

Designing with Dante

and AES67 / SMPTE ST 2110

AES-NY, AVoIP Pavillion
October 16-19, 2019

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Objectives:

Design Principles (and Why We Recommend Them)

Clarify Common Misunderstandings About Dante (and PTPv2).

Highlights of the Dante update with SMPTE ST 2110 support.

Prerequisites:

Dante Domain Manager™

Dante Domain Manager is a key part to Audinate's ST 2110 solution. If you are not familiar with this product, watch this video to learn its role and core functions.

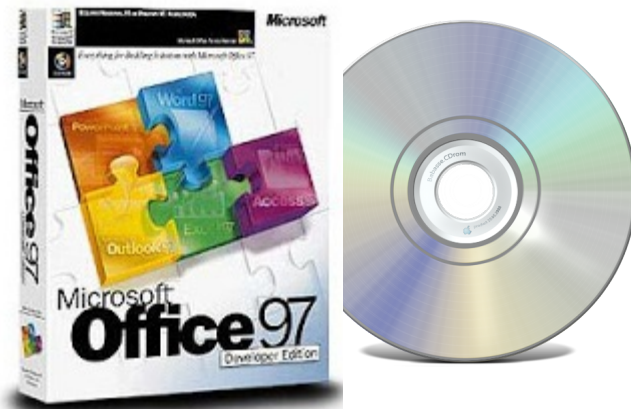


In Depth Tour of Dante Domain Manager

https://youtu.be/xCY3JNpCu_k

History: Audio Networks Solutions and Open Standards

CobraNet™



(1) CD-ROM



(44) 3 1/4" Floppy Disks

https://en.wikipedia.org/wiki/Microsoft_Office_97

History:



QoS

Quality of Service
(Prioritization of Time Sensitive Data)

PTP

Precision Time Protocol
(Network Synchronization)

ZeroConfig

Automatic Peer-to-Peer Configuration
(No need for Static or DHCP config)

IGMP Snooping

Internet Group Management Protocol
(Reduces Impact of Multicast Distribution)

History:



Best Practices for Audio Networks

AES AESTD1003V1 - June 6, 2009

<http://www.aes.org/technical/documents/AESTD1003V1.pdf>

Livewire



“Audio networking systems are characterized by the transport of uncompressed audio in PCM format, which in principle could be reformatted as requested.

In practice, there are several issues for compatibility between formats that should be addressed and solved with specific implementations.”

History:



What is AES67?

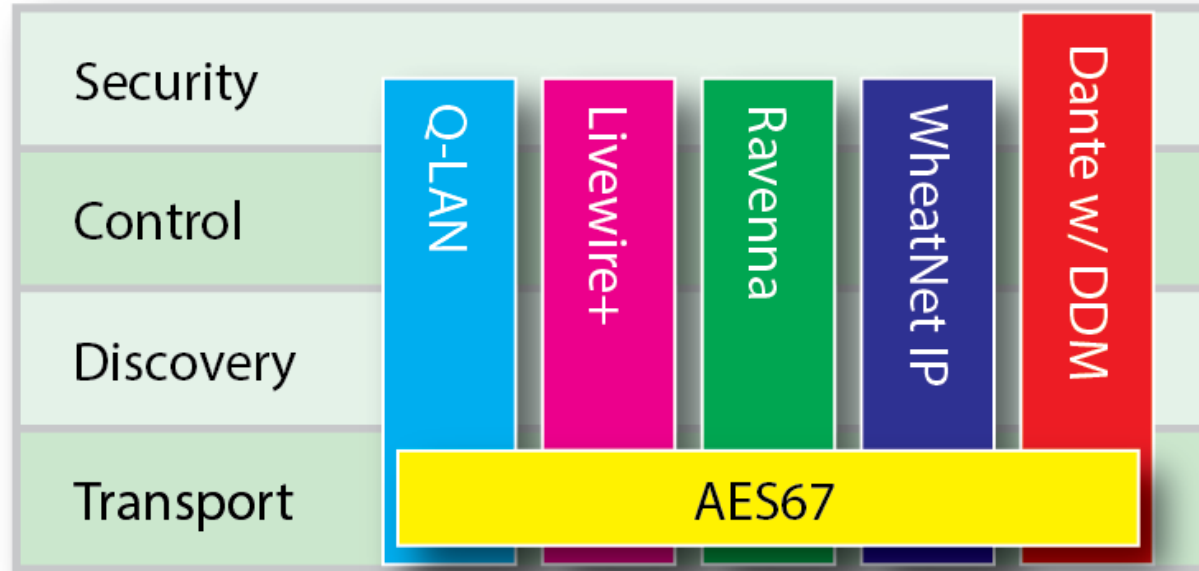
Media Networking Alliance - October, 2015

<http://medianetworkingalliance.com/faq/>

“AES67 enables audio-over-IP streaming interoperability between audio networking [solutions] currently available,

such as Dante, Livewire, Q-LAN, Ravenna [and WheatNet IP]. It is not a new technology, but a bridging compliance mode.”

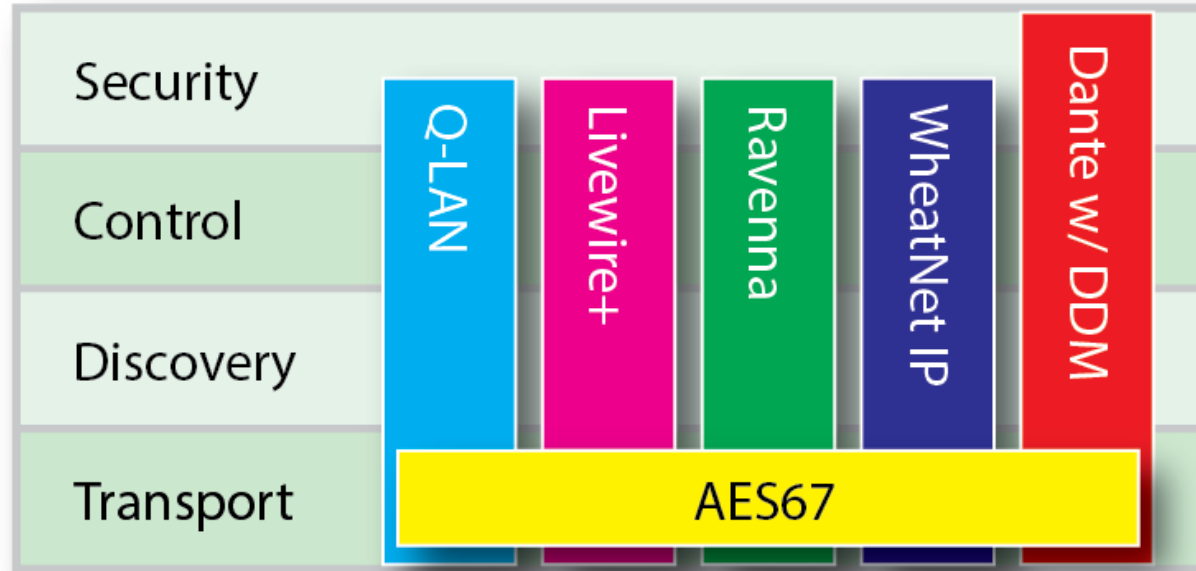
Network Solution vs Interoperability Standard:



Network Solution: Dante, Livewire+, Ravenna, Q-LAN, WheatNet IP

Interoperability Standard: AES67, SMPTE 2110

Network Solution vs Interoperability Standard:



Dante, AES67 & AVB

Aiden Williams, Audinate - March 16, 2015

https://www.youtube.com/watch?v=E_E5JEVGH9c

By remaining pragmatic in scope – by narrowly focusing on the transport piece – AES67 was neither too weighty to get agreement from the various solutions nor too complex to be implemented.

Minimum Stack for IP endpoints

necessary to build and manage a full scale facility

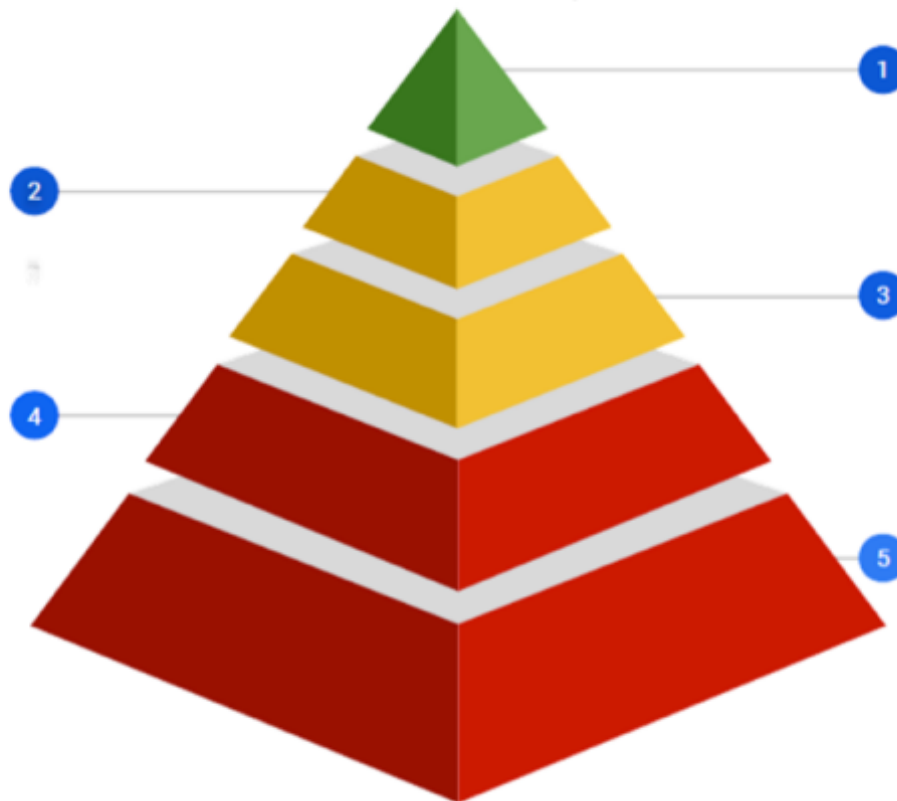
2110 is only the "tip of the pyramid"

Time and Sync

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

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.)



