Curing Common
AV Headaches

Providing systems that will get used and make everyone happy

BUDGET CONSCIOUS | EASY TO USE | FUTURE PROOF | NEXT GENERATION | PROTECT YOUR REPUTATION

Common AV Headaches

	Headache	Prescription
	Accommodating odd room sizes	Adding displays and speaker placement
	New AV technologies not supported by old AV cabling	HDBaseT extension on Category cable
	Hard to share content/collaborate	Auto and manual input switchers
	Video looks great, audio sounds terrible	Audio extraction, amps and speakers
	Grounding and bonding of shielded cable	UTP cable with crosstalk prevention tech

Accommodating Odd Room Sizes

Adding displays

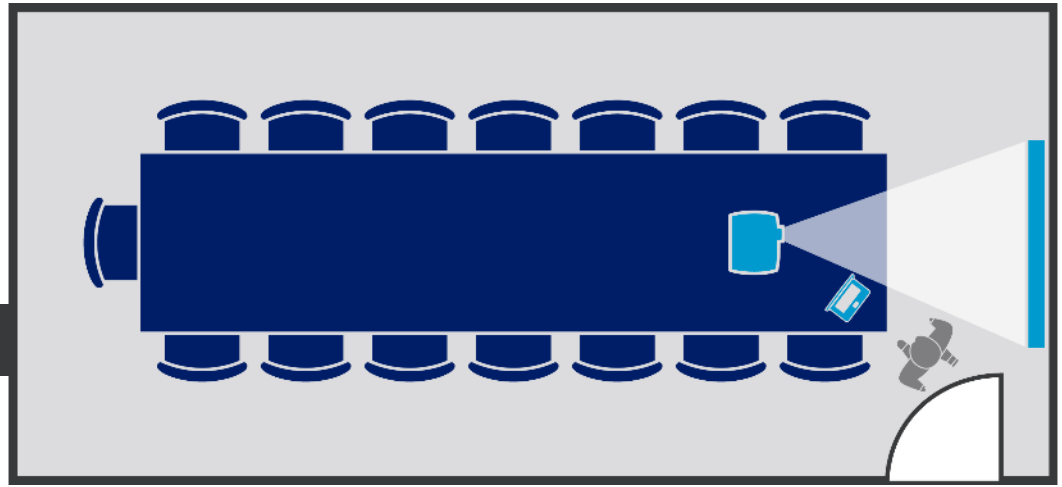
Display or projector placement and size

Accommodating Odd Room Sizes

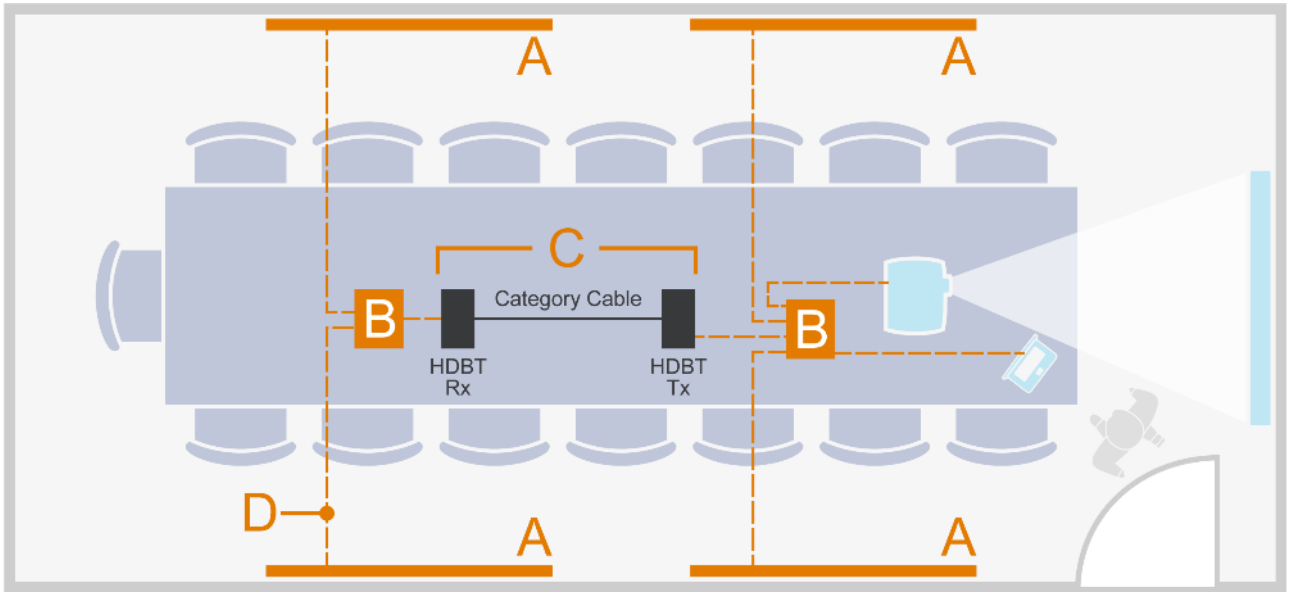
- Every room presents a different challenge
- The audio element is just as important as the video element
- Consider the viewer experience but also consider the presenter
- Maintain the focal point and purpose

Accommodating Odd Room Sizes

The Bowling Alley



Fixing the Bowling Alley



Flat screen displays
(Qty 2 or 4)

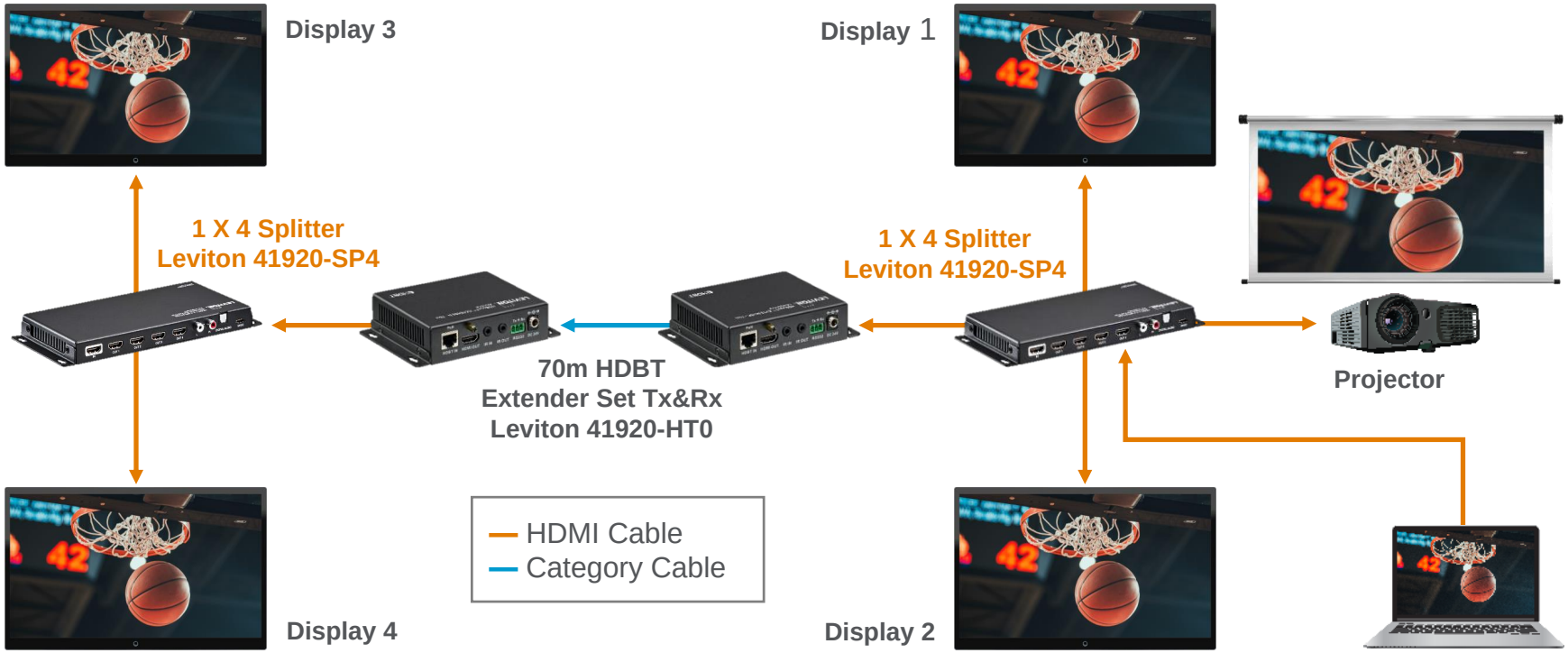
HDMI splitters
(Qty 1 or 2)

