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

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

INTRODUCTION TO DANTE

DANTE CERTIFICATION PROGRAM

LEVEL 1

ABOUT AUDINATE

Headquartered in Sydney, Australia

Network engineers first

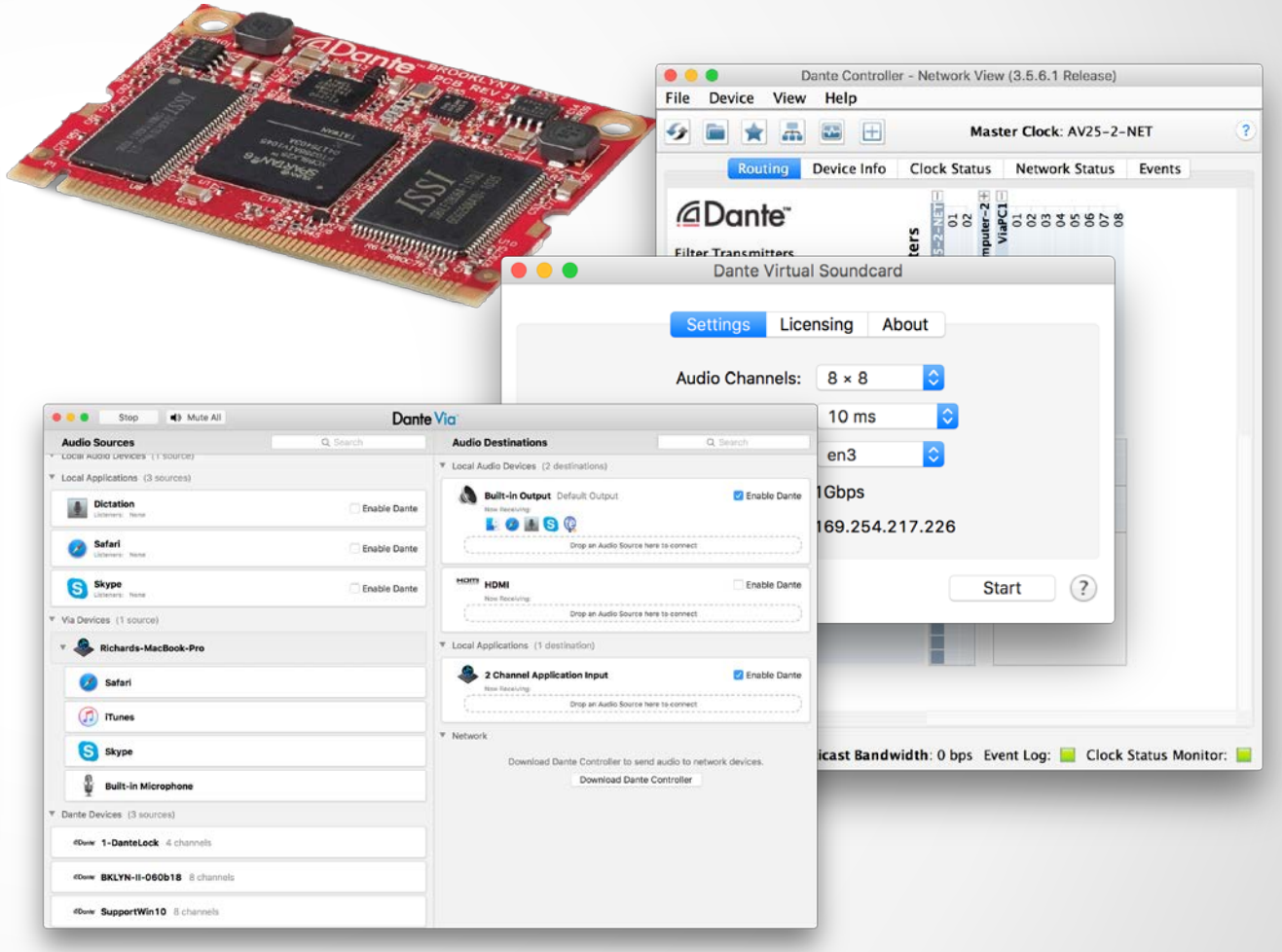
Develop Dante as 100% interoperable solution for all audio manufacturers

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

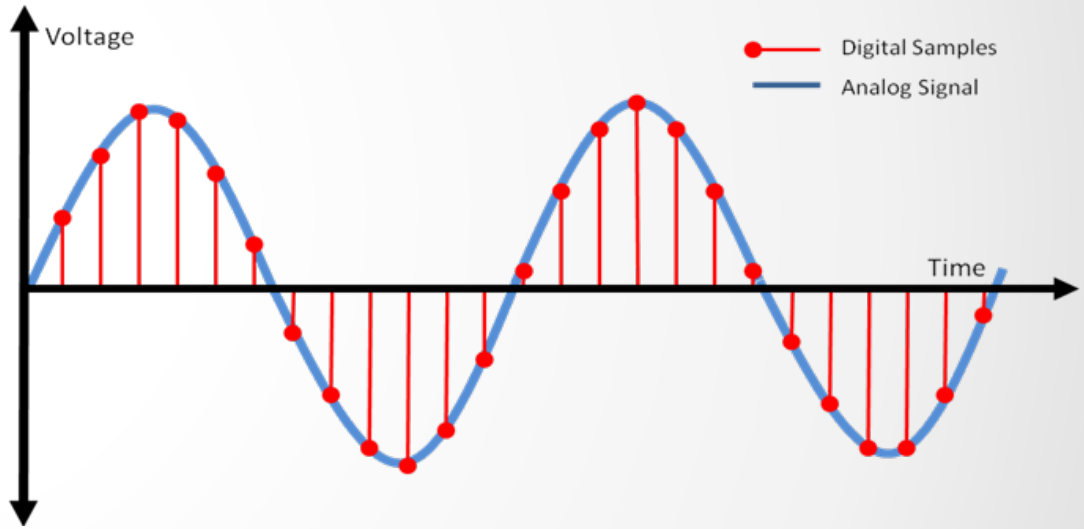
DANTE CERTIFICATION PROGRAM

ANALOG TO DIGITAL CONVERSION

Analog signal is sampled at constant intervals

Yields a stream of values in time

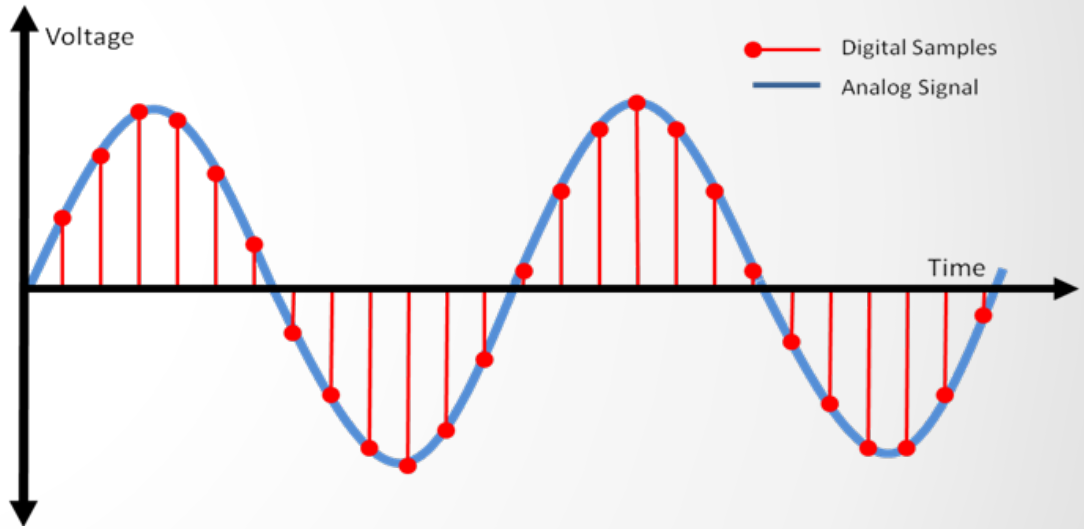
Pulse Code Modulation (PCM)



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

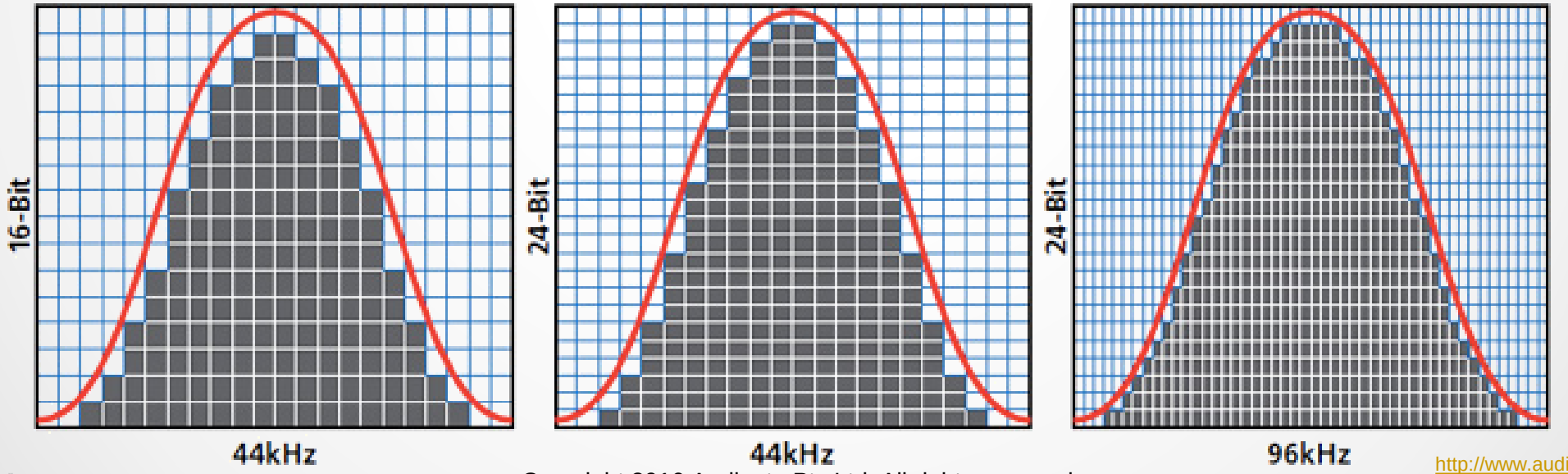
- More bits -> more accuracy
  - CDs: 16 bits
  - Pro: 24 bits

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



BANDWIDTH (AUDIO ONLY)

Audio Bandwidth = (Sample rate) x (Bit depth)

