Configuring OmniSwitch for Dante-Enabled AV Applications

Application Note

Alcatel·Lucent Enterprise

Table of Contents

Configuring OmniSwitch for Dante-Enabled AV Applications

Introduction

This application note is designed to provide IT and AV professionals with a detailed blueprint for integrating the Dante protocol into their network environments, facilitating the transmission of high-quality audio, video and control over IP networks. Dante represents a sophisticated integration of software, hardware, and network protocols meticulously engineered to transmit multiple channels of audio and video across standard Ethernet infrastructure.

Dante technology simplifies complex AV setups by eliminating the need for extensive analog cabling and dedicated video and audio routers, instead leveraging the existing network infrastructure to deliver scalable, high-fidelity AV solutions. This protocol not only supports the real-time distribution of uncompressed, low-latency digital audio signals but also enables the precise synchronization and configuration of networked audio devices. In addition, Dante video (entitled Dante AV) enables transmission of compressed video across the network using 1gbps interfaces.

Moreover, Dante supports both unicast and multicast streams, providing versatility depending on the scope and scale of the project. The system's backward compatibility with existing network standards and its ability to coexist with other data types on the same network underline its practicality in modern IT environments.

The purpose of this application note is to demystify the process of setting up a Dante network, outlining the necessary equipment, ideal network configurations, and best practices for deploying and managing a robust AV over IP network. This guide is intended to help professionals not only implement this powerful AV networking solution but also optimize its operation to achieve unparalleled performance and reliability.

For more information about Dante, please visit their website www.getdante.com. Dante is a registered trademark of Audinate Pty Ltd. All rights reserved.

Prerequisites

Switches

Alcatel-Lucent Enterprise Switches: For a robust integration of the Dante protocol, the OmniSwitch 6360 and OmniSwitch 2260 models are recommended due to their advanced Quality of Service (QoS) capabilities and IGMP Snooping support, which are essential for managing multicast audio and video streams. These switches are optimal for handling large-scale AV deployments typical in stadiums as well as smaller, controlled lab environments for protocol testing. Other OmniSwitch models are also capable of supporting the features described in this application.

Software

Dante Controller: This is the primary tool for configuring and managing Dante devices within the network. It provides a graphical interface for setting up audio and video routes, monitoring device statuses, and managing clock synchronization.

Dante Via: This application extends the flexibility of Dante by enabling non-Dante hardware to participate in the audio network. It allows PCs and other audio devices without native Dante support to send and receive audio streams via the network.

Important Consideration:

In this setup, we are utilizing Dante Via primarily for testing purposes. In a standard customer environment, the network would typically incorporate other Dante-enabled devices, including Dante-enabled audio sources and interfaces. These devices natively support Dante and would be integrated directly into the network, eliminating the need for Dante Via.

This approach is specifically aligned with our lab testbed, where we simulate real-world routing and management scenarios without the full suite of Dante hardware, thus providing a cost-effective yet effective testing environment.

Sample Use Case

Dante Audio Equipment:

- **Microphones and Speakers:** Dante-enabled microphones and speakers to capture and amplify sound across large areas.
- **Audio Mixers and Stage Boxes**: Critical for managing multiple audio inputs and outputs, allowing for precise control over live audio mixing.
- **Dante Amplifiers:** These amplify the audio signals while maintaining high fidelity and low latency, crucial for large venues.
- **Dante Interfaces:** Interface devices that connect traditional analog and digital audio equipment to the Dante network.

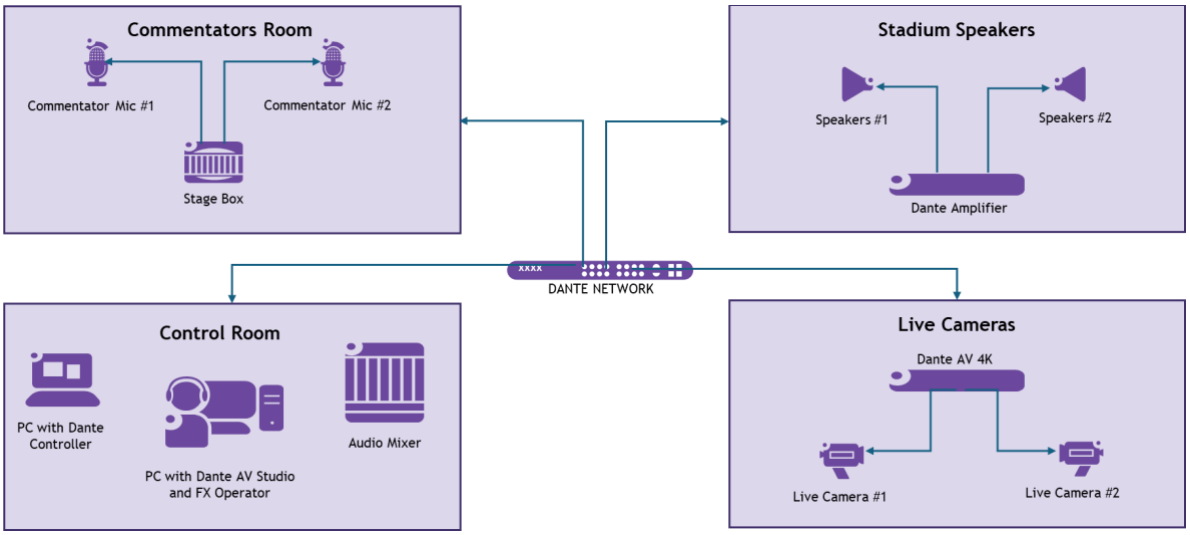

Figure 1: Stadium Use Case

These components are essential for delivering high-quality, synchronized audio and video in a stadium environment, capable of supporting live events with complex requirements.

Test setup

In a lab setting, the setup includes:

- **PCs with Dante Via:** At least two PCs equipped with sound cards to simulate audio source and receiver scenarios.