HDBaseT Extension
(Qty 1 or 2)

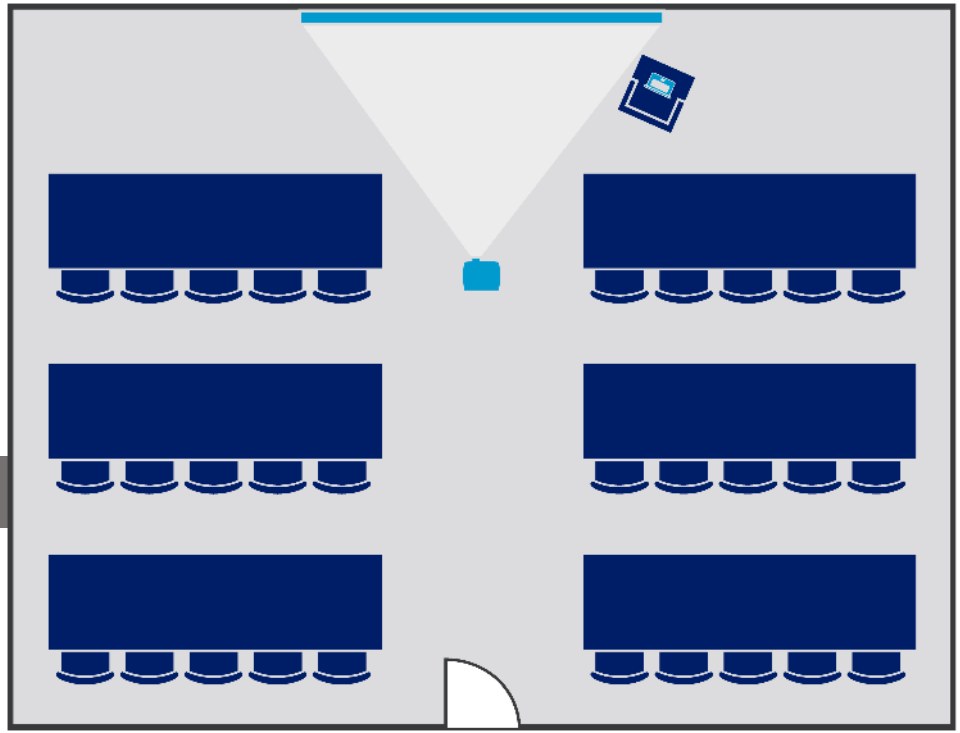
HDMI cables
(Qty 5 or 6)

Maintain the focus at the presenter | Provide detail for every participant

Fixing the Bowling Alley

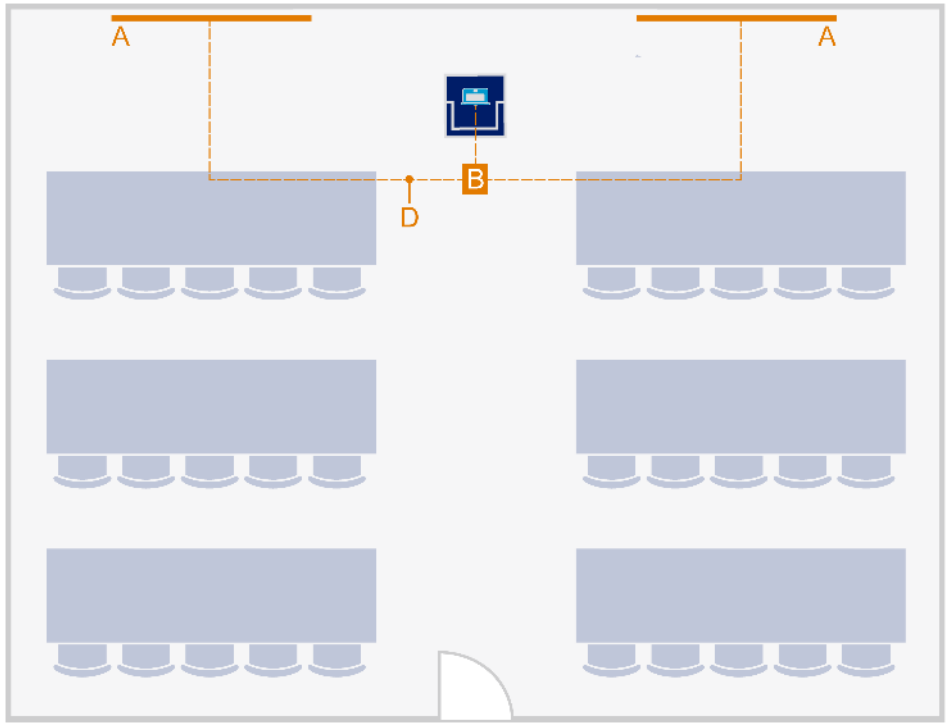


Accommodating Odd Room Sizes



The Training Room

Fixing the Training Room



A. Flat screen displays (Qty 2)

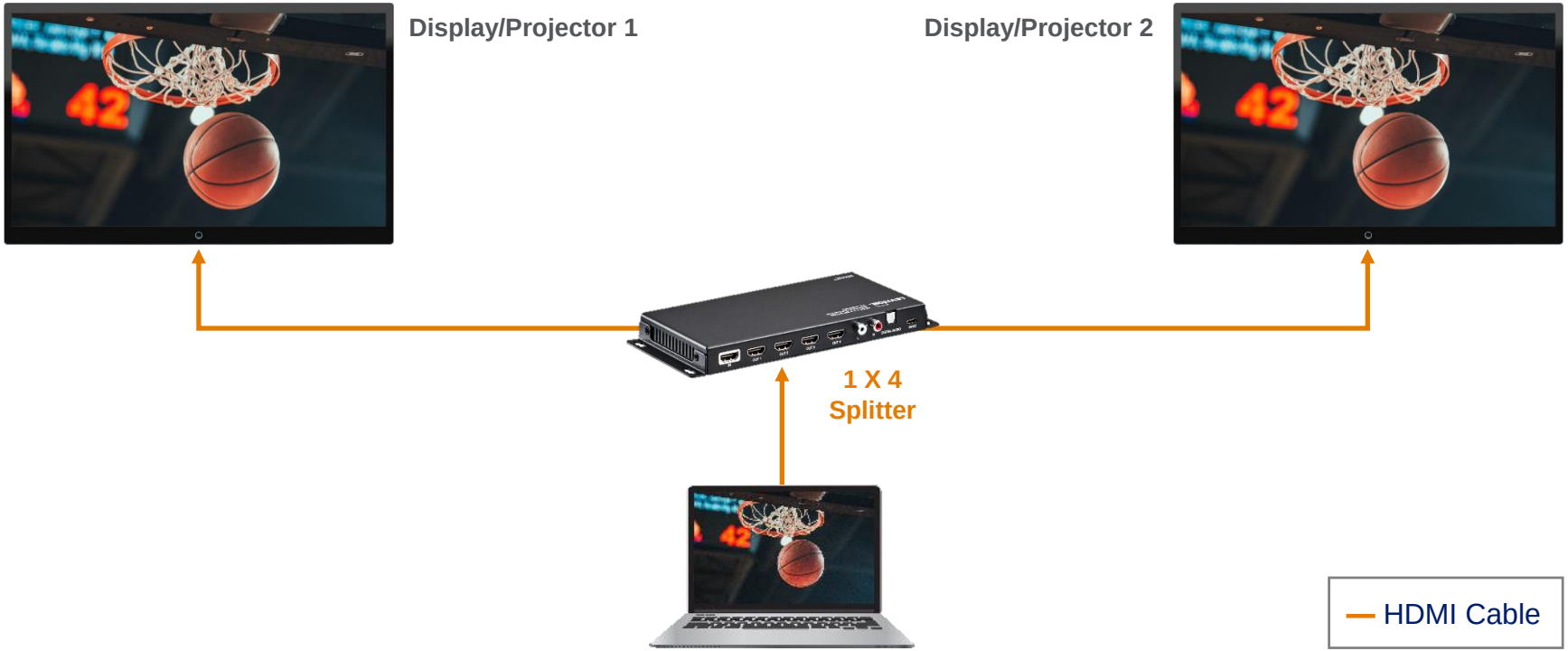
B. HDMI splitter (Qty 1)

C. HDMI cables (Qty 2 or 3)

Clear the view for all participants and provide sharp detail

Maintain focus on the presenter

Fixing the Training Room



Choosing the Correct Screen Size

Where will the viewers sit?

