

# NION *ote*: Using Audinate Dante With MediaMatrix

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# NION<sup>ote</sup>: Using Audinate Dante With MediaMatrix

One of the many strengths of a MediaMatrix audio processing and control system is its ability to use real time audio networking to distribute audio to and from anywhere within an installation. This ability to route audio anywhere allows tremendous flexibility in the placement of equipment, supporting fully distributed, fully centralized or a mix of centralized and distributed equipment placed at any location accessible by a network. Until now, all MediaMatrix systems have used CobraNet audio networking technology to provide audio distribution. MediaMatrix now offers the option of using a newer audio network technology licensed from Audinate, Pty. This technology, or protocol, is named Dante, and offers some important features and advancements over traditional CobraNet.

## 1 Outline of this document

- Assumptions, or prerequisites, about the knowledge and capabilities of the reader will be stated.
- A short description of audio networking and Dante will be given.
- The reader will be shown a Quick Start lesson on how to use Dante Controller software to create an audio network connection using default settings.
- A relatively in depth overview of the different dialogs and tabs in Dante Controller will be given to show how the software is used and, in so doing, also provide a comprehensive overview of the capabilities and functionality of the protocol itself.
- Network configuration caveats and considerations will be discussed as they apply to Dante networks as used under different conditions and to meet different objectives.
- Differences and similarities between Dante and CobraNet will be noted where appropriate.

### 1.1 Assumptions

It is assumed that the reader is familiar with the following basic concepts:

- A basic understanding of local area network technology, including an understanding of the functionality of Ethernet and IP networks.
- The differences and relationship of Layer 2 vs. Layer 3 networking. Briefly:
  - Layer 2 is the physical layer. All data on an Ethernet Layer 2 network travels in frames (often inaccurately called packets) from point to point, from physical MAC address to physical MAC address. CobraNet is a Layer 2 protocol.
  - Layer 3 and above uses a logical addressing scheme known as IP addressing. Data (including Dante digital audio) is sent from logical IP address to logical IP address and these Layer 3 IP data 'packets' are encapsulated in the Layer 2 Ethernet 'frames' on a Local Area Network.

- Layer 3 depends on the basic transport capability of Layer 2 at the lowest local level but also provides additional addressing flexibility, routing, filtering, traffic shaping and discovery functions not available with layer 2 protocols.
- An ability to configure the network interface of the user's computer is assumed. Dante can use static IP addresses but is most efficient when the address is automatically assigned using DHCP or auto-ip, also known as 'link local'.
- An ability to use a web browser to download and install software will be assumed.

## 1.2 Audio Networking Background

Layer 3 network infrastructure was not able to provide the performance necessary to support real time, low latency, audio network delivery at the time the CobraNet audio networking protocol was first developed. Therefore, Layer 2 Ethernet technology was used, by necessity, to provide the necessary functionality of CobraNet. Modern networking infrastructure and protocols have evolved rapidly since that time allowing the development of Dante, a Layer 3 based audio networking technology that provides features, ease of use and more 'IT friendly' traffic not possible using Layer 2 technology. Dante represents a meaningful evolutionary step in the development of real time audio networking and it does this with modern, off the shelf, network equipment. Having said that, both CobraNet and Dante networks will provide reliable, high quality networked audio connectivity when properly configured.

## 1.3 More About Dante

Dante is an audio networking technology that enables the transport of full fidelity, uncompressed digital audio between devices in real time and with low latency, typically one millisecond or less. The connection of an audio channel from one device to another is known as a *route* that is implemented by *subscribing* to a transmitted audio channel. The travel of one or more such channels together from one device to another is referred to as a *flow*. Channels can also be sent to more than one device at a time by sending individual copies of the same channel to different destinations or by sending channels as *multicast* data to ALL devices on a network at the same time. However, unlike Layer 2 CobraNet, Layer 3 Dante multicast audio data can take advantage of IGMP, when available, to multicast only to subscribed devices and not to all devices, thus allowing for much more efficient use of network bandwidth. This concept will be discussed in more detail later.

A receiving device *subscribes* to an audio channel that is available from a sending device. Once configured, the receiver requests that the transmitter send a particular channel or channels to it. When more than one channel is set to go between two devices, then the software will automatically aggregate those channels into a multiple

channel *flow*. Subscriptions are created in a graphical manner using Dante Controller software available from Audinate.

A *flow* can be seen as analogous to a CobraNet *bundle* with one important difference. In CobraNet, one or more audio channels must be explicitly placed in a bundle and the bundle is then addressed to go to a particular destination. The addressable unit is the bundle. In Dante, the addressable unit is the audio channel that may or may not be automatically placed into a multi-channel flow to make better use of network bandwidth. The single channel Dante addressing scheme, with automated aggregation into flows, provides additional addressing flexibility and ease of use not available with the bundle only addressing scheme of CobraNet.

## 1.4 Bandwidth

Dante interfaces are designed to operate on Gigabit Ethernet networks, offering a very meaningful advantage in latency and topology flexibility compared to CobraNet.

## 1.5 Recap of terms

**Channel** – a single channel of audio that can be sent to one or more destinations.

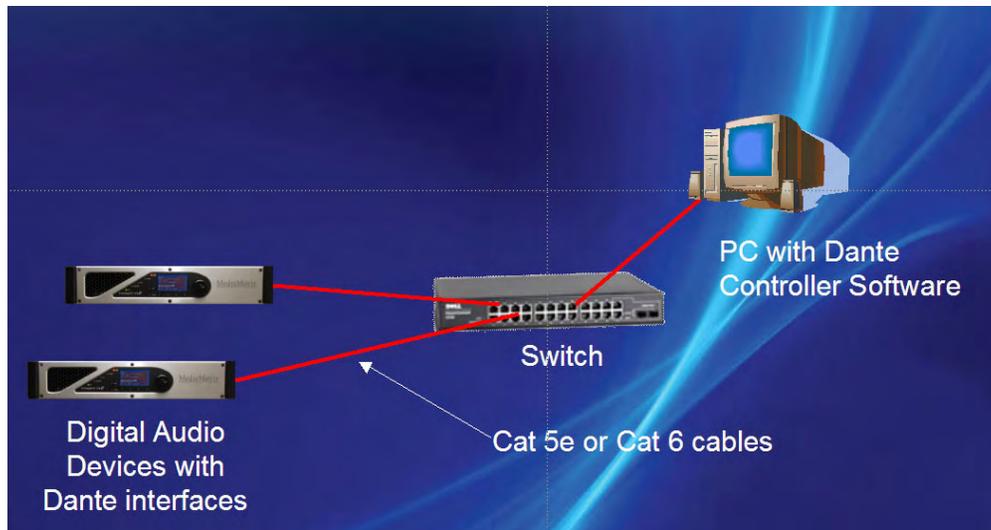
**Route** – The connection or path of one channel on a transmitting device to another channel on a receiving device.

**Subscription** – A route is completed by creating a subscription. The subscription is created by the protocol when the route is selected. The receiving will subscribe to, or request, that a transmitting device send it an audio channel.

**Flow** – One or more audio channels moving between devices on the network are known as a flow. If two or more channels are set to travel between the same devices they will automatically be aggregated into the same flow. The Dante protocol aggregates channels into flows automatically. The user need only be concerned with addressing individual channels. The number of channels placed in a flow will depend on the desired latency. Typically no more than four channels are placed in a flow but more are possible at higher latencies.

## 2 Dante Controller Software Example

Let's get started by demonstrating how easy it is to route audio channels on a network using Dante Controller. Once that is done we will look at the different options and considerations that apply to Dante. To do this we will need a PC running Dante Controller software, two or more devices with Dante Interfaces and a switch and network cabling to connect the equipment together in a network as shown below.



2.1.1.1 Fig. 1 - Minimal Dante Network

Dante Controller is the tool used to route audio on a network. Dante Controller represents all discovered Dante devices in the network as a grid. Each device in the grid can be expanded to show the transmit and receive channels available in that device. The two devices used in the screen shots to follow are Dante DLM modules named Unit 1 and Unit 2. The name of a Dante device within a MediaMatrix system will be automatically assigned from the device in which it is installed. The name will be derived from the name given to the NION in which a Dante module is installed or from the ID number of the CAB 4n in which a module may be installed.