- **Basic Audio Equipment:** Non-Dante microphones and speakers connected via USB or audio jack, allowing for flexibility in testing different audio configurations without the high costs of specialized hardware.

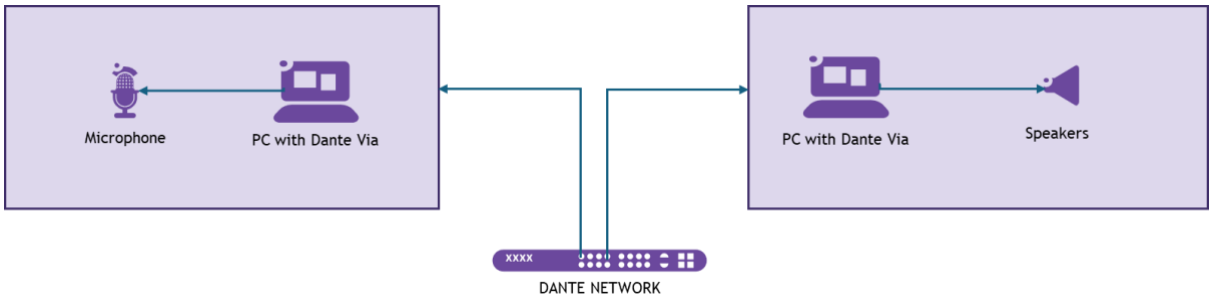

Figure 2: Laboratory Use Case

Additional Considerations

- **Software Licenses:** Ensure that necessary licenses for Dante Controller and Dante Via are acquired. Dante Controller is available free of charge, while Dante Via requires a purchased license.

Summary:

Meeting these prerequisites will ensure that the network is prepared to handle the specifics of Dante streaming, providing high-quality, synchronized AV across your infrastructure. This setup not only optimizes the delivery of audio and video content but also enhances the scalability and manageability of your networked systems.

Network Setup

Programming VLAN

When setting up a network to support services like Dante, it's crucial to properly configure IP interfaces on your network switch. This ensures that devices connected to the network can communicate efficiently both within the local network and beyond. The command discussed here specifically sets up an IP interface for VLAN 100, which will be dedicated to the Dante Network. For optimal performance, it is recommended to use a specific VLAN for Dante. Dante devices should be on the same VLAN or on VLANs that are properly routed to

communicate with each other. Please note that multi-subnet device discovery and routing Dante across subnets requires the Dante Domain Manager software.

Navigate to Layer2 VLAN Management:

From the main menu, select **Layer2 > VLAN Mgmt > VLAN**. This will take you to the VLAN management page where you can view and configure your VLANs.

On the VLAN management page, click the **+ (ADD)** button to initiate the creation of a new VLAN. This action will open the "**Add new VLAN**" window.

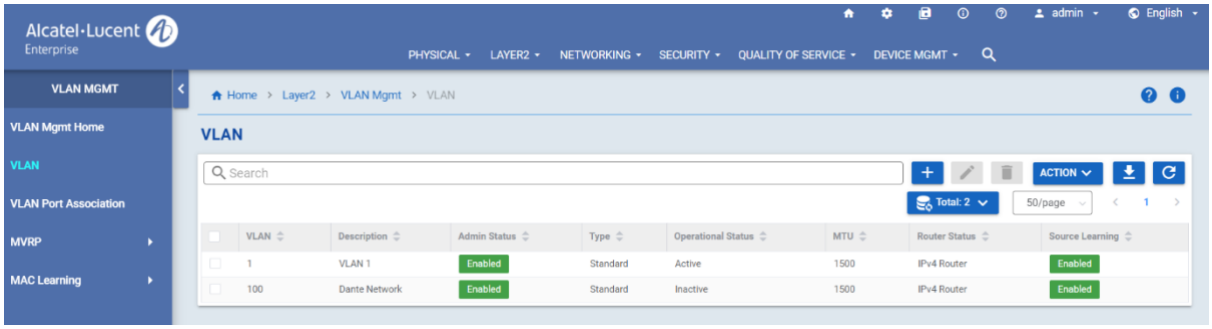

Figure 3: VLAN Management Tab

Specify VLAN Details:

- **VLAN ID:** Enter a number as the VLAN ID.
- **Description:** Enter Dante Network as the description. This helps in identifying the purpose of the VLAN within your network.
- **Admin Status:** Ensure that the toggle is set to Enabled. This activates the VLAN.

After entering the necessary information, click **Next** to proceed to the port association step.

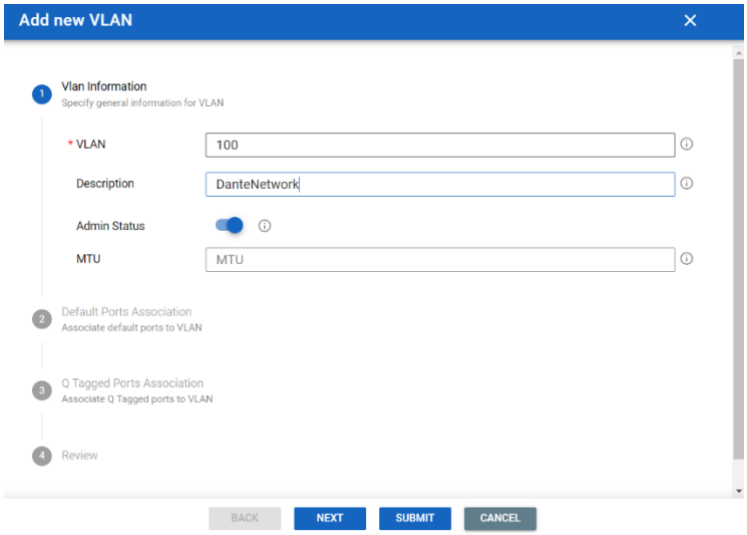

Figure 4: Adding VLAN

Assign Ports to VLAN:

- In the "**Default Ports Association**" section, you will see a list of available ports on the left and the associated ports on the right.
- From the available ports list, select the ports you wish to associate with VLAN 100. For this setup, select ports for example **1/1/3 and 1/1/4**.
- Click the + button to move the selected ports to the Associated list on the right. This action designates these ports to be part of **VLAN 100**.
- Once you have selected the appropriate ports, click **Next** to continue.