- Maximum viewing distance
- Maximum viewing angle
  - Make sure the viewing angle of the viewer falls within the viewing angle of the display or projection screen

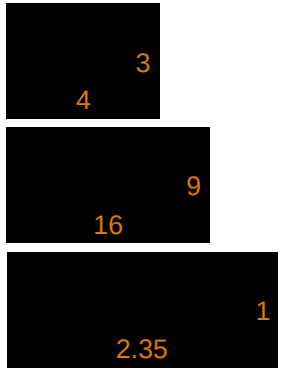
What will the viewers do?

- **Critical** – detailed engineering drawings or spreadsheets
- **Reading** – presentation slides
- **General** – training videos or movies

Screen Size and Aspect Ratio

- 4/6/8 Rule of Thumb
  - **Critical** : Min. Screen Height x **4** = Max. Viewing Distance
  - **Reading** : Min. Screen Height x **6** = Max. Viewing Distance
  - **General** : Min. Screen Height x **8** = Max. Viewing Distance

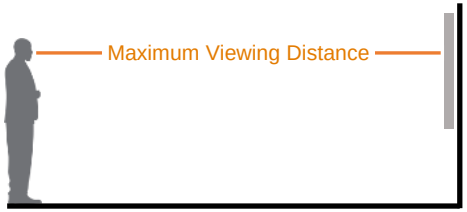
- Aspect Ratio (AR) is the ratio of width (W) to height (H)
  - **NTSC**: 4 / 3 = **1.33**
  - **HDTV**: 16 / 9 = **1.78**
  - **Cinemascope**: 2.35 / 1 = **2.35**



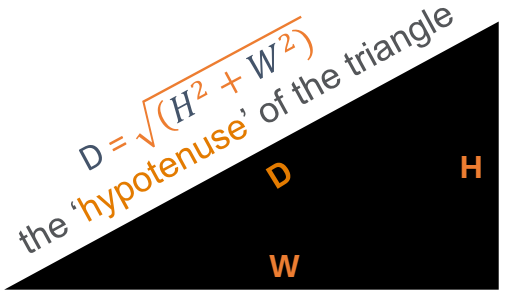
Find the missing screen size!

1. Solve for Screen Height
2. Calculate Width
3. Determine Diagonal Size

Solving for Display or Screen Size

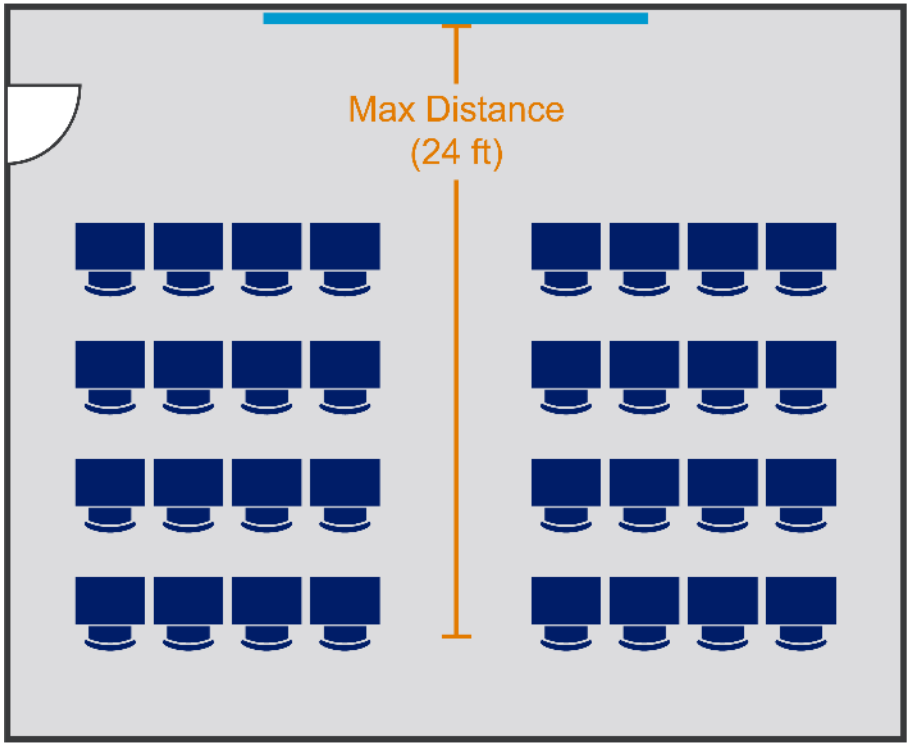


1. We start with max distance — **20’ = 240”**
2. Solve for required height using the 4/6/8 Rule of Thumb (H x (4, 6, or 8) = Max Distance)
   - *H* = Max Distance / (4, 6, or 8) — **240” ÷ 6 = 40”**
3. Solve for the width using the aspect ratio (W / H = AR), in most cases HDTV (16 / 9 = 1.78)
   - *W* = *H* x *AR* — **40” x 1.78 = 71.2”**
4. Use Pythagorean Theorem ($H^2 + W^2 = D^2$) to solve for the diagonal size (D)
   - $D = \sqrt{(H^2 + W^2)}$ — $\sqrt{(71.2)^2 + (40)^2} \approx 82”$



Classroom Example

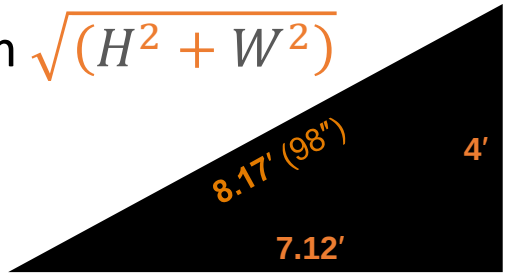
- Students in the back row are 24 feet from the screen
- They will be looking at slide presentations
- The client plans on an HDTV format display



Classroom Example

1. Use 6x Rule of Thumb for **Reading** to get recommended screen height (Max Distance / 6 = H)
   a) Find the Height 24′ / 6 = 4′ H
   b) Find the Width for HDTV 4′ H x 1.78 AR = 7.12′ W

2. Find the diagonal using the Pythagorean Theorem $\sqrt{(H^2 + W^2)}$
   a) $\sqrt{(4^2 + 7.12^2)} = \sqrt{(16 + 50.7)} = \sqrt{(66.7)}$ = 8.17′
   b) Convert feet to inches by multiplying by 12
      8.17′ x 12 = 98 inches

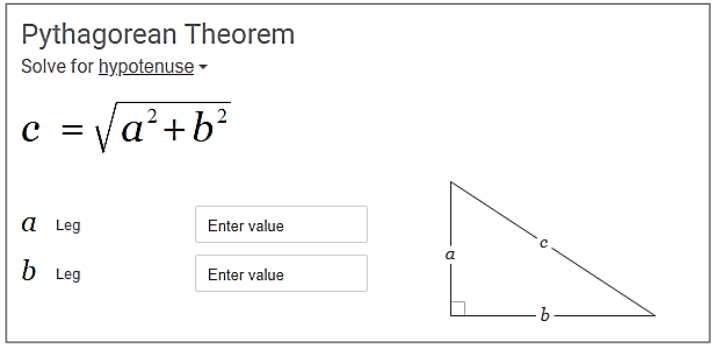


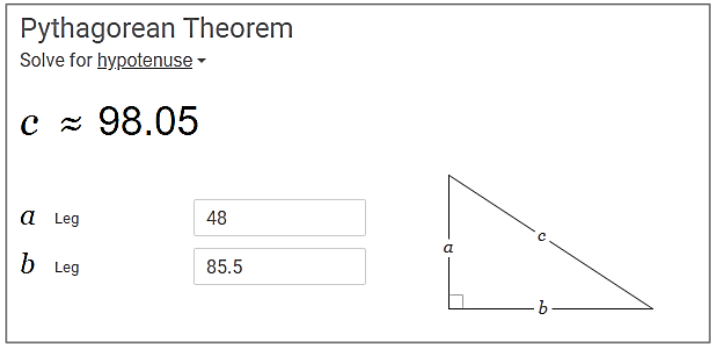
We need a display or projector screen of at least 98″ diagonal

Thank Goodness for the Internet

1. Max Viewing Distance = 24′
2. Min Screen Height
   - 24′ / 6 = 4′ (48″)
3. Aspect Ratio = 1.78
4. Screen Width
   - 4′ x 1.78 = 7.12′ (85.5″)
5. Internet Search
   “Pythagorean Theorem calculator”

