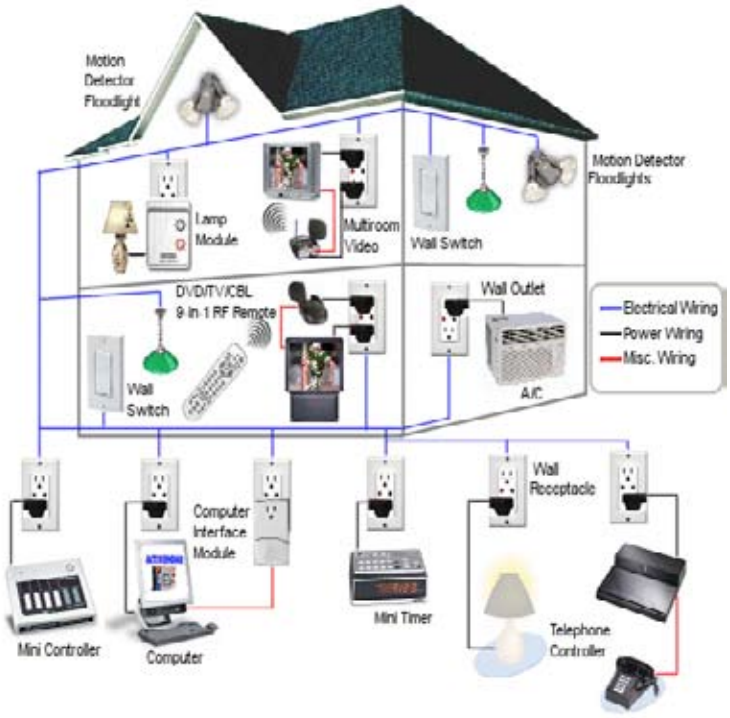
CEPro Advantage Series

HOME Networking Foundations:

From LANs to RF Distribution to Windows 7



In this Advantage Series from CE Pro read about the four key aspects of home networking that every installer needs to know.

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Home networks are not sexy, and they shouldn't be. But dealers need to know how to wire for them and set them up for clients in the most efficient manner, especially as more consumers move to streaming large files from the Internet over wireless networks.

This Advantage Series looks at four key aspects of home networking that every installer should know.

Table of Contents

Designing Virtual LANs to Bridge A/V, IP Networks

Integrators can't stream HD video over the same home network that supports computers without eventually creating a "broadcast storm" that slows the network. VLANs solve the problem. By Nick Phillips

I ATTENDED MY COLLEGE CLASS REUNION LAST YEAR. 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.

If there had been smaller, breakout rooms where people in the same majors, departments or clubs could go, it would have made finding friends easier.

It's a similar predicament facing CE pros 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 an IP-based network infrastructure. The popularity and affordability of IP networking has driven custom integrators to use this technology more and more.

With this development, however, a major problem has evolved over the past few years concerning sharing IP-based computer networks with A/V and home control networks: These devices send out a lot of broadcasts which can clog up 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 was not sufficient, the computing experience was not impacted. The user's satisfaction was not changed if he or she received 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. nstallers can experience issues when terminating Cat 5/6 HDMI extenders.

Network Infrastructure Technology is Archaic

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 were 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 only "for the home," right?

Eliminate Wide Broadcasts

One problematic feature we've discovered is that IP-based A/V 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 - Layer 2 devices - 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-plus 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.

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

Just like at my class reunion, home networks need "breakout rooms" or Virtual LANs (VLANs). Essentially, VLANs are segmentations of the entire LAN into services which address issues around broadcast filtering, security, and traffic flow management. CE pros 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. At the most basic level, a VLAN is nothing more than a broadcast domain. Devices that perform critical communications must be grouped together, such as:

- Devices that use VoIP
- Devices that stream audio and video from a central server
- Devices that provide home automation

Each of these categories of devices needs to be in its own breakout room where they can perform the critical task they do without being affected by other devices they don't communicate with.

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 3 device or a router with VLAN-aware capabilities, needs to be added.

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 necessary.