If everything looks correct, click **Submit** to create the new VLAN. This action will save the configuration and apply the new VLAN settings to your switch.

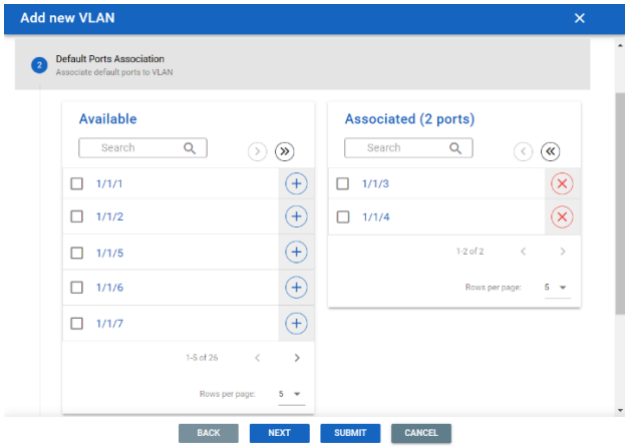

Figure 5: Assigning VLAN to ports

Verify VLAN and Port Association:

- After submitting, navigate back to **VLAN Mgmt > VLAN Port Association**.

Check the list to ensure that the ports **1/1/3** and **1/1/4** are now listed under **VLAN 100** and that their status is active.

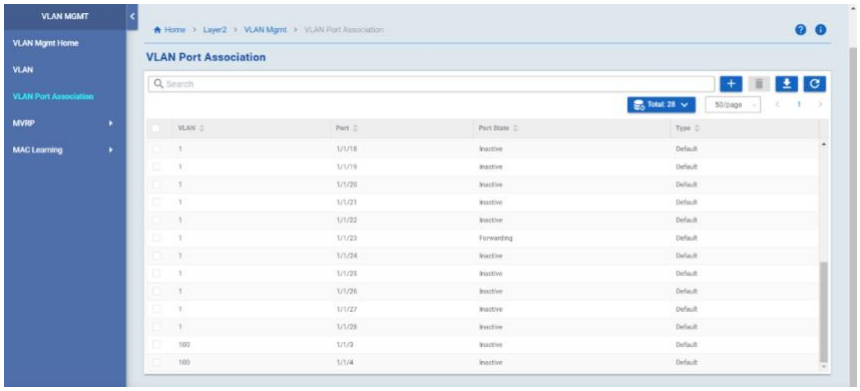

Figure 6: VLAN Port Association Verification

IP Interface

Navigate to Interface Configuration:

- From the main menu, go to **Networking > IP > Configuration > Interfaces**.
- Click on the + (Add) button to open the "Add new IP Interfaces" window
- Enter the corresponding configuration interface name.
- Click **Submit** to add the IP interface.

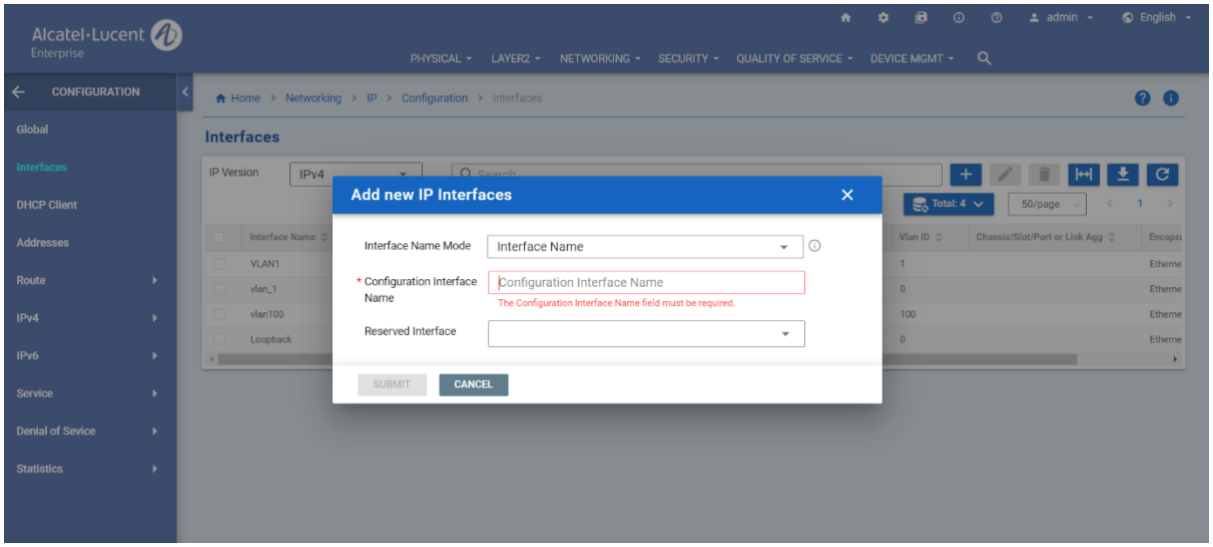

Figure 7: IP Interface Configuration 1

In the list of interfaces, select the newly created interface (e.g., vlan100) and click on the edit icon (pencil).

Configure Interface Settings:

- **Interface Name:** Ensure the name is correct (e.g., vlan100).
- **SNMP Interface Index:** This field is auto-filled.
- **IP Address:** Enter the IP address for the interface (e.g., 192.168.100.1).
- **Subnet Mask:** Enter the subnet mask (e.g., 255.255.255.0).
- **Encapsulation:** Choose the encapsulation type (e.g., Ethernet2).
- **Forwarding:** Enable or disable forwarding.
- **Admin State:** Toggle the switch to On to enable the interface.
- **Local Proxy ARP:** Enable or disable this option as needed.
- **Primary Config:** Choose Yes or No depending on whether this interface is the primary configuration.
- **Device:** Select Vlan.
- **Vlan ID:** Enter the corresponding VLAN ID (e.g., 100).

