NETWORK CONFIGURATION GUIDE

Listen EVERYWHERE (LE) was designed to be used on pre-existing wireless networks as a plug-and-play system, however it might be necessary to have an IT/Network Administrator assist with the initial setup to ensure proper functionality. This guide will provide you instructions for configuring the network where the LE system will be deployed.

HOW IT WORKS

LE streams audio over Wi-Fi to connected Android and iOS smart-devices. This process has two phases: Discovery and Streaming, in the discovery phase the LE app on the smart-device seeks out the LE Server on the Wi-Fi network via mDNS. It then moves to the streaming phase, where audio is streamed unicast (UDP) from the LE server to the LE app on the connected smart-device.

NETWORK REQUIREMENTS

The network requirements can vary based on the number of simultaneous users the system will need to support. The most basic requirements are:

- Enterprise Grade Router. Consumer Grade routers do not always have the required features or configuration options. Contact Listen for more info on compatible routers.
- Enterprise Grade Access Point(s), 802.11n or better (802.11ac is recommended).
- Multicast UDP (mDNS/Bonjour/Avahi) is enabled (see Enabling Multicast UDP).
- The data load is approximately 140 kbps per connected user. It is recommended that Listen Everywhere traffic only account for 20% of the total available bandwidth.
- Internet connectivity to the LE server is required for initial setup and for some features to be available (See Internet Connectivity).

SUGGESTED SETTINGS

Though not required for the LE system to function, there are several optimizations that can improve performance:

- No Wi-Fi Encryption is used. Using encryption will lower the number of users that can connect to the Access Point and add latency to the LE system. If encryption is used, WPA2-AES is preferred. TKIP encryption should not be used.
- Enable Quality of Service (QoS) on the network (see Enabling QoS).
- Do not use range extenders, mesh networks, or multi-hop networks. Doing so may add latency, noise, or cause dropouts.
- Set the BSS Minrate to 12,000 (12 Mbps). This will disconnect clients from the network if their signal strength is too low, reducing strain on the AP.

- Assign the Listen Everywhere server a static IP through the LAN Manager.
- Set access points to static channels (see AP Channel Optimization).

INTERNET CONNECTIVITY

Note, an internet connection is not required for the LE system to function. However, the LE server must be able to reach the Cloud Manager (see Ports and Services) for the initial setup and for some features to function.

The following features are available without a persistent connection to the cloud manager:

- Audio Streaming
- Theme Settings (title, colors, images)*
- Channel Settings (names, images, gain, delay)*
- Welcome ad (image or video)*

The following features require a persistent connection to the Cloud Manager:

- Banner Ads
- Offers
- Documents
- Analytic Reports
- Firmware updates
- Downloading log files

Initial setup requires an internet connection and will then function without.
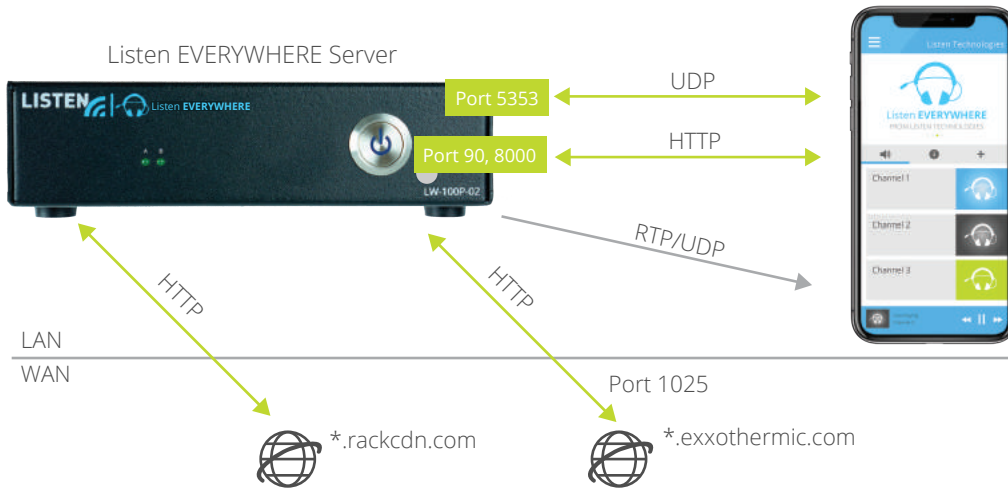
STAND-ALONE NETWORKS

When a stand-alone network is desired, the LE server can function as the DHCP server. This setup does require that at least one access point be used. When the LE server is powered on, it checks for a connected DHCP server. If it doesn't find one within 5 minutes, it will become a DHCP server. No internet connectivity is available when in this mode. The network setting when in DHCP mode are:

- Gateway: 172.30.0.1
- Netmask: 255.255.0.0
- Lease Time: 2 Hours

PORTS AND SERVICES (see graphic on next page)

- LAN ports and services
    - LE server / phone app discovery:
        - LE server exposes an HTTP server on **port 8000**
        - LE server exposes a file server on **port 90** to download promotional media (e.g., images, labels, etc). Protocol is HTTP.
    - Audio Streaming:
        - LE server sends RTP packets using UDP to the apps over a range of ports Mobile apps listen for UDP on **port 16384**
- WAN ports and services
    - LE server communicates with the Cloud Manager at ***.exxothermic.com** (IP address: 108.166.110.178, but subject to change) via **port 1025**. Protocol is HTTP.
    - Media files are stored on ***.rackcdn.com**. Protocol is HTTP

Listen EVERYWHERE Server

Port 5353 — UDP
Port 90, 8000 — HTTP
RTP/UDP

HTTP
HTTP

LAN
WAN
Port 1025

*.rackcdn.com   *.exxothermic.com

ENABLING MULTICAST UDP (mDNS/Bonjour/Avahi):

Multicast is used in the discovery process for the app and the server to connect via the "Scan" feature, which allows automatic connection when the app is opened.

