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# Application Guide

Q-SYS Network Video Series: NV-32-H (Core Capable)



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# **THE Q-SYS™ ECOSYSTEM NOW SUPPORTS HIGH QUALITY NETWORK NV-32-H (CORE CAPABLE) DISTRIBUTION.**

Q-SYS networks can now support high-quality (up to 4K60), low-latency video distribution through the NV-32-H Network Video Endpoint. This application guide will discuss ways to use this versatile piece of gear.

The NV-32-H (Core Capable) allows the systems integrator the ability to utilize the NV-32-H in either Peripheral Mode or Core Mode.

In Peripheral Mode, the product supports all the functionality found in the original NV-32-H product and can be used as either an IP video encoder or IP video decoder.

When operated in Core Mode, the NV-32-H (Core Capable) provides audio, video and control processing as a Q-SYS Core processor while also supporting the local 3x2 HDMI video switching features of the NV-32-H.

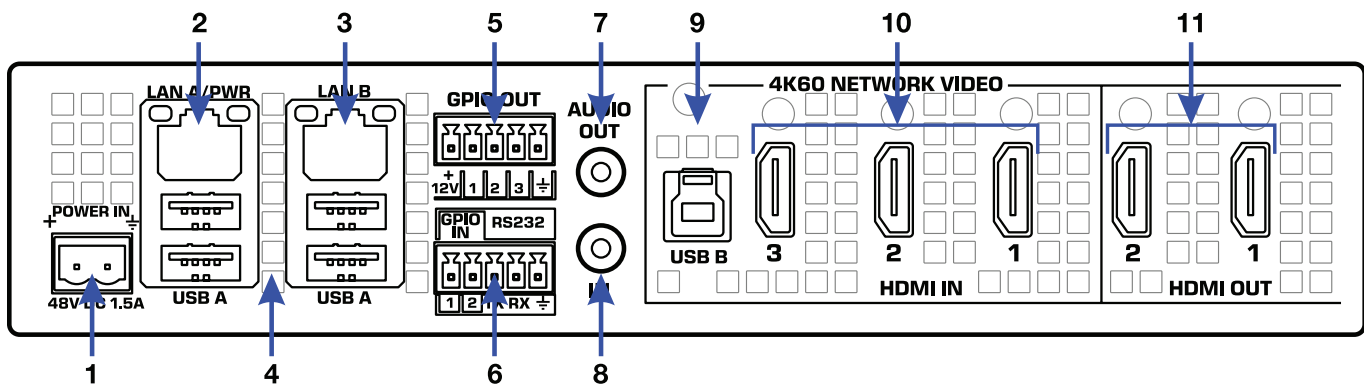
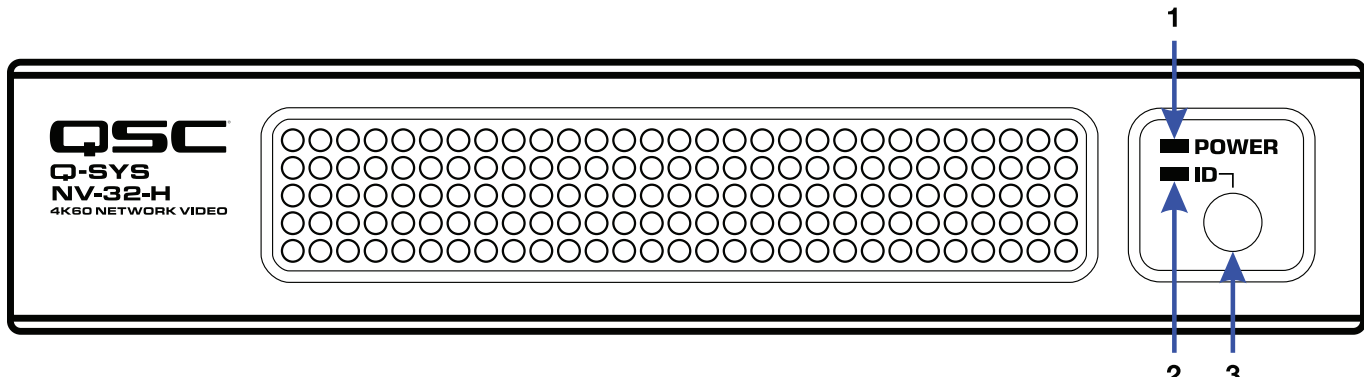
Note: When operating in Core Mode, the NV-32-H (Core Capable) does not support IP video encoding or decoding.

All NV-32-H (Core Capable) products ship with Peripheral Mode enabled by default.

**1. Power LED**

**2. ID LED** — Blinks when the ID Button is pressed on the front panel or when its ID button is clicked in Q-SYS Designer Software.

**3. ID Button** — Helps locate the NV-32-H in Q-SYS Designer Software and in Q-SYS Configurator.



- 1. External power input** — 48 V DC @ 1.5 A; use instead of PoE ++ or along with it for redundancy.
- 2. LAN A / PoE ++** — RJ-45 connector for Q-LAN network and for 802.3bt power; use instead of external power or along with it for redundancy.
- 3. LAN B** — RJ-45 connector; provides QLAN network redundancy when operated in Core Mode.
- 4. USB Type A** — Four host

- connectors; up to 1.0 A total current available.
- 5. GPIO Outputs** — +12 V out; three open-collector outputs; ground reference
- 6. GPIO Input / RS-232** — Two analog voltage or contact-closure inputs; RS-232 transmit and receive; ground reference.
- 7. Analog audio output** — stereo audio on 3.5 mm TRS jack.

- 8. Analog audio input** — stereo audio on 3.5 mm TRS jack.
- 9. USB Type B** — Type B Device connector for web conference integration.
- 10. HDMI Inputs** — Three HDMI 2.0 inputs; supports HDCP 2.2 and HDCP 1.4.
- 11. HDMI Outputs** — Two HDMI 2.0 outputs; supports HDCP 2.2 and HDCP 1.4.

The main AV interfaces utilized in this application guide are three HDMI inputs, two HDMI outputs, and a USB type B connection for audio and video bridging.

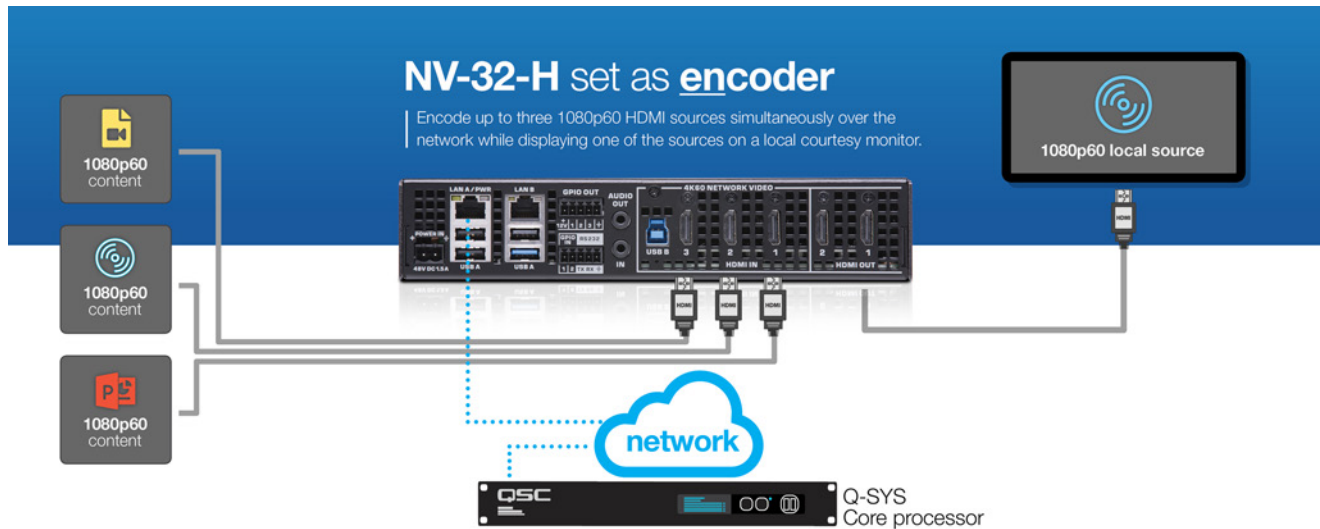
# 1. PERIPHERAL MODE

The NV-32-H (Core Capable) is shipped with Peripheral Mode active by default. The following sections describe the operation and applications surrounding the use of the product when operated in Peripheral Mode. Refer to the Core Mode section for further applications information about how to configure and utilize the NV-32-H (Core Capable) in Core Mode.



## The NV-32-H as an encoder

As an encoder, the NV-32-H can route video from any of three local HDMI sources to anywhere on the local network, at resolutions as high as 4K60 4:4:4. In this setup, HDMI Out 1 feeds a courtesy monitor, and it can scale the video as needed.



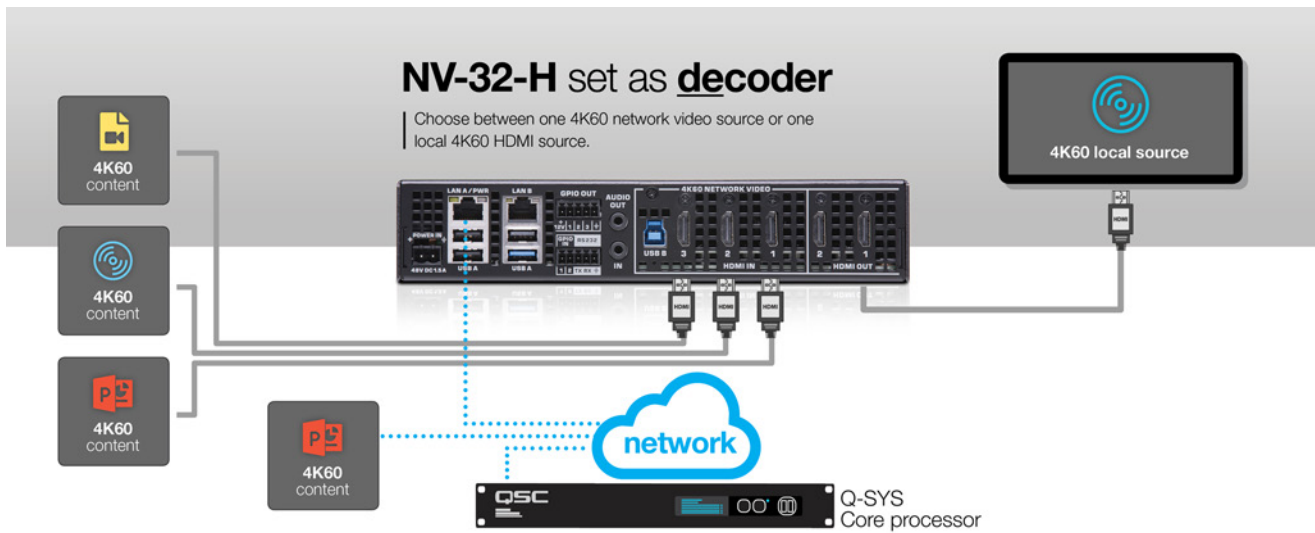
The NV-32-H is able to stream all three local HDMI sources simultaneously at a maximum resolution of 1080p60 4:4:4 while providing a single courtesy monitor output as well.

## The NV-32-H as a decoder

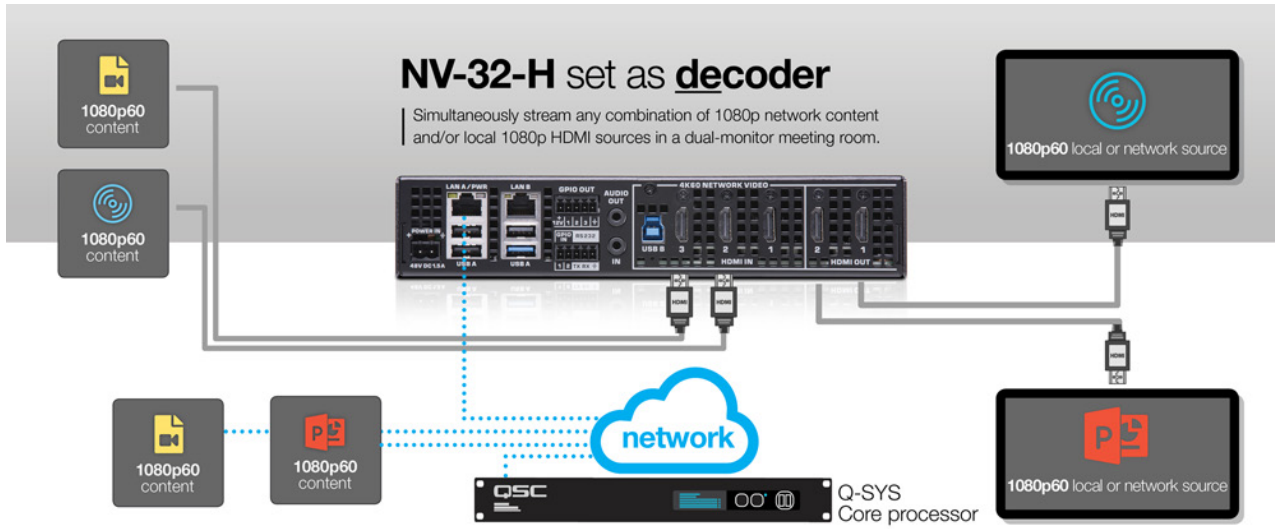


As a decoder, the NV-32-H can receive a single 4K60 AV stream from the network and deliver it to HDMI Out 1. As in the previous examples, the HDMI output will automatically scale to the resolution of the connected display.





