

The Modern Workspace

Wired and Wireless AV Collaboration

-Karl Rosenberg-



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“Build me a Unified Collaborations Space”



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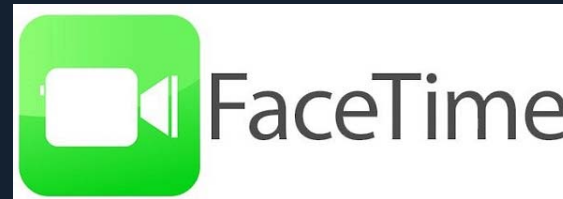
JPEG



SUPER UHD TV 4K



4K HDR
HIGH DYNAMIC RANGE



zoom



HEVC
H.265 - HIGH EFFICIENCY VIDEO CODING



4K UHD
COMPATIBLE

4K 30
ULTRA HD



VP9
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Huddle Room



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Huddle Room with Soft VTC



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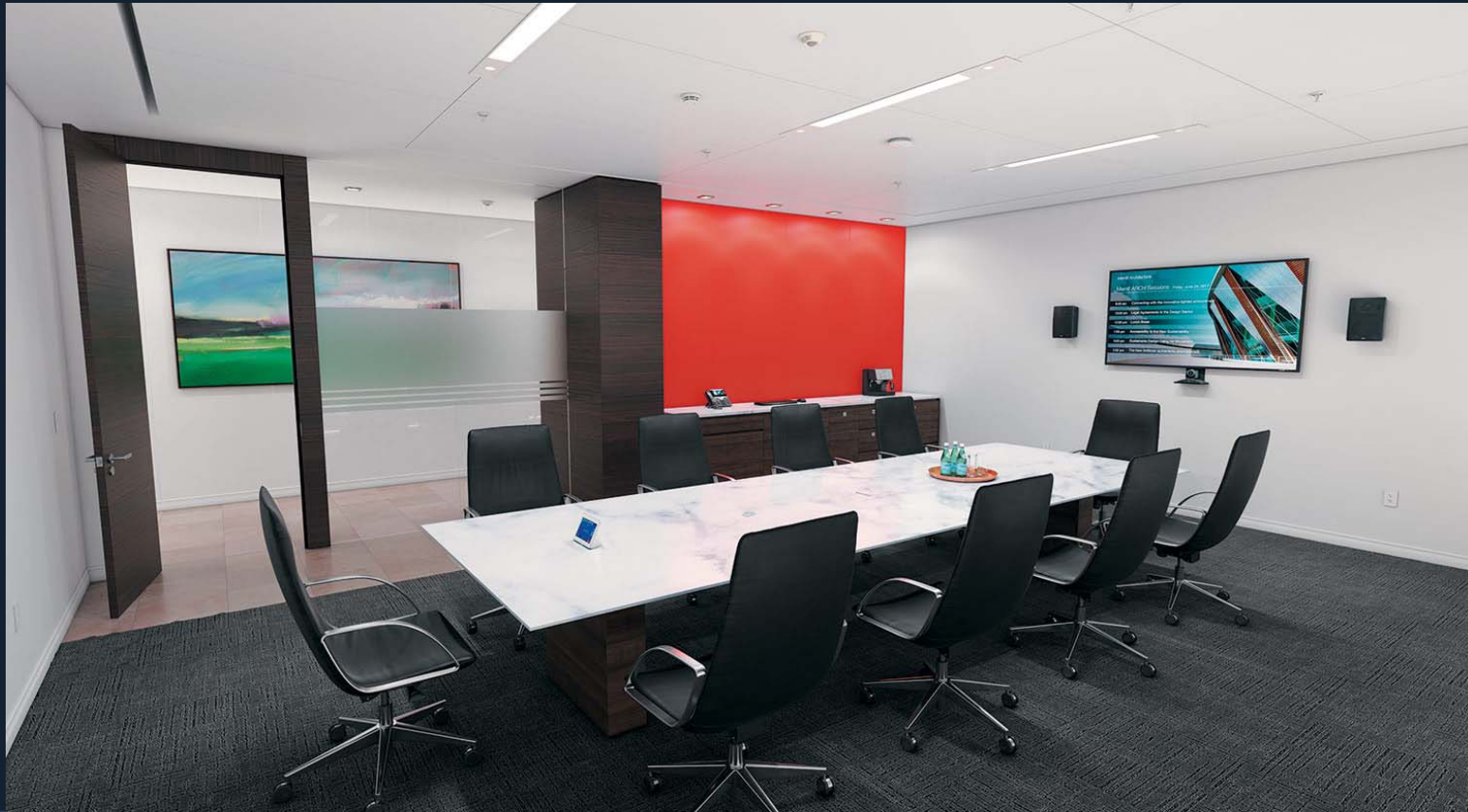
Huddle with ZOOM ROOM



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Large Conference Room



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Classrooms and Boardrooms are changing



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Classrooms and Boardrooms are changing



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AV Technology Deployment

4 types



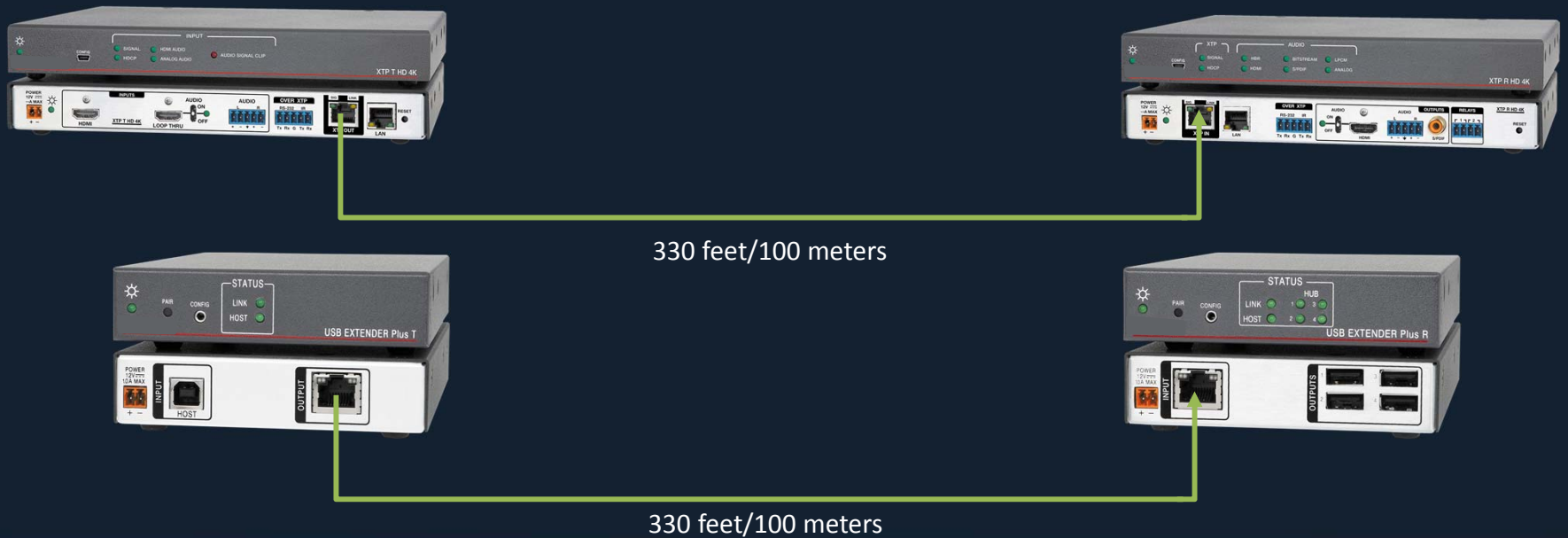
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Hard Wired AV Infrastructure using CATx

- Wired AV connections offer benefits related to reliability
- To INCLUDE a CATx for USB

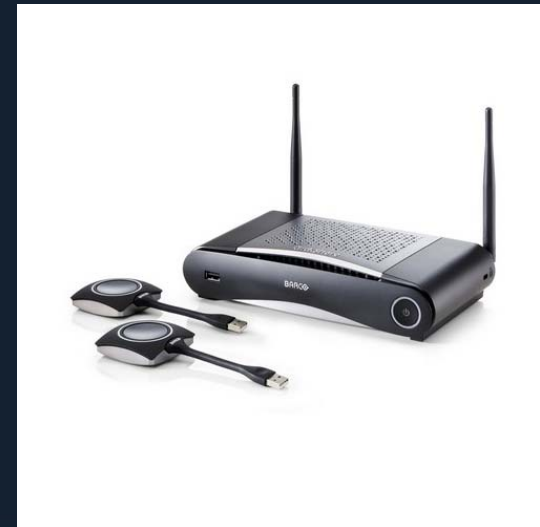
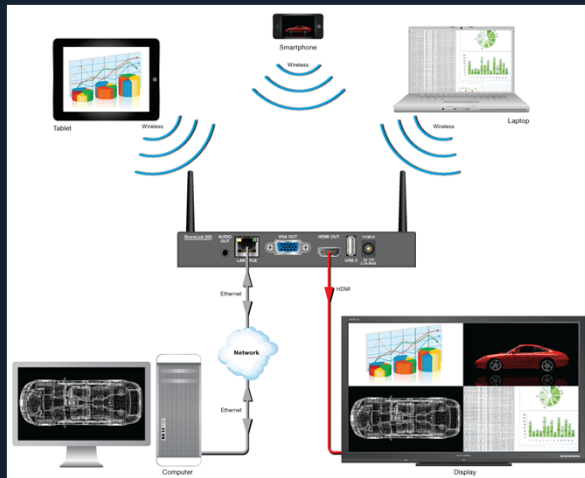


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Wireless AV

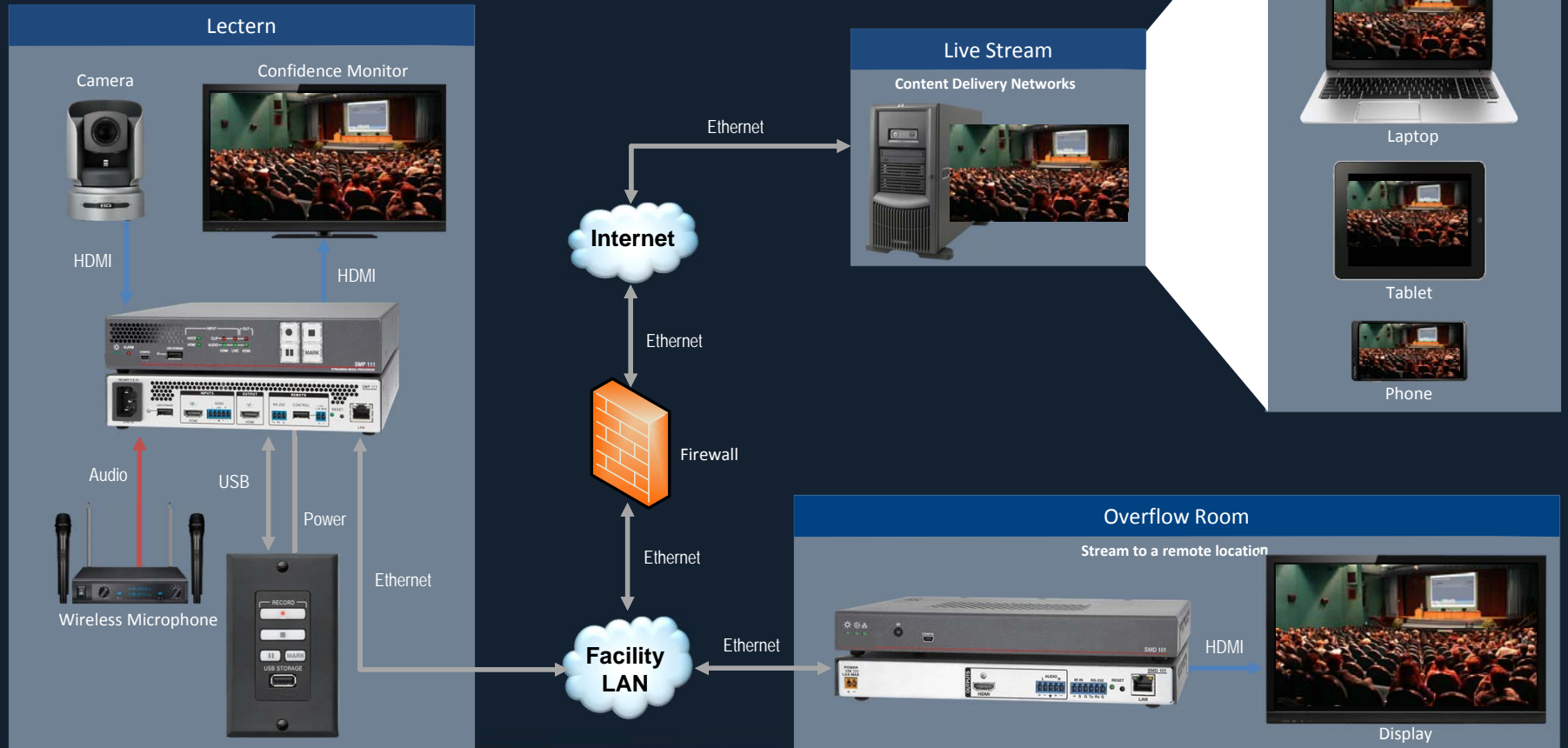
- Wireless AV offers flexibility, mobility, and benefits for installations that have architectural challenges
- Network reliability, access, coverage, and congestion can effect performance



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AV Streaming

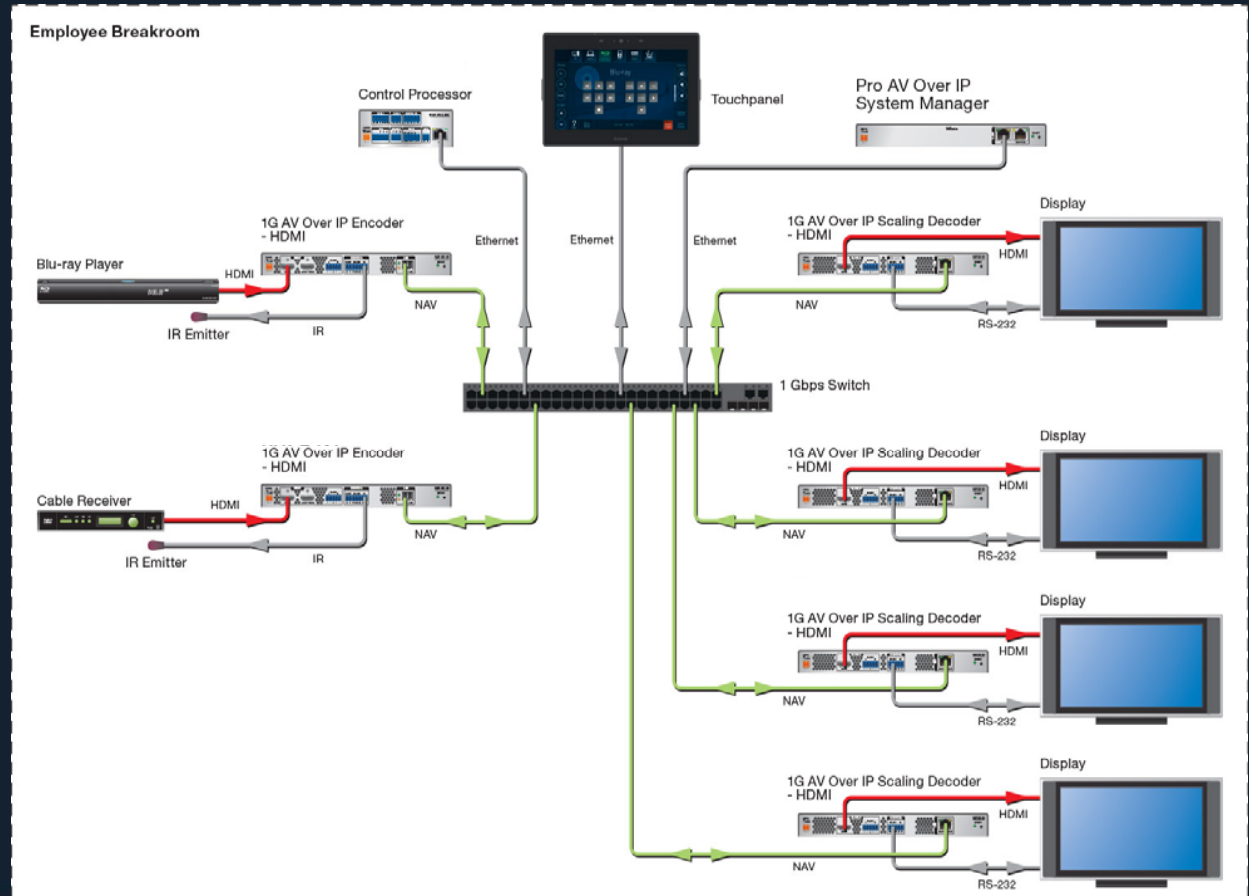


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AV over IP

- Control?
- Audio distribution?
- Bandwidth/Data rate?
- Compression...yes
- Client Network?
- Your Network?
- 1G
- 10G



