DANTE
CERTIFICATION PROGRAM

LEVEL 1

Dante™ by Audinate

http://www.audinate.com/resources

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

http://www.audinate.com/resources

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 with Dante Controller
- Setting up Dante in simple systems (approximately 6 devices, 1 switch)
- Recording with Dante Virtual Soundcard

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 in depth

http://www.audinate.com/resources

THE DANTE CERTIFICATION PROGRAM

Required steps:
- Level 1: Pass Level 1 **online** exam
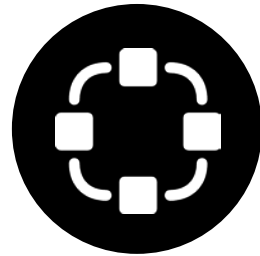- Level 2: Pass Level 2 **online** exam PLUS "hands on" exam at event

http://www.audinate.com/resources

INTRODUCTION TO DANTE

DANTE CERTIFICATION PROGRAM

LEVEL 1

http://www.audinate.com/resources

ABOUT AUDINATE

Headquartered in Sydney, Australia

Network engineers first

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

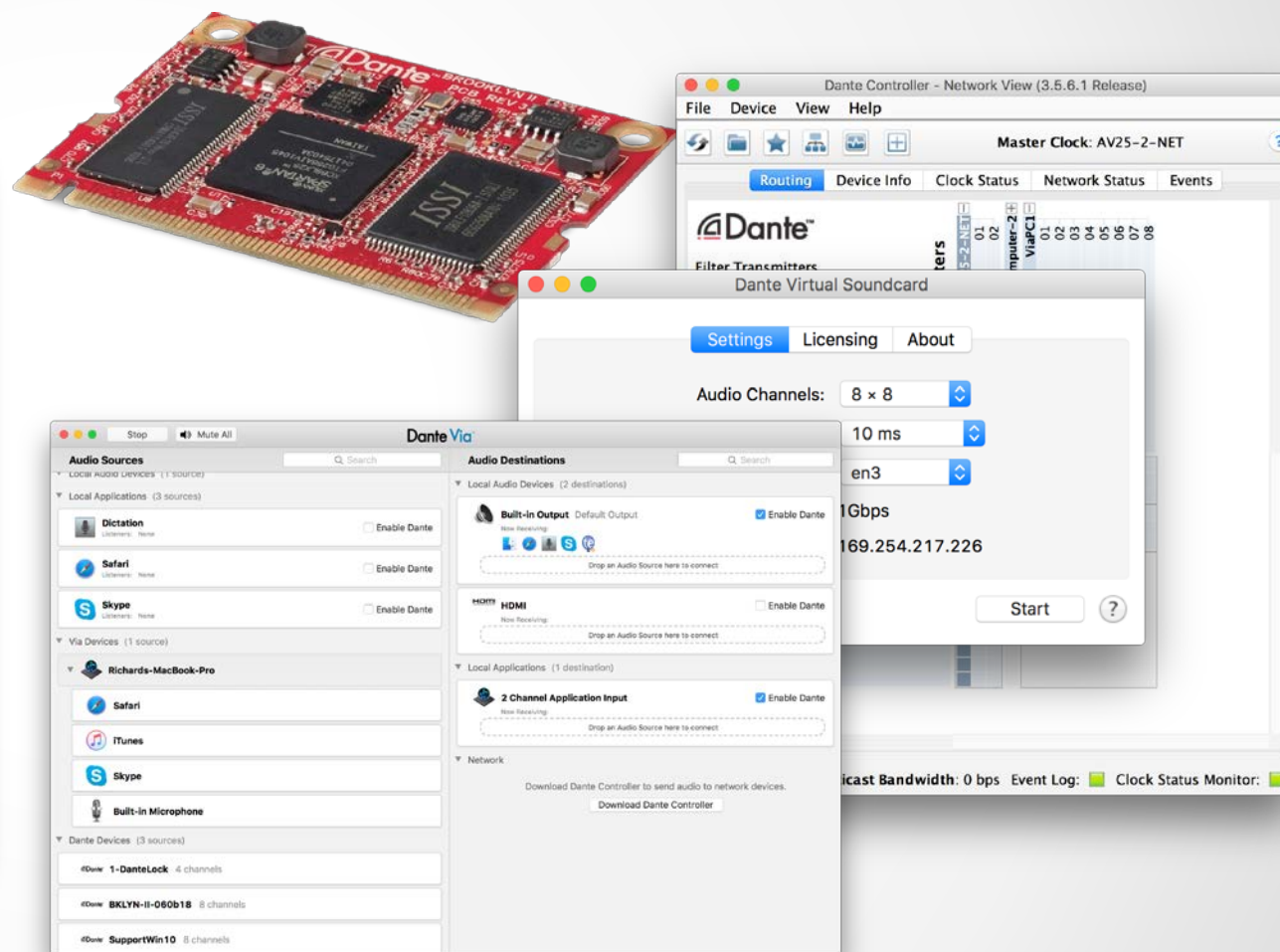http://www.audinate.com/resources

WHAT WE MAKE

Dante technology
(all of it)

Hardware modules

Development tools

Software products:

- Dante Controller
- Dante Virtual Soundcard
- Dante Via

http://www.audinate.com/resources

LEVEL 1 TOPICS

Digital audio basics

IP networking basics

What is Dante™

Using Dante™

http://www.audinate.com/resources

DIGITAL
AUDIO BASICS

LEVEL 1

DANTE CERTIFICATION PROGRAM

ANALOG TO DIGITAL CONVERSION

Analog signal is sampled at
constant intervals

●

Yields a stream of values
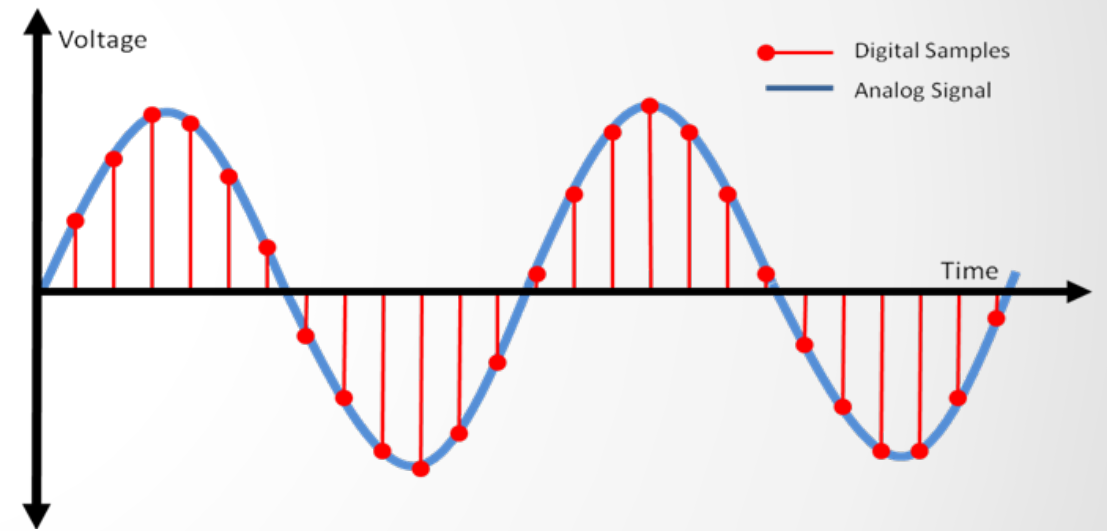in time

●

Pulse Code Modulation (PCM)

http://www.audinate.com/resources
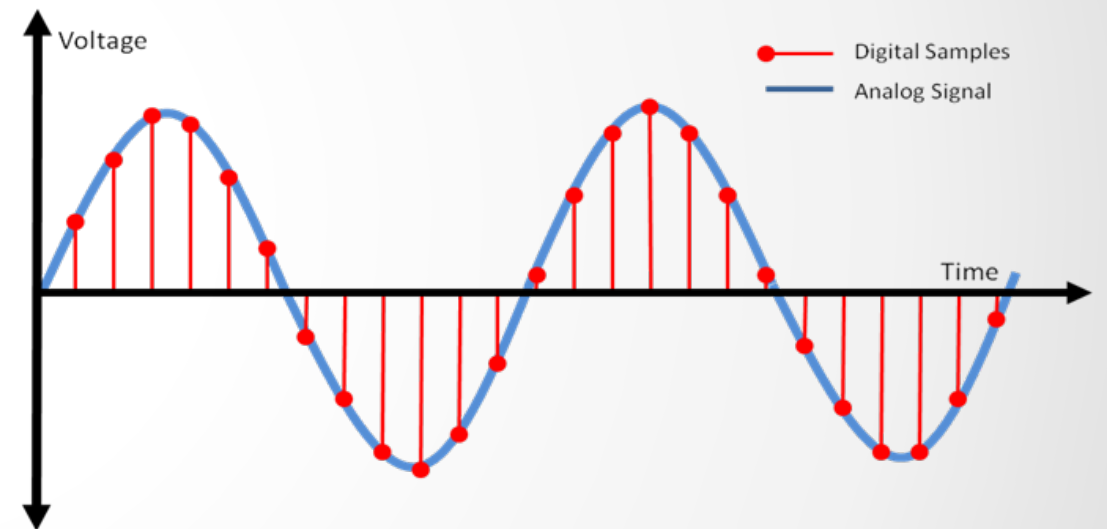
SAMPLE RATE