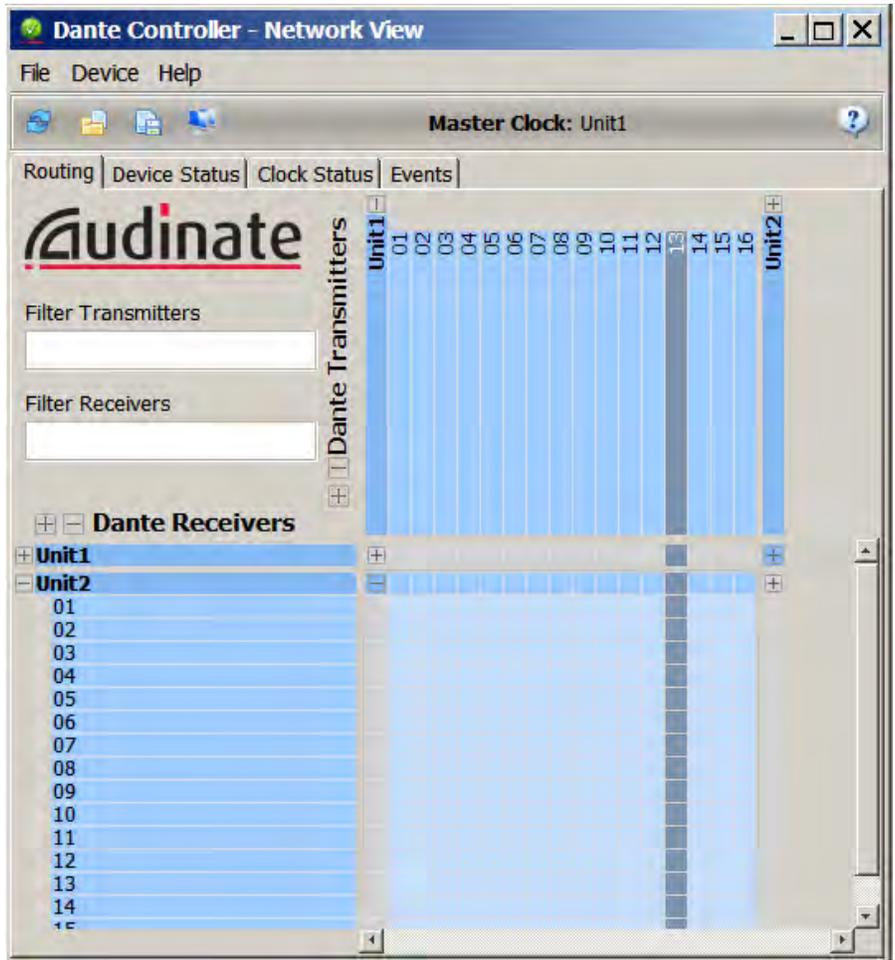
First we must configure the PC that will be used to run Dante Controller. The PC can be a MAC or Windows device. Download and install the appropriate version of Dante Controller from this link: [Dante Controller](#). Registration with Audinate will be required. Dante controller relies on the MDNS protocol to discover and identify Dante devices on the local area network. This protocol, also known as Bonjour or Apple Print Services, is available for download to Windows devices at [Apple Bonjour for Windows](#). Bonjour is also automatically installed with iTunes. Bonjour will already be installed if running iTunes or an Apple PC so, typically, Bonjour only needs to be installed on Windows PCs that do not have iTunes installed.

After ensuring that Dante Controller and Bonjour are installed, connect at least two MediaMatrix Dante devices and your PC to a Gigabit Ethernet switch. Dante can be run at increased latency and lower channel counts on small 100BT networks if necessary. However, this is not recommended and is not supported by Audinate or Peavey. Gigabit switches should always be used. Additional desirable switch features will be discussed later.

Once the equipment is set up then each device, including the PC, must have its IP address set so that all devices can communicate with each other on the same subnet. This is very easy to do. Simply leave the Dante modules at their default settings and

make sure your PC is set to use DHCP or to assign an address automatically. If there is a DHCP server on your network then all devices will receive a compatible address. If not then they will revert to using 'link local' addresses, or auto-IP and will also be set correctly. Please note that the link local negotiation process will take a small amount of time to complete on a windows system. The Dante modules and a Mac PC will resolve their addresses much more quickly.

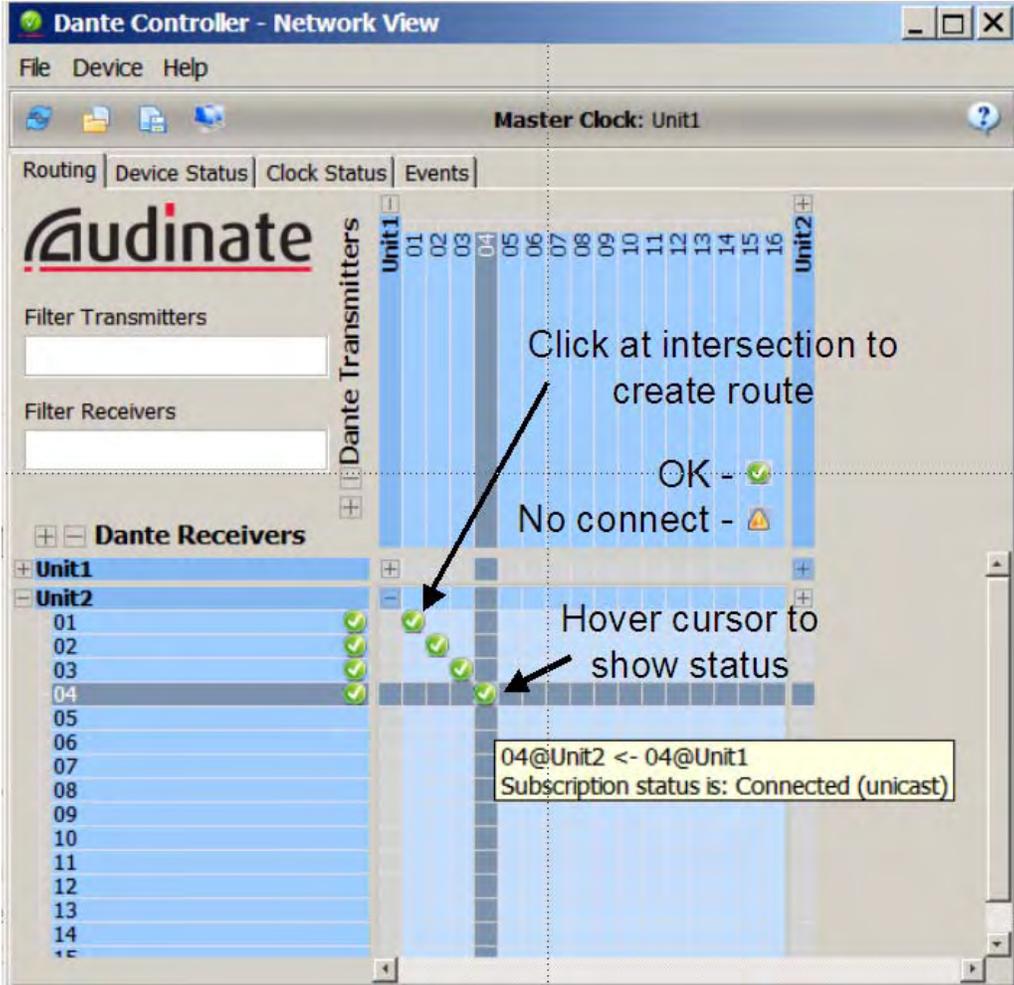
Once all devices are running with compatible IP addresses, run Dante Controller and you will see a display similar to figure 2 below.



2.1.1.2 Fig. 2 - Basic Grid of Dante Controller

Above we see the main routing screen of Dante Controller. On the top (X) axis above, we see two discovered devices. Each device can be expanded to show all of the *transmit channels* available for that device. On the left (Y) axis are the same discovered devices showing their *receive channels*. There is selectable +/- box next to each device name that can be used to toggle the channel view of each device. In the figure above we see the transmit channels expanded for **Unit 1** and the receive channels expanded for **Unit 2**. To establish an audio route, expand the transmit channels of the transmitting device

and the receive channels of the receiving device as shown above. Then simply click the mouse at the intersection of a transmitting and receiving audio channel. Once the intersection is clicked, the receiving device will create a subscription and send a request to the transmitting device to begin transmitting the selected channel.