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)

Discovery and Connection

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

Security

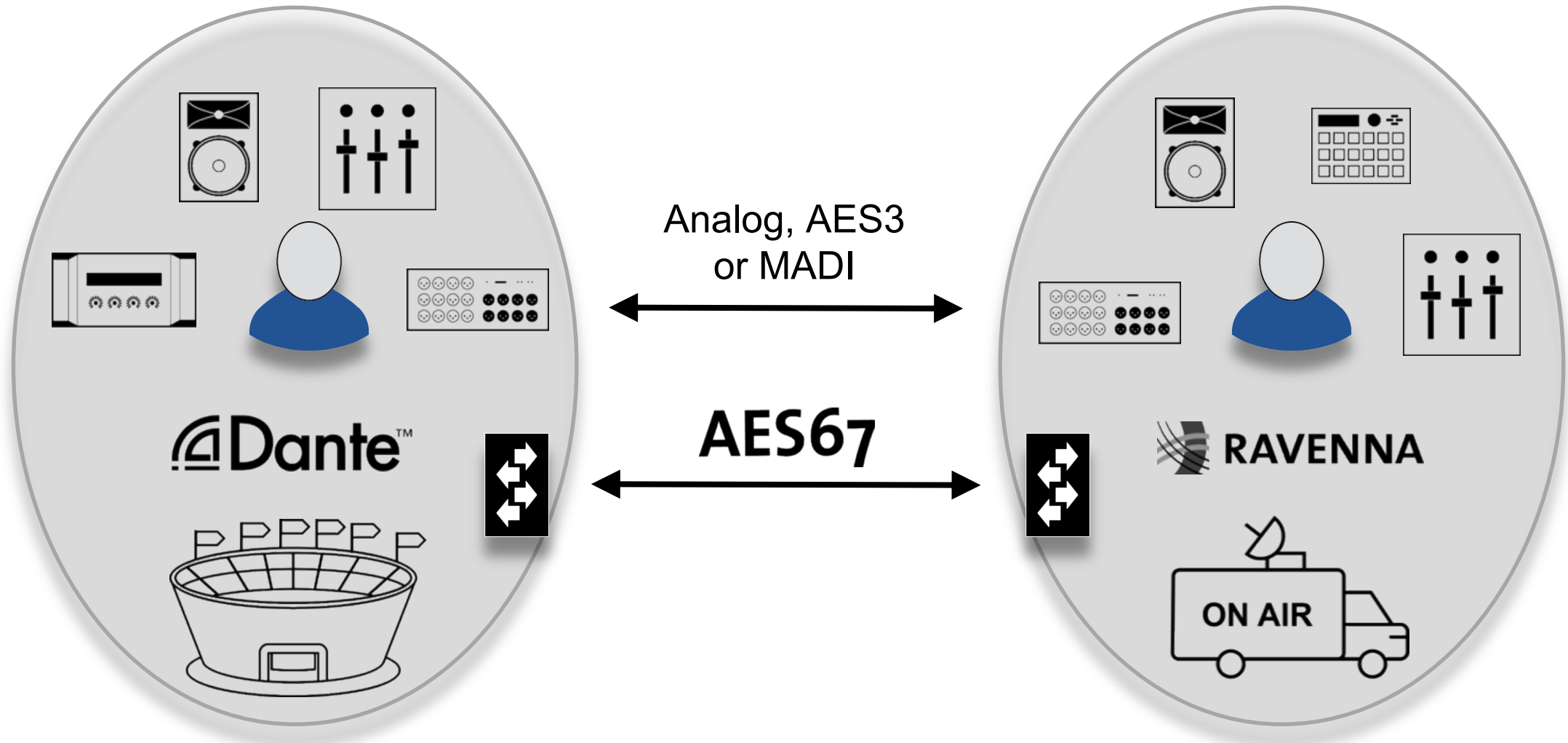
- EBU R148 Tests
- HTTPS API calls
- AD, LDAP or Certificates - Authentication