Min display size 98” diagonal





New AV Technologies Not Supported by Old AV Cabling

Moving on from VGA

Passive HDMI cables are not enough

HDMI extension – plug and play

Video Extension Options

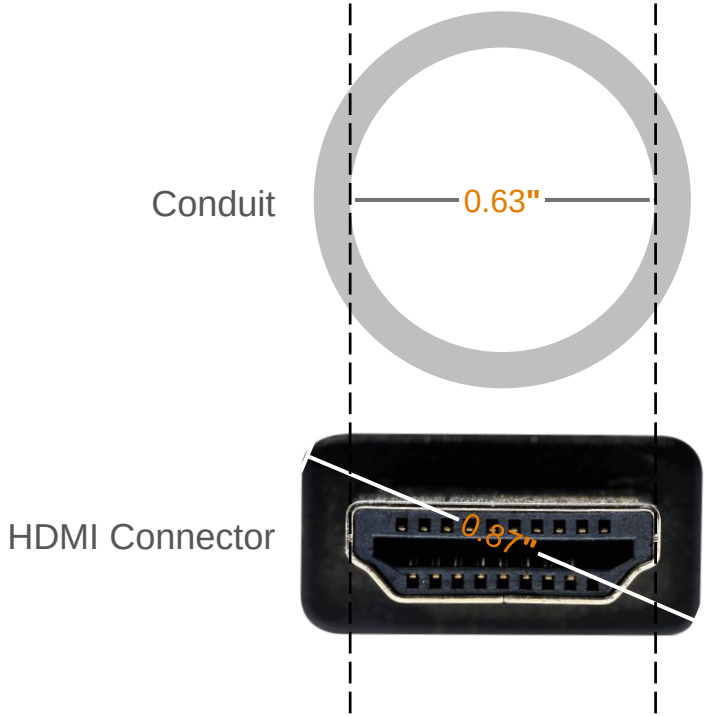
- Why are HDMI Cords not enough?
  - Distance
  - Retrofit
- What solutions are available that require an AV staff to support?
  - Traditional distribution amplifiers and matrix switches
- What solutions are available that the IT team can support?
  - Video over Ethernet/IP
  - Wi-Fi
- What if there is no AV or IT staff to support?
  - Dependable plug-and-play solutions

Moving from a VGA to HDMI Projector

- 1/2” conduit in the wall
- VGA cable (field terminated)

- But, the HDMI cable connector is huge
- At least 7/8” diagonal

- Oh oh!



HDBaseT – More than Just Video and Audio

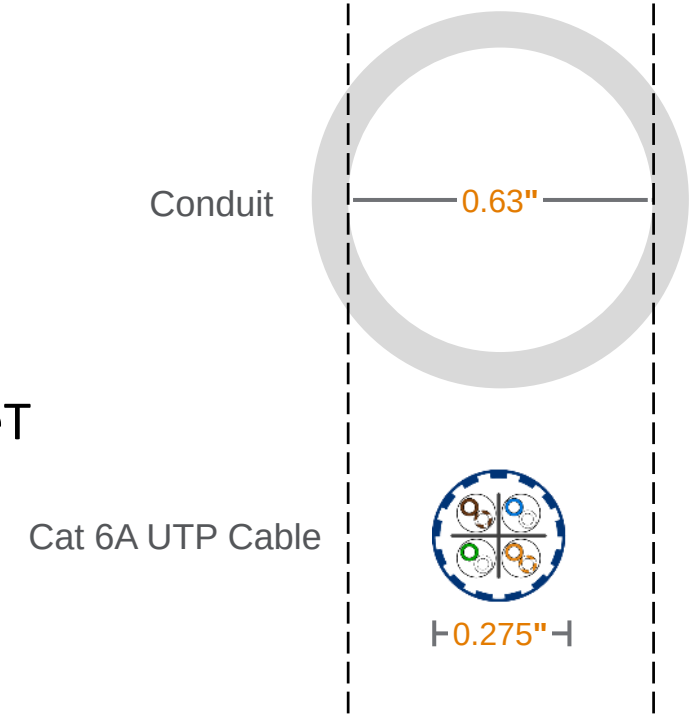
1. Full digital audio
2. HDMI uncompressed video
3. 100Mb Ethernet channel
4. Power over HDBaseT (PoH)
5. Control via RS-232 and IR

Simultaneous transmission of **All 5** on a **single** category cable

HDBT™ 5Play™

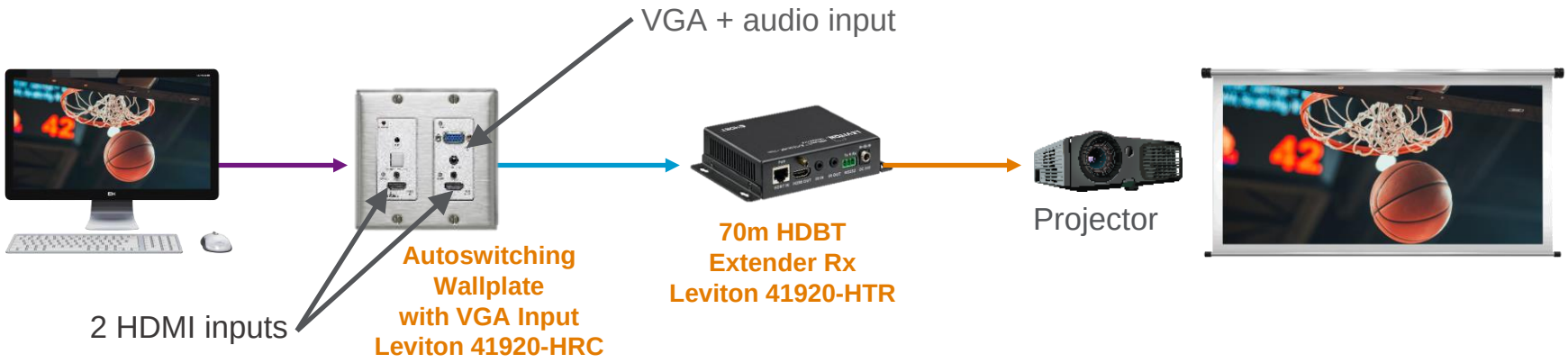
Moving from VGA to HDMI Projector

- 1/2” conduit in the wall
- Not a problem for Cat 6A cable
- But remember the properties of HDBaseT
  - Like 10GBaseT
  - Alien crosstalk



Moving from VGA to HDMI Projector

Moving from VGA to HDMI Projector



If you still have VGA devices — no problem — use an HDBaseT transmitter with built-in VGA to HDMI scaler

- HDMI Cable
- Category Cable
- VGA + Audio Cable

The Distance Headache – HDMI Cables

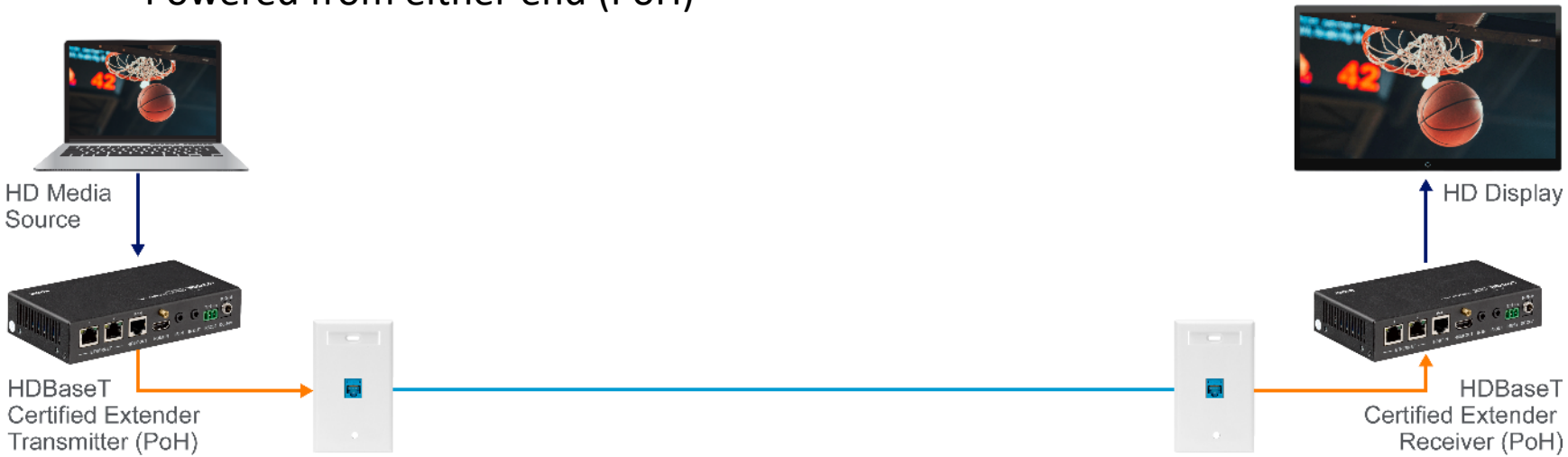
- When the source is right next to display? All is good!

