Sydney Trains Networked digital PA

Mark Lownds
Salzbrenner Stagetec Mediagroup

Introduction: Stagetec Mediagroup

SALZBRENNER STAGETEC MEDIAGROUP

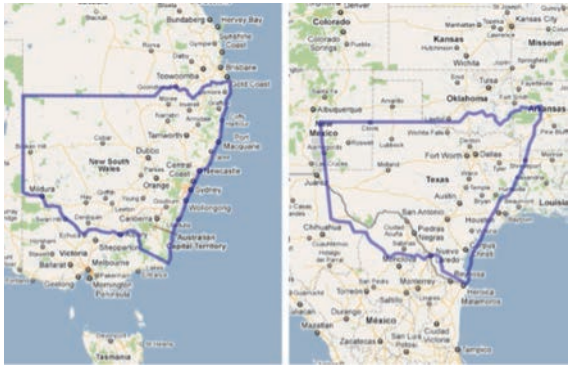
Stagetec
(nexus and consoles)

Delec
(Communications)

AVM
(Systems House)

Introduction: Sydney Trains Project

- Investing in new technology
- Enhanced customer experience as mandated from the government
- Geographically large



- We had to meet the following requirements…

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Digital PA: Audio Requirements

- **Communicate with passengers on platforms and concourse areas throughout the Sydney Trains Network**

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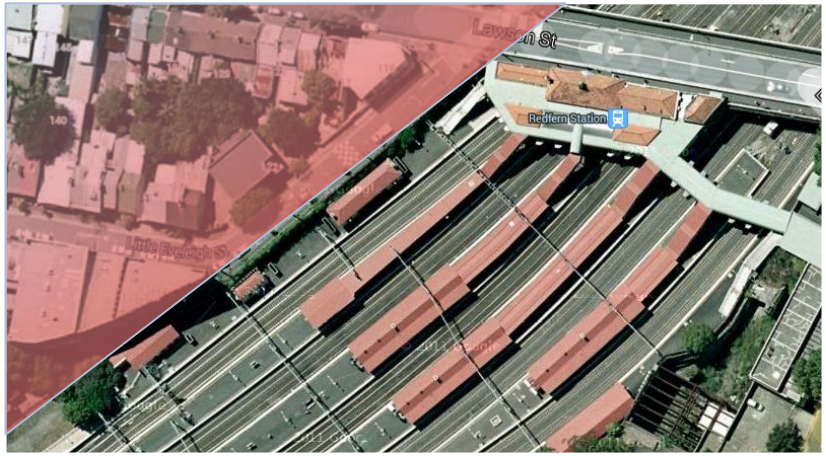
Digital PA: Audio Requirements

- **Environmental pollution control including Ambient Noise Control, Directional Speaker Design and Time Of Day switching**



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Digital PA: Audio Requirements

- **Natural sounding speech with measurable Speech intelligibility**
  (Aiming for 0.75 without a train at platform)

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Digital PA: Audio Requirements

- **Time Alignment along average 200 metre long platforms up to 500ms or a maximum of 1.46 seconds**

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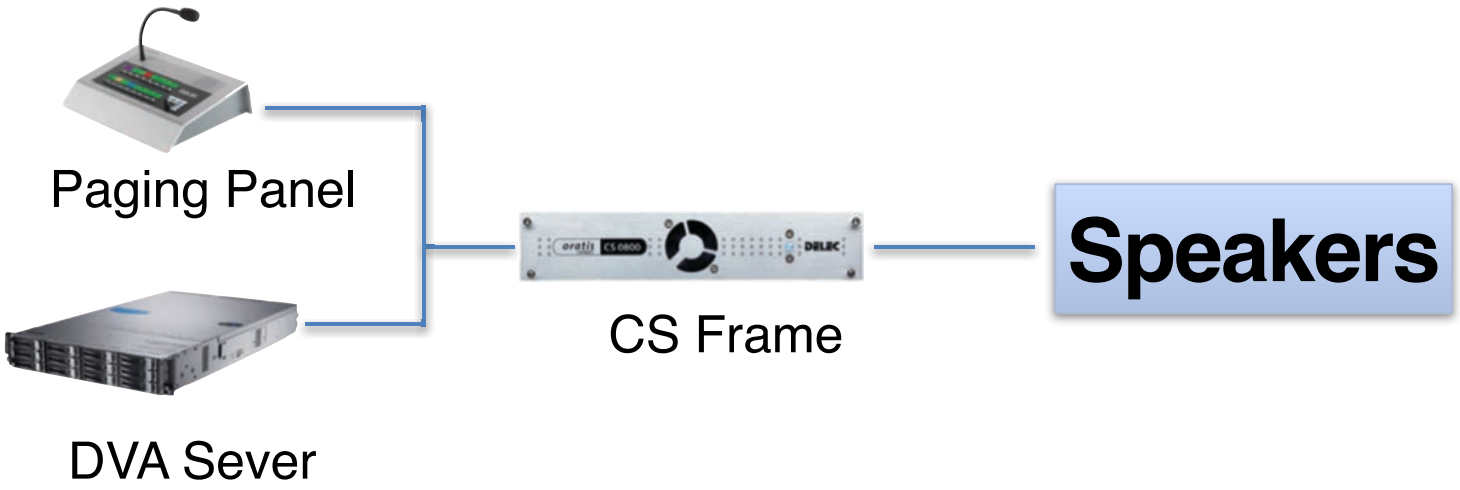
Digital PA: Audio Requirements

- **Announcements will originate from both centralised Digital Voice Announcements (DVA), local live announcements and centralised live announcements**



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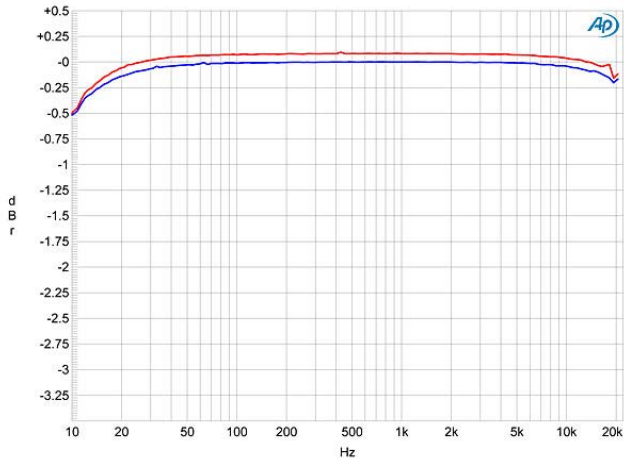
Digital PA: Audio Requirements

