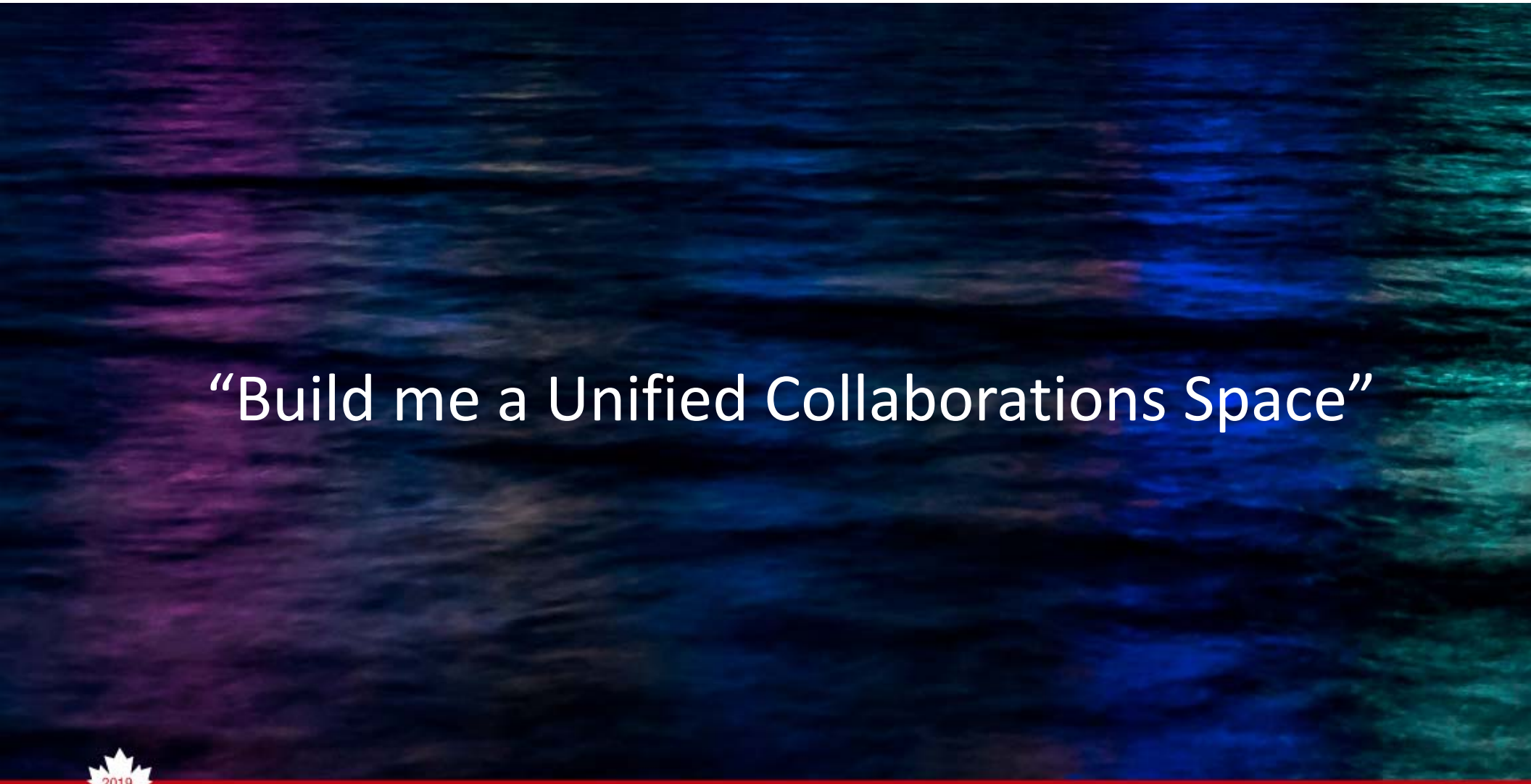
The Modern Workspace

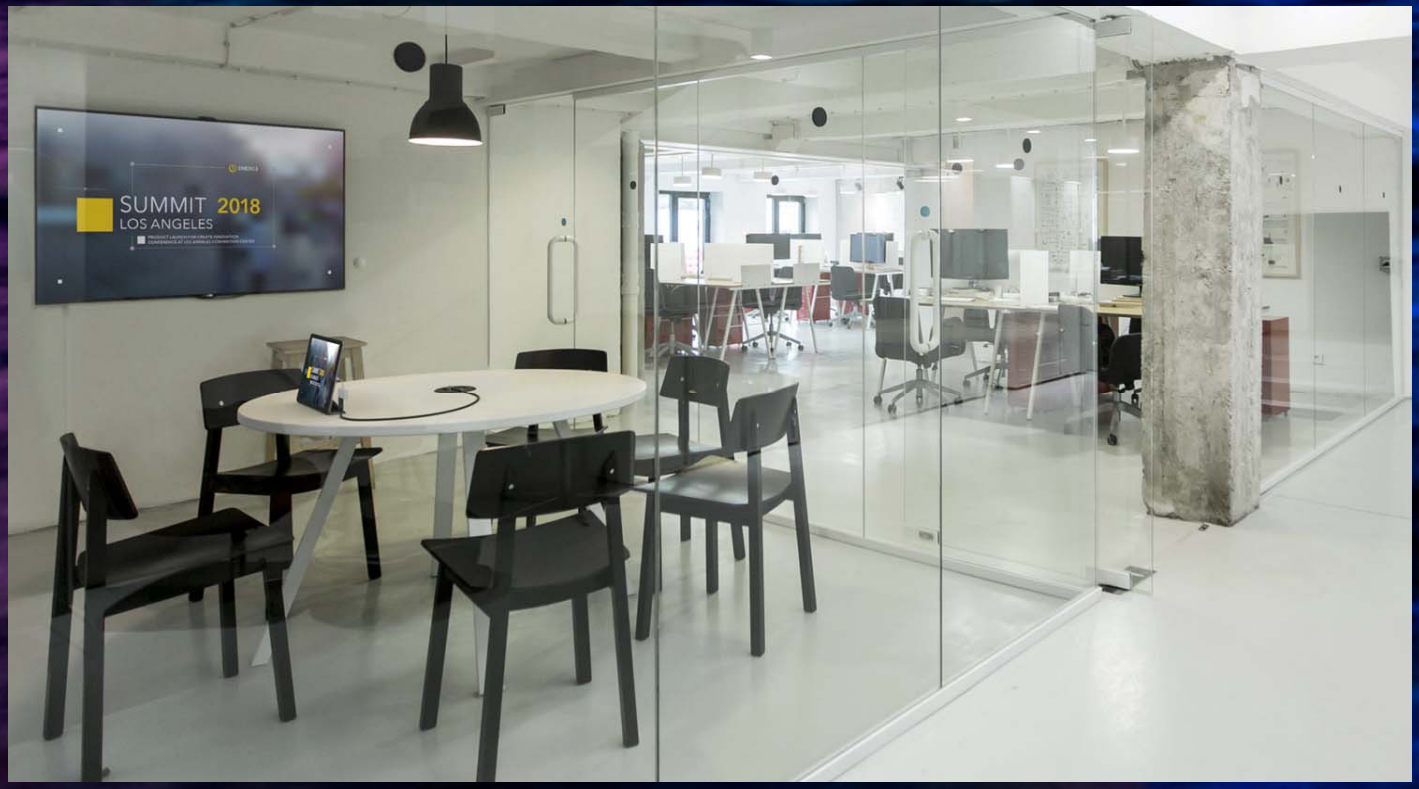
Wired and Wireless AV Collaboration

-Karl Rosenberg-


“Build me a Unified Collaborations Space”


JPEG
VTC
skype™
SUPER UHD TV 4K
BlueJeans
4K HDR
HIGH DYNAMIC RANGE
MPEGLA
The Standard for Standards
POLYCOM
Bluetooth®
COLLABORATION
FaceTime
zoom
Cisco webex
HEVC
H.265 - HIGH EFFICIENCY VIDEO CODING
4K UHD COMPATIBLE
4K 30
ULTRAHD
Vidyo
Personal Telepresence
YouTube
VP9
ICT/CANADA
PRESENTED BY BICSI
Bicsi

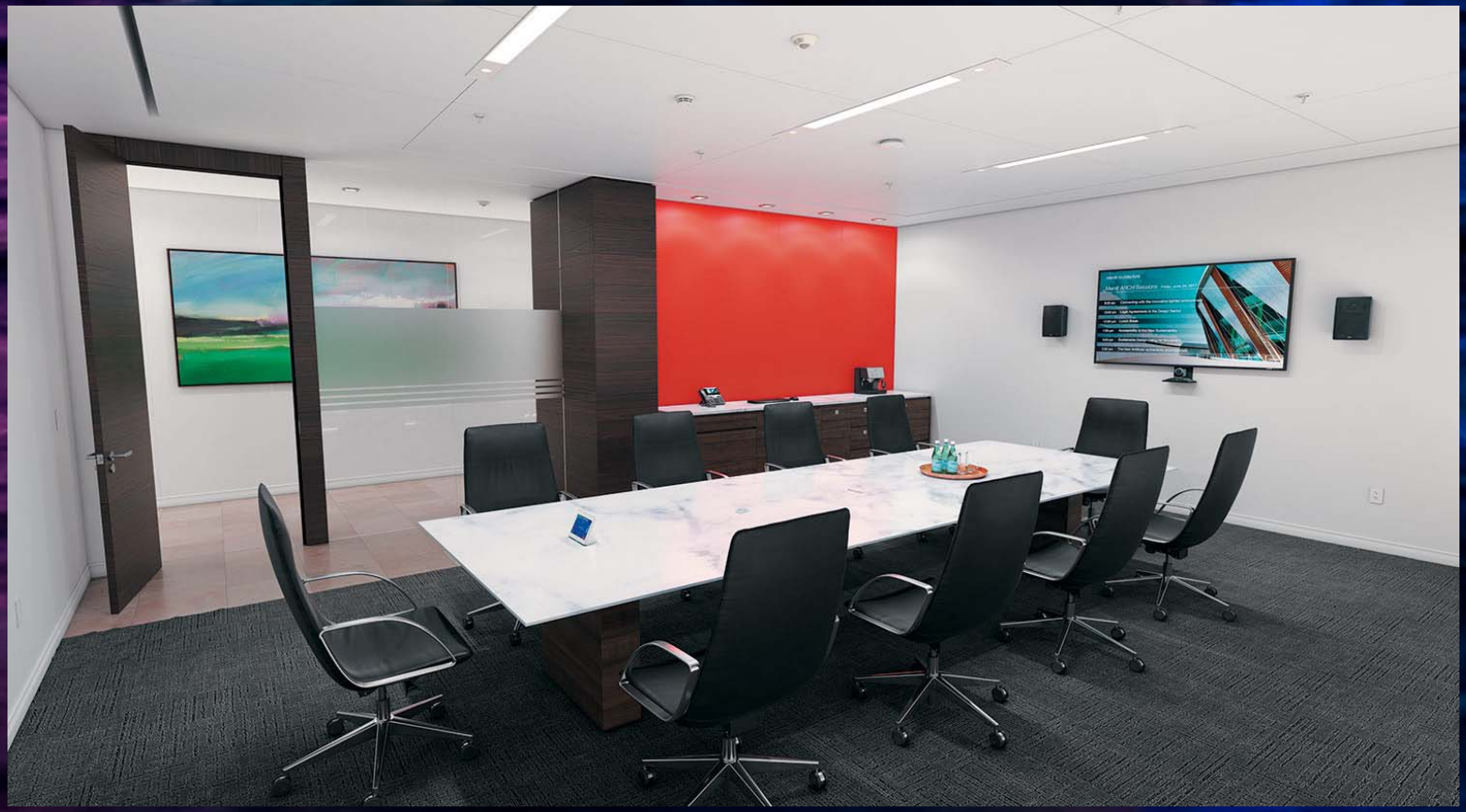
Huddle Room



Huddle Room with Soft VTC

Huddle with ZOOM ROOM

Large Conference Room



Classrooms and Boardrooms are changing

Classrooms and Boardrooms are changing

AV Technology Deployment

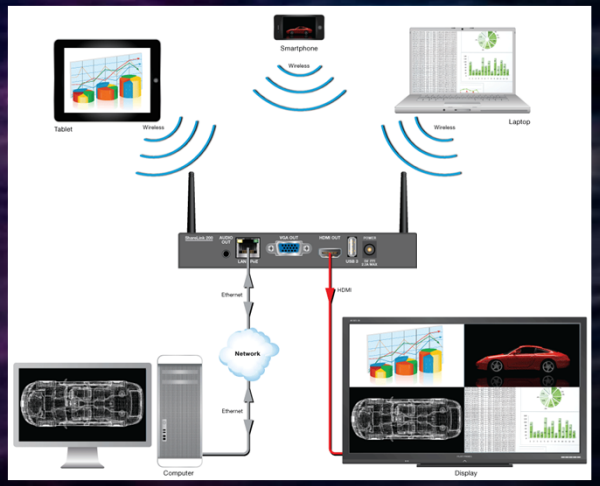
4 types

Hard Wired AV Infrastructure using CATx

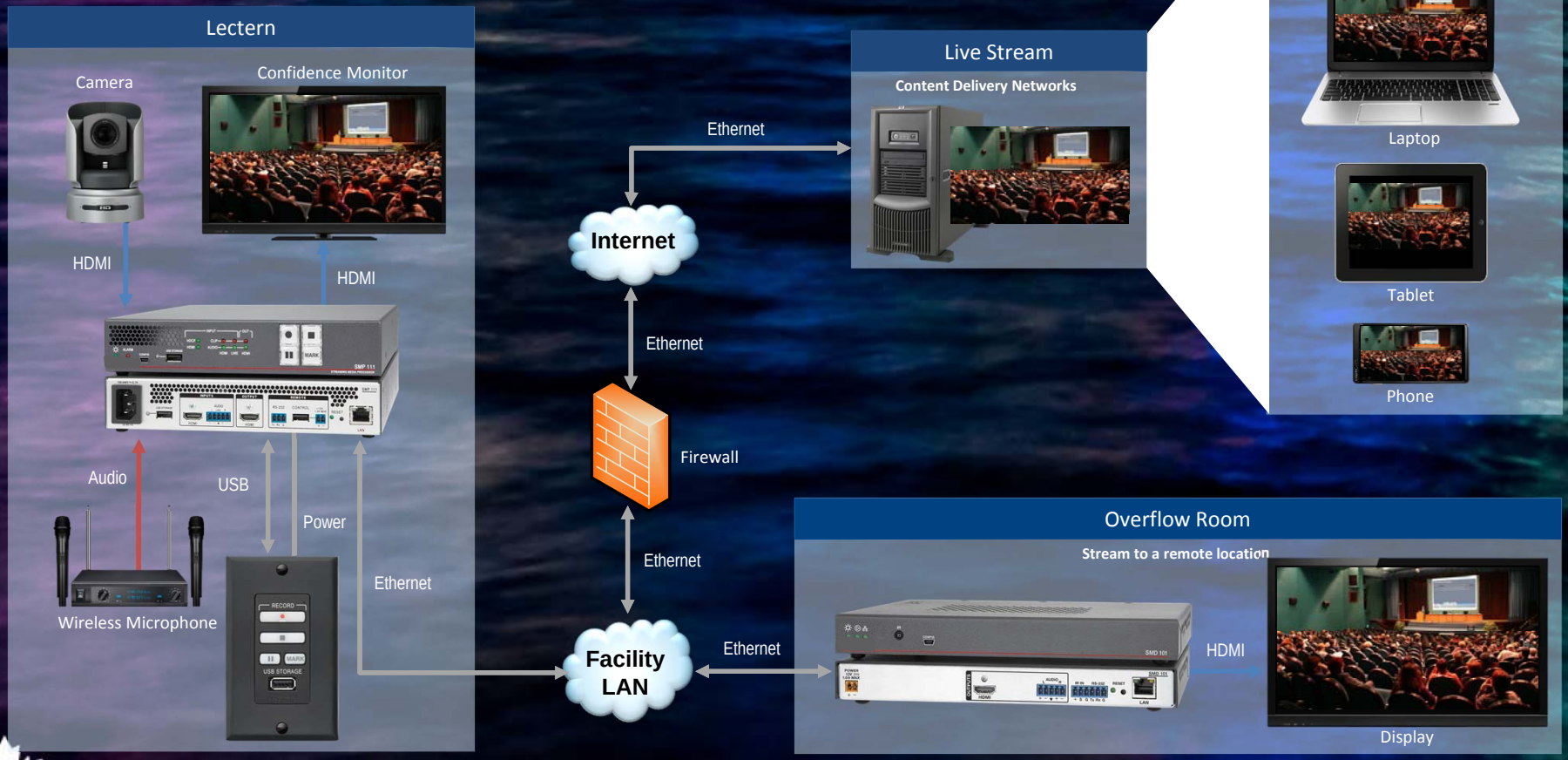
- Wired AV connections offer benefits related to reliability
- To INCLUDE a CATx for USB

