

DANTE CERTIFICATION PROGRAM

Level 1

THE DANTE CERTIFICATION PROGRAM

New 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



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



THE DANTE CERTIFICATION PROGRAM

Level 1: Introduction to Dante

- In-person and online delivery
- Background
- Basic signal routing
- Setting up Dante in simple systems (approximately 6 devices, 1 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



INTRODUCTION TO DANTE

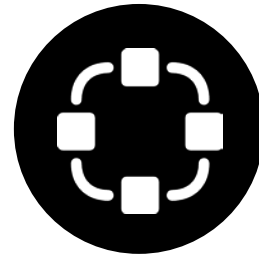
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ABOUT AUDINATE



Headquartered in
Sydney, Australia



Network
engineers first



Develop Dante as
100%
interoperable
solution
for all audio
manufacturers

WHAT WE MAKE

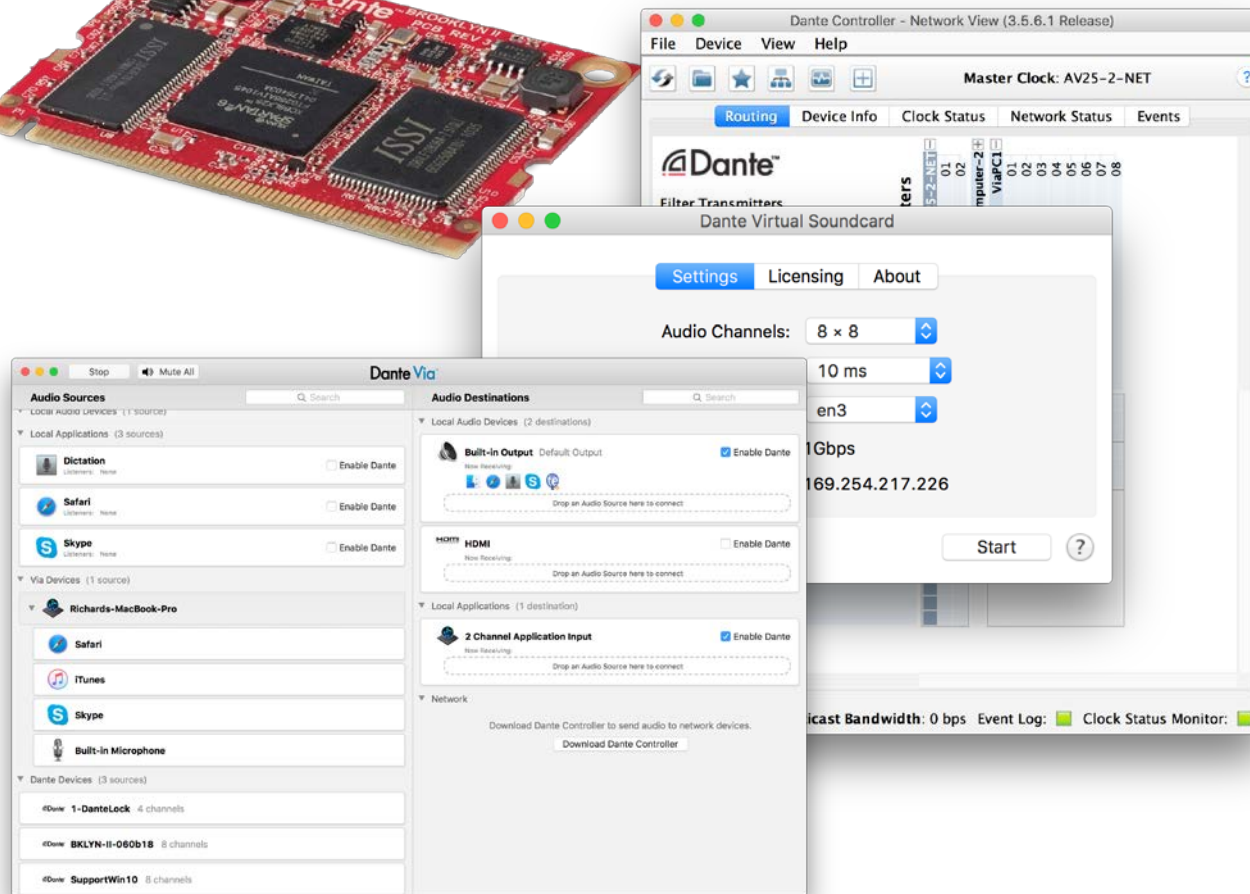
Dante technology
(all of it)

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 hands-on test



LEVEL 1 TOPICS

Digital audio
basics

IP networking
basics

What is

Dante™

Using

Dante™

DIGITAL AUDIO BASICS

Level 1

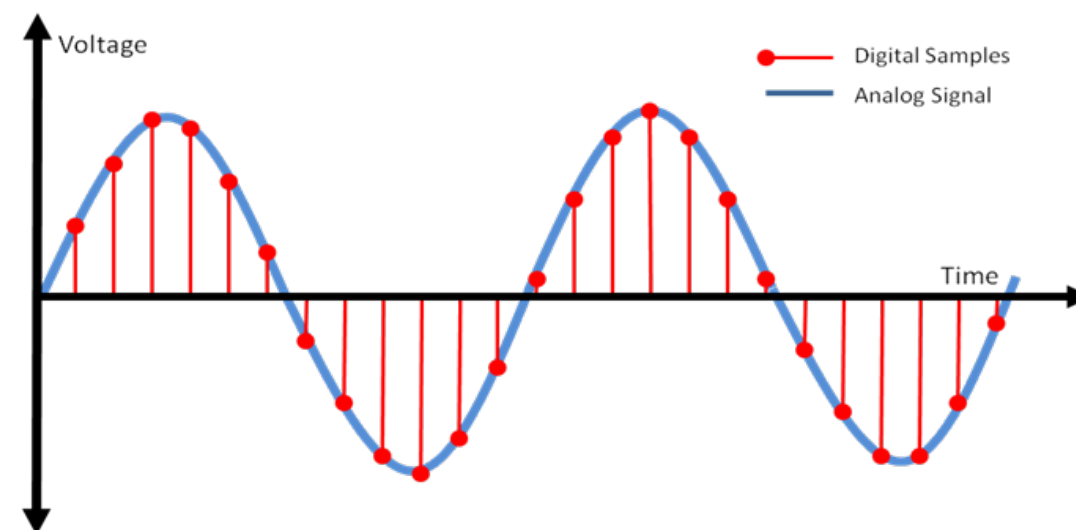
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ANALOG TO DIGITAL CONVERSION

Analog signal is sampled at constant intervals

- Yields a stream of values in time

- Pulse Code Modulation (PCM)