- When the source is remote from the display? Not so good!

Max recommended HDMI cable length for dependable performance is 15′ (5m) at 1080p

The Distance Headache — Cured!

- 100m HDBaseT Extender Solution – Leviton 41920-HTE
  - Single Cat 6A UTP cable
  - Powered from either end (PoH)



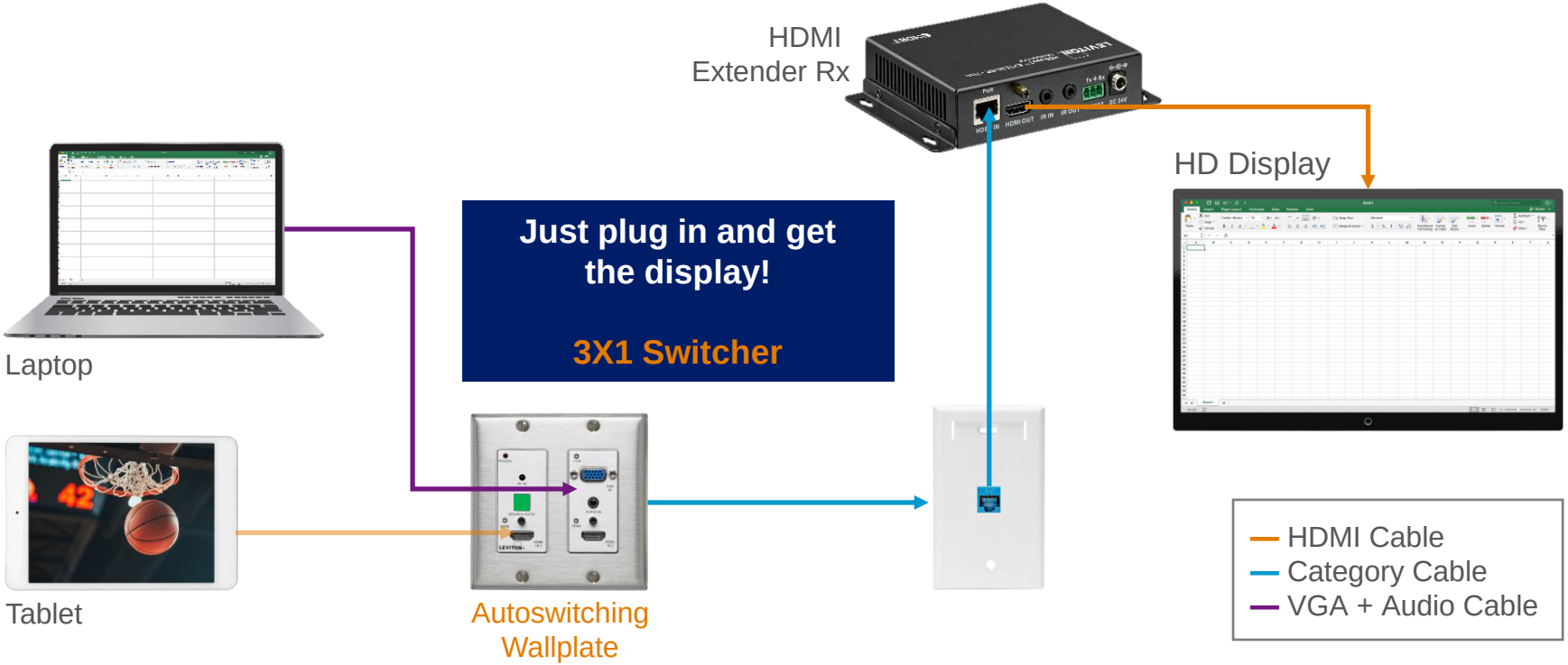
Hard to Share Content / Collaborate

Multiple input switching

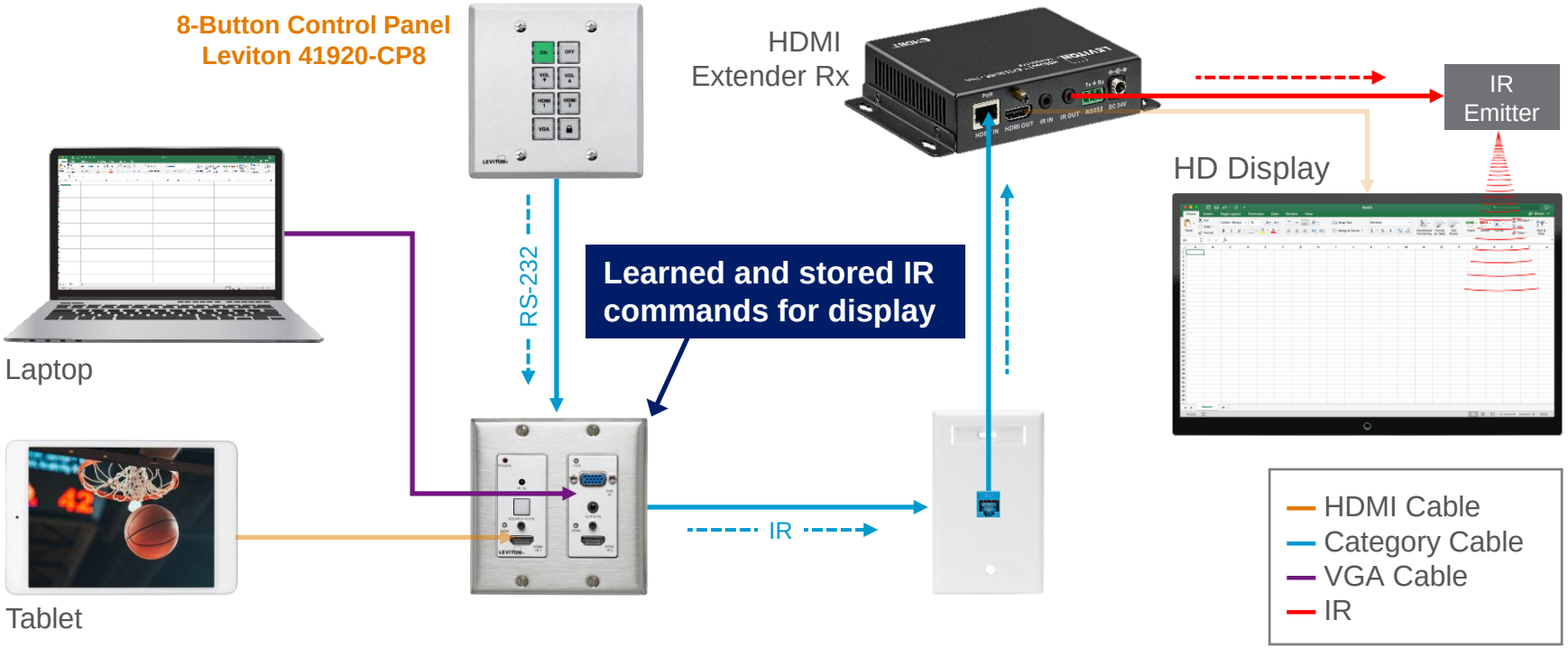
Collaboration and Huddle Spaces

- Popularity of impromptu meeting spaces and remote collaboration
- Attempting to share wirelessly or connecting directly to the display
- Security concerns for both the network and guest devices

