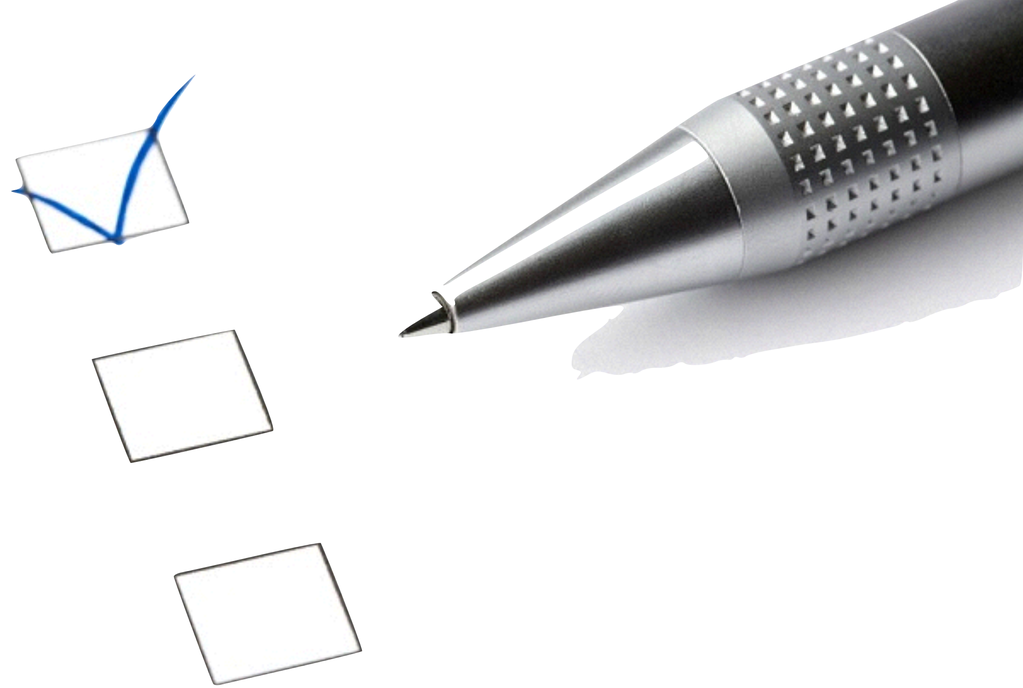
Audionetwerken en protocollen, de huidige stand van zaken en wat kunnen we in de toekomst verwachten

Ing. Ruben van der Goor
Senior Application Engineer Digital Systems
Yamaha Music Europe, Commercial Audio

Topics

- Connection types and protocols
- Why networking, definitions
- Audio networks overview and history
- Ethernet compliancy
- AES67 and AVB



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“ A group or system of electric components and connecting circuitry, designed to function in a specific manner.”

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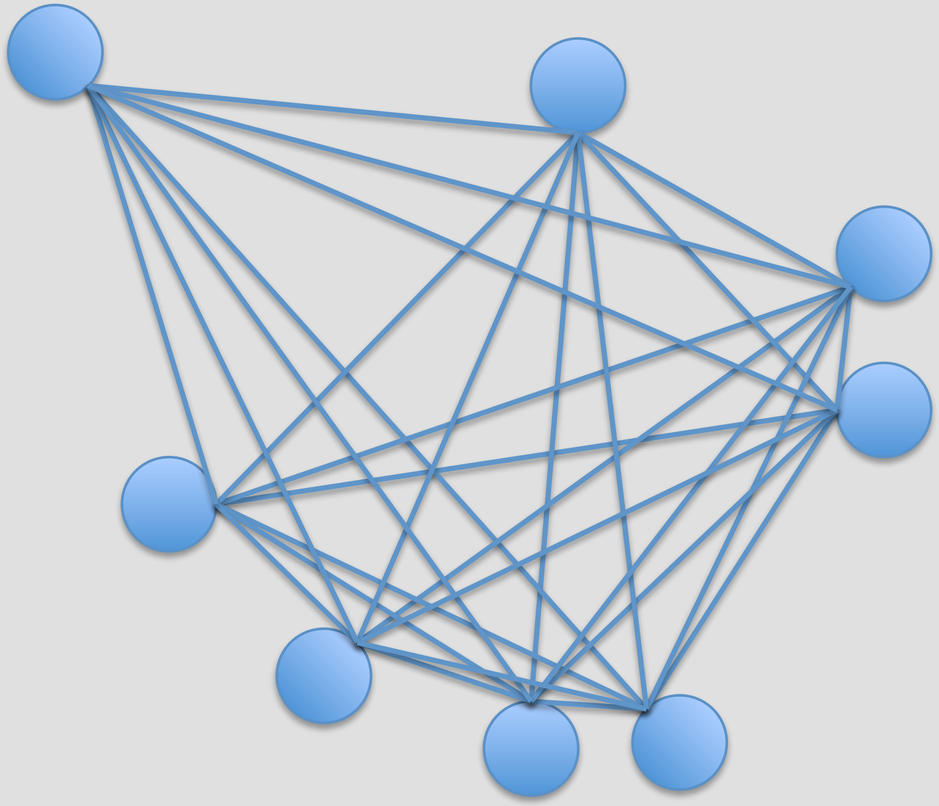

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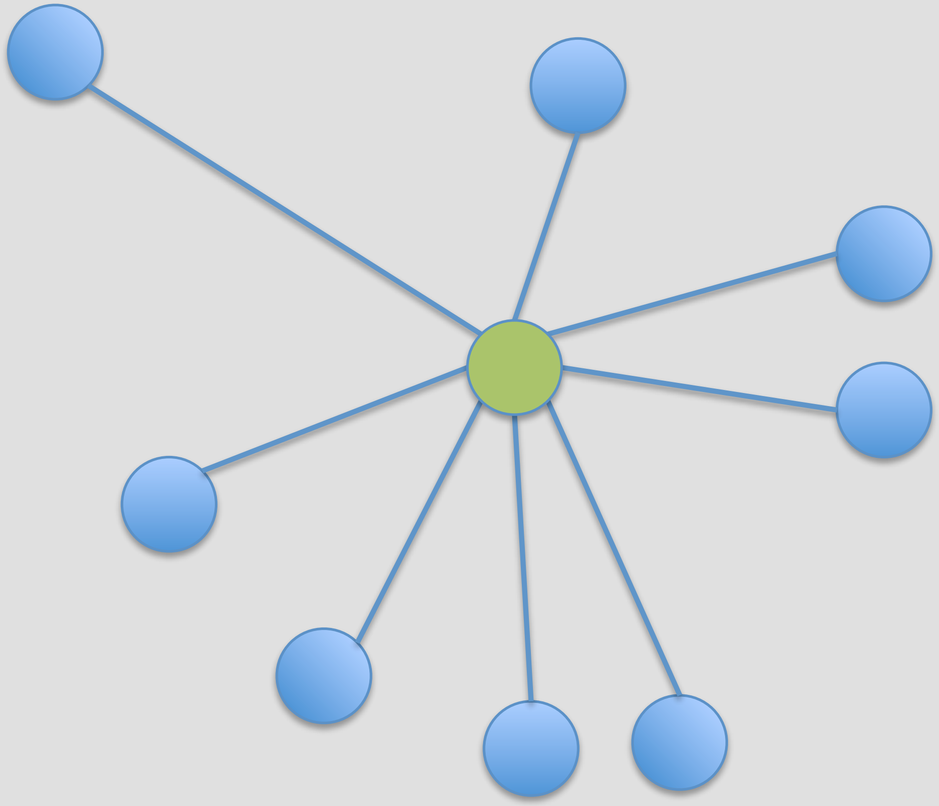

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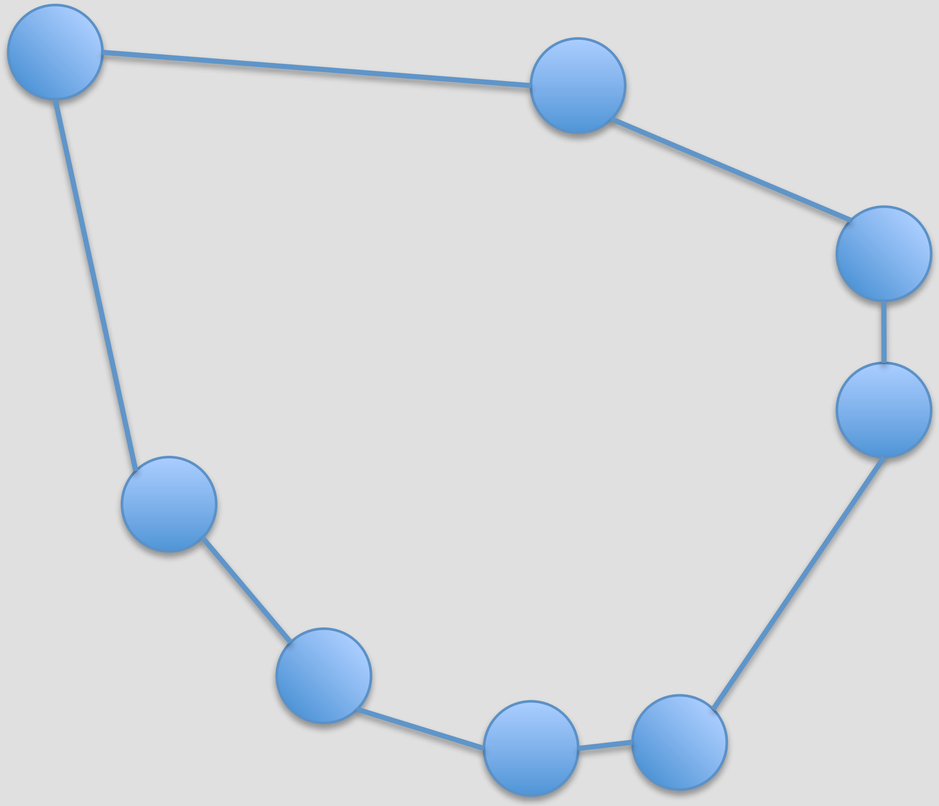

