IP
Networking
Guide

Contents

1. Networking Overview and Switch Requirements

As intercom or communications systems move to Audio-over-IP networks, standardized protocols like SMPTE ST2110 and AES67 are being used for connectivity between various devices on the network such as the IP connection between a FreeSpeak Edge® (FSE) Base Station and IP Transceivers or an Arcadia™ Central Stations and IP Transceivers. The setup of the IP network has a very large impact on the success of any project due to the fact that the IP network infrastructure is more reliant on correctly configured network switches.

Both FreeSpeak II® (FSII) IP transcievers and FSE transceivers (networked IPTs) depend on PTP clocking to allow beltpacks to seamlessly roam through an RF zone. In order to keep transceivers synchronized, the network switch used in the deployment must meet specific standards.

Switch Requirements:

- 1Gb (or more) bandwidth for every port
- Layer III - Perform at or near wire speed and have IP routing intelligence built in
- Switching capacity equal to 2x number of ports (Tx/Rx). For a 10-port switch, it should have a switching capacity of 20 Gb/s
- EEE (Energy Efficient Ethernet) or Green Ethernet must be disabled
- QoS - Quality of Service prioritization of audio traffic
- Fiber to Copper conversion preferable using the SFP/mini-GBIC form factor
- IGMP snooping must be properly configured

See Sections 4 and 5 of the Clear-Com AoIP Network Recommendations for additional information on network switches.

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2. About Clear-Com IP Transceivers

Clear-Com IP transceivers have higher than average timing accuracy requirements due to the need to synchronize the devices in a radio frequency (RF) space.

The following table shows guidelines, rather than rules, as tolerances will vary depending on the use of external PTP Leader Clocks and where transceivers are located in the network relative to the leader clock.

Your network setup and topology must meet these timing requirements for networked IPTs to work correctly and to ensure smooth reaming between IPT transceivers.

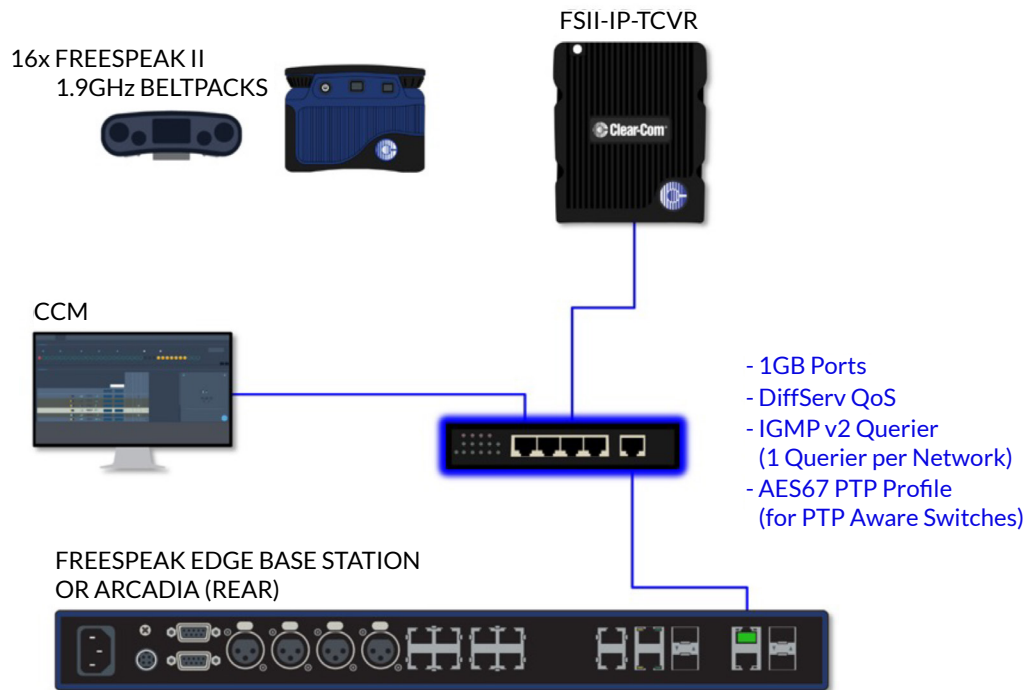| PTP Parameters	Value (range)	Performance
Offset from the Leader Clock (OFM)	± 100 ns	Excellent
	± 500 ns	Potential for roaming issues
	± 1,000 ns	Issues with roaming likely
	>± 1,000 ns	Cannot roam between transceivers and intermittent loss-of-lock issues
Packet Travel Time* + OFM	Packet time@ 125 µs > 2 ms	No audio
	Packet time@ 1 ms > 20 ms	

See Section 3 of the Clear-Com AoIP Network Recommendations for additional information on PTP Parameters.