Interval at which samples are taken

●

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

Voltage

● Digital Samples
— Analog Signal

Time

http://www.audinate.com/resources

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

http://www.audinate.com/resources

COMBINING SAMPLE RATE & BIT DEPTH

More of each -> greater fidelity

●

Increased bandwidth usage

●

Greater sample rates -> fewer I/O channels

16-Bit | 44kHz

24-Bit | 44kHz

24-Bit | 96kHz

http://www.audinate.com/resources
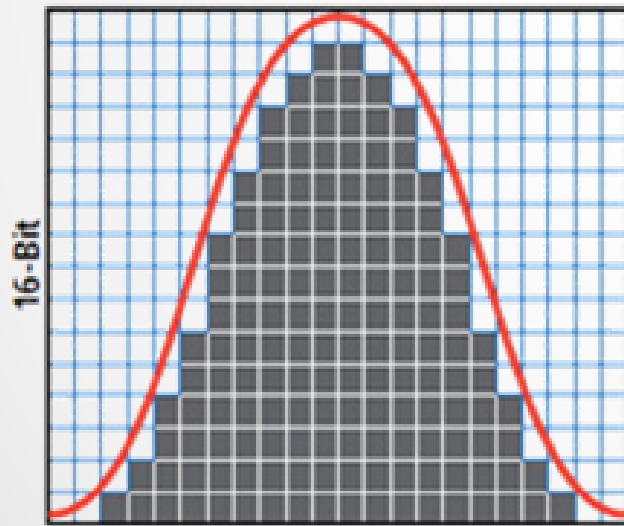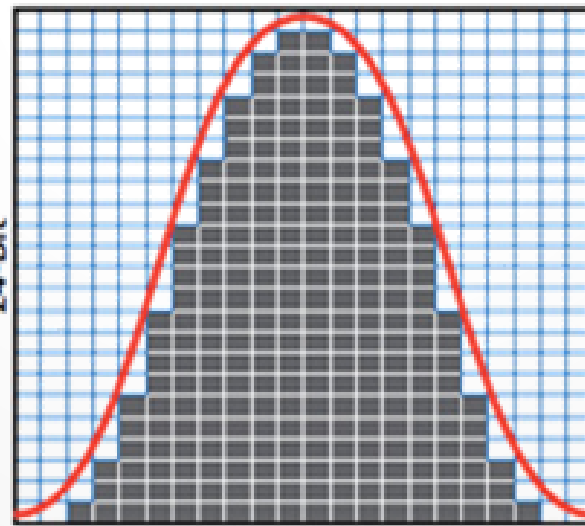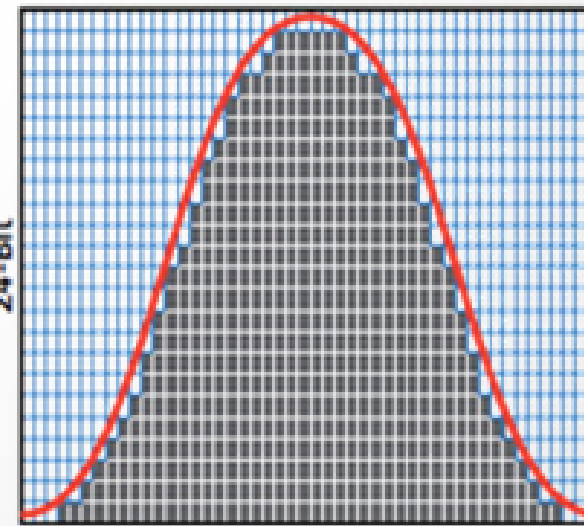
BANDWIDTH USAGE

PCM Audio Bandwidth = (Sample rate) x (Bit depth) x (No. of channels)

●

Example: 64 channels of PCM audio at 48kHz/24-bit = 48,000 x 24 x 64 = <u>74 mbits/sec</u>

●

With network overhead, 64 channels ≈ 96mbps

●

Less than 10% of a gigabit link

http://www.audinate.com/resources

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

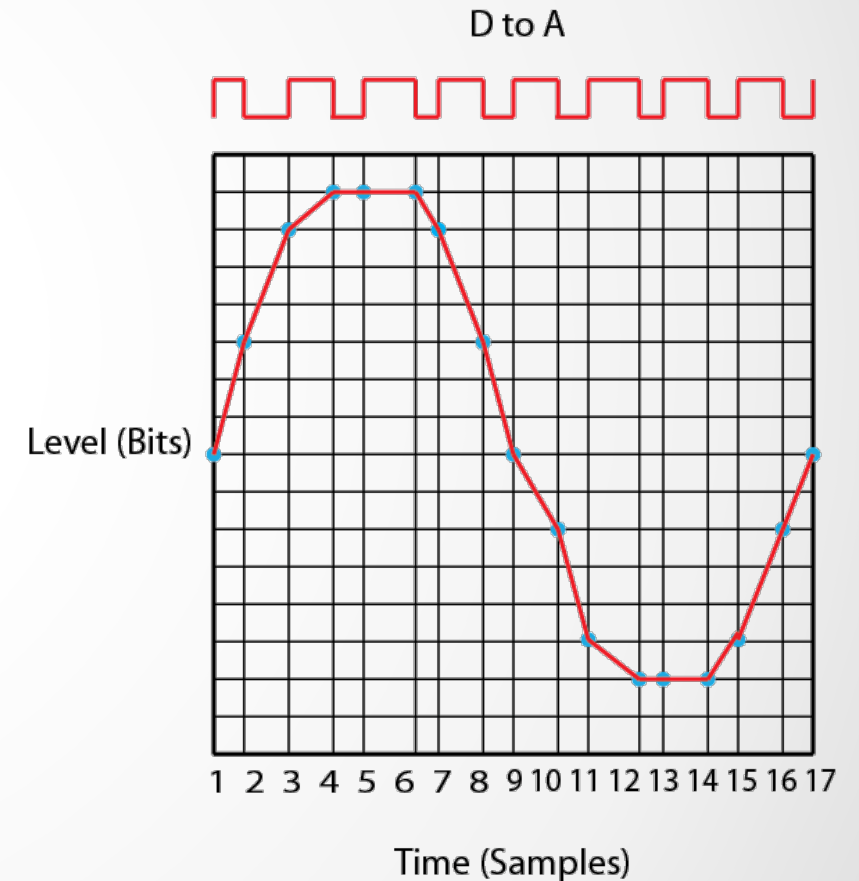http://www.audinate.com/resources

JITTER

Distortion caused by inconsistent word clock in playout

●

Exists in all Digital Audio Systems

●

AES3, MADI, ADAT, S/PDIF

●

Expensive to solve in older systems

D to A

Level (Bits)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Time (Samples)

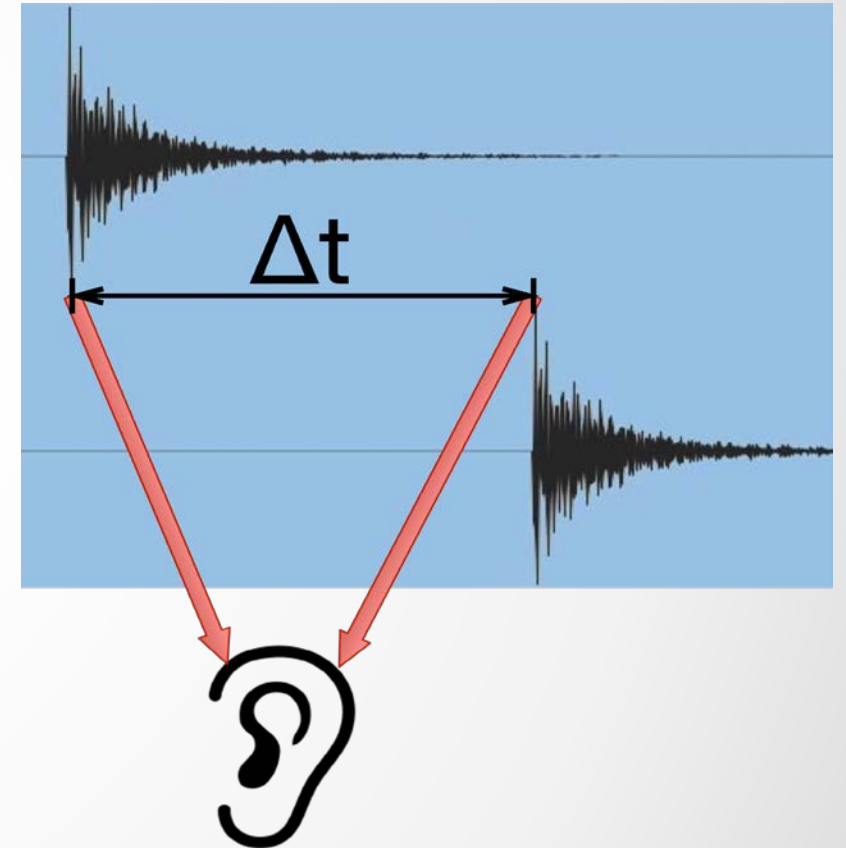http://www.audinate.com/resources

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)

http://www.audinate.com/resources

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 – *time* is the key that Dante provides

http://www.audinate.com/resources

IP NETWORKING BASICS

DANTE CERTIFICATION PROGRAM

LEVEL 1

http://www.audinate.com/resources

HOW MUCH NETWORKING DO I NEED TO KNOW?

NOT VERY MUCH

(USUALLY)

http://www.audinate.com/resources

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

http://www.audinate.com/resources

WHAT KIND OF CABLE FOR DANTE?

Same as for any regular computer network

•

Gigabit rated:
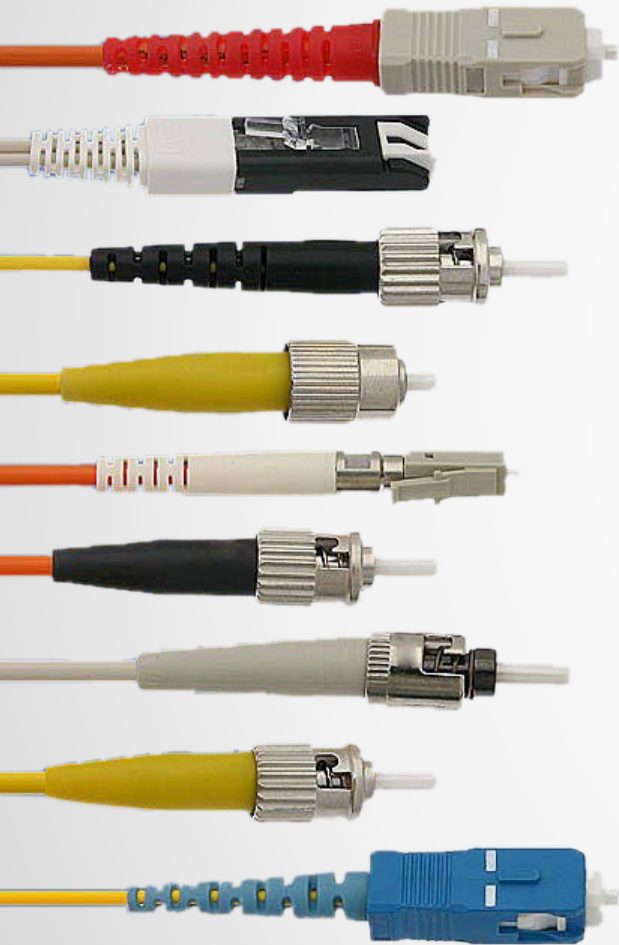CAT5E
CAT6

•

100 meters max per run

WHAT ABOUT WI-FI?

Wi-Fi is another way to connect to IP networks

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

http://www.audinate.com/resources

WHAT ABOUT FIBER?