- Example: 48kHz sample rate, 24-bit depth
  48,000 x 24 = 1.152 mbits/sec per channel
- 64 channels of audio at 48kHz/24-bit
  48,000 x 24 x 64 = 74 mbits/sec
- Typical Dante **network** flow of 1 to 4 channels ≈ 6 mbits/sec

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

WORD CLOCK EXAMPLE

Without word clock sync:

A: 0011 1100 0000 1111
B: 1001 1110 0000 0111 1
Time →

Values can be **different**

With word clock sync:

A: |0011 1100 0000 1111
B: 1|0011 1100 0000 1111
Time →

Values are **the same**

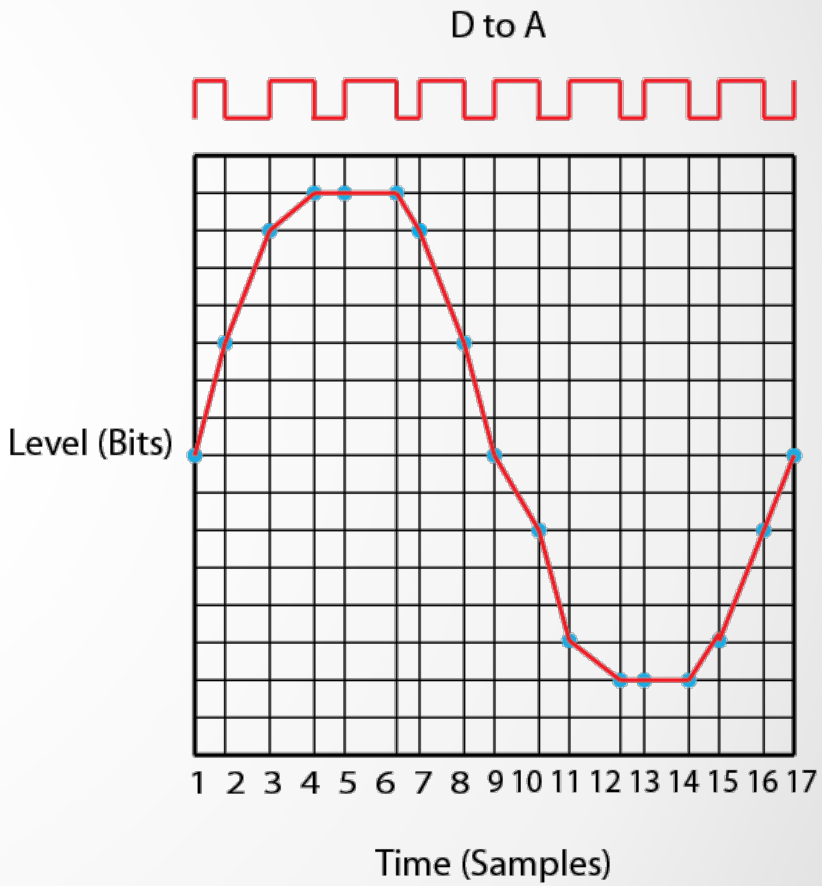
JITTER

Distortion caused by inconsistent word clock in playout

Classic problem with older “daisy chained” digital audio

AES3, MADI, ADAT, S/PDIF

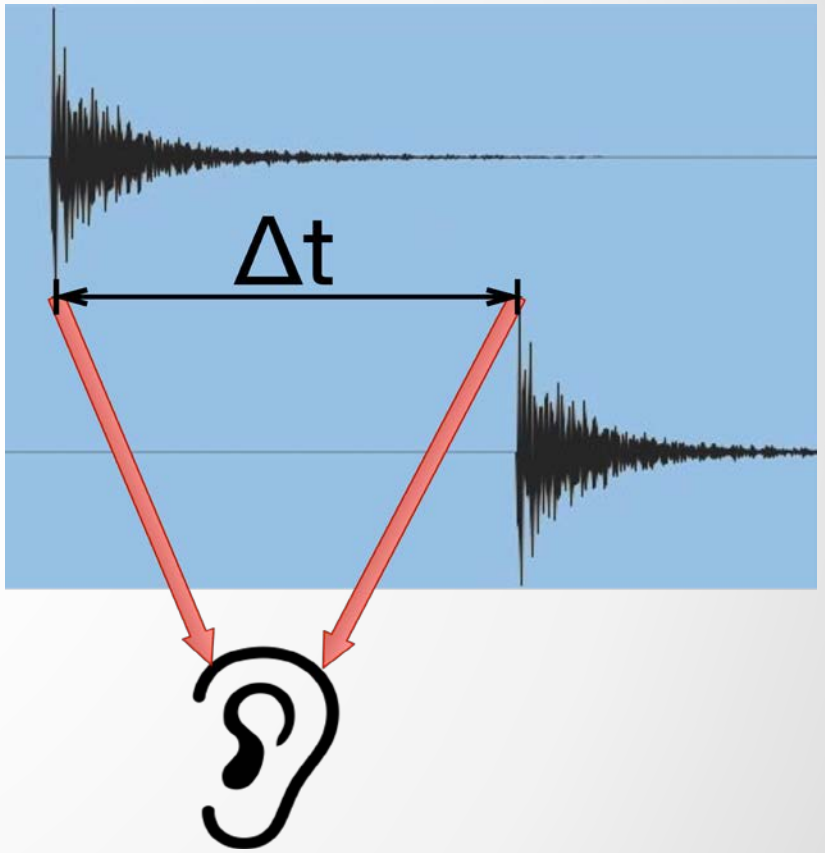
Expensive to solve in older systems



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 – *time* is the key that Dante provides

IP NETWORKING BASICS

DANTE CERTIFICATION PROGRAM

LEVEL 1

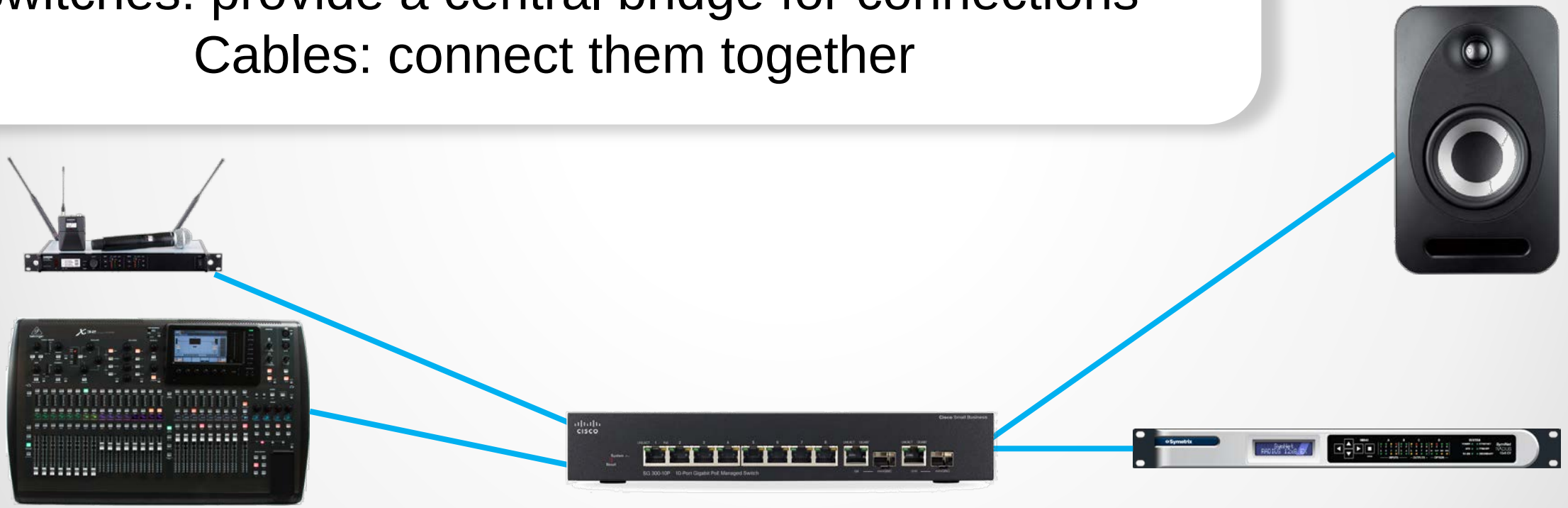
HOW MUCH NETWORKING DO I NEED TO KNOW?

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

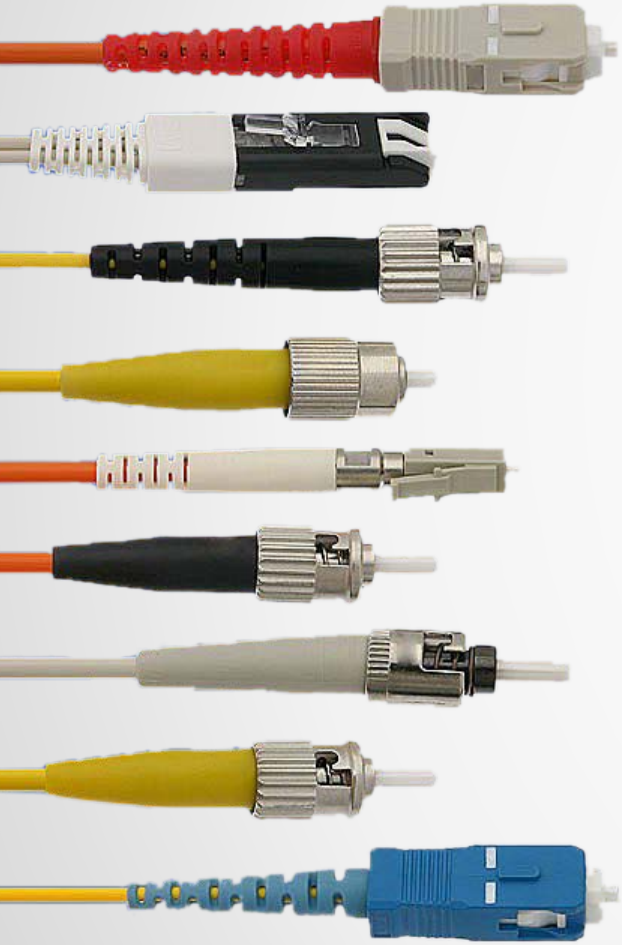
- Gigabit rated:
  CAT5E
  CAT6
- 100 meters max per run

WHAT ABOUT WI-FI?