3. Common Network Layouts

Below are some basic scenarios showing how an Arcadia Central Station or FreeSpeak Edge Base Station can be deployed with an IP network.
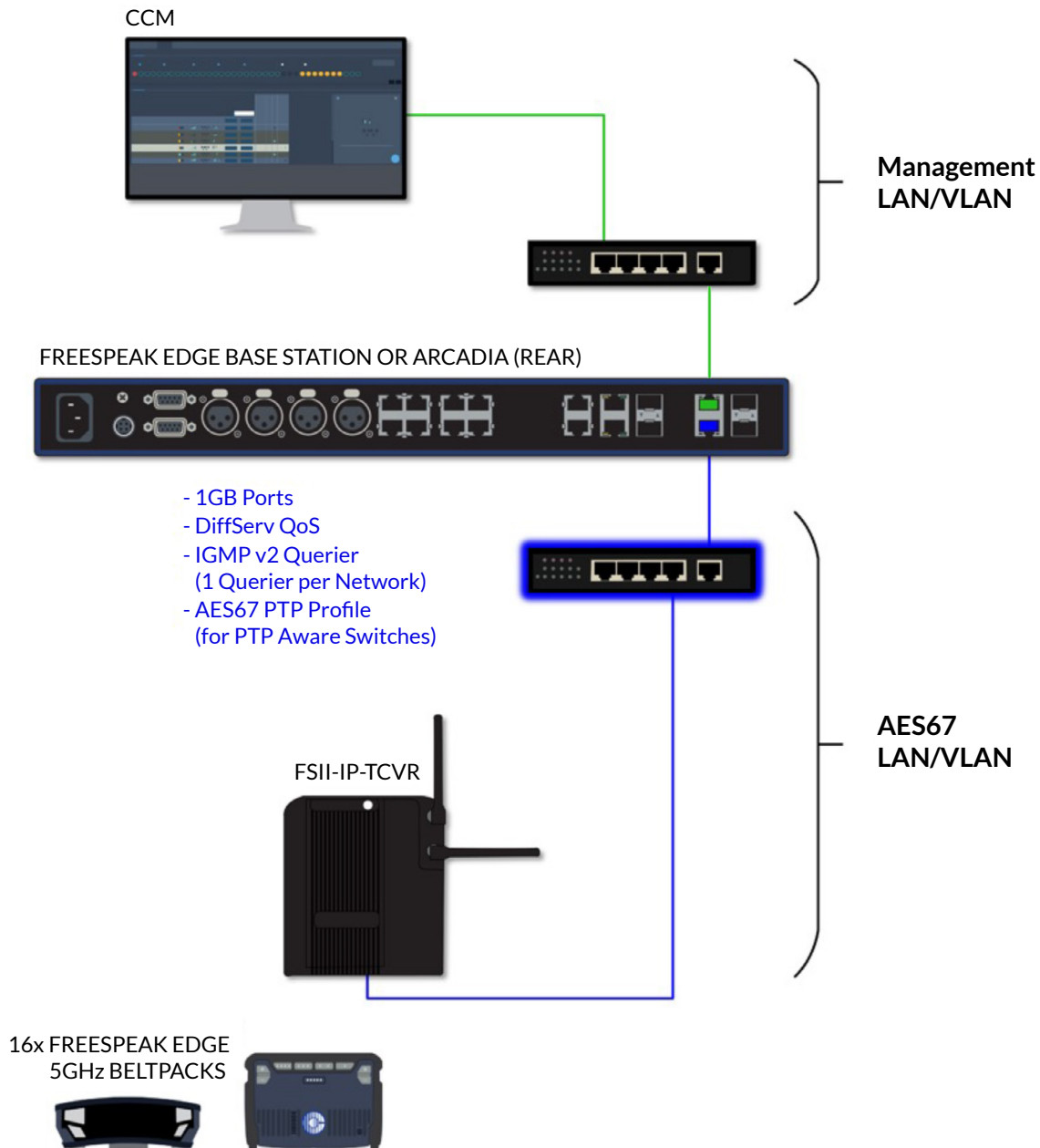
3a. Default IP Set Up

Default IP port set up designed for a dedicated switch used solely for Clear-Com transceivers with both management and AES67 network audio coexisting on the same network switch. Static or link local IP addresses can be used in this layout. This deployment is not recommended for a system that requires other AES67 traffic on the switch.

