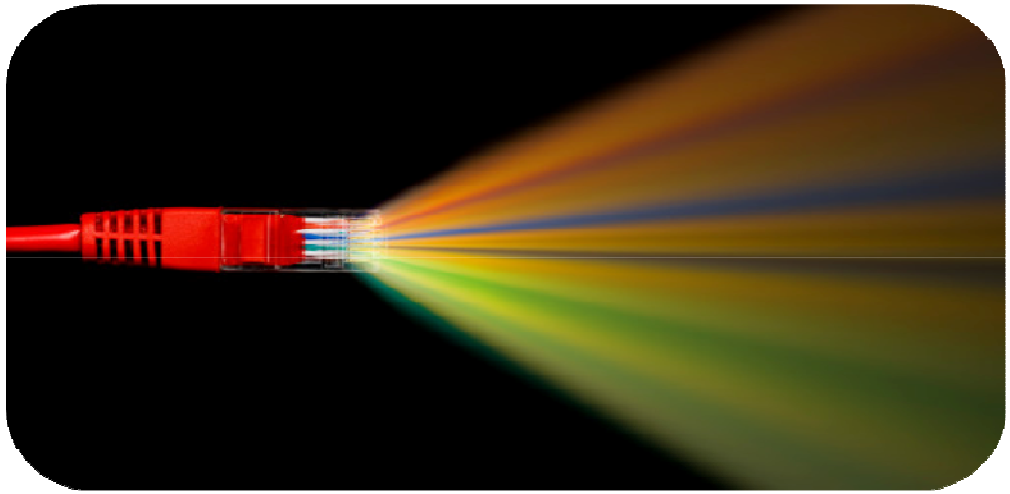
Audinate



Dante Media Networking

Kieran Walsh
Senior Technical Solutions Manager- EMEA

About Audinate

- The leading developer of media networking technology with core competencies in media networking, time synchronization techniques, and zero-network configuration
- Audinate has pioneered an open standards based approach to develop high quality audio and media over standard TCP/IP computer networks
- Our vision is to revolutionize the way that AV systems are connected. We do this by transporting high quality media over standard IT networks

We are not just networking implementers…
We are the inventors who are leading the way

Audinate…leading the way

- First media networking solution to implement IEEE1588 for ultra accurate clock synchronization.
- First Pro AV networking solution to fully exploit gigabit and QoS in Ethernet switches.
- First AV solution to implement label based routing to simplify complex network configuration.
- First networking solution to enable a common shared network for audio, control and data traffic.
- First company to implement full glitch free redundancy.

Over 45 licensed manufacturers and growing

Audinate's markets today…

Professional AV systems

Live Concerts Venues
Live Events
Music Instrument Equipment

Installed Systems

Stadiums
Auditoriums
House of Worship
Universities
Corporate Buildings
Casinos

Broadcast AV systems

Recording
Post Production
Broadcast Systems

Public Address

Conference Systems
Rail
Airports
Voice Alarm
Evacuation Systems
Boardrooms

Audinate in Use: Sound Reinforcement

Paul McCartney

"Dante sounded significantly better than other digital formats and definitely sounded better than long runs of analog cable."

Stevie Wonder

"Dante's easy to configure text based channel labeling and routing helped smooth the transition between acts."

Dante in installed sound

2010 Winter Olympics

"Dante network system connected 2 million watts of amplifiers"

Broadway, NYC- West End, London

"With the Dante Virtual Soundcard, we have a complete recording solution"

Dante in Stadiums

Twinkenhem Stadium
London, England

Lord's Cricket Ground
London, England

Voice Evacuation Audio Alarm and
Public Address Systems

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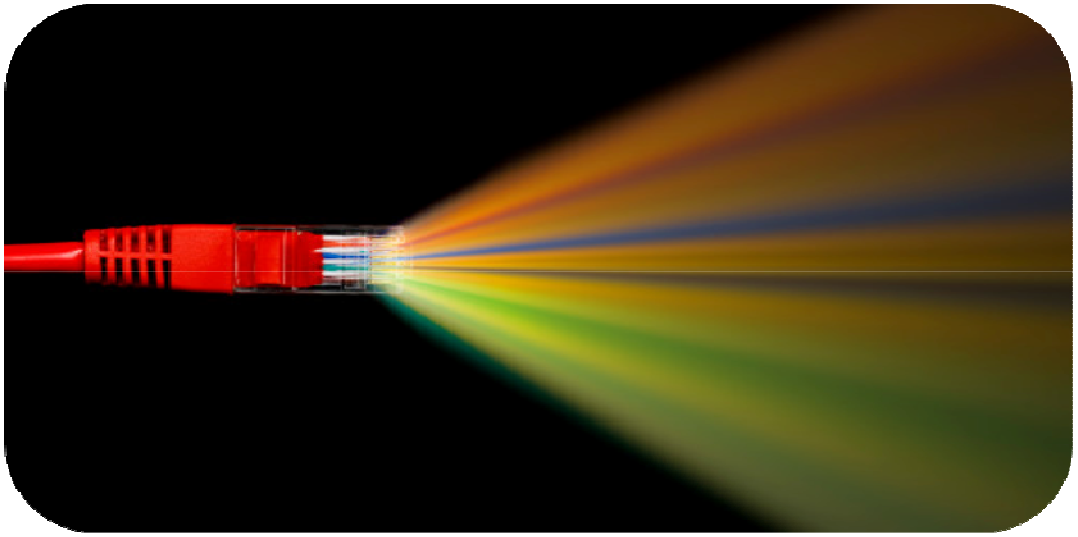


