# Beyond AV Club

## Simplifying K-12 AV Applications

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# Simplicity

- sim·ple
  - Easily understood or done; presenting no difficulty
  - Straightforward, easy, uncomplicated, effortless, **painless**

# Simplicity

*AV system design*

- "In ~~machinery~~ as in life, simplicity is the ultimate sophistication."

# Simplicity in AV Systems

- At least 3 ways to think about this:

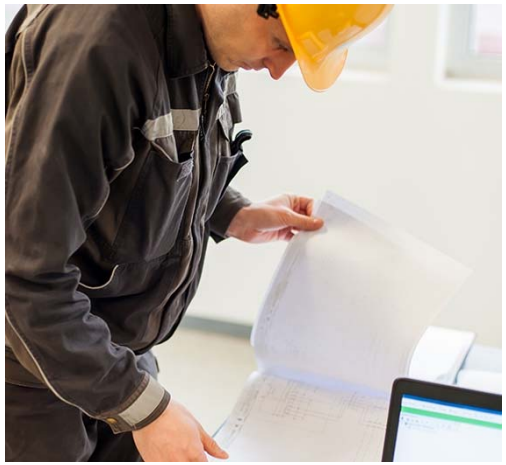
1. AV solution consists of few components that are easily installed and maintained

2. Anyone can intuitively walk up and use the AV system

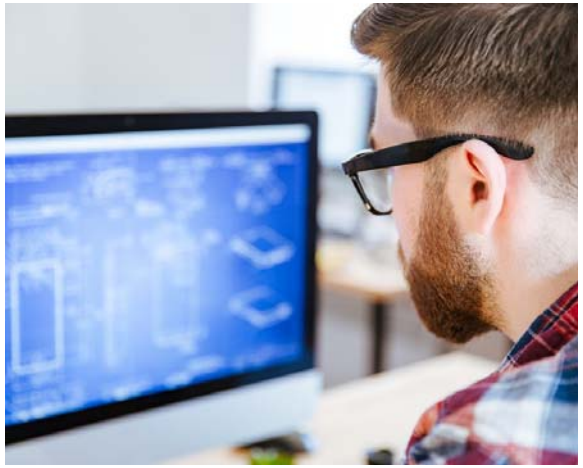
3. Everything is automated, so the user should only have a single button to push

# Simplicity in AV Systems

- Different meaning for different stakeholders



**Installer:** Simple to install, connect, and make work without callbacks



**Customer:** Simple to install and maintain with the least cost and fastest set-up

**End User:** Simple to use, making the experience efficient, pleasant, and free from frustration

# Simplicity in AV Systems

- For each, the goal is the same:
  - Create a system that is as painless as possible

# Usability in AV Systems

- The end user is the ultimate judge of an AV system: Will they use it or not?
- In classrooms and conference rooms, we see a wide variety of users who infrequently utilize the system
- Every user is looking for:
  - Intuitive control for ON/OFF
  - Instant ON and feedback that the system is working
  - Easy and fast connection of a variety of devices; free from configuration and setting changes
  - Dependability that does not require time-wasting system resets or panic calls to the IT or AV support person
- Again, the goal is a system that is painless to use

# Cost in AV Systems

- The AV system is usually the very last system to be installed and is often the last system to be adequately budgeted for
- In schools, we find conflict between the budget and the number of classrooms that can be outfitted with a chosen technology
- Sometimes in commercial spaces, there is no budget at all and an AV system upgrade is driven by a component failure such as a display or projector
- Often, the total lifecycle cost that includes maintenance and upgrades over the lifetime of the system is overlooked

# Cost in AV Systems

- Components of AV system lifecycle cost
  - Display or projector: Usually 60-80% of the room budget
  - Control: Can dominate the budget
  - Signal scaling and switching: Usually a necessity
  - Connectivity from source(s) to display(s): Usually a certain percentage of the room budget
  - Maintenance:
    - Projector lamps
    - Device failure
    - Control software updates
    - Connectivity updates to accommodate newer technology (e.g. VGA to 1080p to 4K)
    - Service calls

# Cost in AV Systems

- Reducing complexity
  - Reduces initial system cost and lifecycle cost
- Frees up budget for larger displays or better projectors
- Enables deployment in additional rooms
- Makes the budget process as painless as possible

# Simplicity, Usability, and Cost

- What is the first thing to happen when a teacher begins a class?
  - Frustration and wasted time (and money) using the audio-video technology
    - Where is the ON switch?
    - Where is the remote?
    - What screen do I need on this touch panel?
    - How do I adjust the audio volume?
    - Why hasn't the projector come on?
    - Where is the IT support phone number?
    - Who gave us all of this costly complexity that doesn't work?
    - Get them in here to fix it!

# Our Goal for Today

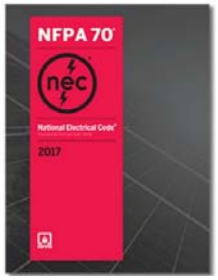
- Provide practical techniques and tools for evaluating and simplifying classroom and conference room AV requirements
  - Balancing the diverse functions desired by the end user against the complexity and cost of the system
- Help with potential end user experience enhancements
  - Creating a solution that is intuitive to use for a wide range of non-technical users
- Provide guidelines for cost-effective design of dependable systems based on industry standards
  - Providing a durable infrastructure platform with upgrade capability
- Provide you with some tools to help you make money and grow your business

# Let's Get Up To Speed

What does "standards-based" mean?