Wireless AV

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

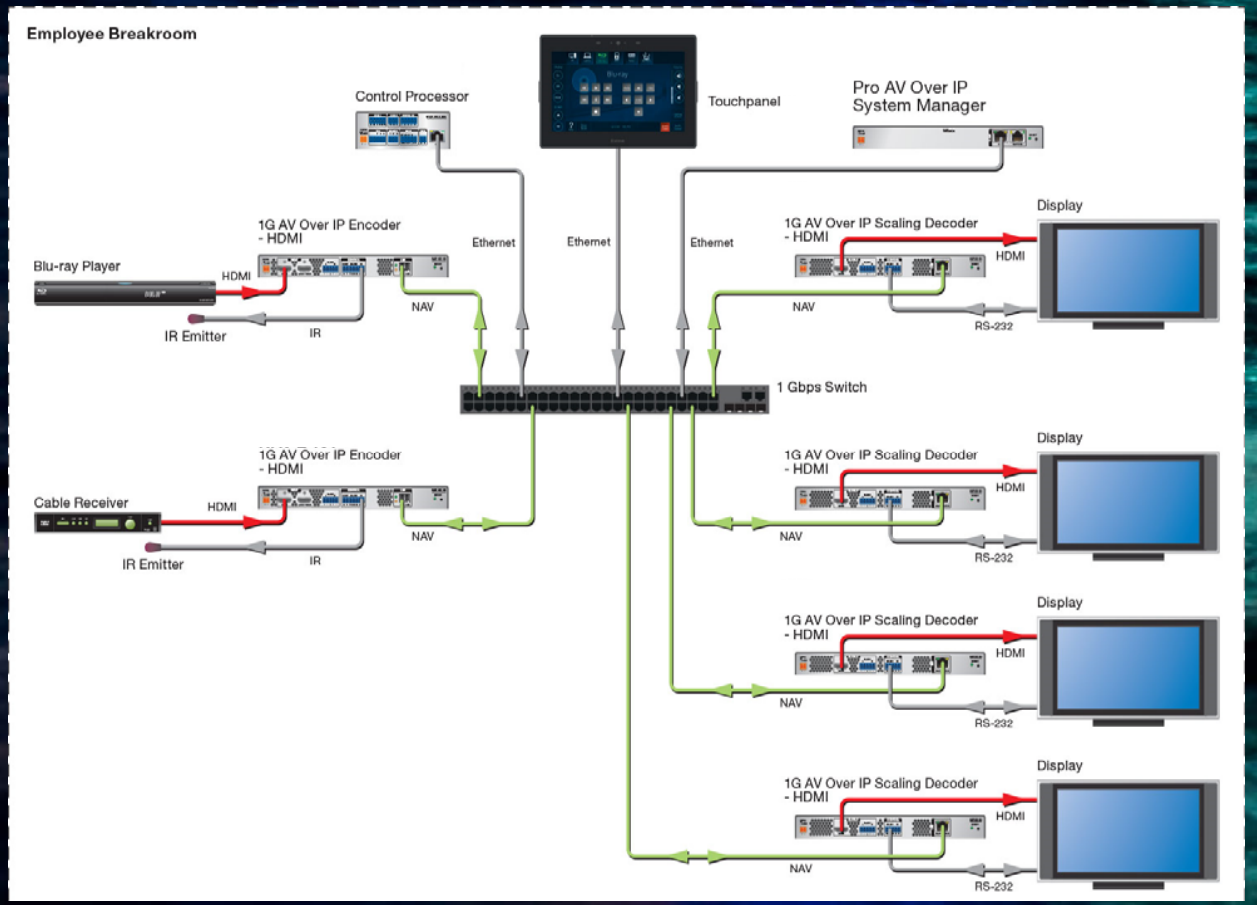


AV Streaming



AV over IP

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

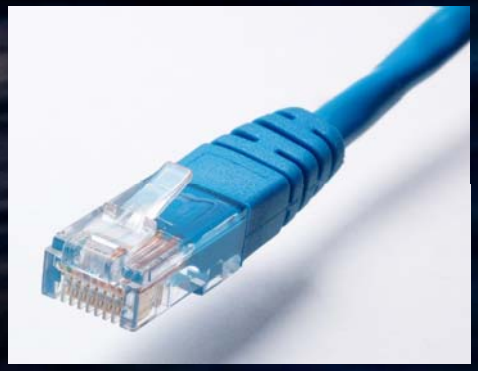


AV over IP Considerations

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

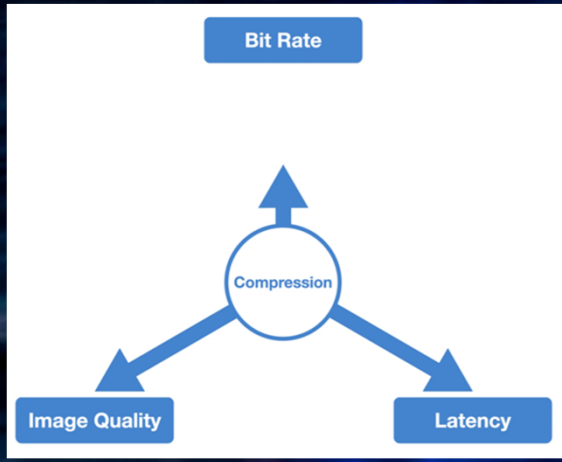
+



= AES 67

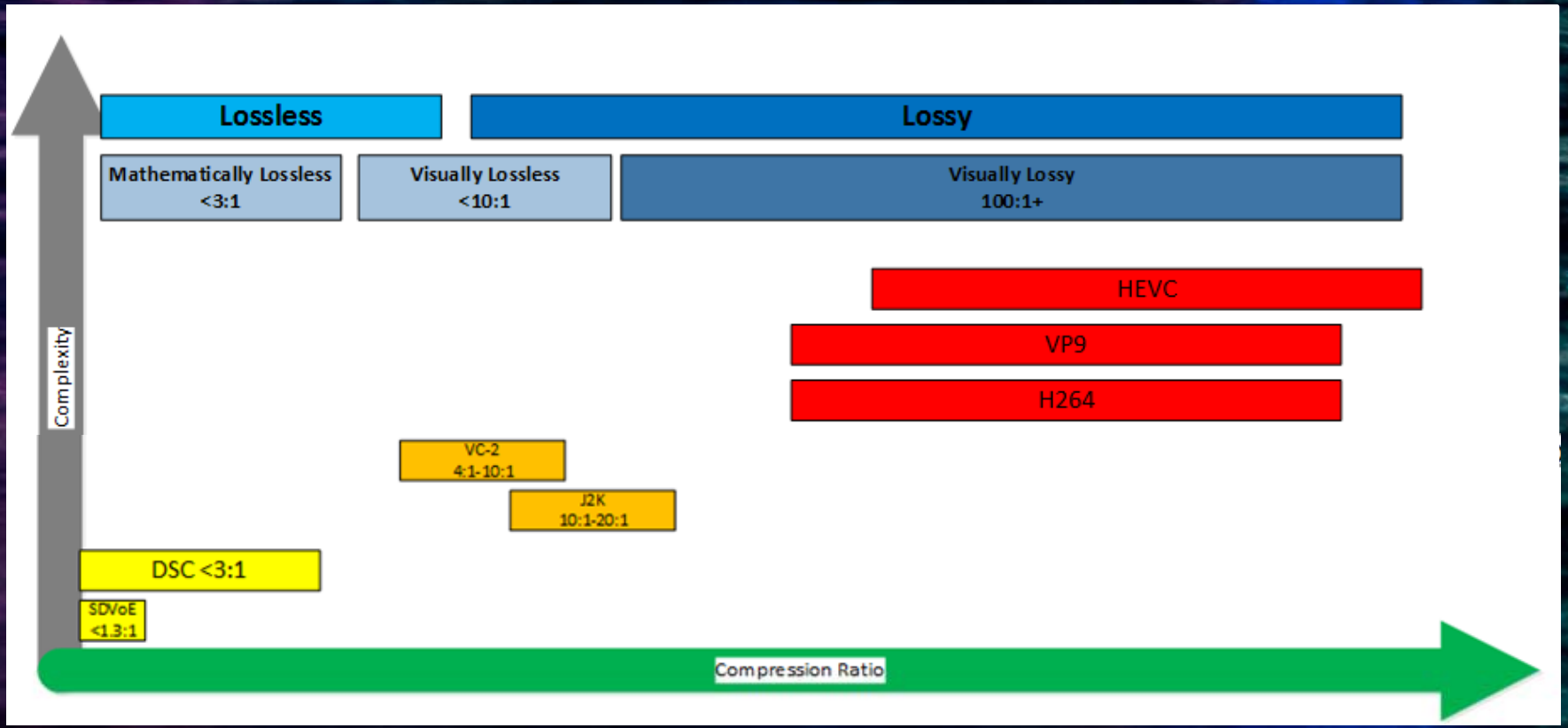
AV over IP – Compression

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



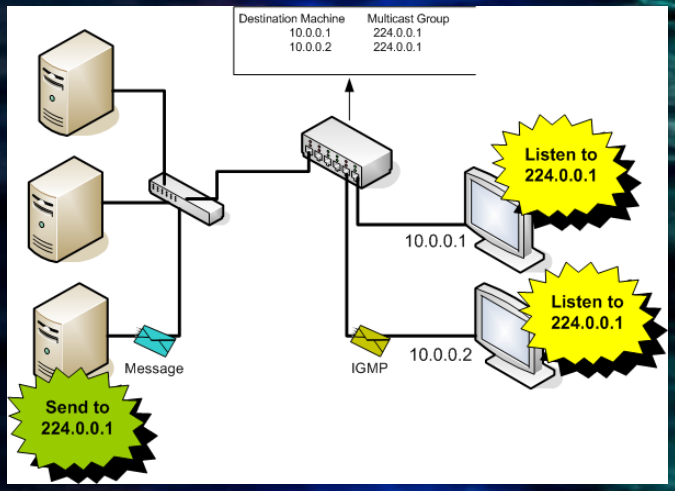
Video Rate	Uncompressed Bit Rate @ 24 bpp	1G Compression @ 880 Mbps	10G Compression @ 4 Gbps
480p60 (SD)	422	1:1	1:1
720p60 (HD)	1,330	2:1	1:1
1080p60 (HD)	2,990	3:1	1:1
2160p60 (UHD)	11,940	14:1	3:1
4096x2160 @ 30 (4K/30)	6,370	7:1	2:1
4096x2160 @ 60 (4K/60)	12,740	14:1	3:1

AV over IP – Compression Ratios



AV over IP – Network

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



Collaboration Space Considerations

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?

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

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

- **C**onnectivity
  - CATx or Wireless
- **C**onferencing Interface
  - Zoom..Skype…your laptops or phones
  - Phone interface
  - VOIP
- **C**ontrol
  - Simple
  - Push button
  - Motion sensor
  - Touchpanel with Interface

VoIP
zoom

Connectivity

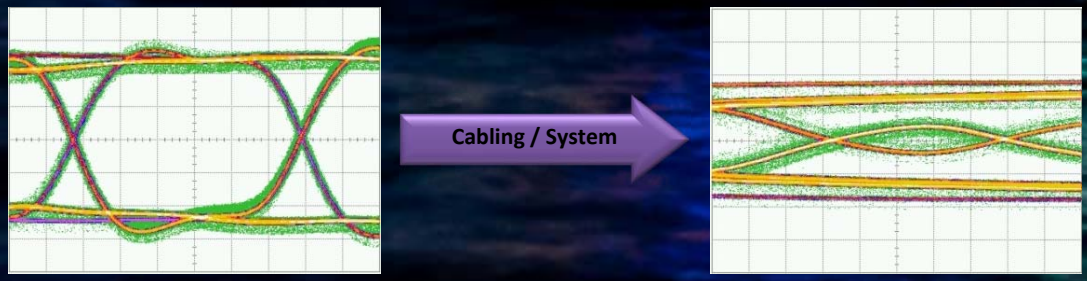
Video Signals

Digital Signals – HDMI

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

Digital Video Characteristics – Loss

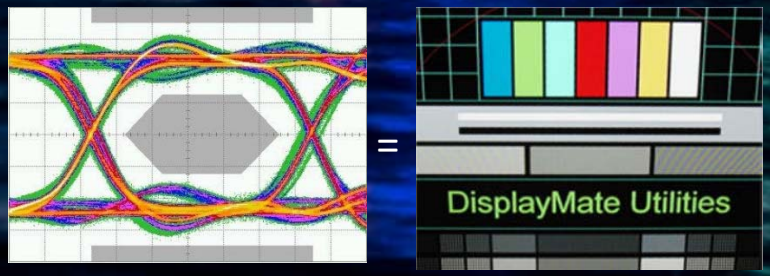
- Digital video signals consist of high speed transitions
- Very susceptible to degradation from:
  - Cable attenuation
    - Cable capacitance
    - Cable resistance
    - Impedance mismatch
  - Noise coupling
  - Crosstalk
  - Jitter



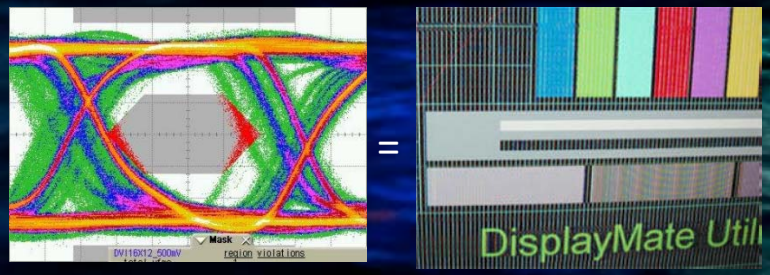
- All factors that Affect the receiver's ability to distinguish high and low transitions

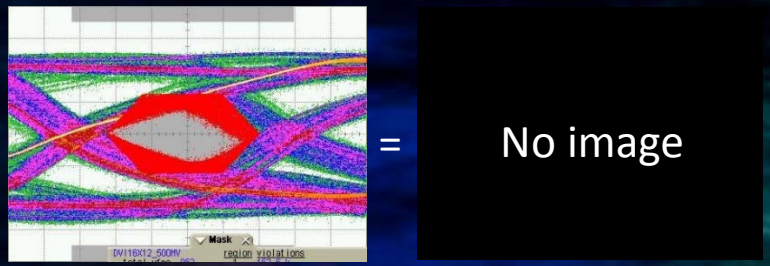
Digital Video Characteristics – Loss

- 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

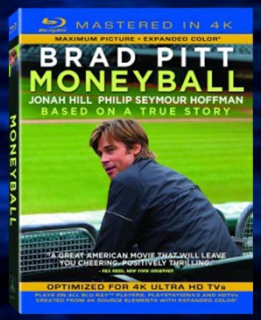
Resolutions

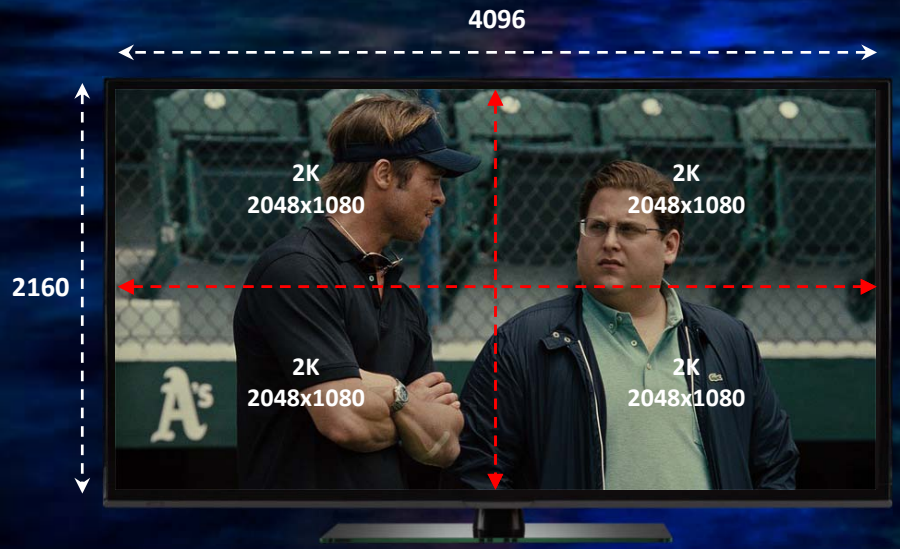
- Old Resolutions
- New standard 1080p
- Headed to 4K/UHD and 8K