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AV over IP Considerations

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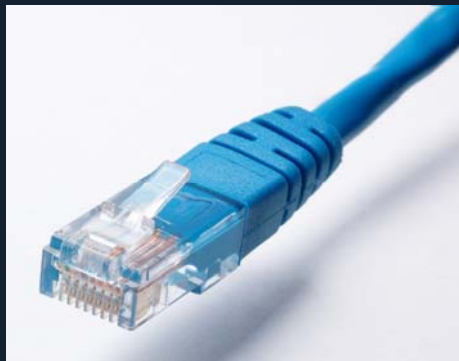


AV over IP – AES 67 Audio Distribution

- AES 67 Standard allows audio transportation over IP based systems
- Interoperability between network audio over IP protocols
- Adds audio networking technology into a variety of applications
- Supports both multicasting and unicasting



+



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AES 67



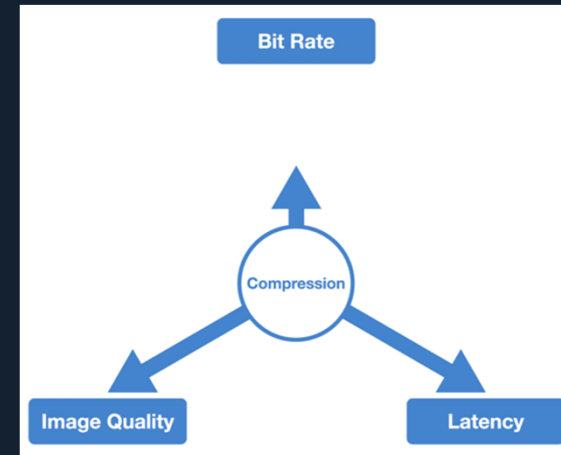
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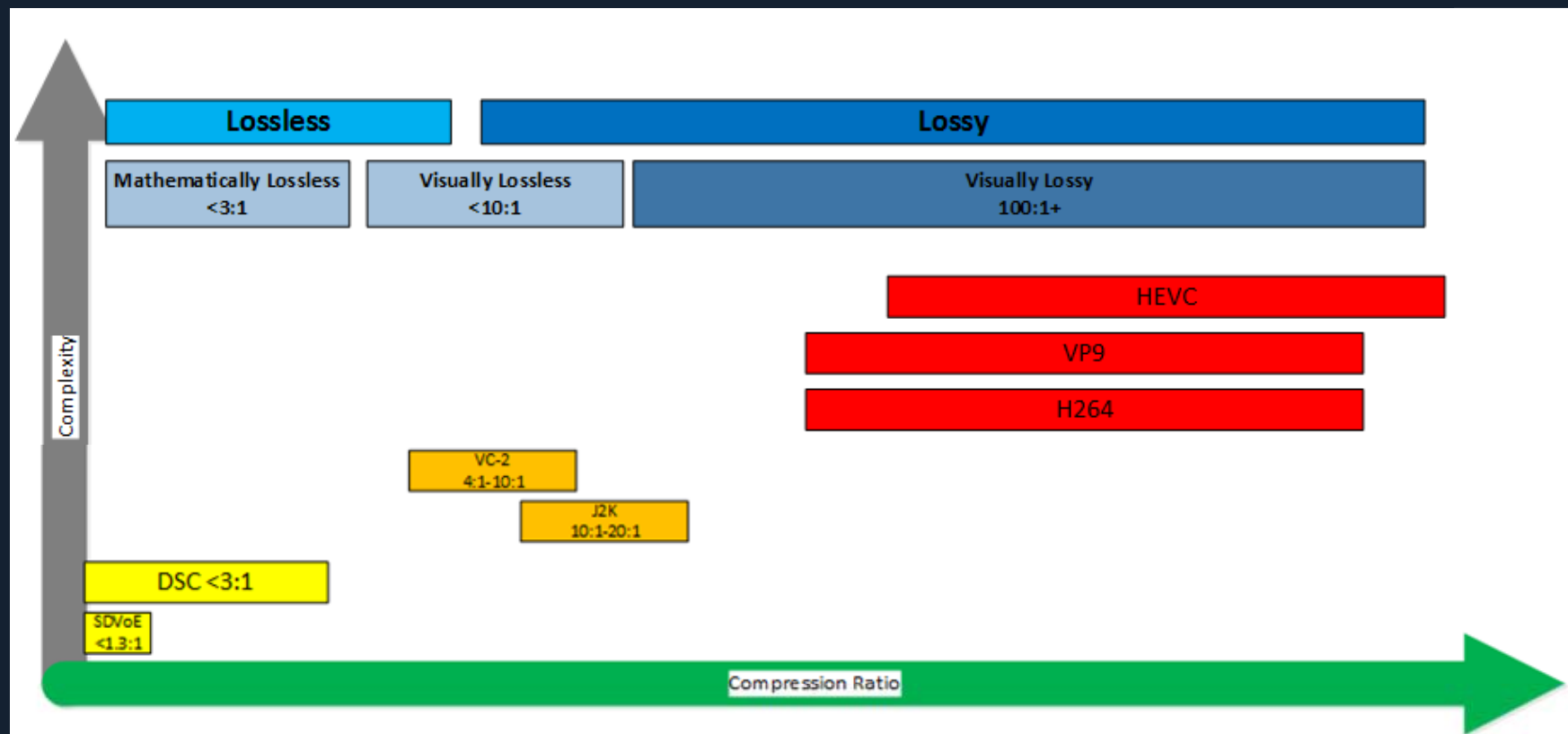
AV over IP – Compression

- Compression – Three factors
 - Bit Rate
 - Image Quality
 - Latency



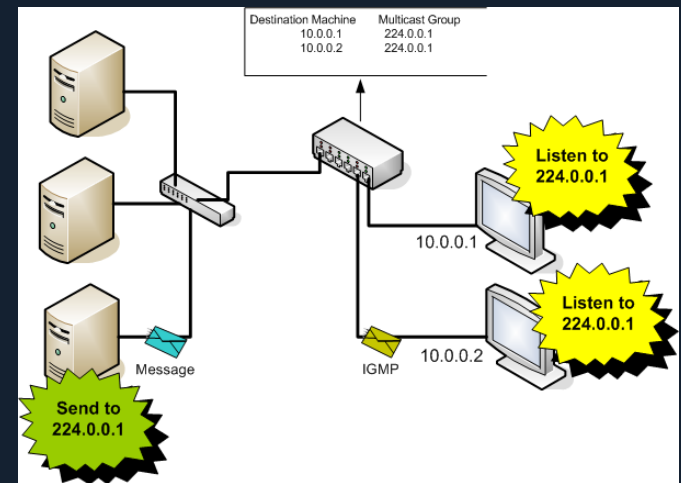
Video Rate	Uncompressed Bit Rate @ 24 bpp	1G Compression @ 880 Mbps	10G Compression @ 4 Gbps
480p60 (SD)	422	1:1	1:1
720p60 (HD)	1,330	2:1	1:1
1080p60 (HD)	2,990	3:1	1:1
2160p60 (UHD)	11,940	14:1	3:1
4096x2160 @ 30 (4K/30)	6,370	7:1	2:1
4096x2160 @ 60 (4K/60)	12,740	14:1	3:1

AV over IP – Compression Ratios



AV over IP – Network

- Layer 3 Protocols
 - Multicasting
 - IGMP Snooping
- Client Network?
- Private Network?



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Collaboration Space Considerations

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Your Goals for the Room?

- How will the space be used?
- What is the budget for this space?
- Who will be using the space?
- VTC?
- How will the space be managed?
- Usability of the space?
- How will the space be operated?
- Cable management within the space?



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Making Collaboration Spaces Work

- Signal Integrity
 - Using Shielded CATx cable
 - HDMI and USB
- Table Power
- Conferencing Interface
 - ZOOM Skype
- Wireless Video
- Audio
 - Usually using Speakers on Display
- Control
 - “people forget this all the time”
- Room Scheduling
- Annotation



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Keys to success in this Collaboration arena (three C's)

- Connectivity

- CATx or Wireless



- Conferencing Interface

- Zoom..Skype...your laptops or phones
- Phone interface
- VOIP



VoIP
zoom

- Control

- Simple
- Push button
- Motion sensor
- Touchpanel with Interface



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Connectivity

Video Signals



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Digital Signals – HDMI

- HDMI is an uncompressed digital video signal
 - Designed for the consumer market



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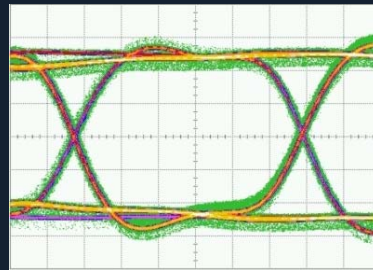
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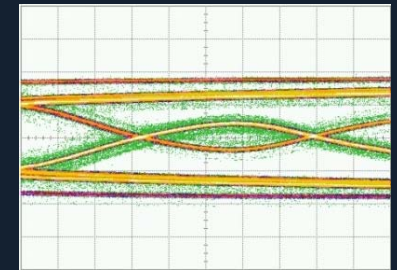
Digital Video Characteristics – Loss

- Digital video signals consist of high speed transitions
- Very susceptible to degradation from:

- Cable attenuation
 - › Cable capacitance
 - › Cable resistance
 - › Impedance mismatch
- Noise coupling
- Crosstalk
- Jitter



Cabling / System



- All factors that Affect the receiver's ability to distinguish high and low transitions



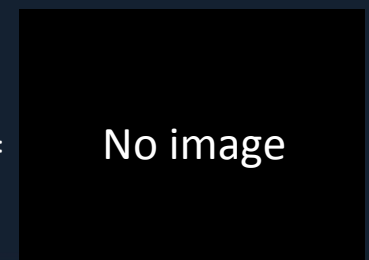
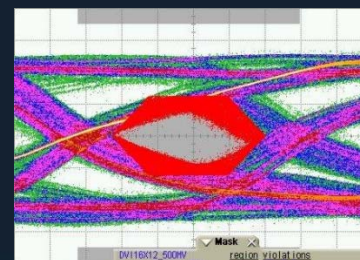
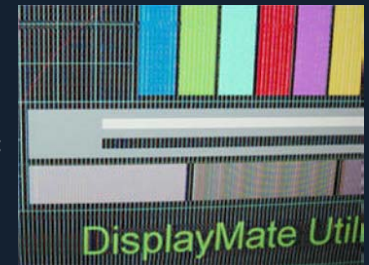
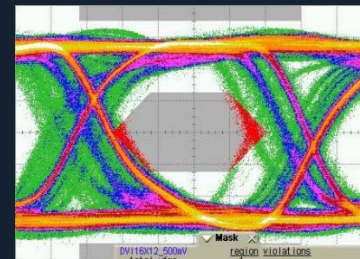
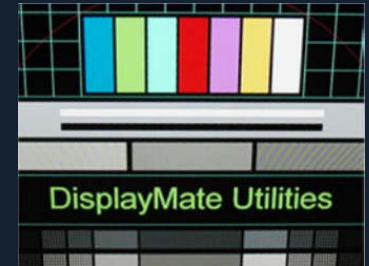
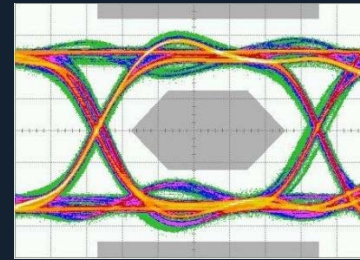
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Digital Video Characteristics – Loss

- Difficult to anticipate
 - Image quality does not degrade like analog
- Cliff effect
 - Occurs when the receiver can no longer distinguish high and low values
 - › Too many bit errors have occurred



Digital Video Characteristics – Variables

- Cables can vary widely in performance
 - Adapters are useful but may affect signal quality



Damage caused by faulty HDMI connector



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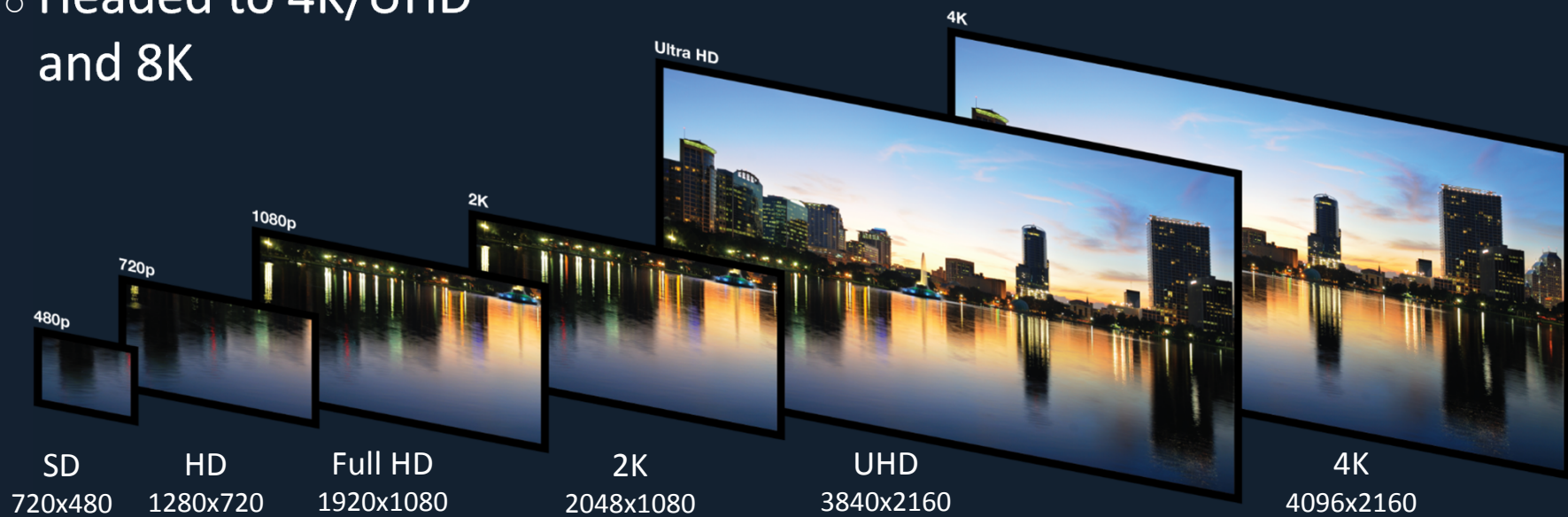
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Resolutions

4K UHD

- Old Resolutions
- New standard 1080p
- Headed to 4K/UHD and 8K



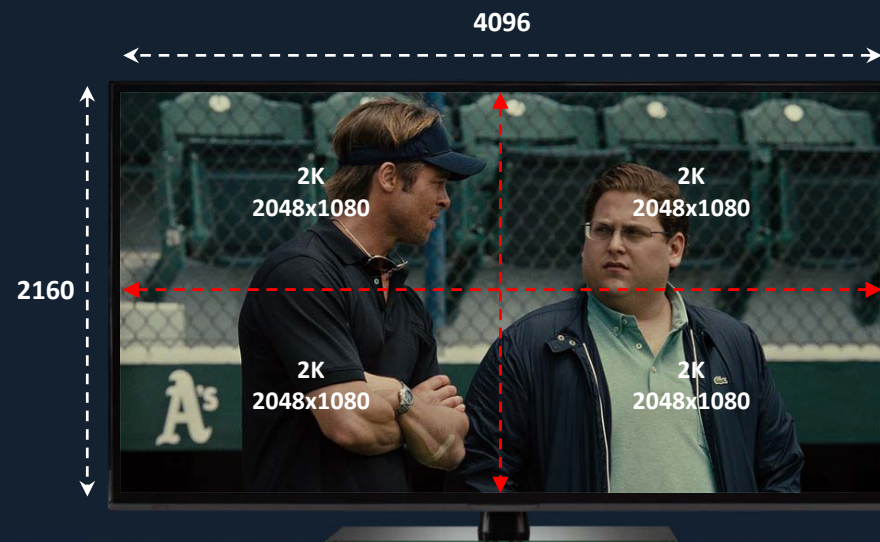
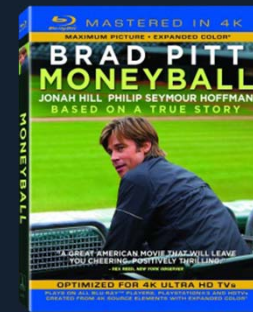
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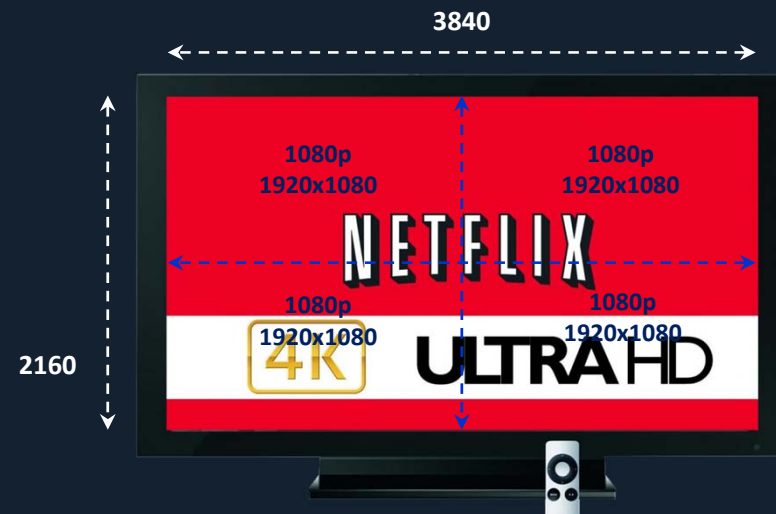
4K Signal Parameters