# Key Safety and Industry Standards

- NEC or NFPA 70 is enforced in the United States
  - Article 250 Grounding and Bonding
  - Plenum requirements (NEC 300-22 [b] [c])
- ANSI/TIA
  - Genuine Category-rated connectivity
- HDBaseT™
  - Certified for HDBaseT Alliance performance and power



# HDBaseT™

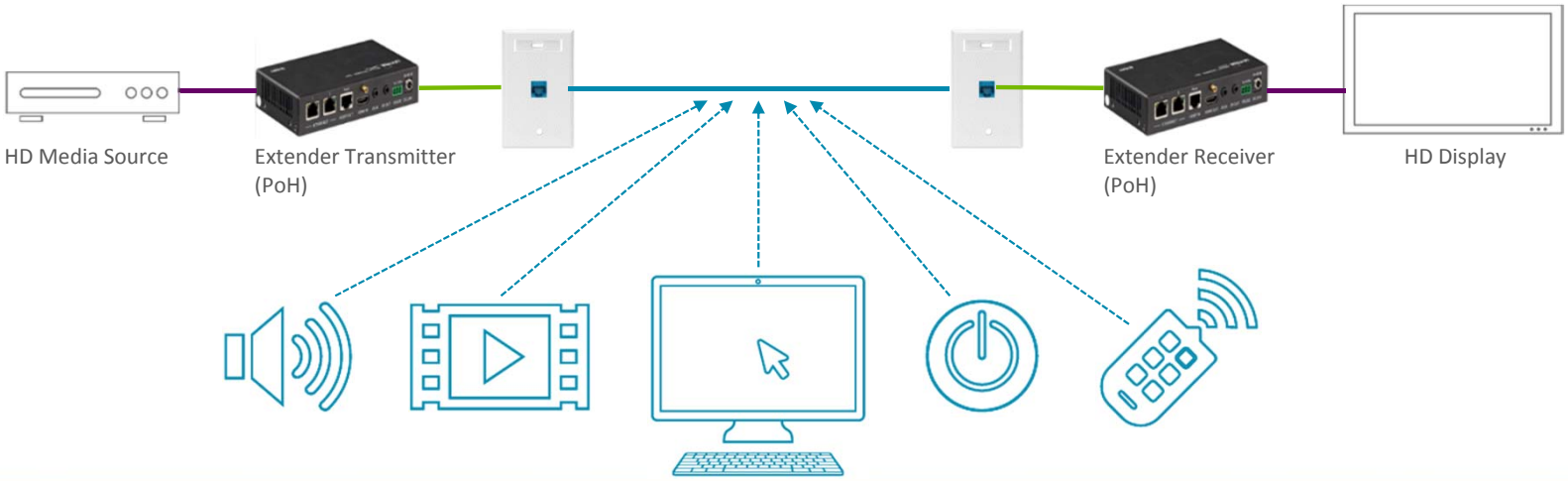
## 5Play™

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

**Simultaneous** transmission of

**All 5**

on a **single** category cable



# Connectivity: HDBaseT™

- HDBaseT Alliance 1.0 specification lists Cat 5e cabling and above as supported media types
- TIA Specifications for standards compliant UTP cable
  - **Cat 5e Frequency Range = 100 MHz**
  - **Cat 6 Frequency Range = 250 MHz**
  - **Cat 6A Frequency Range = 500 MHz**
- HDBaseT 1.0 signals have a PAM16 300 MHz clock
  - **Similar to 10GBASE-T signal**
  - **Generates significant Alien Crosstalk**
- HDBaseT 2.0 devices require 500 MHz cable

# Connectivity: HDBaseT™

- Cat 5e and 6 UTP can carry HDBaseT 1.0 signals in isolated links
- Cat 6A UTP can carry HDBaseT 1.0 signals in bundles
- Cat 6A UTP with AXT prevention and Cat 6A FTP best for HDBaseT
- Cat 6A UTP with AXT prevention and Cat 6A FTP needed for HDBaseT 2.0

| Cable Type | Number of Disturbers | | | | | | | Pixel Errors |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | |
| Cat 5e UTP | | | | | | | | 6 million |
| Cat 6 UTP | | | | | | | | 400 thousand |
| Premium Cat 6 UTP | | | | | | | | 25 |
| Cat 6A with AXT (Mylar Wrap) | | | | | | | | 0 |
| Cat 6A Shielded | | | | | | | | 0 |

Errors as measured with Quantum Data 780B HDMI Tester over 800ms capture time.