SD	HD	Full HD	2K	UHD	4K
720x480	1280x720	1920x1080	2048x1080	3840x2160	4096x2160

4K Signal Parameters

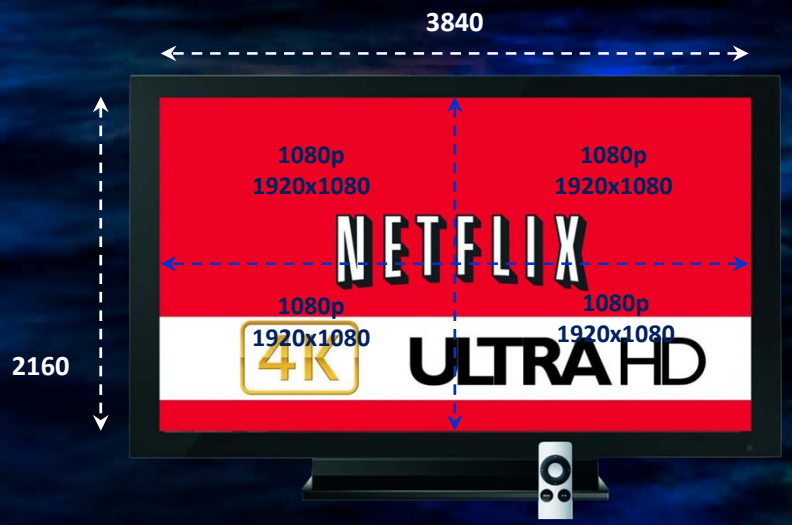
- 4K DCI is 4096x2160
  - Four times the resolution of 2K DCI
  - Targeted towards digital cinema
- 4K refresh rates
  - Varies – 24 Hz up to 60 Hz
- Color bit depth
  - 8-Bit, 10-bit, and 12-bit
- Aspect Ratio
  - 17:9 – same as 2K





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

USB

Universal Serial Bus

HDMI and USB

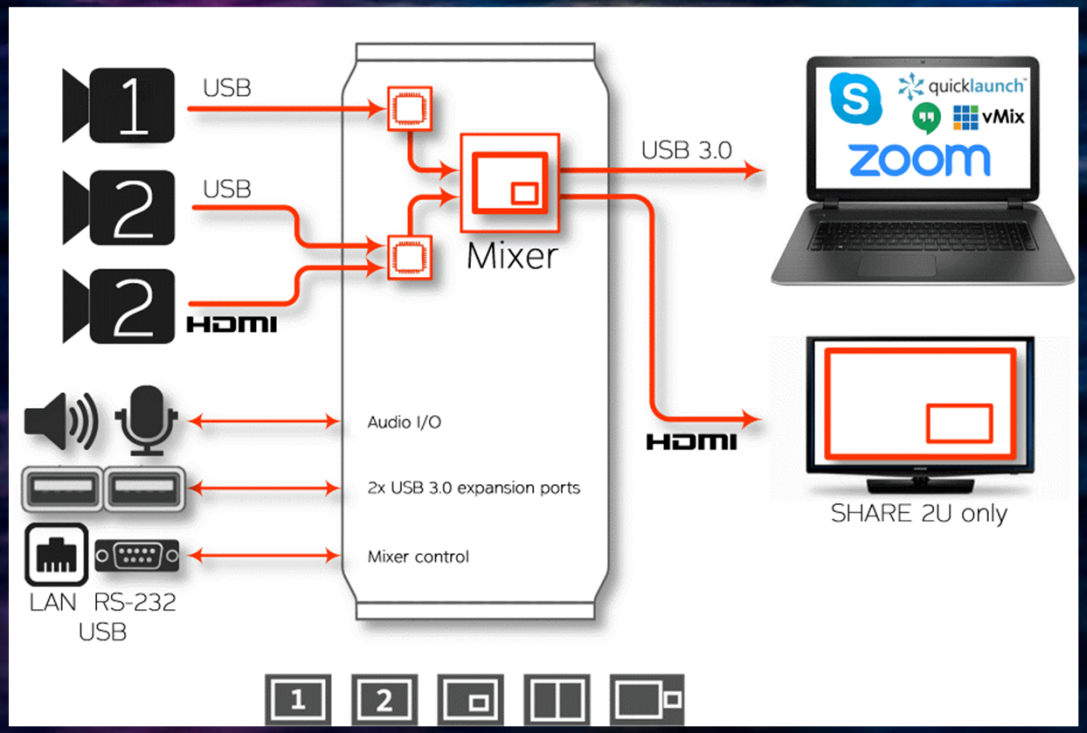
Digital Signals – USB

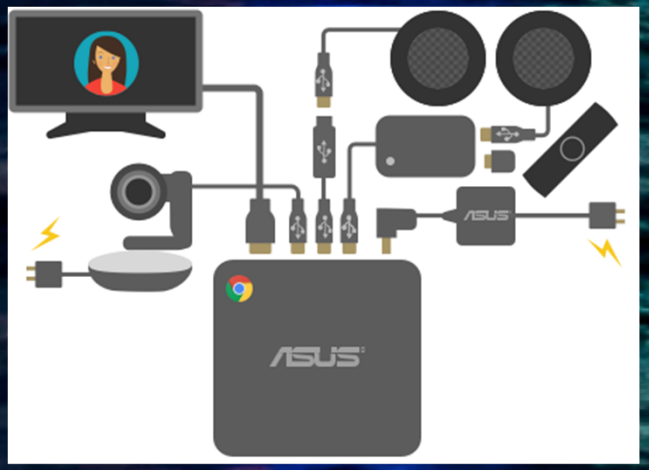
- A standard for communication protocols that includes cables and connectors
- Historically used for attaching peripheral devices to computers
- Maximum length of USB 2.0 cable: The 2.0 specification limits the length of a cable between USB 2.0 devices (Full Speed or Hi-Speed) to **5 meters** (or **about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

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

USB over distance?

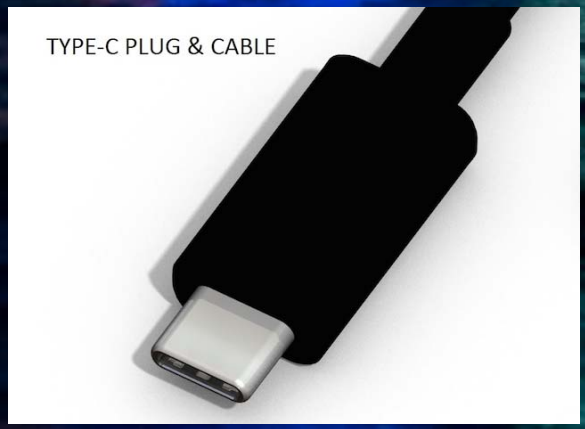




USB Type-C

- 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


TOP-MOUNT RECEPTACLE


TYPE-C PLUG & CABLE

USB Hubs

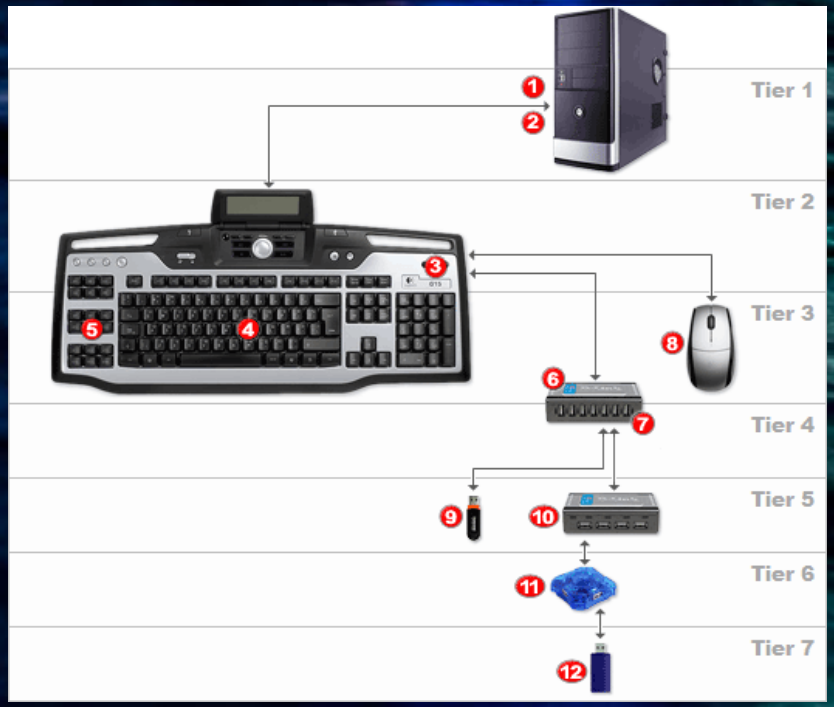
- Connects upstream port and multiple downstream ports
- Port sharing bandwidth among all connected devices
- Provides status and control information

USB Hubs

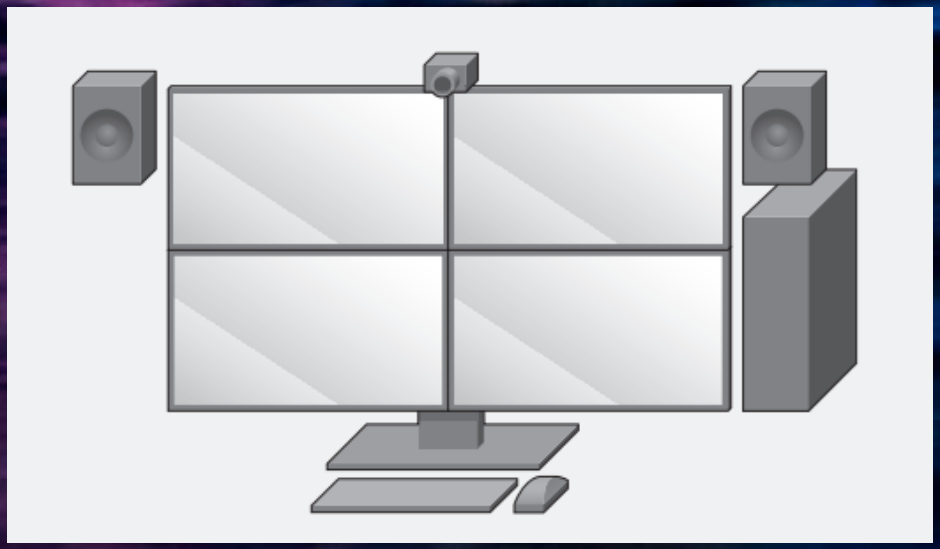
- Connects upstream port and multiple downstream ports
- Port sharing bandwidth among all connected devices
- Provides status and control information

