

INFORMATION AND PREREQUISITES

DANTE NETWORK



Dante (Digital Audio Network Through Ethernet) is an audio-over-IP technology that enables digital audio signals to be transported over a standard computer network.

Dante is based on common IT standards, allowing it to operate on networks made up of conventional switches and cabling.

To ensure the proper functioning of your Dante-compatible equipments, here is some information and prerequisites to respect.

1 - ADDRESSING DANTE DEVICES

Dante devices use DHCP for addressing when available or will auto-assign an IP address in the **169.254.0.0/16** range on the primary network and **172.31.0.0/16** on the secondary network if DHCP is not available. Dante devices continue to look for a DHCP server even after auto-assigning an IP address. Most Dante devices support static IP addressing.

2 - AUDIO TRANSPORT AND EXPECTED BANDWIDTH

The majority of audio used in professional settings is PCM (uncompressed), **sampled at 48 kHz** and a bit depth (word length) of **24 bits**. **Dante audio is unicast by default but can be set to use multicast for cases of one-to-many distribution.**

- Dante packages audio into flows to save on network overhead.
- Unicast Audio flows contain up to 4 channels. The samples-per-channel can vary between 4 and 64, depending on the latency setting of the device. Bandwidth usage is about 6 Mbps per typical unicast audio flow.
- Bandwidth for multicast flows is dependent on the number of audio channels used. Bandwidth is about 1.5 Mbps per channel.
- **Dante audio cannot be sent over Wi-Fi.**

ADDRESS	PORT	USAGE	TYPE
Device IP	UDP 14336-14591	Unicast Audio/Video	Unicast
239.255.0.0/16	UDP 4321	Multicast Audio/Video	Multicast

3 - VIDEO TRANSPORT AND EXPECTED BANDWIDTH

Dante video is optimized to run on Gigabit Ethernet and has a bandwidth cap of 700 Mbps. Video bandwidth is impacted by resolution, frame rate, chroma sampling, color bit depth, compression codec used, and varies with content shown. Dante video flows must be multicast if video is being sent to more than one destination.

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4 - DEVICE DISCOVERY

mDNS and DNS-SD are used for discovery and enumeration of other Dante devices including Dante Controller.

ADDRESS	PORT	USAGE	TYPE
224.0.0.251	5353	mDNS	Multicast

5 - SYNCHRONIZATION

Digital audio requires synchronization for accurate playback of audio samples. Dante uses Precision Time Protocol (PTP version 1, IEEE 1588-2002) by default for time synchronization. This generates a few small packets, a few times per second. One clock leader is elected on a per subnet basis that sends multicast sync and follow up messages to all followers. Follower devices send delay requests back to the leader to determine network delay.

- Follower devices can be configured to send unicast delay requests to cut down on multicast traffic.
- Dante does not require PTP aware switches. In most cases Dante does not benefit from enabling boundary clock or transparent clock on switches.

ADDRESS	PORT	USAGE	TYPE
224.0.1.129-132	UDP 319, 320	PTP	Multicast
239.254.3.3	UDP 9998	PTP Logging (if enabled)	Multicast

6 - CONTROL AND MONITORING TRAFFIC

Dante monitoring and control traffic uses the following ports :

EXTERNAL

ADDRESS	PORT	USAGE	TYPE
224.0.0.230-233	UDP 8700-8708	Multicast Control and Monitoring	Multicast

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INTERNAL

PROTOCOL	PORT	USAGE	TYPE
UDP	4440, 4444, 4455	Audio Control	Unicast
UDP	8751	Dante Controller metering port	Unicast
UDP	8800	Control & Monitoring	Unicast

A full list of ports used by Dante is available at :
www.audinate.com/learning/faqs/which-network-ports-does-dante-use

7 - QoS

Dante as a real time media streaming service benefits from low latency and jitter on the network. QoS should be used for prioritization of Dante clock and audio on mixed-use networks (including those with Dante Video). It is only a requirement for Dante audio only networks if using 100 Mbps or mixed 1 Gbps/100 Mbps network infrastructure and devices.