- 4K DCI is 4096x2160
 - Four times the resolution of 2K DCI
 - Targeted towards digital cinema
- 4K refresh rates
 - Varies – 24 Hz up to 60 Hz
- Color bit depth
 - 8-Bit, 10-bit, and 12-bit
- Aspect Ratio
 - 17:9 – same as 2K



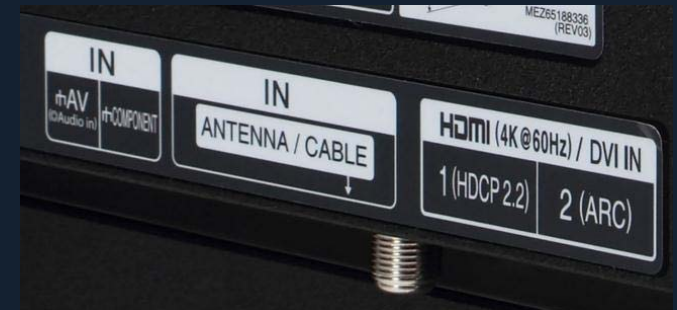
Ultra HD Video Signal Parameters

- Ultra HD is 3840x2160
 - Four times the resolution of 1080p
 - Targeted towards consumer and broadcast markets
- Ultra HD refresh rates
 - Varies – 24 Hz up to 60 Hz
- Color bit depth
 - 8-Bit, 10-bit, and 12-bit
- Aspect Ratio
 - 16:9 – same as 1080p



HDMI 2.0 and HDMI 2.1

- New functionality includes
 - Enables transmission of HDR – High Dynamic Range video
 - Signaling speed to 18 Gbps
 - 4K@50Hz/60Hz, (2160p)
 - › 4 times the clarity of 1080p/60 video resolution
 - Up to 32 audio channels with up to 1536 kHz audio sample frequency
 - › 32 channels @ 48kHz each
 - Dual video streams on same screen, 4 audio streams
 - Support widescreen 21:9 format
 - Dynamic sync of audio/video
 - CEC extensions with expanded control via single point
- Backwards compatible



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USB

Universal Serial Bus



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HDMI and USB



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Digital Signals – USB

- A standard for communication protocols that includes cables and connectors
- Historically used for attaching peripheral devices to computers
- Maximum length of USB 2.0 cable: The 2.0 specification limits the length of a cable between USB 2.0 devices (Full Speed or Hi-Speed) to **5 meters** (or about **16 feet** and 5 inches).



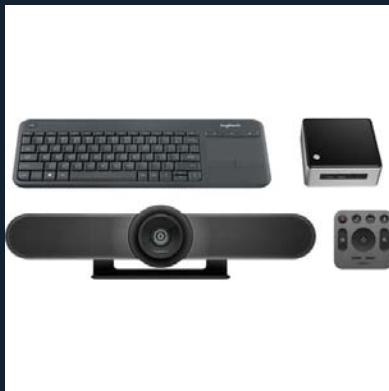
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Digital Signals – USB

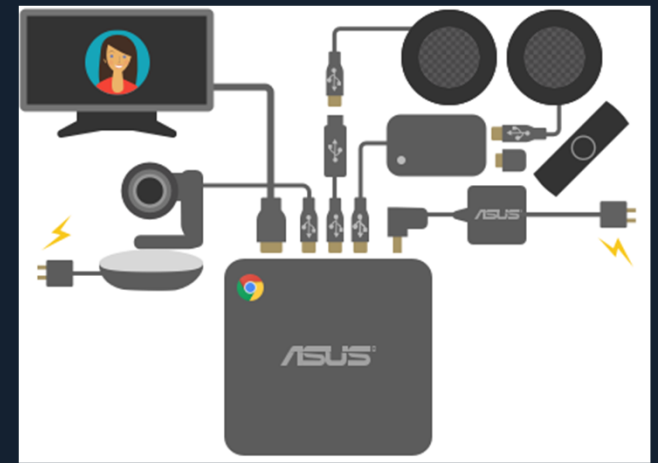
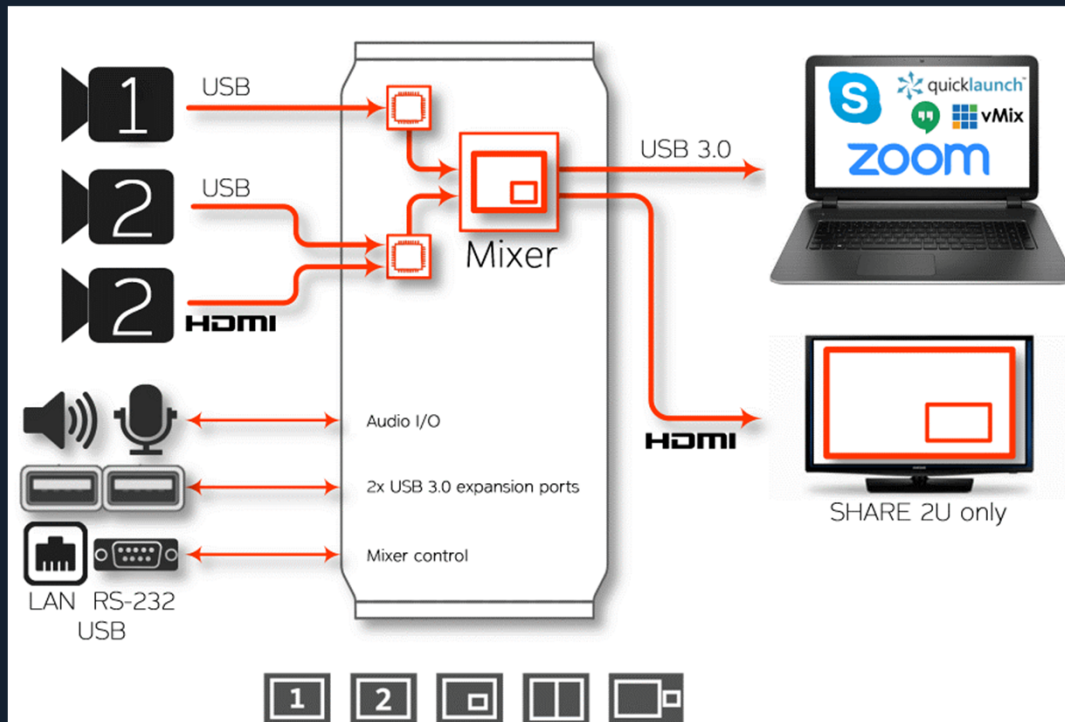
- Over the years speeds have increased and USB supports video and audio transfer
 - USB 2.0 - 480 Mbps
 - USB 3.0 - 5 Gbps
- Providing additional options for transporting video and audio



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USB over distance?



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USB Type-C

- Send Data, Video, Audio, and Power
- Latest, high speed, reversible USB
- 10Gbps data rate (V3.1), V3.0 = 5Gbps
- Deliver up to 100 watts! Devices negotiate...
- Supports “alternate modes” ... like DisplayPort
- “...beyond 20 Gbps in the future.”
 - Pres. USB-IF



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USB Hubs

- Connects upstream port and multiple downstream ports
- Port sharing bandwidth among all connected devices
- Provides status and control information



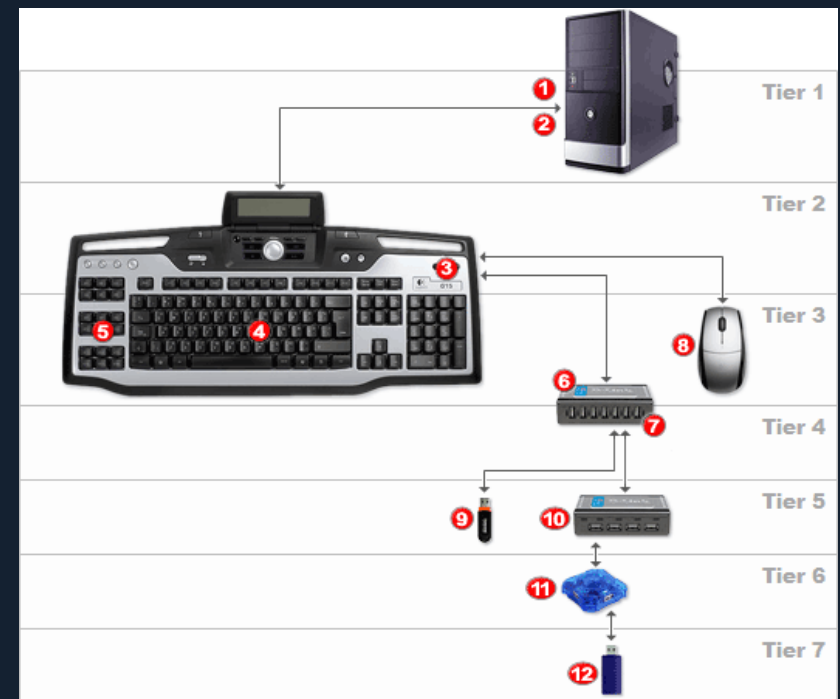
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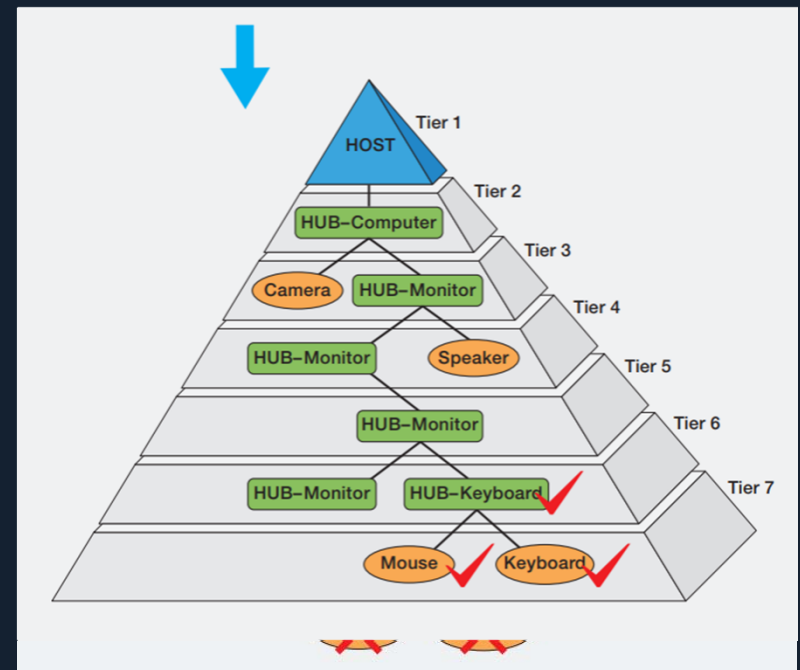
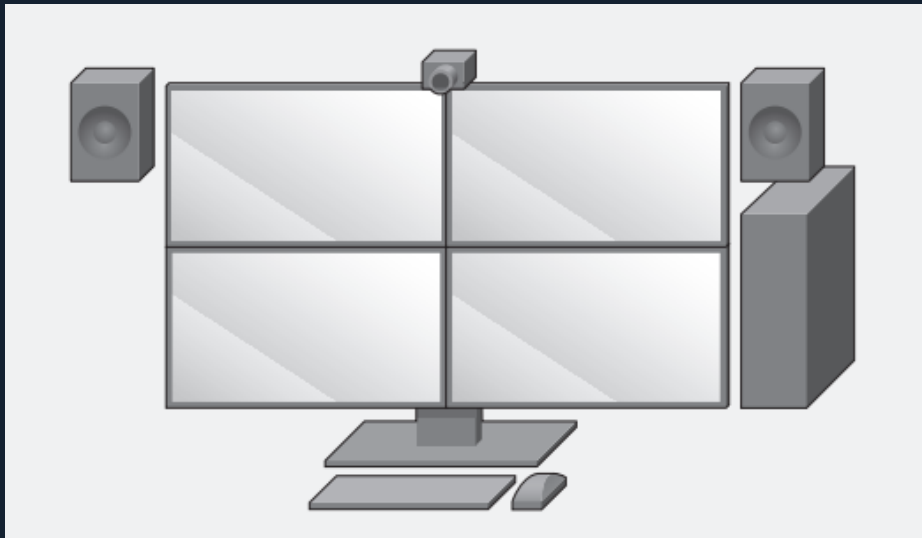


USB Topology

- Broken down into Tiers
- USB cable length is limited by the speed of electrical signals
- Tiered star topology has a max of seven tiers of communication
- Compound vs composite devices



Cascading Hub Limits



Source to Display

EDID and HDCP



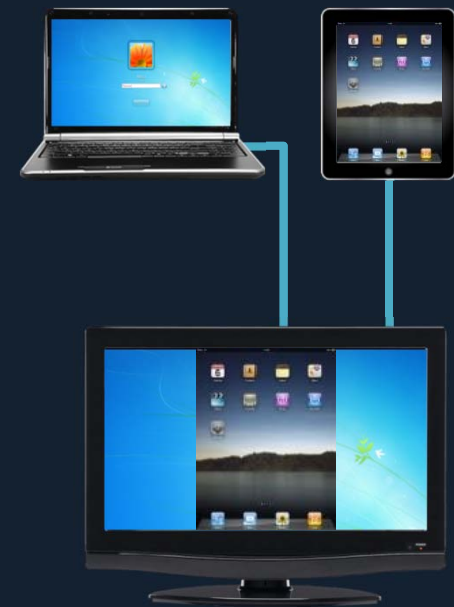
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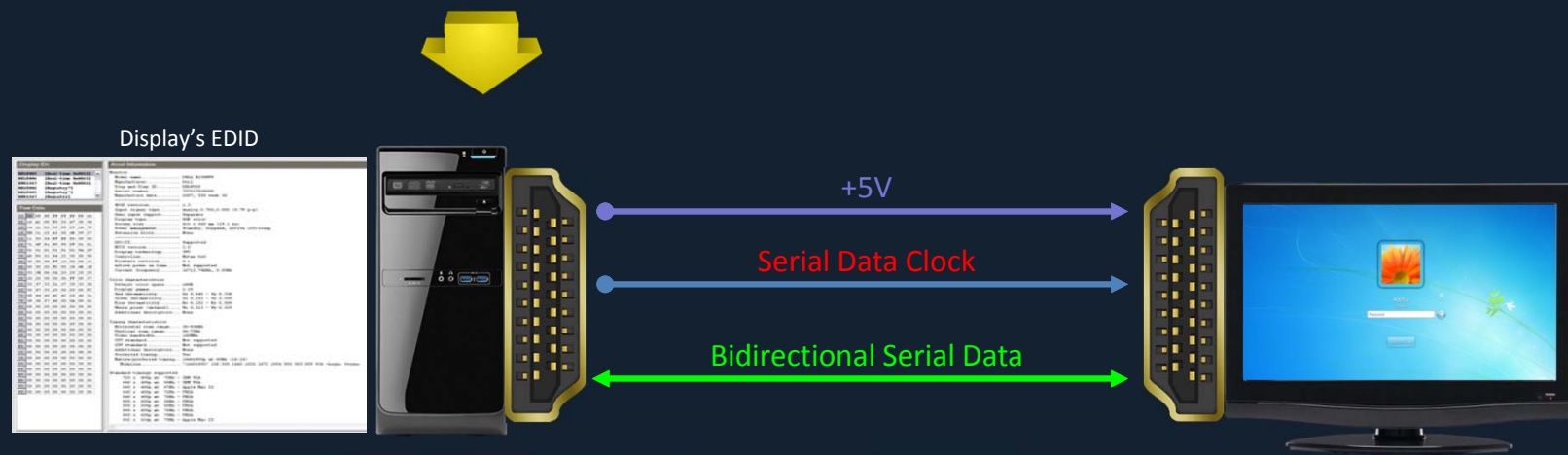
EDID – Extended Display Identification Data

- EDID contains the following information:
 - Sink identity – device type, model number, etc.
 - Sink capability – video/audio
 - › Video timing parameters, color space, audio formats, etc.



