SPECIAL REPORT

BEYOND HOME STEREO SYSTEMS

How to Choose the Best Sound Bar, Audio Receiver, Music Server & More

WIRELESS AUDIO BASICS

An A-to-Z guide to having beautiful music in your house—without wiring.

Sonos Wireless Music System

Do you want more music in your house, but don't want to run wires down the hall or through the walls to get it? How about sending music outside without having to trench your yard and pipe wires through conduits? Oh, and of course you want access to your digitally stored music collection and favorite Pandora stations, right? Then it's time to start shopping for a wireless music system. Here are some frequently-asked questions, with answers, about wireless audio, plus a roundup of some great products, many of which have been thoroughly tested by the *Electronic House* editors.

What does the term "wireless audio" mean, exactly?

Technically, an AM/FM radio is a wireless audio system, but today we generally mean a system that is wirelessly connected to the audio source and usually can play back music from the Internet. These products can be stand-alone players or components. Often they're wirelessly controlled as well via a smartphone or tablet app. Most of the products will still need power, so unless it's a portable product with a battery, then yes, technically you still need at least one wire to plug into a power outlet. Products like the Sonos Connect Amp, NuVo Technologies P200 player and WASP Audio LINK-Mount allow you to connect your own speakers. Others, like VOCO's V-Zone+, connect to another audio system via a digital or analog connection.

How is a system wirelessly connected?

Wirelessly, of course. Seriously, wireless is only part of the product. Some wireless music systems include an Internet gateway device that needs to be connected to your home Internet router or switch. The gateway wirelessly connects to the various receivers in the house (this is how both Sonos and NuVo work) which may or may not require additional speakers, or may be connected to other components, such as a home theater pre-amp or receiver. Other products use a smartphone or tablet, connected by Bluetooth or AirPlay, as their gateway to the Internet.

What kinds of audio components can be wirelessly connected?

The audio components that connect to a wireless music system vary depending on the specific product, and what you want to listen to, but most are capable of streaming music from Web-based

services (such as Pandora, Spotify or vTuner) and locally stored music files from a PC, networked hard drive or smartphone/tablet. With the latter, Bluetooth and Apple's AirPlay are usually the wireless connection methods.

NuVo Wireless Music System

Some products are also able to connect to components, such as a CD player and an external hard drive (via USB or network).

Is a wireless music system better than a wired music system? If so, why?

This depends on what you want out of your music experience. Wireless isn't always better, but it's usually easier to install. Also, with streaming services, you have access to almost any music you can think of. However, few wireless systems can play high-resolution files (24-bit content support, a capability that the Wireless Speaker & Audio Association—WiSA—and its members are pushing forward), so if high-res is important to you, you should look into more traditional hardwired solutions. On the other hand, good digital signal processors (DSPs) and amp designs can enhance the audio quality of wireless audio systems. And if the system is connected to another audio system, like your home theater system, the external amp and speakers can have a great impact on the sound quality.

Bluesound Music System

The performance of wireless audio systems also hinges on the quality of the network, which means network activity, network interference and bandwidth issues can all impact reliability. If your music source is an online app coming from a smartphone, then what happens when the phone leaves the room or runs out of battery power? You'll want to keep a phone charger handy.

Can a non-wireless product be converted into a wireless system?

Yes, somewhat. Nearly any audio device can be connected to a Bluetooth adapter or an Apple AirPort Express. This will facilitate wireless streaming of music to standard speakers. Unfortunately, this solution will yield a listening experience that will be sub-par to that of a wireless multiroom music system, but it's a good option for upgrading a single-room player to wireless capability for $100 or less.

Speaking of affordability, most of the products and systems we've listed on page 9 (go to the manufacturers' websites for more info) cost in the hundreds of dollars, not in the thousands like traditional speakers and audio components. They're scalable, too, so you can start with one or two pieces and add more products to fill your house as you go. There's a good reason more and more companies are riding the wireless audio wave. And it may be the right time for you to start surfin' too.

