

# AVoIP - Streaming Media Comes to Professional Systems

Michael Pincus, RCDD, PE, CTS



# Agenda

- Why AVoIP?
- Bandwidth Considerations
- Compression & Latency
- Streaming Formats
- Hardware
- Control, Monitoring & Management

# Why AVoIP?

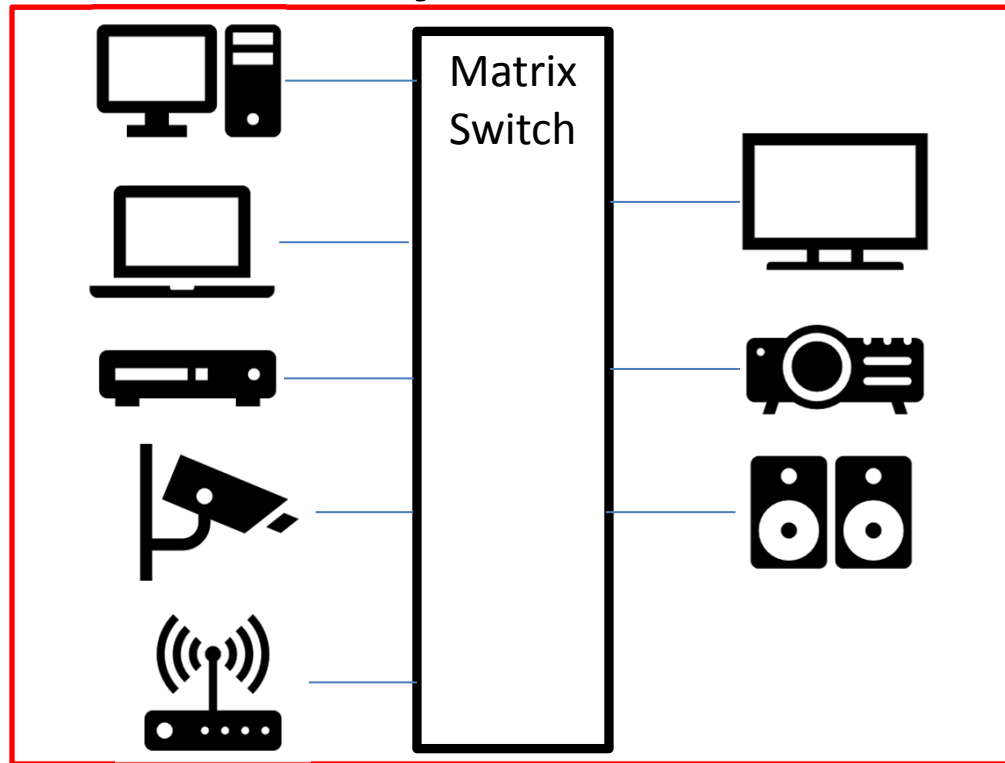
- Simplified Cabling

<i>Analog Mic/Line Loudspeaker VGA HDMI DisplayPort USB RS-232 IR/Serial Relays/Contact Closures Extensions over UTP Ethernet</i>	<i>Ethernet</i>
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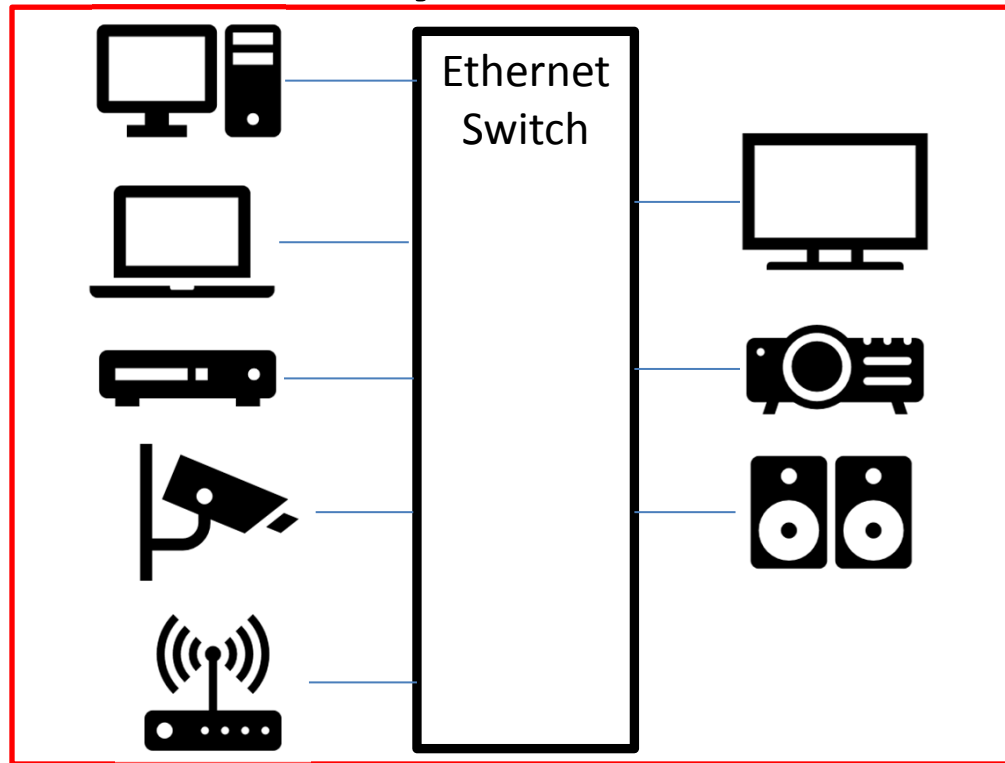
# Why AVoIP?

