TeleConsultants
Panasonic
pebble beach systems
PESA
PHABRIX
ProSiebenSat.1 Produktion
QSC
QVESTMEDIA THE LEADING SYSTEMS ARCHITECT
RIEDEL
ROHDE&SCHWARZ
ROSS LIVING LIVE!
skyline communications
sobey
Solid State Logic OXFORD • ENGLAND
sonovts
SONY
Soundking 音王集团 创始于1988
STAGETEC
STUDIO TECHNOLOGIES INC.
sverigesradio
TAG VIDEO SYSTEMS LTD
Tektronix
THE TELOS ALLIANCE Create. Communicate. Connect.
TOSHIBA
tpc
TVU networks
Utah Scientific
vizrt
WBS WARD-BECK SYSTEMS
Wheatstone BROADCAST AUDIO PERFECTIONISTS
World Wide Technology
YAMAHA
commercial audio

AES67 Standard

What was the original goal?

- “Provide a method to connect disparate Audio-over-IP systems to achieve workaround-free networked audio interoperability”

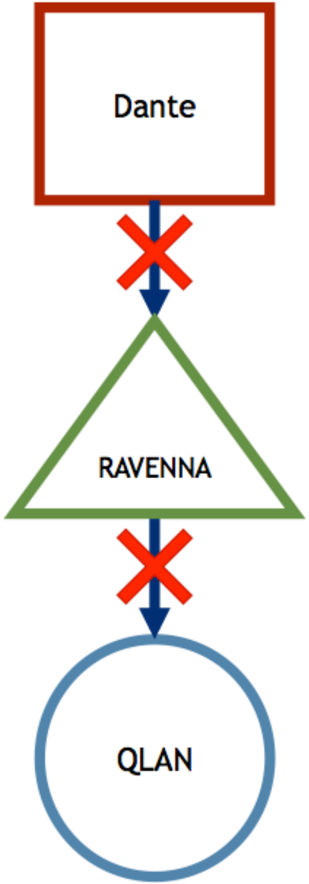
What is AES67?

- Interoperability Standard for high performance Audio-over-IP networks
- Based on existing and trusted IT standards
  - This ensures compatibility with existing network infrastructure
  - Also allows coexistence with other IT data

AES67 Standard

Problem Statement

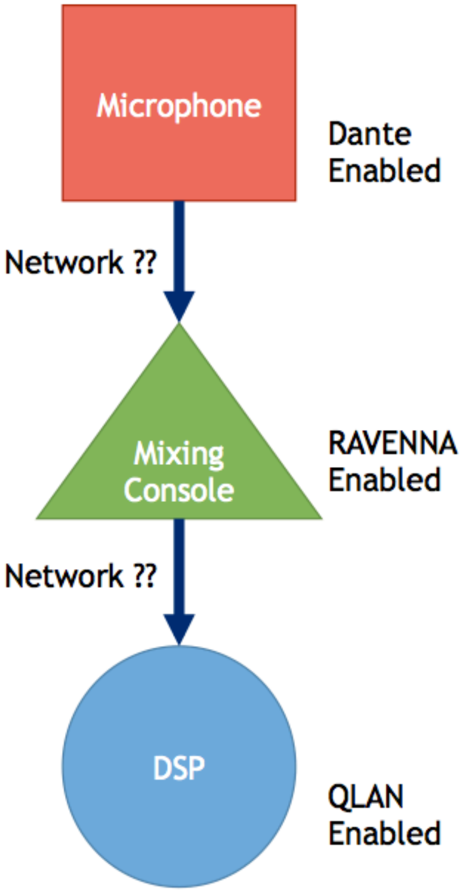
- Audio-over-IP (aka Networked Audio) provides simpler and better connection between audio equipment
- Coupled with many advantages, one clear challenge presented itself: **Compatibility**
- While each Audio-over-IP solution offered in-system connectivity, there was no standard to provide inter-system connectivity



AES67 Standard

Problem Statement

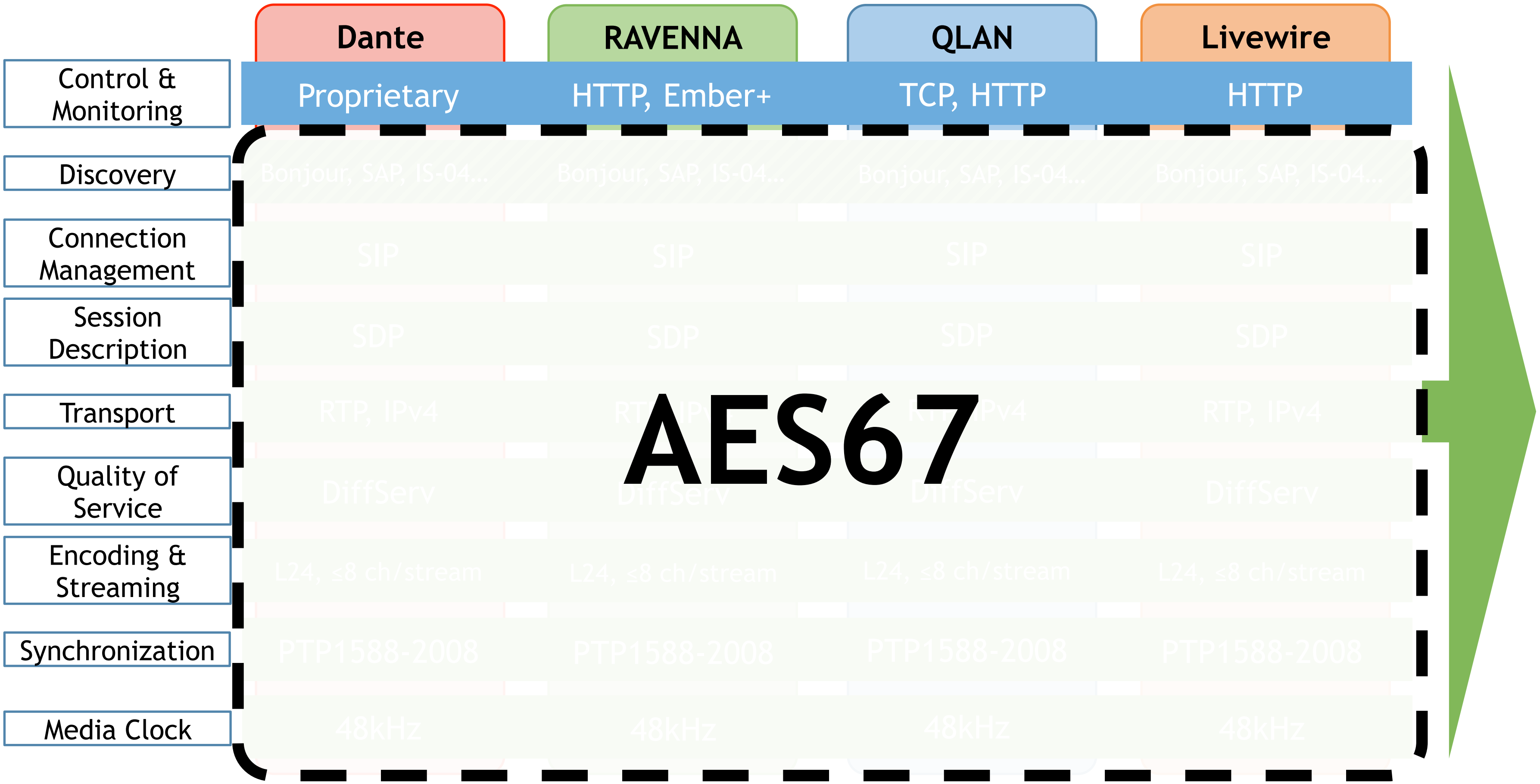
- Prevalent networked audio solutions prior to AES67 were incompatible
- **Consultants, Integrators, Manufacturers** and **End-Users** needed to choose a compromise:
    - Format converters between devices
    - Compromised subset of products
    - Focus on Networked Audio rather than the Product or Solution



The Road to Incompatibility...