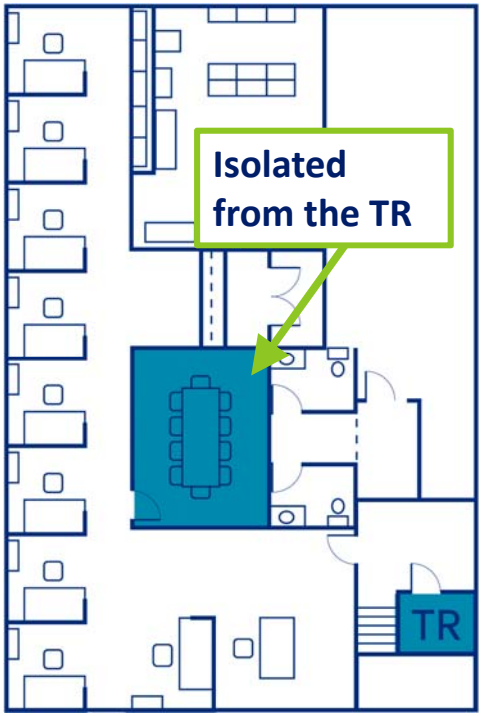
**PASS**
steady video signal

**MARGINAL**
random, infrequent dropouts

**FAIL**
frequent or total link loss

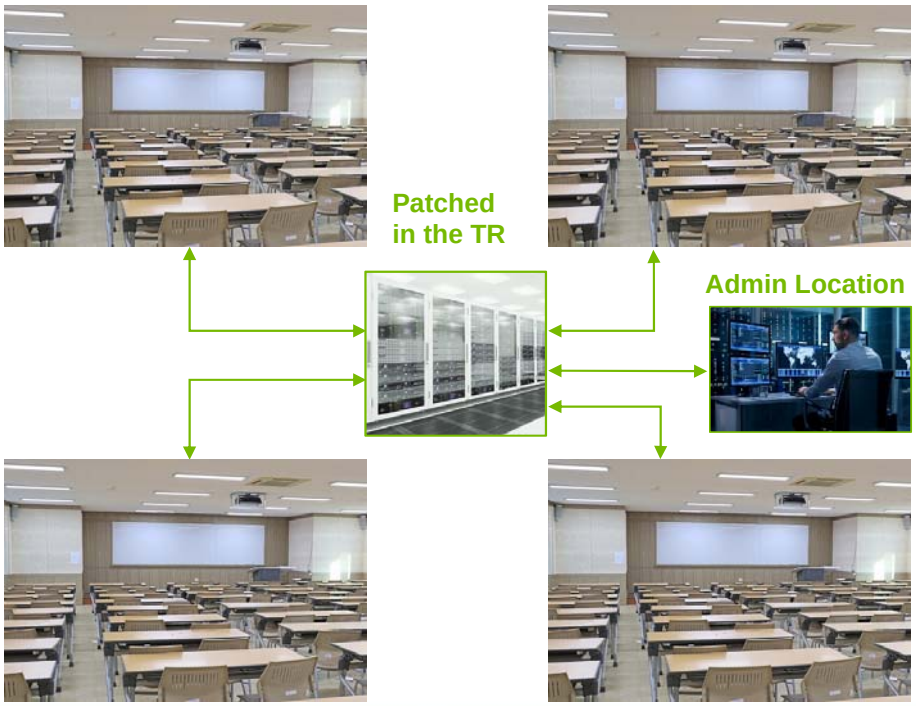
# Connectivity: HDBaseT™

- In point-to-point applications, it is impractical to use shielded cable
  - Bonding and grounding is often not possible
  - More expensive cable and connectivity
  - More labor intensive than UTP cable
- Alternative to shielded cable
  - XTP or intermittent shielded cable with alien crosstalk prevention technology

# Centralized vs. Decentralized System

Centralized AV System




- Upside:
  - Central administrative control and monitoring
- Downside:
  - Complexity
  - Lifecycle cost
    - Components
    - Installation
    - Maintenance

# Centralized vs. Decentralized System

- Upside:
  - Simplicity
  - Lifecycle cost
  - Capability for limited control/automation
  - Every room the same
- Downside:
  - Completely separate room systems
  - No central control

Decentralized AV System




# The AV Project

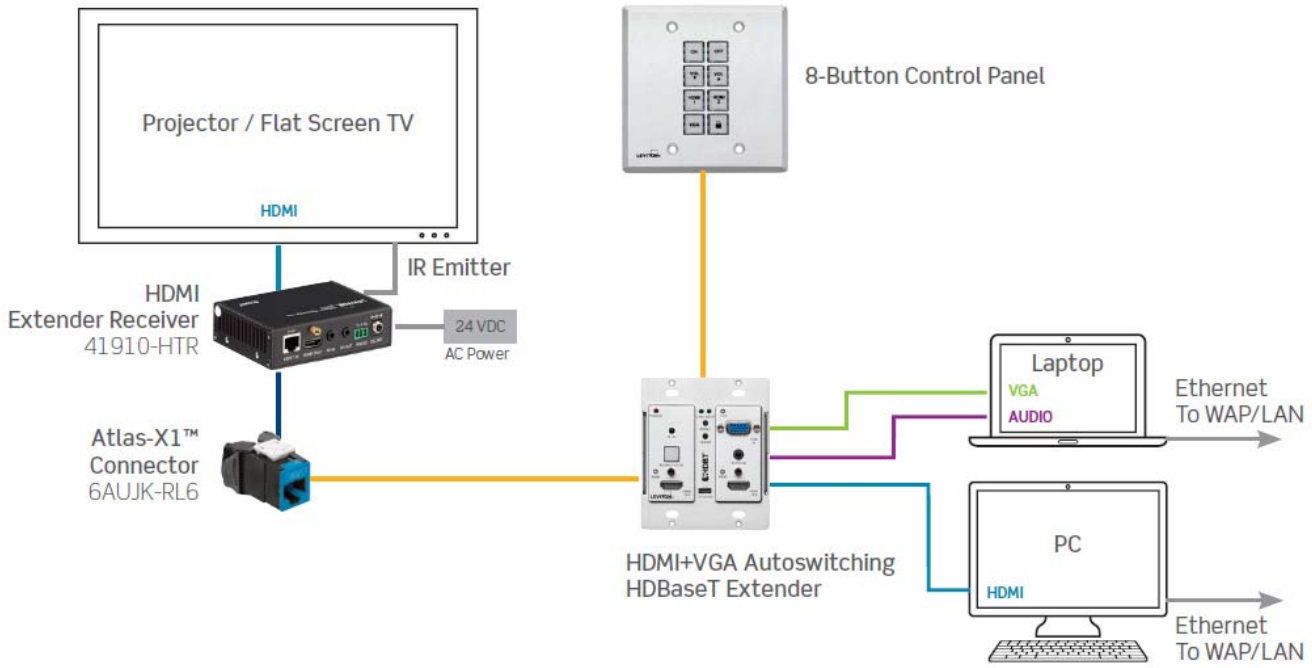
Clarify, Spec/Design,
Price, and Bid

# The AV Project

- Assess your experience in AV design and support before you bid
- Start with basic systems
  - Simple and painless
- Most customers will be fine with splitting the more complex systems from the basic conference rooms or classrooms
  - Because it saves them time and money