- Simplified Cabling
- Reduced Infrastructure

# Why AVoIP?



# Why AVoIP?



# Why AVoIP?

- Simplified Cabling
- Reduced Infrastructure
- Flexibility

# Why AVoIP?

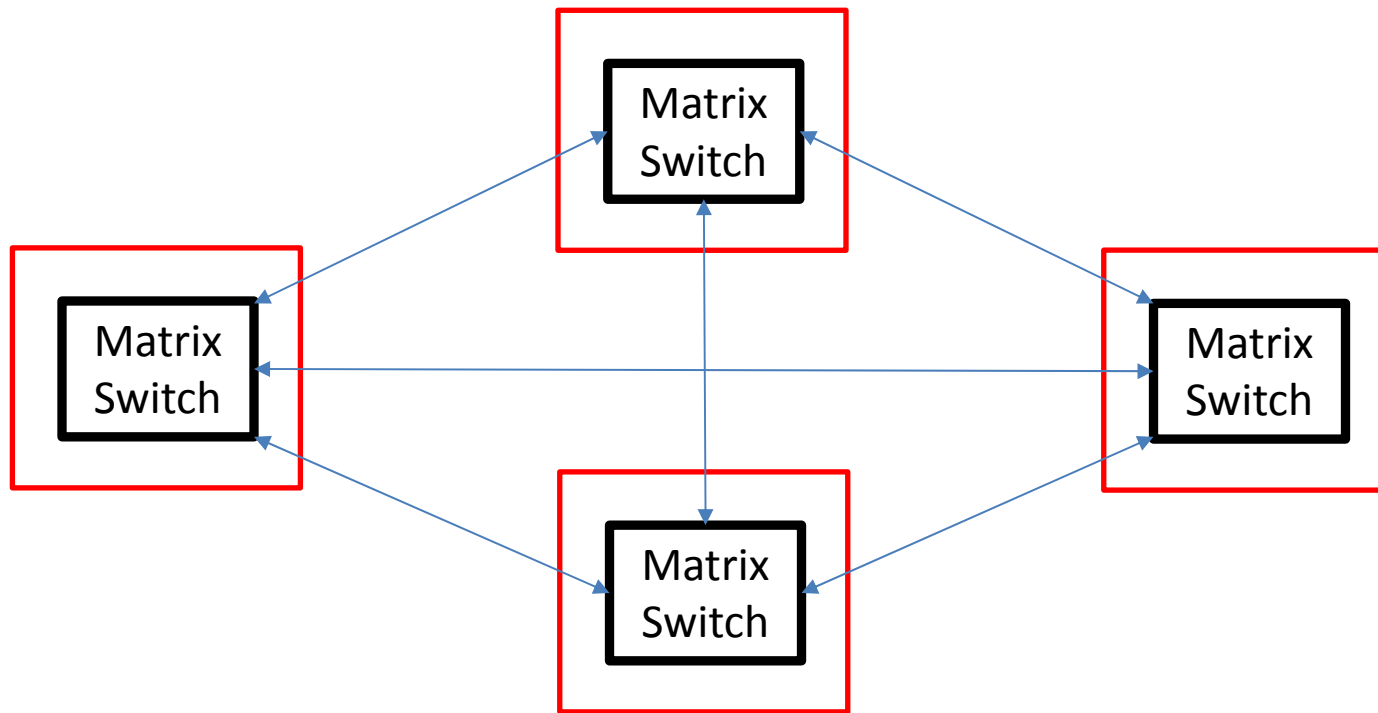
- Simplified Cabling
- Reduced Infrastructure
- Flexibility
- Features



