Application Note

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Q-Sys™ Networking Overview

The intention of this document is to provide network administrators an overview of the requirements needed to implement a Q-Sys Audio System on a converged network. In order to simplify this group of networking requirements for ease of communication between parties, QSC has named these requirements the "Q-LAN Protocol Suite".

Overview of Q-Sys

Q-Sys is a system that performs complex routing, processing and management of audio in a facility. The elements of a Q-Sys system:

- The Core is based on an Intel™ server processor. It runs the system and handles the signal processing functions.
- I/O Frames are connected to the Core via the network and provide a means for audio signals to be brought into the Core from analog and digital sources as well as sending the processed audio to power amplifiers, powered loudspeakers or other audio devices. The I/O Frames are fitted with cards appropriate to the types of inputs and outputs they will receive or send.
- Peripheral devices including Page Stations and Touch Screen Controllers may also be used in a system.
- Q-Sys Designer software is used by the system designer to create signal flows, processing and control screens for a system.

Layer-3 Networking

All Q-Sys network protocols are Internet Protocol (IP) based and support advanced networks beyond the simple Layer-2 LAN. Because Q-Sys is a live system, real-time performance is required on either the LAN or the Layer-3 environments. On a Layer-3 network, routers replace some, or all, of the network switches. Therefore, routers need to have the same performance and feature requirements as the switches they replace.

Q-LAN Protocol Suite

Sampling Clock

- IEEE 1588 Precision Time Protocol (PTP) used for synchronisation
- UDP on Ports 319 and 320
- ≤100 packets per second
- ≤100 bytes per packet
- 224.0.1.129 ~ 224.0.1.132 – registered to IEEE
- Address used depends on clock configuration selected in the Designer software

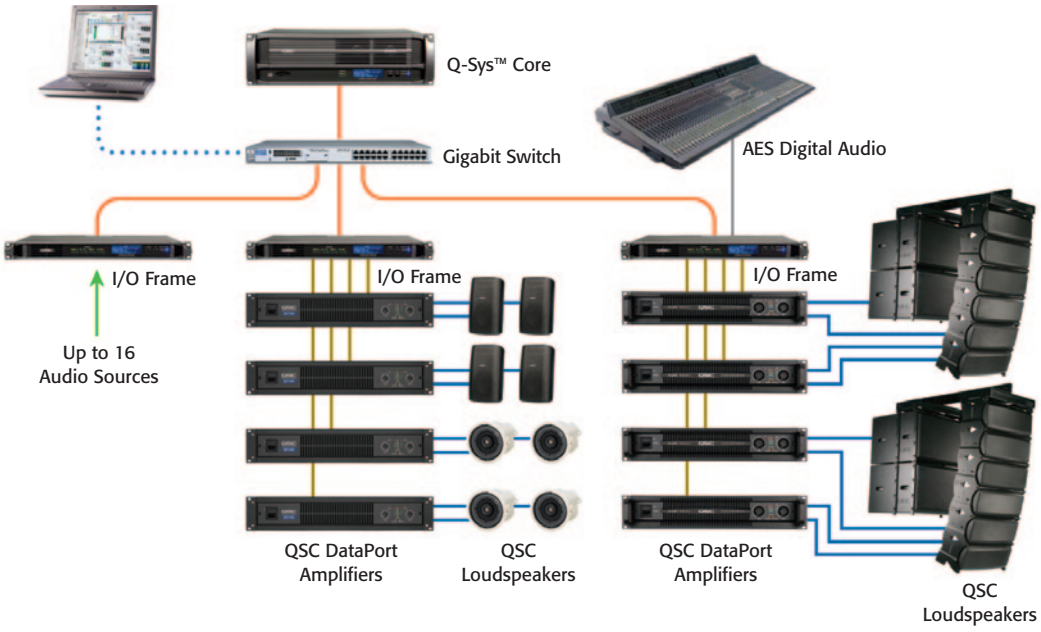


Figure A1

Audio Streams

- UDP on Ports 6511 through 6766 as needed
- Each packet contains 16 samples of up to 16 channels
- 3000 packets per second per stream
- 100 to 1100 bytes per packet or 1.65 ~ 3.31 Mbps per stream – packet size depends on channel count
- Audio sampling is 32 bit floating point format
- Up to 128 streams in and out of each Q-Sys Core
- 1 Stream in and/or out for each I/O Frame or Page Station
- 100 acknowledgements are sent every second and contain receiver-side stats

