

DigitalMedia™

DM NVX Application Design Guide



Network AV

Network AV is audio and video transmitted and distributed over IP. It packetizes digital content and drives it over Ethernet infrastructure.

Why you want it

- Use the existing Ethernet infrastructure you already have rather than expensive specialty cables throughout the buildings
- Greater flexibility to add sources and displays anywhere you want without the constraints of fixed AV matrix switchers, extenders, and cables
- Infinite system scalability



What you need it to do:

- ☐ **4K60, 4:4:4, and HDR video**
Supports the latest laptops and displays
- ☐ **No latency**
Ensures audio and video are synchronized during web collaboration, and real-time keyboard and mouse control for remote workstation and in-room presentation applications
- ☐ **1Gb Ethernet platform**
Provides a cost-effective and ultimately scalable solution
- ☐ **Enterprise-grade security**
Supports the standard policies organizations already have in place to authorize users and devices accessing the network, and protects the data and content transmitted over the network
- ☐ **Video processing**
Scales 4K video to properly display content in any space, and video wall processing with zoom and bezel compensation
- ☐ **Forward Error Correction**
Protects video performance from environmental noise produced by lighting systems, elevators, vending machines, and other sources
- ☐ **Audio processing**
Offers breakaway audio to select audio and video independently; downmix two-channel audio for in-room speakers
- ☐ **USB 2.0 routing**
Accepts and routes bi-directional data for cameras, microphones, electronic whiteboards, keyboards, mice, and other AV devices
- ☐ **Network management**
Provisions, monitors, manages, and controls all network AV endpoints centrally from the cloud or web browser

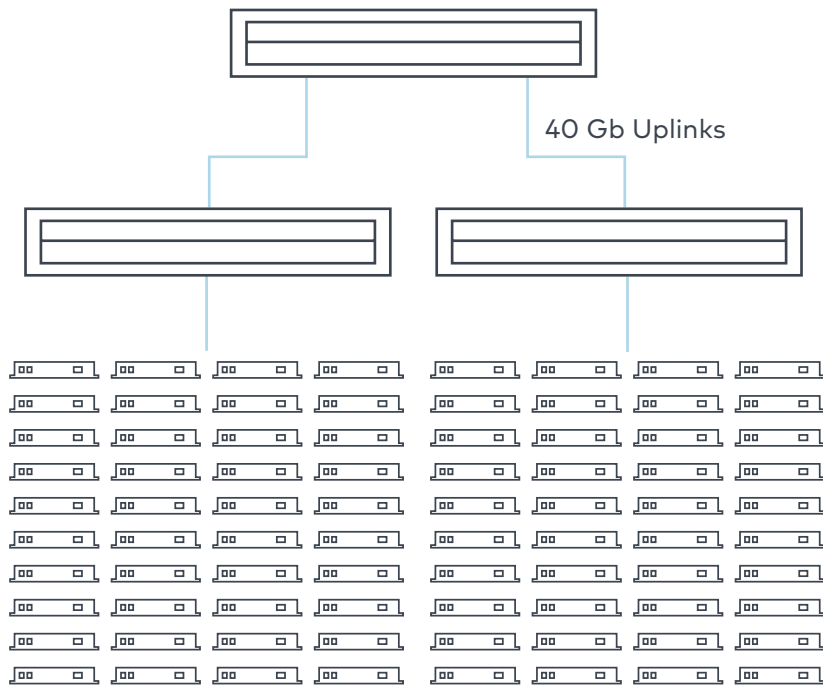
Only DM NVX meets all your needs.

DM NVX uses standard 1 Gb Ethernet infrastructure

10 Gb infrastructure costs more, doesn't scale, and provides no additional benefits:

1 Gb Ethernet AV

40 Gb Standard Core Switch

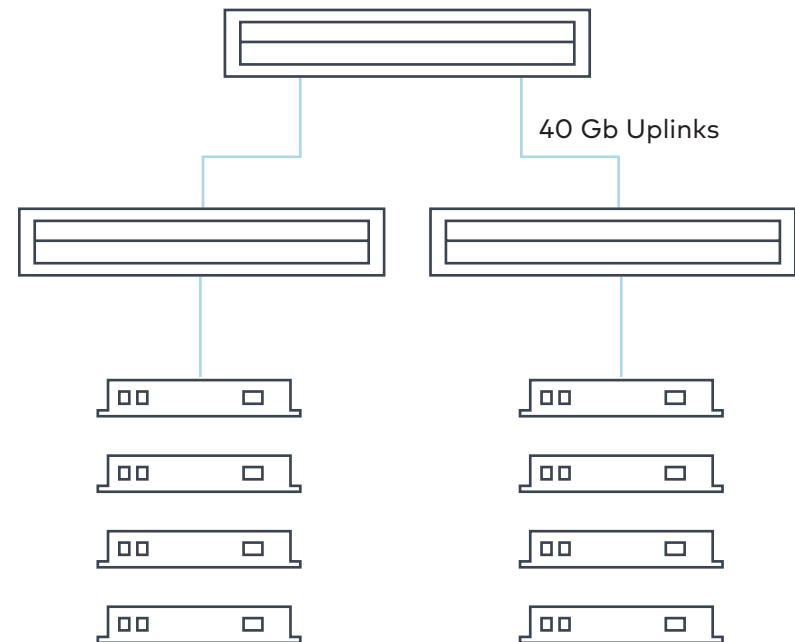


40 - 1 Gb endpoints per switch

vs.

10 Gb Ethernet AV

40 Gb Standard Core Switch



4 - 10 Gb endpoints per switch

1 Gb Ethernet AV	10 Gb Ethernet AV
Standard CAT5e cabling	Special CAT6a/7 cabling
Inexpensive Infrastructure \$10,910	Expensive Infrastructure \$244,770
Low bandwidth	High bandwidth
Infinitely scalable	Limited scalability
4K60, 4:4:4 video	4K60, 4:4:4 video
No latency	No latency

* 80 endpoint system; cables not included. MSRP pricing in USD.



Network Security

Only DM NVX supports all the standard security policies already in place (see page 20 for details):

- 802.1x Network Access Control
- Active Directory
- AES-128, PKI
- SSL
- SSH
- HTTPS

DigitalMedia™



The only AV platform that does it all. Crestron DigitalMedia employs a variety of technologies, so you always have the best solution for any application. And everything works together, and can be monitored, managed, and controlled on the same network.

DM NVX is DigitalMedia on the network



DM NVX is the most secure, reliable, and versatile solution available today, perfect for a variety of spaces and use cases. This guide provides an overview of the most common applications, and answers to frequently asked questions.

- ☐ 4K60 4:4:4, HDR video at 2K prices
- ☐ 1 Gb Ethernet – inexpensive and infinitely scalable
- ☐ Enterprise network security
- ☐ No latency
- ☐ Breakaway audio and audio downmixing
- ☐ USB 2.0 routing for cameras, microphones, whiteboards, keyboards and mice
- ☐ Browser-based provisioning, monitoring, management, and control
- ☐ Forward Error Correction protects against environmental noise and network interference

Plus

- ☐ HDMI source switching
- ☐ Integrated display control
- ☐ Combined encoder/decoder design in multiple form factors
- ☐ Award-winning 24/7 True Blue Support

DM NVX Series

The DM NVX Series is a simple, scalable product line consisting of standalone and card-based encoder/decoders.



