2022-2023 *FIRST*® Tech Challenge

Wi-Fi Event Guide
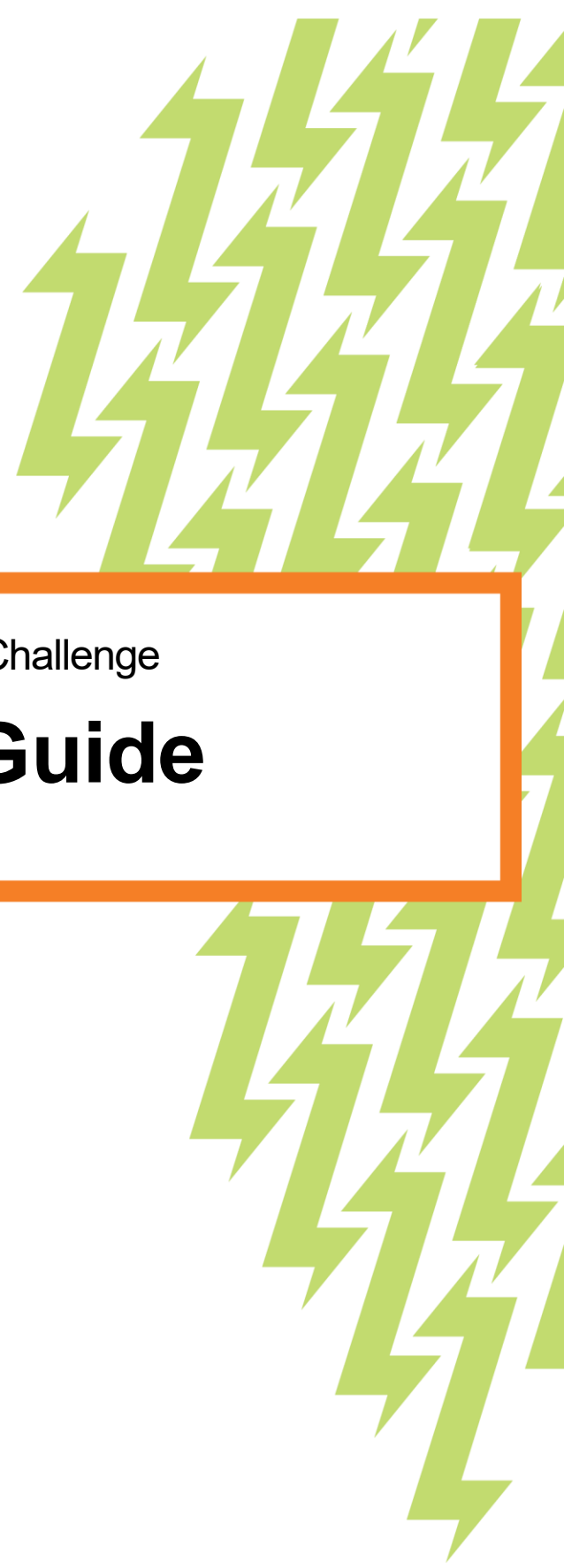
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Volunteer Thank You

Thank you for taking the time to volunteer for a *FIRST*® Tech Challenge event. *FIRST*® and *FIRST*® Tech Challenge rely heavily on volunteers to ensure events run smoothly and are a fun experience for teams and their families, which could not happen without people like you. With over 6,500 teams competing yearly, your dedication and commitment are essential to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!

Revision History		
Revision	**Date**	**Description**
1	05/31/2022	Initial Release

Contents

Introduction

What is FIRST® Tech Challenge?

FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. Participants and alumni of *FIRST* programs gain access to education and career discovery opportunities, connections to exclusive scholarships and employers, and a place in the *FIRST* community for life. To learn more about *FIRST*® Tech Challenge and other *FIRST*® Programs, visit www.firstinspires.org.

Gracious Professionalism®

FIRST® uses this term to describe our programs' intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this short video.

Learn more about the roles of volunteers on our Volunteer Resources page, "Volunteer Role Descriptions".

Introduction to the Wi-Fi Event Guide

The *FIRST* Tech Challenge control system uses an Android device as the primary robot controller. This system enables point-to-point wireless technology to control the robots. This document offers some basic suggestions on how to prepare for and support the wireless control system at any *FIRST* Tech Challenge competition.

Figure 1- FIRST Tech Challenge's Android-based platform

Point-to-Point Wireless Connectivity

The *FIRST* Tech Challenge control system is a point-to-point solution. This means that teams will use two Android devices to control their robot. The first device will be mounted on the robot and act as the *robot controller*. The second device will reside with the team drivers and will be connected to a pair of gamepad controllers. This second device is known as the *driver station*. The driver station will communicate wirelessly with the robot controller.

Teams use their driver station to control their robot. The driver station has a user interface[1] that the teams use to see status information about their robot, and to select special programs (called *op modes*) to run on the robot controller. During the driver-controlled portion of a match, teams can use their gamepad to direct functions on the robot controller. The gamepad may also be used by teams to configure the functionality of their autonomous programs, but during the running of the actual autonomous program, the teams are not permitted to touch their gamepad controllers or *driver station*.
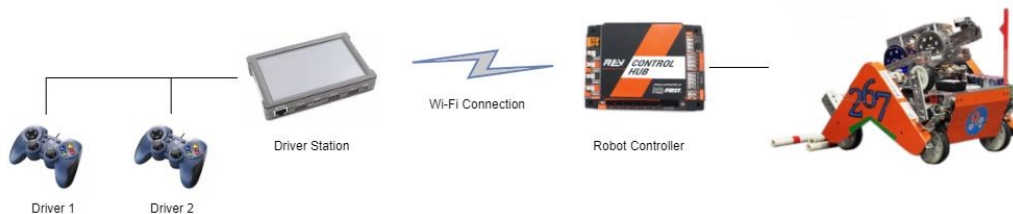

Figure 2- The FIRST Tech Challenge platform is a point-to-point solution

It is important to note that with a point-to-point control system, each driver station-robot controller pair establishes its own independent wireless network.