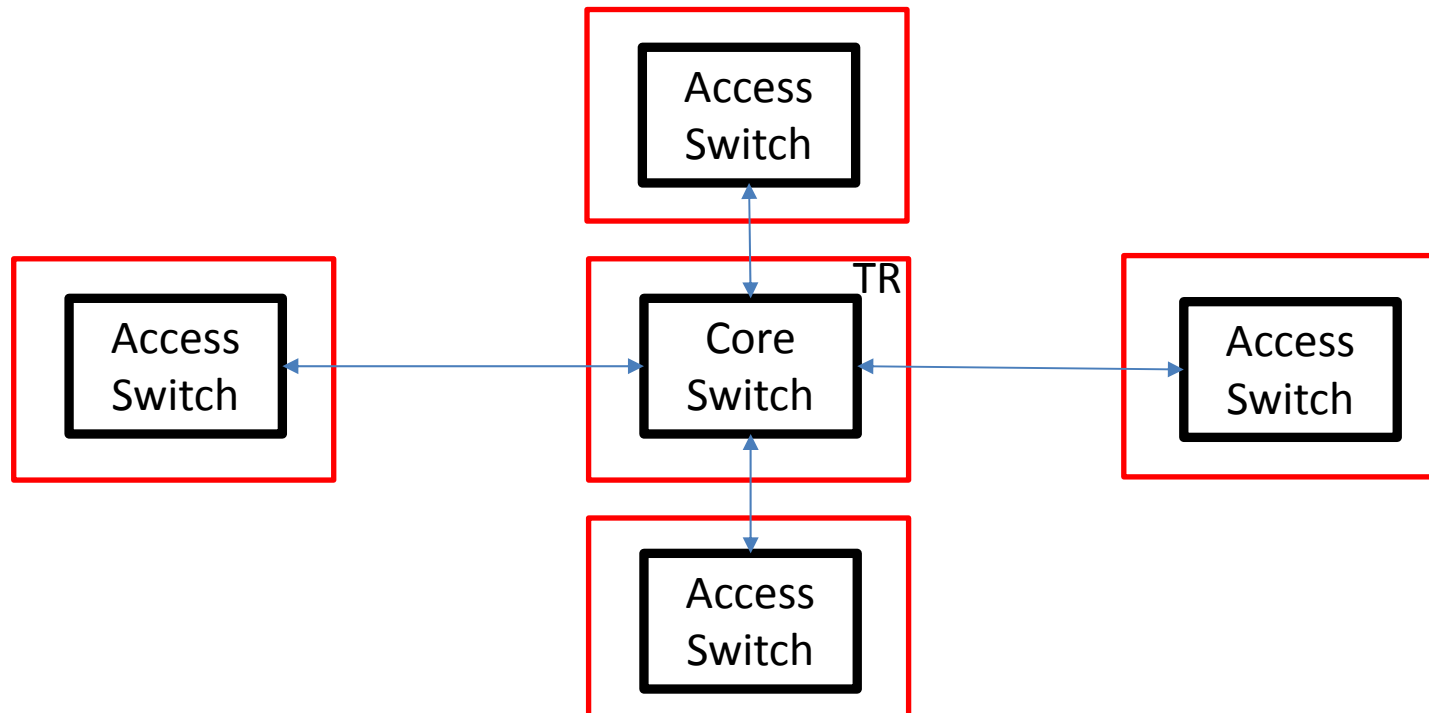
# Why AVoIP?

- Simplified Cabling
- Reduced Infrastructure
- Flexibility
- Features
- Scalability