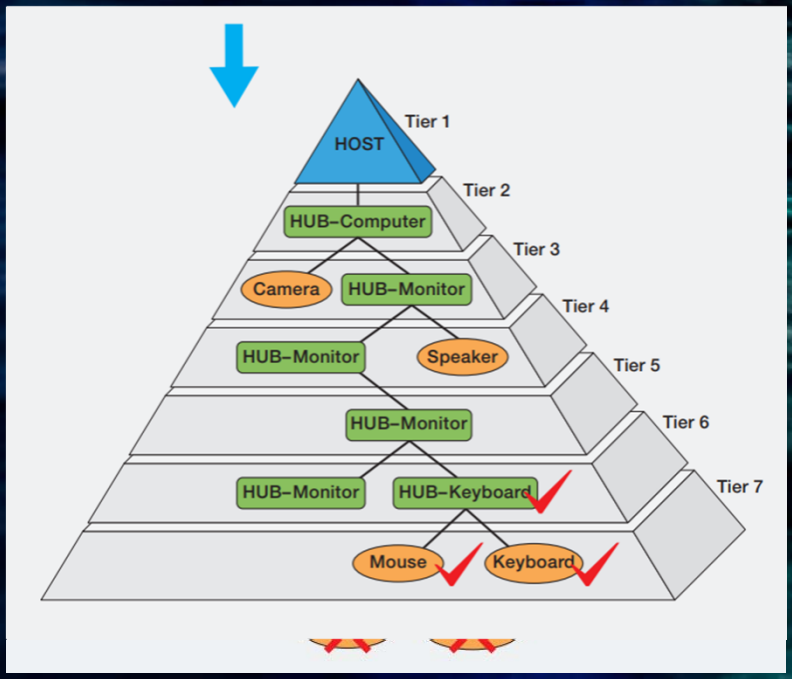
USB Topology

- 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

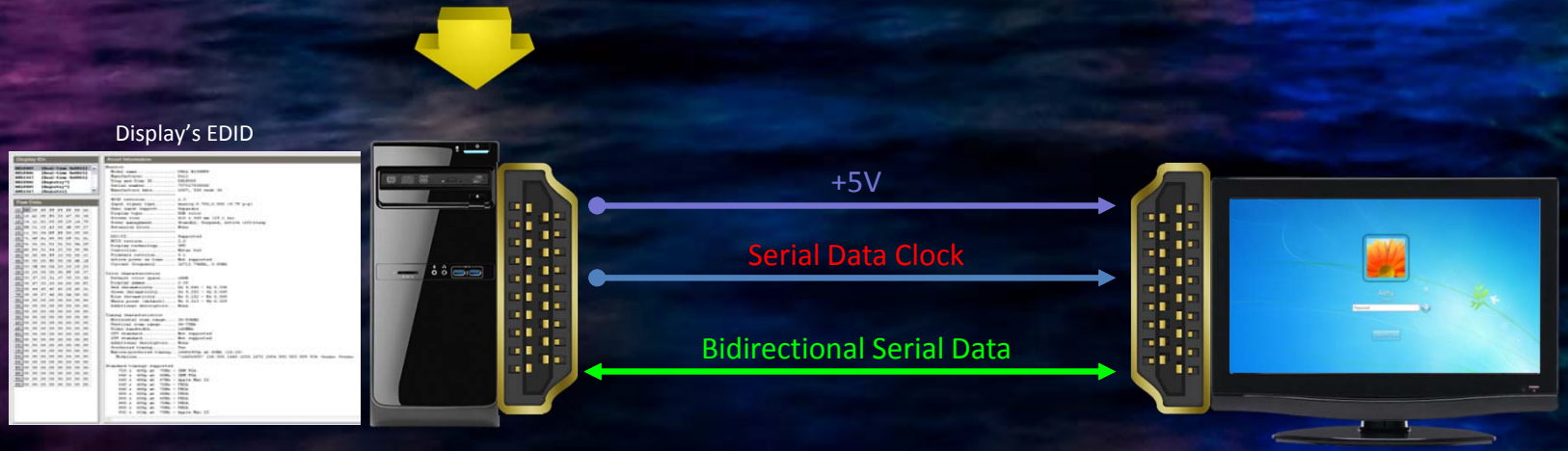
EDID and HDCP

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

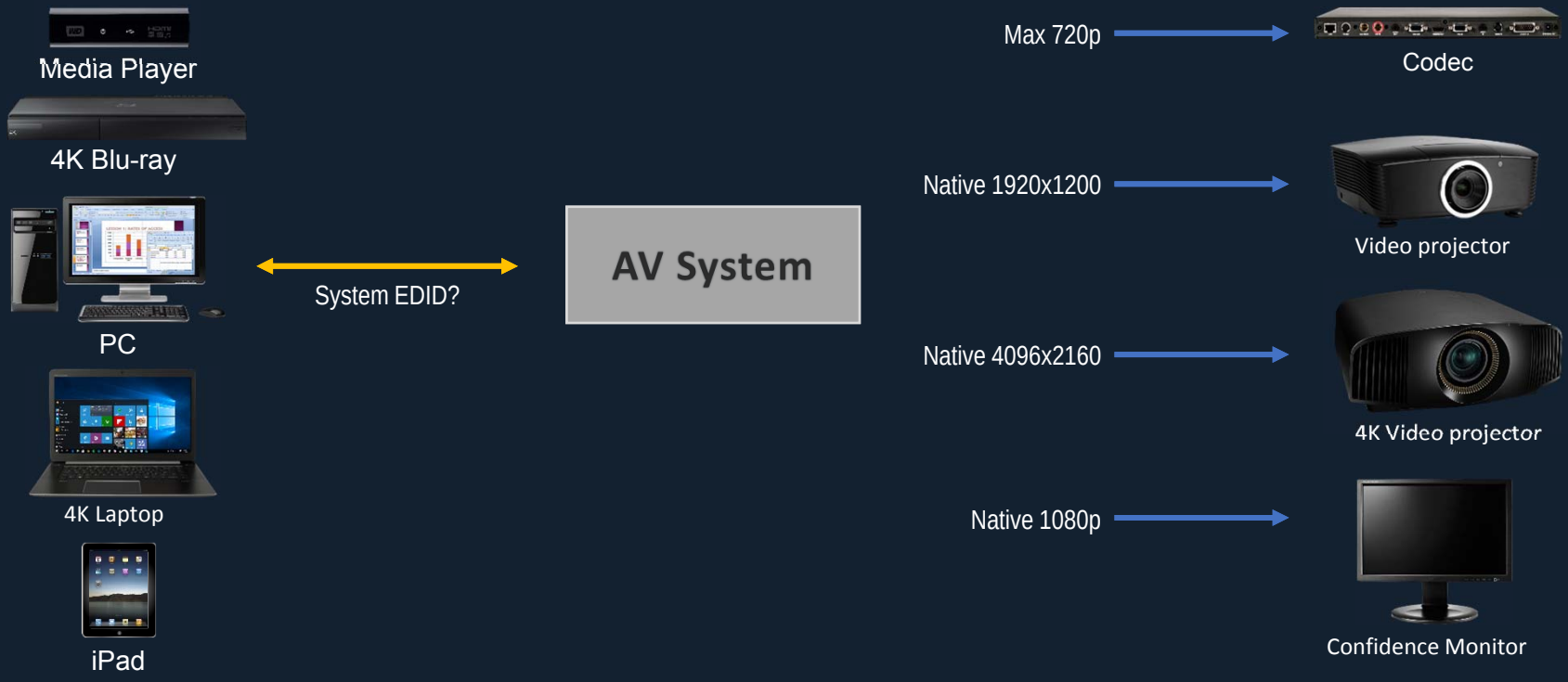
- BYOD equipment
  - How do they respond to EDID?

Portable devices:
- iPad may only output 1080p if audio is requested in EDID
- Other devices may not offer/support requested resolution

EDID set to:
- 1280x720@60
- RGB
- 2-ch audio

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

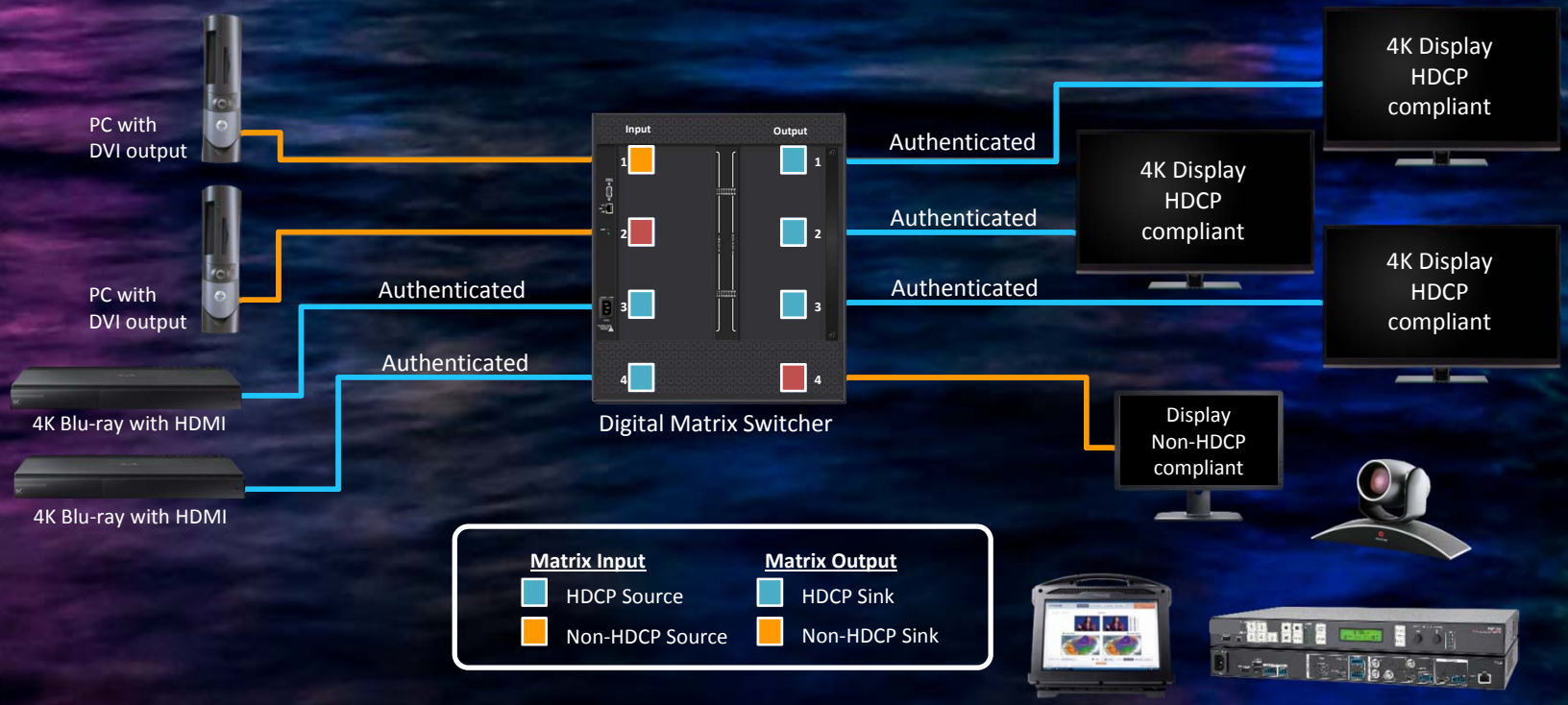
Blu-ray with HDMI

HDCP

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

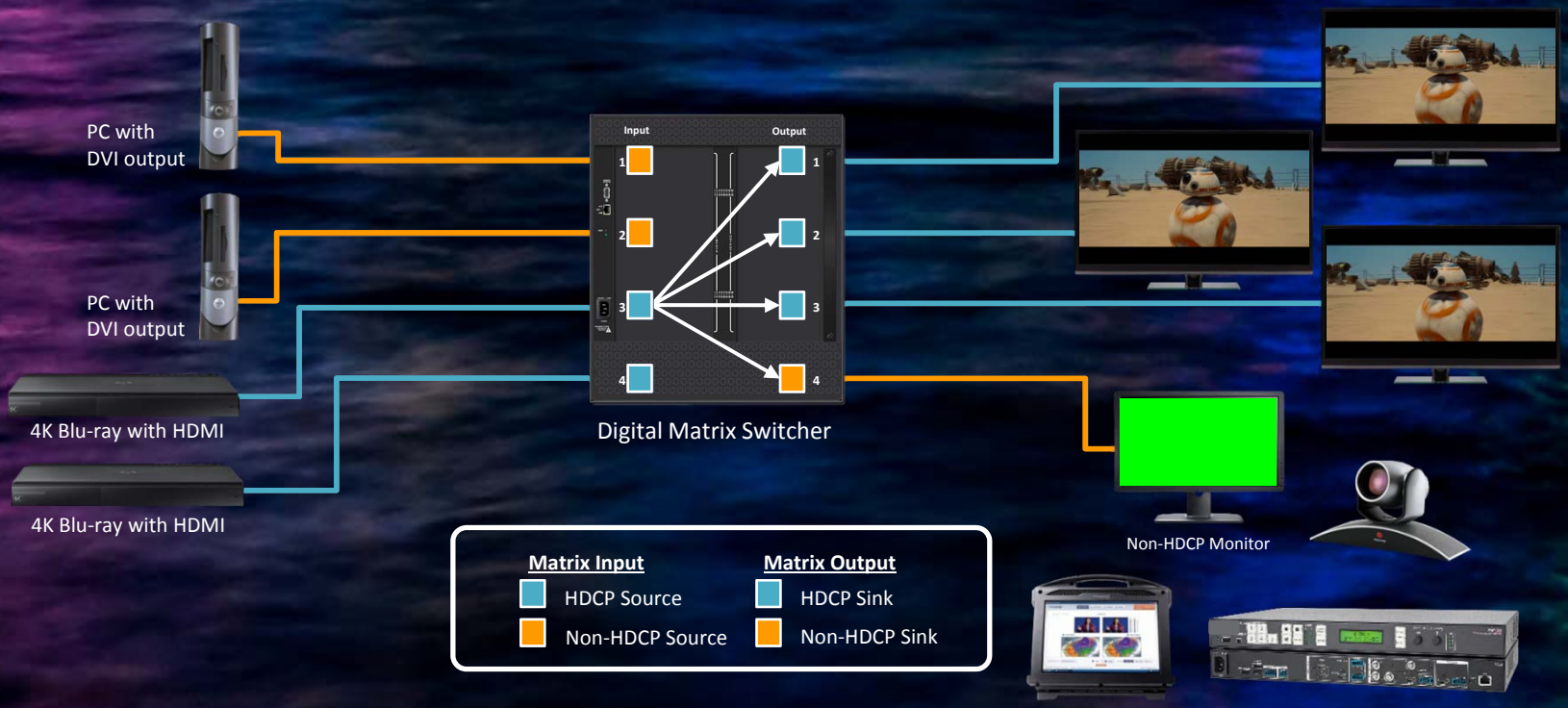
HDCP Handshakes

- I/O authentication



HCDP Handshakes With Products That Are Not HDCP Compliant

- Visual confirmation



Uncompressed Video Over Twisted Pair

HDBaseT

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

Twisted Pair Transmission

- Distance
  - 328 feet (100 meters) between endpoints

Why Use Twisted Pair?

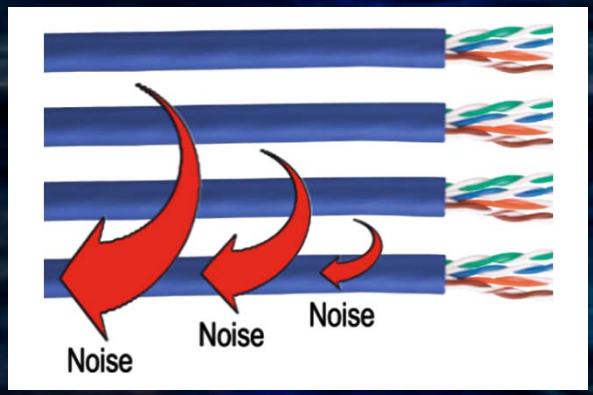
- One twisted pair cable can carry multiple signals
  - Video
  - Audio
  - Bidirectional RS-232 control and IR
  - Ethernet
  - Remote Power

Twisted Pair Transmission

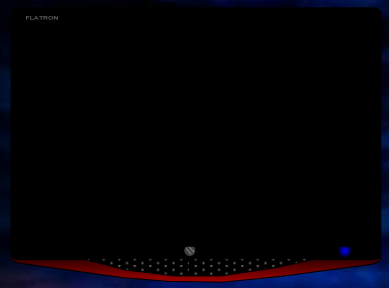
- Cable
  - Supports CATx cable
  - Solid conductor, shielded twisted pair cable with shielded connectors should always be used
  - Skew-free cable ***should not*** be used with XTP Systems

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



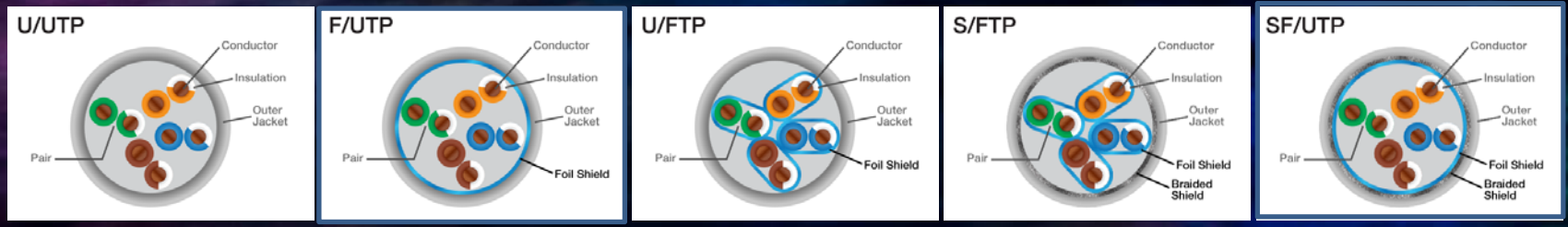
- Symptoms of noisy environments
  - Image drop-out or flashing
  - No image at all