	Dante	RAVENNA	QLAN	Livewire
Control & Monitoring	Proprietary	HTTP, Ember+	TCP, HTTP	HTTP, Proprietary
Discovery	Proprietary	Bonjour	Proprietary	Proprietary
Connection Management	Proprietary	RTSP, SIP, IGMP	Proprietary	Proprietary, HTTP, IGMP
Session Description	Proprietary	SDP	Proprietary	Channel #
Transport	Proprietary, IPv4	RTP, IPv4	RTP, IPv4	RTP, IPv4
Quality of Service	DiffServ	DiffServ	DiffServ	DiffServ/802.1pq
Encoding & Streaming	L16-32, ≤4 ch/flow	L16-32, ≤64 cha/str	32B-FP, ≤16 ch/str	L24, st, surr
Synchronization	PTP1588-2002	PTP1588-2008	PTP1588-2008	Proprietary
Media Clock	44.1kHz, 192kHz	44.1kHz – 384kHz	48kHz	48kHz

AES67 Compatibility Mode

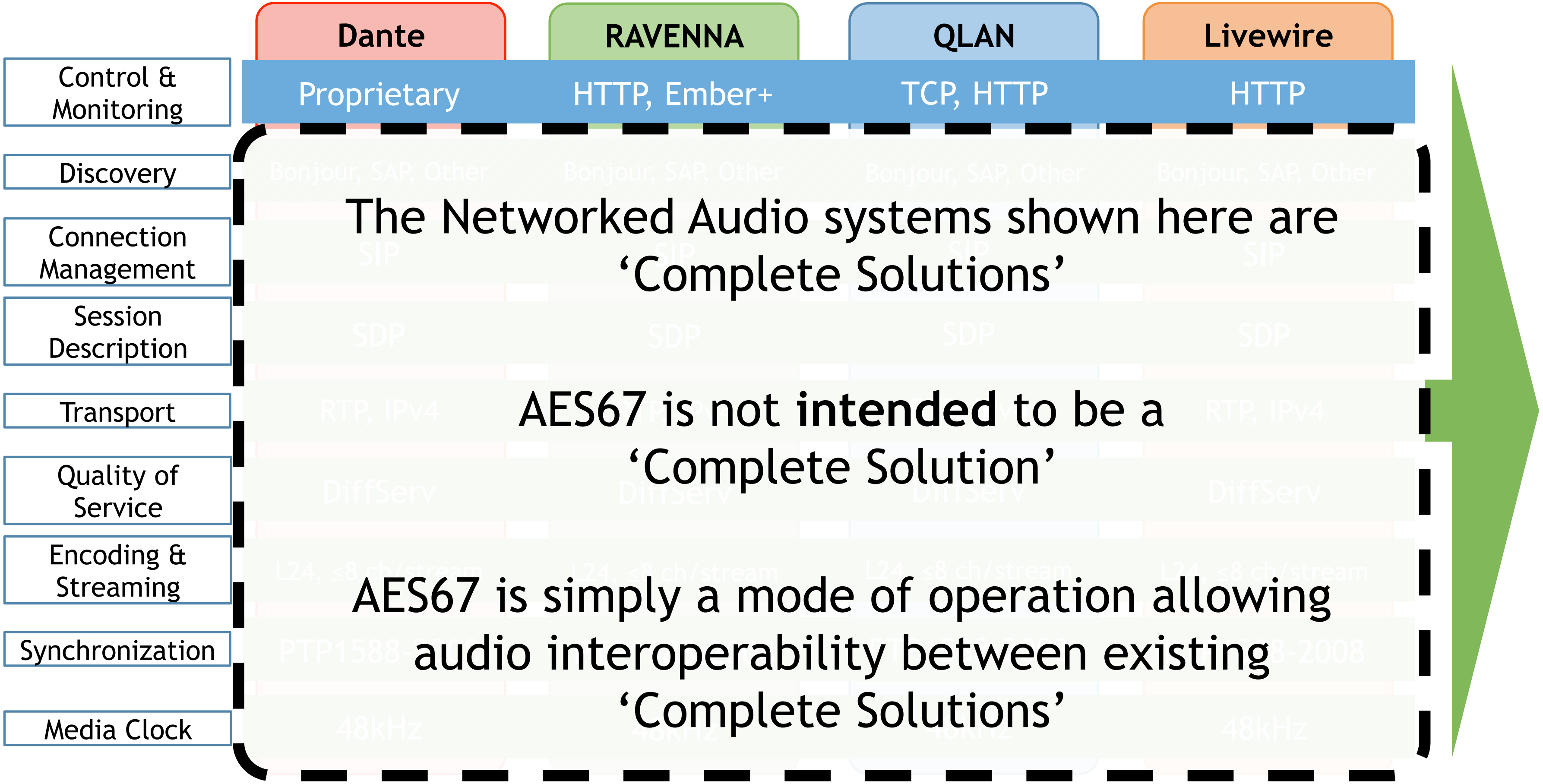


AES67 Compatibility Mode

	Dante	RAVENNA	QLAN	Livewire
Control & Monitoring	Proprietary	HTTP, Ember+	TCP, HTTP	HTTP
Discovery	Bonjour, SAP, Other	Bonjour, SAP, Other	Bonjour, SAP, Other	Bonjour, SAP, Other
Connection Management	SIP	SIP	SIP	SIP
Session Description	SDP	SDP	SDP	SDP
Transport	RTP, IPv4	RTP, IPv4	RTP, IPv4	RTP, IPv4
Quality of Service	DiffServ	DiffServ	DiffServ	DiffServ
Encoding & Streaming	L24, ≤8 ch/stream	L24, ≤8 ch/stream	L24, ≤8 ch/stream	L24, ≤8 ch/stream
Synchronization	PTP1588-2008	PTP1588-2008	PTP1588-2008	PTP1588-2008
Media Clock	48kHz	48kHz	48kHz	48kHz

With a baseline of common protocols and standards, AES67 enables audio interoperability between products featuring different network technologies such as Dante, RAVENNA, QLAN, Livewire, WheatNet-IP and others.

AES67 Compatibility Mode



The Networked Audio systems shown here are 'Complete Solutions'

AES67 is not **intended** to be a 'Complete Solution'

AES67 is simply a mode of operation allowing audio interoperability between existing 'Complete Solutions'

AES67 Compatibility Mode

	Dante	RAVENNA	QLAN	Livewire
Control & Monitoring	Proprietary	HTTP, Ember+	TCP, HTTP	HTTP
Discovery	Bonjour, SAP, Other	Bonjour, SAP, Other	Bonjour, SAP, Other	Bonjour, SAP, Other
Connection Management	SIP	SIP	SIP	SIP
Session Description	SDP	SDP	SDP	SDP
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Media Clock	48kHz	48kHz	48kHz	48kHz

Therefore, AES67 **complements** each of these solutions, it <u>does not</u> **compete** with them

Audio-over-IP Technology Pavilion Demo

Why SMPTE ST 2110?

Mike Cronk
Chairman, AIMS
VP, Core Technology, Grass Valley

The Challenge Before Us

- The ***pace of change*** is faster than ever

Multi-platform

Increasing resolutions/frame rates

Wide Color Gamut/ High Dynamic Range

- How do I build a plant that can flexibly prepare me for the above changes…
- …and that allows me to succeed in an environment with these new entrants?

NETFLIX amazon.com Google

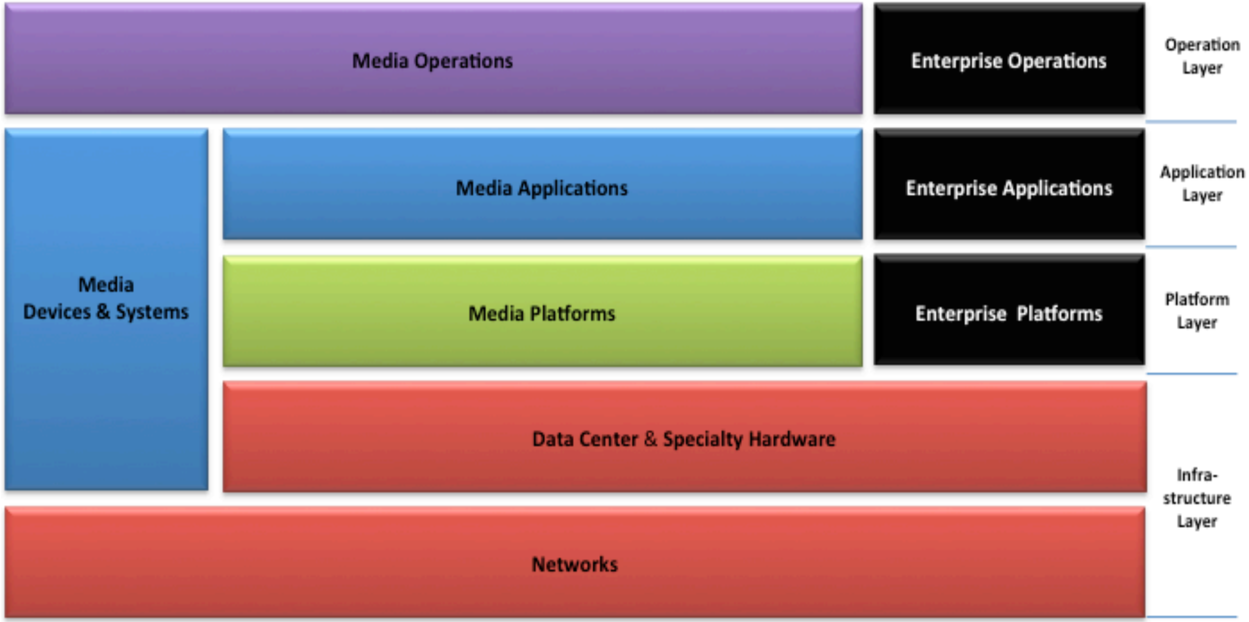
AIMS Alliance for IP Media Solutions

The Joint-Task Force on Networked Media (JT-NM)

"The primary objective of the Joint Task Force on Networked Media (JT-NM) is to ensure interoperability in packet-based systems (networking, equipment and software) for professional media. This includes defining an agile, on-demand, packet-based network infrastructure designed to support a variety of distributed, automated, professional media (file- and stream-based) workflows for local, regional and global production supporting any format, standards based, for interoperability to facilitate new workflows and reduce total cost of ownership and to speed-up content time-to-market"[1]

