

MediaMatrix®

A Division of Peavey Electronics Corporation



Dante Networking Guide

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Scope

This guide is designed to help you understand the considerations when using MediaMatrix products on Dante networks. It is important that it is read and understood by network designers and systems administrators.

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Chapter 1

Basics

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Introduction

A typical MediaMatrix installation will include two separate networks: the *control network* and the *audio network*.

The control network connects hardware devices, such as NIONs and nControls, with NWare, to allow control and monitoring using an NWare project.

The audio network allows digital audio data to flow between hardware devices using the Dante protocol.

The diagram below shows an example set up.



The control network and Dante network are both represented by a single *cloud*. You may choose to physically separate the wiring for the two networks, or logically separate the traffic using VLANs.

The NWare PC and NION are both connected to the control network. This allows the system administrator to configure the NION and use it in an NWare project. The CAB 4n does not have a direct connection to the control network, but it is still configured using NWare. Control data is passed to the CAB across the Dante network, via the NION. Dante Controller software running on the PC allows the user to manage the flow of audio data across the network.

Audio signals from the mics are packetized and made available on the Dante network. The CAB 4n is configured to receive the audio data, decode it, then pass it to the amplifier where it is amplified and sent to the speakers. Both the CAB 4n and NION are fitted with Dante DLMs.

Introducing Pandad

Pandad is a Windows service that allows MediaMatrix nodes, such as NIONs and nControls, to be discovered on the control network. It also allows communication between the units.

Pandad (*pandad.exe*) is started in the background on the control computer when NWare (*nware.exe*) is started. Pandad is also run as a process on nodes.

How Pandad works

Pandad creates and maintains a list of all MediaMatrix nodes on the network. Here are the steps in the process:

1. On the control computer, Pandad listens for multicast packets from other instances of Pandad on the network. It then sends its own multicast packet.
2. Pandad instances on each MediaMatrix node and the control PC respond with their device lists.
3. On the control computer, Pandad creates a list of all the devices on the network from the replies it receives.

As with all discovery processes, this broadcast bursts in the beginning and quickly tapers off. Small multicast packets are then sent every five seconds.

Notes:

- If there is more than one network interface available on the control computer (wired or wireless), when NWare is first started, a dialog box will open that asks which network interface to use for communications. The correct interface *must* be selected or no devices will be found on the network.
 - If your network is using multicast filtering, it may interfere with Pandad. We recommend that you disable this feature.
-

For more information, refer to the *Pandad Administrator Guide*.

Multicast traffic

MediaMatrix products communicate and discover one another by utilizing multicast health and discovery packets. The transmission of this multicast traffic is critical to the operation of the system and *must not* be impeded. No multicast traffic blocking is acceptable.

Even though the multicast traffic comprises a large number of packets, the total volume of data is small because each packet is very small. Expect to see a large number of multicast packets when monitoring network traffic while a MediaMatrix system is being used, but notice that the actual amount of data is minimal.

This multicast traffic is absolutely critical to the successful operation of the system so there must be no other traffic on the network with a higher priority or higher quality of service.

Network Ports for the control network

Different types of network activities on the control network require particular ports to be open. Make sure that the required ports are open for the types of activities you are expecting.

Network activity	Port number(s) required
Copying of audio files to and from MediaMatrix devices using FTP.	20 and 21
Web access using HTTP.	80
Controlling and monitoring devices using SNMP.	161
System health packet transmission. These packets are sent ten times a second by nControls, nTouch 180s and NIONs, and are received by all devices subscribed to the multicast address 239.0.0.10:1234.	1234
Note: These packets are very small and are not aggregated into a significant amount of network traffic.	
Controlling devices from an external program using RATC.	1632
Pandad communication across subnets. For more information, see Linking instances of Pandad across subnets.	4000
Discovery packet transmission. These packets are sent once every five seconds by nControls, nTouch 180s and NIONs, and are received by all devices subscribed to the multicast address 239.0.0.10:4321.	4321
Note: These packets are very small and are not aggregated into a significant amount of network traffic.	
Kiosk2Go websocket communications.	TCP port 7681
Kiosk2Go discovery application running on <i>iOS</i> (https://itunes.apple.com/gb/app/kiosk2go/id916717124?mt=8) and <i>Android</i> (https://play.google.com/store/apps/details?id=com.peavey.kiosk2go&hl=en_GB).	UDP port 7681