Widely available

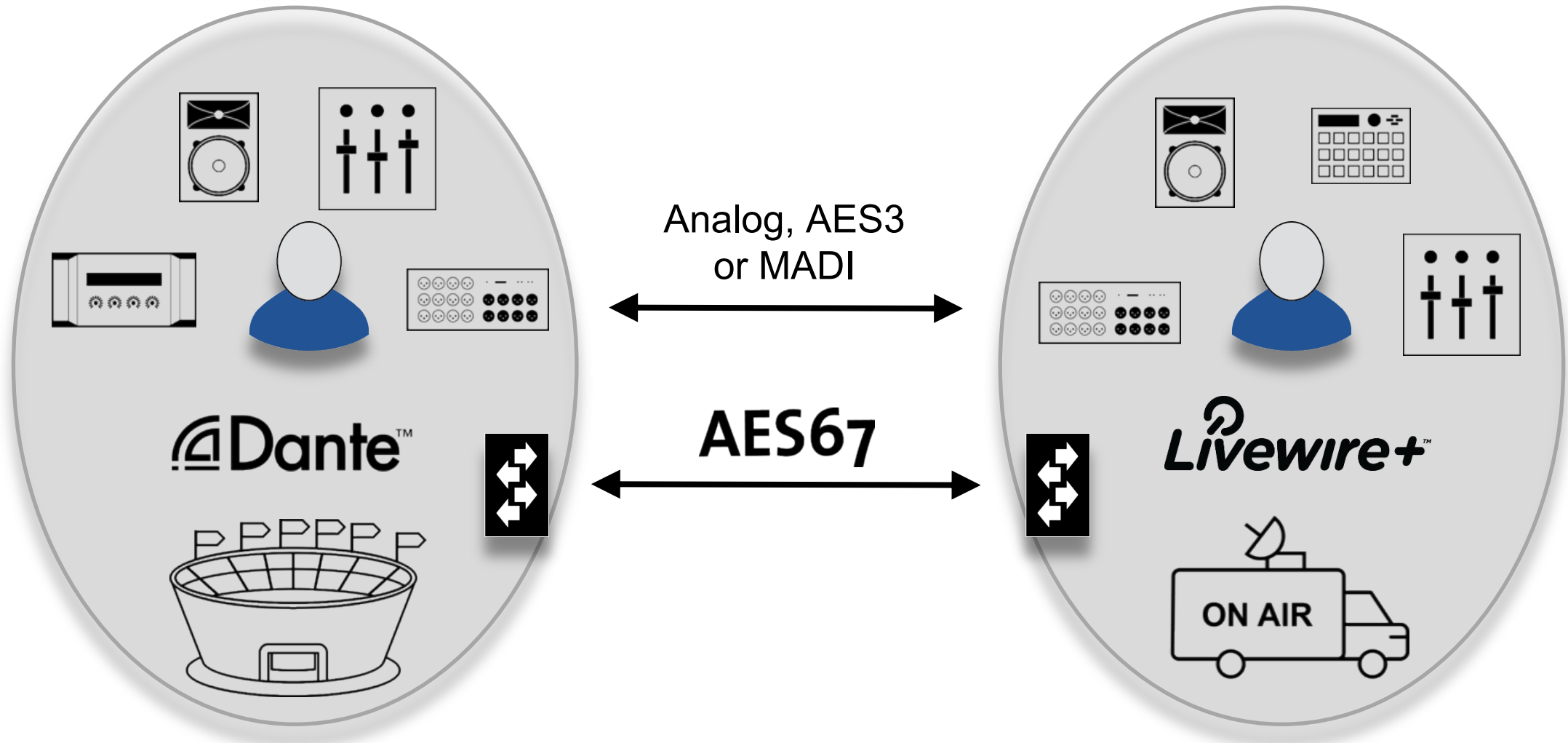
Partially available

Rarely available

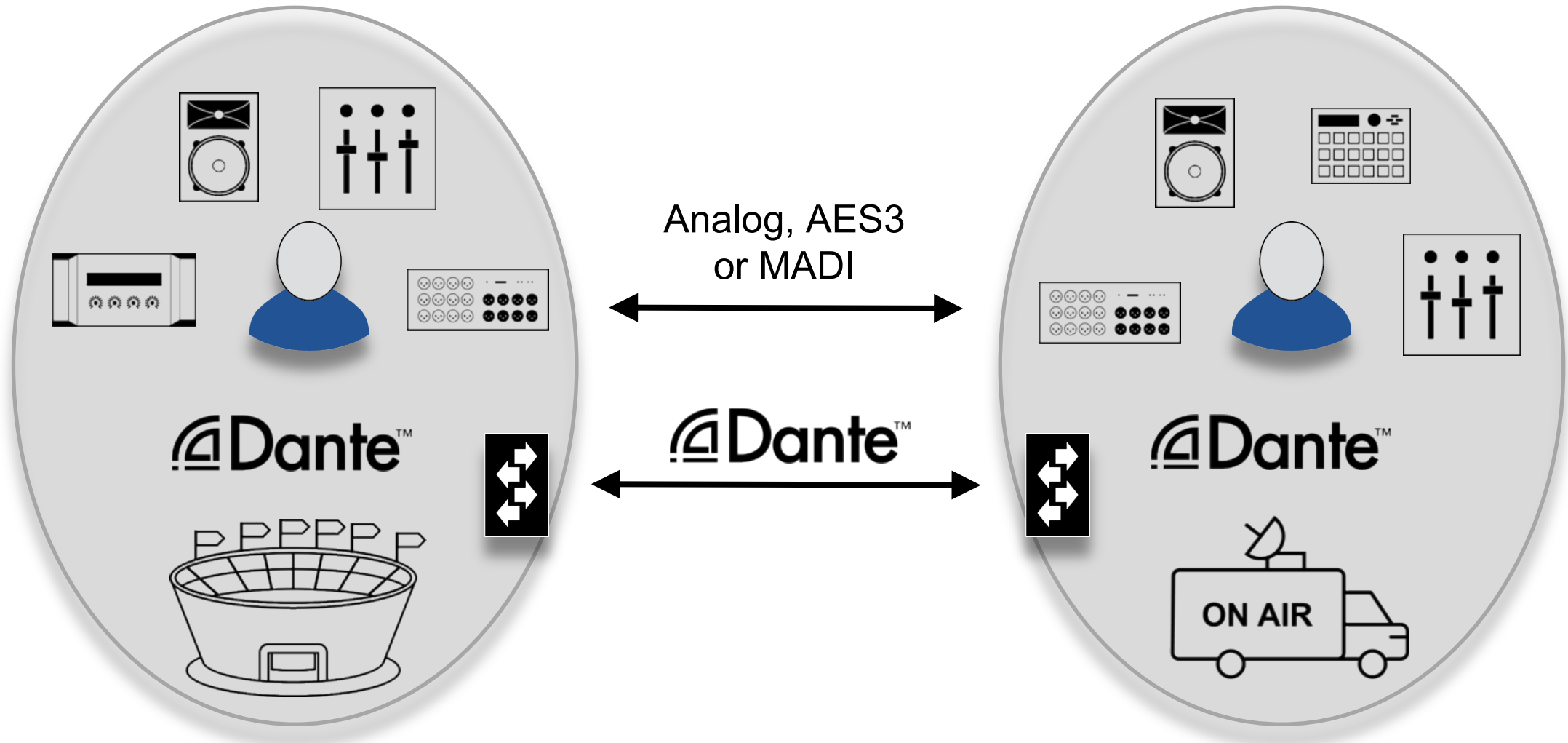
Build a Team on a Network Solution like Dante



Build a Team on a Network Solution like Dante



Build a Team on a Network Solution like Dante



ST 2110's Differing Appeal to Audio and Video.

For video teams, ST 2110 represents the move from point-to-point SDI to networked flexibility and smashing the bandwidth cap.

For audio, ST 2110 is old hat - an improved AES67 representing compatibility with video teams on the network.

Open Standards Replace AES3, MADI, SDI

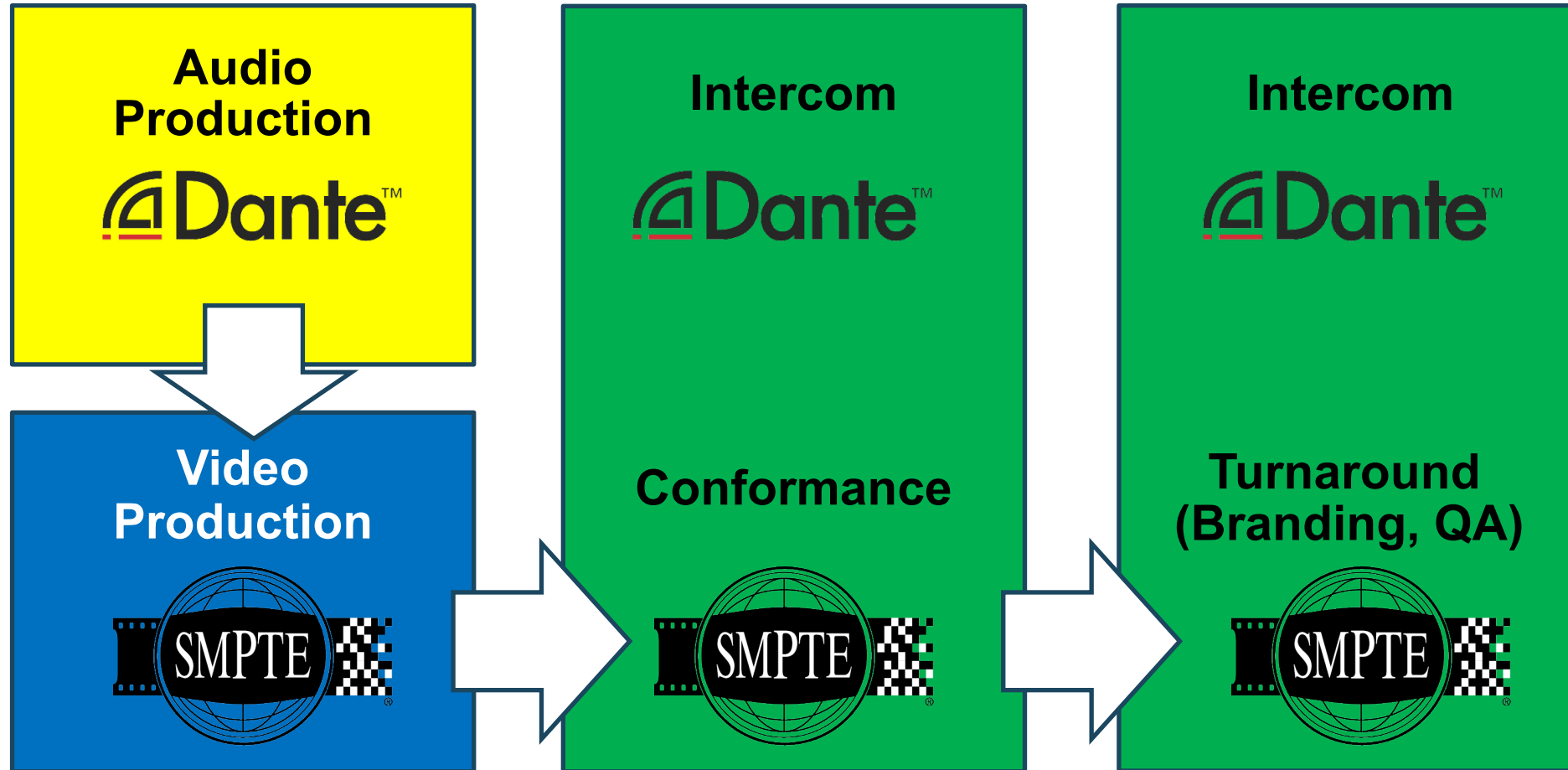


This block features the SMPTE logo at the top. Below it, there are icons representing a professional video camera on a tripod and a television set with the letters "TV" on its screen.

This block features the Dante logo, which includes a stylized 'D' icon followed by the word "Dante" and a trademark symbol. Below the logo is an icon of an audio mixing console with several faders.

This block features the RAVENNA logo, which consists of a stylized 'R' icon followed by the word "RAVENNA". Below the logo is an icon of a broadcast truck with a satellite dish on its roof and the words "ON AIR" written on its side.

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Open Standards Replace AES3, MADI, SDI



ST 2110

Replaces:

- SDI
- MADI
- AES3



Even Video Tends to Stick to a “Family of Products”

BBC Cardiff Central Square

Oct 6, 2019

<https://youtu.be/3GwuGyOmzxM>

Key Takeaway:

Sticking to families of products gains advantage of improved control.



