FTC-Live Network Setup

Setting up a local network for use with FTC-Live and tablets/displays

Revision History	
Revision	**Description**
25-26.1	Initial 2025-26 Season Release

Introduction

Network Topology

The FTC-Live Event Management Software is the official software to manage and run your *FIRST* Tech Challenge event. The software hosts a local web server that is used to communicate with Referee tablets, displays, Judge laptops, and other devices that may want/need to access various features of the software. A local wireless network should be set up in order for devices to connect to the Scoring Server. A simple sample network topology chart can be seen below:

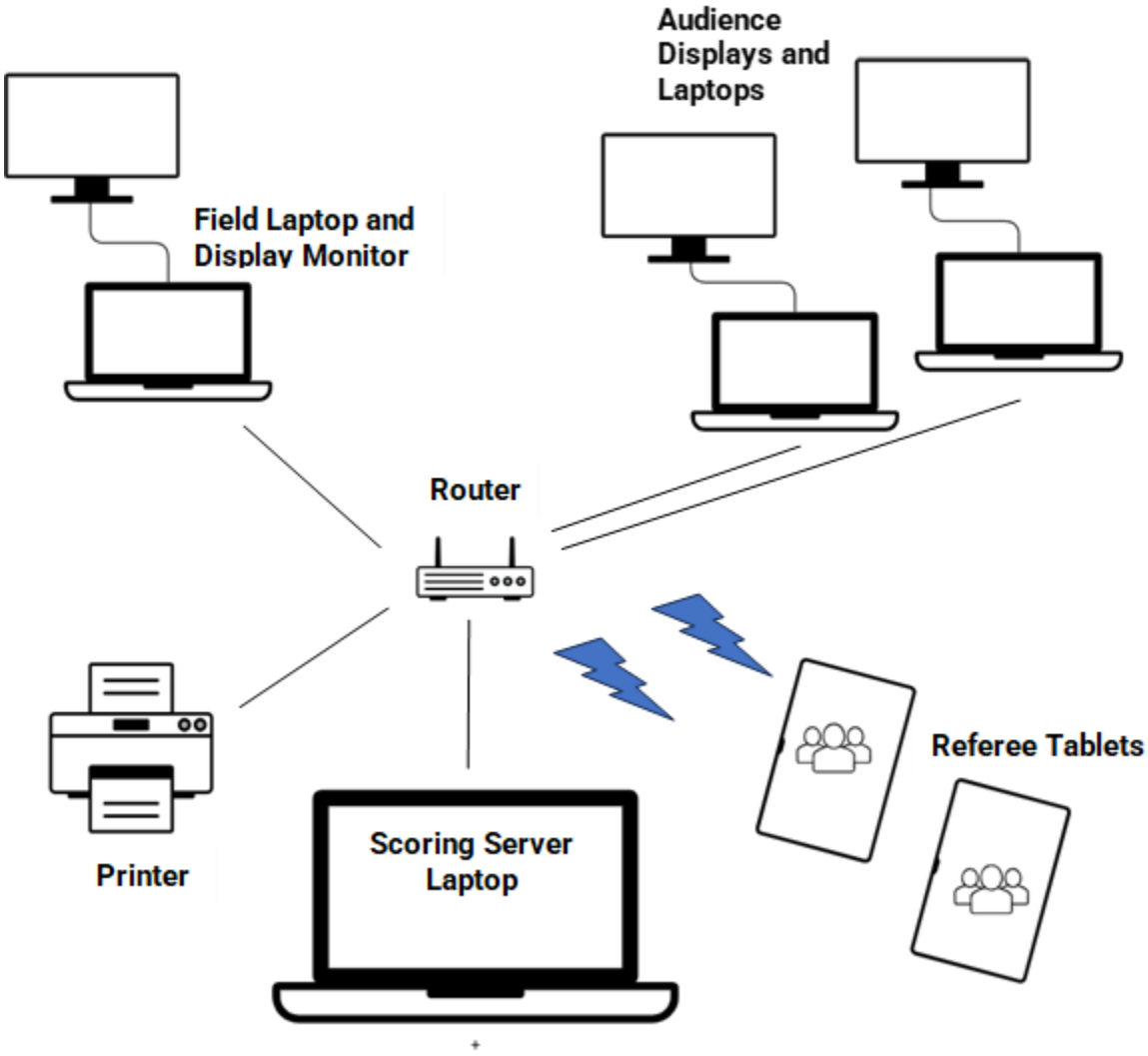

Figure 1: Typical Network Topology for use with Scoring Server.