Can Your HOME NETWORK Handle Your Media?

Better routers and access points can improve the performance of a wireless audio system.

How many of you have had the experience of cuing up a movie on Netflix or other streaming service, and then instead of watching the movie, you're stuck staring at a buffering icon slowly creeping across your screen? If you're lucky, the end result will be the high-definition version of the movie, but too often network issues result in something less than HD.

The same thing happens with streaming music—the audio pauses or stops completely, and the experience of listening to your favorite music channel is ruined. It's enough to make you nostalgic for FM radio.

This goes for IP-based home control systems, too. Without a properly performing network, the system will give you less than what you expected.

As more of our home entertainment devices rely on network connections for their content, the more we need to pay attention to the networks that they run on.

When trying to identify the source of your network problem, it's a good idea to strip it down to the basics and try a process of elimination. "You have to find the broken link in the chain," says Nick Phillips of Pakedge, a maker of high-performance home network products. As much as we want to blame Netflix or Spotify or whatever service you're using, Phillips says these providers are pretty reliable, so the issue is more often in your house.

Even our Internet service providers (ISP) are mostly reliable these days, presuming you're getting the bandwidth you need. After checking the Internet connection (simple tools like Speed Test, via its app or website, can tell you what your download rate is) you need to

Enterprise-grade networking products like these from Pakedge can ensure fast, reliable housewide travel of audio and video signals.

start eliminating parts of your chain to find the culprit.

If your network connections are wired, then unplug all your Ethernet connections and reconnect them one at a time until you find which link is the speed bump. Of course, this could take a while if you have to restart your Netflix movie each time.

Wireless access points, like this one from Luxul, can help push A/V signals to their intended destinations, but only if they are installed correctly.

More problems ensue when people use wireless for all their streaming devices. In this case, try connecting to a different access point or change to a wireless channel that's not being occupied by other devices in the area.

If your modem, router and wireless access point are all bundled into one product (which is typical of the products supplied by ISPs), consider whether it's placed in the best location for your home. It may be fine to put a modem in the basement, but a wireless access point should be located at the center of the house so it can effectively reach all of your wireless devices.

Wi-Fi extenders can help push signals to hard-to-reach places, but they can also cut your home network's bandwidth in half.

Using Wi-Fi connections for entertainment products is convenient, but convenience can come at a price. "People are over-dependent on wireless," says Phillips. "You can't control the airspace around you, so you never know what's going to interfere with your Wi-Fi. Someone can turn on a microwave or a baby monitor, or your neighbor could install a high-power access point that overpowers your area."

So, use wired connections when at all possible.

Say you've done that, but you're still having problems. "Often the router is the first culprit," says Brannon Young, director of systems engineering at Luxul. Most homeowners rely on the cheap routers provided by their ISP, but Comcast, Verizon and Time Warner are in the business of getting the Internet to your house. Once it's there, they consider their work done. These routers, as well as many of the inexpensive devices found at mass market electronics stores, are not designed for heavy network functions. When you start hooking up multiple Apple TVs, game consoles, wireless music devices and a home automation system, a low-performance router can easily get bogged down.

Young compares the situation to driving a sports car on a lousy road. "If you drive your Ferrari on the Autobahn it's going to perform great; but when you take it on I-70 your mileage may vary."

A smart practice is to upgrade to an enterprise-grade router that's designed to handle data more efficiently. Phillips says one thing to look for in a good router is processor capacity. "A lot of consumer-grade products are just single-core, low-speed. Better products have high-speed processors with more capacity in a system-on-a-chip approach."

Another common characteristic of high-end routers is a higher session count. "That's the amount of applications the device can handle at any given time," says Phillips.

Also be sure you're using gigabit-level equipment. Gigabit routers and switchers have higher throughput to enable data to travel quickly its destination. Look for products with a backplane that can handle all ports at full bandwidth—it should be double the number of ports on your switch or router. For example, if you have an 8-port switch, it needs to be able to support a data transfer rate of 16 Gb/s.