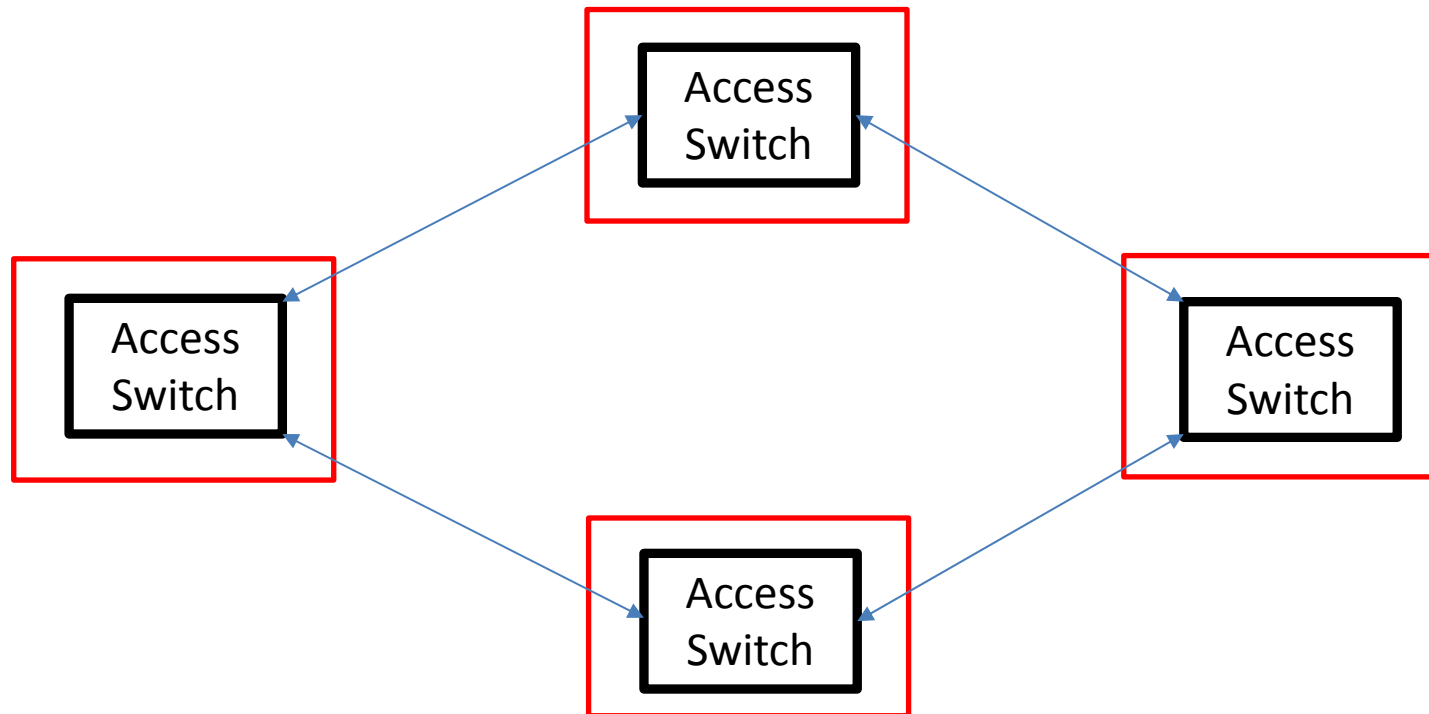
# Why AVoIP?



# Why AVoIP?



# Why AVoIP?



# Why AVoIP?

- Simplified Cabling
- Reduced Infrastructure
- Flexibility
- Features
- Scalability
- Control, Management & Monitoring

# Bandwidth - Audio

- 44.1 kHz, 16-bit  
 $44,100 \times 16 = 705.6 \text{ kbps} \rightarrow 1,417 \text{ ch/1 Gb link}$
- 48 kHz, 24-bit  
 $48,000 \times 24 = 1.152 \text{ Mbps} \rightarrow 868 \text{ ch/1 Gb link}$
- 96 kHz, 24-bit  
 $96,000 \times 24 = 2.304 \text{ Mbps} \rightarrow 434 \text{ ch/1 Gb link}$

# Bandwidth - Video

- 1080p/60

$$1920 \times 1080 \times 3 \times 10 \times 60 = 3.73248 \text{ Gbps}$$

- UHD (3840 x 2160)

$$3840 \times 2160 \times 3 \times 10 \times 60 = 14.92992 \text{ Gbps}$$

- True 4K (4096 x 2160)

