

**DANTE**

# **CERTIFICATION PROGRAM**

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LEVEL 2

# THE DANTE CERTIFICATION PROGRAM

Training program from Audinate

Official certification lets your customers know that you have the knowledge and skills to implement Dante networks

Ensures a consistent set of methods and knowledge



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- The Dante Certification Program is a new training program being offered by Audinate.
- This official certification lets your customers and peers know that you have the knowledge and skills required to successfully design and roll-out Dante networks
- We're doing this to provide a consistent set of methods and general knowledge about audio networking. This is sure to become increasingly important as the technology becomes widespread and is adopted by more and more vendors, installers and customers.

# THE DANTE CERTIFICATION PROGRAM

## With Dante Certification, you receive:

- Use of the Level 1 and Level 2 “Dante Certified” logos
- A certificate of completion for each level passed.
- Optional listing in directory of Dante Certified professionals



- With your Dante certification, you get use of the “Dante Certified” logo for yourself. You also have the option to be listed in a directory of fellow Dante Certified professionals at [audinate.com](http://audinate.com).

# THE DANTE CERTIFICATION PROGRAM

## Level 1: Introduction to Dante

- 100% online delivery
- Background
- Basic signal routing
- Setting up Dante in simple systems (approximately 6 devices, 1 switch)



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- Level 1 of the Dante Certification Program is delivered online
- It provides a background in digital audio concepts
- It covers basic automatic and signal routing in Dante
- Level 1 may be all you need to successfully use smaller Dante networks, typically with 6 or so devices and 1 network switch.

# THE DANTE CERTIFICATION PROGRAM

## Level 2: Intermediate Dante Concepts

- Delivered in-person
- Larger systems (approx. 12 devices)
- Clocking options
- Understanding unicast & multicast
- Latency
- Redundancy
- Dante Virtual Soundcard and Dante Via



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- Level 2 of the Dante Certification Program is targeted towards more experienced users who are running larger systems
- It covers details of Dante clocking options
- It outlines unicast and multicast network traffic and how Dante allows you to use both types
- It covers adjustment and monitoring of Dante latency
- It covers redundant Dante networks
- And it covers Dante software, such as Dante Virtual Soundcard and Dante Via.

# THE DANTE CERTIFICATION PROGRAM

## Required steps:

- Level 1: Pass Level 1 **online** exam
- Level 2: Pass Level 2 **online** exam  
PLUS “hands on” exam at event



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- Taking a class like these is the first step to certification.
- All tests are conducted online at [audinate.com](http://audinate.com)
- There are 2 basic requirements to becoming Dante Certified:
  - Pass the Level 1 online exam
  - Pass the Level 2 online exam PLUS “hands on” exam at a live event

# **INTERMEDIATE**

# **DANTE CONCEPTS**

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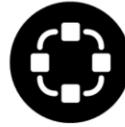
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LEVEL 2

# ABOUT AUDINATE



Headquartered in  
Sydney, Australia



Network  
engineers first



Develop Dante as  
**100%**  
**interoperable**  
**solution**  
for all audio  
manufacturers



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A bit about Audinate, first.

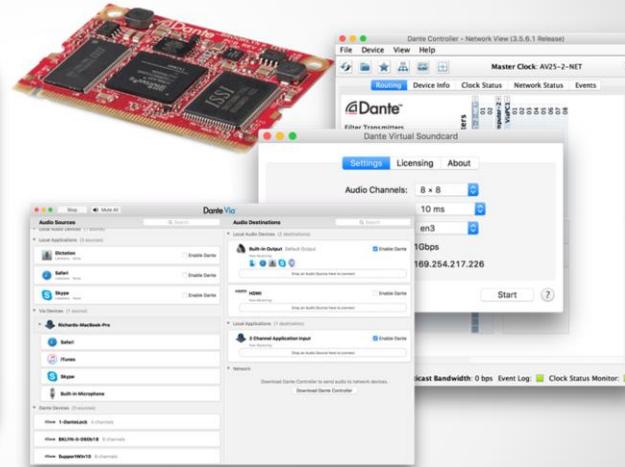
- We are headquartered in Sydney, Australia.
- We are founded by, and employ many network engineers who deeply understand how networking and network standards work, and how best to maximize performance for audio.
- We develop Dante as a 100% interoperable solution for ALL audio manufacturers. In this respect we are unique. We offer the same technology to everyone, ensuring that every product that uses Dante can freely connect to any other, no questions asked.

# WHAT WE MAKE

## Dante technology (all of it)

### Hardware modules Development tools Software products:

- Dante Controller
- Dante Virtual Soundcard
- Dante Via



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What do we make?

We are the sole creators and developers of Dante audio networking technology. We make all of it, from:

- Hardware modules and chipsets, sold to manufacturers in order to quickly and easily integrate Dante into their products.
- Development tools for manufacturers, so they can customize Dante to suit their needs and designs.
- And software products that allow audio professionals to use Dante;
- Dante Controller, which is the essential tool for managing a Dante network
- Dante Virtual Soundcard, software that lets you use any Digital Audio Workstation software you prefer directly on a Dante network, and;
- Dante Via, another software product that allows you to put connected audio products and applications directly on a Dante network.

## 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



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Level 2 topics:

It is assumed in this class that you already understand the basic operation of a Dante network, such as how to use Dante Controller to discover and connect Dante-enabled devices. We're going to go deeper into some related topics to get a better understanding of Dante.

- 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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Let's begin with switch features. We're starting with this topic as it is frequently misunderstood, and the cause of several misapprehensions and common mistakes.

# MANAGED VS. UNMANAGED

## Managed

More expensive



Many possible settings  
(and risks)



May be required in some  
conditions

## Unmanaged

Less expensive



100% plug and play



May not be appropriate in  
some situations

Switches are important in a Dante network, but we can reduce this to some fairly simple ideas.

Managed switches:

- More expensive than unmanaged
- Have many, many possible settings (and risks if used improperly)
- They may be required for some conditions

Unmanaged switches:

- Less expensive than managed
- Totally plug and play – no settings at all
- May not be appropriate for some conditions

# THEN YOU DON'T NEED A MANAGED SWITCH

If you use only **one** switch to connect your Dante devices...

If you are **only** using the network for Dante audio...



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Here's a helpful thing to know:

- If you are using only one switch to connect your Dante devices, and
- If you are only using the network for Dante audio

Then you don't need a managed switch!

It is very common for small Dante systems to use only a single switch, and the settings that are recommended for very busy or mixed use networks simply aren't needed under those conditions. You can safely use unmanaged switches in these small networks.

# SWITCH FEATURES **RECOMMENDATIONS**

Start with the default features

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 a common cause of problems



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- Start with default settings of switches (generally this means extra features are OFF)
- Do not change until there is a well understood problem that a feature may resolve
- Resist the temptation to over-configure switches!
- In typical stand-alone Dante networks, features are rarely required
- In our experience, incorrectly configured switches are a common cause of problems. The customer would have been far better off not implementing features they do not understand.

In other words, in many settings an unmanaged switch may be a better choice than an incorrectly configured managed switch.

# CLOCKING

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Understanding clocking in a digital system is as fundamental as understanding gain structure in an analog system. The rules are straightforward, the systems may get bigger and have more components, but sticking to the basic principles will make this painless.

# 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

 Dante

**CLOCK  
MASTER**

While several adjustments are permitted, the important thing to know is that by default, Dante handles clocking 100% automatically. If you did nothing to adjust clocking on a Dante system, it will work perfectly. Only external clocks require any configuration to work.

Dante uses IEEE 1588 – Precision Time Protocol. Note that this is not Precision Clock Protocol, because Dante distributes time.

Time is a good thing to distribute, as an endpoint can “chop up” this time into a local clock – so for a 44.1kHz clock, 1 second will be chopped up into 44100 divisions, and for a 48kHz clock the same second (derived from the same PTP master) will be chopped into 48000 divisions etc.

Just like all digital systems – there must be one “master” in a clock “domain”, and all other devices should be slaved to that master. This ensures that all digital “words” start and end at the same agreed point.