Just another way to do Ethernet

Much greater distances if needed

Requires switches with SFP
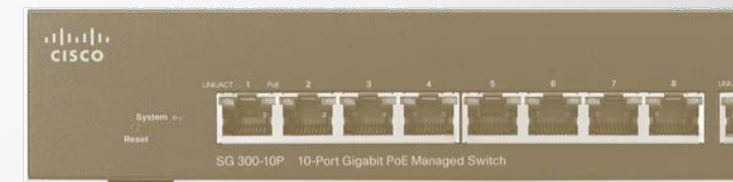
http://www.audinate.com/resources

27

SWITCHES

Switches connect devices on a common network

●

Available small (5 ports) up to large (48 ports)

●

Switches support all ports going full speed all the time

●

Use gigabit (or faster) switches!

http://www.audinate.com/resources

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 "mixed" (e.g., audio + other data) or heavily loaded networks

●

Unmanaged switches good in small dedicated audio networks

http://www.audinate.com/resources

29

THEN YOU DON'T NEED A MANAGED SWITCH

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

And you are **only** using the network for Dante audio…

http://www.audinate.com/resources

EEE SWITCHES

One special note:

- EEE or "Green" switches are often not good choices for real time media

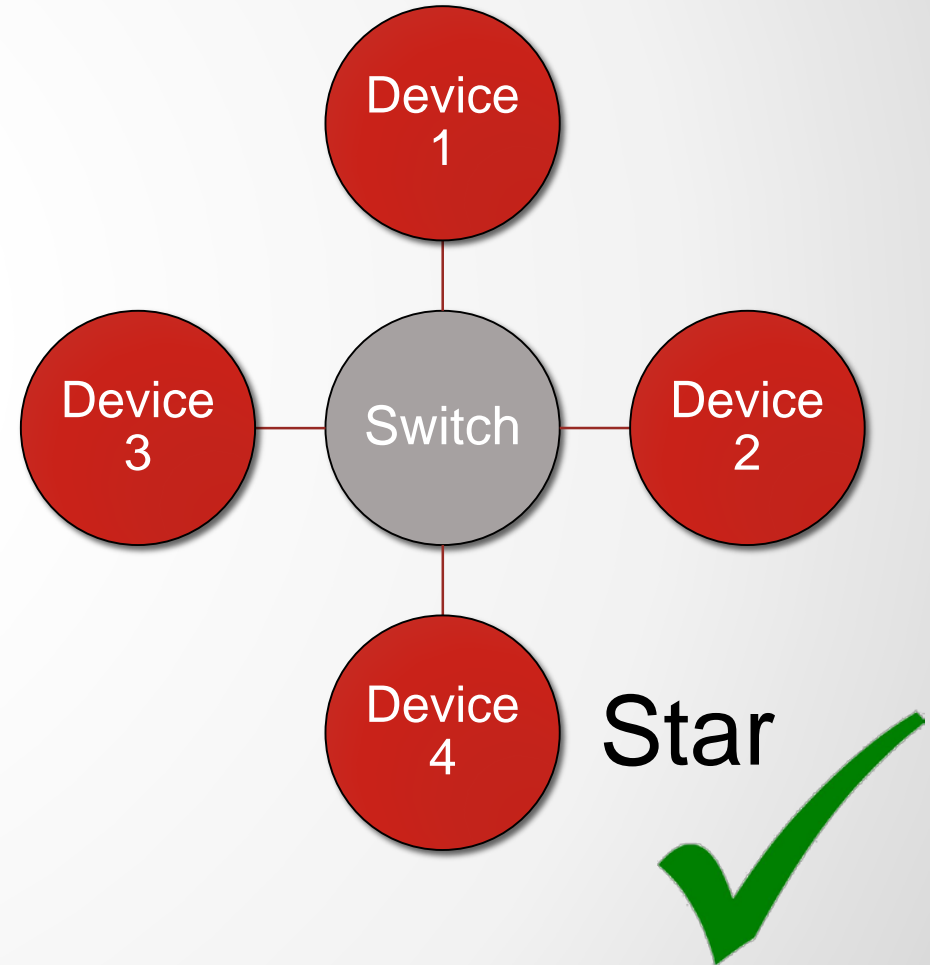- The energy saving feature will shut down ports and prevent parts of Dante from working properly
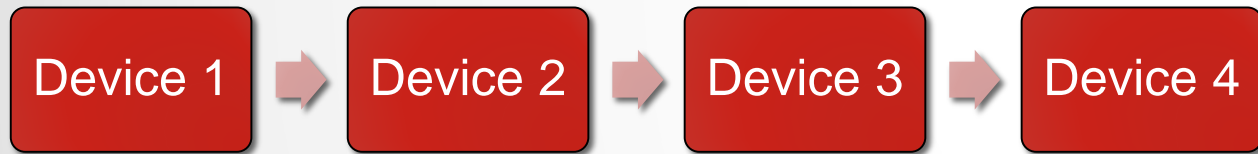
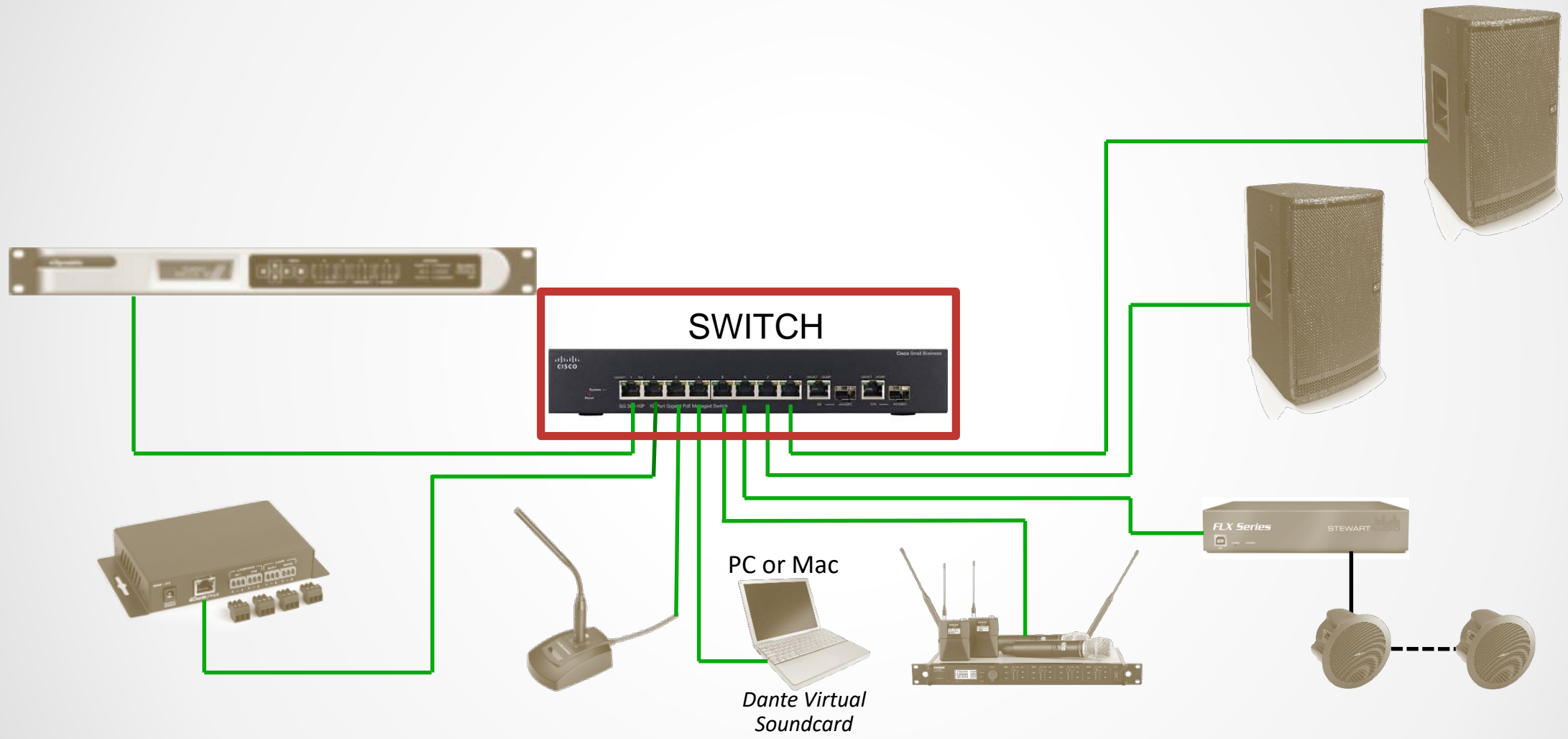- Disable this feature, or use switches that do not support it

