

Intermediate Dante Concepts

DANTE CERTIFICATION PROGRAM

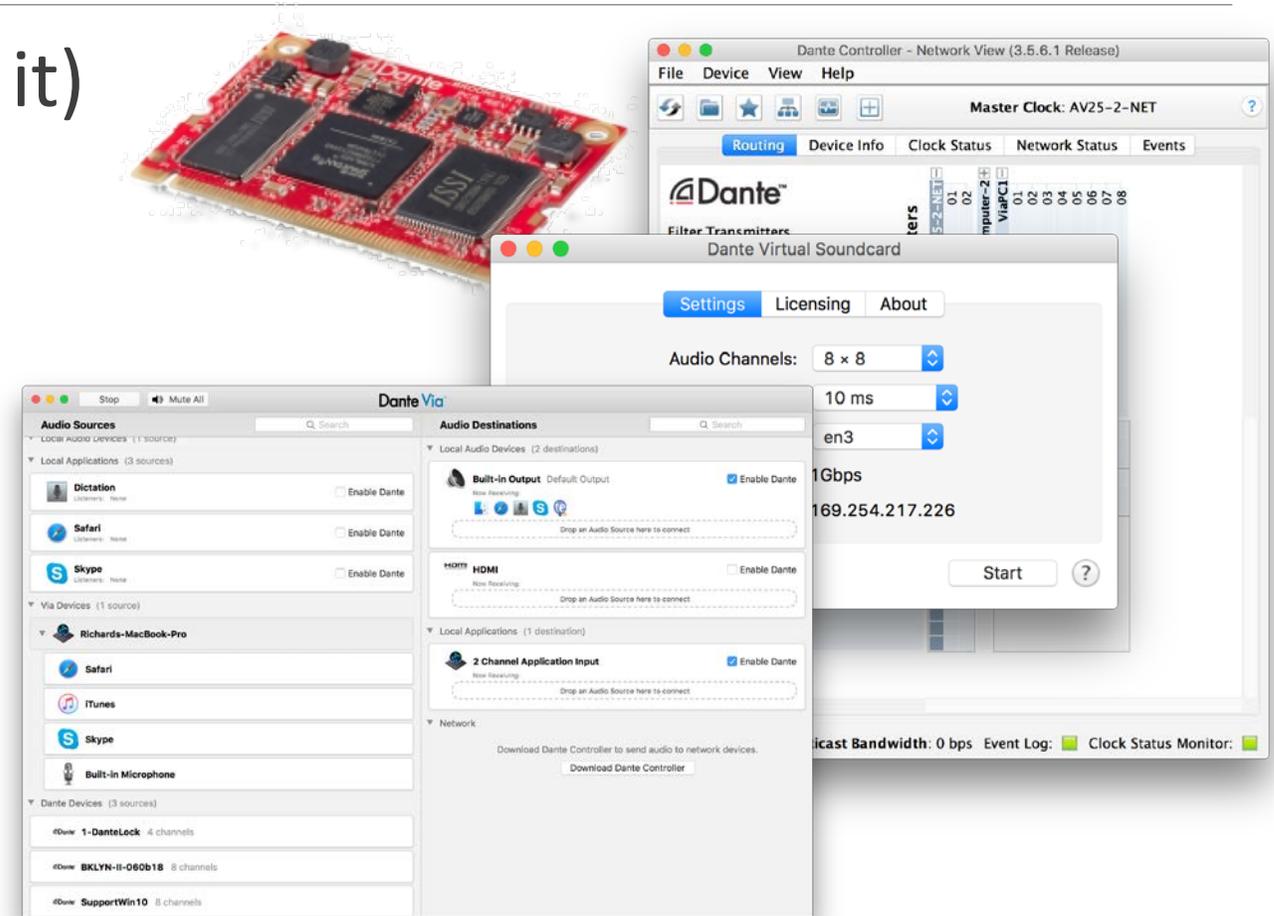
LEVEL 2

About Audinate

- Headquartered in Sydney, Australia
- Network engineers first
- Develop Dante as 100% interoperable solution for all audio manufacturers

What we make

- Dante technology (all of it)
- Hardware modules
- Development tools
- Software products:
 - Dante Controller
 - Dante Virtual Soundcard
 - Dante Via



The Dante Certification Program



- Course structure:
 - Level 1: Introduction to Dante
 - Level 2: Intermediate Dante Concepts
- Certificate requires:
 - Pass Level 1 online test
 - Pass Level 2 online test
 - Pass Level 2 in-person hands-on test



The Dante Certification Program



- Do your *hands-on* testing for Level 2 **today** at test stations
- All attendees will receive an email within 24 hours detailing next steps if you wish to become certified
- Both Levels 1 & 2 must be passed
 - If you are in Track 2, you will be able to pass the Level 1 online test

Level 2 Topics

- Switch Features
- Clocking options in Dante
- Understanding latency in networks
- Dante Flows and Multicast
- Creating backup devices with Dante names
- Dante redundancy
- Dante Virtual Soundcard
- Dante Via
- AES67 and Dante
- Converged networks and Dante

Switch Features

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Managed vs. Unmanaged

MANAGED

- More expensive
- Many possible settings (and risks)
- May be required in some conditions

UNMANAGED

- Less expensive
- Plug and play 100%
- May not be appropriate in some situations

Common managed switch features

- QoS
 - Quality of Service
 - Traffic prioritization
- IGMP snooping
 - Internet Group Management Protocol
 - Multicast group membership
 - Manages multicast traffic

Common managed switch features

- VLAN
 - Virtual Local Area Network
 - Segregates devices into groups connected to common switch
 - No traffic between groups
- RSTP
 - Rapid Spanning Tree Protocol
 - Prevents multiple network pathways from creating “loops”

Switch features and Dante

- QoS
 - No need in *most* Dante networks
 - Useful in mixed traffic networks
 - Useful in heavily loaded Dante networks (hundreds of channels each link)
- IGMP Snooping
 - No need in most Dante networks
 - Useful when a very large number of multicast channels
 - Useful when using 100Mbps endpoints

Switch features and Dante

- VLANs
 - Administrative tool only!
 - Useful only in coordination with IT managers
- RSTP
 - Very advanced feature for larger networks
 - Useful only with deep knowledge of networking
 - Useful only when absolutely necessary

Switch features recommendations

- Start with features disabled
- Do not change settings until there is a problem that the feature may help
- Resist temptation to over-configure!
- In most stand-alone Dante networks, features are not required
- Incorrect switch configurations are common cause of problems

Clocking

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How does Dante clocking work



- Dante handles clocking **automatically** via election
- IEEE1588 PTP
- All devices sync'd to Master
- Each device has a clock
- New Clock Master elected as needed

Clock Masters

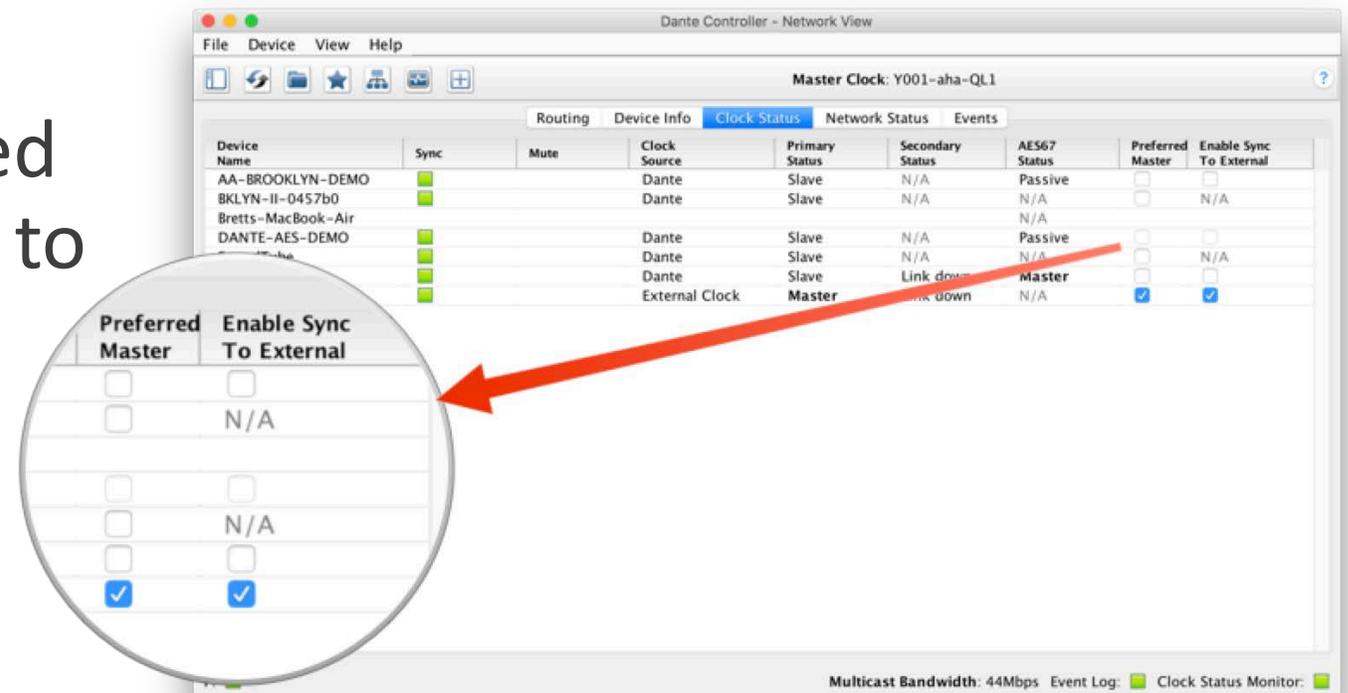
- Clock Master determined by election
- Rig Election with “Preferred Master” and “Enable Sync to External” settings
- Understanding the election process

	Preferred Master	Enable Sync To External
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	N/A
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	N/A
	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