# Application Drawing Examples

- Arm yourself with example solutions
- Start with a basic conference room or classroom solution



# Application

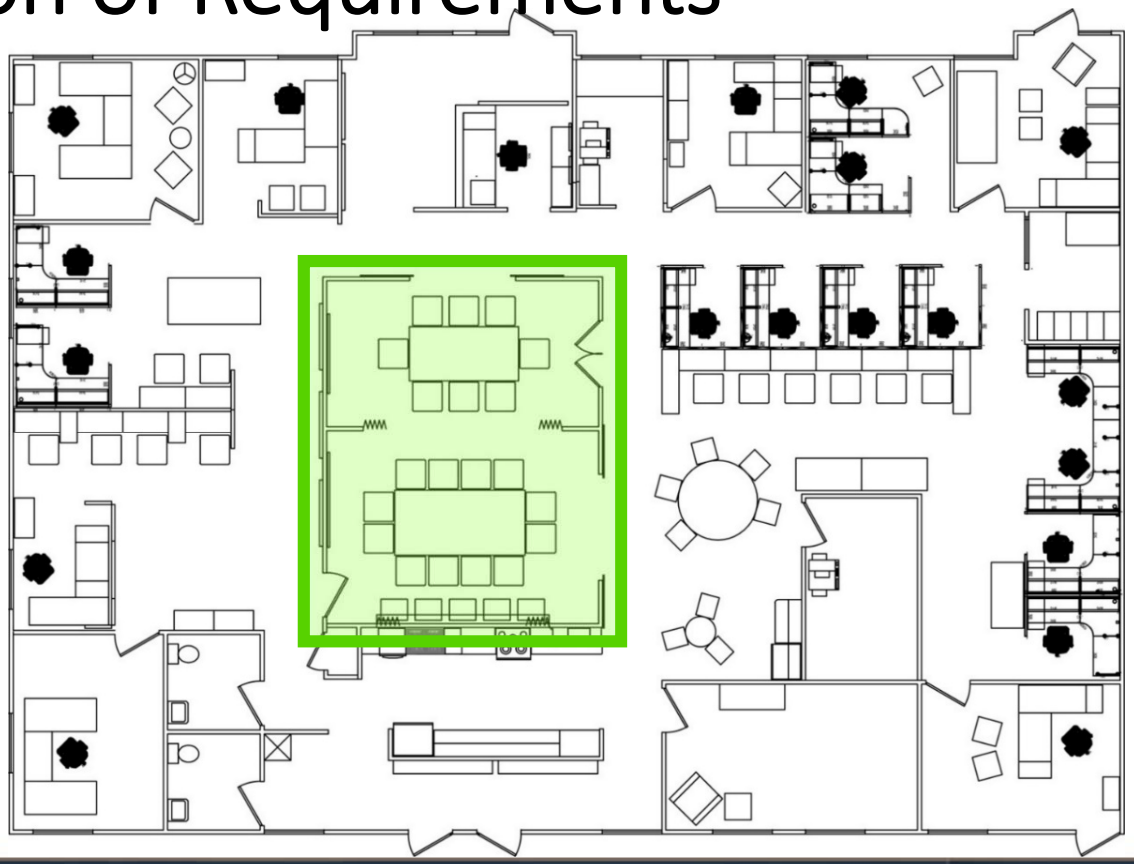
- Define the application needs
  - Devices and signals
  - Room layout
  - Distances
  - Connectivity options
  - Available pathways
  - Audio needs
  - Usage scenarios
    - User location(s)
    - Desired functions

# Focus on the Basics to Cover the Vast Majority

1. Single Display/Projector
2. Single Input Location

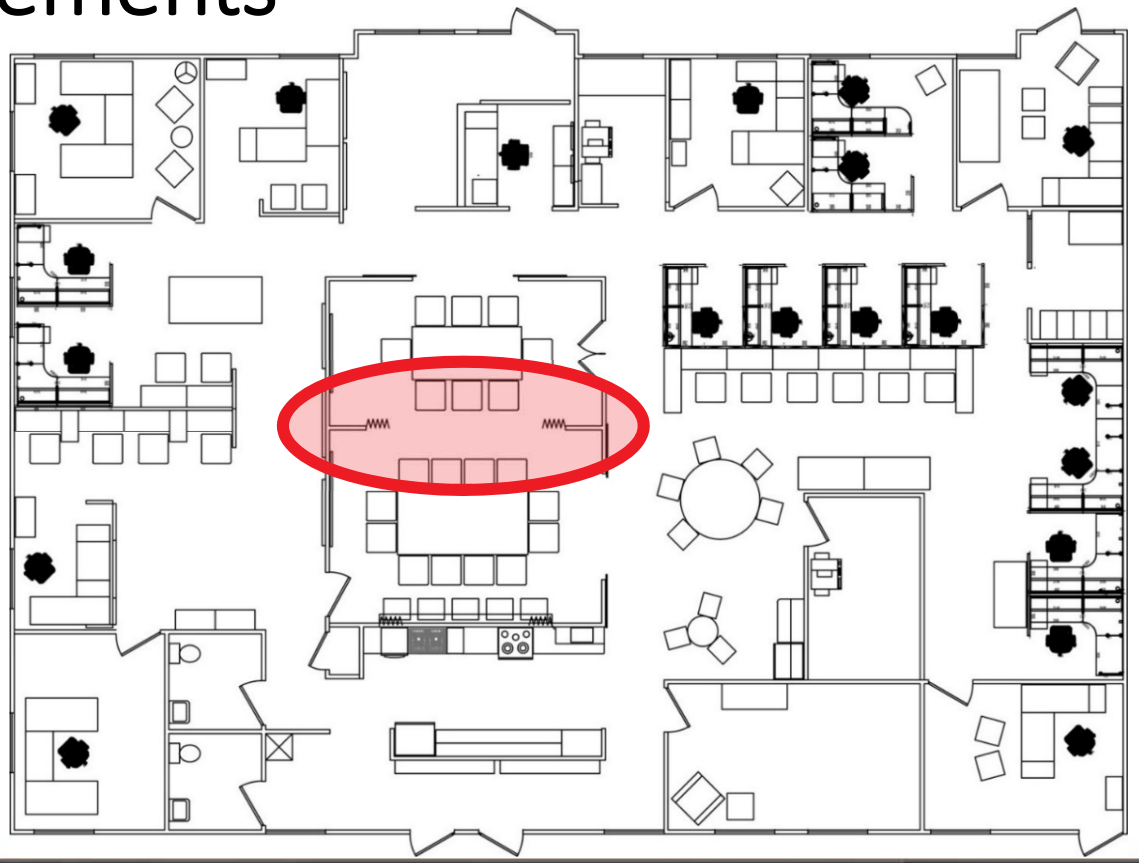
# Careful Identification of Requirements