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Connection types

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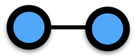

- Network

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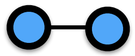

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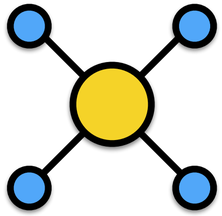

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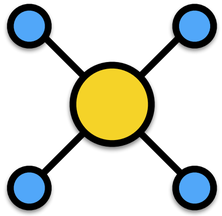

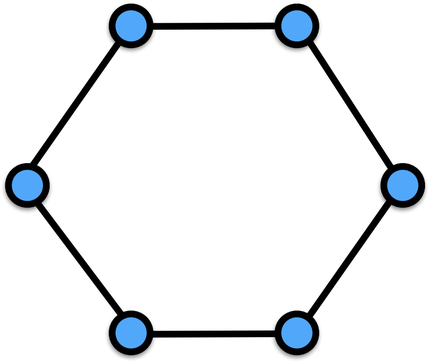

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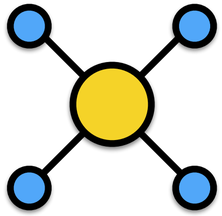

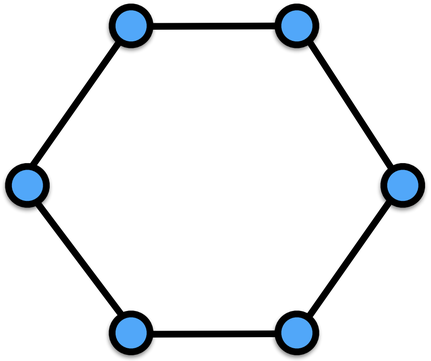

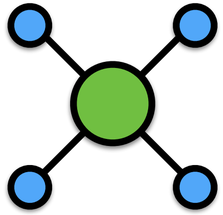

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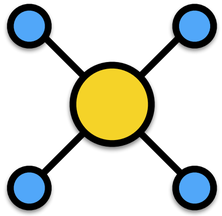

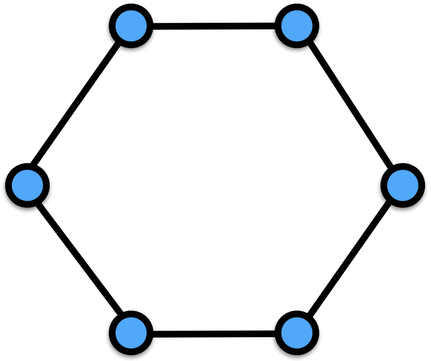

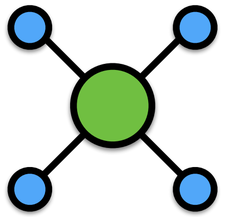

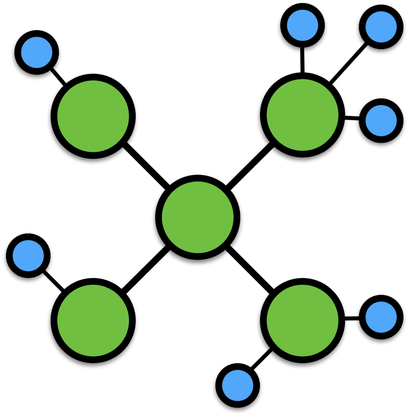

The are many ways to make a connection.

ALC Networx Ravenna

HyperMac

AVB

Riedel RockNet

Cirrus Logic CobraNet

ADAT

Optocore

BSS BluLink

Audinate Dante

SuperMac

Riedel MediorNet

SDI-SD/HD

EtherSound ES100

Waves Soundgrid

Roland REAC

AES50

MADI

TDIF

Avion Anet

TwinLANe

AES/EBU

AES67

YAMAHA commercial audio

Only a few follow the definition of a network

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Even fewer are ethernet compliant

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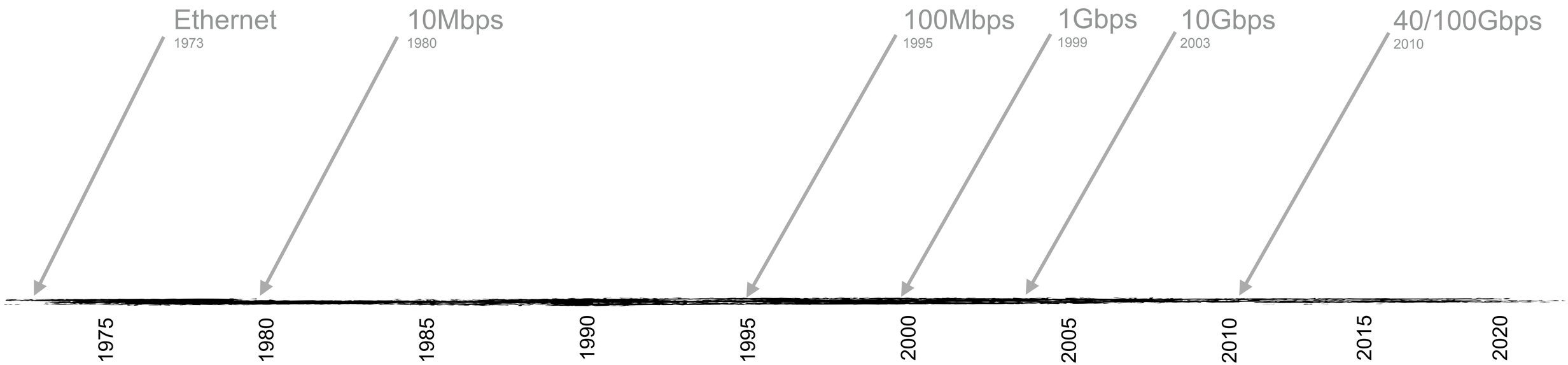
Some history



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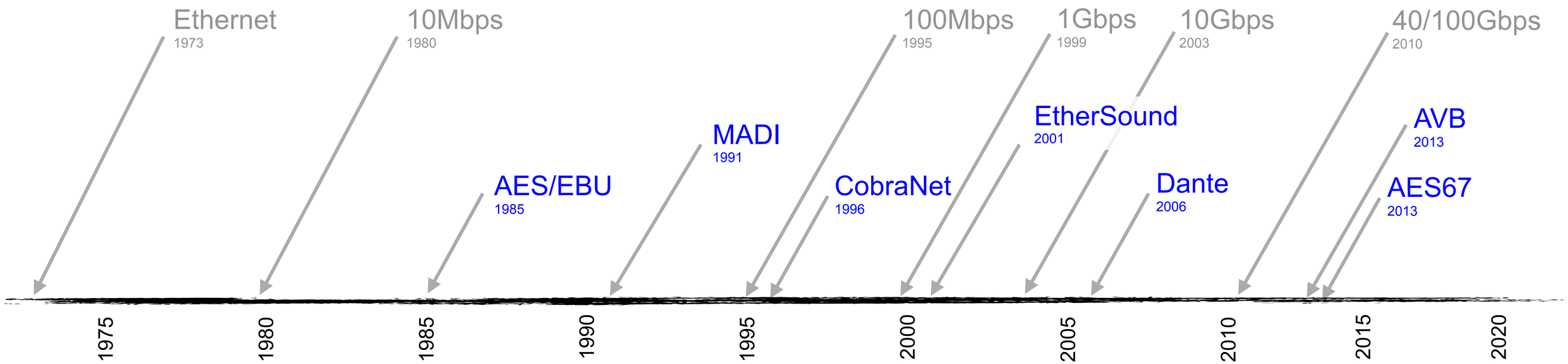