In this configuration the Wi-Fi router provides DHCP-assigned addresses to all connected devices whether they are wired or wireless, whether the router is connected to an internet connection or not. The router provides a Wi-Fi SSID that all wireless devices connect to, and all devices on the network can communicate with one another.

Components of this topology include:

Table 1: Devices used as part of FTC-Live Network

Device	Purpose	Count
Scoring Server Laptop	Running FTC-Live Software	1-3, depending on Single or Dual Division and available hardware
Wi-Fi Router	Provides Wired/Wireless Connectivity between devices	1
Field Display	Show Field Timer content	1-3 per division, depending on the number of fields in use and number of divisions in play
Audience Display	Show Audience Display content	1-2, depending on the number of divisions in play
Pit Display	Show Rankings and Pit content	1-2, depending on size of event
Referee / Inspector Tablets	Used for data entry and monitoring for Inspectors and Referees	3-5 per Referee crew, depending on number of Referees and role configuration
Printer	For printing materials for FIELD staff, teams, and event staff	Optional
Additional Devices	Judging laptops, etc.	Optional

Every component of this network can be run wirelessly – however, the Scoring Server Laptop(s), Field Display(s), and Audience Display(s) are recommended to be directly connected (via Ethernet cables) to the Wi-Fi router whenever possible in order to ensure minimal lag and disruption of key gameplay information during a match.

Wi-Fi Router Selection

The most overlooked aspects of running a *FIRST* Tech Challenge event is how to connect devices together via a Wi-Fi network – specifically connecting the Referee tablets to the scoring server. Often it is believed that the venue's Wi-Fi infrastructure will support this, when in fact it almost always will not. The ***only*** recommended method of connecting devices together via a Wi-Fi network is via a local Wi-Fi router that you supply. The reason is that most Wi-Fi networks in schools and venues have a feature known as "Access Point (AP) Isolation" or "Client Isolation" enabled, which is a security feature that prevents devices on the same local network from talking to one another across the network. More specifically it filters and discards all communications except those bound for the gateway (e.g., "the internet"), which prevents malicious actors on the network from communicating with or compromising other devices on the network (especially compromised IoT devices). "AP Isolation" is generally enabled on all public or "guest" Wi-Fi networks and enabled by default on most modern Android-based Wi-Fi hotspots (there is no setting to disable, however). Older pre-Android 11 hotspots like those used in FTC (e.g., REV Control Hubs and legal smartphones) often have AP Isolation disabled by default, as do most modern iPhone hotspots. However, this can vary greatly by manufacturer and/or carrier.

Remember, the only reliable Wi-Fi is the one you bring with you - and have tested beforehand on-site!

Most consumer-grade Wi-Fi routers will work fine for this use, often with very little configuration, though the difficulty in configuring will vary depending on the brand and the complexity of the device.

Most portable travel Wi-Fi routers (like the TP-Link TL-WR3602BE or ASUS RT-AX57 GO) are designed to work well for *FIRST* Tech Challenge uses, they more often can be put into a "Hotspot" mode that allows the router to connect to and share a Wi-Fi network (usually the school or venue Wi-Fi internet connection) while also creating its own private Wi-Fi network that devices can connect and communicate with one another on – this feature is also known as WISP (Wireless Internet Service Provider) mode. "Hotspot"/WISP mode is not required but is a convenience especially when holding events in parts of a venue without wired internet access.