- Small office floor plan
- Conference room in the center looks like a candidate for a basic system



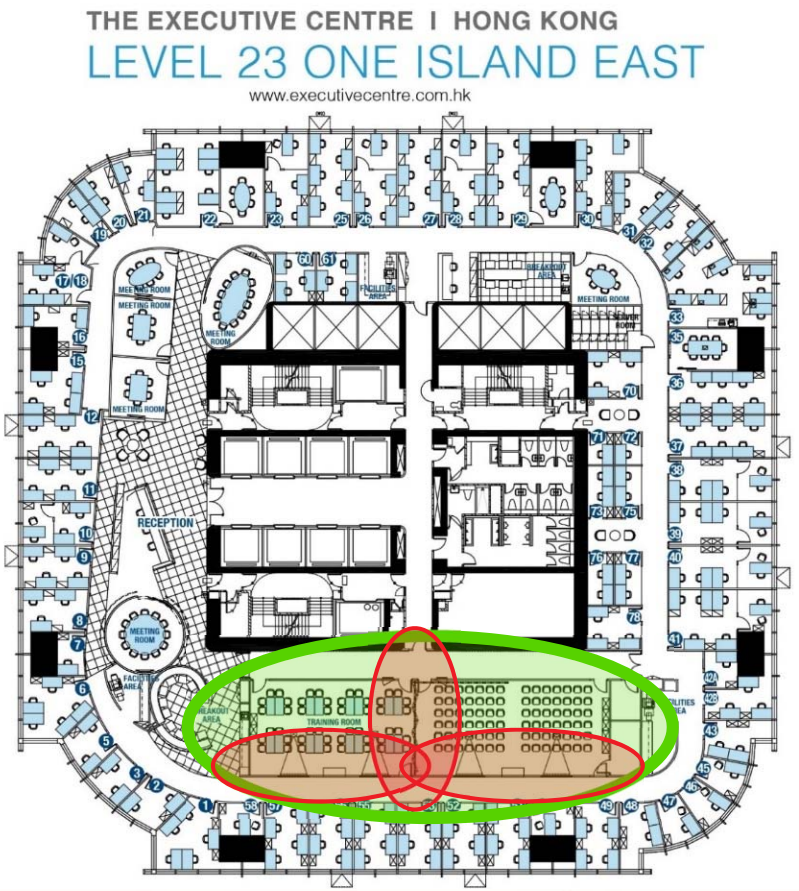
# Non-Obvious Requirements

- This air wall indicates that the rooms can be combined
- This is a multi-input and multi-output system
- The room requires a complex, matrix-based AV system with programmable control



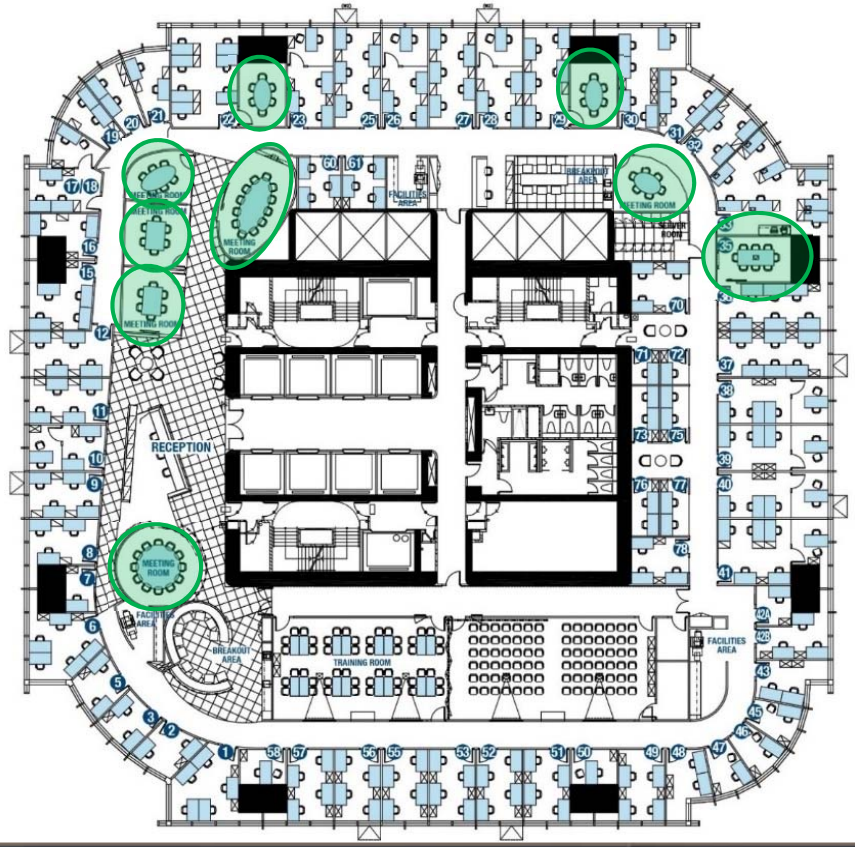
# Non-Obvious Requirements

- 23rd floor of a high rise
- Large training/conference facility
- Heads-up!
  - Air wall
  - Multiple screens
- This room requires a complex, matrix-based AV system with programmable control

