HDBaseT vs. IP

Bob Ferguson, RCDD, CTS-I
Belden
Regional Sales Engineer
Broadcast and Audio Video Group

2018 BICSI WINTER
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System Support All Three

HDBaseT 5Play™

Video and Audio | USB 2.0 | Control Signals | 100BaseT Ethernet | Power 100W

*5Play is a trademark of HDBaseT Alliance

SDVoE

- Video
- Audio
- USB
- Control
- Ethernet
- PoE

Need for speed – pushing the edge

WHY HIGH END VIDEO

Bandwidth Demand

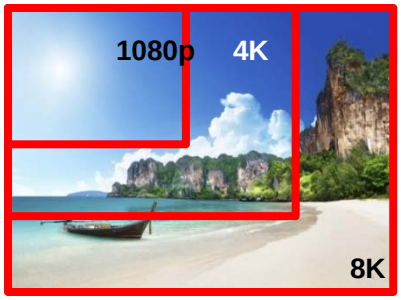
- Video makes up biggest user of bandwidth.
  - **82 percent** of all consumer Internet traffic by 2021

- Video Bandwidth 4 factors
  - Pixels
  - Frame Rate
  - Color Sampling
  - Color Depth

Pixels and Frame Rate

How many pixels?

- 1080P = 2,073,600 pixels
  - 1080 x 1920
- 4K UHD = 8,294,400 pixels
  - 2160 x 3840
- 8K UHDTV2 = 33,177,600 pixels
  - 4320 x 7680

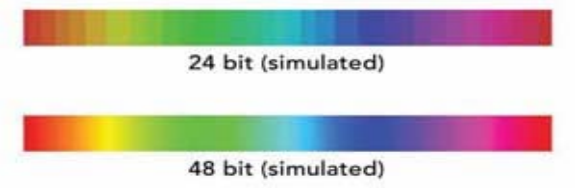


How many frames per second?

- 30 – legacy
- 60 - Standard
- 120 – Cutting edge

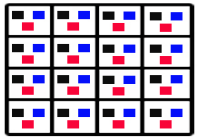
Basics of Pixel

- Each pixel 3 colors of light
  - Red / Green / Blue
- Color depth
  - Each can represent 8-16 bits
    - 8bits = 16 million choices
    - 16bits = 281 trillion



- High Dynamic Range (HDR)

- Color sub sampling
  - 4:4:4 Each pixel has it own
  - 4:2:0 Pixel share colors
    (1/2 data required)



4:4:4
Full bandwidth

4:2:0
½ bandwidth

Matrix of Data Bandwidth

Image	Pixels	Frame	Color	Sampling	Bandwidth
1080P HD	2,073,600	30	8 Bits	4:4:4	1.87 Gbps
4K UHD	8,294,400	30	8 Bits	4:4:4	7.47 Gbps
4K UHD	8,294,400	60	8 Bits	4:2:0	7.47 Gbps
4K UHD	8,294,400	60	10 Bits	4:4:4	17.92 Gbps
8K UHDTV2	33,177,600	60	10 Bits	4:4:4	71.67 Gbps

FH x FW x FR x (CD+2) x 3 x CS

Add in more bandwidth for frame timing, audio, control

In the end it's all data and lots of it!

THE PLAN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Organization which adds in the interpretation and creating standard for infrastructure for data.

Credentialing Program

- Registered Communications Distribution Designer (RCDD®)
- Registered Telecommunications Project Manager (RTPM)
- Cabling Installer Programs

Standard

- Bonding And Grounding
- Education Facilities
- Healthcare
- Intelligent buildings

Standards vs Alliances

Standards

- Free to use
- Everyone chance for input
- Slow to change
- Resist change
- Good Interoperability

Alliance

- Pay to play or some incentive
- Limited participation
- Quick to change
- Limited Interoperability
- Cutting edge performance
- Tied to one technology

SDVoE™ ALLIANCE

The SDVoE Alliance is a nonprofit consortium allowing software to define AV applications over Ethernet infrastructure.