- **Full Bandwidth Linear Audio IP in real time**



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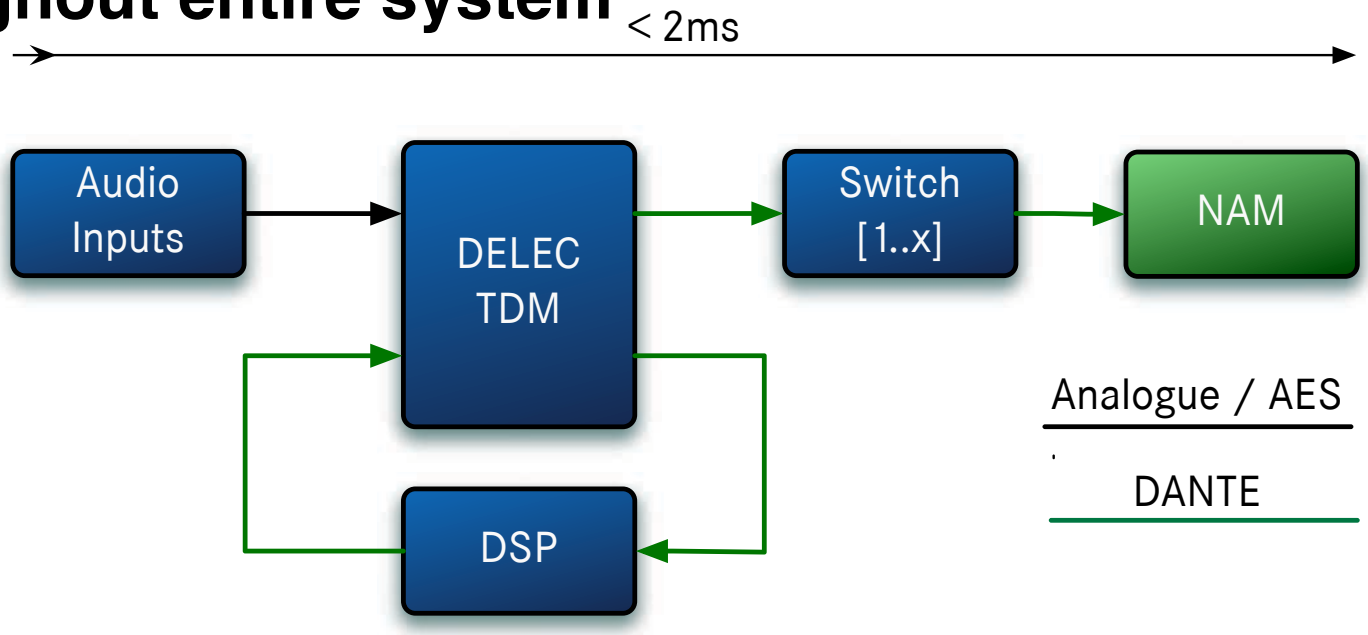
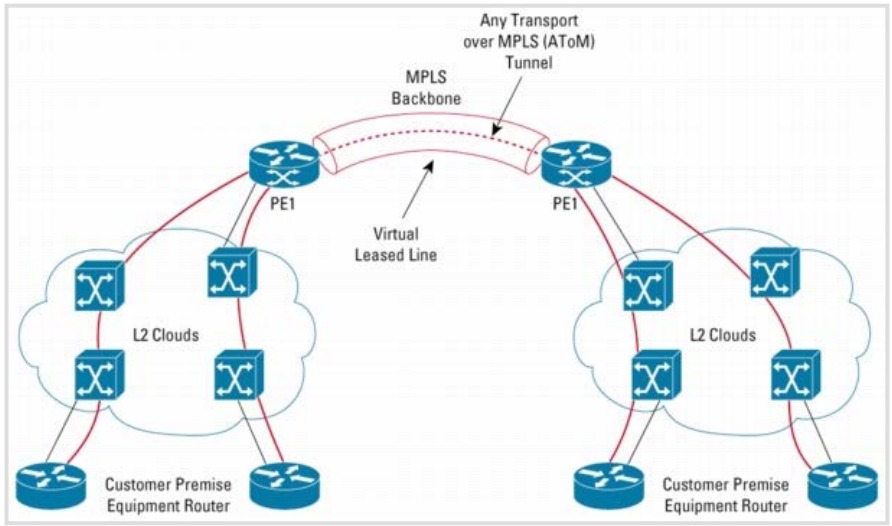
Digital PA: Audio Requirements

- **The System had to have less than 2ms delay throughout entire system**



Digital PA: Network Requirements

- **Must exist on the Sydney Trains MPLS Network called the OCDN**



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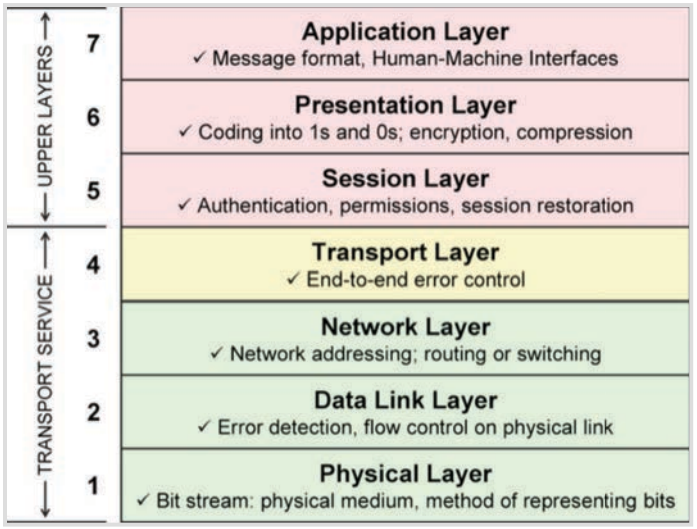
Digital PA: Network Requirements

- **Must be based on standard TCP/IP protocols**



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Digital PA: Network Requirements

- **All local stations are linked by an IP network and must be controllable and monitored from the CNMS**

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Digital PA: Network Requirements