If there is no need to define a particular master clock device - which is true in the vast majority of cases - Dante will automatically handle election of the master device.

# CLOCK MASTERS

Clock Master determined by election in accordance with IEEE1588

•  
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"/>



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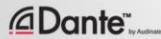
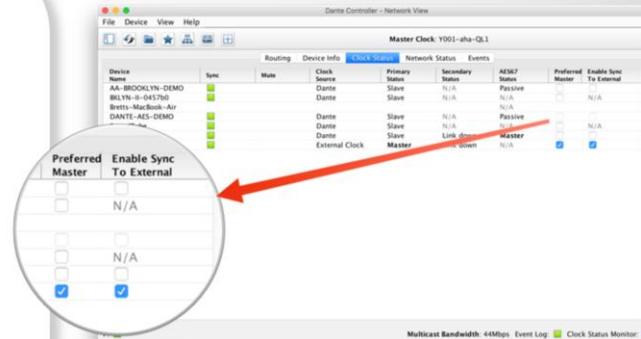
We mentioned how Dante automatically elects a clock from among Dante devices. This is done in accordance with the IEEE1588 standard. Now we'll talk about how to exercise more control over clocking to suit your needs.

Opening the Clock Status tab in Dante Controller, we see two adjustments that we can make. The first is to set a Preferred Master or Masters, and the second is to “Enable Sync to External”. What do these settings do? Let's understand the Dante clock election process to find out.

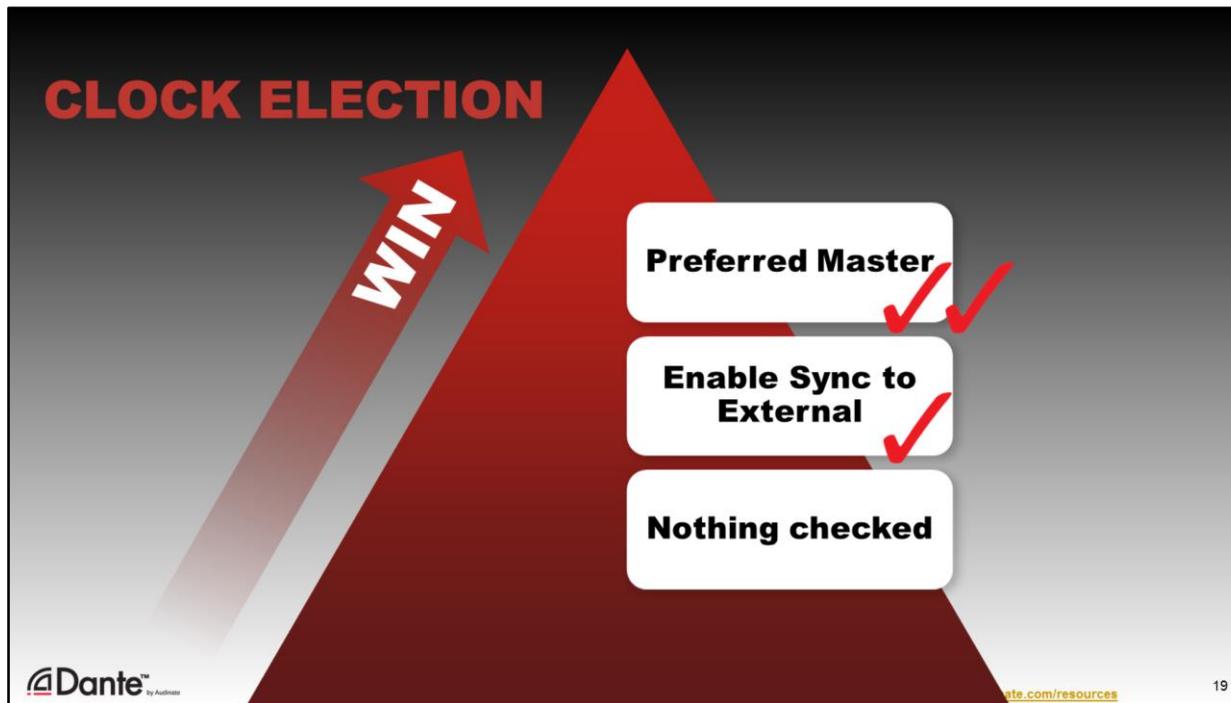
# ADJUSTING CLOCKS

Clock Status tab in Dante Controller

•  
Checkboxes for Preferred Master and Enable Sync to External



Making these adjustments in Dante Controller is easy. Simply open the Clock Status tab to see your present clocking setup, and make changes using the Preferred Master and Enable Sync to External checkboxes. Next, we'll see how these adjustments affect the outcome of Dante clock elections.



To understand this, let's look at how Dante normally elects a clock Master

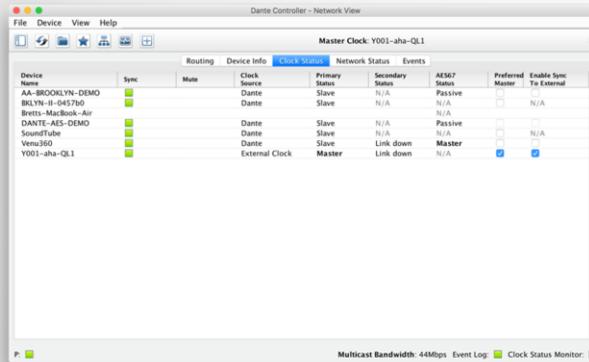
- By default, Dante elects a clock without any intervention. This is recommended for most systems.
- If “Enable Sync to External” is checked for a device, it will win if no others are designated “Preferred Master”
- If “Preferred Master” is checked for a device, that device will win the election or compete against other Preferred Masters to win.

A couple of notes:

1. If there are multiple Preferred Masters, one will automatically be selected as Clock Master.
2. Configuring Externally Synced clocks requires interactions with the device itself, not only Dante Controller.
3. Devices using “Enable Sync to External” should have “Preferred Master” checked.

Remember, there is very often no reason to change the clock election process. Unless you are using external clocks to synchronize non-Dante devices that are part of the system, it is usually best to allow Dante to choose a Clock Master automatically.

# PREFERRED MASTER



The screenshot shows the Dante Controller Network View window. The title bar indicates 'Master Clock: Y001-aha-Q11'. The window contains a table with columns for Device Name, Sync, Mode, Clock Source, Primary Status, Secondary Status, AES67 Status, Preferred Master, and Enable Sync To External. The table lists several devices, with Y001-aha-Q11 highlighted as the Master.

Device Name	Sync	Mode	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"/>
BLYN-II-045760	<input checked="" type="checkbox"/>		Dante	Slave	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>
Brett-MacBook-Air	<input checked="" type="checkbox"/>		Dante	Slave	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>
DANTE-AES-DEMO	<input checked="" type="checkbox"/>		Dante	Slave	N/A	Passive	<input type="checkbox"/>	<input type="checkbox"/>
SoundFile	<input checked="" type="checkbox"/>		Dante	Slave	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>
Venu360	<input checked="" type="checkbox"/>		Dante	Slave	Link down	Master	<input type="checkbox"/>	<input type="checkbox"/>
Y001-aha-Q11	<input checked="" type="checkbox"/>		External Clock	Master	Link down	N/A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Dante will always elect a Clock Master without intervention

Changes to Clock Master are automatic and do not affect audio

Any hardware device can be made a "Preferred Master" clock

Preferred Master should be a device that is always present in system

Why would we make a device a Preferred Master?

In the majority of cases, this choice does not need to be made. Dante's automatic clock election process ensures that clocking will work as designed with no user intervention. Even if an election occurs while audio is flowing, there is no interruption or artifact.

Sometimes users prefer to have a single device always be elected Clock Master, by using the Preferred Master checkbox.

If this option is taken, it makes sense to choose a device that is always in the system, by definition. For example, a mixing console is always present and necessary for a live show. It thus makes sense to make the mixing console a Preferred Master, as without it there is no system.

If a Preferred Master goes offline, don't worry – Dante will always elect a new Clock Master, regardless.

Note that with software it is a different picture; Dante Virtual Soundcard cannot provide a clock, while Dante Via can. Still, hardware clocks are always preferred in elections.