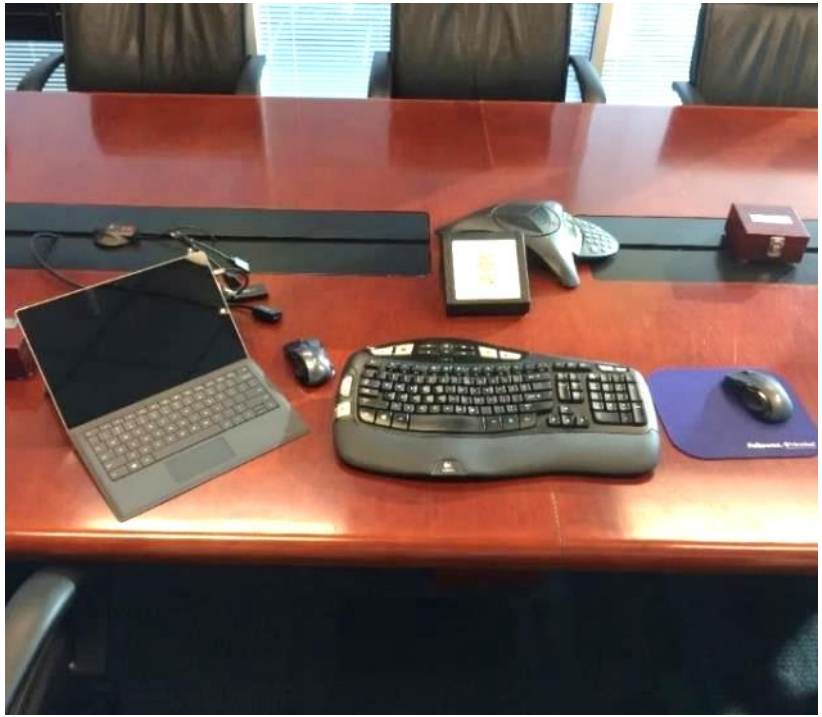
Automatic Sharing (Switching)



Controlled Sharing (Switching)



Controlled Sharing (Switching)



Display Sharing - 4 Input Sources

Video Looks Great! (*Audio Sounds Terrible*)

Eliminating lip sync

Audio extraction

More speaker and amp options

Multiple levels of volume control

Speaker Layout

Eliminating the Lip Sync Headache

- Lip Sync: technical term for matching a speaking or singing person's lip movement to the audio heard by the listener
- Can be video or audio delay – usually video delay due to signal processing at the display or projector

- Simplest and least expensive cure: Utilize the audio output from the video display device

Eliminating the Lip Sync Headache

Eliminating the Lip Sync Headache

Audio Amplifier

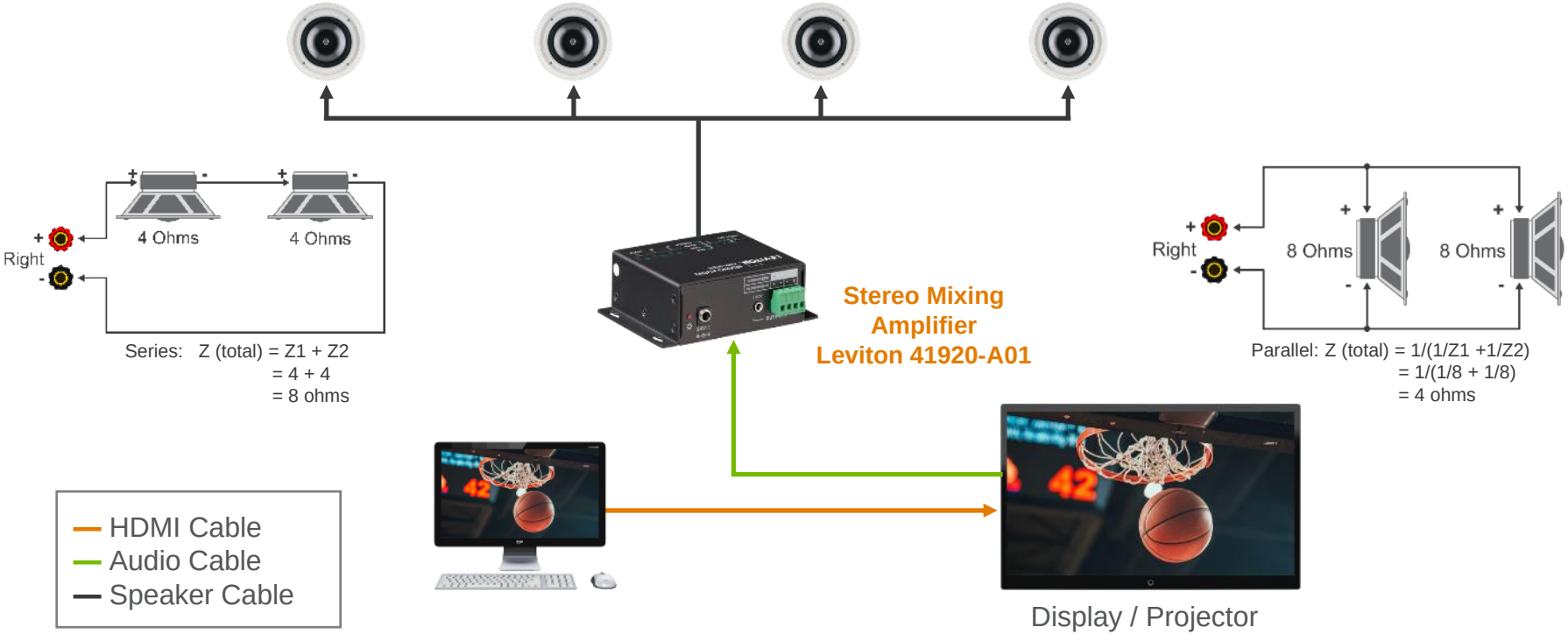
When you don't have a convenient audio output — insert an HDMI audio extractor!

HDMI Cable
Audio Cable
Speaker Cable

HDMI Audio Extractor Leviton 41920-HAE

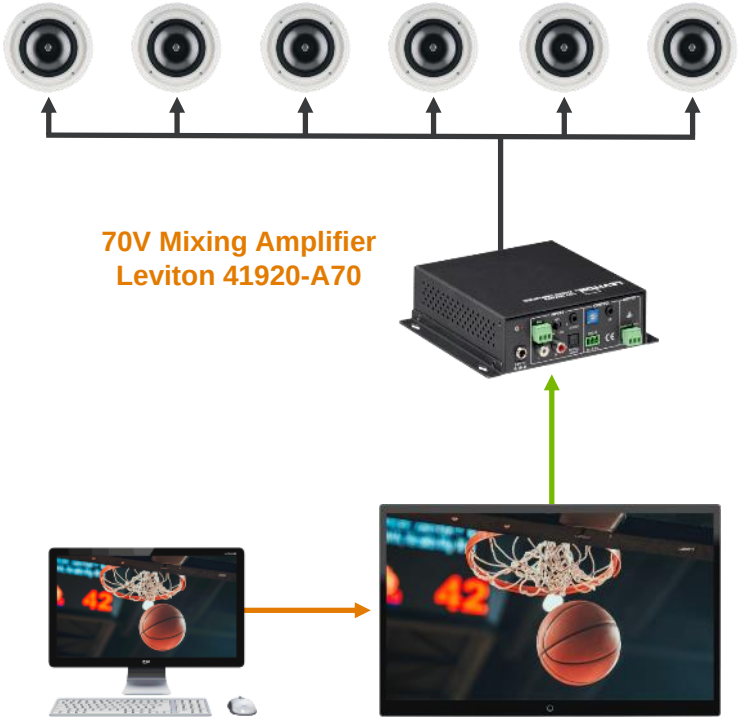
Display / Projector

Adding More Speakers



Even MORE Speakers!

- 70V amplifier supports many speakers up to 40 watts
- Mono output
- Simple daisy chain with 16/2 wire
- Select appropriate transformer tap to adjust level for various areas



Headache: Microphones

- Leviton audio amplifiers are mixing amplifiers
- Multiple inputs including mic
- Each input controllable for level and tone
- Mic input supports:
  - Dynamic mic
  - 48V phantom power for a condenser mic
  - Line level input
- Ducking function on 70v

Multiple Volume Controls

- Best to have 1 volume control
- But many sources have their own volume control
- Add a display or projector and amplifier – yet another headache!