DM-NVX-350 encoder/decoder



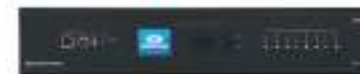
DM-NVX-351 encoder/decoder with downmixing



DM-NVX-350C encoder/decoder card

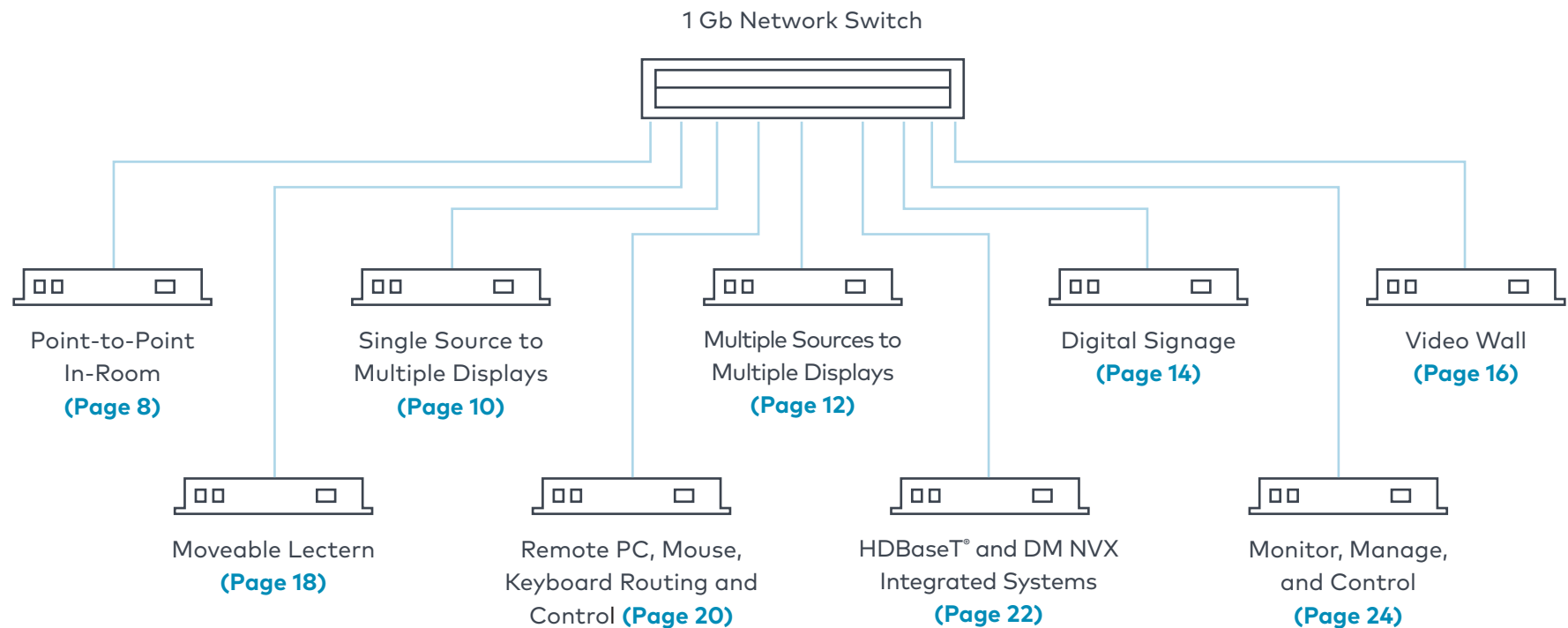


DM-NVX-351C encoder/decoder card with downmixing



DMF-CI-8 DigitalMedia card chassis

All your DM NVX applications on one network



Appendix – System Requirements, Network Security and Topology (Page 26)

Point-to-Point In-Room



Use the existing Ethernet infrastructure for AV presentation in meeting rooms, conference rooms, and boardrooms. DM NVX network AV provides ultimate flexibility and scalability. Simply add an encoder/decoder to any space to get video onto or off of the network. Use DM XiO™ Director to centrally monitor, manage, and control the entire DM NVX network.

Typical Spaces

Meeting rooms, presentation rooms, and executive offices

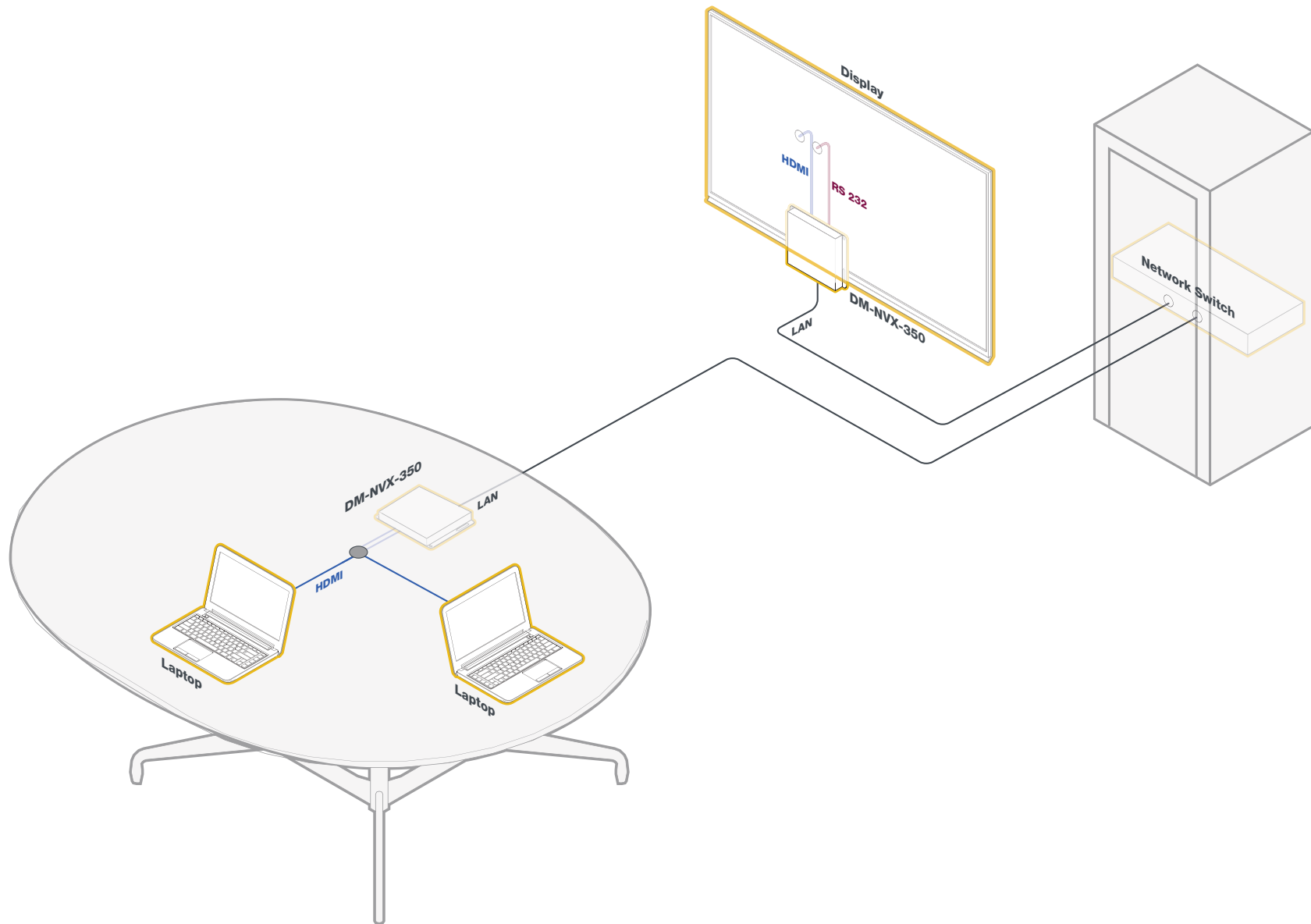
Benefits

- Use inexpensive, standard 1 Gb Ethernet infrastructure, or reuse CAT5e cabling
- Use small, flexible network switches rather than big, fixed AV matrix switchers
- Infinitely scalable
- Combined encoder/decoder
- HDMI and USB 2.0 routing
- Breakaway audio and 2-channel downmixing
- Video scaling and processing