1) Joint Task Force on Networked Media Report on User Requirements, 2013

JT-NM Reference Architecture



Scope is far beyond mere transport

- JT-NM RA 1.0 published September 4, 2015
- http://www.jt-nm.org/

AIMS Alliance for IP Media Solutions

Circa Fall of 2015

Vendor 1 → Vendor specific implementation #1

Vendor N → Vendor specific implementation #N

VIDEO SERVICES FORUM

SVIP Activity Group formed
April 17, 2014

→

Video Services Forum (VSF)
Technical Recommendation TR-03

Transport of Uncompressed
Elementary Stream Media over IP

November 12, 2015

Technical Recommendation
Fall, 2015

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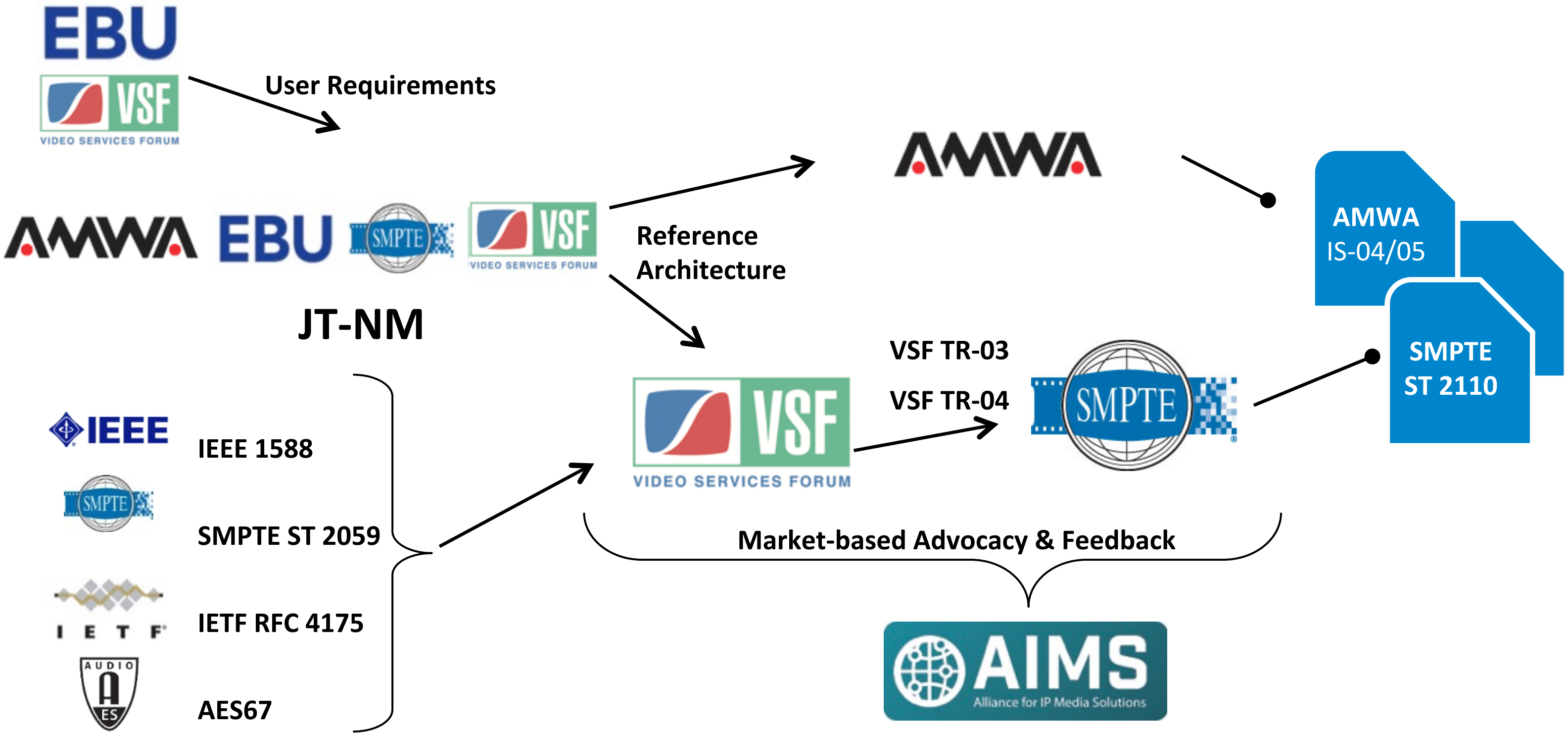
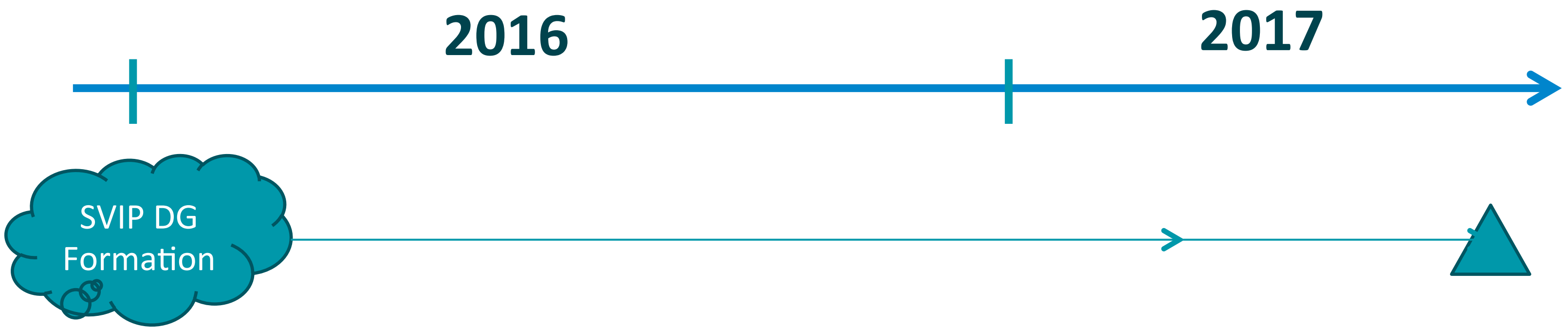
Market Confusion

AIMS Role and The Power of Collaboration



ST 2110 on a timeline



Base Standards Suite Published
December 2017

SMPTE ST 2110 is Essence-Based

2022-6

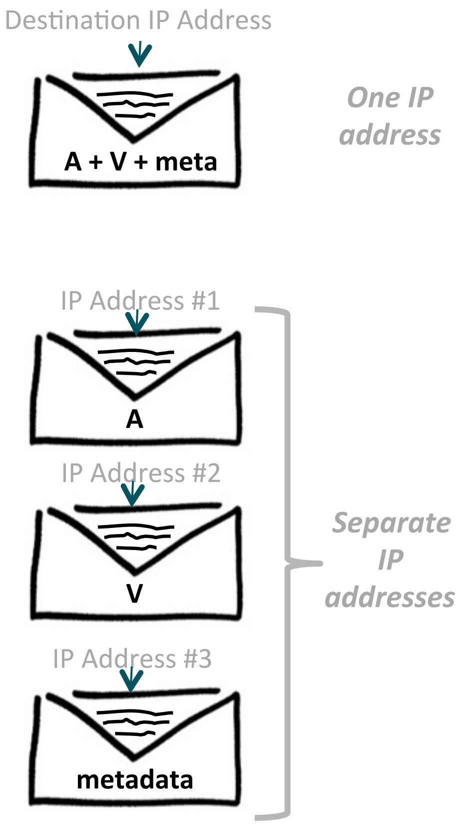
Bundled (Audio, Video, Metadata together)

- Audio/Video/Metadata/Sync travel ***coherently***
- Requires extra work to “unpack” separate essences
- Well suited for ***Playout/Distribution*** workflows
- Well suited for ***WAN/Contribution*** across timing domains

2110

Essence Based (Audio, Video, Metadata separate)

- Ideal for ***Studio/Production*** workflows
- Individual essence kept in sync using PTP timing



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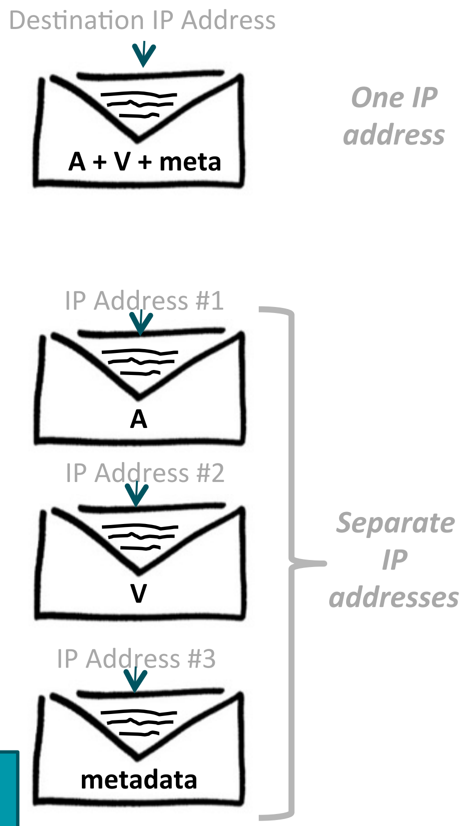