$$4096 \times 2160 \times 3 \times 12 \times 60 = 19.1102976 \text{ Gbps}$$

# Bandwidth - Video

- 4K60 4:4:4

$$4096 \times 2160 \times 3 \times 12 \times 60 = 19.1102976 \text{ Gbps}$$

- 4K30 4:4:4

$$4096 \times 2160 \times 3 \times 12 \times 30 = 9.5551488 \text{ Gbps}$$

- 4K60 4:2:0

$$4096 \times 2160 \times 1.5 \times 12 \times 60 = 9.5551488 \text{ Gbps}$$



# Compression

- Audio – no compression needed

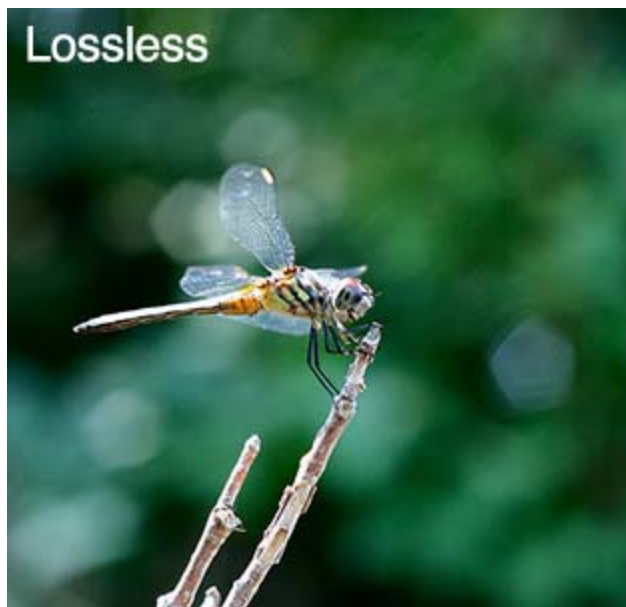
# Compression

- Audio – no compression needed
- Video – may require compression
  - 4K60 4:4:4 -> ~20:1 (1Gb), <2:1 (10Gb)
  - 4K30 4:4:4/4K60 4:2:0 -> ~10:1 (1Gb), 1:1 (10Gb)

# Compression

- Audio – no compression needed
- Video – FHD and above require compression
- CBR vs. Adaptive/Dynamic BR

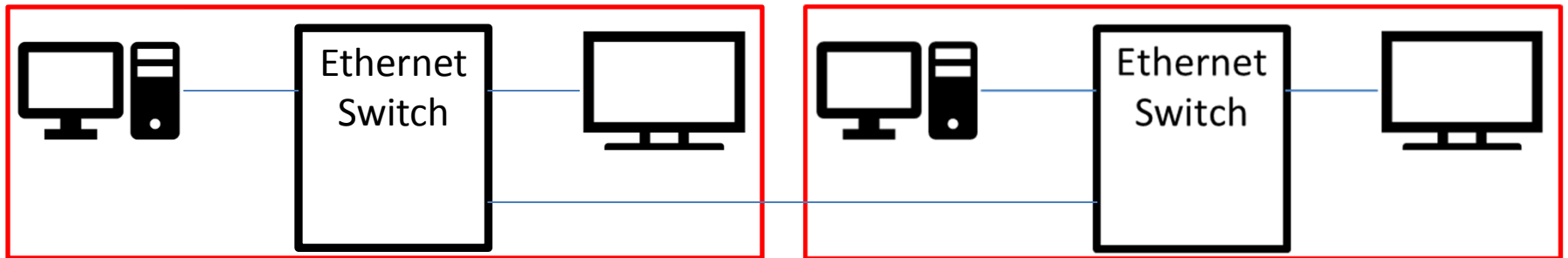
# Compression



Imagery by Keerthana Chandran

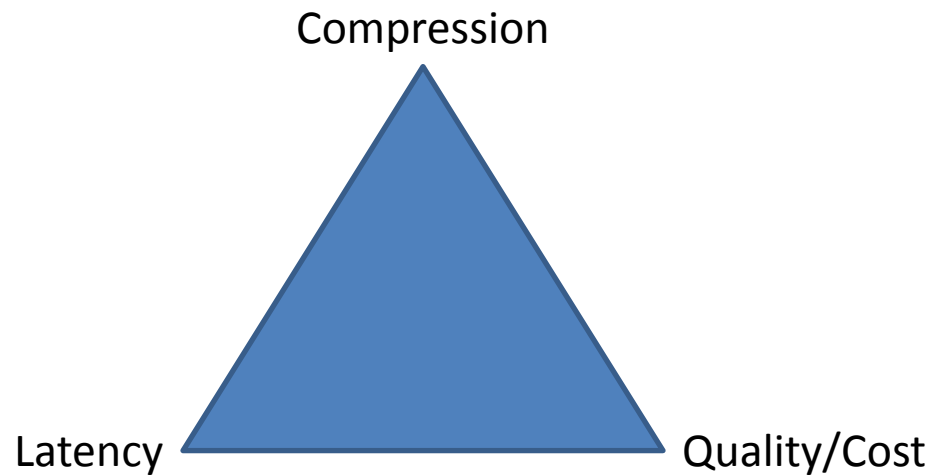
# Latency

- Encoding + Network + Decoding



# Streaming Formats

- Trade-offs:



# Streaming Formats

- H.264/H.265
- JPEG2000
- Dante (<https://audinate.com/products/dante-enabled/partners>)
- AES67
- Q-LAN
- ST 2110
- 802.1BA (AVB) (<https://avnu.org/our-members/>)
- NDI
- SDVoE (<https://sdvoe.org/alliance/members/>)

# Hardware

- Encoder
  - 1G or 10G
  - Wall plate
  - Standalone
  - Card



# Hardware

- Encoder
- Decoder
  - 1G or 10G
  - Wall plate
  - Standalone
  - Card

# Hardware

- Encoder
- Decoder
- Transceiver
  - 1G or 10G
  - Wall plate
  - Standalone
  - Card