Energy-Efficient Ethernet

TOPOLOGY

Daisy chain

Star

http://www.audinate.com/resources

SINGLE SWITCH EXAMPLE

SWITCH

PC or Mac

Dante Virtual Soundcard

http://www.audinate.com/resources

MULTIPLE STARS

http://www.audinate.com/resources

MULTIPLE STARS EXAMPLE

PC or Mac

Dante Virtual Soundcard

PC or Mac

Dante Virtual Soundcard

PC or Mac

Dante Virtual Soundcard

PC or Mac

Dante Virtual Soundcard

http://www.audinate.com/resources
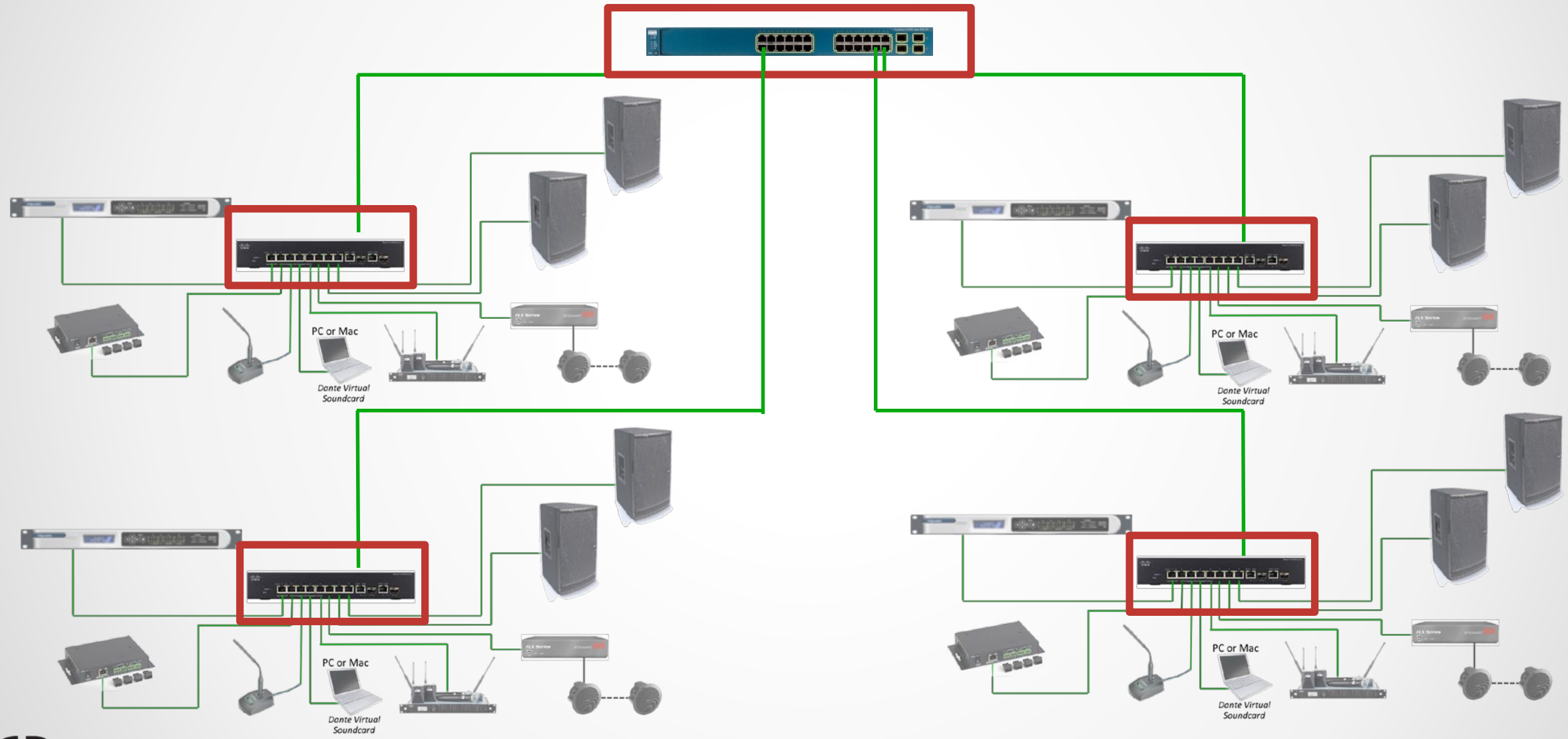
35
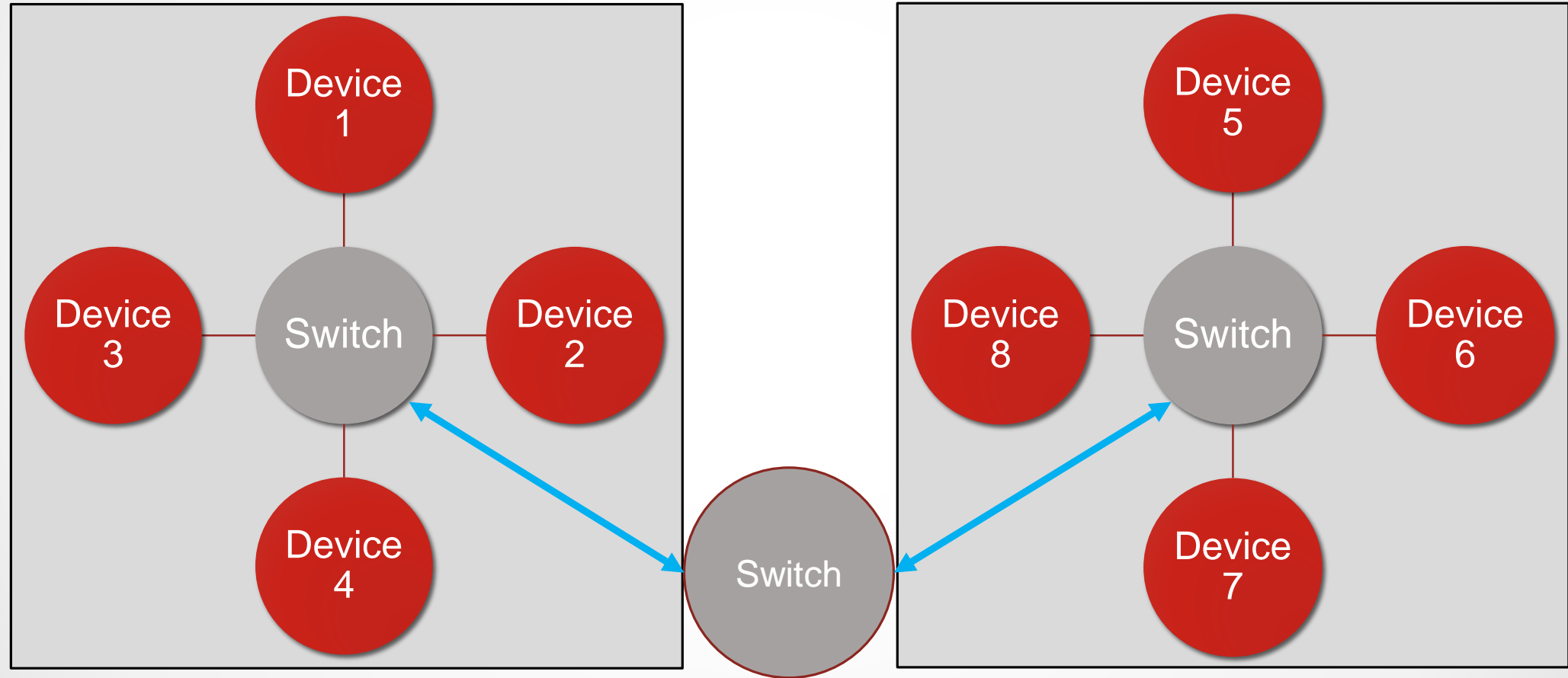
SUMMARY

- 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

http://www.audinate.com/resources

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

http://www.audinate.com/resources

A WORD ABOUT NETWORK LAYERS

Each layer passes data to the next

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

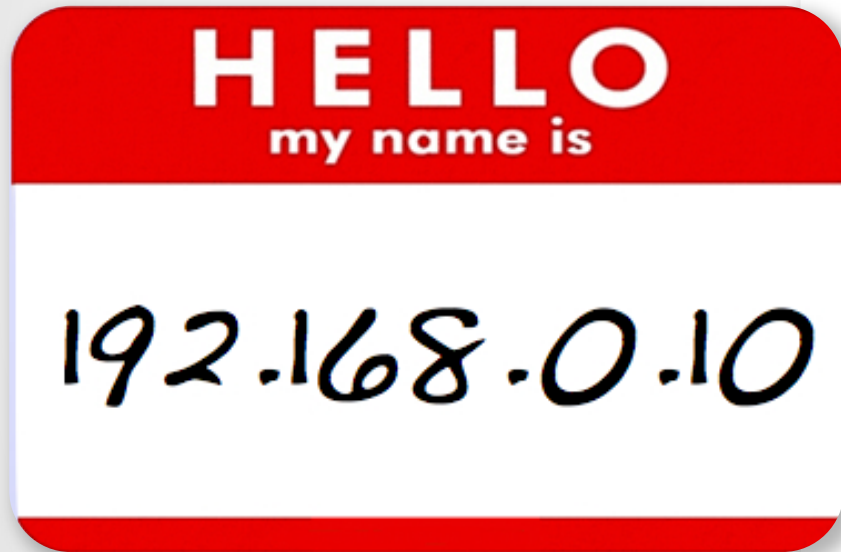**Layer 2:** devices represented by fixed hardware addresses (MAC)

Layer 3: devices represented by variable IP addresses

Physical (hardware & cables)

Hardware addresses

IP addresses

WHAT IS AN IP ADDRESS?

HELLO my name is

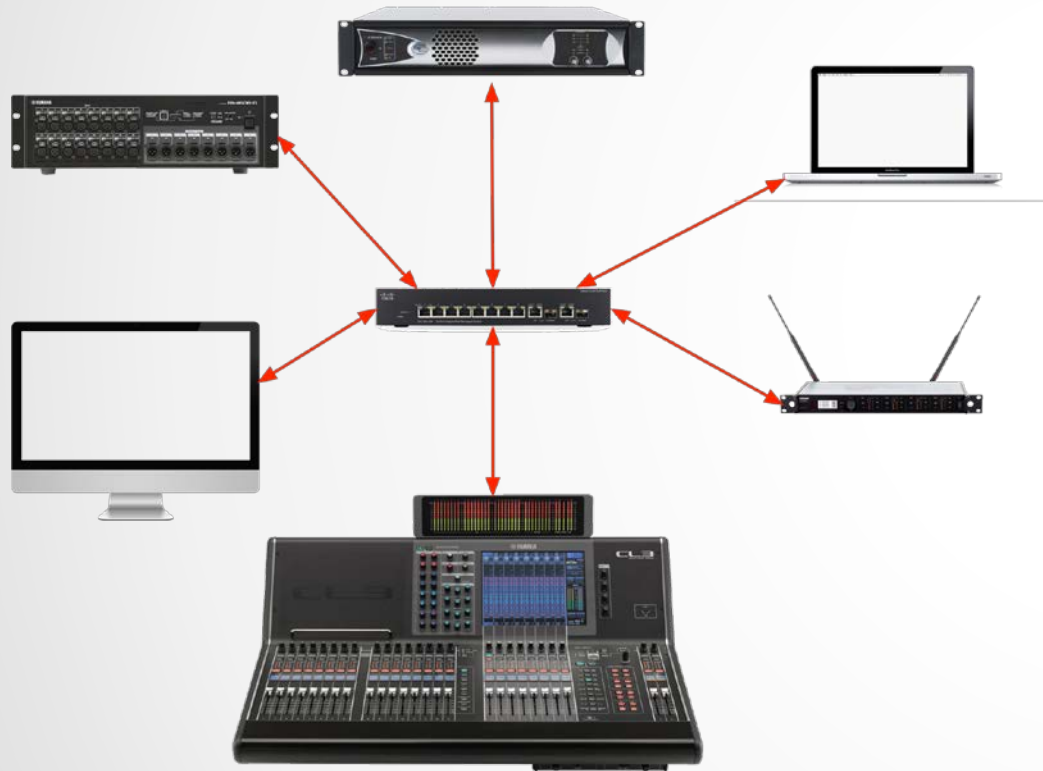**192.168.0.10**

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

http://www.audinate.com/resources

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

http://www.audinate.com/resources

WHAT IS A "STAND ALONE" NETWORK?