Enables better, more streamlined compatibility with Audio (AES67) workflow s

Growing Adoption: IBC 2018 IP Showcase Statistics

- 58 manufacturers
- 168 unique products
- 36 reference sites

Key Benefits

As Articulated by Early Adopters

- Scale
- Format Flexibility
- Future-proof Infrastructure
- Resource Sharing
- Improved Signal Monitoring

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Summary: Why SMPTE ST 2110

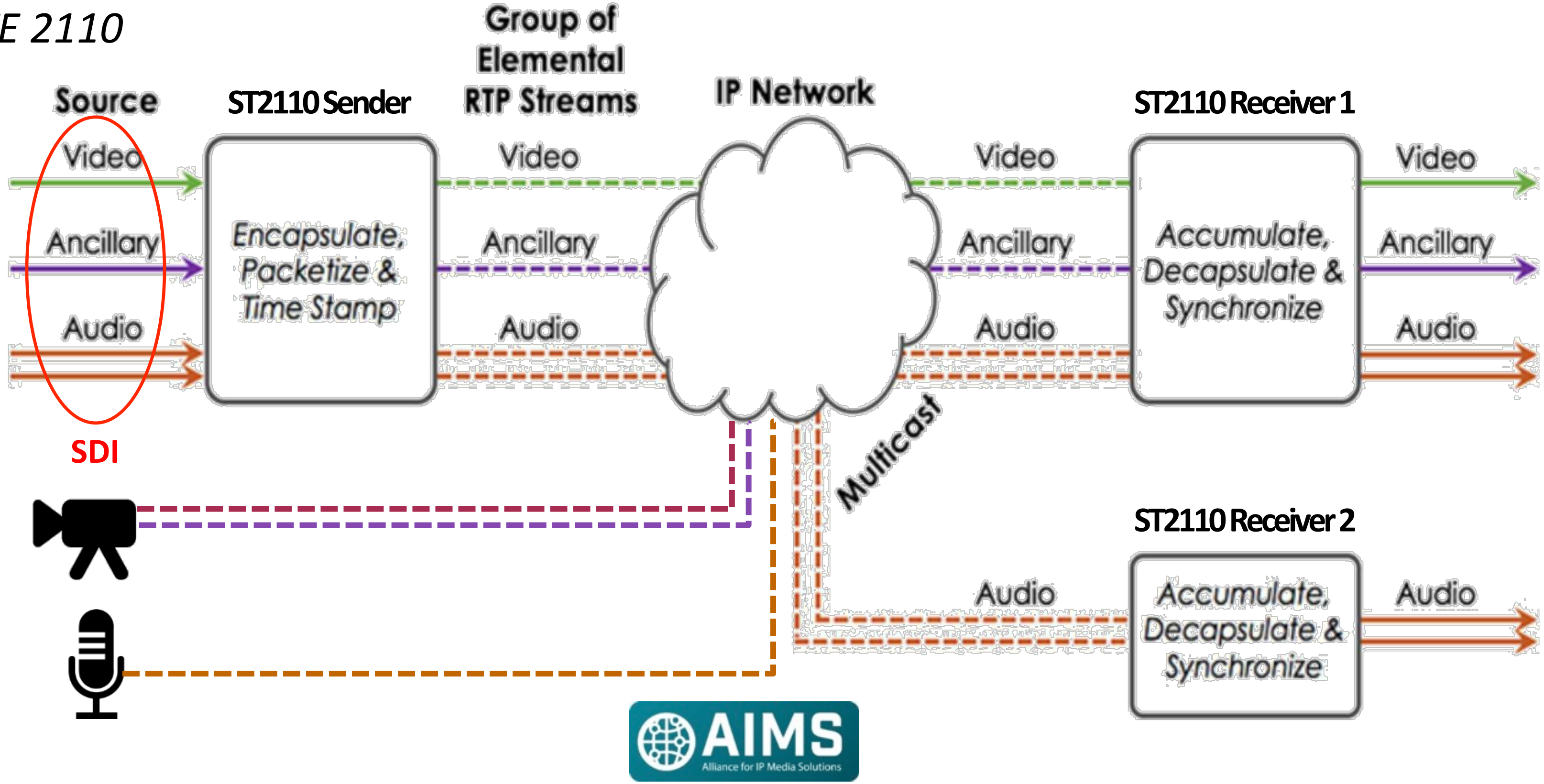
- Enables a new, flexible architecture for video and audio production allowing media and entertainment companies to be much more ***agile*** to meet the growing demand for content
- Provides a common set of protocols for industry-wide ***interoperability***
  - Including AES67 compatibility (at specific operating points)
- Delivers tremendous ***benefits***
  - Scale, Format Flexibility, Future-proof Infrastructure, Resource Sharing, Improved Signal Monitoring

The Audio Parts of ST 2110 Explained

- Andreas Hildebrand –
RAVENNA Technology Evangelist
ALC NetworX, Munich

Interoperability Standards for IP Media Networking

SMPTE 2110



Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Document structure (audio):

- 2110-**10**: System Timing & Definitions
  - defines transport layer and synchronization (SMPTE2059, clocks, RTP, SDP etc.)
- 2110-**30**: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)
- 2110-**31**: AES3 Transparent Transport
  - defines payload format for non-linear audio (RAVENNA AM824)

Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Document structure (linear PCM audio):

- 2110-**10**: System Timing & Definitions
  - defines transport layer and synchronization (SMPTE2059, clocks, RTP, SDP etc.)
- 2110-**30**: PCM Digital Audio
  - defines payload format for linear audio (AES67, constraints)

AES67

Constraints!

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SMPTE 2110 - Professional Media over Managed IP Networks

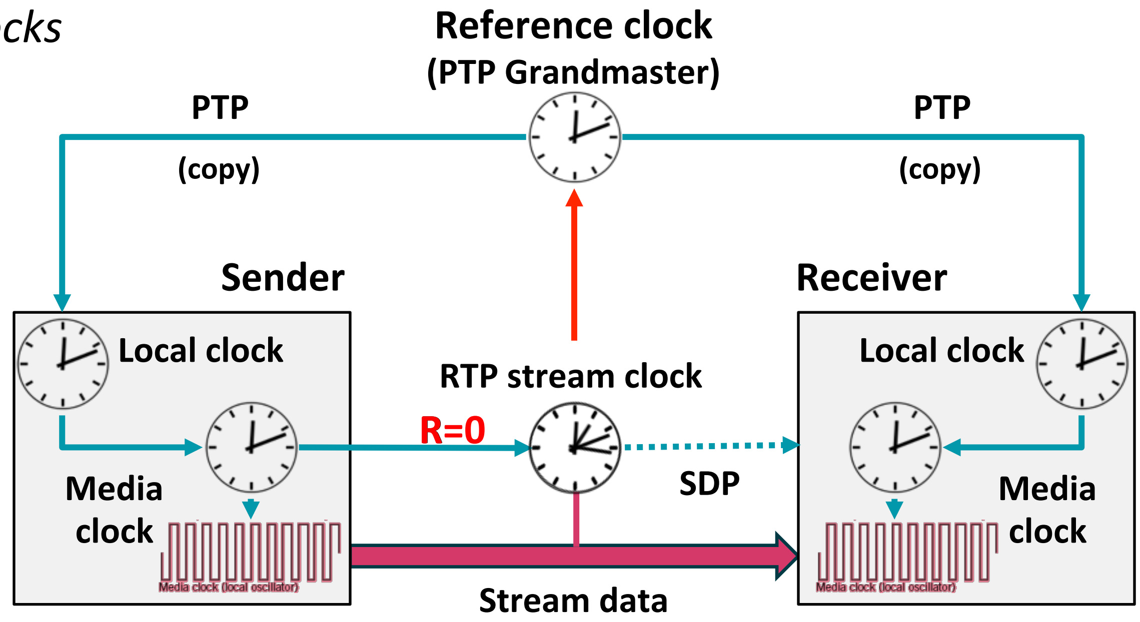
Constraints of 2110-10 & -30 w/ respect to AES67

- Synchronisation & Timing -

- PTP:
  - support of SMPTE 2059-2 required
  - message rate according to AES-R16-2016 (AES67 PTP Media profile)
  - `defaultDS.slaveOnly=true` to intentionally prevent devices from entering PTP master state
  - `a=ts-refclk:ptp=traceable` and `a=tsrefclkts-refclk:localmac=<mac_addr>` allowed
- RTP clock: offset= 0 w/ respect to media clock / reference clock
  - `a=mediaclk:direct=0`

Interoperability Standards for IP Media Networking

AES67 synchronization & media clocks



- Offset **R** is established on stream start-up
- **R** may be random to defeat crypto-text attacks
- This offset will be constant throughout the stream's lifetime
- The offset (**R**) will be conveyed via SDP (a=mediaclk:direct=<offset>) **– must be "0" in ST2110**