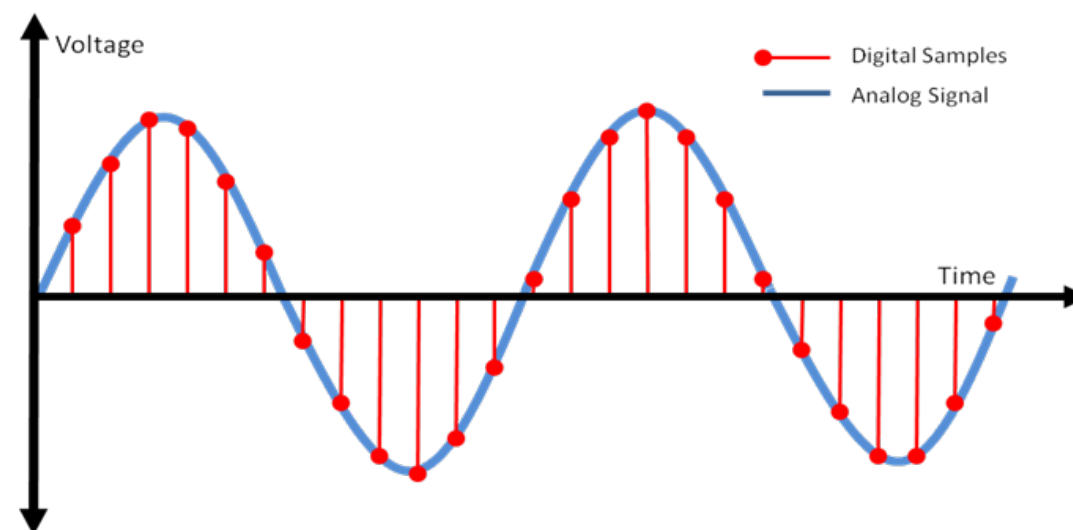


SAMPLE RATE

Interval at which samples are taken



Nyquist Theorem:
Samples must be taken at
least 2x maximum audio
frequency



BIT DEPTH

How many bits are used to represent amplitude



More bits -> more accuracy

CDs: 16 bits

Pro: 24 bits

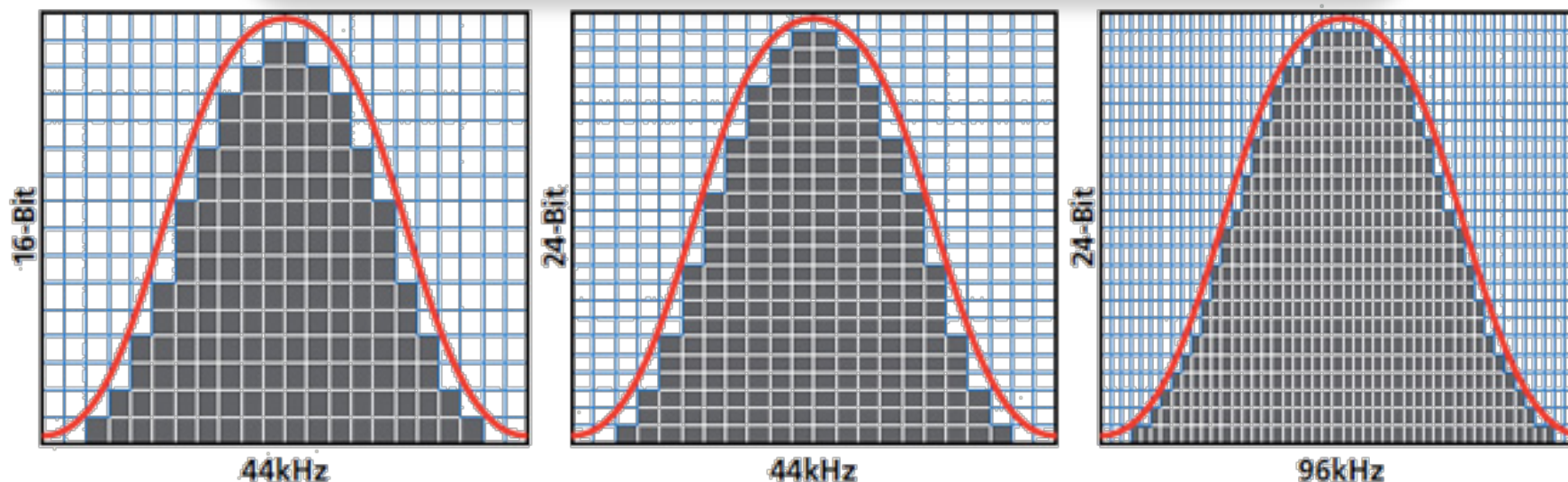
Number of Bits	Number of Values
1	2
2	4
4	16
8	256
16	65536
24	16777216
32	4294967296

COMBINING SAMPLE RATE & BIT DEPTH

More of each -> greater fidelity

- Increased bandwidth usage

- Greater sample rates -> fewer I/O channels



WORD CLOCK

The clock that determines where in the data an audio sample begins

- Must be consistent for all devices in a digital system so that data is read the same way
- Single Clock Master for multi-device systems



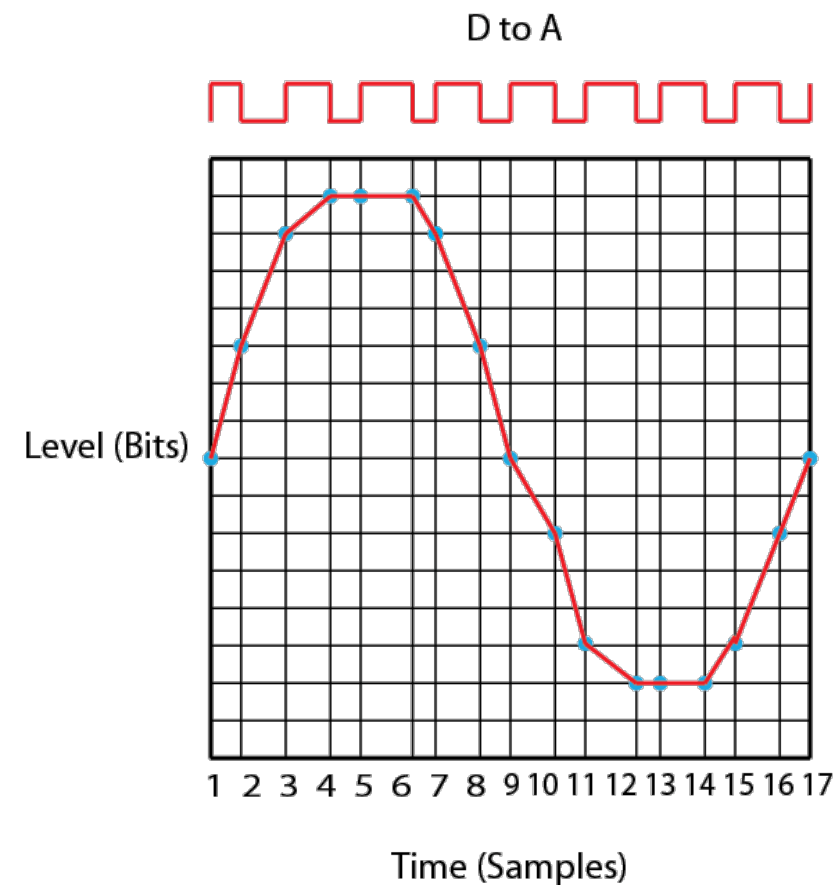
JITTER

Distortion caused by inconsistent word clock in playout

- Exists in all Digital Systems

- AES3, MADI, ADAT, S/PDIF

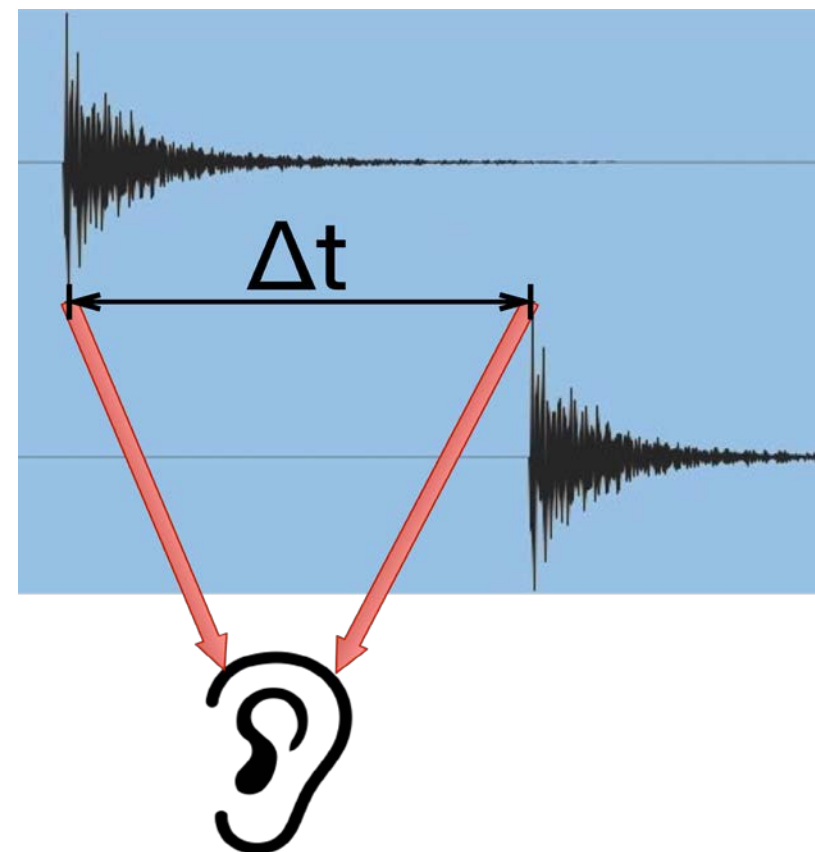
- Expensive to solve in older systems



LATENCY

Audio signal delay in a system

- Transport and processing
- Mainly a problem when we hear delayed and un-delayed signal simultaneously
- Problem for legacy networking systems (VoIP)



SUMMARY

Digital audio works by playing out or recording samples

Bit depth describes amplitude resolution

Sample rate determines maximum analog frequency



Word clock must be consistent and correctly sync'd



Digital audio produces data that can be transported like any other

IP NETWORKING BASICS

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HOW MUCH NETWORKING DO I NEED TO KNOW?

Not very much
(usually)

PHYSICAL SIDE OF NETWORKING

Modern small networks are made of 3 things:

Things that get connected

Switches: provide a central bridge for connections

Cables: connect them together



WHAT KIND OF CABLE FOR DANTE?