- **Audio and control must travel over the same IP network**

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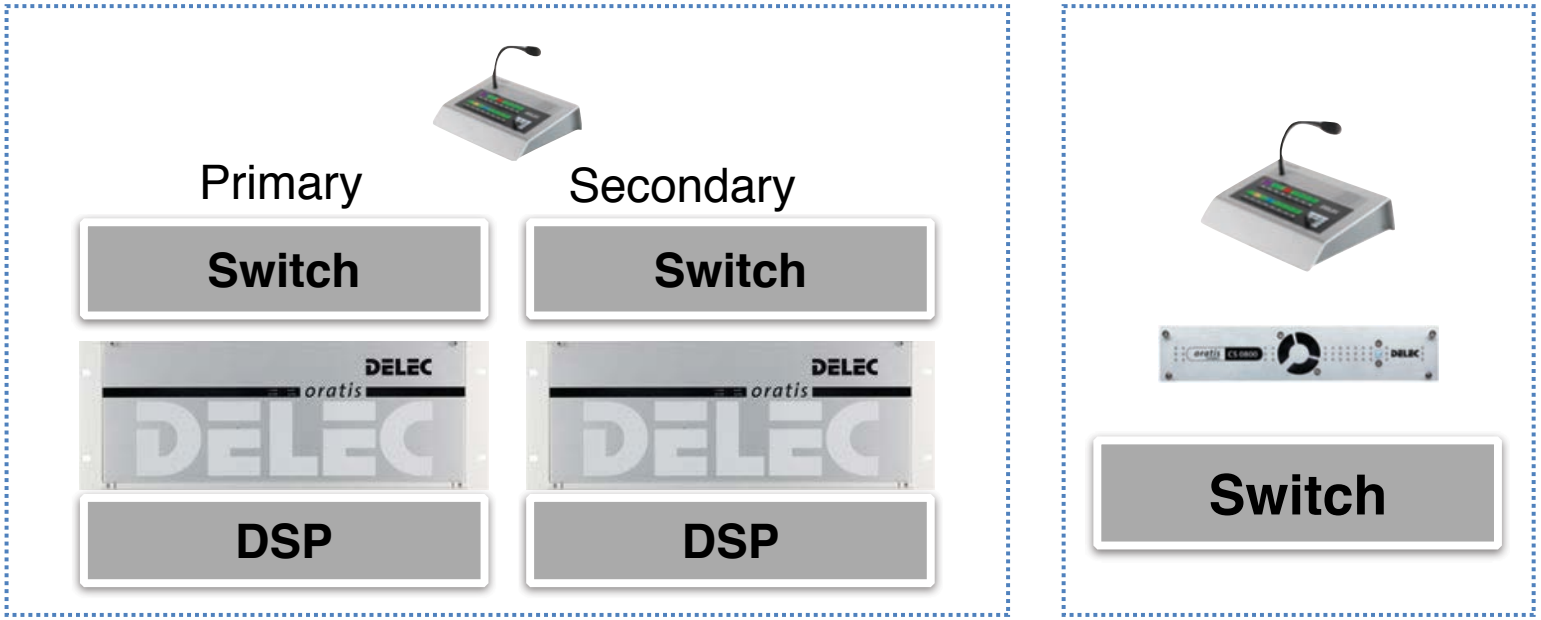
Digital PA: Design Requirements

- **The Centralisation of voice based announcements using a Node Based design to allow for minimal equipment installed on remote sites**



Node **Station**

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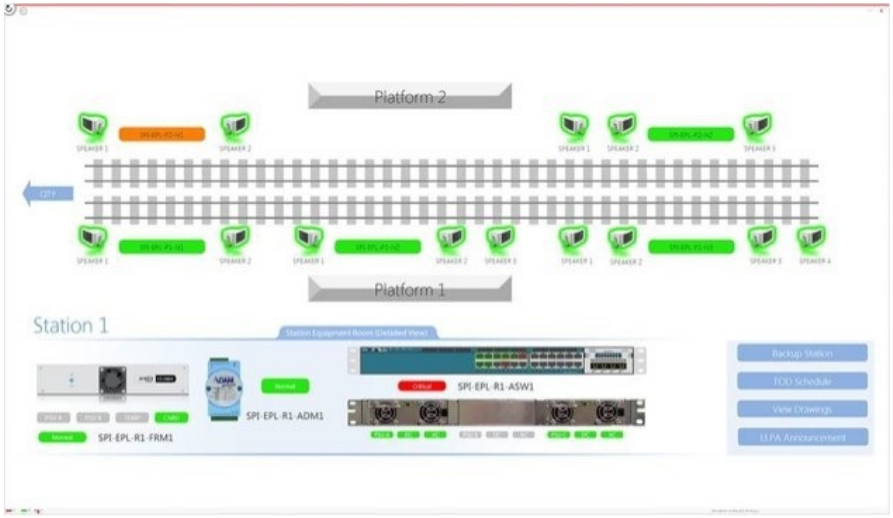
Digital PA: Design Requirements

- **Ease of Maintenance with network connectivity and monitoring on every device all the way to the speaker for Central Network Management System (CNMS) integration**



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Digital PA: Design Requirements

- **CNMS must have compete control of all systems, programming, monitoring, audio routing, operation and monitoring.**

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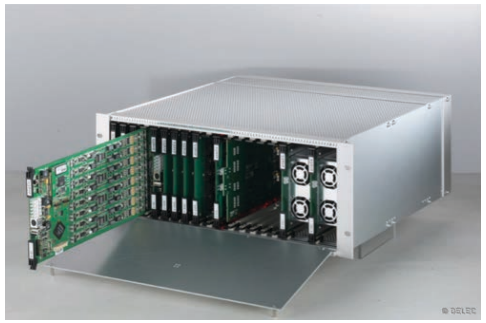
Digital PA: Design Requirements

- **A hardware based design is preferred**



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Digital PA: Design Requirements

- **Scalable to 400+ sites**

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Digital PA: Design Requirements

- **Interoperable with different products with the same standards**

BIAMP SYSTEMS

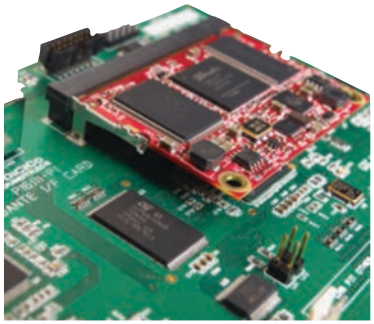
Symetrix

Intracom

SHURE

Digital PA: Chosen Components

- **Dante Audio over IP**



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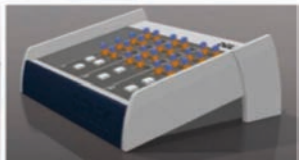
Digital PA: Chosen Components