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- Protocols -

- Support of RTCP not required (but must be tolerated)
- Support of SIP (or any other connection management protocol) not required
- Redundancy (optional): SMPTE 2022-7
  - no identical IP source and destination addresses
- Channel assignment map (SDP attributes - optional)
  - a=fmtp:<payload type> channel-order=<convention>.<order>
  - Example: a=fmtp:101 channel-order=SMPTE2110.(51,ST)

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- 6 conformance levels:

Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- 6 conformance levels:

Level	Supported by the Receiver
A (mandatory)	**Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms**

AES67 compliant

Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- 6 conformance levels:

Level	Supported by the Receiver
A (mandatory)	**Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms**
B	Level A + 1 to 8 channels at packet times of **125** µs

AES67 compliant

Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- 6 conformance levels:

Level	Supported by the Receiver
A (mandatory)	**Reception of 48 kHz streams with 1 to 8 audio channels at packet times of 1 ms**
B	Level A + 1 to 8 channels at packet times of **125** µs
C	Level A + 1 to **64** channels at packet times of **125** µs

AES67 compliant

Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

Constraints of 2110-10 & -30 w/ respect to AES67

- 6 conformance levels:

Level	Supported by the Receiver
A**X**	Level A (⇨ 48 kHz) + Reception of **96** kHz streams with 1 to **4** audio channels at packet times of 1 ms
B**X**	Level B + AX + 1 to **8** channels at packet times of **125** µs
C**X**	Level C + AX + 1 to **32** channels at packet times of **125** µs

96 kHz

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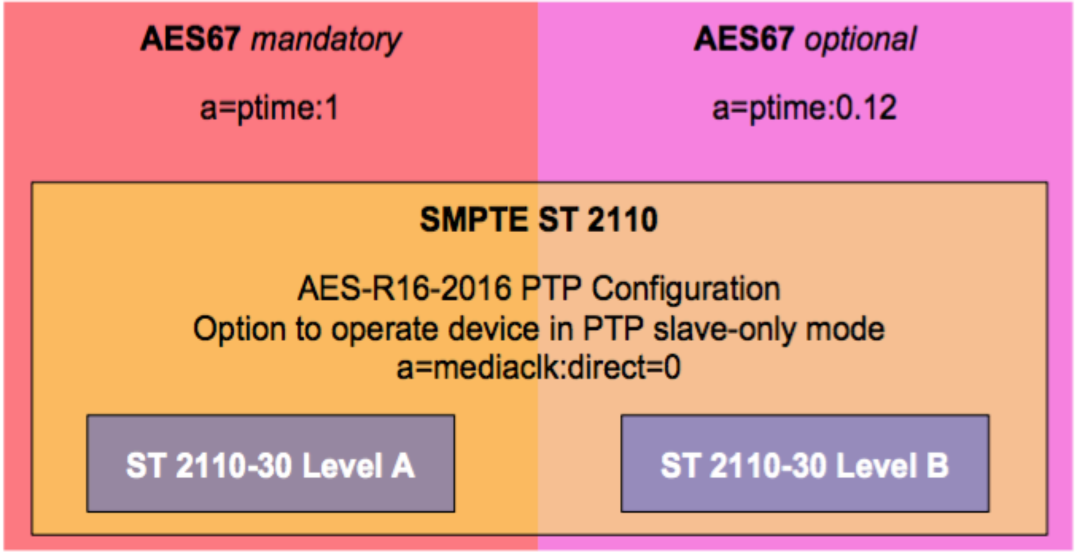
Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

SMPTE ST 2110-30 is a subset of AES67,
adding constraints to clocking and streaming



Interoperability Standards for IP Media Networking

SMPTE 2110 - Professional Media over Managed IP Networks

AES67 / ST2110 audio compatibility?

Constraints!

- AES-R16-2016 PTP configuration
- option to operate device in PTP slave-only mode
- a=mediaclk:direct=0

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SMPTE 2110 - Professional Media over Managed IP Networks

2110-31 – transparent transport of AES3 audio data

- Can transport any format which can be encapsulated in AES3
  - L24 PCM w/ AES3 subframe meta data (PCUV bits)
  - non-PCM audio and data formats as defined by SMPTE ST 337 / 338 (i.e. Dolby®E etc.)

SMPTE 2110 - Professional Media over Managed IP Networks

2110-31 – transparent transport of AES3 audio data

- Builds on RAVENNA’s AM824 (IEC 61883-6) payload definition:
  - retains AES67 definitions for synchronization and RTP usage
  - uses 3 bytes for PCM24 + 1 byte for AES3 meta data

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|0|B|F|   PCUV |                    DATA24                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

  - RTP payload format signaled in SDP:

```
a=rtpmap:<pt> AM824/48000/<nchan>
```

  - retains all other SDP parms

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Latest Developments on the SMPTE ST 2110 Standards Suite

Mike Cronk
Chairman, AIMS
VP, Core Technology, Grass Valley

Existing SMPTE Standards for IP (1 of 2)

SMPTE 2110-10	Professional Media Over Managed IP Networks: **System Timing and Definitions**
SMPTE 2110-20	Professional Media Over Managed IP Networks: **Active Video**
SMPTE 2110-21	Professional Media Over Managed IP Networks: **Traffic Shaping and Delivery Timing for Video**
SMPTE 2110-30	Professional Media Over IP Networks: **PCM Digital Audio**, based on and compatible with AES67

Existing SMPTE Standards for IP (2 of 2)

SMPTE 2110-40	Professional Media Over Managed IP Networks: **SMPTE ST 291-1 Ancillary Data**
SMPTE 2059-1	Generation and Alignment of Interface Signals to the SMPTE Epoch
SMPTE 2059-2	SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications
SMPTE 2022-7	Seamless Protection Switching of SMPTE ST 2022 IP datagrams

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SMPTE Standards/RPs in Development

- SMPTE ST 2110 – 31 Professional Media over Managed IP Networks: **AES3 Transparent Transport**
- SMPTE ST 2022 – 8 Professional Media over Managed IP Networks: **Timing of ST 2022-6 streams in ST 2110-10 Systems**
- SMPTE ST 2110 – 22 Professional Media over Managed IP Networks: **Constant Bit-Rate Compressed Video**
- SMPTE **RP** 2110-23 **Single Video Essence Transport over Multiple ST 2110-20 Streams**

Alliance for IP Media Solutions

Interoperability testing and certification

Kevin Gross

Standards development

Ideally, describes an already-working system

More ideally, describes use of already-working and well-established standards

Integration is still hard

Language is still hard

Standards testing

Existing standards may have already been tested

Demonstration of independent implementations

Plug tests and other developer interaction

Standards revisions - AES67-2013, 2015, 2018

Protocol implementation conformance statement (PICS)

AES67 PICS excerpt

H.2.4.3 Transport layer

6.3-1	Does the device use Real-time Transport Protocol as defined in RFC 3550?	6.3		M	Yes [ ] No [ ]
6.3-2	Does the device operate in accordance with RTP Profile for Audio and Video Conferences with Minimal Control as defined in RFC 3551?	6.3		M	Yes [ ] No [ ]
6.3-3	Does the device use the default port allocated for RTP: 5004?	6.3		O	Yes [ ] No [ ]
6.3-4	Does the device use the default port allocated for RTCP: 5005?	6.3	Devices are not required to implement RTCP	O	Yes [ ] No [ ]
6.3-5a	Is the device capable to use for RTP or RTCP any other port different from the default ports, either fixed or configurable through the management interface or another method?	6.3		O	Yes [ ] No [ ]
6.3-5b	If different ports are used, indicate which:				
6.3-6	Does the device use UDP as defined in RFC 768 for transport of RTP?	6.3		M	Yes [ ] No [ ]
6.3-7	Does the RTP payload size not exceed 1440 bytes, (when no contributing source (CSRC) identifiers or header extensions are included)?	6.3		M	Yes [ ] No [ ]
6.3-8	Does the sender not include contributing source	6.3		O	Yes [ ] No [ ]

Protocol implementation conformance statement

One row for every compliance statement - may, should, shall…

Requirement level

Supported response

Other notes - port numbers, channel counts...

AES67 excerpt

6.3 Transport layer

The transport layer provides end-to-end communications between devices on a network. The layer handles issues of packet loss and reordering and implements multiplexing so that a single network connection can serve multiple applications on the end station.

Devices shall use Real-time Transport Protocol as defined in RFC 3550. Devices shall operate in accordance with RTP Profile for Audio and Video Conferences with Minimal Control as defined in RFC 3551. Devices should use the default ports allocated for RTP: 5004 for RTP and 5005 for RTCP (see RFC 3551, section 8). Senders may use other or additional ports. Receivers shall support use of other or additional ports by corresponding senders.

Devices shall use UDP as defined in RFC 768 for transport of RTP.

Fragmentation is undesirable and, under this standard, receivers are not required to perform reassembly (6.1). The standard 1500-byte Ethernet MTU is assumed. To prevent fragmentation through a standard Ethernet infrastructure when using IPv4, and to assure future compatibility with IPv6, the maximum allowed RTP payload size shall be 1440 bytes.