TIPS FOR YOUR MEDIA NETWORK

1. **Tell your CE pro exactly what kind of media you want and how frequently you use it.**
2. **Use wired connections whenever possible.**
3. **Use commercial or enterprise network equipment rather than equipment supplied by your ISP or carried by a big-box retailer.**
4. **Use VLANs to wall off some data from parts of your network.**
5. **Use managed switches and Quality of Service Settings to maximize your network for media devices.**

Unfortunately, many consumer products don't list all the critical specs, so it's important to consult with a trained custom electronics (CE) professional about your network equipment. In addition to providing high-quality equipment, an experienced CE pro will be able to assess your needs better than anyone else. Some CE pros will set up virtual LANs (VLANs) to segment some data away from the network to prevent network traffic jams.

Another common problem of routers is the need for them to be power-cycled occasionally. This can be accomplished manually by unplugging the router and then plugging it back in, or your CE pro can install a product to do this automatically or remotely.

For Wi-Fi, routers with beam-forming capability will focus media signals to your media players rather than send the signal out omnidirectionally.

Also, wireless routers with multiple antennas will automatically select the best antenna to broadcast to an individual device.

Some products are going to be more bandwidth-intensive than others. Phillips says that Apple TV is a particular offender because of the way it broadcasts data—it uses a multicast protocol that "sends signals to everybody on the network, whether they should receive them or not." This creates a lot of overhead data that can flood the network. Imagine a house with several Apple TVs, a couple of online game consoles, a wireless music system and several smartphones or tablets, and you can quickly see how both wired and wireless networks can get overloaded.

Media distributed within the house (rather than that coming from outside) from high-definition video servers, such as those offered by Kaleidescape or Dune, or even stored on a network-connected hard drive, can also bog down a network. The high-definition content must travel through the same routers or switches as every other signal; it creates a lot of overhead for the system to handle. Again, a CE pro with a strong networking background can ensure that you won't have problems when it's time to sit down and enjoy a movie.

If you have an IP-based home automation system, and today most use IP, a confused network can result in signal latency or even devices dropping off the network completely.

So how much bandwidth is necessary? This will depend on your specific home entertainment system and the number of streaming or downloading devices you connect to it (and how many will be used at once). One high-definition stream from Netflix takes between 2 and 5Mb/s. If you plan to have several streaming devices in the house all watching different movies, you better tell your ISP to give you the biggest pipe they offer.

5 Tips for Better WIRELESS NETWORKS

by Bjørn Jensen

WIRELESS NETWORKING is a regular fact of life, but there are many potential pitfalls to the ubiquitous, routine installation of the necessary networking equipment. Here's a look at some of those risks and how to avoid them.

1. Don't ever set your home's wireless access points (WAPs) to the same channel (unless you have a single-cell architecture) if they are located close enough to each other to create interference.

It gets easier to find open channels when using 5GHz (for now, until 802.11ac becomes more common), but when equipment operates in the 2.4GHz range, remember that there are only three non-overlapping channels in North America. These are channels 1, 6 and 11. Think of multiple WAPs residing on the same channel as being akin to multiple meetings going on in the same room. Splitting up the channels is like putting each meeting in its own room. It's a good idea to use a wireless spectrum analyzer such as Metageek's WiSpy to look at your environment and so that you choose the right channels to use.

2. Know the polarization of your antennae.

For example, too often I see WAPs with bipole antennae laying flat in a one-floor home. Think of the antenna as if it's holding onto a doughnut through the center of it. This is how the "Fresnel" zone acts within this type of antenna. In most of these antennas, the signal literally looks like a large doughnut radiating outward in a circle from the pole. If it's laying flat, the signal is mostly going up and down and not side to side. If you're trying to reach an area on the second-floor, then this position can work. But if not, you're wasting valuable signal. Also keep this in mind when mounting your WAP, especially as these days many come without external antennae. Of course, dual polarized WAPs are also available, and in this case you don't really have to worry about the positioning as much.