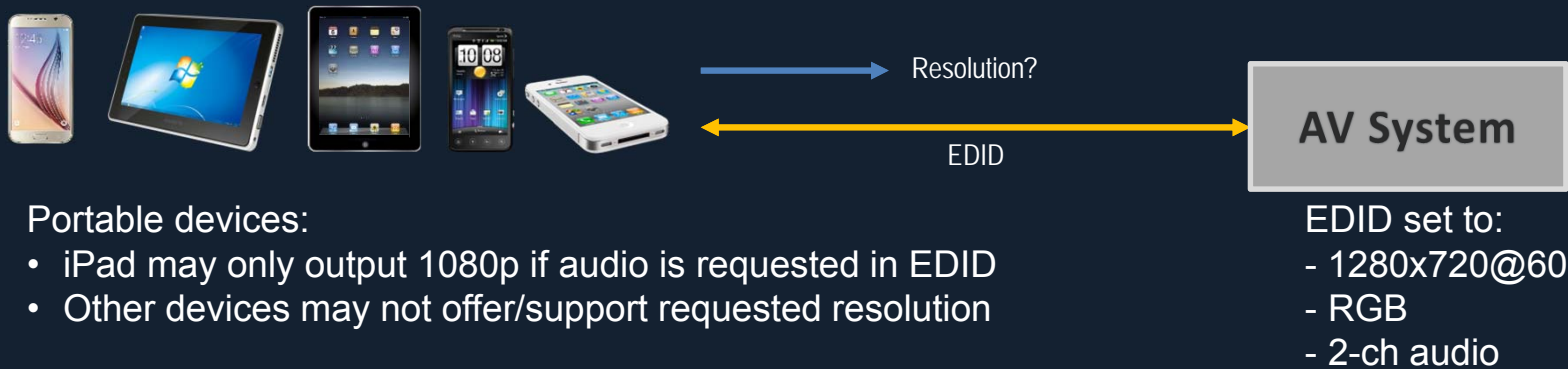
EDID – Sequence

1. Power on PC or activate external graphics card
2. Computer requests EDID data from display
3. Display sends EDID data to computer
4. Computer attempts to match display parameters



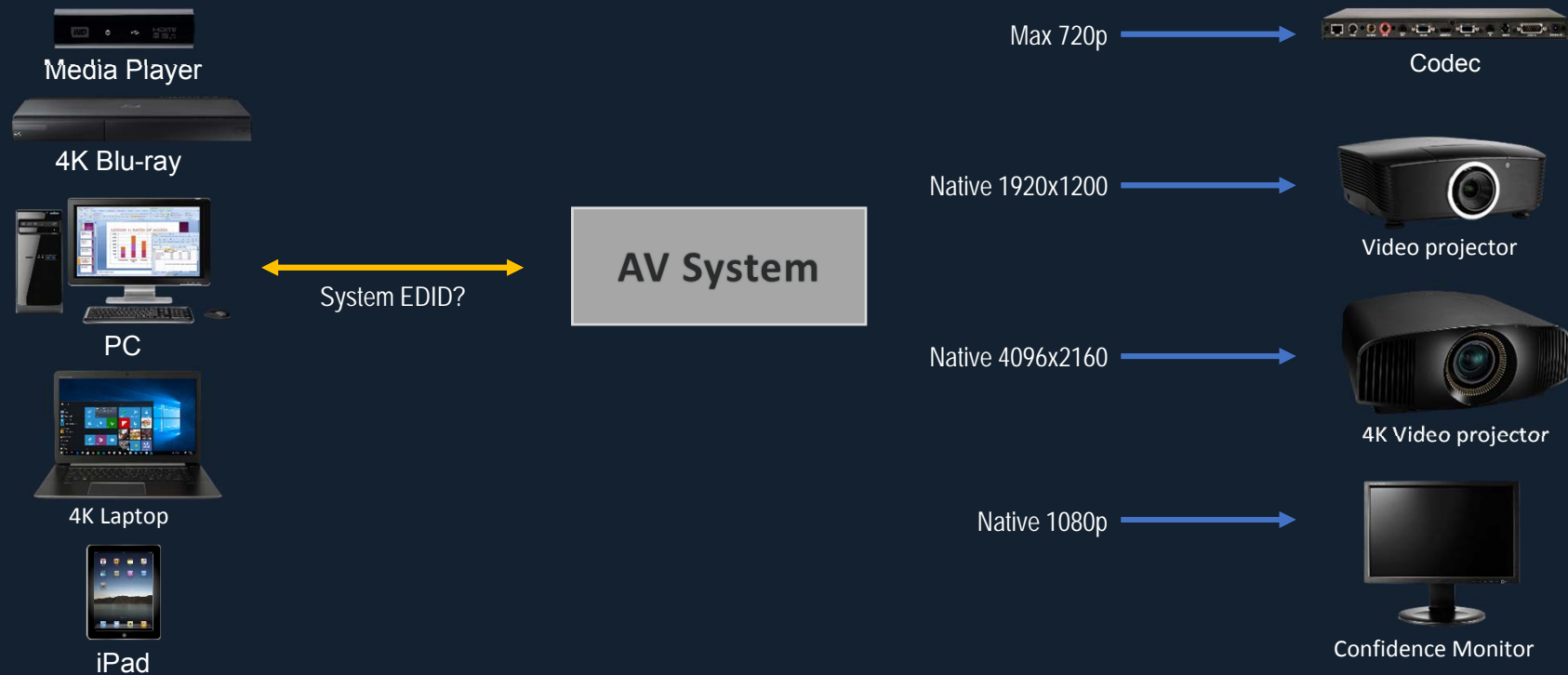
AV System Disparities

- BYOD equipment
 - How do they respond to EDID?



AV System Disparities

- Display's native resolution versus other equipment
 - How to choose?

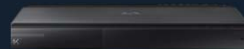


HDCP – High-bandwidth Digital Content Protection

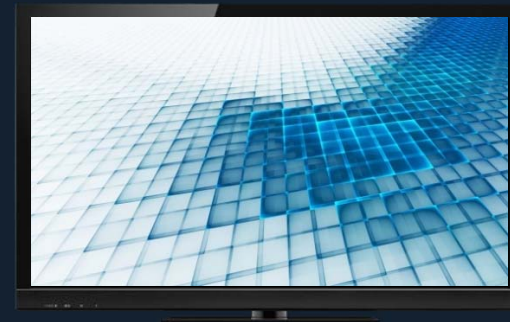
- HDCP protocol is a 3-phase process
 - Authentication
 - Content encryption
 - Renewability
- This can take a few moments depending on the number of downstream devices



DVD Player



Blu-ray with HDMI



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HDCP

- Most collaboration spaces don't have Blu-Rays or Cable Tuners
- You will have to worry about Apple , Recording and VTC products



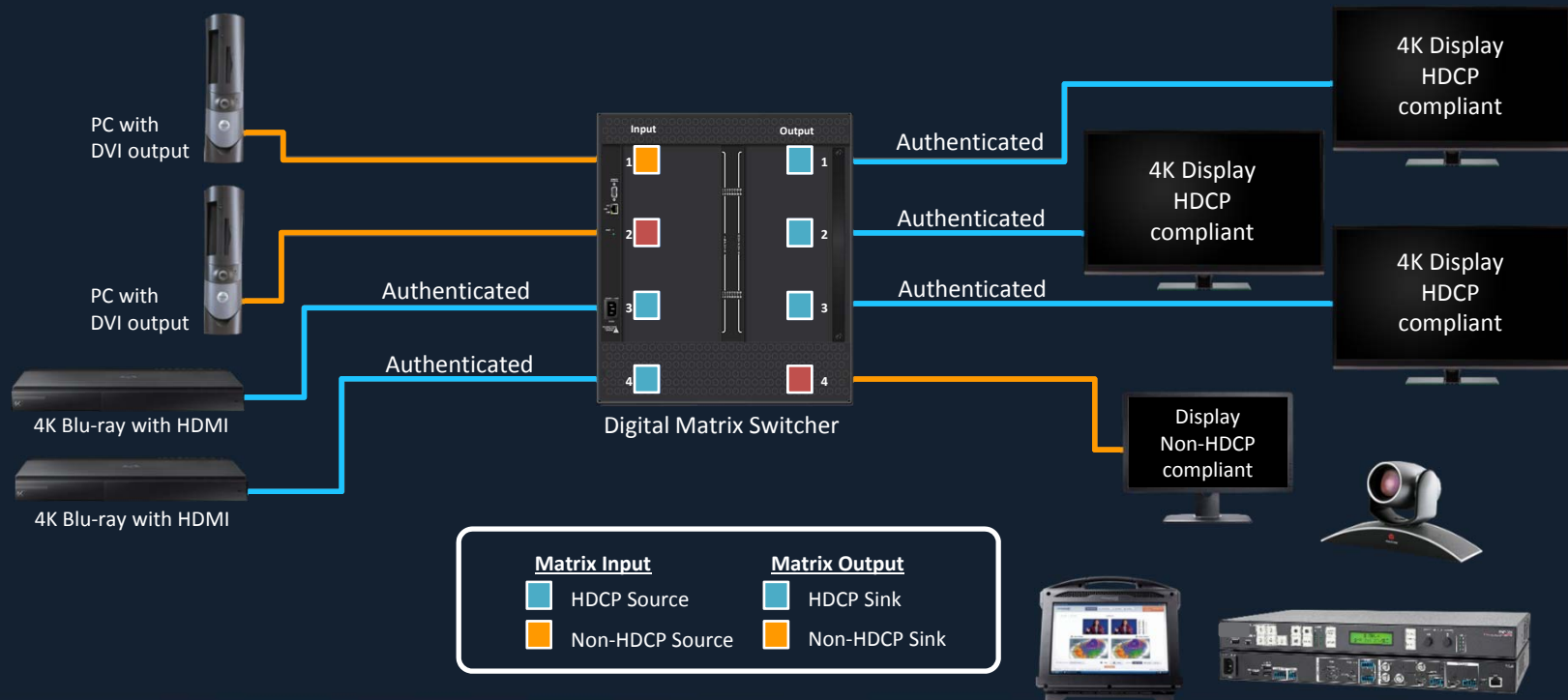
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HDCP Handshakes

o I/O authentication



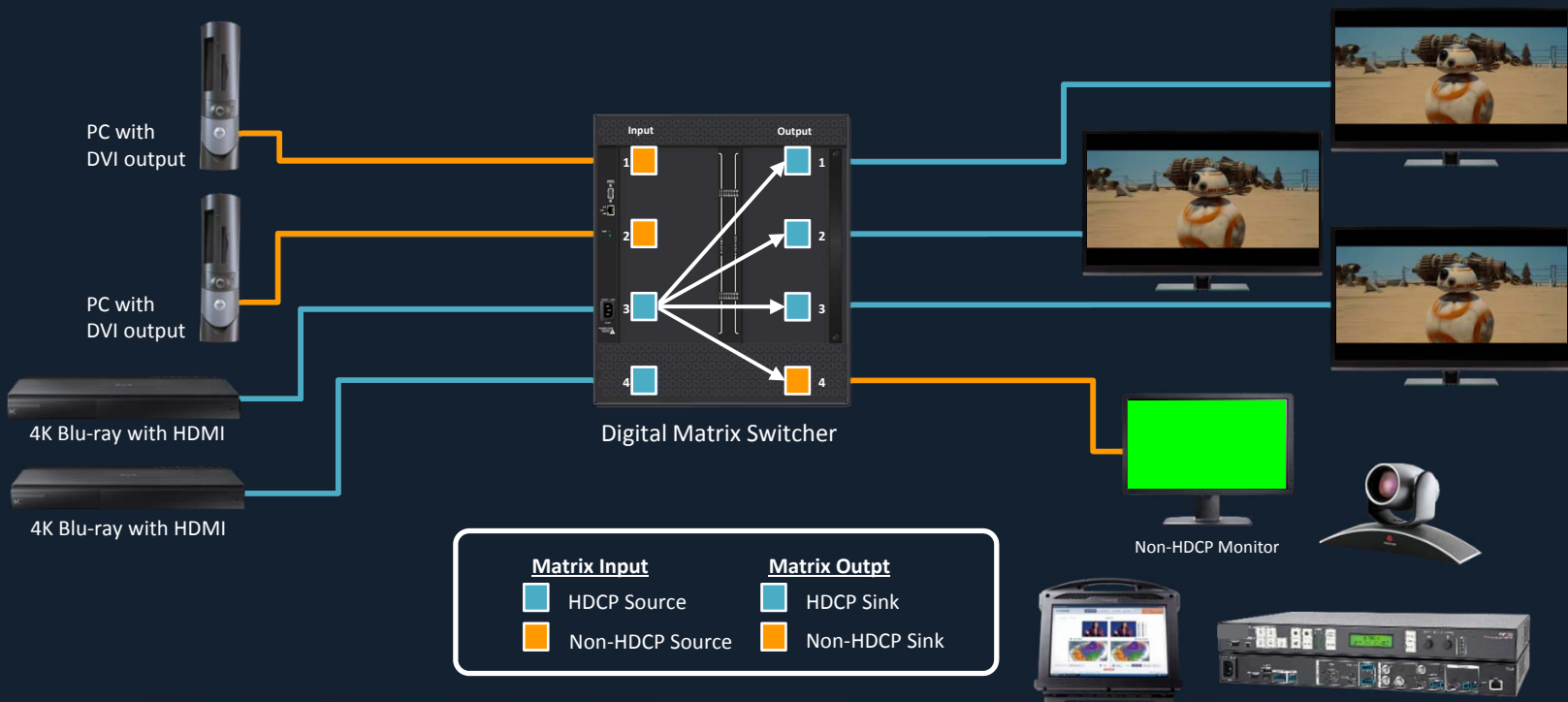
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HDCP Handshakes With Products That Are Not HDCP Compliant

- Visual confirmation



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Uncompressed Video Over Twisted Pair



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HDBaseT

- HDBaseT Alliance, is a consumer electronic (CE) and commercial connectivity standard for transmission of uncompressed high-definition video (HD), audio, power, home networking.



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Twisted Pair Transmission

- Distance
 - 328 feet (100 meters) between endpoints



Twisted Pair Transmitter
for HDMI



Twisted Pair Receiver
for HDMI

328 feet/100 meters

Why Use Twisted Pair?

- One twisted pair cable can carry multiple signals
 - Video
 - Audio
 - Bidirectional RS-232 control and IR
 - Ethernet
 - Remote Power



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Twisted Pair Transmission

- Cable

- Supports CATx cable
- Solid conductor, shielded twisted pair cable with shielded connectors should always be used
- Skew-free cable ***should not*** be used with XTP Systems



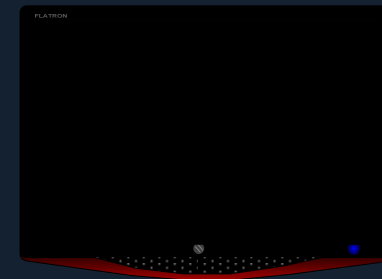
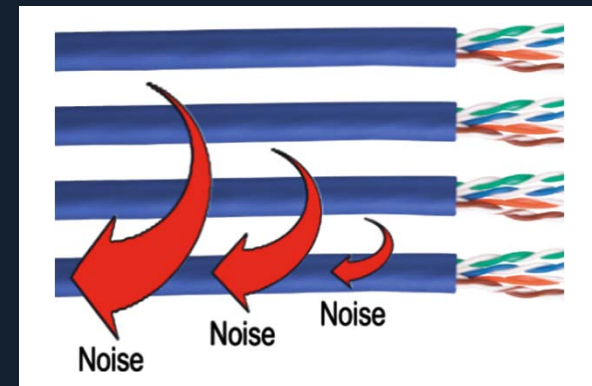
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Twisted Pair Signal Transmission

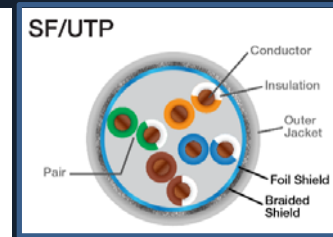
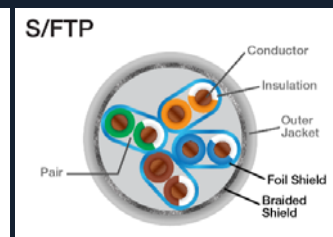
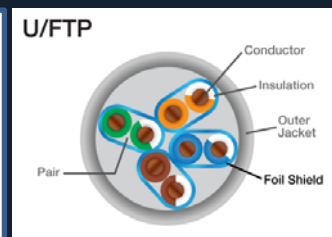
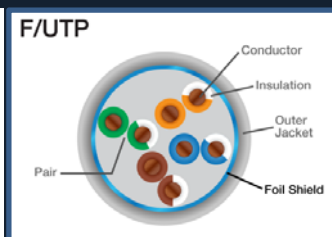
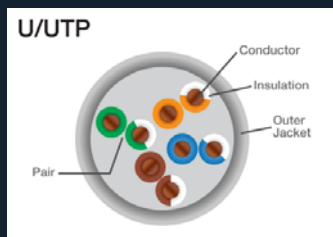
- Shielded cable protects against outside interference from:
 - Air conditioning units
 - Power from adjacent cabling
 - Crosstalk from other cables or within the same cable
 - Radio interference from walkie-talkies
- Symptoms of noisy environments
 - Image drop-out or flashing
 - No image at all



