AoIP – Why Should You Care?

Ievgen Kostiukevych

IP Media Technology Architect

European Broadcasting Union

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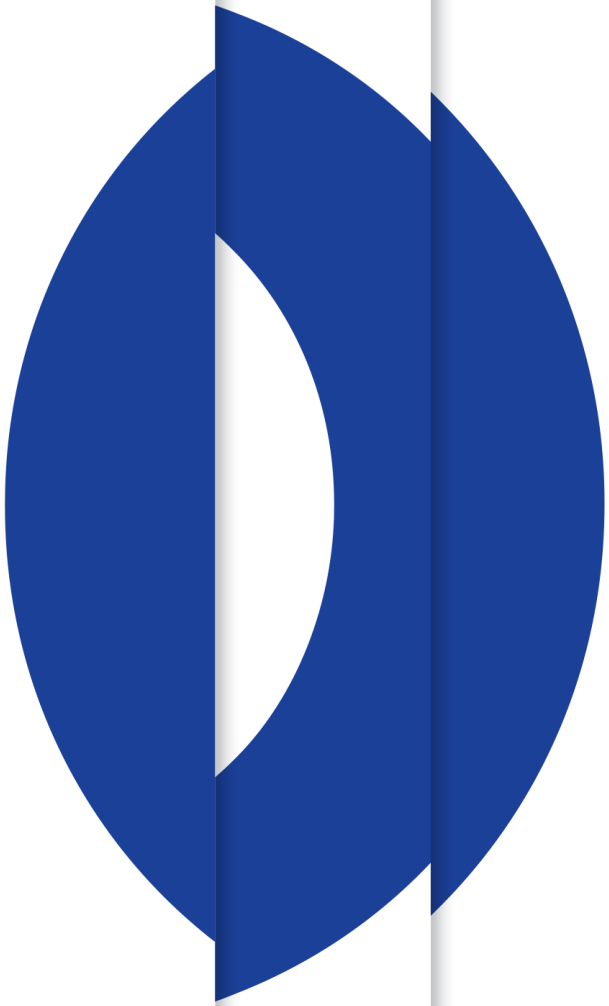
AUDIO NETWORKING BASICS

- WHY?



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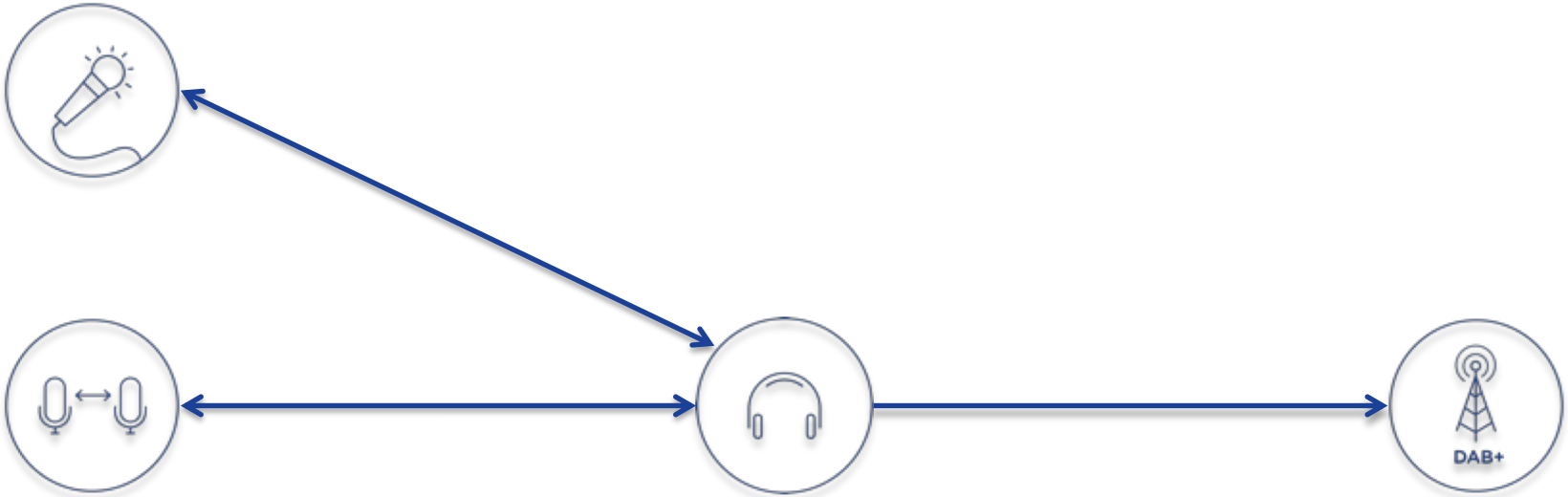

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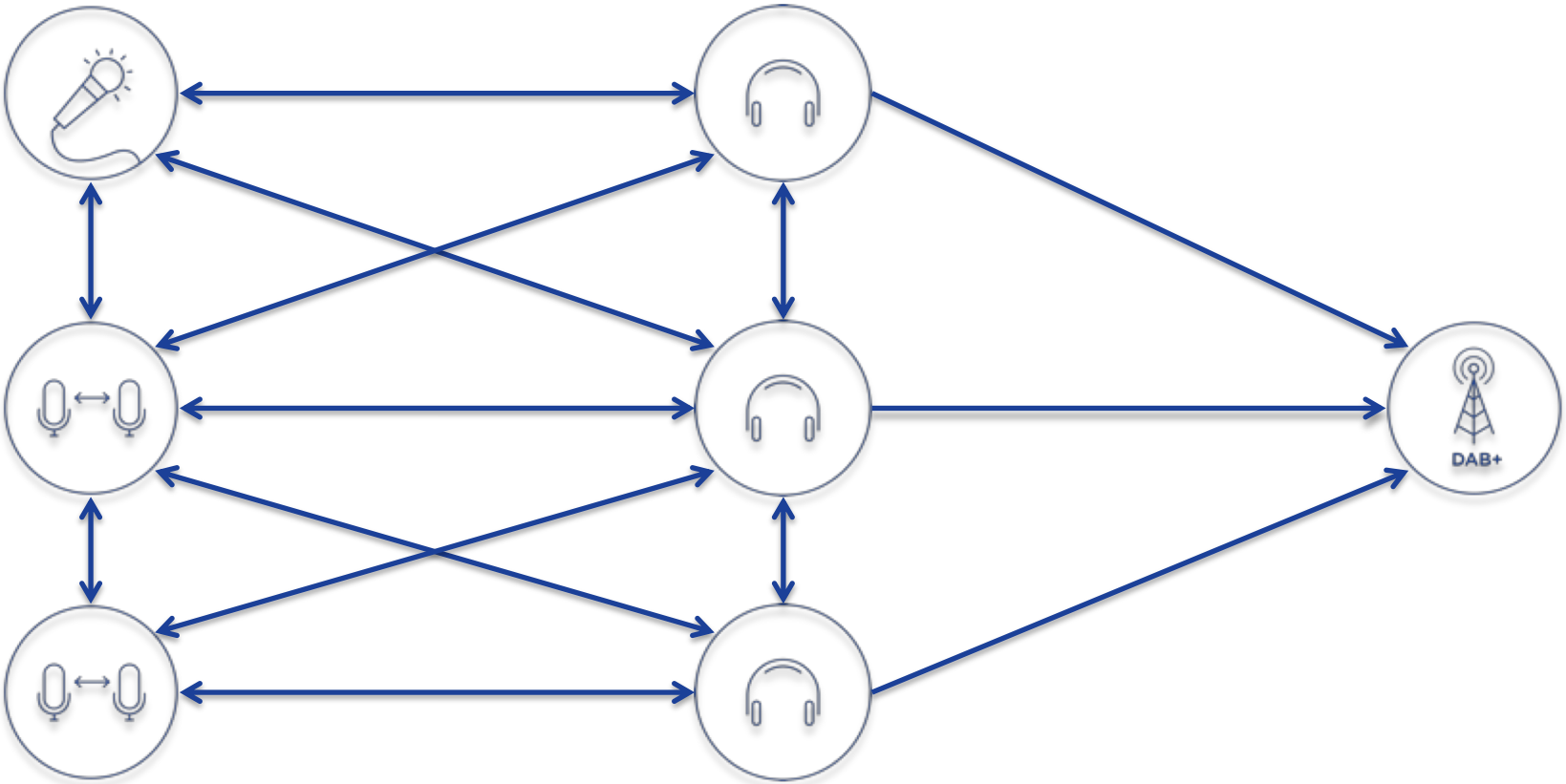