FSII-IP-TCVR

16x FREESPEAK II
1.9GHz BELTPACKS

CCM

- 1GB Ports
- DiffServ QoS
- IGMP v2 Querier
  (1 Querier per Network)
- AES67 PTP Profile
  (for PTP Aware Switches)

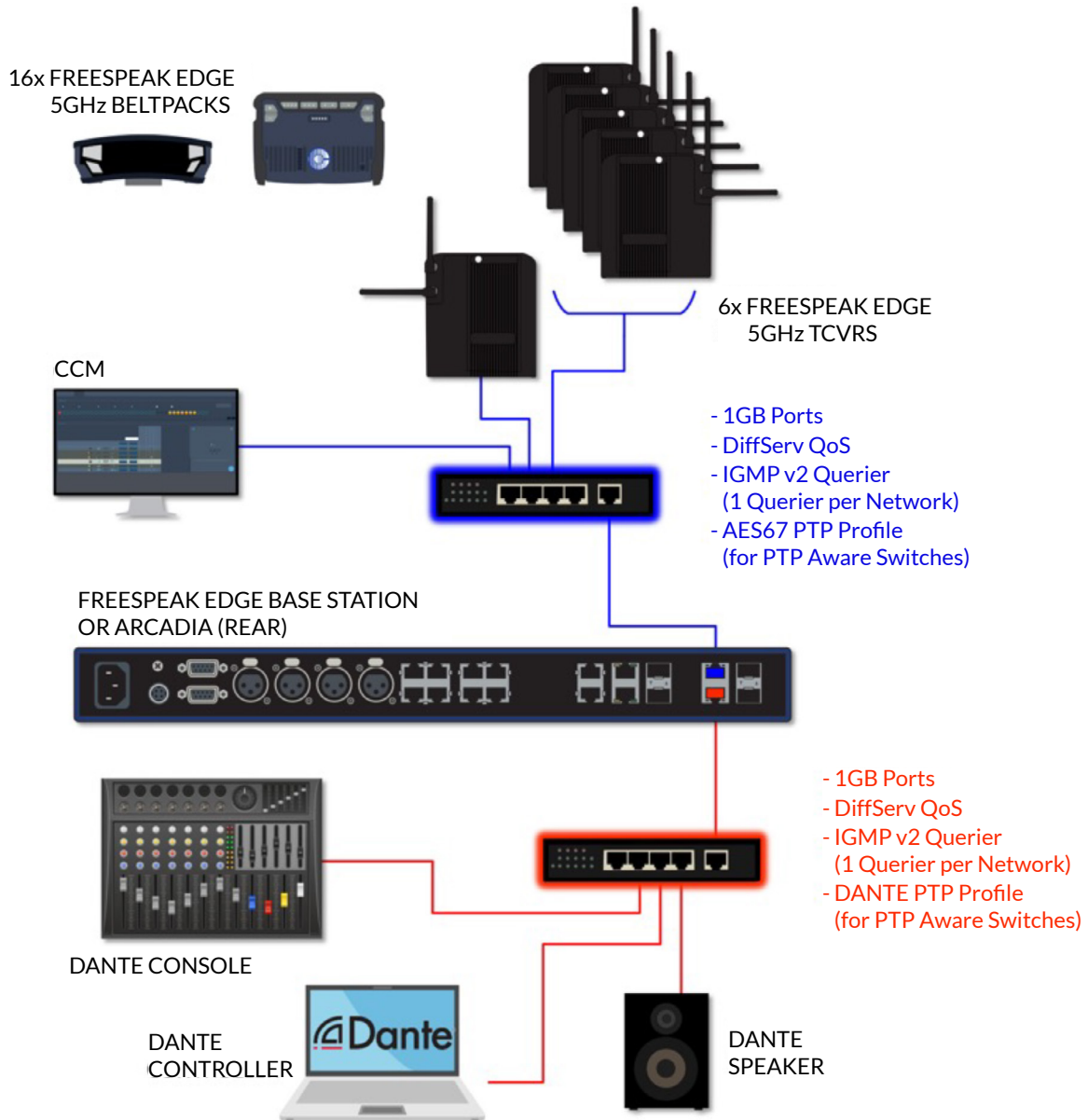FREESPEAK EDGE BASE STATION
OR ARCADIA (REAR)

3b. Separating Management and AES67 IP Traffic

In a more advanced network set up, additional devices can be supported on both the management network and the AES67 network. The network designated for management can be deployed on an existing LAN or VLAN without the need for GB speeds. Adding Clear-Com devices to an existing AES67 network requires the LAN or VLAN to follow the recommended switch settings noted above. Please note the deployment does not include Dante.

CCM

Management LAN/VLAN

FREESPEAK EDGE BASE STATION OR ARCADIA (REAR)

- 1GB Ports
- DiffServ QoS
- IGMP v2 Querier
  (1 Querier per Network)
- AES67 PTP Profile
  (for PTP Aware Switches)

AES67 LAN/VLAN

FSII-IP-TCVR

16x FREESPEAK EDGE
5GHz BELTPACKS

3c. Networked IPTs and Dante Networks

Dante and AES67 use different versions of PTP for timing – Dante utilizes PTPv1 and AES67 uses PTPv2 to synchronize the network. Because of this timing difference, we do not recommend running both standards on the same network as the timing difference will cause audio issues.