Some consumer home Wi-Fi routers (like the TP-Link Archer BE6500 or ASUS RT-AX1800S, for example) can also be used, though many home Wi-Fi routers do not have a "hotspot"/WISP mode (or it is buried pretty deep within the configuration menus) and often only provide connection to the internet via a wired connection.

Connecting Devices

Once you have a Wi-Fi router set up and configured (consult the documentation for the router on how to do this – this is not generally something On-Call FTC Support can help you with) - and have connected/joined the devices to the router (by joining the router's Wi-Fi network) - there are a few simple steps that might, or might not, seem obvious.

Connecting the Wi-Fi Router to the Internet

It's not required that the Wi-Fi router be connected to the internet – this is only required if there is a desire to have ALL devices connected to the Wi-Fi router to have access to the internet (see "Connecting the Scoring Server to the Wi-Fi Router" for details about only giving the Scoring Server internet access). If this is your desire, there are several ways to connect the Wi-Fi router to the internet. This can be done wirelessly (via using a "Hotspot" mode on the Wi-Fi router or using WISP functionality to directly connect to the venue Wi-Fi) or wired (via connecting a venue's wired internet cable into the WAN port on the router). Consult your device's user manual for instructions on setting up Hotspot/WISP functionality. Understand that the venue might not by default allow routers on the wired internet, and if so then it might be necessary to work with the venue's IT department to place the router's MAC Address on the "allowed list"/"safe list" (if even allowed at all).

When using wired connections, be very careful about creating network loops – this is where a wired internet cable is used to plug a device (usually the router) into itself, and in some cases can cause the entire venue's network to stop working!

Most Wi-Fi routers have their different network ports color-coded, such as the TP-Link Archer AX21 shown in Figure 2.

Figure 2: WAN (blue) and LAN (yellow) ports on a Wi-Fi router.

In Figure 2 the blue port is the “Wide Area Network” (WAN) port, and the yellow ports are the “Local Area Network” (LAN) ports. Not all routers use the same color combinations, or any colors at all, to clearly differentiate between WAN or LAN ports; consult your router’s manual for port designations.

- WAN Port - ONLY the venue’s wired connection should be plugged into the **WAN** port; no local devices (laptops, peripherals, etc.) should ever connect to the WAN port. If no external wired internet connection is available, leave the WAN port unused.
- LAN Port – **LAN** ports are for local devices (laptops, peripherals, etc.). Never plug a venue’s wired connection into a LAN port, it can cause significant disruption to the venue’s network.

It is possible for some routers to configure the port labeled as a WAN port to operate as a LAN port - commonly done for portable Wi-Fi routers with only a few ports - but unless you have configured the router yourself you should not assume the Wi-Fi router has been configured in this way.

Connecting the Scoring Server to the Wi-Fi Router

The first step in connecting devices together is connecting the Scoring Server to the Wi-Fi router. This can be done either via a wired connection to a LAN port on the router or by connecting wirelessly to the router. The preferred method is to connect the Scoring Server to the Wi-Fi router via a wired connection, this type of connection is going to provide a more stable connection free of Wi-Fi interference in the venue, especially if robots are not sequestered to their own Wi-Fi channels. Any interference issues should be addressed by your *FIRST* Technical Advisor (FTA) or Wi-Fi Technical Advisor (WTA) to ensure that tablets can connect (and stay connected) to the Wi-Fi router. The Scoring Server is also recommended to use a wired connection to the Wi-Fi router to allow for the ability for the Wi-Fi on the laptop to be used to access the venue internet (if the Wi-Fi router itself has no internet connection). In this case, the Scoring Server will have internet access, but tablets and other devices connected to the network would not, which is completely fine.

Once the Scoring Server is connected to the router, the router will assign an IP address to the Scoring Server. If the Scoring Server only has a single network connection, then the IP Address shown at the top of any FTC-Live browser page is almost guaranteed to be the one to use to connect tablets to the Scoring Server. However, if the Scoring Server is using multiple network connections, (e.g., a Wi-Fi connection to connect to the internet as well), the IP address shown on the top of FTC-Live browser pages is just a “best guess.” To see all the possible IP addresses for the computer, ensure that the FTC-Live page is logged into the “local” account and expand the “Event Admin” drop-down menu to select the “Manage Server” option.