After configuring all the settings, click Submit to save the changes.

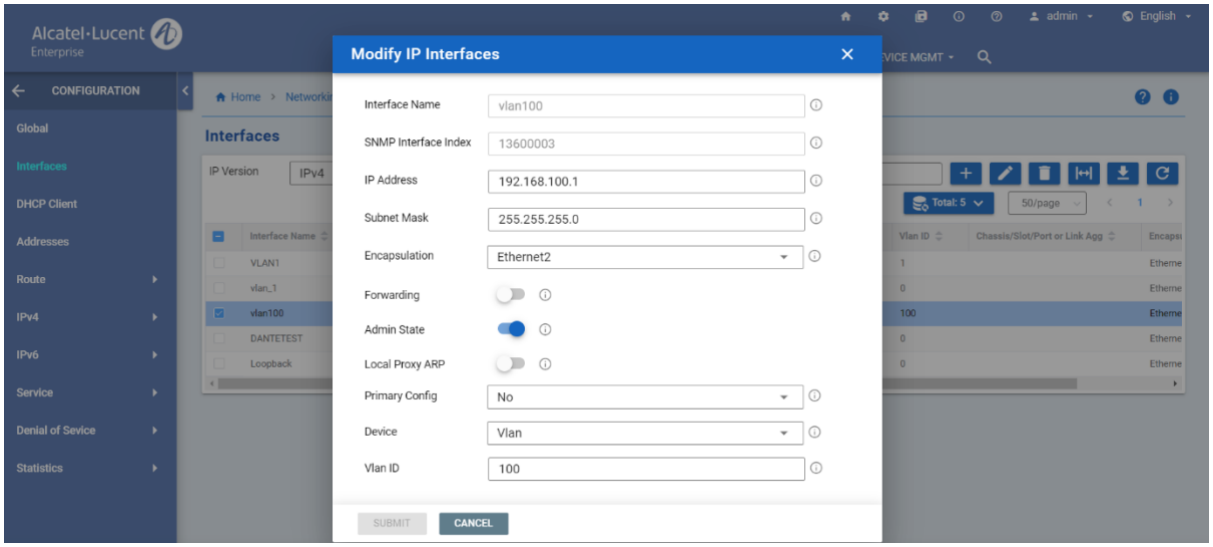

Figure 8: IP Configuration 2

Switch Configuration – Multicast

To ensure your network is optimized for handling multicast traffic efficiently, particularly for systems like Dante that heavily rely on multicast for device discovery as well as audio and video streaming, configuring IGMP (Internet Group Management Protocol) settings is critical. Below, we explain the necessary configurations for IGMP Snooping, IGMP Querier, and multicast enhancements such as Immediate Leave.

Navigate to VLAN Configuration:

- From the main menu, go **to Networking > IP Multicast > IP Switching > Configuration > VLAN.**

Select the VLAN:

- Locate the VLAN you want to configure for multicast. In this example, we will use VLAN 100 named “Dante Network”.

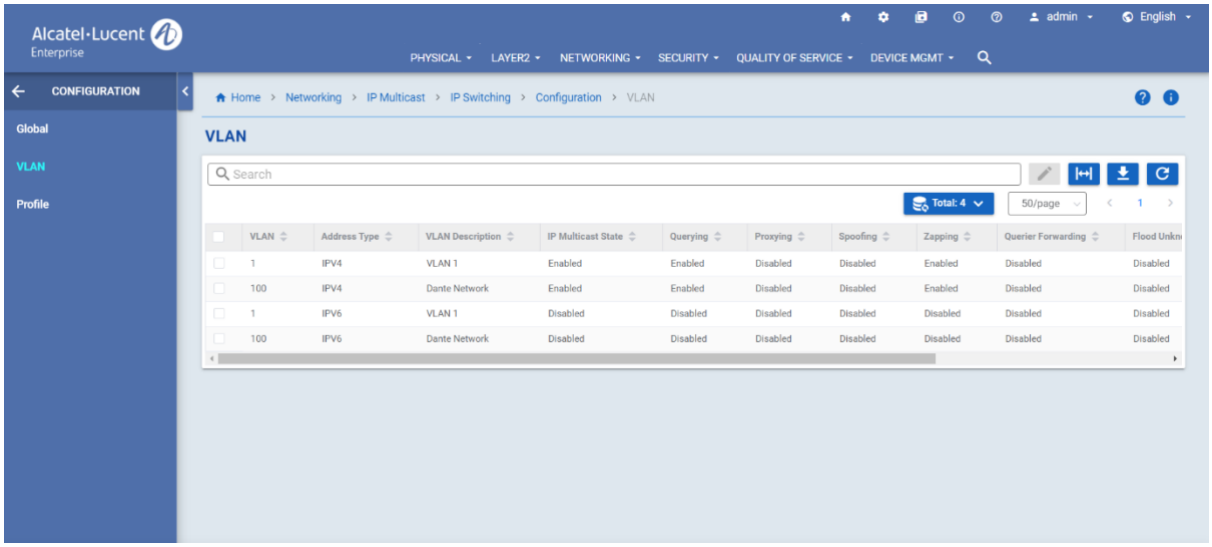

Figure 9: VLAN Multicast

Open VLAN Settings:

- Click on the Edit icon (pencil) next to VLAN 100 to modify its settings

1) Enable IP Multicast on the Switch

Enable multicast switching on the switch, allowing it to handle multicast traffic.

2) Enable IGMP Querier Globally

Activates the IGMP Querier function on the switch. This function allows the switch to manage and maintain the multicast group memberships across the network efficiently.

3) Enable Immediate Leave (also known as "Zapping")

Immediate Leave optimizes the response to leave messages from multicast group members. It is particularly useful in environments where quick changes to multicast group membership are frequent, reducing the leave latency.