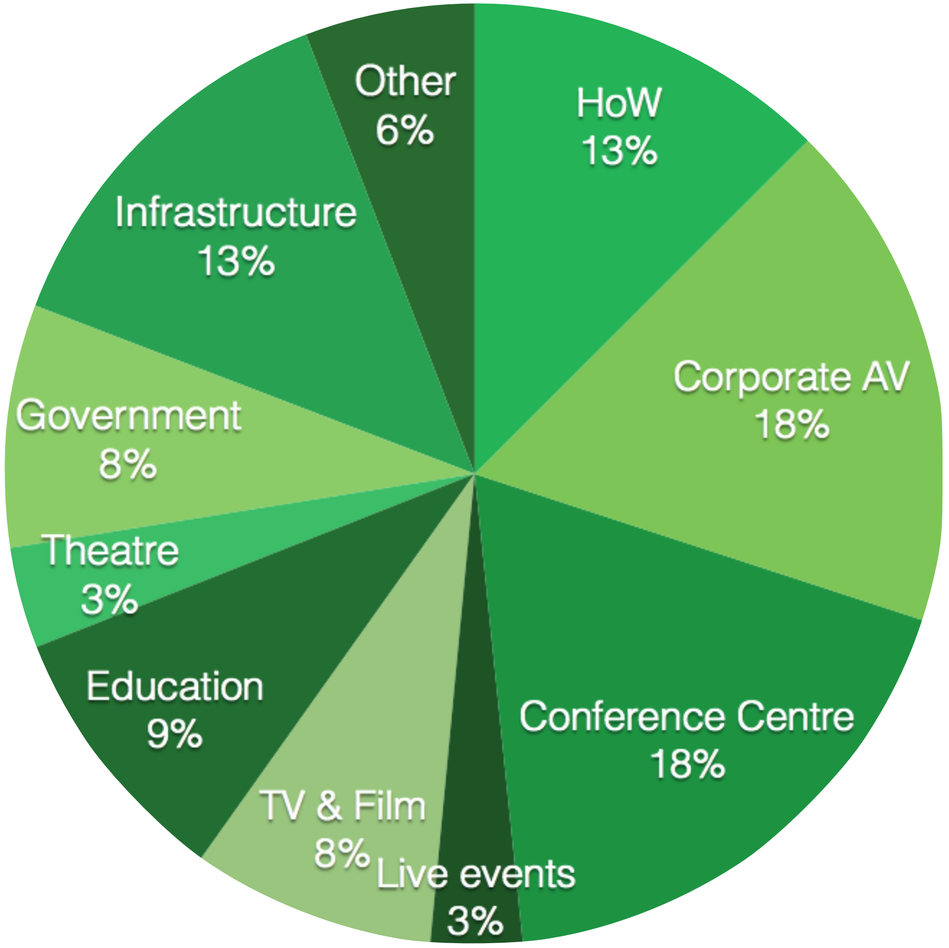
Protocols

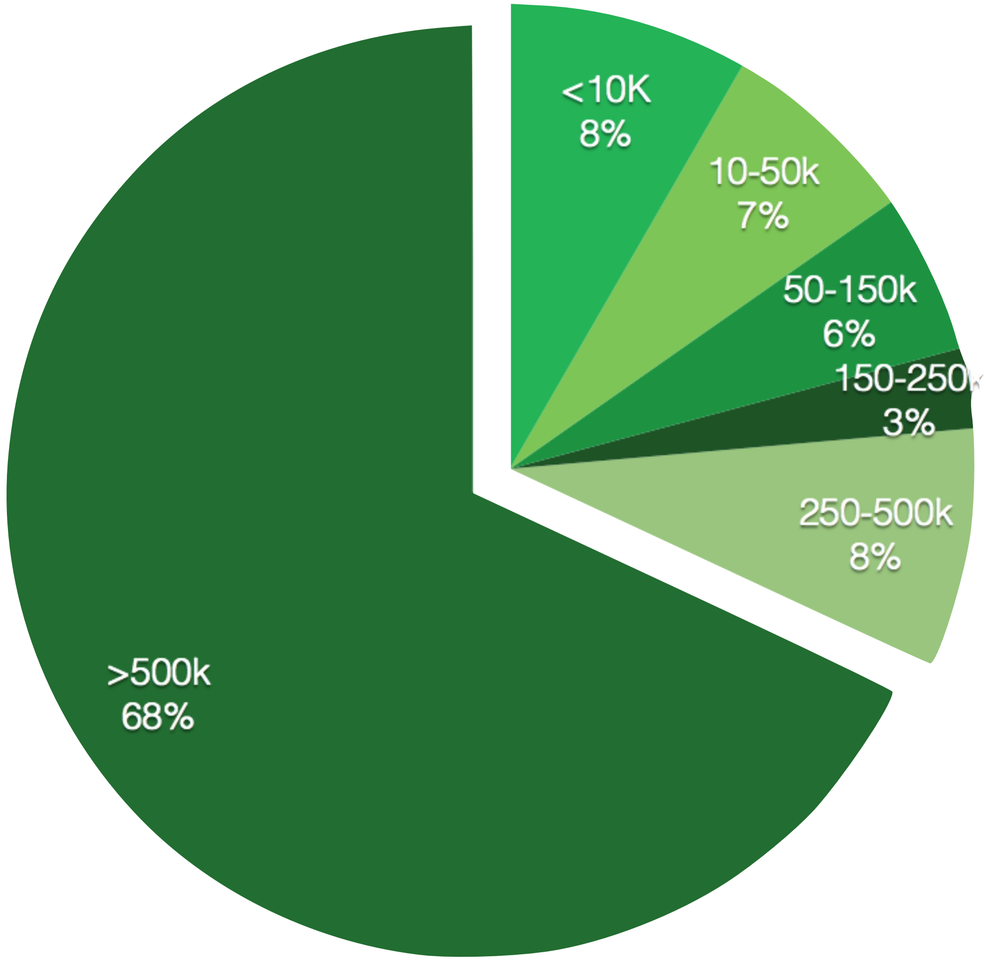
- Way of packing audio in a standardized format
- Backbone of the system
  - Control in parallel with audio
  - Audiochannel sacrificed for control
- All system feature various subsystems

A&H	- Giga-ACE
AVID	- AVB
Behringer	- AES50
Cadac	- MegaCOMMS
Crest Audio	- Soundgrid
DiGiCo	- MADI - Optocore
MIDAS	- AES50
Roland	- REAC
Soundcraft/Studer	- MADI
SSL	- MADI - Blacklight
Yamaha	- Dante - TWINLANe

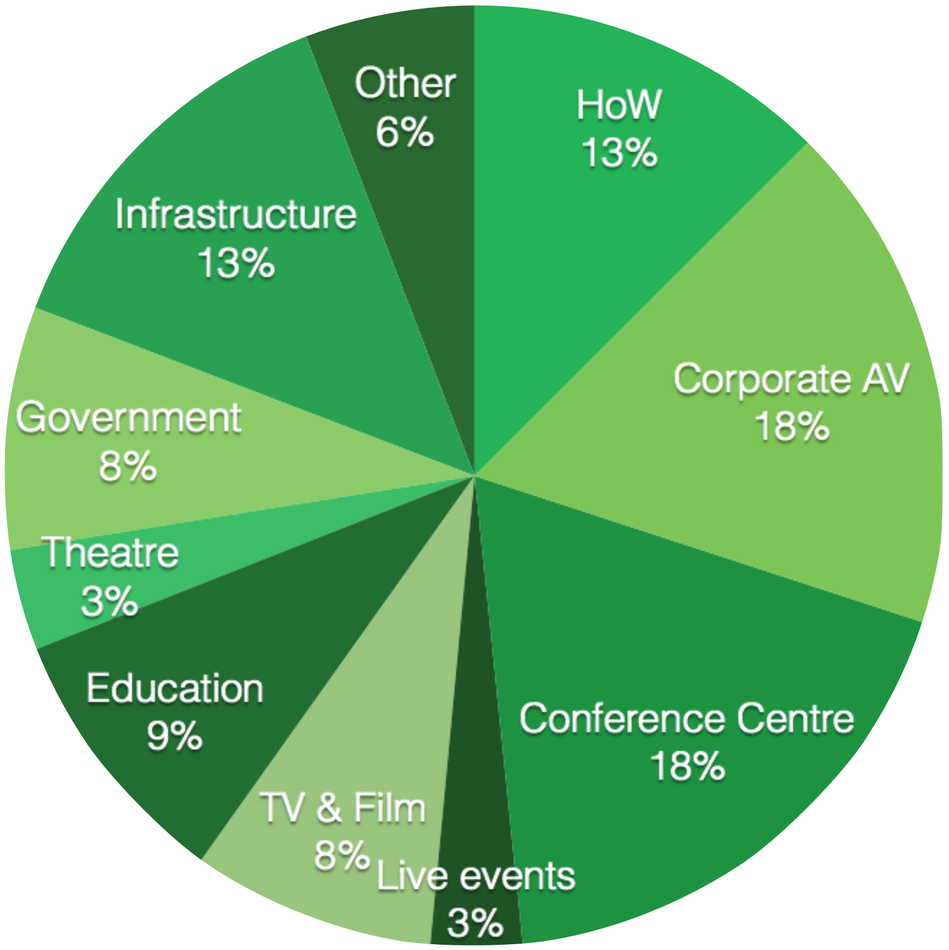
Why network at all?

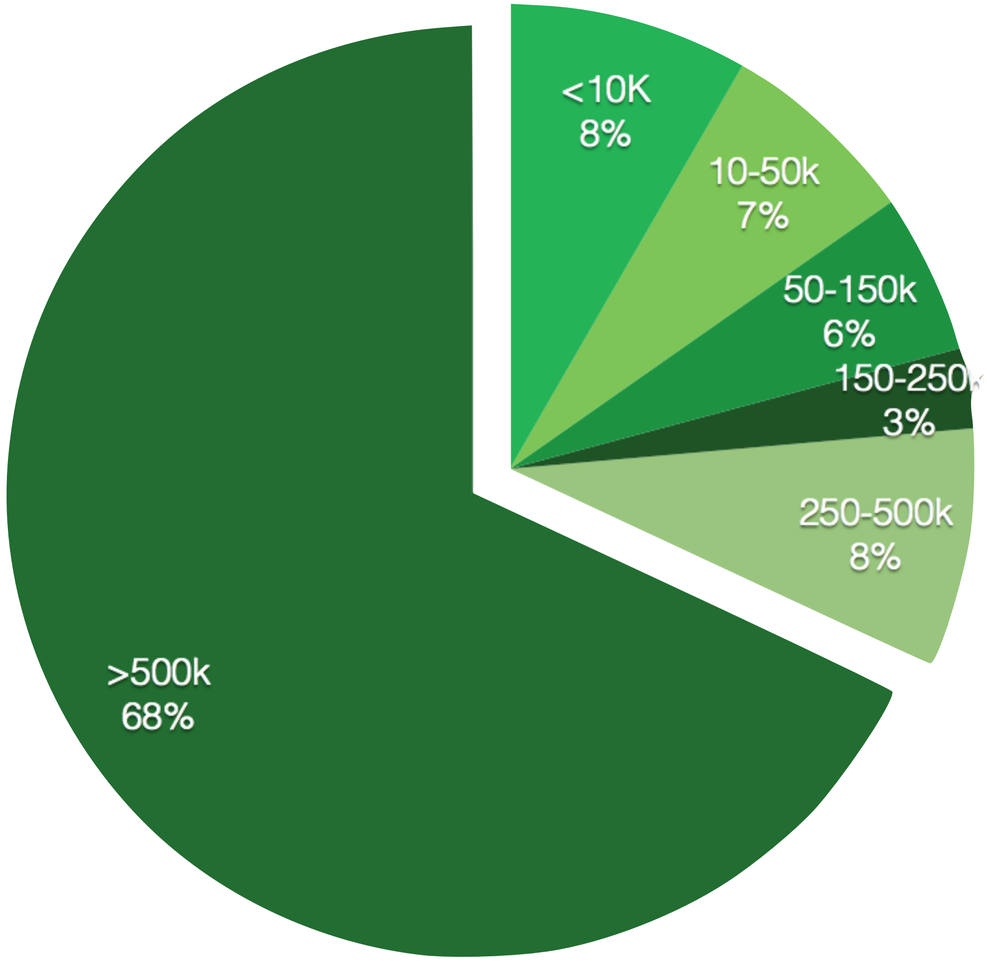
- Integration of audio, lighting, control, data, video
- Ultra large size systems possible, and stay flexible
- Distributed I/O, DSP, control
- Quality
- Cost
- Logistics


Other
6%
HoW
13%
Infrastructure
13%
Corporate AV
18%
Government
8%
Theatre
3%
Education
9%
Conference Centre
18%
TV & Film
8%
Live events
3%


<10K
8%
10-50k
7%
50-150k
6%
150-250k
3%
250-500k
8%
>500k
68%

Statistics





Research by RH Consulting 2015

But, it might take some planning

- Who owns the network ?
  - Which rights do I have ?
  - What to do to get more rights….?
  - What does IT need to know from me ?
  - What and how to communicate with IT ?

