Understanding Your Options for Wired, Wireless, and Hybrid-Wireless Whole-House Audio

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Objective

The objective of this white paper is to provide enough information about Whole-House Audio (WHA) so that you can make an informed decision about how best to set up your home for high quality listening and control of music, TV audio, and other audio sources. For new home construction, I clarify what types of cable (if any) should be run before the walls and attic space get closed in.

I end with a summary of HTD’s current wired and hybrid wireless solutions.

I’d like to preface by stating that “wired versus wireless” refers to the way in which a system is installed, not the way it is controlled. Any good WHA system, whether wired or wireless, should provide a way to control the system wirelessly via an app. A reliable and robust WiFi network is imperative for the smooth operation of any WHA system and is even more important should you choose a wireless or hybrid wireless solution, both of which are taxing on band width.

Summary

For large homes, modern whole-house audio systems should include in-ceiling speakers wherever possible, inexpensive but sophisticated audio streamers (including at least one or two with voice user interfaces (VUI) such as Amazon Alexa and Google Assistant), an app for controlling all audio zones, and the ability to integrate audio into home automation scenes, e.g. adding music to your “welcome home” and “wake up” scenes for lights, thermostats, security, etc.

Additional features are icing on the cake- such as control from wall-mounted keypads and touchscreens, the ability to integrate audio sources located throughout the home (not just in one central location), and the ability to stealthily hide your equipment wherever possible.

In many cases, the only cables that need to be run are speaker cables that connect your amplifiers to your ceiling speakers. At HTD, we highly recommend running a Cat 5e or Cat 6 cable (hereafter referred to as “Cat cable”) to the center ceiling of every major room for adding and concealing a Voice Assistant/Streaming device, and a Cat cable to any wall where you might choose to add a keypad, now or in the future.

With a little education and guidance, you can purchase the necessary equipment on your own and install everything yourself, with a huge cost savings and a better understanding of how everything works so that you’re not dependent on a third party for future enhancements and modifications.

Whole House Audio Defined

For purposes of this white paper, “Whole House Audio” (WHA) is synonymous with “multi-room”, “multi-zone” and “distributed” audio. It refers to a system that divides your home into unique audio zones, typically listening in stereo. A zone is defined as an area forced to listen to the same source. It is possible to have different rooms within one zone, each with its own control over volume. So, as an example, it is possible to
have 8 rooms covered by a 6 zone system. The primary function of the WHA system is listening in stereo from “streamers” and TV, although any equipment that outputs audio such as a media player, smart phone, home theater receiver, gaming system and even older tech like CD/DVD players, tuners, etc. can be utilized.

In addition to individualized control of each zone, to truly be considered WHA, you must also easily be able to simultaneously hear the same source, in sync, in any combination of zones. Wired systems achieve this because each source is routed through a centralized controller or matrix that can “feed” that signal into the desired zone(s). Being able to wirelessly stream into different zones of your home and have the speakers in those zones play in sync (that is, without noticeable echo from one room to the next) is a fairly recent innovation popularized first by SONOS.

Today, there are several competing wireless options, including some that are significantly less expensive, offered by behemoths like Amazon, Apple and Google. Each of these companies (and several others) offer all-in-one “smart speakers” that can be placed on tablespops and bookshelves. Thankfully for us smaller manufacturers, Amazon and Google also offer the brains of these smart speakers separately and inexpensively (e.g. Amazon Echo Dot and Echo Input and Google Home Mini) for those looking to use better quality amplifiers and speakers, including the more custom solution of speakers installed in the ceiling or wall.

Whole House Audio versus Surround Sound

It is important not to confuse whole-house audio with surround sound. Surround sound refers to the way in which sound is distributed within a single room, typically for the purpose of matching the audio to a video source displayed on a screen- think “home theater” and “media rooms”- although it is not uncommon for master bedrooms and other rooms in the house to be set up with surround sound.

