CASE STUDY: The $1 Professional Conference Suite

Project Scope: Secure A/V-over-IP via Repurposed Mobile Hardware

Organization: Cahaba Medical Care (FQHC)

Architect: David Culp, Principal Solutions Architect

Key Value: Delivered $20k+ professional conferencing functionality at near-zero hardware cost.

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1. EXECUTIVE SUMMARY

Faced with the need for high-fidelity, multi-endpoint conferencing in a non-profit environment, I architected a custom **A/V-over-IP (AoIP)** solution. By repurposing "E-waste" (Samsung S21FE mobile devices) and leveraging the **NDI (Network Digital Interface)** protocol, I built a modular, broadcast-quality conference suite. The system provides sub-millisecond latency and professional-grade audio/video without the five-figure price tag of proprietary hardware.

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2. THE CHALLENGE

- **Budgetary Constraints:** Commercial-grade conferencing solutions (Polycom/Logitech) for 30+ sites were cost-prohibitive.
- **Hardware Waste:** The organization had a surplus of "outdated" FirstNet mobile devices and network switches slated for E-waste.
- **Technical Complexity:** Delivering synchronized, low-latency audio and video over a standard clinical network without causing congestion or security vulnerabilities.

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3. THE ENGINEERING SOLUTION

I transformed discarded mobile phones into high-definition NDI endpoints, controlled by a central production hub.

A. The NDI & A/V-over-IP Pipeline

- **Visuals:** Each mobile device was configured as an **NDI Camera HX** source, delivering high-bitrate video over the network.
- **Audio:** Integrated USB-C gooseneck and lavalier microphones into the mobile units to serve as distributed "mic arrays."
- **Production Hub:** A centralized Mac Mini M4 running **OBS Studio** and **Reaper** acted as the mixer, aggregating all NDI streams into a single virtual camera for Google Meet/Teams.

B. Network & Security Architecture

To prevent A/V traffic from impacting clinical operations, I engineered a dedicated "Media Layer":

- **Isolated VLAN:** Created a high-bandwidth, non-routed VLAN specifically for NDI traffic.
- **Power & Data:** Utilized **Texas PoE+ to USB-C adapters** to provide continuous power and a wired data connection to the mobile units, ensuring stability that Wi-Fi could not provide.
- **Endpoint Hardening:** Used **Hexnode MDM** to lock the devices into "Single-App Mode," preventing unauthorized use and ensuring the devices remain headless utility nodes.

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4. MULTI-NEED CONFIGURATIONS

I designed the system to be modular, supporting three distinct use cases:

1. **Attendee Array:** Desktop gooseneck mics for interactive board meetings.
2. **Presenter Setup:** Mobile lavalier mics for dynamic, high-movement speakers.
3. **Ceiling Array:** Strategic overhead placement for room-wide ambient audio capture.

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5. BUSINESS & OPERATIONAL IMPACT

- **Extreme ROI:** Achieved professional-tier results using $1 FirstNet promotional hardware and E-waste network switches.
- **Scalability:** The "Template" can be deployed to any clinic with existing network infrastructure.
- **Sustainability:** Diverted dozens of high-performance mobile devices and switches from the landfill, aligning with corporate social responsibility (CSR) goals.
- **Deterministic Quality:** Wired PoE connectivity eliminated the jitter and lag typically associated with wireless conferencing solutions.

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6. TECHNICAL DOCUMENTATION INDEX

- **Project Presentation:** [Link to Conference Room Tests Slideshow]
- **VLAN Configuration:** Documented in the *Remote Clinic Network Diagram*.
- **MDM Policy:** Standardized via Hexnode (SOP available upon request).