HDBaseT Extended
The Webinar Series for AV Pros

Experts Only: Professional-Grade USB Extension

Presented by Valens

Agenda

- Market Overview
- Inside USB Technology
- HDBaseT & USB
- Chipset Support
- Q&A

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Market Drivers and Trends

Acceleration in use of Video Conferencing – Corporate

VaaS
Cloud based to multiple devices

BYOD
Anytime / Anywhere

HYBRID
Meeting equity

Acceleration in use of Video Conferencing - Education

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Market Drivers and Trends

Acceleration in use of Video Conferencing

IMPACT

- **Retrofits**
- **Network (Corporate IP backbone)**
  - Needs to support increased bandwidths
  - Security considerations
  - Recording and archiving sessions
- **Supportive AV equipment and peripherals for Meeting equity include:**
  - Cameras
  - Audio devices
  - Controllers / touch panels (one click to join)
  - Multiple Screens
  - Interactive Whiteboards
- **Software enhancements**
  - Remote Management and Control
  - AI based (cameras, Speech to text)

So What's Being Installed Today?

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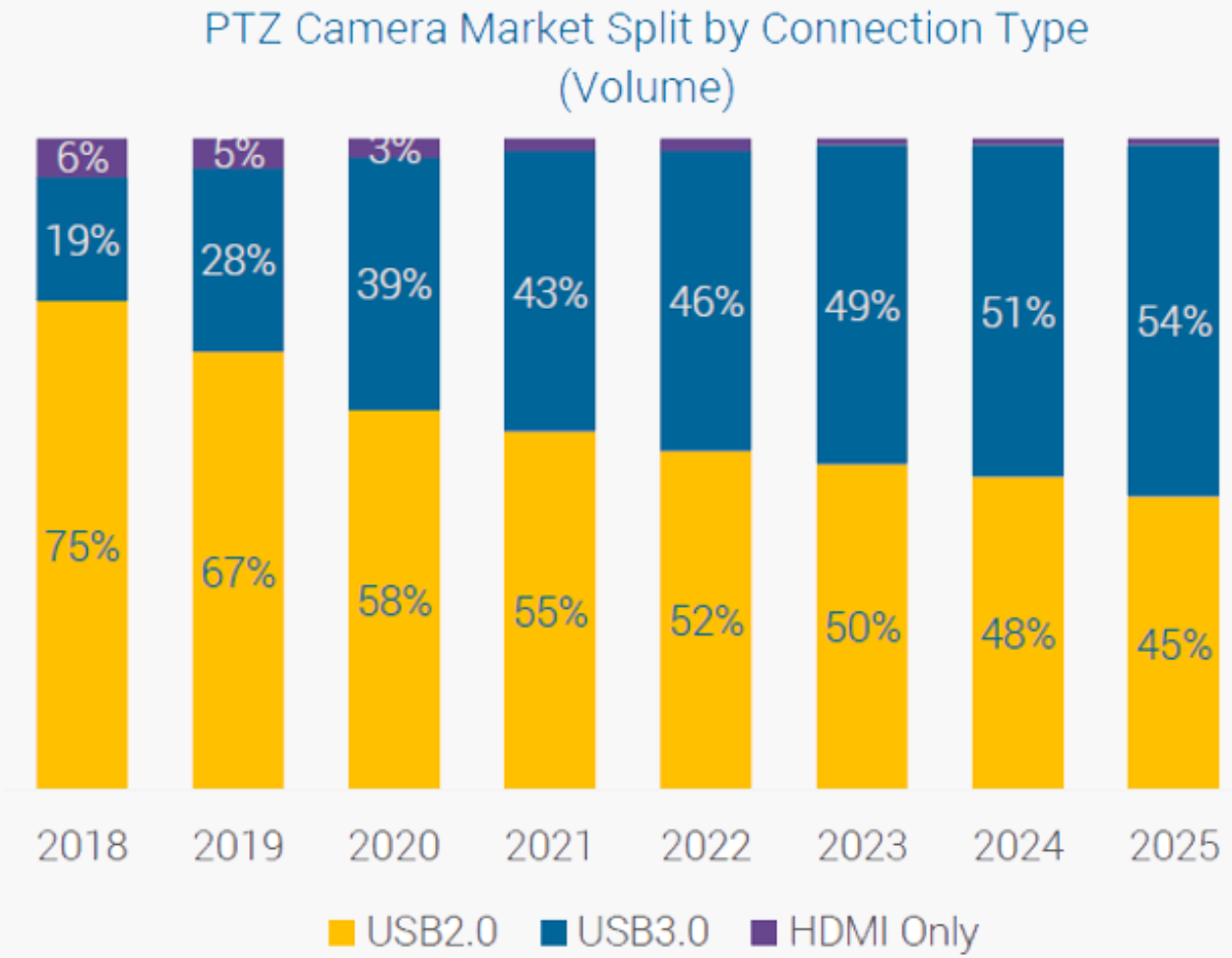
Conference Camera Market Data