Network Evolution

Early audio networking over Ethernet approaches

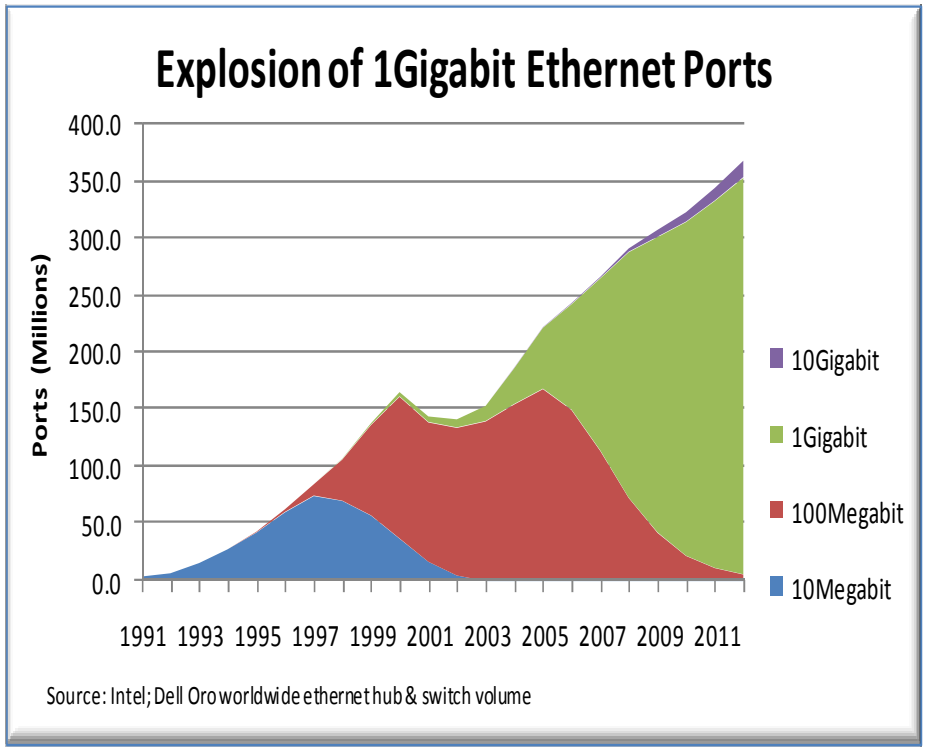
- Used Ethernet, but not IP
- Typically closed non-standard systems
- “Layer 2” only – no higher network functionality
- Solved problems of that time period but imposed limitations
  - Latency or scalability tradeoffs
  - Could not easily support data, voice and control

Early audio over Ethernet limitations

- 100Mbps networks
- High latency (CobraNet)
- Complex to set up
  - "Bundles" of channels difficult to manage, channels, or route
- Multiple VLANs required to break network into 100Mbps parts
- No way to interface directly with PCs

Convergence of A/V & IT Networks

- Huge, standards-driven industry
- Ubiquitous, fast, cost effective
- Incredibly reliable
- Deep integration with computer applications



Using modern networking technology keeps you future-proof!

AVB Markets and Applications

- Pro A/V
- Automotive
- Consumer

AVnu Alliance™

- AVnu Alliance is an alliance dedicated to the advancement of professional-quality audio video by promoting the adoption of the IEEE 802.1 Audio Video Bridging (AVB), and the related IEEE 1722 and IEEE 1733 tranports.
- Member companies include Analog Devices, Audinate, Avid, Bosch, Broadcom, Cisco, Extron, Intel, Harman, Loud, Marvell, Meyer Sound, Peavey, PreSonus, Sennheiser, Shure, TC Group, Xilinx and Yamaha.

Audio Video Bridging (AVB) IEEE 802.1

- AVB is a set of core standards with a goal of enabling interoperability of networked audio and video devices
- AVB is a set of standards-not a specific implementation or brand
  - AVB is a system that defines behavior of both endpoints *and* intermediate network switches
  - AVB switch improves configuration issues related to Quality of Service settings
  - AVB should ultimately allow for interoperability at the transport level.

Basic functions of AVB

- Precise synchronization
- Traffic shaping for media stream
- Admission controls
- Identification of non-participating devices.