Twisted Pair Shielding

- o Different types of twisted pair shielding

Cable Name	Outer Shielding	Individual Pair Shielding
U/UTP	None	None
F/UTP	Foil	None
U/FTP	None	Foil
S/FTP	Braided	Foil
SF/UTP	Braided & Foil	None



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Twisted Pair Signal Transmission

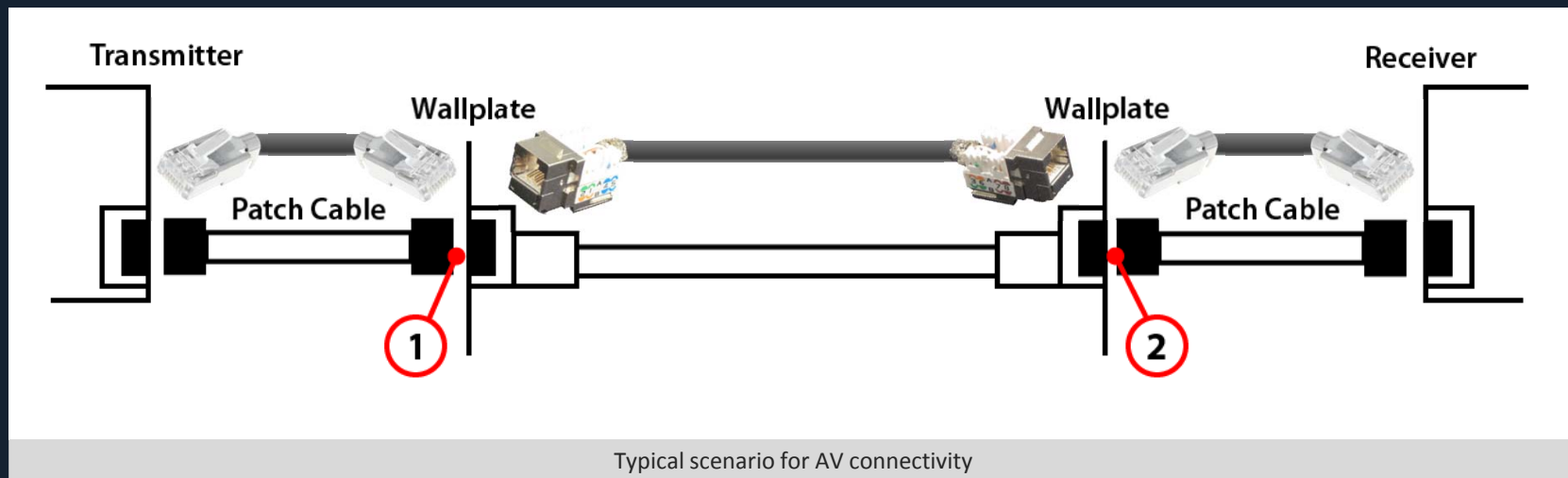
- Types of Category cable

Cable	Gauge	Conductor	Outer Shield	Pair Shielding	Required Bandwidth	Crosstalk Loss
CAT 5e (U/UTP)	24	Solid	None	None	100 MHz	~27dB
CAT 5e (F/UTP)	24	Solid	Foil	None	100 MHz	~27dB
CAT 6 (U/UTP)	24-23	Solid	None	None	250 MHz	~37dB
CAT 6 (STP)	24-23	Solid	Foil	None	250 MHz	~37dB
CAT 6a (U/UTP)	24-23	Solid	None	None	500 MHz	~37dB
CAT 6a (F/UTP)	24-23	Solid	Foil	None	500 MHz	~37dB
CAT 6a (U/FTP)	24-23	Solid	None	Foil	500 MHz	~37dB
CAT 6a (SF/UTP)	24	Solid	Braid and Foil	None	500 MHz	~37dB
CAT 7 (S/FTP)	24	Solid	Braid and Foil	Foil	600 MHz	~60dB
CAT 7a (S/FTP)	24	Solid	Braid and Foil	Foil	1 GHz	~60dB



Twisted Pair Installation

- Cable infrastructure and patch points
 - Up to 2 patch points recommended



Wireless Technologies

Compressed and Uncompressed

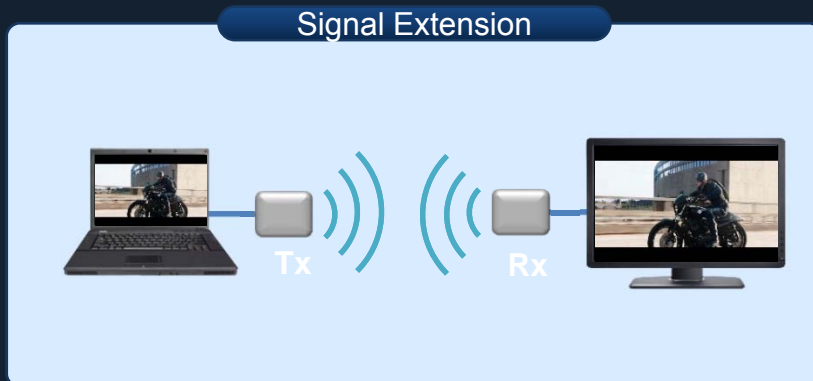


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Wireless Video Applications



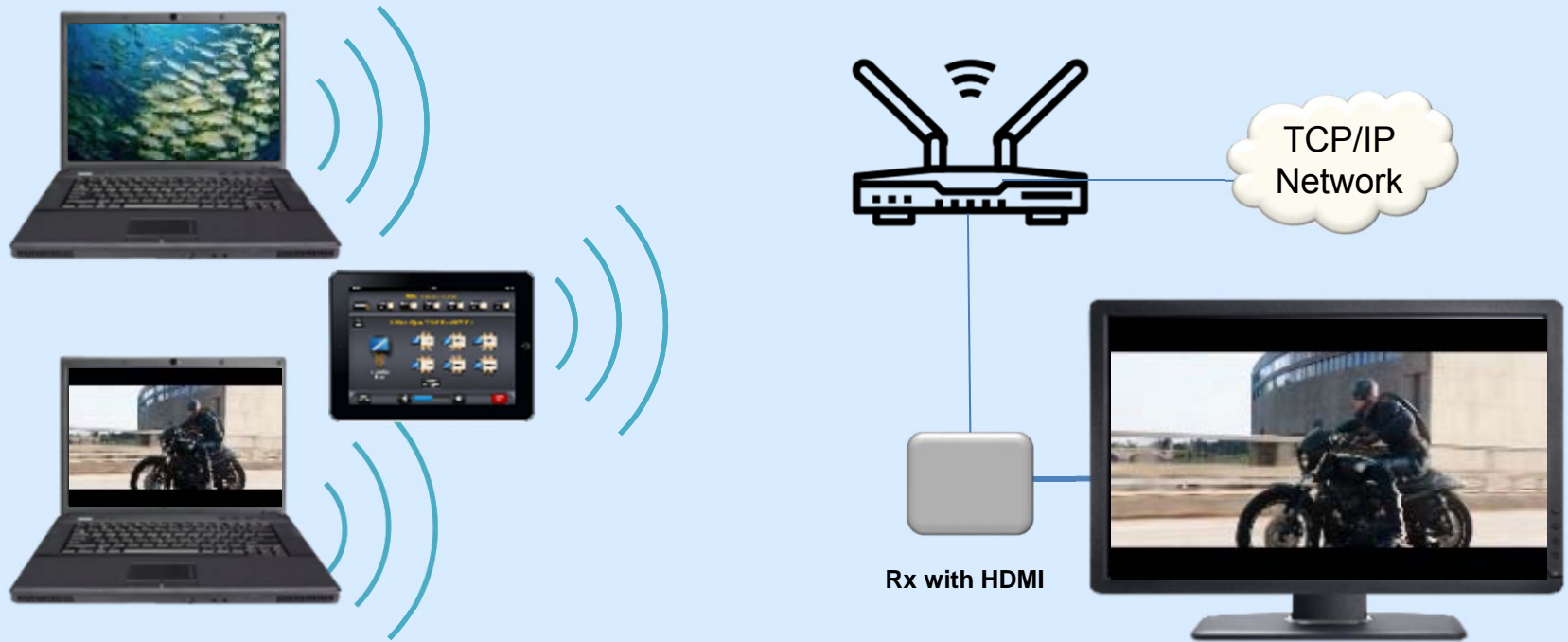
- Point-to-point applications where source video signal is converted to a modulated RF signal for wireless transmission to a receiver connected to a display



- BYOD applications where computing device encodes and transmits video content over a Wi-Fi network to a receiver connected to a display



Collaboration with their WAP



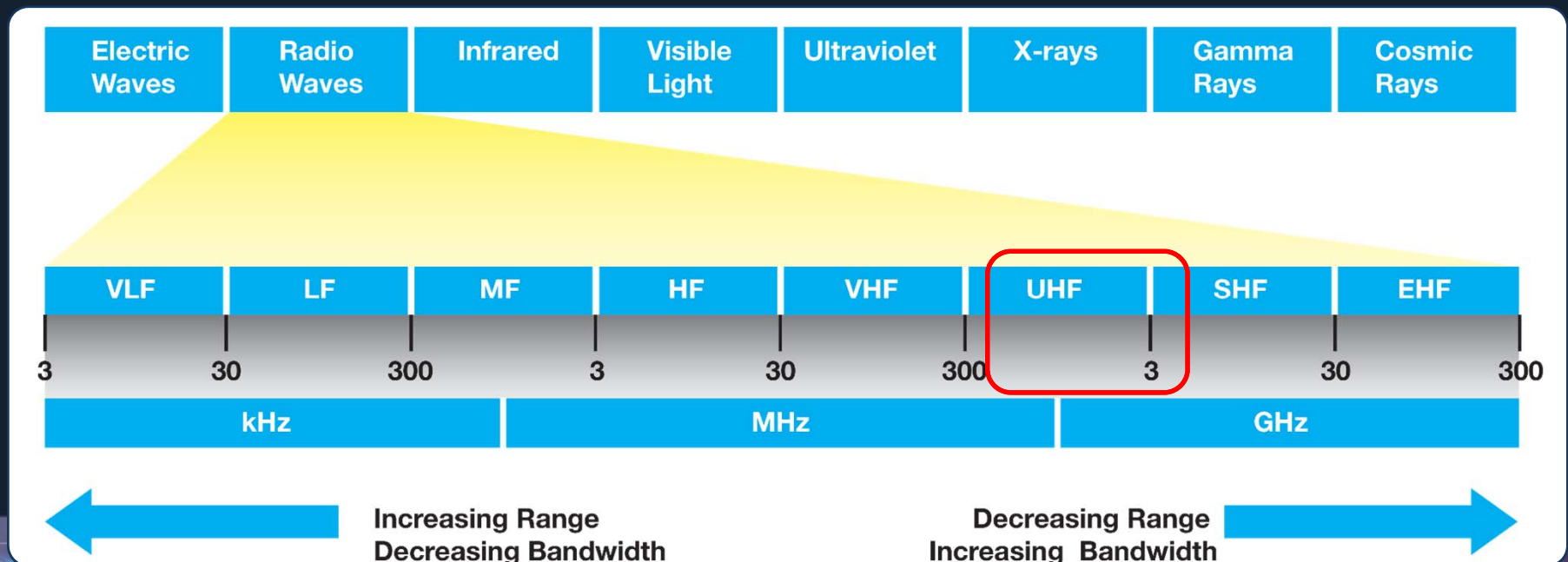
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Radio Frequency Spectrum

- 500MHz to 5GHz balances capacity and range
- Transmits through common obstacles, such as walls, with low to moderate loss

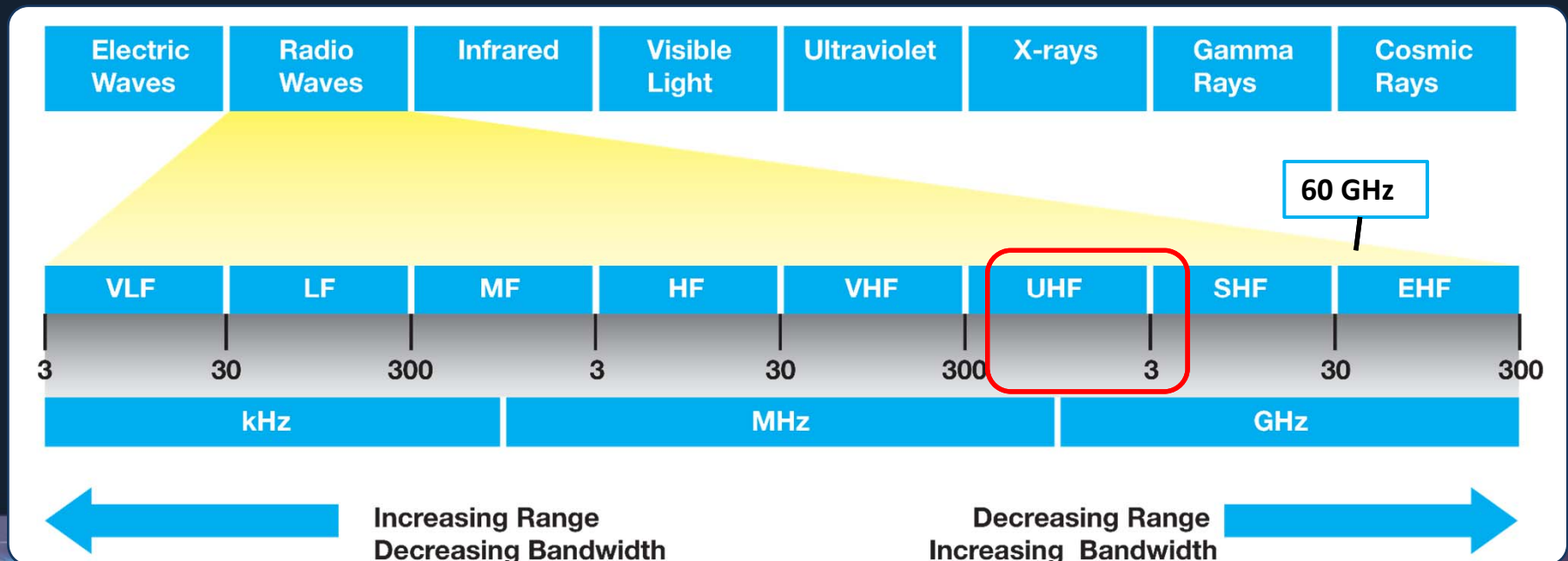


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Radio Frequency Spectrum

- 60 GHz used for higher data carrying capacity
 - Cannot penetrate solid objects
 - Short range



Proprietary Wireless Protocols

Wireless Interface	Frequency Band	Computing Hardware Required	Uncompressed Video
AirPlay	Wi-Fi	Apple Products	No
Chromecast	Wi-Fi	PC, tablet, smartphone	No
Miracast	Wi-Fi	PC, tablet, smartphone	No
WiDi	Wi-Fi	Intel Products	Yes
WiGig	Wi-Fi, 60 GHz	PC, tablet, smartphone	Yes
UWB	3.1 – 10.6 GHz	None	Yes
WHDI	5 GHz	None	Yes
WirelessHD	60 GHz	None	Yes



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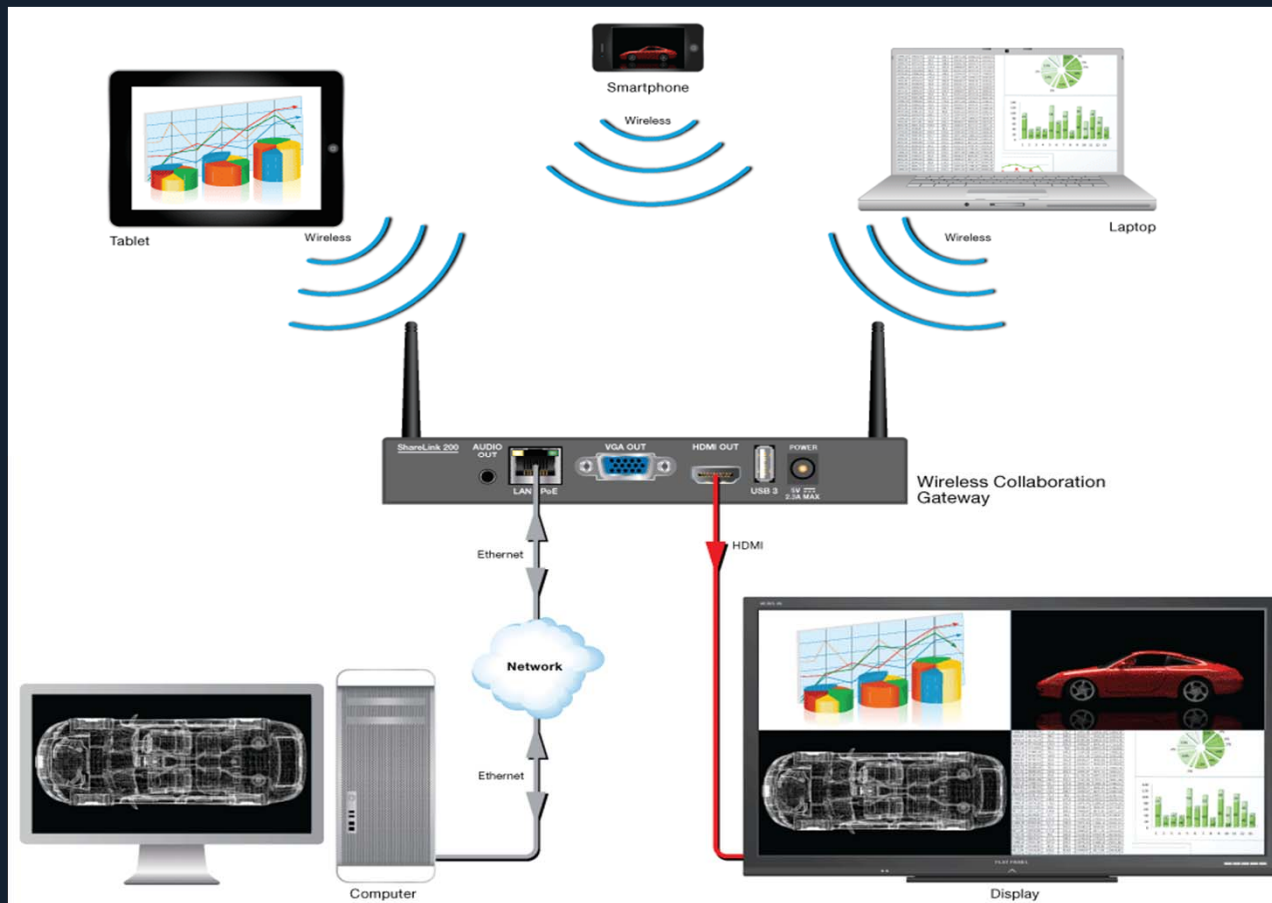