When set as a single-output decoder, the NV-32-H can select from AV streams as well as locally connected HDMI sources.



With both outputs HDMI 1 and HDMI 2 enabled, the NV-32-H can select any two content sources from among network AV streams and the local HDMI inputs. It will scale the output content to match the resolution of the displays.

<b>Amplifiers</b>	<b>Audio-Video I/O</b>
<b>Loudspeakers</b>	<b>I/O USB Bridge</b> I/O USB Bridge
<b>Peripherals</b>	<b>NV-32-H</b> Network Video Endpoint (Encoder/Decoder). Provides 3 HDMI 2.0 Inputs, 2 HDMI 2.0 Outputs
<b>Streaming I/O</b>	<b>Cameras</b>
<b>Video</b>	<b>PTZ-12x72</b> 12x Zoom, 72° Field of view, PTZ-IP Camera
	<b>PTZ-20x60</b> 20x Zoom, 60° Field of view, PTZ-IP Camera
	<b>Displays</b>
	<b>Generic HDMI Display</b> Generic HDMI Display
	<b>Sources</b>
	<b>Generic HDMI Source</b> Generic HDMI Source

## Setting up the NV-32-H Network Video Endpoint in a Q-SYS design

In Q-SYS Designer Software v8.1 and later, place a NV-32-H into the design as you would any other Q-SYS component. Find it in the Video category under Audio-Video I/O. Use Generic HDMI Display devices and/or Generic HDMI Sources with the NV-32-H.

Under Properties, configure the parameters as needed. In the examples portrayed in this application guide, the only configuration necessary in most cases is selecting Encoder or Decoder.

You can set up multiple NV-32-H devices in the design as needed to accommodate additional sources, displays, and locations.

Properties

### Network Video Endpoint Properties

Name	NV-32-H-2
Location	Default Location
Is Required	Yes
Dynamically Paired	No
External USB Audio	Disabled
Device Type	Decoder
AV Input Count	3
HDMI Output Mode	HDMI 1
HDMI 1 Audio Pins	2

### USB Bridging

USB Video Bridge	Disabled
USB Audio Bridge	Disabled

### Graphic Properties

Fill

### Control Pins

- Output 1
  - Active
    - AV 1
    - AV 2
    - AV 3
    - HDMI 1
    - HDMI 2
    - HDMI 3
  - Select
    - AV 1
    - AV 2
    - AV 3
    - Graphic 1
    - Graphic 2
    - Graphic 3
    - HDMI 1
    - HDMI 2
    - HDMI 3
- Select by Name
- Select by Number



# Peripheral Mode Uses and Applications

## Introduction

This section of the guide describes operation and usage of the NV-32-H video endpoint device in a Q-SYS ecosystem.

### Technical notes

The NV-32-H transmits video across the network with no more than two frames of latency end-to-end.

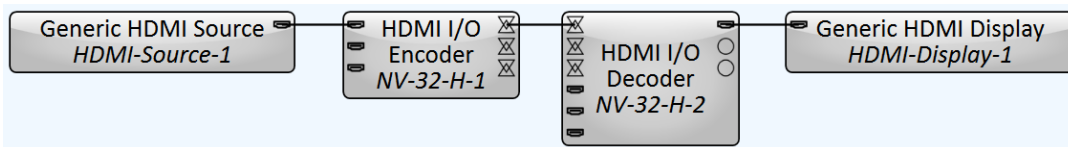
Switching among these is seamless:

- Multiple sources on the same encoder.
- Multiple sources on the same decoder.
- Sources on different encoders.
- Between an encoded source and a locally connected one.

## Audio modes

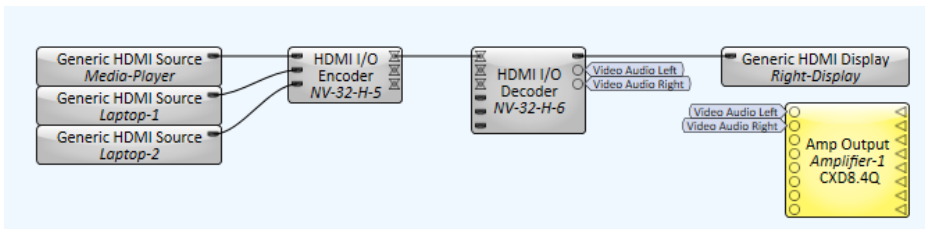
**HDMI Link** — Audio and video stream across the network together from an encoder to a decoder. Audio passes along with video on the HDMI output to play through the loudspeakers on the connected display. The audio destination could also be an HDMI-enabled soundbar or AV receiver.

The number of audio channels sent by the source device—as defined in its Extended Display Identification Data (EDID)—is set in its property **Audio Channels**.

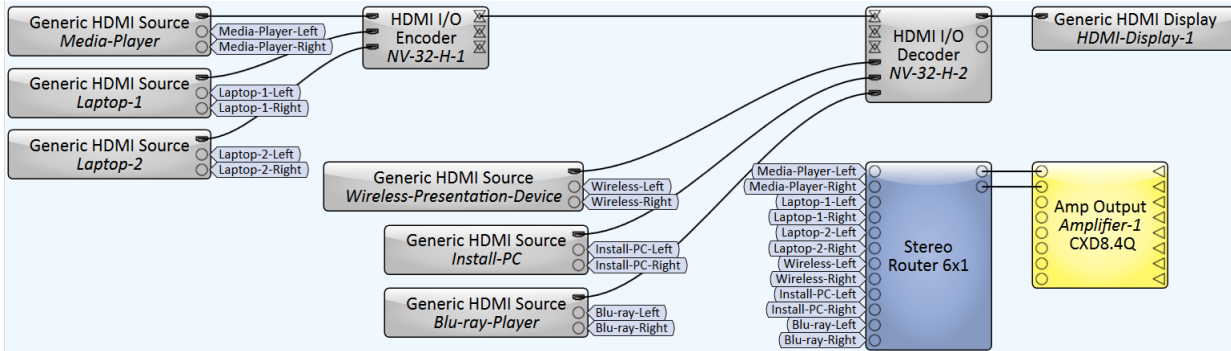


**Decoder to Core** — This mode is used for routing audio from the Q-SYS NV-32-H to your Q-SYS system. It inherently contains all the logic for audio-follows-video; the audio pins will play content from the active selected video source. This mode makes the most efficient use of networked audio channels while still harnessing the power of the Q-SYS platform for routing, processing and control.

Define the number of audio channels the decoder can send to the Q-SYS Core under its component properties in Q-SYS Designer Software.

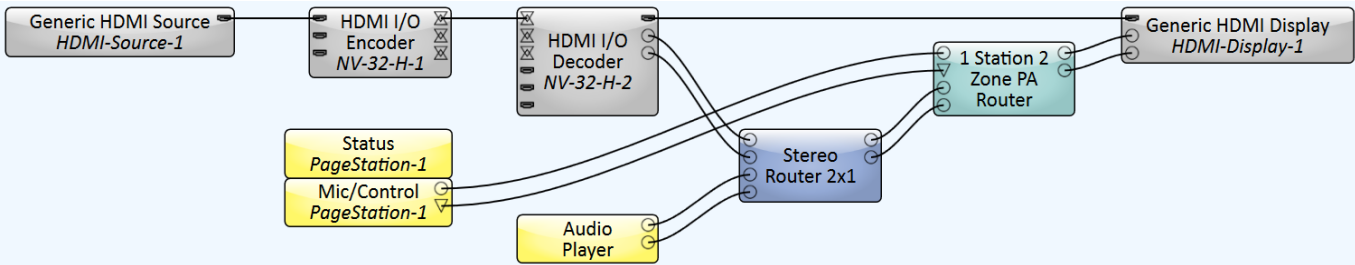


**Source to Core** — This mode takes audio directly from the sources themselves and offers a system designer the greatest flexibility for routing or individual source processing. It uses the most networked audio channels, though.



**Core to HDMI Display** — To combine the convenience of an installed HDMI display with built-in loudspeakers (or some other HDMI audio device, for that matter) with the power and flexibility of the Q-SYS Ecosystem, simply route the audio—and not necessarily just program audio—directly to the HDMI output of the NV-32-H.

To do so, go to the **Audio Source** property of the Generic HDMI Display component and select **Audio Input Pins**. Then you can wire audio from a decoder or source component or any other Q-SYS audio pins directly to the Generic HDMI Display.

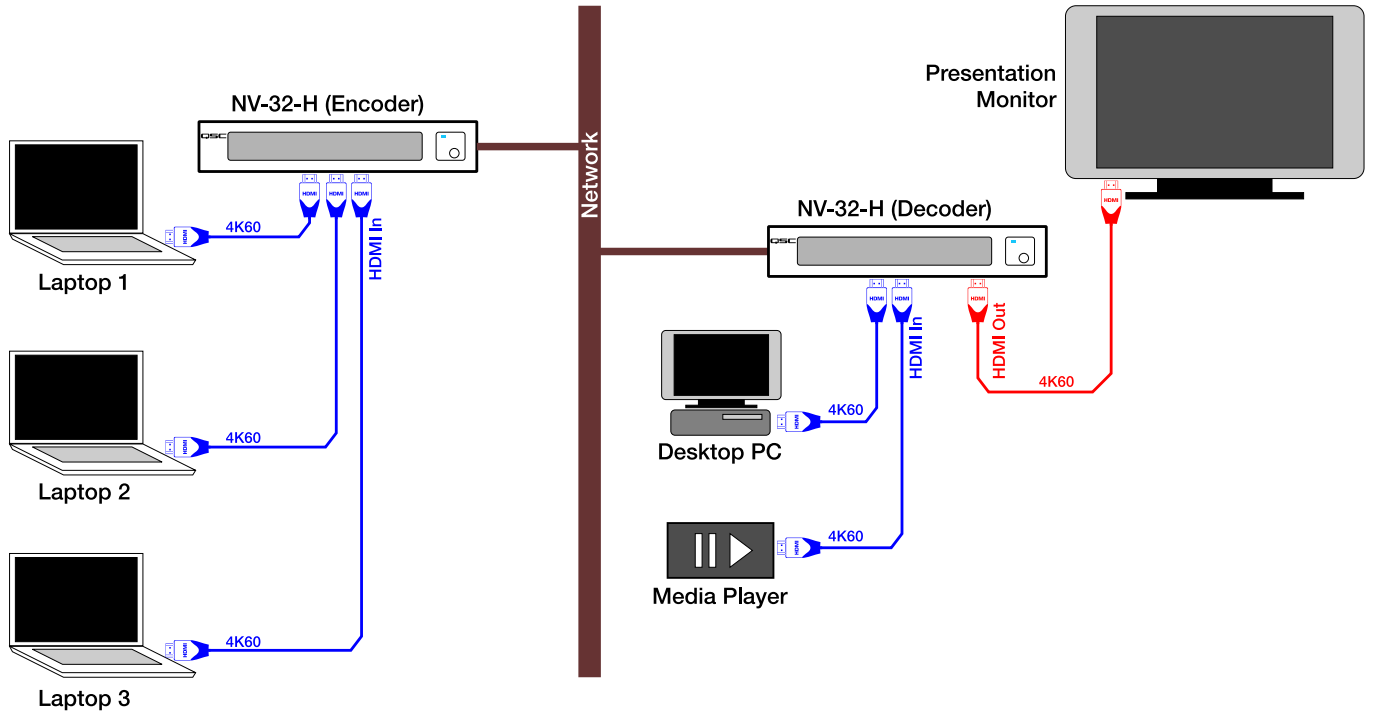


# Single-Room Operational Modes

## Single Room—4K60 Mode; Video and Audio

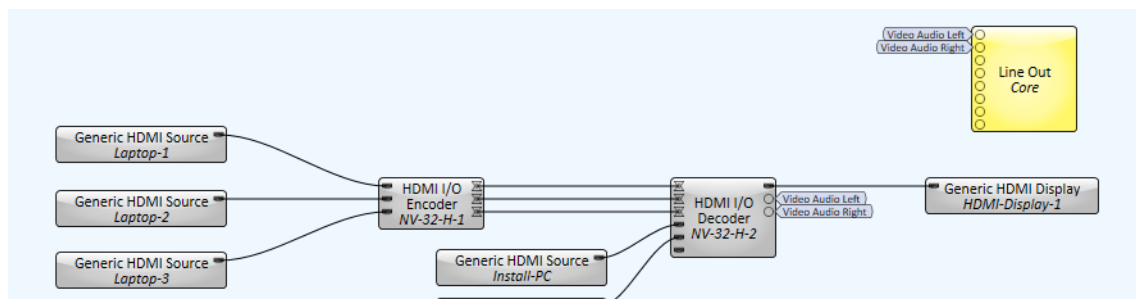
This example portrays a traditional conference / meeting space designed for audio-visual presentation.