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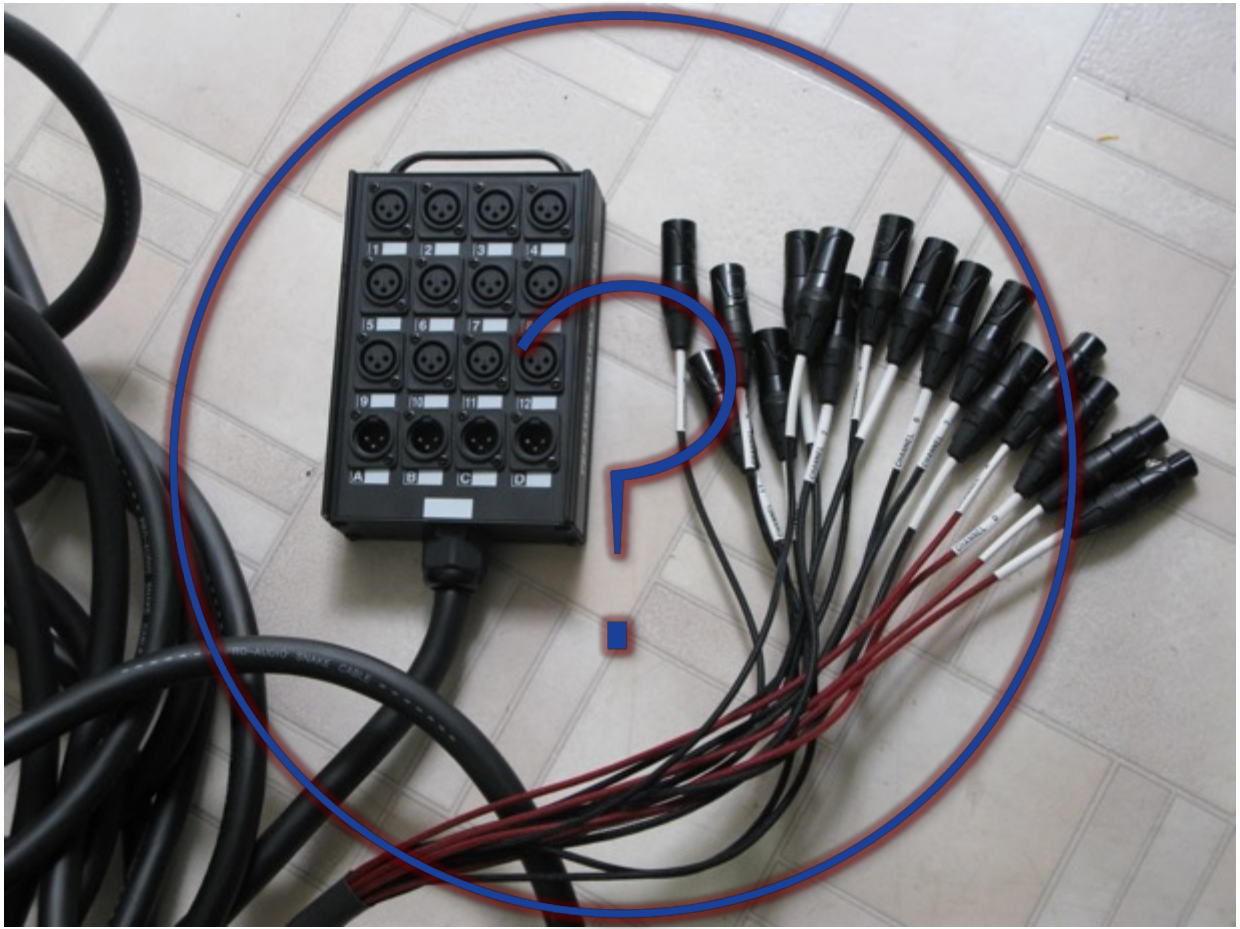

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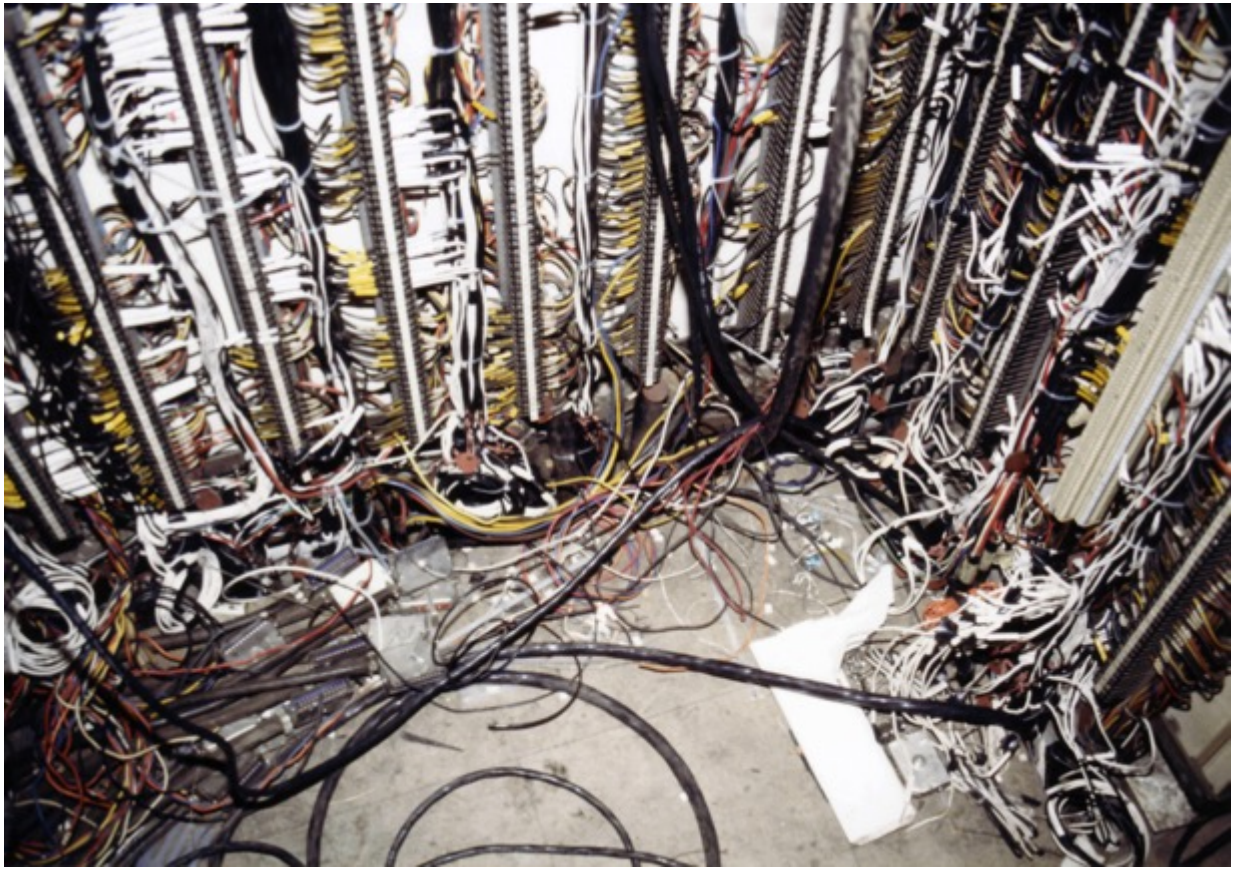