Source: future source, June 2021



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Technology Trends

Features & Specs

USB EXTENSION

Video Conferencing Peripherals
Camera, speaker, microphone

Interactive/Control

Storage Devices

USB Specification	Max. Data Transfer Rate	Recommended Cable Length
USB 1.0 (Full Speed)	12 Mb/s	3 m (9 ft.)
USB 2.0 (High Speed)	480 Mb/s	5 m (16 ft.)
USB 3.2 Gen 1	5 Gb/s	2-3 m (6-9 ft.)
USB 3.2 Gen 2	10 Gb/s	2-3 m (6-9 ft.)

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Some USB Terminology

Host – the bus Master. Responsible for initiating USB transactions.

Device – a USB peripheral connected to a Host

Endpoint – the source or sink of data within a Device

Transfer – the process of making a communications request with an endpoint

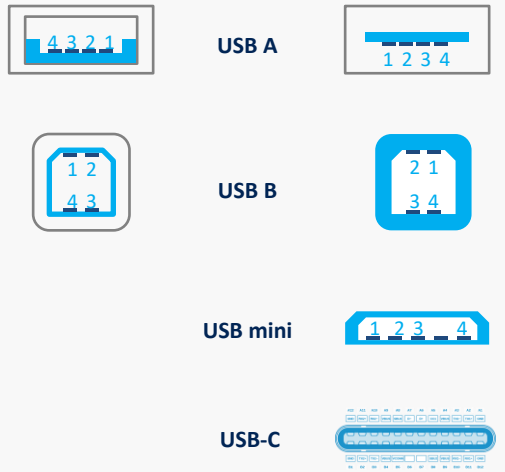
- Periodic: occurring at fixed intervals and frequently
- Non-periodic: occurring only when required

Hub – a device to expand the number of devices that can connect to a Host

USB 2.0

USB Basics

- USB is Host controlled, with only one Host per bus permitted.
- The Specification does not define a Multi-Master arrangement (although On-The-Go allows for devices to negotiate who will be host).
- The USB Host is responsible for undertaking all transactions and scheduling bandwidth.
- Data is sent serially by various transaction methods using a token-based protocol.
- The protocol requires only 4 wires (USB 2.0)
  - VCC (+5V)
  - D-
  - D+
  - GND
- Multiple connector types available