4) Enable Flood Unknown

When a traffic flow is first seen on a port, there is a brief period of time where traffic may get dropped before the forwarding information is calculated. When flooding unknown multicast traffic is enabled, no packets are dropped before the forwarding information is available. Enable Flook Unknown to make sure that unregistered multicast such as mDNS and PTP are forwarded.

5) Set Last-Member Query Interval

Sets the interval for last-member queries to 1 second. This setting helps determine the presence of remaining group members more quickly when a leave message is received.

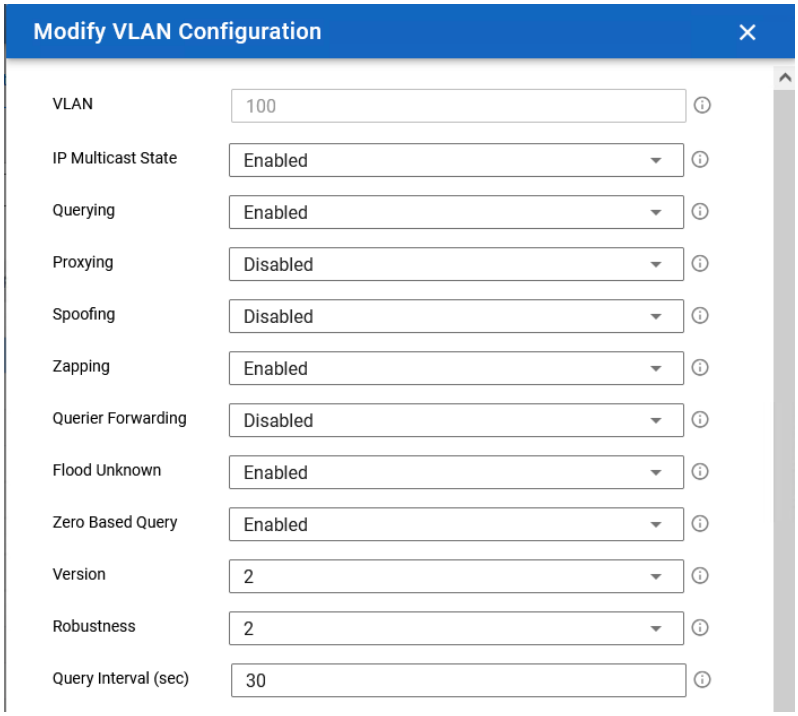

Figure 10: Multicast Configuration 1

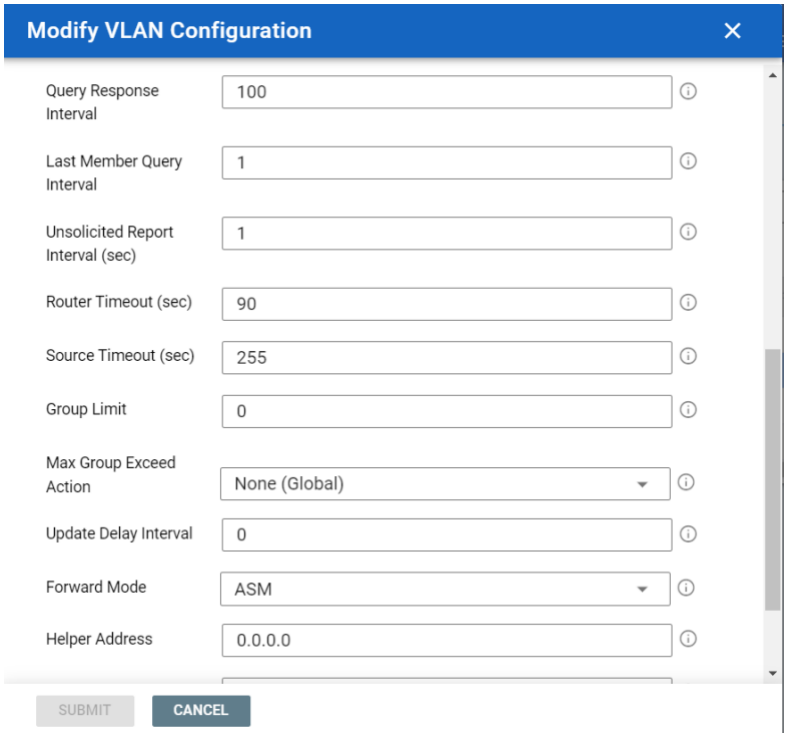

Figure 11: Multicast Configuration 2

Programming QoS

In most small audio networks where all Dante devices are equipped with 1Gbps ports and there is minimal or no other data traffic, QoS settings are not critical. However, as the number of audio or video channels increase, or other data types consume more bandwidth, configuring QoS becomes beneficial. Additionally, if any Dante devices in the system have 100Mbps ports, proper QoS configuration is essential.

Dante uses DSCP (Differentiated Services Code Point) for QoS (Quality of Service). Different types of data are assigned varying levels of priority. Timing data is the highest priority, followed by audio and video data, and then control data. All other data is considered to have low priority.

Navigate to QoS Port Settings:

From the main menu, go to **Quality of Service > Groups > Ports.**

In the Ports section, select the port you want to configure for QoS. For this example, we will modify settings for port **1/1/3**. Click on the port number to open the Modify Ports window.

Modify QoS Parameters:

- **Trusted:** Set to Yes. This ensures that the switch will trust incoming QoS markings from the connected devices, allowing Dante devices to manage their own QoS settings effectively.
- **Def 802.1p:** Set the default 802.1p priority value as needed. This is typically set to 0 for Dante networks unless a specific priority is required.
- **Def DSCP:** Enter the default DSCP value for the port. This is usually 0 unless specified otherwise for your network.
- **Max Egress Bandwidth:** This can be set to 0, adjust as necessary to limit the bandwidth on this port.
- **Def Class:** Select DSCP from the dropdown menu to apply DSCP-based QoS classification.