What is AVB: Core AVB Standards

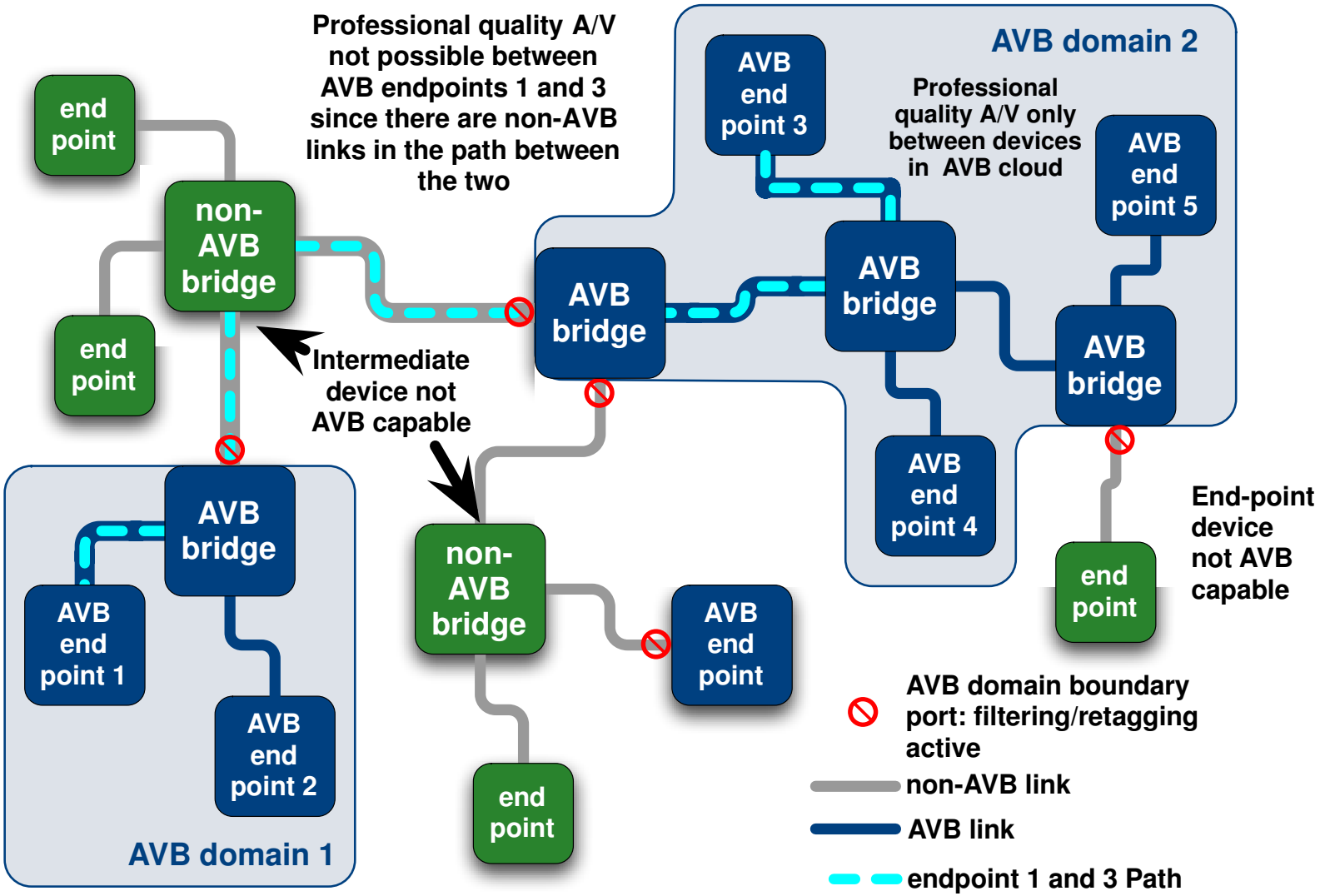
- IEEE 802.1AS – Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks
- IEEE 802.1Qav – Forwarding and Queuing Enhancements for Time-Sensitive Streams
- IEEE 802.1Qat- Stream Reservation Protocol

AVB vastly improves configuration of QoS in switches

AVB and Switches

- AVB requires a new AVB compliant network switches
- AVB automates QoS configuration in AVB switches
- All AVB traffic must pass through AVB-compliant switches
- Non-AVB switches compromise connections between AVB-compliant endpoints
- Compliance testing process being defined

AVB Clouds


Professional quality A/V not possible between AVB endpoints 1 and 3 since there are non-AVB links in the path between the two
AVB domain 2
Professional quality A/V only between devices in AVB cloud
end point
non-AVB bridge
end point
Intermediate device not AVB capable
AVB end point 3
AVB bridge
AVB bridge
AVB end point 5
AVB bridge
AVB end point 4
AVB bridge
AVB end point 1
AVB end point 2
AVB domain 1
non-AVB bridge
AVB end point
end point
end point
End-point device not AVB capable
AVB domain boundary port: filtering/retagging active
non-AVB link
AVB link
endpoint 1 and 3 Path

Additional AVB Standards

- IEEE P1722- Layer 2 Transport Protocol for Time Sensitive Applications in a Bridged Local Area Network
- IEEE P1733- Layer 3 Transport Protocol for Time Sensitive Applications in Local Area Networks
- Both standards have been ratified and published.