2.1.1.3 Fig. 3 - Grid of Dante Controller Showing Active Subscriptions

We can note a number of things in fig 4. Placing the cursor over an intersection will cause the path between the transmitter and receiver to be highlighted so we can easily identify the devices and channels that correspond to that route. Hovering over an intersection with a route selected will produce a textbox showing the source, and destination channel and connections status of the route. We can clearly see above that channel 4 of Unit 1 will be sent to channel 4 of Unit 2 by either following the highlighted paths from the intersection or by viewing the textbox displayed when hovering over the intersection. **04@Unit2 <- 04@Unit1** tells us that channel 4 of Unit 1 will be sent to channel 4 of Unit 2, or, expressed another way, Channel 4 of Unit 2 is subscribing to Channel 4 of Unit 1. And we also see in the text box that the subscription is connected and is a unicast, or point to point, connection.

The receiver is being commanded to establish a route by subscribing to a channel when clicking at the intersection of a transmitter and receiver. It is that easy. Just click at the intersection of a transmit and receive channel and verify that the green check mark appears. And simply click again at an established route intersection to remove that route.

Once all routes are established they will be remembered by the system in a distributed manner. Each receiving device will store its own subscriptions locally in NV RAM. If a device shuts down or loses power it will use the stored subscriptions to re-establish the audio routes when powered on again. The subscription data is stored automatically when established the first time.

## 2.2 Saving Routing Information

Once the routes for all devices are established and verified, they can be saved for recall on the PC. Click on **File | Save Preset** in Dante Controller to save the current routing configuration to a file. That file or any other previously saved file can then be loaded using **File | Load Preset** to re-establish a pre-configured routing configuration.

## 3 A Closer Look - Tabs

Now that we have seen how to configure audio routes at a basic level and how to save and recall routing configurations, let's look at more features and options available using Dante Controller.

In figure 4 above we see the routing tab of Dante Controller displayed. There are three other tabs available, four in total: **Routing**, **Device Status**, **Clock Stats** and **Events**. We will now describe the contents and use of these additional tabs.

### 3.1 Routing Tab

An additional feature of the routing tab is the **Filter** text boxes. When a name is typed into a text box then only those devices with names that match or partially match what is typed will be displayed.

## 3.2 Device Status Tab

This will display a list of all devices discovered on the network with current status shown in is seven columns.

Device Name	Product Type	Product Version	Primary Address	Primary Link Speed	Secondary Address	Secondary Link Speed
unit1-dlm	DLM	3.4.2	192.168.0.188	1Gbps		Link down
unit2-dlm	DLM	3.4.2	192.168.0.153	100Mbps		Link down

3.2.1.1 Fig. 4 - Device Status

### 3.2.2 Device Name

This is the name of the Dante Interface. As stated earlier the name will always be derived from the name or Id number of the device in which it is installed. We will see later that it is possible to change the name of a device but this change will not be persistent and will revert to the automatically generated name on the next power cycle.

### 3.2.3 Product Type

Audinate supplies different interface models to their customers. The interface module currently supplied for use in MediaMatrix products is the **DLM**.

### 3.2.4 Product Version

This is the software revision of the Dante Module. All modules should run the same and the latest revision of software. Software revisions are made available from time to time from MediaMatrix technical support and can be updated using a web interface.

### 3.2.5 Primary Address

Each Dante module features two Ethernet network interface connections that supports use of a redundant, fault tolerant network topology when needed. The primary address is the current IP address of the Primary Ethernet connection. The primary connector will be seen on the left of the module when viewing it from the rear panel of a NION or CAB4n.

### 3.2.6 Primary Link Speed

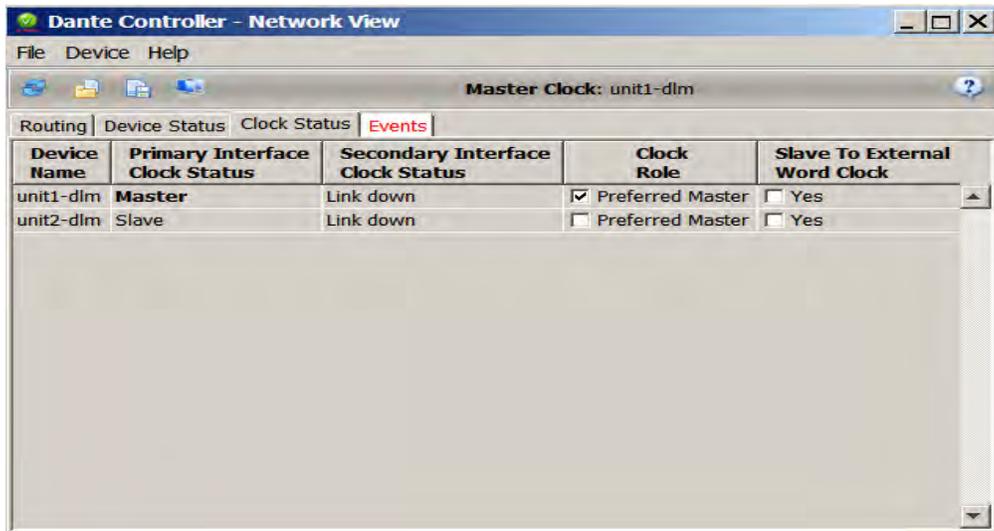
This column will display if the Primary connection is active and, if so, at what speed it is connected to the network. The device will auto-negotiate 10, 100 or 1000 MB connections as provided. 10 MB connections should NEVER be used. 100 Mbit connections can work if necessary, but are not recommended and are not supported. All connections in a production environment should show 1GBs in this column.

### 3.2.7 Secondary Address and Secondary Link Speed

These columns show the address and link speed of the secondary Ethernet connection, similar to the primary status columns. The secondary connector will be seen towards the center of the Dante module when viewing it from the rear panel of a NION or CAB4n.

## 3.3 Clock Status Tab

All devices in a Dante Audio network must remain synchronized to the same audio clock. The audio clock is distributed over the network using the Precision Time Protocol, also known as IEEE 1588. One device on the network will be the Master clock device to which all other devices will be slaved. This tab shows the clock status on a per device basis.



3.3.1.1 Fig. 5 – Clock Status

### 3.3.2 Device Name

This column shows the name of the Dante Interface just as shown in the device Status tab.

### 3.3.3 Primary and Secondary Interface Clock Status

These columns will show if the Primary and or Secondary interfaces are active and, if so if they are providing a master clock or receiving a slave clock on the interface. Only one device in the list should show that it is a Master clock.

### 3.3.4 Clock Role

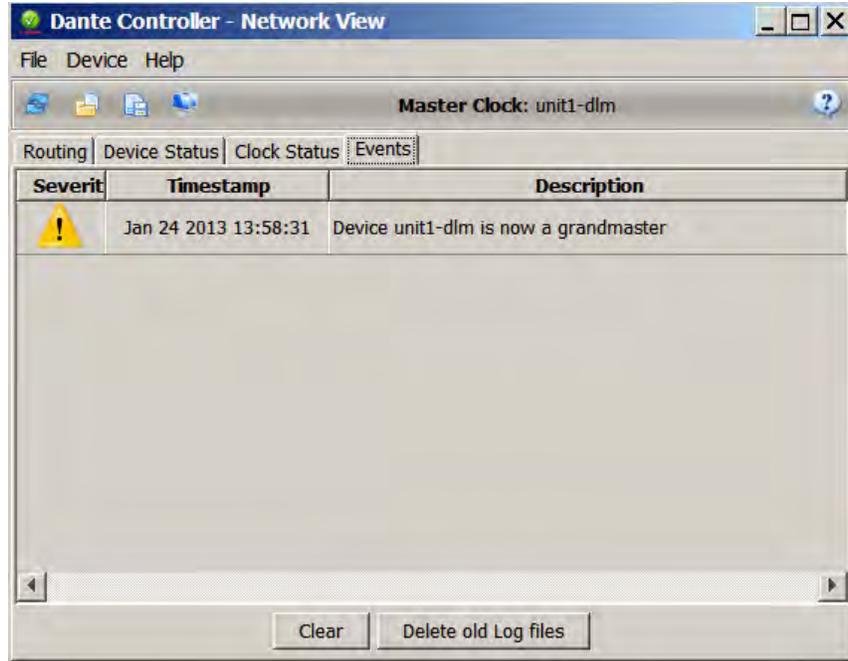
The Master Clock node in the network will be automatically selected by the protocol to insure that the device with the best characteristics becomes the clock master. However, there may be a time when a particular device should be forced to become the clock master, for instance when syncing to an external clock source. The Preferred Master check box can be selected to force a particular device to become the clock master. Multiple devices can be so selected and the protocol will choose among the Preferred devices to become the clock master.