# USING EXTERNAL CLOCKS

“Enable Sync to External” allows use of console (or other) clock

•  
Configure in console, too

•  
Check “Preferred Master”

•  
Mismatch may result in pops and clicks

•  
Using Active Clock Monitoring to ensure quality of external clock



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- You may wish to use the clock that is inside your mixing console, especially if you are using that clock to keep multiple types of digital I/O in sync with each other.
- Dante supports this, but first you must understand how to properly configure it.
- In your mixing console (or whatever device is using an internal clock) configure the Dante I/O to use the internal clock.
- In Dante Controller, go into Clock Status and check “Enable Sync to External” for the mixing console
- Also enable “Preferred Master” for the mixing console
- It is important that both steps be taken
- Failure to do so will likely result in clicks and pops, as there will be 2 independent clocks attempting to run the network. By checking “Enable Sync to External”, we are telling the Dante system to use the mixing console clock as it’s source.
- Use Active Clock Monitoring to ensure that the external clock is well behaved

## EXTERNAL CLOCK BEST PRACTICES

If using an external clock, configure in both device and Dante Controller (Enable Sync to External)



Always check Preferred Master on the device using Enable Sync to External



Symptom: clicks and pops



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Our Support staff have asked us to include this short list of best practices. They hope that the number of cases will go down by 50% if followed ;-)

- When using a external clock, be sure to configure it in both the device and Dante Controller, using the Enable Sync to External setting
- Always check Preferred Master on the device using Enable Sync to External
- You'll know something is wrong with clocking when you hear clicks and pops. And a large percentage of the time, a misconfiguration of Enable Sync to External is at fault.
- In the vast majority of cases, one should not have multiple devices configured to use "Enable Sync to External". There are some rare advanced situations in which this might be advisable, but that is beyond the scope of this course.

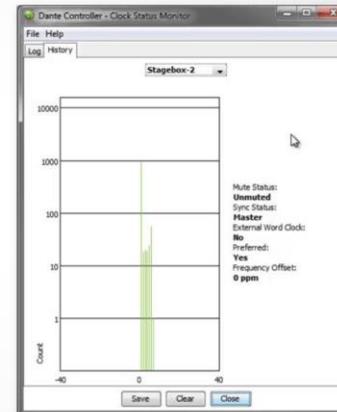
# CLOCK STATUS MONITORING

## Passive: always on

- Clock Master changes only

## Active: select in toolbar to turn on

- Useful for troubleshooting external clocks
- Looks for instability
- Accumulates data over time
- Displays spread of clock frequency



Dante Controller supports 2 types of clock monitoring: passive and active

- Passive is on all the time, and provides alerts when a Clock Master changes on the network
- Show Clock Status monitor window
- Active clock monitoring is turned on by selecting it in the Dante Controller menu bar (show icon)
- Active clock monitoring checks to see if the Clock Master is exhibiting any signs of instability. This can be important when using an external clock, such as that in a mixing console.
- If you are using the built-in Dante clocks, clock stability will not be a problem.
- The Active monitoring indicator will turn yellow if there is trouble. Click the indicator to open a window displaying clock behaviors over time.

# LATENCY

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## ABOUT LATENCY – A REFRESHER

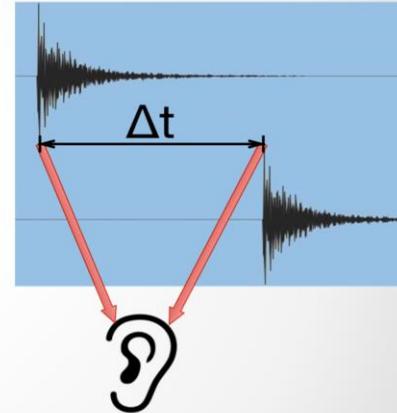
Audio signal delay in a system

•  
Transport and processing

•  
Mainly a problem when we hear delayed and un-delayed signal simultaneously

•  
Air travel 34cm = 1msec

•  
Problem for legacy networking systems (VoIP)



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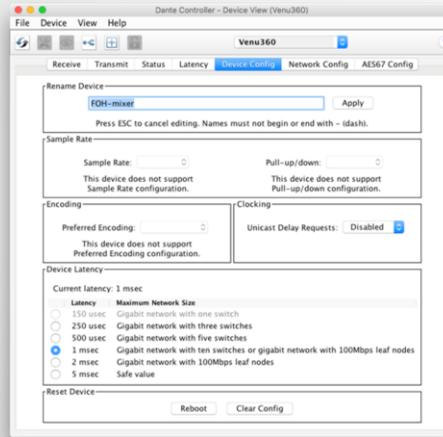
Latency is an issue in all audio systems. It is the delay incurred by the transport and processing of audio signals. This is really only a problem in settings where the delayed and un-delayed signals are heard simultaneously, as in a recording studio when doing overdubs on a digital recording system or floor wedges on stage that are combined with the sound of live instruments.

Of course, audio latency is very pronounced without any electronics at all. Since sound travels at about 343 meters per second, each 34 cm of travel requires about 1 millisecond. If you'd like to hear what a system sound like with about 2ms delay between sources, stand in the middle of 2 stereo speakers and move 34 cm to the left or right.

And of course this air travel latency is why delay towers are used to align speaker output with the audio coming from the stage in large outdoor concerts; the travel time results in a very large latency problem to overcome.

In earlier audio networking solutions, such as VoIP, high latency was a real issue. As we'll see, this is an area where Dante gives you complete control.

# 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

- To access controls and monitoring for Dante latency for any device, double-click the device name to open the Device View window.
- Set latency for device in the Device Config tab
- View latency monitoring for channels being received by device in the Latency tab.

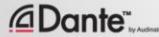
# LATENCY IN DANTE

- 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



In Dante, latency is strictly defined and consistent. Default latency device latency is 1 millisecond, far below the threshold of noticeability for live performances or studio overdubs. At this setting, receiving devices can be used on very large networks employing up to 10 switches. This setting is made on a per-device basis, and is extremely conservative to ensure trouble-free operation.

The Advanced Filter in Dante Controller may be used to see devices filtered by latency settings. This can be useful for quickly checking to see that all devices are set for consistent playout.

You can set Dante devices to go as low as 150 microseconds, or as high as 5 milliseconds to suit different situations. The factors that affect how these settings can be used are dominated by the network structure.

# LATENCY - LOWER BOUNDS

- If only 1 switch, Dante latency can be set to 150µs
- 3 switches, 250µs
- 10 switches, 1ms (Dante default)
- Recommended values are based upon worst-case scenarios
- **Monitor actual network performance**

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
<input type="radio"/> 2 msec	Gigabit network with 100Mbps leaf nodes
<input type="radio"/> 5 msec	Safe value



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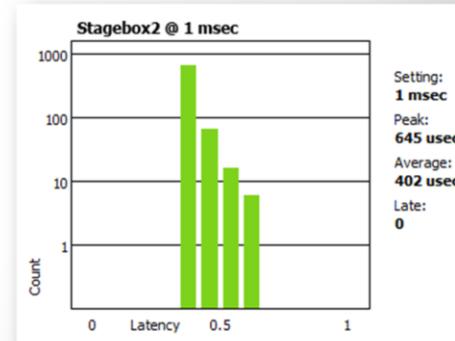
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- Dante latency is deterministic - that is, we set a value on each device and they all use that value in order to playout samples in exact sync. But this fixed latency has some lower bounds to which we must pay attention.
- As an example, a very small Dante network with only 1 switch may use the lowest Dante latency setting of 150µs.
- As the number of switches and thus devices grows, our minimum value increases. For networks with 3 switches, minimum latency is typically 250µs.
- At 10 switch hops, the recommended Dante latency is 1ms, which is a common default value. Keep in mind that 10 switches is quite a lot- if each switch has only 10 ports, that is 100 devices supported. And 1ms is very small, only 34 cm of air travel time. It's important to note that the recommended latency values, while already very small, reflect worst-case scenarios. In many cases, you may safely use lower latency settings than the recommended values in Dante Controller.
- Dante Controller allows you to monitor actual network performance, which allows you to determine if your latency settings are workable.