- IP addresses ?
- Integration ?
- VLANs ?
- Security ?
- Maintanance ?

Protocol considerations ?

- Bandwidth requirements
- Redundancy requirements
- Clocking requirements
- Latency requirements
- Open or proprietary
- Level of flexibility
- Level of investment
- .....

Ethernet protocols

CobraNet (1996)

+ License based protocol
+ Huge range of devices available
+ Still available

- Complex to design, lots of parameters
- Software from each manufacturer or even product
- Not developed anymore

CobraNet®

Ethernet protocols

EtherSound (2001)

+ License based protocol
+ 30 licensees
+ No need for switches, daisy chain
+ Low latency
+ One common software

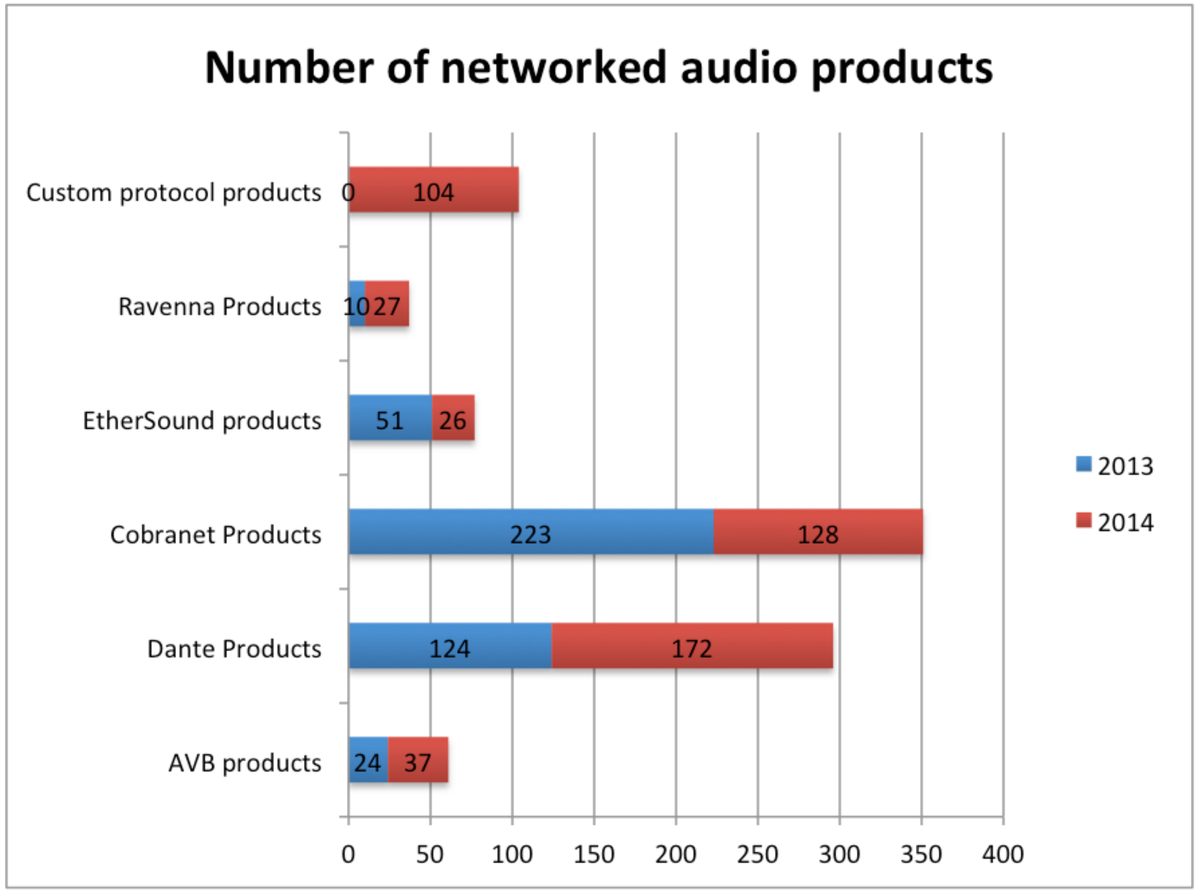
- Can be tricky to design
- Limited in channel count, especially in redundant ring mode

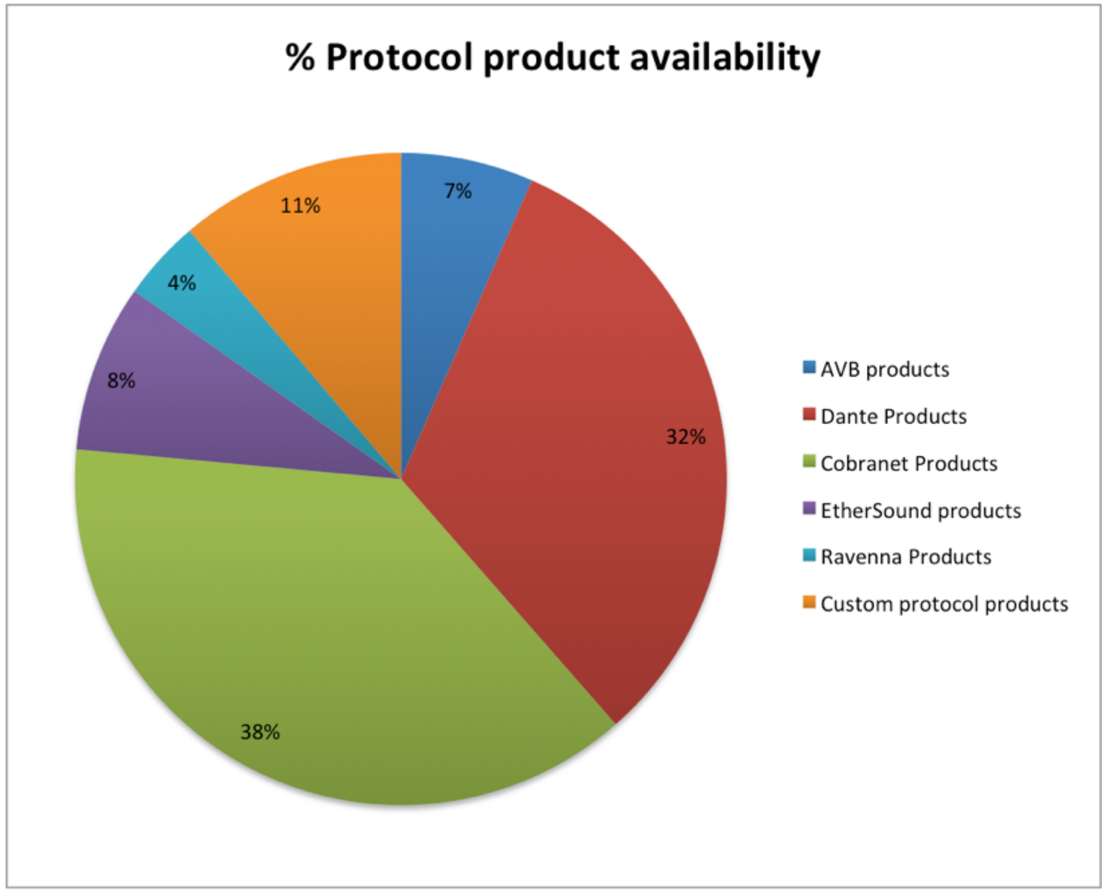
Ethernet protocols

Dante (2006)

- Dante is a protocol developed by the Australian Audinate company
- Dante supports IEEE802.3 networks
- Dante is an IP based media network protocol
- Dante is sample and phase accurate
- Dante has a low latency (<1ms)
- Dante can have multiple sample rates and bit depths on the same network
- Dante is based on 1Gbps network (Legacy products may have 100Mbps)
- Dante is not limited to a maximum number of channels
- Dante channel depends on available bandwidth (500 ch though 1Gbps)

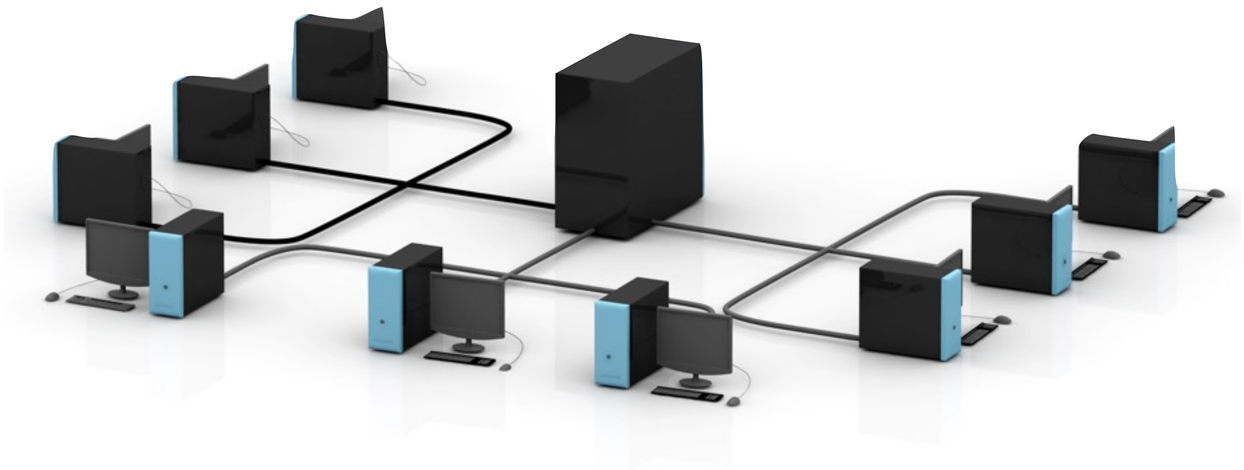
Recent study by Roland Hemming





Ethernet compliancy

- Commonly available
- Use existing infrastructure
- Integration
- Great innovations
- Cheap components