# Hardware

- Encoder
- Decoder
- Transceiver
- Network Switch

# Hardware

- Network Switch Considerations
  - Managed
  - Non-blocking
  - 1Gb or 10Gb ports
  - Uplink(s)
  - PoE

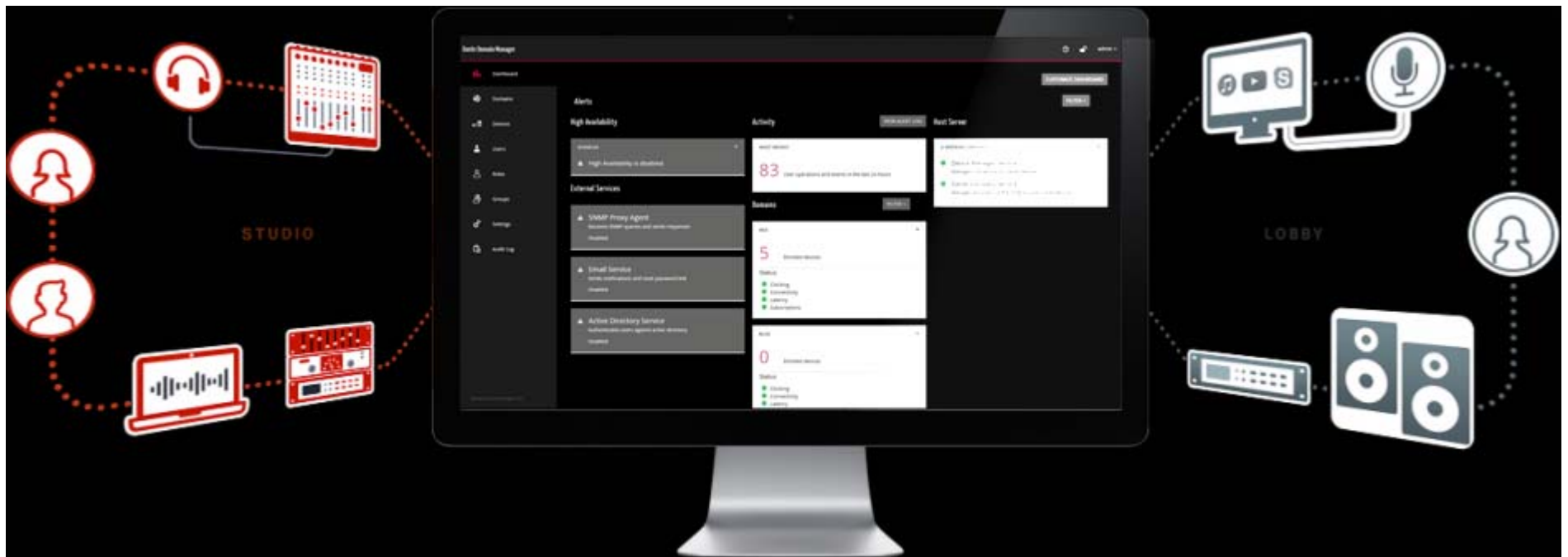
# Hardware

- Encoder
- Decoder
- Transceiver
- Network Switch
- Management Appliance

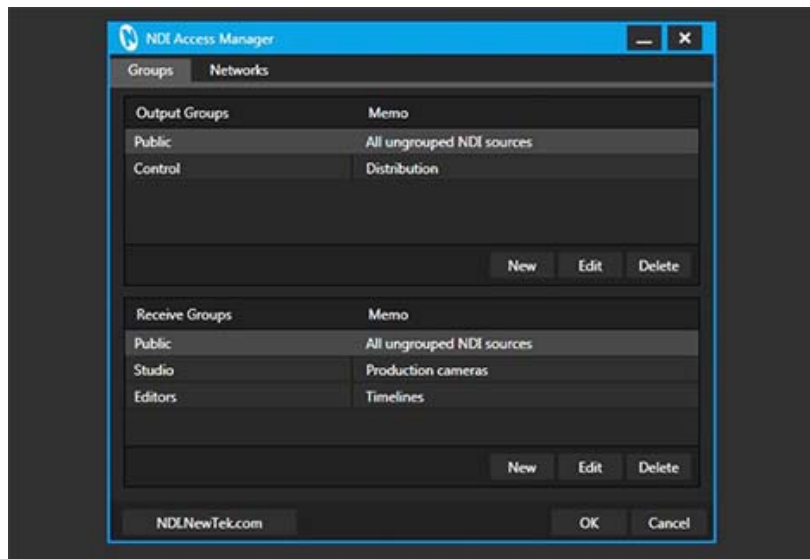
# Control

- Software-defined
- APIs

# Control & Management



# Control & Management



- Configure channels as public or private on your network
- Group systems, devices, and applications to preference
- Connect to and access channels on other networks via IP address
- Connect to and access channels on other networks via IP address
- Advanced tab allows preference for TCP or UDP connections, multicast operation, and optional discovery server support