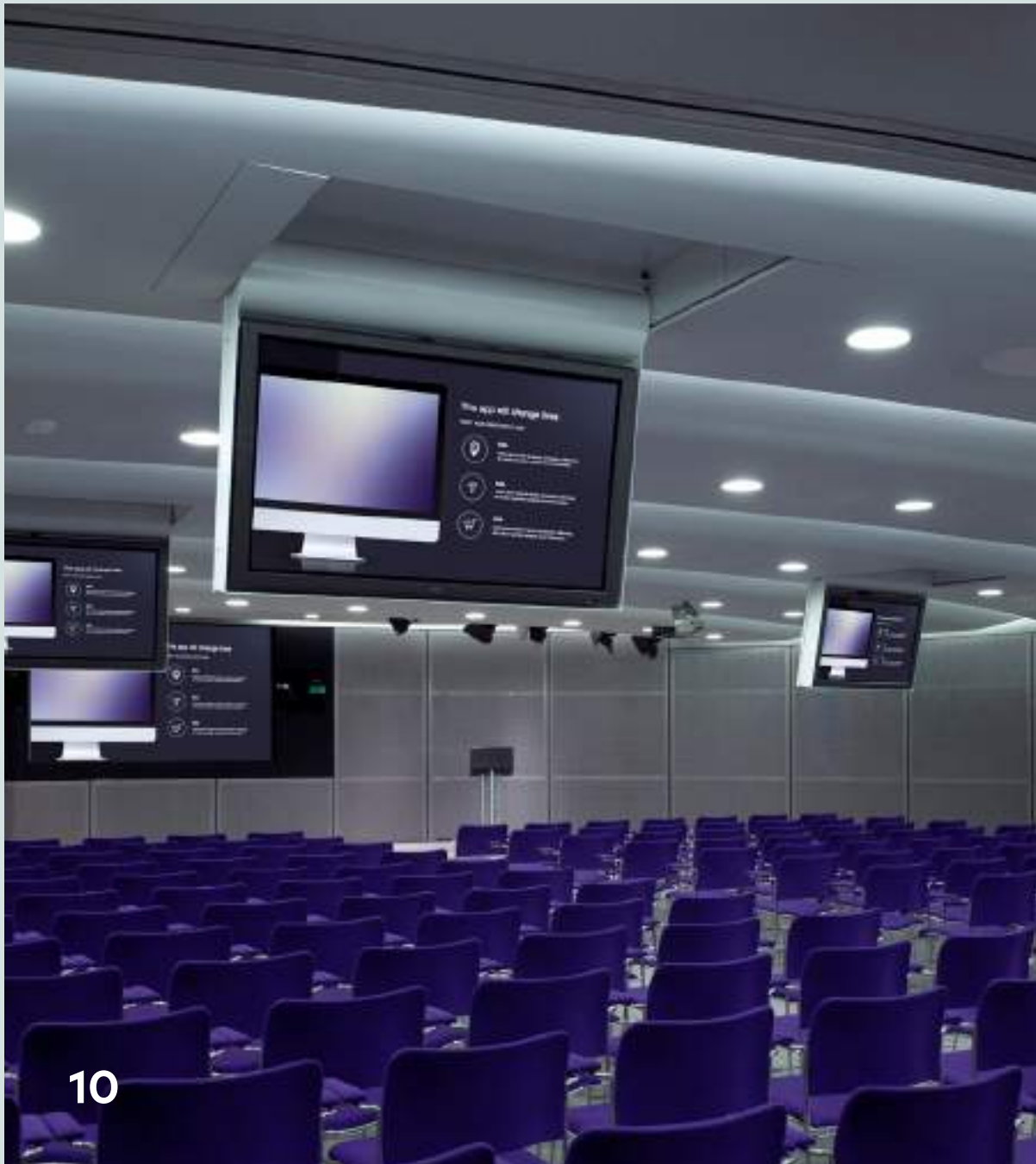
Key Products

DM-NVX-350

DigitalMedia Encoder/Decoder



Single Source to Multiple Displays



Present stunning 4K60 content with zero latency to audiences in large spaces on multiple displays, so every seat in the house gets an unobstructed view. Also perfect for digital signage and broadcast messaging for events, meetings, menus, or weather warnings across the enterprise. Or target specific buildings or floors.

Typical Spaces

Auditoriums, all-hands spaces, and lecture halls

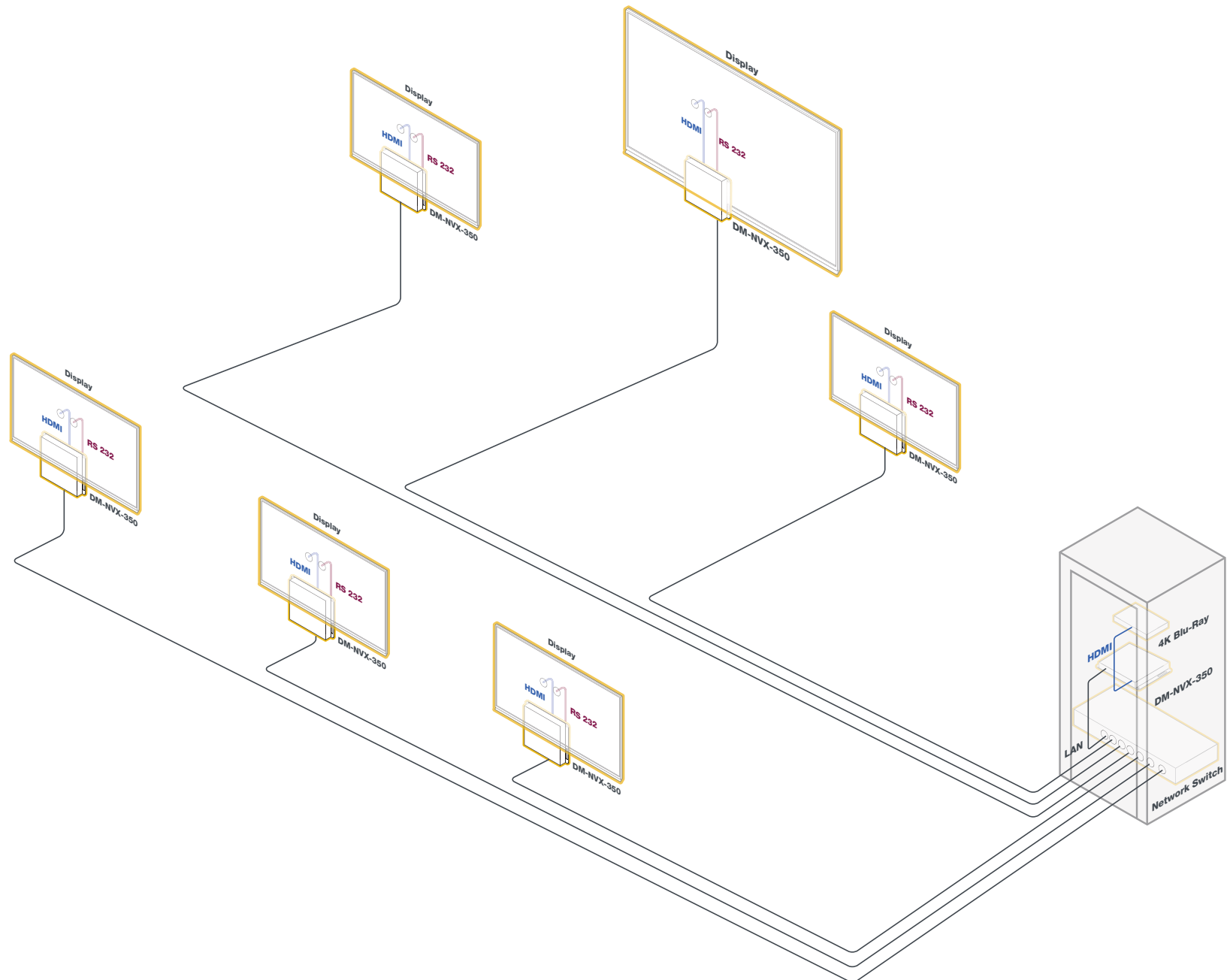
Benefits

- Best video quality: 4K60 4:4:4, HDR
- Use standard 1 Gb Ethernet
- No latency
- Network Access Control
- Infinite scalability
- Enables broadcast messaging

Key Products

DM-NVX-350

DigitalMedia Encoder/Decoder



Multiple Sources to Multiple Displays



Concourse - Coaches Club



VIP Box

Show 4K60 4:4:4 video from content servers, satellite receivers, cable boxes, and Blu-ray® players on various displays throughout a building, campus, or global enterprise. Even connect personal laptops and view multiple sources on a single display in a stadium suite or airport lounge.