A single LAN

●

Usually dedicated to one purpose

●

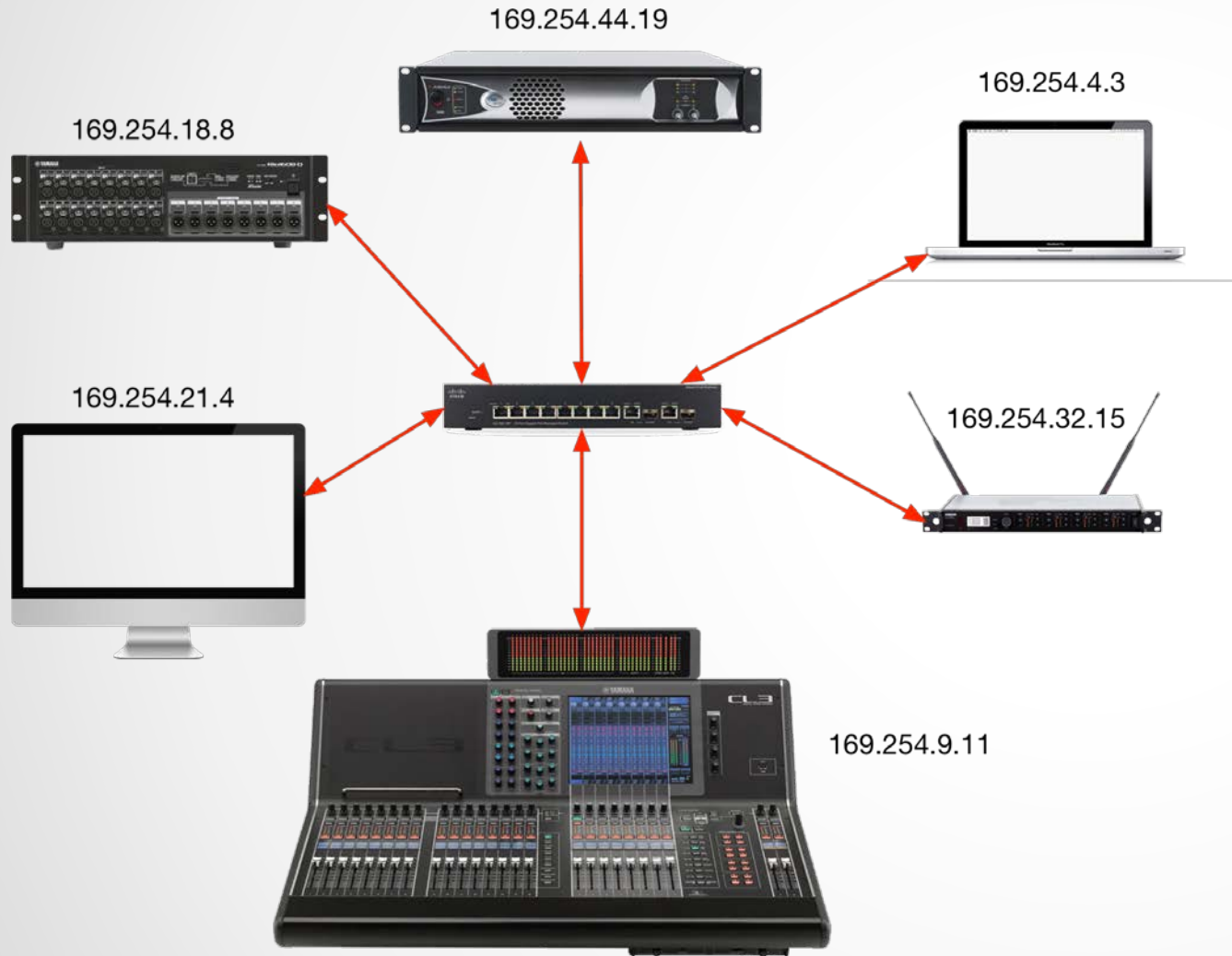Not dependent upon external resources
(e.g., internet, servers)

●

Not connected to other LANs through a router

●

Commonly used to separate responsibilities of AV installer

http://www.audinate.com/resources

AUTOMATIC ADDRESSING

169.254.44.19

169.254.4.3

169.254.18.8

169.254.21.4

169.254.32.15

169.254.9.11

LAN requires IP addresses in a common range

●

Automatic addressing enabled by default on Dante devices

●

Self-assigned addresses create a working LAN

http://www.audinate.com/resources

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

43

WHAT IS DANTE?

DANTE CERTIFICATION PROGRAM

LEVEL 1

http://www.audinate.com/resources

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

http://www.audinate.com/resources

DANTE FEATURES AND BENEFITS

All devices use human-readable names

•

Precise time alignment of all audio

•

Automatic device discovery

•

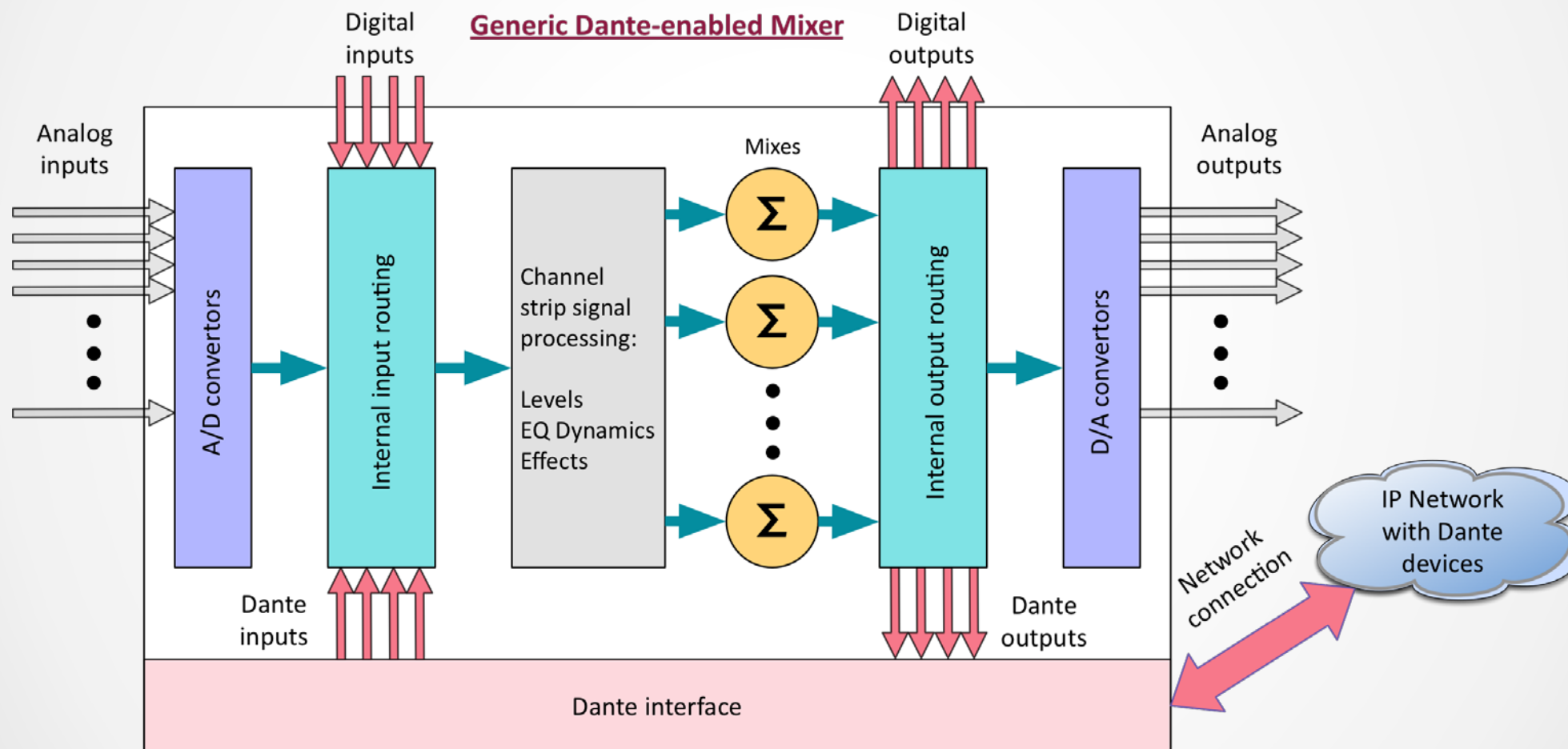One-click routing

Low, deterministic latency

•

Virtually jitter-free

•

Automatic re-connection after power cycles

http://www.audinate.com/resources

46

HOW IS DANTE BUILT INTO PRODUCTS?

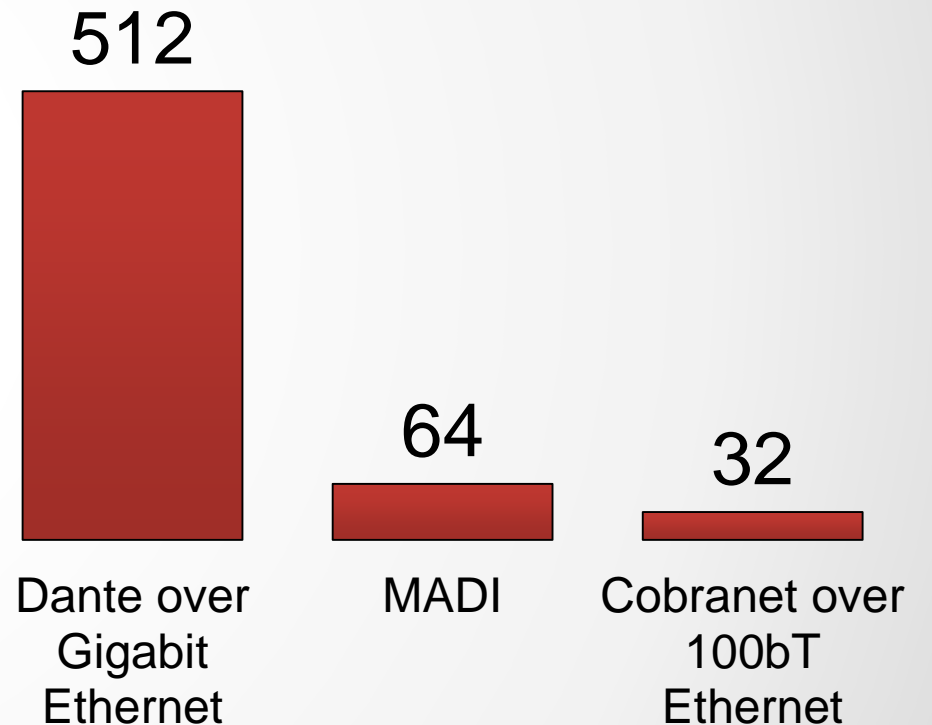Generic Dante-enabled Mixer

http://www.audinate.com/resources

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 <u>per link</u>

512 — Dante over Gigabit Ethernet

64 — MADI

32 — Cobranet over 100bT Ethernet

http://www.audinate.com/resources

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
150 usec	Gigabit network with one switch
250 usec	Gigabit network with three switches
500 usec	Gigabit network with five switches
1 msec	Gigabit network with ten switches or gigabit network with 100Mbps leaf nodes
2 msec	Gigabit network with 100Mbps leaf nodes
5 msec	Safe value

http://www.audinate.com/resources

CLOCKING

Dante handles clocking **automatically**

•

Clock Master is determined by election

•

All devices sync'd to Master

•

Each device has a clock

•

New Clock Master elected as needed

CLOCK MASTER

WHAT DOES DANTE **NOT** DO?