Layered Volume Control

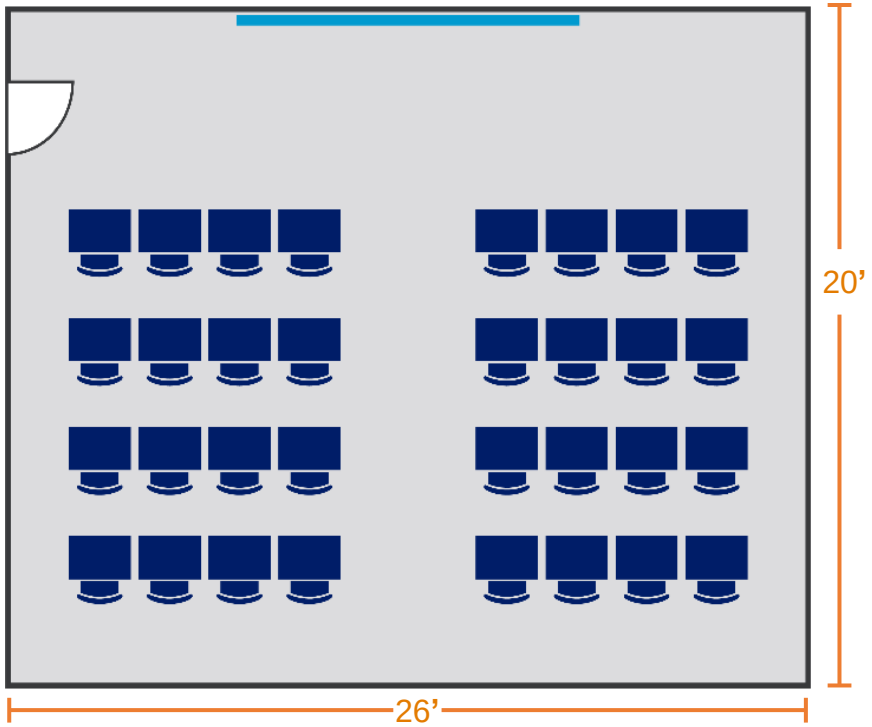
- If possible, take the remote out of the equation by using display settings to set a constant audio output level (line out)

- Set source to mid level
- Set amplifier to lowest setting and set display output level to maximum without distortion
- Adjust amplifier for appropriate listening level and if needed adjust display output level again for no distortion

Speaker Layout Example

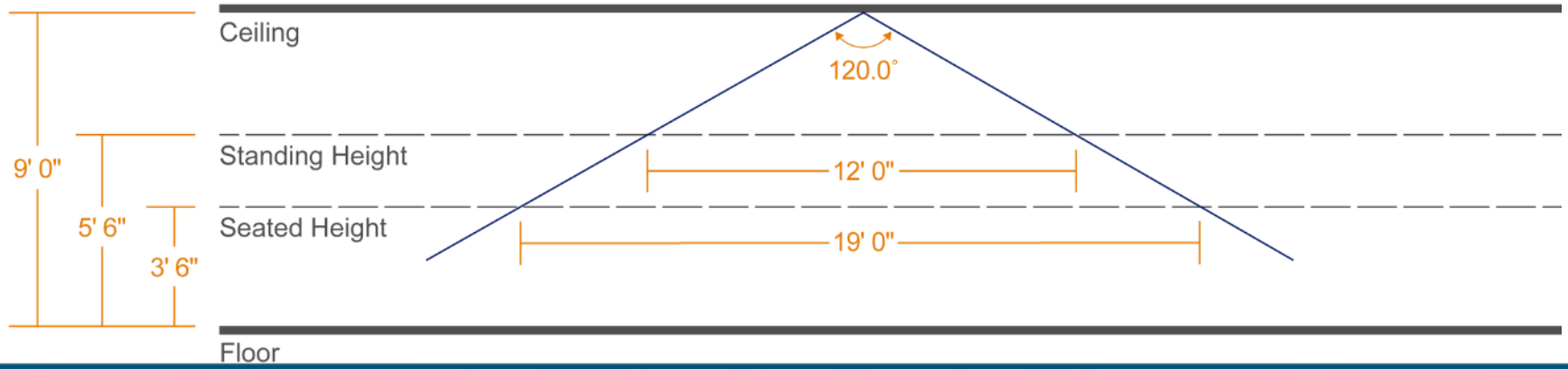
- 26’ x 20’ Classroom size
- Students will be seated, but will sometimes move around in a technical lab atmosphere

- How many in-ceiling speakers do we need?
- What is the distance between in-ceiling speakers?

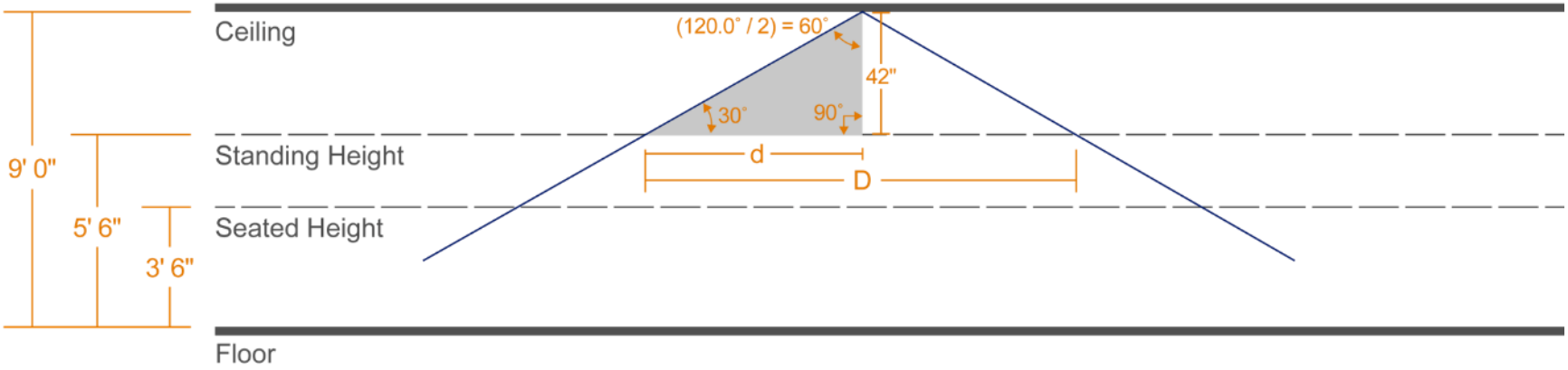


Speaker Layout

- Sitting or standing?
  - Sitting – 3’6” standard height
  - Standing – 5’6” standard height
- Identify speaker dispersion angle
  - Determine diameter of the conic section that intersects the standard height of the listener



Speaker Layout



Known:

Ceiling = 9′

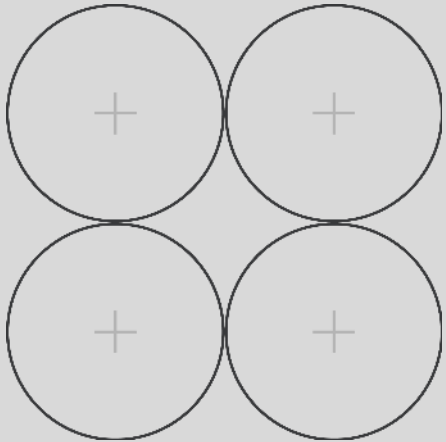
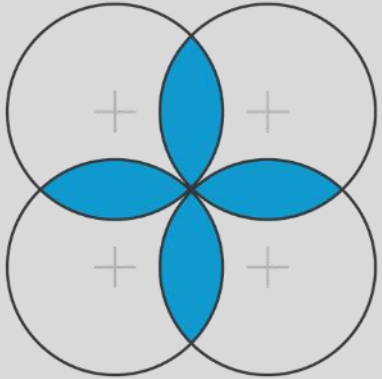
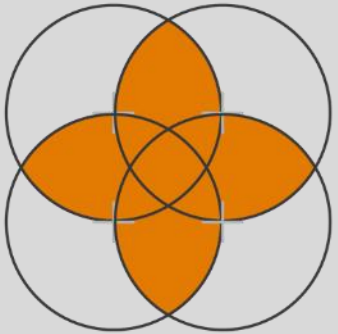
Standing 5′6” = 3’6” from ceiling (42″)

Sitting 3′6″ = 5′6″ from ceiling (66″)

Assume dispersion angle is 120°

1. Calculate speaker coverage distance (conic section) at standing height, D
2. Divide dispersion angle by 2 to obtain a right triangle: 120° / 2 = 60°
3. Using the properties of a right triangle we determine ½ the coverage distance, d
   a) Tangent 60° = d / 42″ and d = Tangent 60° x 42″ = 72.75″ =TAN(RADIANS(60)) * 42
   b) D = 2 x d = 72.75 x 2 = 145.5″
   c) D = 145.5″ / 12” = 12.1′
4. Similarly the calculation for seated height (3′ 6″) yields a conic section = 19′