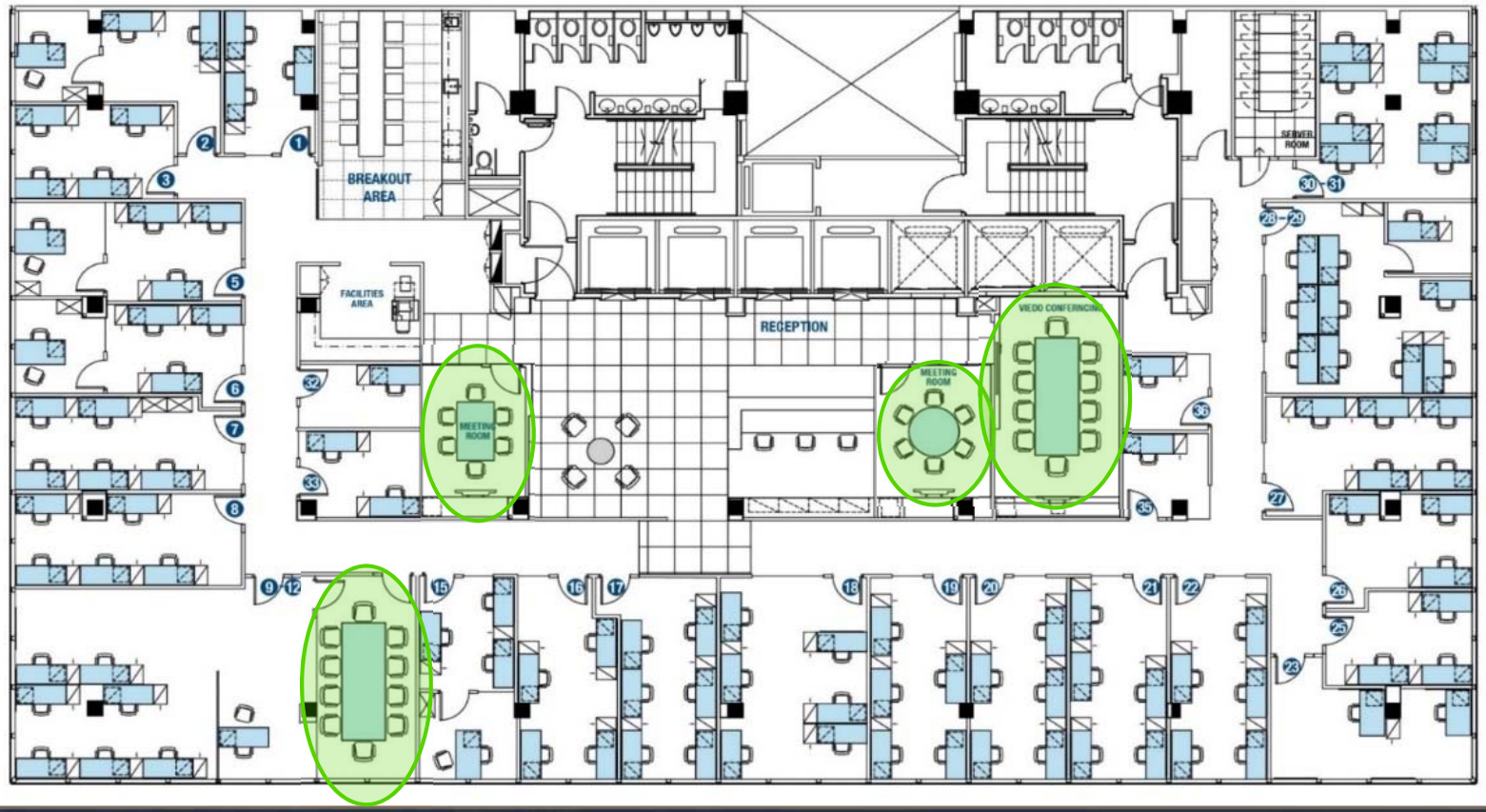


# Non-Obvious Opportunity

- Take a closer look!
- 9 other spaces on this floor alone
- Small conference rooms with a single screen

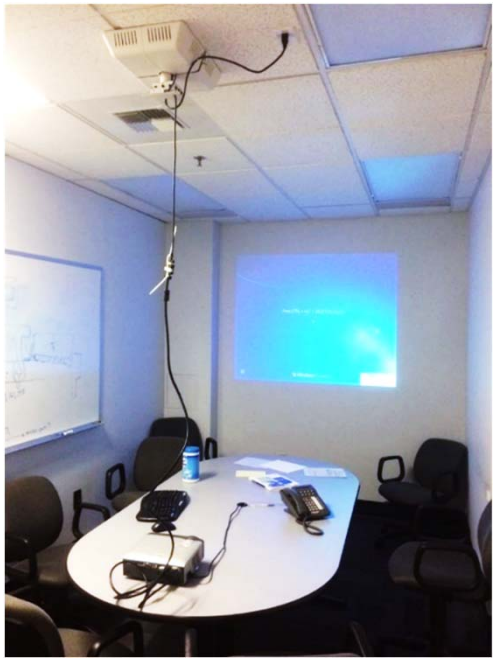


# Enterprise Common Application



# Common Situation

- Broken or unused technology and work-arounds
- Opportunity for a simple approach