- Dante can make use of DiffServ QoS where needed.
- Dante will tag packets, and its tags can be integrated into an existing IT network QoS scheme.
- When used, QoS must be configured with strict priority queueing.

PRIORITY	USAGE	DSCP LABEL	HEX	DECIMAL	BINARY
High	Time critical PTP events	CS7	0x38	56	111000
Medium	Audio, PTP v2	EF	0x2E	46	101110
Low	(reserved)	CS1	0x08	8	001000
None	Other traffic	Best effort	0x00	0	000000

Note : the QoS DSCP values can be re-marked, provided that the PTP packets still receive high priority.

8 - MULTICAST MANAGEMENT (IGMP)

When Dante resides in mixed networks, those where IP video is on the same network segment, or a significant amount of multicast audio is in use, IGMP should be used to assist with multicast management. IGMP is not a requirement for Dante audio only networks with few or no multicast audio flows.

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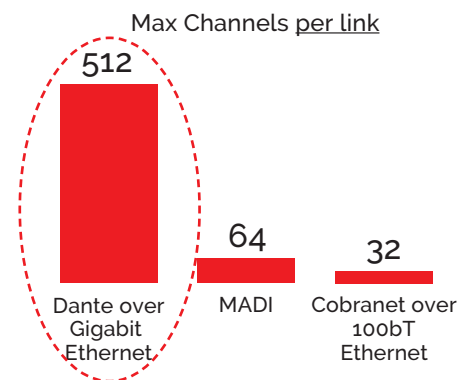
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- Dante implements IGMP v2 or v3.
- One IGMP Querier should be elected per VLAN.
- Query intervals should be short, and time out values long.

9 - DANTE BANDWIDTH

- Legacy digital systems constrained to lower channel count.
- Gigabit means Dante is capable of **512x512** at each link.
- Even a large 64 channel console consumes only 1/8 capacity of a single port.



10 - BANDWIDTH USAGE

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

Example : 64 channels of PCM audio at 48kHz/24-bit =
 $48\,000 \times 24 \times 64 = 74 \text{ Mbits/sec}$

With network overhead, 64 channels = 96mbps

When sample rate is increased, i.e. from 48 kHz to 96 kHz, **the channel count is reduced.**

11 - LATENCY

- Latency is always a defined well-know time to match playouts and **set per device.**
- **Default latency is 1ms (ultra-fast !) up to 10 switches.**

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- Multiple devices can use different latency settings on the same network :
 - minimum : 150 μ s
 - maximum : 5 ms

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

12 - CABLES

- Dante requires the same cables as for regular computer network.
- Use **CAT5E** or **CAT6** (preferred) Ethernet cables.
- Up to 100m max per run.

13 - FIBER

- **Dante works on fiber networks.**
- Required for **greater distances (over 100m).**
- Fiber requires SFP (Small Form-factor Pluggable) switches.

14 - 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.

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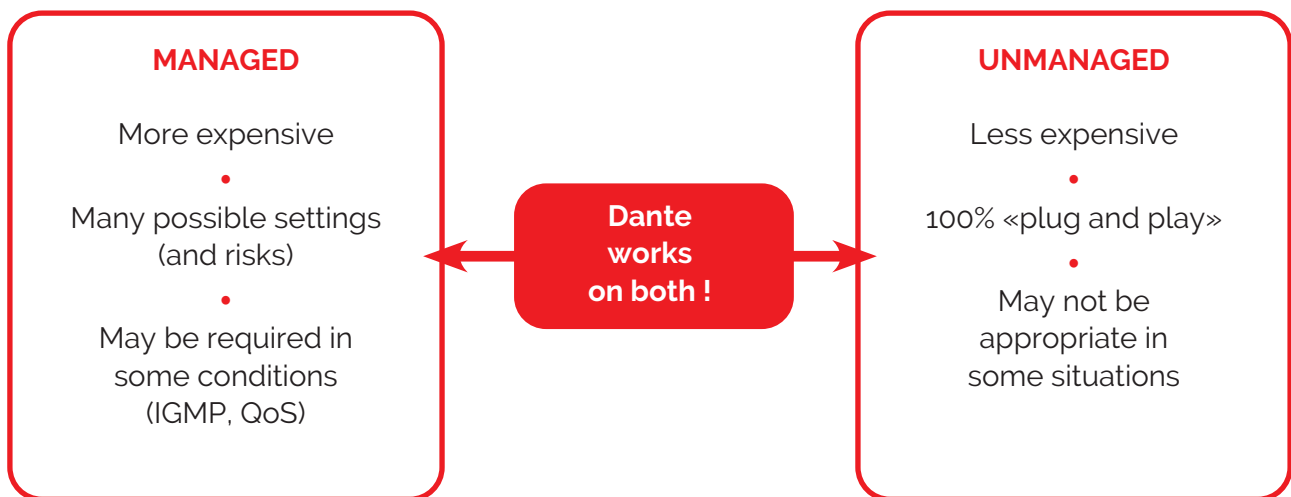