### Room 1—Medium Conference Room



At left are three devices (laptop computers) plugged into a single NV-32-H video endpoint configured as an encoder. At the right are two devices (a media player and a laptop computer) plugged into another NV-32-H configured as a decoder and on the same network. The HDMI output of the decoder connects to a display.

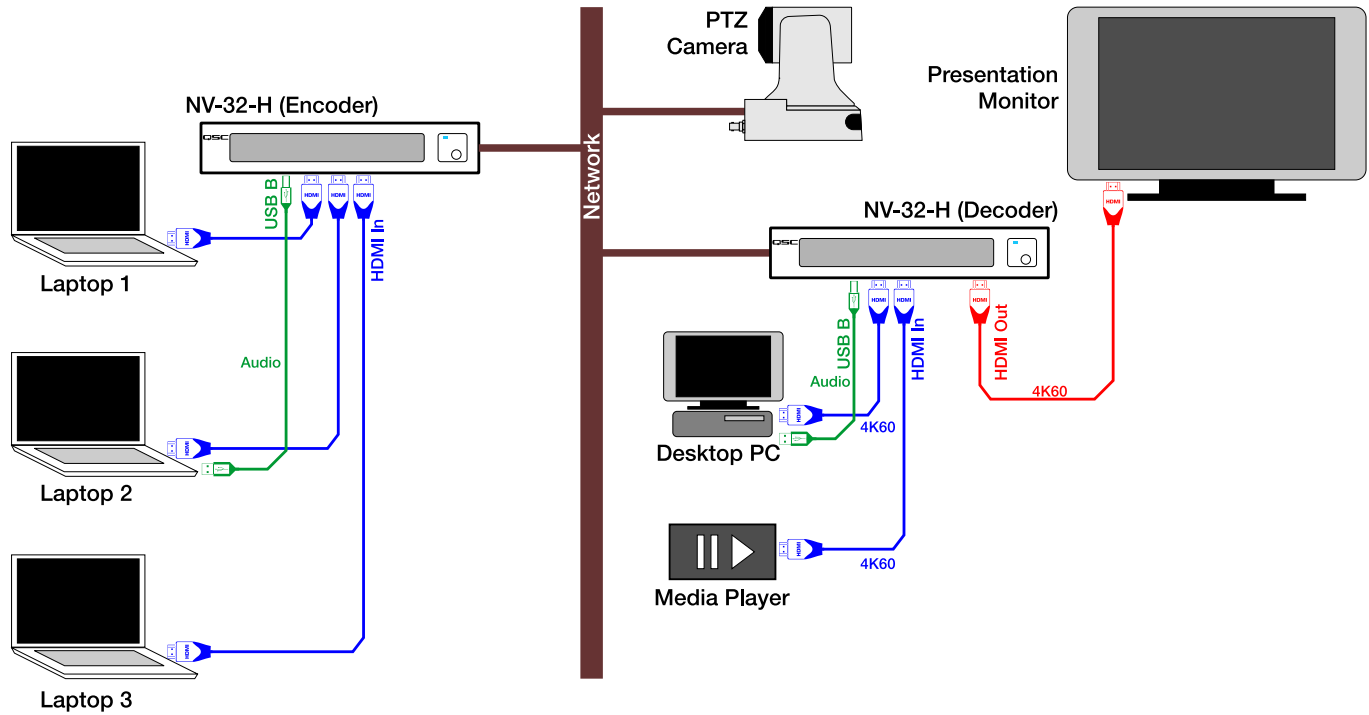
This configuration makes a 5 × 1 switching environment within the room: the display can show program content from any of the three laptops, from the media player, or from the desktop computer, depending on the control commands sent to the encoder and decoder by the Q-SYS system. Audio will also route from the selected source (i.e., audio-follow-video), and it can be broken out at the decoder for processing and routing by the Q-SYS Core Processor.



### Single Room—4K60 Mode; Video and Audio with AV Bridging

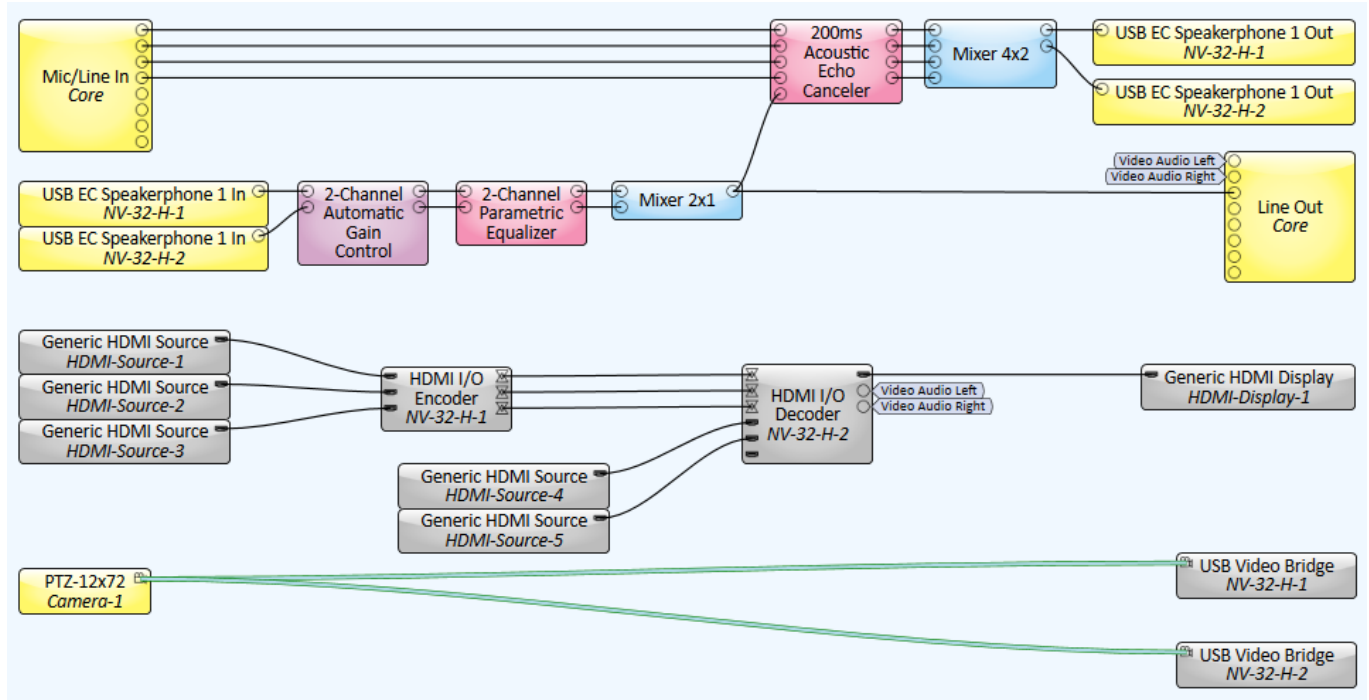
This example also portrays a traditional meeting room design, but with a larger number of Q-SYS products and peripherals. This system not only has audio-visual presentation capability, but video / audio conferencing capability as well.

### Room 2—Medium Conference Room



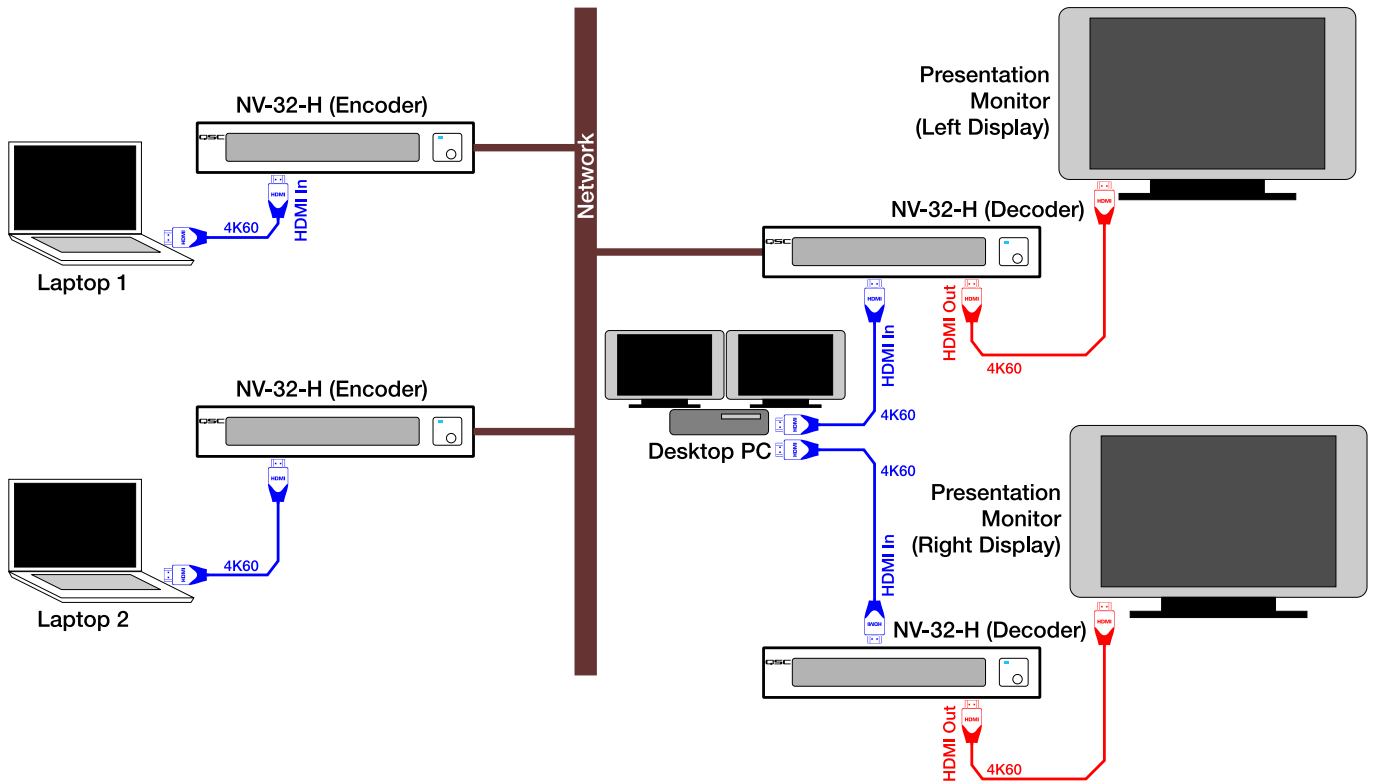
As in the previous example there are three devices (laptop computers) plugged into the NV-32-H encoder and a media player and desktop computer plugged into the decoder, which is connected to the HDMI display. The display can show program content from any of the five sources. In addition, a PTZ-IP camera can deliver its video feed via the Q-SYS network to both the encoder and the decoder. From the encoder and decoder, computers can receive the camera feed through USB connections.

To enable audio and video bridging on the NV-32-H, go into its device properties in the Q-SYS design.