Typical Spaces

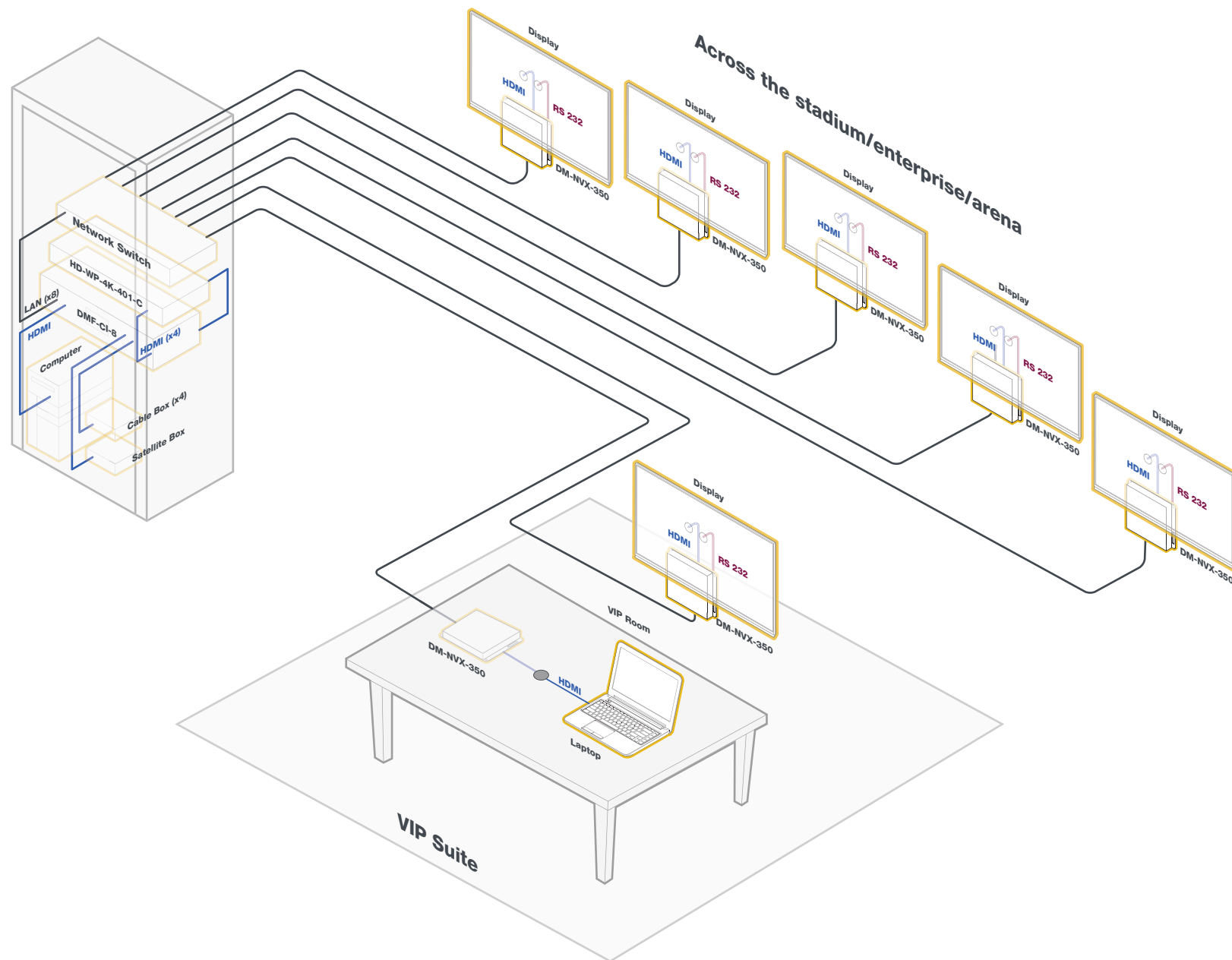
Stadiums, arenas, airports, hotels, conference rooms, and boardrooms

Benefits

- Best video quality: 4K60 4:4:4, HDR
- Use standard 1 Gb Ethernet
- No latency
- Easy signal routing via DM XiO Director
- Network Access Control
- Infinite scalability

Key Products

DM-NVX-351C	DigitalMedia Encoder/Decoder Card with Audio Downmixing
DMF-CI-8	DigitalMedia Card Chassis
DM-NVX-351	DigitalMedia Encoder/Decoder with Audio Downmixing
DM-NVX-350	DigitalMedia Encoder/Decoder
HD-WP-4K-401-C	4K Multi-Window Video Processor



Digital Signage



Display content such as menus, promotions, meeting or event schedules, weather reports, and announcements from a central content server. Using DM XiO Director, the same content can be routed to all displays or groups of displays, or unique content can be distributed to each display.

Typical Spaces

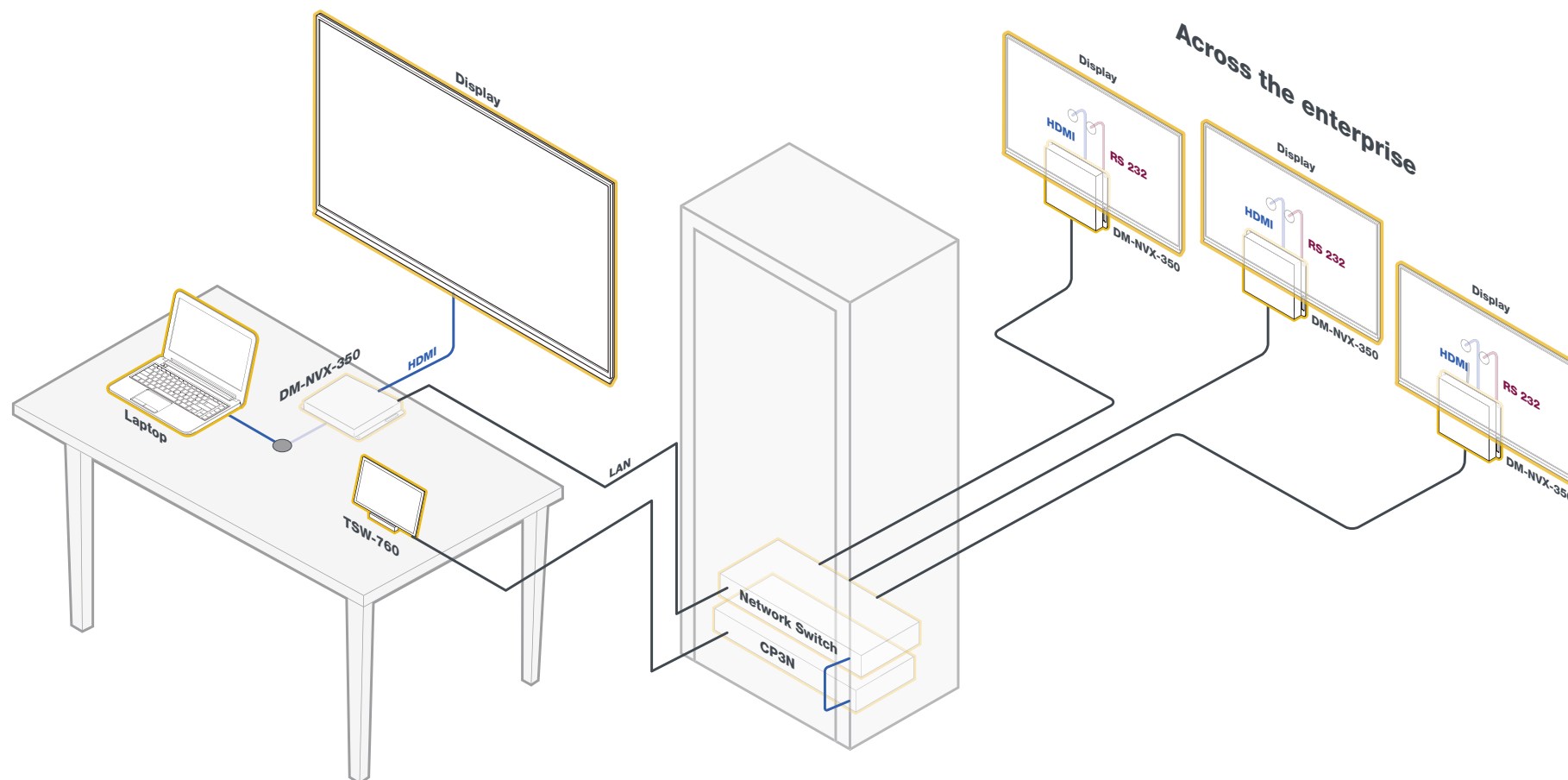
Hotels, corporate campuses, convention centers, museums, and retail

Benefits

- Best video quality: 4K60 4:4:4, HDR
- Use standard 1 Gb Ethernet
- Easy signal routing via DM XiO Director
- Network Access Control
- Infinite scalability
- Broadcast messaging

Key Products

DM-NVX-350	DigitalMedia Encoder/Decoder
TSW-760	7-Inch Touch Screen Controller
CP3N	3-Series Control System®



Video Wall



Process 4K60 video to create video walls composed of up to 64 individual displays. Video walls provide the ultimate high-impact visual experience. Show live data, such as energy savings, Twitter® feeds, or stock prices; display company news, sales promotions, or ads; stream unique content on every display or one image across all screens.