Control Methodology

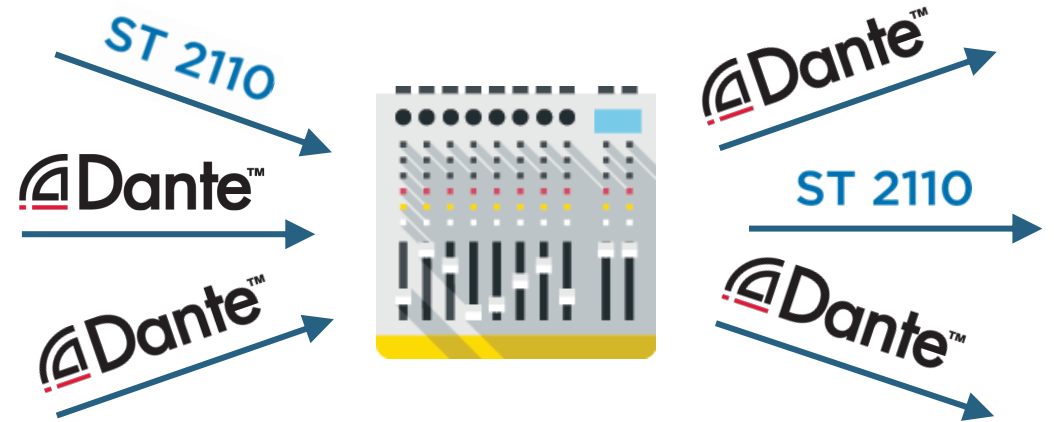
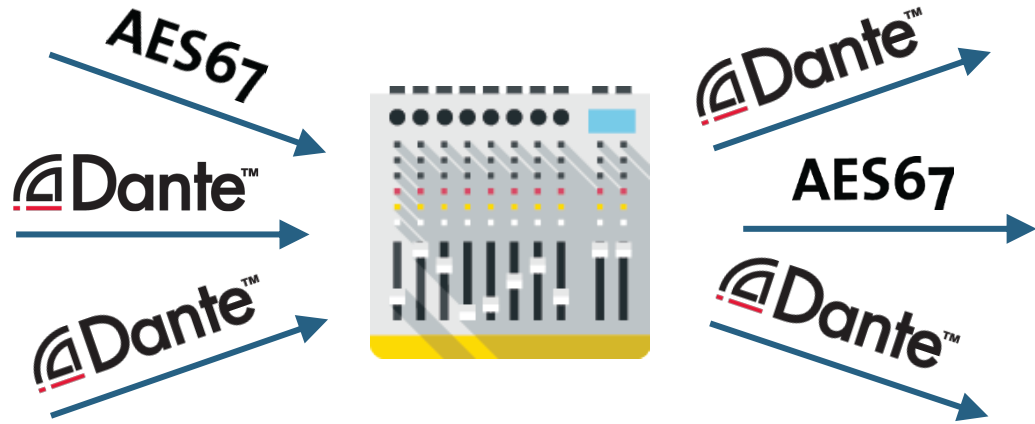
- Separate & secured control network
- BNCS control interface to GV Convergent using NP0017
- GV Convergent controls the network fabric via Cisco DCNM
- GV Convergent connects GV edge devices via GV APIs
- Intention was to integrate NMOS IS-04 and IS-05 but the necessary level of interop has not matured in time.



IP SHOWCASE THEATRE AT IBC2019 : 13-17 SEPT 2019

<https://youtu.be/3GwuGyOmzxM>

Send/Receive Dante and Open Standards Simultaneously



Build on Dante, Connect to Other Teams with ST 2110



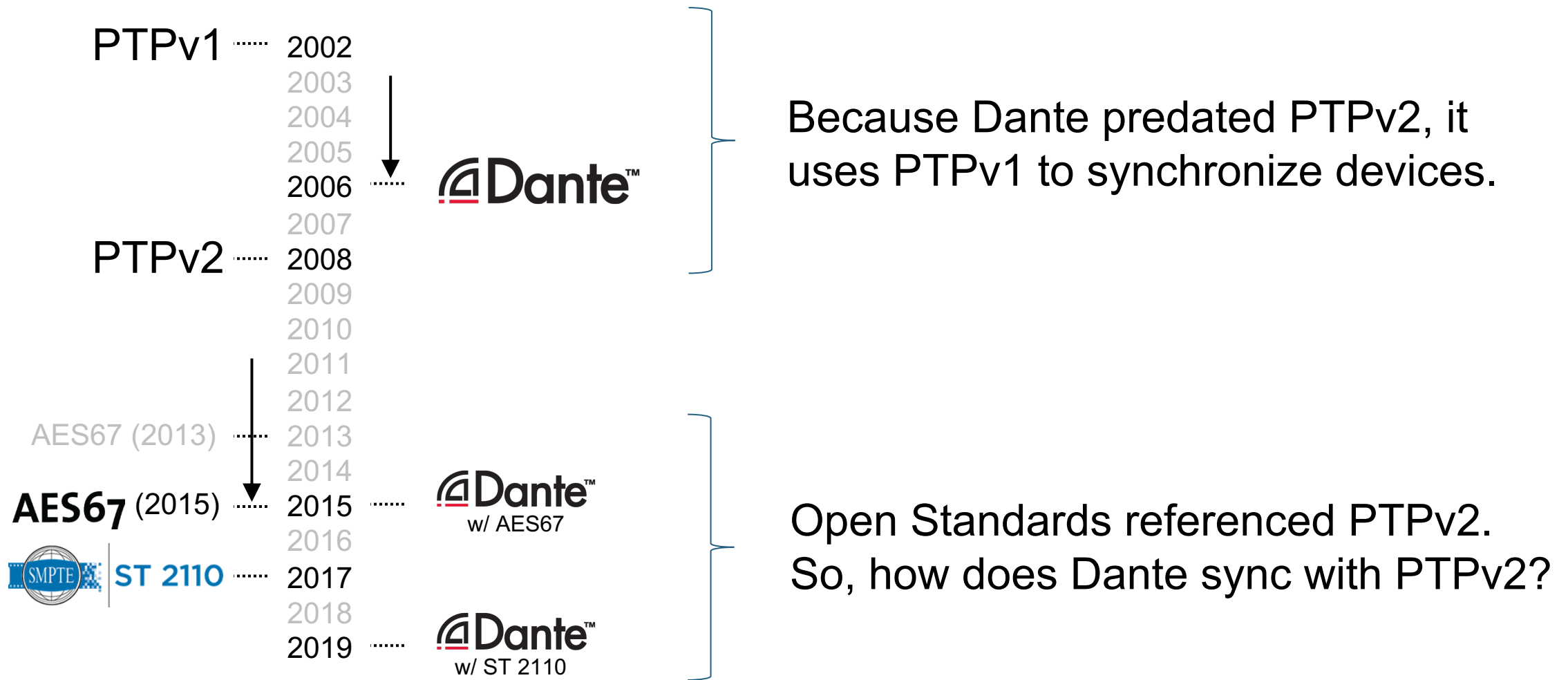
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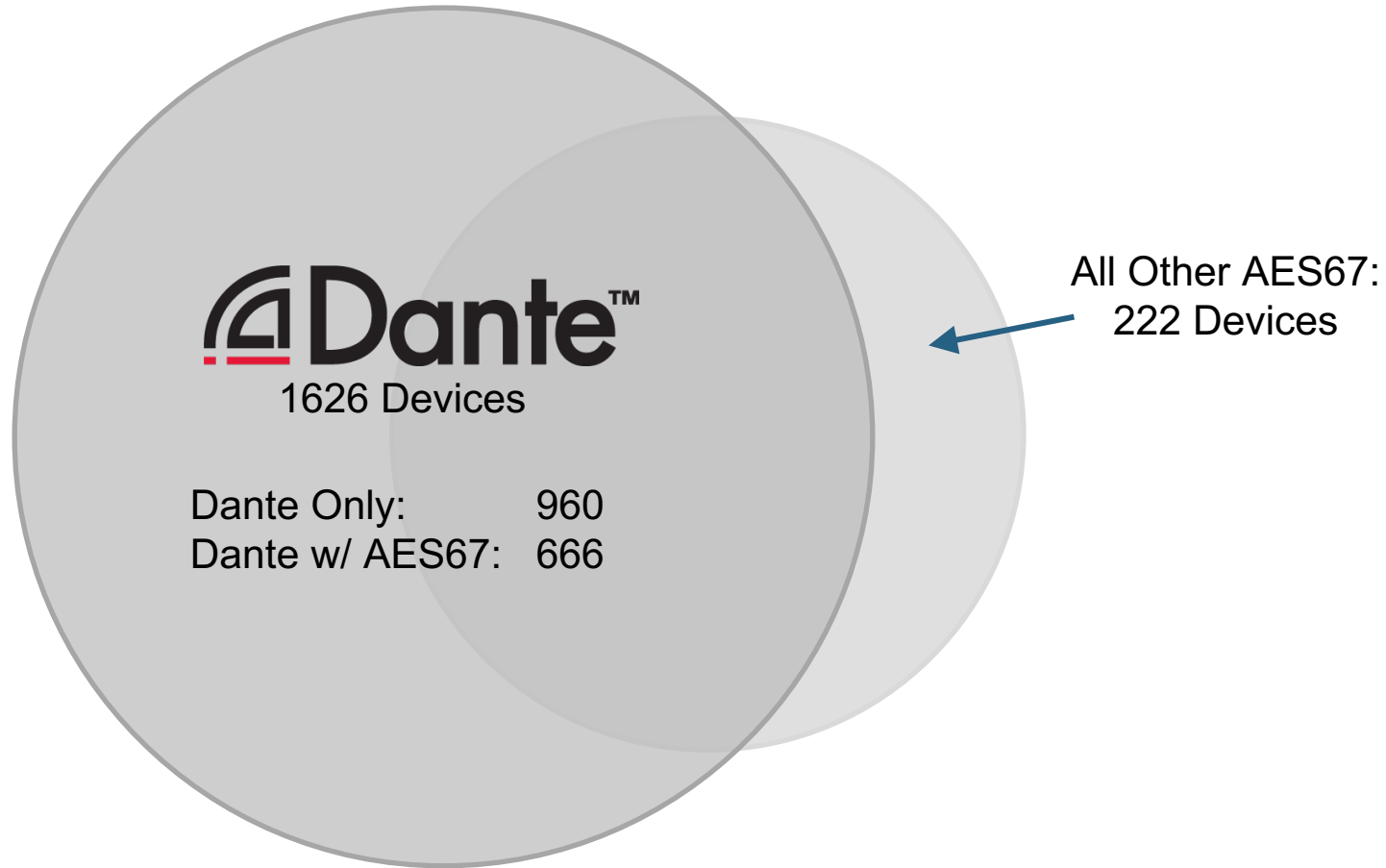
This block features the RAVENNA logo at the top. Below it, there is an icon of a truck with a satellite dish on its roof and the words "ON AIR" written on its side.