15 - SWITCHES



- Switches connect devices on a common network.
- Available small (5 ports) up to large (48 ports).
- **Gigabit switches are preferred for extra bandwidth !**

UNMANAGED VS MANAGED



EEE SWITCHES

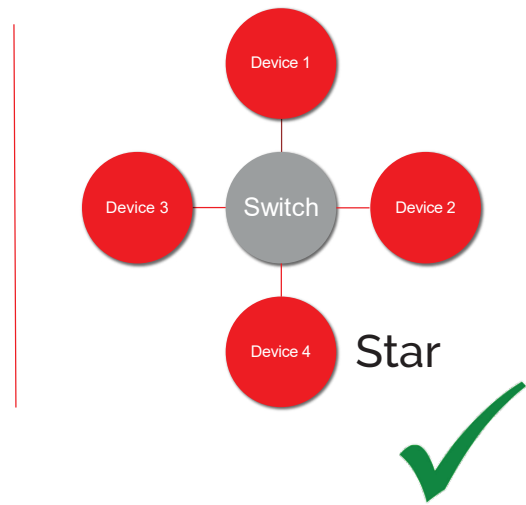
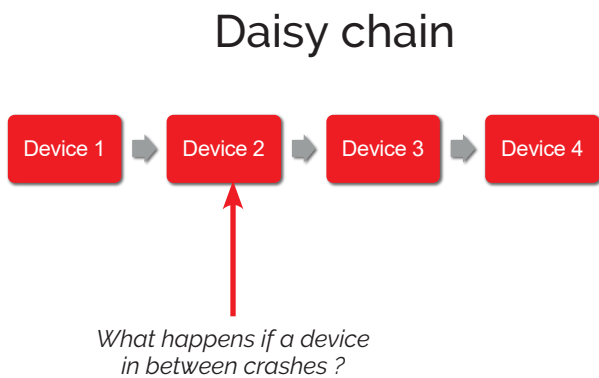
- **EEE (Energy Efficient Ethernet) or «Green» switches are not recommended** for real time media.
- The energy saving feature will shut down ports and prevent parts of Dante from working properly.
- **Avoid «green» / EEE switches** or disable this feature on all ports used for Dante traffic.