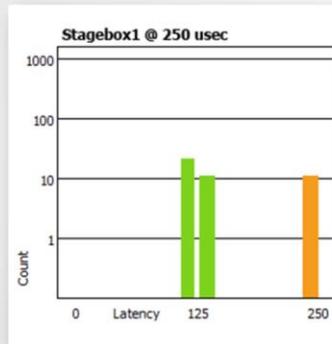
# MONITORING LATENCY – GOOD EXAMPLE

- Visualize actual latency in Latency Tab of Device View
- Example:
  - 3 switches
  - 1ms latency setting
- All packets safely inside window
- Try lower values and see what happens



- The Latency monitor in Dante Controller shows you the real status of latency, and is the best indicator that you have configured it to work well on your real-life network.
- In this example, we are using 3 switches and a latency setting of 1ms, the default for most Dante devices.
- We can see that the packets are arriving at different times, but that all of them are well below the latency setting of 1ms. This is a healthy state of affairs, all of our packets are arriving within our window of safety.
- You can safely experiment with lower values if you wish. As long as packets are arriving well within the defined window of time, the Dante network will work fine.

# MONITORING LATENCY – BAD EXAMPLE



## Example:

- 250 $\mu$ 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
- Disable unneeded switch management

- In this example, we have reduced the latency setting to 250 $\mu$ s, a very low value.
- When we look at the latency monitor, we can see that some packets are now falling dangerously close to the limit of our latency setting. We have selected a value that is too small for the physical network we are using, and should change settings to avoid problems.
- Latency monitoring can also be used to diagnose network problems, even those that are infrequent. Monitoring may be left on for hours or even days to capture the occasional dropout.
- The exact time that packets arrive will vary with traffic, and so it is normal for packet arrival times to vary some. If packets are falling outside the latency range desired, then there are a few possible causes.
  - Too many switch hops: increase latency to accommodate size of network.
  - Too much traffic increase latency and/or implement QoS
  - Marginal equipment a switch or cable may be misbehaving and need replacement
  - Turn off any unneeded switch management features.

# **FLOWS** **AND MULTICAST**

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Another area that brings questions is that of multicast networking. What is it, how is it used in Dante, and what do we need to worry about?

# UNICAST AND MULTICAST

## Unicast

One to one traffic

•  
“Private conversation” – data sent uniquely from transmitter to each receiver

•  
Multiple receivers require multiple copies of data from transmitter

## Multicast (unmanaged)

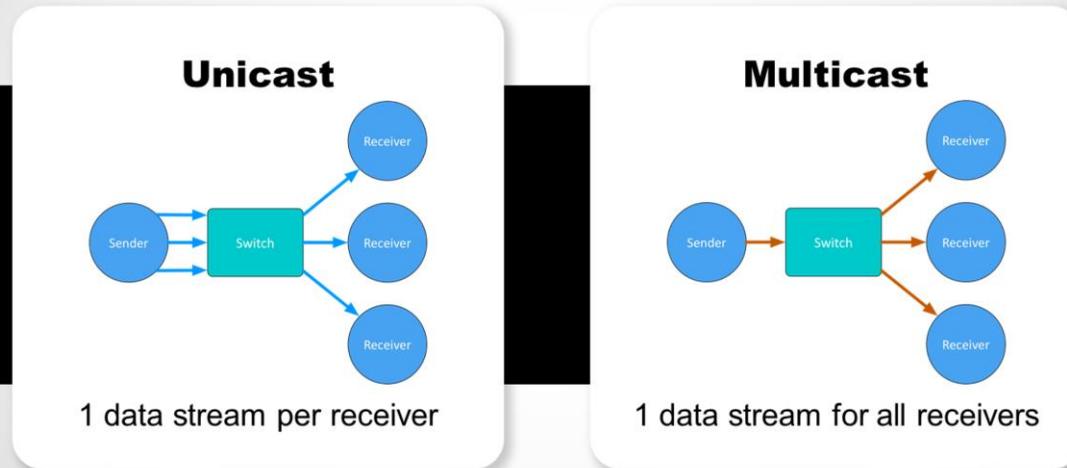
One to many traffic

•  
“Public announcement” – messages sent to everybody on the network

•  
Data is processed by all receivers

- In IP networking, unicast is a very common type of 1-to-1 traffic.
- Similar to a private conversation, data is sent uniquely from transmitter to receiver. No other devices “see” or process the traffic. If the transmitter needs to send the data to multiple receivers, it must duplicate that traffic for each one.
- Multicast is a type of 1-to-many traffic.
- Left unmanaged, the behavior is similar to a public announcement – all receivers on the network receive the traffic, but the transmitter only has to send it once.
- Left unmanaged, all devices must devote some processing power to assessing these packets.

# UNICAST AND MULTICAST



Here is another way to imagine how unicast and multicast differ.

In Unicast, the transmitter (or Sender) must generate a data stream for each receiver, as if it is having a private conversation with each one. This becomes inefficient as the number of receivers grows, all getting the exact same data.

Unmanaged multicast is more like a bullhorn, sending the same data once to all receivers. In one-to-many settings, it is more efficient and less taxing on the transmitter/sender of data.

## DIFFERENCES: BROADCAST AND MULTICAST

If *unmanaged*, both send data out of all members of a LAN

•  
Multicast traffic can be organized to send data only to requesters (receivers) – IGMP snooping

•  
Organization of multicast receiving groups is done with managed switch

•  
Separate LANs or VLANs used to manage both types

If you know some networking, this description of Unmanaged Multicast sounds an awful lot like Broadcast. There are, of course, differences.

- In unmanaged environments, both Broadcast and Multicast send data to ALL members of the LAN, and are functionally equivalent.
- But Multicast traffic can be managed in ways that Broadcast cannot.
- Multicast traffic can be organized so that only requesters of data have to see it, eliminating the problem of unwanted traffic on some nodes.
- This organization is done at the switch, using the feature called IGMP Snooping
- IGMP snooping determines which devices are actually requesting the data, and makes sure that it only goes to that group of devices.
- When large amounts of multicast or broadcast are necessary, they are often segmented into different LANs to avoid problems with other devices.

# DANTE UNICAST FLOWS

1 Flow to 1 Receiver containing 1 channel of audio



1 Flow to 1 Receiver containing 4 channels of audio



Dante packages audio into 4-channel "Flows" when using unicast, for efficiency

Flows are unique to each receiver

Flows may contain empty audio channels

1 channel sent to 1 receiver uses the same bandwidth as 4 channels



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- By default, Dante uses unicast to transmit audio between devices.
- When a subscription is setup, Dante devices create "flows" for efficient network use
- Flows always contain 4 channels, even if not all are used for audio
- This means that, when sending unicast audio from one transmitter to one receiver, the bandwidth used remains the same whether 1, 2, 3 or 4 channels of audio are in use.
- Adding a 5<sup>th</sup> channel subscription adds another Flow.