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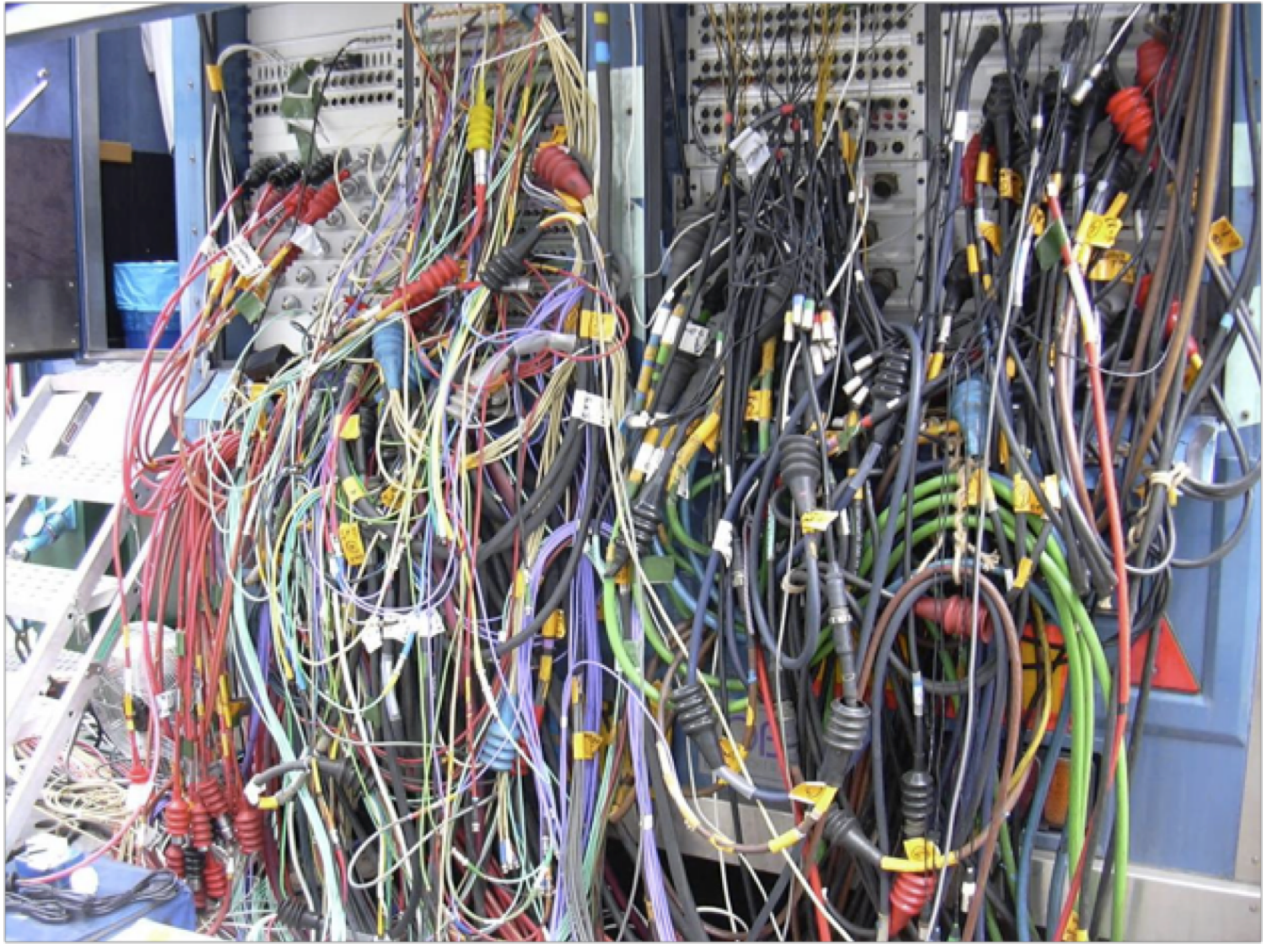

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AUDIO NETWORKING. WHY?

We want less cables!

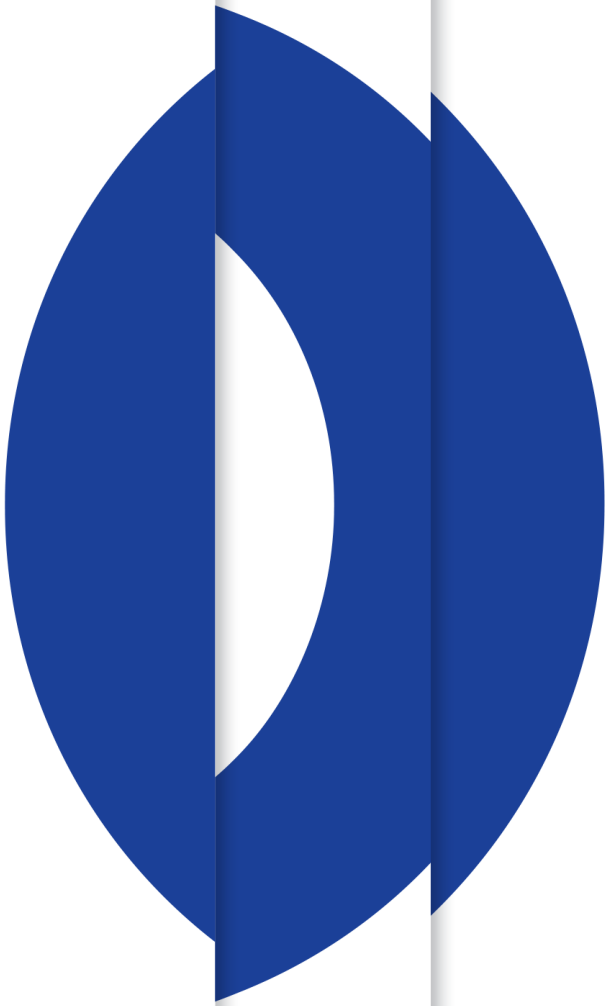
- A way to encapsulate multiple audio signals into one physical cable.

We want more flexibility!

- Audio source has to be available for any destination anywhere at any time.
- No additional cabling should be needed.

AUDIO NETWORKING BASICS

- WHY?
- HOW?



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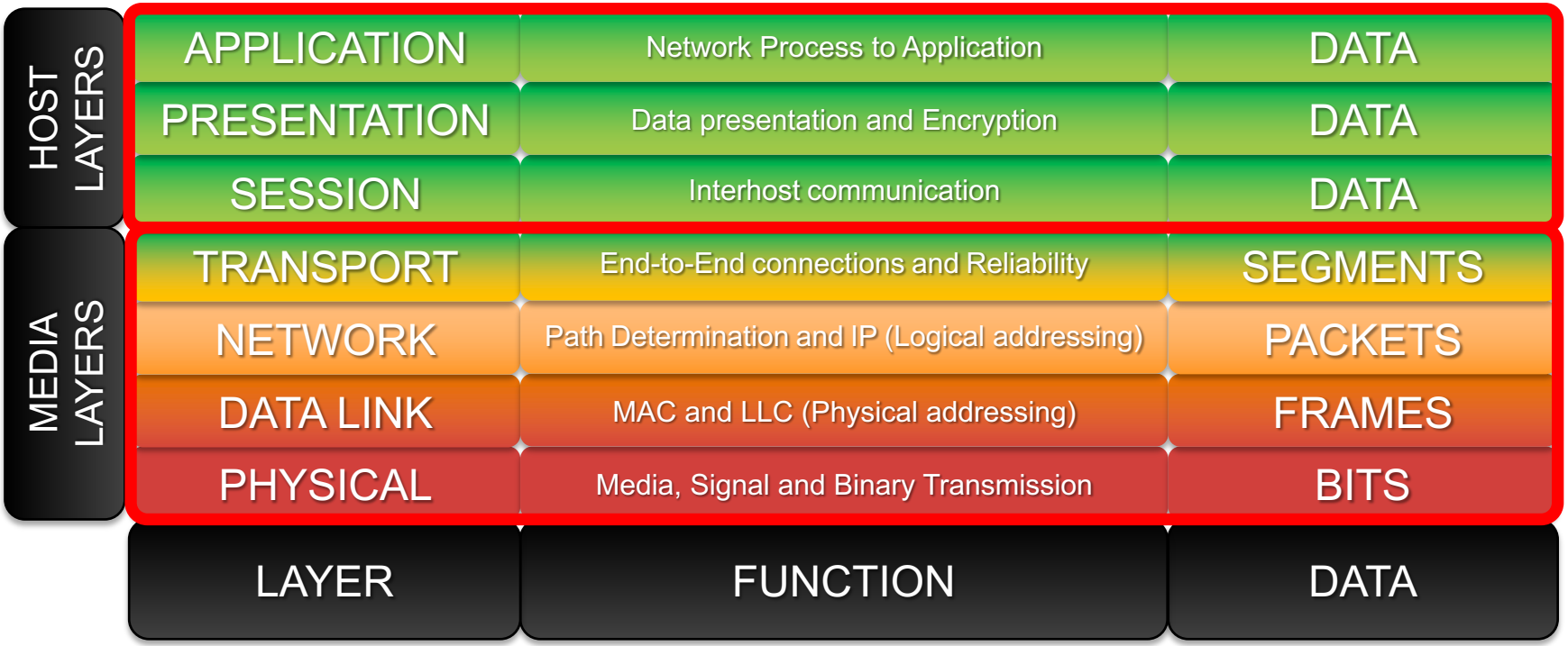
OPEN SYSTEMS INTERCONNECTION (OSI) MODEL