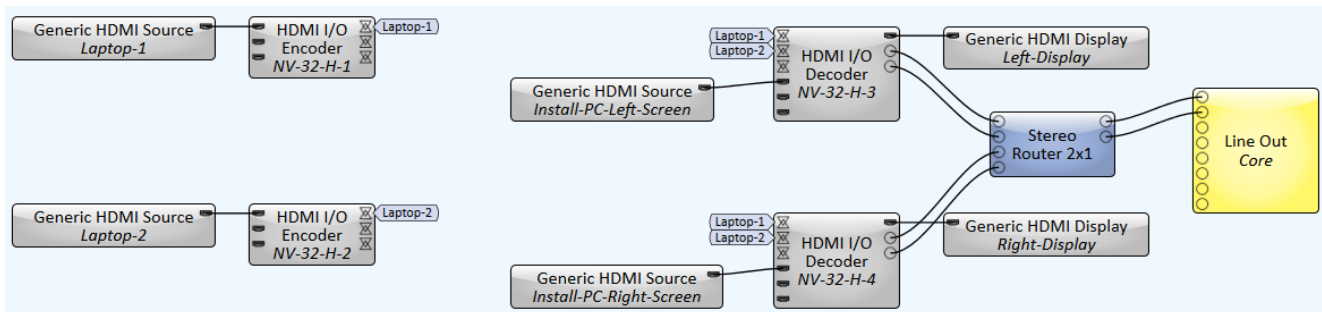


## Single Room—4K 60 Mode; With Multiple Devices

This next example shows how have two or more 4K60 displays or other devices in a meeting room.

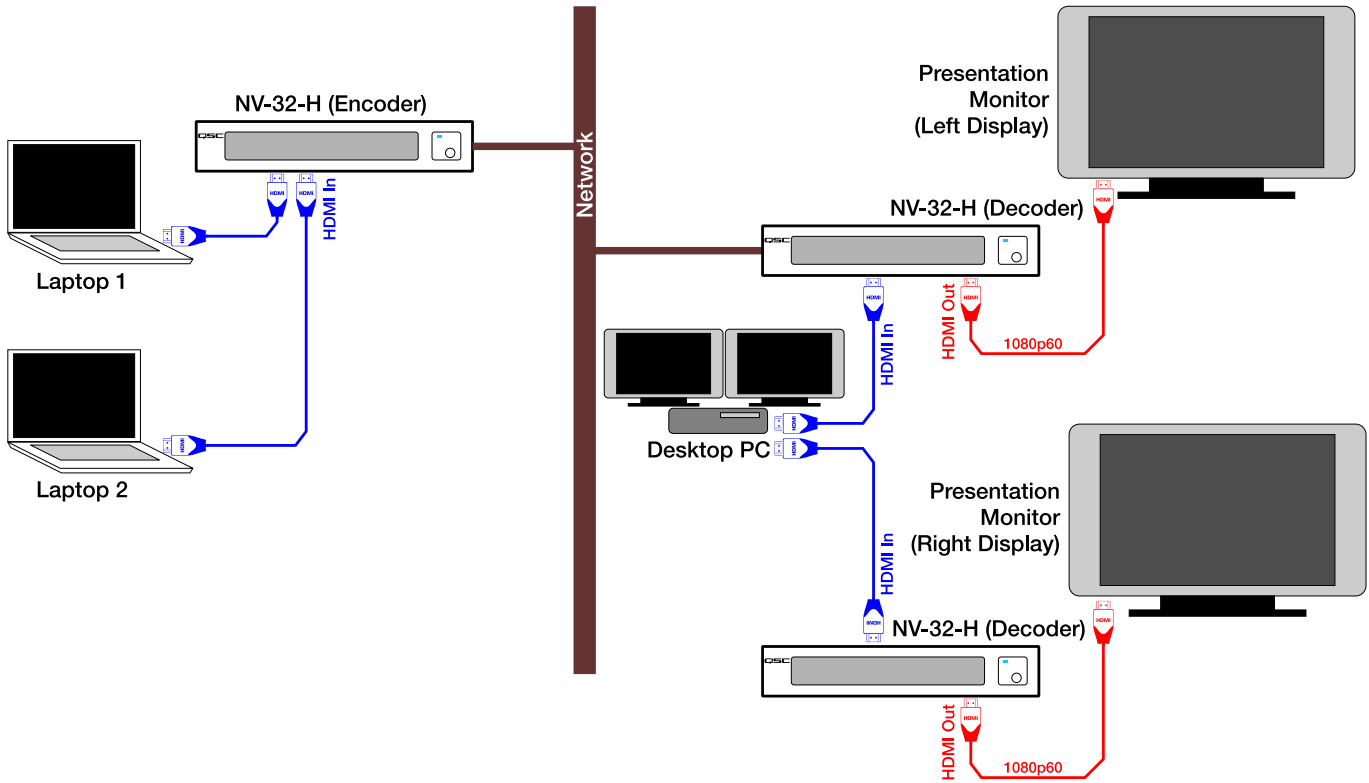


This scenario requires multicast. Therefore, you would set the NV-32-H encoder's **AV IP Streaming** property to either **Multicast** or **Compiler Choice** (the default setting).

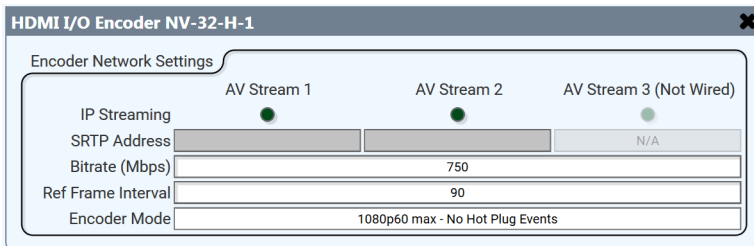


### Single Room—Dual Screens with Dynamic Switching

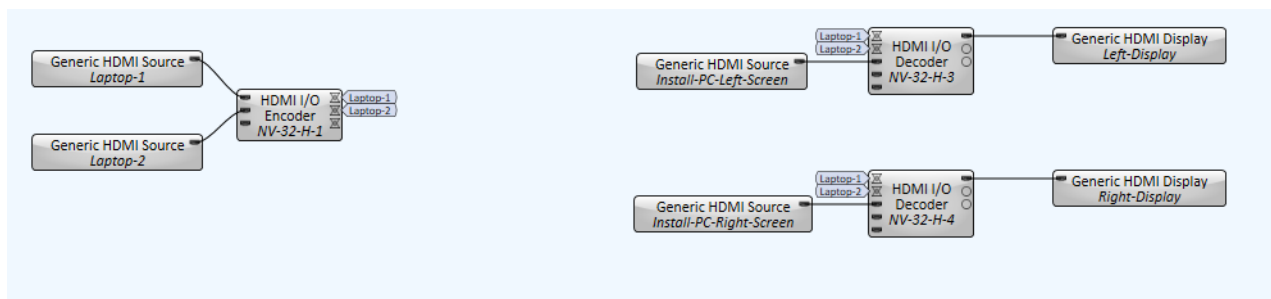
Both decoders in this scenario can send content up to 4K60 to their respective connected displays, whether it comes from network AV streams or locally connected sources. The encoder, though, can stream only *one* source at 4K60; if multiple sources are selected simultaneously on the same encoder, each source will see it as a Hot Plug Detect (HPD) event and dynamically lower the resolution in its EDID to a maximum of 1080p60.



To prevent HPD events that change video performance, the encoder can be configured so that all its sources are limited to 1080p60. This is done through the **Encoder Mode** setting in the Encoder HDMI I/O component.

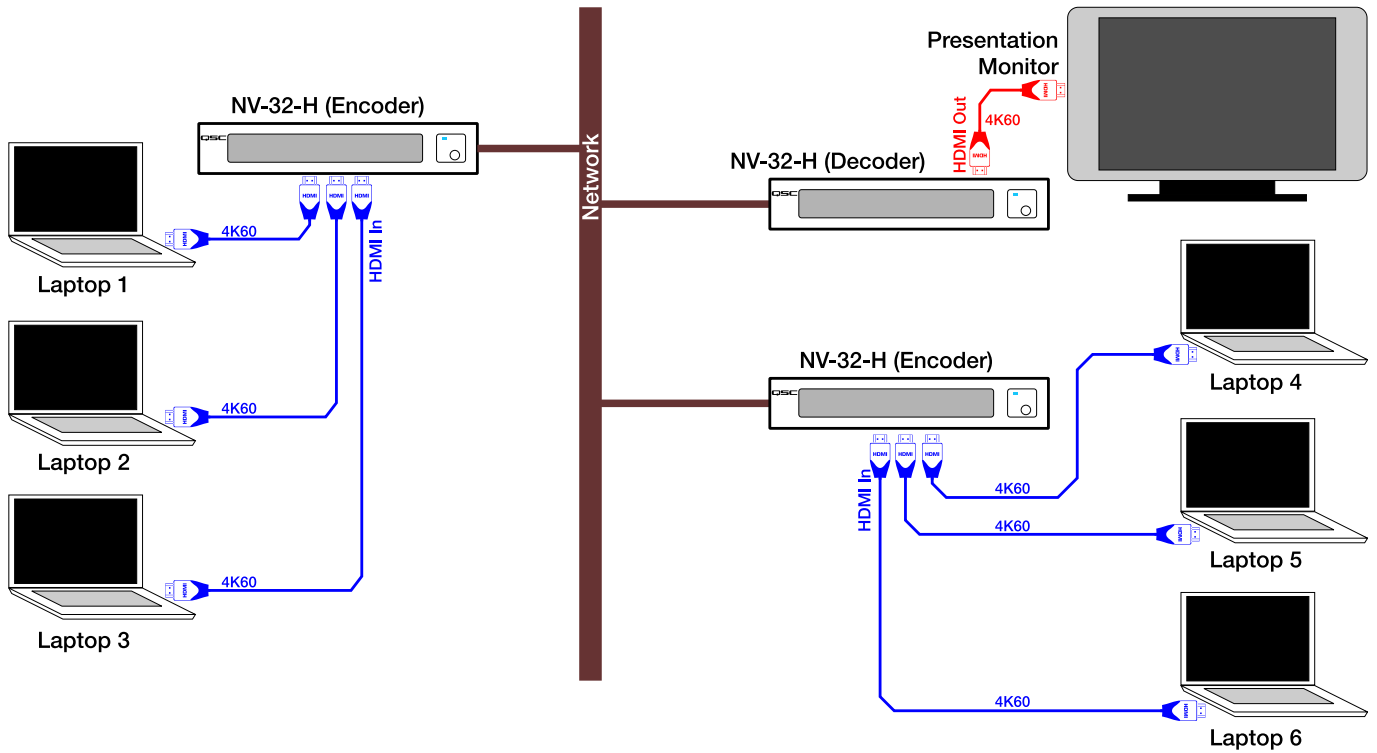


Here is the above scenario set up in Q-SYS Designer Software with dynamic switching.



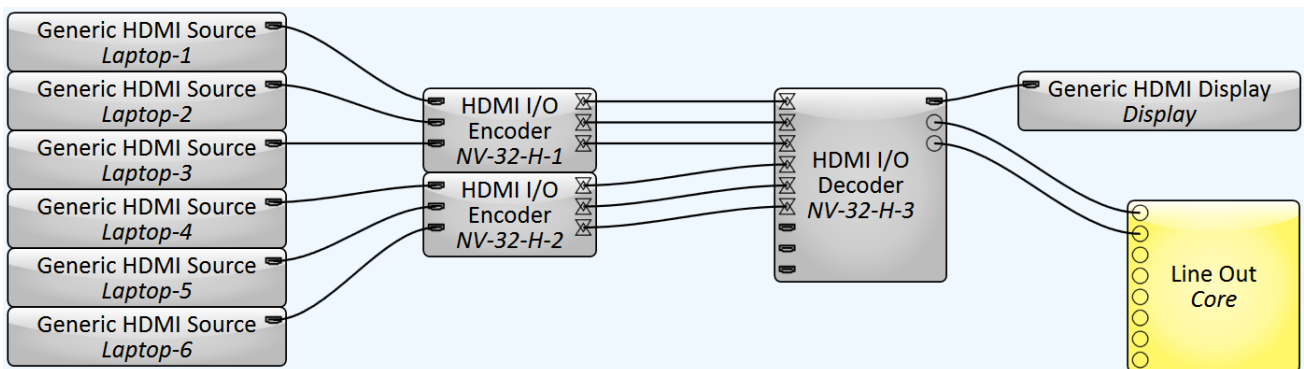
### Single Room—Multiple Encoders and Single Decoder

Here, a display on a single decoder can select from several encoders, each fed from a laptop or other HDMI source offering up to 4K60 AV. Because each encoder refrains from putting streaming data on the network until the decoder sends it a request, streaming from source all the way to the display can be a full 4K60 all the time.