NOTE 1 On connections offering lower MTU than Ethernet's 1500 bytes, senders may wish to use a smaller maximum payload than specified here.

AES67 PICS excerpt

H.2.4.3 Transport layer

6.3-1	Does the device use Real-time Transport Protocol as defined in RFC 3550?	**6.3**		M	Yes [ ] No [ ]
6.3-2	Does the device operate in accordance with RTP Profile for Audio and Video Conferences with Minimal Control as defined in RFC 3551?	**6.3**		M	Yes [ ] No [ ]
6.3-3	Does the device use the default port allocated for RTP: 5004?	**6.3**		O	Yes [ ] No [ ]
6.3-4	Does the device use the default port allocated for RTCP: 5005?	**6.3**	Devices are not required to implement RTCP	O	Yes [ ] No [ ]
6.3-5a	Is the device capable to use for RTP or RTCP any other port different from the default ports, either fixed or configurable through the management interface or another method?	**6.3**		O	Yes [ ] No [ ]
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6.3-8	Does the sender not include contributing source	**6.3**		O	Yes [ ] No [ ]

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PICS applications

Development testing - Test plan based on PICS (and other things)

Plug test - Program development based on subset of the PICS

Certification testing - Test development based on mandatory PICS items

Interoperability assessment - Comparison of optional PICS items and notes

Certification testing vs. self-certification

Heavy weight vs. light weight

Waterfall vs. agile

Guarantee vs. agreement

Arbitrated vs. collaborative

AMWA
Networked Media. Working.

networked media
NMOS
open specifications

Project Overview

Andreas Hildebrand, RAVENNA Evangelist

AIMS
Alliance for IP Media Solutions

Interoperability Standards for IP Media Networking

JT-NM ROADMAP

of networked media open interoperability

AMWA

EBU

SMPTE

VSF

VIDEO SERVICES FORUM

AIMS

Alliance for IP Media Solutions

JT-NM Roadmap

IV. DEMATERIALIZED FACILITIES

CLOUD FIT
Open, secure, public/private cloud solutions

NON MEDIA-SPECIFIC IT
Self-service open APIs suitable for virtualization

III. NETWORK & RESOURCE MANAGEMENT

Automated resource management for more flexible and sharable infrastructure at scale

II. ELEMENTARY FLOWS

ST2110

More flexible and efficient workflows
New formats supported like UHD and mezzanine compression

I. SDI OVER IP

ST2022-6

CURRENT AND MATURE TECHNOLOGY

0. CURRENT SDI

JT-NM Roadmap

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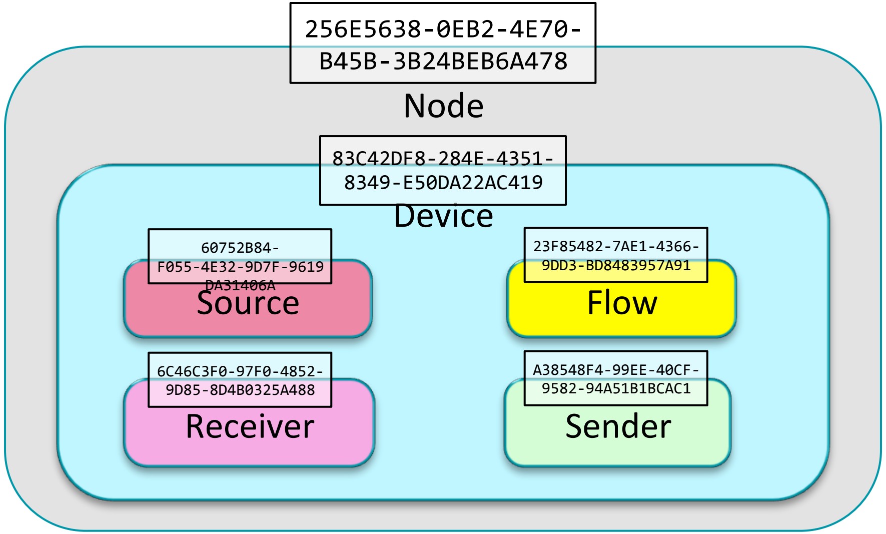
CURRENT AND MATURE TECHNOLOGY

