The 7th Circle Of Hell
Making Whole-Facility Network Audio Work
Matt Ward, Head Of Audio
Jigsaw 24
Whole Facility?

- Multiple Rooms 20
- Shared Resources
- Streaming audio between them
- May need to integrate with Video Devices

Network Audio (AoIP)

Audio Transport over IP.
Production Capable
Built on standard technologies
Transport Over IP

- QLAN
- CobraNet
- Livewire
- AES50 / SuperMac
- Ravenna
- Soundgrid
- Dante
- Riedel-Rocknet
- ?AES67?
- Aviom-Pro64
- AVB

Production Capable

- Linear | PCM | Uncompressed
- Minimum Sampling
  - Frequency 44.1kHz
- Minimum Bit Depth 16 bits
- “Low” Latency <10mS

Built on Standard Technologies

- RTP (RTCP RTSP) media transport
- SIP (Session Initiation Protocol)
- SDP (Session Description Protocol)
- PTP synchronisation
- Bonjour / SAP
- Etc...

Why Bother? AoIP Advantages

- Bi directional
- Many channels on a single cable
- Audio routing at the IP layer
- Commodity Hardware
- Consolidated Clocking Architecture
- Automated Device Discovery
- CHEAPER
- MORE FLEXIBLE
- EFFICIENT

“To the ‘disinterested observer’, an ideal network audio system and an ideal conventional audio system should be identical.”
Why Bother? AoIP Disadvantages

• Audio engineers are not network engineers
• Complexity of setup?
• Fear of change
• Timing / Clocking?

Any sufficiently advanced technology is indistinguishable from magic

Making Network Audio Work

1. Easy Wins
2. Clocking
3. Network Considerations
Easy Wins

Name your paths and devices
Logically Group devices by IP address
Simplify routing options
Redundancy?
Static Reservation DHCP
Don’t just think about logical networking, consider the physical realities
Cable Performance

Cable ID: 74022  Test Summary: PASS
Date / Time: 19/07/2017  12:54:02  Operator: WES CYRUS
Model: DTX-1800
Headroom 3.3 dB (NEXT 36-45)
Software Version: 2.7700
Main S/N: 9480027
Test Limit: TIA Cat 6A Perm. Link
Limits Version: 1.9400
Remote S/N: 9480028
Cable Type:  * ULTIMA CAT6A U/FTP *
Calibration Date:
Main Adapter: DTX-PLA002
NVP: 74.0%
Main (Tester): 21/04/2016
Remote Adapter: DTX-PLA002
Remote (Tester): 21/04/2016
Project: DTDC VIRTUS
Site: VIRTUS DC

<table>
<thead>
<tr>
<th>Length (m), Limit 90.0</th>
<th>Pair 36</th>
<th>6.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prop. Delay (ns), Limit 498</td>
<td>Pair 12</td>
<td>28</td>
</tr>
<tr>
<td>Delay Skew (ns), Limit 44</td>
<td>Pair 12</td>
<td>1</td>
</tr>
<tr>
<td>Resistance (ohms)</td>
<td>Pair 12</td>
<td>1.3</td>
</tr>
<tr>
<td>Insertion Loss Margin (dB)</td>
<td>Pair 36</td>
<td>39.2</td>
</tr>
<tr>
<td>Frequency (MHz)</td>
<td>Pair 36</td>
<td>490.0</td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>Pair 36</td>
<td>43.2</td>
</tr>
<tr>
<td>Worst Case Margin</td>
<td>MAIN</td>
<td>PASS</td>
</tr>
<tr>
<td>Worst Case Value</td>
<td>MAIN</td>
<td>SR</td>
</tr>
<tr>
<td>NEXT (dB)</td>
<td>36-45</td>
<td>3.3</td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>492.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>26.9</td>
<td></td>
</tr>
<tr>
<td>Worst Pair</td>
<td>36-45</td>
<td></td>
</tr>
<tr>
<td>PS NEXT (dB)</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>492.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>Worst Pair</td>
<td>12-45</td>
<td></td>
</tr>
<tr>
<td>ACR-F (dB)</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>366.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>Worst Pair</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>PS ACR-F (dB)</td>
<td>15.8</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>61.2</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>MAIN</td>
<td>SR</td>
</tr>
<tr>
<td>Worst Pair</td>
<td>12-45</td>
<td></td>
</tr>
<tr>
<td>ACR-N (dB)</td>
<td>24.1</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>Worst Pair</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>RL (dB)</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>500.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>MAIN</td>
<td>SR</td>
</tr>
<tr>
<td>Worst Pair</td>
<td>36-45</td>
<td></td>
</tr>
<tr>
<td>ACR-N (dB)</td>
<td>42.9</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>-16.5</td>
<td></td>
</tr>
<tr>
<td>Worst Pair</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>RL (dB)</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Freq. (MHz)</td>
<td>500.0</td>
<td></td>
</tr>
<tr>
<td>Limit (dB)</td>
<td>8.0</td>
<td></td>
</tr>
</tbody>
</table>
Clocking
Review Best Master Clock Algorithm

Is there a flaw?
Clocking

Review Best Master Clock Algorithm
   Is there a Flaw

Ptp is a time protocol
   Not a timing protocol

Networking Considerations
Network Segregation and QoS

It is not required to keep network traffic segregated.
- When appropriate
- How can we segregate

If not segregated QoS is essential for performance.

Spanning Tree Protocol

“The Spanning Tree Protocol (STP) is a network protocol that builds a loop-free logical topology for Ethernet networks. The basic function of STP is to prevent bridge loops and the broadcast radiation that results from them. Spanning tree also allows a network design to include backup links to provide fault tolerance if an active link fails.”

• Turn it off! At least check it isn’t turned on.
• Unless
  — You know what you are doing and designed the network with a schema in mind.
  — You don’t have segregated traffic on your network (QoS?).
  — You are implementing a per VLAN spanning tree protocol (MTSP or similar)
Multicast

If you’re an operator make sure you know when to use multicast flows.
Think about the old-fashioned analogue parallel

IGMP Snooping
Means that only devices that want to listen to multicast traffic need to
Make sure you configure this to conserve bandwidth on your backplane,
particularly if you’re in a situation where you’re likely to use a lot of
multicast flows (splitting large live feeds to recorders and transmission /
live mix? 2110 Running Dante AES67 mode?)
You may need to disable on specific ports if you need wi-fi access for
control!

Thank you
Matt Ward, Jigsaw24
matt.ward@jigsaw24.com, +44 (0) 7824 691 687

Thank you to our Media Partners