Same as for any regular
computer network

- Gigabit rated:
CAT5E
CAT6

- 100 meters max per run



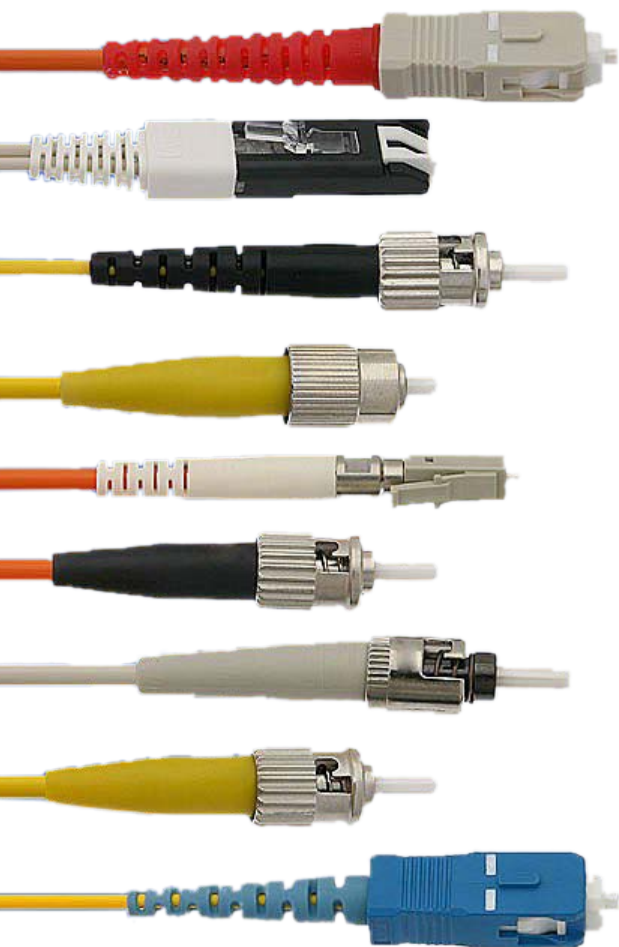
WHAT ABOUT WI-FI?



Wi-Fi is another way to connect to IP networks

- Less reliable than wired Ethernet
- Not compatible with Dante audio
- OK for Dante Controller only

WHAT ABOUT FIBER?



Just another
way to do
Ethernet

Much greater
distances if
needed

Requires
switches with
Fiber Interface
or a media
convertor

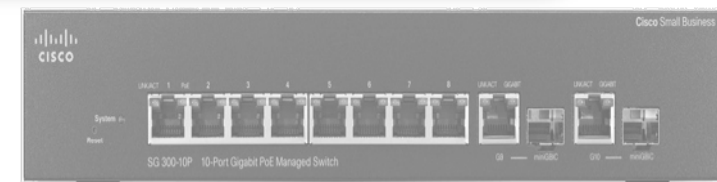
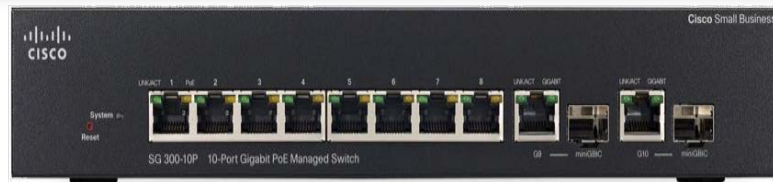
SWITCHES

Switches connect devices on a common network

- Available small (5 ports) up to large (100's+ ports)

- Switches support all ports going full speed all the time

- Use gigabit (or faster) switches!



SWITCHES – UNMANAGED & MANAGED

Unmanaged switches – plug ‘n play, limited



Managed switches – many, many options, tests and adjustments



Dante works with either type



Managed switches useful in heavily loaded networks



Unmanaged switches good in small networks

THEN YOU DON'T NEED A MANAGED SWITCH

For the statistical majority of networks using Dante today this is true...

Managed switches can help you build the network and have desirable features used by larger facilities

EEE SWITCHES

One special note:

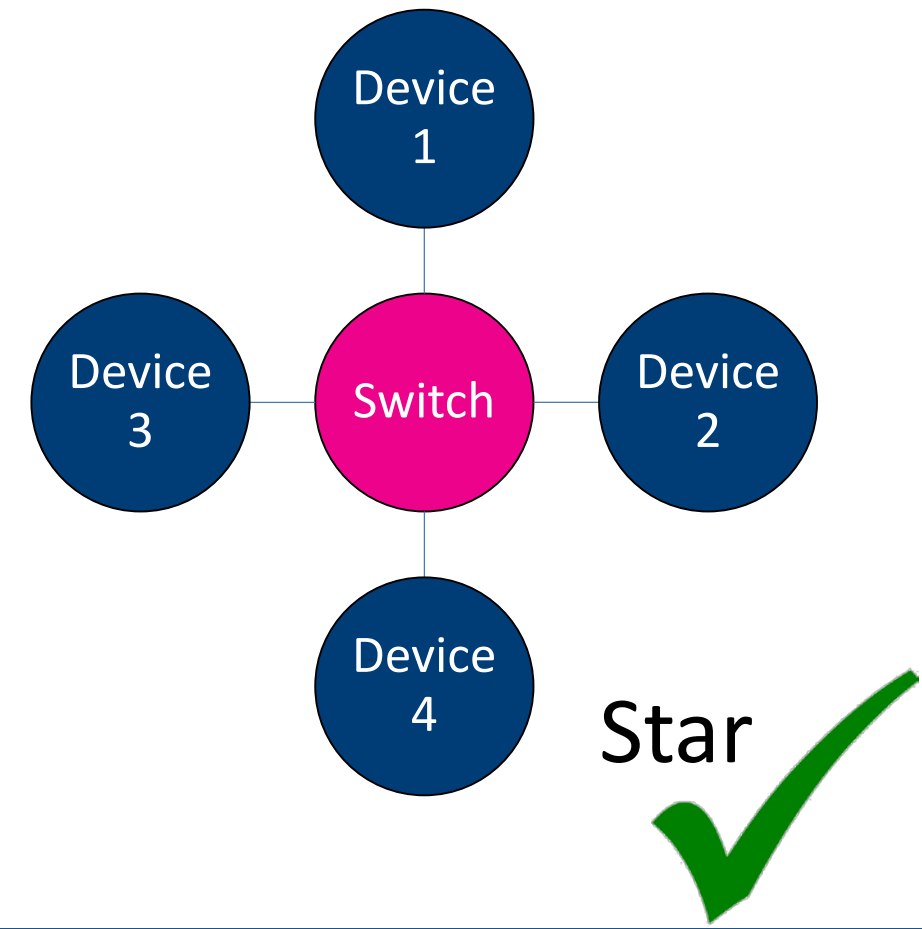
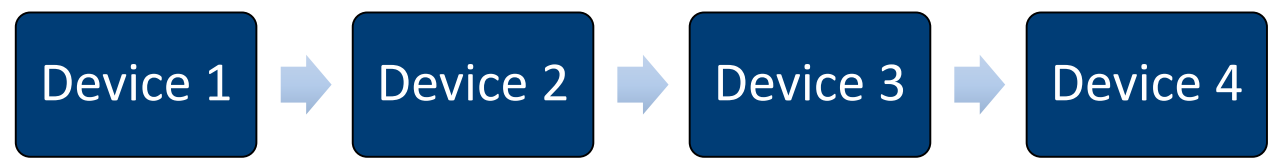
- EEE or “Green” switches are often not good choices for real time media
- The energy saving feature may shut down ports and prevent parts of Dante from working properly
- Disable this feature, or use switches that do not support it