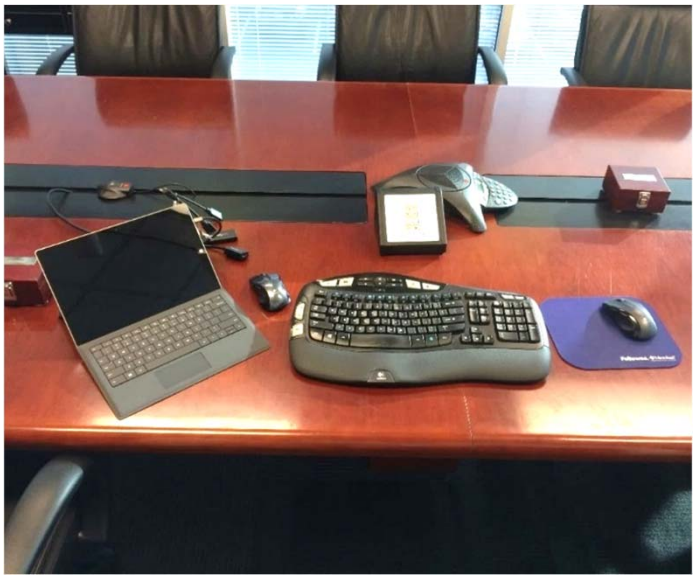
**Before**

**After**

- 4K display via HDBT extender
- Webcam via USB 2.0 extender
- Simple wall-mounted button control

# Executive Conference Room Example

- 80” 1080p Sharp display
- PC inside the table leg



- Replaces ceiling-mounted projector, powered screen, and remote control
- Adds guest input capability without setup, software or additional hardware

# Executive Conference Room Example

# Enhance the User Experience

- Start with a single source to display or projector solution
- Easy to add an autoswitching wallplate input
  - Adds capability to accept both HDMI and VGA+ audio inputs
  - Automatically switches to the active input without user interaction


Autoswitching Wallplate

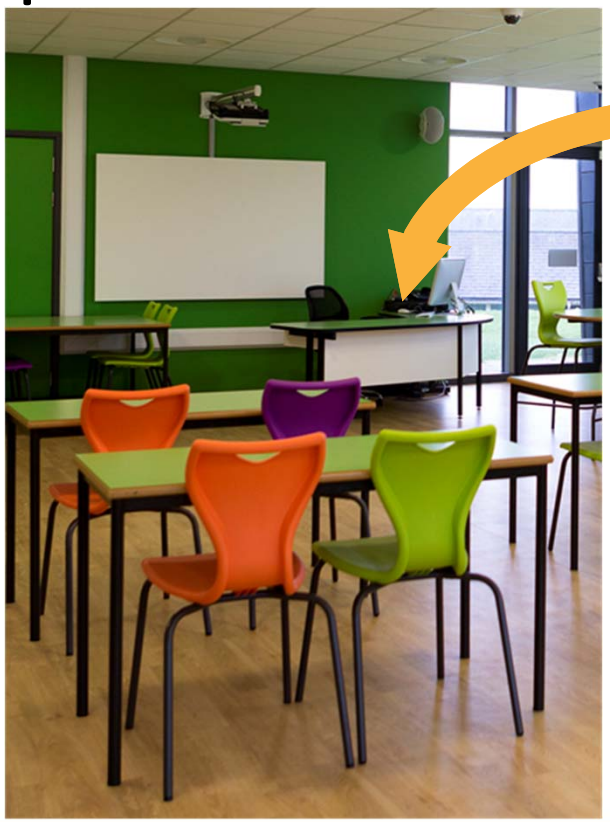
# Enhance the User Experience

- Add a dedicated push button control panel
  - Can be located at a standard teaching location away from the inputs
  - Simple ON/OFF, VOLUME, SOURCE selections for non-technical users

8 Button Control Panel

# Enhance the User Experience

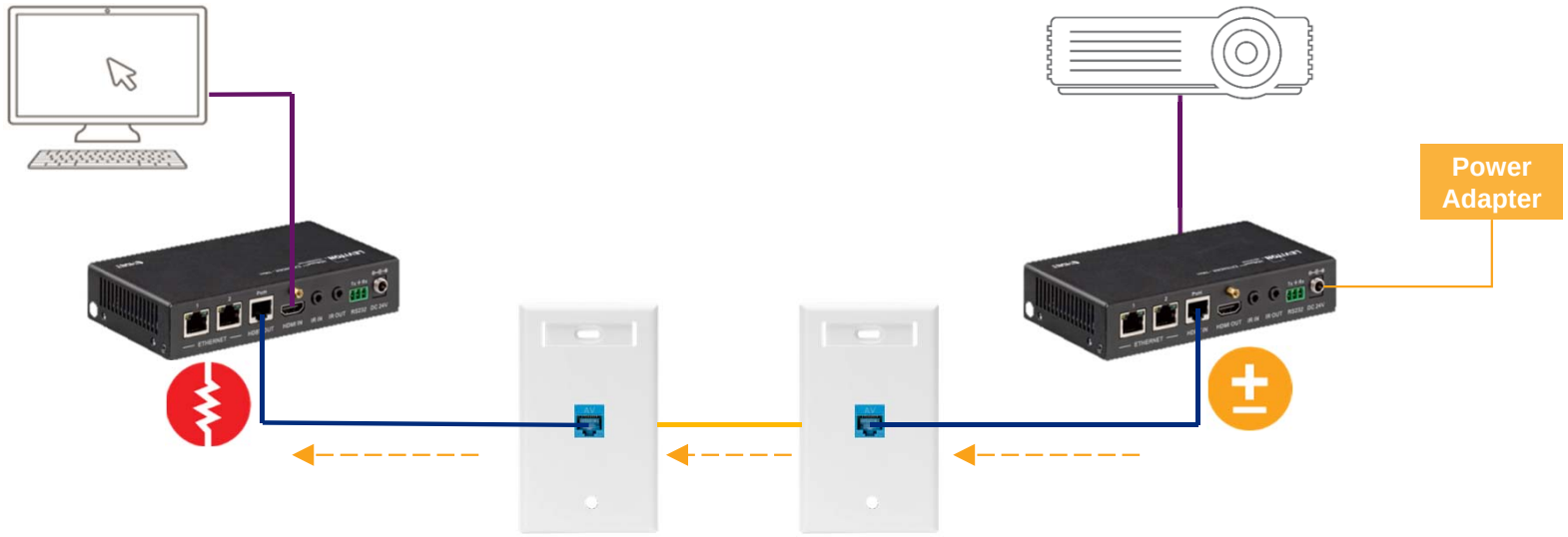
- Add interactivity with USB extension between the source and projector
  - Just add another tested Category cable link and
    USB 2.0 plug-and-play
    transmitter and receiver pair