Opening a port in Windows Firewall

» For Windows 7 users

1. Click the **Start** button.
2. In the **Search** box, type firewall.
3. In the results list, click **Windows Firewall with Advanced Security**.
The **Windows Firewall with Advanced Security** dialog box is displayed.
4. If you're prompted for an administrator password or confirmation, type the password or provide confirmation.
5. In the left pane, click **Inbound Rules**, and then, in the right pane, click **New Rule**.
6. Follow the instructions in the **New Inbound Rule** wizard.

» For Windows Vista users

1. Click **Start**, and then click **Control Panel**.
2. Click **Security**, and then click **Windows Firewall**.
3. Click **Allow a program through Windows Firewall**.
4. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.
5. Click **Add port**.
6. In the **Name** box, type a name that will help you remember what the port is used for.
7. In the **Port number** box, type the port number.
8. Click **TCP** or **UDP**, depending on the protocol.
9. To change scope for the port, click **Change scope**, and then click the option that you want to use.

The term *Scope* refers to the set of computers that can use this port opening.

» For Windows XP users

1. Click **Start**, and then click **My Network Places**.
2. Under **Network Tasks**, click **View Network Connections**.
3. Right-click the connection that you use for the Internet, and then click **Properties**.
4. Click the **Advanced** tab, and then click **Settings**.

Note: If the *Settings* button is unavailable, the Internet connection firewall is not enabled on this connection, and you do not have to open any ports (because they are all already open).

5. Click **Add**.
6. In the **Description** box, type a friendly name.
For example, *File Sharing : Port 445*.
7. In the **Name or IP address of the computer hosting this service on your network** box, type 127.0.0.1.

Note: You can specify the IP address of an internal computer, but the address 127.0.0.1 is typically used.

8. In the **External port** and **Internal port** boxes, type the port number.

Generally, the same number is used in both cases.

9. Click either **TCP** or **UDP**, and then click **OK**.
10. Repeat steps 1 through 9 for each port that you want to open.

Chapter 2

Working with Dante

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Introduction

Dante technology is designed to deliver digital audio over a standard IP network. This eliminates the use of bulky cables to provide point to point wiring for AV installations.

With Dante, existing infrastructure can be used for high performance audio as well as for ordinary control, monitoring or business data traffic. Digital networks offer high bandwidth, which is capable of transporting hundreds of high quality audio channels over Fast Ethernet or Gigabit Ethernet.

Dante is relatively easy to configure and manage because Dante-enabled devices discover one another over the network and learn each other's capabilities (number of input and output channels, sample rates and bit depths supported etc.) Dante devices and channels can be given *friendly* names, meaning audio can be routed without having to use numeric references.

Dante connections using MediaMatrix devices are configured using NWare and Dante Controller. Audio routing and device monitoring in Dante Controller can be performed using a PC or Mac.

Notes:

- It is not recommended to split a Dante network up using VLANs.
 - We recommend that no more than four Dante CAB 4ns are used per NION in a design.
-

Connections

The PC running NWare and Dante Controller is connected to the Dante network.

Connections are generally made between Dante devices via a switch. However, Dante also allows for direct connections between equipment to be made.

In all cases, routes must be configured using *Dante Controller* (http://www.audinate.com/index.php?option=com_content&view=article&id=305&Itemid=167).

Notes:

- If only one Dante enabled device is available to connect to your PC, you can eliminate the switch and connect the two with a Cat5e or Cat6 Ethernet cable.
 - The secondary port found on some Dante devices is for Dante redundancy only.
-

Traffic and switches

Voice over IP (VoIP) Quality of Service (QoS) switch features are used in Dante networking. This prioritizes the clock sync and audio traffic over other network traffic.