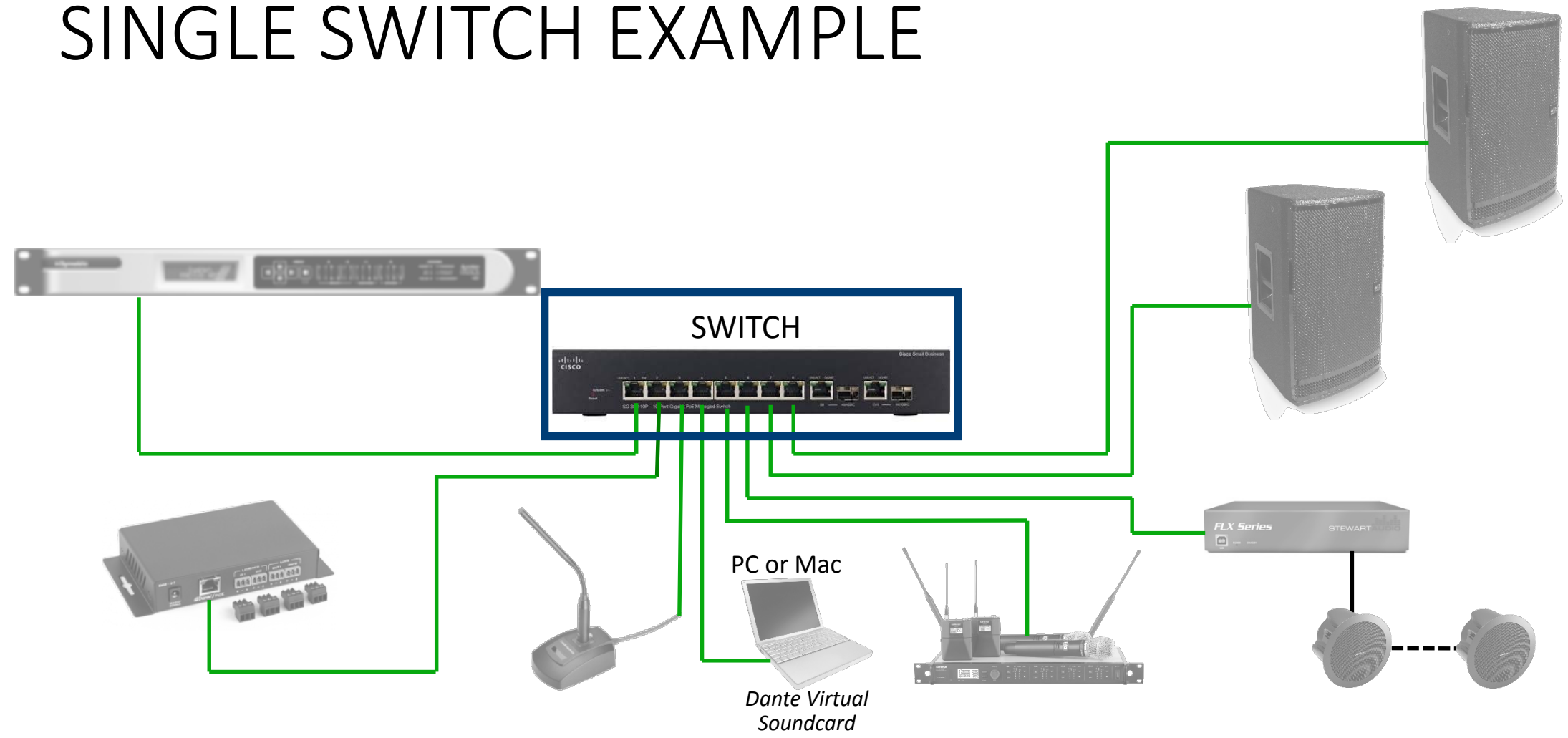
**Energy-Efficient
Ethernet**

TOPOLOGY

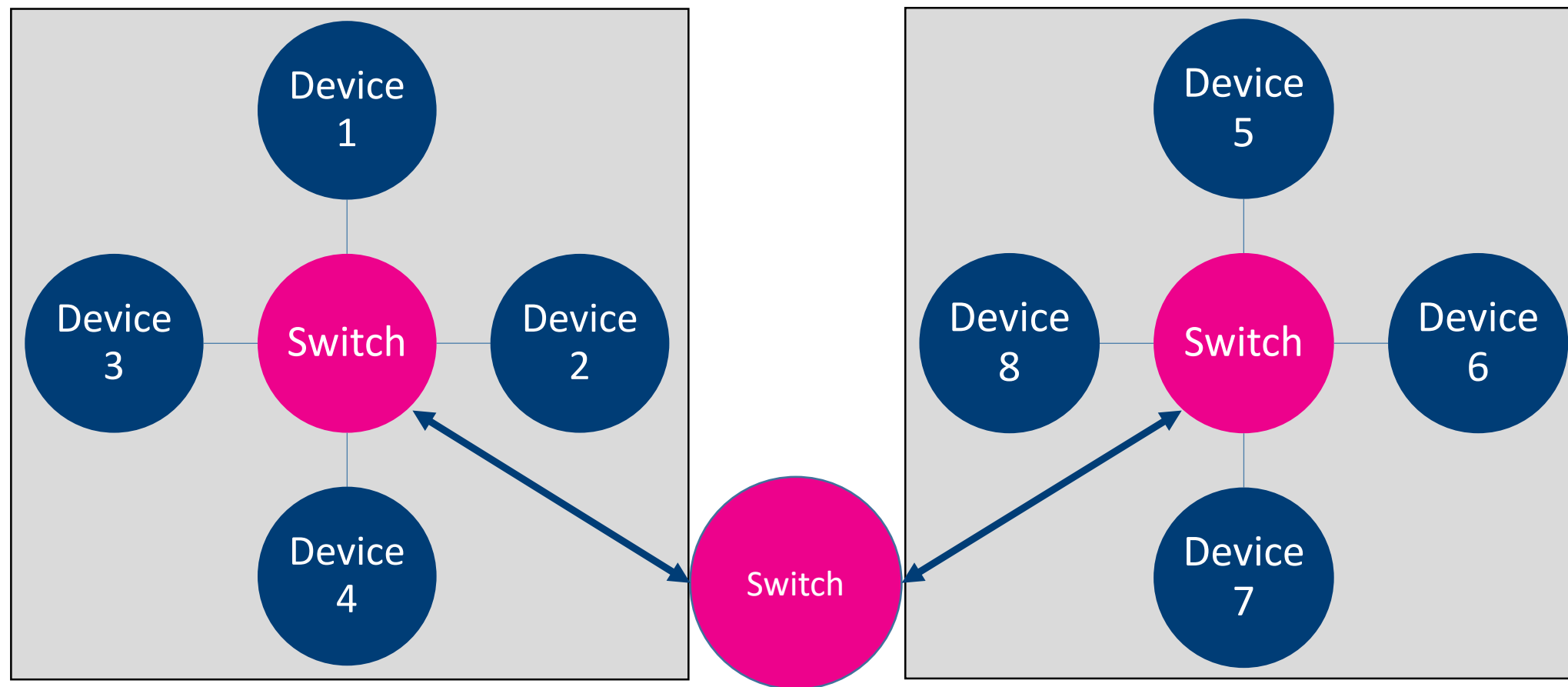
Daisy chain



SINGLE SWITCH EXAMPLE



Hierarchical networks



SUMMARY

- Always use gigabit switches
- Use CAT5E or CAT6 cable
- Use fiber for long runs (over 100 meters)
- Use either managed or unmanaged switches for smaller networks
- Dante-only networks with one switch do not require management features, and may safely use unmanaged switches.
- Use a "Star" topology to minimize switch hops
- Avoid or disable "green" or EEE features

LOGICAL SIDE OF NETWORKING

In analog, physical wiring showed signal paths

- In networks, connections “logical” – name-to-name

- Each cable carries many signals for many devices

- Data delivered in packets

- Network technology is neutral; no special gear needed for audio

A WORD ABOUT NETWORK LAYERS

Each layer passes data to the next

Layer 1: physical connections (e.g., cables)



Layer 2: devices represented by fixed hardware addresses (MAC)



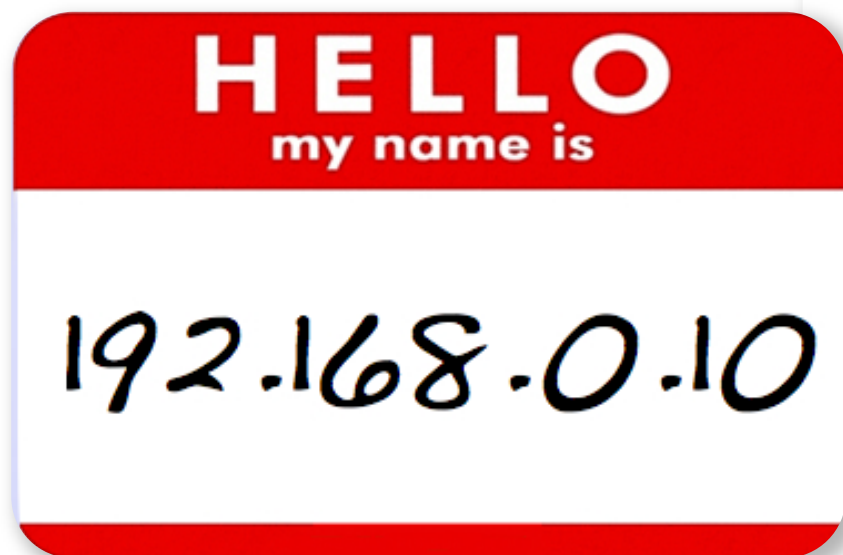
Layer 3: devices represented by variable IP addresses

Physical (hardware & cables)

Hardware addresses

IP addresses

WHAT IS AN IP ADDRESS?



Numeric addresses associated with devices

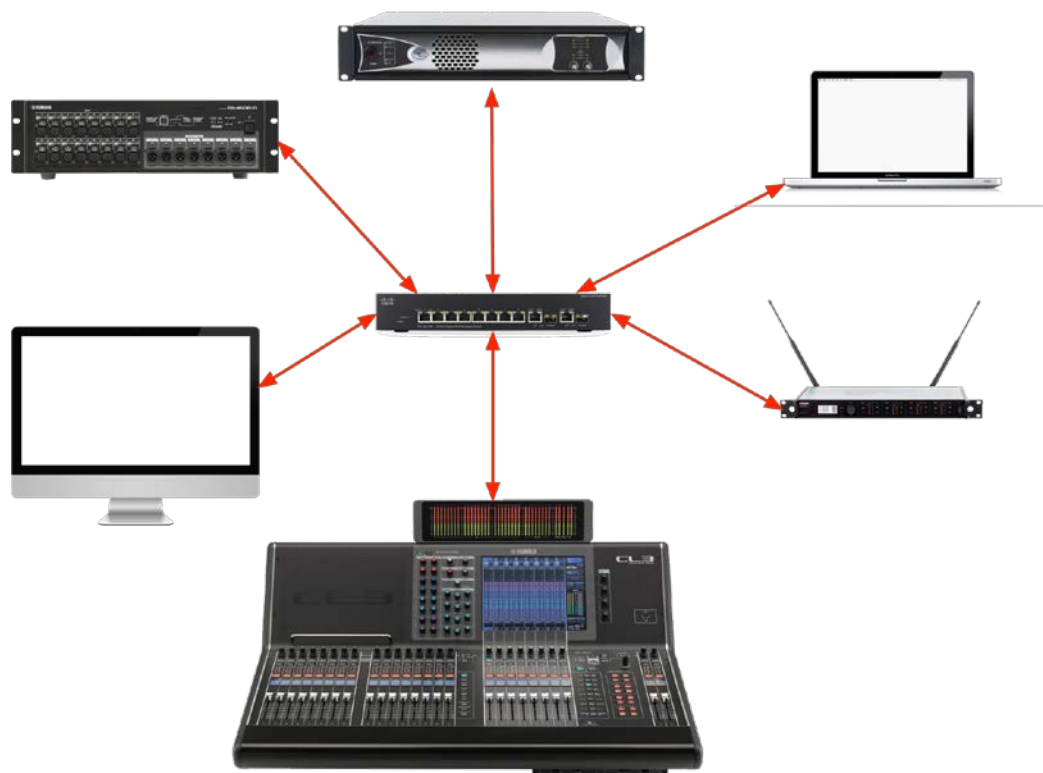
- On a LAN, direct communication only possible between devices in the **same** IP address range