Wi-Fi is another way to connect to IP networks

- Less reliable that 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 SFP

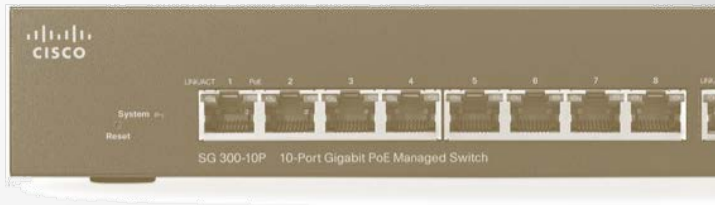
SWITCHES

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!



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

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…

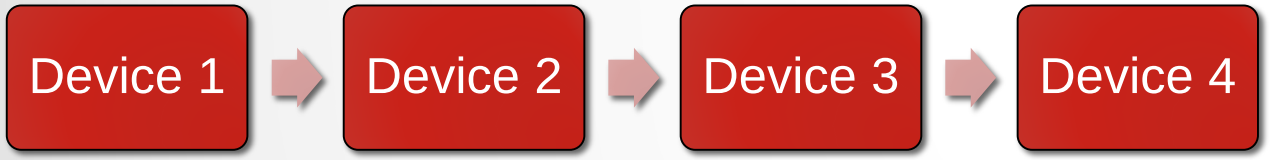
EEE SWITCHES

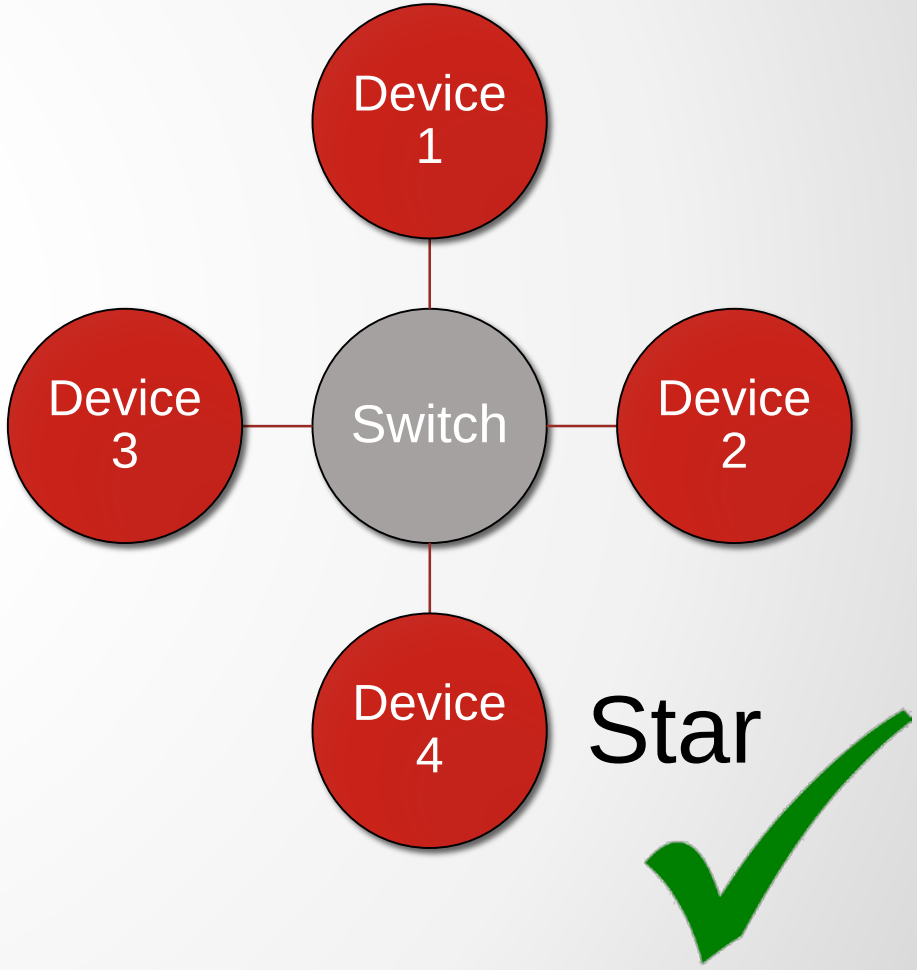
One special note:

- 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

TOPOLOGY

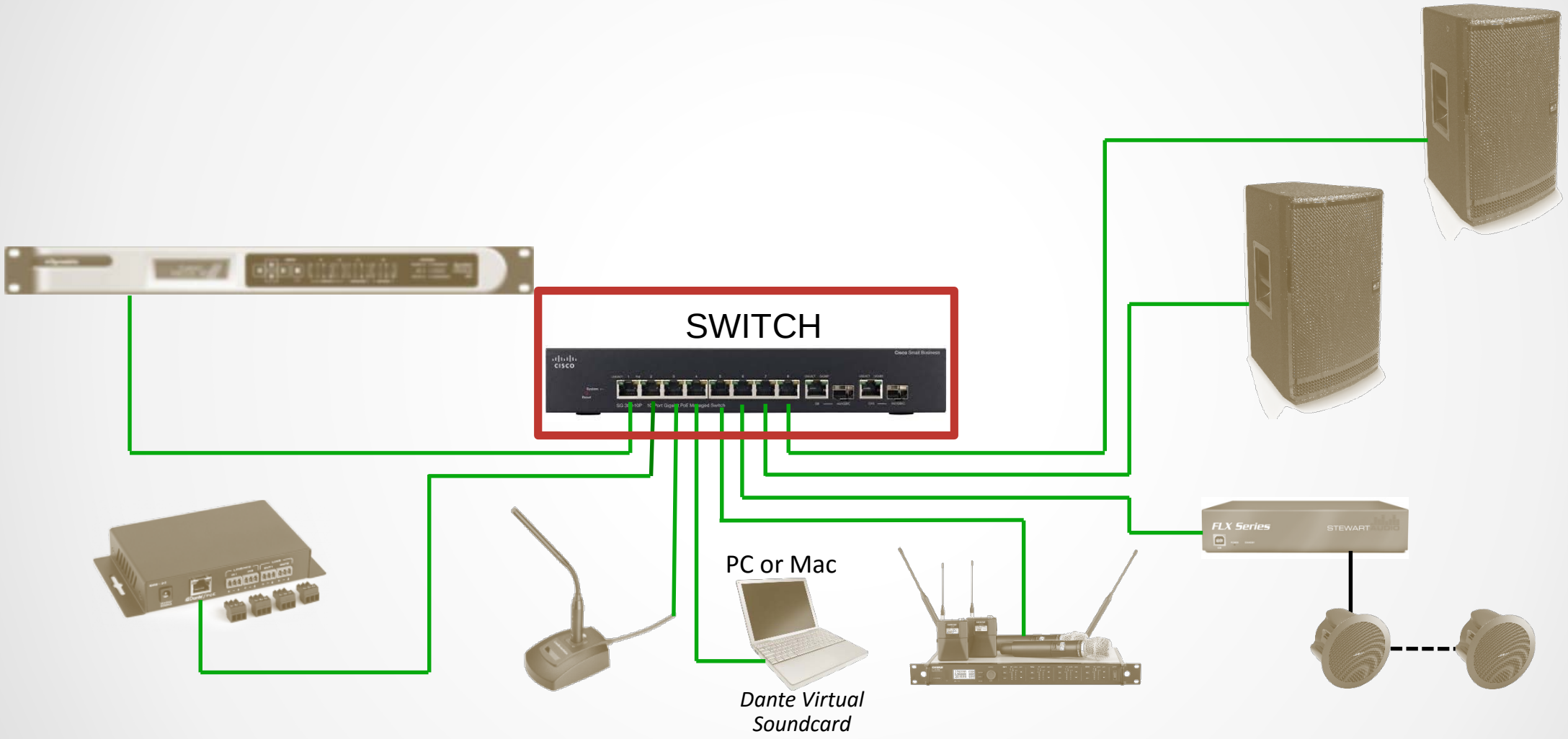
Daisy chain



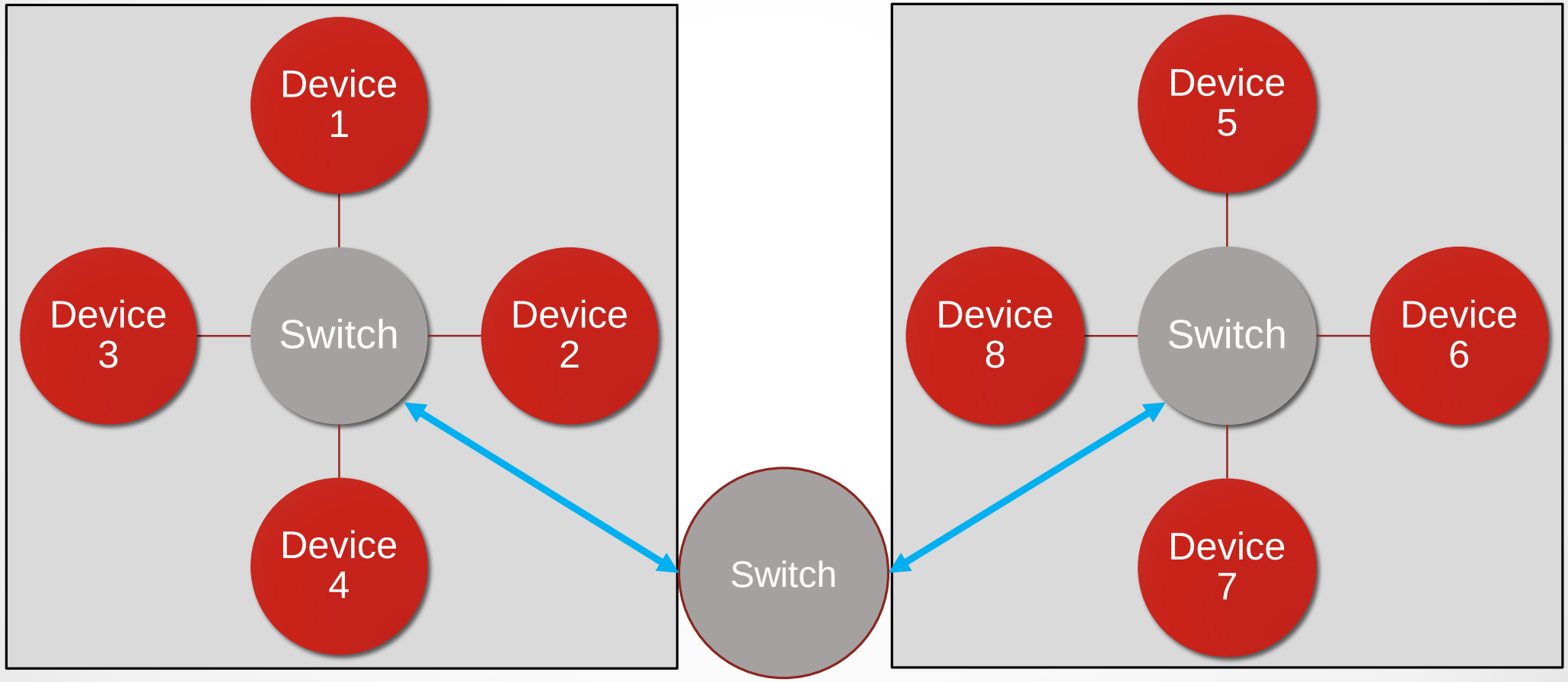


Star

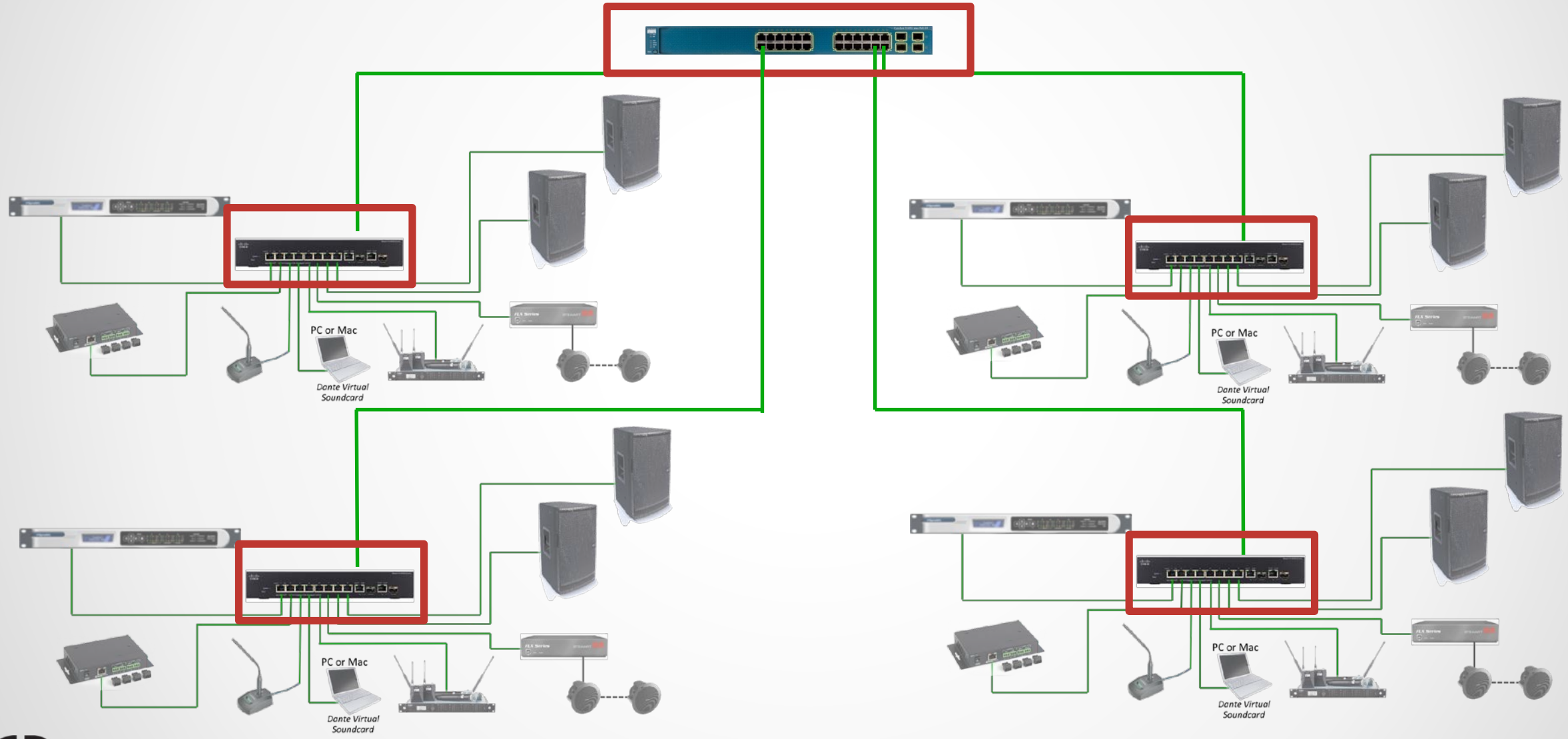
SINGLE SWITCH EXAMPLE



MULTIPLE STARS



MULTIPLE STARS EXAMPLE



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

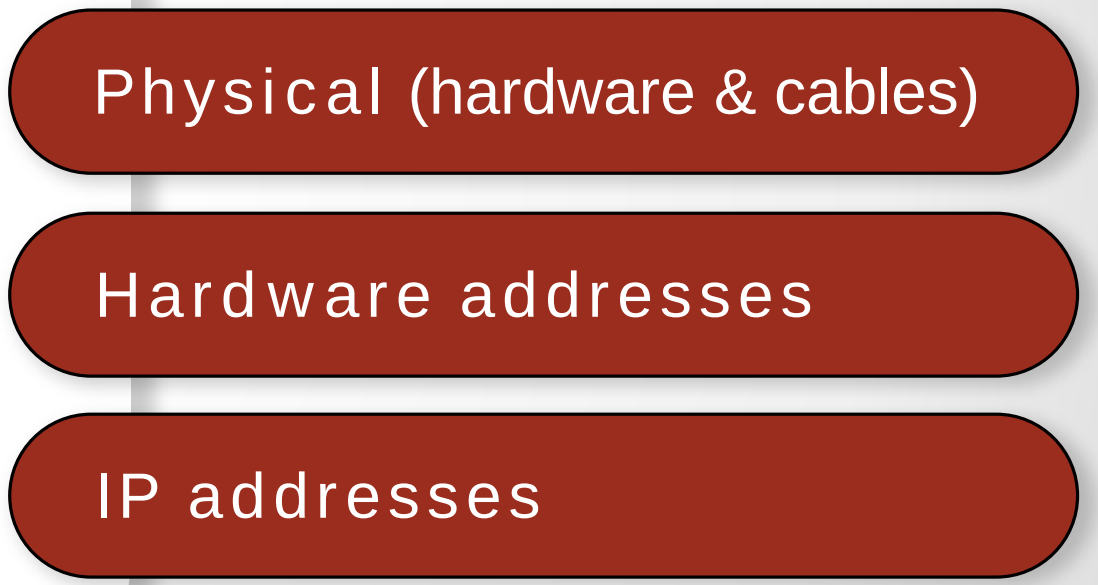
A WORD ABOUT NETWORK LAYERS

Each layer passes data to the next

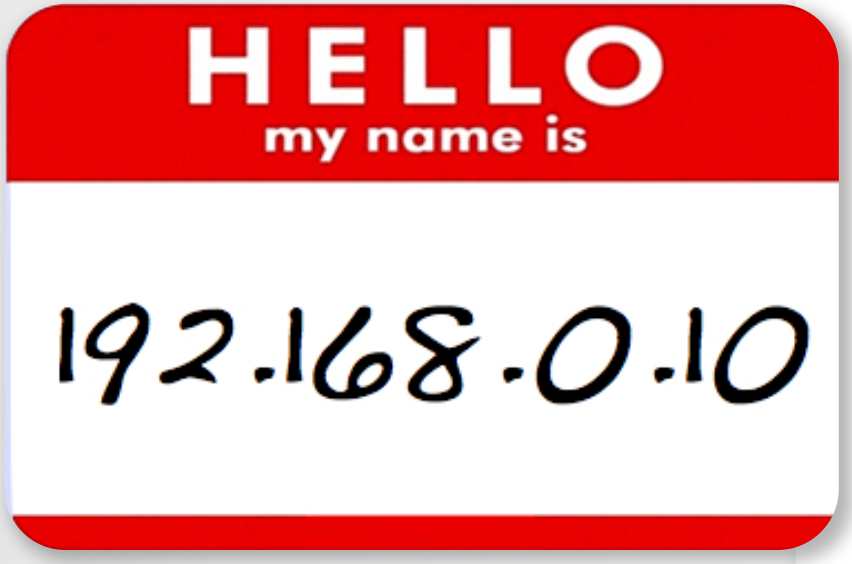
Layer 1: physical connections (e.g., cables)

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

Layer 3: devices represented by variable IP addresses



WHAT IS AN IP ADDRESS?



Numeric addresses associated with devices

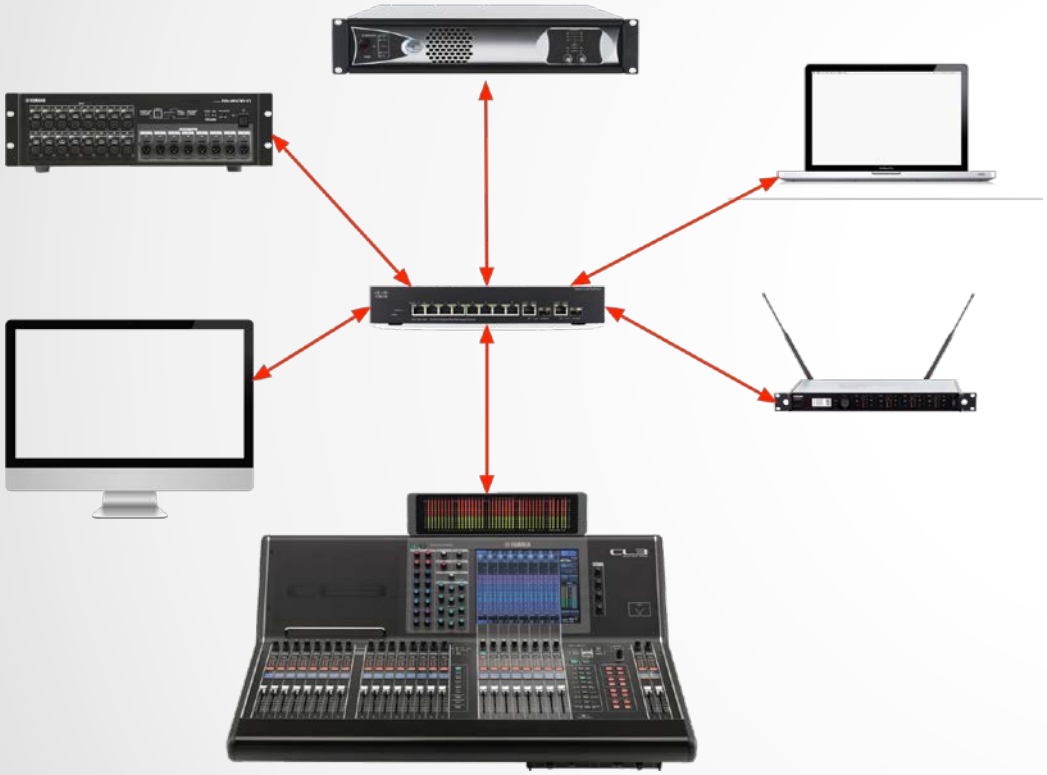
On a LAN, direct communication only possible between devices in the **same** IP address range