Twisted Pair Shielding

- 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



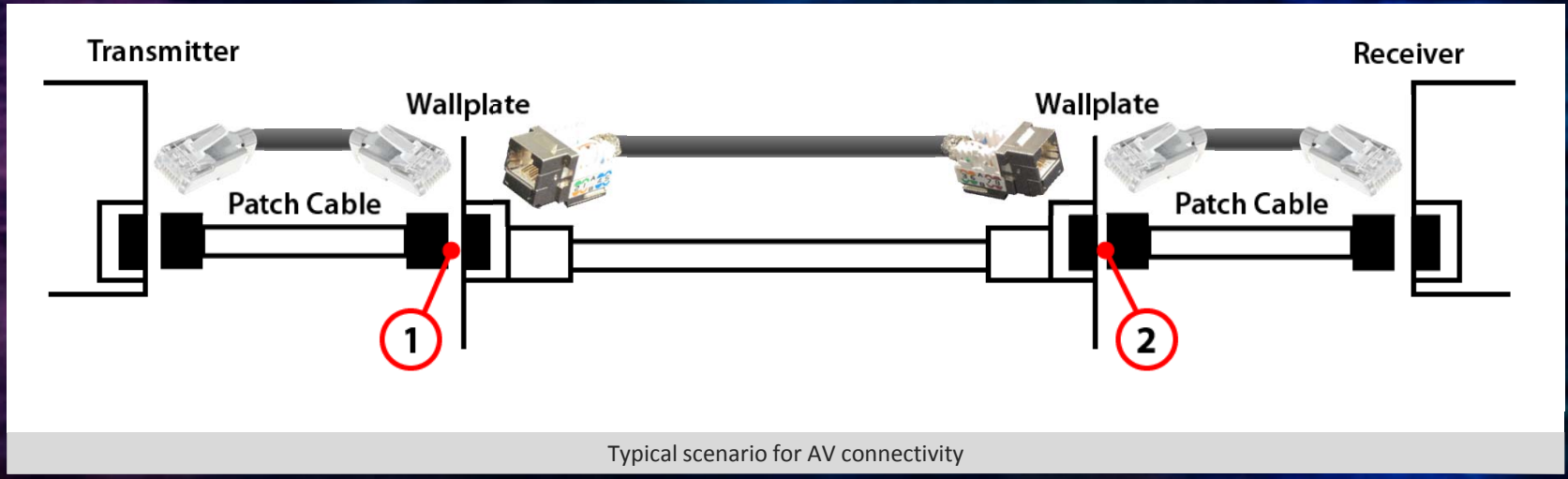
Twisted Pair Signal Transmission

- 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

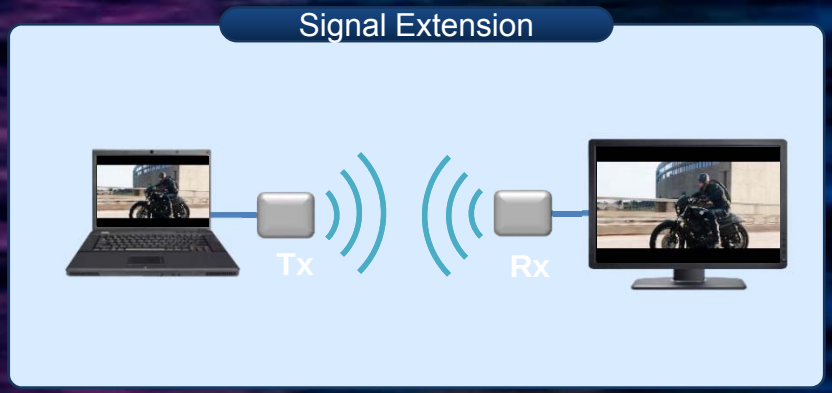


Typical scenario for AV connectivity

Wireless Technologies

Compressed and Uncompressed

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

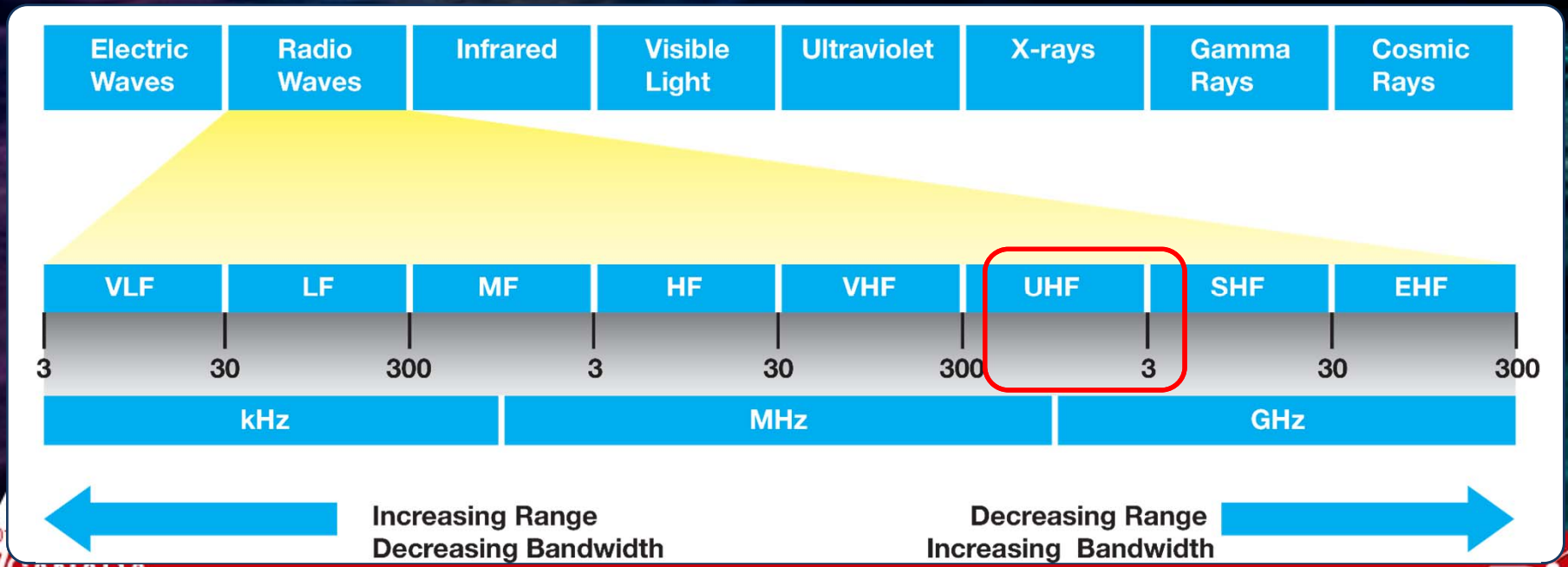
Collaboration with their WAP

TCP/IP Network

Rx with HDMI

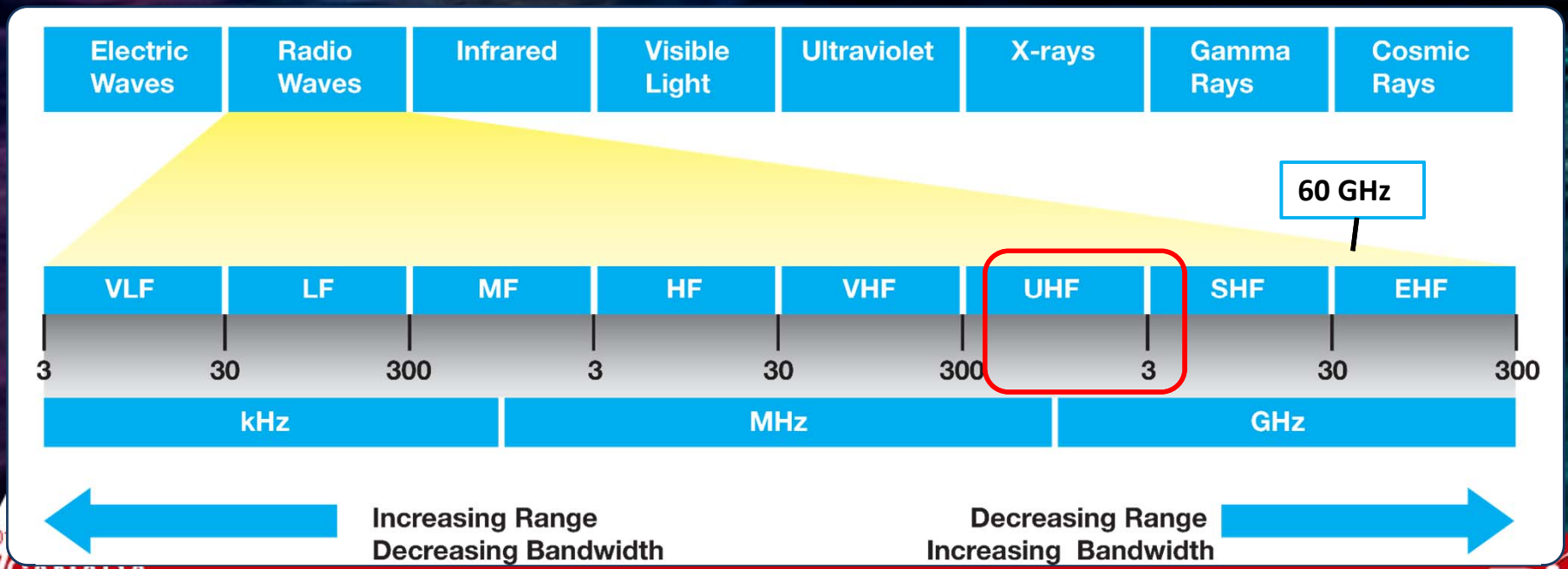
Radio Frequency Spectrum

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



Radio Frequency Spectrum

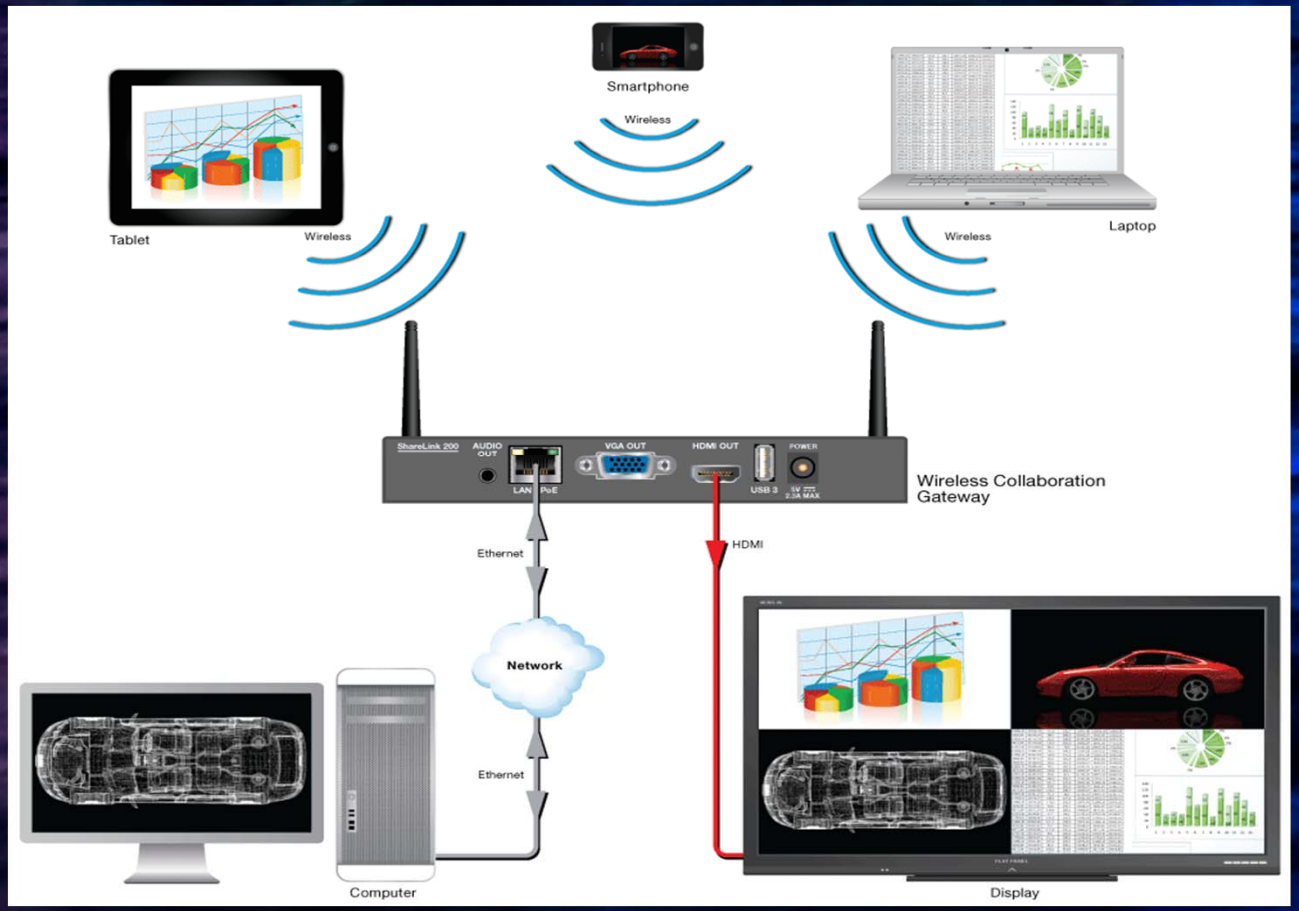
- 60 GHz used for higher data carrying capacity
  - Cannot penetrate solid objects
  - Short range



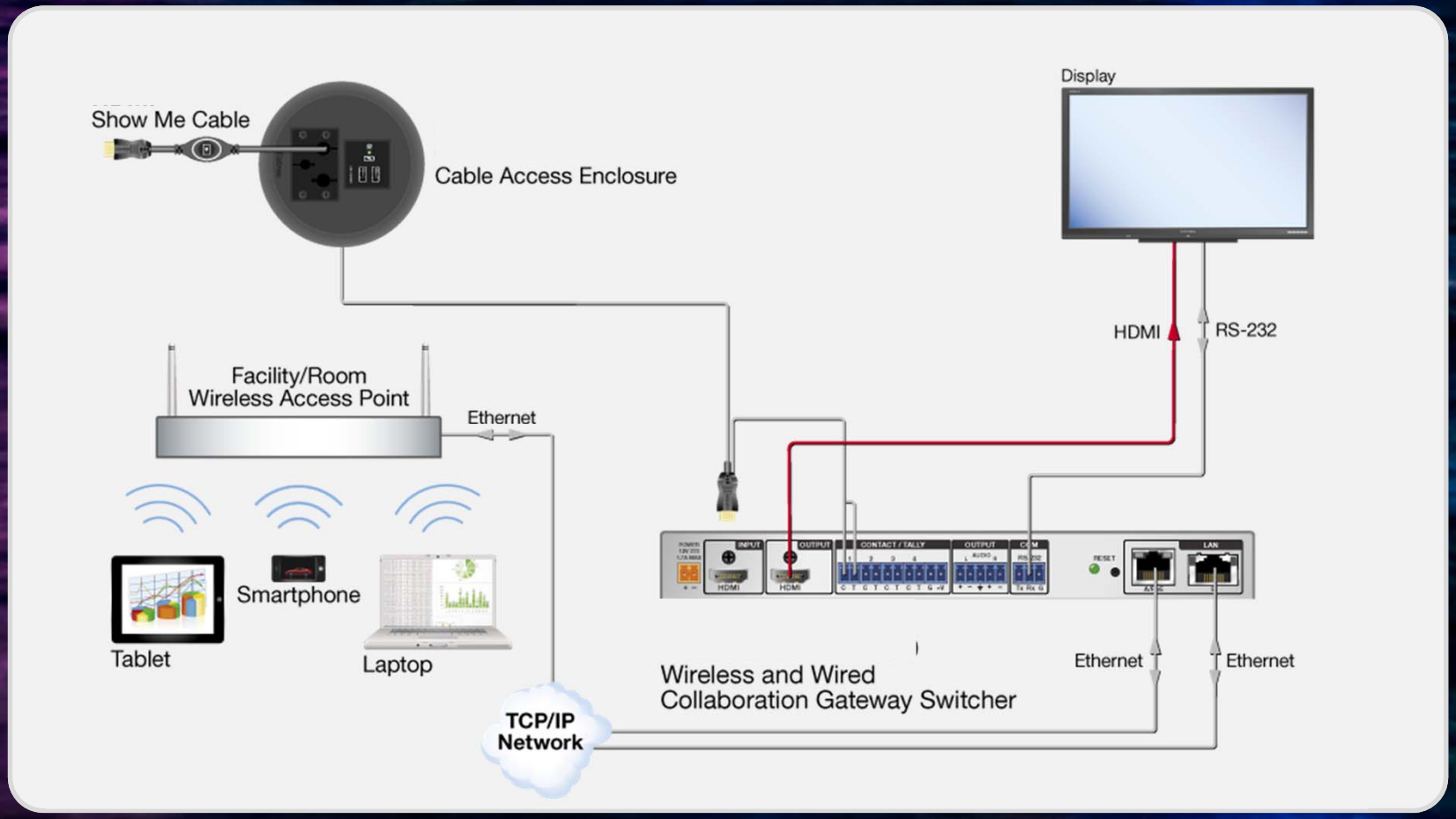
Proprietary Wireless Protocols

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

Using Your Own WAP

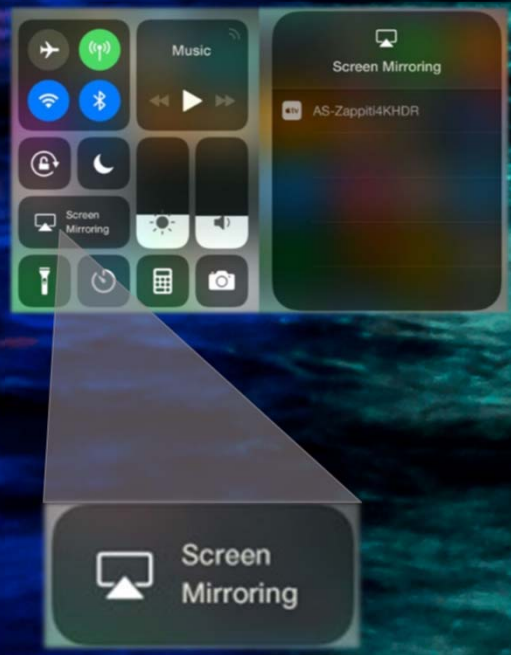

Smartphone
Wireless
Tablet
Wireless
Wireless
Laptop
ShareLink 200
AUDIO OUT
LAN
PoE
VGA OUT
HDMI OUT
USB 3
POWER
Wireless Collaboration Gateway
Ethernet
HDMI
Network
Ethernet
Computer
Display