Dante networking is appropriate to use on any switch that supports DiffServ (DSCP) QoS with strict priority and four queues, and has Gigabit ports for inter-switch connections.

While Gigabit switches are recommended, 100Mbps switches may be used in limited scenarios. For a network operating on applications with a low channel count (less than 32), a 100Mbps switch may be used, however, it must be supported by proper QoS. For applications with a higher channel count, Gigabit switches are recommended.

Dante can work alongside TCP/IP network traffic and other standard control protocols. Control and audio data can be mixed on the same network provided the QoS has been configured correctly.

Notes:

- QoS is available in many Ethernet switches.
 - The use of 100Mbps devices without QoS is not recommended.
 - QoS DiffServ is preferable but not a necessity.
-

Bandwidth allocation

Dante utilizes standard IP based networking over Ethernet, whilst making full use of bidirectional Ethernet switches.

Gigabit:

- 512 x 512 48kHz/24bit audio channels
- 1024 bi-directional channels.
- For 96kHz 24bit audio the channel capacity is halved.

100Mbps:

- 48 x 48 48kHz/24bit audio channels

- 96 bi-directional channels.
- For 96kHz/24bit audio the channel capacity is halved.

Latency

Audio latency on a Dante network is deterministic. A Dante receiver can be configured to use different levels of latency by using different size receive buffers. Larger receive buffers are useful to ensure uninterrupted audio delivery on larger networks, slower networks or networks subject to inconsistent forwarding delays. Use of gigabit switches, with lower inherent forwarding delays, will result in lower and easier to achieve latency.

The default latency setting is 1 ms, but it is best to select the latency depending on the size of the network.

The latency options are displayed in the table below.

Latency	Maximum Network size
0.15	Gigabit network with one switch
0.5	Gigabit network with five switches
1.0	Gigabit network with ten switches or gigabit network with 100Mbps leaf mode
5.0	Safe value

Latency does not have to be the same for all connections on the network, as different devices can be assigned different latency values.

While running higher latency connections, Dante allows you to configure low latency connections for critical audio paths, so that the user can use a broadcast or recording feed where latency is less critical.

Notes:

- Latency settings are configured using Dante Controller.
 - Values selected should be based upon the size of the network.
 - Adding new devices to a network does not affect the latency of the other devices already on the same network.
-

Wiring

Digital audio distribution eliminates masses of bulky, heavy, expensive, and inflexible copper wires. Installation is made simple using digital networking; a single lightweight, inexpensive Cat5e or Cat6 cable can carry all the required inputs and outputs as digital audio data.

Notes:

- Make sure all cables are properly terminated.
 - Do not use *kinked* cables. If a cable is kinked during installation, do not straighten it out; use a new cable. The sensitive internal wiring twist which influences noise rejection and maximum data rate has been damaged.
 - Do not run cables parallel to AC mains lines.
 - Do not run cables close to noise sources, such as motors, fans, compressors, dimmer circuits, A/C lines etc..
 - If running longer links or in noisy environments, use optical fiber.
 - Use Cat 6 for copper gigabit links when copper must be used. Use fiber instead of copper on gigabit links whenever possible. The way in which data is modulated on gigabit copper makes it more sensitive to outside interference. Therefore, when copper gigabit links must be used, pay particular attention to cable routing and ensure that the cables are not in proximity to any potential noise or interference sources. A data integrity problem on a gigabit link may go unnoticed on a data network but will cause audio dropouts on a Dante network.
 - If possible, perform bit error rate tests on each link and correct problems before commissioning.
 - Check switch statistics for indications of errors and dropped or malformed frames. Find the root cause and correct it before commissioning.
 - Do not exceed the maximum recommended run length of the media in use, i.e. no more than 100 meters for copper Ethernet cables. Fiber run lengths can vary depending on cable and switch manufacturer. Typically lengths of no more than 2 km are recommended for 100 megabit multimode fiber, 600 meters for gigabit and 300 meters for 10 gigabit. Single mode fiber supports much longer runs but is also more expensive and seldom used in LAN applications. Consult the documentation for the particular equipment and wiring used in order to ensure maximum lengths are not exceeded.
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Chapter 3

Using XDAB clusters with VLANs and Dante

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Introduction

Use of NIONs in an XDAB cluster, particularly when also using Dante and VLANs, creates specific considerations and rules that must be observed in order to ensure proper operation of the system. This chapter is intended to provide awareness of the technical issues that must be considered when using XDAB clusters and VLANs with Dante. A basic knowledge of Dante, NIONs and VLANs is assumed.