# DANTE UNICAST FLOWS

More receivers means more Flows

•  
More channels (4 at a time, 1 receiver)  
means more Flows

•  
Small Dante devices (1 to 4 channels)  
support 2 Flows

•  
Large Dante devices (16 channels and  
up) support 32 Flows



8

8 channels -> 2 flows



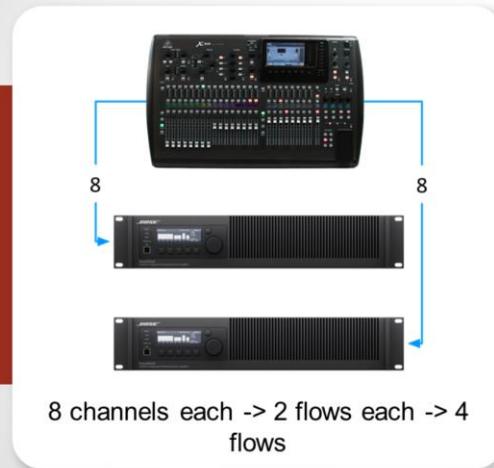
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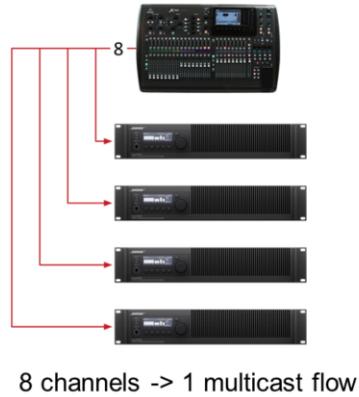
- Because unicast Flows are unique to each receiver, as we subscribe more receiving devices to a transmitter, the number of Flows in use increases.
- Because Flows contain 4 channels of audio, subscribing more channels of audio to a single receiver increases the number of flows in use (in units of 4 channels each)
- Dante transmitters support a limited number of Flows, which may affect unicast and multicast decisions.
- Smaller Dante devices with 1 to 4 channels support 2 Flows
- Larger Dante devices with 16 or more channels support 32 Flows

# DANTE AND UNICAST FLOWS



- When a transmitter sends audio to multiple receivers, each receiver needs separate flows even if each flow only contains one channel! This can be inefficient, causing the transmitter to resend the exact same data individually to each receiver. Eventually, the transmitter runs out of flows and cannot route more channels.
- This condition is called a “Fan out”. Dante Controller will warn you when this condition is possible, so that you can take steps to improve efficiency with multicast.

# DANTE AND MULTICAST FLOWS



Multicast solves “fan out”  
condition

- 

Up to 8 audio channels in 1  
multicast flow

- 

Configured in Dante Controller

- With multicast, a transmitter can create a single flow that sends audio to as many receivers as desired, thus eliminating the problem of a “fan out” condition.
- Multicast flows are created by users in Dante Controller, and contain up to 8 audio channels in a single flow

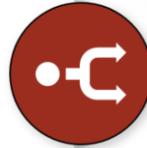
# CONFIGURING MULTICAST FLOWS

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



Channel Name	Add to New Flow
Overhead	<input checked="" type="checkbox"/>
Snare	<input checked="" type="checkbox"/>
Kick	<input checked="" type="checkbox"/>
Vox1	<input checked="" type="checkbox"/>
Vox2	<input checked="" type="checkbox"/>
Guitar1	<input type="checkbox"/>
Keys	<input type="checkbox"/>
Guitar2	<input type="checkbox"/>

- In Dante, multicast is invoked manually at the transmitter. No adjustments to receivers or routes are necessary at all.
- If you receive a “fan out” warning, or simply wish to configure a set of channels for multicast in order to distribute them to multiple receivers, then it can be a good idea.
- Open the Device View for the transmitter
- Click the “Create Multicast Flow” button in the toolbar to open the Create Multicast dialog
- Select up to 8 channels from the transmitter to include in the flow. You can create multiple flows if transmitting more than 8 channels.
- Click Create, and that’s it.
- You may delete a multicast flow, too. It simply reverts to unicast, no subscriptions are changed.

## DO I NEED TO CONTROL MULTICAST?

On gigabit networks, multicast traffic is unlikely to be a problem

•  
Example: 64 channels of multicast produces approximately 100mbits/sec of traffic

•  
If using 100mbps devices or Wi-Fi access on the same network, use multicast filter (IGMP Snooping)

•  
Use multicast selectively!



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- The question of control comes up frequently in discussions about multicast. What about all that traffic that is going to devices that aren't using it? Isn't that a problem?
- Actually, no. Not much. Not with gigabit networking, due to the large amount of surplus bandwidth.
- Even a large multicast of 64 channels represents less than 100mbits/sec of bandwidth, only 10% of a gigabit connection
- Multicast traffic will slow down Wifi networks. If you are connecting a Wifi access point to a Dante network, be sure to engage the multicast filter function found in most.
- By using multicast selectively, explicit management in a switch is largely unnecessary. In most environments, the actual need for one-to-many connections is often less than 16 channels.
- If you must control multicast, the tool to use is IGMP Snooping, a feature found in managed switches.

## SUMMARY

Dante uses unicast by default

Dante audio is packaged into multi-channel flows

Number of flows is limited (between 2 and 32)

Each receiver requires at least 1 flow

Unmanaged multicast sends data to all devices

Multicast is useful for conserving flows in one-to-many situations

Explicit management of multicast often not necessary



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- Dante uses unicast by default, sending data directly to receivers only.
- Dante packages audio channels into “flows” that typically contain several channels.
- Dante devices have a limited number of flows, depends upon device type.
- A subscription to a receiver always uses at least 1 flow, regardless of number of channels.
- Unmanaged multicast sends the same data to all network devices, regardless of subscriptions.
- When sending the same audio channels to multiple receivers at once, consider creating multicast flows to increase efficiency and conserve available flows
- Explicit management of multicast traffic using IGMP Snooping is often not necessary on a gigabit network

# NAMING DEVICES

DANTE CERTIFICATION PROGRAM  
LEVEL 2



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Dante supports human-readable names for devices and channels, but this is more than a cosmetic feature.

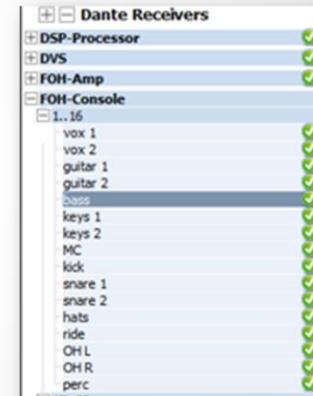
# NAMING DANTE DEVICES

All Dante devices have editable names

•  
Name devices to make a system easy to understand

•  
Channel labels help in busy environments

•  
Name first, then route



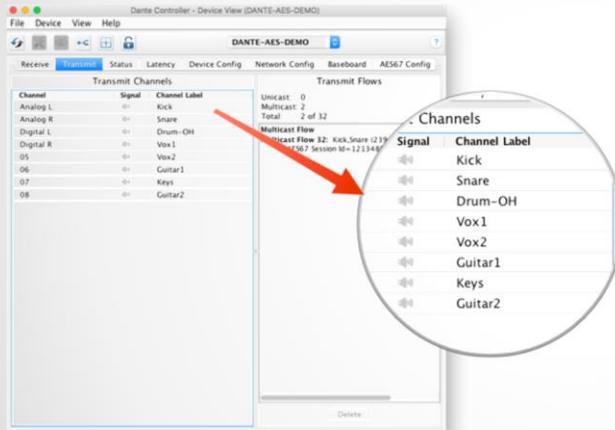
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- All Dante devices have editable names and channel labels
- Naming devices makes a system much easier to understand
- Using names and channel labels keeps things clear in busy environments!
- We highly recommend naming your devices before you start routing in order to make your system easier to understand and remember.

# 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



- Use the Device View to adjust names.
- In addition to naming devices, you can use the Device View to label individual channels of transmitters or receivers.
- This is great for quickly identifying individual channels in a live mix, and makes it easy for volunteers or newbies to use the system.
- Think of it as a software version of the masking tape we typically find on consoles!

## 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 and channels identically

If the primary device fails, connect backup device to network  
Subscriptions are automatically re-established using names



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- Dante uses the names of devices to create subscriptions
- This allows you to create backup devices for critical pieces of gear by using identical names
  - Name primary device and backup devices identically
  - If the primary device fails, connect the backup device
  - Subscriptions are automatically re-established by other Dante receivers on network

# DEVICE LOCK

DANTE CERTIFICATION PROGRAM  
LEVEL 2



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We'd like to introduce you to a new feature in Dante – Device Lock.

## 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 Dante Controller
- Changes from inside products are not locked



- New feature in Dante v3.10 that allows you to prevent tampering with Dante routes and settings
- Requires updated firmware and Dante Controller 3.10 together.
  - Not all hardware will be updated by manufacturers right away
- Supported in Dante Virtual Soundcard and Dante Via.
- Only affects device behavior as seen through Dante Controller. If settings can be adjusted inside product, this is not lockable.