### 3.3.5 Slave To External Word Clock

This checkbox has no meaning in a MediaMatrix System. A DLM module cannot slave to an external clock.

## 3.4 Events Tab

Each device keeps a log of notable events that can be reviewed when commissioning or troubleshooting an installation in order to verify operation or identify and correct problems. Those logs can be viewed on the Events Tab.

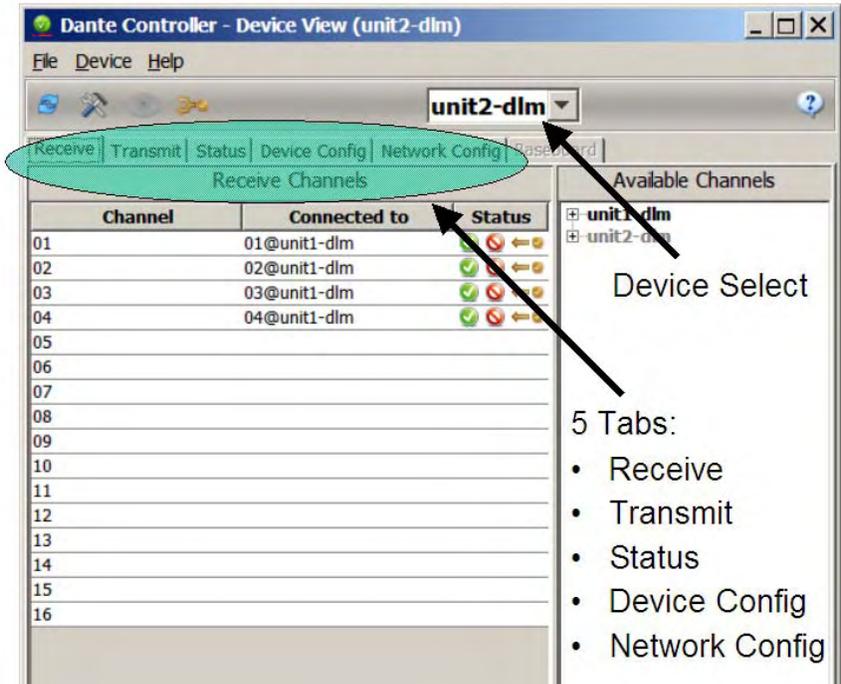


3.4.1.1 Fig. 6 – Events Tab

## 3.5 Device View

In addition to the tabs seen in the main dialog, additional configuration tabs can be seen by clicking on *Device / Device View* on the main toolbar. This dialog has five tabs and a device

select droplist as shown below. Each of the tables shows status and configuration for the device select in the drop list.



3.5.1.1 Fig. 7 – Device View – Receive Tab

### 3.5.2 Device View - Receive Tab

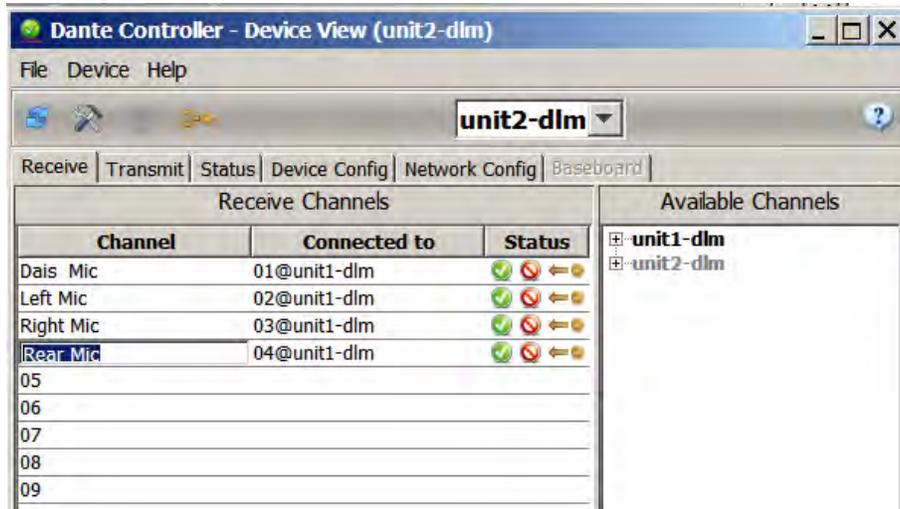
The Receive Tab shows the audio channel receive status of the selected device. We see in Fig 7 that unit2-dlm is selected in the Device Select drop list. We also see the channel number in the channel column; we see that Channels 1, 2, 3, and 4 of this unit are being received from unit-1dlm and we symbolic status indicators in the status column. These indicators are straightforward to interpret.

- ✓ Subscription is OK and audio should be flowing
- ✗ No subscription, or a subscription error
- ← Subscription is via unicast connection
- ↔ Subscription is via multicast connection

We can also see above in Fig. 7 that we have a have a good Unicast connection for each channel but also see something that appears confusing. We see the good subscription and no subscription symbols shown for each active audio channel. This is because the DLM has redundant Ethernet connections and one is currently active and working properly while secondary connection is not in use. The two symbols are showing the status for the 2 possible connections.

### 3.5.3 Device View - Channel Naming – Transmit and Receive Tabs

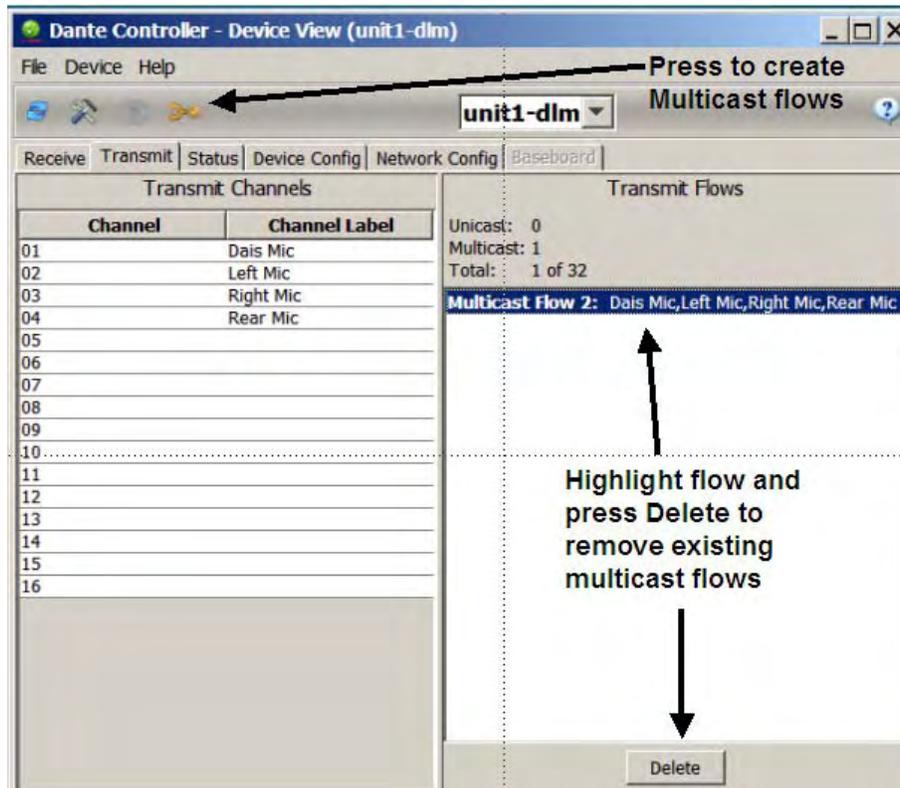
We have been viewing each channel by channel number until now. One of the useful features of the Dante and Dante Controller is that individual channels can be given user-friendly names. These names can be assigned to both the transmit and receive channels of a device in the Receive and Transmit Tabs of the Device View Dialog. Simply click on the channel number or name to open the edit box for that channel as shown below in Fig 8 where Channels 01 through 04 have been given user friendly names and the edit box of channel 04 is shown open. These names will be stored in the Non Volatile RAM of the device.