Control

- TCP and HTTP for Control Data and Core redundancy
- 1 Mbps or less – dependant on connections to User Control Interfaces (UCI's) or AMX and Crestron

QoS

- Ensures timely delivery of packets
- Employs DiffServ or Differentiated Services Code Point (DSCP)
- DSCP 63 normally reserved for Network Admin
  - DSPC 46 EF (Expedited Forwarding) for PTP
  - DSPC 34 AF (Assured Forwarding) for Audio data
  - DSPC 0 for control data
- Minimum of 4 egress queues per switch port with Strict Priority Queuing – other selection schemes (e.g. round robin, shaped round robin, fair queuing, guaranteed minimum bandwidth) are not recommended
- Each Q-Sys switch port must have 40kB of egress queue memory available
- Note: Don't enable bandwidth throttling on ports connected to the Cores

QDP and Multicast Routing

- For Q-Sys to work across a Layer-3 network, you will need to configure the network to route the multicast addresses used by the PTP Clock and Discovery protocols. Q-Sys devices implement the Internet Group Management Protocol (IGMP). IGMP allows Q-Sys devices to register to receive specific multicast addresses.
- QDP – Device Discovery – 224.0.23.175 – registered to QSC
- – Used to find Q-Sys products on the network by name regardless of IP address
- IEEE 1588 – 224.0.1.129 ~ 224.0.1.132 – Registered to IEEE

Latency

- Time on Wire @ 1 GB ≤ 12 micro seconds
- Time on Switch @ 1 GB ≤ 10 micro seconds
- Allowed Time on Network = 243 micro seconds
- Option to increased buffer size for larger networks via Designer software

Switch Requirements

- Must be a managed, non-blocking Gigabit switch with bandwidth meeting or exceeding "wire speed" bridging
- Must support DiffServ QoS
- Packet forwarding delay of less than 10 micro seconds
- No Jumbo frames on any Q-LAN paths

Bandwidth Usage

- Bandwidth equation: Mb = (1.77 x total stream count) + (1.54 x total channel count)
- Dual network redundant configurations will produce the same bandwidth on both ports

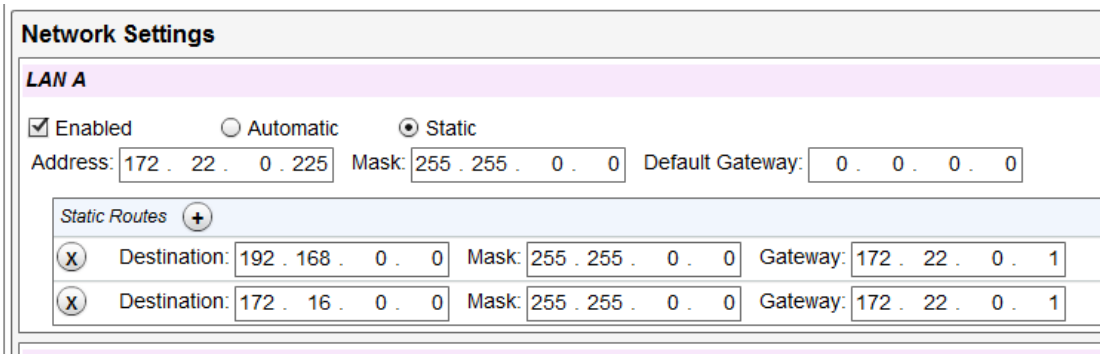
- Core bandwidth calculations are available on the "Check Design..." screen in the Designer software
- Core to Core redundant housekeeping data can be up to 6 Mbps when a Q-Sys System is being polled by AMX or Crestron

IP Address

- Three methods are use to assign IP's: Manual, DHCP, or IPv4LL (Auto-IP) – QSC recommends using Manual IP's

End Point Device Routing

This allows a device on one subnet to communicate with a device on separate subnet. There are two methods used to accomplish this task – a static route or the default gateway. A static route defines a specific destination/mask pair. The default gateway is a "catchall" for everything which doesn't match a static route. Here's an example of a static routing configuration using the "Q-Sys Configurator..." screen in the Designer software:



To see if Discovery and routing are working on the Core, enter the following URL into any web browser: http://<core-ip-address>/discovery/discovered and confirm there are files called "device.ioframe.<ioframe-name>" for each I/O Frame

If you have any questions or need additional assistance, please contact your local QSC representative, QSC's sales department or myself.

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