Does Dante Support PTPv2? Yes.

PTPv1 and PTPv2:

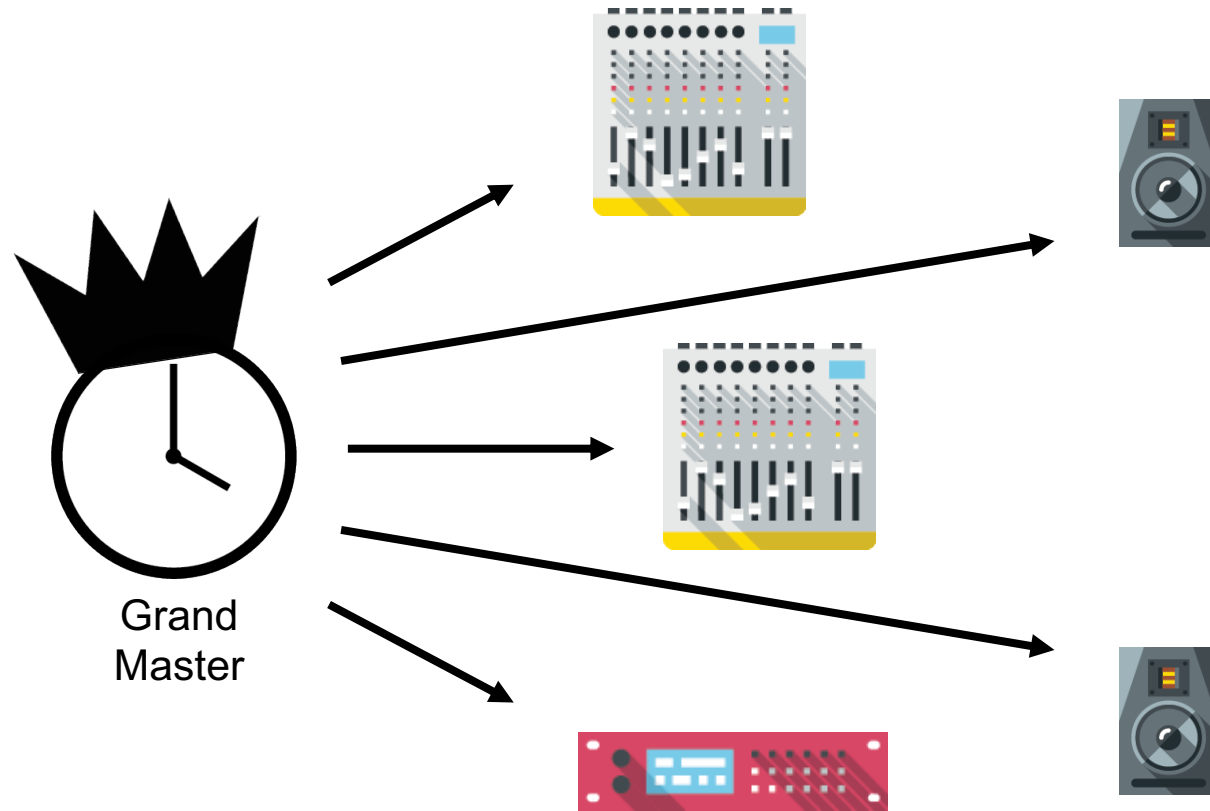


Dante Is 75% of the Open Standards Market

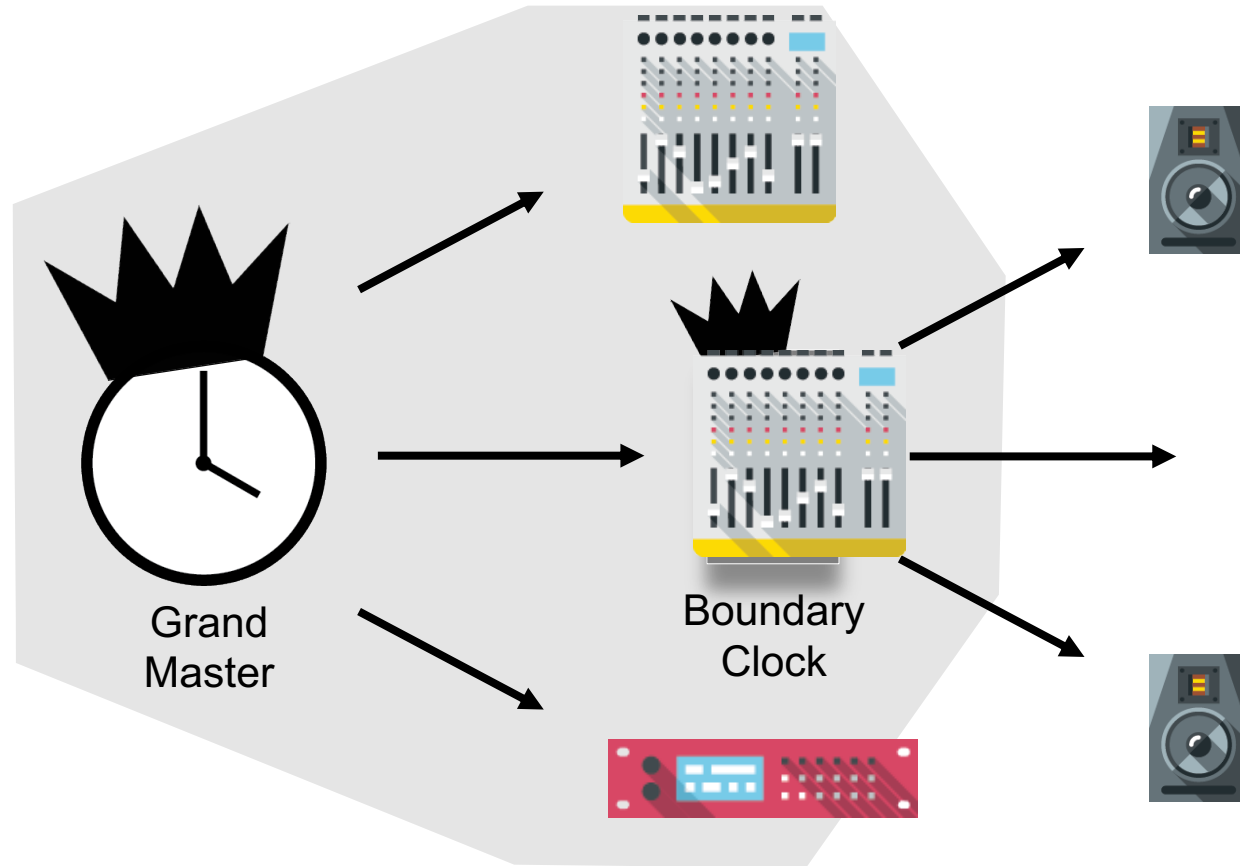


Source: 2018 Roland Hemming Networked Audio Products
<http://www.rhconsulting.eu/blog/files/NetworkedAudio.html>

