Listen Tech-Note

Understanding & Minimizing Wi-Fi Latency

Overview:

This tech note covers the inherent latency when transmitting audio data over Wi-Fi systems and the contributing factors to this latency, and create an understanding of these factors in an effort to optimize the system for best audio and video timing.

Inherent Latency:

There is an inherent amount of latency within Wi-Fi technology. This means it takes the audio data a certain amount of time to reach the mobile device, which can often mean there will be a difference between the audio and video timing. Inherent latency is a result of the time required for an audio signal to be extracted and sent to the PL-900 server for processing. The signal is then sent to the PL-301 Wireless Access Point (WAP) to be broadcasted to the mobile devices. The majority of inherent latency is attributed to the WAPs time to transmit the audio data and for the mobile devices to process and play the audio.

Mobile devices vary greatly in performance and latency, largely dependent on their make and model. Please see Figure 1 below for latency ranges of Apple and Android.

Note: Apple devices typically perform better and have lower latency ranges in comparison to Android devices.

Figure 1 – Latency Ranges

Operating System	Latency in Milliseconds
Apple	170-214 ms
Android	252-463 ms

Other Contributing Factors to Latency:

There are multiple contributing factors that can increase the amount of inherent latency with a Wi-Fi system.

- Wi-Fi Interference: If there are multiple WAPs operating on a similar frequency within the same area, then the devices connected to those WAPs may experience an increase in latency due to interference.

- WAP Encryption: When encryption is enabled on the WAP, latency generally increases. This means if you program your WAP so that clients must enter in a password to connect to the WAP, additional latency may be added to the inherent latency of the system.

- Mobile Device: Certain phones have a longer delay in Wi-Fi reception & audio data processing. As seen in Figure 1 above, the latency can vary greatly. Outdated models tend to have slower processing power, thus increasing the amount of overall latency.

Minimizing Audio Latency:

There are multiple methods that can be used to help minimize the difference between audio and video timing.

- Minimize Wi-Fi Interference: Areas that already have existing Wi-Fi networks can create a dense environment of Wi-Fi and potentially create interference with the ListenWiFi system. By using a Wi-Fi analyzer, the environment can be monitored and the analyzer will display which channels other WAPs are broadcasting on. This helps determine which channel(s) can be used with the PL-301 WAP to avoid those occupied channels. The PL-301 WAP can be accessed via a computer to manually set the channel of operation. Android devices can use a free app called 'Wifi Analyzer' to scan an environment for Wi-Fi signals, unfortunately Apple does not have a similar app available at this time.

- Proper WAP Placement: Avoid placing the WAP within 10 ft. of other WAPs or Wi-Fi emitting sources, it ideally should be placed within the same room/area where the mobile devices will be used so that they are all line-of-sight of the WAP.

- Avoid WAP Encryption: Setting a password on the WAP increases the latency in the system. If security is a concern, the internet connection can be pulled from the ListenWiFi server so there is no connection to the building's network; the ListenWiFi server still functions as normal without a connection to the internet.

- TV Input Lag: A television's input lag is the amount of time that elapses between a picture being generated by a source and that image appearing onscreen. Some TVs can have input lag of over 100 ms (though most are less.) Using a TV with a higher input lag can be advantageous in aligning the audio timing to the ListenWiFi system, due to this inherent input lag.

- Method of Audio Extraction: The audio timing can often be out of sync with the video before even being sent to the ListenWiFi system. This is largely dependent on where the audio is being extracted from.
    - Cable Box – This is the method of extracting the audio from the auxiliary output of the cable box that supplies audio/video to the TV. Typically, the audio timing can be slightly ahead of the video, due to TV input lag, which helps minimize the overall latency.
    - HDMI Audio Extractor – This method uses an HDMI audio extractor. The HDMI TV signal is routed through this device so that the audio may be extracted and routed to the ListenWiFi system. Typically, the audio timing can be slightly ahead of the video, due to TV input lag, which helps minimize the overall latency.
    - TV Audio Output – This method is extracting the audio directly off the TV audio output. Typically, the audio and video are aligned properly when using this method. This is disadvantageous when trying to minimize the overall latency.

Audio Delay:

In certain scenarios, the audio timing can be ahead of the video display. There is a setting within the PL-900 server to set an audio delay so that the audio timing can be properly aligned with the video. The server can be setup to delay audio up to 3000 ms, this setting can be changed via the server admin page.

Should you have any further questions, require assistance in applying settings or help determining which solution would be best for your application, please contact Listen Technologies' technical service team at 801.233.8992 or support@listentech.com for further assistance.