USB Extender Set

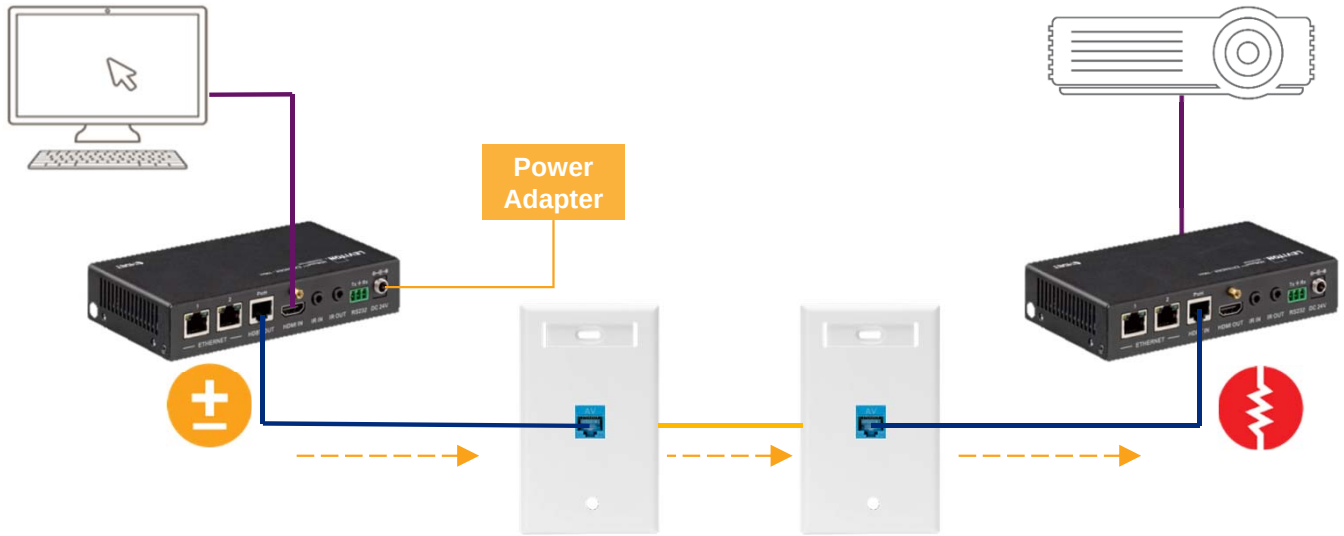
# Eliminate Some Electrical Work

- Utilize Power over HDBaseT (PoH)
  - Look for extension systems that can be powered from the display end



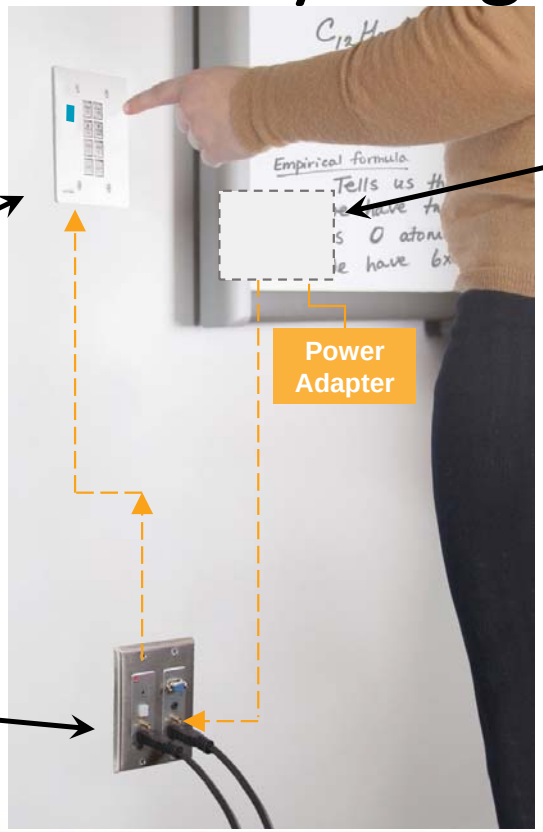
# Eliminate Some Electrical Work

- Utilize Power over HDBaseT (PoH)
  - Or, better yet, extenders that can be powered from either end



# Use PoH to Power Everything

- A single AC outlet




**HDBaseT Receiver**

**Control Panel**

**Autoswitching Wallplate**

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