- Founding Members
  - Aquantia
  - Christie
  - Netgear
  - Sony
  - ZeeVee
  - SemeTech (Chipset Mfg.) Acquired Aptovision
- Belden is adopter member

Technology Convergence

- The combination of technology on a single network (Ethernet)
- Lots of choose for IP convergence systems
  - Compatibility issue
  - Limitations on system
- SDVoE
  - Uncompressed 4K Video
  - 10 Gigabit
  - Compatibility goal with partners

The HDBaseT Alliance is a not-for-profit organization tasked with promoting and advancing HDBaseT technology as the global standard for ultra-high-definition, digital connectivity.

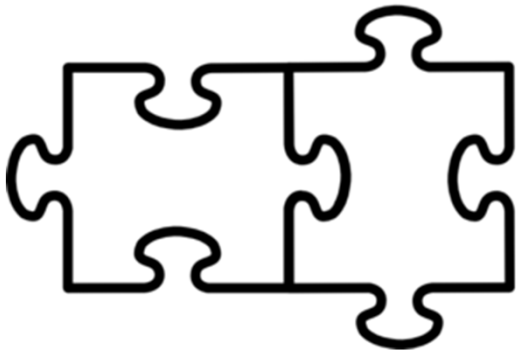
- Board Members
  - GM
  - LG
  - Samsung
  - Sony
  - Valens (Chipset MFG.)
  - 190 Members
  - HDBaseT 2.0 specification
- Belden is adopting member

Infrastructure Convergence

- HDBaseT is based on category cabling
- Category UTP not enough for:
  - Higher bandwidth signals 4K and above
  - 330 feet distances
  - bundled cabling
- 1080P signal
  - Minimum Category 6A or Shielded F/UTP
- 4K and above
  - Specialty cables
  - Class F / Category 7A*

What HDBaseT IP Does

- Combines :
  - 10Gigabit Ethernet
  - HDBaseT signal
- Then signals is package together at 4 through 6 layers of OSI model



Getting the stream

TO FIT INTO THE PIPE

Video Quality Formula

Quality = Bandwidth / Latency

What level quality you get is dependent on bandwidth (speed) and Latency (time) of the video data.

Bandwidth

- 1Gigabit – Minimum
- 10 Gigabit – 4K Better
- 40 /100 Gigabit – Future

Latency

- Buffering
  - 4k Movie – 100 Gigabits
  - 10 Mbps – 24 hours

How to Address Bandwidth Issue

- Compression
  - There are lot of ways to compress video
  - Color Compression 4:2:0
  - Grouping areas data
  - Forward / Backward looking packets
- Error correction
  - Also takes time

- Compressing takes time
- Compression can leave artifacts or errors

Compression Chart

Compression	Picture	Latency	Bandwidth
Uncompressed	Exceptional	Extreme low	Very high
1.5 – 3 to 1	Very good	Low	High
5 – 8 to 1	Good	Light	Good
20 to 1 *	Acceptable	Medium	Fair
100 to 1	Fair	High	Marginal

- Static pictures show more errors – than moving pictures
- HDMI Standard for Picture quality – 1 / Billion
- *4K – compression required for existing networks

CABLING FOR AV

Cabling Choices

Ethernet – IP

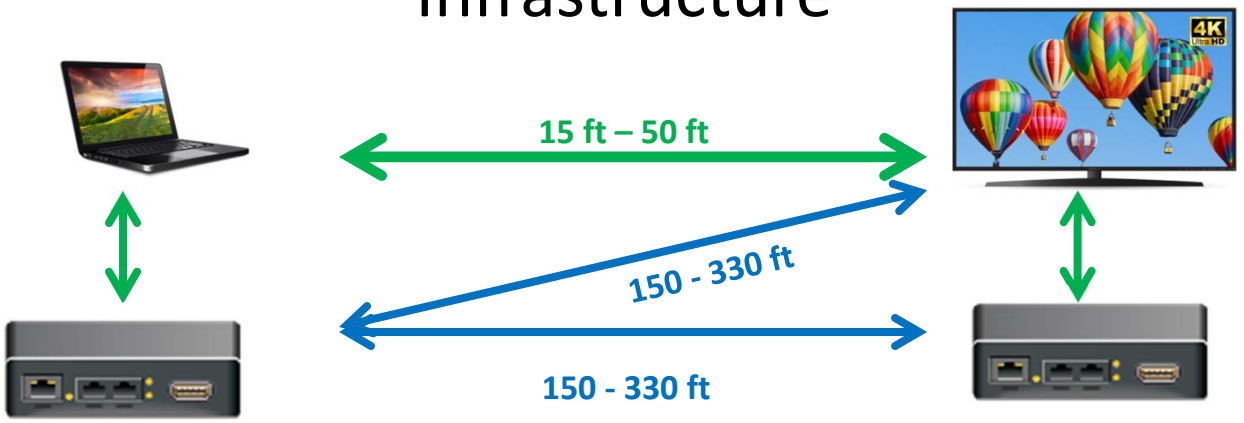
- Assemblies
  (HDMI, DisplayPort, Etc...)
- Traditional Network UTP
  - Category 5e
  - Category 6
- Category 6A
  - 4K Video -
  - SDVoE and HDBaseT