Using Their WAP


Show Me Cable
Cable Access Enclosure
Display
HDMI
RS-232
Facility/Room
Wireless Access Point
Ethernet
Smartphone
Tablet
Laptop
Wireless and Wired
Collaboration Gateway Switcher
Ethernet
Ethernet
TCP/IP
Network

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



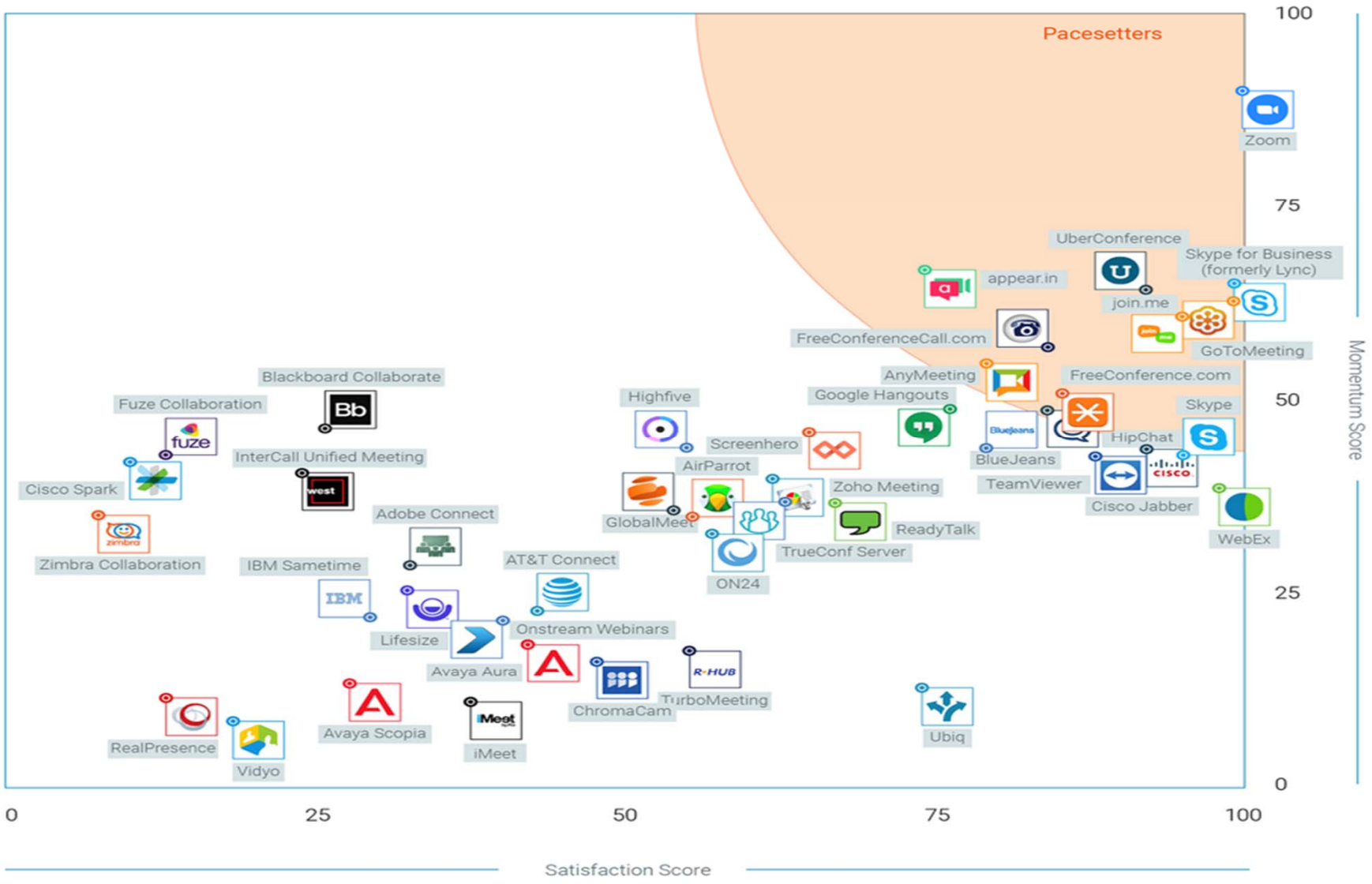
Conference Interface

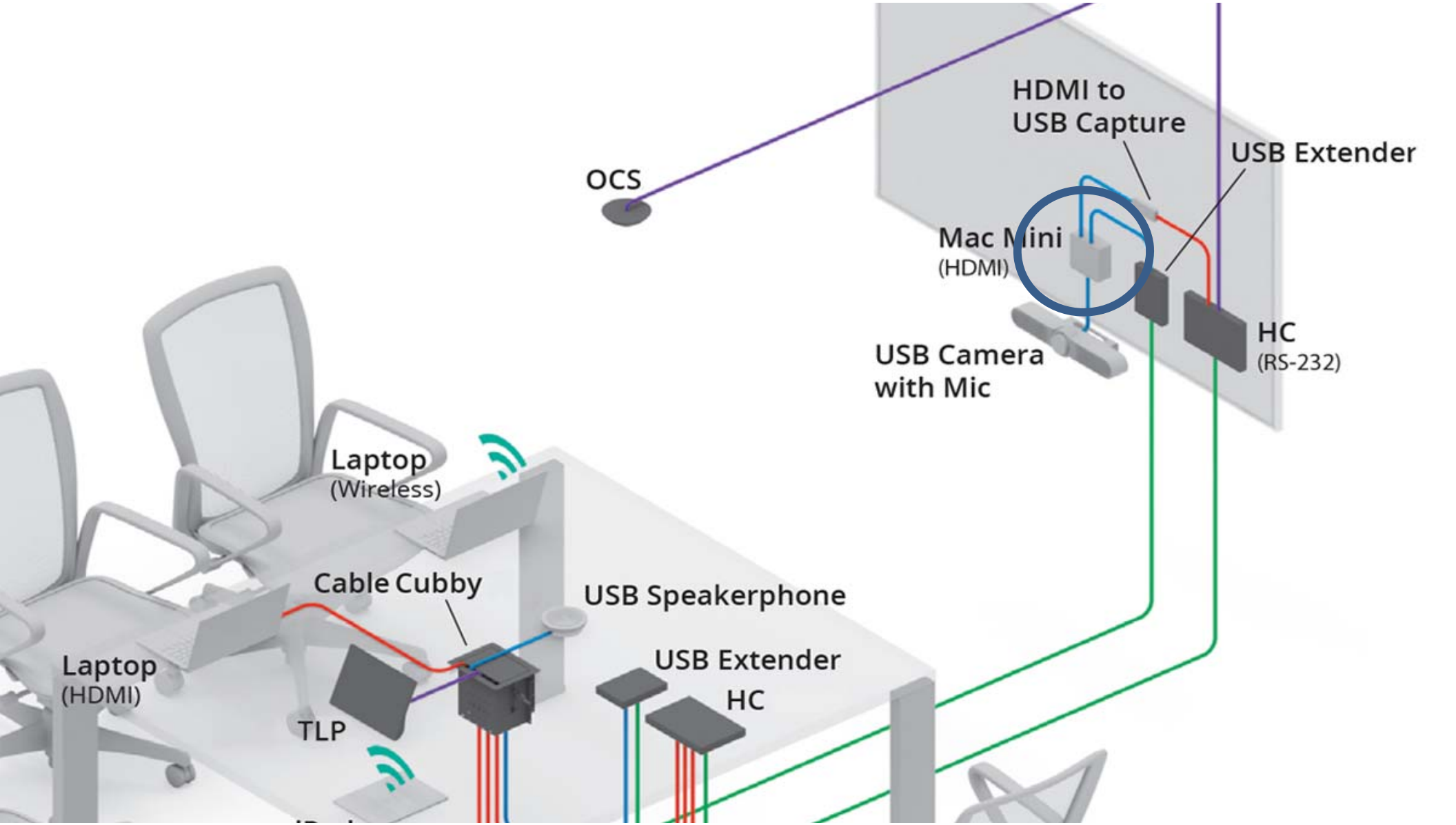
Multiple Types of Devices

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

Table connectivity including Power and USB charging

Seamless Conferencing Experience


Pacesetters
Zoom
UberConference
Skype for Business (formerly Lync)
appear.in
join.me
GoToMeeting
FreeConferenceCall.com
AnyMeeting
FreeConference.com
Google Hangouts
Skype
HipChat
BlueJeans
TeamViewer
Cisco Jabber
WebEx
Highfive
Screenhero
AirParrot
Zoho Meeting
ReadyTalk
TrueConf Server
ON24
GlobalMeet
Blackboard Collaborate
Fuze Collaboration
InterCall Unified Meeting
Cisco Spark
Zimbra Collaboration
Adobe Connect
IBM Sametime
AT&T Connect
Onstream Webinars
Lifesize
Avaya Aura
ChromaCam
TurboMeeting
Avaya Scopia
iMeet
RealPresence
Vidyo
Ubiq
100
75
50
25
0
Momentum Score
0
25
50
75
100
Satisfaction Score


OCS
HDMI to
USB Capture
USB Extender
Mac Mini
(HDMI)
HC
(RS-232)
USB Camera
with Mic
Laptop
(Wireless)
Cable Cubby
USB Speakerphone
Laptop
(HDMI)
USB Extender
HC
TLP

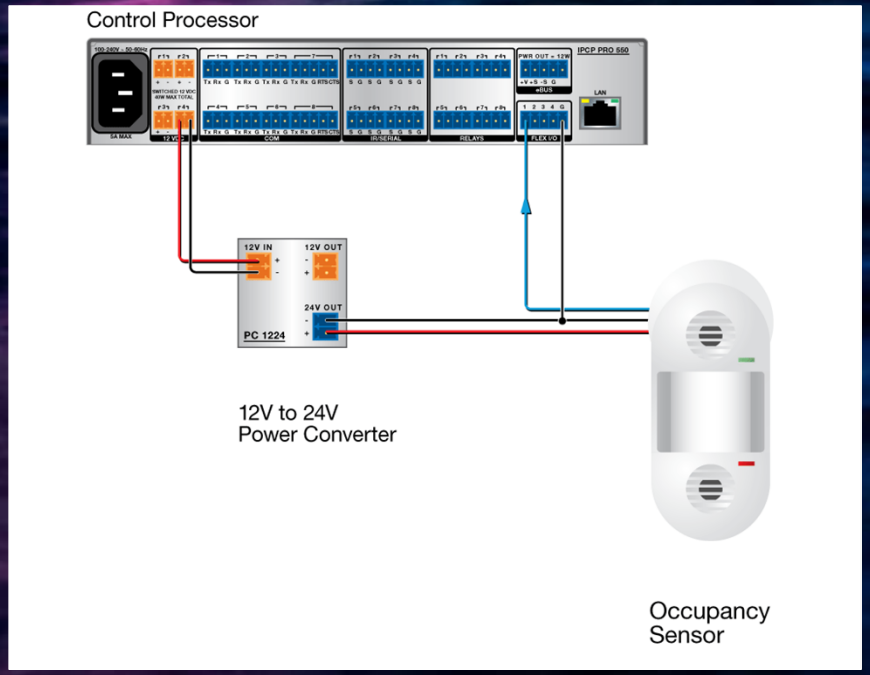
Control

Motion Sensor or Timed System

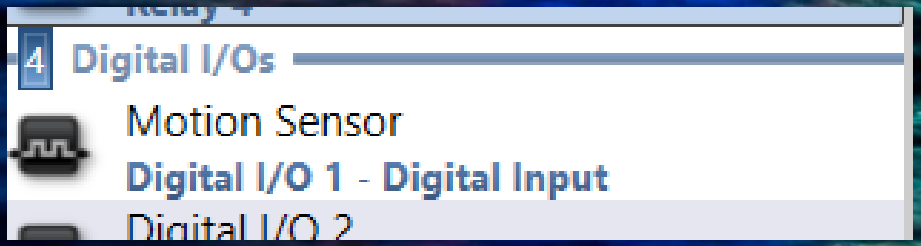
Meeting Space Collaboration System

Simple Motion Sensor

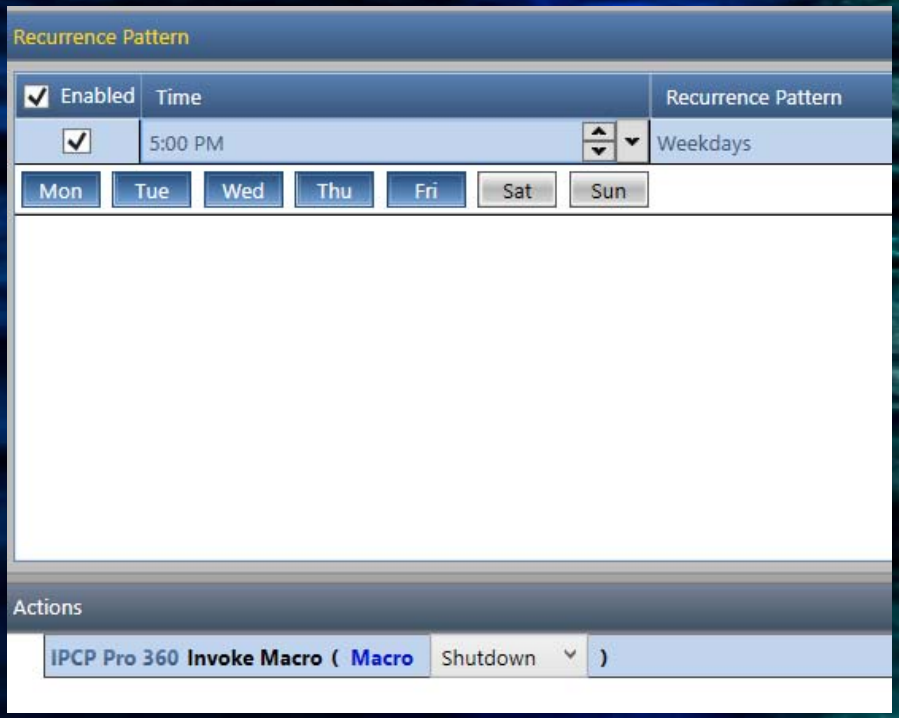
- Motion Sensor wiring



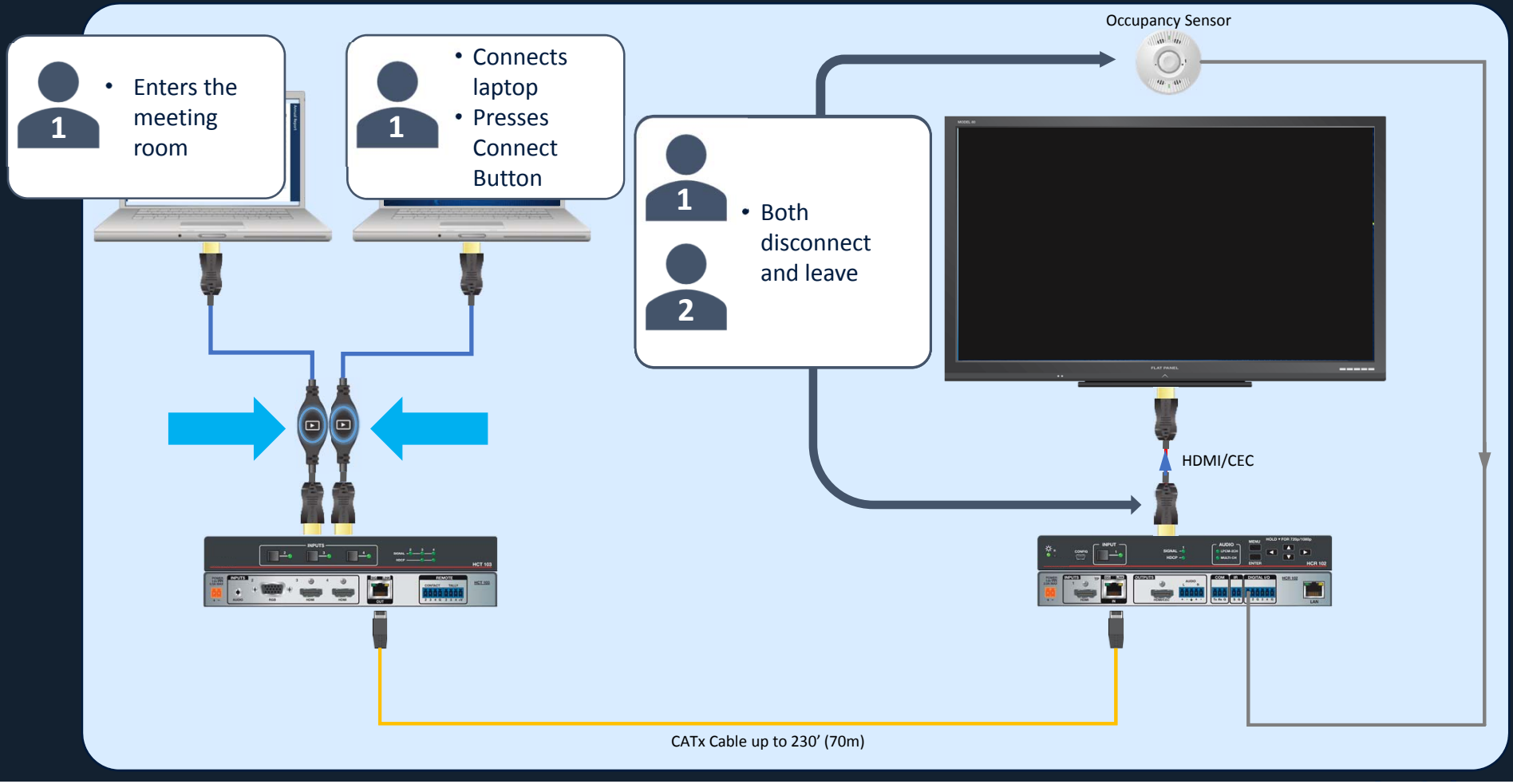
- Control system module for Motion Sensor configuration