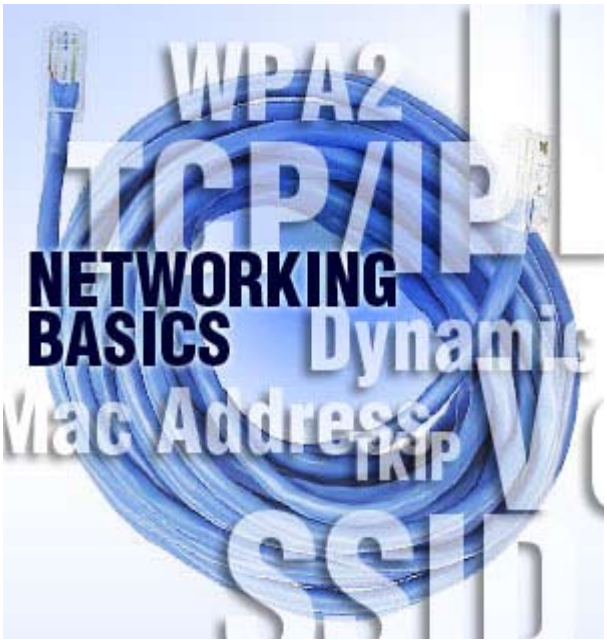
To finalize this new type of IP-based network, each newly created VLAN, when accessing shared resources such as the Internet, cannot have equal priority with the others. The VLANs containing devices with digital media assets such as audio, video, camera, and voice must be given first priority in this 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 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.

Networking Basics FAQ

10 most popular and useful questions about networking basics. By Universal Remote Control

FOR NEARLY 20 YEARS, THE CONSUMER electronics world has claimed that convergence, the merging of audio, video and computers to work together seamlessly, is just around the corner.



Convergence is now a reality, and in the last few years, installers have begun to experience the confusion, difficulties and amazing opportunities that it has spawned.

But if you want to expand your design and installation capabilities to include "Cloud Content," archived entertainment and on-demand media, you'd better know the basics of wired and wireless computer networks.

A recent networking basics webinar we hosted at Universal Remote Control drew so many attendees that the system was maxed and started kicking people out. Our goal in a non-product specific course such as this is to help elevate everyone in the industry to greater heights, and we were thrilled by the interest.

For that reason, we happily offer up the 10 most useful, intriguing and popular questions we were asked concerning network basics.

What terms are used in the IT world that CI professionals should know?

Transfer Control Protocol/ Internet Protocol (TCP/IP): It's simply the language spoken between devices in networks.

Temporal Key Integrity Protocol (TKIP) and Advanced Encryption Standard (AES): When setting up security for a network it is recommended that you use a PSK (Passkey, password or pass phrase). TKIP and AES are types of passkeys, but AES is more secure and takes much longer. For AV based networks TKIP is faster and highly recommended.

Dynamic Host Configuration Protocol (DHCP): The system used by network routers to automatically assign dynamic IP addresses. Keep this feature turned on, but limit the number of addresses available and assign static IP addresses to all AV components for faster and more reliable operation.

IP Address: The location of devices on a network. This is created by the DHCP server or assigned long-term by the installer.

Dynamic/Static: When referring to IP addresses, Dynamic means changing (it expires periodically) and Static means it doesn't change.

MAC Address: The physical address of a device, MAC is set by the manufacturer and unique for every component. Think of it as the internet serial number.

Service Set Identifier (SSID): The name of the network.

WEP/WPA/WPA2: Levels of network security. WPA2 is the most difficult to hack, but you must set the networks overall security to the level that is supported by all devices in the network.

Is there any particular software we should have on our computers when setting up a network?

InSSIDer: This network sniffing software can be downloaded here http://www.inssider.com/ and is free if you only use it to discover nearby networks. Invaluable to any installer.

We rarely install routers that cost more than $100. Is there any benefit to using more expensive routers?

Yes. Routers are like AV Receivers — for less than $200 you can buy a receiver that spec's out much better than one costing ten times as much. Do you doubt the value of more expensive receivers? Of course not, but router functionality, range (wirelessly) and reliability are directly related to the selling price just like a receiver. They just work better.

My customer's router gives the option to not broadcast the networks SSID (name). Should I do that?

No. If you turn off SSID broadcast, your customer will likely need you to roll a truck whenever they change something in their network.

There are 11 channels a router can use. Which is the best one?

If there are no other networks in the area, use channel 1 for slightly greater range. If there are other networks, pick a channel that is not in use and, ideally, five channels away from any that are in use.

Can't I just set the router to automatically pick a channel?

Yes, but picking the best channel during installation will ensure the best reliability over the long term.