- LAN: all addresses in same range

- Dynamic (preferred) or user-assigned

- Avoid manual (static) addressing to avoid duplicates or unreachable addresses

WHAT IS A LAN?



Local-area Network

- Small number of devices (<200)
- Very reliable, fast
- Shares a common IP address range
- Majority of audio networks are LANs

WHAT IS A “STAND ALONE” NETWORK?

A single LAN



Usually dedicated to one purpose



Not dependent upon external resources
(e.g., internet, servers)

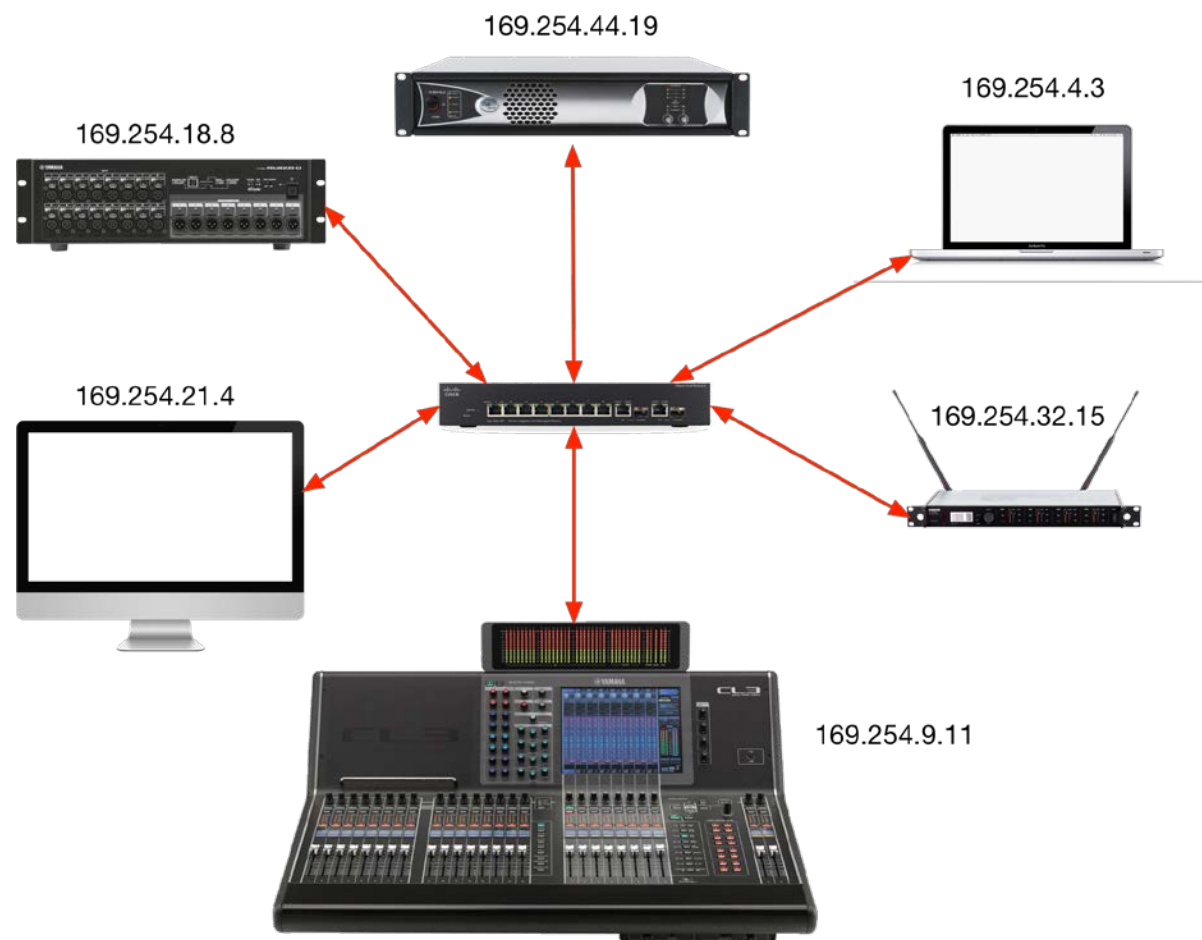


Not connected to other LANs through a router



Commonly used to separate responsibilities of AV installer

AUTOMATIC ADDRESSING



LAN requires IP addresses in a common range

- Automatic addressing enabled by default on Dante devices

- Self-assigned addresses create a working LAN

SUMMARY

Layer 3 networking allows use of IP addresses for connections

Automatic addressing enables simple “plug and play” use of Dante in stand alone networks – use it!

“Stand alone” networks are commonly used to separate and simplify responsibilities

WHAT IS DANTE?

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DANTE IS A HARDWARE AND SOFTWARE SOLUTION THAT TRANSPORTS PRECISELY TIMED DIGITAL AUDIO BETWEEN DEVICES USING STANDARD IP NETWORKING

DANTE FEATURES AND BENEFITS

All devices use human-readable names



Precise time alignment of all audio



Automatic device discovery



One-click routing

Low, deterministic latency

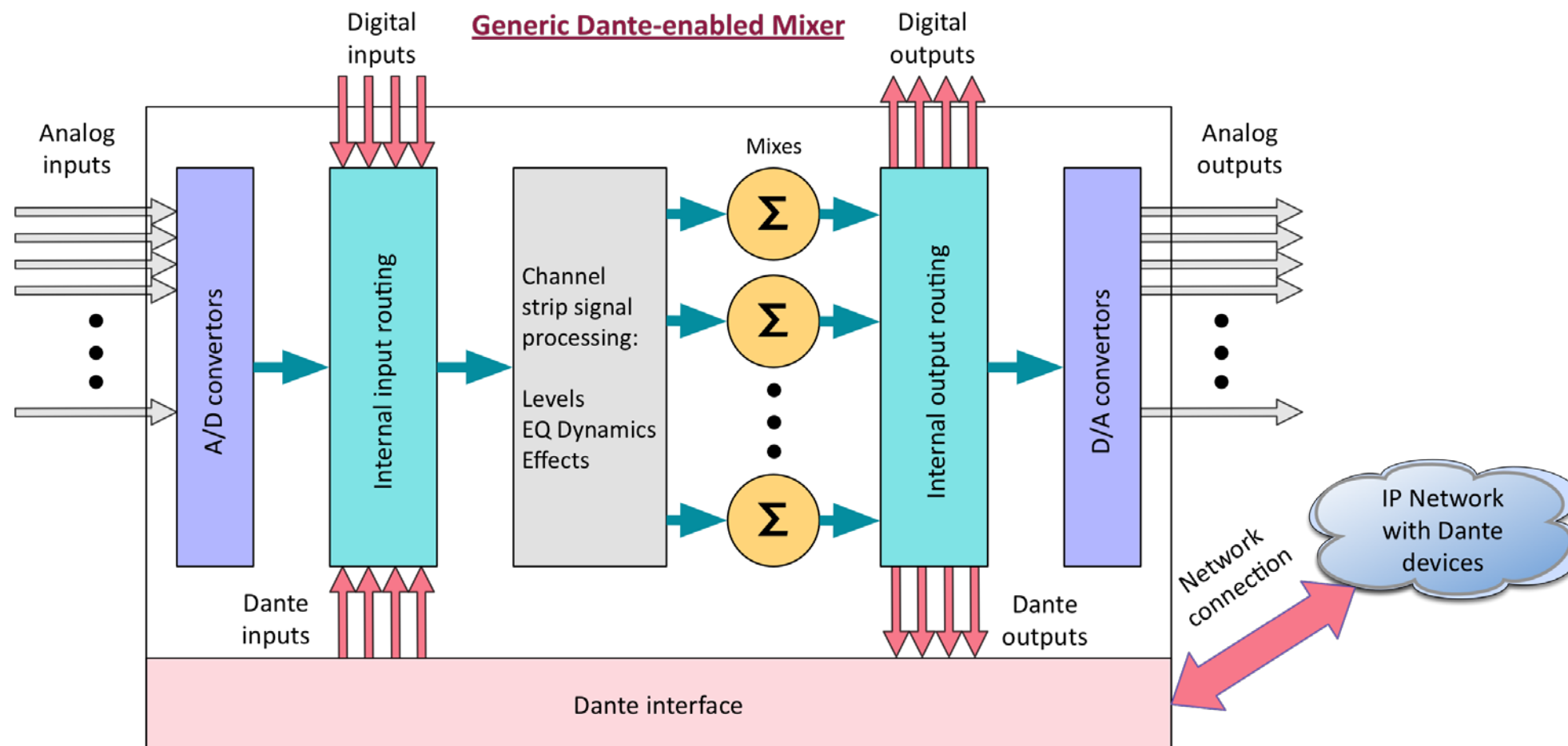


Virtually jitter-free



Automatic re-connection after power cycles

HOW IS DANTE BUILT INTO PRODUCTS?