3. Don't slap a WAP on the back of a TV or install it in a rack.

Try your best to avoid anything that can cause RF interference, like having eight Sonos systems piled on top of each other or even something as simple as a wireless Blu-ray player. You also want to avoid light fixtures, electrical powerlines, A/C units, elevators, fish tanks, trees, and anything with lots of metal or water, as these elements will block signals from getting through. Ideally, a WAP should be mounted at least a couple of meters away from any possible RF interference and in line of sight of what they're to be connected to. Also, mount WAPs as high as possible.

4. Don't just use your laptop to test signal strength.

Try your best to test with the actual devices that will be used because each device has its own power requirements, antenna polarizations and other nuances. At the very least, use your laptop as well as some handheld devices to monitor the difference. One of the best tests is to use an iPhone to connect. Apple handheld devices are notorious for having extremely poor signal strength.

5. Don't use your name as your SSID.

This is like broadcasting to the world, "Hey this is my wireless network, now come and hack me!" Also avoid WEP encryption, since nowadays it can be hacked in mere minutes. If a legacy device requires WEP encryption because it can't handle anything else, use MAC address filtering and put it on a secure VLAN that allows routing only to the device it needs to talk to.

Bjorn Jensen is owner of WhyReboot, a Miami-based company that specializes in the design and installation of commercial-grade networks for home automation systems.

15 Great Wireless AUDIO PRODUCTS

NuVo Wireless Audio System

The Wireless Audio System combines dual-band Wi-Fi and MIMO to transmit up to 16 audio streams at once. And it can do this at 600kbps, says NuVo. Designed to hook to the home network, the NuVo system can tap into music stored in iTunes and Windows Media and stream services such as Pandora, Rhapsody and Siri-usXM. The NuVo system includes three components: the two music players (P200 and P100) and a network gateway (GW100). Listeners can use a smartphone or tablet to control the units, via NuVo's free iOS and Android apps. Other features include support for up to 16 separate listening zones, aptX Bluetooth technology, and gold 5-way binding posts for connecting to stereo speakers. The P200 boasts 60 watts of power per channel, with the P100 doing 20 watts per channel (2 channels @8 ohms). **nuvotechnologies.com**

Bluesound Wireless System

The Bluesound music system, from PSB Speakers and NAD Electronics parent company Lenbrook, uses Wi-Fi (or wired Ethernet) to distribute Internet-based or locally-stored music to speakers all over your house, controlled through iOS or Android apps. Each system connects to your home's network to communicate to the Internet or to each other. There are four main products: The Node, Power Node, Pulse and Vault, plus a speaker/sub combination called the Duo. The Pulse and Duo are networked speaker products, while the Node and Power Node (which includes a 50-watt amp and subwoofer output) let you connect the system to your own speakers. The Vault is unique in this product category, as it features a CD-ripper with a 1TB hard drive for storing your digital music in MP3 or lossless FLAC formats to then stream. **bluesound.com**

Bose SoundTouch Wi-Fi

Based on 802.11g Wi-Fi, the SoundTouch music systems allow users to stream music from the Web or from a stored collection. The units also include Apple AirPlay, and Bose plans to add music services like Deezer, iHeartRadio and others. Products include the SoundTouch 30 Wi-Fi, designed for larger spaces; the SoundTouch 20 Wi-Fi, a more compact unit for smaller rooms; and the SoundTouch Portable Wi-Fi, a book-size speaker that has a rechargeable lithium-ion battery. On top of each unit are six simple preset buttons that can be pressed and held to preset a station, Pandora channel or playlist from a PC or iDevice. They have a front-facing OLED screen that gives feedback on what song or Internet radio station has been selected using metadata, and each speaker comes with an IR remote. A control app for iOS, Mac, Android and Windows is also available. **bose.com**