- **Delec digital PA Hardware Including:**
  - MF4 TDM Based Fully Summing Communications Router
  - CS Compact TDM Based Communications router
  - NAM Network amplifier module
  - Delec Paging and Intercom Panels



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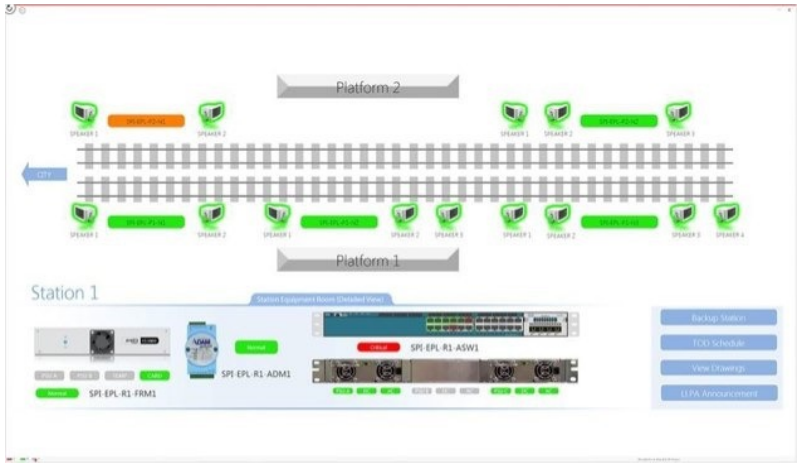
Digital PA: Chosen Components

- **Dataminer CNMS**



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Digital PA: Chosen Components

- **Cisco and Microsoft**

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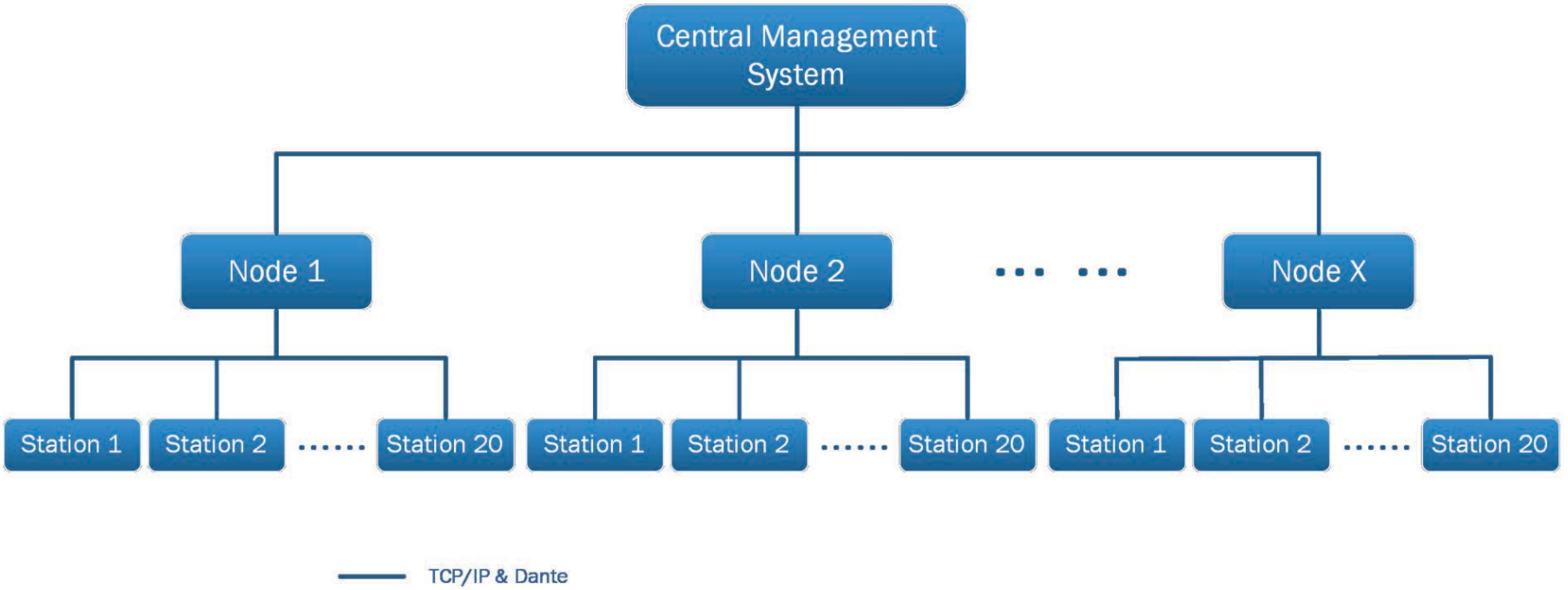
Digital PA: System Concept