Typical Spaces

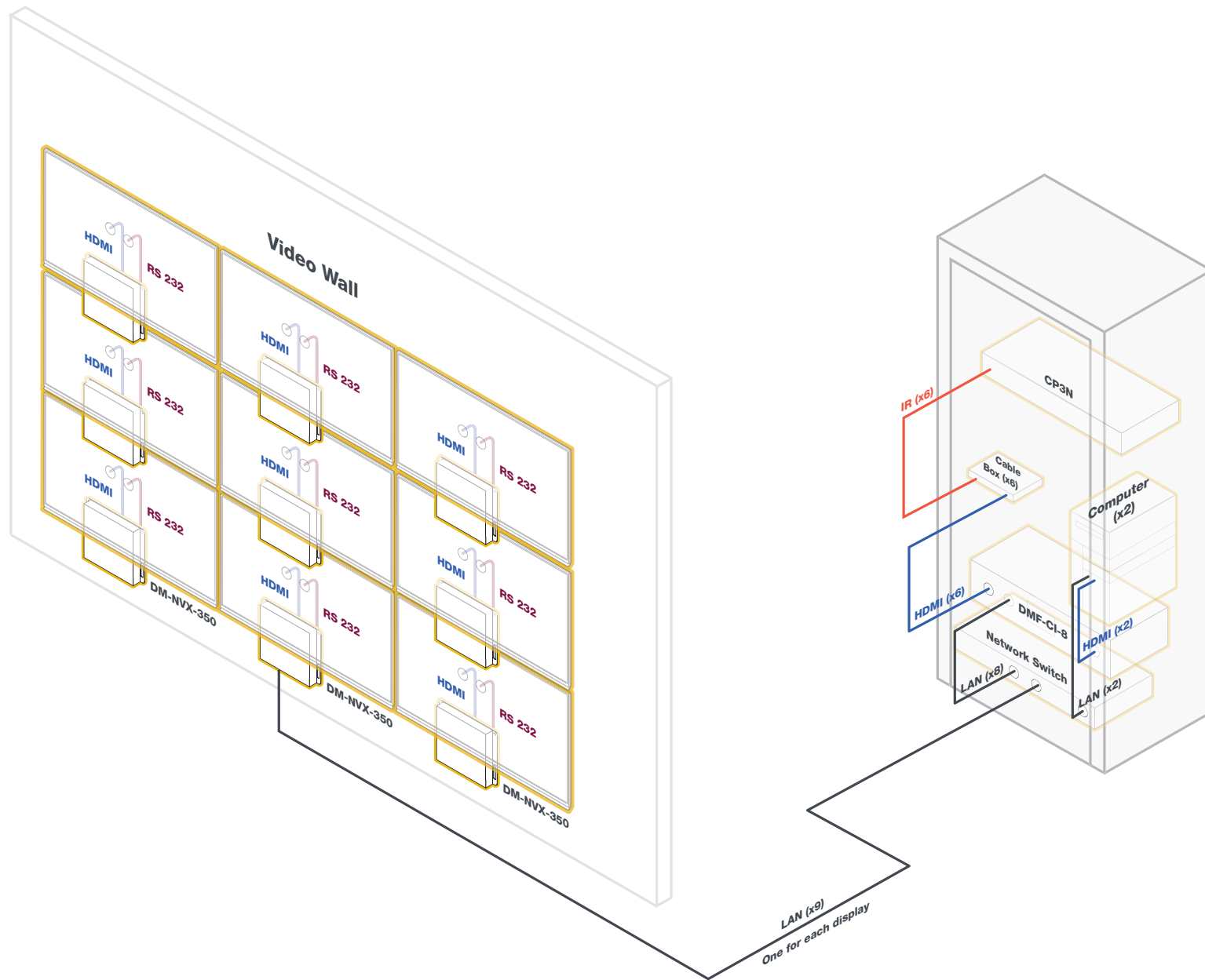
Lobbies, reception areas, command and control centers

Benefits

- Deliver engaging, interactive multimedia presentations
- Collaborate with remote colleagues and share information site-to-site
- Create a high-impact digital canvas to reinforce brand identity and welcome visitors
- 4K video scaling and video processing
- Network Access Control

Key Products

DM-NVX-350	DigitalMedia Encoder/Decoder
DM-NVX-350C	DigitalMedia Encoder/Decoder Card
DMF-CI-8	DigitalMedia Card Chassis
CP3N	3-Series Control System



Moveable Lectern



Accommodate maximum flexibility in room design and usage. DM NVX is versatile enough to install in a lectern or cart, and plug in wherever content is needed.

Typical Spaces

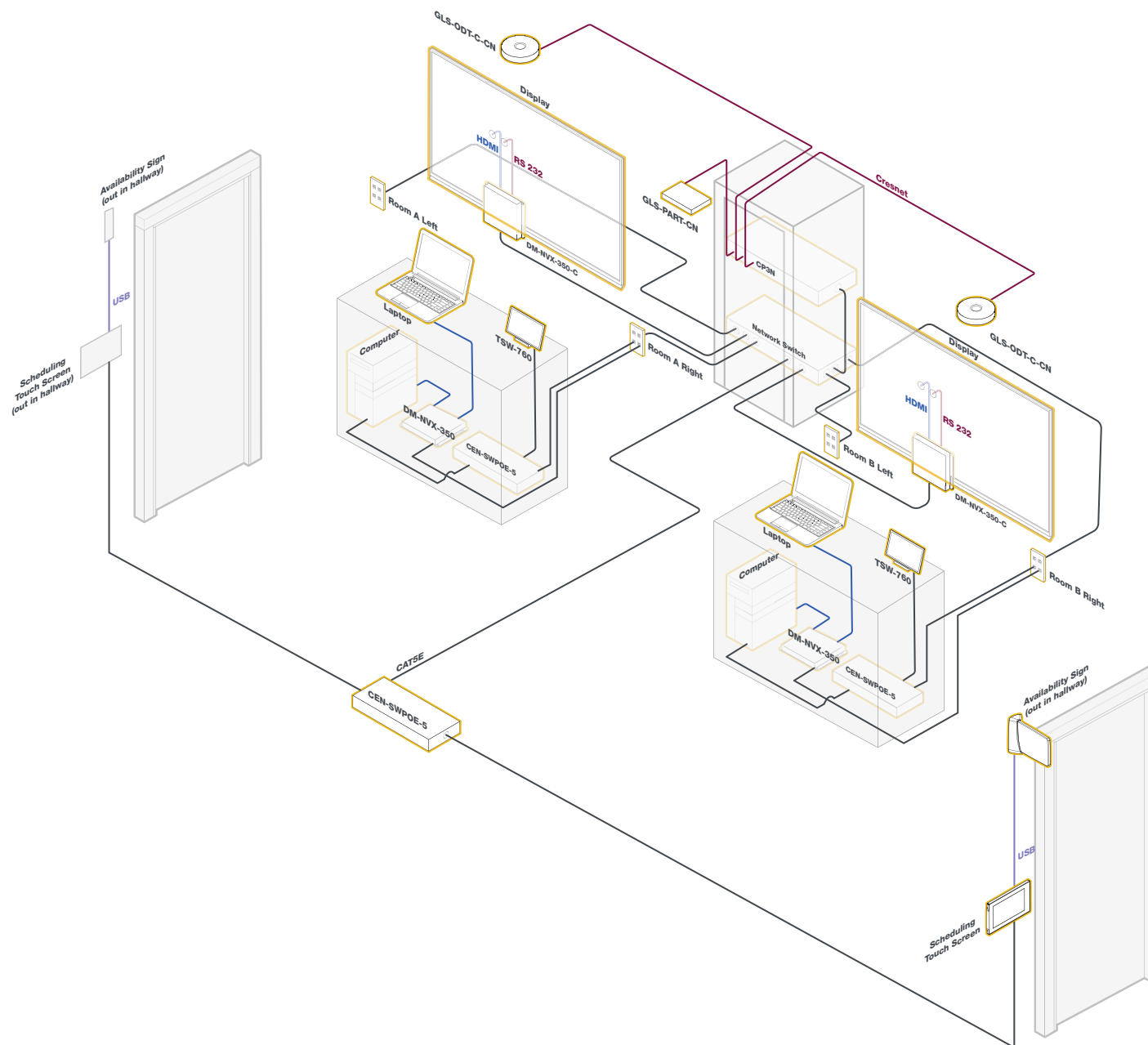
Divisible rooms and auditoriums

Benefits

- Design flexibility
- Affordable, flexible scalability
- Choice of rack mounted or standalone endpoints
- Best video quality: 4K60, 4:4:4, HDR
- No latency
- Supports standard network security protocols