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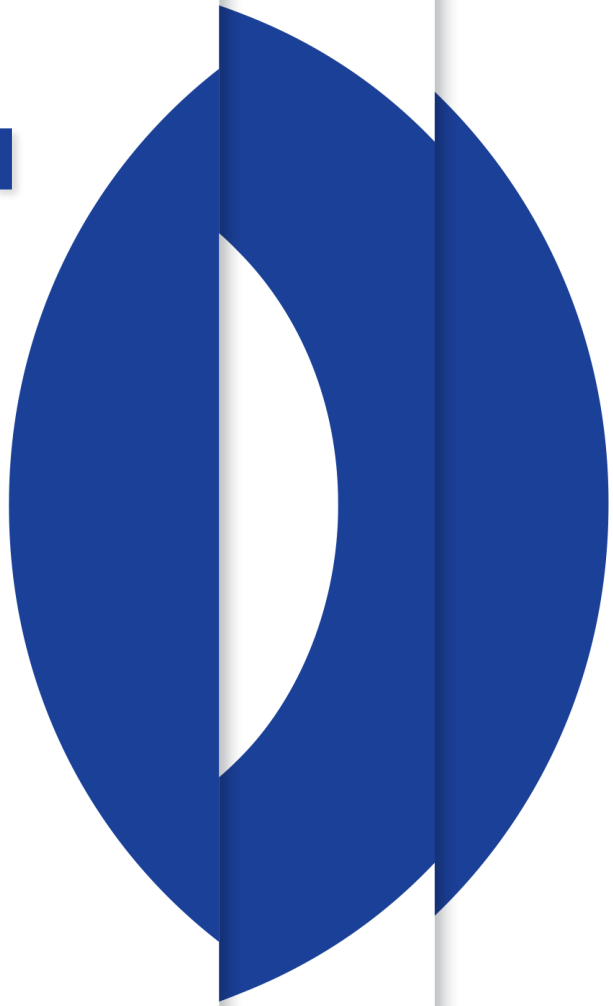
AUDIO NETWORKING ON LAYER 1

THE PHYSICAL LAYER



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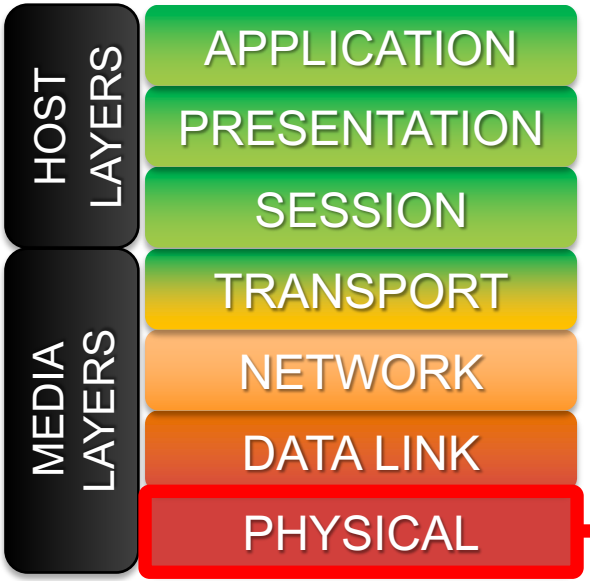
AUDIO NETWORKING ON OSI LAYERS



- Defines the electrical and physical specifications of the data connection
- Describes relationship between a device and a physical transmission medium

Typical examples:

- Ethernet physical layer
- 100BASE-T
- 1000BASE-% (T, X, etc.)
- 10GBASE-% (T, SR, LR, etc.)
- IEEE 802.11 (b, g, n, ac)
- IEEE 1394 “Firewire”
- ISDN, DSL

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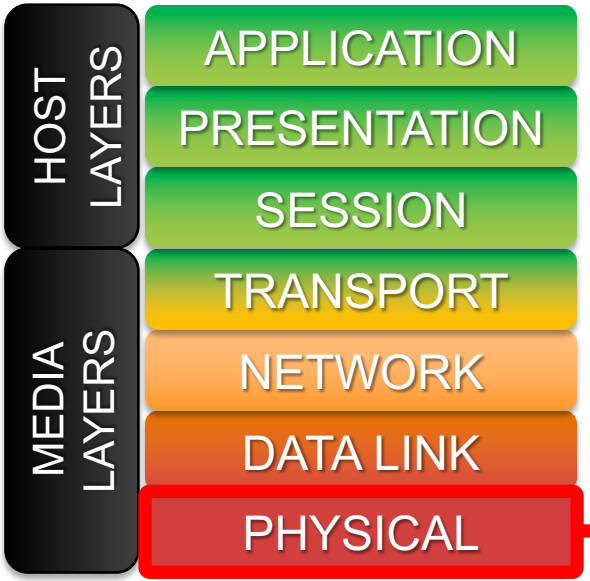
AUDIO NETWORKING ON OSI LAYERS



AUDIO RELATED EXAMPLES:

- AES3 – Electric (balanced XLR)
- AES10 – Optical (multimode/singlemode duplex SC fiber), electric (BNC coax)
- AES50 – Electric (100BASE-TX)
- ADAT – Optical (TosLink), or electric (RCA)
- S/PDIF – Optical (TosLink), or electric (RCA)

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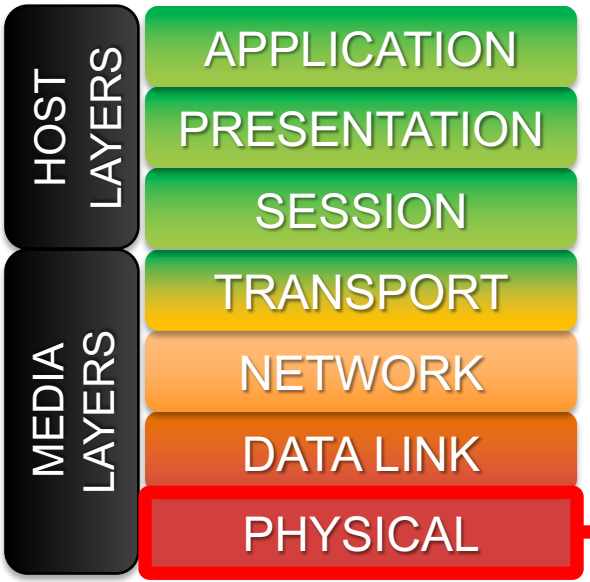
AUDIO NETWORKING ON OSI LAYERS



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TDM (Time Division Multiplexing based) solutions

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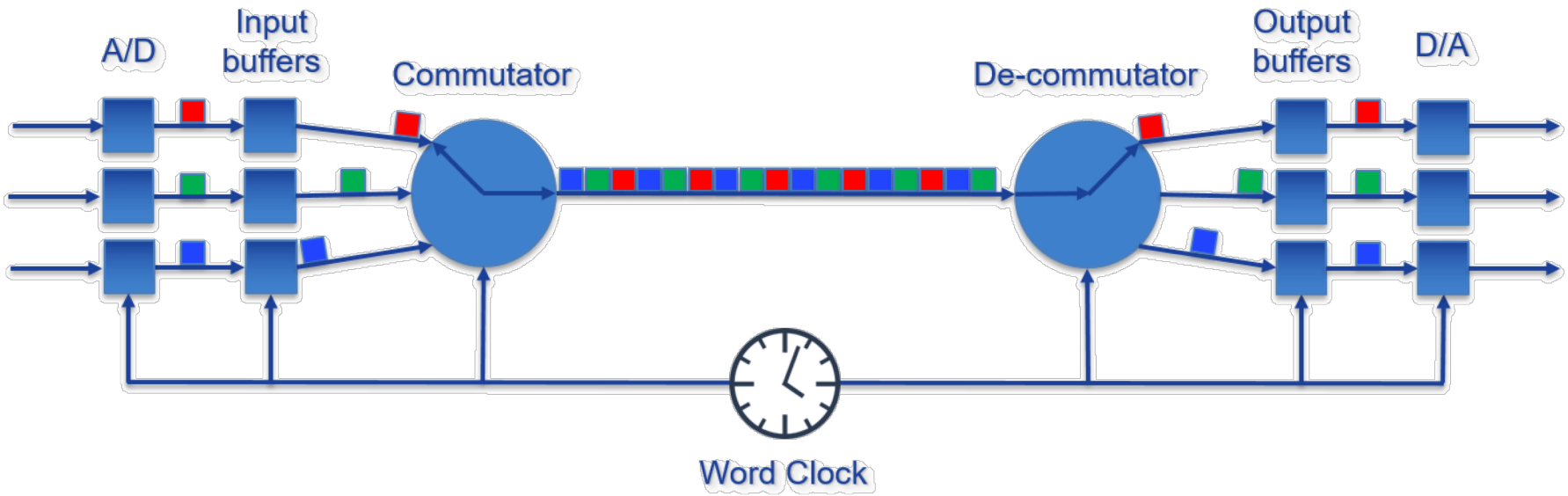
TDM - TIME DIVISION MULTIPLEXING



