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BY VICTOR PAK

Breaking Out With VLANs

A Better Approach to Audio/Video Bridging Networks

I attended my college class reunion last year (I'm not going to say which year), and when I arrived I found that we were all crammed into a big, crowded lobby. I had a heck of a time finding old friends and when I did, I had to stand really close in order to hear them. Smaller groups would crowd around and try to hold intimate conversations while some boisterous, uninhibited alumni would shout across the room for classmates they haven't seen in many years.

This was not an ideal scenario: lots of people talking and yelling made catching up in a meaningful way nearly impossible. Due to the noise level, you could barely understand what old friends were saying.

If, however, there were smaller breakout rooms where people in the same majors, departments or clubs could have gone, it would have made finding friends easier and the conversations could have been a lot better.

Let's keep this scene, and its potential solution, in mind while we discuss a similar predicament in the convergence of IP-based audio/video and home control devices with computers—cramming all of your devices onto one large network and expecting them to communicate efficiently and trouble free.

Evolution of the IP Network

A major trend in the custom integration channel has been the evolution of audio/video and home controls using the IP-based network infrastructure. The popularity and affordability of IP networking has driven the custom integrators to utilize this technology more and more. However with this development, a major problem has evolved over the past few years concerning sharing IP-based computer networks with audio/video and home control networks.

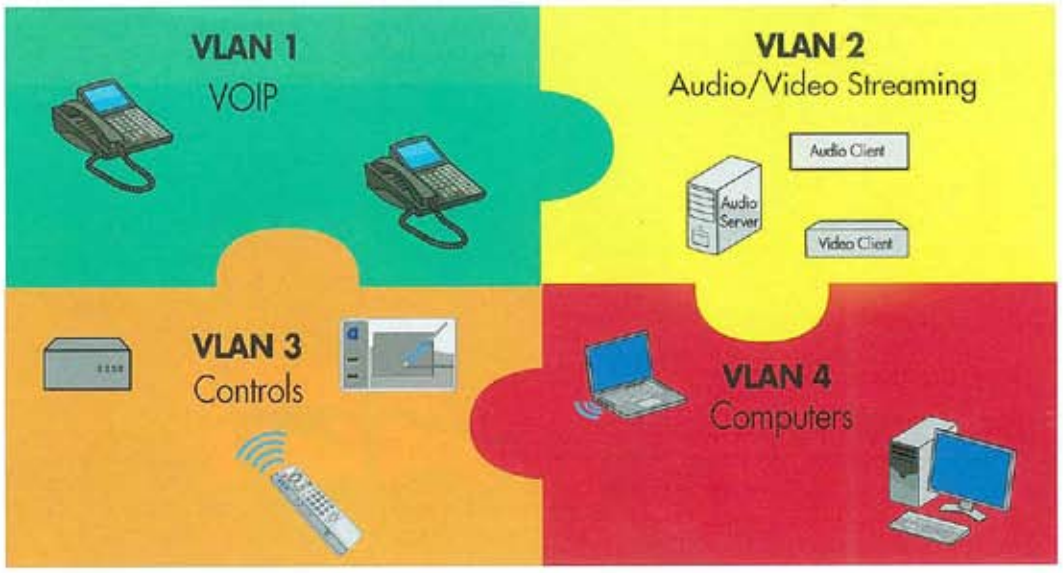
Having spent countless hours supporting dealers and installers, we've encountered a common problem that is caused by sharing the IP-based network. We have found that audio/video and home control devices send out a lot of broadcasts, which can clog bandwidth on the network, and thus affect the performance of the entire network for all devices.

In the past, with only personal computers on the network, if bandwidth is not sufficient, the computing experience was not impacted. The user's satisfaction was not changed if he or she receives a file in 30 seconds or 35 seconds. Unlike computer data networks that can tolerate a certain degree of unpredictable latency, video streaming, audio streaming and control systems cannot. The packets that carry audio and video must arrive on time and in order, and IP-based controls cannot lose critical command packets. Today's sophisticated home networks require the same robustness as an enterprise network in order to have a positive user experience.

Network Infrastructure Needs to 'Get With the Program'

As technology evolves, it seems as though infrastructure is the last to catch up. As automobiles became more prevalent and faster, for example, non-dirt roads and then multi-lane highways took decades to develop. The same is true for computers and home devices versus their infrastructure. Audio and video devices have advanced and are now on the computer network while IP-based network infrastructure gear (e.g., routers, switches and wireless access points) remains the same in features and functionality as if there are only computers on the network.