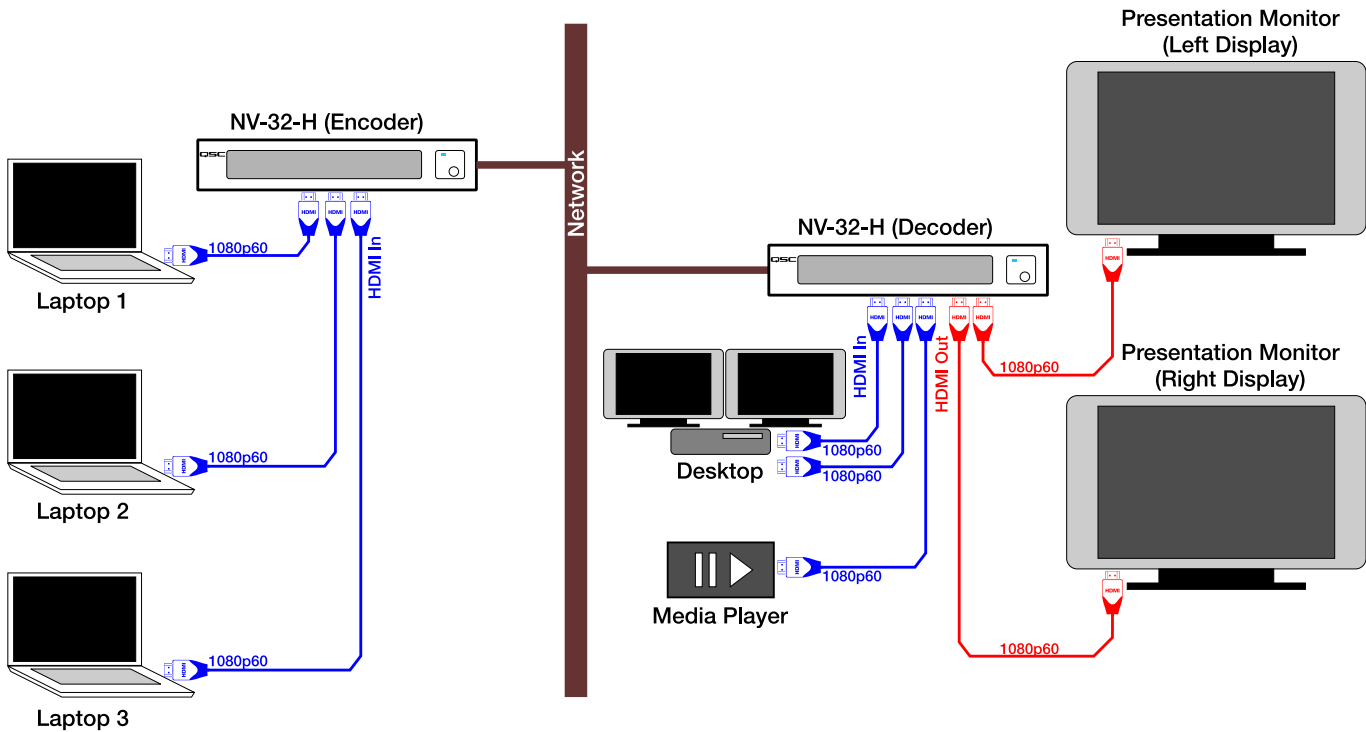
This arrangement could be used in such situations as: a large room that uses many HDMI inputs in various locations; a room with a number of HDMI sources at a table; or a room where the HDMI sources are in a rack location away from the decoder and display.

Below is the setup in a Q-SYS design, constructed in Q-SYS Designer Software.

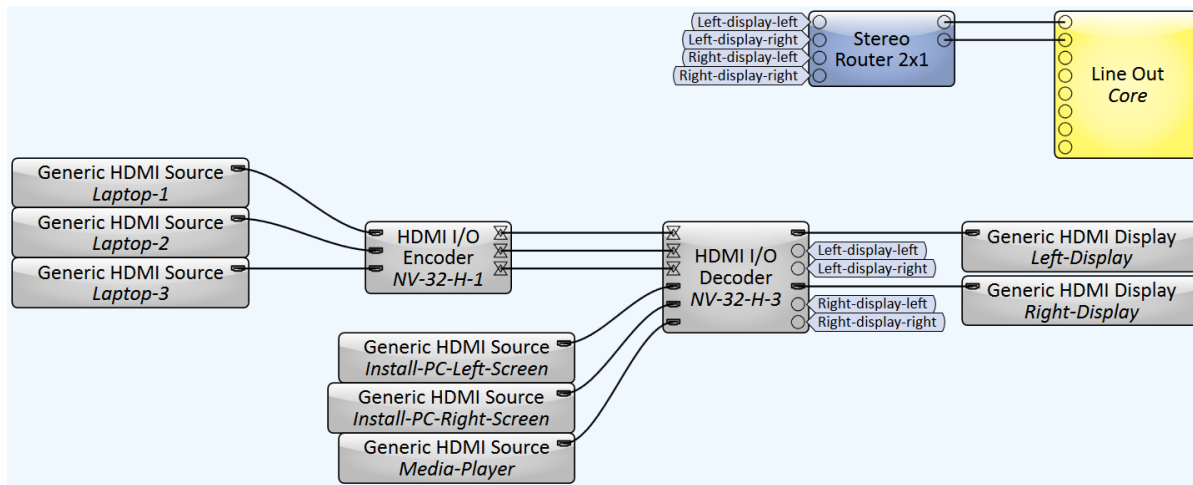


## Single Room—1080p60 Dual Screens

If you opt for a lower video resolution such as 1080p60 or lower, the Q-SYS AV endpoint hardware pieces can handle more simultaneous streams. In this scenario, the encoder handles three 1080p60 streams simultaneously. The decoder can decode two of the sources from the encoder or display two local sources and send them to two displays. Thus, the system is a 6 × 2 matrix.



In the Q-SYS design, the audio feeds to the two HDMI outputs can be mixed together or they can be controlled through a router (see below) so the audio follows the video



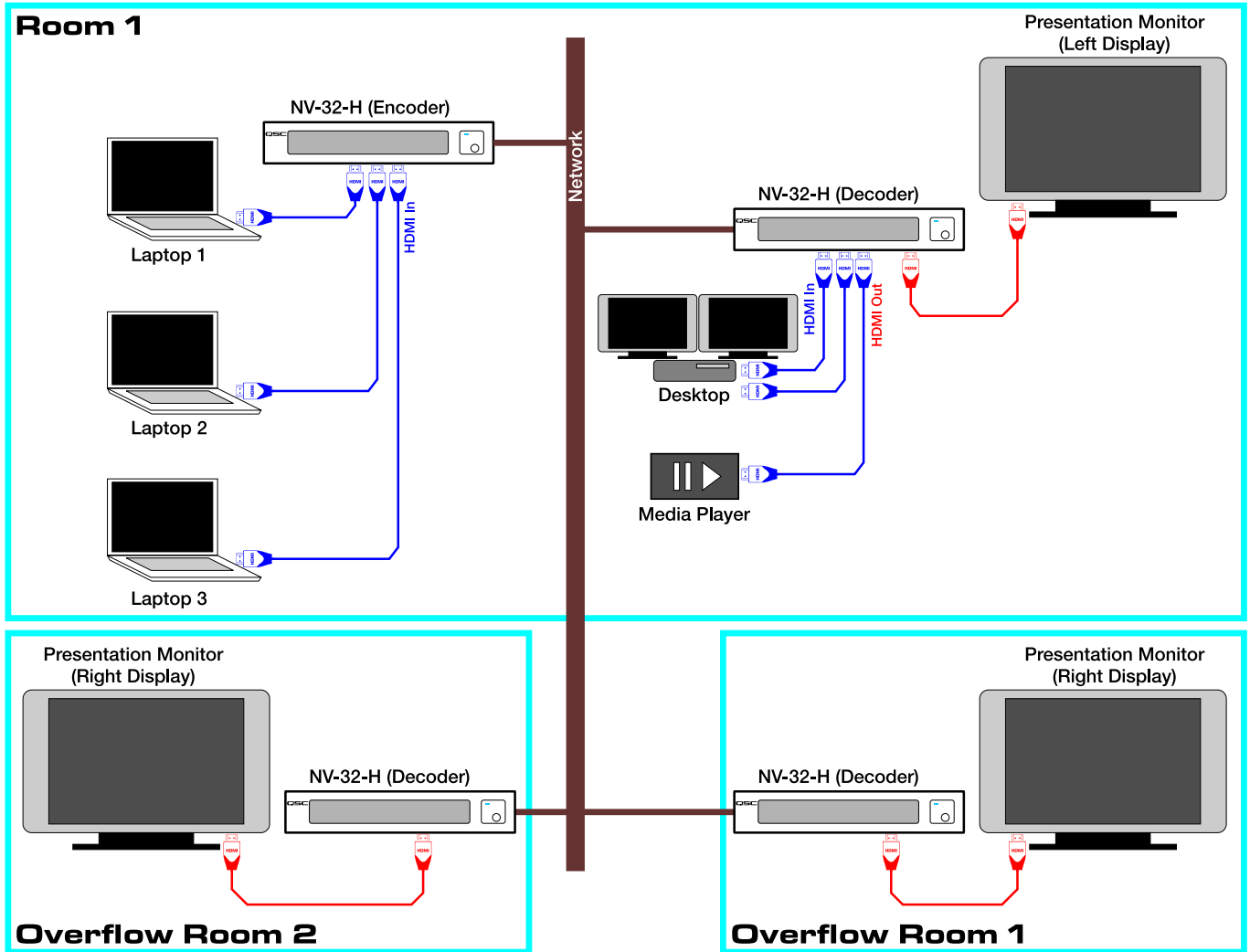


## Multi-Room Operational Modes

You can easily scale up AV capabilities for a larger system by adding multiple Q-SYS NV Series video endpoints and associating them with the same Q-SYS Core Processor in the same design.

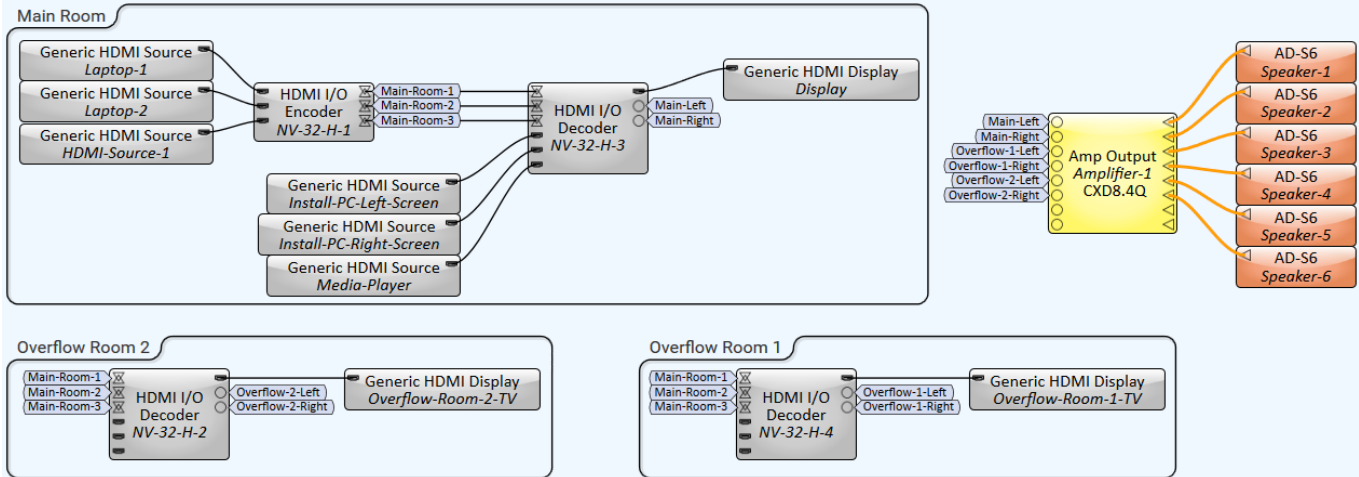
### Overflow Applications

Start with a simple design. Add one or more rooms as needed. This overflow system features 4K60 connectivity.



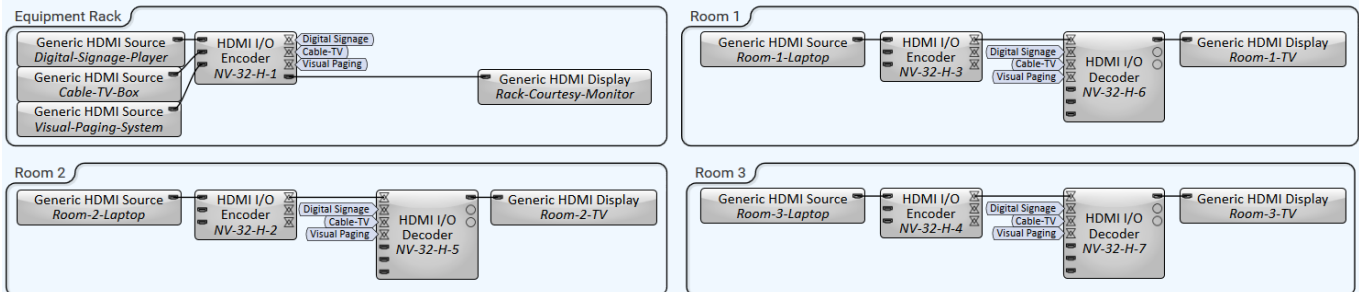
For example, a facility may have a main meeting area while several other other moitors in other rooms or elsewhere in the building can show the same AV feed. The feed must originate from an encoder. In the Q-SYS design, select Multicast or Compiler Choice as the device's IP Streaming property.