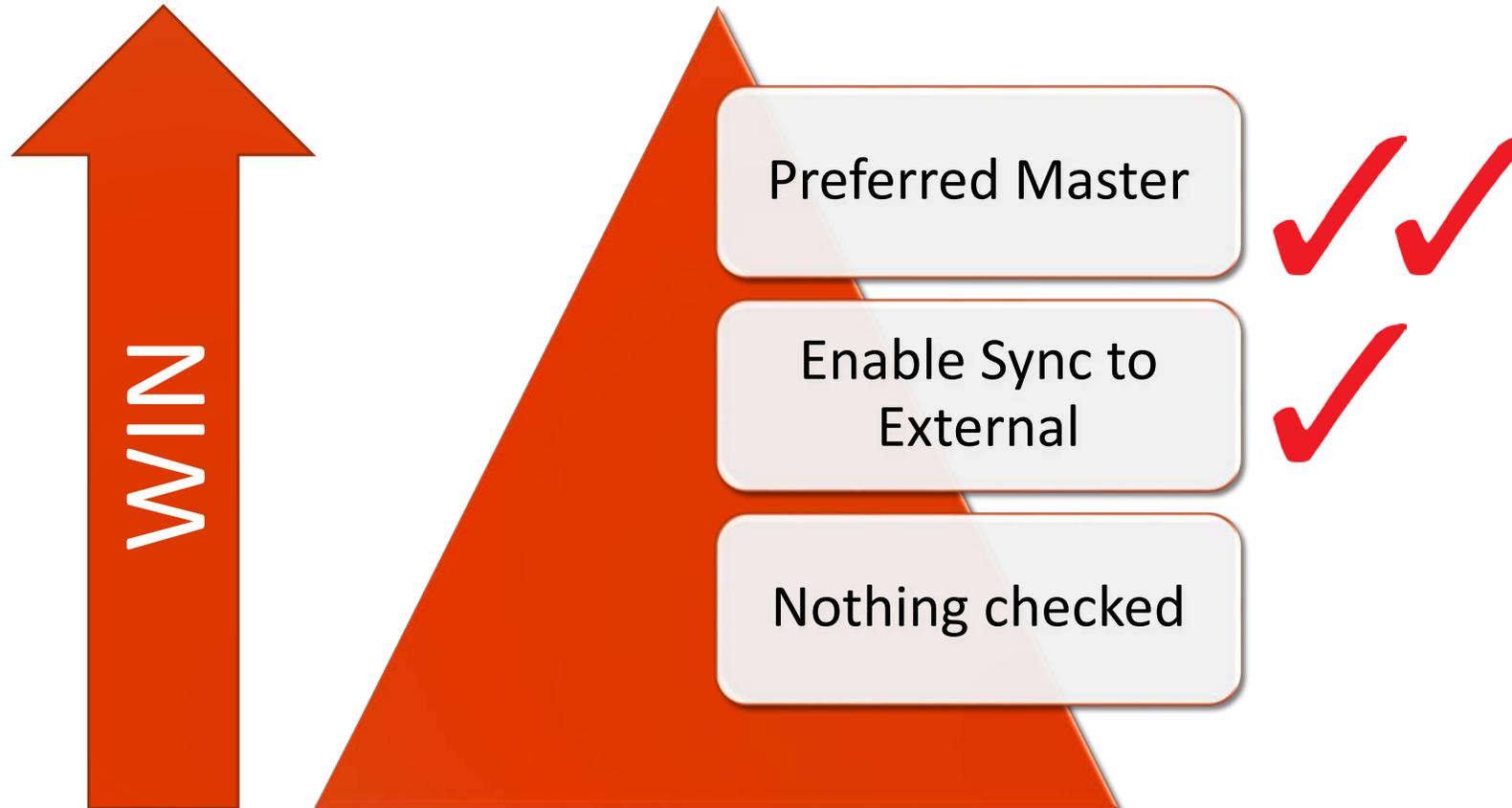


Adjusting clocks

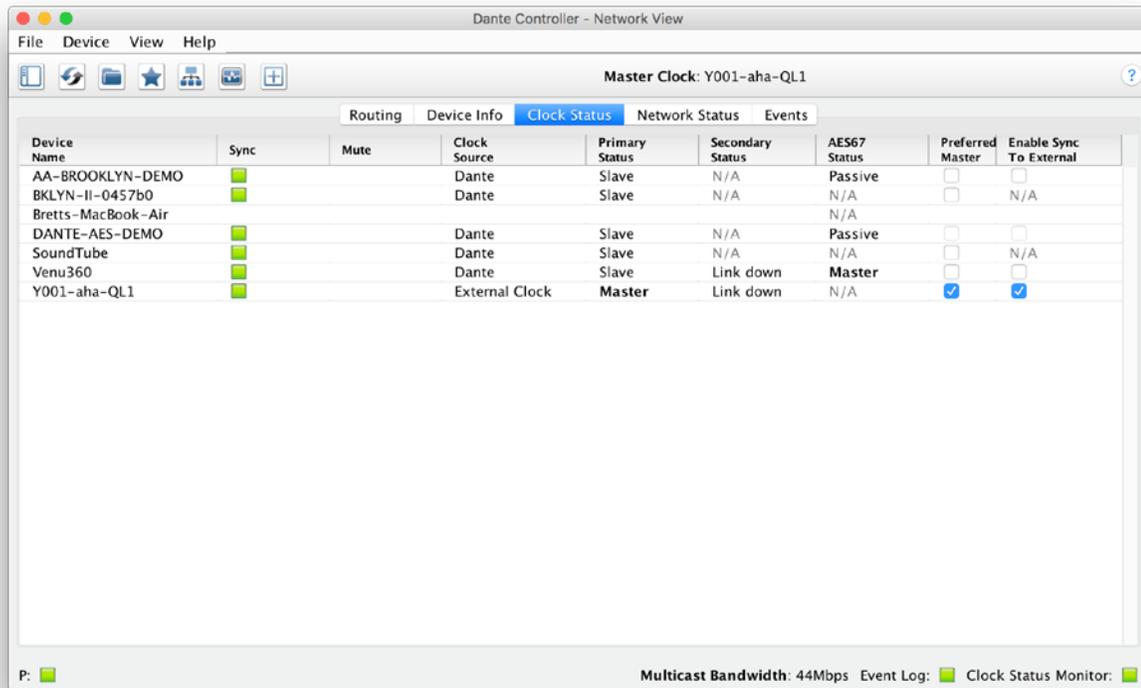
- Clock Status tab in Dante Controller
- Checkboxes for Preferred Master and Enable Sync to External



Clock Election



Preferred Master



The screenshot shows the Dante Controller interface with the 'Clock Status' tab selected. The table below represents the data shown in the interface.

Device Name	Sync	Mute	Clock Source	Primary Status	Secondary Status	AES67 Status	Preferred Master	Enable Sync To External
AA-BROOKLYN-DEMO	<input checked="" type="checkbox"/>		Dante	Slave	N/A	Passive	<input type="checkbox"/>	<input type="checkbox"/>
BKLYN-II-0457b0	<input checked="" type="checkbox"/>		Dante	Slave	N/A	N/A	<input type="checkbox"/>	N/A
Bretts-MacBook-Air						N/A		
DANTE-AES-DEMO	<input checked="" type="checkbox"/>		Dante	Slave	N/A	Passive	<input type="checkbox"/>	<input type="checkbox"/>
SoundTube	<input checked="" type="checkbox"/>		Dante	Slave	N/A	N/A	<input type="checkbox"/>	N/A
Venu360	<input checked="" type="checkbox"/>		Dante	Slave	Link down	Master	<input type="checkbox"/>	<input type="checkbox"/>
Y001-aha-QL1	<input checked="" type="checkbox"/>		External Clock	Master	Link down	N/A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

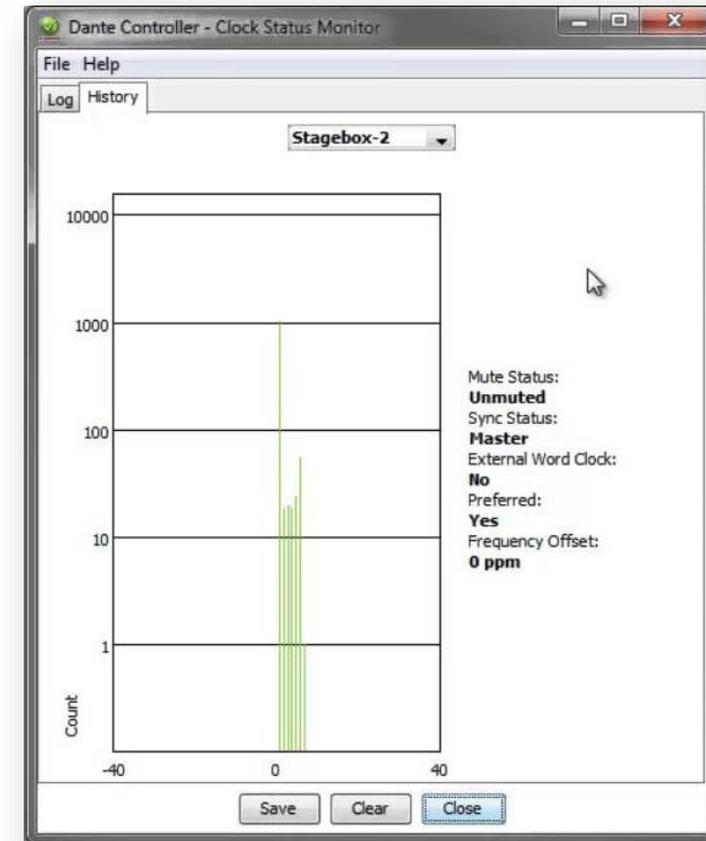
- Any hardware device can be made a “Preferred Master” clock
- Avoids issues with changes in Clock Master
- Choose device that is always present in system
- Don’t panic! Dante will always elect a Clock Master

External clock best practices

- If using an external clock, configure in both device and Dante Controller (Enable Sync to External)
- **Never** have more than one device using Enable Sync to External
- **Always** check Preferred Master on the device using Enable Sync to External
- Symptom: clicks and pops

Clock Status Monitoring

- Passive: always on
 - Clock Master changes only
- Active: select in toolbar to turn on
 - Looks for instability
 - Useful for troubleshooting external clocks
 - Accumulates data over time
 - Displays spread of clock frequency



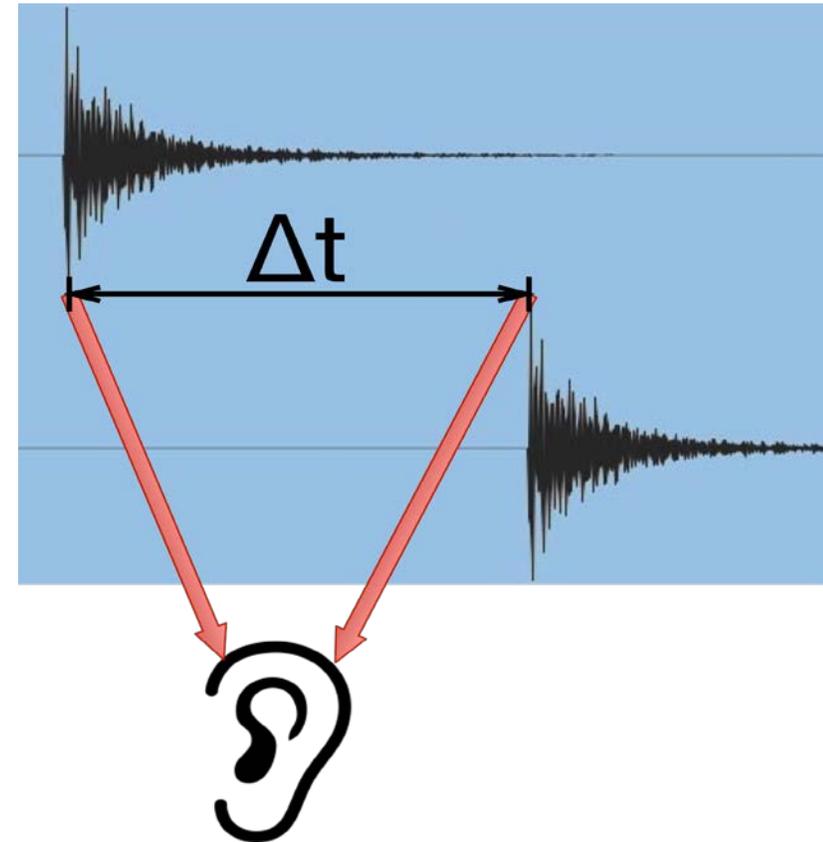
Latency

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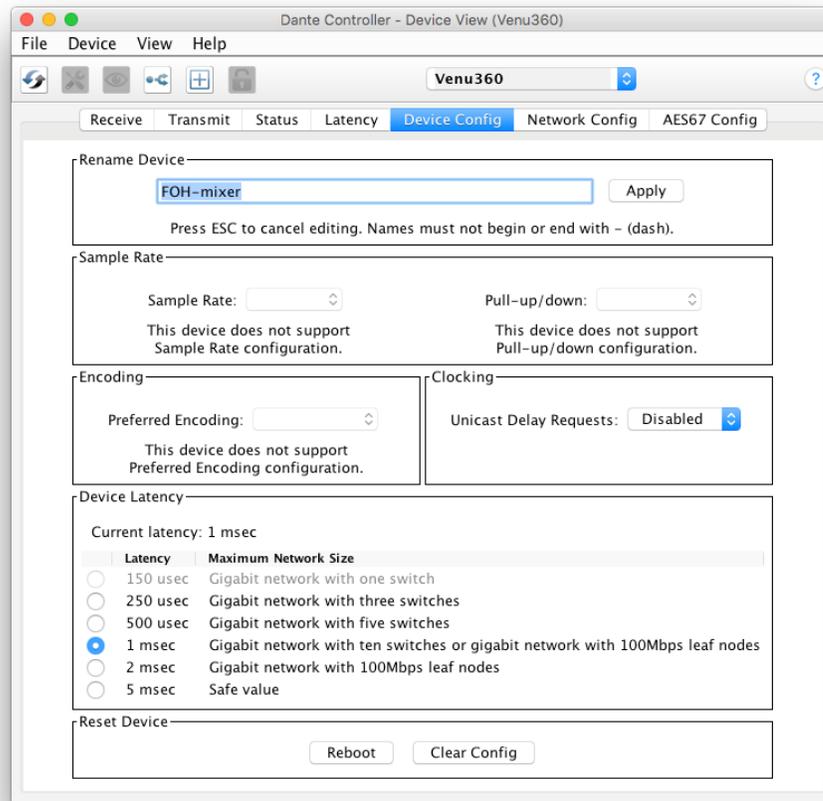
LEVEL 2

About latency – a refresher

- Audio signal delay in a system
- Transport and processing
- Mainly a problem when we hear delayed and un-delayed signal simultaneously
- Air travel 1ft \approx 1msec
- Problem for legacy networking systems (VoIP)



Setting and monitoring latency



- Double click any device in routing view to open the Device View
- Set latency in Device Config tab
- Monitor latency in Latency tab

Latency in Dante

- 100% deterministic – always well-defined
- Default Dante latency 1ms – suitable for large networks
- Adjustable to suit needs
 - Minimum 150µs
 - Maximum 5ms
- Set per Device