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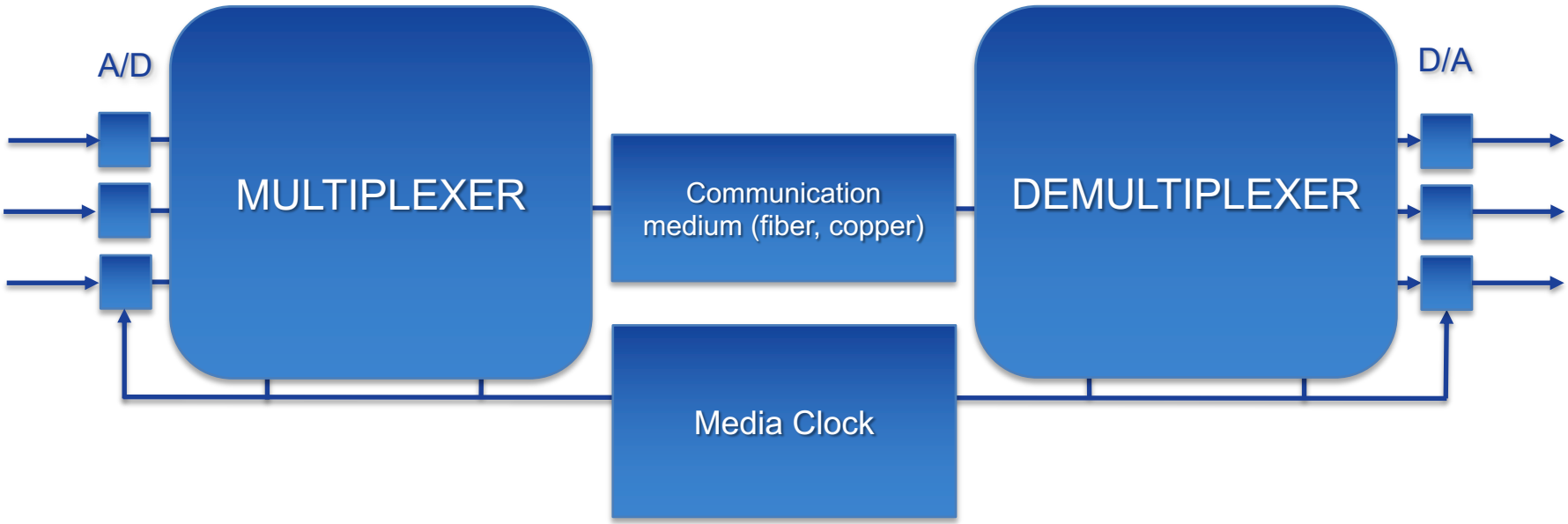
TDM - TIME DIVISION MULTIPLEXING



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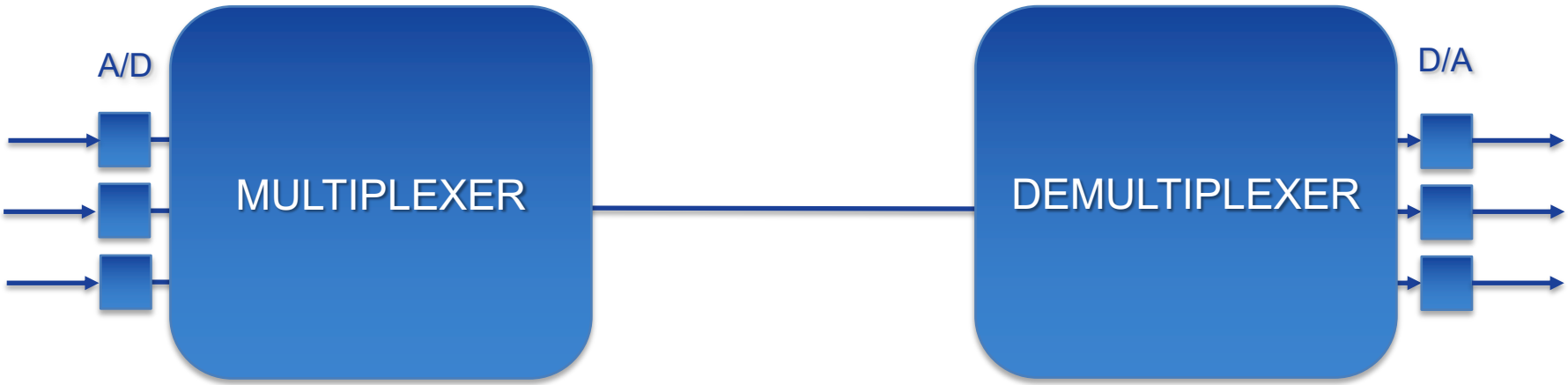
TDM - TIME DIVISION MULTIPLEXING



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AUDIO NETWORKING ON OSI LAYERS

- Layer 1 audio solutions are using **circuit-based** principle of data transmission
- Mostly TDM-based
- Often called “Digital Audio Snakes”
- Still provide only point to point connectivity
- No real flexibility or scalability

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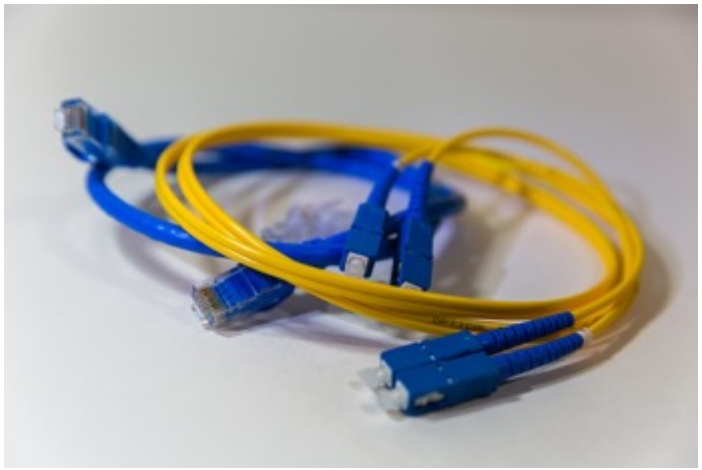

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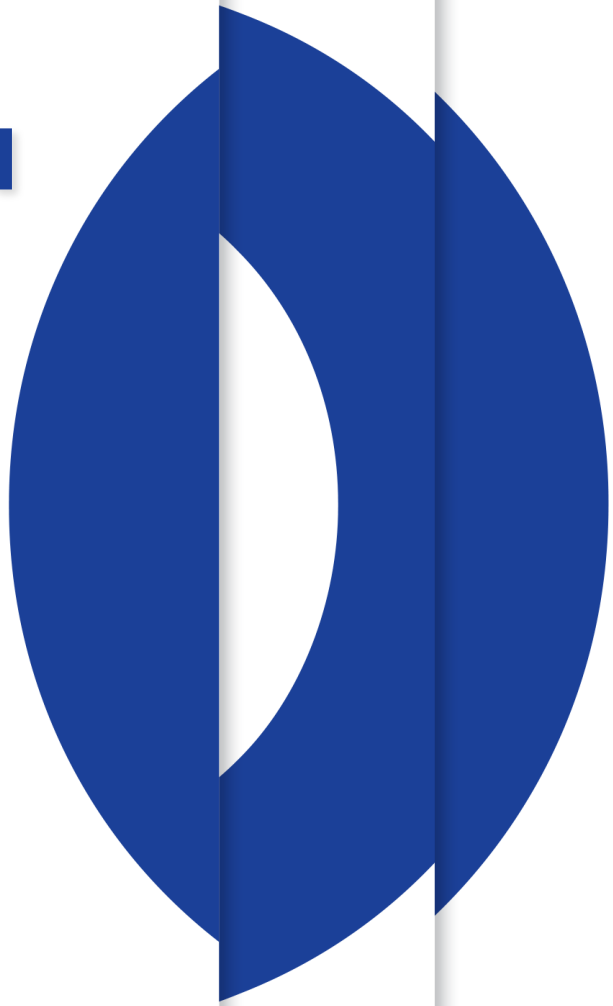
AUDIO NETWORKING ON LAYER 2