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

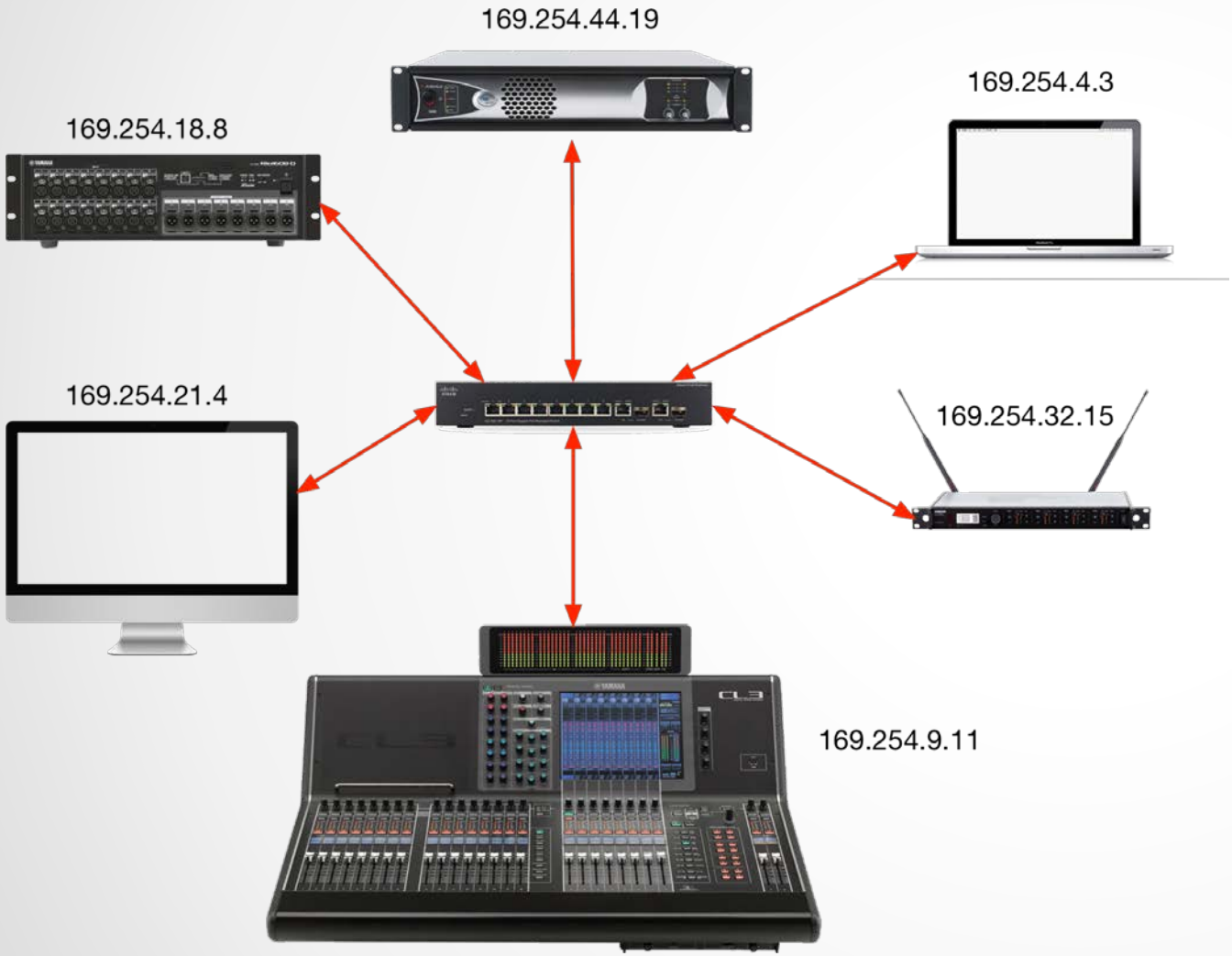
- Small number of devices (<200)
- Very reliable, fast
- Shares a common IP address range
- Majority of audio networks are LANs

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?

DANTE CERTIFICATION PROGRAM

LEVEL 1

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

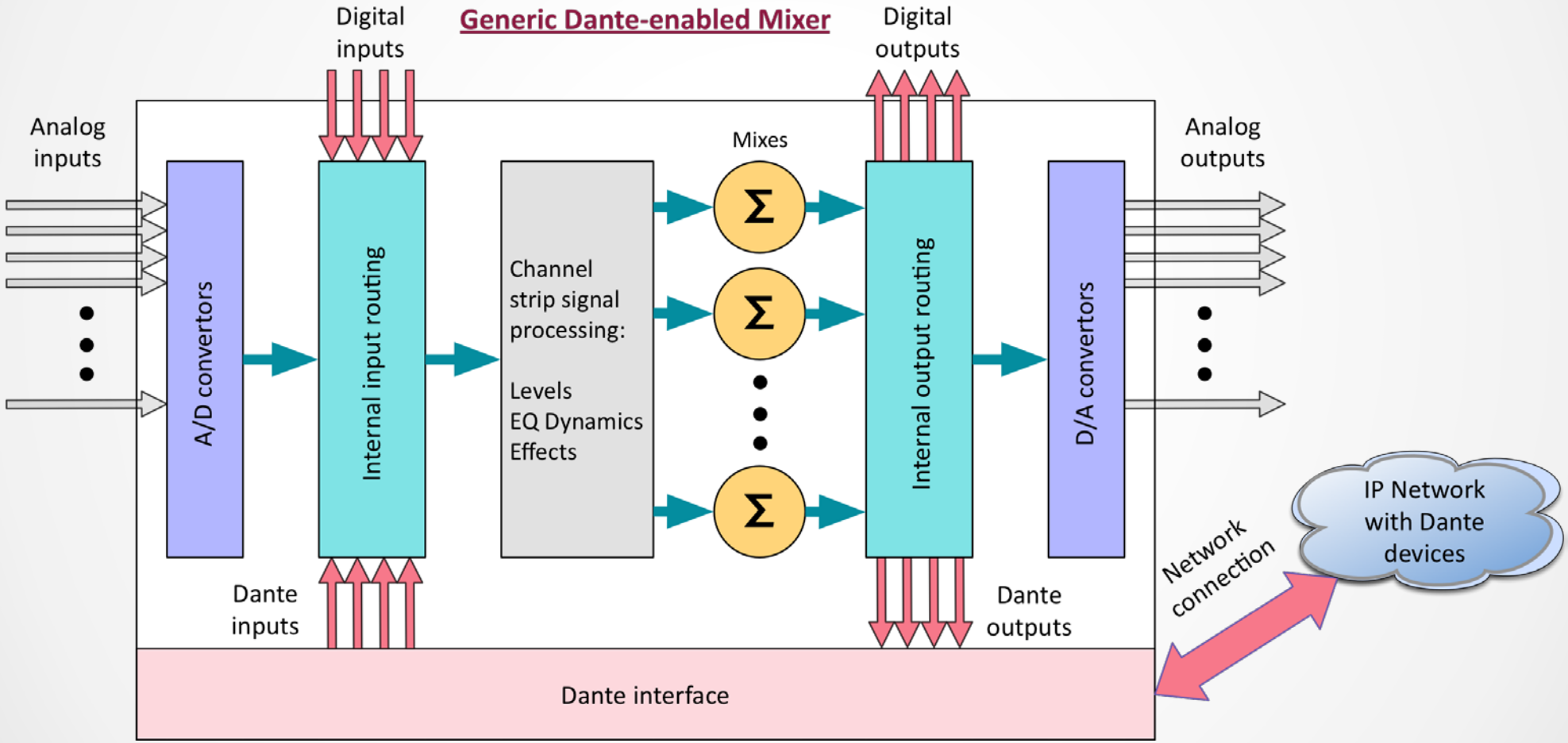
One-click routing

Low, deterministic latency

Virtually jitter-free

Automatic re-connection after power cycles

HOW IS DANTE BUILT INTO PRODUCTS?