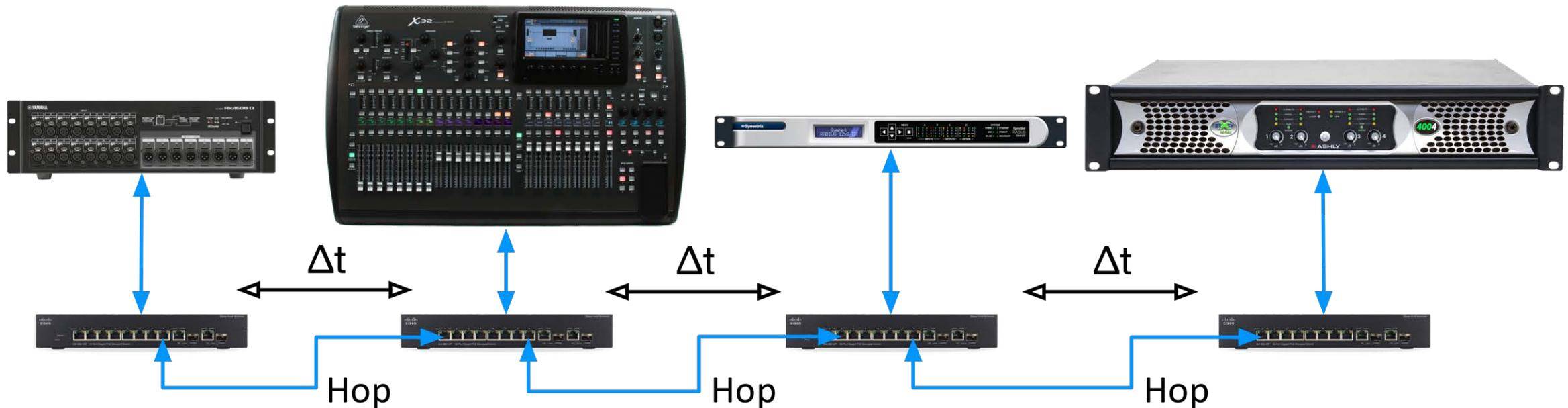
Device Latency

Current latency: 1 msec

	Latency	Maximum Network Size
<input type="radio"/>	150 usec	Gigabit network with one switch
<input type="radio"/>	250 usec	Gigabit network with three switches
<input type="radio"/>	500 usec	Gigabit network with five switches
<input checked="" type="radio"/>	1 msec	Gigabit network with ten switches or gigabit network with 100Mbps leaf nodes
<input type="radio"/>	2 msec	Gigabit network with 100Mbps leaf nodes
<input type="radio"/>	5 msec	Safe value

Switch hops and minimum latency

- Data passing from switch to switch is a “hop” with delay Δt
- Rarely an issue with gigabit switches!



Latency - lower bounds

- If only 1 switch hop, Dante latency can be set to 150µs
- 3 switch hops, 250µs
- 10 switch hops, 1ms (Dante default)
- Simple rule: Dante latency settings must be **larger** than network latency

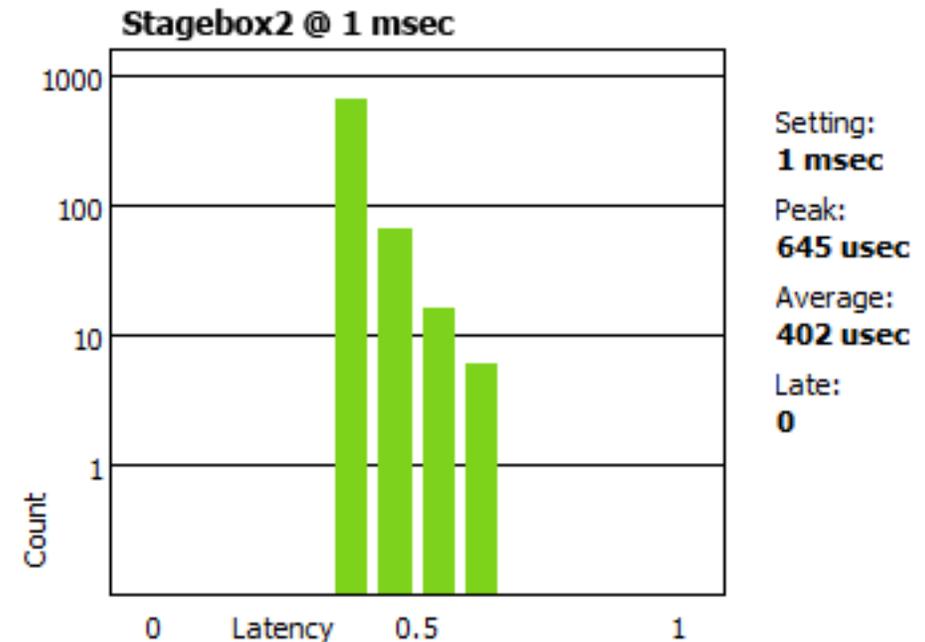
Device Latency

Current latency: 1 msec

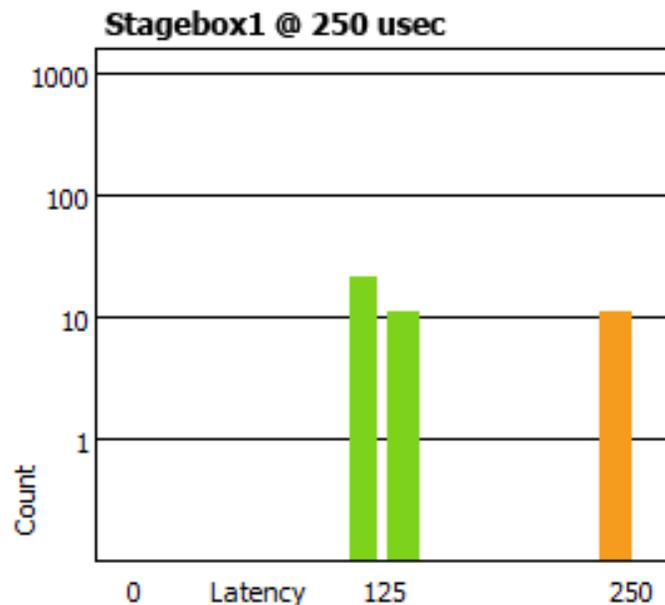
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<input checked="" type="radio"/>	1 msec	Gigabit network with ten switches or gigabit network
<input type="radio"/>	2 msec	Gigabit network with 100Mbps leaf nodes
<input type="radio"/>	5 msec	Safe value

Monitoring latency – good example

- Visualize latency in Latency Tab of Device View
- Example:
 - 3 switch hops
 - 1ms latency setting
- All packets safely inside window



Monitoring latency – bad example



- Example:
 - 250 μ s latency setting
 - Some packets are dangerously close to the edge of the window
- Solutions:
 - Increase latency
 - Improve network performance (QoS, etc.)
 - Replace faulty equipment

Flows and Multicast

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Unicast and Multicast

UNICAST

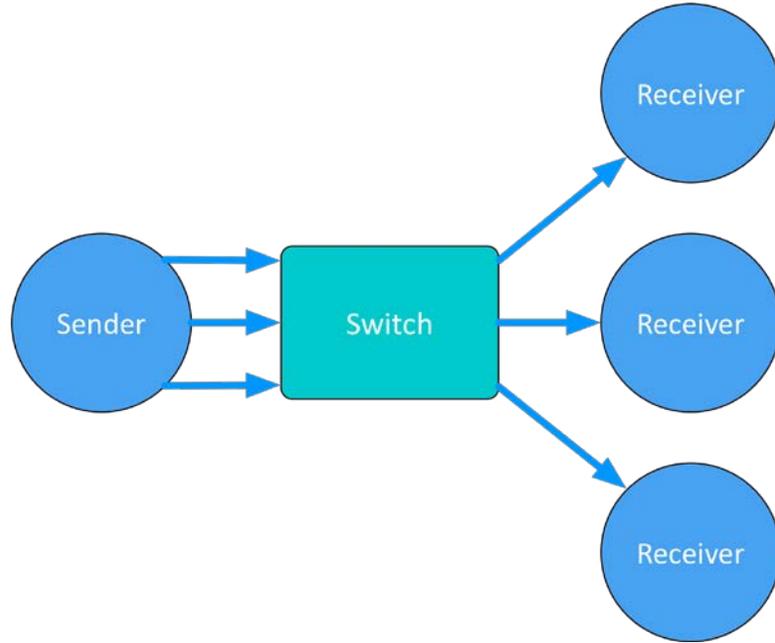
- One to one traffic
- “Private conversation” – data sent uniquely from transmitter to each receiver
- Data duplicated for each receiver

MULTICAST

- One to many traffic
- “Public announcement” – messages sent to everybody on the network
- Data sent at once to all receivers

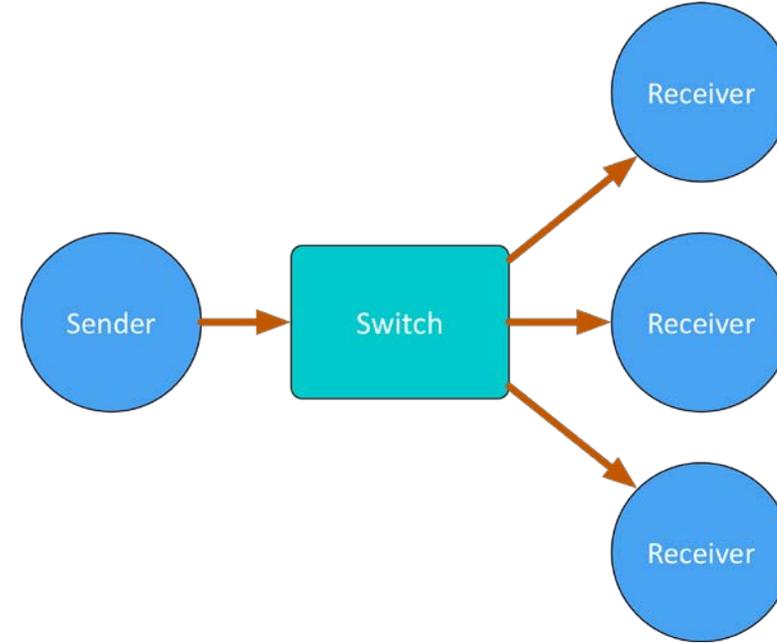
Unicast and Multicast

UNICAST



1 data stream per receiver

MULTICAST



1 data stream for all receivers

Differences: Broadcast and Multicast

- If unmanaged, both send data to all members of a LAN
- Multicast traffic can be organized to send data only to requesters (receivers)
- Organization of receiving groups is done with managed switch
- IGMP Snooping – traffic only goes to requesters

Do I **need** to control multicast?

- On gigabit networks, multicast traffic is **unlikely** to be a problem
- Consider: 64 channels of multicast (that's a lot) is **less than** 100mbits/sec of traffic
- Use multicast selectively
- Improper IGMP setup worse than none at all!