16x FREESPEAK EDGE 5GHz BELTPACKS

6x FREESPEAK EDGE 5GHz TCVRS

CCM

- 1GB Ports
- DiffServ QoS
- IGMP v2 Querier
  (1 Querier per Network)
- AES67 PTP Profile
  (for PTP Aware Switches)

FREESPEAK EDGE BASE STATION
OR ARCADIA (REAR)

- 1GB Ports
- DiffServ QoS
- IGMP v2 Querier
  (1 Querier per Network)
- DANTE PTP Profile
  (for PTP Aware Switches)

DANTE CONSOLE

DANTE CONTROLLER

DANTE SPEAKER

3d. AES67 and Dante via a Single Switch with VLAN Separation

In some situations, you may need to deploy the FreeSpeak Edge Base Station or Arcadia Central Station with a single switch for both Dante and AES67 standards. As explained, Dante and AES67 use different versions of PTP and therefore a VLAN on the switch will be required.
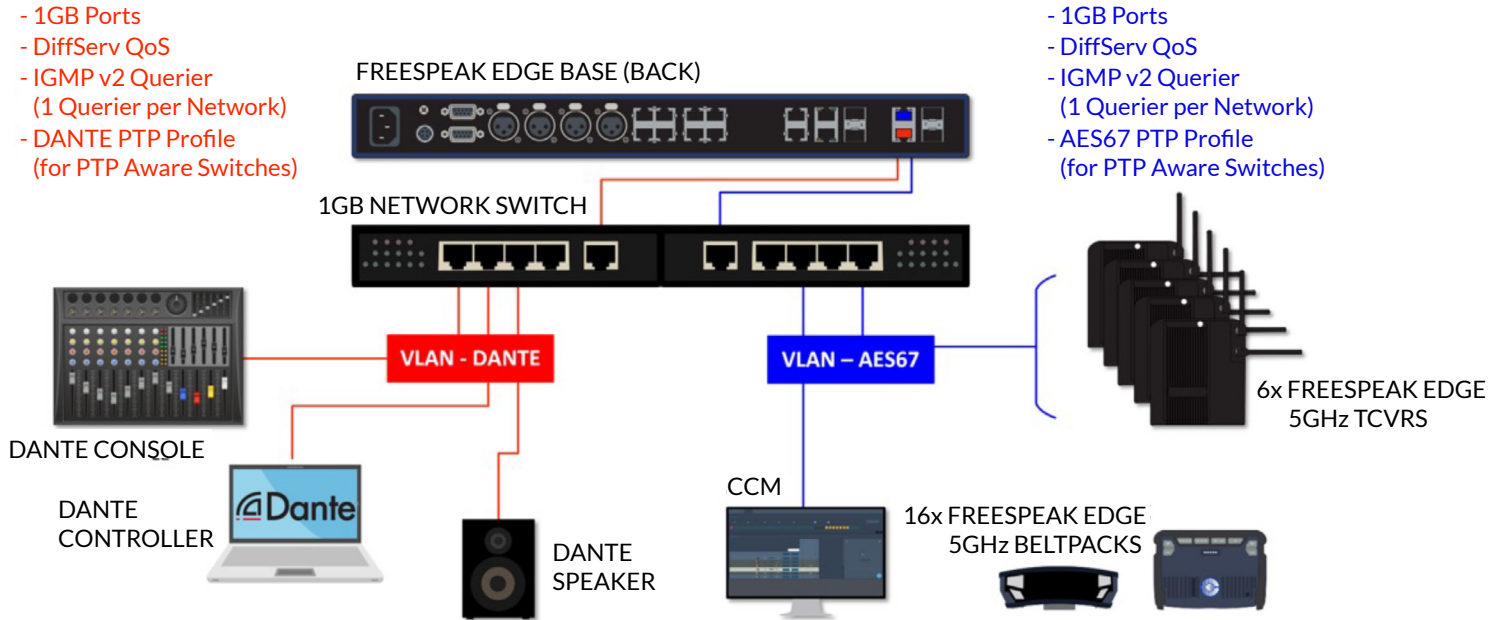
VLAN design and set-up can be very complex. We strongly recommend consulting with a competent IP network engineer in all scenarios where the switch requires specific settings to allow PTP packet forwarding to be of expedited delivery.

4. Further Information

For more detailed information please see the Clear-Com AoIP Network Recommendations document on the Clear-Com Website.