Note: XDAB is available on NION n3 and N6 models, but not nX or nE models.

Important concepts

XDAB cluster

NIONs connected together via XDAB are referred to as an XDAB cluster.

There is one XDAB master that provides the audio clock to all other devices in the cluster. The other devices in the cluster are XDAB slaves.

Audio clock domain

All Dante devices on the same network or VLAN segment must operate within the same audio clock domain. A system wide isochronous audio clock is automatically generated. A NION or CAB will always receive its audio clock from Dante.

However, if NIONs are operating within an XDAB cluster, the behavior is different:

- In the XDAB master, the Dante clock can be taken from the Dante network as a Dante slave or the XDAB clock can be supplied as the Dante master. Normal Dante clocking concepts apply.
- In XDAB slaves, the Dante clock will always be taken from XDAB and will not be taken from the Dante network audio clock directly. The clock will be taken indirectly from Dante via the clock generated by the XDAB master.

Logical separation of the network

Use of VLANs creates a logical separation of the network that causes the VLAN segments to behave as if they are physically separate networks. Use of the term VLAN also applies to physically separate networks.

Each VLAN segment must therefore have its own Dante master.

Multiple VLANs

Audio can be exchanged between different VLANs through the use of devices that have a network interface on each VLAN. This can be accomplished by:

- exchanging analog audio between devices. Devices connected using analog I/O do not need to be concerned with audio clocking issues between them.

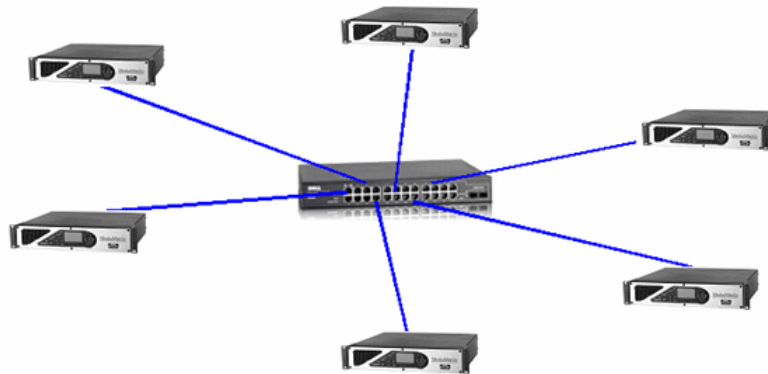
or

- exchanging digital audio between devices. In this case, the audio clocks of the devices must be synchronous *or* the use of sample rate converters on the digital audio inputs is required.

Tip: The XDAB digital audio bus is the most convenient way to exchange digital audio between NIONs.

Use Cases

Scenario 1 - Basic network

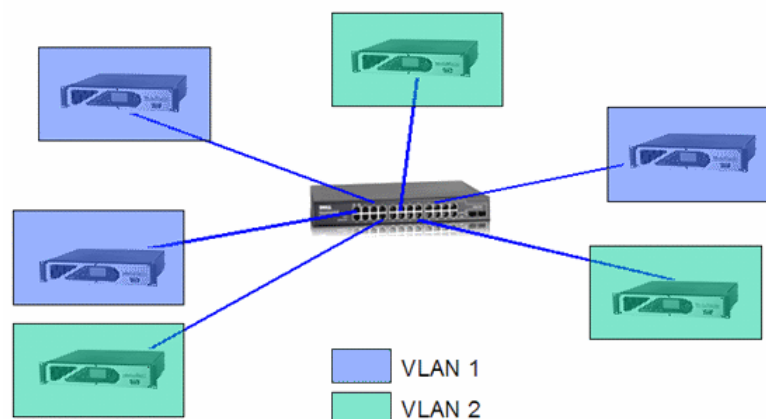


In this scenario, there are:

- no XDAB interconnections between NIONs.
- no VLANs defined.
- no outboard audio connections, either analog or digital, between NIONs.