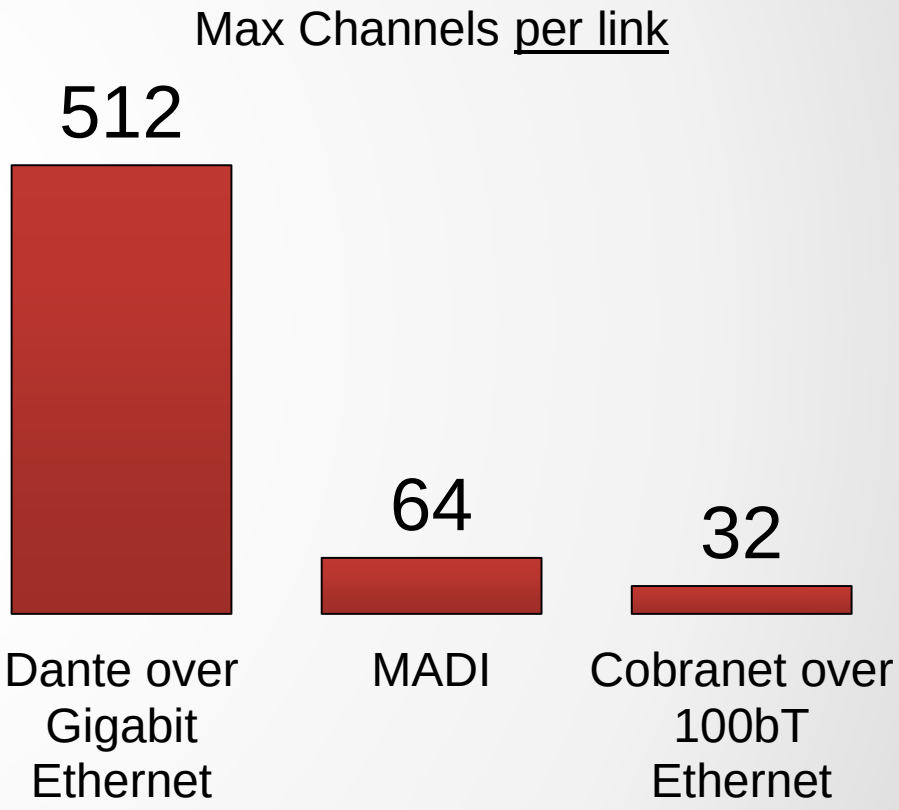


DANTE BANDWIDTH

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



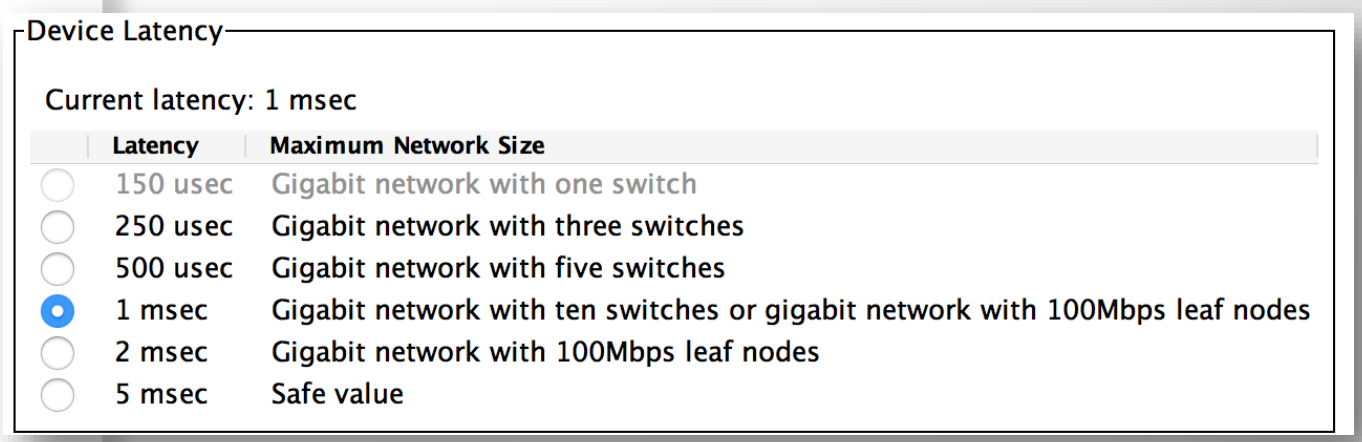
SAMPLE RATE AND CONNECTION

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



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

WHAT DOES DANTE NOT DO?

Sample rate conversion

Level control

MIDI

SMPTE time code

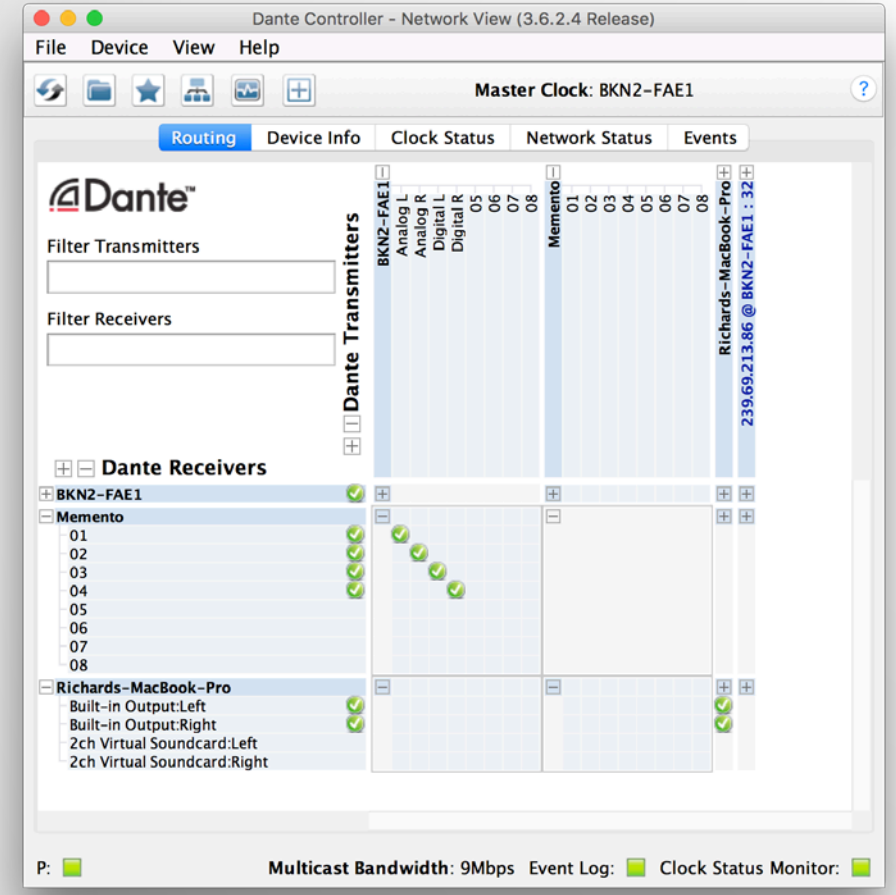
These are handled by products
Control and other data runs alongside Dante on network

USING DANTE

DANTE CERTIFICATION PROGRAM

LEVEL 1

DANTE CONTROLLER



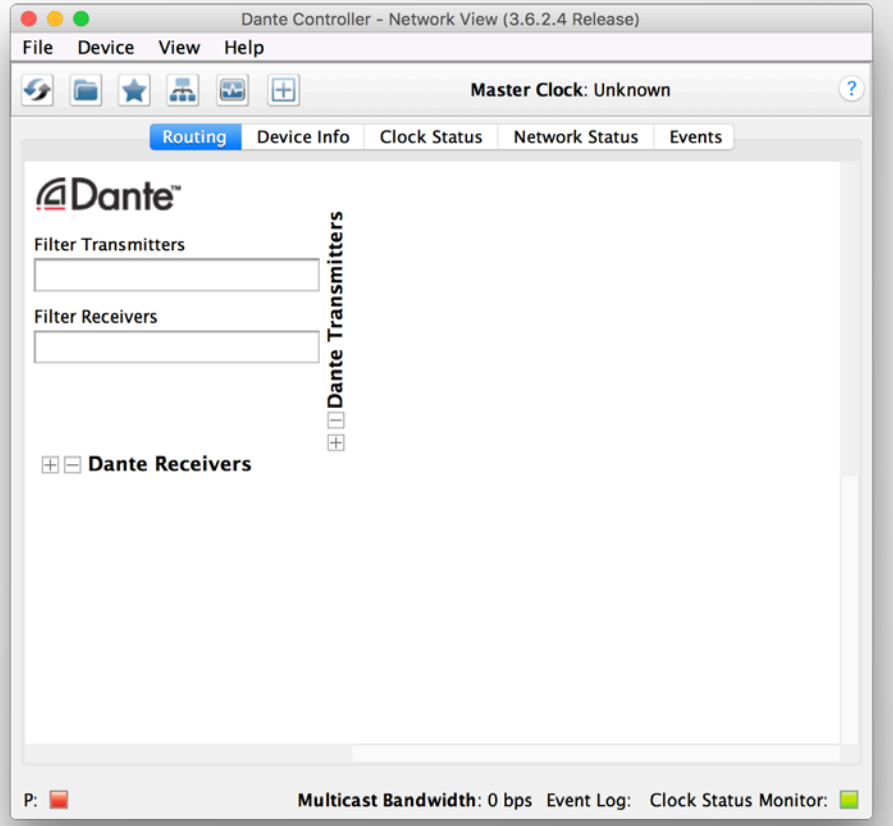
- Primary Dante tool
- Routing: Setup, view, change
- Clocking adjustments
- Sample Rate settings
- Latency settings
- Clock and Latency monitoring

DISCOVERY AND ROUTING

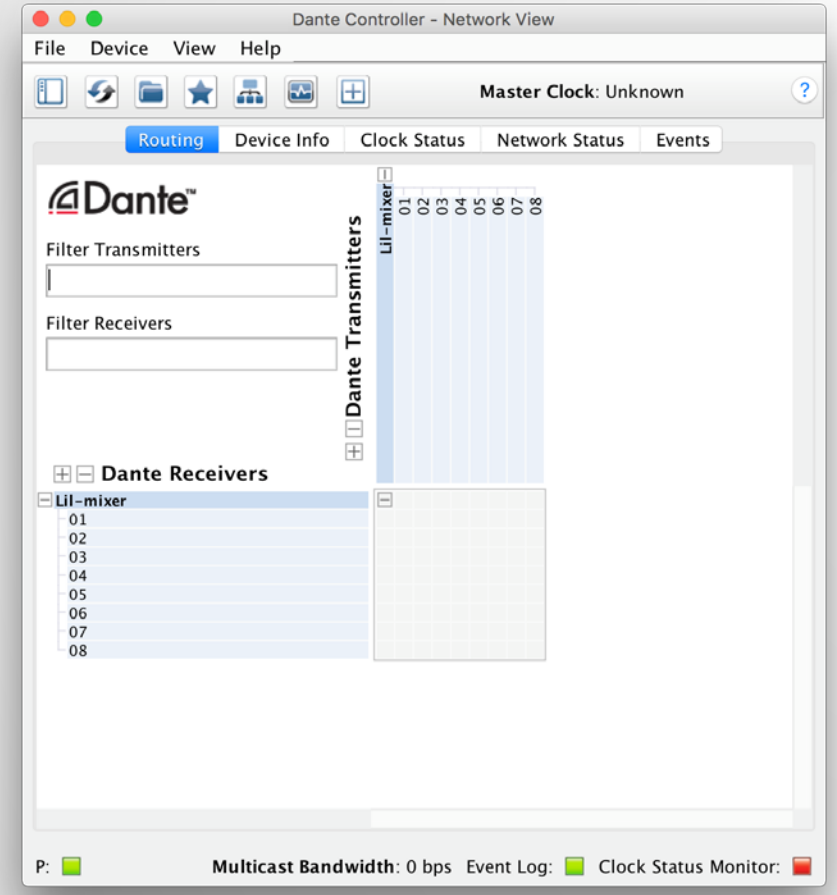
If no devices are connected, Dante Controller is empty