Wi-Fi is available in A, B, G or N. Which should I use?

Unless your customer has really old gear that requires it, you should avoid A. B and G have the same range, but G sends data faster. N is superior in every way, but not compatible with all current devices. Use an N class router set to "Mixed" so it can talk to any devices in B, G or N.

Shouldn't I set up the network to filter MAC addresses instead of worrying about security?

No. MAC filtering tells the router to only communicate with devices whose MAC address you told it about. Your customer would call you every time they changed a component or if they wanted to let friends connect to the network.

We're seeing Verizon FiOS quite a bit here. Anything special we should know about them?

Yes. The FiOS system includes a router with the installation. While no one will ever tell you this, FiOS takes the addresses from 100–150 and locks you out of them, meaning you can't use them for static addressing.

Is this PowerPoint available for download?

URC dealers can click here to download https://www.urccontrolroom.com/ the entire URC basic networking presentation.

5 Reasons Windows 7 is Good for Installers

Windows 7 release will lead to more competition, more integration with A/V components, more automation functionality, more system design options and more revenue for CE pros. By Arash Marzban

WITH THE LAUNCH OF WINDOWS Vista in 2007, Microsoft took an incremental step towards creating a platform custom installers could use as a base for everything from home automation to media distribution.

Vista was met with positive reviews, but it failed to deliver in areas that were beneficial to custom installers.

With the official release of Windows 7, this could mean the start of a revived movement towards Media Center-based products.

Here are five reasons Windows 7 is good for installers.

Competition is Good for Bottom Line

Microsoft has opened up Cable Card support to all system builders. This means CE pros won't be stuck paying a premium for a Cable Card-equipped systems. By doing a little searching, chances are you can find an OEM system builder in your area willing to design and sell you a Media Center at a fraction of what the "big boys" charge.

While 'White Glove' vendors do provide an extended level of service and support, such as training, the benefit of a local supplier is in the speed and accessibility of support when it is needed. Don't be surprised to see a whole new generation of Media Center builders popping up in the coming months.

As for the features, the new Guide and Record features in Windows 7 are a nice improvement over Vista. And the ability to move Cable Card HDTV recordings between Media Center systems is smooth and long awaited.

Automation Options Still Plentiful

The real benefit of a Media Center installation is the ability to control multiple aspects of the users experience through a single portal or GUI.

By installing third-party applications such as the ones available from Exceptional Innovation, Autonomic Home, Embedded Automation, or Cortexa, installers can expand the functionality of any system and boost margins substantially while reducing the number of components that require support.

Improved Netflix Integration, Internet TV

Netflix has also pumped out a new GUI for its streaming movie services to coincide with the Windows 7 launch. Combined with CinemaNow, which will be offering 3D content in the future, and Blockbuster's movie services, a Windows 7 Media Center is the most complete and full-featured content delivery platform on the market.

If you did not get a chance to play with the Internet TV features in Windows Vista, you owe it to yourself to check it out on Windows 7. With an expanded catalog, users can access content such as CBS TV or even concerts. And, of course, you can always access Hulu, which might start charging users to view content, from a Windows 7 system.

Blu-ray & Catalog Integration

While early Vista Media Center systems could leave an unpleasant taste in your mouth when it came to Blu-ray playback, today's DirectX 11-capable video cards and third-generation Blu-ray playback software are nearly bulletproof. Add in the ability to catalog (albeit controversially) your movies, including Blu-ray, using applications such as My Movies or AnyDVD and you've got an all-in-one entertainment machine.

Groundbreaking Integration with Other Components

In August, Onkyo announced three Windows 7-ready amplifiers (TX-NR1007, TX-NR3007, and top-of-the-line TX-NR5007) that have built in a tremendous level of codec support, giving users the ability to stream audio from their PC directly to a 9-channel amp via the network.

If this is a sign of things to come, CE pros can expect improved compatibility, connectivity, and usability as more products begin to communicate openly over the home network.

RF Distribution: A Refresher Course

A seasoned installer says RF distribution can generate a great picture. It's time for CE pros to revisit various RF architectures. By Grayson Evans

MANY INSTALLATION COMPANIES consider the baseband signal distribution system to be the only respectable way to distribute video around the house.

Tools like this ZvBox from ZeeVee serve as a reminder that RF distribution is anything but dead. ZvBox turns PC content into a digital cable signal that can be enjoyed as HDTV.