AVB Transport Protocols – IEEE1722

- IEEE1722 is new transport protocol which runs entirely at Layer 2
- Firewire/IEEE1394 frames are encapsulated into Ethernet frames
  - 802.1Qat is used to reserve bandwidth
  - Ethernet packets use 802.1Q headers with priority
- IEEE1722 uses 802.1as to provide timestamps for synchronization
- IEEE1722 is not routable across subnets

AVB Transport Protocols – IEEE1733

- IEEE1733 is an extension to the Real-time Transport Control Protocol (RTCP)
  - Supports AVB 802.1as clock synchronization
- RTP is a well established media transport protocol
  - RTP use in VoIP, video conferencing and IPTV
- RTP streams can easily use AVB QoS services:
  - Reserve bandwidth using 802.1Qat
  - Mark packets with 802.1Q priorities
- RTP can be routed across subnets
- 1733 supports 33% more channels over link

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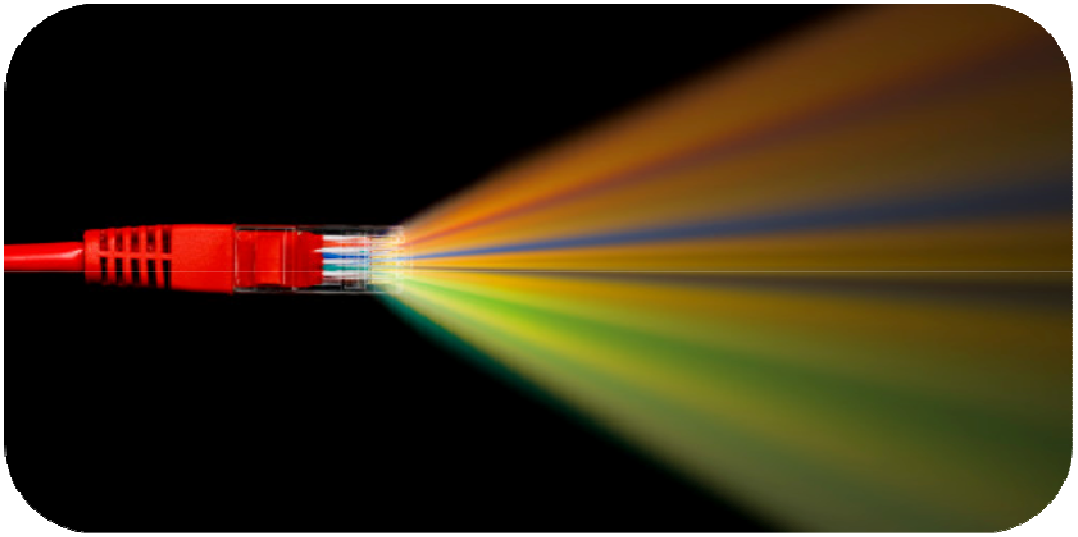
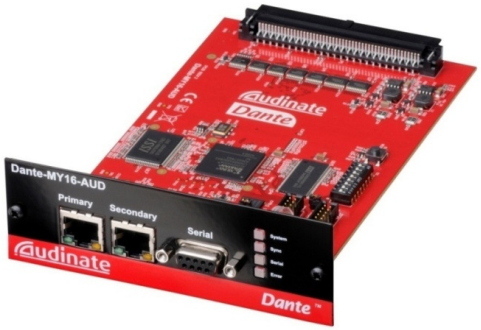


Migrating to AVB

Dante- Making Digital Networking Easy

- Dante offers a complete network solution
- Dante self discovery and label based routing.
- Simplified ease of use and set up time.
- Dante's architecture is built on standard Internet Protocols – not just Ethernet
- AVB Ready- Built on global networking standards including IEEE 802.3, UDP/IP and IEEE1588