The routers and switches sold today for the ▶



residential and commercial market have the same basic "intended use" limitations as devices sold 10 years ago. The standard, by and large, still assumes that a given network will only be used for basic computing such as file sharing and Internet access. This archaic standard also assumes that there is very little broadcast packet traffic—after all, it's for the "home," right?

Eliminate Wide Broadcasts

As mentioned before, one problematic feature we've discovered is that IP-based audio/video streaming and home control devices send out numerous broadcasts to stay in sync. Let's say that all of your devices are connected in a single local area network (LAN) with a switch. Switches, a Layer 2 device, are designed to forward all broadcasts, but that's not always a good thing.

A switch in a typical home might have anywhere from 12 ports to 100+ with all the devices using the network. By default, all hosts connected to that switch are going to be in the same broadcast domain. Remember, everything is connected in a single LAN.

Now, let's say you have 100 ports on your network. If one host connected to that switch sends a broadcast, then, by default, all of the other 99 hosts are going to receive that broadcast. These unnecessary broadcasts will soak up your network's available bandwidth. But it gets worse. For some network services and protocols that are used today, a broadcast received by a host results in that receiving host transmitting a broadcast of its own. When all of the hosts receive that second broadcast, they respond by transmitting still more broadcasts. In moments, these broadcasts have swelled into a broadcast storm. A broadcast storm can take up a major part of a network's bandwidth and make normal network operations almost impossible. And you are trying to stream video over this network? Just wait until you start streaming 1080p or even higher resolution video.

Virtual LANs Are Breakout Chat Rooms

Back at the class reunion, if each alumnus responded to every greeting he or she heard in the big lobby, it would look ridiculous and you might never get a real conversation going. Breakout rooms would help clear out some unnecessary communications for the reunion attendees. For the IP-networking devices, similarly, it's virtual LANs, or VLANs, that will do the trick. Essentially, VLANs are segmentations of the entire LAN into services which address issues around broadcast filtering, security and traffic flow management.

Today's AV installers need to segment the network into smaller networks where similar devices reside, otherwise there's potential for trouble. VLAN technology has been around for many years now. At the most basic level, a VLAN is nothing more than a broadcast domain. Devices that perform critical communications must be grouped together: devices that use voice-over-IP, and devices that stream audio and video from a central server, or devices that provide home automation.

Each of these categories of devices needs to be in its own breakout room where it can perform the critical task it does without being affected by other devices with which they do not need to communicate. The installer's job is to logically construct VLANs to separate out VoIP, audio/video streaming, home controls and computing into broadcast domains. Broadcasts won't be forwarded or 'propagated' between VLANs and a broadcast sent by one host in a VLAN will be forwarded only to other hosts in that same VLAN.

By default, there will be no inter-VLAN traffic on the switch. But what if a computer needs to communicate with a video server? For traffic to go between VLANs, a Layer Three device or routers with VLAN-aware capabilities, needs to be added for devices to communicate between VLANs. Using our class reunion example, think of the VLAN-aware router as a dedicated messenger between the smaller breakout rooms; this messenger will only pass necessary communications between the segmented VLANs if it is necessary.

To finalize this new type of IP-based network, each newly created VLAN, when accessing shared resources such as the Internet, cannot have equal priority with the others. The VLANs containing devices with digital media assets such as audio, video, camera and voice must be given first priority in this new network. Remember, a computer downloading a file in 30 seconds or 35 seconds does not affect the user experience, whereas a lost or delayed video packet can completely ruin a new box office thriller.

Designing and implementing a VLAN-with-priority network allows an integrator to break up a large, loud network into smaller, separated groups that can communicate effectively while each is still connected to the main LAN. I wish we had had a VLAN-priority structure at the reunion—otherwise I wouldn't have had to shout across the room the entire time. CR

Victor Pak is president of Pakedge Device & Software. Founded in 2003, Pakedge Device & Software was created to fill the voids in high performance home computer networking products. Before the company was founded, computer networking products for the home were too compromised, unreliable and lacked the "right" features. Pakedge Device & Software delivers the ultimate wireless and networking products for the uncompromising home owner. www.pakedge.com