Pin	Signal	Description
1	VCC	+5V
2	D-	Data -
3	D+	Data +
4	GND	Ground

USB 3.X

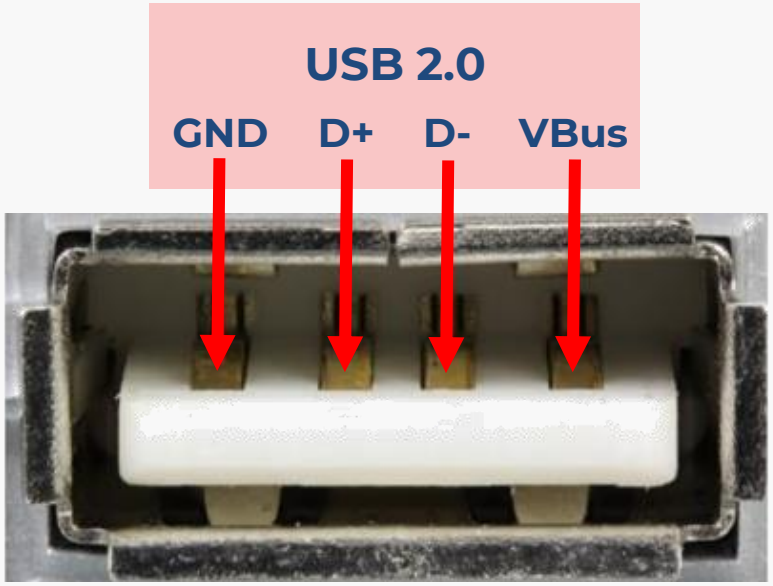
USB Basics

- Builds on the existing USB 2.0 spec but with greatly increased speeds
- USB 3.2 is the latest version of the USB 3 specification

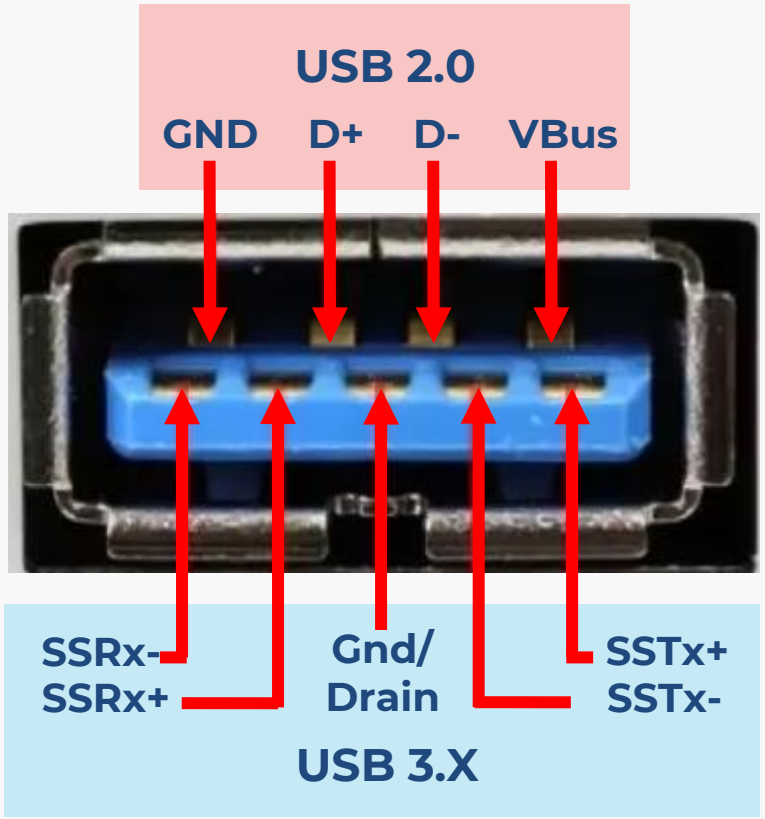
Marketing name	USB 3.2 Specification	Nominal speed	Connectors
SuperSpeed USB 5Gbps	USB 3.2 Gen 1x1	5 Gbit/s	USB-A, B, Micro B, USB-C
SuperSpeed USB 10Gbps	USB 3.2 Gen 2x1	10 Gbit/s	USB-A, B, Micro B, USB-C
SuperSpeed USB 20Gbps	USB 3.2 Gen 2x2	20 Gbit/s	USB-C

USB2 & USB3 – Connector Types

Achieving Backward Compatibility



USB 2.0 Type-A Receptacle



USB 3.X Type-A Receptacle

Theoretical vs. Net Transfer Speeds

- When thinking of USB speeds, most people know the speeds shown in the table below
- These are the speeds that the USB protocol runs at, and include the protocol overhead – they are not the actual net data transfer speeds
- Actual data transfer speeds are considerably slower (for example, USB 3.2 Gen 1 will not exceed 4Gb/s)
- When connecting Host and Device from different spec versions, the lowest common speed will be supported
  - For example, a USB 3.0 Device connected to a USB 2.0 Host will operate at speeds of USB 2.0

USB Specification	Max. Data Transfer Rate	Net Data Transfer Rate	Recommended Cable Length
USB 1.0 (Full Speed)	12 Mb/s		3 m (9 ft.)
USB 2.0 (High Speed)	480 Mb/s	~320 Mb/s	5 m (16 ft.)
USB 3.2 Gen 1	5 Gb/s	4 Gb/s	2-3 m (6-9 ft.)
USB 3.2 Gen 2	10 Gb/s	8 Gb/s	2-3 m (6-9 ft.)