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

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



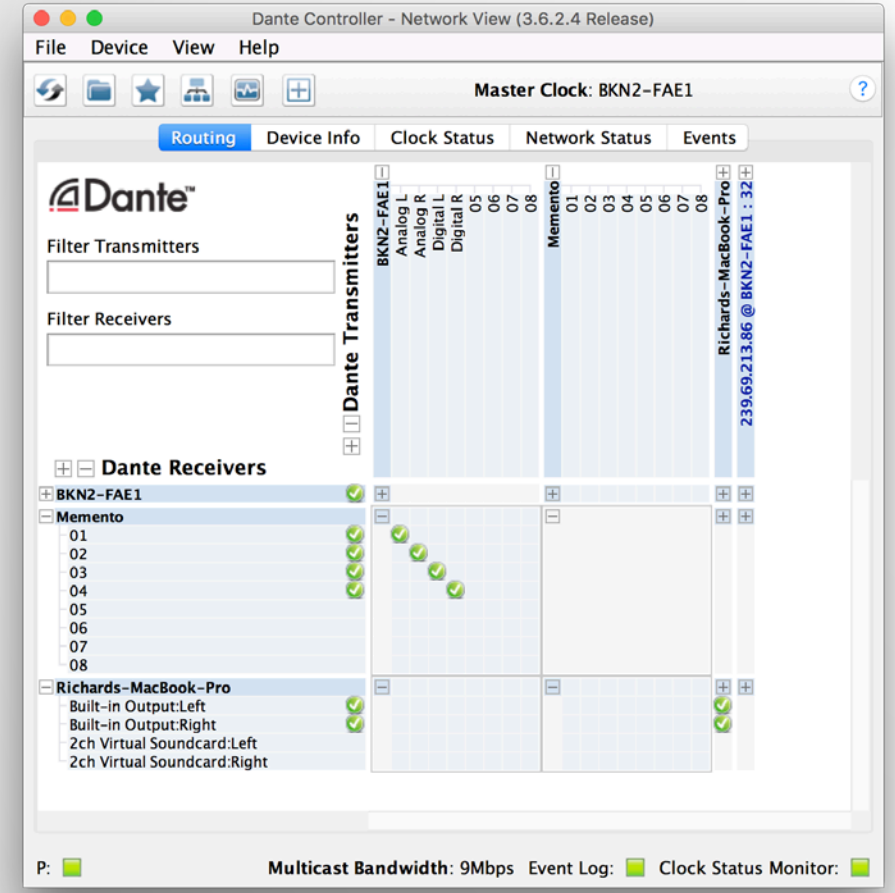
DISCOVERY AND ROUTING
DIRECTLY CONNECT ONE DEVICE



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

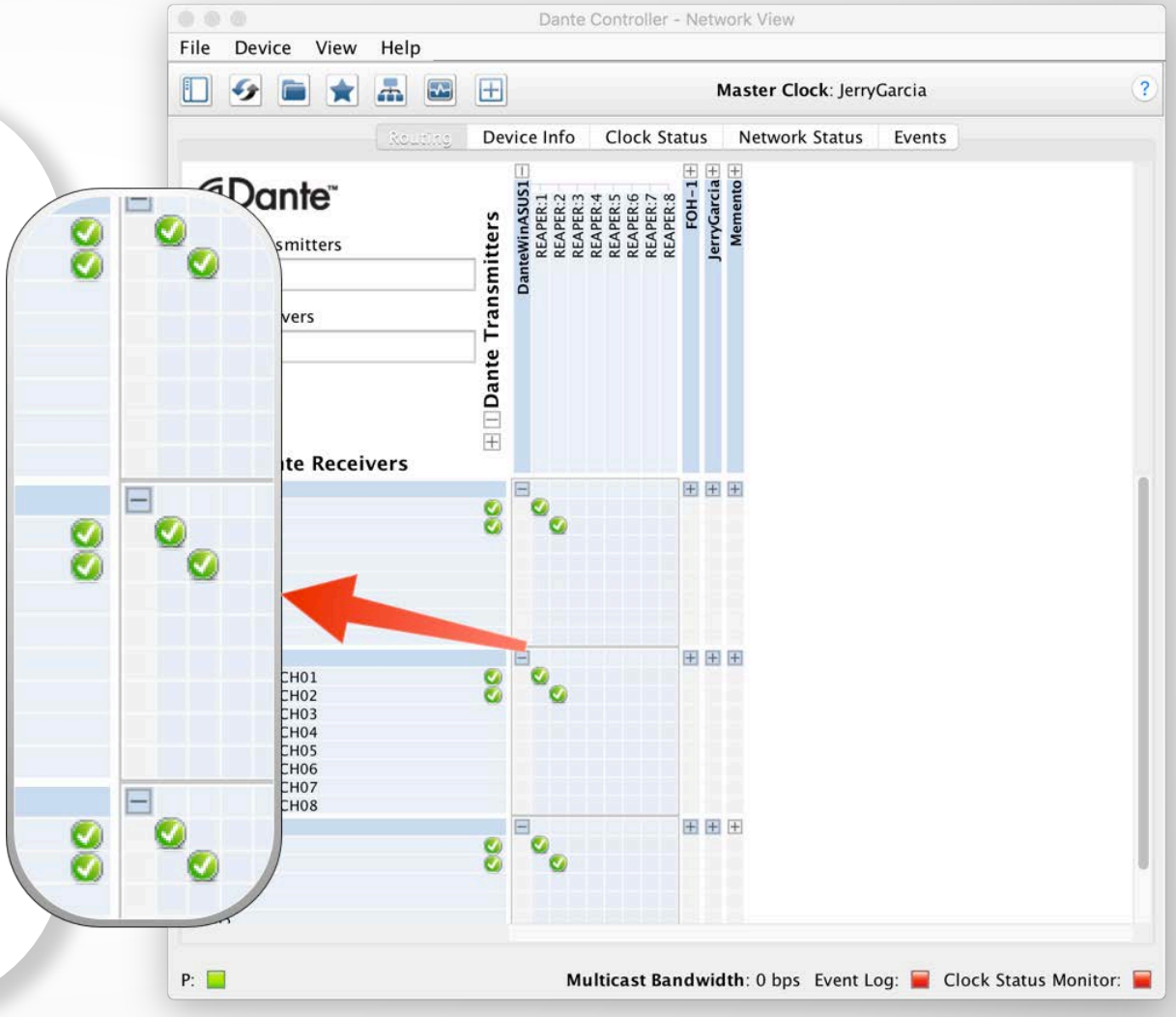
To delete a subscription, click on green checkmark

Checkmark disappears, subscription deleted

DISCOVERY AND ROUTING
SPLITS

Splits are easy with Dante

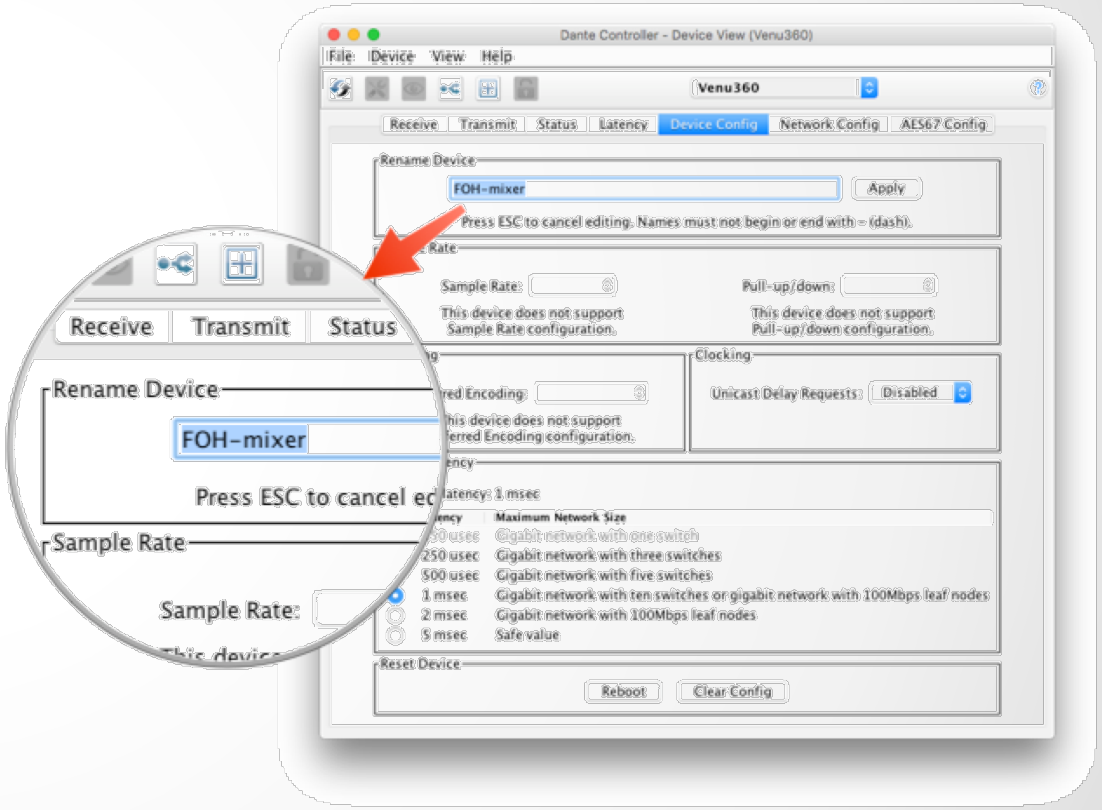
- Simply click at intersections of multiple receiver's channels for a desired transmitter
- Audio is sent to all subscribed devices and channels