Once you have entered the desired settings, click Submit to save the configuration.

After submitting, ensure that the port configuration reflects the changes made. You can verify this in the Ports section under Quality of Service.

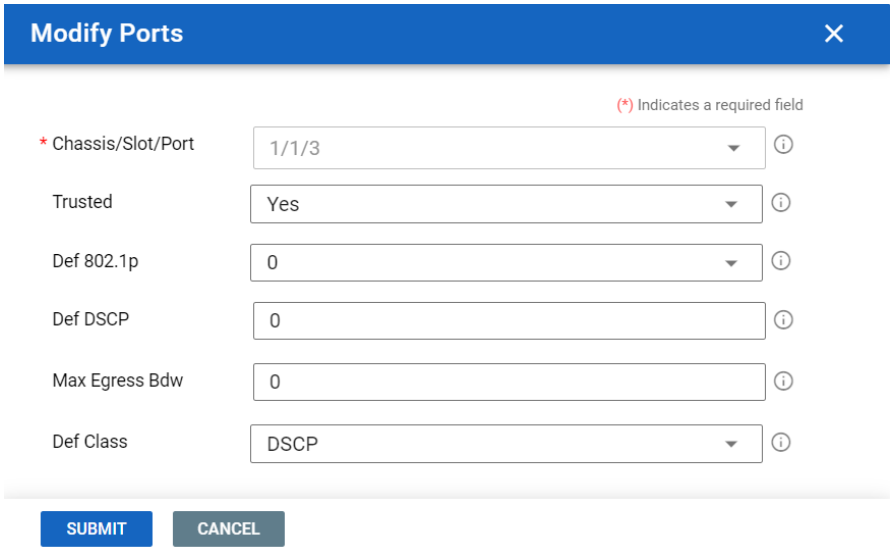

Figure 12: QoS Configuration

CLI Verification

```
-> show qos port 1/1/3
Slot/                Default    Default              Bandwidth          DEI
Port    Active  Trust P/DSCP Classification  Physical  Ingress Egress    Map Mark   Type
-------+-------+-----+------+--------------+----------+-------+------+------+------+-------------
1/1/3     Yes    +Yes  0/ 0          DSCP         1G       -      -     No    No   ethernet-1G

-> show qos port 1/1/4
Slot/                Default    Default              Bandwidth          DEI
Port    Active  Trust P/DSCP Classification  Physical  Ingress Egress    Map Mark   Type
-------+-------+-----+------+--------------+----------+-------+------+------+------+-------------
1/1/4     Yes    +Yes  0/ 0          DSCP         0K       -      -     No    No   ethernet
```

Figure 13: CLI Verification

PC Configuration – IP Assignment

1) **Assigning IP Addresses**

Manual IP Address Assignment:

If your network lacks an active DHCP server or if you prefer more stable device management, assign static IP addresses to each PC. Ensure that the IP addresses are on the same subnet to allow direct communication without additional routing.

Configuration examples:

PC1:

- IP Address: 192.168.100.10
- Subnet Mask: 255.255.255.0

PC2:

- IP Address: 192.168.100.11
- Subnet Mask: 255.255.255.0

2) **Configuring Network Settings**

Set Gateway:

Default Gateway: Set the default gateway if PCs need to communicate with devices on other subnets or access the internet. This gateway is typically the IP address of your main router or switch.

Configuration on a Layer 2+ Switch

Since these are Layer 2+ switches, you can configure the IP interface for the subnet directly on the switch. This setup will allow the switch to handle routing within the subnet and act as a gateway for devices on the network.

Connectivity and Synchronization Test

To verify that the network configuration is properly established and that the PCs can communicate with each other, perform a connectivity test:

Network Connectivity Check

From PC1, open a command prompt or terminal. Execute the following command:

- ping 192.168.100.11

This will send ICMP packets to PC2. If everything is configured correctly, you should see responses indicating that the packets reach PC2 and return to PC1.

Check Firewall Configurations:

Ensure that firewalls on both PCs are configured to allow ICMP traffic (used by ping) and Dante traffic (typically on specific UDP ports). If the firewall is blocking this traffic, you will need to adjust the rules to permit communication. For a list of the ports and protocols used by Dante, please refer to this link: https://www.getdante.com/support/faq/which-network-ports-does-dante-use/

By following these steps, you ensure that the PCs in your Dante network are properly configured to communicate effectively, thereby minimizing the risk of network-related issues that could impact your Dante system's performance.