Dante and Unicast Flows

- Default audio transport is **unicast**
- One-to-one traffic
- More receivers -> more traffic
- Each unique receiver gets its **own** flow(s)
- Most devices have 32 flows available

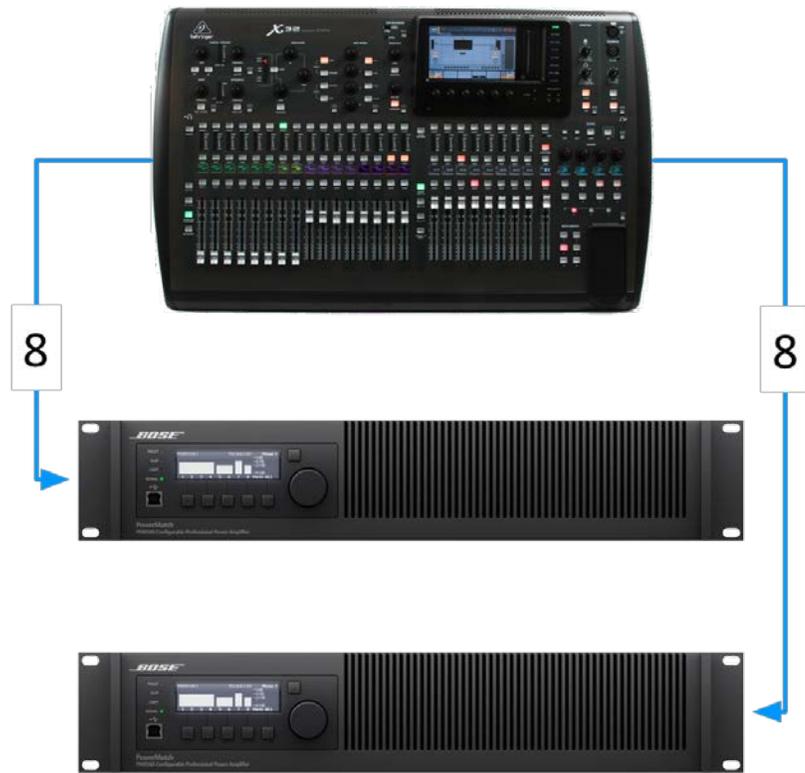


8

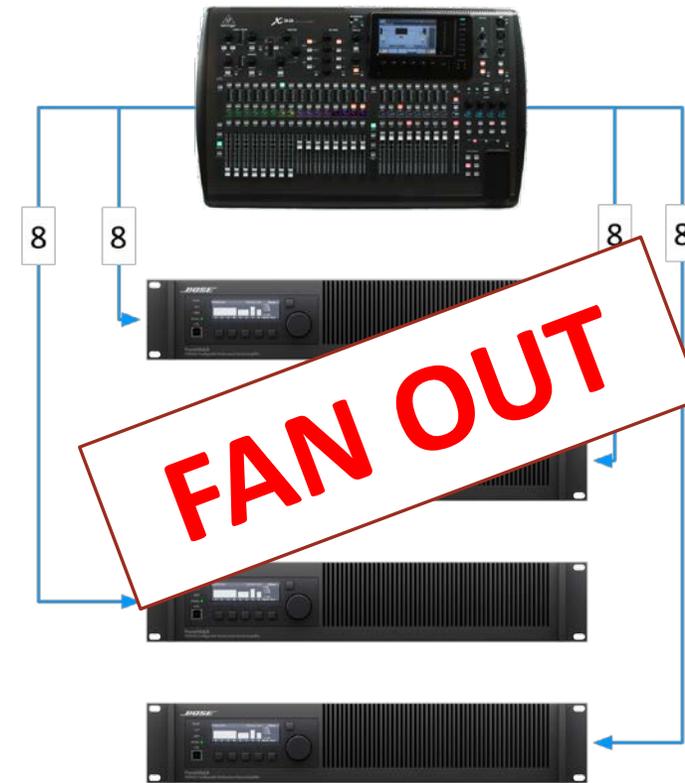
8 channels -> 2 flows



Dante and Unicast Flows

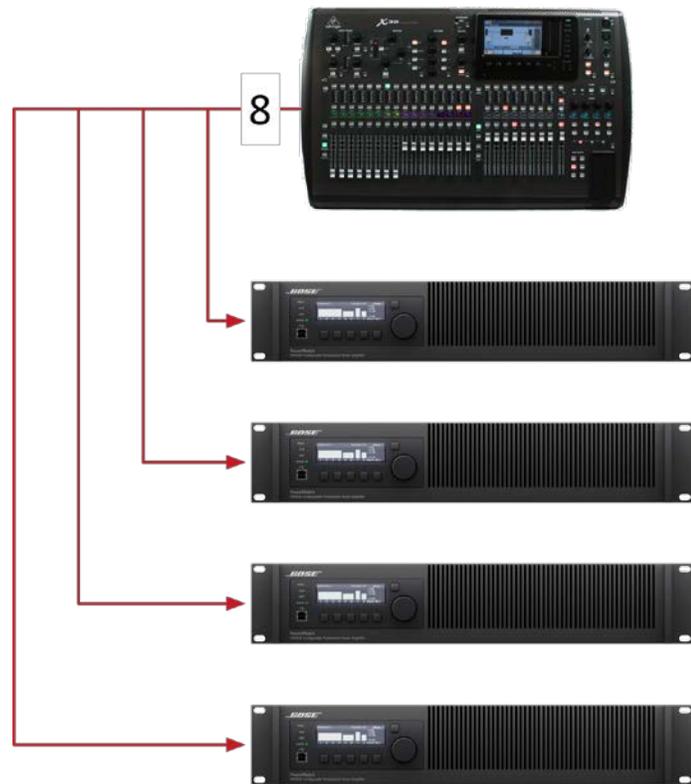


8 channels each -> 2 flows each -> 4 flows



8 channels each -> 2 flows each -> 16 flows

Dante and Multicast Flows

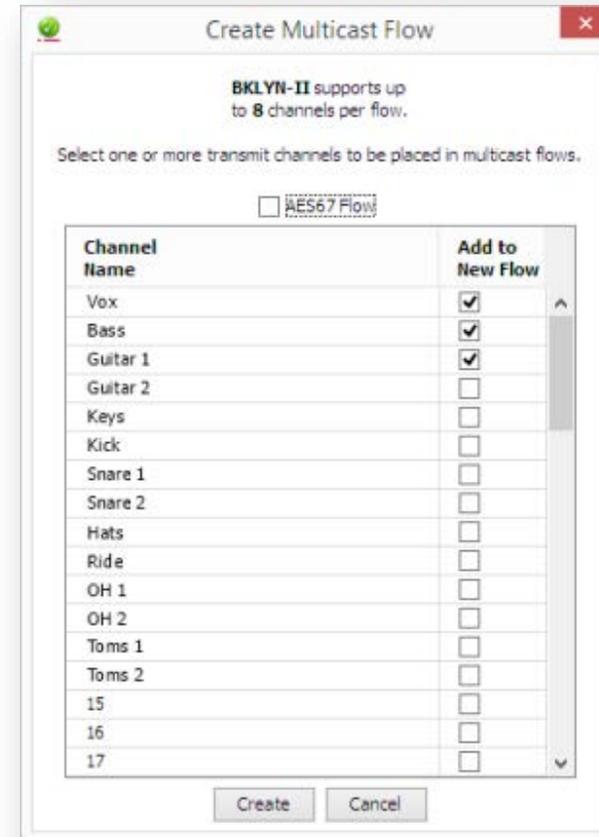


8 channels -> 1 multicast flow

- Multicast solves “fan out” condition
- Up to 8 audio channels in 1 multicast flow
- Configured in Dante Controller

Configuring multicast flows

- Open Device View
- Click “Create Multicast Flow” button in toolbar 
- Choose up to 8 channels for a single multicast flow
- You may create more multicast flows if needed



Summary

- Dante uses unicast by default
- Dante audio is packaged into multi-channel flows
- Number of flows is limited (typical 32)
- Each receiver requires at least 1 flow
- Multicast sends data to all devices
- Multicast is useful for conserving flows in one-to-many situations
- Explicit management of multicast often not necessary

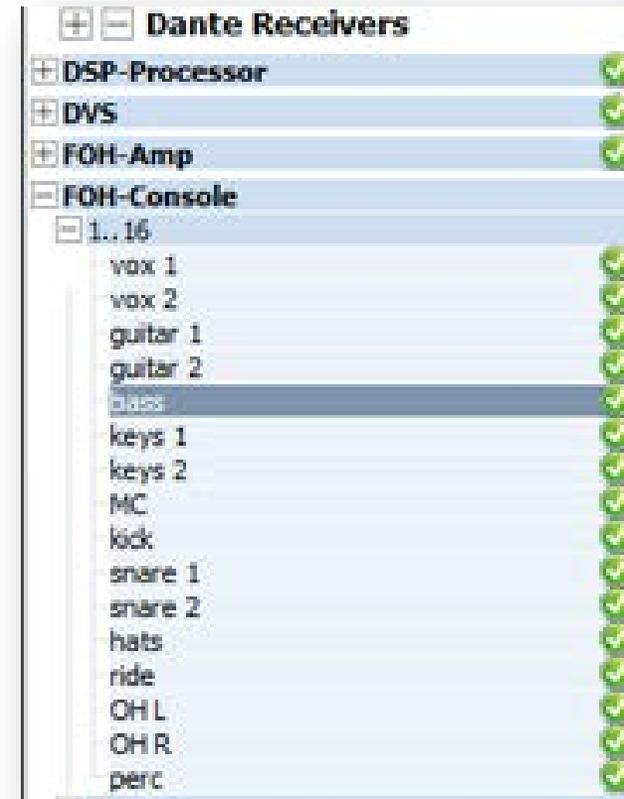
Naming Devices

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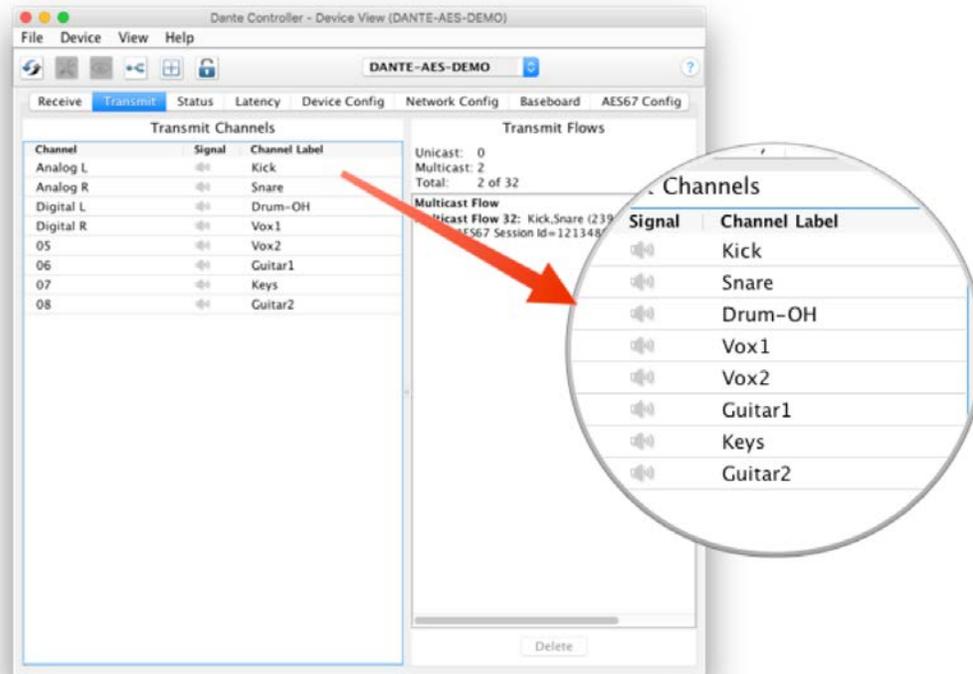
LEVEL 2

Naming Dante Devices

- All Dante devices have editable names
- Name devices to make system easy to understand
- Channel labels help in busy environments
- Name first, then route



Channel labels



- Use Device View
- Labels can be applied to any channels
- Makes it easy for volunteers or newbies to use system
- Software version of masking tape 😊

Creating backup devices using names

- Dante uses names to create subscriptions
- Use this to create backup devices for critical gear
- Name primary and backup devices identically
 - When the primary device fails, connect backup device to network
 - Subscriptions are automatically re-established using names
 - Channel labels have no effect

Device Lock

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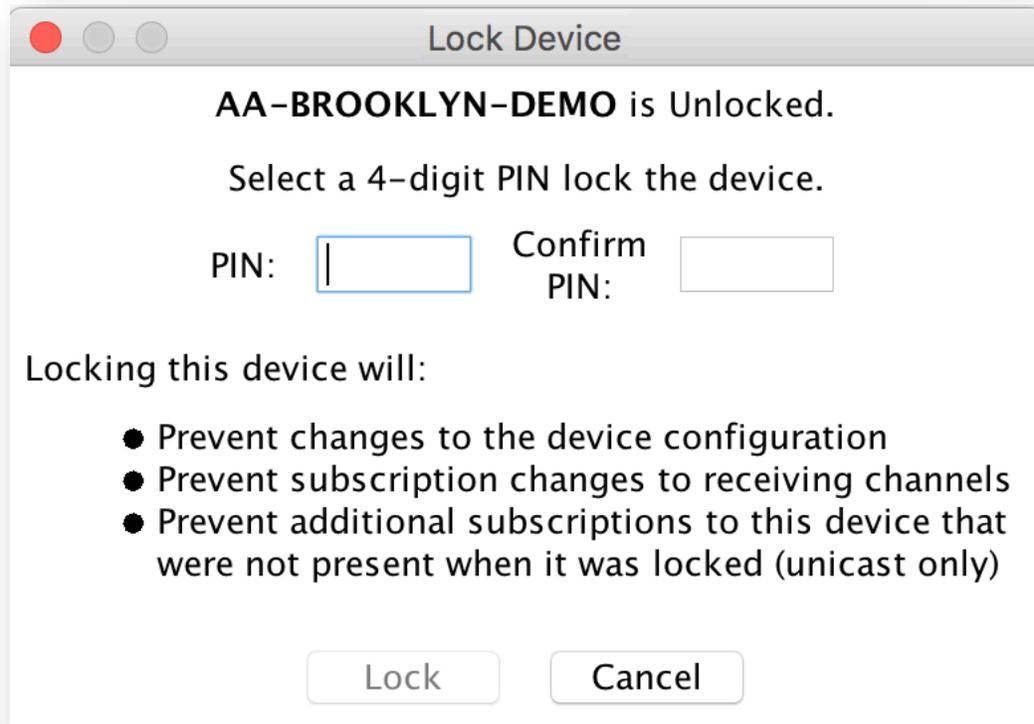
LEVEL 2

What is Device Lock?