USB3 Camera Extension Requirements

- **USB3.2 Standard compatible**
  - **Interoperable with off-the shelf USB devices**
  - USB2.0 backward compatible
- **Support high-bandwidth transfer to enable**
  - **High-resolution, high frame-rate imaging in real time**
  - **Uncompressed video for processing**
  - Camera's integrated processing and AI capabilities
- **Low latency:**
  - **Maintain USB3 protocol timing (interoperability)**
  - Support AI related action and Enhanced Processing capabilities
  - Improved camera tracking response time
- **Power delivery**
  - Power is not always available at the camera side
  - Simplify the installation without the need for camera dedicated AC outlet
- **Non-USB Control channel**
  - UART/RS232 - for PTZ cameras
  - GPIO – dedicated control signals

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Options for USB Extension

USB3 over Fiber

Pros
Rate and performance without degradation

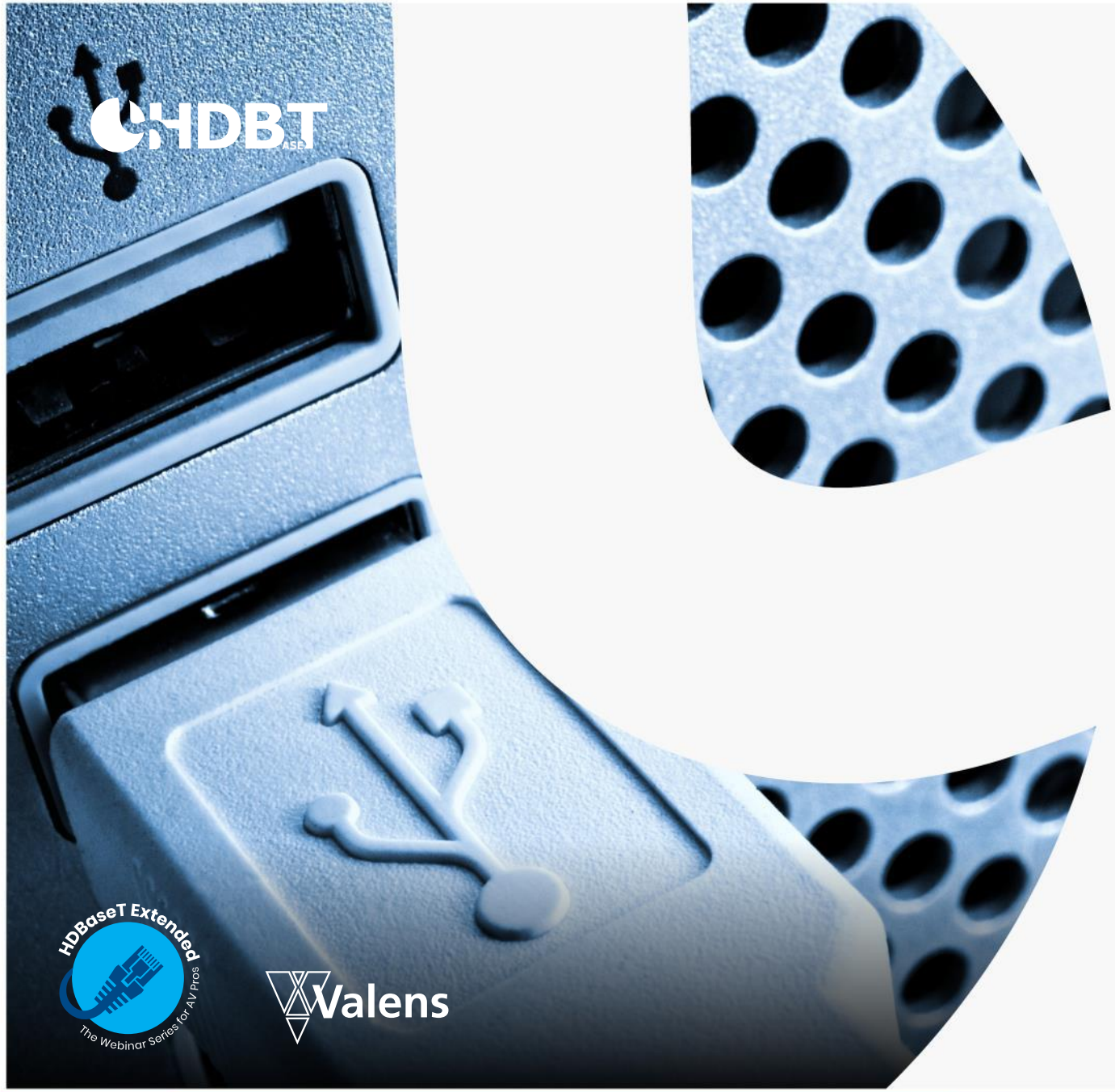
Cons
- Proprietary
- Predefined fixed length (cannot be field terminated)
- Expensive
- No power delivery over the cable