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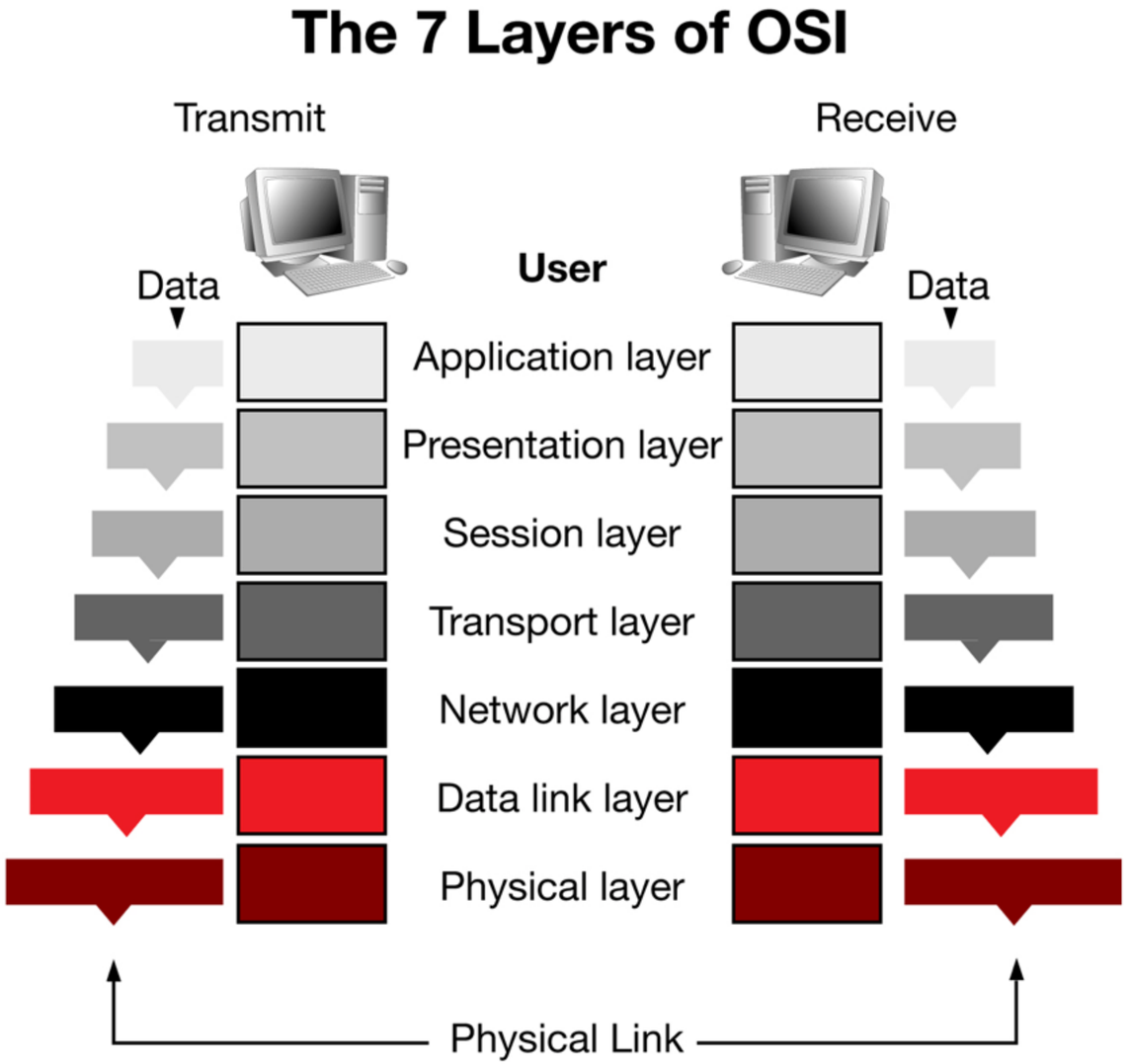
Feature	Description		
Performance			
Switching capacity and forwarding rate All switches are wire-speed and non-blocking	**Model Name**	**Capacity in Millions of Packets per Second (mpps) (64-byte packets)**	**Switching Capacity in Gigabits per Second (Gbps)**
	SG300-10	14.88	20.0
	SG300-10P	14.88	20.0
	SG300-10MP	14.88	20.0
	SG300-20	29.76	40.0
	SG300-28	41.67	56.0
	SG300-28P	41.67	56.0
	SG300-52	77.38	104.0
	SG300-52P	77.38	104
	SG300-52MP	77.38	104
	SG300-10SFP	14.88	20

IP networking in a nutshell

Layer 1; Physical Layer

- NIC, CAT5E, WiFi
- Components: NIC, cable, fiber, hub



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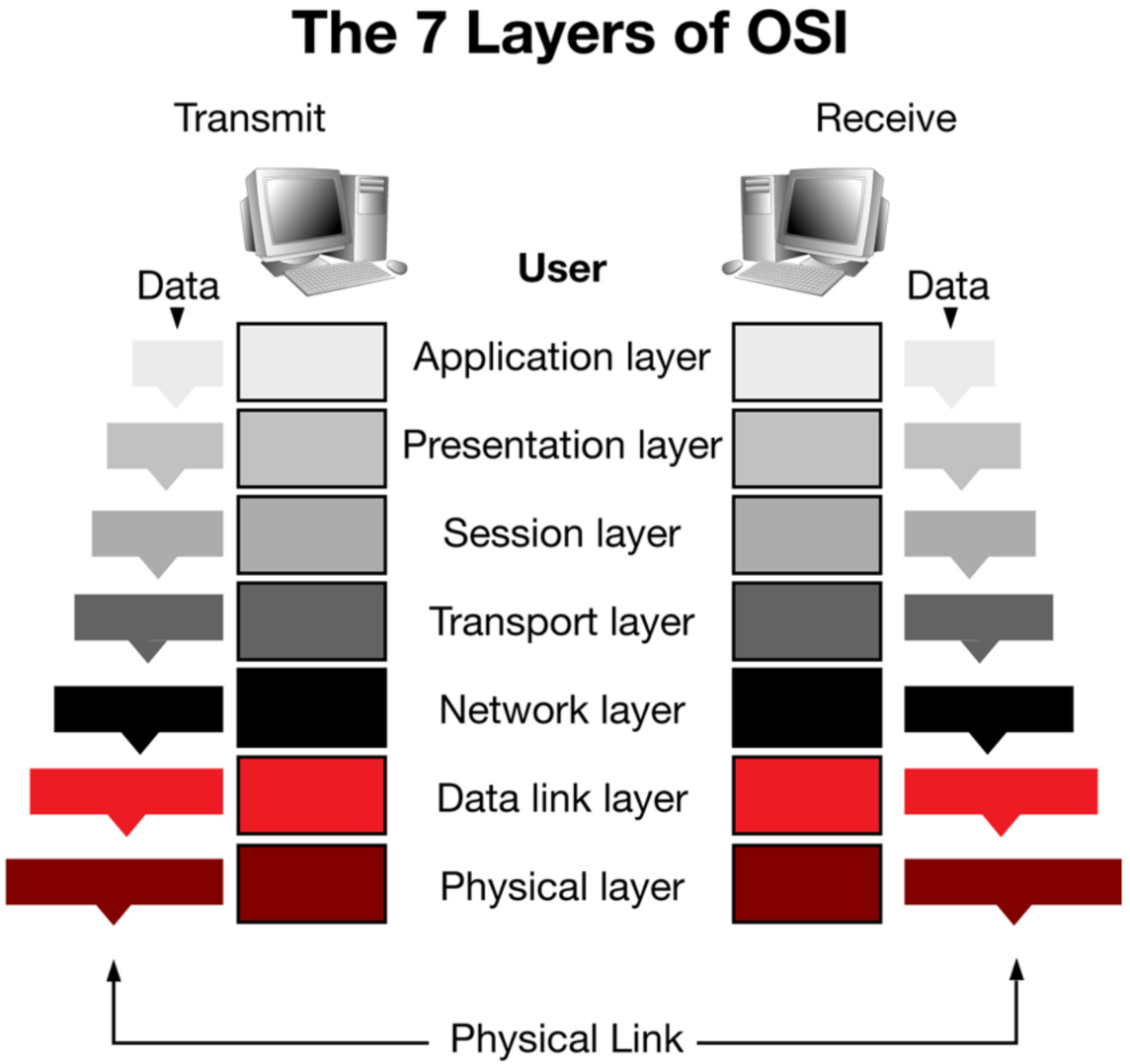
Layer 2; Data Link Layer