Sample rate conversion

•

Level control

•

MIDI

•

SMPTE time code

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

¯_(ツ)_/¯

http://www.audinate.com/resources

USING DANTE

DANTE CERTIFICATION PROGRAM

LEVEL 1

DANTE CONTROLLER
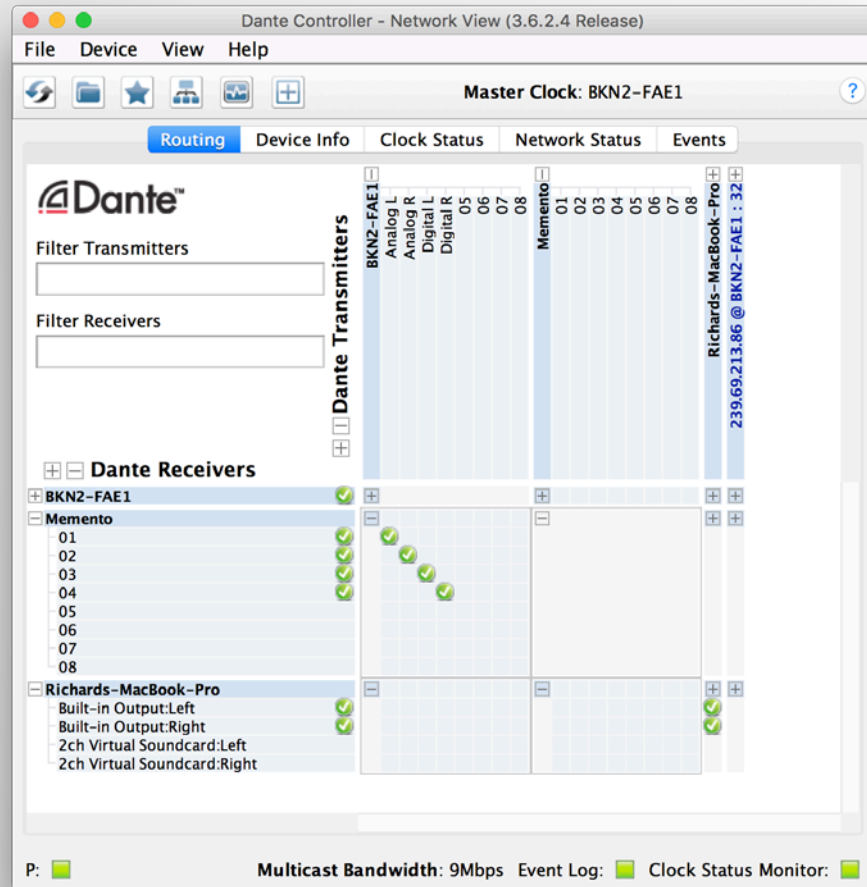
Primary Dante tool

Routing: Setup, view, change

Clocking adjustments

Sample Rate settings

Latency settings
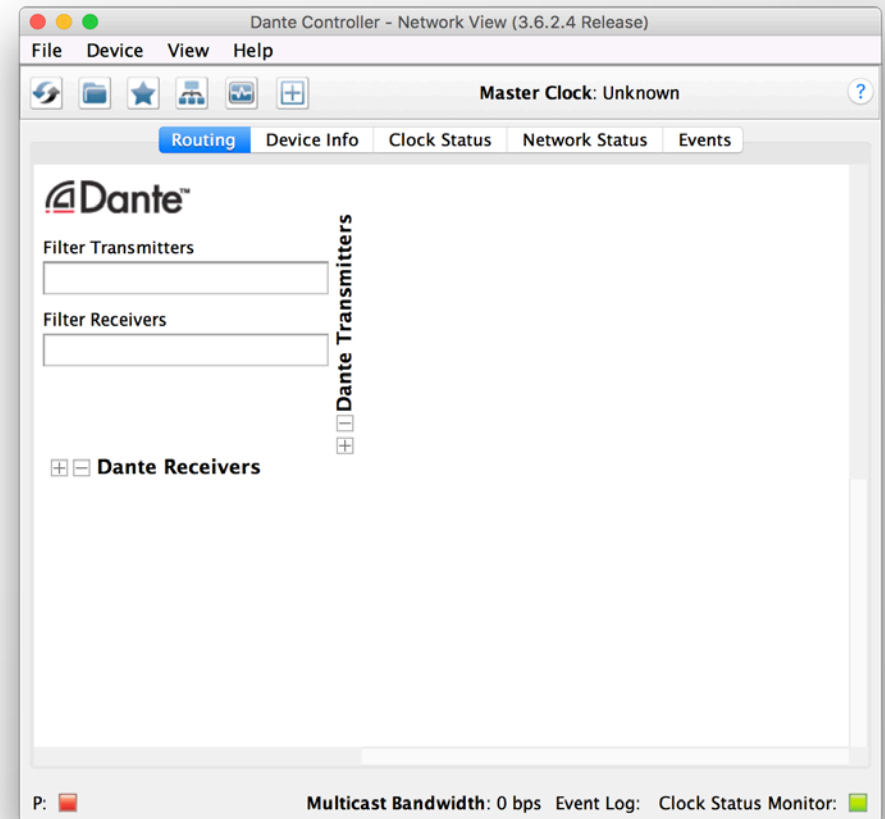
Clock and Latency monitoring

http://www.audinate.com/resources

DISCOVERY AND ROUTING
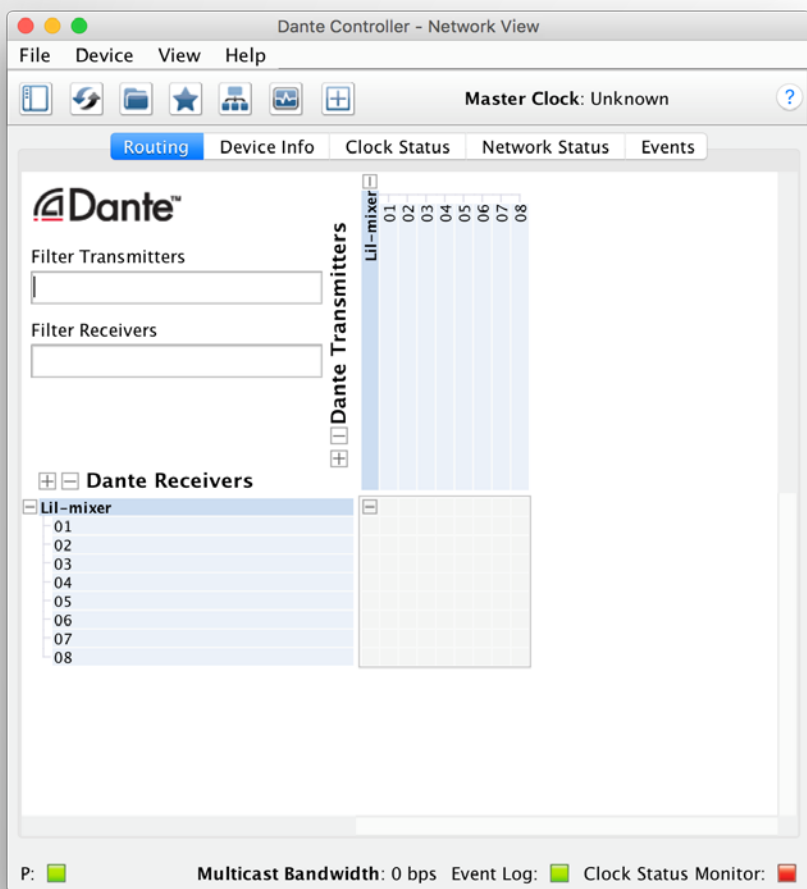
If no devices are connected, Dante Controller is empty

●

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

●

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

http://www.audinate.com/resources

DISCOVERY AND ROUTING
DIRECTLY CONNECT ONE DEVICE

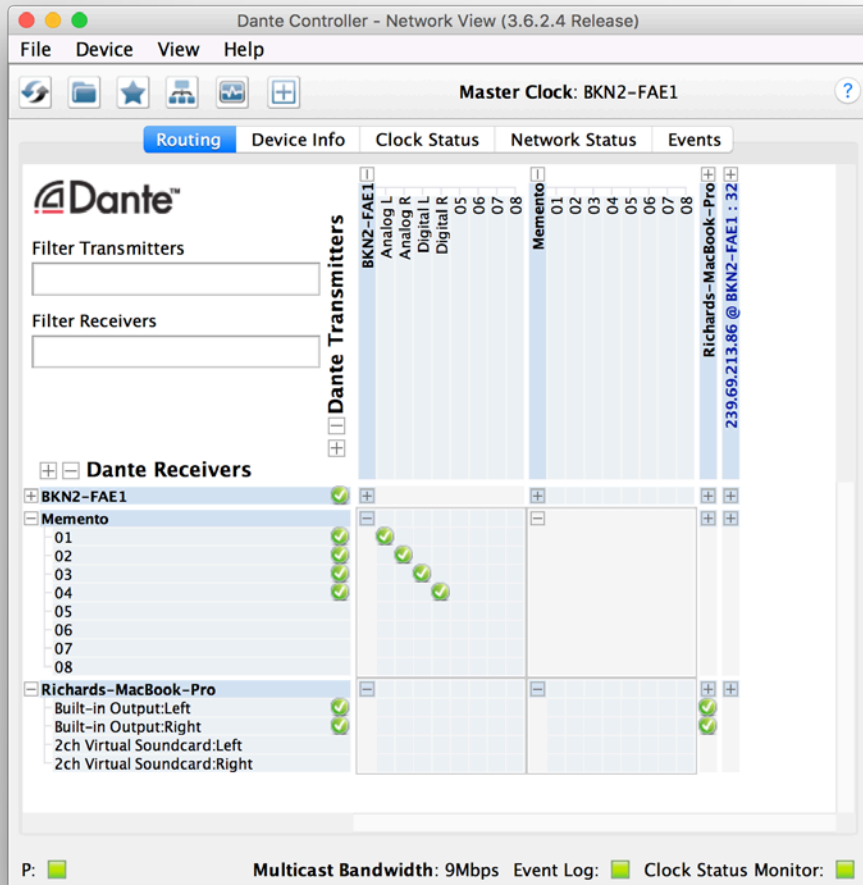When they are connected to network, Dante devices automatically appear in Dante Controller