To enable mDNS, perform the following:

- Add the following services to the allowed list in the Router/AP mDNS settings:
    - **_ExXothermic._tcp**
    - **_AsClient_ExXothermic._tcp**
- Open **Port 5353**
- Add the mDNS IP address to the allowed subnets list. **224.0.0.251** is the most common mDNS IP address, but it could be any of the **244.0.0.0/24** range

In the event multicast discovery is not the preferred connection method, mDNS can be disabled and connections to the LE server can be achieved by entering the IP address or hostname (serial number) of the server into the app.

*Note: for specific assistance with Aruba APs: **www.listeneverywhere.com/aruba/***
*Note: for specific assistance with Cisco Aps: **www.listeneverywhere.com/cisco/***

AP CHANNEL OPTIMIZATION

Many access points can automatically change channels to try and find one with less interference, which can cause audio drops each time the channel changes (as frequent as every 20 seconds). If a channel is not settled on after 30-60 minutes, it may be best to choose a channel manually.

When manually setting channels, you should use a Wi-Fi signal analyzer.* A Wi-Fi signal analyzer will provide a clear picture of the signal congestion in your space.

Channel width for 2.4GHz is very important. It should be set to 20MHz. Wider channels are more susceptible to interference.

*For Android devices, we suggest the 'Wifi Analyzer' app. No comparable app is available for iOS.
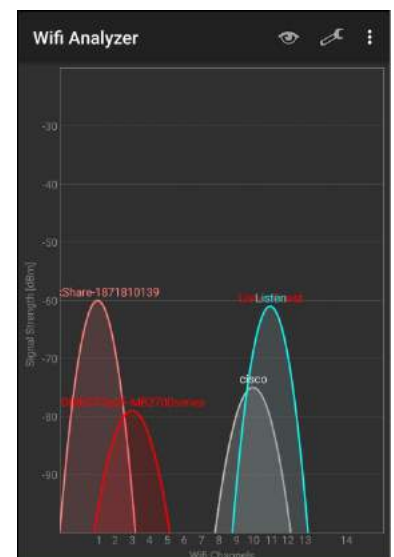
ENABLING QoS (QUALITY OF SERVICE)

By default, the LE system uses QoS tags so that audio data can be prioritized over other data traffic on the network, which can provide improved audio quality. However, for this to function, it must be enabled on the network as well.

- Turn on WMM (Wireless Multimedia Extensions) in the access point.
- Turn oon QoS in Switch/Router.

GUEST NETWORKS

Most access points have a 'guest network' option, which creates a network with tighter security settings. Settings can vary by manufacturer but will usually include client isolation, which prevents connected wireless devices from communicating with other devices on the network (such as smart-devices communicating with the LE server) and disables mDNS (Multicast DNS).

To bypass client isolation to allow wireless clients to connect to the Listen Everywhere server, you must add the Listen Everywhere server to the allowed address list (whitelist) for the Guest VLAN in the router configuration. For some routers require that this is done by IP address, and some by MAC address. The Listen Everywhere Server MAC address can be found on the serial number label on the unit and in the Cloud Manager. The IP address is also available in the Cloud Manager. The mDNS IP address must also be whitelisted (see Enabling Multicast UDP).

*Note: Visit **www.listeneverywhere.com/guestnet/** for more detailed*

MESH NETWORKS

A mesh network is a type of network topology where each node in the network is connected to every other node, which can cause Multicast discovery issues, increased latency, and audio dropouts. The use of Mesh Networks are not recommended.

CISCO FLEX CONNECT:

Cisco's Virtual Network Controller requires the use of FlexConnect, Cisco's version of a mesh network, which is not recommended, whenever possible. By default, only recognized mDNS services are allowed, such as from a brand-name printer. To allow the Listen Everywhere services you will need to go to CONTROLLER > mDNS > General in your Cisco Network Controller, then do the following:

- Ensure mDNS Global Snooping is enabled
- Add the following services to the Master Services Database
    - **_ExXothermic._tcp**
    - **_AsClient_ExXothermic._tcp**

TROUBLESHOOTING

The app on the smart-device will not connect to the LE server:

- Verify that the smart-device is on the same network. Check the IP address of the smart-device and the IP address of the Listen Everywhere server to verify they are in the same IP range.
- If it will connect by IP or hostname but not via the scan feature there is an issue with the Multicast settings (see Enabling Multicast UDP).

Audio cuts out, has high latency, or excessive noise:

- Wi-Fi interference from other Wi-Fi signals (see AP Channel Optimization)
- Bandwidth bottleneck at the access point
    - Is there enough bandwidth for the number of users? More capable or additional access points may be added.
    - Encryption lowers bandwidth. Consider disabling encryption, or make sure WPA2-AES is being used, as it has the lowest impact on bandwidth.
    - Enable QoS (see Enabling QoS).

    Check the audio source
    - Long cable runs from the audio source to the Listen Everywhere server should be balanced to avoid introducing interference.
    - Is the audio being input at the nominal level? Input audio should be line level, not Mic level.

    Please contact Listen Technologies with additional questions at **support@listentech.com** or **1-800-330-0891**.