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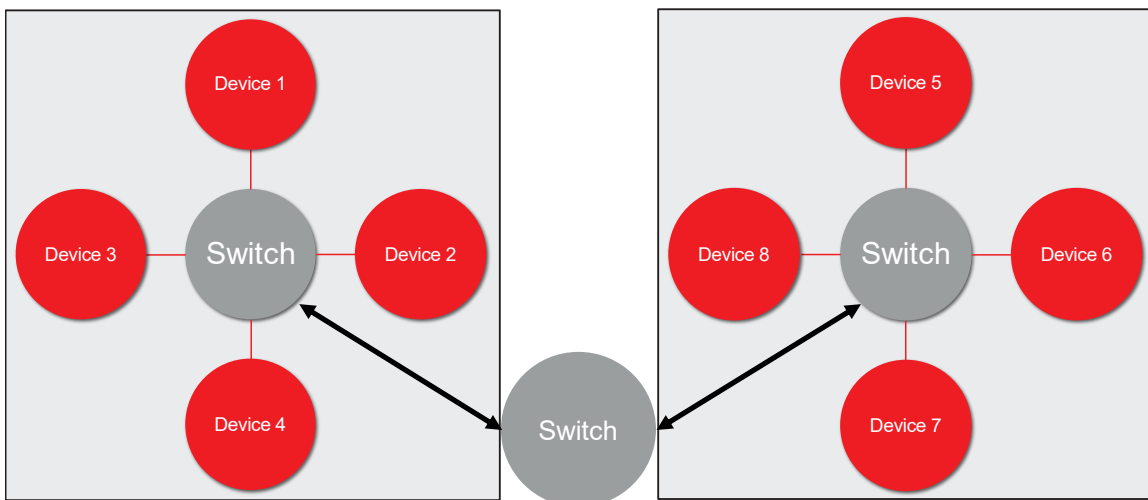


16 - NETWORK TOPOLOGY



- Use a **"Star" topology** to minimize switch hops.

MULTIPLE STARS



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SUMMARY

- Always use **gigabit switches**.
- Use **CAT5E or CAT6** (preferred) Ethernet cables.
- Use **fiber for long runs** (over 100 meters).
- **Wi-fi is not compatible with Dante audio.**
- **Dante works either on managed or unmanaged switches.** Smaller Dante-only networks do not require management features, and may safely use unmanaged switches.
- Use a **"Star" topology** to minimize switch hops.
- **Avoid «green» / EEE switches** or disable this feature.

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ANNEX - MAJORCOM'S DANTE-ENABLED PRODUCTS

EVAMATRIX - VOICE ALARM (VA) SYSTEM	
REFERENCE	DESCRIPTION
EVAMATRIX	Main controller, EN54-16 certified
DPN-240S	240W Dante Digital Network Amplifier, EN54-16 certified
DPN-240D	2X240W Dante Digital Network Amplifier, EN54-16 certified
DPN-240Q	4X240W Dante Digital Network Amplifier, EN54-16 certified
DPN-480S	480W Dante Digital Network Amplifier, EN54-16 certified
DPN-480D	2X480W Dante Digital Network Amplifier, EN54-16 certified
RM-VA 1000	Microphone station with Dante, EN54-16 certified
DIGITAL AUDIO MATRIXES	
REFERENCE	DESCRIPTION
DNM-88D	Digital audio matrix 8x8 analog I/O + 8x8 Dante I/O
DNM-1616D	Digital audio matrix 16x16 analog I/O + 16x16 Dante I/O
DIGITAL AMPLIFIERS	
REFERENCE	DESCRIPTION
DPN-240S	240W Dante Digital Network Amplifier, EN54-16 certified
DPN-240D	2X240W Dante Digital Network Amplifier, EN54-16 certified
DPN-240Q	4X240W Dante Digital Network Amplifier, EN54-16 certified
DPN-480S	480W Dante Digital Network Amplifier, EN54-16 certified
DPN-480D	2X480W Dante Digital Network Amplifier, EN54-16 certified
DSA-500Q	300W / 8Ω Dante Digital Network Amplifier
DSA-2000Q	1 200W / 8Ω Dante Digital Network Amplifier
MICROPHONES	
REFERENCE	DESCRIPTION
DANTE DMIC 3	Microphone station with Dante
RM-VA 1000	Microphone station with Dante, EN54-16 certified
CONVERTORS	
REFERENCE	DESCRIPTION
AVIO ANALOG IN 2X0	Dante analog-to-digital converter 2 analog inputs
AVIO ANALOG O 0X2	Dante analog-to-digital converter 2 analog outputs
DASR-288	8-channel digital audio transport system over IP
WALL PLATE	
REFERENCE	DESCRIPTION
DW-BT	Bluetooth and Dante wall plate

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