Active cable (signal boosting)

Pros
Low cost, ‘Good enough’ for short range

Cons
- **Limited cable reach** - Up to ~10m for USB3 and 40m for USB2.0
- Predefined fixed length (cannot be field terminated)

While the above will work, they are limited in their functional capabilities



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USB Termination Mode

- HDBaseT implementations for USB extension are based upon termination of the incoming USB data stream, and not signal boosting
- The USB protocol is stripped away (“terminated”) and only the actual data bits are sent across the link in HDBaseT packets
- On the far side of the link, the data is repacked into USB protocol such that the USB Host and Device have no idea that there was an HDBaseT link in the middle
- Some of the termination is done in firmware, so hardware acceleration is used to boost performance

USB over HDBaseT

HDBaseT Specifications 2.0/3.0

- Compliant with USB 2.0 specification
- Supports all types of USB transfers

PERIODIC

- Isochronous – e.g. web cameras, audio devices
- Interrupt – e.g. keyboard, mouse

NON-PERIODIC

- Bulk – e.g. disk drives
- Control (all devices)

- Supports maximum of 7 USB devices
- Bandwidth
  - HDBaseT Spec 2.0: up to 190Mb/s
  - HDBaseT Spec 3.0: up to 320Mb/s

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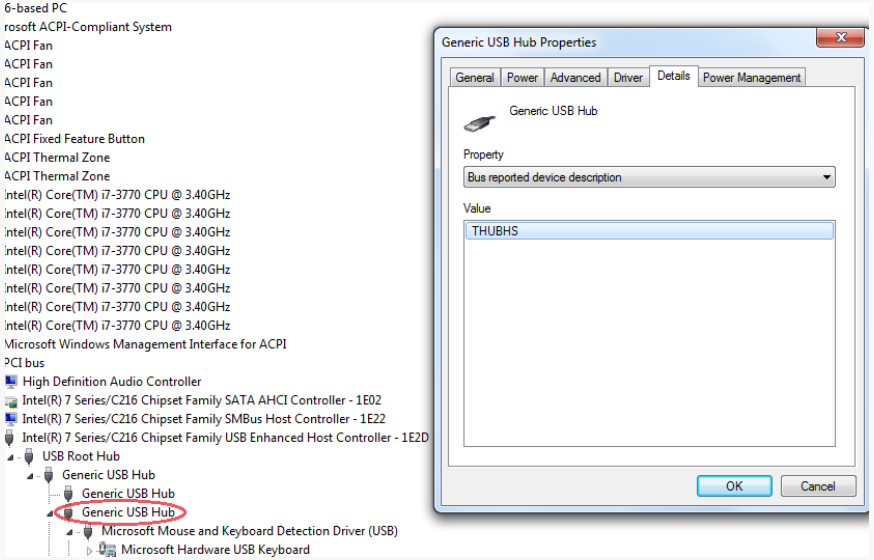
“USB-T”
(USB the HDBaseT Way)

- Extends USB cable reach from a few meters up to 100m
- Acts as virtual hub (devices see the HDBaseT chipsets as a single hub)
- Allows us to create unique USB switching capabilities