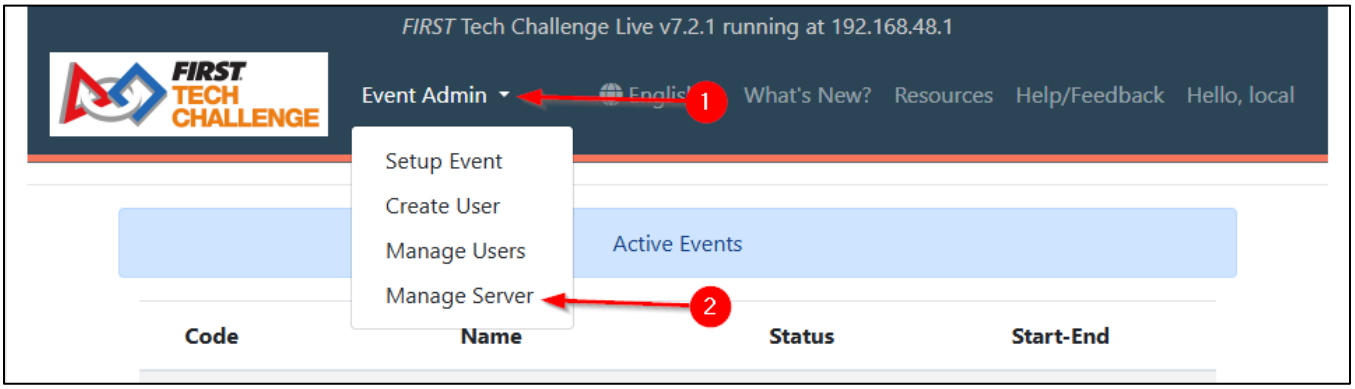

Figure 3: Opening the "Manage Server" page.

In the “Manage Server” page, scroll down to the “Refresh IP Address” section. This section shows you all of the IP addresses that are used on your computer and allows you to manually override which address shows at the top of browser pages (it has no functional use, only cosmetic). Figure 4 is an example of a computer with multiple network adapters in use. For the most part, if the IP address is in the list then it is a possible IP address for the computer; the lone exception is an address that starts with 169.254.x.y, that is a “link local” address and it means the adapter has not been issued an address by a router or other device serving up DHCP addresses. For *FIRST* Tech Challenge this is typically a sign of an improperly configured network router.

The ”update IP override” button can be used to display a different IP address on the top of the browser pages than the “best guess” one that is selected by default. Just select the IP address and click the button.