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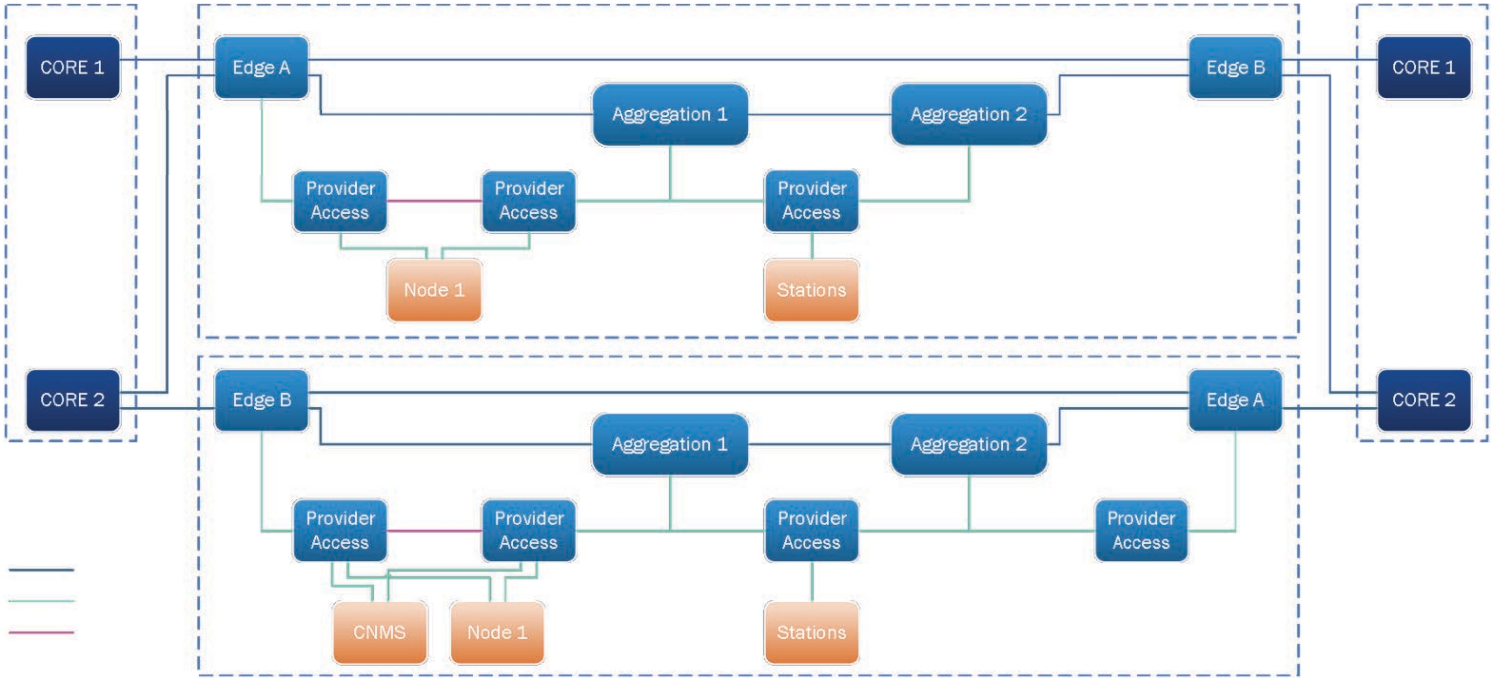
Digital PA: System Concept



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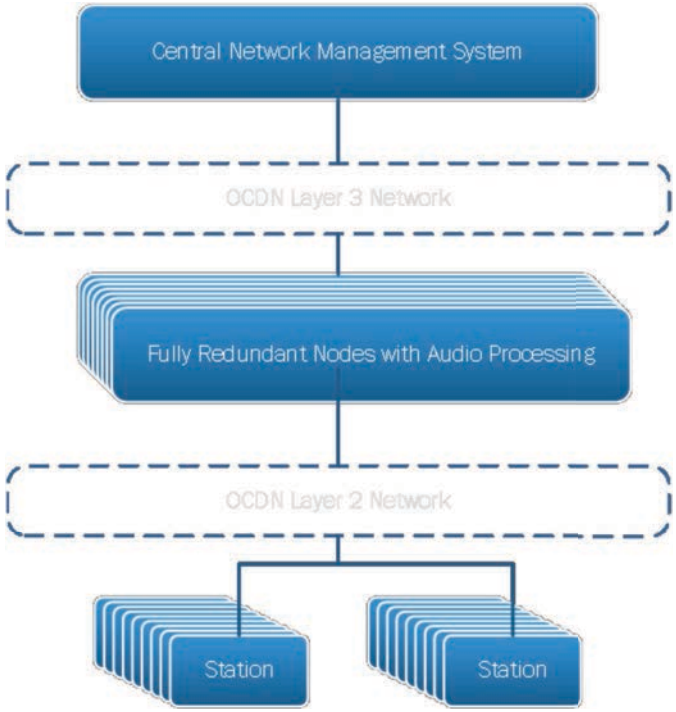
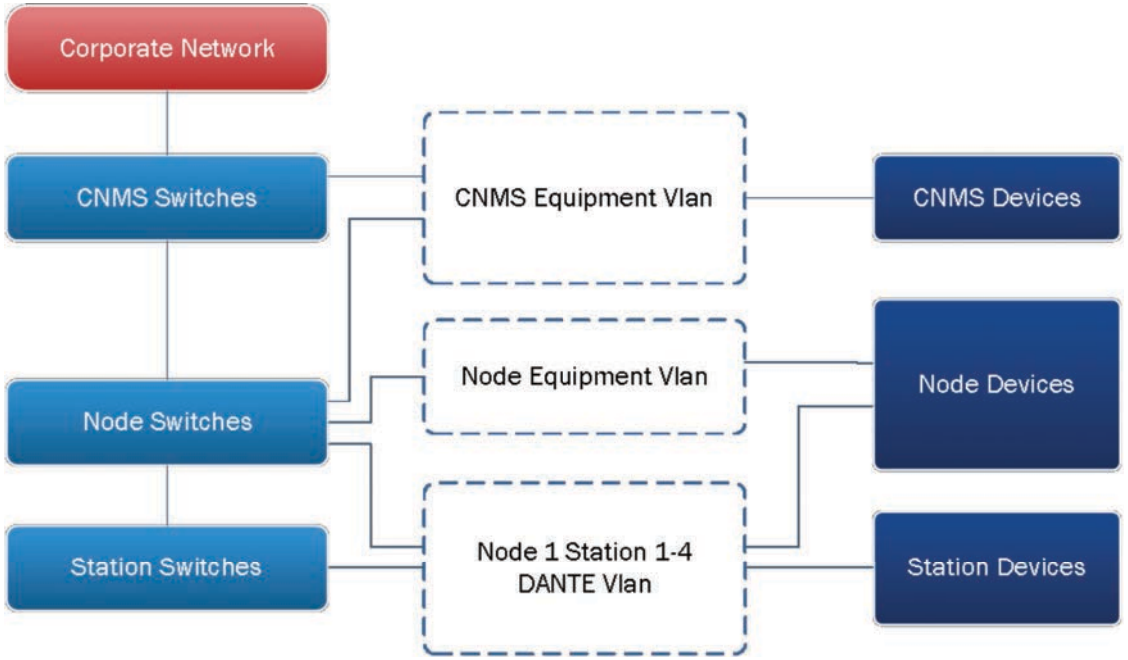
Digital PA: System Concept