## ENABLING DEVICE LOCK

Lock Device

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)



- 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

- First, determine if Device Lock is supported on devices in your network
  - Device Info Tab Device Lock column
  - Filtered View
- Device Lock is activated per-device by:
  - Checking “Device Lock” box in Device Info tab, or;
  - Clicking the Lock button in Device View
  - Enter 4-digit PIN, and confirm
  - Device now shows as locked in Dante Controller 3.10 and higher

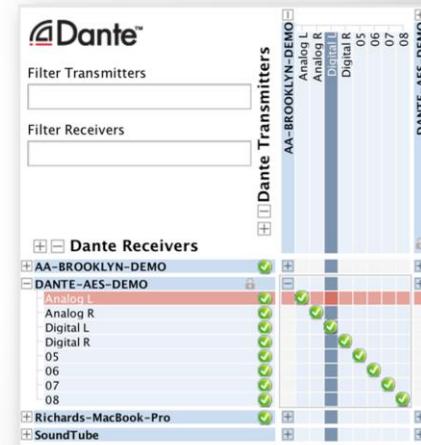
# WORKING WITH DEVICE LOCK

Locked devices have a lock icon in the name bar

When a locked channel is selected, highlight is red

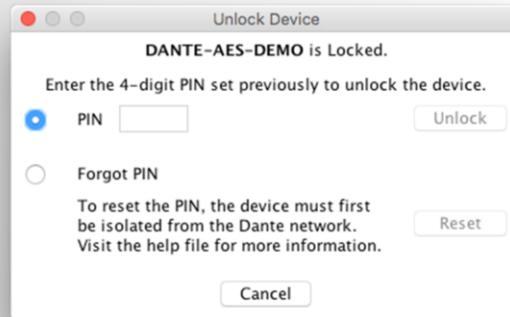
Attempts to change routes result in no action

Limit flows used by transmitters



- In Dante Controller, a small lock icon appears on the name bar of each locked device in the Routing view.
- When channels of locked devices are selected or moused-over they are highlighted in red.
- Attempts to change routes on locked receivers will result in no action.
- Locked transmitters prevents unwanted additional flows from being created

# UNLOCKING A DEVICE



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

- To unlock a device and make changes to it, open it in Device View
- Click the Lock icon in the toolbar
- Enter the PIN that was entered to lock the device
- Device is unlocked
- Old PIN is forgotten
- Did YOU forget the PIN? Don't worry. Devices can be "force unlocked" by physically disconnecting from Dante network and being directly connected to Dante Controller after several minutes.

## 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



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- Device Lock works best when both transmitting and receiving devices support the feature. However, we know that many times not all devices on a Dante network will be updated.
- In Dante, Receivers request channels from Transmitters and maintain subscription status
- A locked Receiver can have none of its subscriptions changed
- A locked Transmitter knows only what devices it was transmitting to when it was locked.
  - Locking will thus prevent transmission to other receivers
  - A locked Transmitter cannot prevent a Receiver from disconnecting
  - A locked Transmitter can prevent new Receivers from being added to its subscriptions, thus conserving available flows
- Older devices that do not support Device Lock may still be connected, but may generate error messages when interacting with locked devices.
  - Example: an unlockable Transmitter may be connected to a locked Receiver, but other connections to this Transmitter are always possible.
  - Example: an unlockable Receiver may be connected to a locked Transmitter, but subscriptions may still be deleted.

# PRESETS

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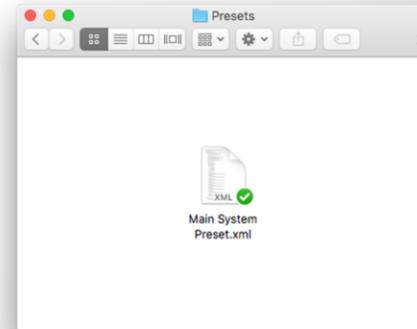
DANTE CERTIFICATION PROGRAM  
LEVEL 2

# DANTE PRESETS

Dante network configuration can be saved in a file

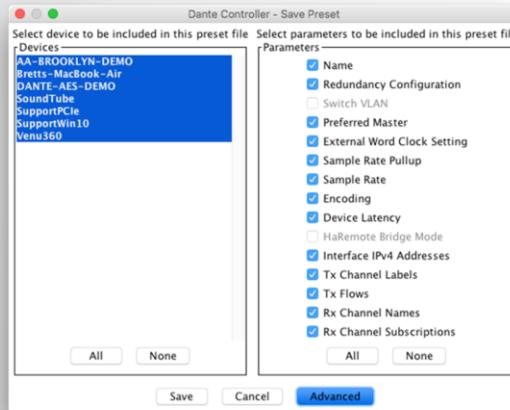
•  
Preset may include device names and roles

•  
Quickly reconfigure a Dante system to a known state



- You can store Dante network configuration in a file that can be read by Dante Controller
- This configuration can even be applied to networks with different device names, by using the concept of a “role” - e.g., the FOH mixer, the left stage amp, etc.
- This allows you to 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 folder

- Click the 'Save Preset' button in the main toolbar:
- Select the devices that you wish to include in the preset.
- Click Save to save the file in any folder you wish

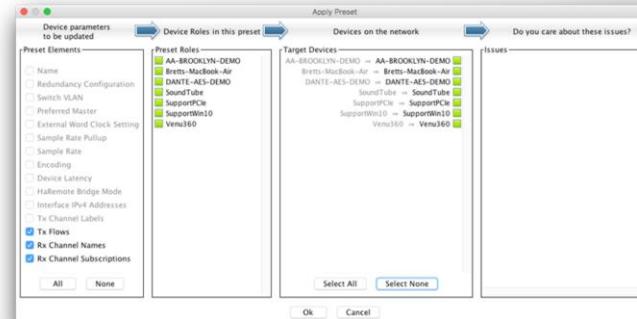
# DEPLOYING A PRESET

Choose “Load preset” 

Select preset file

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

Apply



- Choose “Load preset” from toolbar
- Choose preset file
- Check to see that elements match the parameters of your current network, assign as needed
- Apply
- The Dante network will stop audio and apply all settings and subscriptions.

# REDUNDANCY

---

DANTE CERTIFICATION PROGRAM  
LEVEL 2



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Redundancy is a special Dante feature for critical networks.

## WHAT IS DANTE REDUNDANCY?

Create two physically independent networks using Primary and Secondary Dante ports

•  
Audio flows on both networks at once, no failover

•  
No clicks or pops

•  
Completely automatic setup

•  
For mission critical systems

DEPARTMENT OF  
**REDUNDANCY**  
DEPARTMENT



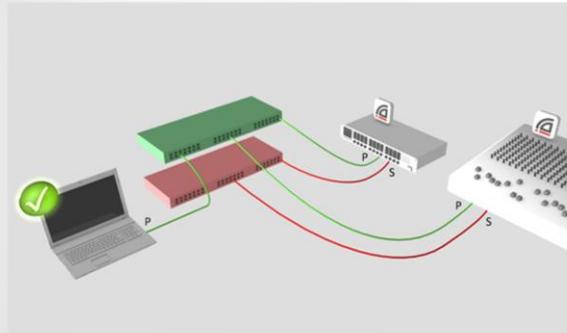
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- A feature available on some Dante-enabled devices that allows you to use two different physical networks at once as a safeguard against equipment or cable failure
- Permits 100% uninterrupted flow of audio even when a network switch or cable fails completely during use
- Dante redundancy uses a completely automatic setup for error-free configuration
- Ideal for mission critical systems

## 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

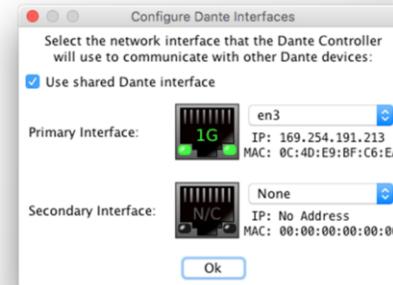
- First, cables and switches are used to create a network of Dante devices, all using Primary (non-redundant) ports. This is very important; make sure that your Primary network is functional BEFORE setting up a Secondary network!
- A separate, equivalent set of cables and switches are connected to the Secondary ports of all redundant Dante devices to form a separate network
- A secondary Dante network is automatically created, duplicating all routes from the Primary
- **No user interaction is required in Dante Controller**
- Any changes made to Primary network are automatically duplicated on the Secondary
- If the Primary network is disrupted due to equipment or cable failure, audio on the Secondary is used
- You may have Dante devices that do not support Redundancy. It's OK to use them on the Primary network as usual – but remember that if the Primary network fails, non-redundant devices will be offline.