There is only one audio clock domain in this scenario established by Dante and no special Dante master, topology or XDAB usage considerations apply.

Scenario 2 - Network using VLAN

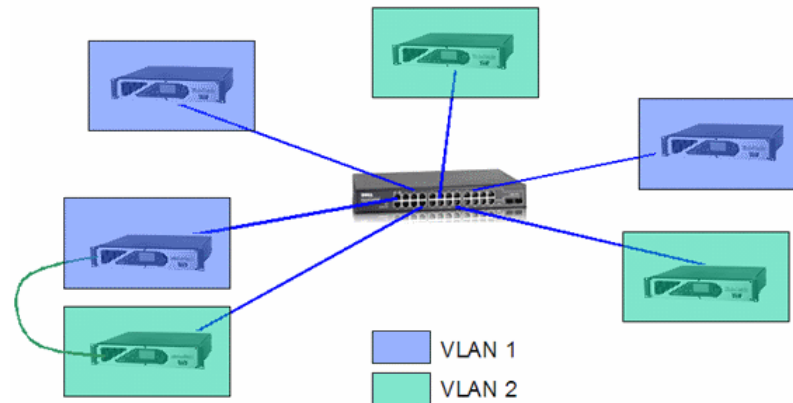


In this scenario, port based VLANs have been configured within a managed switch:

- There will be no audio passed, either externally or via Dante, between devices residing on different VLANs.
- Audio is only exchanged via Dante between NIONs that reside on the same VLAN.
- One device on each VLAN must be a master for that VLAN, i.e. each VLAN has its own master.

- It is not important, logically, which devices are chosen to be masters. Consideration of master location will only be determined when necessary, by standard network topology considerations that would apply to any Dante network.

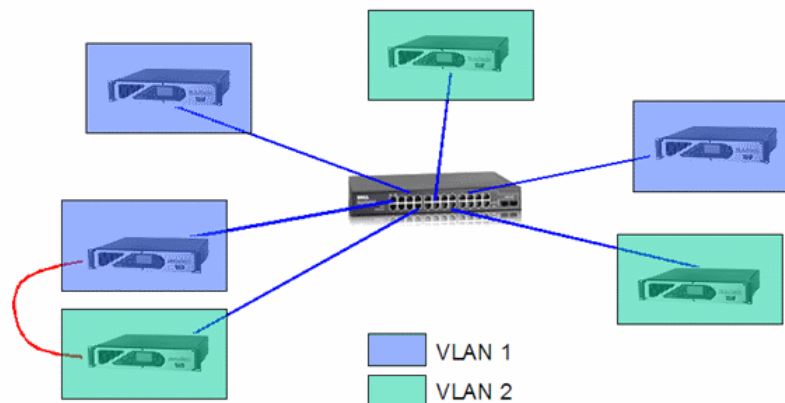
Scenario 3 - Network with VLAN and analog interconnects



In this scenario, VLANs are configured using the port based VLAN capability of a managed switch.

- Audio is bridged between the two VLANs using analog interconnects.
- The same rules for Dante masters would apply as in the previous scenario.
- The analog interconnect creates no digital audio clock domain issues.

Scenario 4 - Network with VLAN and digital interconnects



This scenario is similar to the previous scenario, but substitutes digital interconnects, such as AES/EBU or SPDIF, for analog interconnects.

- NION digital interface cards contain built-in sample rate converters (SRCs), which isolate audio clock domains from each other and allow interchange of digital audio data regardless of which clock domain the transmitting and sending devices are in.
- VLAN 1 and VLAN 2 each have their own Dante masters, so are in different audio clock domains.
- The SRC built into the digital interface card will allow exchange of digital audio between the NIONs in the two clock domains.
- Bypassing the SRC, which is possible, will cause errors on the AES/EBU interface.

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