3.5.3.1 Fig. 8 – Channel Naming – Done the same in Receive or Transmit Tab

### 3.5.4 Device View - Transmit Tab

The Transmit Tab is similar to the Receive Tab in that it allows the assignment of user-friendly names to the Transmit channels of a device. But it does not show channel status. Channel status is shown in the Receive Tab. It does, however, show flow status. In our case we have Unit 2 set to send 4 channels to Unit 1. These four channels can be aggregated into one flow. And we see in the right hand pane of the Transmit tab below for unit2-dlm that this is exactly what has happened. The transmit status shows one active Unicast flow out of 32 total available flows.



3.5.4.1 Fig. 9 – Device View – Transmit Tab

The transmit tab is also used to create multicast flows. Multicast flows are managed at the transmitting device using the device's transmit Tab. Press the Multicast Icon, as shown above, to launch the multicast flow dialog and then select which channels, up to eight, will be placed within the flow. The flow will then be displayed in a list of flows on the right hand side of the Transmit Dialog Tab. A flow can be selected, and deleted from this list.

#### 3.5.4.2 Important notes on Multicast Audio Flows

- Because the multiple routes a multicast flow may take through the network cannot be known ahead of time, **the latency of these flows defaults to the highest setting of 5ms.**
- A receiving device will subscribe to a multicast channel in the same way as it subscribes to any other audio channel. But the protocol will ensure that the receiving device will always prefer to receive a channel contained in a multicast flow before it will request transmission of a Unicast channel. Therefore nothing unique must be done to receive a multicast flow
- Multicast network data is normally known to be sent to **all** devices in a network at all times. This is certainly true of a Layer 2 network and also true of a Layer 3 Dante network when IGMP (Internet Group Management Protocol) is not used, which is often the case in a local area network.
- However, if the network switches or routers being used support IGMP and it is enabled, then Dante will utilize this protocol to limit the transmission of multicast flows to **ONLY** those devices that want to receive them. This is done automatically and transparently if IGMP is supported by the network infrastructure. This represents a significant improvement in network bandwidth management over traditional Layer 2 Multicast transmissions.

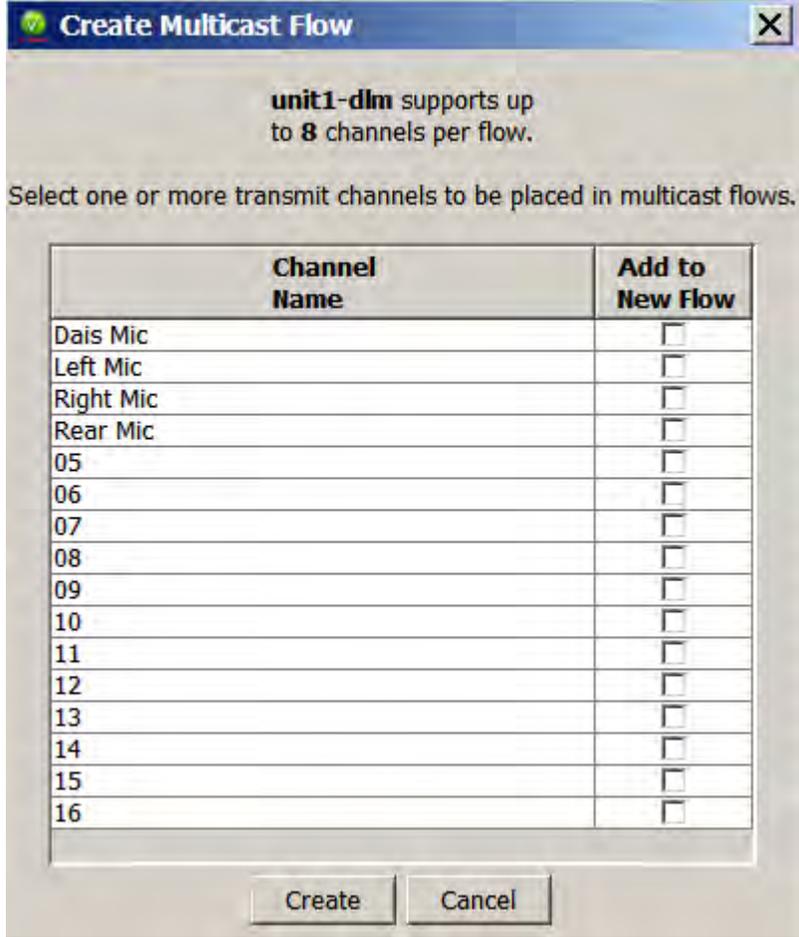
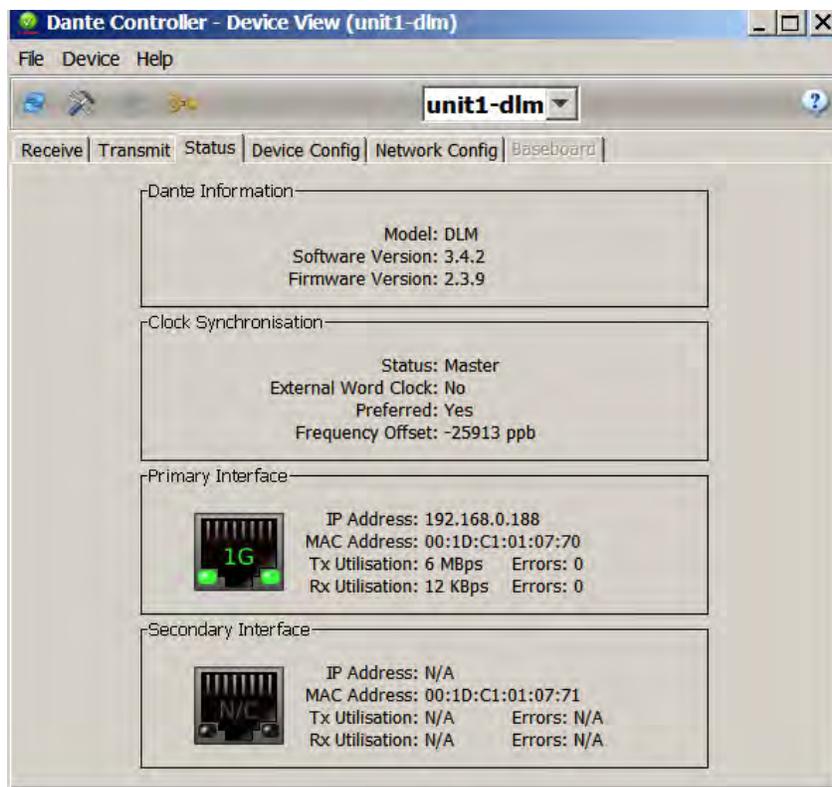


Fig. 10 – Device View – Transmit Tab – Multicast Dialog

Shown to create multicast flows after the Multicast Icon is pressed in the Transmit Tab of the Device View dialog.

### Device View - Status Tab

The Status Tab shows status information for the device, some of which is available elsewhere, and arranged in four groups. **Dante Information**, **Clock Synchronization** and **Primary** and **Secondary Ethernet** interface status.



3.5.4.3 Fig. 11 – Device View – Status Tab

#### 3.5.4.4 Dante Information

The first group of data is Dante Information. It simply shows the device type and software and firmware revisions.

#### 3.5.4.5 Clock Synchronization

The next group of data shows clock information also available and described on the clock Status Tab of the Main Dialog. There is one extra arcane data point named Frequency Offset that indicates the offset in parts per billion of this device's clock from the Network Master.