The equipment (made by Crestron, Elan, Niles and many others) provides numerous baseband inputs, such as composite, component, DVI and even HDMI, from source devices. It provides matrix switching functions to route the signals to locations around the house in a star topology (home-run cables to each outlet/device location). The less sexy approach of simply modulating A/V sources onto the cable system to be viewed on any TV seems to have gone out of style.

Some installers associate the word "modulator" with "crummy picture" because, so often in the field, modulators are installed incorrectly. Levels can be incorrectly measured. The equipment can be connected to a poorly designed coax infrastructure — there are a number of common mistakes made in modulating A/V sources this way. Even CEDIA has pared down its RF distribution course offerings. Here are five reasons Windows 7 is good for installers.

Perhaps a contributing factor to the demise of correct modulation was the confusion over the analog broadcast shutdown. It's important to note that this was not the end of analog transmissions, just broadcast analog. Cable operators will still be carrying analog for many years to come.

The signal generated by a modulator (and tuned, or demodulated, at a receiver) can generate as good of a picture as that fed to a TV directly via composite or S-video. Tuners in modern television displays are very good. If the modulator generates a "clean" signal, the TV will generate a great picture.

Using a coax infrastructure to distribute video has many advantages:

- No matrix-type switching function required
- All sources available everywhere simultaneously
- Sources can located be anywhere
- Supports long cable runs with minimum loss
- One cable for everything
- Uses TVs' built-in tuners for source selection
- Very low-cost distribution infrastructure (cable, amps, splitters, etc.)
- Used to distribute CTV anyway
- Easy to distribute over-the-air broadcasts (still the best source of HD programming)

Of course, there are also disadvantages, such as:

- The trickiness of combining in-home modulated channels with existing CTV channels
- A lack of digital (8VSB or QAM) modulators
- The need for a demodulator (tuner) on the other end
- A lack of single-source dealer support

The following is not intended as a short course on coax distribution, but a quick review to help you in your next job.

Comparing RF Distribution Infrastructures

There are two basic cable distribution architectures: a single-cable system and a dual-cable system.

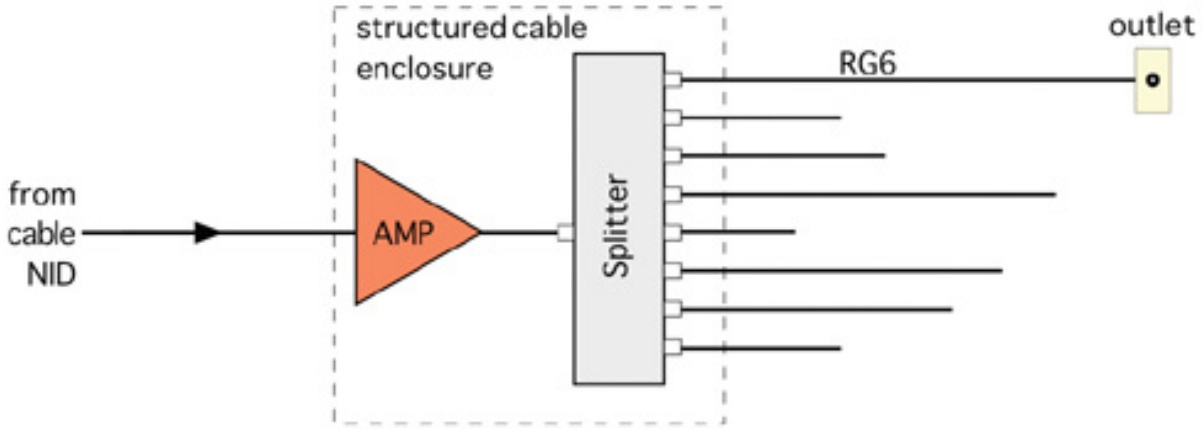
A single-cable, downstream-only system is typically used to distribute cable TV (CTV). A dual-cable system, originally developed as part of the CEBus standard, supports an upstream cable used to attach in-home modulated video sources. The dual-cable architecture combines in-home and CTV signals so that they can be viewed at any downstream outlet (not to be confused with just running two coax cables to an outlet — the second cable being a spare or used for satellite signals to a set-top box).