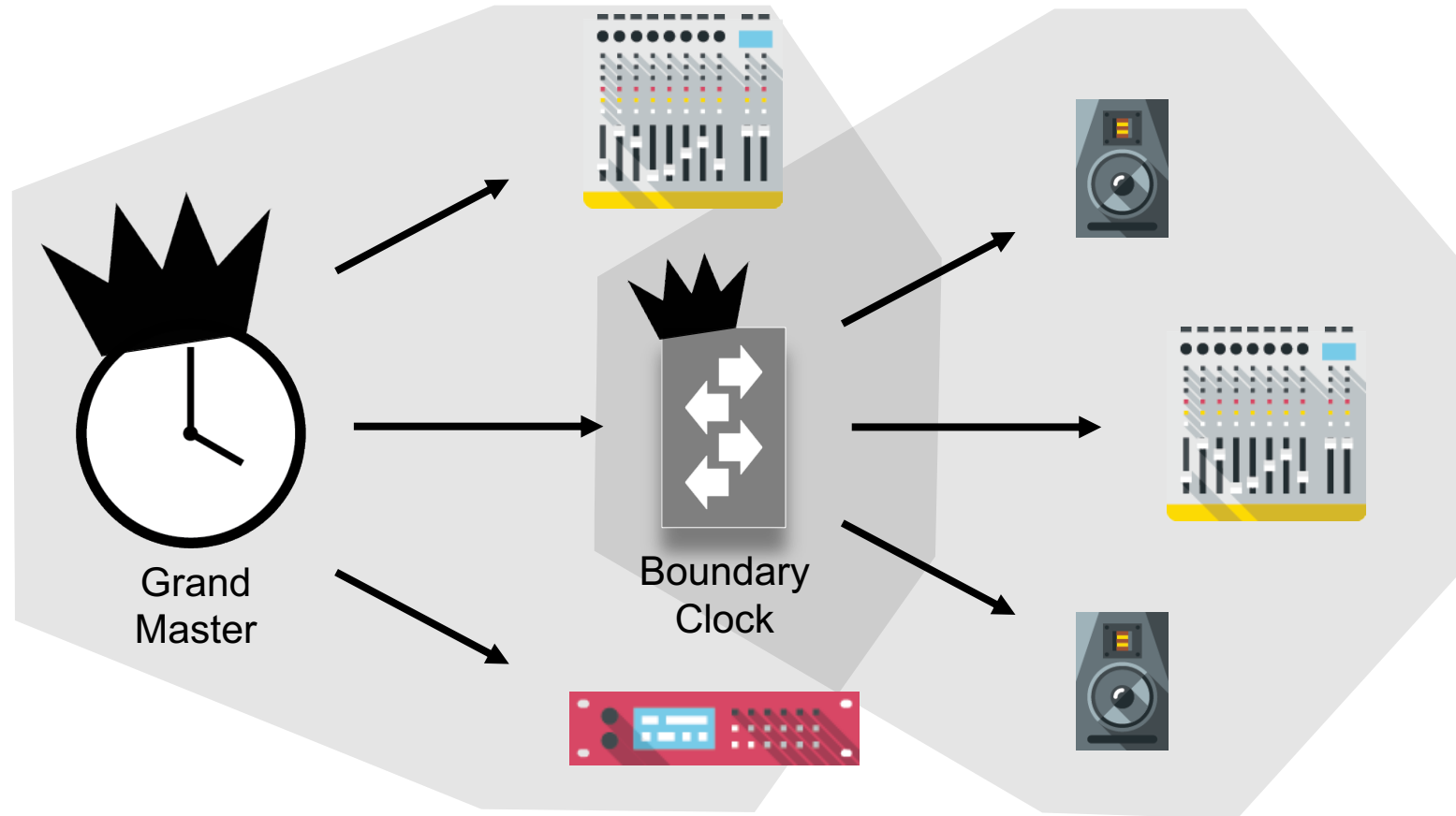
PTP Clock Distribution



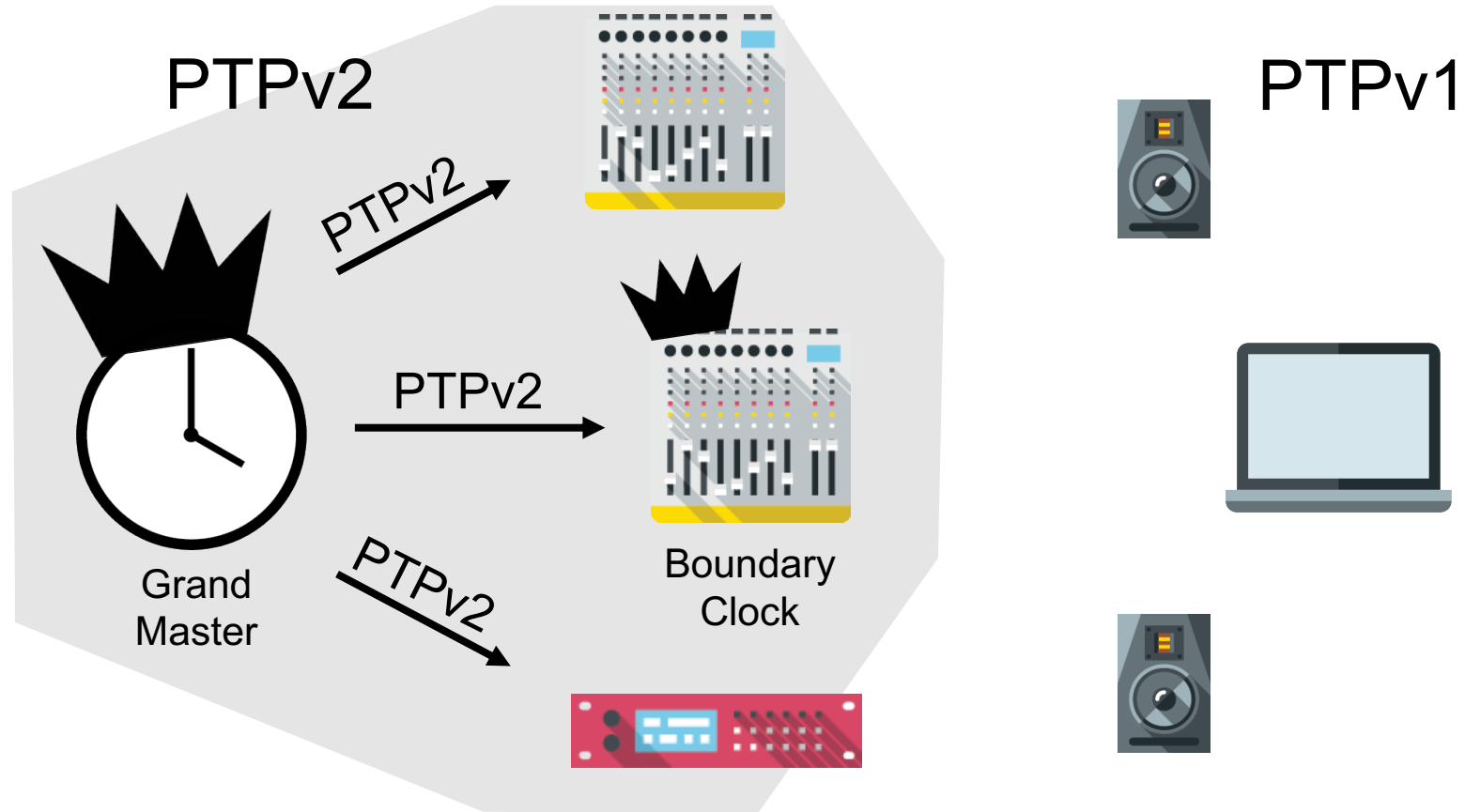
PTP Clock Distribution



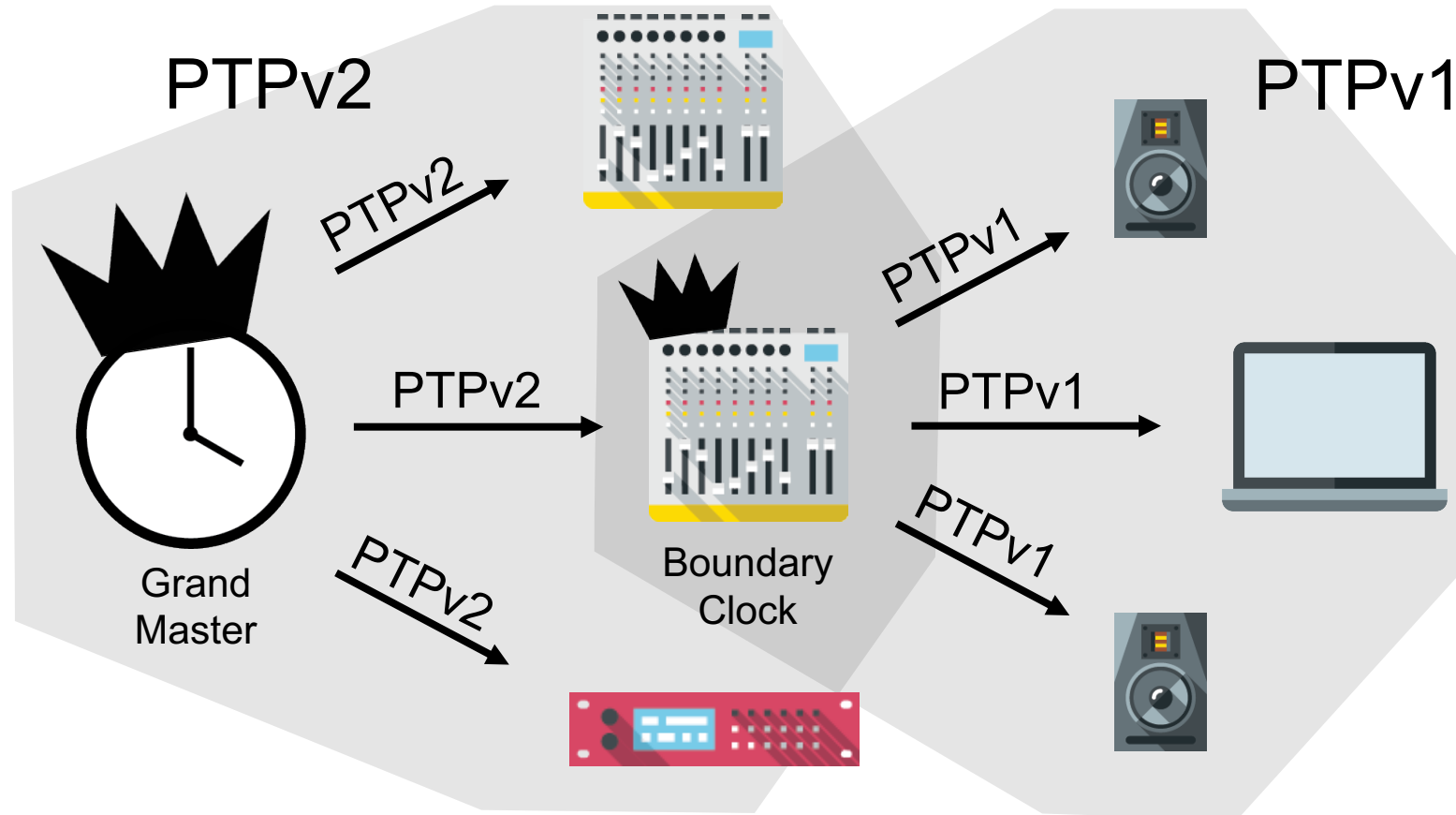
PTP Clock Distribution



PTP Clock Distribution



PTP Clock Distribution





Choose a Mode

- OR -



This is not a “format war” – the streams in each mode are compatible.