#### 3.5.4.6 Primary/Secondary Interface

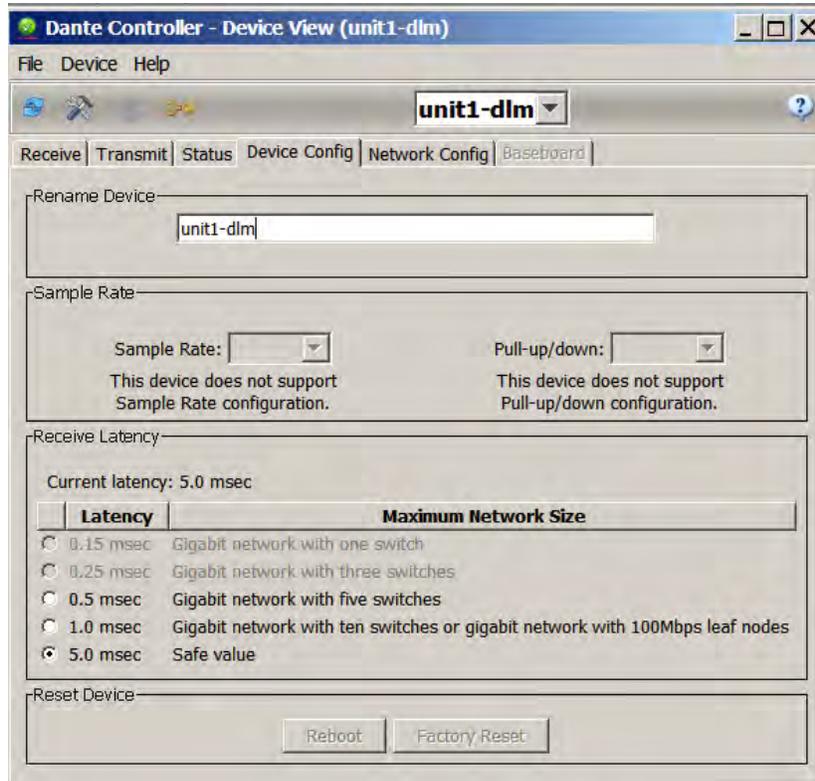
The final two data groups show IP address, MAC address, connection status and speed and average data rates per interface. The Errors count should be low or zero, as shown, for the active interface, and should not be increasing noticeably in a properly functioning network.

### 3.5.5 Device View - Device Configuration Tab

There is little to change in this dialog other than the audio latency. The device name can be changed. But the name will be automatically changed back after reset or reboot to reflect the Name of the NION in which it is installed or the ID number of the CAB in which it is installed.

The only other fields that apply and can be changed are the receive latency values. All Dante interfaces will attempt to transmit their audio with the lowest latency possible. But interface and network characteristics, particularly the speed of the network, number of switch hops and network forwarding delay variability may require longer latencies. The network conditions (speed and switch hops) that dictate particular latency settings are shown adjacent to each setting. In general, a latency setting of 1 mS should work well in an all Gigabit network. If an interface is running with a 100BT connection then use of 5mS latency is probably in order. Conversely, when running a point-to-point connection in a live audio digital snake type of application, it would useful and reasonable to set the latency to a sub millisecond value. If the receive error count shown in the status tab is seen to be increasing or if occasional or chronic audio dropouts are heard, then increase the latency setting to introduce more forwarding delay margin.

Many people can be very dogmatic about network audio delay. Keep in mind that 5mS of delay is equal to less than 1.5 meters of audio fly time delay through the air. This level of delay is completely inconsequential in all but the most demanding live applications. Do not hesitate to use longer delays when necessary to insure robust network performance

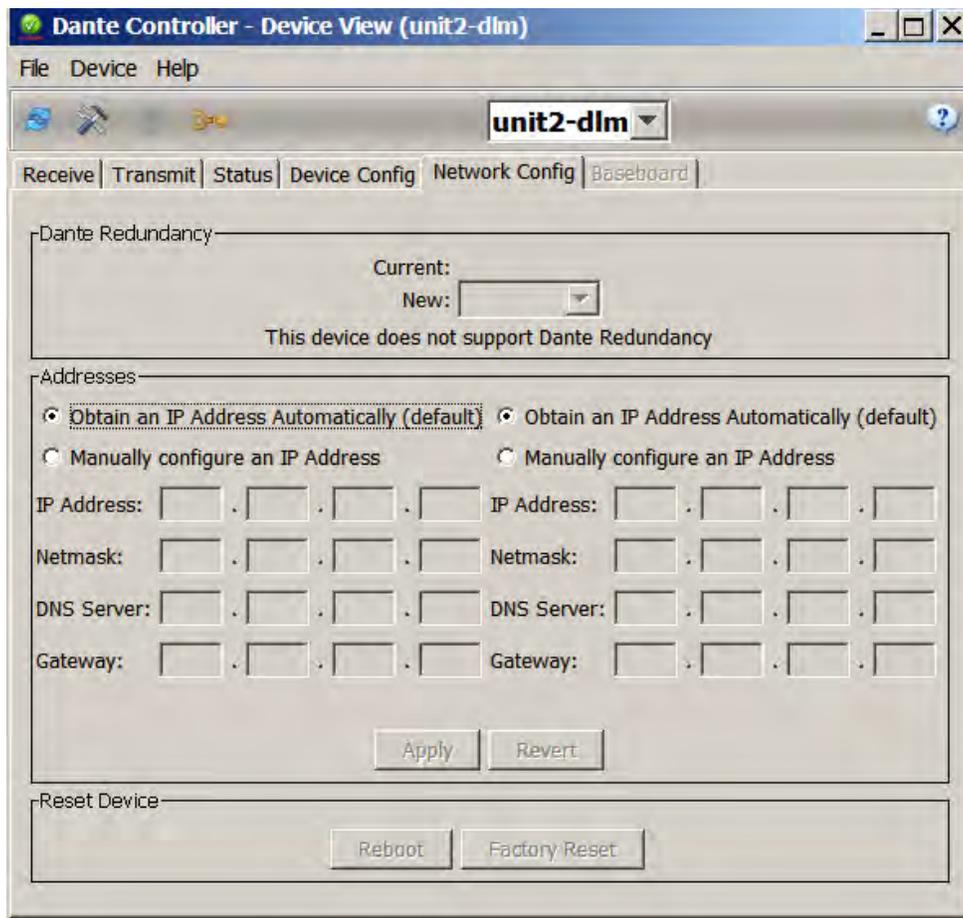


3.5.5.1 Fig. 12 – Device View – Device Configuration

### 3.5.6 Device View - Network Configuration Tab

The Network configuration Tab is very straightforward. Neither redundancy nor reset and reboot functions are supported on DLM devices. This dialog simply provides the means to either automatically assign network parameters: IP Address, Subnet mask, Gateway and DNS server values or to set these values statically. Because Dante relies on Bonjour (MDNS) for device discovery and because Bonjour is not routable, Dante installations will typically exist within a single subnet and, as such, will only require an IP address and subnet mask to be set. A Gateway address, and even less likely, a DNS server address, will only be required when network traffic is to span more than one subnet. Consult with your IT staff on this issue if not sure of your requirements.

Because all devices are discovered by Bonjour and accessed in Dante Controller by name, the assignment of static IP addresses to insure access, as is often done with CobraNet, is usually not necessary. Leave the interfaces set to obtain an address automatically and they will then receive their network settings from a DHCP server on the network, which must be properly configured by your IP staff, or will generate and validate a link local address. Regardless of which scheme is used, static, DHCP or Link Local, be sure that all devices on the network, including Dante Controller PCs, obtain their addresses the same way and are addressed within the same subnet.

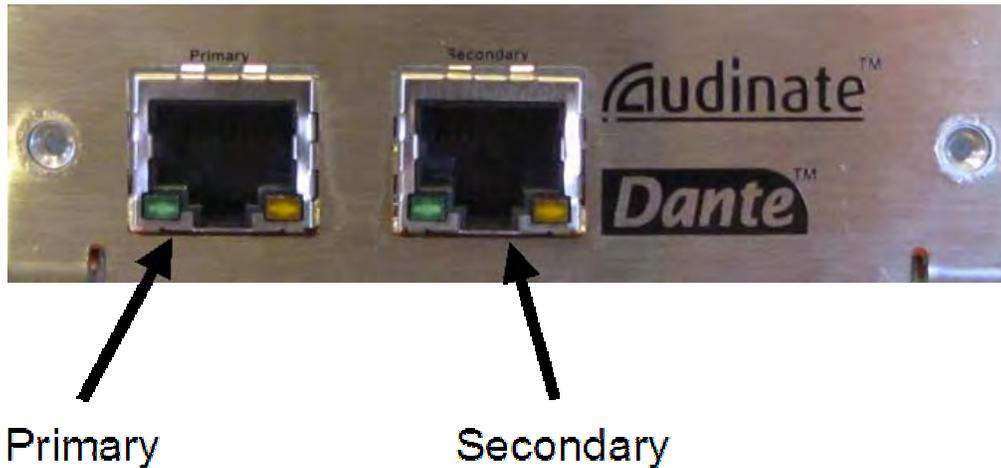


3.5.6.1 Fig. 13 – Device View – Network Configuration

## 4 Network Redundancy

### 4.1 Overview

MediaMatrix equipment, as commercial audio gear, is often used in mission critical applications and has a long and proven track record of providing robust and reliable service. But there is an additional level of fault tolerance that can be implemented. Each Dante interface card features two Ethernet connections. The primary connection is used in a standard installation while both are used when redundant audio network connections are required.