- MAC addresses
- Components: Switch



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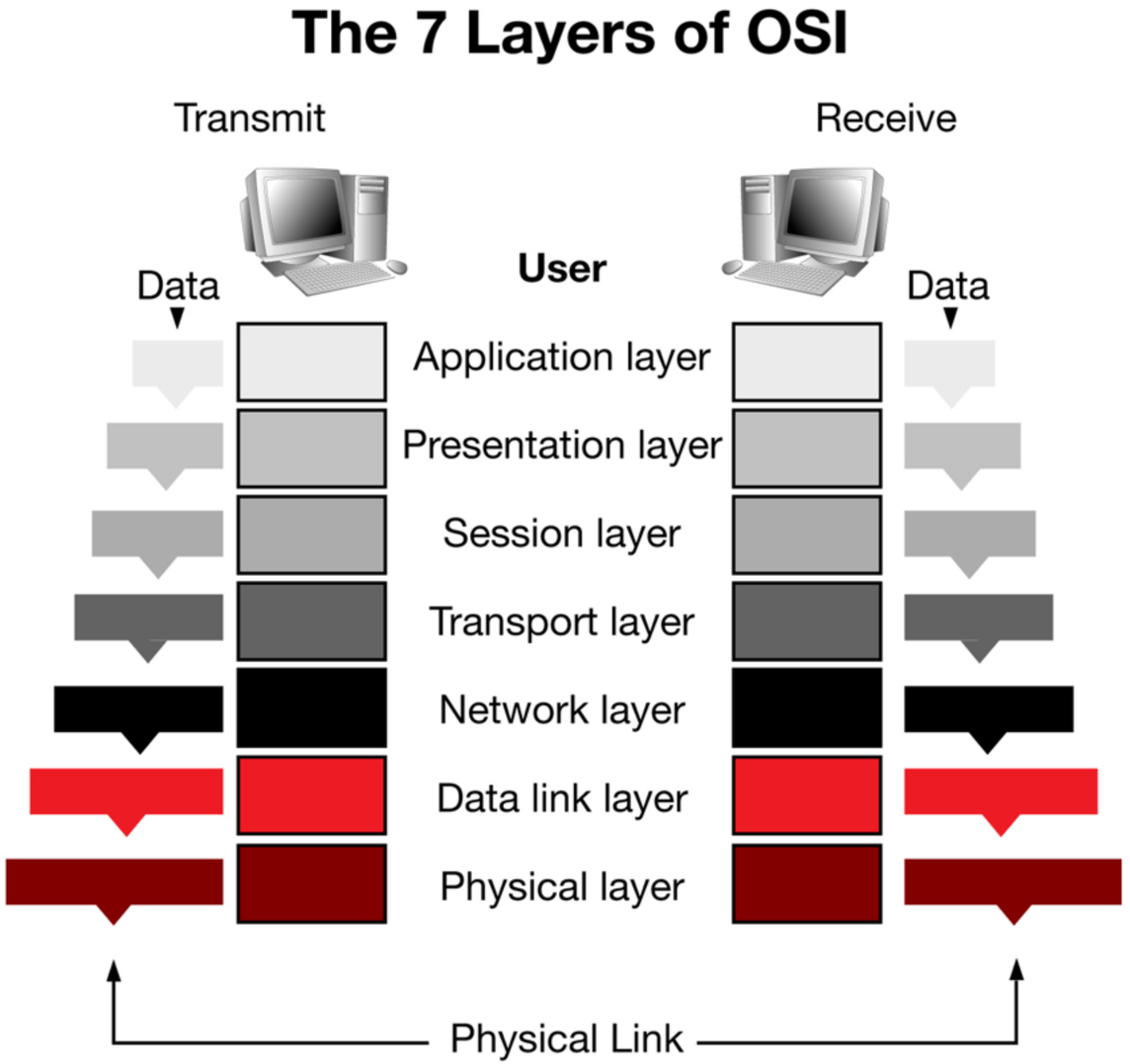
Layer 3; Network Layer

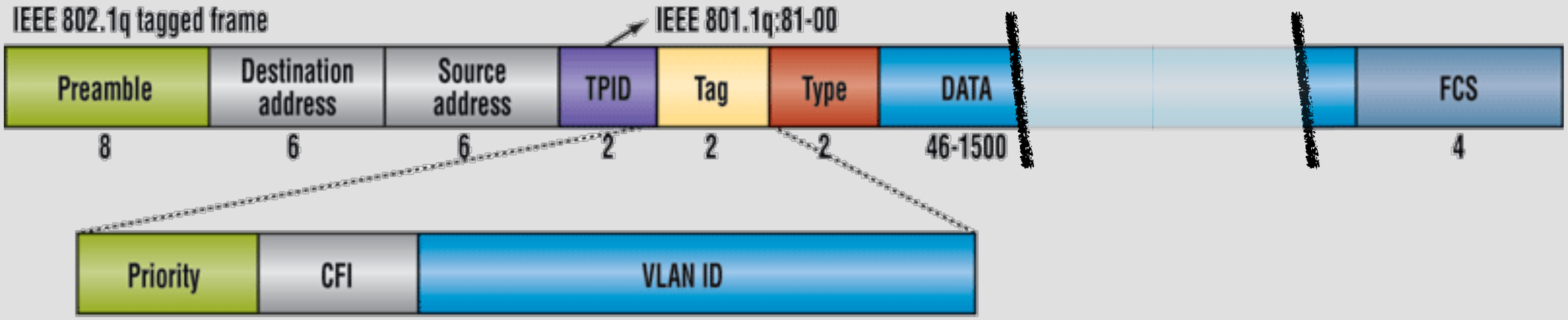
- IP addresses
- Components: Router, L3 switch



Ethernet compliancy

- The only difference is the way of transporting.
- 0’s and 1’s are packed into the “payload” of a standard ethernet packet

- So networks have no sound, they only take care of transport.

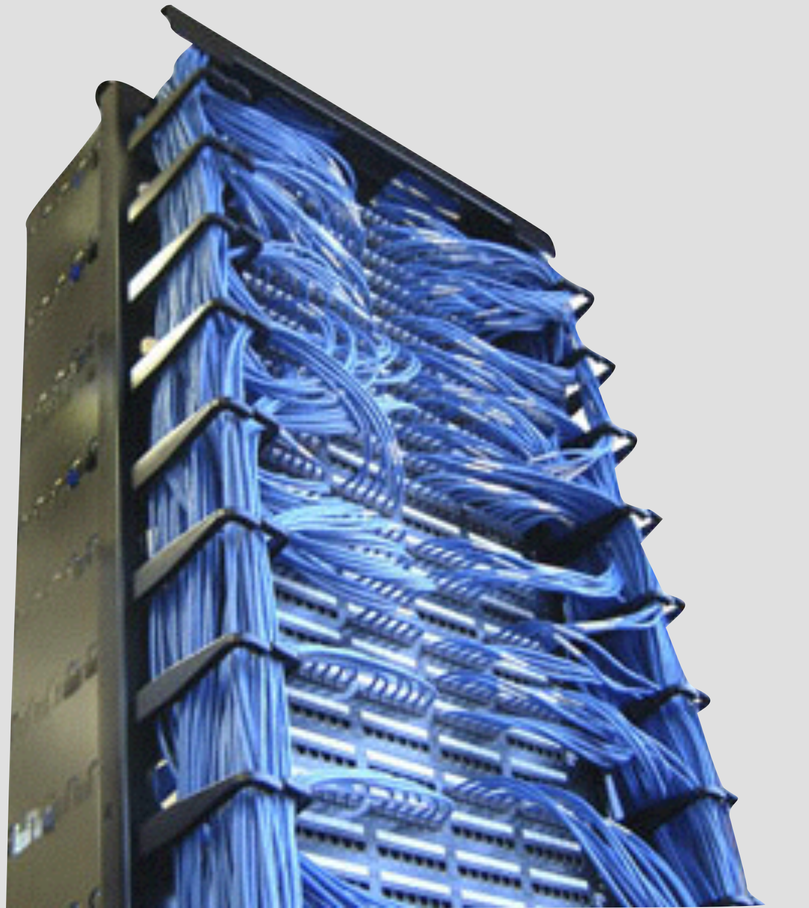


Topology

- IEEE802.3 networking standards
- So the standard topology is a star network

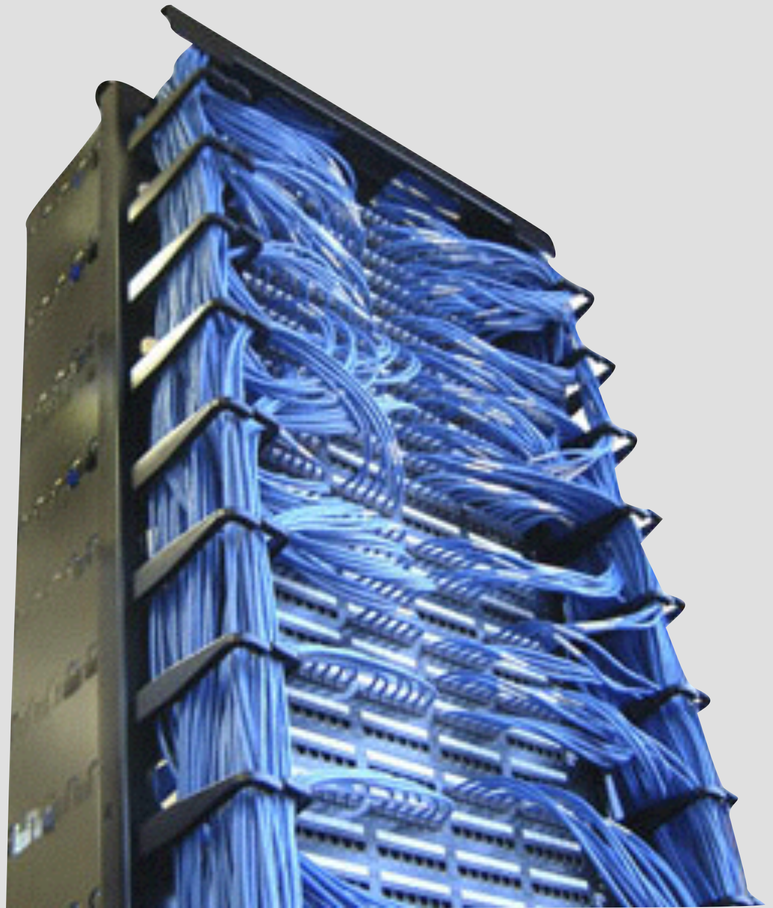
- But other compliant topological structures can be used too.
  - Daisychains of switches
  - Ring of switches (needs RSTP)
  - Meshes (needs special switches)

- IEEE802 compliant techniques can be used
  - VLANs (IEEE802.1Q)
  - Trunking or Link aggregation (IEEE802.3ad)
  - IGMP snooping (RFC 3376)
  - RSTP (IEEE802.1D)



Networks are introducing a new kind of “problem”