- Prevents tampering with Dante routes and settings
- Requires Dante Controller 3.10 and firmware update for hardware
- Supported in Dante Virtual Soundcard and Dante Via
- Only affects devices as seen through network interface
 - Changes from inside products are not locked



Enabling Device Lock



The screenshot shows a 'Lock Device' dialog box with the following content:

AA-BROOKLYN-DEMO is Unlocked.

Select a 4-digit PIN lock the device.

PIN: Confirm PIN:

Locking this device will:

- Prevent changes to the device configuration
- Prevent subscription changes to receiving channels
- Prevent additional subscriptions to this device that were not present when it was locked (unicast only)

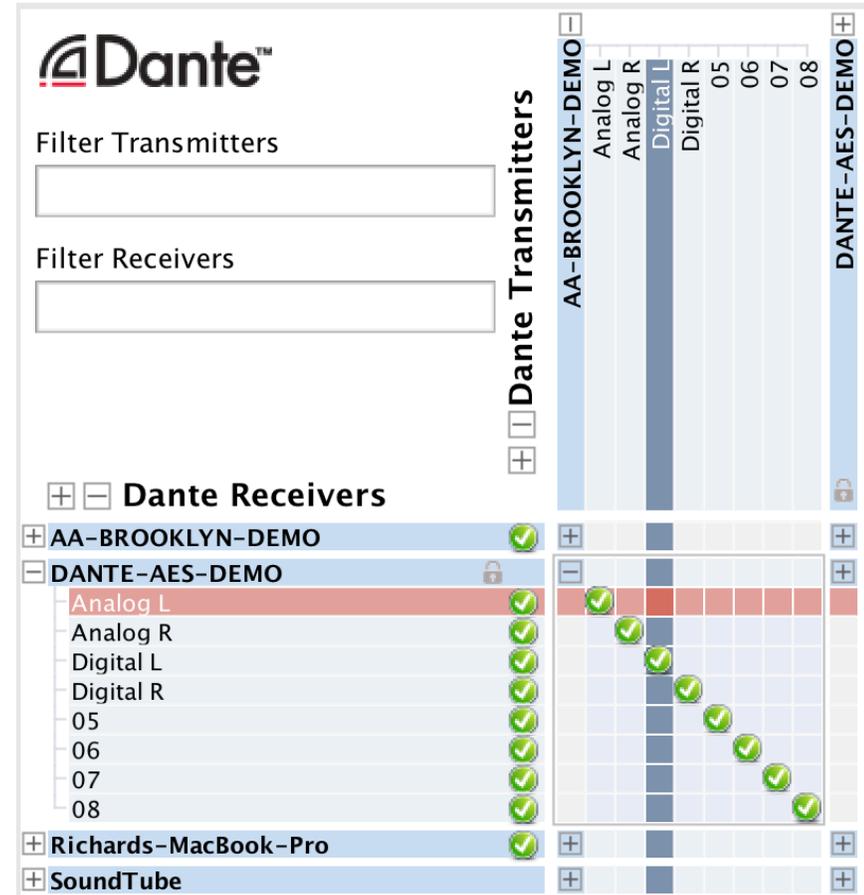
Buttons: Lock, Cancel

- Check to see which devices support locking
- Click Lock button in Device View or check Device lock checkbox in Device Info
- Select PIN in dialog box
- Done

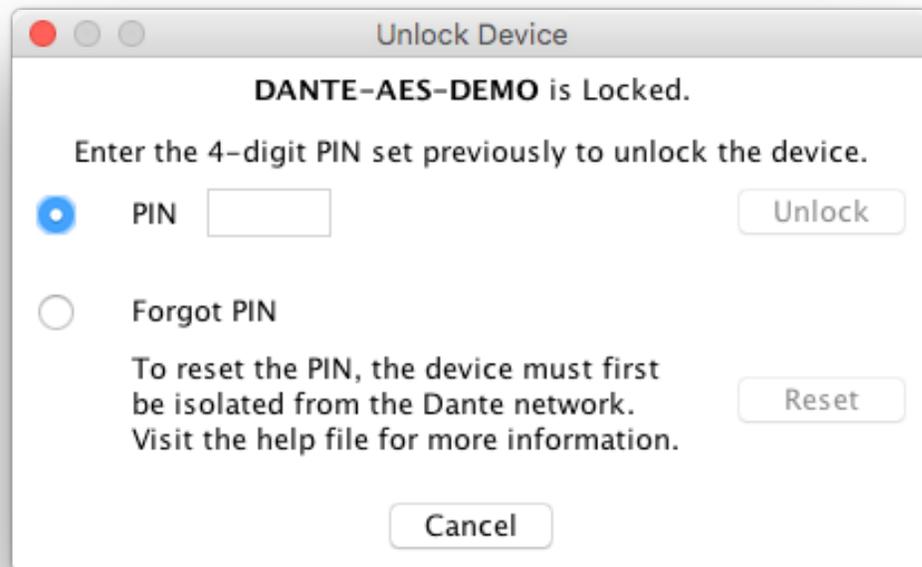


Working with Device Lock

- Locked devices have a lock icon in the name bar
- When a locked channel is selected, highlight is red
- Attempts to change routes result in no action



Unlocking a device



- Open Device View
- Click “Lock” button
- Enter PIN in dialog box
- Unlock device
- Old PIN is forgotten
- Yes, there is a recovery scheme!



Device Lock in mixed environments

- Best when both Transmitter and Receiver support feature
 - Lock both for maximum security
- A Locked Receiver prevents changes to its subscriptions
- A Locked Transmitter can prevent transmitting to other devices only
- Lockable and unlockable devices can be mixed

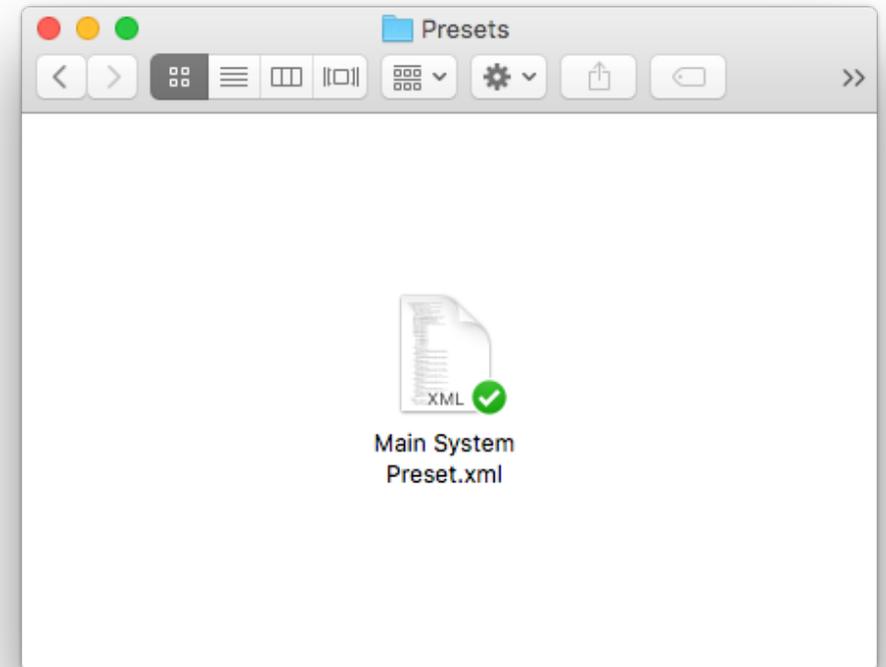
Presets

DANTE CERTIFICATION PROGRAM

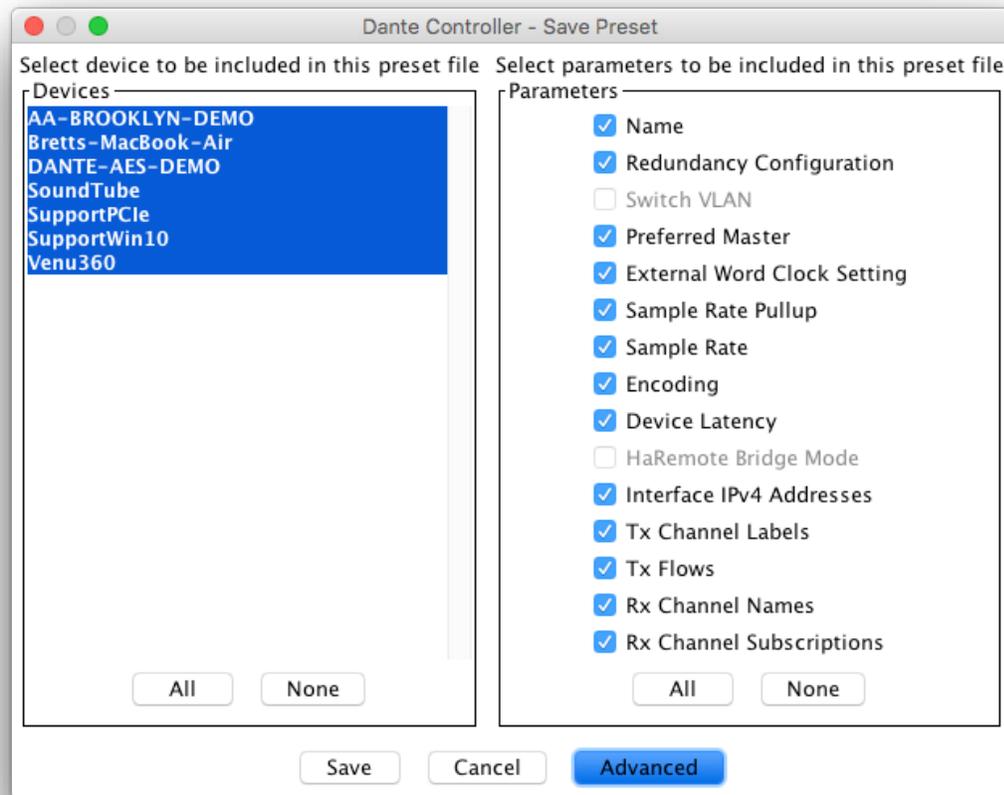
LEVEL 2

Dante Presets

- Dante network configuration can be saved in a local file
- Preset may include device names and roles
- Quickly reconfigure a Dante system to a known state



Capturing a preset



- Click the ‘Save Preset’ button in the main toolbar 
- Select devices that you wish to include in the preset
- Select parameters to save
- Save the file in any local folder on your computer

Deploying a preset

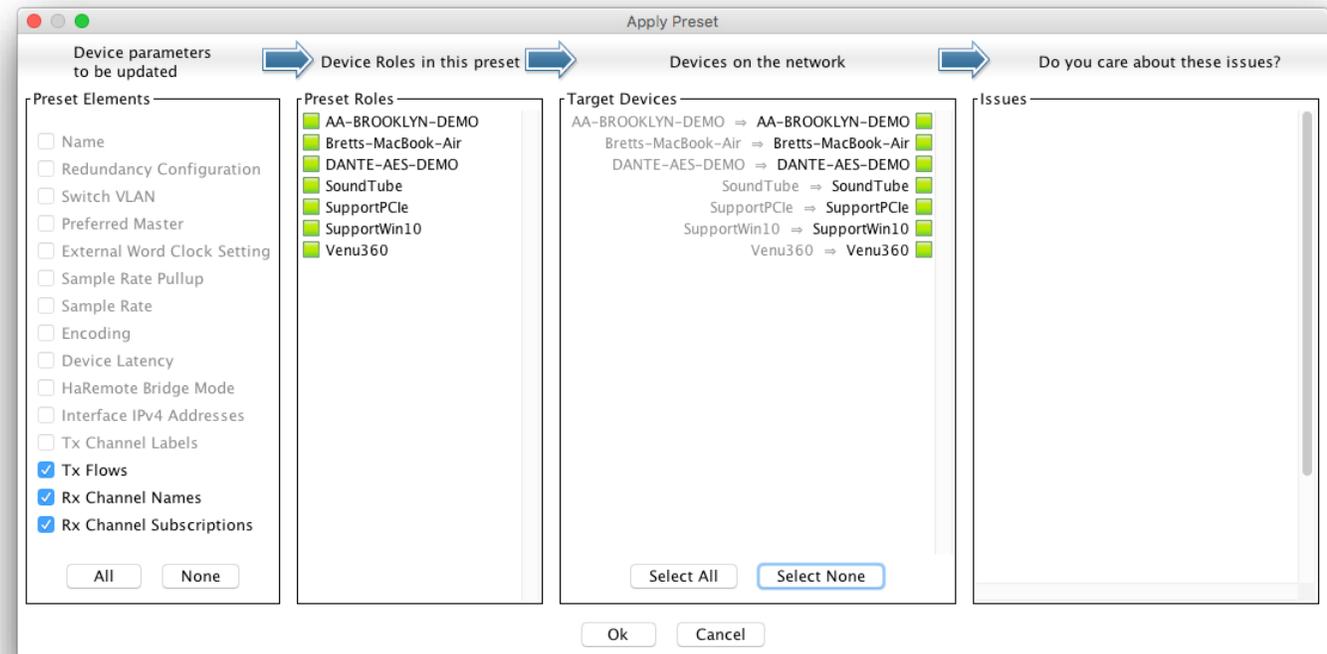
- Choose “Load preset”



- Select preset file

- Check elements to apply (names, sample rates, etc.)