Q-LAN timing protocols will ensure that all the HDMI video outputs are synchronized with each other and all audio paths are synchronized with the video, preventing any lip-sync issues. Below is a representation of the Q-SYS design.



### Facility-Wide Distribution

In this example there are three conference rooms with an equipment closet shared among them. Each room has local presentation capabilities. The rack of gear in the equipment closet can also provide feeds when any of the rooms are not in use.



The equipment rack in the closet has a courtesy monitor so that a technician could verify signals, select appropriate alternate program material, or navigate through guides or menus.

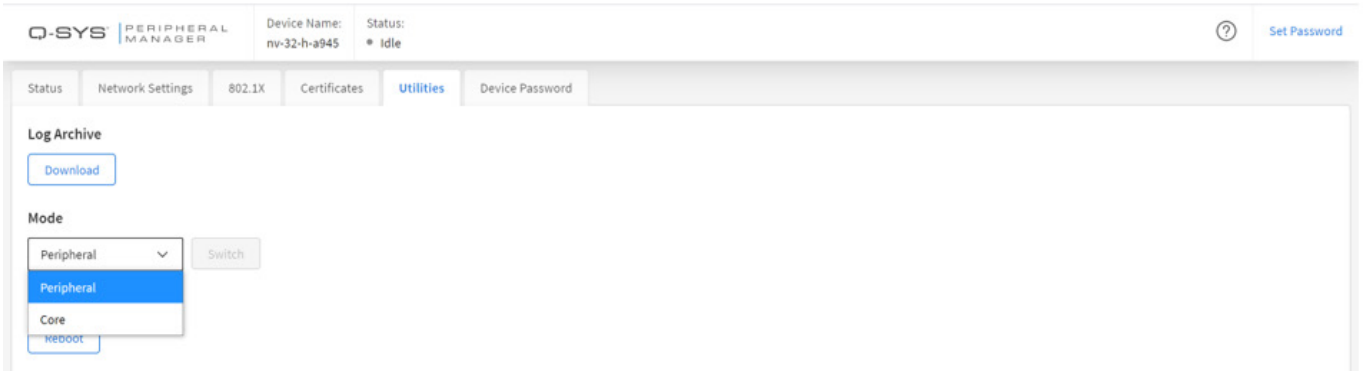
If the Q-SYS Core Processor is licensed to run scripts, the system could be scripted so that if nothing is plugged into a room's encoder, the decoder would send digital signage, cable TV, or other material to the display instead. It could also be scripted to switch all the decoders to display a certain source if an emergency arises.

## 2. CORE MODE

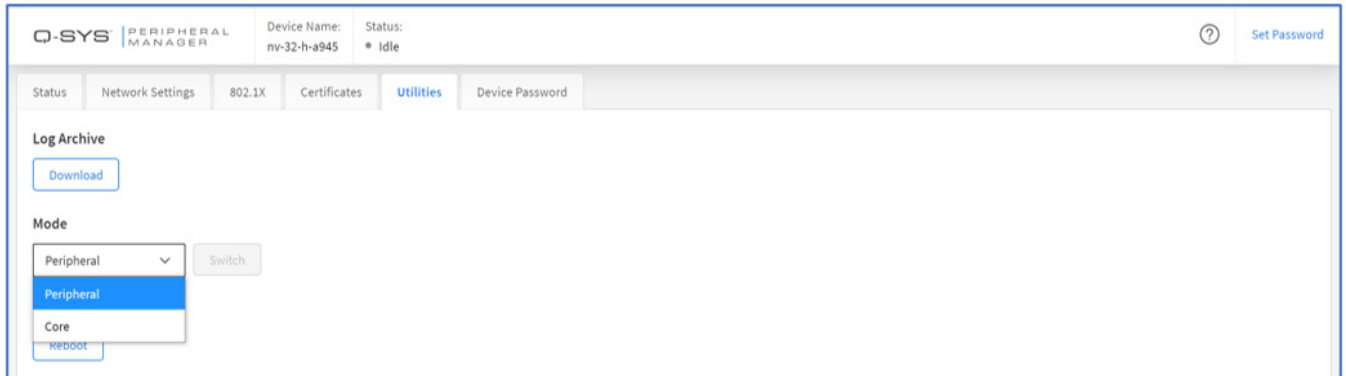
To enable Core Mode, the user may use Peripheral Manager to switch the NV-32-H (Core Capable) from Peripheral Mode to Core Mode.

Steps to switch to Core Mode:

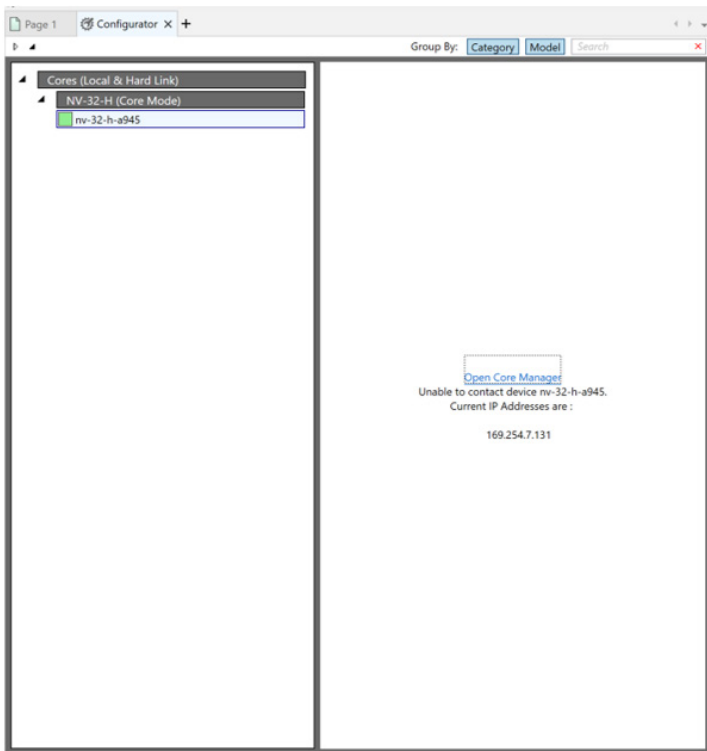
1. Open Peripheral Manager on the target hardware.
2. Navigate to the Utilities tab and select Core under the Mode drop-down.



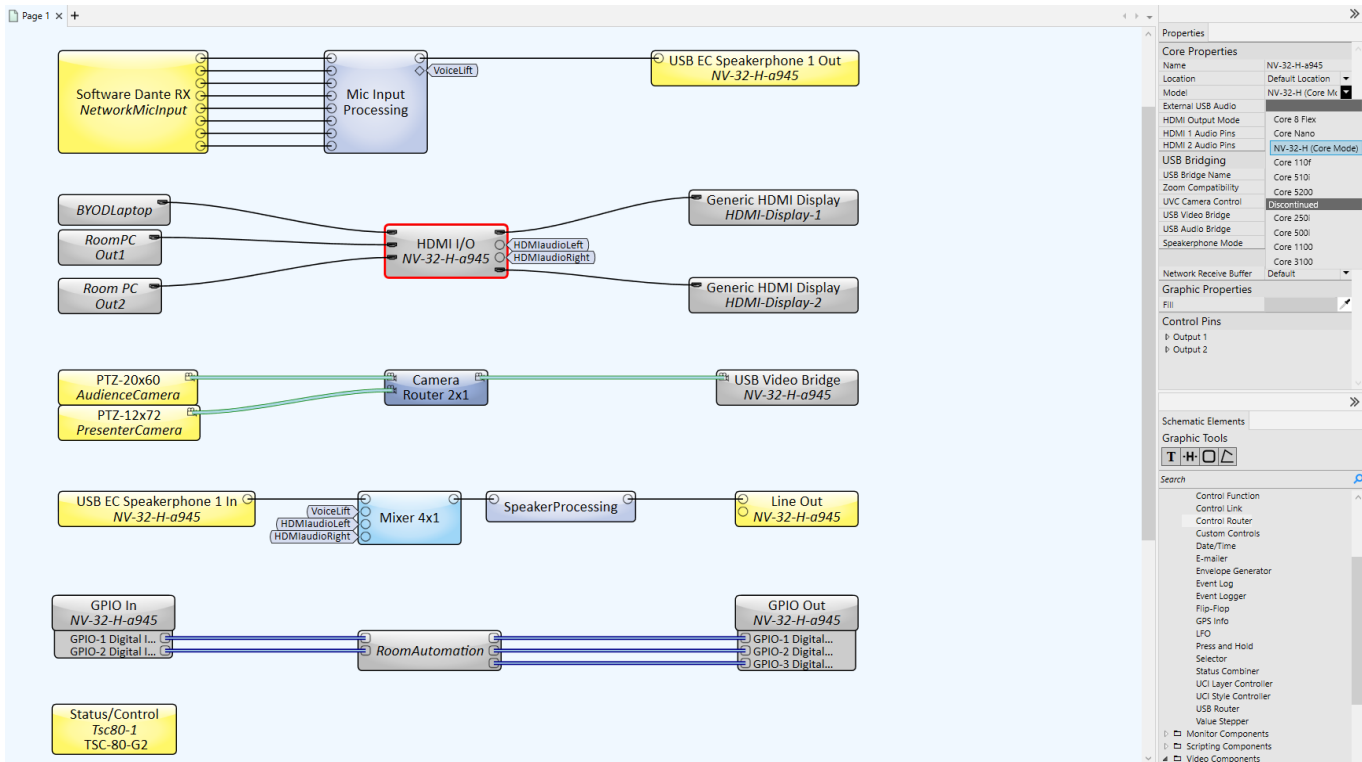
3. Confirm selection the NV-32-H (Core Capable) will reboot in Core Mode.



4. Within Q-SYS Designer, confirm the device is in Core Mode by viewing the Q-SYS Configurator screen. The product should now be listed as NV-32-H (Core Mode).



After confirming that Core Mode is active, the designer may target the NV-32-H in Core Mode, by selecting NV-32-H (Core Mode) as the Core with the appropriate device name.



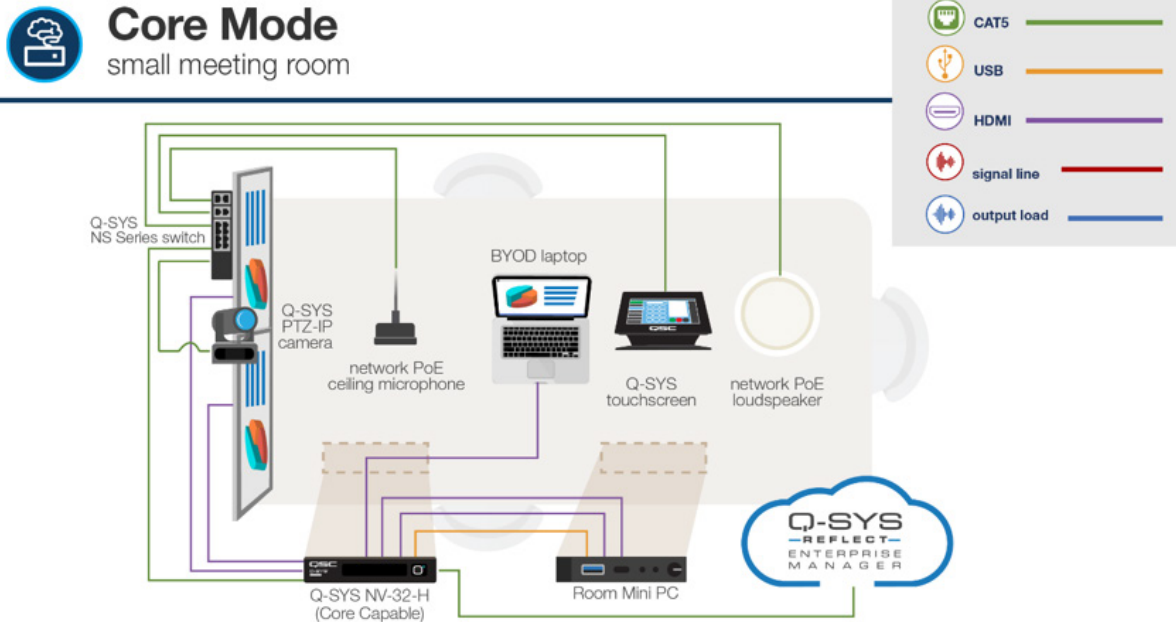
## **Reverting to Peripheral Mode**

The steps to convert the NV-32-H (Core Capable) back to Peripheral Mode are similar. While the product is running in Core Mode, open Core Manager on the target NV-32-H (Core Capable) and navigate to the Utilities tab and choose Peripheral in the Mode drop-down. Confirm the selection and the product will reboot into Peripheral Mode where it may be used in other designs.