> Single-Cable Architecture

The single-cable architecture is pretty straightforward, but there are several things to keep in mind:

- Combining the amplifier and splitter is not recommended. Using a separate amplifier and splitter gives you the ability to pick the best parts for each task and measure how each performs.

- Always use top-quality parts from companies in the cable/CATV industry.
- The gain in the amp will need to be equal to the loss in the splitter plus the loss of the longest cable run. Your goal is provide a signal between 0 and +10 dBmV at every wall jack.
- Use attenuators on the splitter outputs for short cable runs that result in a signal over +15 dBmV at the outlet.
- Use a signal level meter capable of measuring the video or digital carrier on each channel from 2-125 (for cable).



This single-cable system is pretty straight-forward. Even so, it's important to use top-quality parts built to the proper specs.

> Dual-Cable Architecture

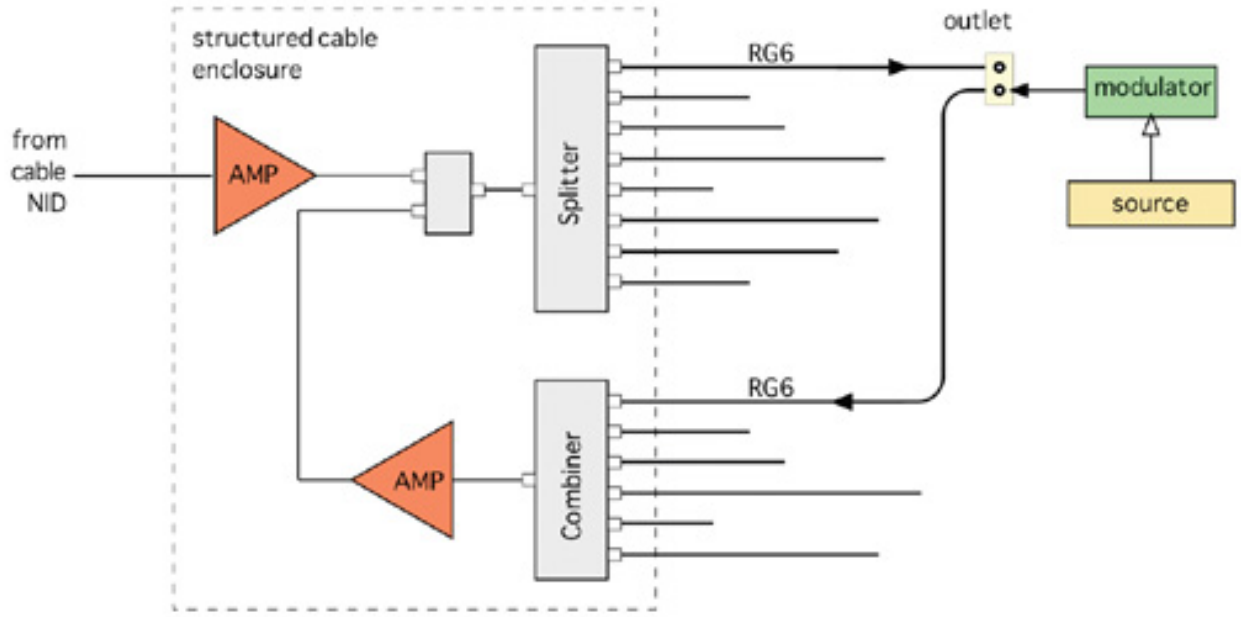
The typical dual-cable architecture is supposed to provide an internal cable path back to the structured cable enclosure, where signals are combined, amplified and mixed with external signals for redistribution on the external cables.

In-home modulated signals have to be placed on a channel not used by the cable company. Even "high-end" modulators require two channels (the channel to which it is tuned and the channel below). If there are many modulated sources (DVD players, satellite receivers, etc.), it could take many channels.

Unfortunately, in the last decade, most cable operators have used up nearly all of the available 124 cable channels. It's nearly impossible, without a spectrum analyzer, to tell which channels are not used, causing many to abandon this solution.