- Apply



Redundancy

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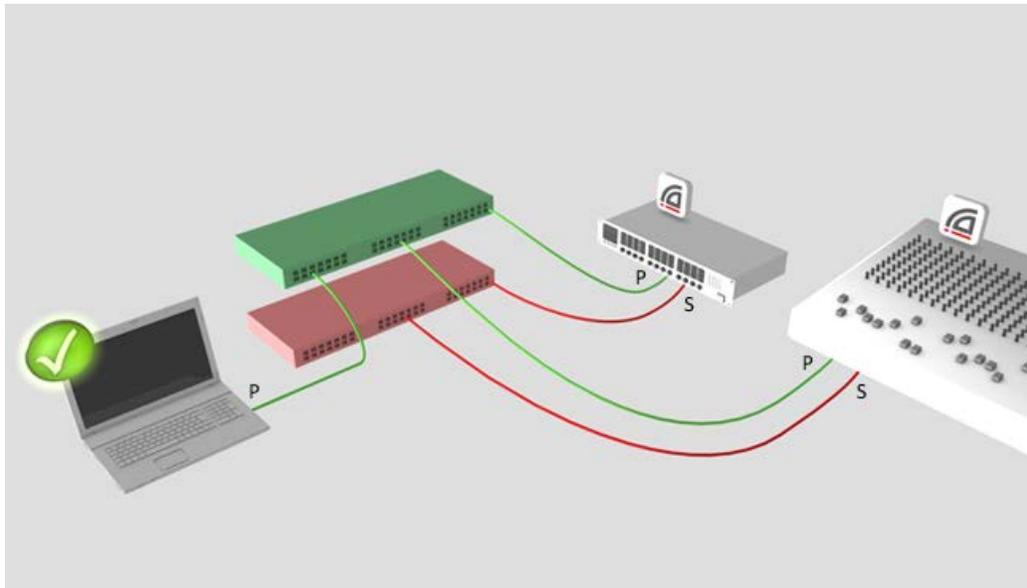
LEVEL 2

What is Dante Redundancy?

- Create two physically independent networks using Primary and Secondary Dante ports
- If either network fails, other is used without interruption
- No clicks or pops
- Completely automatic setup
- For mission critical systems

**DEPARTMENT OF
REDUNDANCY
DEPARTMENT**

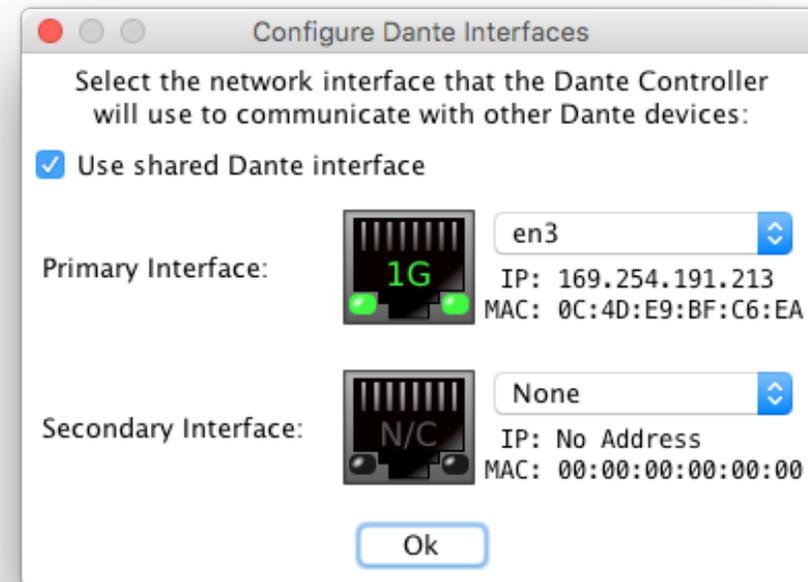
Setting up redundancy



- Setup Primary network **first**
- Separate set of cables & switches connected to Secondary ports
- **No other interaction required**
- OK if not all devices supported

Redundancy and Dante Controller

- Dante Controller can be connected to both Primary and Secondary interfaces
- Control is passed from one network to the other
- If Primary fails, Dante Controller can be connected to Secondary



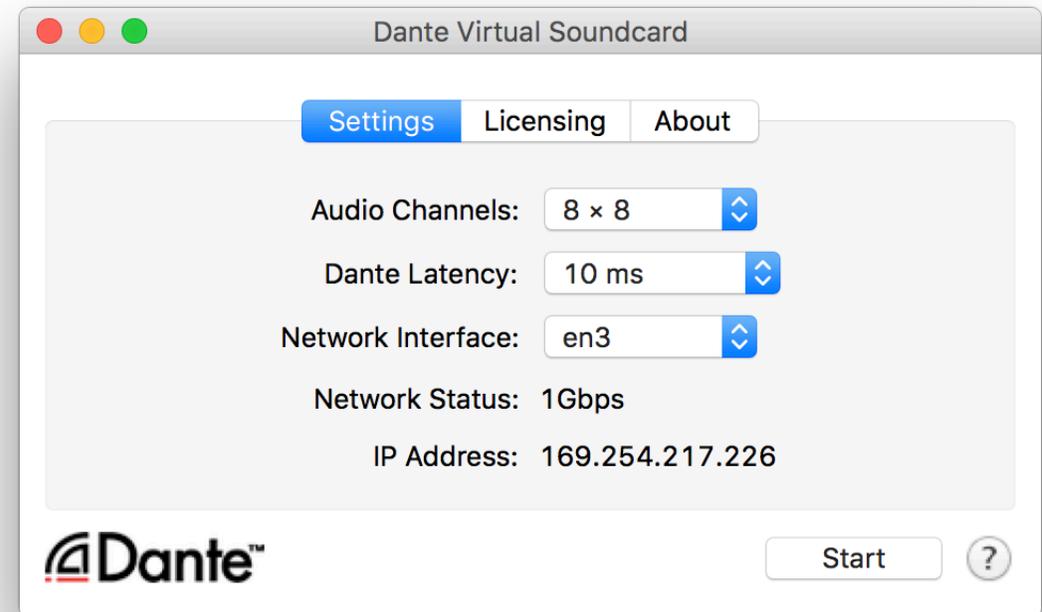
Dante Virtual Soundcard

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LEVEL 2

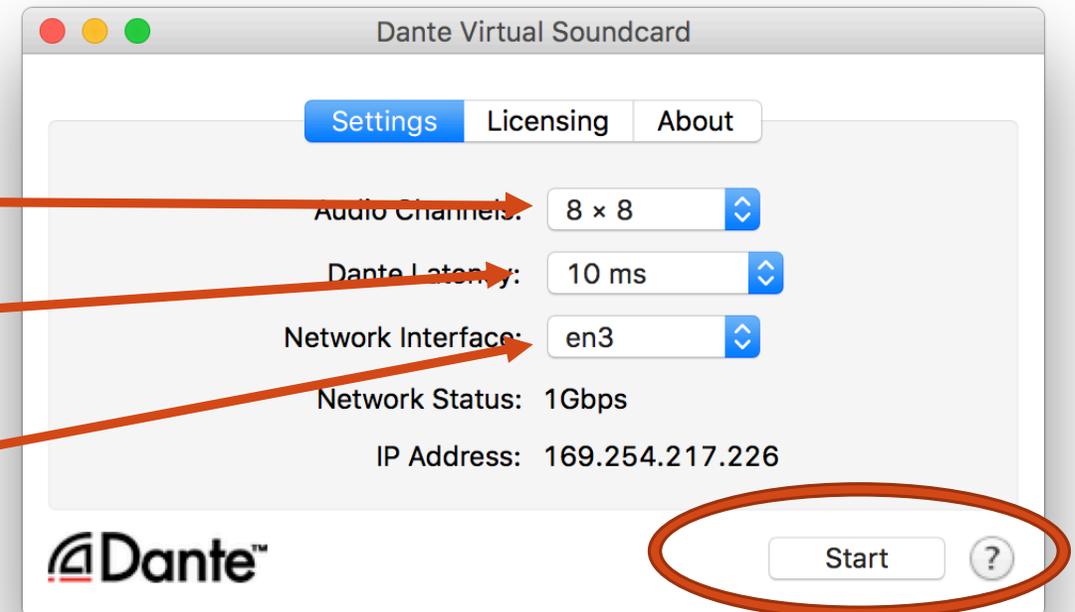
What is Dante Virtual Soundcard?

- Software for Mac or PC
- Behaves like hardware soundcard
- Connects to Dante network
- Record and playout up to 64 channels with your favorite DAW software

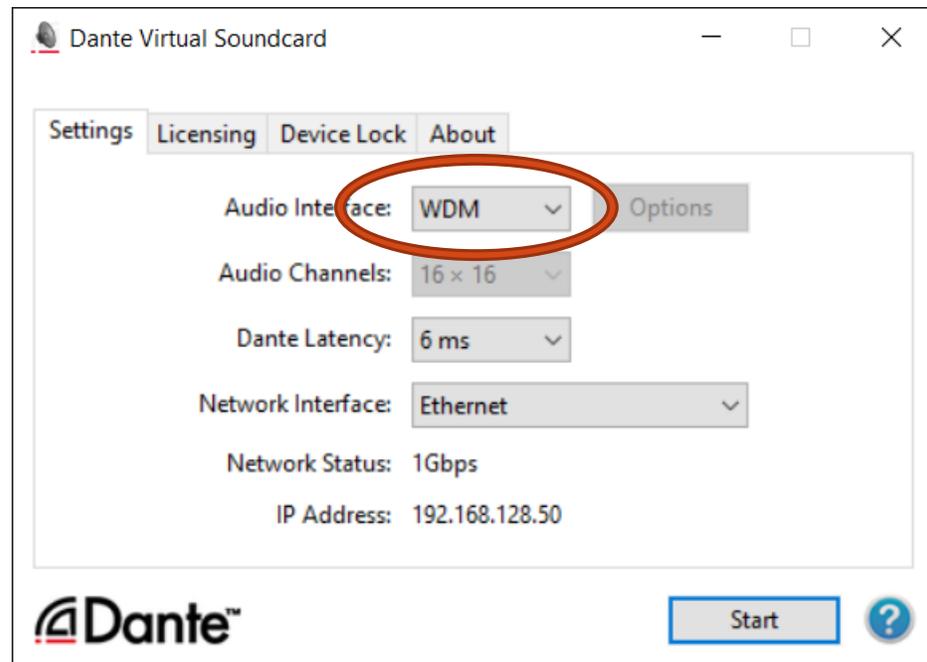


Setting up Dante Virtual Soundcard

- Start or Stop the service
 - Must be stopped to adjust
- Audio channels 2x2 – 64x64
- Latency – 4ms – 10ms
- Choose network interface