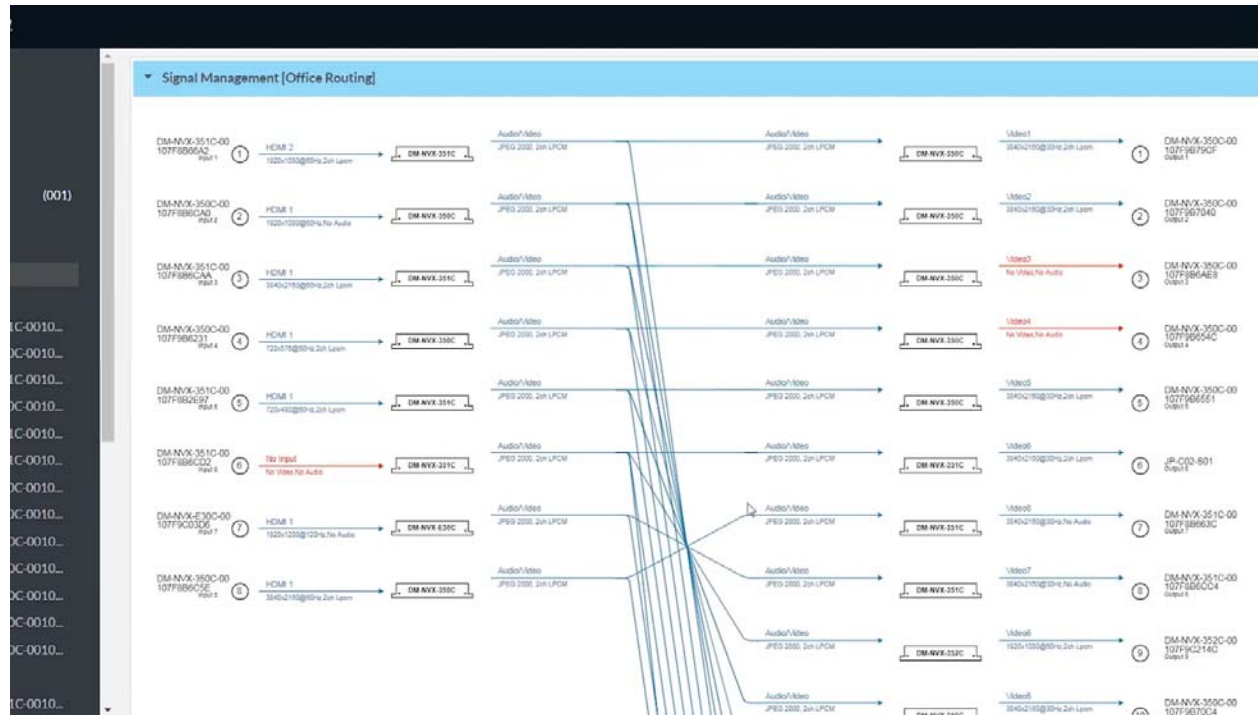


# Control & Management

The screenshot displays the IPBT Manager Aurora web interface. At the top, there is a navigation bar with 'Tools', 'View', 'Setup', 'Groups', and 'Help' menus, and a 'Logout' button. Below this is a toolbar with icons for Matrix Switching, Videowall Setup, Preview Routing, Serial Routing, Macro Recall, and Firmware Update. The main content area is divided into two sections: 'Encoders' and 'Decoders'. Each section contains a grid of 10 device cards, each representing a device with its IP address, version, status, and other details. A search bar is present in each section. At the bottom, there is a red notification bar that says 'Macro recording in progress' and a copyright notice: '© Copyright Aurora Multimedia Corp. - Version 1.52.2'.