As of v4.2 firmware for Dante devices, AES67 streams now use a fixed time offset value matching SMPTE 2110 requirements.

The question is, “How do you want to work?”

Dante Modes: AES67 or SMPTE ST 2110



Choose a Mode

- OR -

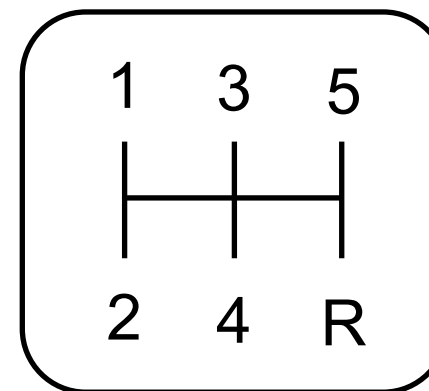


Simple, Automatic Config


Manual Configuration



Clocking Architecture
SDP Customization



AES67 Stream Configuration

 Create Multicast Flow ✕

Dante-Demonstration-Device supports up to **64** channels per flow.

RTP flows for AES67 have a maximum of **8** channels per flow.

Select one or more transmit channels to be placed in multicast flows.

Flow Config (Optional)

Dante AES67

Destination Address: Auto Manual

IP Address: . . .

Port:

| Channel Name | <input type="checkbox"/> Add to New Flow |
|--------------|--|
| Left | <input type="checkbox"/> |
| Right | <input type="checkbox"/> |
| Digital L | <input type="checkbox"/> |
| Digital R | <input type="checkbox"/> |
| 05 | <input type="checkbox"/> |
| 06 | <input type="checkbox"/> |
| 07 | <input checked="" type="checkbox"/> |
| 08 | <input checked="" type="checkbox"/> |



SAP Announcement

Fixed SDP Profile

```
v=0
o=- 13769332640 13769332640 IN IP4 192.168.1.169
s=Dante-Demonstration-Device : 32
i=2 channels: 07, 08
c=IN IP4 239.69.8.15/32
t=0 0
a=keywds:Dante
a=recvonly
m=audio 5004 RTP/AVP 97
a=rtpmap:97 L24/48000/2
a=ptime:1
a=ts-refclk:ptp=IEEE1588-2008:00-1D-C1-FF-FE-10-29-96:0
a=mediaclk:direct=0
```

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| Digital R | <input type="checkbox"/> |
| 05 | <input type="checkbox"/> |
| 06 | <input type="checkbox"/> |
| 07 | <input checked="" type="checkbox"/> |
| 08 | <input checked="" type="checkbox"/> |

- Manual Stream IP/Port Addressing

Flow Config (Optional)

Dante AES67

Destination Address: Auto Manual

IP Address: . . .

Port:

Dante Modes: AES67 or SMPTE ST 2110



Choose a Mode

- OR -

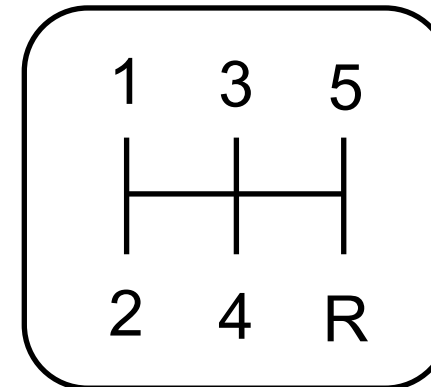


Simple, Automatic Config

Manual Configuration



Clocking Architecture
SDP Customization





Dante™
w/ **AES67**

Choose a Mode

- OR -



Dante™
w/ **ST 2110**

Dante Domain Manager™

Optional

Required

Which ST 2110 parameters can be controlled?

- **PTP v1 Multicast:** Disabling PTP V1 multicast can prevent instability in non-Dante SMPTE devices – requires all Dante devices 4.2 firmware.
- **PTP v2 Domain Number:** Can be set to any value between 0 and 127
- **PTP v2 Priority 1 / 2:** Determines which devices in a SMPTE clock domain will be automatically elected as clock master
- **PTP v2 Sync Interval:** Time interval between two successive PTP V2 multicast sync packets
- **PTP v2 Announce Interval:** Time interval between two successive PTP v2 multicast announce packets.
- **PTP v2 Multicast TTL:** The range over which a PTP V2 multicast packet is propagated in your network
- **PTP Slave Only:** Devices in domain will not be elected as clock master

The screenshot shows the 'Advanced Settings' interface for 'Broadcast Studio'. The 'Audio/Clocking Parameters' section is active, displaying various PTP and SMPTE settings. The 'MODE' is set to 'SMPTE'. The 'PTP V1 MULTICAST' toggle is turned on. The 'PTP V2 DOMAIN NUMBER' is set to 127. The 'PTP V2 PRIORITY 1' and 'PTP V2 PRIORITY 2' are both set to 128. The 'PTP V2 SYNC INTERVAL' is set to -3. The 'PTP V2 ANNOUNCE INTERVAL' is set to -2. The 'PTP V2 MULTICAST TTL' is set to 1. The 'PTP SLAVE ONLY' toggle is turned off. The 'RTP TRANSMIT PORT' is set to 5004. The 'SYSTEM PACKET TIME' is set to 1ms. The 'RX LATENCY' is set to 2ms. The 'RTP PREFIX V4' is set to 69. There are 'SAVE CHANGES' and 'CANCEL EDITING' buttons at the top right of the settings panel.

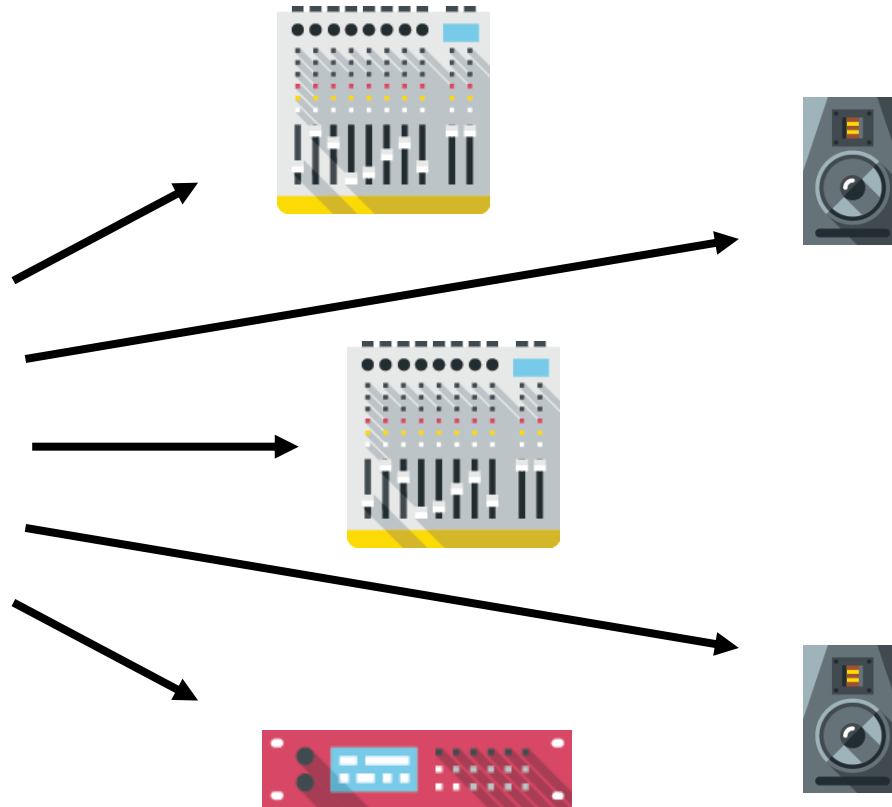
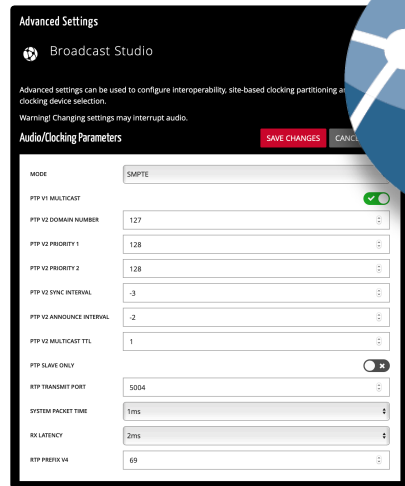
| Parameter | Value |
|--------------------------|-------------------------------------|
| MODE | SMPTE |
| PTP V1 MULTICAST | <input checked="" type="checkbox"/> |
| PTP V2 DOMAIN NUMBER | 127 |
| PTP V2 PRIORITY 1 | 128 |
| PTP V2 PRIORITY 2 | 128 |
| PTP V2 SYNC INTERVAL | -3 |
| PTP V2 ANNOUNCE INTERVAL | -2 |
| PTP V2 MULTICAST TTL | 1 |
| PTP SLAVE ONLY | <input type="checkbox"/> |
| RTP TRANSMIT PORT | 5004 |
| SYSTEM PACKET TIME | 1ms |
| RX LATENCY | 2ms |
| RTP PREFIX V4 | 69 |

Which ST 2110 Standards Used?

- SMPTE 2110 is a suite of standards Dante products support:
 - 2110-10 Defines the timing relationships between all components in the system
 - 2110-30 RTP Audio transport, similar to AES67
 - 2059-2 PTP Media Profile (IEEE 1588-2008)
 - 2022-7 Redundancy

Dante Domain Manager Propagates Settings For You

Dante Domain Manager™



ST 2110 Stream Configuration

Create Multicast Flow

Dante-Demonstration-Device supports up to 64 channels per flow.