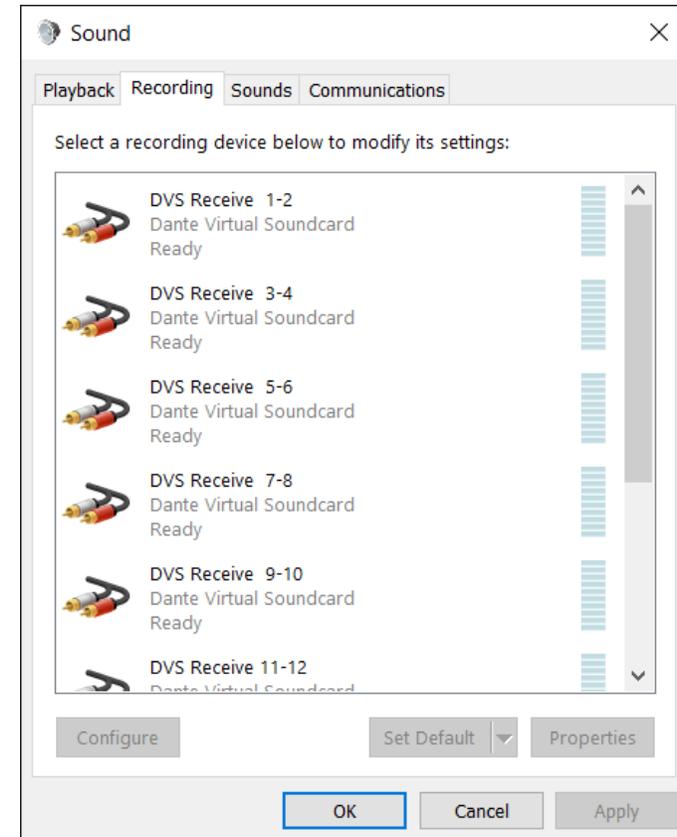
Dante Virtual Soundcard in Windows



- Choice of WDM or ASIO drivers
- ASIO common in professional audio applications
- WDM common in consumer audio products

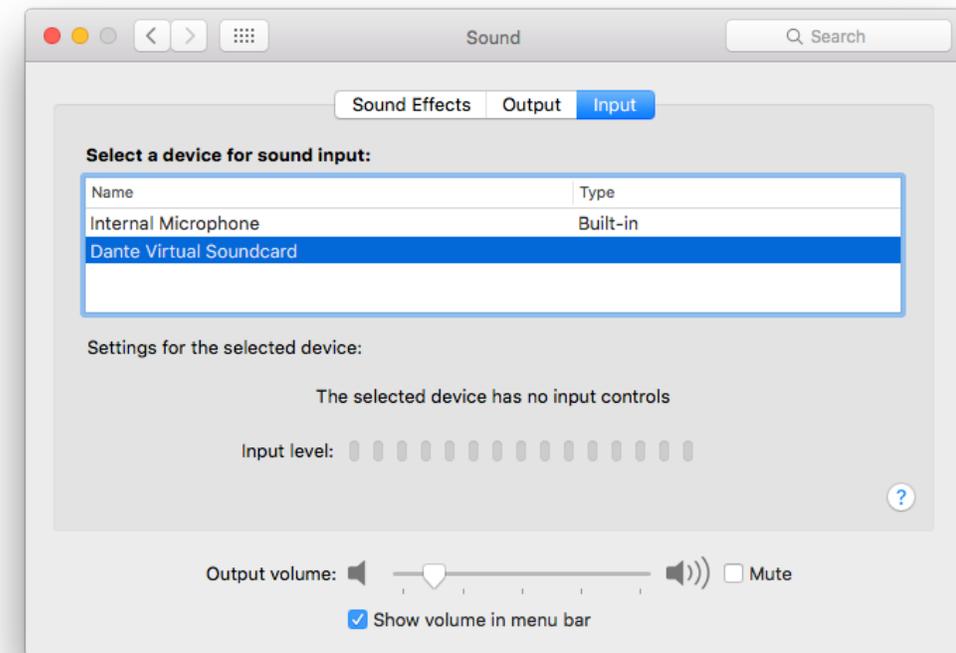
Dante Virtual Soundcard in Windows

- WDM drivers 16x16 channels only
- WDM channels presented by Windows as stereo stems
- Each stem appears as a stereo “device” in Windows Sound settings

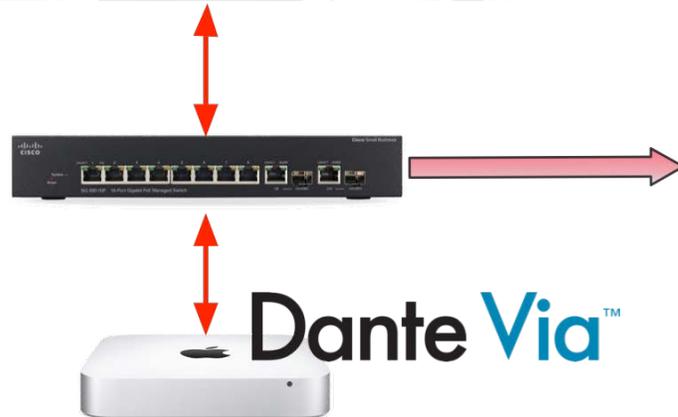


Dante Virtual Soundcard in OSX

- On OS X, Dante Virtual Soundcard appears as a regular Core Audio device
- Works with both pro and consumer applications
- Can be made default sound device



Clocking Dante Virtual Soundcard

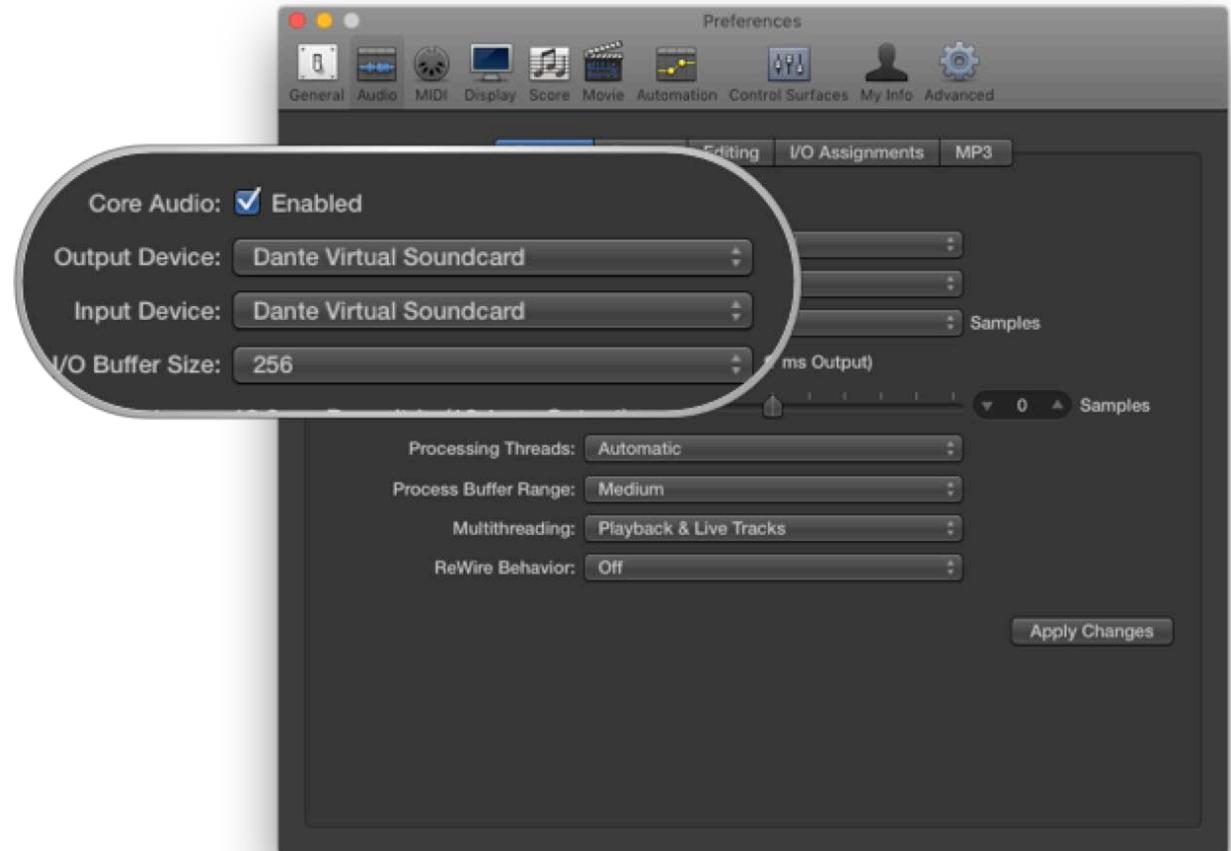


- Dante Virtual Soundcard does *not* contain a clock
- Computer **must** be connected to a network with Dante-enabled hardware **or** another computer running Dante Via

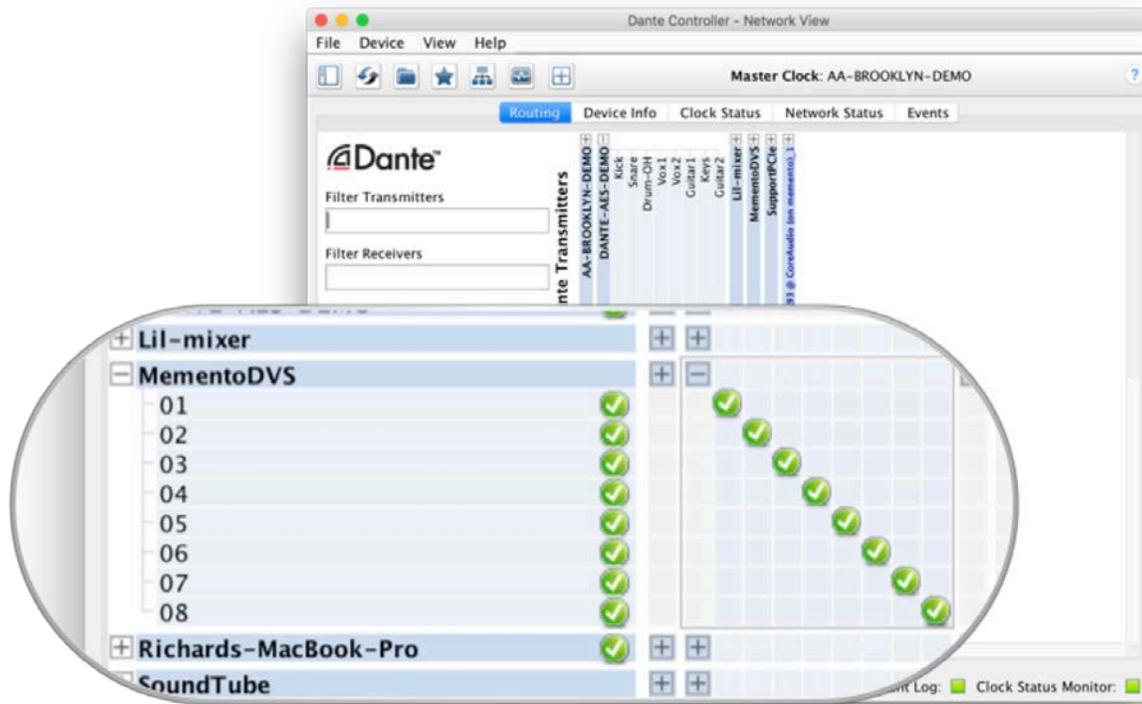


Connecting to a DAW

- Start DVS
- DVS will appear as audio device on computer
 - Mac – Core Audio
 - Win – ASIO or WDM
- Select as device in DAW preferences



Subscribing channels



- Open Dante Controller
- Computer appears as Dante device
- Subscribe channels to Dante devices on network
- Record/Playout
- Adjust sample rate in Dante Controller like other devices

Dante Via

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LEVEL 2

What is Dante Via?