Using Your Own WAP

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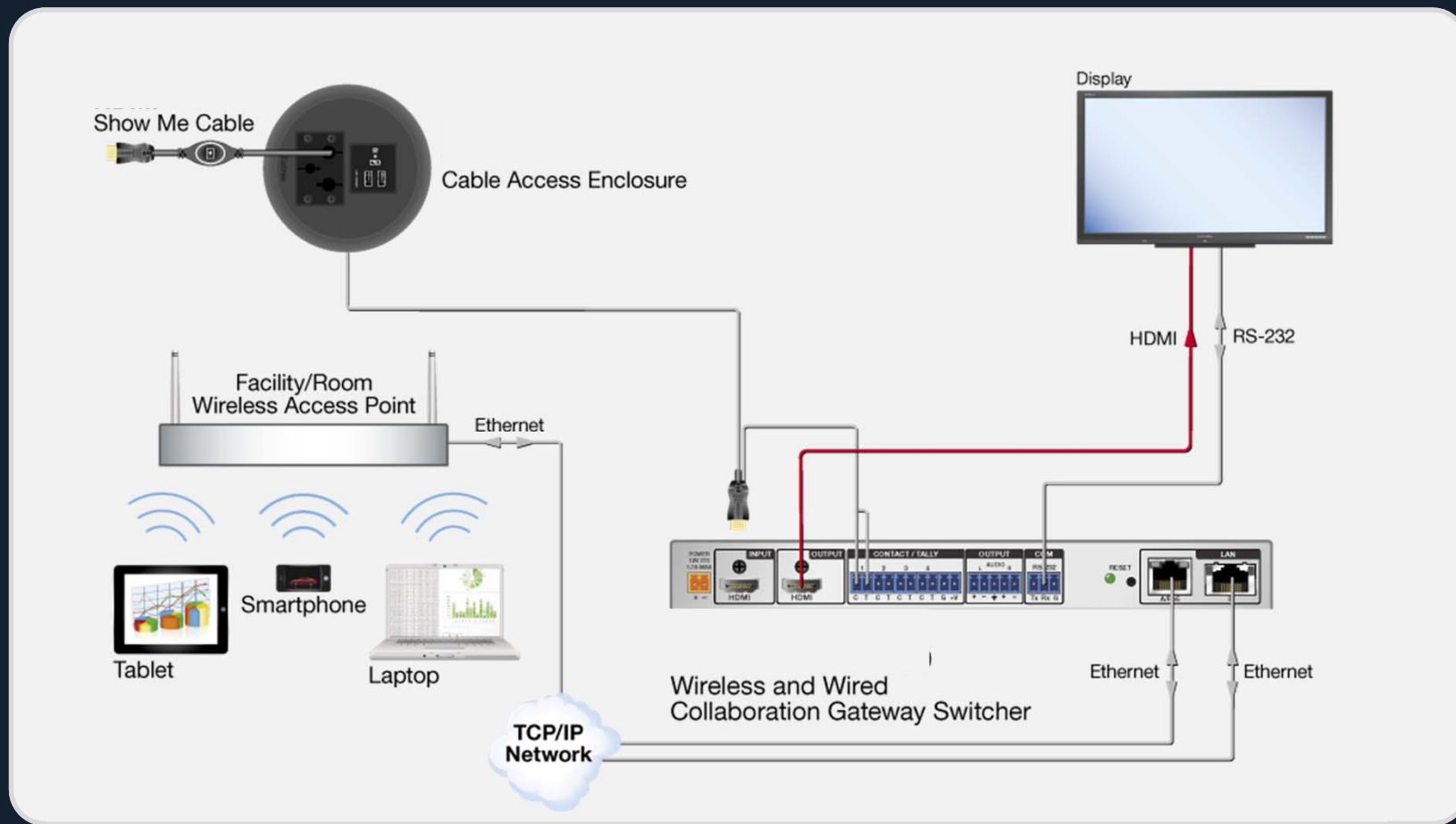


Using Their WAP

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Key Features to have in a Wireless Video Platform

- Easy Wireless and Wired Collaboration

- Wireless connections via OS mirroring or app
- Wired connections via HDMI Input
- Contact/Tally I/O ports
 - › Add Motion Sensor
 - › Add Button control

- Multi-Platform Support

- Mac / Windows runtime or installed app
- Android / iOS app
- Apple & Android mirroring



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Conference Interface



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Multiple Types of Devices

- Networks need to be capable of handling multiple types of devices and environments where BYOD is common



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Table connectivity including Power and USB charging



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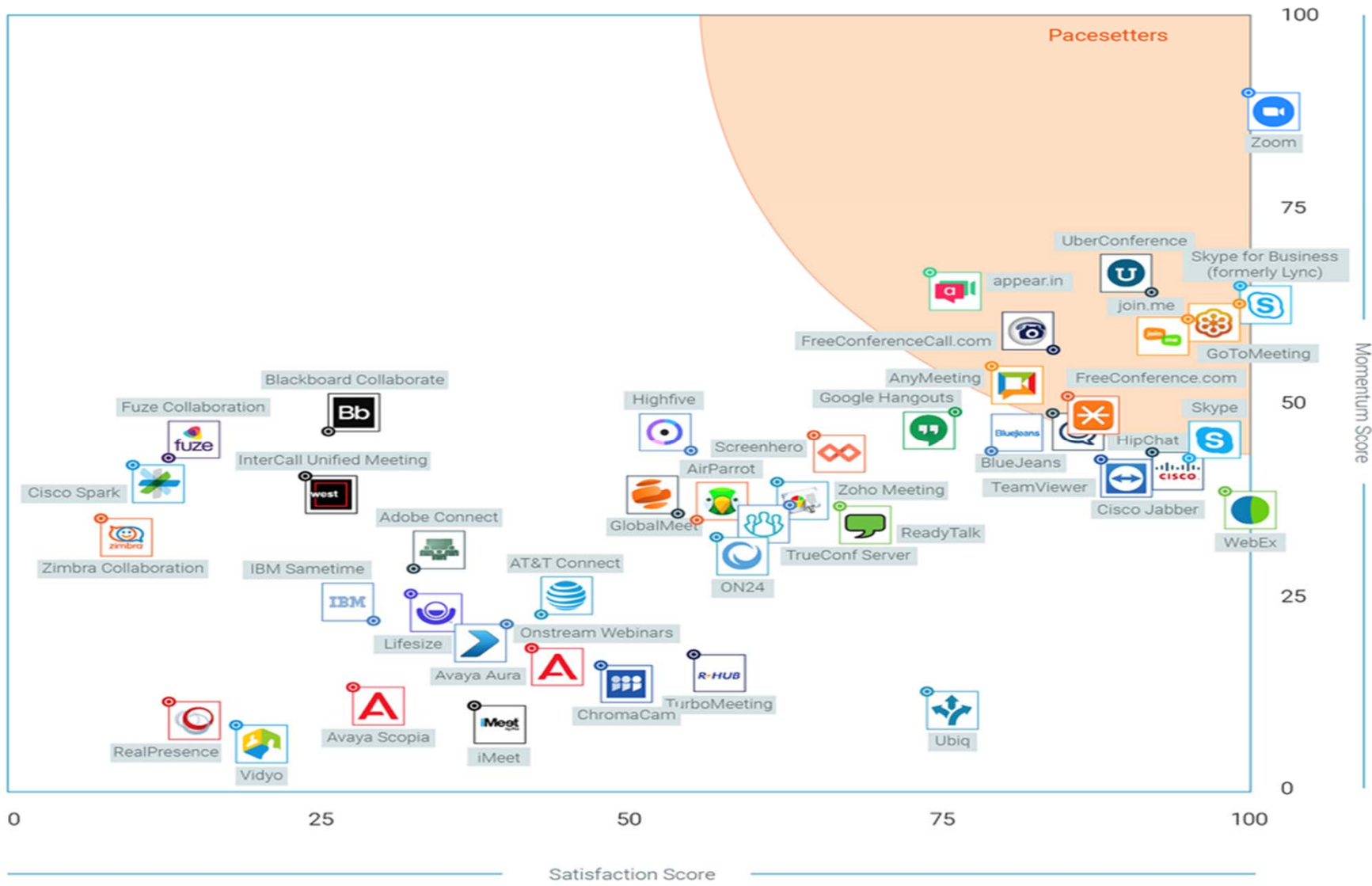
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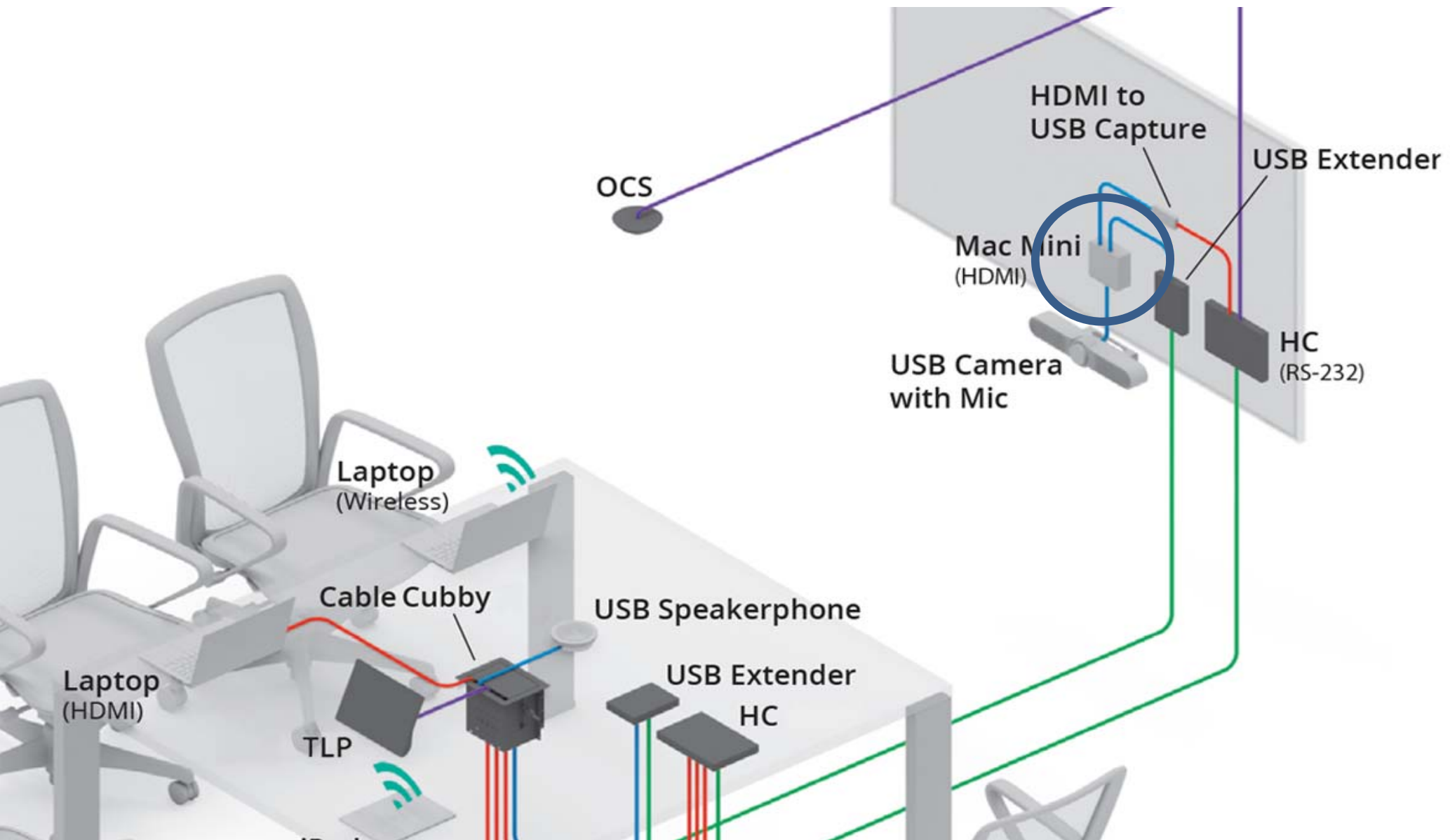
Seamless Conferencing Experience



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Control

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Motion Sensor or Timed System

Meeting Space Collaboration System



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How a timer works



Recurrence Pattern

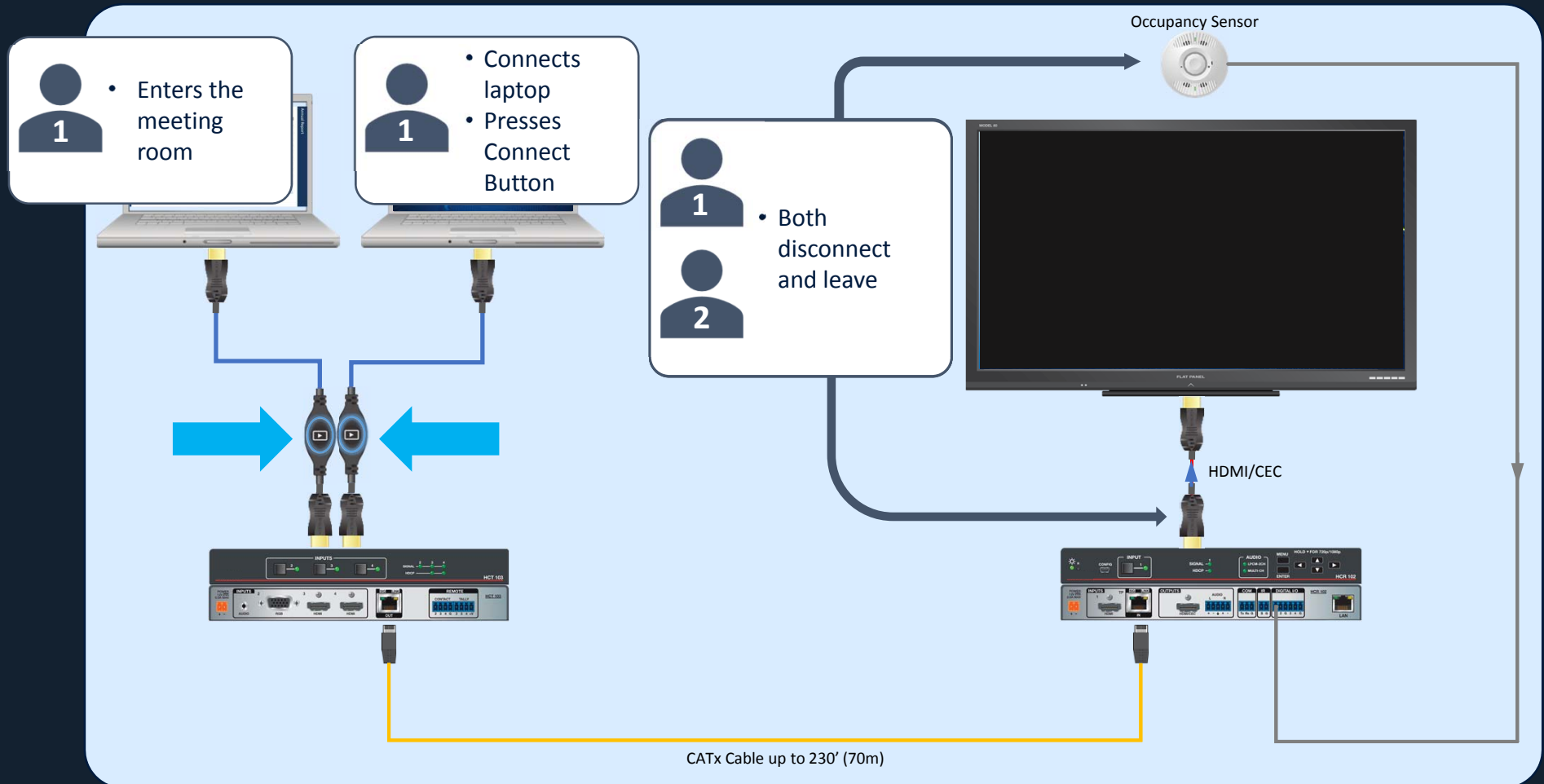
<input checked="" type="checkbox"/> Enabled	Time	Recurrence Pattern				
<input checked="" type="checkbox"/>	5:00 PM	Weekdays				
Mon	Tue	Wed	Thu	Fri	Sat	Sun