THE DATA LINK LAYER



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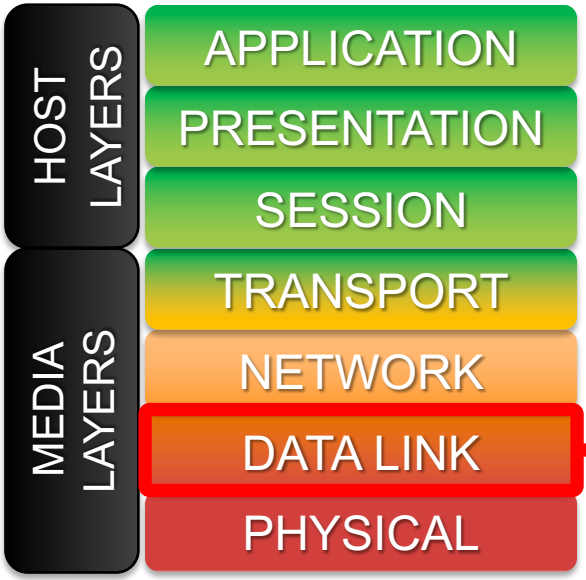

- Provides addressing between hosts on the same network
- Establishes and terminates connection between two physically connected devices

Typical protocols:
Ethernet, MAC, STP, VLAN, 802.1Q

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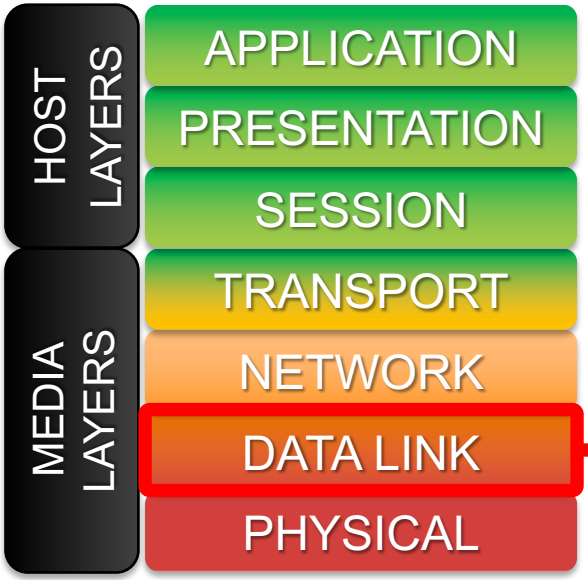
AUDIO NETWORKING ON OSI LAYERS



AUDIO RELATED EXAMPLES:
Audio over Ethernet

- EtherSound
- CobraNet
- Audio Video Bridging (AVB)
- AES51

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AUDIO NETWORKING ON OSI LAYERS

- Most Layer 2 audio solutions are still **circuit-based**
- Certain point-to-multipoint functionality is possible
- Sometimes called “hybrid”
- Require dedicated or special network equipment
- Operate only within one LAN/VLAN
- Do not scale

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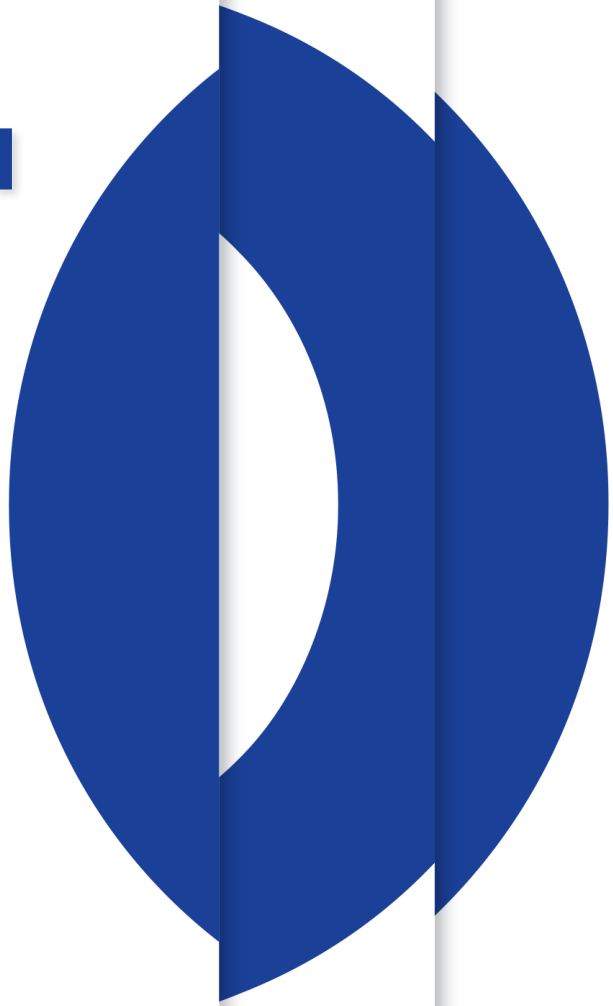
AUDIO NETWORKING ON LAYER 3

THE NETWORK LAYER



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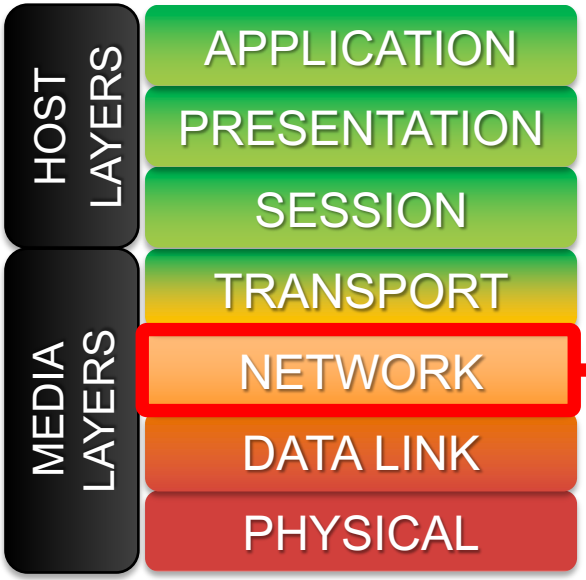

- Provides fragmentation of data streams into packets and further reassembly of data streams from packets
- Provides addressing functionality to the networks and means for network path determination

Typical protocols:

IPv4, IPv6, OSPF, RIP, VRRP, IGMP, DiffServ

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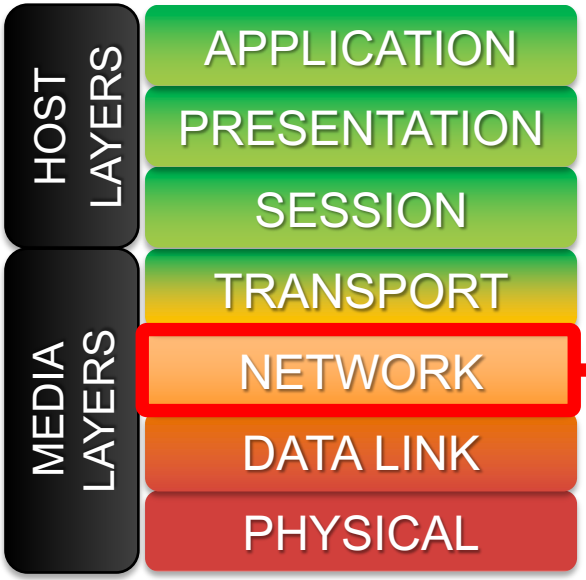

AUDIO RELATED EXAMPLES:

- Livewire+
- Ravenna
- Dante
- Q-LAN
- WheatNet-IP
- AES67
- SMPTE ST 2110-30

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AUDIO NETWORKING ON OSI LAYERS

- Layer 3 “Audio over IP” solutions are **packet-based**
- Utilize all higher layers (4, 5, 6, 7)

Benefits:

- Scalable thanks to network segmentation (VLANs, subnetting) and multicasting
- Can operate on **standard** IT networking equipment
- Can share same infrastructure as i.e. office network