# REDUNDANCY AND DANTE CONTROLLER

Dante Controller can be connected to both Primary and Secondary interface

•  
Control is passed from one network to the other

•  
If Primary fails, Dante Controller can be connected to Secondary



Dante Controller works with Redundancy, forwarding control data to both Primary and Secondary networks as any changes are made.

If you open the Configure Dante Interfaces window in Dante Controller, both interfaces are shown if available. If you have 2 Ethernet interfaces on your computer, you may connect both at once. If (like most) you have only one Ethernet port, connect to the Primary network. If the Primary network fails and you need to control the Secondary, connect the computer to the Secondary network only. Dante Controller will then be able to control devices on the Secondary network.

# DANTE VIRTUAL SOUNDCARD

DANTE CERTIFICATION PROGRAM  
LEVEL 2



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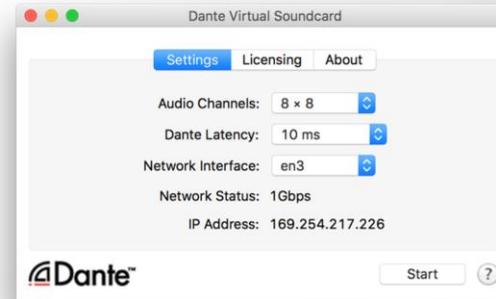
Dante Virtual Soundcard is one of our most popular products, widely used to record sessions using Dante in live and studio settings.

# WHAT IS DANTE VIRTUAL SOUND CARD? (DVS)

Soft Soundcard for Mac or PC

•  
Connects to Dante network

•  
Record and playout up to 64 channels of networked audio directly to/from applications



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- Dante Virtual Soundcard is software from Audinate that you install onto your Mac or PC.
- It behaves like a regular hardware soundcard in your computer, but instead of connecting to attached hardware, Dante Virtual Soundcard connects to other Dante devices using a regular wired network connection.
- With Dante Virtual Soundcard, your computer becomes part of the Dante network. You can easily record and playout up to 64 channels of audio directly on your computer, using your favorite applications such as Logic, ProTools, Cubase, etc.

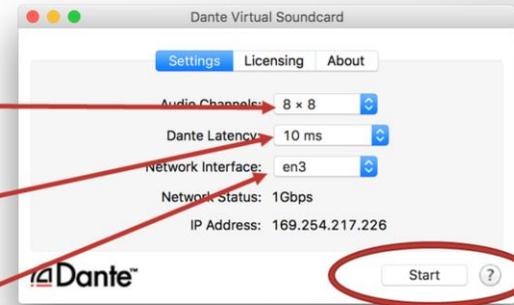
# SETTING UP DANTE VIRTUAL SOUND CARD

Start or Stop the service  
Must be stopped to adjust

•  
Audio channels 2x2 – 64x64

•  
Latency – 4ms – 10ms

•  
Choose network interface



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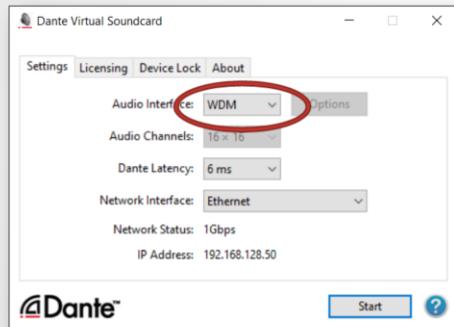
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Initial adjustments to Dante Virtual Soundcard:

- When you open the Dante Virtual Soundcard application, you can Start or Stop the service.
- Adjustments can only be made while Dante Virtual Soundcard is Stopped (off)
- Audio Channels allows you to set the number of channels to match your project needs, from 2x2 up to 64x64. Use only as many channels as needed to reduce unnecessary computational overhead.
- Dante Latency allows you set the receiving latency that an application would see relative to the Dante transmitter. Value depends upon computer performance, with 4ms for very good machines and 10ms for those with lower effective performance. Recommendation: start at default value.
- Network Interface specifies which Ethernet connection Dante Virtual Soundcard will use to connect to a Dante network. In most computers, there is only one and so this is easy.

# DANTE VIRTUAL SOUND CARD IN WINDOWS



Choice of WDM or ASIO drivers

•  
ASIO common in professional  
audio applications

•  
WDM common in consumer  
audio products



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- If you are using Dante Virtual Soundcard on the Windows platform, there are some additional setup elements.
- Dante Virtual Soundcard can be configured to represent an ASIO or WDM device
- ASIO is the third party solution that is favored by professional audio applications such as Cubase, Nuendo, ProTools, etc.
- WDM is the common “Windows System” audio driver used by consumer applications such as iTunes or Amazon Music Player.

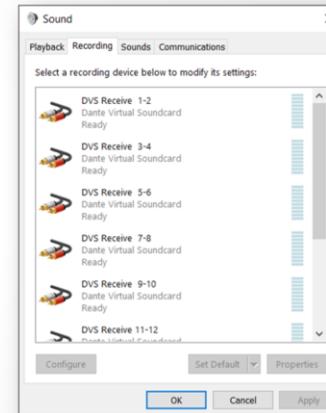
ASIO is developed by Steinberg as a higher performance audio driver interface for professional applications on the Windows platform. It is not part of the Windows operating system, and so isn't available to all applications. Audinate works closely with Steinberg to ensure that Dante Virtual Soundcard conforms to their specification.

# DANTE VIRTUAL SOUND CARD IN WINDOWS

WDM drivers 16x16 channels only

•  
WDM channels presented by  
Windows as stereo pairs

•  
Each stem appears as a stereo  
“device” in Windows Sound  
settings



- If you elect to use the WDM drivers in Dante Virtual Soundcard, keep in mind that this configuration is limited to 16x16 channels.
- WDM channels are always presented by Windows as stereo pairs
- Each pair appears as a 2-channel device in Windows Sound settings.

# DANTE VIRTUAL SOUND CARD 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



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- On Macs running OSX, Dante Virtual Soundcard appears as a regular Core Audio device.
- Core Audio is used in OSX to support both pro and consumer applications.
- Dante Virtual Soundcard may be designated at the default sound device if desired.

## CLOCKING DANTE VIRTUAL SOUND CARD



Dante Virtual Soundcard does not contain a hardware clock

•  
Computer must be connected to a network with Dante-enabled hardware or another computer running Dante Via



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Unlike Dante hardware devices, Dante Virtual Soundcard does not generate a PTP clock that may participate in Dante clock elections.

- Your computer must be connected to a network that contains Dante hardware devices and/or a running copy of Dante Via software on another computer in order to receive a clock.
- This means that a network composed of only computers running Dante Virtual Soundcard cannot be used to transport audio.
- Dante Via and Dante Virtual Soundcard cannot run simultaneously on the same computer.

## CONNECT TO A DAW

- Launch Dante Virtual Soundcard
- Set number of channels and Start DVS
- DVS will appear as audio device on computer
  - Mac – Core Audio
  - Windows – ASIO or WDM
- Select as I/O device in DAW preferences



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When Dante Virtual Soundcard is turned ON, it appears to be a regular audio device to your computer, just like any audio hardware you might connect via USB, etc.