Actions

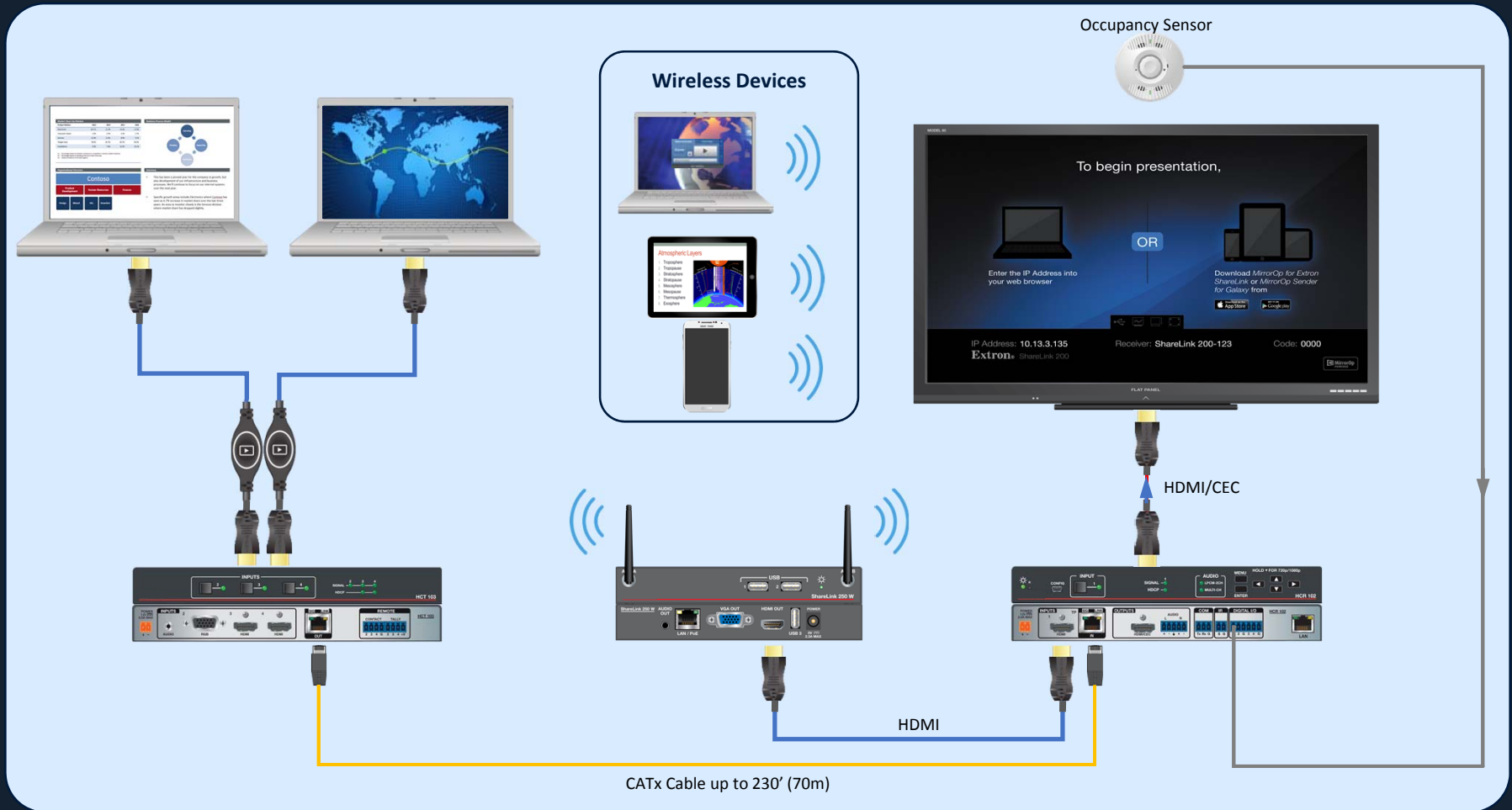
IPCP Pro 360 Invoke Macro (Macro Shutdown)



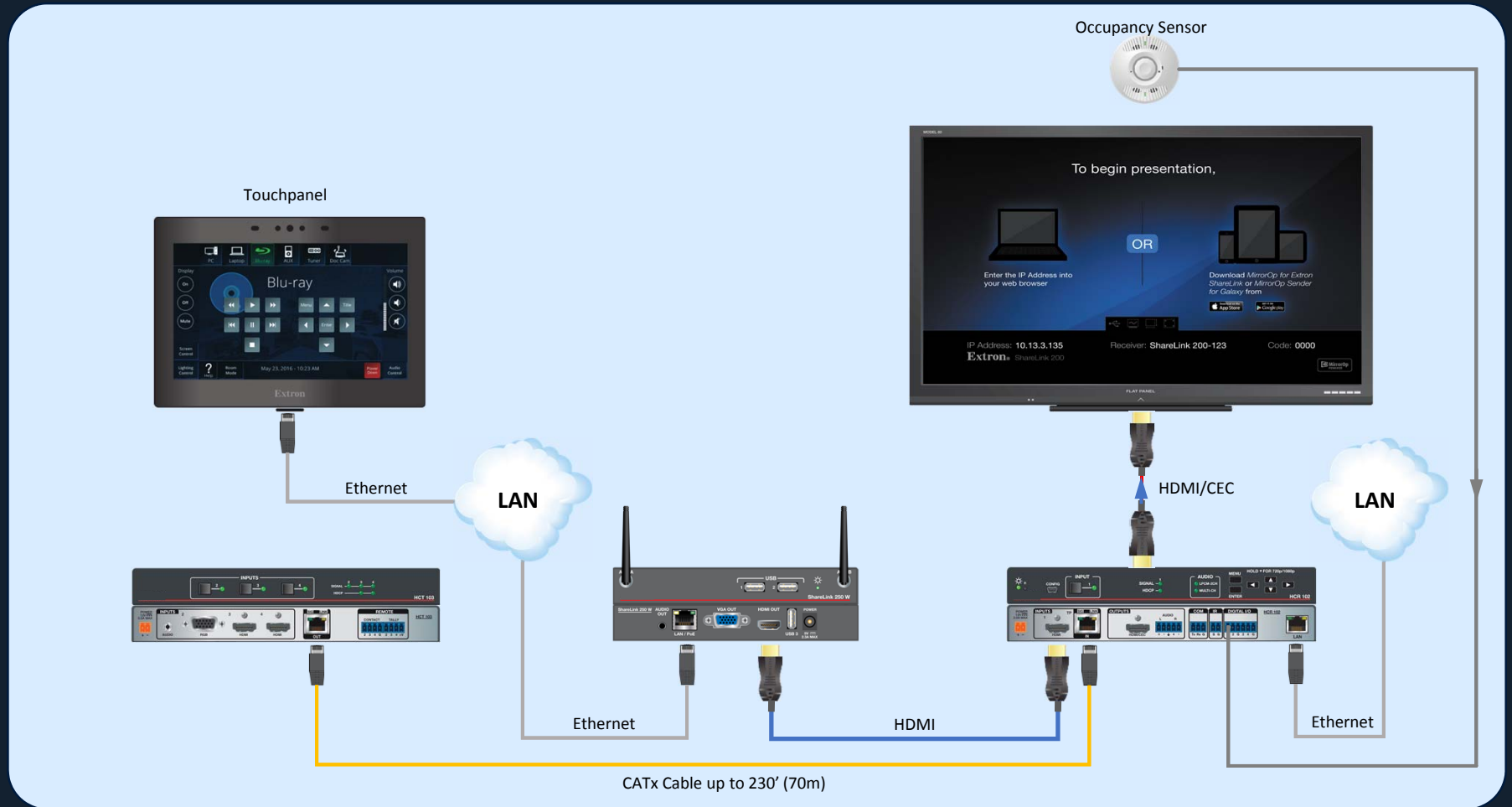
TeamWork System with Show Me Cables



Upgrade Options – Wireless Connectivity



Upgrade Options – Touchpanel Control



Push Button Controllers

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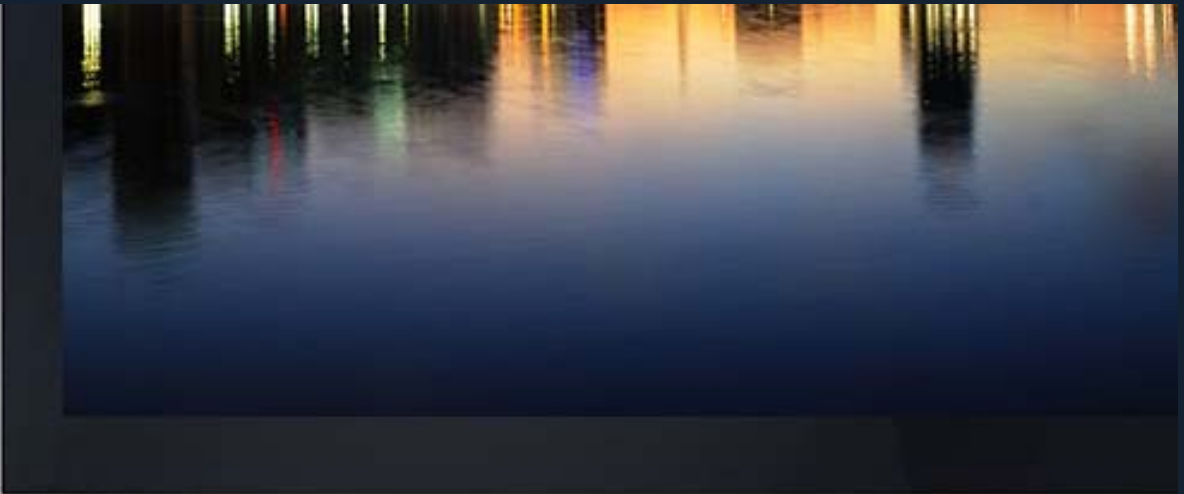


These do NOT count!



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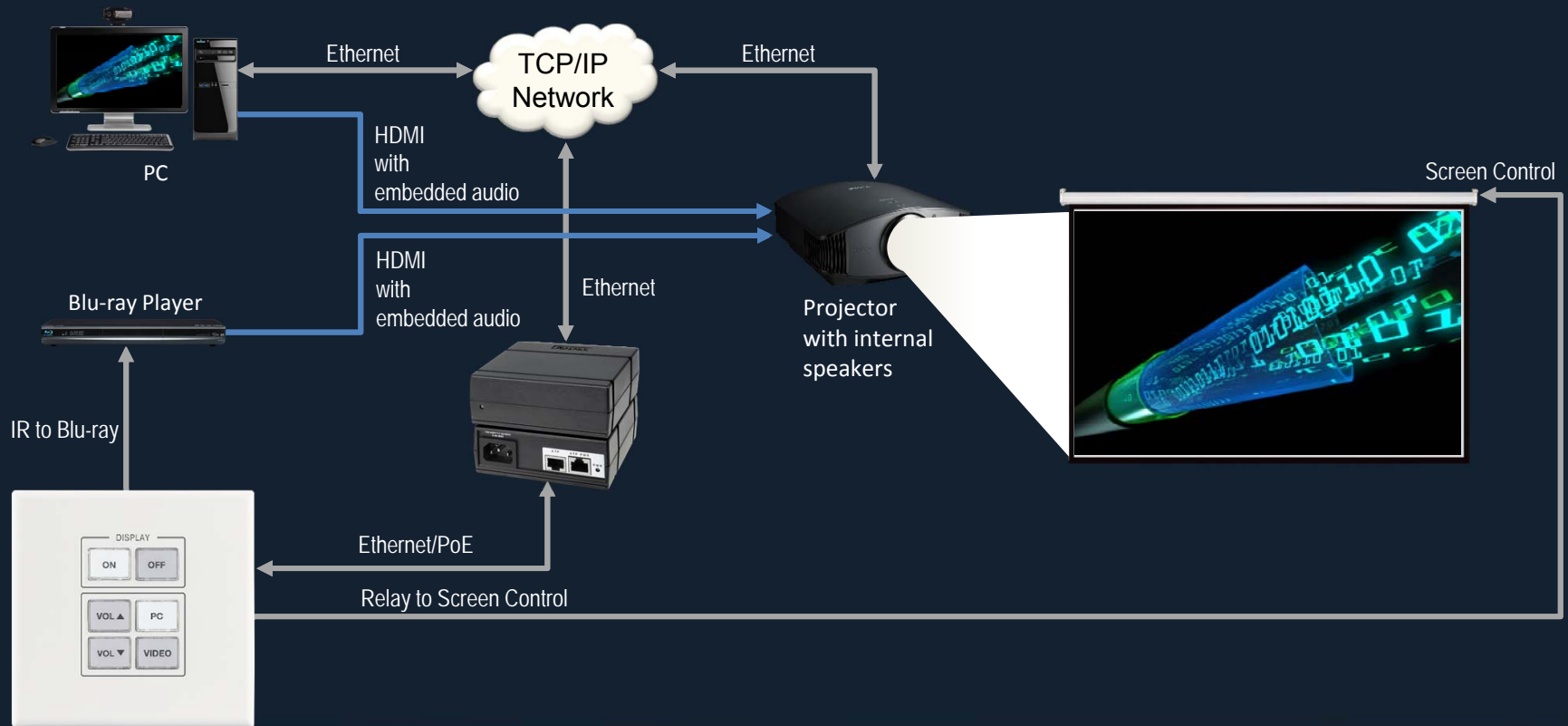


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Single Display Application



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Features of PUSH –Button controllers

- Manage, monitor, and control AV devices using a standard Ethernet network
- Fully configurable ...NO Programming
- Two bidirectional RS-232 ports
- Two relays for controlling room functions
- One IR port for connecting up to two emitters
- Remote volume control port for external third-party AMPS