●

No pre-configuration

●

Human readable names

●

A Dante device can be connected directly to a computer

http://www.audinate.com/resources

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

http://www.audinate.com/resources

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

http://www.audinate.com/resources

DISCOVERY AND ROUTING
DELETING

To delete a subscription, click on green checkmark

●

Checkmark disappears, subscription deleted

http://www.audinate.com/resources

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
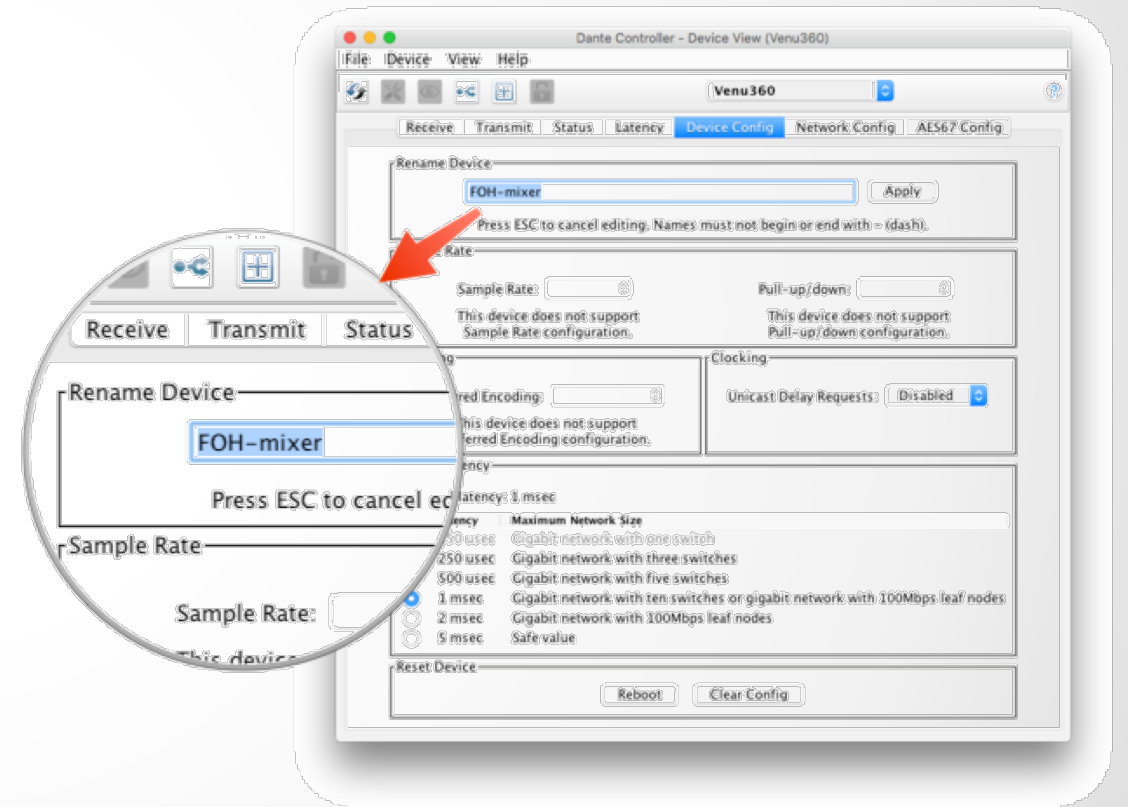
http://www.audinate.com/resources
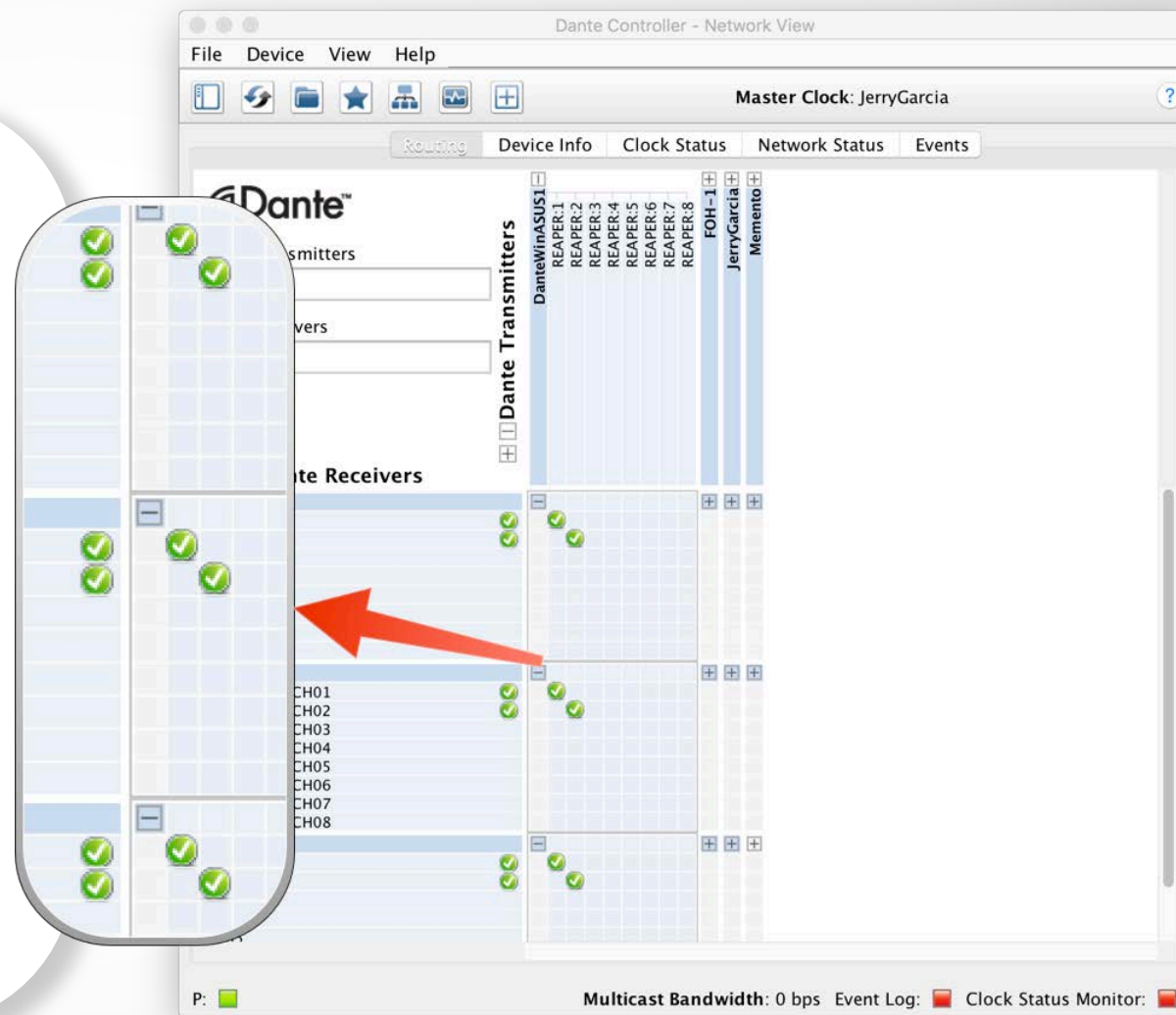
DEVICE NAMES

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

http://www.audinate.com/resources
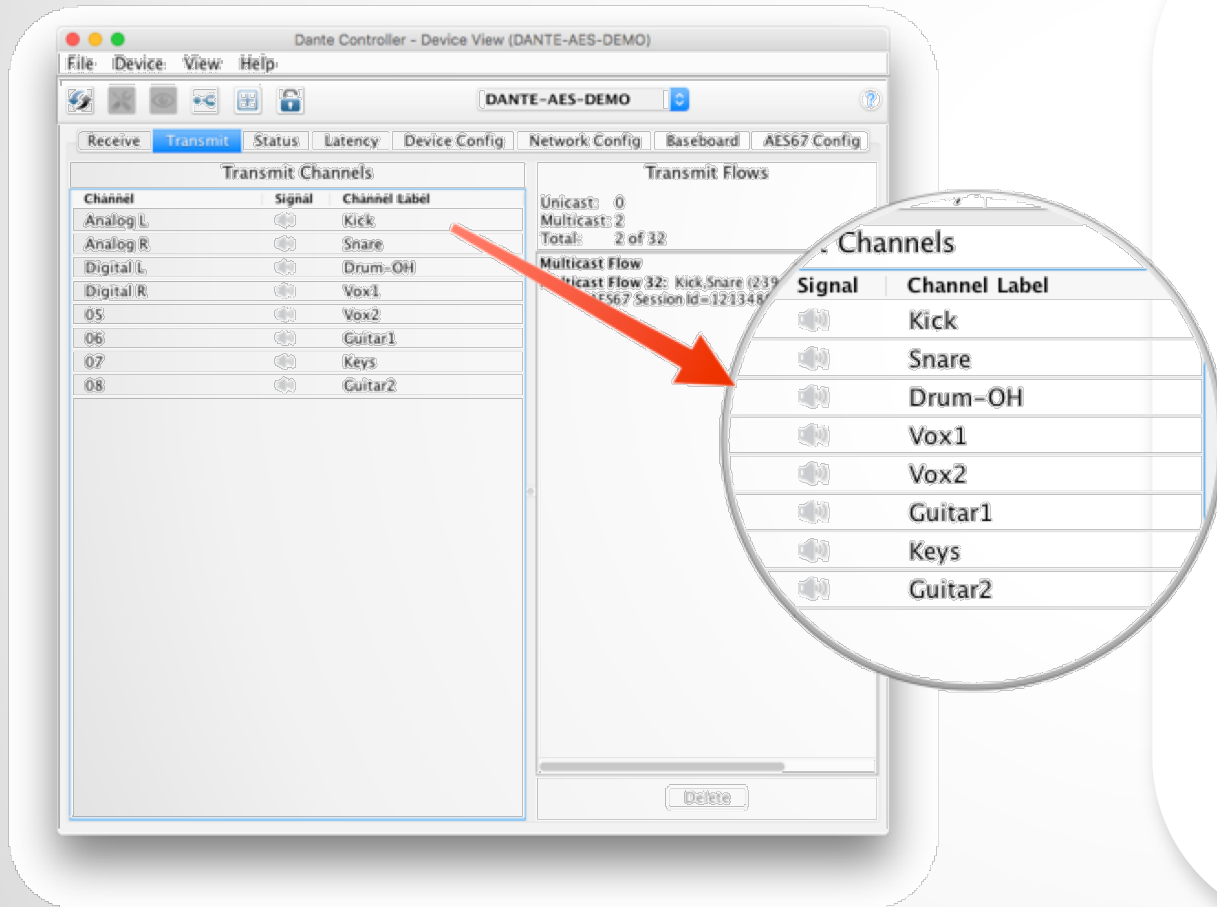
CHANNEL LABELS