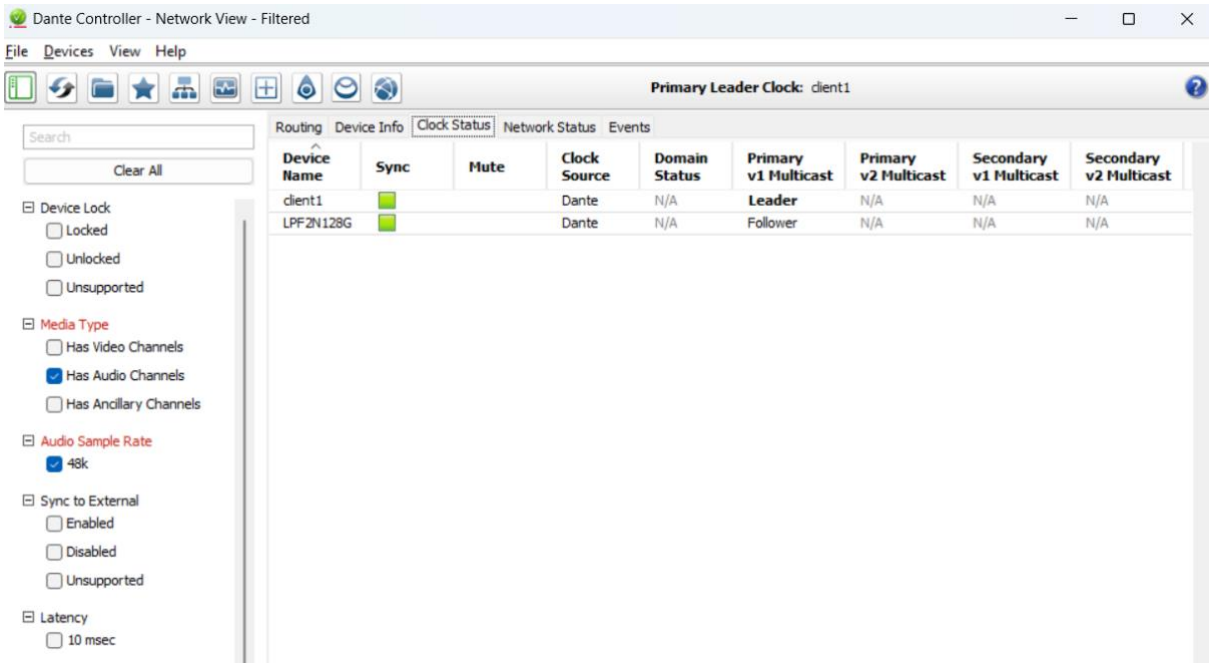

Figure 14: Clock Status Verification

Dante Software Setup Dante Via Configuration

Before configuring your audio input and output devices with Dante Via, it is crucial to ensure that these devices are set correctly within Dante Via and not selected as the default audio input/output devices in your operating system's sound settings. This step is necessary to avoid conflicts and ensure that Dante Via can manage the audio streams properly.

PC2 (Audio Source)

Launch Dante Via: Start the Dante Via application. This software transforms your computer into a fully functional Dante device, allowing it to send and receive audio over the network.

Configure the Microphone: Within Dante Via, ensure that your microphone is set to "Available to Network." This setting makes the microphone accessible as an audio source to other devices on the Dante network. It effectively turns your PC's connected microphone into a networked audio input that can be routed to different destinations across the Dante audio network.

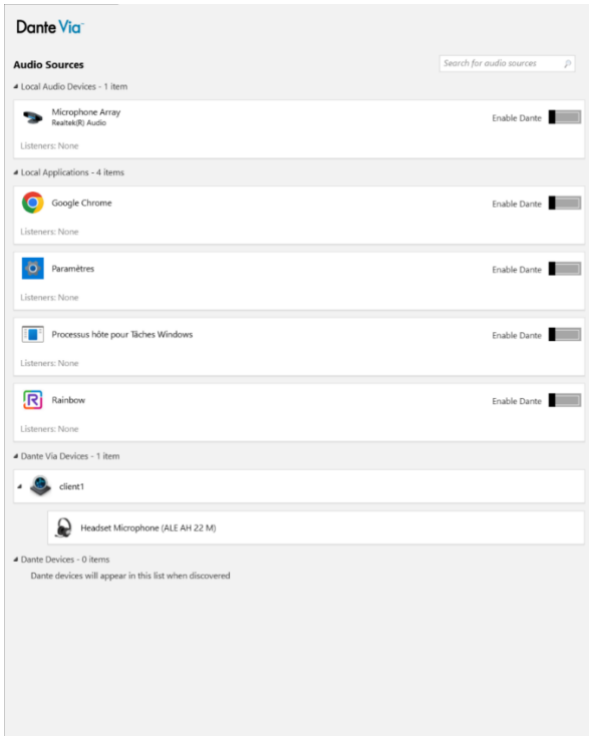

Figure 15: Dante Via Audio Source

PC1 (Audio Destination)

Launch Dante Via:

Open the Dante Via application on this PC as well. Just like with PC2, Dante Via will allow this computer to interact with the Dante audio network.

Configure Output Devices:

Set up the speakers, or any other audio output device connected to this PC, to be "Available to Network." This configuration step ensures that these devices can receive audio streams from any source within the Dante network. It essentially turns your output devices into networked audio receivers that can be targeted by Dante-enabled sources.

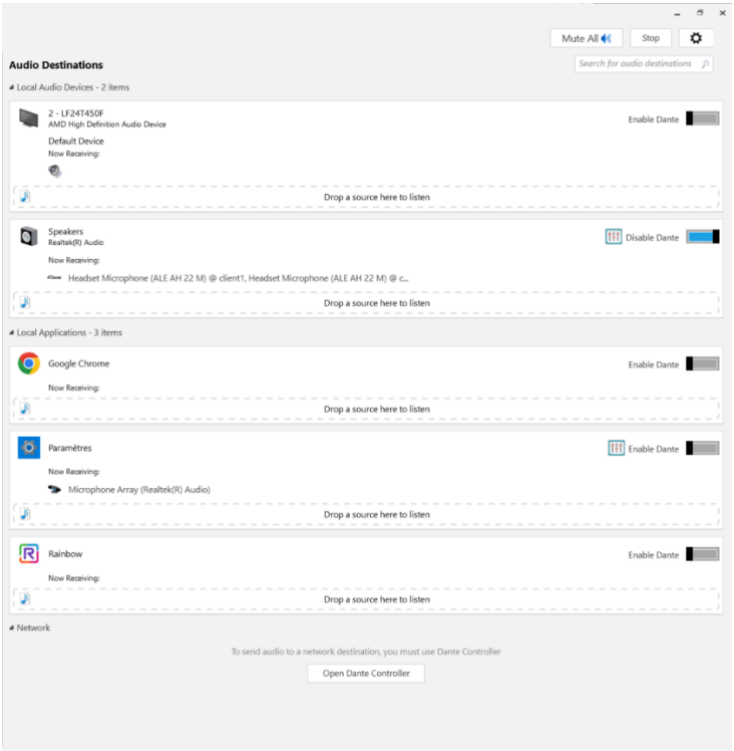

Figure 16: Dante Via Audio Destination

Dante Controller

Launching Dante Controller on PC2

Open Dante Controller:

Launch the Dante Controller software. This application provides a comprehensive view of all Dante-enabled devices on the network, including those made available via Dante Via. Dante Controller is essential for routing audio signals across the network.