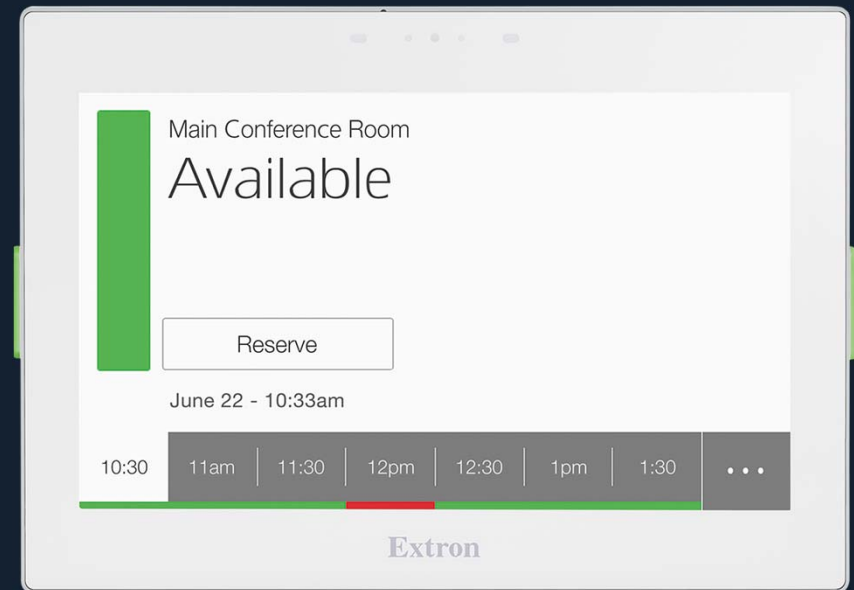
Room Scheduling



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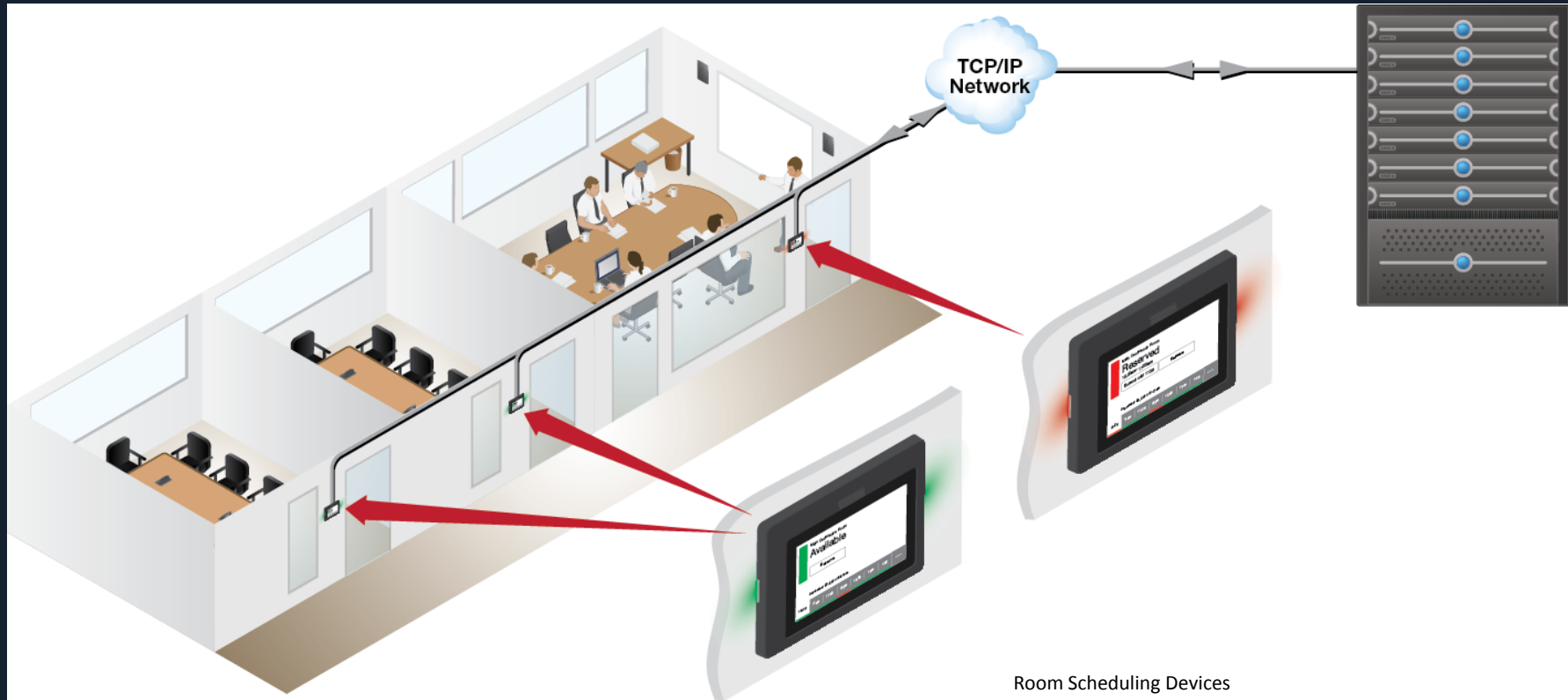
Room Scheduling Panels



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Room Scheduling



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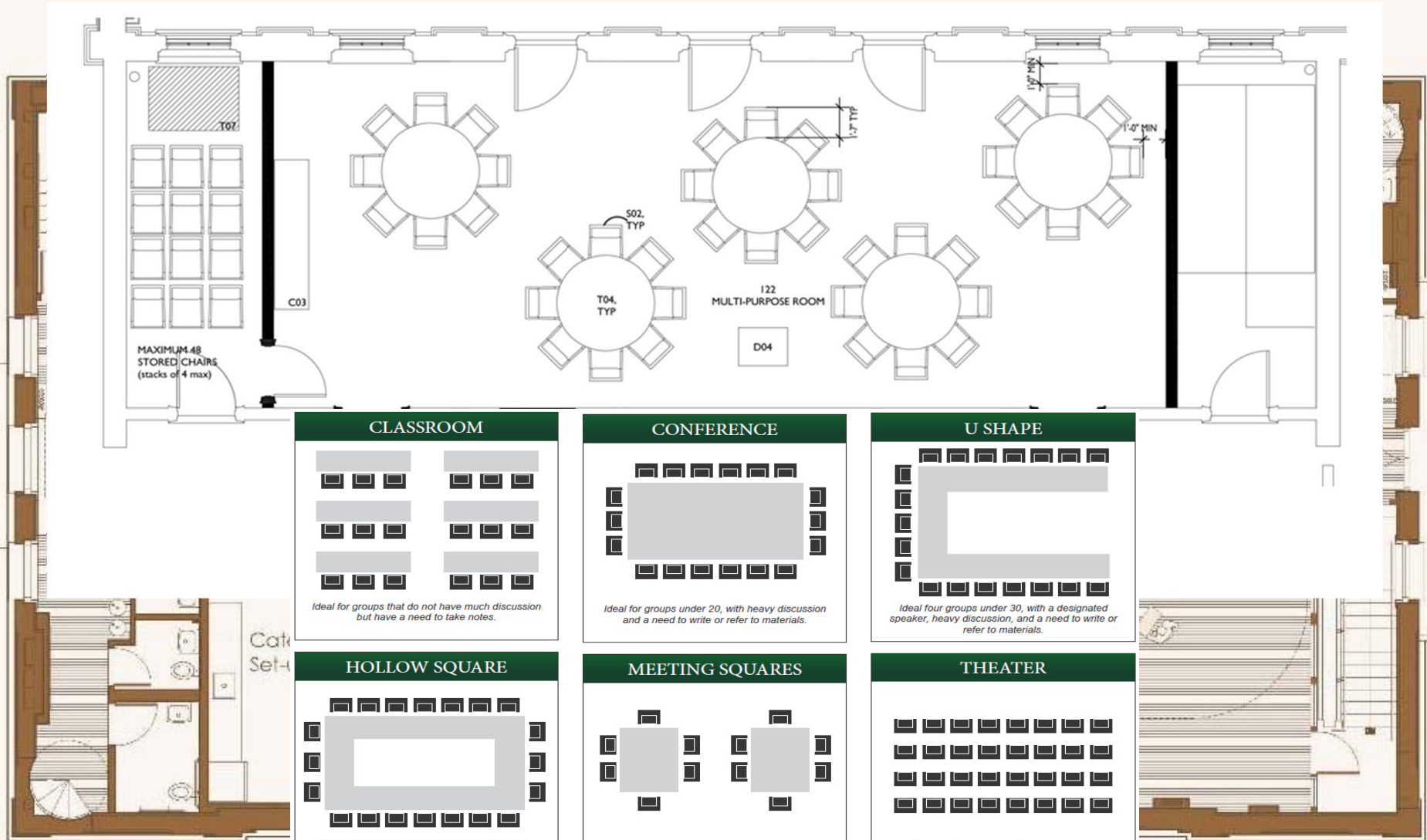
Designs



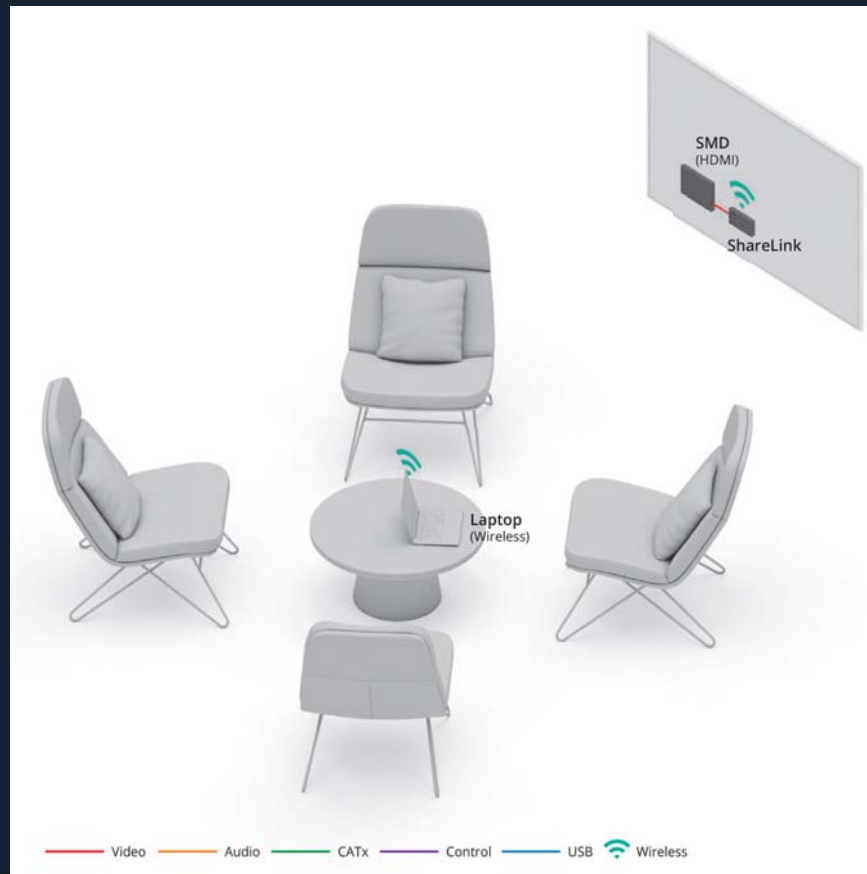
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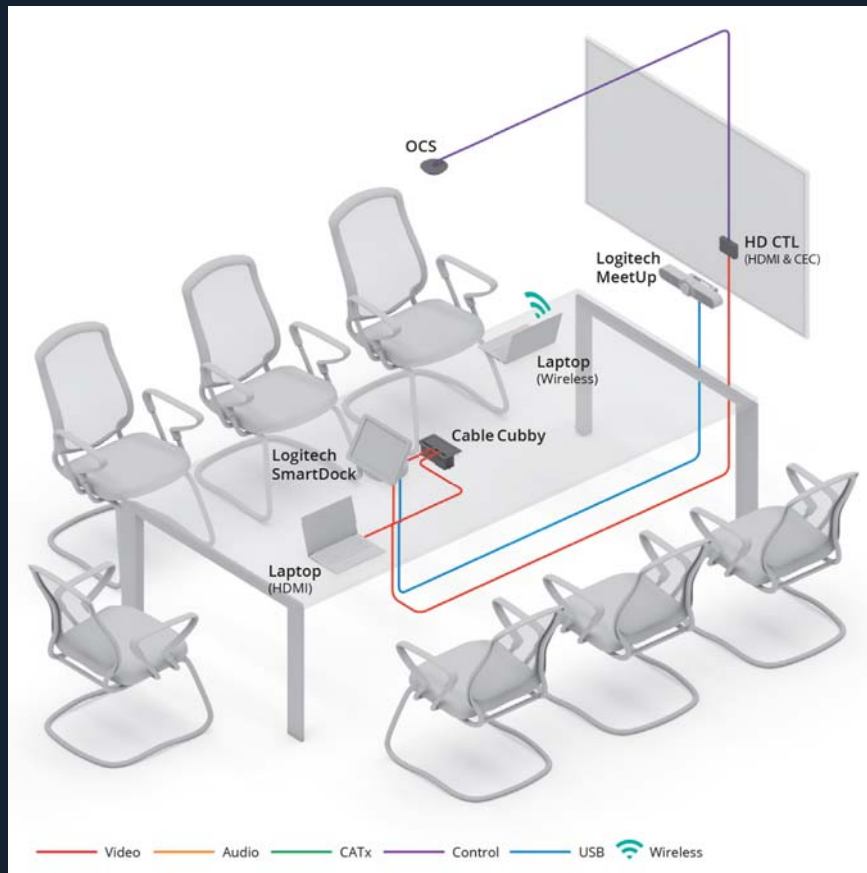


Equipment



- Wireless only
- No power at Table

Equipment



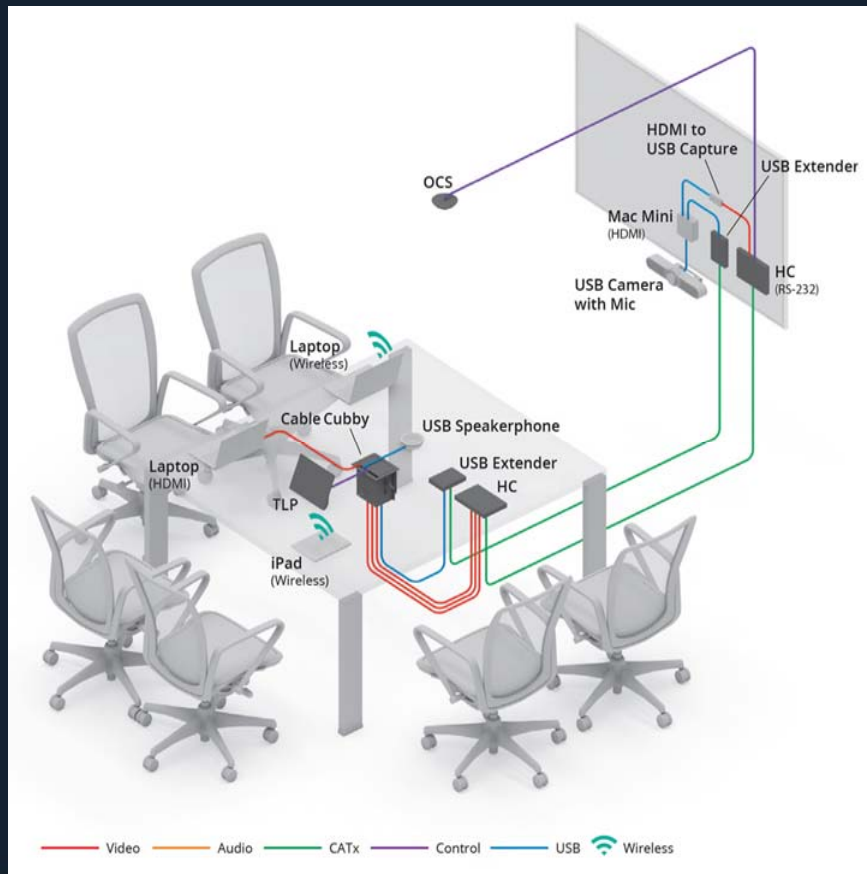
- Cable Table system
- Controller
- Occupancy Sensor
- Shielded CAT 6a



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Equipment



zoom

logitech

cisco

Google

Microsoft

DOLBY

StarLeaf

Polycom™

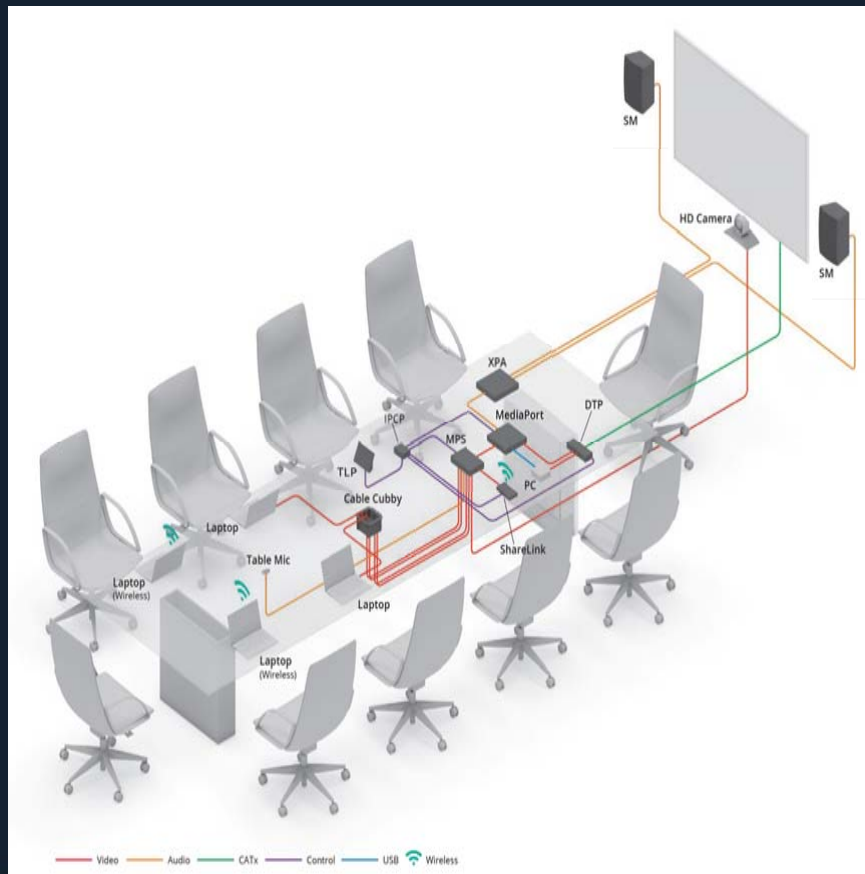
lifesize

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Equipment



- Shielded CAT x cables
- HDMI switcher
- Four Input HDMI Switcher
- HDMI and Audio to USB Scaling
- Wireless Collaboration Gateway
- Tabletop Touch Panel
- Control Processor
- Stereo Amplifier - 100 Watts/Channel
- Speakers

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The Modern Workspace

-Thank You-
Karl Rosenberg



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