LIVE DESIGN PRODUCTS 2010-2011 OF THE YEAR

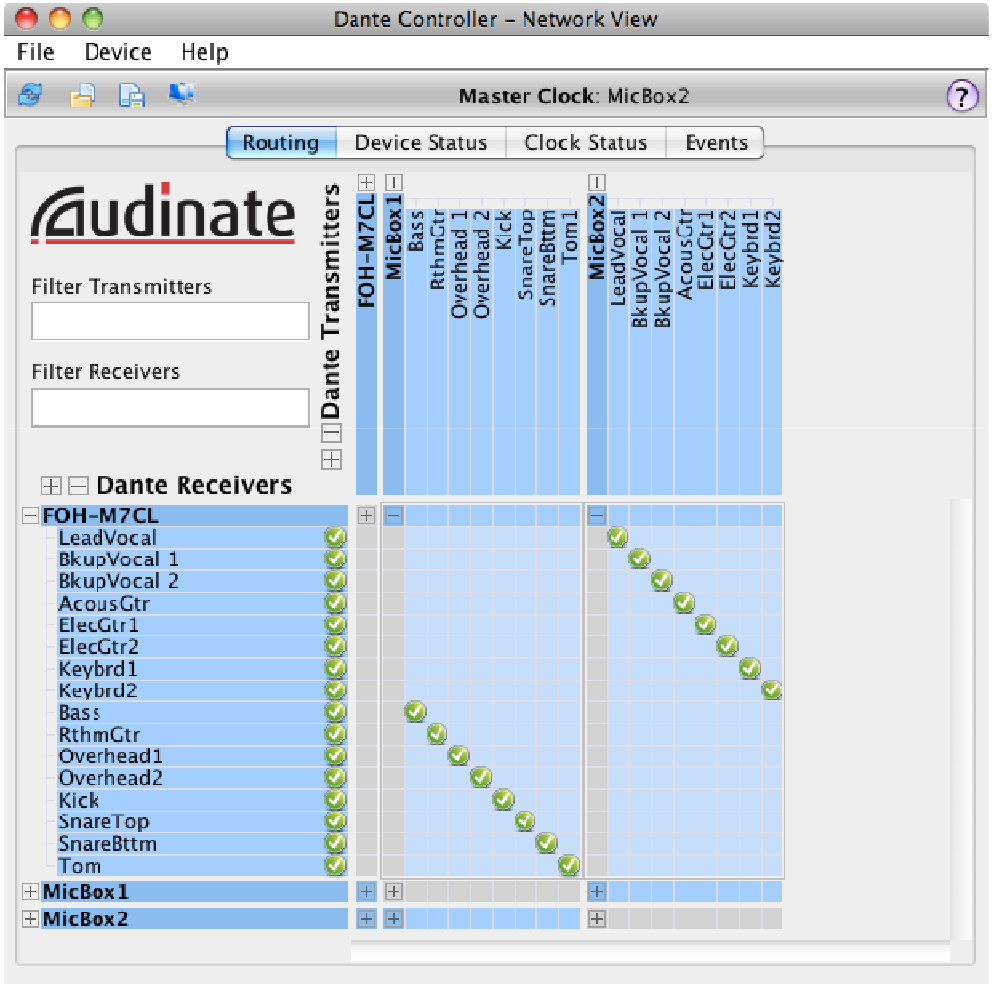


Second Annual ProSoundWeb AND Live Sound International Readers' Choice AWARDS 2010 WINNER

PALME MIDDLE EAST AWARDS

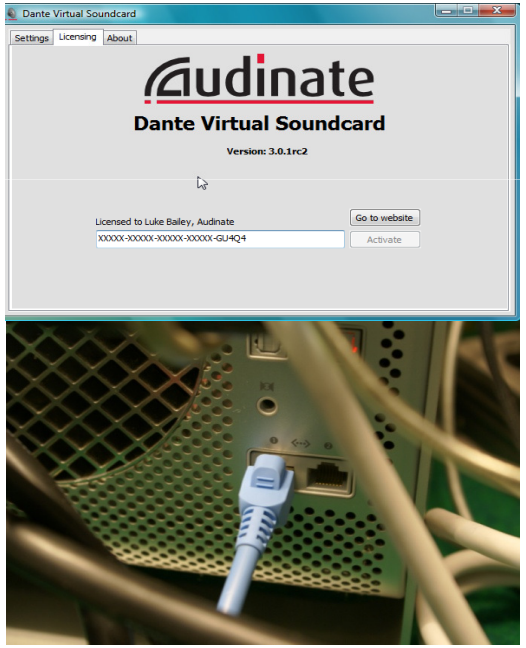
Network Configuration

- Automatic discovery of Dante enabled devices on the network.
- Simple label-based routing. No “magic numbers” or MAC addresses to learn
- Easily to make changes to systems without touching equipment.



Dante Virtual Soundcard

PC networked implementation that turns your audio applications into network audio applications with Dante Virtual Soundcard