Soundcast Melody

Ideal for extending music's reach outdoors, Melody is an omni-directional Bluetooth wireless speaker. Weighing just 9 pounds, it's compact enough to hit the beach or sit by the pool. Also, because it has Bluetooth, it can stream music wirelessly right to the speaker from any smartphone, tablet or PC. Even better, the Melody has a water- and UV-resistant, all-weather plastic enclosure. It also features four bass radiators and four high-performance full-range speakers to belt out 360 degrees of sound. Other features include a sturdy handle, a 3.5mm input, and a rechargeable battery that promises up to 20 hours of playtime. It comes with an AC adapter, a 12-volt car adapter, and a USB charging cable. **followmelody.com**

Bowers & Wilkins A7

The A7 is an all-in-one speaker system that includes Apple's wireless AirPlay technology. Wrapped in a contemporary industrial design, the A7 employs built-in Class-D amplification that drives two 1-inch B&W Nautilus tweeters, two 3-inch midrange drivers and a single, 6-inch woofer. Rated frequency response is 40Hz to 36kHz. The A7 also includes DSP processing to handle signal management, 24-bit/96kHz digital-to-analog converters (DACs) that augments the quality of wireless music streams and the AirPlay technology. Control of the speaker system is accomplished via an iPhone, iPad and iPod running iOS 4.3.3 or greater. **bowers-wilkins.com**

VOCO V-Zone+

V-Zone+ is a wireless music and video receiver that provides quick access to music (and videos) and wirelessly streams them throughout your home using a smartphone or tablet. Connect the V-Zone+ to any stereo, powered speakers or TV and start streaming. The unit is configurable as a Wi-Fi hotspot and has a built-in music server that automatically finds music when an iPod, MP3 player, or USB hard drive is plugged into one of the two USB inputs. You can download the VOCO Controller to use voice control for accessing and selecting your stored music, Internet radio, streaming services and YouTube. **myvovo.com**

Sonos Ecosystem

The Sonos ecosystem includes a variety of wireless speakers (even a soundbar, the PLAYBAR) and audio components that talk to each other through the gateway Bridge. The PLAY:1, PLAY:3 and PLAY:5 speakers can be used individually or paired for stereo playback of all your digitally stored music and streaming services the Sonos system doles out. You can add a Connect amp to bring the wireless audio goodness to an existing stereo system via analog and digital outputs. The Sonos Controller App choreographs the wireless playback, letting you use a smartphone or tablet to select sources and songs, group rooms together and queue up playlists. **sonos.com**

Samsung Shape

The wireless speaker and multiroom audio system features two devices: the M7 speaker and the WAM250 hub. The speaker can connect to a wireless network and run a suite of streaming music apps, and it includes Bluetooth and NFC connectivity. Two M7s can be set up as a set of stereo speakers, or you can just play stereo from a single speaker. To extend the system beyond one room, the M7 hub connects to a router via Ethernet to function as a music gateway that can send music wirelessly to any M7 speaker. By using the Shape app (iOS or Android), you can stream music throughout the house or just to individual M7 speakers. With the hub installed, you can access a handful of music apps including Pandora, TuneIn Radio, Amazon Cloud Player and Rhapsody. **samsung.com**

WASP Audio LINK-Mount

Standing for "wireless audio solution products," WASP Audio puts your traditional speakers (on-wall or freestanding) on a wireless platform through a universal wall-mount installation bracket. Transmission works over a tri-band chip that can be used to find uncluttered signals over 2.4GHz for whole-house, or 5.2/5.8GHz for in-room applications. The LINK-Mount can set up at distances as far as 60 feet and once the product is installed, a custom electronics pro can easily hook up the bracket's 50-watt Class D monoblock amplifier to power a mounted speaker. **waspaudio.com**

Bang & Olufsen Immaculate Wireless Sound

Bang & Olufsen's (B&O) new Immaculate Wireless Sound system uses the Dynamic Frequency Selection (DFS) multi-channel open wireless audio standard from the Wireless Speaker and Audio Association (WiSA). As a result, B&O says its branded speakers and televisions will reproduce 24-bit, uncompressed music at native sampling rates wirelessly using the 5.0GHz to 5.8GHz DFS range to avoid interference from other signals. The new standard claims to overcome the latency and error problems associated with low-end wireless speaker solutions. Lip synch issues due to compression-induced latency have also been eliminated. B&O will be using microchips from Summit Semiconductor to comply with the standard. **bang-olufsen.com**