Note: When the NV-32-H (Core Capable) is operated in Peripheral Mode, the design must include another Core processor.

# Core Mode Usage and Applications

## Small Meeting Room



In this example, the following audio and video sources and sinks are available.

### HDMI Input Sources:

- Wired BYOD Screen Share
- Room PC – Display Output 1
- Room PC – Display Output 2

### HDMI Output Sinks

- Display 1
- Display 2

### Audio Sources

- Network Microphone (Dante or AES67)
- USB Audio from Room PC (from Far End)

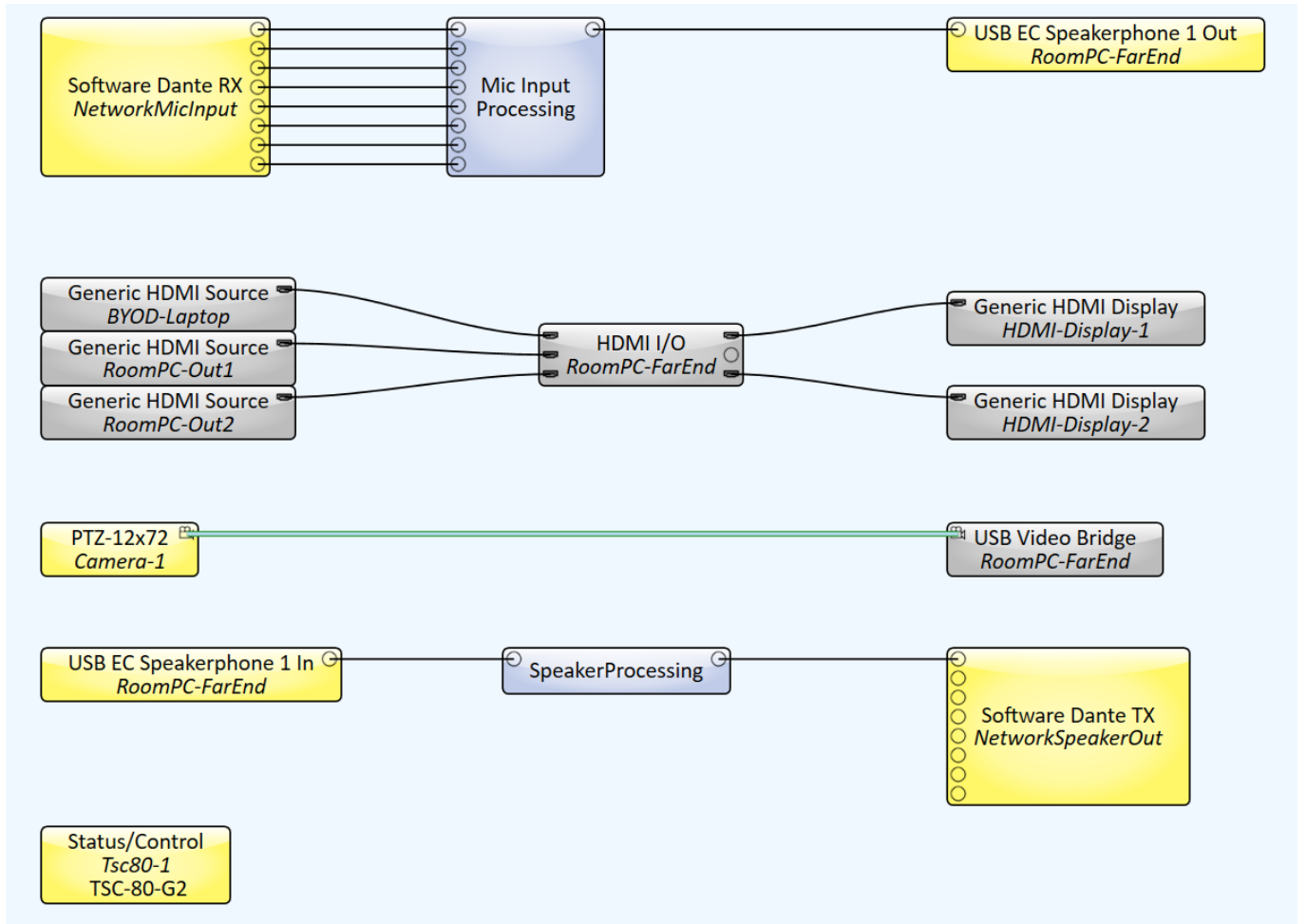
### Audio Sinks

- Network PoE Loudspeaker (Dante or AES67)
- USB Audio to Room PC (to Far End)

### Control

- TSC for in room user interface

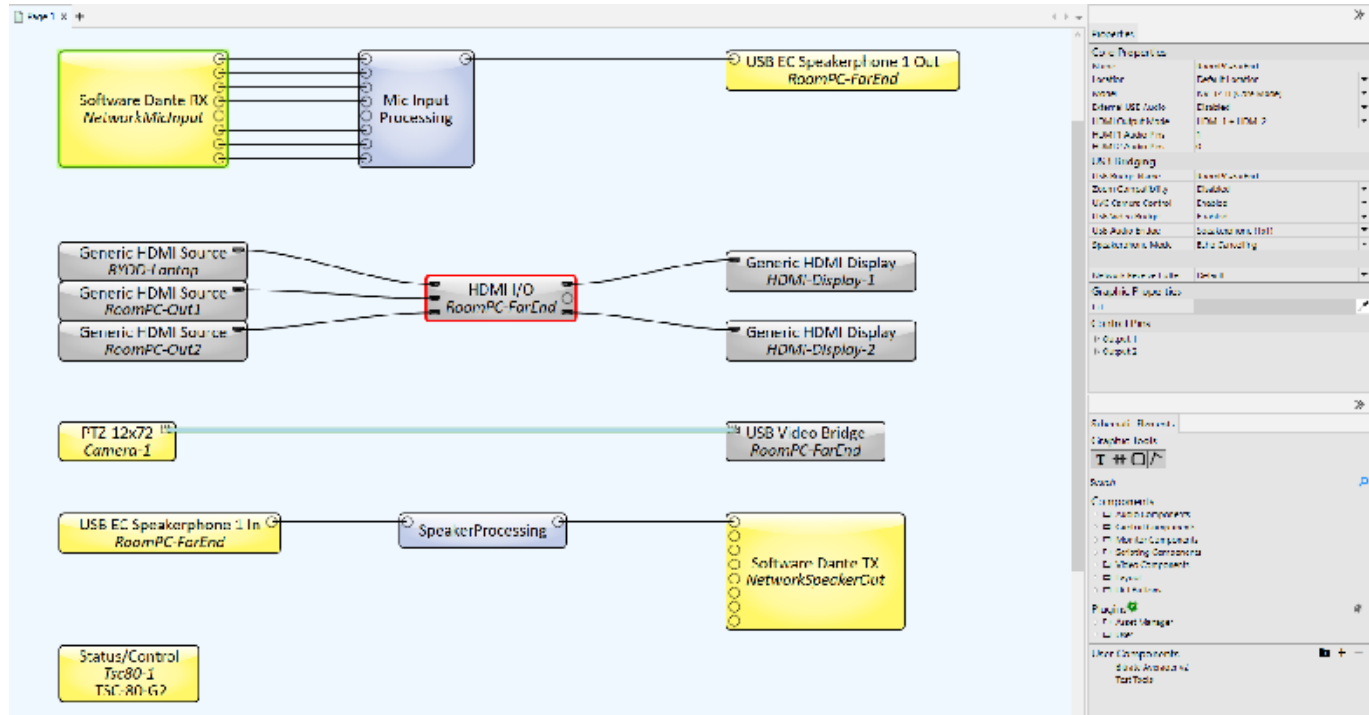
The following sample design illustrates the necessary Q-SYS Designer schematic elements to implement a possible small meeting room use case.



## Video Routing and Configuration

This design enables the use of the NV-32-H in Core Mode as a 3x2 video switcher. The video output count is enabled in a similar manner as the NV-32-H operated in peripheral mode.

To configure the video input, navigate to the NV-32-H (Core Capable) properties to set the HDMI Output mode to HDMI 1 + HDMI 2. When enabling both outputs, the maximum video resolution for each output will be 1080p60. If 4k60 resolution is desired, only a single HDMI output may be used to achieve this resolution.



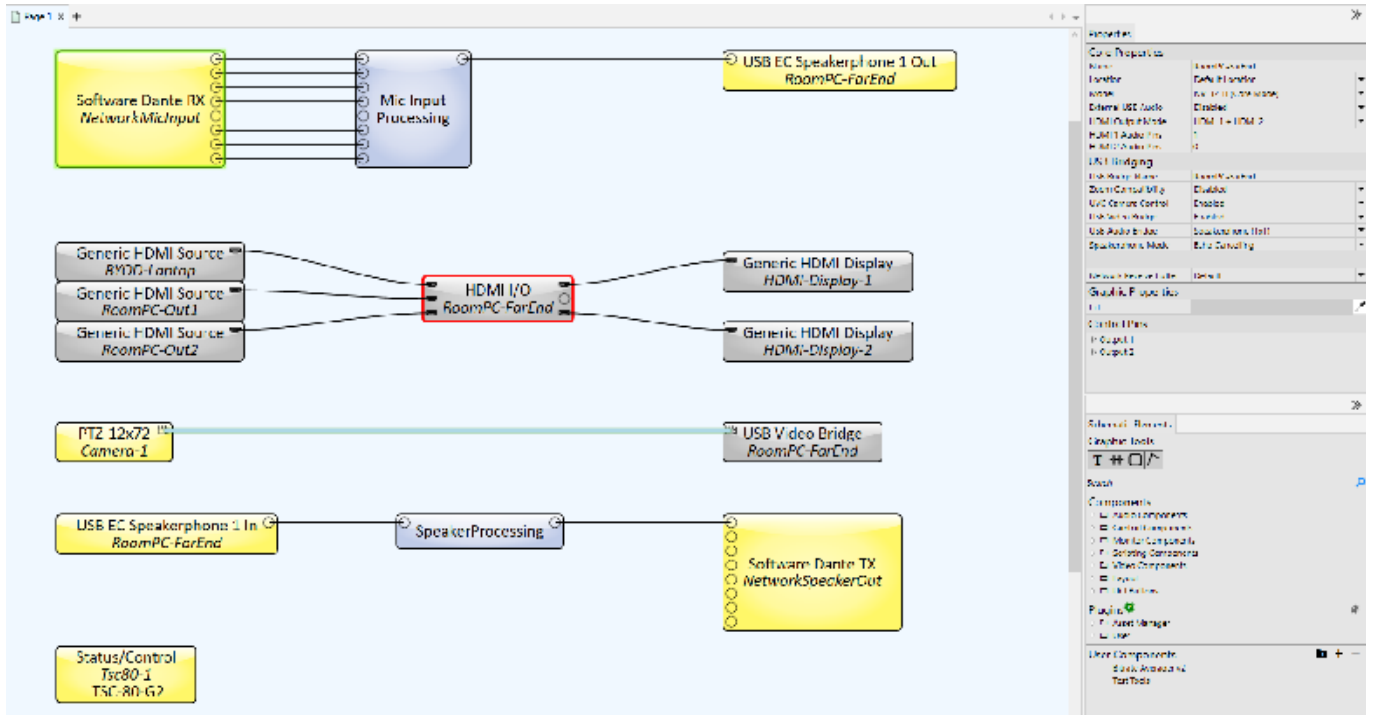


## USB AV Routing and Configuration

In order to enable USB AV bridging, the Core properties for USB Video Bridge and USB Audio Bridge must also be enabled.

Once a USB video bridge is enabled, any Q-SYS IP camera may be routed directly to the USB Video Bridge.

In addition, once USB audio bridging is enabled, the processed microphone audio can be connected to the USB audio bridge that is interfaced to the Room PC in order to deliver this audio to far end meeting participants for web conferencing applications.