HDBaseT

- Assemblies
  (HDMI, DisplayPort, Etc..)
- 1080P signal
  - F/UTP Category Cables
  - UTP Category 6A
- 4K Signal
  - Special cables
  - Class F / Category 7A

Fiber cables are option for both for increase bandwidth and increase distance.

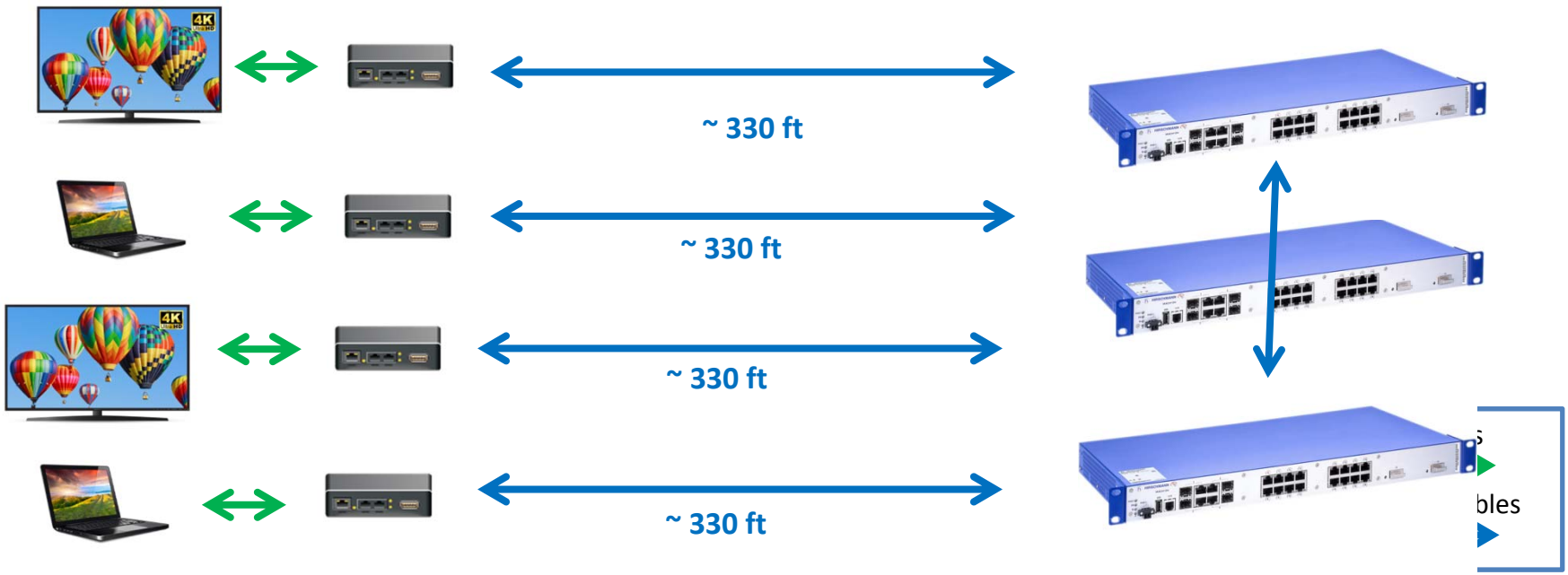
Infrastructure



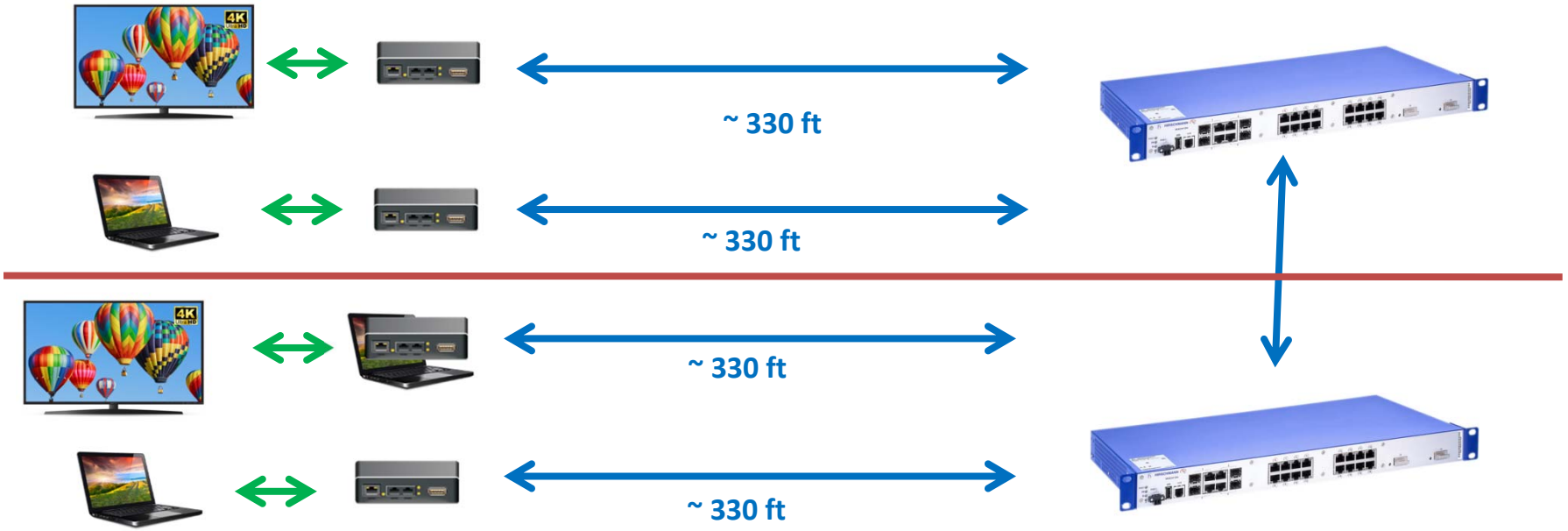
Signal	Copper Cable	Distance
SDVoE	Category 6A UTP	330 ft
HDBaseT	Specialty / Class F	330 ft *
HDBaseT – IP	Category 6A UTP	330 ft