Key Products

DM-NVX-350	DigitalMedia Encoder/Decoder
TSW-1060 (x2)	10-inch Room Scheduling Touch Screen
SSW-100 (x2)	Room Availability Hallway Sign
TSW-760 (x2)	7-Inch Touch Screen Room Controller
CEN-SW-POE-5 (x3)	5-Port PoE Switch
CP3N	3-Series Control System
GLS-PART-CN	Partition Sensor
GLS-ODT-C-CN	Occupancy Sensor



Remote PC, Mouse, Keyboard Routing and Control



DM NVX supports USB 2.0 routing for remote PC, keyboard, and mouse control, plus integration of whiteboards, cameras, and microphones in rooms. Use the touch screen to select a remote PC and stream its content to the room, control the whiteboard, and even switch the DM NVX in the room from decoder to encoder mode to stream content from the room onto the network.

Typical Spaces

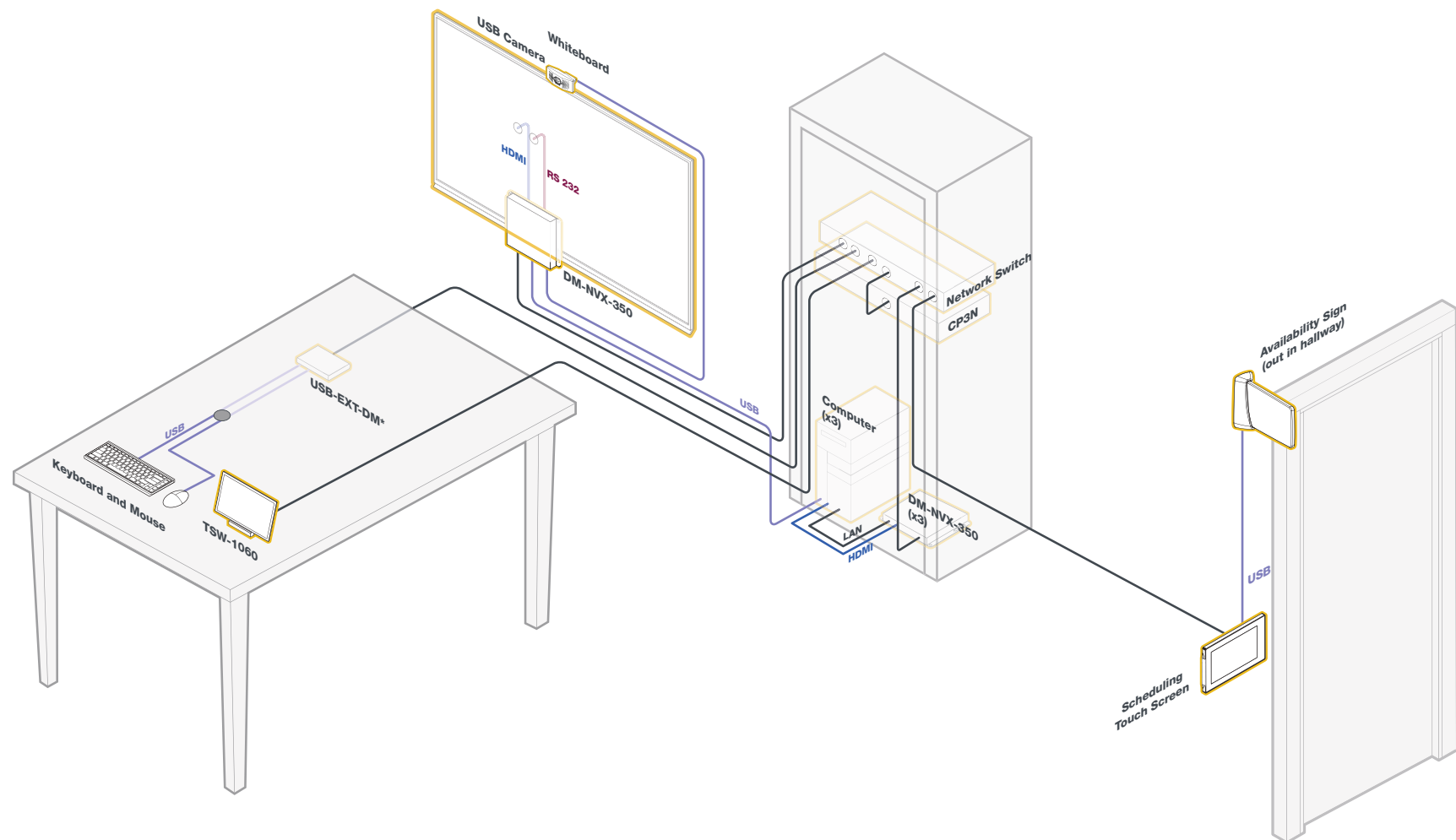
Presentation rooms, conference rooms, and remote workstations

Benefits

- 4K60 video with built-in scaling
- USB 2.0 routing
- Infinite scalability and flexibility
- Network Access Control

Key Products

DM-NVX-350	DigitalMedia Encoder/Decoder
TSW-760	7-inch Room Scheduling Touch Screen
SSW-100	Room Availability Hallway Sign
TSW-1060	10-Inch Touch Screen Room Controller
USB-EXT-DM*	USB Extender
CP3N	3-Series Control System



HDBaseT and DM NVX Integrated Systems



Add DM NVX network AV to installed HDBaseT systems to stream content to overflow rooms or to remote offices. DM NVX devices can switch between encoding and decoding video. Or have two dedicated devices to encode and decode simultaneously.

Typical Spaces

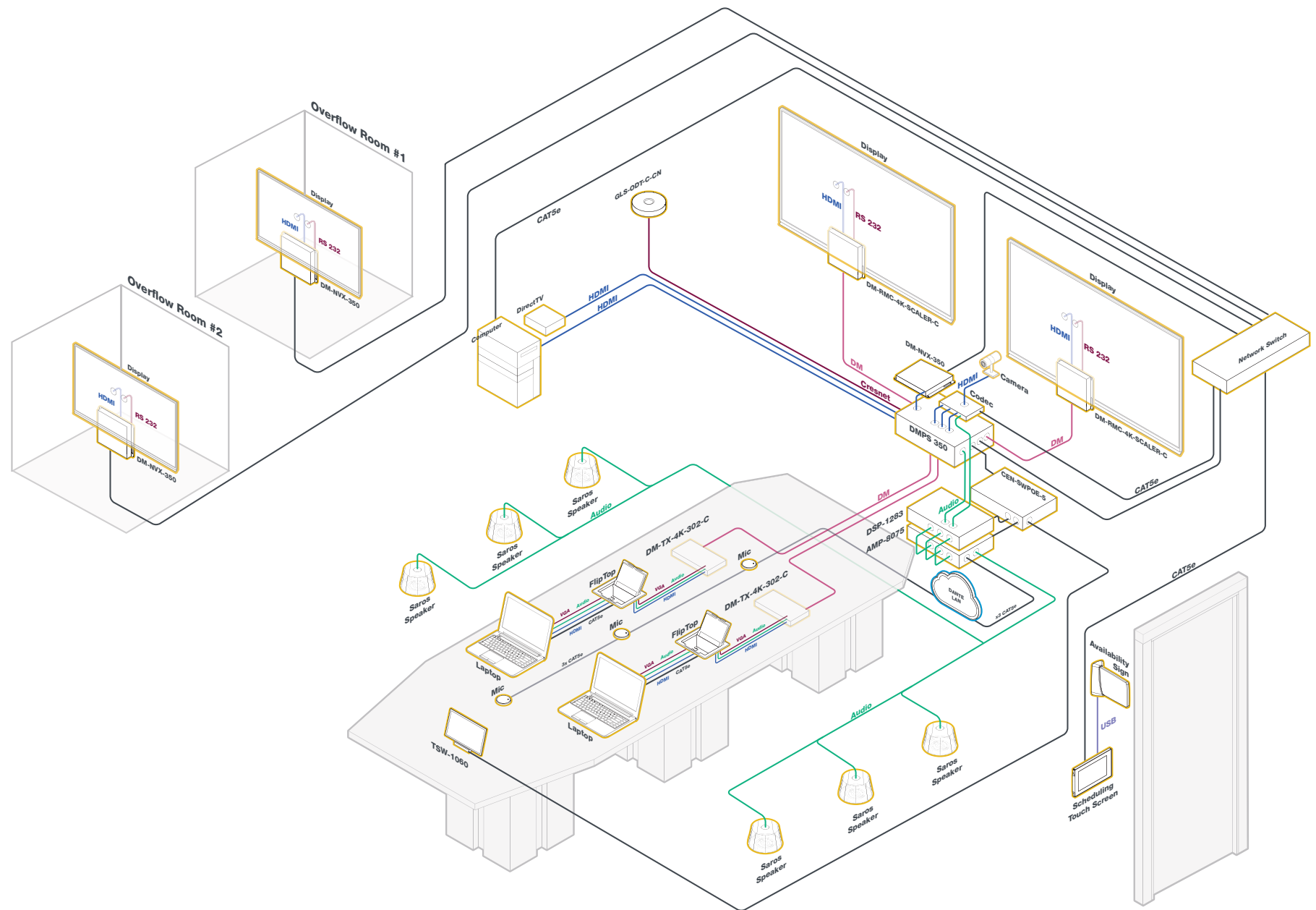
Presentation rooms, conference rooms, and boardrooms