Select one or more transmit channels to be placed in multicast flows.

Flow Config (Optional)

Dante SMPTE A SMPTE B SMPTE C

Packet time: 1 msec

Destination Address: Auto Manual

Primary IP Address: 239 . 69 . 21 . 101

Primary Port: 5004

Secondary IP Address: 239 . 169 . 21 . 101

Secondary Port: 5004

| Channel Name | <input type="checkbox"/> Add to New Flow |
|--------------|--|
| Left | <input type="checkbox"/> |
| Right | <input type="checkbox"/> |
| Digital L | <input type="checkbox"/> |
| Digital R | <input type="checkbox"/> |
| 05 | <input type="checkbox"/> |
| 06 | <input type="checkbox"/> |
| 07 | <input checked="" type="checkbox"/> |
| 08 | <input checked="" type="checkbox"/> |

Create Cancel



- Manual Stream IP/Port Addressing
- SMPTE Audio Levels A,B & C

Flow Config (Optional)

Dante SMPTE A SMPTE B SMPTE C

Packet time: 1 msec

Destination Address: Auto Manual

Primary IP Address: 239 . 69 . 21 . 101

Primary Port: 5004

Secondary IP Address: 239 . 169 . 21 . 101

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ST 2110-3x “Audio Levels”

| | Description | Packet Time |
|----|-----------------|-------------|
| A: | 1 - 8 channels | 1.000msec |
| B: | 1 - 8 channels | 0.125msec |
| C: | 1 - 64 channels | 0.125msec |

(All streams are 24-bit, 48kHz)

Dante Modes: AES67 or SMPTE ST 2110



Choose a Mode

- OR -

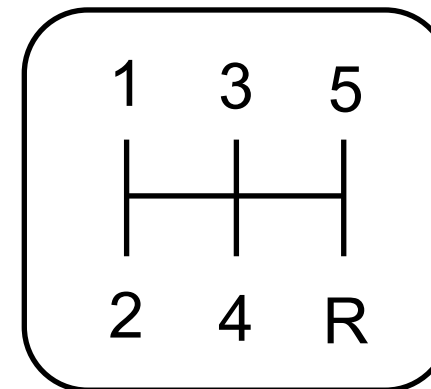


Simple, Automatic Config

Manual Configuration

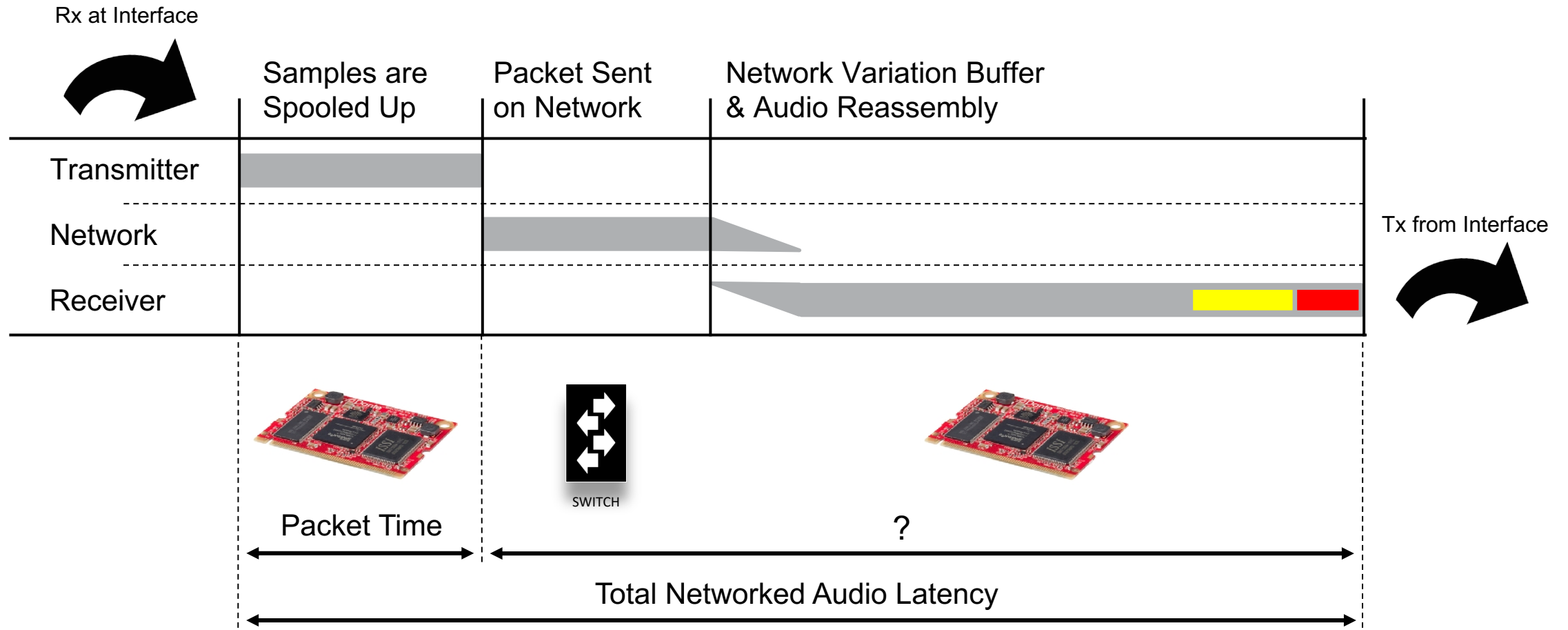


Clocking Architecture
SDP Customization



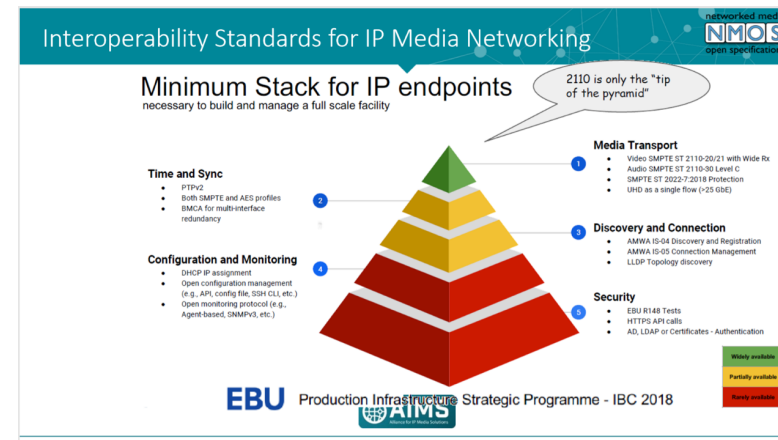
Dante Latency

Latency Definitions:

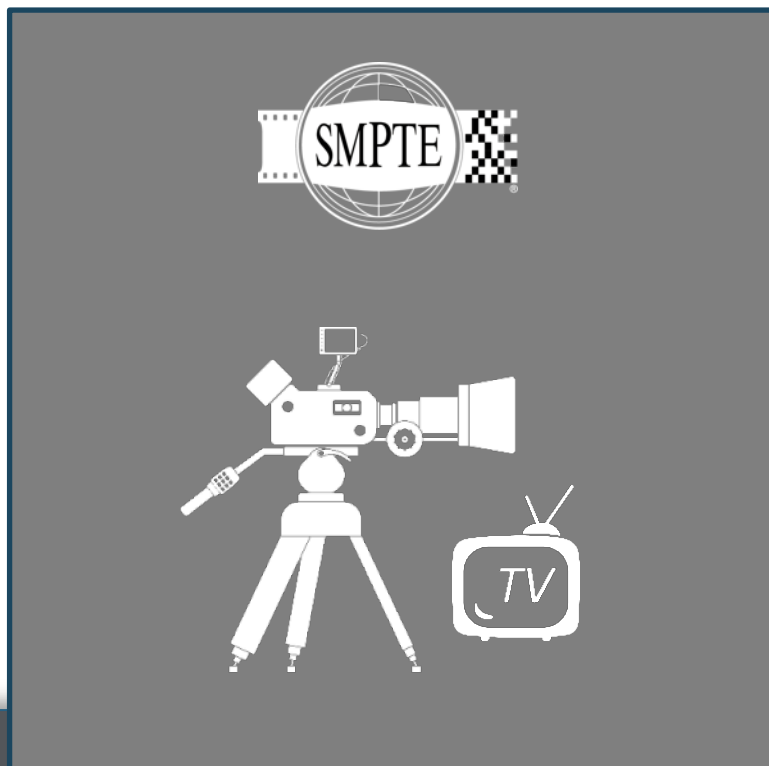


Wrap-Up

History:



Build on Dante, Connect to Other Teams with ST 2110



Dante Modes: AES67 or SMPTE ST 2110



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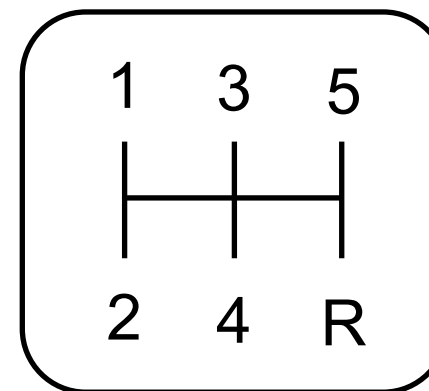


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