Automatic Device Discovery:

Dante Controller should automatically discover all Dante devices on the network, including the microphone connected to PC2 and the speakers connected to PC1 as set up via Dante Via.

Configuring Audio Routing

Route the Audio:

In Dante Controller, identify the device listing that corresponds to PC2, where the microphone is connected. Locate the specific output channel of this device in the routing grid.

Identify the Destination Device:

Similarly, locate the device corresponding to PC1 in the grid, focusing on its input channels where the speakers are connected.

Establish the Connection:

Click on the cell at the intersection of the microphone's output (PC2) and the speaker's input (PC1). A cross or connection icon should appear, indicating that the audio route from PC2 to PC1 has been successfully established. This setup allows audio signals from the microphone on PC2 to be directly streamed to the speakers on PC1.

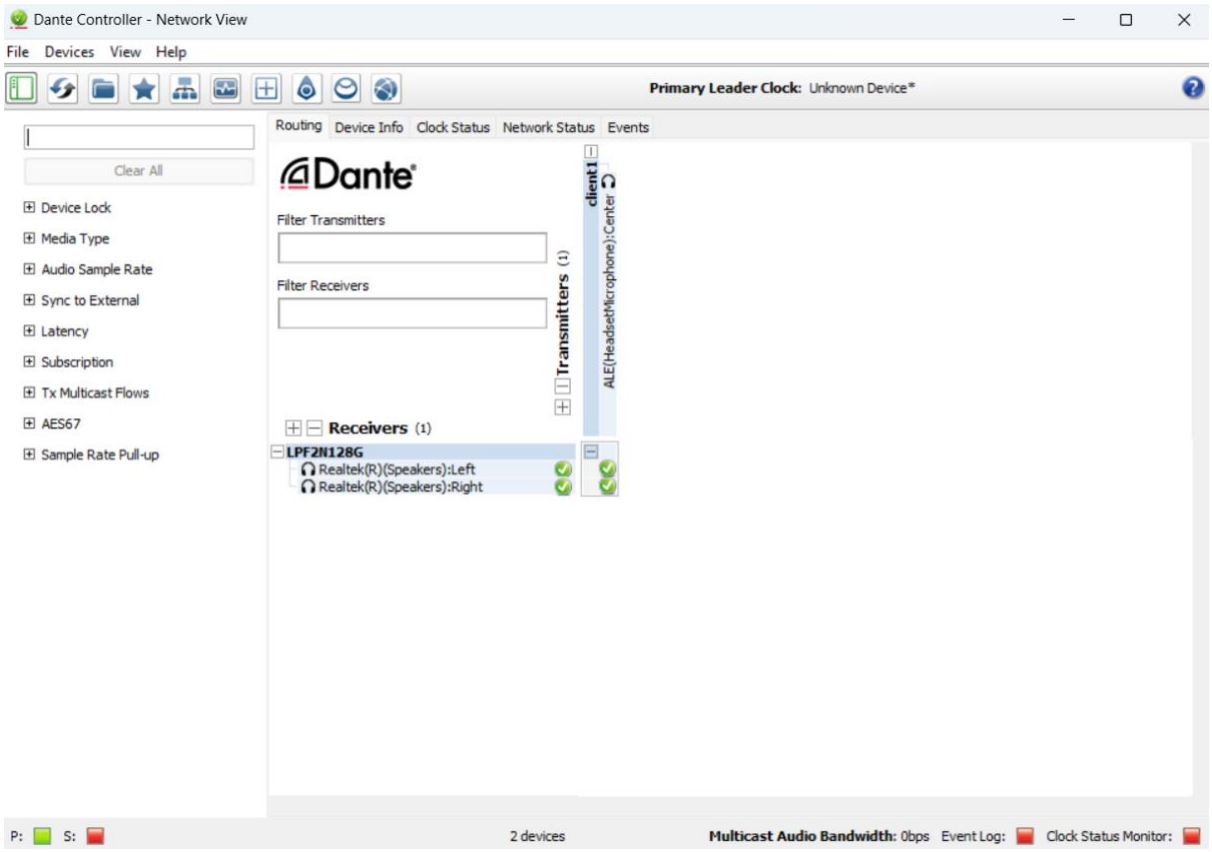

Figure 17: Dante Controller Routing

Testing the Configuration

Audio Routing Test: To ensure everything is configured correctly, perform a practical test:

- Speak into the microphone connected to PC2.
- Listen through the speakers connected to PC1 to confirm that the audio from the microphone is being correctly transmitted and received.

Conclusion

In this application note, we have provided a comprehensive guide for integrating the Dante protocol into your network environment to facilitate the transmission of high-quality audio over IP networks. We have detailed the necessary prerequisites, including the appropriate network hardware, software, and audio equipment, and outlined the optimal network configurations for deploying and managing a robust Dante network.

By following the steps provided for configuring your network switch, setting up multicast, assigning IP addresses, and configuring the Dante software, you can ensure a seamless integration of Dante into your existing infrastructure. This setup not only optimizes audio delivery but also enhances the scalability and manageability of your networked AV systems.

Key takeaways from this guide include:

- **Simplicity and Scalability:** Leveraging Dante's technology for easy scalability and simplification of networked AV systems, eliminating the need for extensive analog wiring.
- **Compatibility and Coexistence:** Dante network configurations are compatible with existing network standards, supporting both unicast and multicast audio and video streams for versatile deployment scenarios.
- **Audio Performance Optimization:** Focusing on configuring the network to enhance audio and video performance, which includes setting up precise synchronization and effective management of streams through Quality of Service (QoS) and IGMP configurations to optimize the delivery of high-quality, synchronized AV.

By adhering to these best practices, you can leverage the full potential of Dante technology to achieve unparalleled AV over IP performance and reliability in your network. This application note serves as a valuable resource for IT and AV professionals looking to implement and optimize Dante in their network environments.