Benefits

- Add the latest network AV to legacy rooms
- Leverage existing Ethernet and HDBaseT infrastructure
- Best video quality: 4K60 4:4:4, HDR
- No latency, infinite scalability, Network Access Control

Key Products

DM-NVX-350	DigitalMedia Encoder/Decoder
DMPS3-4K-350-C	3-Series 4K DigitalMedia Presentation Systems
TSW-1060 (x2)	10-inch Room Scheduling Touch Screen
FT-600	FlipTop™
CEN-SW-POE-5	5-Port PoE Switch
DM-TX-4K-302-C	4K DigitalMedia transmitter
DM-RMC-4K SCALER-C	DigitalMedia 4K Receiver with Scaler
GLS-ODT-C-CN	Occupancy Sensor
DSP-1283	Crestron Avia™ 12x8 Digital Signal Processor with Dante™, USB
AMP-8075	Crestron Avia 8-channel Power Amplifier
SAROS IC6T	Saros® 6.5-inch In-Ceiling Speakers



Monitor, Manage, and Control



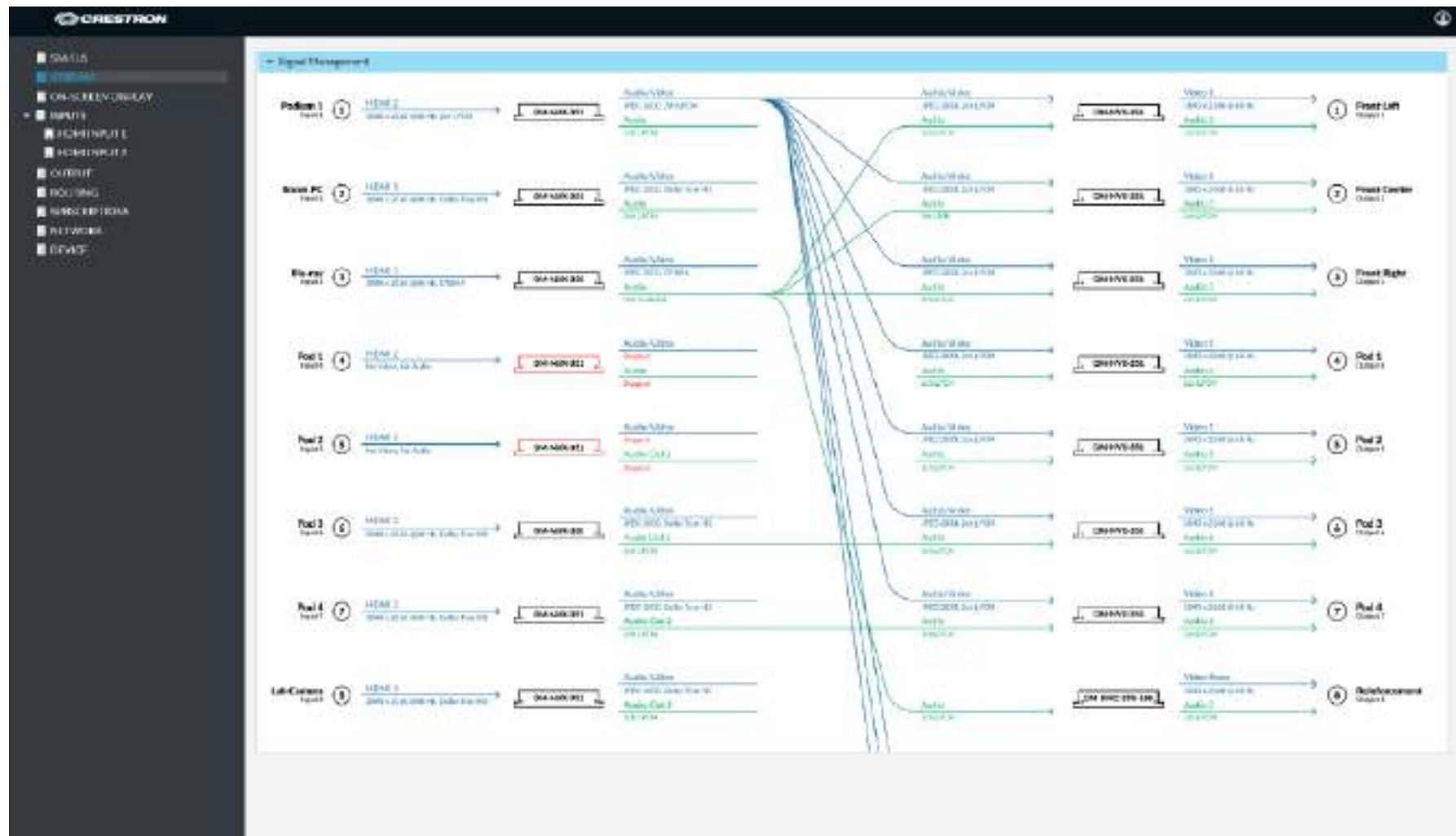
The DM XiO Director is an optional, convenient, and non-proprietary network appliance that provides centralized management of any and all DM NVX endpoints across an enterprise. The DM XiO Director includes a powerful web-based, easy-to-use software application that enables administrators to create customized virtual switching matrices and to remotely manage and control DM NVX systems of any size.

Benefits

- Secure, enterprise-grade appliance
- Single, browser-based dashboard to monitor, manage, and control DM NVX endpoints
- Customizable, user-friendly endpoint naming
- Domain grouping
- XML based device map import and export for rapid configuration

Key Products

DM XiO Director	Network AV management appliance
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Appendix

Minimum Network Requirements

Network Switch

- 1 Gigabit port for every connected DM NVX endpoint
- Non-blocking backplane
- Layer 2 or 3
- IGMPv2 or IGMPv3 implemented

Network Switch Settings

- IGMP snooping enabled
- IGMP querier enabled
- Fast-leave enabled (also known as immediate leave)

If DM NVX video traffic will traverse inter-switch uplinks

- The uplinks must have sufficient bandwidth for all encoders and decoders on the switch, Allocate 1 Gigabit per encoder or decoder attached to the switch.
- Uplinks must be properly configured to support multicast traffic

Audio Video Bridging (AVB) is not required for operation of DM NVX

Network Security

DM NVX employs the following security features:

- 802.1x is used to ensure that devices on the network have been explicitly sanctioned by the network administration team, which protects against unauthorized devices being added to the network and gaining access to sensitive content.

- Active Directory services for endpoint administration can be used to ensure that administrative privileges for DM NVX devices could be centrally managed, granted, and revoked when necessary.
- DM NVX endpoints use the industry-standard AES block cipher with robust PKI for AV content encryption to protect content from unauthorized access as it traverses the network.
- SSL-based Secure Cresnet-over-IP (CIP) for DM NVX control ensures that control systems and DM NVX devices communicate with the intended party device and that commands and status cannot be monitored by any unauthorized device on the network.
- SSH-based command-line console access for device configuration and status protects the device console from access by unauthorized users.
- HTTPS authenticates and encrypts the web interface to ensure DM NVX devices are only accessed by authorized users
- All control interfaces are authenticated and encrypted, ensuring unauthorized users cannot view or modify any control data sent to or from the DM NVX device.