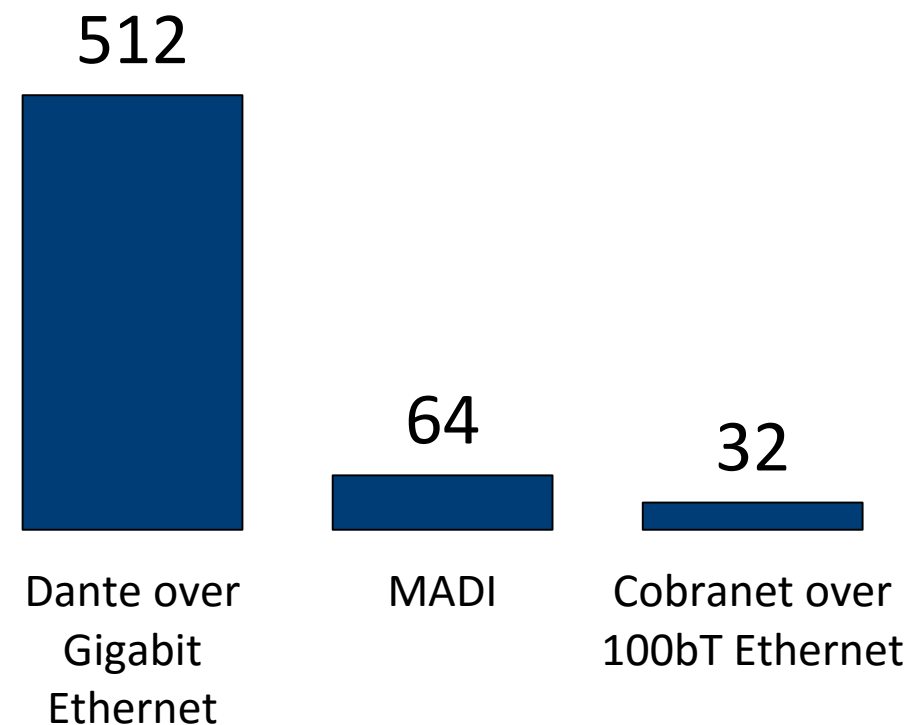
DANTE BANDWIDTH

Legacy digital systems constrained to lower channel count

- Gigabit means Dante is capable of 512x512 at each link, many more for entire network

- Even a large 64 channel console consumes only 1/8 capacity of a single port

Max Channels per link



SAMPLE RATE AND CONNECTION

48kHz



48kHz

Only Dante channels using the same sample rate may connect

- Multiple sample rates on the same network OK

- Higher sample rates = fewer channels for same bandwidth

- All common sample rates supported

LATENCY

- 100% deterministic – always well-defined
- Default Dante latency 1ms – suitable for large networks (10 hops!)
- 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

WHAT DOES DANTE NOT DO?

Sample rate conversion



Level control



MIDI



SMPTTE time code

These are handled by products
Control and other data runs alongside
Dante on network