- OCDN Integration Concept



Digital PA: System Concept

- Network Design



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Digital PA: Audio Protocol

- **Dante**
  - Very easy to implement on layer 2 networks
  - Routable over layer 3 networks
  - Lossless / Full bandwidth Audio
  - Low latency and Clocked
  - Conforms to IP standards
  - Does not require dedicated switching hardware
  - Dante Virtual Sound card (DVS)
  - Large range of 3rd party products available
  - Global Support and Engineering Teams

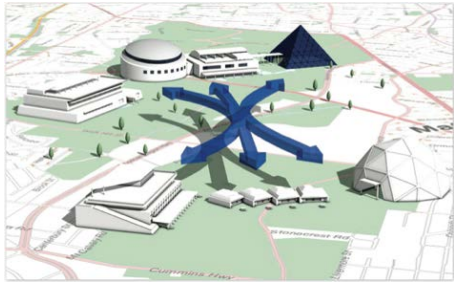
Digital PA: System Concept

- **Dante for Layer 2 Segments in the OCDN and the layer 2 at the Stations**
- **Using Dante within a Layer 2 network is easy even over a WAN**
  - DHCP
  - DNS (for management)
  - QOS already available out of the box
  - Dante Controller
  - Dante Virtual Sound card (DVS)

Digital PA: System Concept

- **Dante for Layer 3 Segments with Netspander**
- **Even with TDM Based Audio Routers we had the requirement to route Dante Via Layer 3 Networks because of OCDN Design**

Dante NETSPANDER™



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Digital PA: System Concept

- **Solution is Netspander along with**
  - Dynamic DNS Updates
  - In order to manage the routed network, the Dataminer CNMS provides clock and layer 3 dante configuration as well as monitoring

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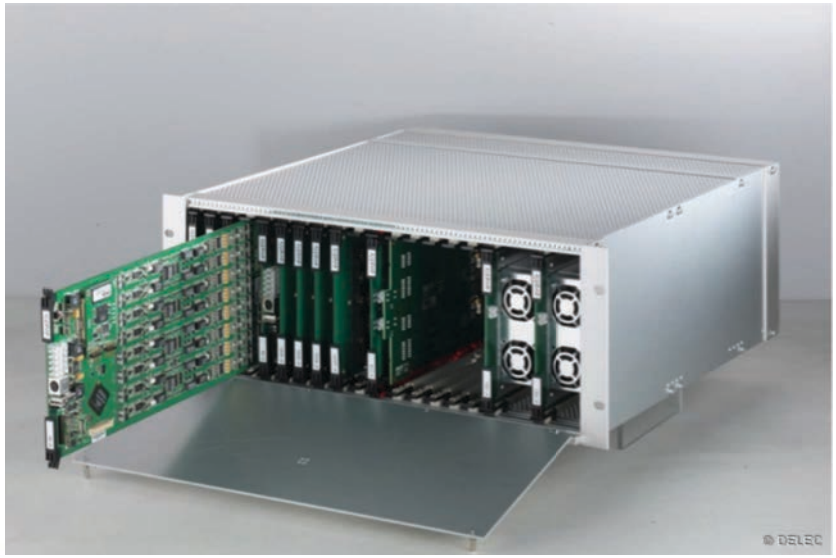
Digital PA: System Concept

- **The Station**
  - Depending on the size of the station, different DELEC engines are deployed



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Digital PA: System Concept

- **THE NAM: Dante Enabled Network Amplifier Module**
  - Can receive either Unicast or Multi-Cast Streams
  - Processes audio locally minimising switched bandwidth.

Indoor NAM

Outdoor NAM

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Digital PA: System Concept

- **Built In:**
  - Precision Delay for time alignment
  - 1000 point FIR Filter per individual channel for STI and speaker processing
  - Audio DSP Possible (EQ DYN etc)
  - Speaker health monitoring (individual channels)

Digital PA: System Concept

- **Additional Features:**
  - Dante enabled with inter-vendor support
  - FULL API available including backup of all parameters
  - Optional IP66 Enclosure for harsh environments
  - 4 x 12 watts or 2 x 24 watts
  - Microphone PreAmp for ANS microphone input

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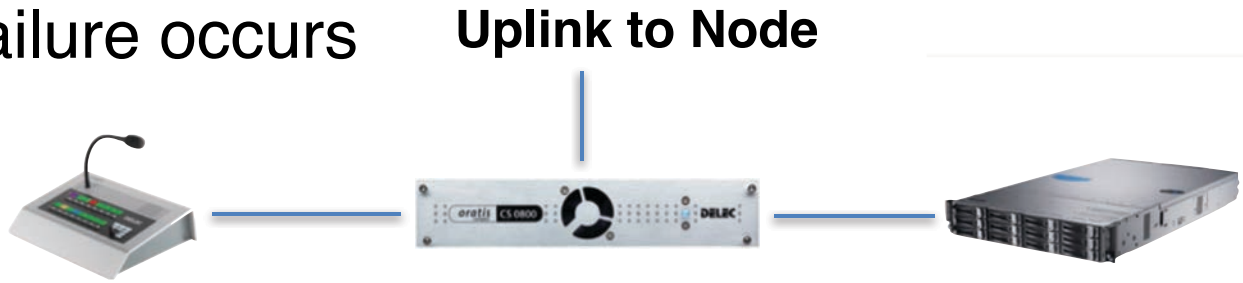
Digital PA: System Concept

- **The Station Engines are used for:**
  - Local DVA insertion, Live Announcements
  - Dante and inter-vendor support including wireless microphone systems etc.
  - Node uplink; local station continues to operate if a network failure occurs



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Digital PA: System Concept

- **Purposely developed cardioid speakers assist in harsh acoustic environments**

Cardioid Speaker

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Digital PA: System Concept

- **The Node:**
  - Uses the Modular DELEC Engine
  - Built in hardware logic for prioritisation
  - Centralised DVA insertion, advertising and background music
  - Audio DSP (Realtime ANS, EQ DYN etc)
  - Dante and inter-vendor support
  - VCOM and Mobile Applications
  - CNMS UPLINK

Digital PA: System Concept

- **VCOM and Mobile Applications**

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Digital PA: System Concept

- **CNMS**
  - 256 channel fully summing audio engine with DANTE
  - Ability to monitor entire system (ANS, Speakers, ALL DEVICES)
  - Ability to backup all devices
  - Web Based CNMS - only servers in entire network