Labels can be applied to any channels

●

Use Device View

●

Makes it easy for volunteers or newbies to use system

●

Software version of masking tape 😉

http://www.audinate.com/resources

ADJUST SAMPLE RATE
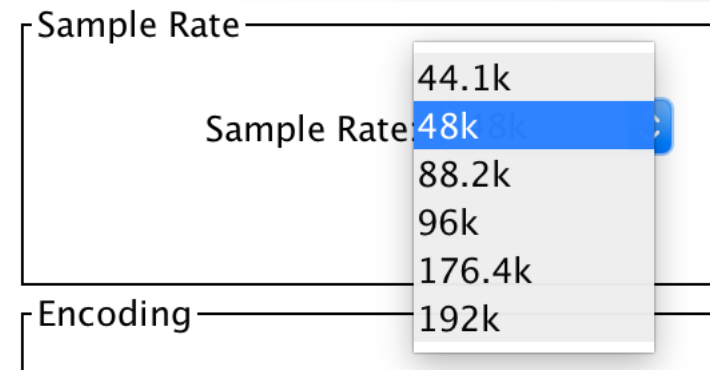
In Device View -> Device Config tab

●

Adjust sample rate and bit depth (Encoding)

●

Choices determined by product

●

Most common 48kHz / PCM 24

http://www.audinate.com/resources

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!

73

NO

DOES DANTE CONTROLLER NEED TO BE
ON THE NETWORK ALL THE TIME?

http://www.audinate.com/resources

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

http://www.audinate.com/resources

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

http://www.audinate.com/resources

RECORDING WITH DANTE VIRTUAL SOUNDCARD

DANTE CERTIFICATION PROGRAM

LEVEL 1

http://www.audinate.com/resources
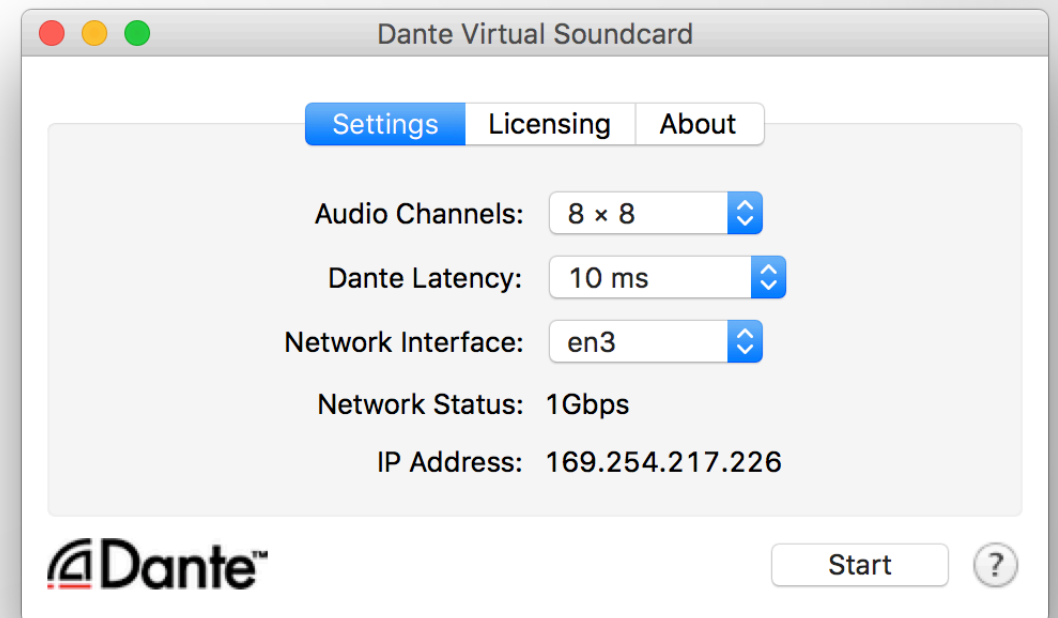
WHAT IS DANTE VIRTUAL SOUNDCARD? (DVS)

Soft Soundcard for Mac or PC

•

Connects to Dante network

•

Record and playout from 2x2 up to 64x64 channels using any DAW software

http://www.audinate.com/resources

CONNECT TO A DAW

Launch Dante Virtual Soundcard
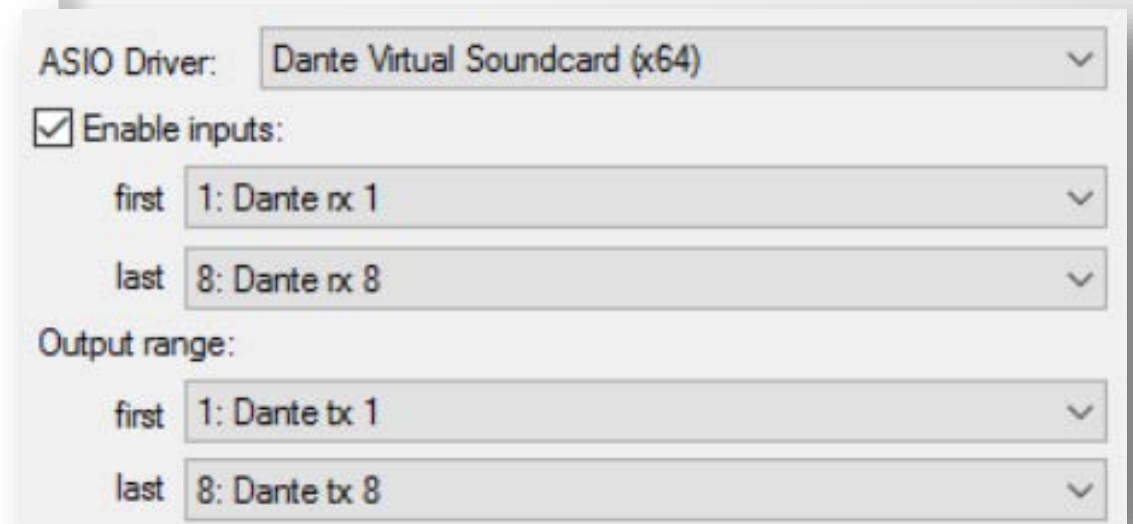
Set number of channels and Start DVS

DVS will appear as audio device on computer
Mac – Core Audio
Windows – ASIO or WDM

Select as I/O device in DAW preferences

Output Device: Dante Virtual Soundcard

Input Device: Dante Virtual Soundcard

ASIO Driver: Dante Virtual Soundcard (x64)

☑ Enable inputs:
first 1: Dante rx 1
last 8: Dante rx 8

Output range:
first 1: Dante tx 1
last 8: Dante tx 8

http://www.audinate.com/resources

Dante™ by Audinate

SUBSCRIBE CHANNELS
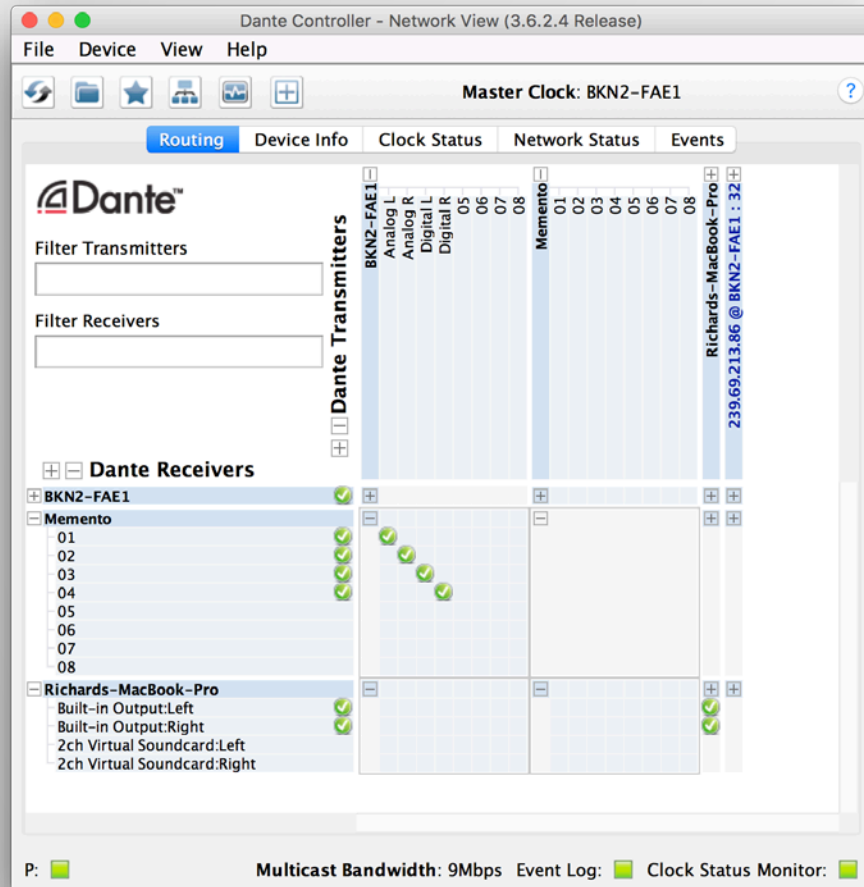
Open Dante Controller

●

Computer with DVS appears as Dante device

●

Subscribe channels to Dante devices on network

●

Record and Playout with DAW

http://www.audinate.com/resources

NOW
WHAT?

http://www.audinate.com/resources

⌂Dante™ by Audinate

NEXT STEPS

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

http://www.audinate.com/resources

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

http://www.audinate.com/resources

THANK
YOU

http://www.audinate.com/resources