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Valens HDBaseT Chips Supporting USB 2.0 Extension

HDBaseT Link Speed	Main: 8Gbps Aux: 300Mbps	Main: 16Gbps Aux: 2Gbps	Symmetrical 500Mb/s
Maximum USB Net Rate	190Mbps (Isochronous) 140Mbps (Bulk)	350Mbps	300Mbps
Tunneled Interfaces	USB 2.0 (Host/Device), HDMI 1.4, 100M Ethernet, I^2S, S/PDIF, CIR, UART, I^2C	USB 2.0 (H/D), HDMI 2.0, 1G Ethernet, I^2S-4, S/PDIF, CIR, UART, I^2C	USB 2.0 (H/D), 100M Ethernet, I^2S, UART, I^2C
Maximum Cable Length	100m/328ft Cat6 Optical fiber (SM/MM)	100m/328ft Cat6a	100m Cat6a (single pair)

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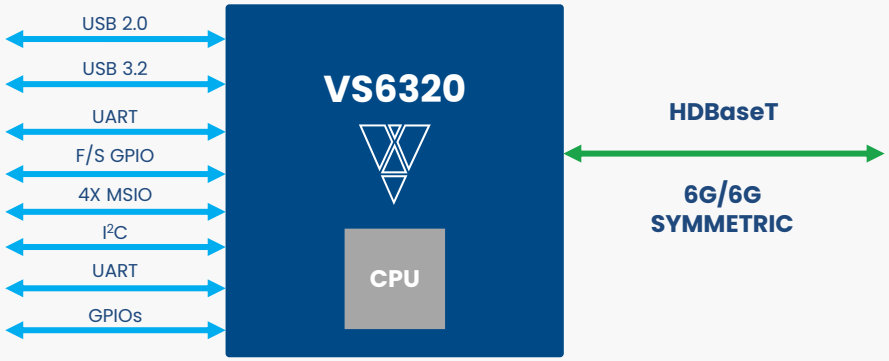
Roadmap Product – VS6320 for USB 3.2 Extension

HDBaseT Link:

- Bi-directional **6G/6G symmetrical**
- Up to 100m/328ft over CAT6A cable

Tunneled interfaces:

- **USB2.0** based on the VS3000 USB2.0 implementation
- **USB3.2 gen 1**, rate of 5Gbps:
  - Configurable USBH or USBD
  - Isochronous and Bulk - HW acceleration
- **UART**: 1xUART-In Port and 1xUART-out Port
- **MSIO:** discrete binary controls for generic low-speed extension
- **Frame synced GPIO**: 1 x Frame Synced GPIO In and Out