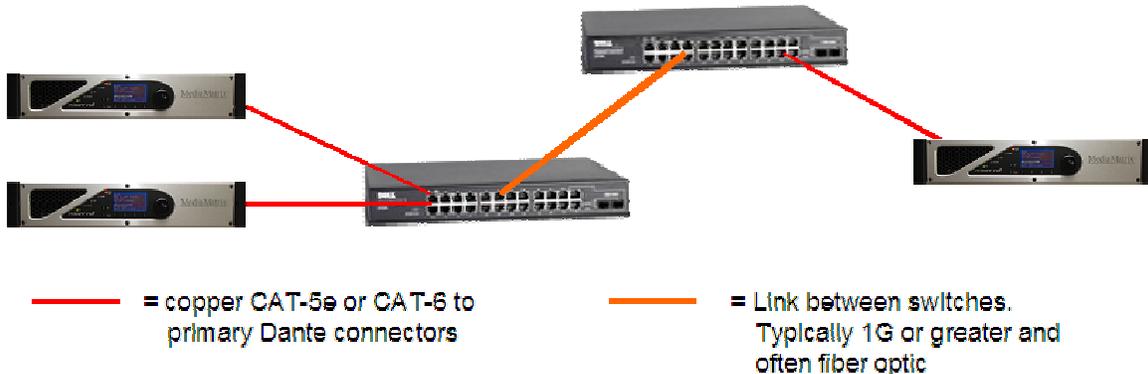


4.1.1.1 Fig. 14 – Rear Panel view of Dante module

A typical installation will use only the primary connections, as shown below. The control network to the NIONs is omitted for clarity and only the Dante Network connections are shown.

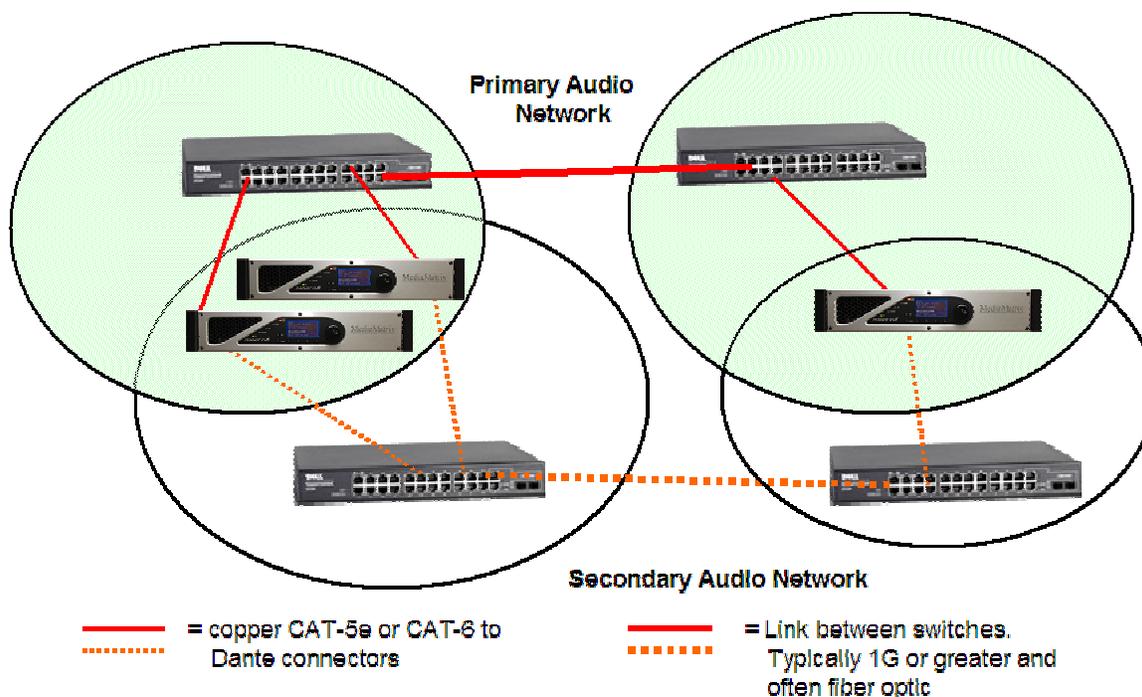
### 4.2 Topologies

#### 4.2.1 Standard – Non Redundant



4.2.1.1 Fig. 15 – Typical single network connection scheme

## 4.2.2 Using Separate Switches



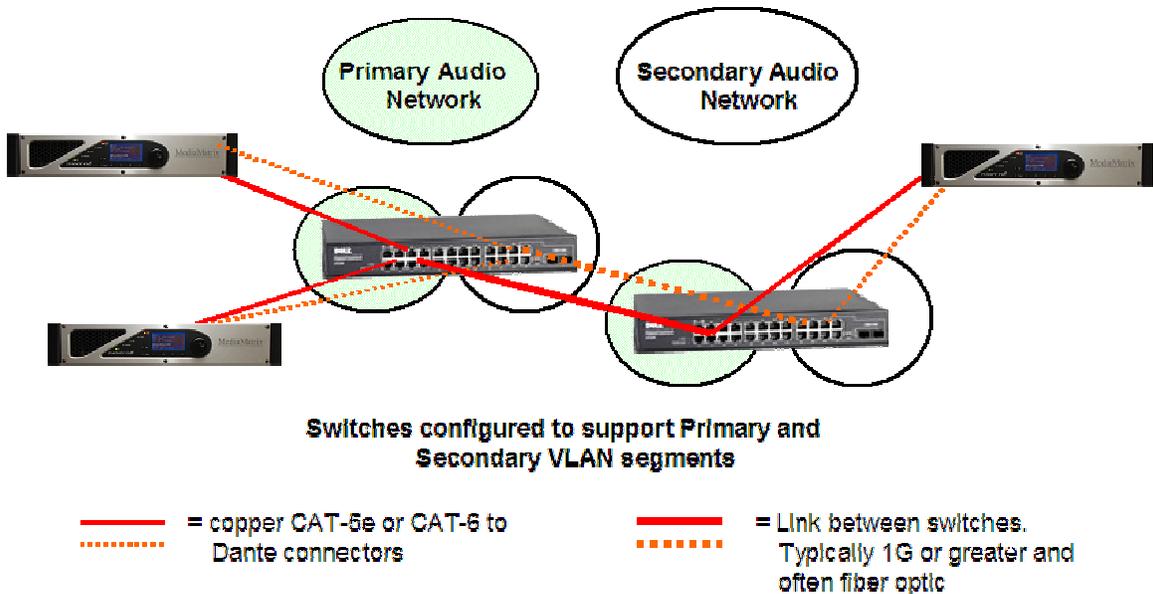
4.2.2.1 Fig. 16 – Typical Redundant network connection scheme

It is easy to set up a fully redundant Dante network, simply use two switches at every point one switch would be used and connect the secondary Dante Interface jacks of each audio device to the secondary switches. There are only a few caveats that apply:

- The link speed of both the primary and secondary interfaces must be the same. You cannot connect one port to a gigabit switch and the other to a 100 BT port.
- The secondary port is a failover port and cannot be used in a non-redundant scheme as the primary connection
- The two networks are completely separate and a device connected to one network cannot communicate with a device on the other network.
- Dante Controller, although connected to only one network, will show the status of all ports in the system on both networks. The connection status for each port is shown in the device tab as depicted in Fig. 11 above.
- The Ethernet cabling can be installed to follow separate physical routes between devices for added reliability. If one cable is accidentally damaged or cut it is unlikely that the secondary network will also be damaged. Likewise switches can also be separately located and/or separately powered to minimize the probability of one event damaging both networks.