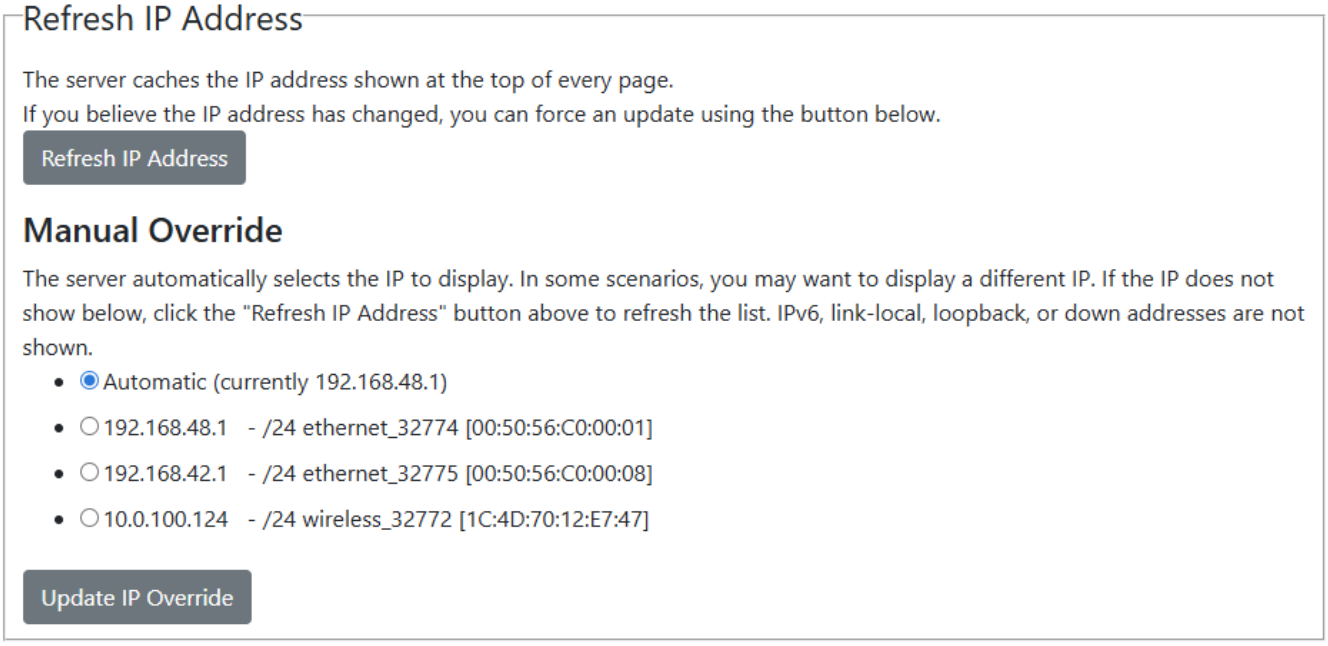

Figure 4: IP Address list when multiple adapters are in use.

Connecting other devices (Display, Tablets, etc.) to the Wi-Fi Router

Displays are recommended to be connected via a wired interface to a LAN port on the Wi-Fi router when possible, and via Wi-Fi when not possible. When connecting via Wi-Fi, connect to the SSID for the network.

To open a session to the Scoring Server, open a web browser (preferably Chrome) and type in the IP address of the Scoring Server in the browser's address bar. This should be the exact IP address shown in the top of the browser window on the Scoring Server; it's possible that there is a port added to the URL if a non-standard port must be used; these IP addresses could look like 192.168.1.23:8080 – the colon and number at the end of the address specifies the use of a different port (without the colon and port number, the browser uses port 80 by default).

Troubleshooting

It is a glorious day when everything "just works," but unfortunately there are just as many things that can go wrong as there are that need to go right. This section helps identify some common troubleshooting steps when connecting to the Scoring Server from a tablet or a display does not "just work." Often devices will connect to the Wi-Fi router just fine, and devices can often connect to the internet, but communicating between devices sometimes runs into trouble – in these cases, connecting to the Scoring Server's IP address usually times out (you get a "This Site Cannot Be Reached" error message, usually along with other messages).

Firewalls

The most common reason a device cannot connect to the Scoring Server, assuming everything has been configured correctly within the router, is the Windows Firewall on the Scoring Server. Disabling the Windows Firewall (both the Public and Private firewalls) is an easy step to determine the source of the issue, though almost always it is the Public Firewall that is blocking incoming requests. Disabling the Microsoft Defender Firewall is a fairly easy thing to do if you have Administrator access on the computer, but if you do not have Administrator permissions, then you may not be able to disable the firewall. An easy Google search can help you identify the steps to disable the Windows Firewall on your version of Windows.

Sometimes routers also have internal firewalls that can block messages, but generally router firewalls block outside network communications and not inter-device communications. However, some router firewalls implement AP Isolation/Client Isolation and may need to be disabled (this is a last resort since very few router firewalls directly manage this).

Third-party Antivirus programs like Norton, McAfee, or BitDefender often have their own internal firewalls that overrides Windows settings and may "lock down" the system when it detects a new network. Be sure to pay special attention to third-party antivirus programs and temporarily disable their firewalls if necessary.