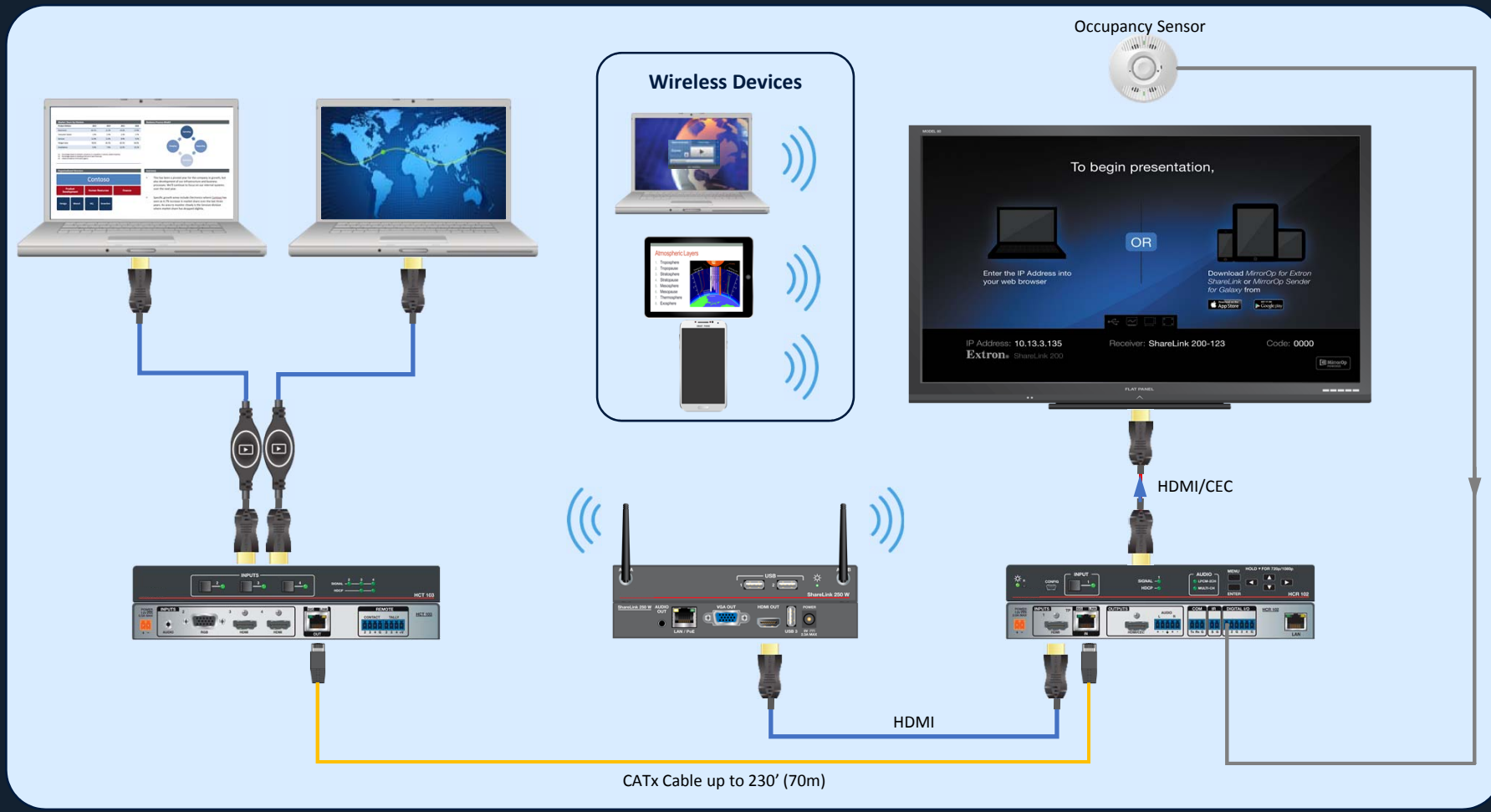
How a timer works



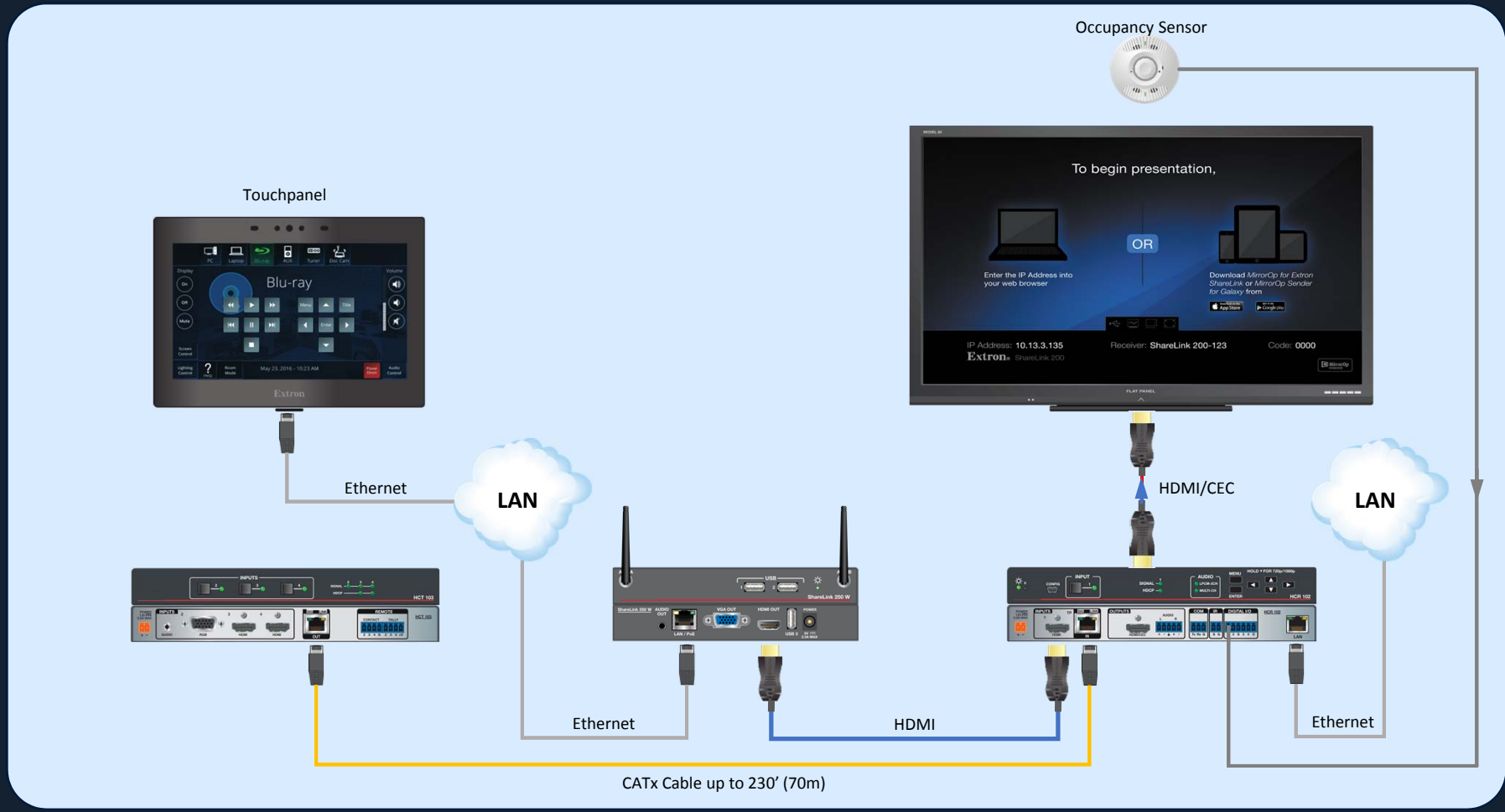
TeamWork System with Show Me Cables



Upgrade Options – Wireless Connectivity



Upgrade Options – Touchpanel Control

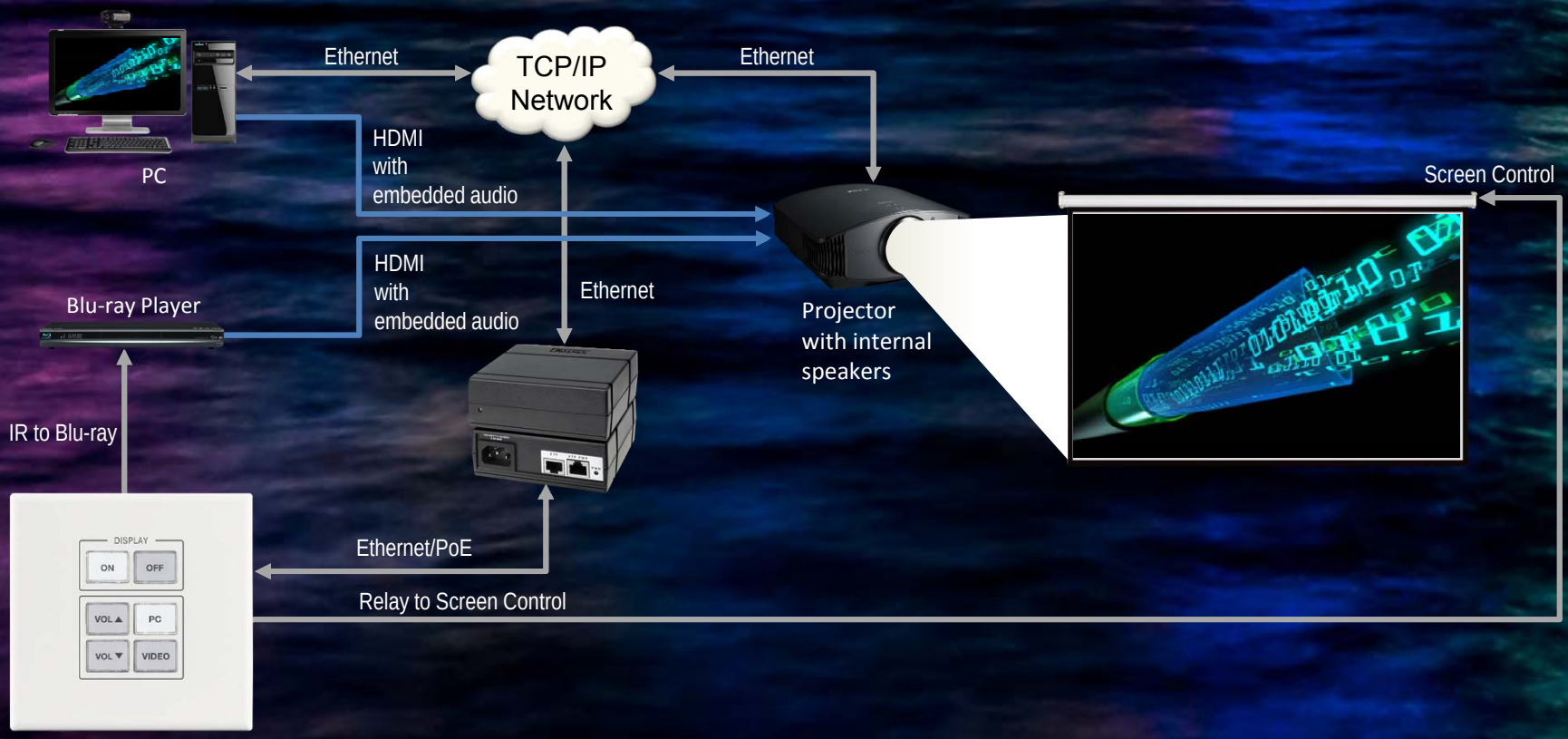


Push Button Controllers

These do NOT count!