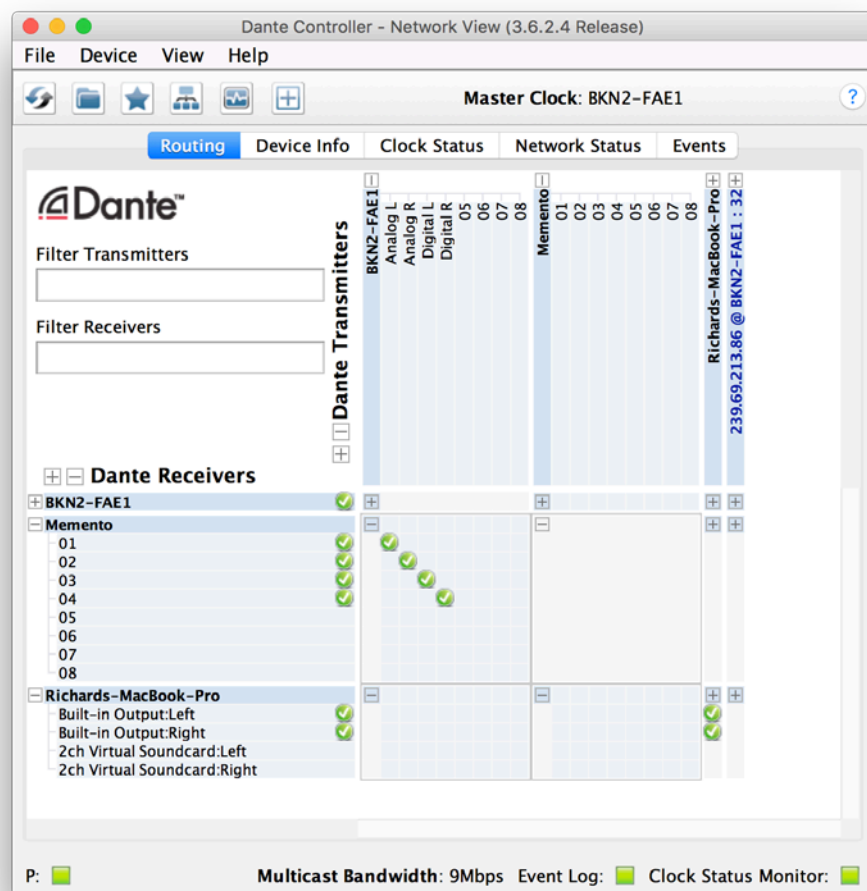


USING DANTE

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DANTE CONTROLLER



Primary Dante tool

•
Routing: Setup, view, change

•
Clocking adjustments

•
Sample Rate settings

•
Latency settings

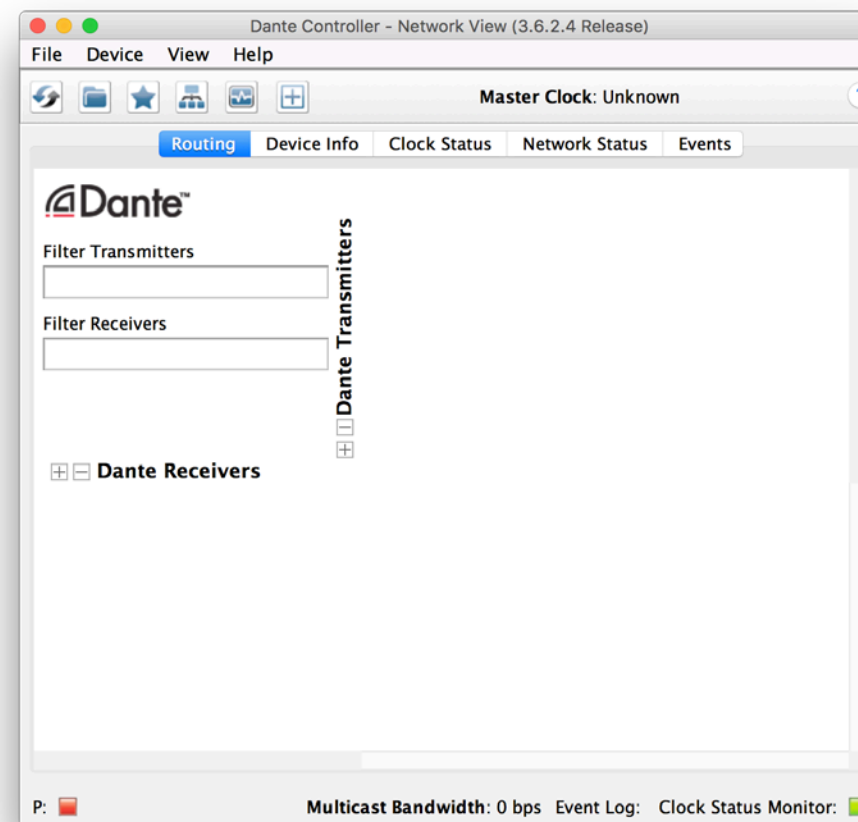
•
Clock and Latency monitoring

DISCOVERY AND ROUTING

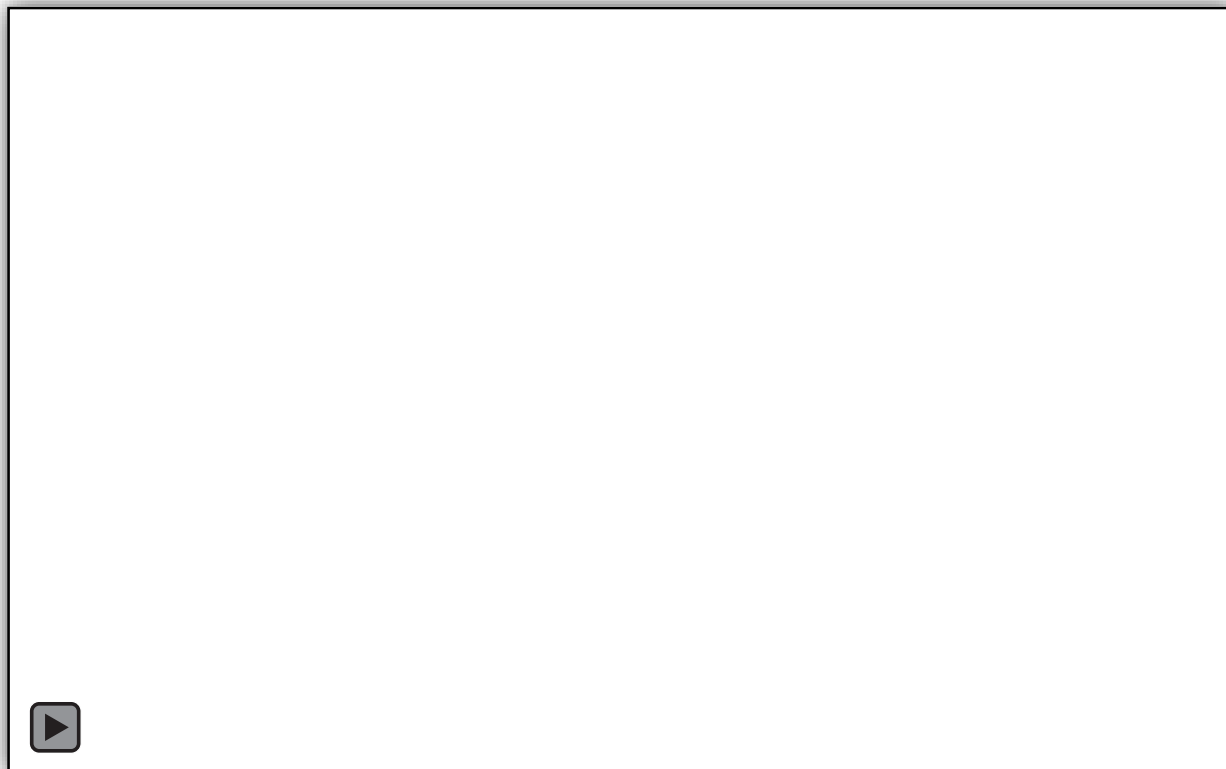
If no devices are connected, Dante Controller is empty

- Dante Controller always shows the *current state of the network*

- Key concept: Dante configuration lives in *devices*, not on your computer



DISCOVERY AND ROUTING DIRECTLY CONNECT ONE DEVICE



When they are connected to network, Dante devices automatically appear in Dante Controller

- No pre-configuration

- Human readable names

- *A Dante device can be connected directly to a computer*

DISCOVERY AND ROUTING

MULTIPLE DEVICES AND CHANNELS

Use switch to connect
multiple devices

- Click “+” sign to view device
channels

Click “-” sign to hide channels

- Transmitter channels on horizontal

- Receiver channels on vertical

DISCOVERY AND ROUTING SUBSCRIPTIONS

Dante connections are
“subscriptions”

- With device channels showing, click at intersection of desired transmit and receive channels

- Green checkmark means subscription is OK
Sample rates and types match

DISCOVERY AND ROUTING DELETING

To delete a subscription, click on
green checkmark



Checkmark disappears,
subscription deleted

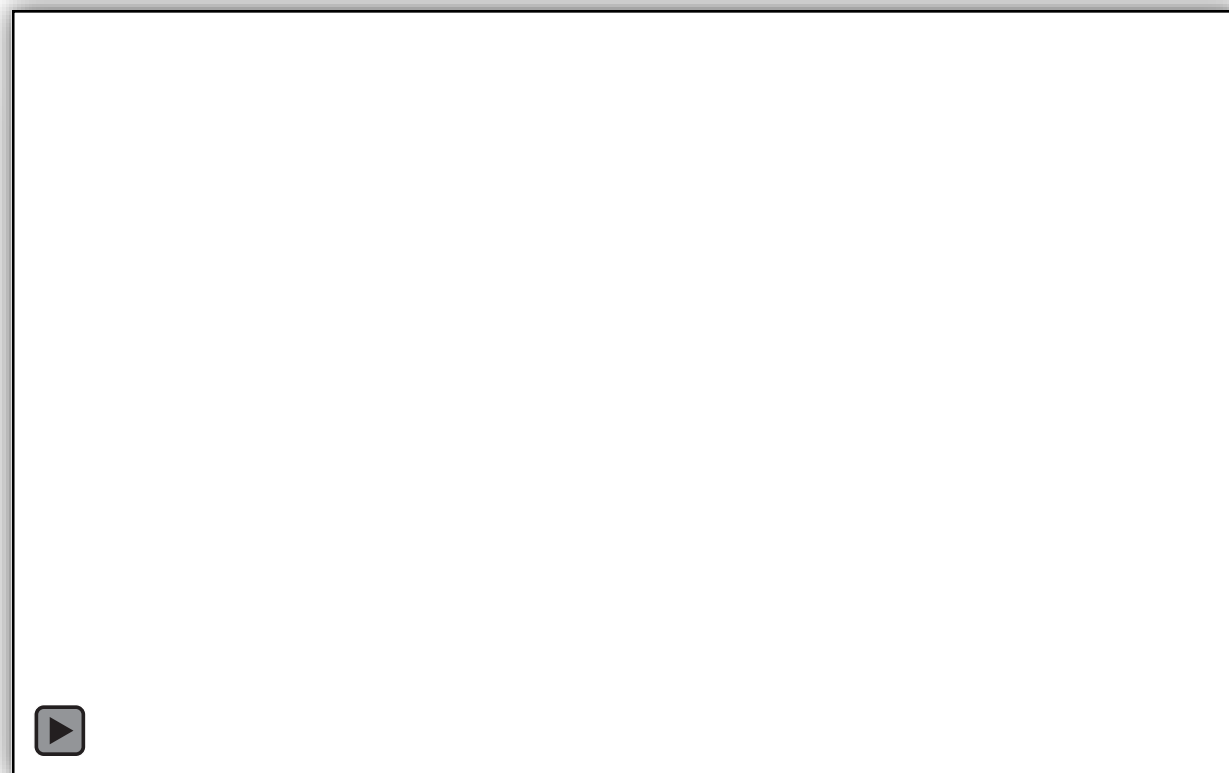


DISCOVERY AND ROUTING SPLITS

Splits are easy with Dante

- Simply click at intersections of multiple receiver's channels for a desired transmitter