Networking requires a new mindset on:



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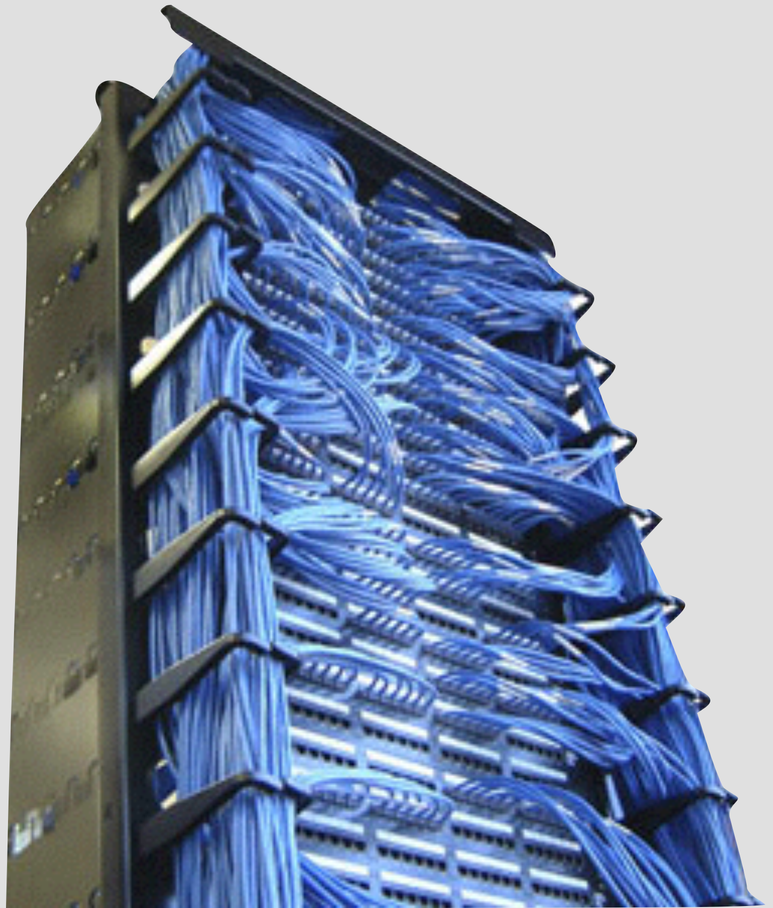

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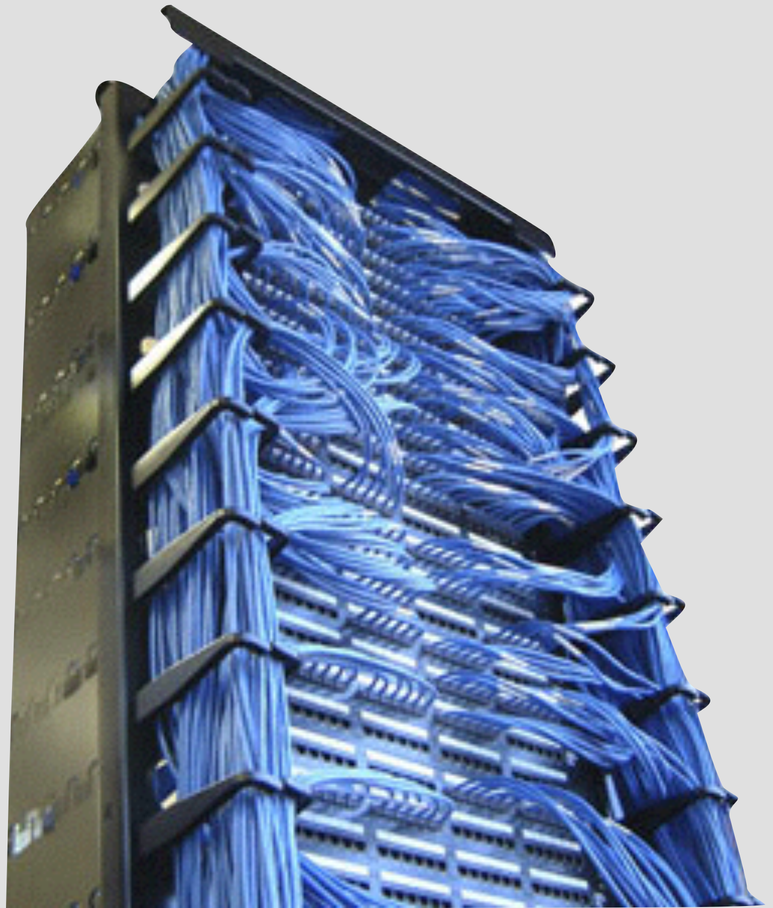

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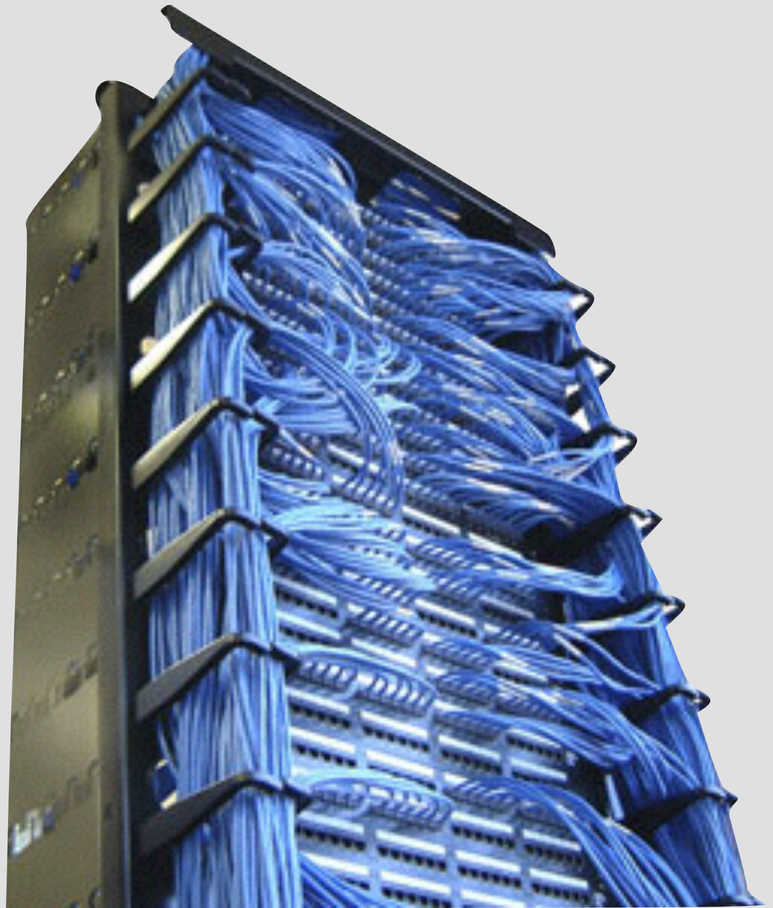
  - *“It’s just a CAT cable”*
  - *“100m max”*



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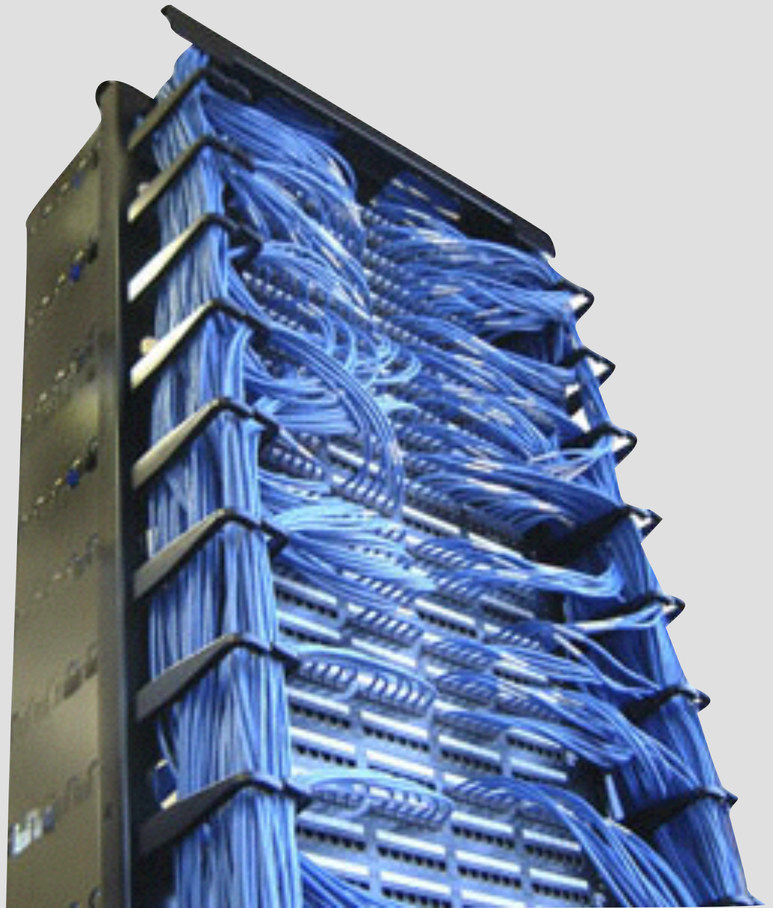