Overlapping IP Ranges

The most common default IP address ranges for Wi-Fi routers are the 192.168.1.x or 192.168.0.x IP address ranges. This IP address range may also be in use by the venue's wired internet connection plugged into the Wi-Fi router or may be used by the venue wireless network connected to the Scoring Server Wi-Fi adapter. If any of these address ranges overlap/conflict, the Wi-Fi router must change its IP address range in order for network communication and routing to work correctly. Prosumer Wi-Fi routers and some home mesh Wi-Fi routers can automatically detect when there is an address overlap and can adjust its IP address range accordingly to avoid overlap; however, this is not very common. It is recommended to configure your Wi-Fi router to use one of the following "rarely used" Class C non-routable IP address ranges if it is determined that there is an IP address conflict:

Table 2: Less commonly used IP Address Ranges

LAN IP Address	DHCP Start IP Address	DHCP End IP Address	Subnet Mask
172.23.45.1	172.23.45.10	172.23.45.250	255.255.255.0
10.67.89.1	10.67.89.10	10.67.89.250	255.255.255.0
192.168.131.1	192.168.131.10	192.168.131.250	255.255.255.0

To determine if there is a conflict, first connect a laptop directly to the venue network and make note of the IP address issued by the network and the subnet mask. Then, connect to the Wi-Fi router and note the IP address and subnet mask. Ask your favorite AI tool if the IP address ranges conflict – this is too complex to describe how to do subnet math here, but your favorite AI tool can make quick work of it.

Generic Troubleshooting with the Ping tool

Most laptop devices have the ping tool built in, and this tool can provide innumerable insights into the health of the local network. To use this tool, use two laptops – one laptop should be the Scoring Server, and a second laptop should be the "test device." Connect both laptops to the same network (it does not matter if one is wired and one is wireless) and run the "cmd" command on the "test device" (Windows Key + R will open a "Run" command window for you to type "cmd" into and press ENTER). This will open a Command Prompt where we can run the "ping" command to send ICMP messages to the Scoring Server to determine its connectivity. "Ping" has a very simple command line, just type "ping" followed by a space and then the IP address of the Scoring Server. For example:

