

**Logitek Electronic Systems, Inc.**  
Technical Bulletin  
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John Davis, CBNT

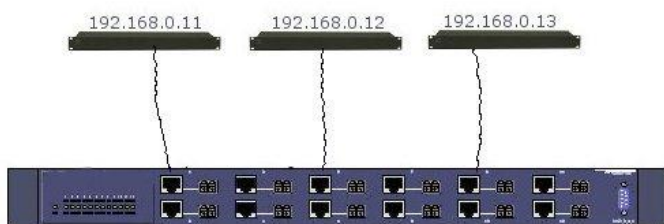
This article, originally written as an application note for logitekaudio.com, was also published in the April 2011 issue of *Radio Magazine*. The *Radio* version was named Best Technical Article by the Society of Broadcast Engineers at its national meeting in September 2011.

## Choosing a Network Switch for Audio over IP

All network switches are not created equal. While all carry Ethernet packets, there are limits to how many packets a switch can handle. Even an expensive business class gigabit Ethernet switch may not be up to snuff.

### When Multicasting Turns to Flooding

Audio over IP systems use multicast streaming technology to send audio around the facility. Multicast streaming was designed for applications like videoconferencing. In a typical office where one or two conferences may happen for an hour or two at any given time, the excess load is minimal. However, in a radio station where many streams run non-stop, it does not take long to overload the network. Here is an AoIP network with an unmanaged switch:



### ***AoIP Unmanaged Network***

Each audio device has its own private IP address, and each device is sending and receiving multiple streams of audio. Those streams are assigned Class D multicast

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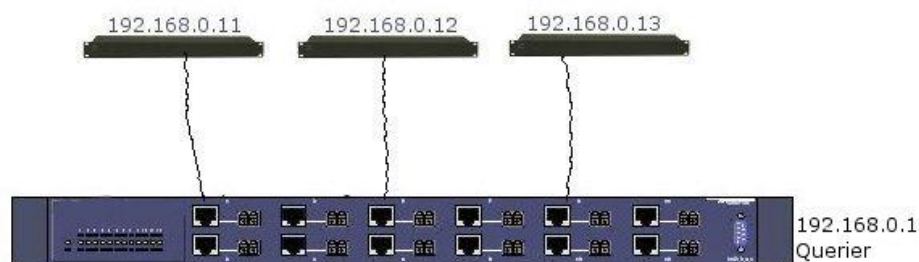
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addresses. This address range is between 224.0.0.0 to 239.255.255.255. Most of that range is reserved for WAN and Internet specific uses by the Internet Assigned Numbers Authority. However, there is a block between 239.192.0.0 – 239.251.255.255 that is reserved for organizations to use locally; this block is used by AoIP devices. Every audio stream gets its own multicast address assigned automatically by its sender, and all network switches will pass that data.

The problem is that once all of the audio devices are powered up and sending anywhere from 8 to 64 different streams out to the network the switch will dutifully pass that traffic to every port – along with the rest of the data flowing across the network – whether the other ports need all of that data or not. This is called flooding. Like in a denial of service attack, once you fill the pipe up with enough unwanted traffic, needed packets won't get through, and the end result is clicks, pops, and holes in the audio. Unless you are building a very small AoIP system, an unmanaged switch will simply not work because the streams that are transmitting but not being used at the moment will flood out the streams that are on air.



### AoIP Managed Network

The solution is a managed switch that keeps track of the multicast traffic and forwards only the streams that are being used. However, with the hundreds of management protocols available, it's entirely possible to pick "managed switches" that aren't capable of managing multicast traffic. There's one set of letters to pick out from the acronym soup: IGMP.

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## Snoop Around To Stop The Flood

Internet Group Management Protocol (IGMP) snooping restrains multicast traffic on a switched network, and was developed to manage multiple videoconferences. AoIP systems are derived from the same standards used in videoconferencing; therefore the same management system accomplishes the same thing for audio.

There are two flavors of IGMP snooping. Passive snooping listens in on the traffic and does not filter or interfere with it in any way. Active or proxy snooping will filter traffic to lessen the load. The switch keeps track of what streams appear. When a user requests that stream, it then forwards that traffic only to the ports that are listening. When that user no longer needs the stream and stops listening, the switch stops sending that data to the port.

There must be one switch on the network that serves as an IGMP querier. The querier creates the tables that keep track of the streams. Without this, snooping will not work. Some switches are capable of snooping but not serving as a querier. These are intended to communicate with a switch that has the feature. If multiple switches with queriers are installed in a facility, only one will serve as the querier, as there can be only one master list.

## The Switch Is The Heart Of The AoIP System

Pretty much any AoIP system can be hooked up as a snake back to back and pass every channel without a problem. When the system increases in scale, it's the network switch that manages the bandwidth. In many respects, the maximum number of network channels is not a function of the AoIP appliance but the network switch that ties the appliances together.

When shopping for a switch, the two most important things to find amid all of the acronyms on the spec sheet are "IGMP Snooping" and "IGMP Querier." If after reading the data sheet you're still not sure that the features are supported, find the manual for that model online and look up how to set up both features. If it's in the manual, the feature had better be there.

## How Much Will This Cost?

A capable switch for an AoIP system can range in cost anywhere from \$600 to over \$1000. Not every switch will be recommended by every AoIP manufacturer and not every switch will be the right tool for the job.

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## Start With A Plan

Map out the network infrastructure before you make a purchase. The first thing to take into account is whether or not you already have suitable Ethernet cable in the walls and/or where you have available conduit or cable trays in place to get to the studios. The second thing to take into account is that unlike a network switch that you can buy at the office supply store, a switch that is capable of handling AoIP will have to crunch a lot of numbers, generate a lot of heat, and have a small noisy fan inside to keep itself happy. Therefore, while the AoIP appliances are fanless and suitable to mount inside of a studio, the network switch is not and should be mounted in a rack somewhere else.

Most radio stations have set up their IT infrastructure with all cable runs terminating in an equipment rack locked away in engineering. This is ideal for AoIP; it's simply a matter of making room in the rack for your AoIP network switch and connecting the studio runs to the switch.

Some facilities may elect to use multiple switches due to the layout of the building or available conduit. In this event, set up the querier switch as the core of the network and have snooping capable switches on the edges talk to the querier at the core.

## What Model To Buy?

Like most computer equipment, the moment that this goes to press, any model numbers listed would be already out of date.

Generally speaking, the top end of Netgear's professional series represents the entry level in IGMP capable switches. HP's ProCurve series is the midrange tier, and Cisco represents the high end.

The support department will be able to recommend a current switch that fits the station's needs and budget.

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