- Launch Dante Virtual Soundcard
- Set the necessary number of channels
- Start Dante Virtual Soundcard using the Start button

How Dante Virtual Soundcard appears as a device:

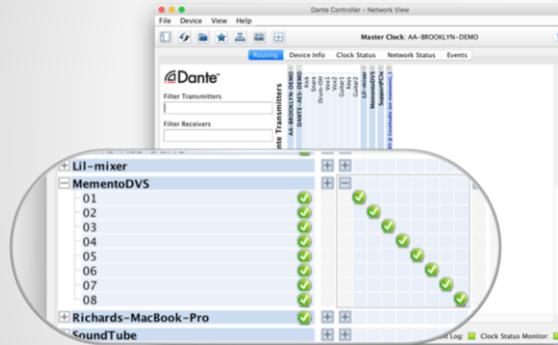
- On Mac OS X, Dante Virtual Soundcard appears as a standard Core Audio device.
- On Windows PC, Dante Virtual Soundcard supports either ASIO (very common for use with high performance recording software) or WDM (very common for use with “consumer” audio products on Windows, such as Windows Media Player)

In the audio application you wish to use, connect to Dante Virtual Soundcard exactly as you would any physical sound device:

- Open the audio preferences for the application
- Choose Dante Virtual Soundcard from the list of possible audio devices to use as source and/or destination

That's it.

# SUBSCRIBE CHANNELS



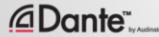
Open Dante Controller

•  
Computer with DVS appears as Dante device

•  
Subscribe channels to Dante devices on network

•  
Record/Playout

•  
Adjust sample rate in Dante Controller like other devices



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- Open Dante Controller (this can be on the same, or a different, computer on the Dante network)
- When Dante Virtual Soundcard is turned ON, your computer will appear in Dante Controller like anything other Dante device
- The name of the Dante device is the same as your computer's name, by default. This can be changed in Dante Controller like any other Dante device.
- The computer will display the number of transmitter and receiver channels configured in Dante Virtual Soundcard, above.
- Subscribe these channels like any other Dante device to send or receive audio.
- Example: to record a show from a mixer, we configure that mixer to send pre-fader outputs to it's Dante card. We then subscribe those Dante transmitter channels to the receiving channels of Dante Virtual Soundcard, and send the audio directly to our DAW.
- Sample rate for Dante Virtual Soundcard is adjusted using the Device View of Dante Controller, exactly like Dante hardware devices.

# DANTE

# VIA

---

DANTE CERTIFICATION PROGRAM

LEVEL 2



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Dante Via is the latest software product from Audinate.

# 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



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- Dante Via is software from Audinate that runs on your Mac or Windows PC, and it is a nifty piece of audio plumbing that is quite different from Dante Virtual Soundcard.
- Dante Via allows you to put any connected audio device on the Dante network
  - USB interfaces
  - USB mics
  - Thunderbolt I/O, etc.
- This feature Dante-enables your non-networked audio products, so your investments in USB, Firewire and Thunderbolt devices can continue to bring value in new environments and settings.
- Dante Via also allows you to connect any locally running audio application to the Dante network
- Different from Dante Virtual Soundcard; Dante Via exposes channels of audio applications by name
- Expose many audio applications to the Dante network at once, easily
- Total number of channels shown by Dante Via will thus vary depending upon what devices and applications are Dante-enabled; it shrinks and grows to fit what you are doing.
- Finally, Dante Via allows you to create novel internal audio routes between devices and applications on your computer, using a simple drag and drop interface
  - Drag any device or application to a destination to make a connection
  - Send audio from one application to another
  - Create “mixes” on the fly by combining audio from multiple sources simply drag them to a destination and choose “Add”

## ABOUT DANTE VIA

Shares some technology with Dante Virtual Soundcard

Dante Via and Dante Virtual Soundcard cannot run on the **same** computer at the **same** time

They will prevent each other from running simultaneously.

Dante Via can be a Clock Master– no hardware devices on network required

Allows creation of “Dante Via only” networks, 100% software-based



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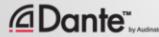
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- While Dante Via is similar in some ways to Dante Virtual Soundcard, the two applications cannot run at the same time on a single computer. They are mutually exclusive.
- They may each be installed, but may only be used one at a time
- Both Dante Via and Dante Virtual Soundcard will prevent each other from running if launched.
- Dante Via can act as a Clock Master, and so unlike Dante Virtual Soundcard it does not require a Dante hardware device on the network in order to function.
- This permits the creation of “Dante Via only” networks comprised of only computers and software.
- Dante Via may be used to provide a Master Clock to Dante Virtual Soundcard when running on different computers on the same network.

## DANTE VIA: EXTENDING USB I/O

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



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### Demonstration 1: Dante-enable a USB I/O

- Here we've plugged a USB I/O into this computer
- When we open Dante Via and start it, we see that the USB I/O is automatically discovered
- Like Dante networks, Dante Via automatically discovers any connected audio devices or running applications that are audio-capable.
- Note that each discovered device has a checkbox to “Enable Dante”
- Check this box
- On a second computer on the network running Dante Via, the USB I/O automatically appears.
  - In Dante Controller, the USB I/O is represented as labeled channels of the computer host name.
- In Dante Via on second computer, drag the discovered USB I/O to a destination of your choice. That's it, the route is made.
- We can also use Dante Controller to route audio from the USB mic to any destination on the network.

## DANTE VIA: AUDIO APPLICATION ON DANTE

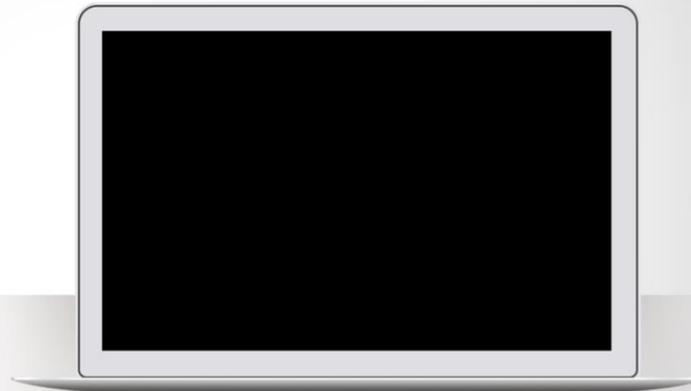
Start audio application, such as iTunes

•  
iTunes is auto-discovered

•  
Select "Enable Dante" for iTunes

•  
iTunes appears as labeled channels in Dante Controller

•  
Application audio only - no system sounds



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### Demonstration 2: Dante-enable an application

- Now we've started running iTunes
- Like most consumer audio applications, iTunes does not permit you to select a soundcard
- No problem for Dante Via. We check "Enable Dante" for iTunes, and it now appears in Dante Controller exactly like the USB mic did in the previous example.
- You can use this feature to create labeled channels for different audio applications all running at once.
- Now we use Dante Controller to send our iTunes audio to destinations on the Dante network.

## 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



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### Demonstration 3: Monitor Dante channels

- Since we can make any audio hardware part of our Dante network, we can also make our headphone jack part of the network
- We may then use headphones plugged into a laptop to monitor any Dante channels on the network
- Simply Enable Dante for the Built-in output (which is our headphone jack and internal speakers). This device now appears as receiving channels on our computer on the Dante network
- Open Dante Controller and send any Dante channels to these receiver channels to hear the audio in your headphones, without disturbing any routes.

Dante Via runs only at 48kHz/24-bit depth, and performs sample rate conversion to ensure that the many different sources and destinations can successfully connect

# NOW WHAT?

## TAKE THE **HANDS-ON TEST**

- Check with your instructor
- Test stations at most certification events
- Demonstrate your Dante knowledge on actual equipment
- Requires less than 30 minutes

Now that you've completed this session, we encourage you to take the hands-on and online tests to become Dante certified at Level 2.

- Hands on tests are available to most Dante certification events
- Check with your instructor
- It's an opportunity to demonstrate what you've learned about Dante, and takes less than 30 minutes to complete

Once that is done, you'll want to complete the online Level 2 test.

## TAKE THE ONLINE TEST

<http://www.audinate.com/certify>

- Create Audinate account if you don't have one
- Login at URL
- Take Level 2 test
- When combined with Hands-on test results, certificate is automatically generated

To take the Dante Certification Program Level 2 online test, start by creating an account at [audinate.com](http://www.audinate.com) if you don't already have one. Once that is done,

- Navigate to <http://www.audinate.com/certify> and login with your Audinate credentials
- Choose the Level 2 test
- Once successfully completed and combined with the successful results of your hands-on test, your certificate will be automatically generated and emailed to you.

**THANK  
YOU**