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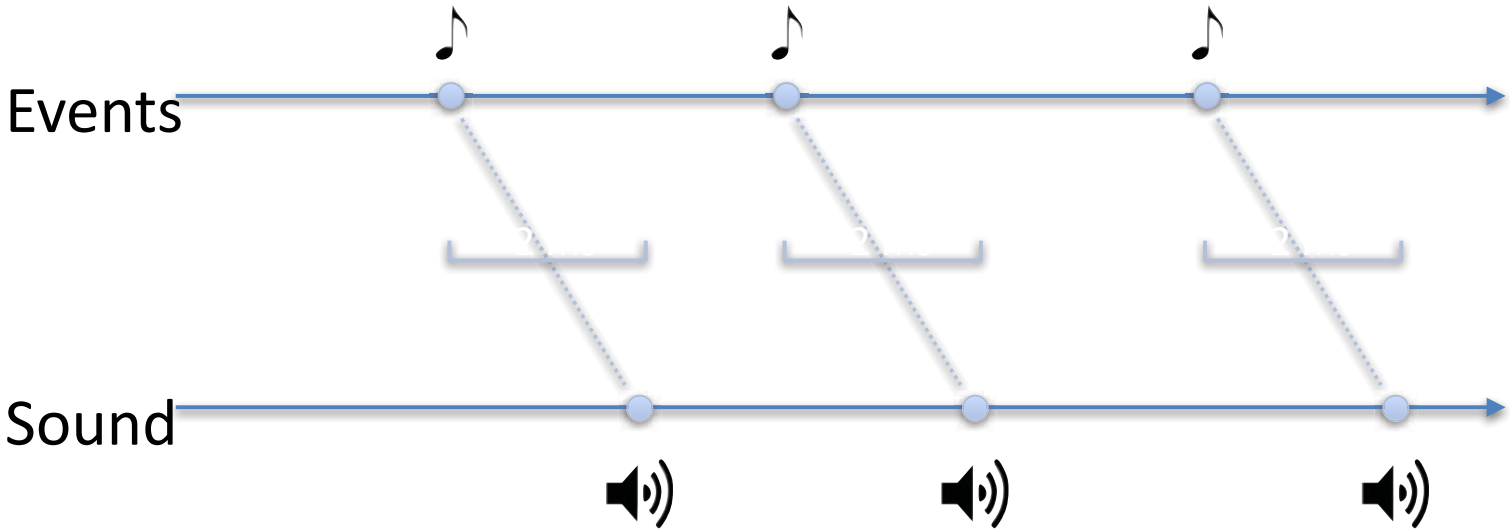
Digital PA: Network considerations

- **Latency**



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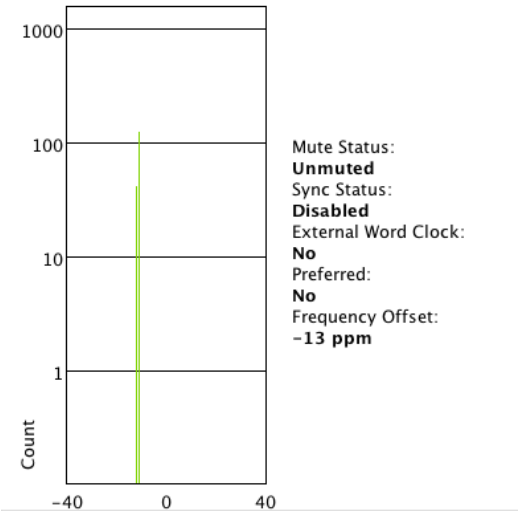
Digital PA: Network considerations

- **Jitter (especially for the health of clock)**



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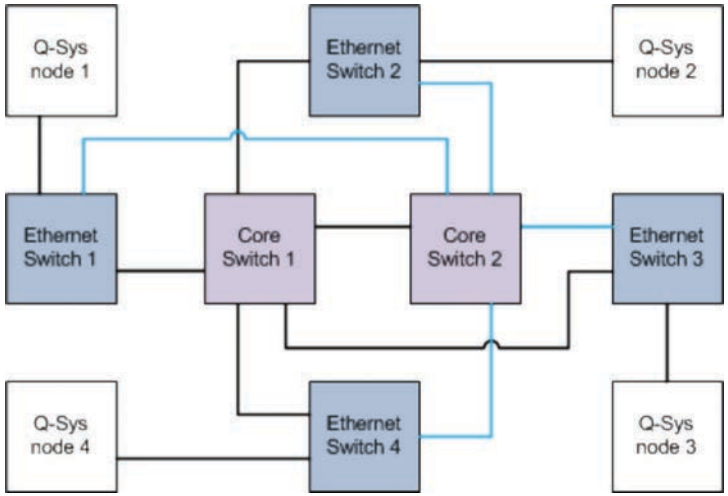
Digital PA: Network considerations

- **Number of Switch hops**



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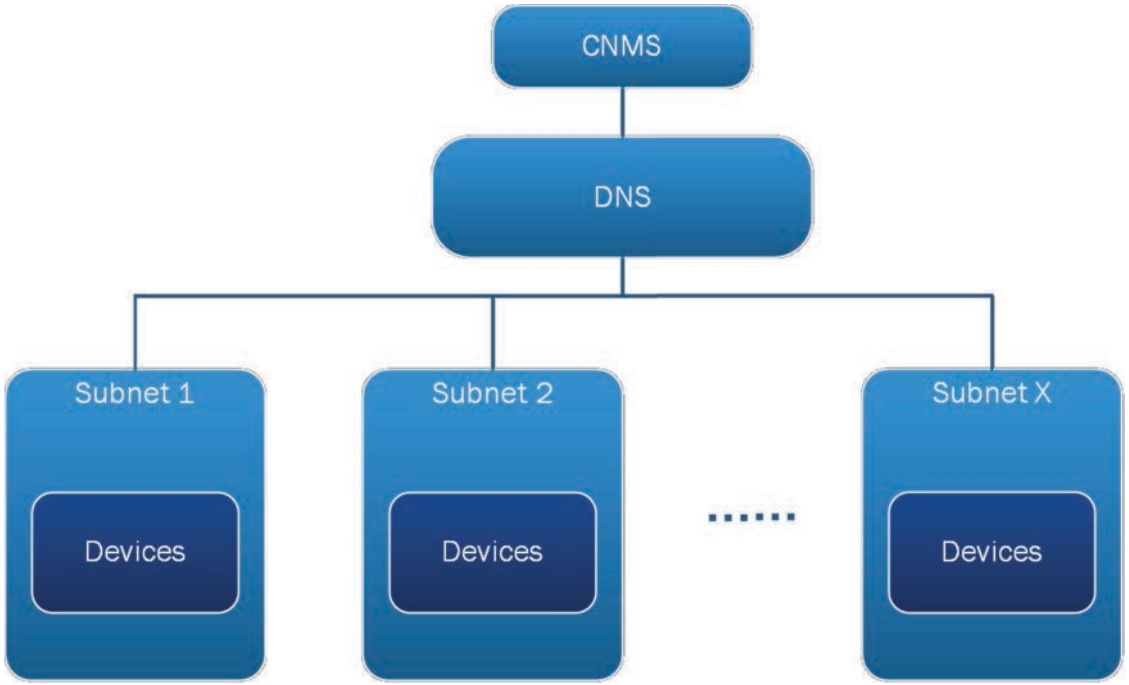
Digital PA: Network considerations