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AOIP OSI LAYERS STACK

- Layer 1: 100BASE-T, 1000BASE-% (T, X, etc.)
- Layer 2: Ethernet
- Layer 3: IPv4, IGMPv2, DiffServ
- Layer 4: UDP
- Layer 5: RTP
- Layer 6: PCM Audio
- Layer 7: “Network-aware” A/D-D/A

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SMPTE ST 2110-30

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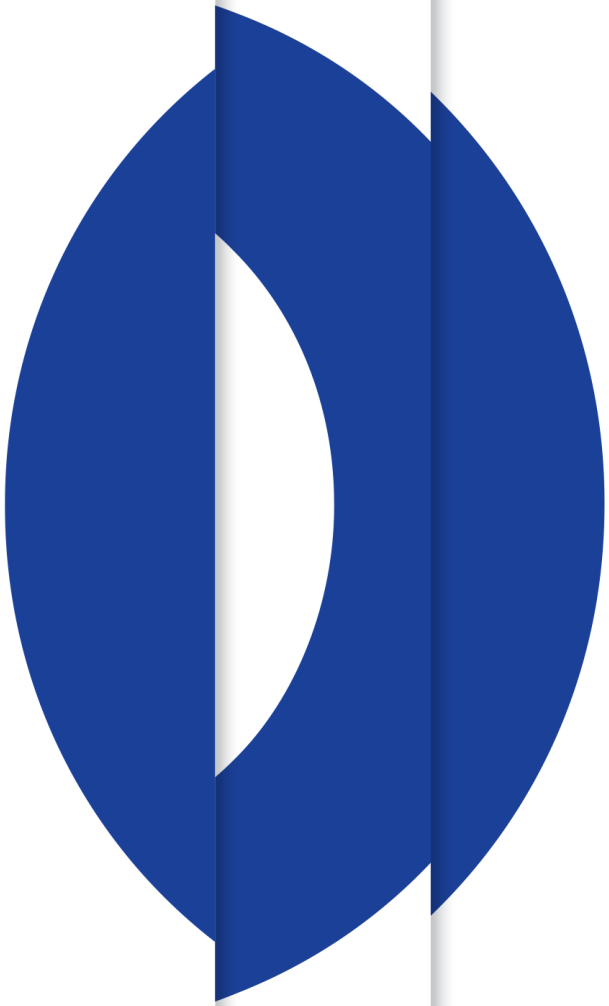
WHY GOING IP?



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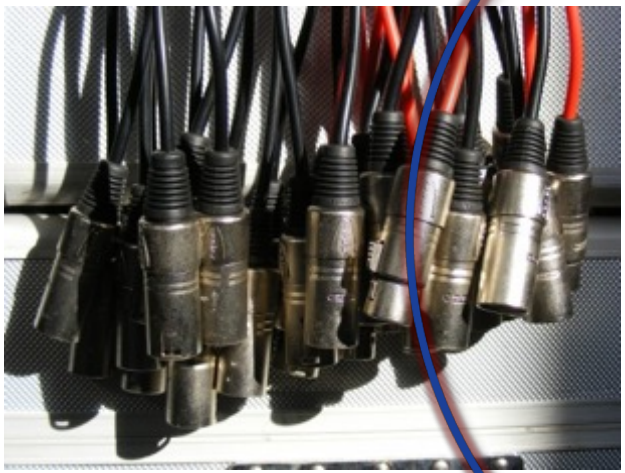

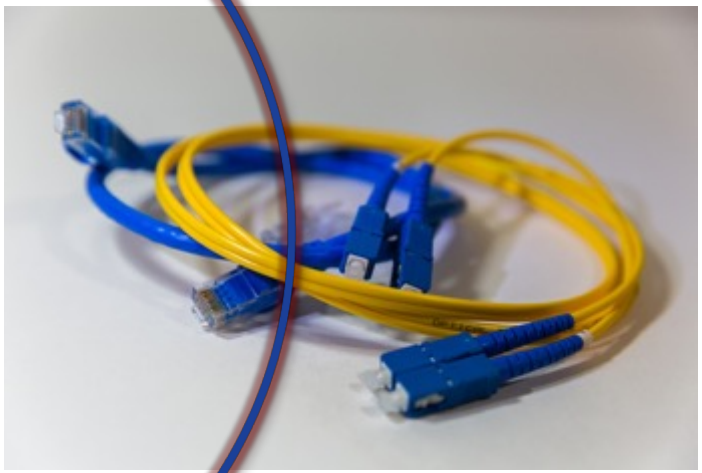

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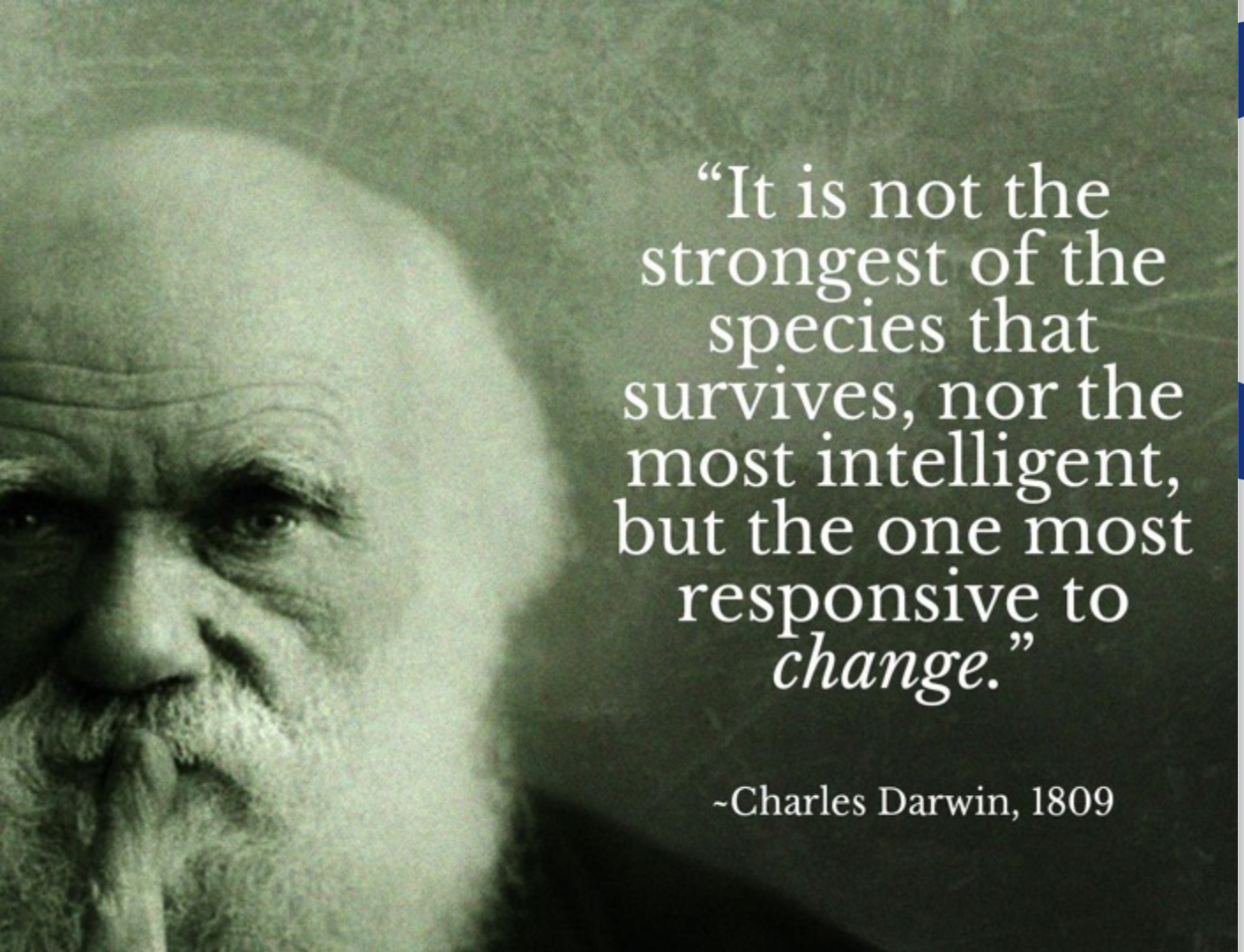
“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to *change*.”
~Charles Darwin, 1809