0. CURRENT SDI

Key elements

Identity

Interoperability Standards for IP Media Networking

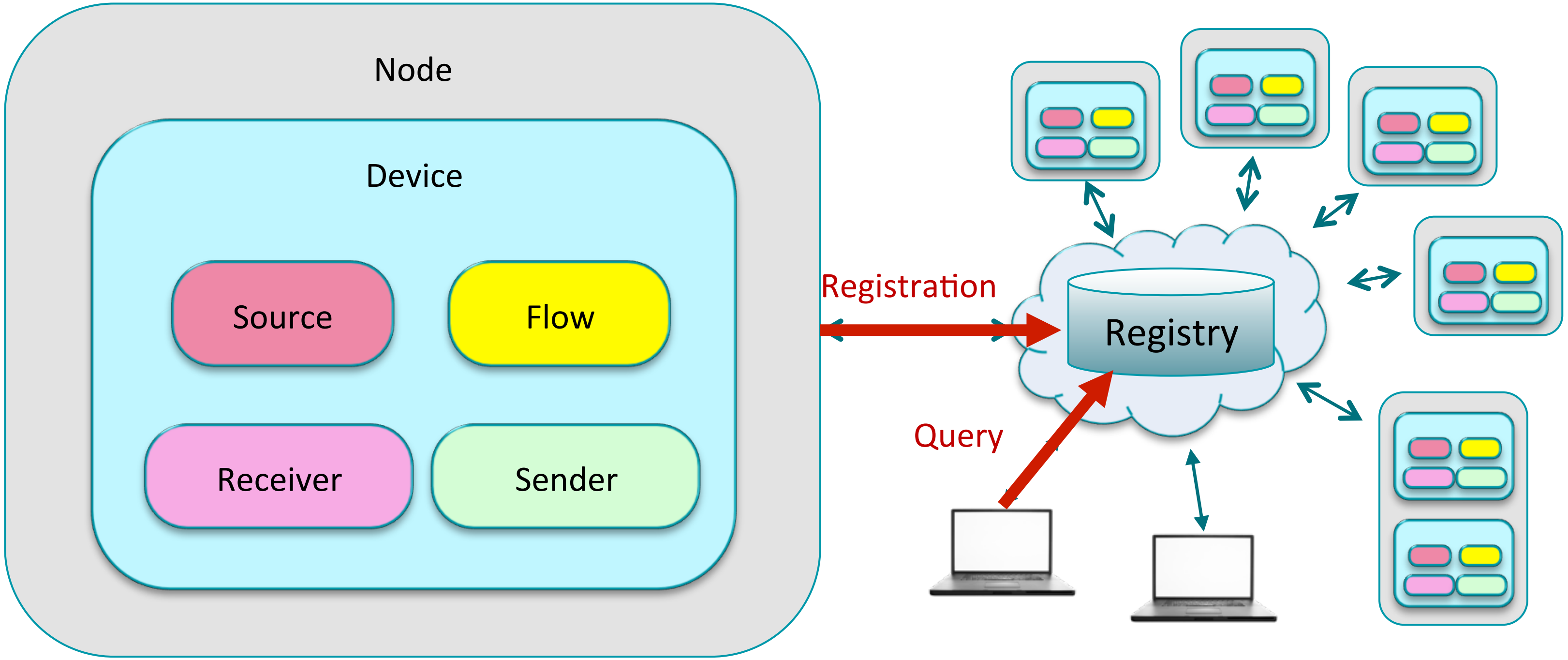


Discovery & Registration

IS-04

Ensure parts of a networked media system can find each other

Interoperability Standards for IP Media Networking



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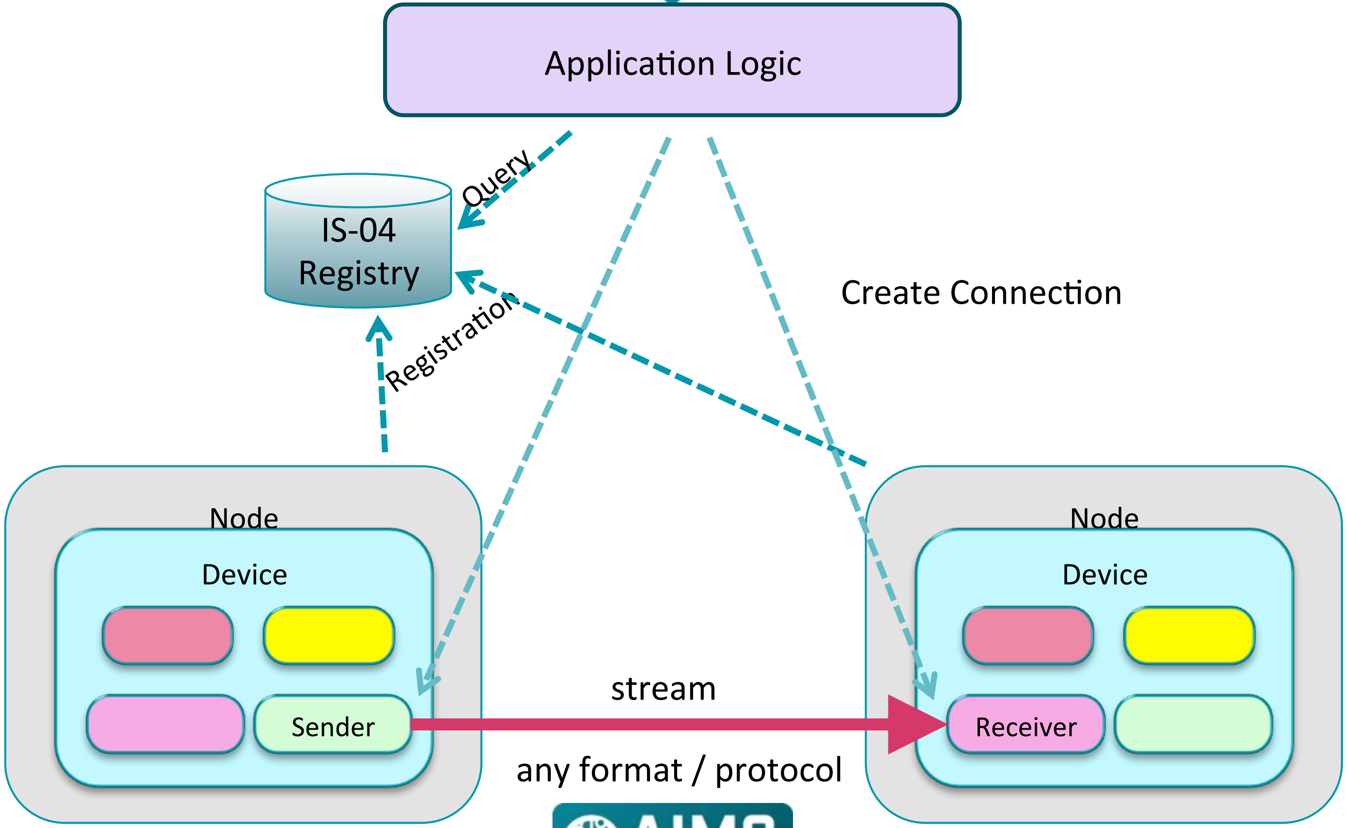
Connection management

IS-05

Make it simple for applications to (dis)connect devices

Interoperability Standards for IP Media Networking



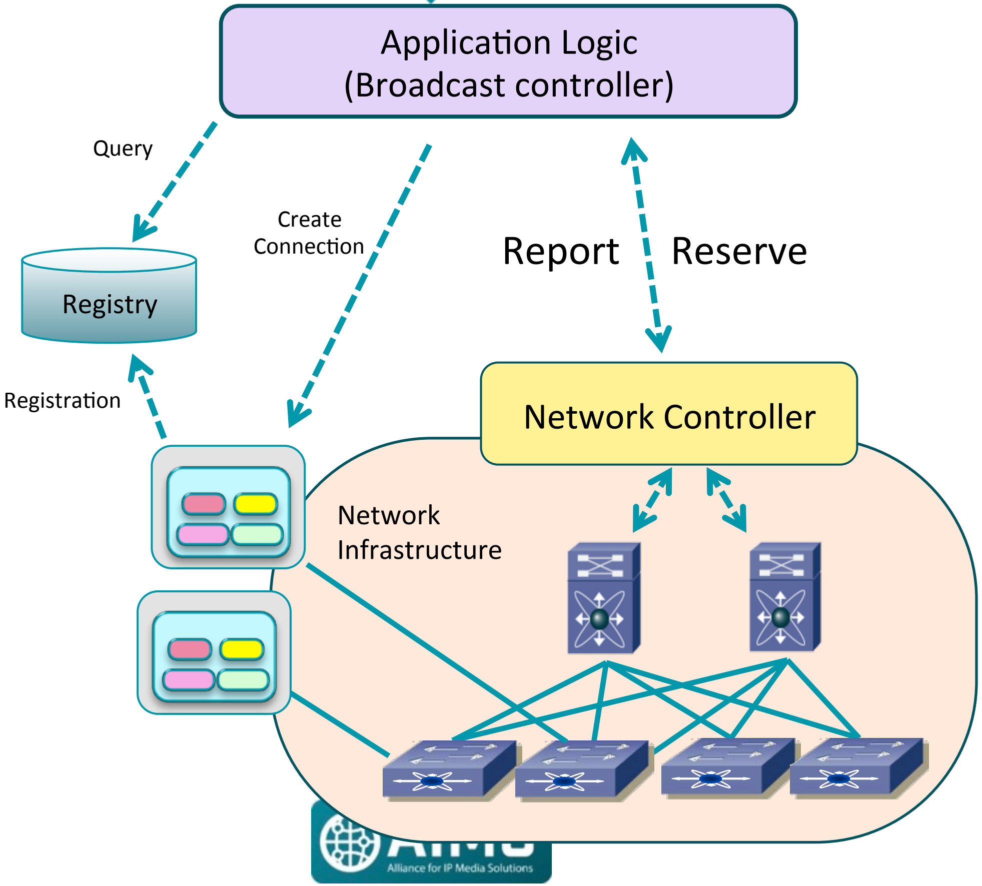
Network Control

IS-06

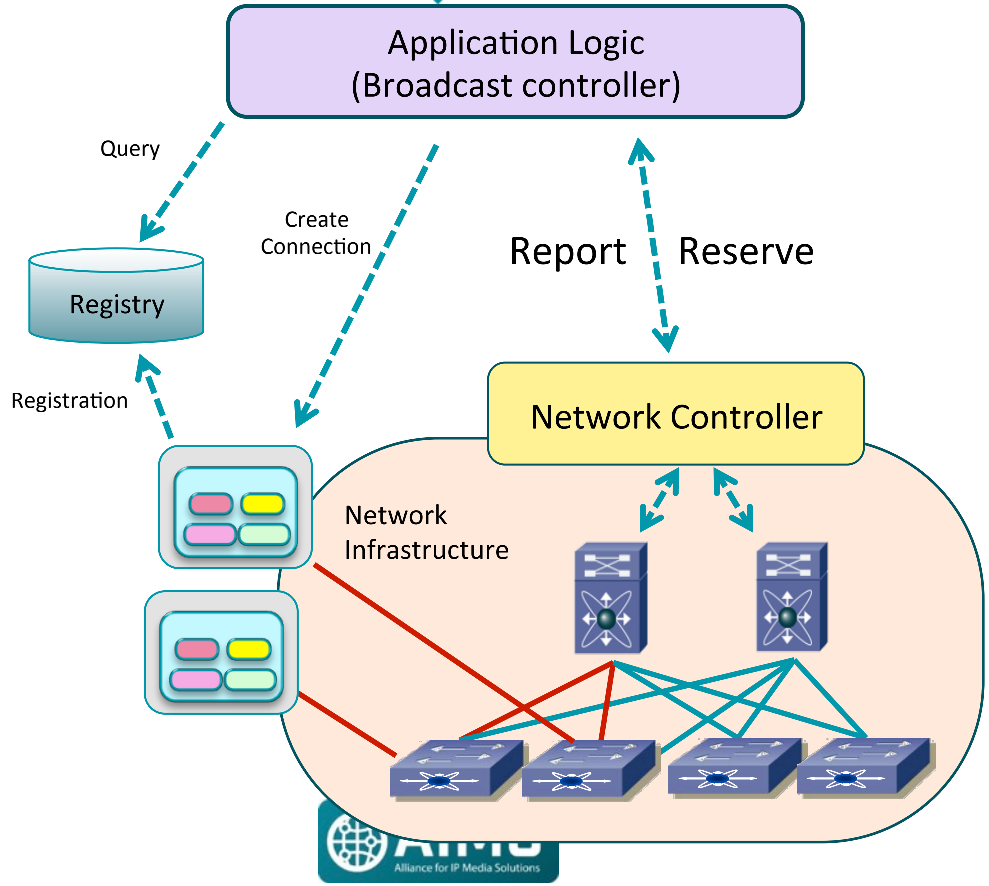
(on-going work)

Reserve and manage low-level network flows

Interoperability Standards for IP Media Networking



Interoperability Standards for IP Media Networking



New Work

IS-07

(on-going work)

Tally & Control

IS-xy

(future work)

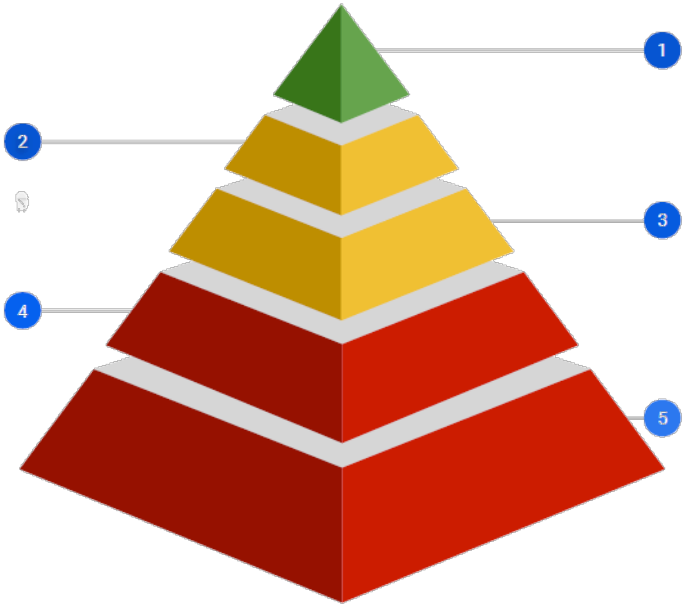
- Audio channel mapping
- Flow grouping
- Scalability
- ID & Timing
- Security
- Full stack