### 4.2.3 Using VLANs

An alternative to using a fully redundant network is to use VLANs that employ the same switch hardware but use separate cabling between switches and Dante devices. This type of scheme will guard against any breakage or failure of cabling or failure of a port a Dante interface, but will not guard against switch failures. This is a legitimate level of redundancy but depending on the installation, guards against a less likely failure mode. It is typically active hardware, and not passive cabling, that is more prone to failure.



4.2.3.1 Fig. 16 – Typical Redundant network connection scheme

### 4.2.4 Compared to CobraNet

CobraNet does not detect loss of signal, it only detects loss of physical link to the CobraNet interface so therefore can only guard against that one unique physical failure mode at the end points. Dante, in contrast, monitors the traffic at both ports and detects any loss of expected data, not a loss of physical link. Dante can therefore detect an interruption in service due to failure for any reason at a point in the network between the transmitting and receiving device. Dante simultaneously keeps active both networks at all times so when a failure is detected on one network it will instantly switch to the secondary network with no loss of signal and resulting audio dropout. By Contrast, CobraNet will take some number of milliseconds to detect loss of link and switch to the other connection. This can result in a short dropout or other audible artifact. The CobraNet 'loss of link' scheme also has an effect on the required network topology. Rather than switch from one active path top another, CobraNet must establish a new path over the network. Without getting into too much CobraNet detail in a Dante document, suffice it to say that redundant networks must be set up carefully with intentional and the use Spanning Tree protocol to dynamically break or establish links when needed due to link failures. None of this complexity or consideration is necessary when establishing a redundant network using Dante.

The Dante scheme is much more robust, much more flexible, much easier to set up properly and it fails over instantaneously with no loss of audio. Dante should be preferred over CobraNet when redundancy is required.

## 5 Important Additional Concepts

### 5.1 Basics

- Dante is a Layer 3 technology that can take advantage of useful Layer 3 features
- Qos - Dante will take advantage of switches that support Quality Of Service differentiation using DiffServ.
- IGMP – or multicast subscriptions. Dante will use IGMP when present to minimize unnecessary traffic when using multicast flows.
- If equipment is available that supports DiffServ with at least 4 ICMP queues or supports IGMP, then make sure those features are turned on in the switches and they will be used to advantage by the Dante protocol.
- Dante was designed to work best using Gigabit Ethernet interfaces. The edge connections to the Dante interfaces themselves should always be 1 Gigabit. Any links between switches should be a minimum of 1 gigabit.
- Always use good quality equipment and wiring
- Try to minimize the number of switch hops in a network. Hops introduce variability in forwarding delay that can require use of higher latency settings. A guideline of allowable hops is shown adjacent to each latency setting in the Network Configuration tab of Cane Controller software.
- Use DHCP or link local to automatically assign IP addresses to Dante equipment. Static IP addresses are not necessary.
- Dante supports fully redundant audio networks. Unlike CobraNet, the two network connections remain active, sending and receiving audio redundantly at all times, not just following failover. A fault is detected by absence of traffic, not absence of link. CobraNet will only failover if the primary local physical link goes down. Dante will failover if it ceases to receive Dante traffic on the interface OR if the physical link goes down. These factors ensure reliable and imperceptibly fast failover in the event of a fault. The Dante protocol provides a meaningful improvement in reliability through redundancy over CobraNet.
- Network size – CobraNet is limited in practical network sizes on the order of roughly 60 nodes per network. So larger networks are divided into smaller subnets using separate switches or VLANs and linked together, when necessary, by NIONs connected to the separate networks but interconnected using the XDAB high speed External Digital Audio Bus. Due to improvements in processing power and network speed, Dante can support much larger networks making the ‘divide and conquer’ design practice of CobraNet less important.

### 5.2 Switches

- Always use good quality managed switches that support useful features such as VLANs, DiffServ/Qos, Port Mirroring, IGMP, and logging. VLAN, QoS and IGMP yield operational

advantages. Mirroring and logging yield advantages at commissioning time if debugging and troubleshooting is needed.

- Some switches can be well integrated with standard IT SNMP tools that allow remote monitoring and fault notifications.
- Beware of the use of so called ‘Smart’ switches. These are switches that attempt to automatically configure themselves to operate optimally for data networks but often do not provide optimized behavior for audio networking. Things to beware of:
  - Switches that automatically configure stacking ports when switch to switch connections are detected.
  - Switches that provide minimal configuration options and do not provide the level of control or configuration flexibility needed.
  - Switches that are too operator GUI oriented and do not have adequate logging OR configuration reporting.
- Always use Gigabit or above links in switch to switch connections
- Use Fiber for longer runs or run that may be in an electrically noisy environment.
- Good grounding and power isolation are required
- Common sources of electrical noise to be avoided near network equipment or wiring includes:
  - Dimmers
  - Electrical motors
  - Cooling equipment
  - Fans
  - Stage rigging motors, etc...
- As a rule, with the exception of IGMP and QoS, the fewer options enabled in a switch the better,

### 5.3 A Useful Analogy

An audio network is the highest performance expression of local area networking today. It turns a non-deterministic, best effort technology into a reliable, flexible, scalable, low latency audio delivery system. Its high performance characteristics can viewed much as one would view a high speed race track.

The data that passes across a network is called traffic for a reason. You can choose to have all the “bells and whistles” in your network, but much like a traffic engineer who can impede the flow of traffic by choosing to use every method of joining roads together simply “because they are available”, a similarly planned network will also result in sub-optimal performance. For high performance media networking, apply the principals that you would expect a race track architect to use in order to minimize all delays and impediments to the flow of traffic:

- Long straights are needed for high speed - That means fast switches with robust, non blocking switch fabric hardware
- Don’t narrow the track suddenly – Don’t go from higher to lower bandwidth port speeds.
- No police check points on a race track - Audio data should not be subject to inspection by firewalls and anti-virus software. That means that the networks must be designed from the start as isolated subnets to ensure security along with high performance.

- No crossing guards or traffic lights on race tracks – Keep remote control systems and other network traffic off of the audio network. It is possible to combine traffic but must be done carefully, if at all. The problem with sharing bandwidth on a network is that audio network bandwidth tends to be constant. Data and human generated traffic tends to be bursty and sometimes uncontrollably so to the point of interfering with the delivery of audio for short periods resulting in audible artifacts. Use of QoS/DiffServ can help in this regard.
- Once the race has started you don't pull the cars over to get the drivers' details; port mirroring, packet sniffing/analysis etc... is OK for commissioning or debugging but should not be used in a production environment.
- Super cars don't do J-turns well at high speed – Avoid switch stacking, and if stacking is needed then avoid possible stacking issues. Usually a simple crossover link is all that is needed between switches. Some switches use proprietary stacking links that usually should be avoided. These links typically pass data through a processor rather than through the standard hardware switch fabric. This can result in non-deterministic and variable forwarding delays that can cause dropouts and make audio clock synchronization more difficult to maintain.
- Don't use lower octane gas, use high octane gas to ensure full power from the engine at all times - Different switches from different manufacturers implement a wide array of features. The method of implementing these features can vary. As a rule, any feature or protocol implemented by passing the data through a CPU, rather than through faster and more powerful hardware logic should be avoided due to the possible introduction of variable forwarding delays.

## 6 Other Resources

A number of other resources that can aid in the understanding of Dante, audio networking and networking in general are available and it is strongly recommended that one take full advantage of all of them. Documentation and application notes are available on The Audinate website <http://www.audinate.com/> as well as the following:

- Dante Help:  
The help feature available in the Dante Controller is very thorough and Comprehensive
- Dante Overview:  
<http://www.youtube.com/watch?v=OAKOAwI-zPo>
- Dante Configuration Video:  
<https://www.youtube.com/watch?v=EdgZ5zbhfwU>
- Media Matrix NioNote 403  
CobraNet Network Considerations OR What the IT guy needs to know..  
This note covers basic networking concepts that apply to CobraNet in particular but applies to the successful implementation of any audio network in general
- The MediaMatrix Forum. <http://peaveyoxford.com/forum/>
- Excellent book on Ethernet:  
**Ethernet – The Definitive Guide** by Charles E. Spurgeon  
O'Reilly & Associates ISBN # 1-56592-660-9
- If you have any questions or suggestions to improve this document please contact the author at [sgray@peavey-eu.com](mailto:sgray@peavey-eu.com)