With this design, be sure:

- The signal level of the modulated sources is the same at the combiner
- To base everything on the modulator with the lowest output level (assuming it's not adjustable) and attenuate the remaining modulators (using inline attenuators) to make their level the same within +/- 3 dBmV
- Combined signals (CTV and inhome) are approximately the same level (within +/- 5 dB)
- To assume 5 dB loss per 100 feet of RG6 as a rule of thumb
- To eliminate only analog channels if you use filters to eliminate channels from the CTV feed



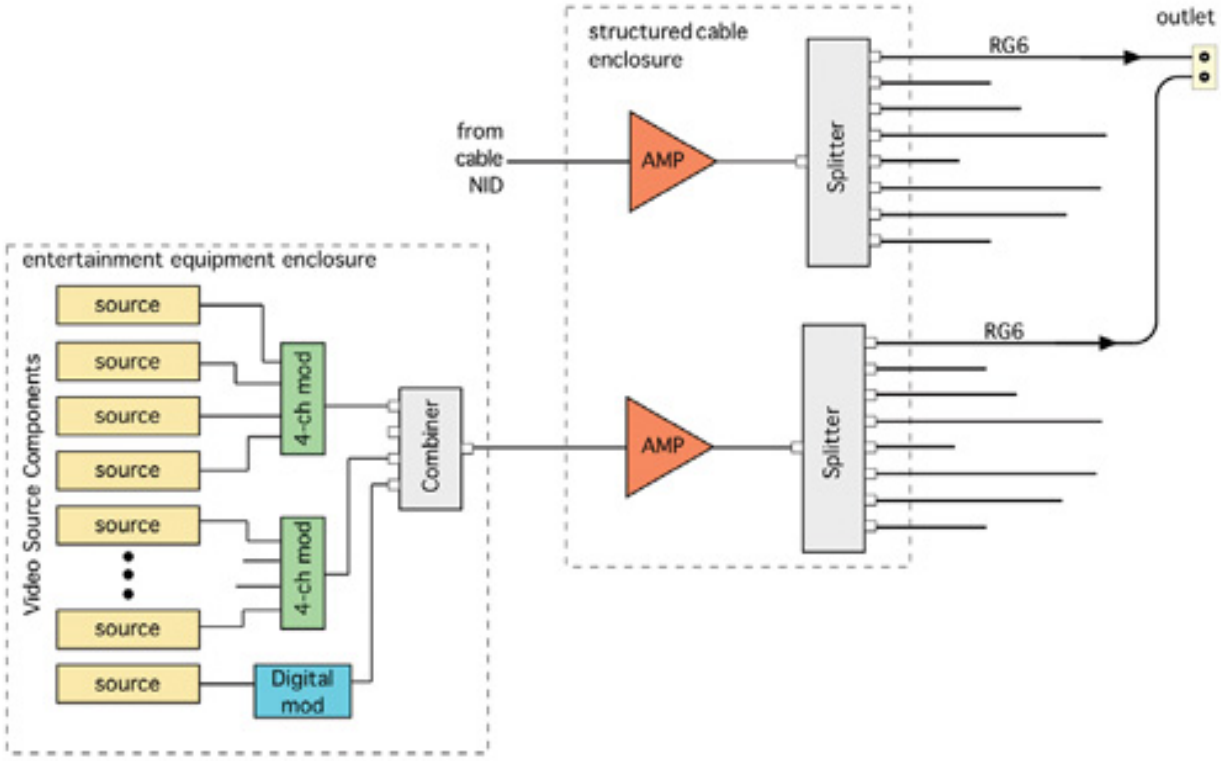
The typical dual-cable architecture became popular in the mid-90s as a way of providing an internal cable path back to the structured enclosure. Difficulties have risen, however, as unused cable channels on which to place modulated signals are rarer.

> Alternate Dual-Cable

Architecture An alternate dual-cable architecture avoids the channel-sharing problem by separating the downstream channels into two physical cables. One cable is dedicated to CTV service and the other cable is dedicated to in-home-generated channels.

Modulators can be located in the central locations (rack, cabinet, etc.), and their output can be combined in one cable to the structured cable enclosure. There, the combined signals are amplified as necessary and split just as in the single-cable architecture. This is a nice application for a two-, three- or four-channel modulator (such as the Channel Plus SVM-24, which takes stereo S-video inputs and is frequency agile on each channel).

The only disadvantage of this design is the TV either needs two cable or RF inputs or, for older TVs, an external A/B switch — note that modulators can be set to output either CTV channels or off-air channels so that either the cable or antenna inputs on receivers can be used.



An alternate dual-cable architecture avoids the channel-sharing problem by separating the downstream channels into two physical cables.

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