Korus Wireless Speakers

Launched by Core Brands, Korus delivers music from your smartphone or tablet to speakers throughout your house. Korus comprises two wireless speakers, the V400 and larger V600. The products employ 2.4 GHz SKAA technology, which is billed as a much better alternative to Bluetooth because of its quality of service (QoS), low latency and multizone capabilities. Both the V400 and V600 have dual side-firing tweeters. The V600 takes six "D" batteries (not included) for roughly 90 hours of continuous playback. The V400 must be plugged in for power. Typical range for the SKAA speakers is around 65 feet, and is playback capable of 480kbps quality. You need to plug a dongle, or "Baton" as Korus calls it, into the source for the speakers to communicate; Korus provides USB, Lightning and 30-pin Batons. **korussound.com**

Russound XStream

The XStream X5 is an all-in-one streamer, web-based controller and digital amplifier (50W x 2). It streams audio over a 802.11n wireless network and features an Ethernet port if a hardwired connection is preferred. The antennas on the rear of the product are detachable and can be remotely mounted if needed to extend the signal up to 20 feet. Each X5 unit also features a 12v DC trigger connection and an IR output, ideal for controlling a TV via the My Russound smartphone/tablet app. Digital audio inputs (coaxial and optical) for a local audio signal and analog RCA line out allows the signal to pass through to a beefier amplifier or A/V receiver. There's also a subwoofer output for those who want extra bass. Up to 16 X5 zones can be installed, and the company's IP-based control protocol makes the XStream compatible with popular automation systems. **russound.com**

Control4 Wireless Music Bridge

The Wireless Music Bridge is a small accessory product for owners of Control4 home automation systems. Its purpose is to get music from iPhones, Android tablets and other little wireless devices into the home A/V system via Control4. It has no built-in streaming services, radio or hard drives, but the WMB supports Bluetooth, Apple AirPlay, and DLNA, which covers pretty much any kind of smartphone or tablet, and sends its music over the Bridge. The WMB connects to the network, in most cases via the home system's Ethernet switch (it can be connected via Wi-Fi too). Once it's configured in the Control4 Composer program, it's ready to play. And you don't need to have a Control4 remote, touchscreen or app to make the WMB work—you just need the device that holds your music (or music services). **control4.com**

Klipsch Stadium

This wireless music system was designed to commemorate the partnership between Klipsch and Live Nation. It's a slick tabletop system that promises to deliver big stadium-style sound from a compact package, which includes brushed aluminum cabinetry with soft-touch accents. It has Wi-Fi, AirPlay and aptX Bluetooth, so you can stream up a storm using your preferred wireless method. The Stadium also has plenty of Klipsch goods, including the company's Tractrix Horn technology, Linear Travel Suspension (LTS) tweeters, and midrange drivers with Faraday Rings. Other features include an amplifier that can deliver 400 watts (peak), a frequency response rated at 26Hz to 24kHz (+/-3dB), and an output of 112dB. **klipsch.com**

CasaTunes Multi-Room Music Servers

Designed to work seamlessly with most A/V receivers, CasaTunes Music Servers offer many music playback options. For instance, you can stream music to three wired rooms with five wireless rooms. If it's a big house to fill, there's a system that can support up to 24 wired and 10 wireless rooms. CasaTunes says each system can distribute music to both wired and wireless speakers, via AirPlay, multichannel amps and multizone A/V receivers. Opt for a different playlist in every room or rock them all to the same tune. The system can be controlled via the company's iOS, Android and BlackBerry apps, as well as a web browser or keypad. Tap into tunes from a music library on a computer, phone or tablet, as well as the popular streaming services built into CasaTunes. **casatunes.com**

If you're interested in learning more about
home stereo systems check out these useful resources

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EH Daily: Helpful articles on a variety of home tech topics.

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