Assemblies
Copper Cables

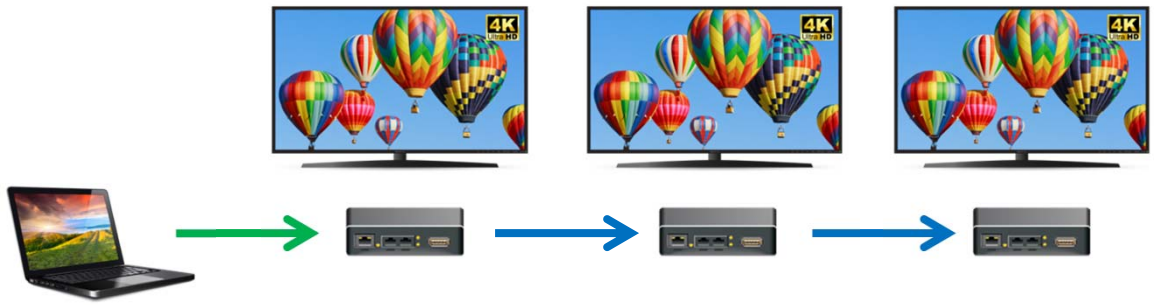
Infrastructure



Infrastructure



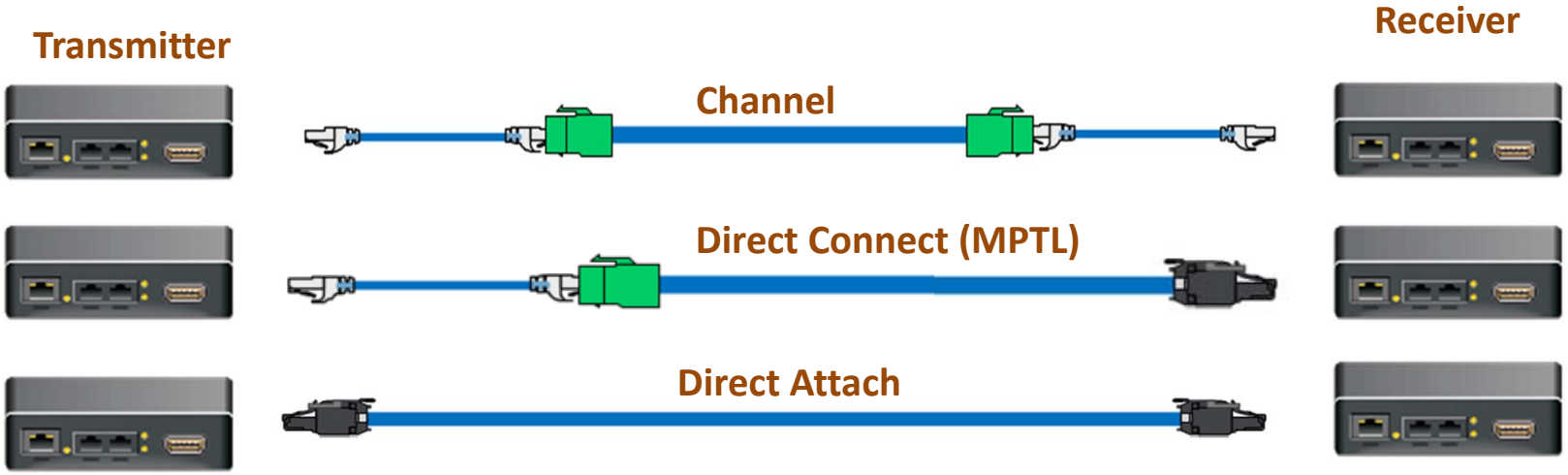
Daisy Chaining



Types of Connectors

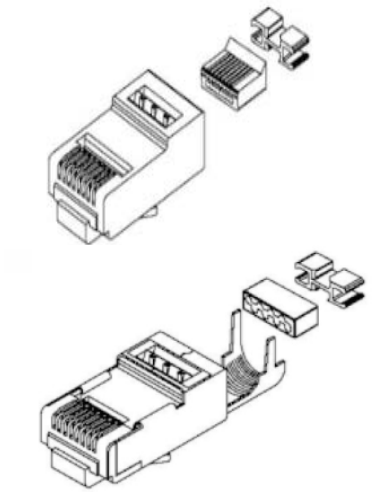
MAKING THE CONNECTIONS

Direct Attach vs Channel vs Direct Connect



RJ45 Plug Issues

- "Ice Cube" Style
  - Cheapest item in network cause most issues
  - Time to terminate
  - Error in termination
  - Sized for specific cable
  - Poor performance field term
  - Cheap tools - issues