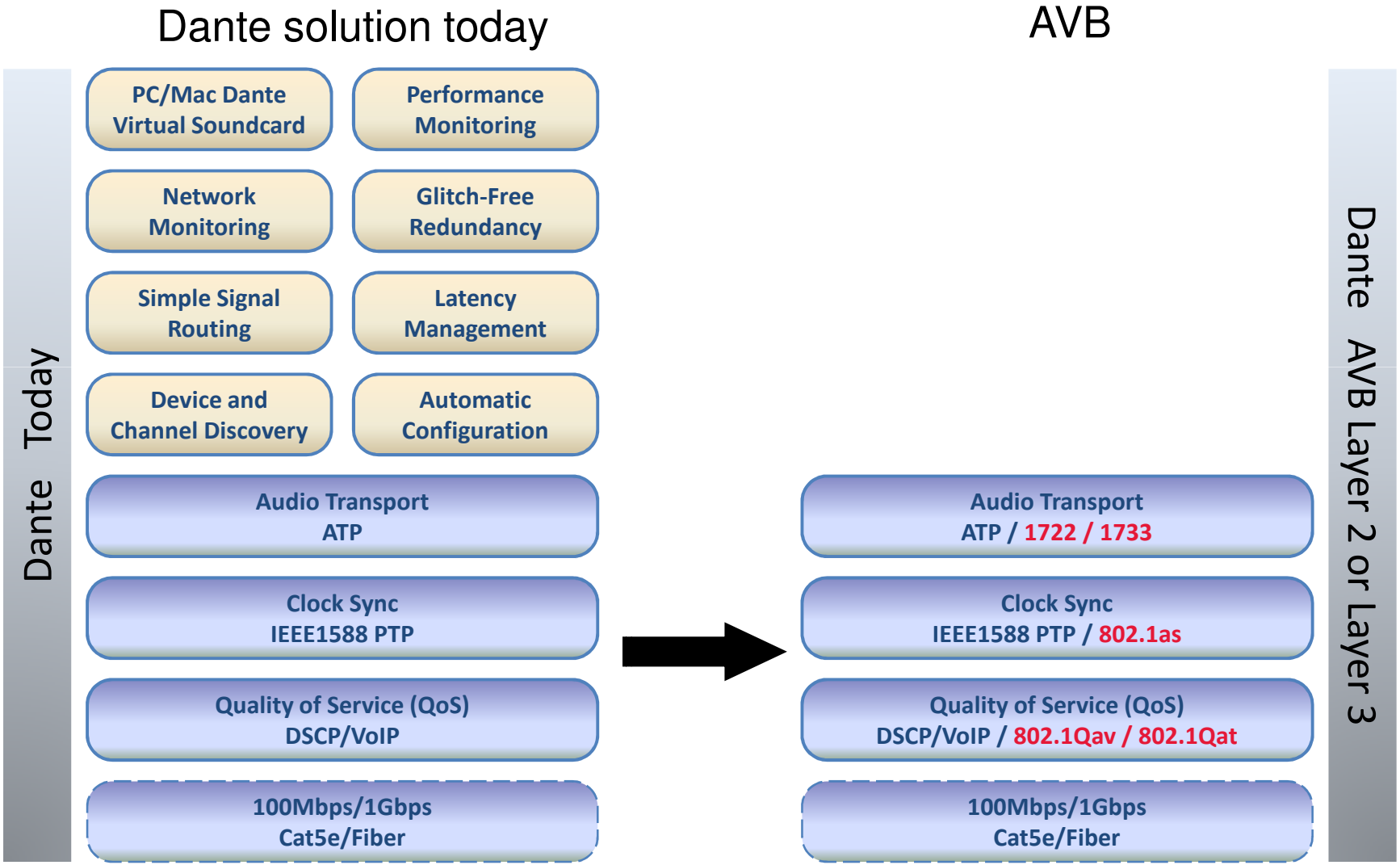
- Dante enables your PC/Mac
- Record, playback, process networked digital-audio with no loss of quality
- No soundcard hardware needed
- Just use the Ethernet built-in to your PC or MAC
- Virtual Soundcard appears as a multichannel ASIO or Core Audio device