- Software for Mac or PC
- Connect **any** connected audio device to Dante network
- Connect **any** audio application to Dante network
- Drag and drop to create novel audio routes on computer

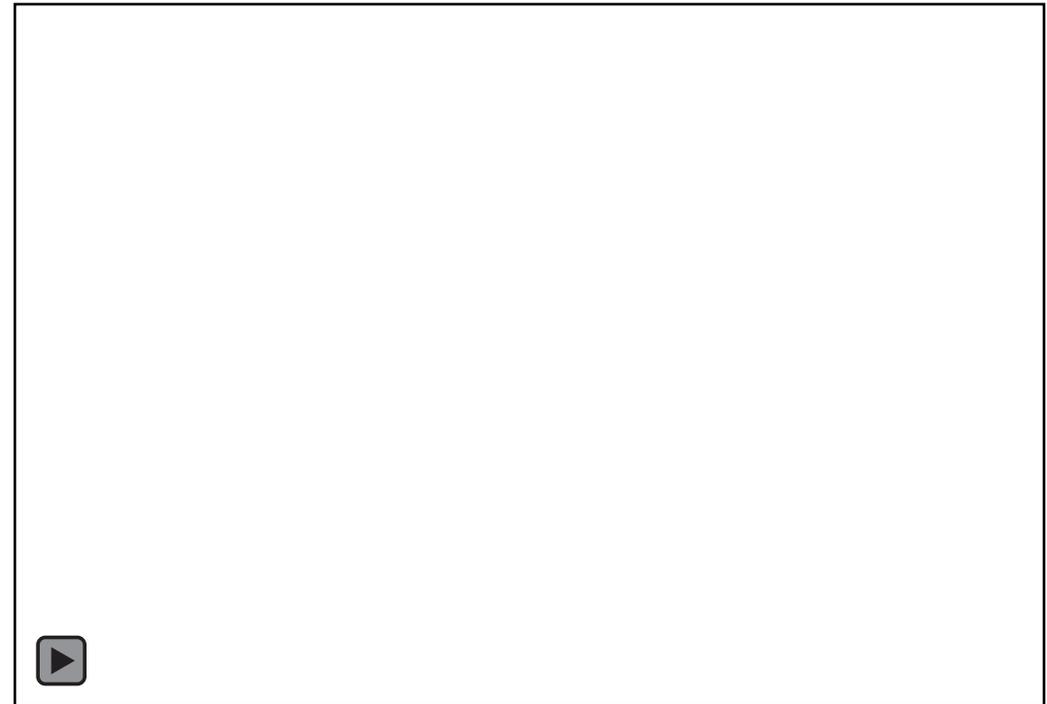
Dante Via[™]

About Dante Via

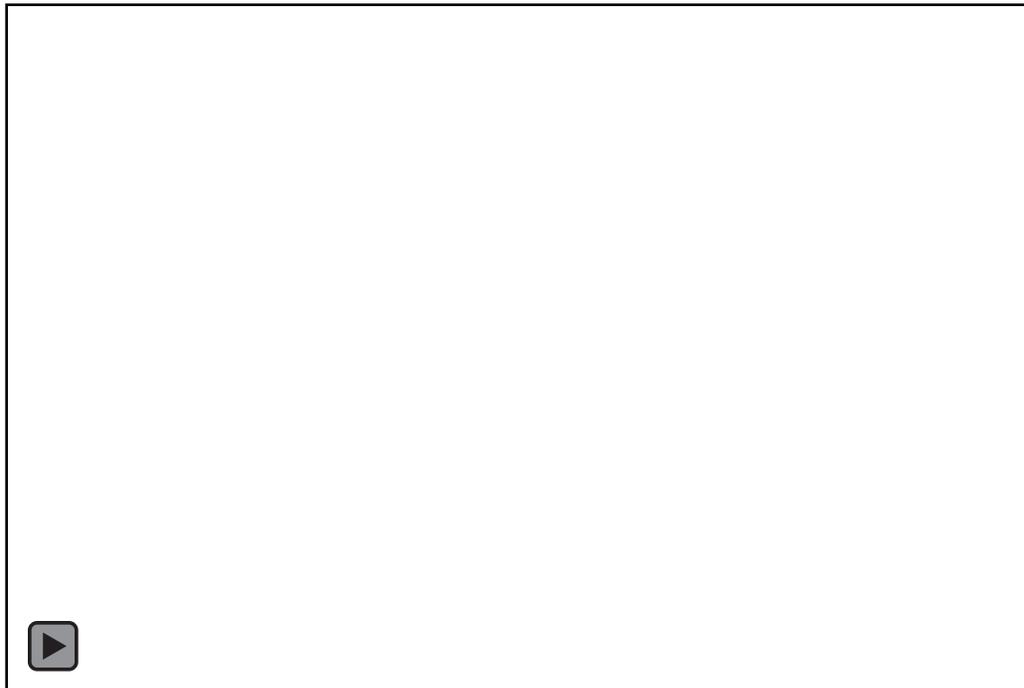
- Share some technology with Dante Virtual Soundcard
- Dante Controller and Dante Virtual Soundcard cannot run on the **same** computer at the **same** time!
 - They will prevent each other from running simultaneously.
- Dante Via provides its own clock – no hardware devices required!
 - Allows creation of “Dante Via only” networks, 100% software-based

Dante Via: Extending USB I/O

- Connect USB I/O
- Launch Dante Via
 - USB I/O discovered
- Check “Enable Dante”
- On second computer running Dante Via, USB I/O appears
 - Also in Dante Controller
- Drag USB I/O to destination in Dante Via



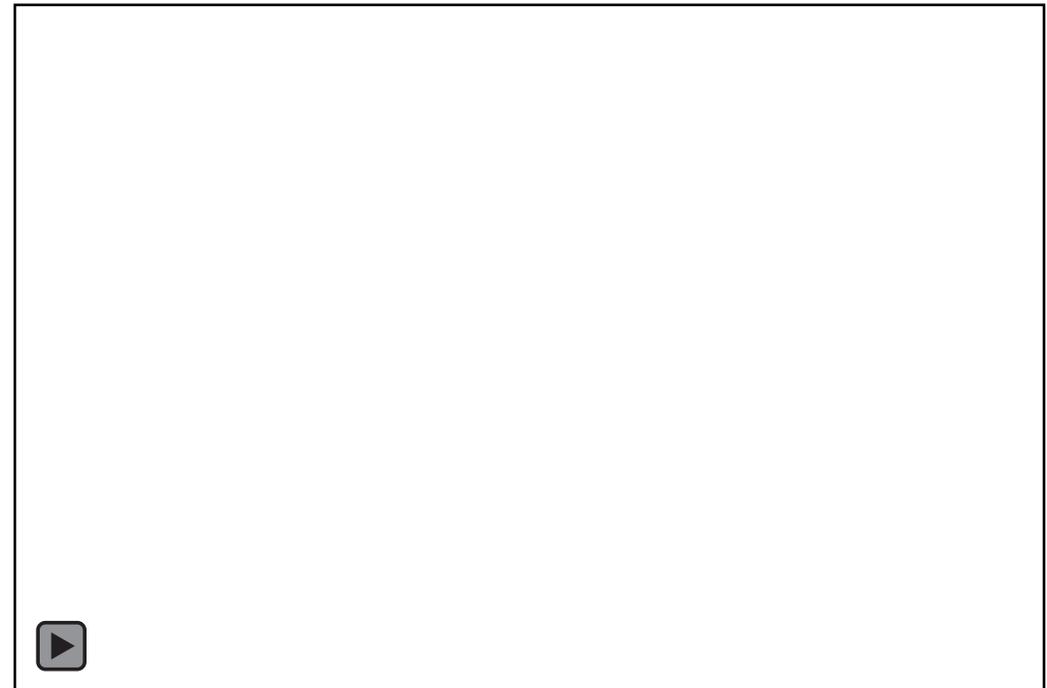
Dante Via: Audio application on Dante



- Start audio application, such as iTunes
- iTunes is auto-discovered
- Select “Enable Dante” for iTunes
- iTunes appears as labeled channels in Dante Controller

Dante Via: Monitoring channels

- “Enable Dante” for your headphone jack (built-in output)
- Headphone jack appears in Dante Controller
- Route any Dante channels directly to headphones without disturbing audio



AES67

DANTE CERTIFICATION PROGRAM

LEVEL 2

What is AES67?

- Standard that defines means of basic audio connectivity between different audio networks
- *Not intended to be a stand-alone solution.* Does not specify:
 - Consistent means of discovery
 - Control of devices
 - Redundancy
- A “tie line” between disparate networks



AES67 in Dante

- 3rd party AES67 devices must support discovery via SAP
- Only **transmitter** channels of AES67 devices are shown
- Receivers are configured in manufacturer's software
- Multicast transmission **only**, up to 8 channels per stream
- 48kHz/24-bit **only**
- 1ms packet time **only**
- Manual entry of channel stream address prefixes **required**

AES67 in Dante Controller

AES67 Mode

Current: Enabled

New: 

Tx Multicast Address Prefix

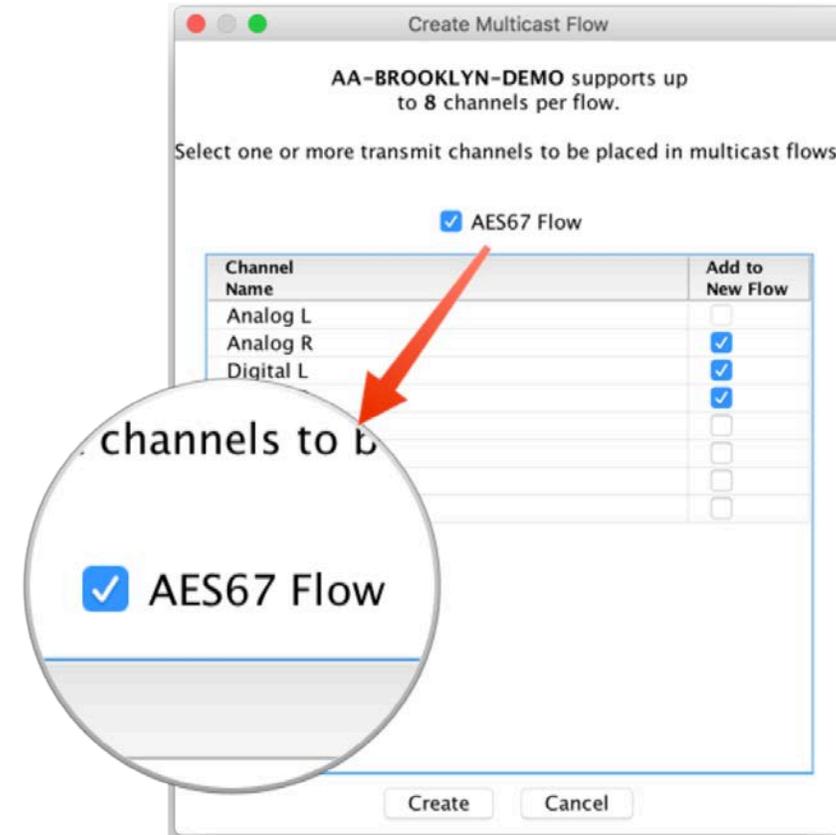
Current Prefix: 239.68.XXX.XXX

New Address Prefix:

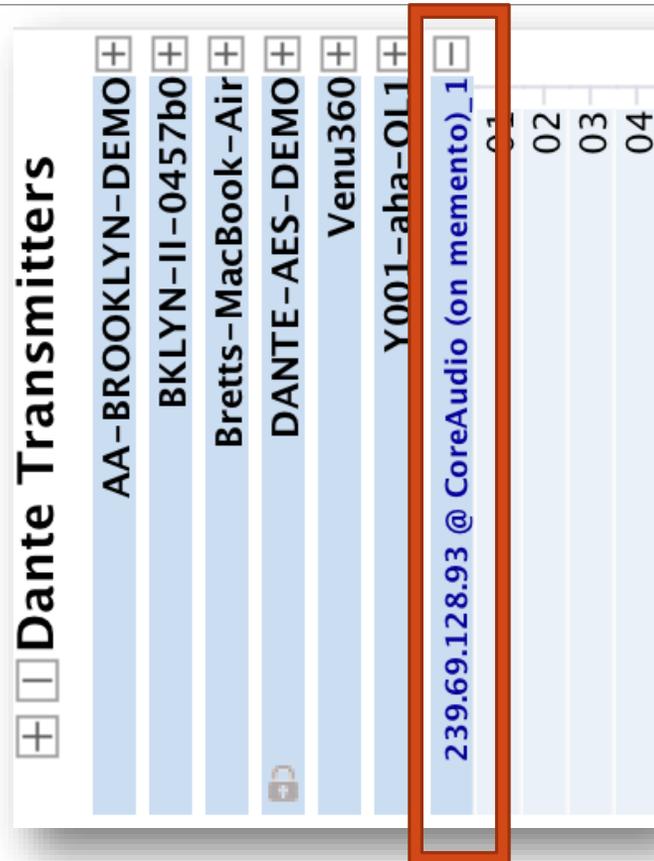
- AES67 Config tab
 - Enable AES67
 - Multicast Address Prefix
- Prefixes must match
- 3rd party tools required to configure non-Dante devices

AES67 in Dante Controller

- Device View -> Create Multicast Flow
- Check “AES67 Flow”
- Assign up to 8 channels per flow



AES67 in Dante Controller



- Devices with AES67 flows appear as Transmitter with **blue** text
- Devices appear twice: regular Dante & AES67 versions
- 3rd party receivers must be configured in 3rd party software

Converged Networks

DANTE CERTIFICATION PROGRAM

LEVEL 2

What is a converged network?

- One that combines all functions for a facility
 - Audio
 - Lighting control
 - Internet
 - File transfers
 - Server communications
- Dante fully compatible with all standard IP technology
- Cooperation with IT is critical to implement

Communication with IT

- Audinate has key 1-page doc, “So you’re adding Dante”
- Discuss with IT BEFORE adding Dante to an existing network
- Accommodations are not difficult for experienced IT
- Several options
- Keep expansion in mind

Thank you

DANTE CERTIFICATION PROGRAM

LEVEL 2