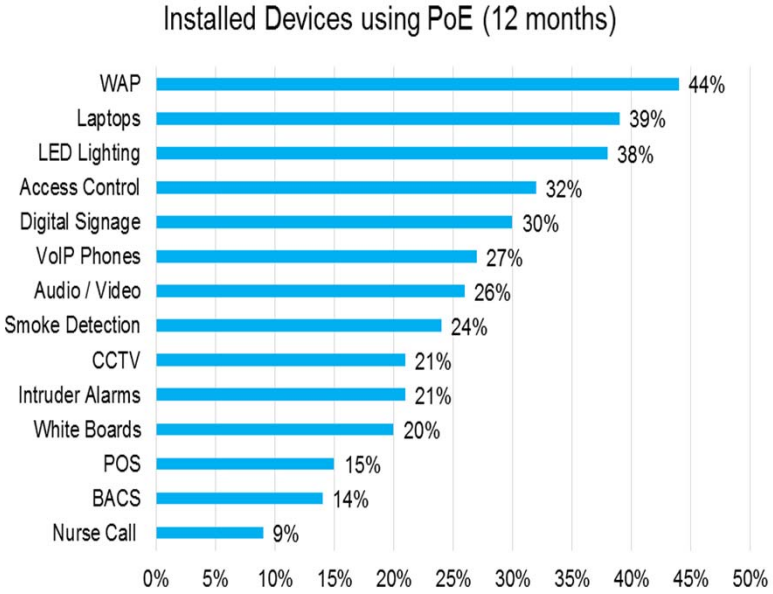
Field RJ45 Plugs Types

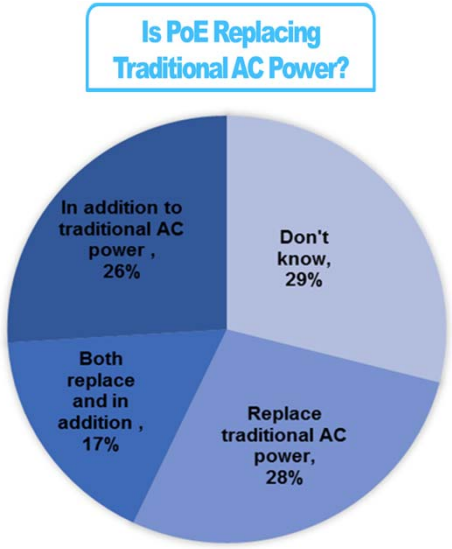
Printed Circuit Board

- Reliable performance
- Easy to terminate
- Error free
- Standard tools
- Larger size

POWER IS THE NEW SIGNAL

PoE / POH Adoption





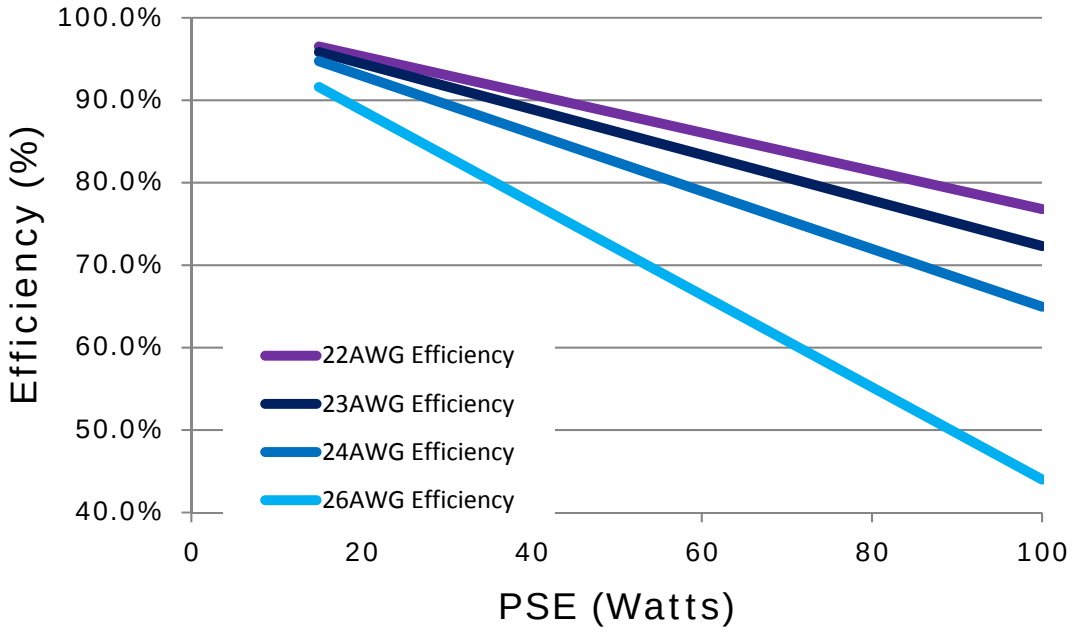
Audio/Video is 26%: Component of this is PoH

PoE and POH Applications

Capability	POE / POH Type 1	POE/ POH Type 2	POE # 3 * POH Twin #2	PoH Twin #3	PoE Type 4*
PSE Minimum voltage	44V	50V	50V	50V	52V
PSE Minimum Out	15.4W	30W	60W	95W	90-99W
PD Maximum input Power	13 W	25.5W	51W	71.25W-95W **	68.3W-99W**
Low Minimum Power Signature	No	No	Yes (PoE) No (PoH	No	Yes
Support PSE classes ***	Class 0-3	Class 0-4	Class 0-6 (PoE) 0-4 (PoH)	Class 0-4	Class 7-8