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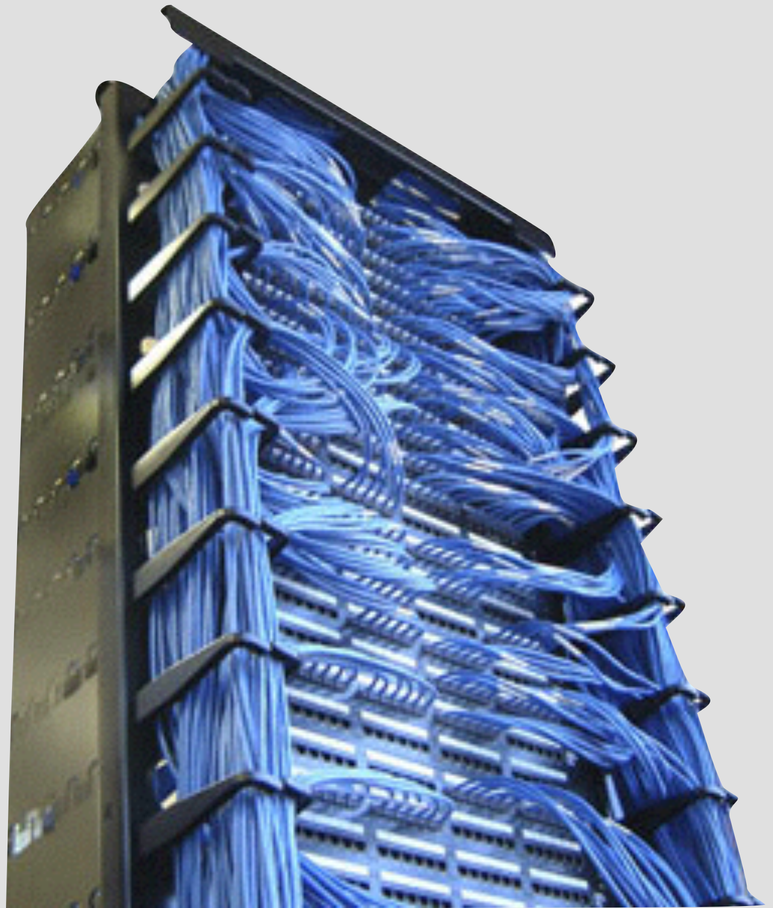

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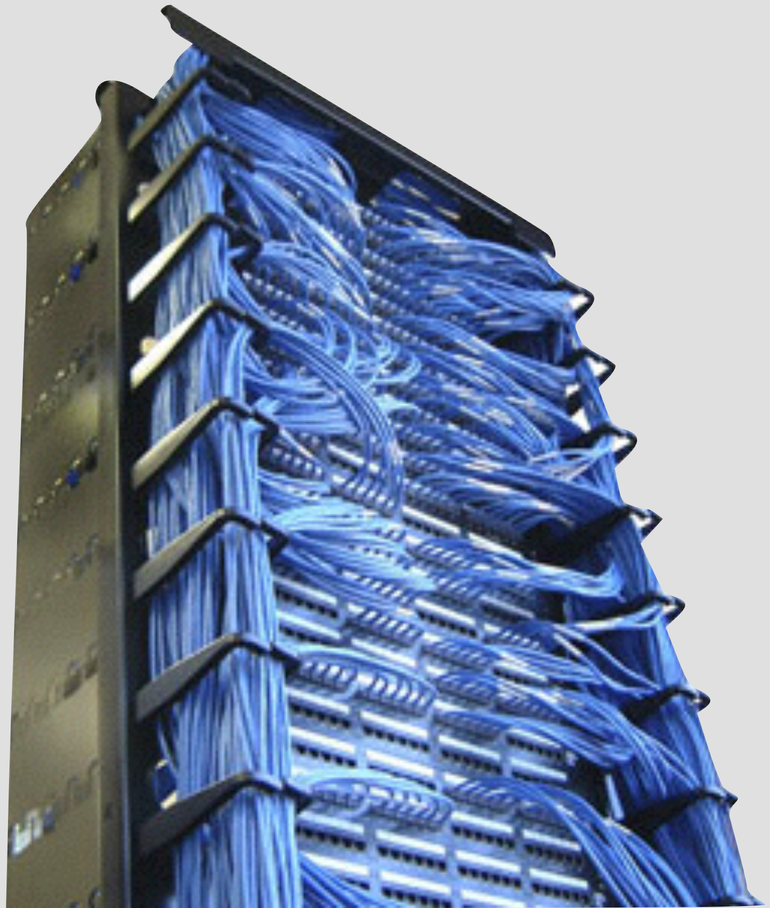
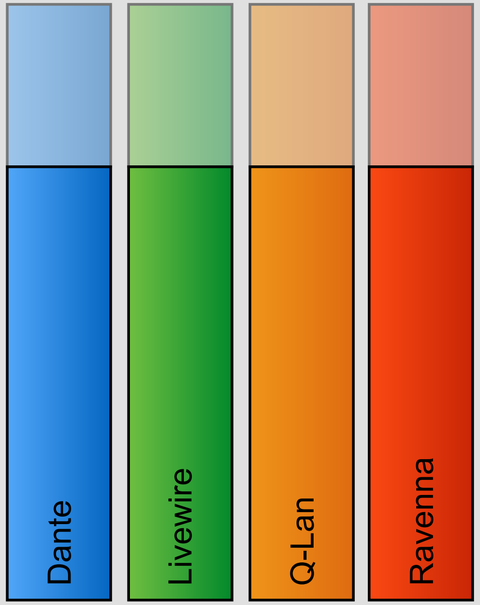
- Helicopter view



A word on AES67

- AES initiative to protocolize interoperability between:
  - Dante (Audinate)
  - Livewire (Axia audio)
  - Q-Lan (QSC)
  - Ravenna (Lawo)
- Drafted and published around 9.2013, revised 10.2015
- Can be used with conventional switches



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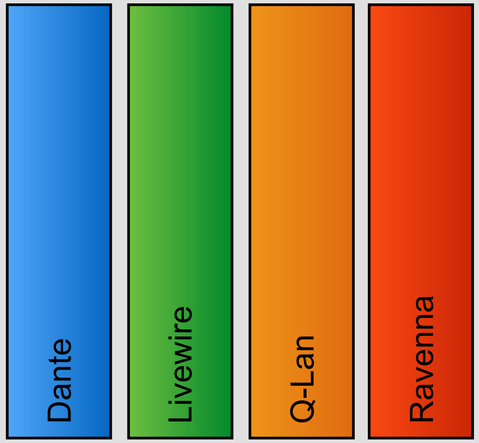

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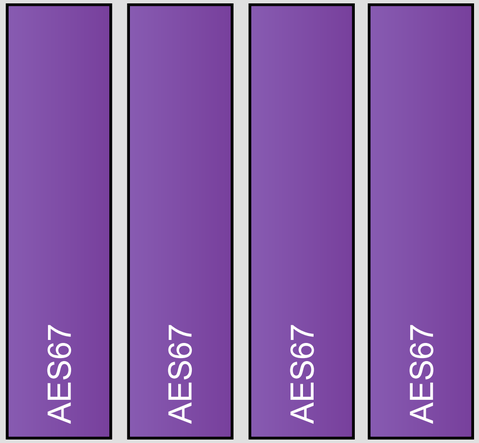
  - Livewire (Axia audio)
  - Q-Lan (QSC)
  - Ravenna (Lawo)
- Drafted and published around 9.2013, revised 10.2015
- Can be used with conventional switches



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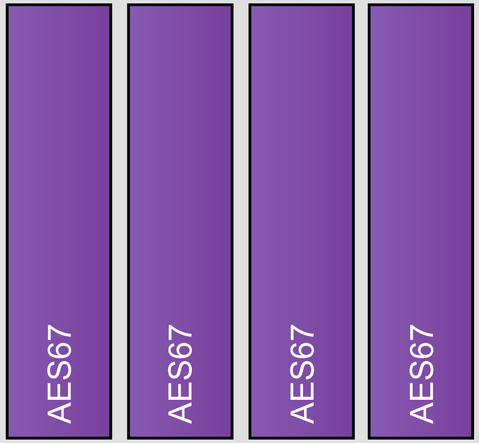

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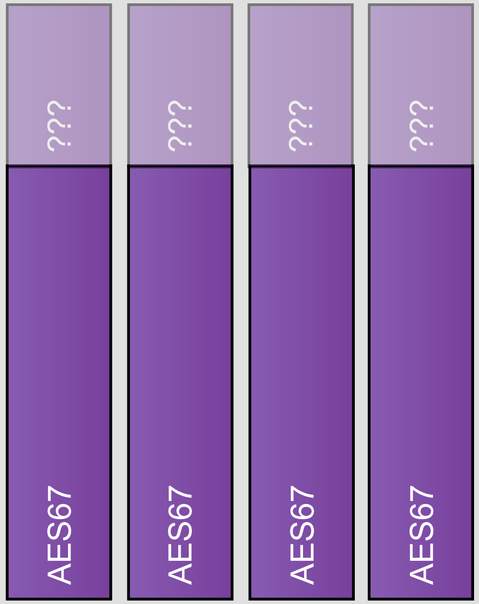
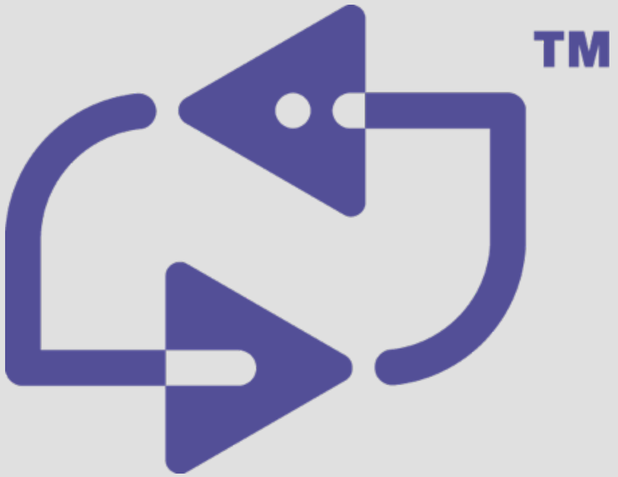


A word on AVB

- AVB stands for Audio Video Bridging
- IEEE standard transport protocol for audio and video data over ethernet

- AVnu Alliance promotes interoperability between devices designed & manufactured by members.
- AVnu is the official organ that will certify AVB devices
- AVB focusses on:
  - Automotive industry
  - Consumer industry
  - Pro AV industry



Audionetwerken en protocollen, de huidige stand van zaken en wat kunnen we in de toekomst verwachten

Ing. Ruben van der Goor
Senior Application Engineer Digital Systems
Yamaha Music Europe, Commercial Audio