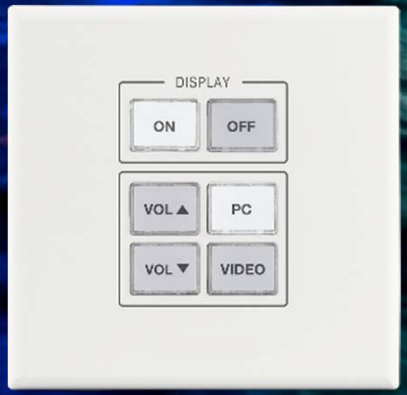

DISPLAY
ON
OFF
VOLUME
PC
LAPTOP
VIDEO
MUTE

Single Display Application



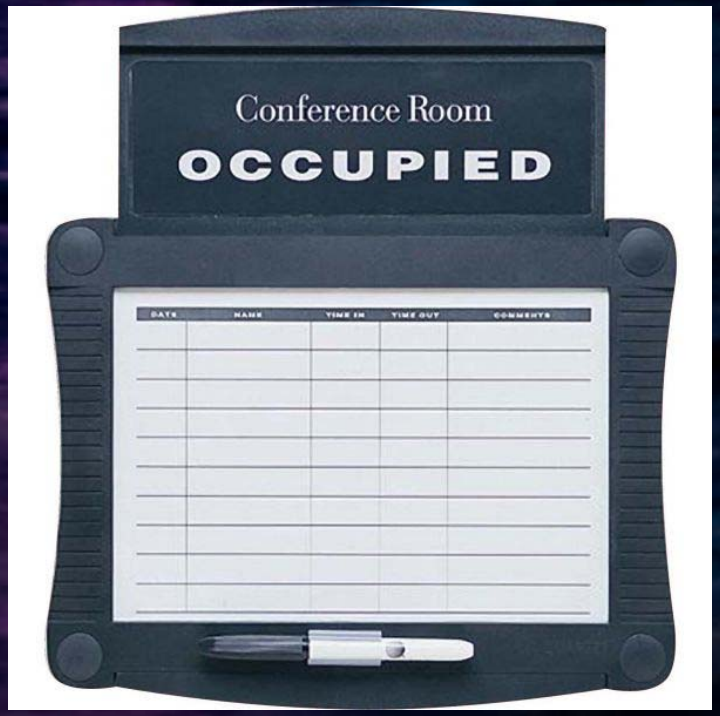
Features of PUSH –Button controllers

- 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

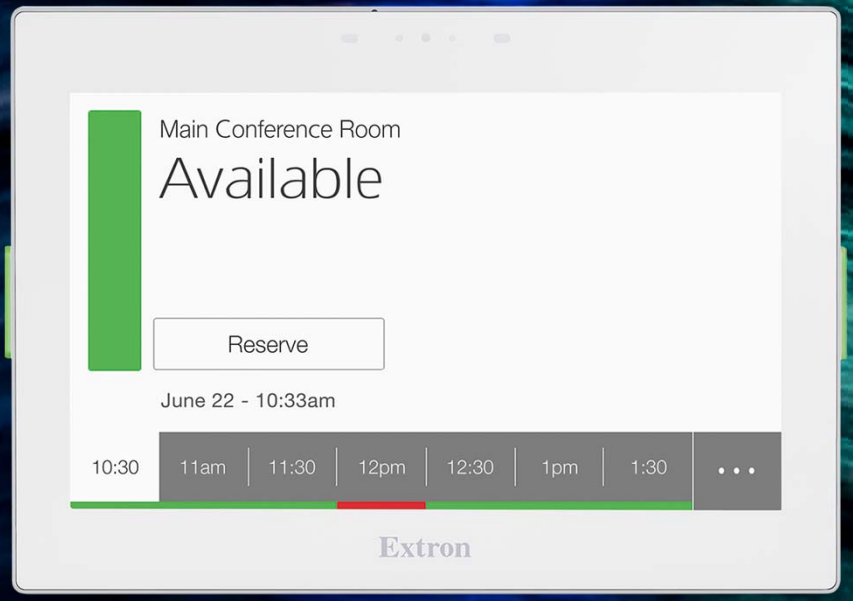


Room Scheduling

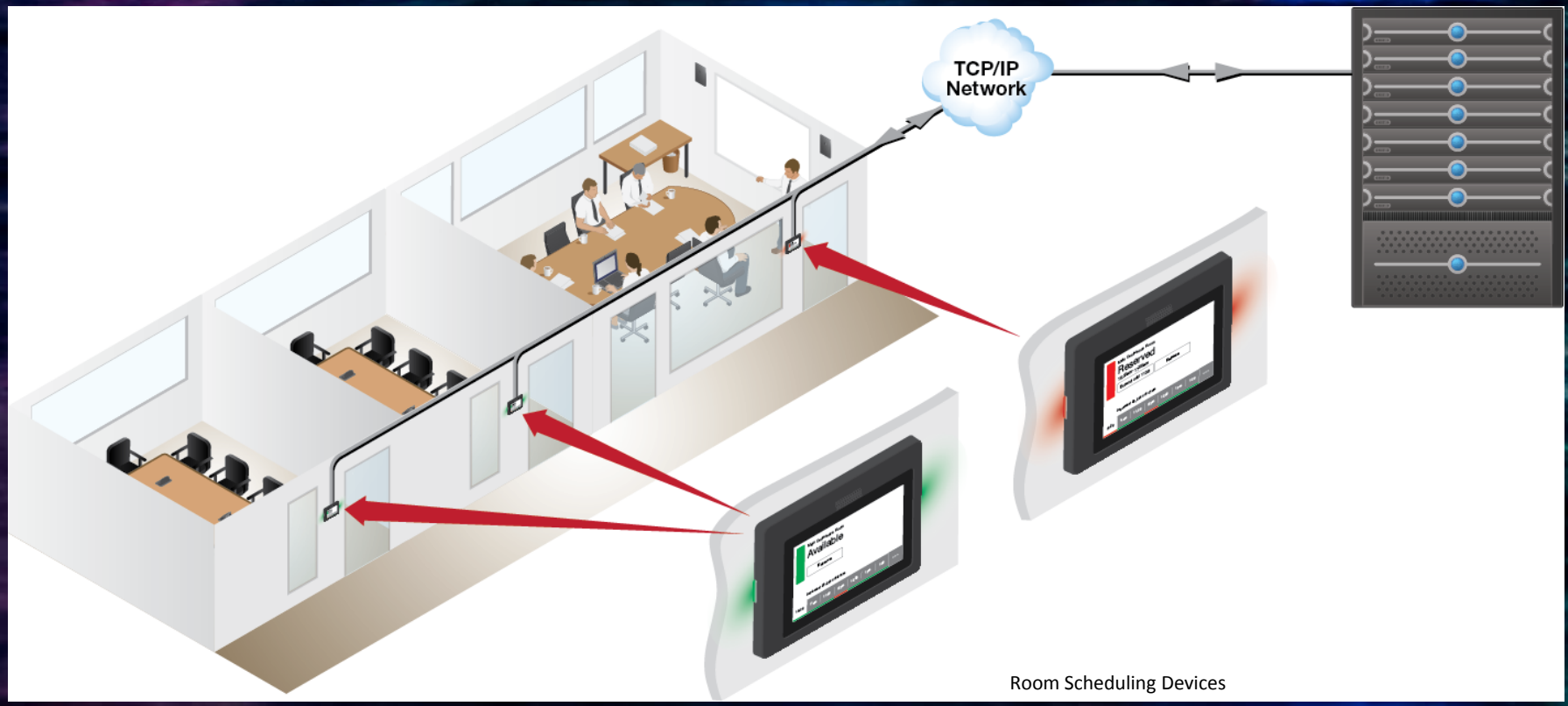
Scheduling – How it used to be



Room Scheduling Panels

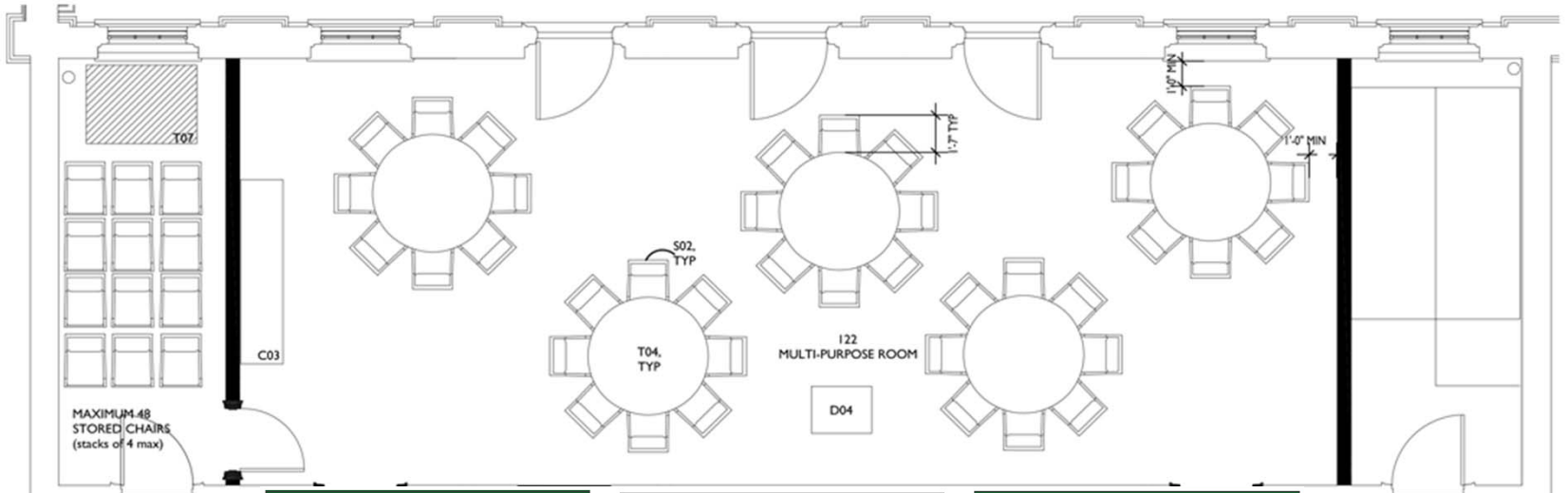


Room Scheduling



Room Scheduling Devices

Designs



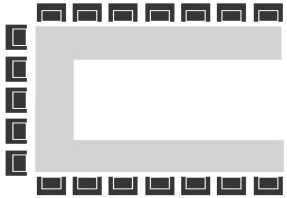
CLASSROOM

Ideal for groups that do not have much discussion but have a need to take notes.

CONFERENCE

Ideal for groups under 20, with heavy discussion and a need to write or refer to materials.

U SHAPE

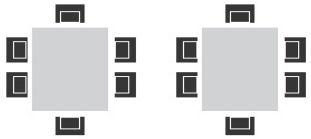


Ideal four groups under 30, with a designated speaker, heavy discussion, and a need to write or refer to materials.

HOLLOW SQUARE

Ideal for groups under 40, with heavy discussion and a need to write or refer to materials.

MEETING SQUARES

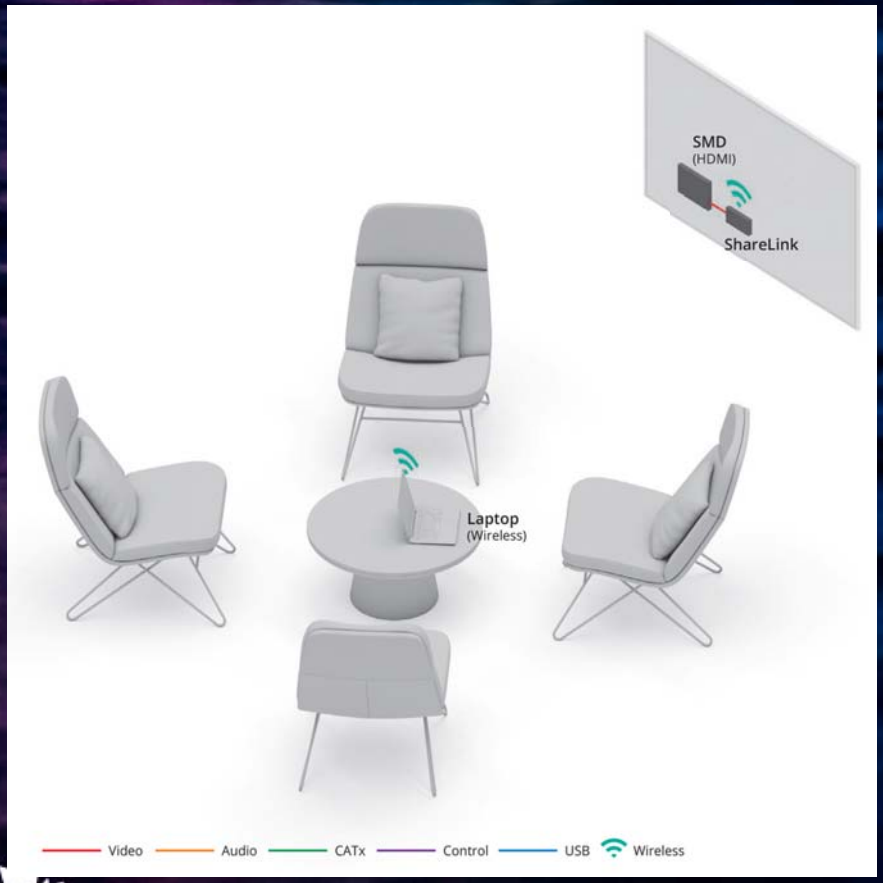


Ideal for any size group that needs to break into smaller groups.

THEATER

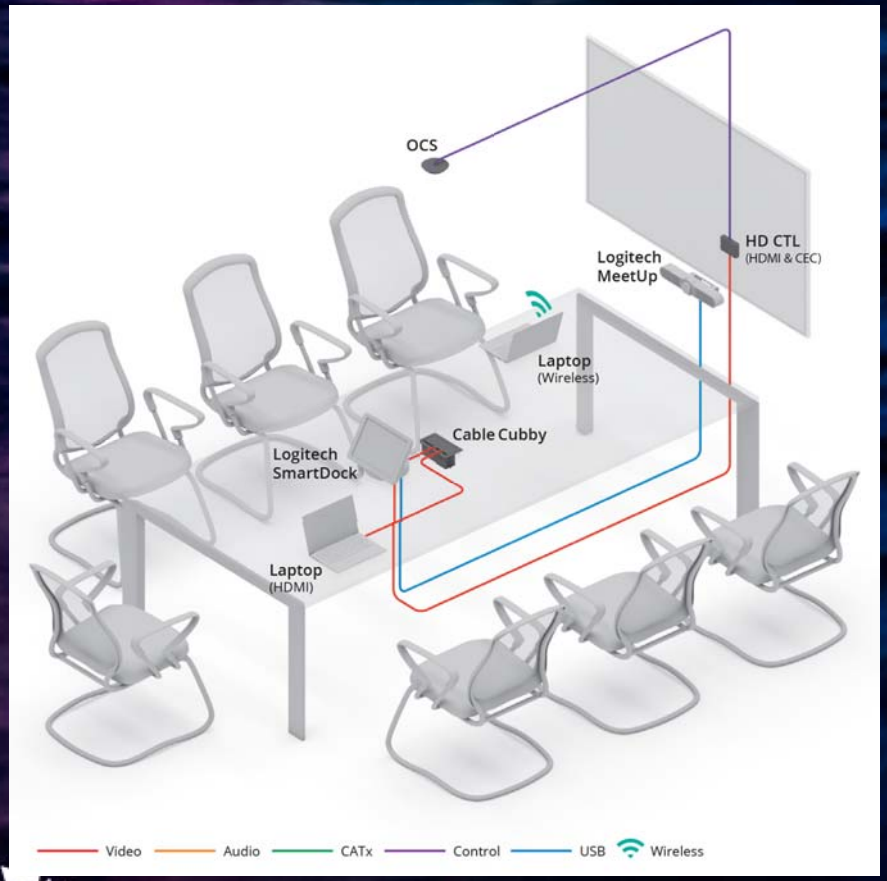
Ideal for any size group that does not have much discussion or does not need to refer to material.

Equipment



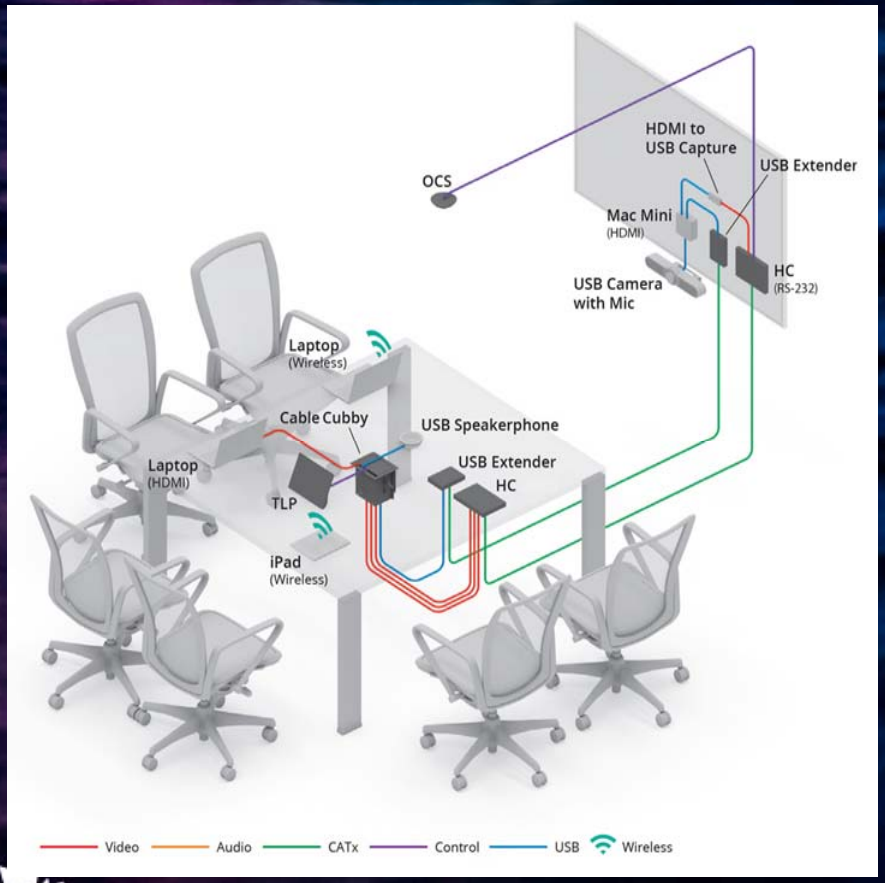
- Wireless only
- No power at Table

Equipment



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

Equipment



zoom logitech cisco

Google Microsoft DOLBY

StarLeaf Polycom lifesize

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

The Modern Workspace

-Thank You-

Karl Rosenberg