## Network Audio Routing, Audio Processing and Configuration

In this design, we are targeting the use of network audio peripherals. These could be either Dante or AES67 enabled endpoints. Add the respective network audio blocks to the design from the Inventory and the Streaming I/O component list.

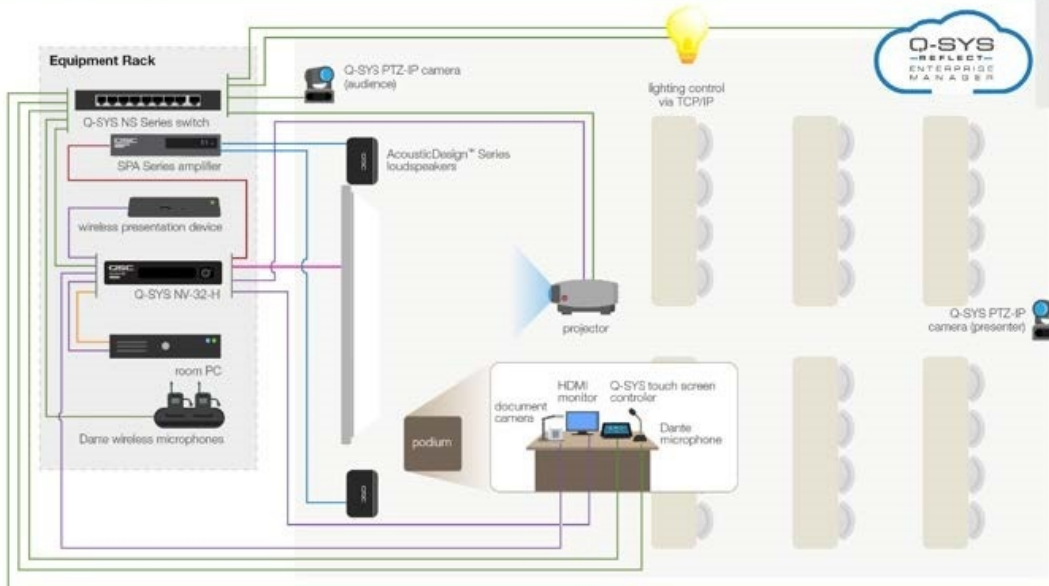
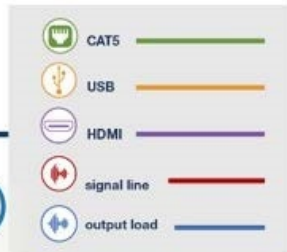
Input and output audio processing can be applied by the NV-32-H while operated in Core Mode to simplify the design and limit additional processing hardware that would otherwise be required for the application.

**Note: The NV-32-H (Core Capable) does not include software Dante and requires the purchase of a license to support this functionality.**



# Core Mode

small classroom



In this example, the following audio and video sources and sinks are available. The application diagram shows a podium and equipment rack. Depending on the distances between the sources and sinks, it may be advisable to locate the NV-32-H (Core Capable) at the podium location. As distances exceed HDMI video extension limits, it is advisable to install CAT-x or fiber video extender solutions.

### HDMI Input Sources:

- Wireless Presentation Device
- Room PC – Single Video Output
- Document Camera

### HDMI Output Sinks

- Projector
- Monitor (Located on Podium)

### Audio Sources

- Network Microphone (Dante or AES67)
- USB Audio from Room PC (from Far End)

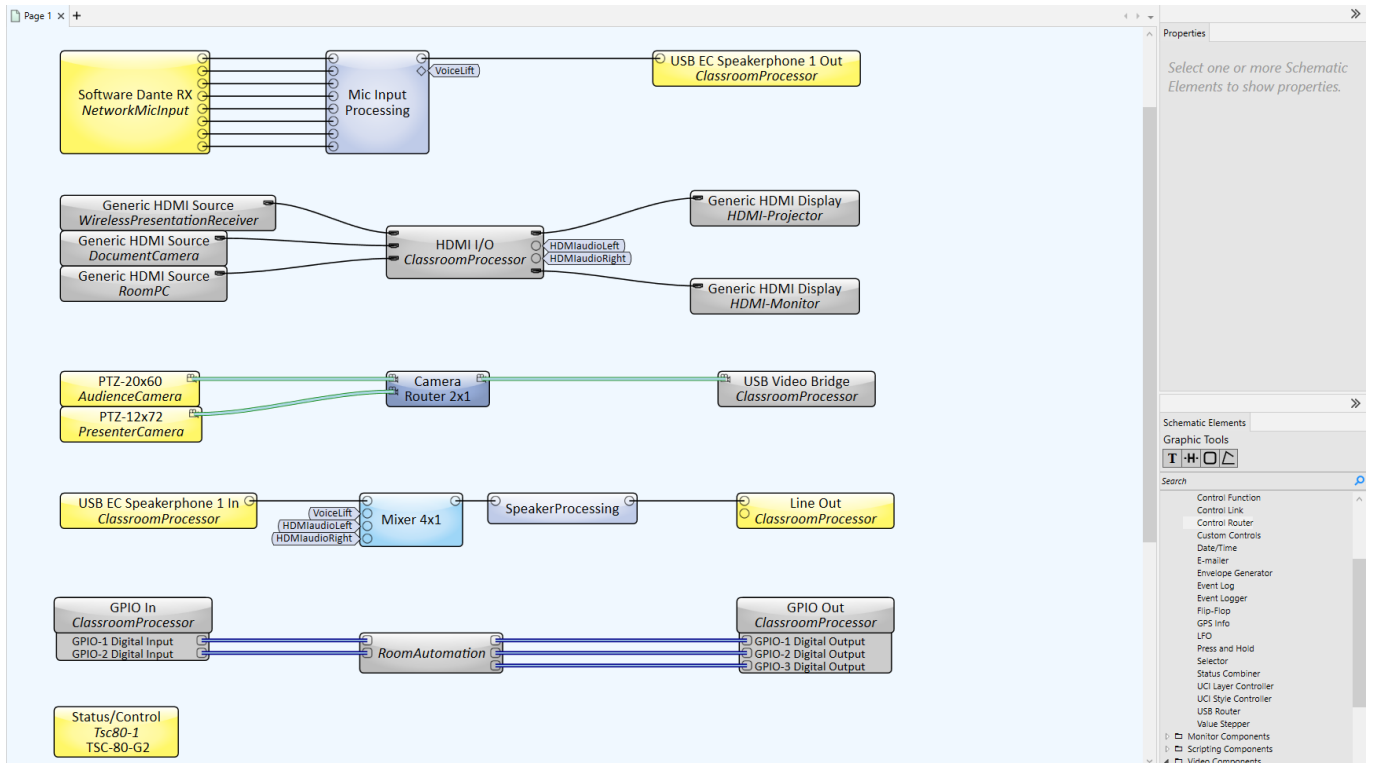
### Audio Sinks

- Line Out to QSC SPA series amplifier
- USB Audio to Room PC (to Far End)

### Control

- TSC for in room user interface
- Occupancy Sensor Logic Input
- Projector Screen Lift Control
- IP Lighting Control

The following sample design illustrates the necessary Q-SYS Designer schematic elements to implement a possible small meeting room use case.



# Video Routing and Configuration

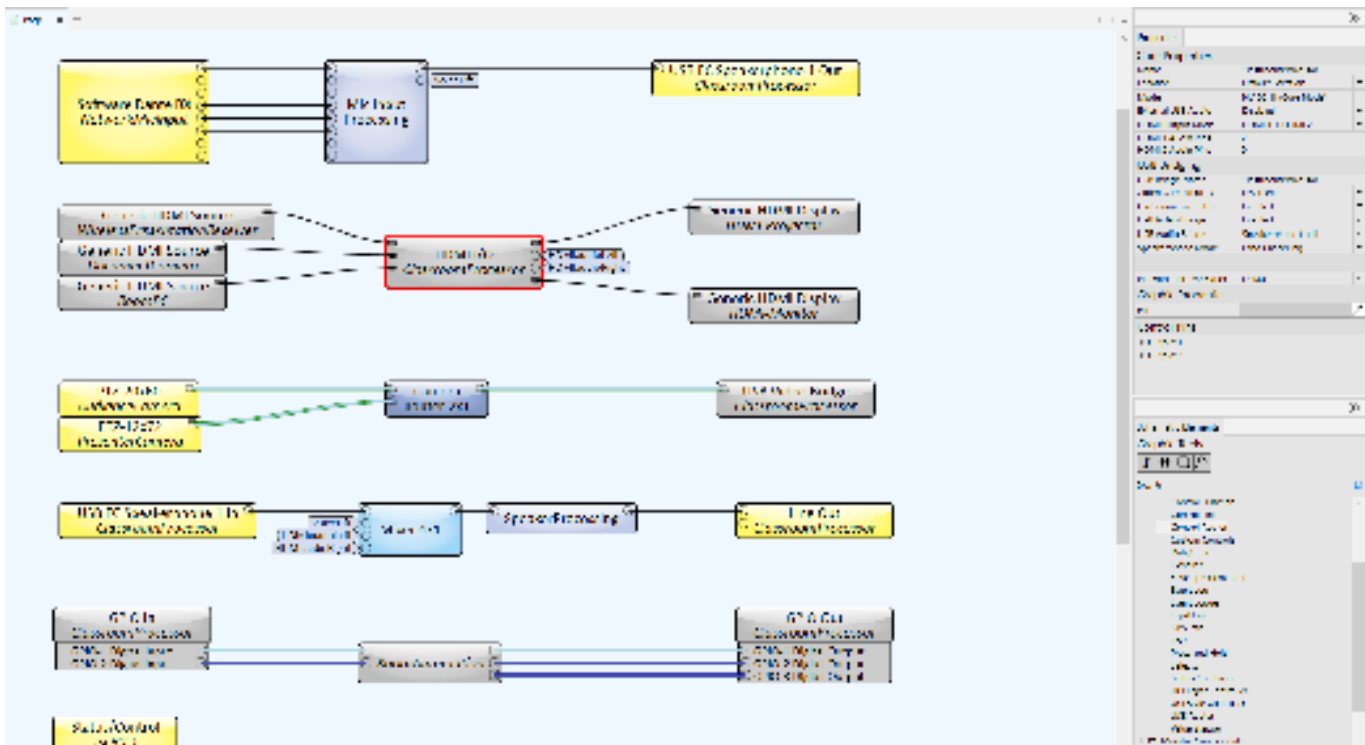
## USB AV Routing and Configuration

To enable the USB AV bridging, the Core properties for USB Video Bridge and USB Audio Bridge must also be enabled.

Once a USB video bridge is enabled, any Q-SYS IP camera may be routed directly to the USB Video Bridge. In this application, multiple Q-SYS IP cameras are supported for both audience and presenter camera views which may be switched by the system operator using a customized UCI running on the TSC hardware.

In addition, once USB audio bridging is enabled, the processed microphone audio can be connected to the USB audio bridge that is interfaced to the Room PC in order to deliver this audio to far end meeting participants for web conferencing applications.

Additionally, any USB audio source content from web conferencing applications or presentation media from the Room PC can be used for local playback within the conference room by connecting USB Audio bridge input of the NV-32-H (Core Capable) and routing it to the main mixer comp.



## Network Audio Routing, Audio Processing and Configuration

In this design, we are targeting a mix of both analog and digital audio I/O.

For microphone input, a podium mounted Dante or AES67 enabled microphone as well as a Dante or AES67 wireless microphone receiver can be added by adding a Software Dante RX component from the System I/O inventory.

For local audio reinforcement, the Line Out component of the NV-32-H can be used to route analog audio to an SPA series amplifier connected to the analog output of the NV-32-H.

Input and output audio processing can be applied by the NV-32-H while operated in Core Mode to simplify the design and limit additional processing hardware that would otherwise be required for the application.

**Note: The NV-32-H (Core Capable) does not include software Dante and requires the purchase of a license to support any required Dante audio functionality.**

## Control

In this design, the NV-32-H GPIO inputs can be connected to contact closure output occupancy sensors to facilitate room automation (i.e., wake up projector, raise/lower projector screen and automate room lighting).

Additionally, the GPIO output can be interfaced to a motorized projector screen lift to raise and lower the screen by manual input from the system operator utilizing the TSC with a customized UCI or via room automation based on sensor hardware interfaced to the NV-32-H GPIO inputs.

Customization of the control logic is left to the system designer and could be applied in the Room Automation block shown in the schematic example.

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1 (800) 854-4079 or +1 (714) 957-7100  
Outside the U.S. +1 (714) 754-6175  
Fax: +1 (714) 754-6174

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QSC, LLC  
1675 MacArthur Boulevard  
Costa Mesa, CA 92626 USA