Crestron's link encryption, Secure Crestron-over-IP, and SSH command line console access are both inherently available and configured within devices and support software with no need for specific network support. The system designer should therefore focus on 802.1x and Active Directory services within the design.

For additional information on deploying security with Crestron products, refer to the DM NVX Series Supplemental Guide (Doc. 7839), the IP Considerations Guidelines for the IT Professional Design Guide (Doc. 4579), and the Crestron Secure Deployment Guide Online Help (OLH 5571).

Corporate vs Dedicated Network

Using the existing corporate network or a dedicated network

DM NVX is a powerful and versatile network AV solution. It can be deployed either on existing 1 Gb Ethernet infrastructure or on a dedicated network. There are a few considerations when determining which option is better for your organization.

Existing corporate or campus network

For isolated groups of encoders and decoders that are all connected to the same Ethernet switch, the existing network may be used. Confirm that the installed switch meets the minimum requirements as defined in the “DM NVX Minimum Network Requirements” document. When reusing corporate infrastructure, Crestron recommends that all Crestron devices be put on a dedicated VLAN.

Dedicated AV network

A dedicated network may be preferable in the following cases:

- a. If corporate or campus IT policy requires segregation of AV and IT networks
- b. If the existing Ethernet switches don't meet the minimum requirements for DM NVX
- c. If DM NVX encoder/decoders that will share video are connected to different switches and the existing inter-switch uplink connections may not be designed to handle the appropriate bandwidth

While this approach will use dedicated switches, you may be able to use cabling already in the walls, significantly cutting down on installation costs.

This network can also be used for other devices in your AV installation, such as touch screens and control systems. If desired, this network can still have a connection back to the primary network for access to services such as DHCP or Active Directory®, but the video and control traffic will be isolated to the AV network.

Network Topologies

Devices such as DM NVX endpoints, control processors, touch screens, servers, personal computing devices and the like are connected directly to network switches. The relationships between network switches and their interconnection to each other define the network's topology.

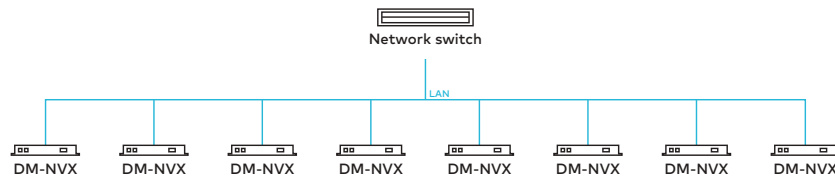
Star (Single Switch)

The default recommended network topology is a star, which has a hub-and-spoke appearance that connects to the DM NVX endpoint and other devices through a single switch.

The star topology using a fully non-blocking switch allows any combination of one or more endpoints to connect to any other combination of endpoints. It also more easily allows the network to grow beyond a single switch if the uplink in the switch supports the maximum specified bandwidth.

For small DM NVX systems that employ only one network switch, use a non-blocking switch so that there is no opportunity for a bottleneck. Star topologies can accommodate very large DM NVX installations by using large modular switch frames.

Star Network Using a Non-blocking Switch



Tree

In a typical large network with multiple layers of switch hierarchy, DM NVX and other AV devices will be situated at the network's edge. The network edge switches are connected via uplinks to other switches to aggregate traffic from the network edge and form the network's core. This is referred to as a tree topology.

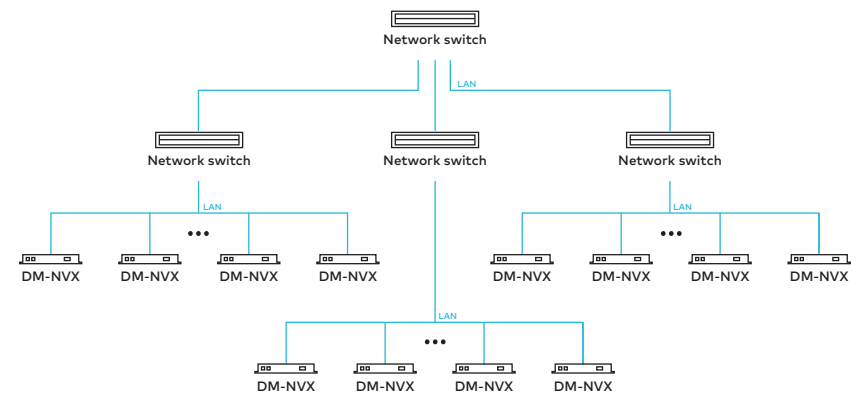
The following general rules apply for sizing network switches and uplinks:

- The network core switch must support a non-blocking bandwidth and port speed equal to one gigabit multiplied by the greater of either the total number of encoder endpoints or decoder endpoints.
- The gigabit edge switch must support a non-blocking backplane bandwidth and the uplink speed must equal one gigabit multiplied by the greater of either the total number of encoder endpoints or decoder endpoints.

The tree network allows a failure in one part of the attached star networks without widely affecting the other star networks in turn. The core network denoted by the larger network switch can be configured

for the purposes of redundancy and scalability as the network designer sees fit. This normally means the use of more than one switch per the network designer's requirements.

Tree Topology Using Non-blocking Switches on a Core Network

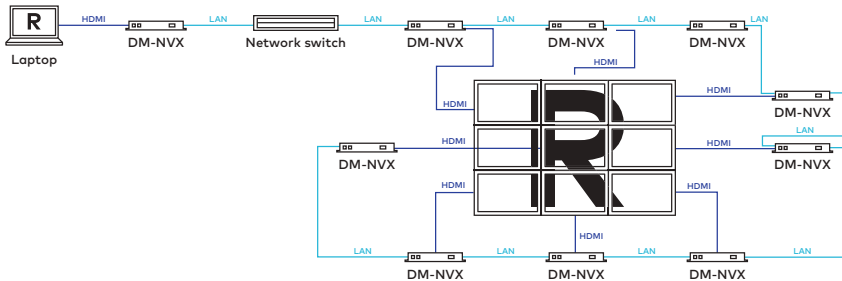


Daisy Chain

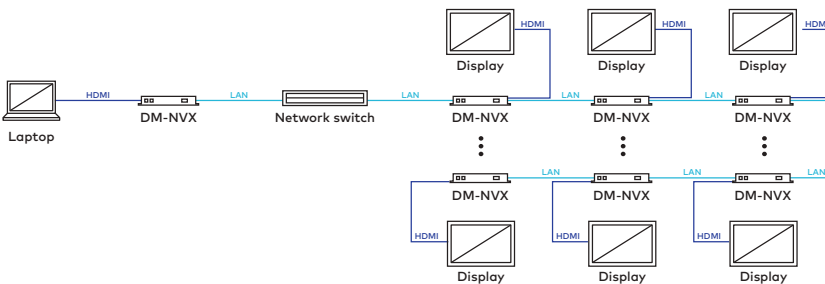
Daisy chaining is a topology that DM NVX endpoints support which is appropriate for specific applications such as video walls, digital signage or video reinforcement applications where all displays receive the same video source as the first DM NVX in the chain.

For video wall applications and any application where displays will share the same source, up to 64 endpoints can be daisy chained together. Larger video walls should be divided on individual daisy chains no longer than 64 endpoints.

Daisy Chain Network Configuration for 3x3 Video Wall



Daisy Chain Network Configuration for Twelve-Person Jury Box



Due to limited bandwidth for audio and video, using USB host or device functionality on a daisy chained endpoint is not recommended. For maximum flexibility and the ability to reconfigure video walls with multiple sources, connect DM NVX endpoints directly to switches rather than use a daisy chain.

Other Topologies and Network Functionality

There are other valid deployment topologies for DM NVX, such as ring and mesh. These deployments require project-specific discovery, engagement of the customer's IT staff, and advanced configuration of network switch beyond the scope of this guide.

For projects using advanced topologies for deployments, a networking professional with vendor-specific knowledge of the network hardware being deployed must be involved as early as possible in the network design process.

* Contact Crestron regarding feature update

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