Interoperability Standards for IP Media Networking

Minimum Stack for IP endpoints

necessary to build and manage a full scale facility

2110 is only the "tip of the pyramid"



Media Transport

- Video SMPTE ST 2110-20/21 with Wide Rx
- Audio SMPTE ST 2110-30 Level C
- SMPTE ST 2022-7:2018 Protection
- UHD as a single flow (>25 GbE)

Time and Sync

- PTPv2
- Both SMPTE and AES profiles
- BMCA for multi-interface redundancy

Discovery and Connection

- AMWA IS-04 Discovery and Registration
- AMWA IS-05 Connection Management
- LLDP Topology discovery

Configuration and Monitoring

- DHCP IP assignment
- Open configuration management (e.g., API, config file, SSH CLI, etc.)
- Open monitoring protocol (e.g., Agent-based, SNMPv3, etc.)

Security

- EBU R148 Tests
- HTTPS API calls
- AD, LDAP or Certificates - Authentication

Widely available

Partially available

Rarely available

EBU Production Infrastructure Strategic Programme - IBC 2018

AIMS Alliance for IP Media Solutions

More information on

NMOS wiki on Github:

https://github.com/AMWA-TV/nmos/wiki

Implementations

AMWA

Networked Media. Working.

Networked Media Incubator

AIMS Alliance for IP Media Solutions

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networked media NMOS open specifications

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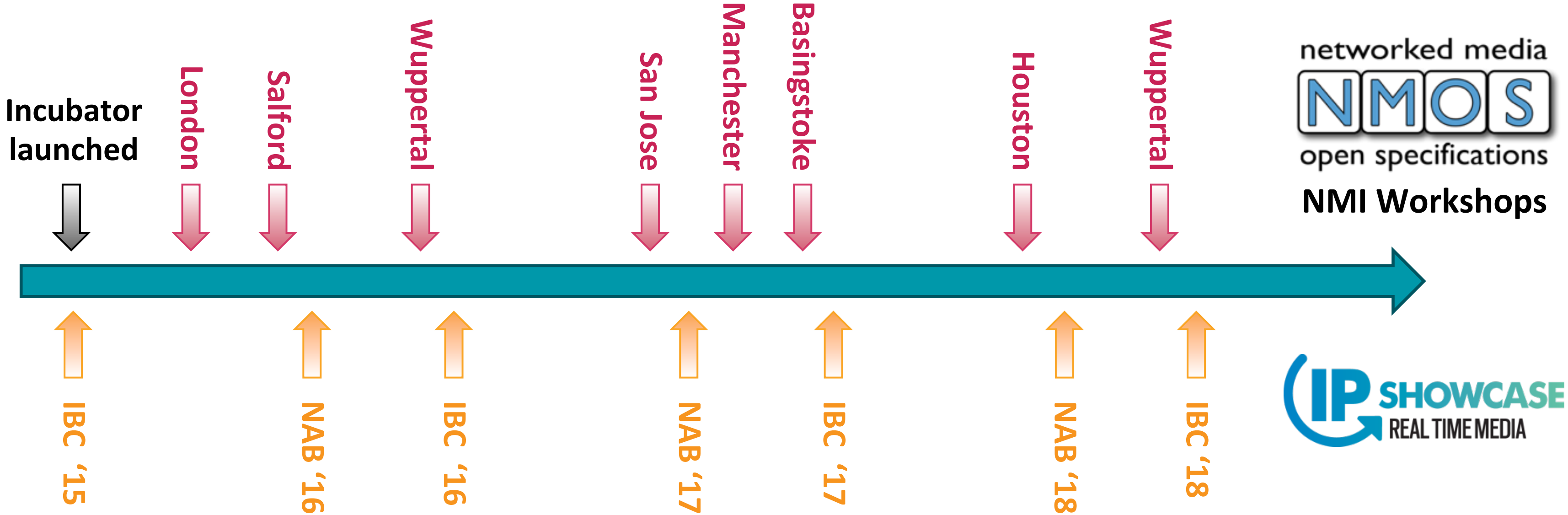
Interoperability Standards for IP Media Networking



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Interoperability Standards f ... ing

networked media NMOS open specifications

IP SHOWCASE
REAL TIME MEDIA

AES 2018

AES AoIP Pavilion

#971

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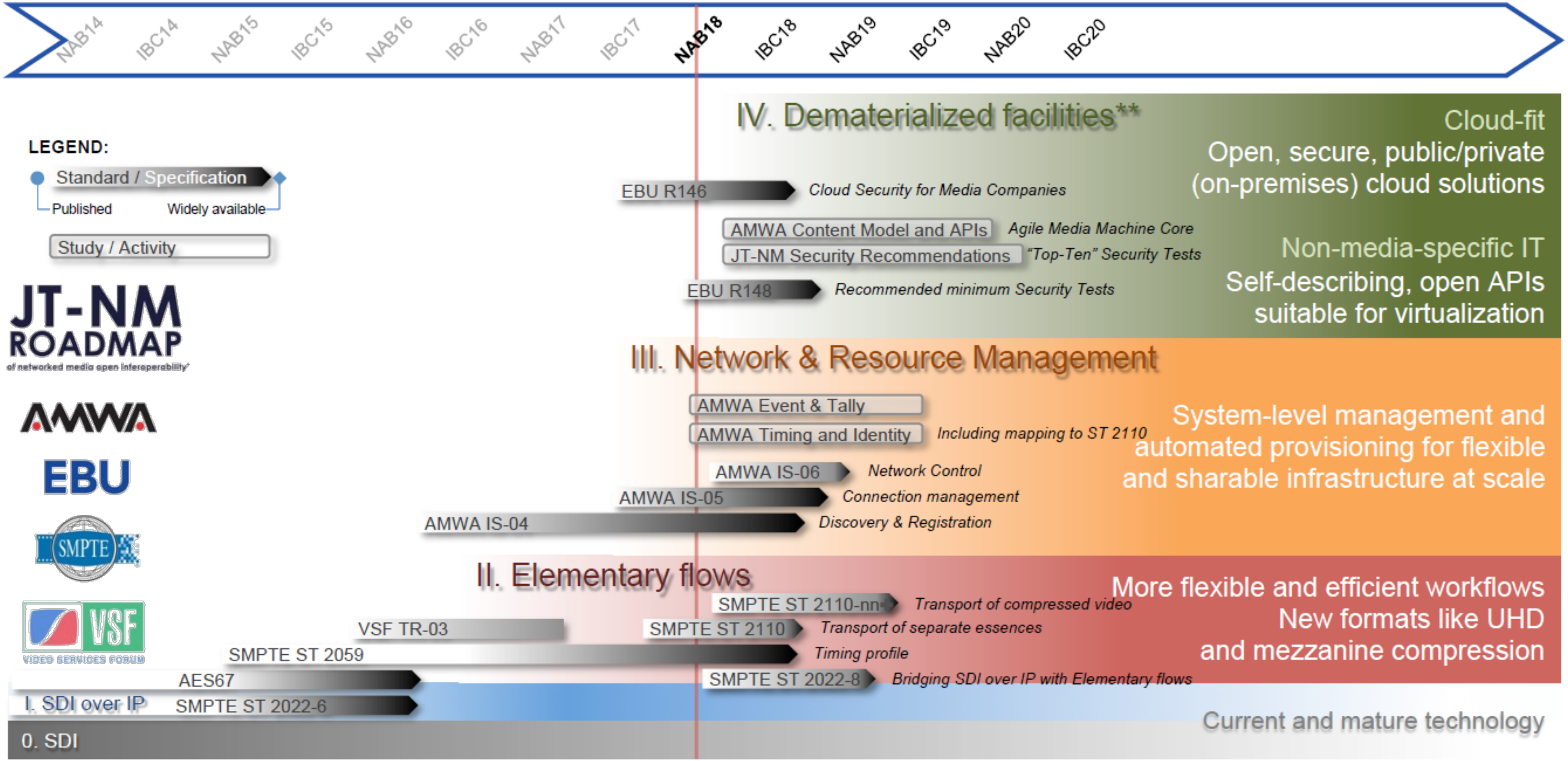
Interoperability Standards for IP Media Networking



➕ Number not yet assigned. **See Dematerialized Facilities FAQ at JT-NM.org for more information.
* JT-NM assumption as of March 2018 and will evolve over time. Visit JT-NM.org for the latest update. Feedback to jt-nm-info@videoservicesforum.org