WHA refers to the distribution of stereo audio throughout the home. Whereas surround sound requires a home theater receiver for processing video and audio in multiple formats (e.g. Dolby Digital, Dolby Atmos, DTS, Auro-3D, etc.), a whole-house audio system requires equipment that manages what audio source is heard, and at what volume, within each zone.

Key Components of Any Audio System

To best understand the different ways audio can be distributed throughout a home, it is necessary to understand at a high level the key components of any audio system, including so-called “smart speakers”. The primary audio components are: Source, Amplifier, and Speaker.

- **Sources** are components that provide the content of the audio signal. They connect to the amplifier with a signal that is in analog format. Even if you have a digital source, the signal must be converted to analog before it is sent into the amplifier using a DAC (digital to analog converter). Sometimes this DAC is built-in to the source equipment, sometimes in the amplifier itself, and sometimes the DAC is a stand-alone unit (usually of higher quality than built-in DACs).
- The **amplifier** then amplifies that analog signal and sends its now-powered signal along speaker cable into a speaker.
- The **speaker** vibrates in sync with the audio signal, ultimately creating the sound waves you hear.

Definitions of Common Audio Systems

A **powered speaker** is simply a speaker with an amplifier built inside the same enclosure.
**Wireless speakers** take the powered speaker a step further and include a source (often a Bluetooth player) built-in as well.

**Smart speakers** are wireless speakers that include a source that can stream music from internet services, and very often include a Voice User Interface (VUI) or Voice Assistant such as Google Home, Amazon’s Alexa, or Apple’s Siri.

A **wireless system** is a collection of multiple smart speakers placed on bookshelves, nightstands, etc. spread throughout the home. To be considered a WHA system, at least one common source must be able to play in sync on every smart speaker.

A **wired system** is one in which the source, amplifier, and speaker are not all built into one box. As such, the wires or cables required to connect them are exposed. Wired systems are not nearly as complicated to connect as many people imagine, and they offer a huge benefit in their ease of sharing a single source to every zone in addition to the flexibility of being able to place speakers virtually anywhere. In fact, the amplifier and speaker can be separated by hundreds of feet, allowing amplifiers and sources to be centrally located (in some cases sources can also be spread throughout the home such as with our Lync system), while speakers are installed throughout the home, most often in the optimum position for background music and entertaining the ceiling.

A **hybrid wireless** solution is a combination of a wired and wireless system. A hybrid wireless solution does not typically utilize a centrally located amplifier, but instead relies on multiple stereo amplifiers spread throughout the home. For zones to play the same source at the same time, a music streamer capable of playing in sync with other streamers must be connected to each amplifier. Speakers are wired to each amplifier and can be placed on bookshelves, night stands, and whenever possible, within the ceilings and walls of the room.

A hybrid wireless solution offers the same functionality as spreading multiple smart speakers around the home, but without the limitations inherent in all smart speakers:

1.) By including the amplifier and the speaker in a single enclosure, a smart speaker is, by definition, mono unless you put two into every room to create the stereo effect. This adds a little complexity to setup, but mostly it just doubles the cost.

2.) Smart speakers include smaller drivers and a plastic enclosure, both of which limit performance - especially bass and volume.

3.) Most importantly for WHA, there is no smart speaker option for in-ceiling speakers (due to mounting and electrical outlet location issues). The larger woofers built into in-ceiling speakers mean better performance and volume, and their placement is not only less obtrusive but also better for filling a room even when that room is packed with people.

**Music Streamers and Music Services**

HTD systems are “source agnostic”, meaning they work with any audio source. What you connect to the system now and in the future is completely up to you. That said, in nearly every case, we highly recommend connecting at least one music streamer as one of those sources.

A **music streamer** (sometimes called a network player) is a device that accepts digital audio files, most often from the internet via a service, and outputs the sound into your whole-house audio system or amplifier. **Music services**, such as Pandora, Spotify, Apple Music, Amazon Music, Tidal, SiriusXM, etc. are subscription-based platforms that provide music files, in various formats and quality levels, that you don’t own or download per
se, but that play through your music streamer. Some music streamers also include the ability to retrieve and play music files stored on your smart phone or tablet or elsewhere on your home network.