Migration path of Dante to Dante/AVB

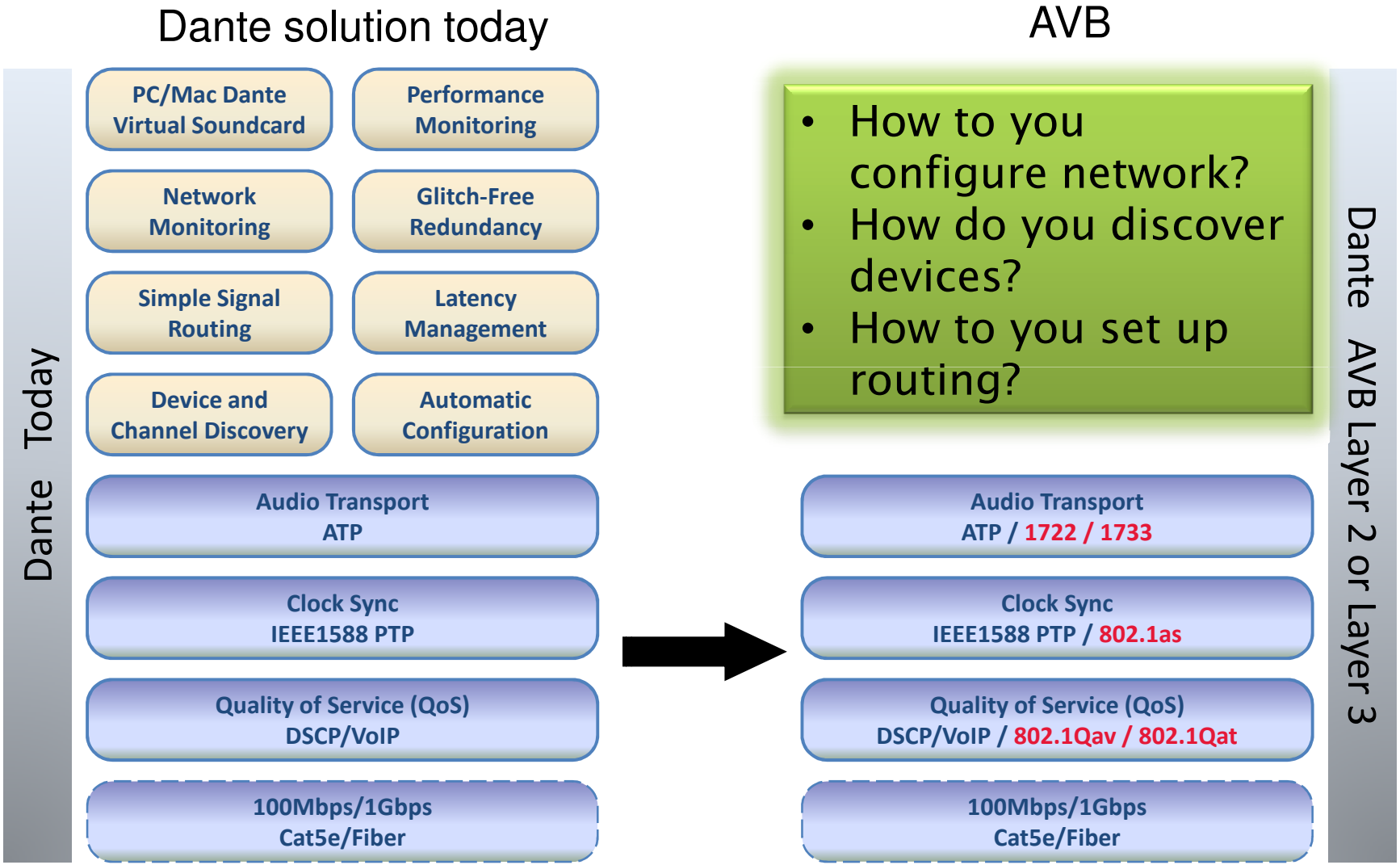
Dante Transport

Migration path of Dante to Dante/AVB

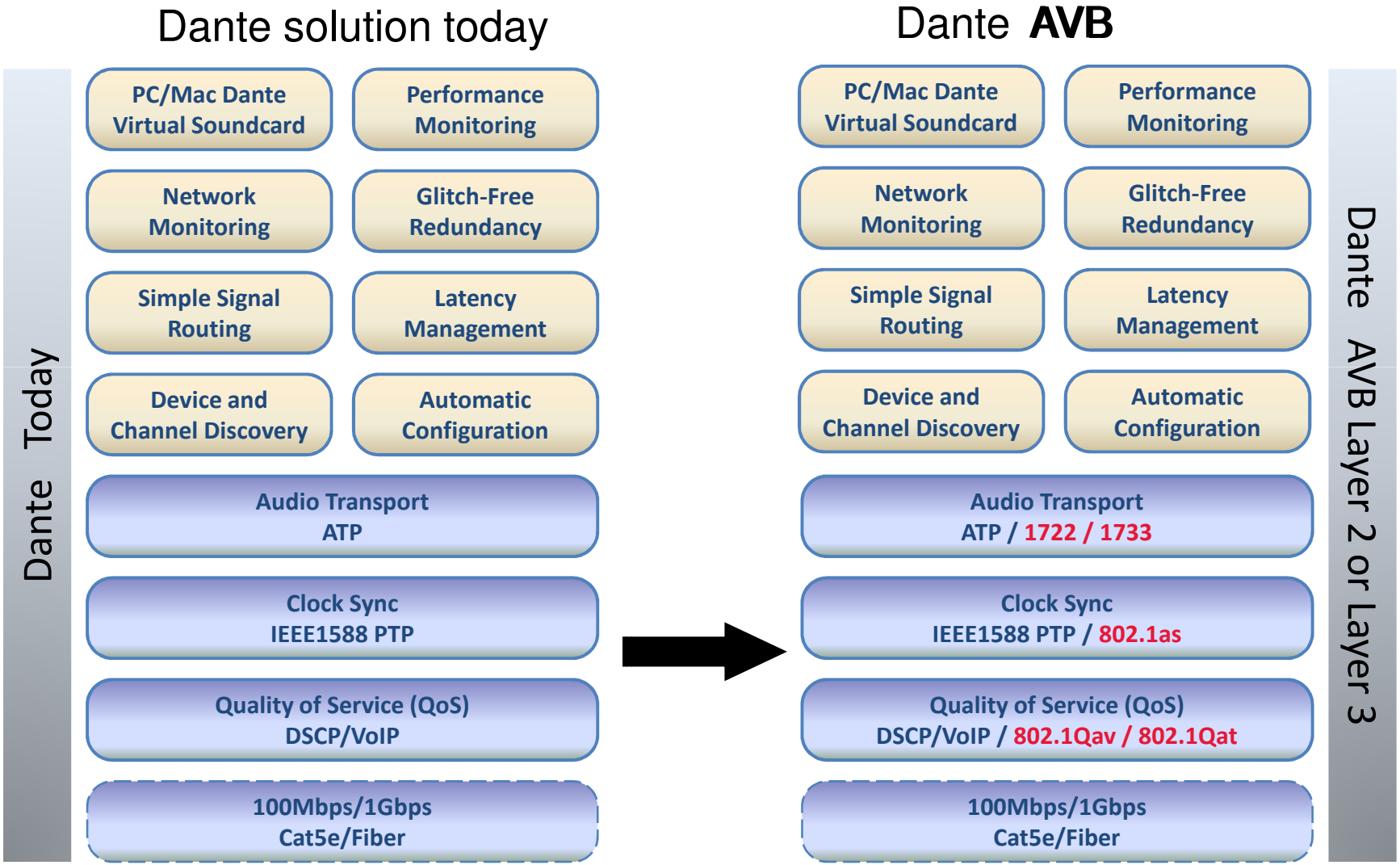
Migration path of Dante to Dante/AVB



Migration path of Dante to Dante/AVB

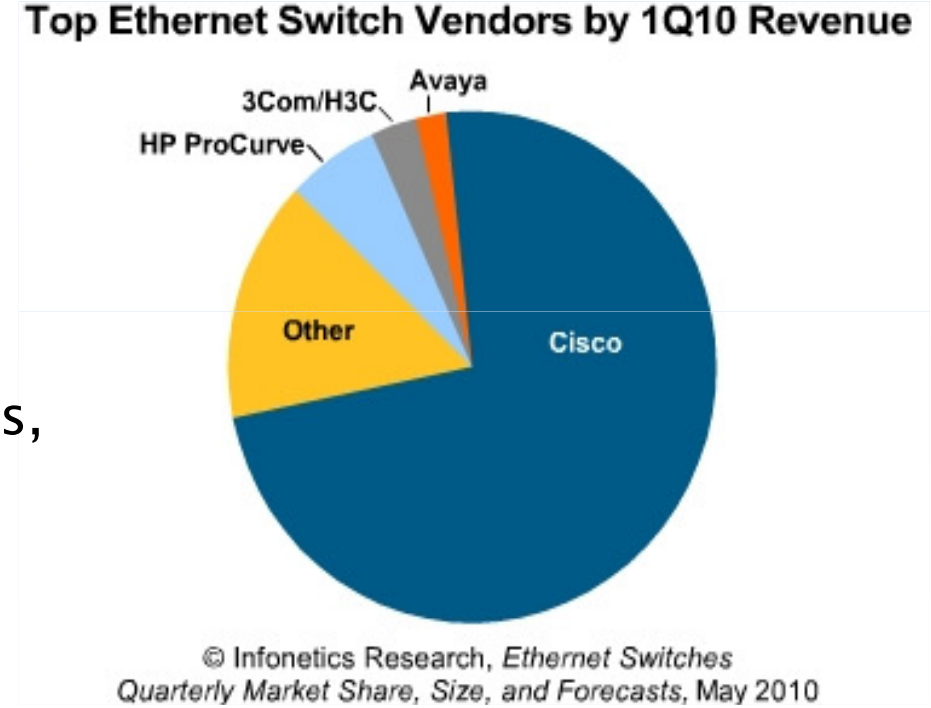


Migration path of Dante to Dante/AVB



AVB and network switch market

- Broadcom and Marvel shipping "AVB capable HW chips"
- Firmware development is still required by switch vendor.
- One switch announced
- No major switch vendors have yet to announce support.
- Just like we saw in 3G networks, or 802.11 WiFi… you need backward compatibility.