*PoE type 3 & 4 as defined in 802.3bt draft. ** Extended capability depends on cable quality, cable length, PSE output voltage and the ability to support Auto Class *** PoE PSE base Classes : 1 = 4W, 2 = 7W, 3 = 15.4W, 4 = 30W, 5 = 45W, 6 = 60W, 7 =75W, 8 = 90W. Task force is considering the removal of class 7

Wire Gauge and Efficiency



↑ Wire Diameter
↓ DCR

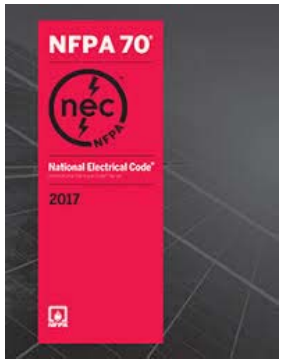
CAT 5e - 24awg
CAT 6 – 23awg
CAT 6A – 23awg

Shield F/UTP can help with heat

New Safety Codes

- Cable over 60 watts
  1) bundling
     OR
  2) have LP rating printed on cable

- Test done by UL Certification labs
- Not a performance measurement



HDBT™

- UL 4299 Specification: PoH
- Supports 100W power
- Performance with signal
- Part new certification program

UL VERIFIED
PoH™ Power over HDBaseT
ALSO VERIFIED BY UL FOR 100 W POWER over HDBaseT

Testing

Ethernet Work

- Cable Analyzer
  - Test TIA standards
  - by Category Level
- Signal Tester
  - 1G – 10G signal

HDBaseT

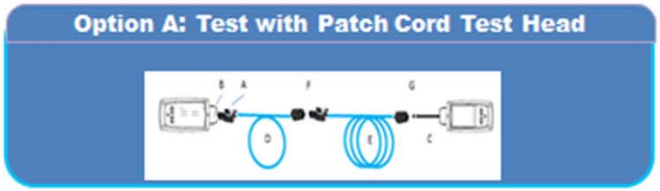
- Specialty Tester
  - Test signal
- Cable Analyzer
  - Category test not enough
  - Special parameter can be loaded

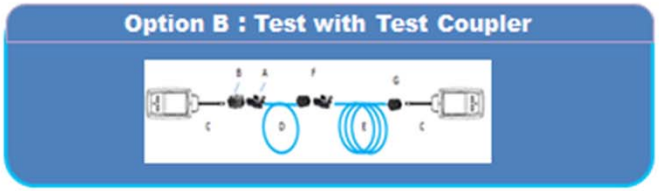
Using a Cable Analyzer to Testing to new wire layouts

Direct Attach **Direct Connect** **Channel**

Direct Connect Assemblies

- Modular Plug Terminated Link (aka Direct Connect)
- Will meet PL tests
- Normative Annex
- Standard expected in 2018,
  - (TIA 568.2-D)





SVDoE + / -

Advantages

- Support all AV signals
  - 4K video
  - Audio
  - Control
- IEEE standard based infrastructure
- Good at large networks
- Off the shelf switches / routers
- Low Latency across multiple hops
- Compatibility

Disadvantage

- New Technology
- Shares network with other traffic
- 6a cabling upgrade bandwidth
- Switches to support 10G
- Pricing within room
- Compatibility

HDBaseT + /-

Advantages

- Support
  - 4K Video
  - Audio
  - Control
- Large installed base
- Low Latency
- Design small and mid size deployments
- Certified products program
- Compatibility

Disadvantages

- Not optimal for Category UTP infrastructure for high end requirements
- Requires separate infrastructure
- HDBaseT Switches
- Expensive for large deployments
- Compatibility

HDBaseT over IP +/-

Advantages

- Support
  - 4K video
  - Audio
  - Control
- Blends HDBaseT with IP infrastructure
- IEEE standard based infrastructure
- Good at large networks
- Off the shelf switches / routers
- Compatibility

Disadvantages

- Shares network with other traffic
- 6A cabling upgrade bandwidth
- New technology
- Latency
- Compatibility

Conclusions

- Lots of options we only looked at three of them
- What kind of video and quality do need
  - 4K video
  - How much latency is expectable
- Who is going to manage your AV System
  - IT Staff
  - AV Staff
- Distances from source to displays
- Size of installation
  - Within a signal room
  - Within a building
  - Within a campus / more
- Universal compatibility