FEATURES OF “TRADITIONAL” AUDIO

- Trusted and established solutions
- Often point-to-point
- Often unidirectional
- Need for audio matrixes
- Defined by AES, SMPTE, etc. therefore somehow niche
- Control is often separate
- Built-in “own” clocking mechanisms
- Does not fully leverage standard IT OSI stack

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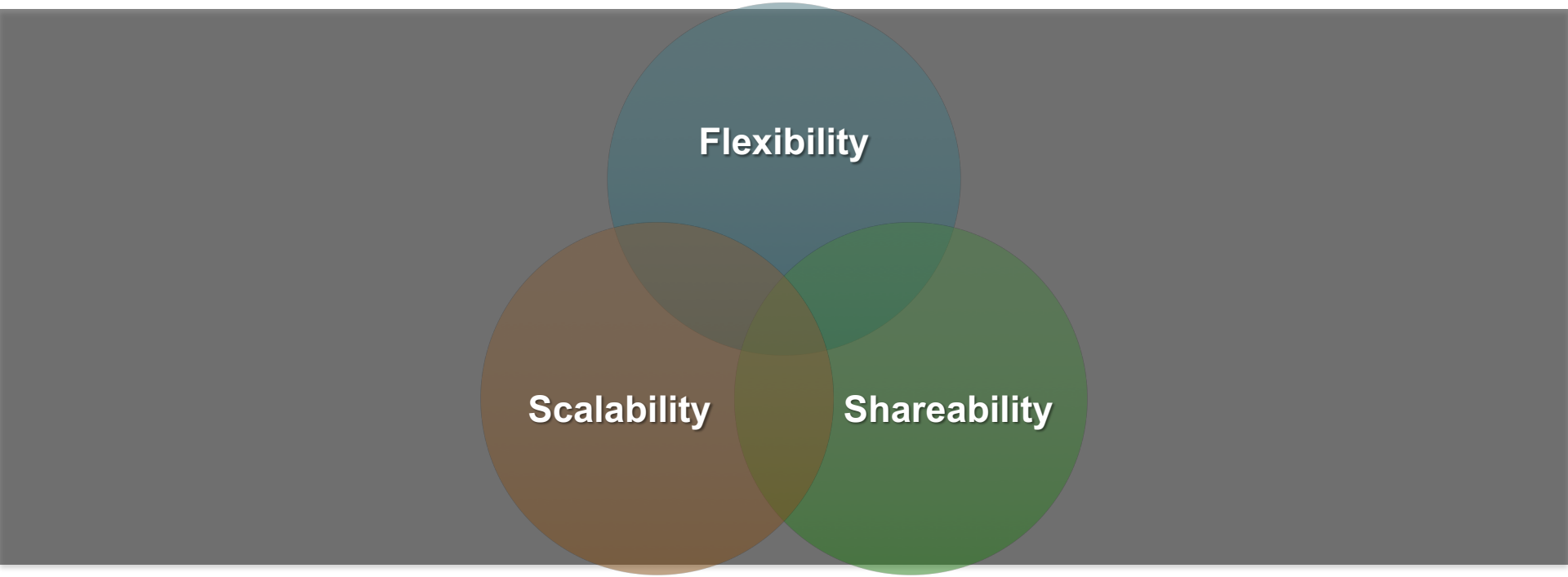
FEATURES OF IP TECHNOLOGIES

- Trusted solution for IT industry
- Flexible routable topologies
- Full duplex (bidirectional) links
- Unicast or multicast
- Defined by IEEE, IETF, and others
- Properly layered
- Commodity both in software and hardware

BROADCASTERS REQUIREMENTS



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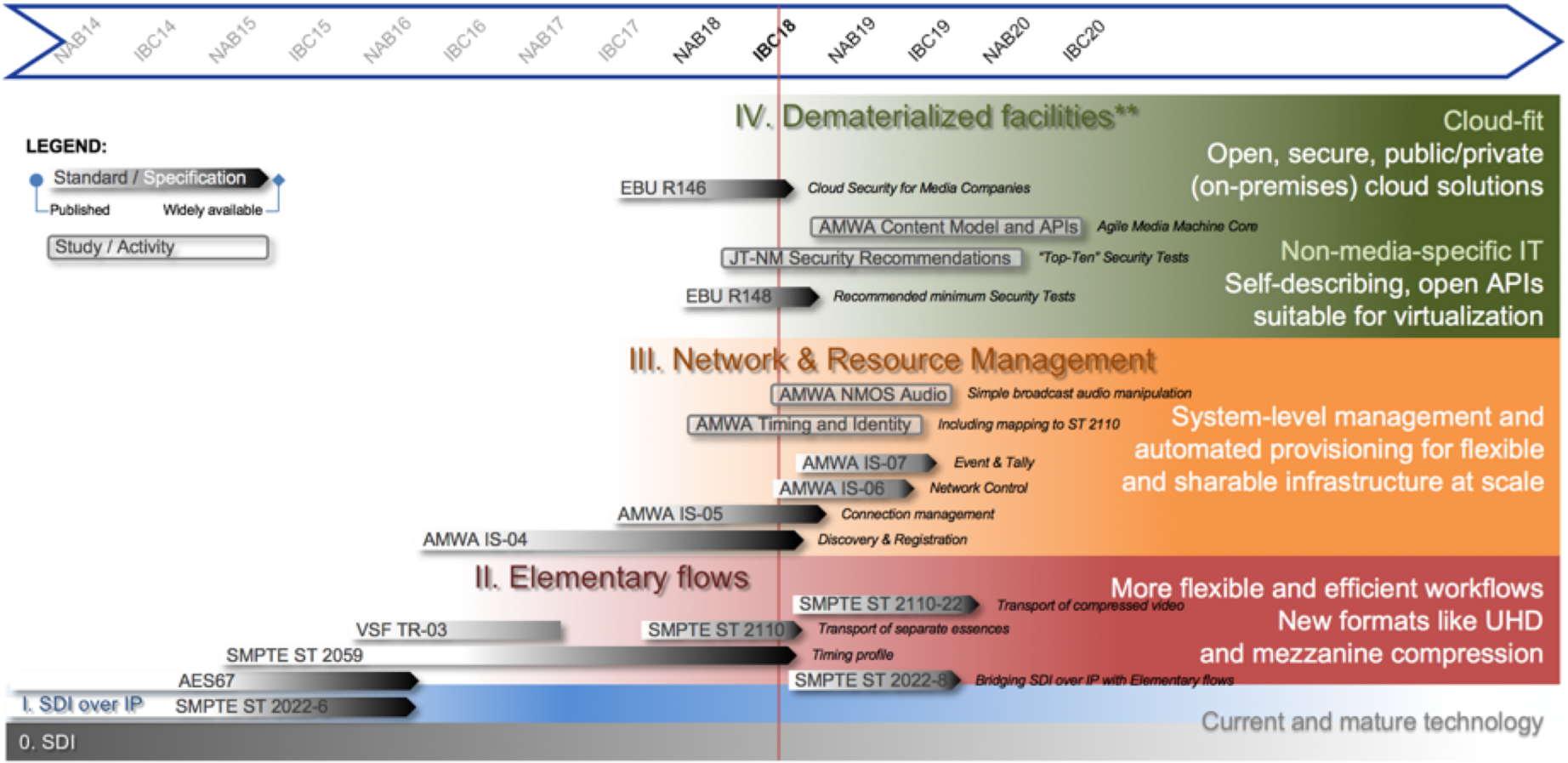
JT-NM Roadmap of Networked Media Open Interoperability*

AMWA EBU SMPTE VSF



**See Dematerialized Facilities FAQ at JT-NM.org for more information.

* JT-NM assumption as of August 2018 and will evolve over time. Visit JT-NM.org for the latest update. Feedback to jt-nm-info@videoservicesforum.org

TO IP?..

- New facilities
- New formats and content types
- New distribution platforms
- Production flexibility
- New tools
- Simplified connectivity

- Joined-up operations
- Dynamic scaling
- Virtualization & cloud
- Cost reduction from COTS components
- Modern development techniques
- New market opportunities

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… OR NOT TO IP?

- Existing workflows
- Legacy equipment
- Organizational limitations
- Product roadmaps
- Perceived issues

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NEED FOR INTEROPERABILITY

- Implementations are based on standard IT protocols and formats
- However true open audio transport interoperability remains the key factor
- Users should demand the full support for open interoperability
- Exclusive features, functionality and quality should be the drivers for healthy competition

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Thank You

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