Music streamers sometimes have their own app, but in most cases the app provided with your music service is what you will use to control what artist, album, playlist, etc. you listen to. With a whole-house audio system, you can spread that single source (in this case, a music streamer) to as many zones as you’d like.

The most popular music streamers are inexpensive ($25-100, with the exception of Sonos Connect at $350) and new models and new features are continuously evolving. For this reason, our systems do not include a built-in streamer. Keeping our systems “source agnostic” allows you to easily replace or add new streamers as they become available without having to scrap the entire system.

The music streamer(s) you select will depend on:

- The brand of phone(s) and/or tablet(s) you use
- The music services (Pandora, Spotify, Tidal, Amazon Music, iTunes, etc.) you select
- The resolution of the audio files you choose to stream (i.e. CD quality to High Resolution Audio (HRA))
- The features you want – examples include whether or not you want a Voice Assistant built-in or the ability to stream music files stored on your phone and/or network

Some of the most popular music streamers right now include Google Chromecast Audio, Google Home Mini, AudioCast, Sonos Connect, and Amazon Echo Dot.

Choosing a Wired or Hybrid Wireless Solution

A wired solution implies that cables be run from each zone to a central location. This includes speaker cables for ceiling speakers and Cat cables wherever a Voice Assistant or Keypad would be installed. A hybrid-wireless solution requires cables to only be run within a zone for ceiling speakers and a ceiling-mounted Voice Assistant. With hybrid-wireless, zones are grouped together wirelessly. As mentioned earlier, in both cases zones can be controlled wirelessly and include wireless streaming audio.

Wired Mid-Level Systems (models MC and MCA). Sources and amplifiers are located in a common central location and speakers are individually “wired” with speaker cable spread throughout the home. The app for your smart phone or tablet determines which source to play into each zone and at what volume. You have the flexibility of independently assigning every source into one or multiple zones including the ability to play the same source simultaneously in all zones. The app includes the ability to create Groups for quickly and easily controlling multiple zones all at once, and an unlimited number of Presets so that a single button press sets up your entire house exactly the way you want it – think “dinner party”, “relaxing evening”, “wake up”, “end of day”, etc.

A choice of two Keypads can be mounted into the wall for added convenience within a room using a separate Cat cable (Cat 5, Cat 6) run between the central location and each keypad.

Our mid-level systems integrate with many of today’s popular home automation platforms and apps. Benefits include adding voice control of the system, adding audio to home automation “scenes”, and adding audio to scheduled or triggered events.

Click here for a complete list of features and more details about our mid-level MC and MCA systems.
**Wired Lync Systems (models Lync 6 and Lync 12).** Amplifiers and some sources are located in a common central location; other sources are spread throughout the home and “wired” back to the same central location with their own Cat cable or daisy-chained with a keypad connected via Cat cable. The most common “zone sources” are a TV or music streamer with VUI (such as Amazon Dot or Google Home Mini), although computers/media players, gaming systems, and CD/DVD players are also often utilized. Speakers are spread throughout the home and are connected back to the central amplifier with speaker cable.

See **Music Streamers** above. With Lync, music streamers can be located centrally or spread throughout the home. In addition to the central location, Lync also allows one source located within every zone to be used as a dedicated or common source.

LyncPad keypads can be mounted in a wall for added convenience and to take advantage of Lync’s built-in intercom feature. LyncPads are connected to the central location via Cat cable (at least one per zone). An inexpensive Standard Input Panel (SIP) can be daisy-chained with Cat cable to any LyncPad providing a convenient source input point located within each zone. Specialized input panels, such as a Blue-tooth Input Panel (BIP) and Digital Input Panel (DIP), can also be added using Cat cable.