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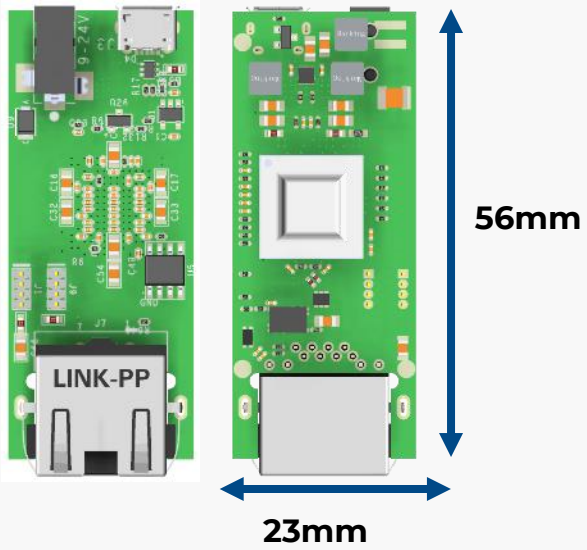
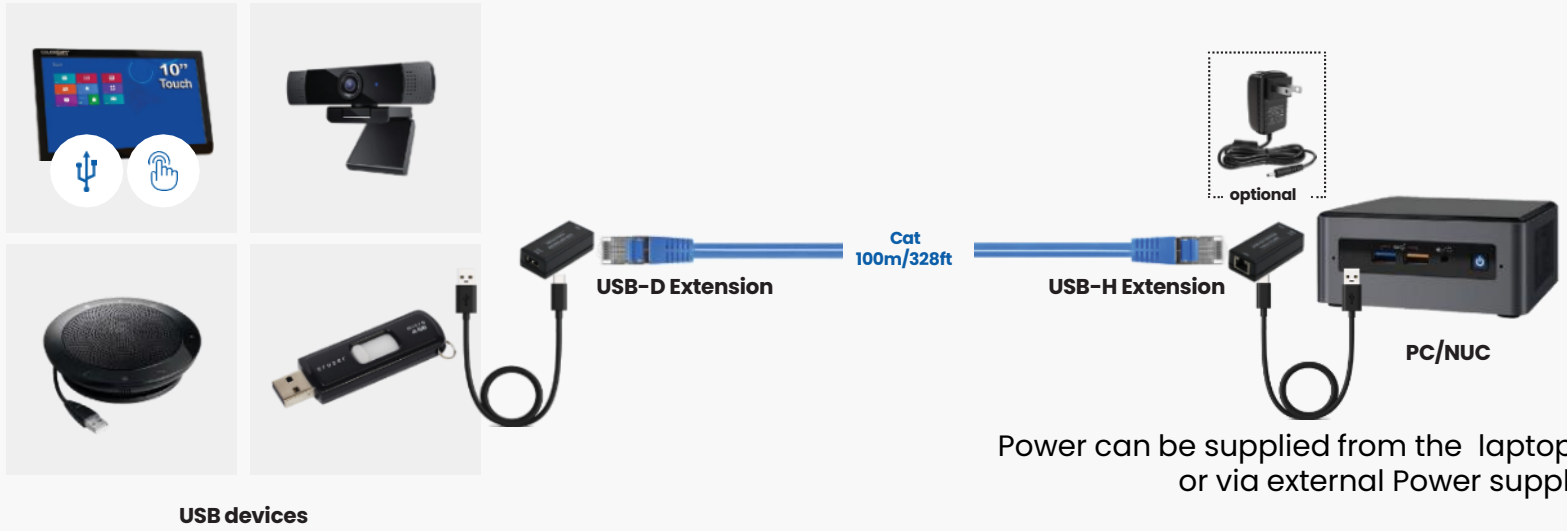
Example Implementation: USB2.0 dongle extender

- Small form factor; cost optimized
- USB2.0 & Power (5V) up to 100m
  - Two options for Power over cable delivery:
    - Supply power from **PC USB3 port** (no external power supply required)
    - Using external Power supply injected via the “PC side” dongle





Power can be supplied from the laptop’s USB3.0 port or via external Power supply

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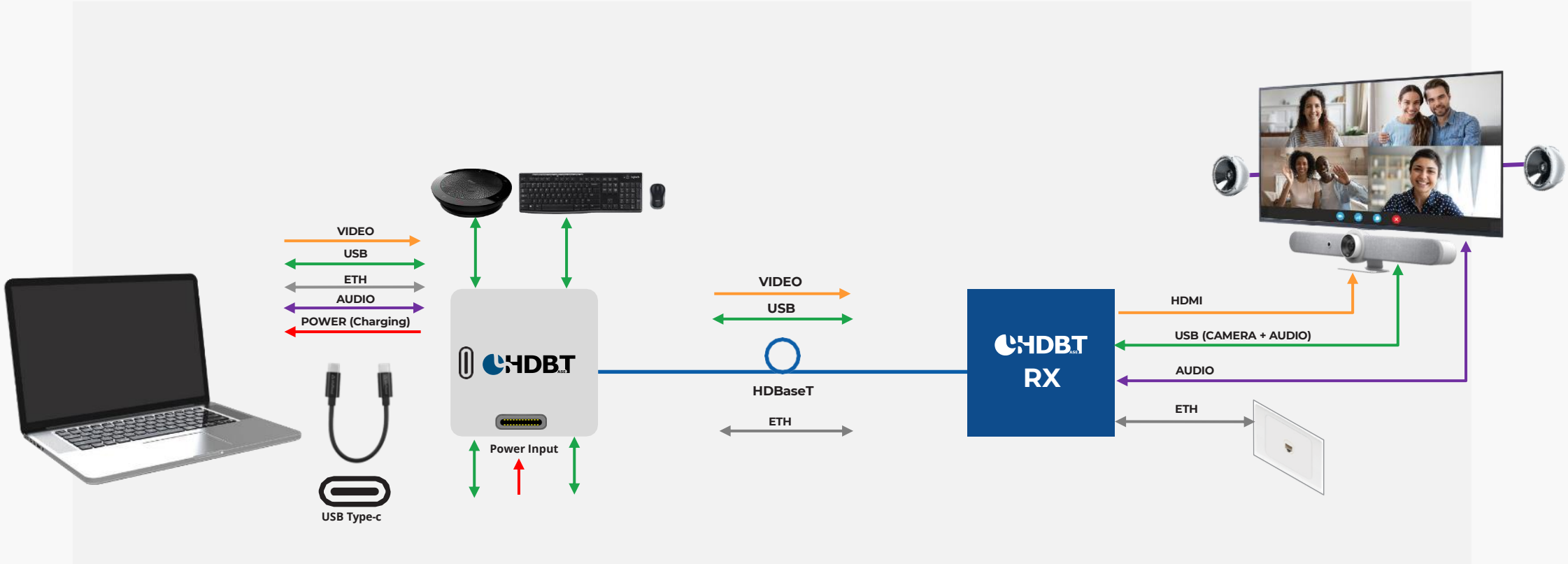
Type-C (Video + USB2.0) Extension over HDBaseT