- **Scaleable (DNS is a major factor)**



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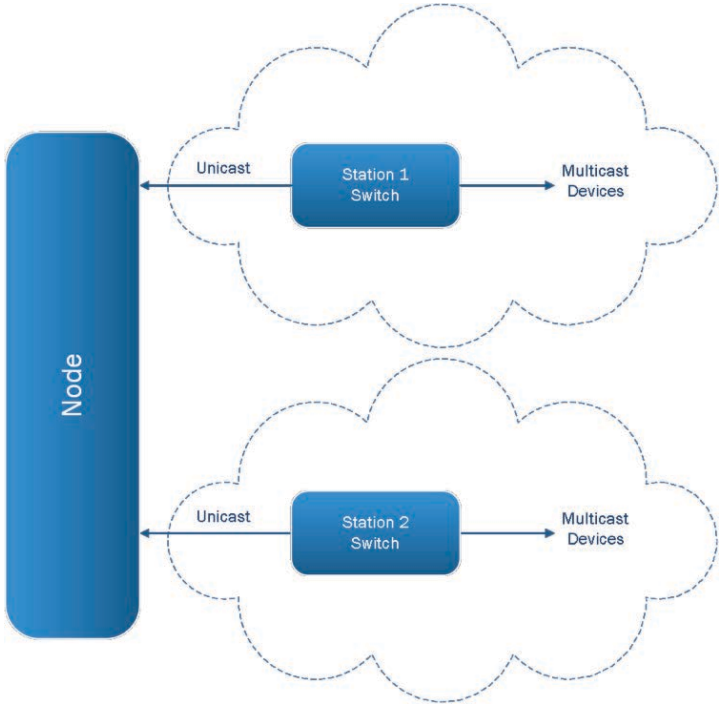
Digital PA: Network considerations

- **Multicast Boundaries and IGMP**



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Using right products in right place

- **DANTE**
  - Allows seamless integration to a huge amount of products
  - DVS and software nearly unlimited
  - Routable over IP Networks
  - Redundancy

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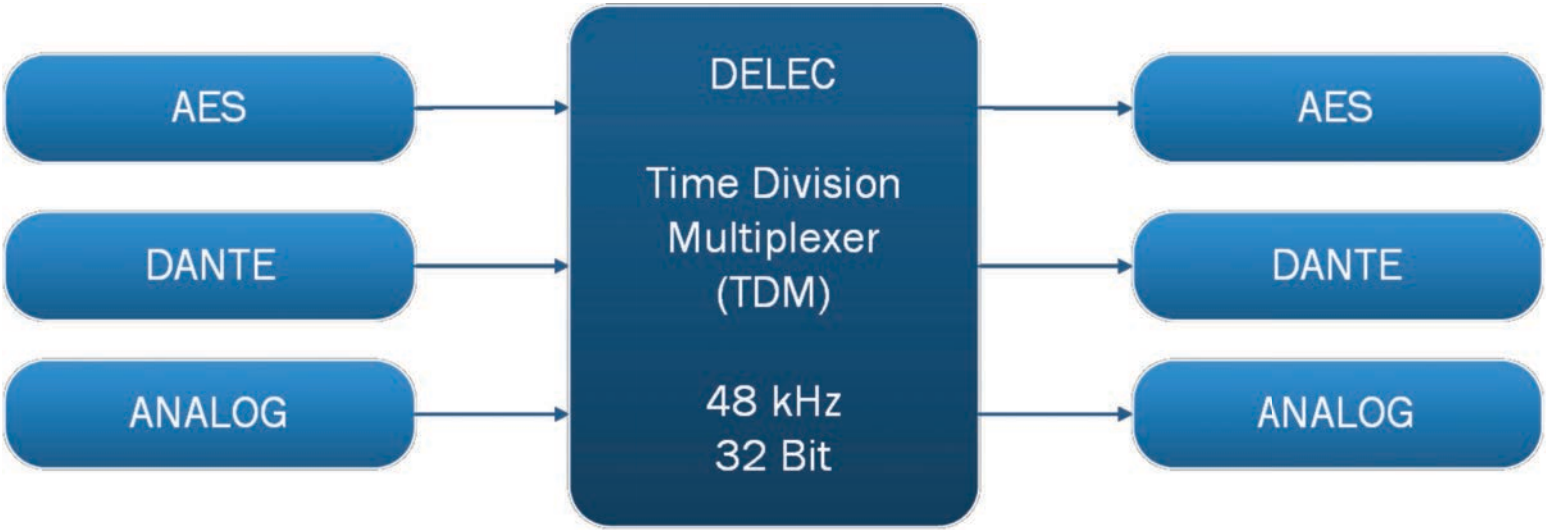
Using right products in right place

- **TDM Audio Routing with FPGA based Processing for scalability (DANTE simply transport medium).**



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Using right products in right place

- **Network Amplifier Module with distributed DSP allows for large scale implementations and unlimited zoning.**

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Using right products in right place

- **Web CNMS for centralised management**

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Result

- **Hugely scalable system**
- **Minimal Limitations of Product Integration especially for both hardware and software (DVS)**
- **Seamlessly integrates to existing IP infrastructures**

Result

- **Allow for sites from 4 speakers to 1000's of speakers**
- **Everything is monitored, backed up and managed centrally**
- **Minimal and proactive maintenance**
- **Completely future proof and upgradeable**
- **Predictable High STI (0.6 with train, 0.75 without train)**

Questions

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