- Audio is sent to all subscribed devices and channels



DEVICE NAMES

Recommended: Name first, then
route



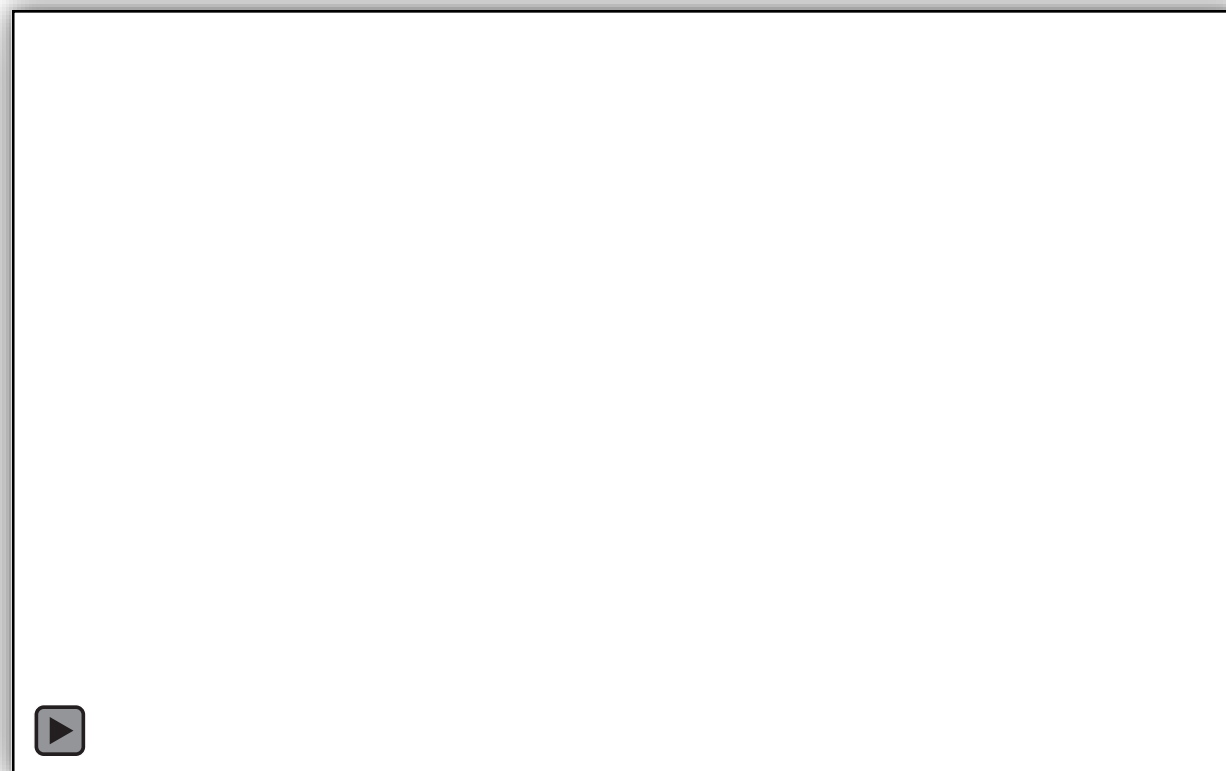
You can use device names of
your choice



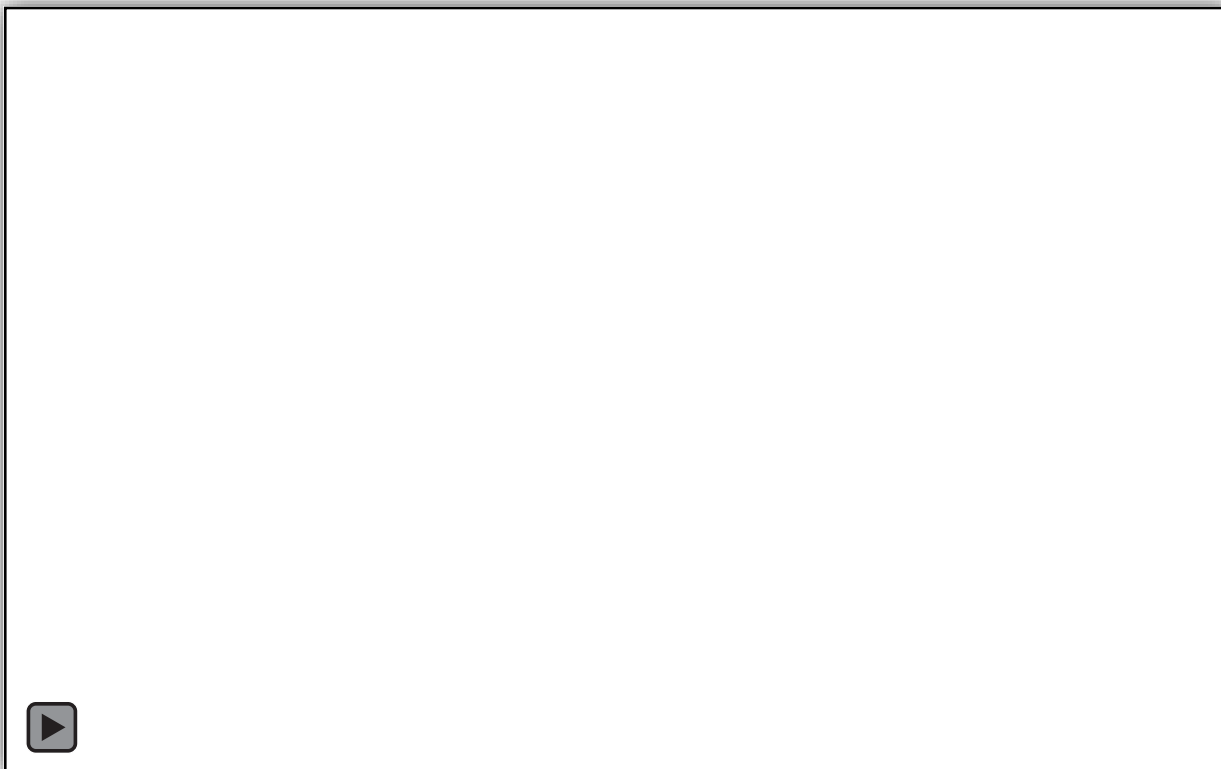
Double click device in Routing
view, go to Device Config tab



Edit name



CHANNEL LABELS



Labels can be applied to any channels



Use Device View



Makes it easy for volunteers or newbies to use system



Software version of tape 😊

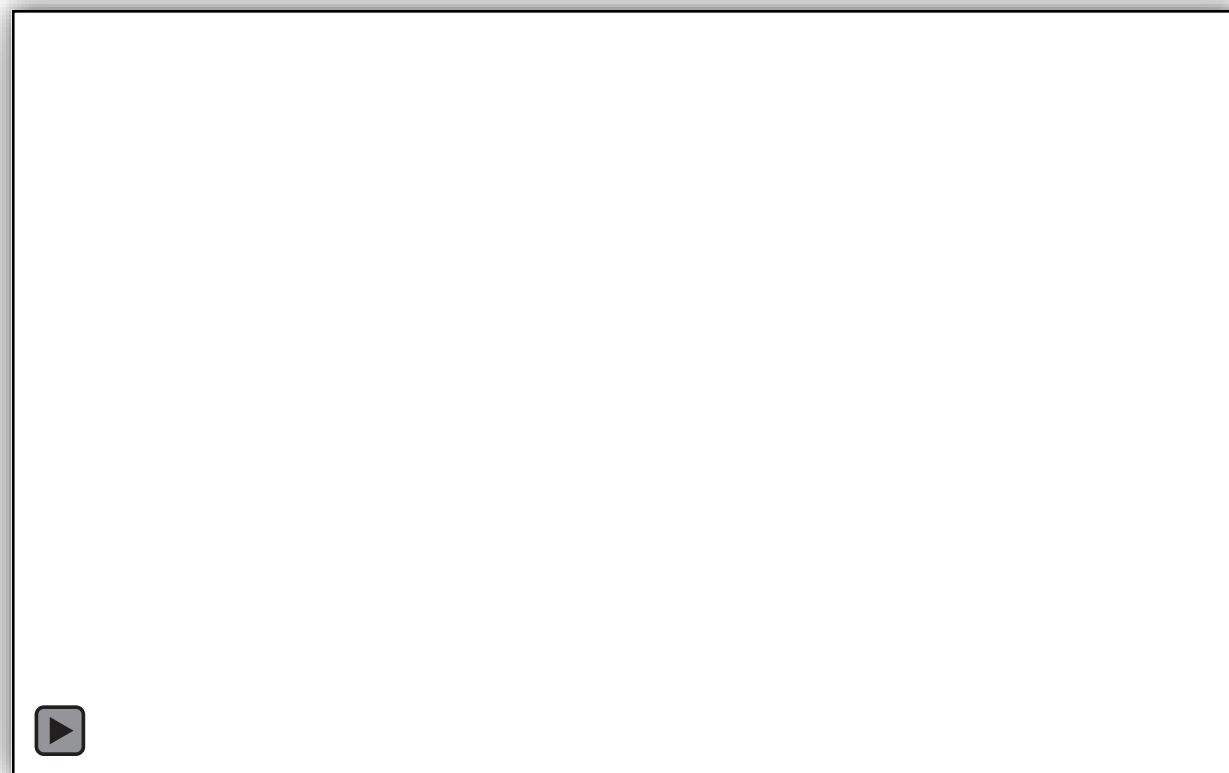
ADJUST SAMPLE RATE

In Device View -> Device Config
tab

- Adjust sample rate and bit depth
(Encoding)

- Choices determined by product

- Most common 48kHz / PCM 24



POWER CYCLE RECOVERY

Configurations are stored in Dante devices – not in Dante Controller



At power up and/or reconnection,
all subscriptions are re-
established



Dante Controller not required!



NO

Does Dante Controller need to be
on the network all the time?

SUMMARY: KEY TAKEAWAYS 1

- Dante Controller automatically displays connected devices
 - Dante devices and channels have user-definable names
- Dante Controller displays both transmitter (source) and receiver (sink) channels
 - Channel to channel connections are called **subscriptions**
- Subscriptions are made and deleted by clicking at the intersection of transmit and receive channels

SUMMARY: KEY TAKEAWAYS 2

Subscriptions may only be made between devices running the same sample rate, adjusted in Device View

- Dante devices “remember” settings and subscriptions

- Dante automatically selects a Master Clock

- Dante Controller does not need to remain on network

- Dante does not alter audio data in any way

NEXT STEPS

- Want to know more?
- Take Level 2!
- Go in depth on:
 - Dante Controller
 - Dante Virtual Soundcard
 - Using Multicast
 - Redundant Dante networks
 - More!



TAKE THE TEST

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

- Create Audinate account if you don't have one
- Login at URL
- Take Level 1 test
- Certificate automatically generated

THANK
YOU