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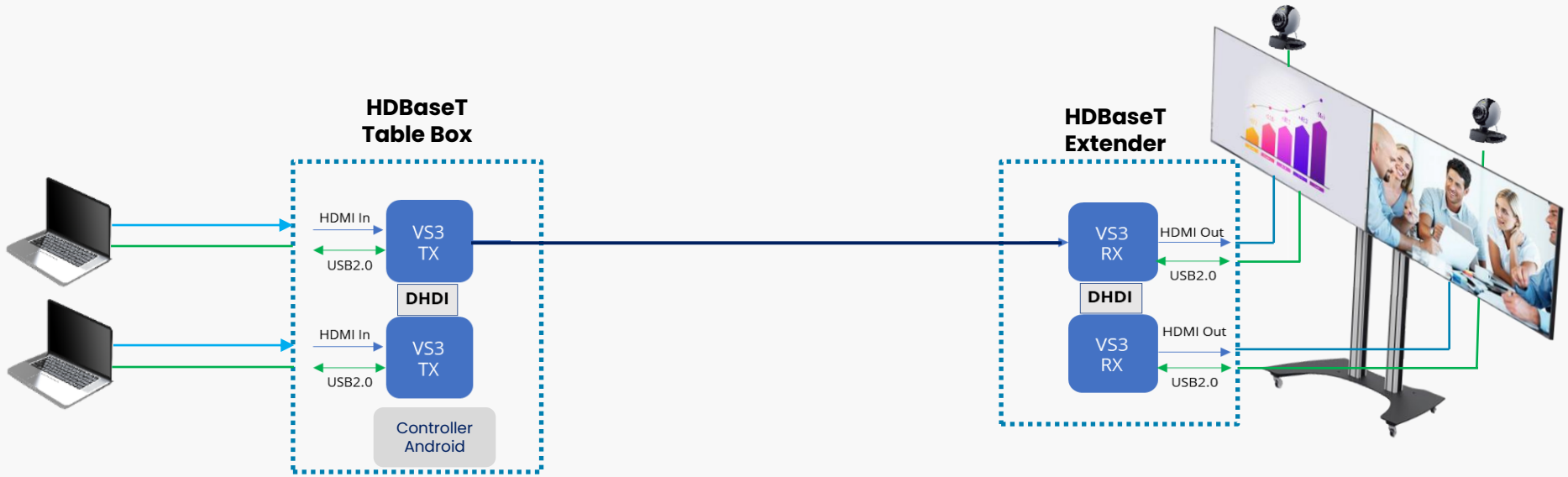
2 X 2 for Conference Room

- Supports in room 2 x Displays and 2 x Cameras
- BYOD and Appliance mode with Laptop screen sharing



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