Device ID	IP Address	Version	Status
Via series enc-0903	189.254.1.33	V3.22.2.rc	STOPPED
Via series enc-0902	189.254.1.8	V3.22.2.rc	STOPPED
Via series enc-0409	189.254.1.21	V3.22.2.rc	STOPPED
Via series enc-0407	189.254.1.12	V3.22.2.rc	STOPPED
Via series enc-0406	189.254.1.28	V3.22.2.rc	STOPPED
Via series enc-0405	189.254.1.13	V3.22.2.rc	STOPPED
Via series enc-0400	189.254.1.20	V3.22.2.rc	STOPPED
Via series enc-0447	189.254.1.9	V3.22.2.rc	STOPPED
Via series enc-0446	189.254.1.21	V3.22.2.rc	STOPPED
Via series enc-0445	189.254.1.20	V3.22.2.rc	STOPPED
Via series dec-0498	189.254.1.17	V3.22.2.rc	STOPPED
Via series dec-0497	189.254.1.6	V3.22.2.rc	STOPPED
Via series dec-0496	189.254.1.29	V3.22.2.rc	STOPPED
Via series dec-0492	189.254.1.39	V3.22.2.rc	STOPPED
Via series dec-0491	189.254.1.27	V3.22.2.rc	STOPPED
Via series dec-0490	189.254.1.24	V3.22.2.rc	STOPPED
Via series dec-0488	189.254.1.5	V3.22.2.rc	STOPPED
Via series dec-0454	189.254.1.16	V3.22.2.rc	STOPPED
Via series dec-0449	189.254.1.15	V3.22.2.rc	STOPPED
Via series dec-0448	189.254.1.28	V3.22.2.rc	STOPPED

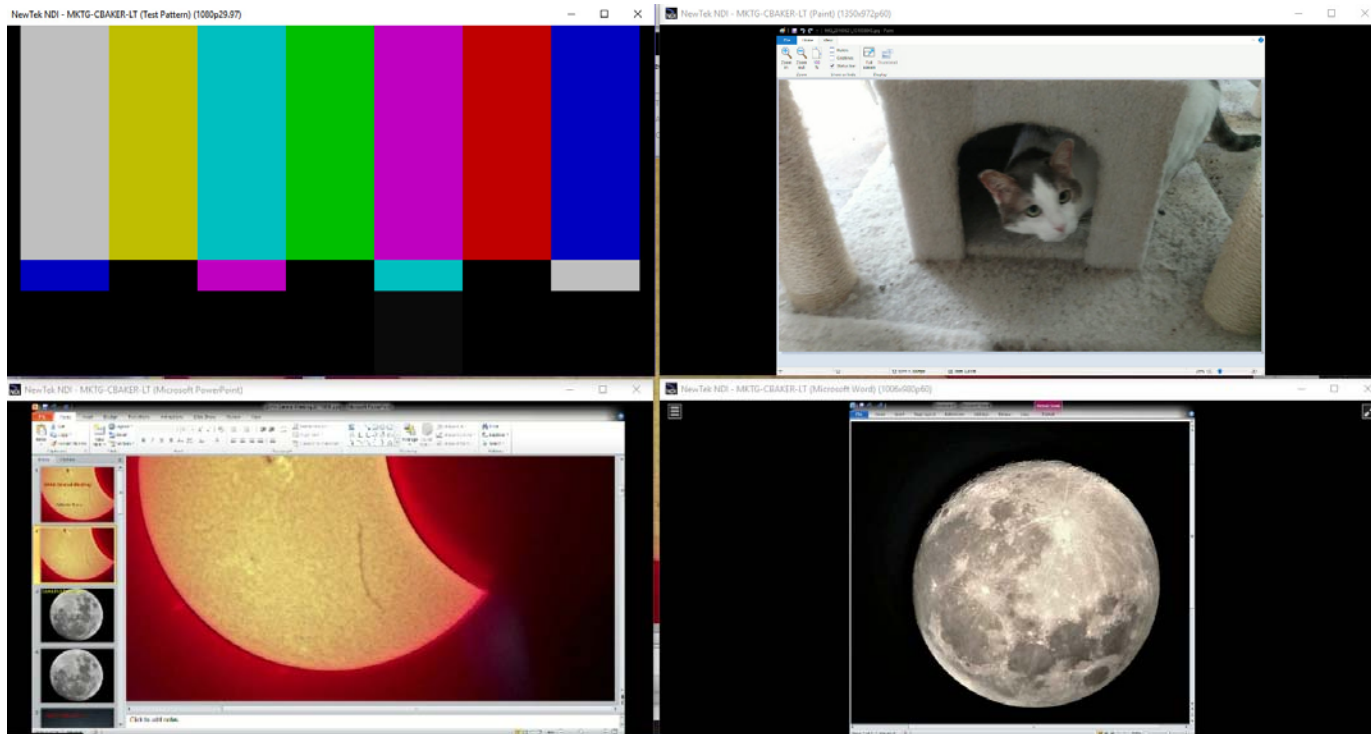
# Control & Management



# Testing



# Monitoring



# Summary

- Commercial AV systems moving to AVoIP solutions for network transport and virtual switching
- Audio can be transported without compression
- High resolution video often needs to be compressed
- Choose codec/streaming solution based on application (tolerance for compression & latency)
- HW & SW codecs, and software control, management & tools allow for an end-to-end digital solution

# Thank You!

Michael Pincus, RCDD, PE, CTS

Michael.Pincus@vantagecgroup.com