- Think about a transition strategy when it makes sense.



Audinate offers a safe migration path to AVB

Summary AVB

- AVB is an Audio over IP solution
- AVB improves QoS in switches
- AVB requires specialized switches
- Major enterprise switch suppliers have yet to announce an AVB supported switch
- Recommend designers have flexibility when implementing AVB and have a solution that will work with or without AVB switches
- Dante “Futureproofs” designs

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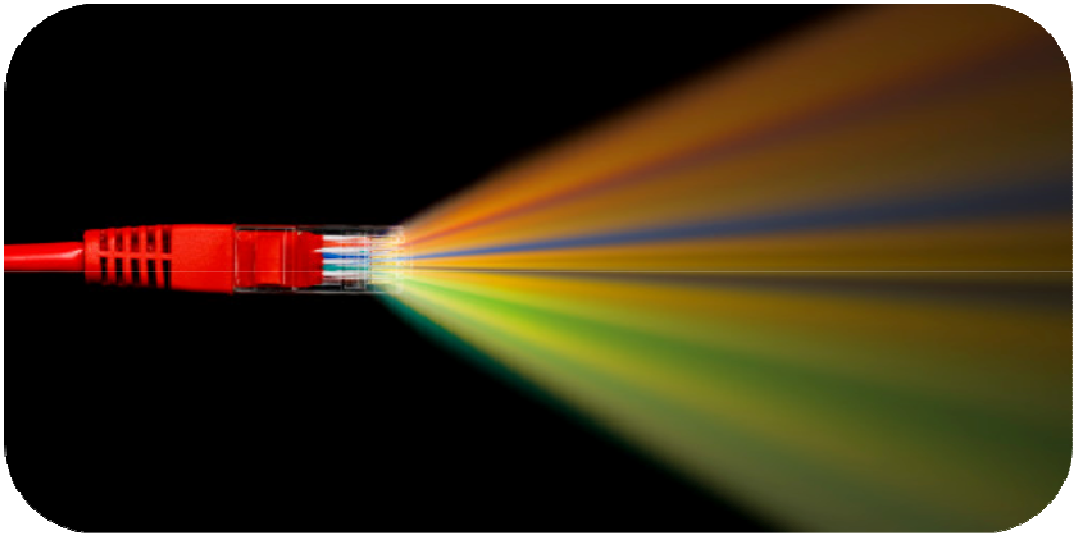

Dante- Leading the Way

www.audinate.com