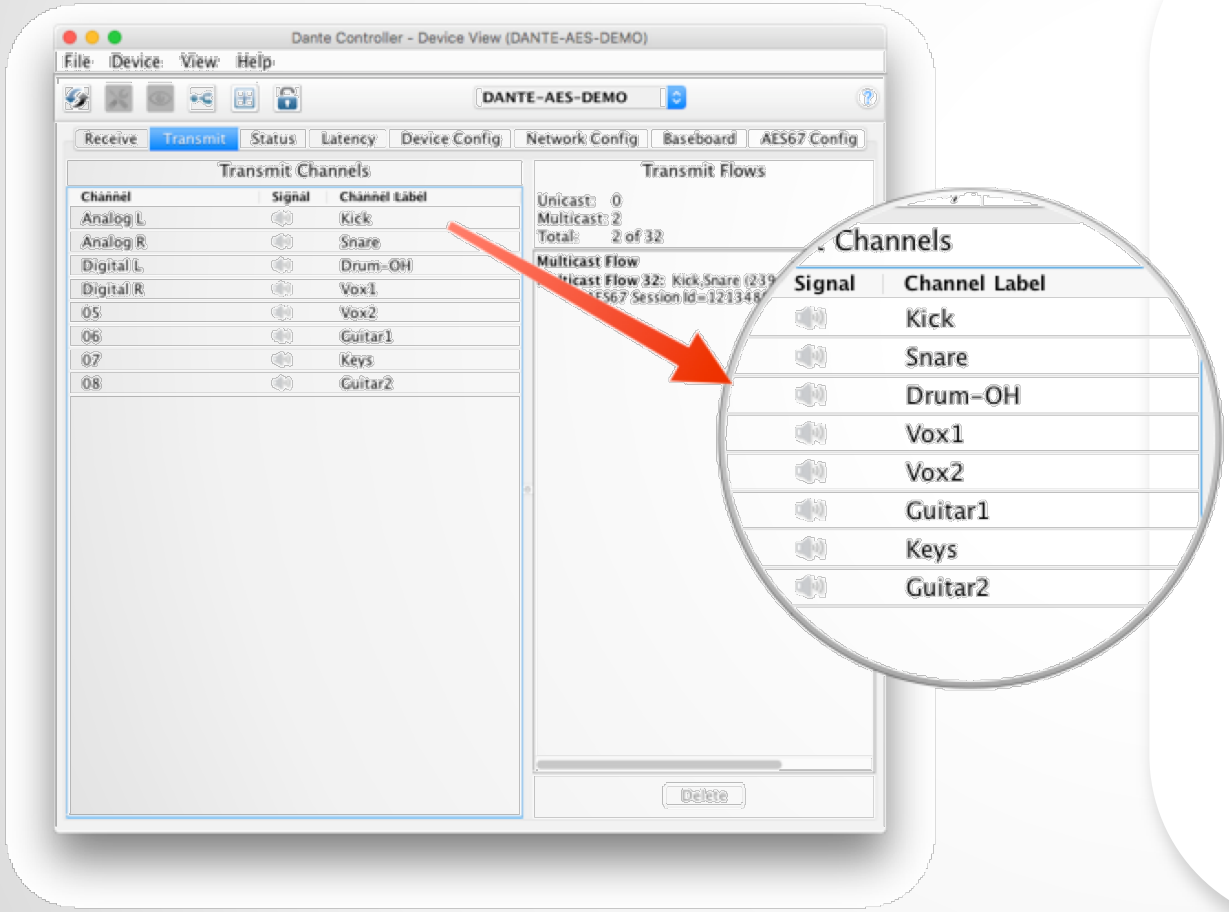
DEVICE NAMES

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



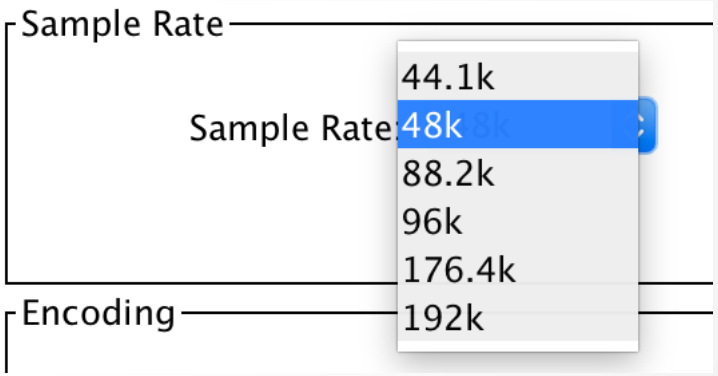
Labels can be applied to any channels

- Use Device View
- Makes it easy for volunteers or newbies to use system
- Software version of masking 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

RECORDING WITH DANTE VIRTUAL SOUNDCARD

DANTE CERTIFICATION PROGRAM

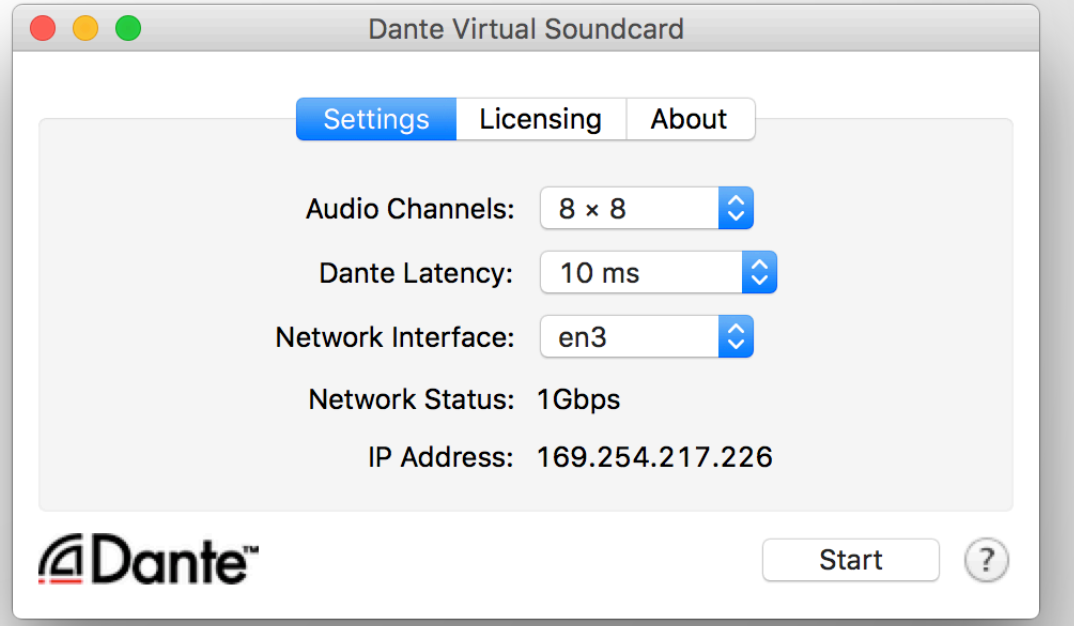
LEVEL 1

WHAT IS DANTE VIRTUAL SOUNDCARD? (DVS)

Soft Soundcard for Mac or PC

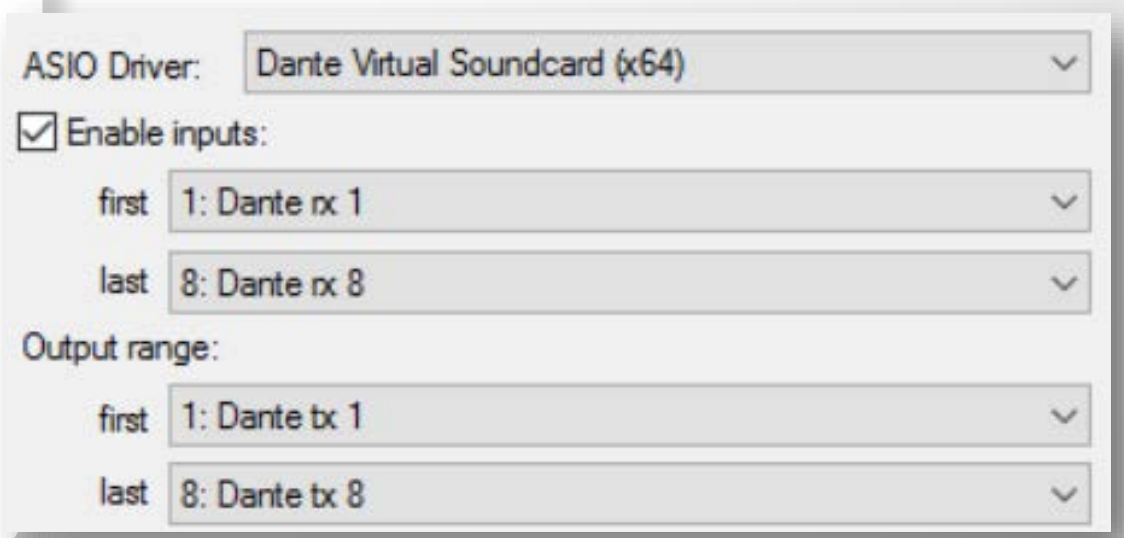
Connects to Dante network

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

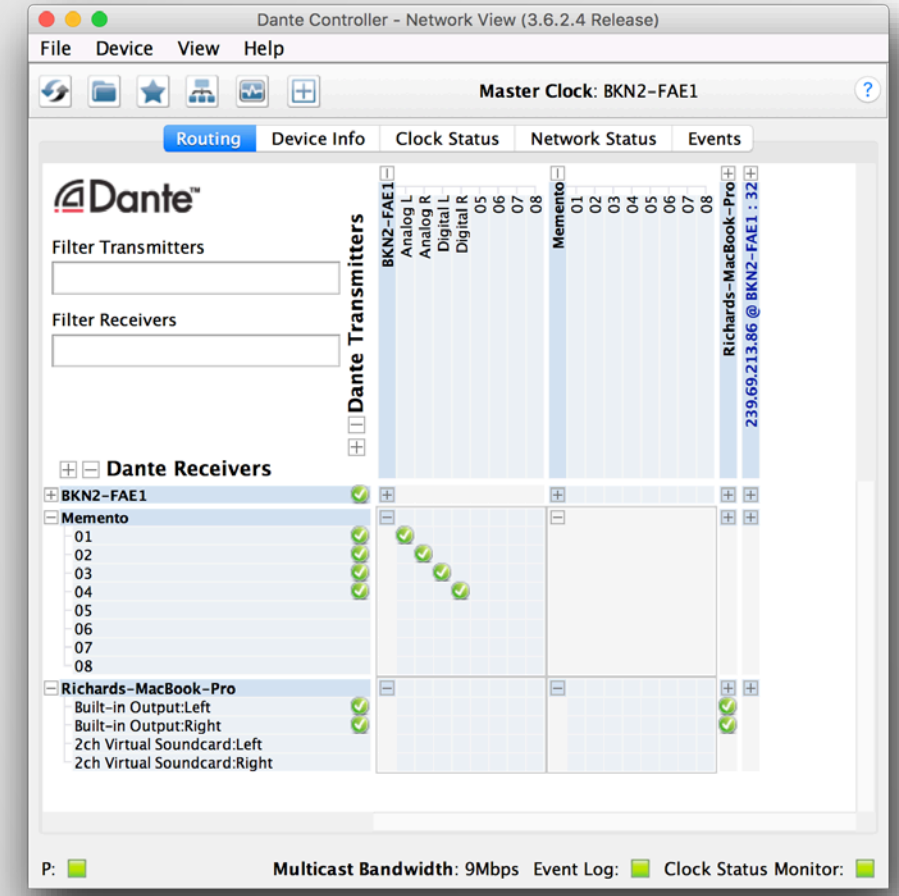


CONNECT TO A DAW

- 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



SUBSCRIBE CHANNELS



Open Dante Controller

Computer with DVS appears as Dante device

Subscribe channels to Dante devices on network

Record and Playout with DAW

NOW

WHAT?

http://www.audinate.com/resources

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

Dante™ by Audinate

http://www.audinate.com/resources