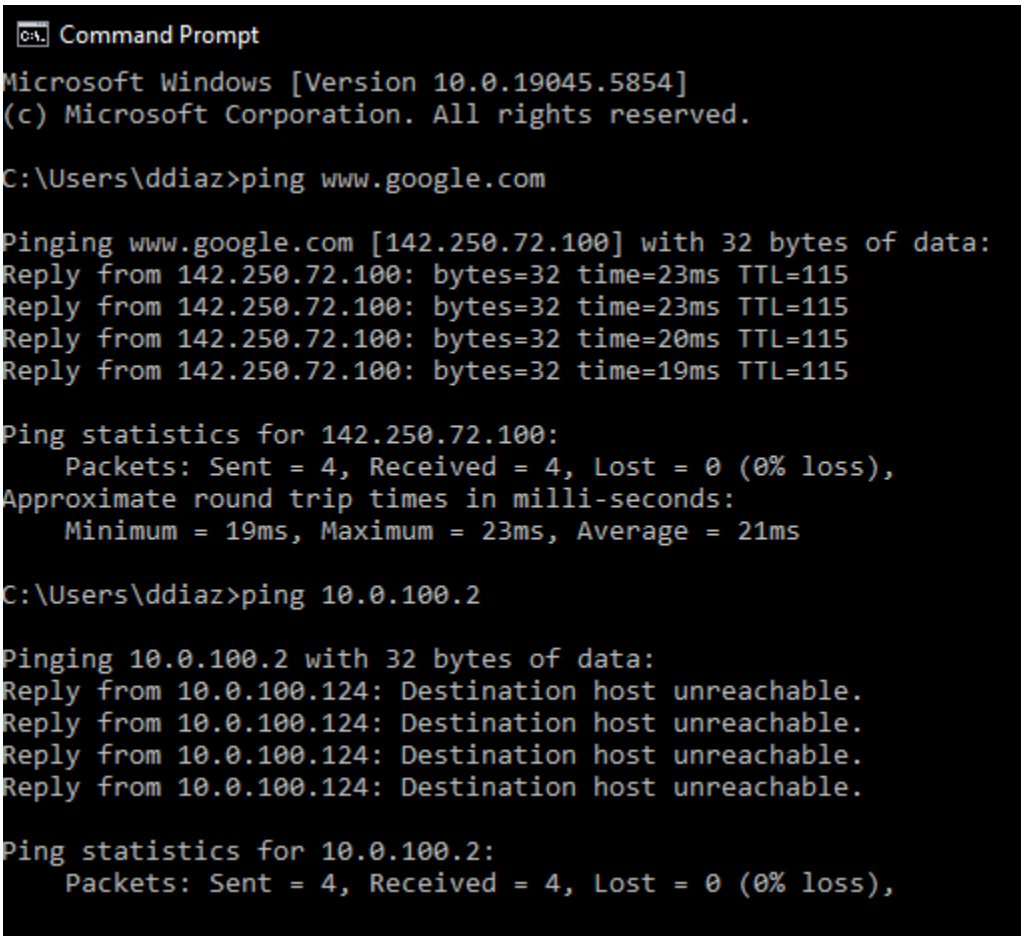

Figure 5: Running the "Ping" command with a URL and an IP Address

"Ping" can be used to test for a number of network-related issues. In the above example the Ping command is being used to test connectivity with the "Google" website as well as with a general IP address. The following table lists the most common results from the "ping" command:

Message	Potential Cause	Remediation
bytes=32 time=xx ms TTL=yy	Successful communication	None needed
Request timed out	IP Address is not communicating. Firewall may be blocking the receipt of the message on the destination machine, or the destination may no longer be online.	Check to make sure destination is online and connected. Ensure firewalls are not blocking messages.
Destination host unreachable	Could not find a valid route to the device. Network settings may not be configured correctly, such as a missing or incorrect default gateway.	Check the IP address, you may have entered the wrong IP. Check to ensure that both computers are connected to the same router. Check the IP address on both machines to ensure they are similar. Check to ensure a correct gateway has been set (or left blank)

Fun Fact: When you receive the "Destination host unreachable" error message, the IP address of the "reply" is the IP address of the local computer.

If the "ping" command successfully communicates with the Scoring Server, but tablets and devices still cannot connect to the FTC-Live interface via the IP address, it is possible that the device you are communicating with is not actually the device you expect. Remove the Scoring Server from the network and attempt the ping again; if the device continues to ping successfully, there may be a device with a static IP address on the same network or there might be overlapping/conflicting IP addresses between the venue network and the local network.

Rogue AP Suppression/Containment/Quarantine

It is important to note that most enterprise Wi-Fi systems, especially those in use by school districts and large venues, are equipped with functionality known as "Wireless Intrusion Prevention Systems" (WIPS). These systems are capable of sending messages to clients of "Rogue APs" (any access point not known by the system is classified as "rogue") that cause those devices to suddenly disconnect from the hotspot. This is also known as a "de-auth attack" in networking terms, but venue networks that have this type of functionality enabled can make it impossible to use an Access Point of any kind – this includes the Wi-Fi router used for the FTC-Live system as well as robots using SmartPhones for the robot or driver station. If devices are noticeably disconnecting from the Wi-Fi router, or robots are having a difficult time staying connected to their smartphone driver station device, consult with the local IT folks to determine if a WIPS system is being used in the venue.

Useful Links and Information

On-Call Support Numbers

On-Call Support

These numbers are for *volunteer support only*. Teams should not use these numbers to call about rulings or technical assistance.

Administrative, Judge, Referee and Non-Technical Issues:	(603)206-2412
Scoring System (FTC Live) or other Technical Issues: Call or use the built-in chat feature on FTC Live	(603)206-2450

Pre-Event Support

Mon – Fri	8:30am – 5:00pm Eastern Time (UTC-4 or UTC-5)
Phone:	(603)666-3906
Email:	firsttechchallenge@firstinspires.org

Program Resources

FIRST Tech Challenge Website	Event Search
Game and Season Resources	*FIRST* Tech Challenge Blog
Volunteer Resources	Team Email Blasts

Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!