Speaker Layout

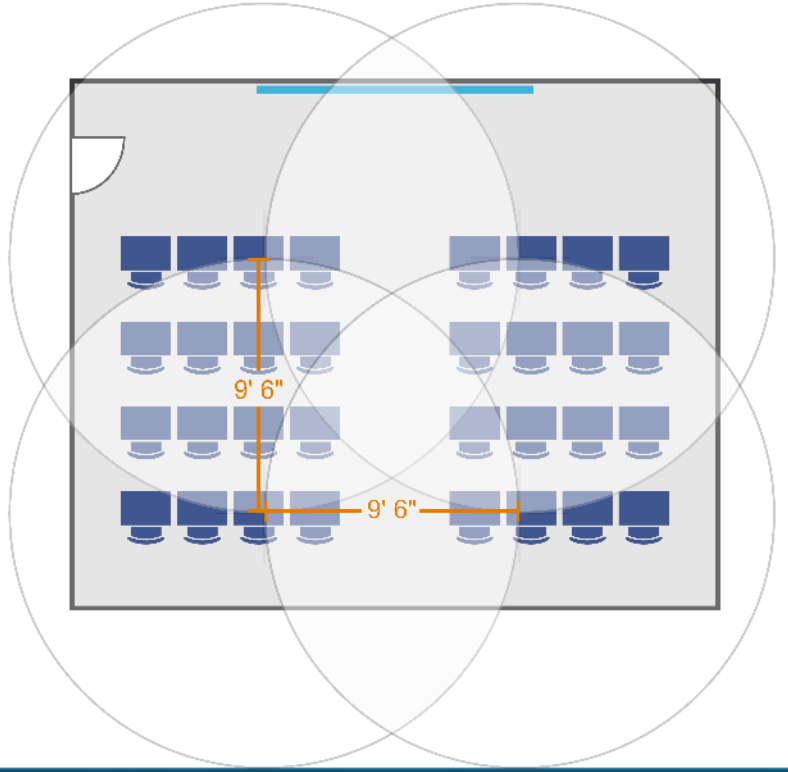
No Overlap	Minimum Overlap	Maximum Overlap
		
-4.4dB SPL Variation throughout sound field Distance between speakers = Conic Section	**-2.0dB** SPL Variation throughout sound field Distance between speakers = 75% of Conic Section	**-1.4dB** SPL Variation throughout sound field Distance between speakers = 50% of Conic Section

* SPL = Sound Pressure Level

Speaker Placement

- 26′ x 20′ classroom
- Seated Listeners = 3′6″ high
- Conic section = 19′
- Distance between Speakers = 50% of Conic section (9′6″)

Provides maximum overlap for students who will be seated and move around the room in a technical lab atmosphere

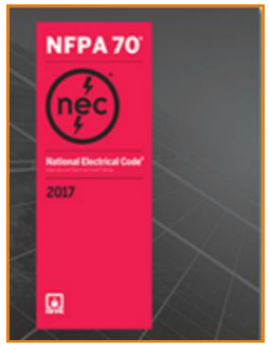


Grounding and Bonding of Shielded Cable

UTP cable with crosstalk prevention technology

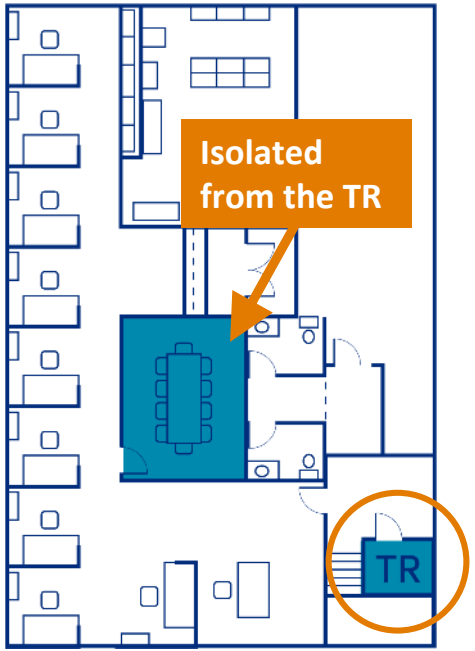
Grounding and Bonding of Shielded Cable

- HDBaseT signals are similar to 10GBase-T
  - 300-500MHz clock
  - Alien crosstalk
  - Headaches when there are adjacent rooms or multiple links
- Which cable?
  - Shielded or UTP
  - If shielded you must ground and bond
- Where do you ground and bond?
  - Your option is the Telecommunications/Equipment Room



Grounding and Bonding of Shielded Cable

- In point-to-point applications, it is often impractical to get to the TR
  - More expensive cable and connectivity
  - More labor intensive than UTP cable
- Perils of not bonding and grounding
  - Safety
    - High voltage crossed onto the shield
  - Signal integrity
    - Drain wire becomes an antenna



Grounding and Bonding of Shielded Cable

- An alternative to shielded cable
  - XTP or intermittent shielded cable with alien crosstalk prevention technology

Berk-Tek Leviton Technologies Connectivity Systems for AV

AV6850

Cat 6A Premium 10G AV System

- Recommended for high speed and low-latency AV applications over 10GBASE-T infrastructure

AV6400

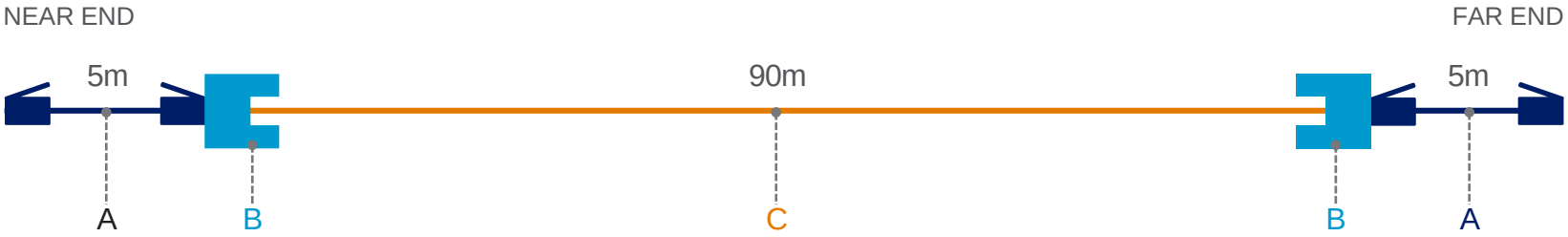
Cat 6 Shielded 1G AV System

- Recommended for shielded AV applications over 1GBaseT infrastructure

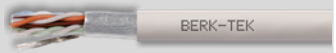
AV6850 | Cat 6A Premium 10G AV System

System Name	Patch Cord	Jack	Cable	Application
AV6850 Premium Cat 6A 10G AV System	**A)**  SlimLine Boot 6AS10-xx*	**B)**  Atlas-X1 6AUJK-Rx6	**C)**  LANmark-XTP	10G AV support: Business, Universities, Hospitals, Industrial, Retail

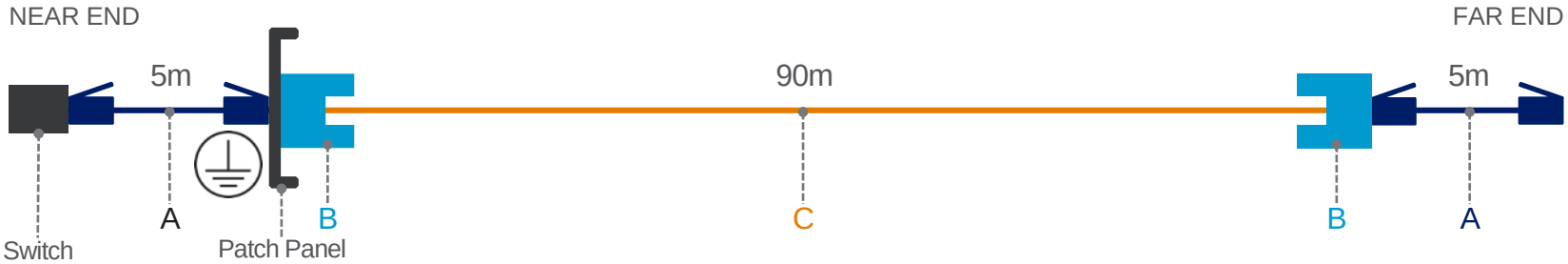
System Topology



AV6400 | Cat 6 Shielded 1G AV System

System Name	Patch Cord	Jack	Cable	Application
AV6400 Cat 6 Shielded 1G AV System	**A)**  SlimLine Boot 6S560-xxx	**B)**  Atlas-X1 61SJK-Rx6	**C)**  LANmark-HD	1G AV support: Business, Universities, Hospitals, Industrial, Retail

System Topology



Common AV Headaches – *Prevented*

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	Hard to share content/collaborate	Auto and manual input switchers
	Video looks great, audio sounds terrible	Audio extraction, amps and speakers
	Grounding and bonding of shielded cable	UTP cable with crosstalk prevention tech

Thank you

David Stoltz, Leviton Network Solutions

www.leviton.com/itav