Like our MC and MCA systems, Lync can be controlled using our highly customizable and user-friendly app. Lync systems also integrate with many of today’s popular home automation platforms and apps. Benefits include adding voice control, adding audio to home automation “scenes”, and adding audio to scheduled or triggered events.

[Click here](#) for a complete list of features and more details about our Lync systems.

**Hybrid Wireless.** There is no central location. Sources and amplifiers are spread throughout the home. Speakers are connected to the amplifier via speaker cable and typically remain in the same room or general area as the sources and amplifier. Speakers can be mounted on a wall, placed on a shelf or stand, or preferably mounted in the wall or ceiling with some DIY handiwork. The amplifier is compact, so it can easily be hidden within the room on a bookshelf, in a nightstand, or even mounted to a wall behind a TV.

The amplifier includes Auto-Detect and Switch (ADS™) between a primary and secondary source. Automatic signal detection and source switching means you hear the source you want, when you want, automatically. While it is not easy to share a source located in one zone with any other zone, it is still possible to play the same streaming music at the same time in multiple zones as long as each zone includes a compatible music streamer—examples include Google Chromecast Audio, AudioCast, Sonos Connect, and Amazon Dot.

HTD offers an innovative solution to custom install an Amazon Echo Dot into the ceiling in a way similar to that of our in-ceiling speakers. A single Cat cable carries both the power for the Dot and its audio signal back to your equipment over a distance up to 200 feet. **Regardless of the type of WHA system you choose,** if you are building a new home or are in the middle of a significant remodel, do yourself a favor and run a separate Cat cable from each zone’s amplifier location to a location in the ceiling of every zone. This will allow you to add a Voice Assistant (such as Alexa) into that zone providing voice control over not just home audio, but all types of home automation.

There is no HTD app for controlling a hybrid wireless solution. Instead, power on/off and source selection occurs automatically with ADS™. Volume is controlled by the source itself, whether it be the remote control for the TV (assuming the TV is one of your sources) or by the app for the music service you are streaming. Amazon’s Echo Dot is the perfect primary source. The volume and the music service you stream can be
controlled by both the Alexa app and via voice commands. Check with Amazon for their current list of music services (e.g. Amazon Music, Spotify, Pandora, iHeart Radio, SiriusXM, etc.) that stream through the Echo Dot. Click here for a complete list of features and more details about our Hybrid Wireless solution.

In Conclusion

Purely wireless solutions provide the easiest installation but do not provide the sound performance and coverage that is possible with a wired or hybrid-wireless WHA solution. Unlike wireless systems, wired and hybrid-wireless solutions require speaker cable be run to in-ceiling speakers, but the benefits are worth it. Additional cable is not required but Cat cable should be run if you are in the process of building a new home in order to benefit from additional features and to add the convenience of wall-mounted control pads and ceiling-mounted voice assistants and streamers. For all quality systems - whether wireless, wired, or hybrid wireless - an easy-to-use and well-conceived app makes control of the audio spread throughout your home a joy to use every day.

A Quick Note About Centralized vs Local VIDEO. HTD does not make video equipment but we are often asked by our customers about whether or not to attempt to centralize video switching in a way similar to a whole-house audio system. We highly recommend AGAINST centralizing video. Unlike audio, where the amplified signal can be transmitted over long distances of speaker cables quite easily without degradation in performance, video technology is constantly improving and requiring more bandwidth. Had you installed an expensive centralized HDMI matrix switch just a few years ago, it would already need replacing if you wanted to upgrade to 4K, let alone 8K which is already making its way into retail. And, there is a distinct possibility that the Cat cable you installed for video transport will not work with 4K or 8K. In short, inexpensive video streamers can easily be connected to your TV, projector, or home theater receiver and later replaced as new technology is introduced.

Our highly trained and experienced customer support reps are tasked specifically with ensuring your home audio project is a success. We offer a free upload-your-plans service where we assist you in identifying all of the audio equipment you need, whether or not it is made by HTD, and make suggestions on where key equipment and speakers should be installed.

Ask a general question. Free Upload-Your-Plans Service.

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