For example, if you have four robots operating in a venue, then you will have four independent wireless networks, one for each Driver Station-Robot Controller pair. If you have 16 robots operating in a venue, then you will have 16 independent wireless networks in that venue, one for each driver station-robot controller pair.

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[1] Note that the user interfaces that are pictured on the Android devices are simulated and do not reflect the current user interfaces that are available with the platform.
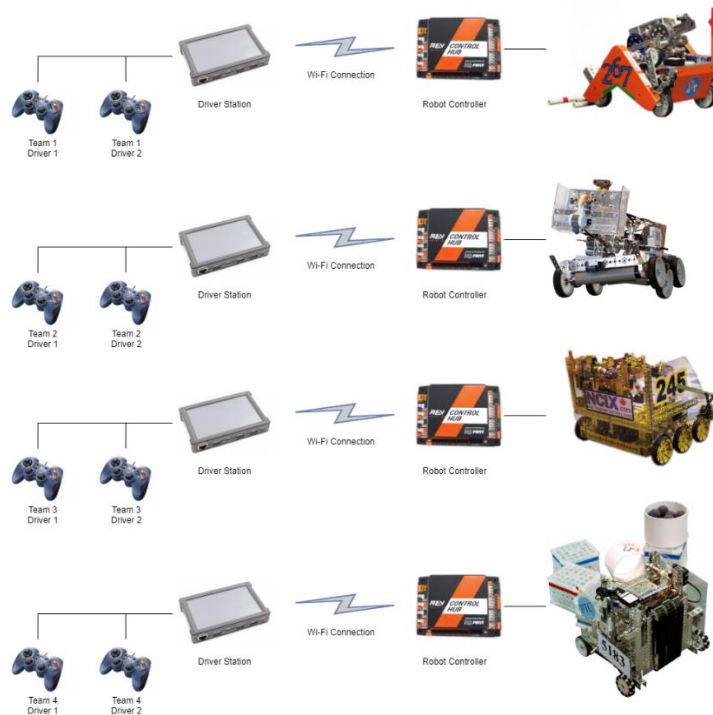
Gracious Professionalism® - "Doing your best work while treating others with respect and kindness - It's what makes *FIRST*, first."

Figure 3- Each driver station-robot controller pair establishes its own unique wireless network.

During a competition, each team will bring their own gamepads, driver station and robot controller. The teams are responsible for understanding how to establish and maintain the Wi-Fi connection between their driver station and robot controller. However, it is the responsibility of the Tournament Director to take some precautions before and during a *FIRST* Tech Challenge event to ensure that the wireless environment is "clean enough" so that the teams will have reliable, uninterrupted connections to their robots.

Volunteer Roles to Help Support the Control System

Field Technical Advisor (FTA)
The Field Technical Advisor (FTA) role is an important technical volunteer position responsible for identifying and troubleshooting minor technical issues on the competition field. The FTA should have good communication skills and be able to work with the drivers and coaches to troubleshoot minor problems and keep the matches running smoothly and on time.

The FTA should have a basic familiarity of the following subjects:
1. How the Android devices and robot hardware modules are connected and operate.
2. How the teams write and execute *op modes* for their robots.
3. How the wireless control system works.
4. How to identify and troubleshoot common minor problems with the robots and control system.

If a technical problem on the field arises and the FTA is unable to quickly identify and resolve the issue, then the FTA should pull the team aside and direct them to a Control System Advisor (if one is available). There should be at least one FTA per competition field at any *FIRST* Tech Challenge event.

Control System Advisor (CSA)

The Control System Advisor (CSA) role is another important technical volunteer position. The CSA is responsible for identifying and troubleshooting technical issues in greater depth than an FTA. Although the skills of a CSA and FTA overlap, it is important to have a CSA present at most *FIRST* Tech Challenge events. At a typical event, the FTA will not have time to provide in depth technical support while keeping the matches running on time. It is the CSA who is responsible for troubleshooting more in-depth problems with the robots, wireless control system and other technical issues at an event. The CSA might be required to work with the event venue's IT staff to ensure that the wireless environment will be clear and accessible at a planned *FIRST* Tech Challenge event. They should also have good problem-solving skills and be a good communicator. The CSA should be persistent and be gracious under pressure.

The CSA should have an in-depth understanding of the following subjects:
1. How the Android devices and robot hardware modules are connected.
2. How the teams write and execute op modes for their robots.
3. How to use development tools like the Android Debug Bridge (ADB).
4. How Wi-Fi and the *FIRST* Tech Challenge wireless control system work.
5. How to do basic monitoring of the wireless spectrum at an event.
6. How to troubleshoot wireless connectivity and performance issues at an event.
7. How to identify and troubleshoot common minor and more serious problems with the robots and their control system.

The CSA should have a solid understanding of these subjects and be able to act as a technical expert to the FTA, teams and mentors at an event. In addition to being able to solve robot-related issues, the CSA should also have enough knowledge of how Wi-Fi technology works so that he/she can troubleshoot wireless issues at an event and help an event manager plan, in advance, for a *FIRST* Tech Challenge event.

Wi-Fi Technical Advisor (WTA)

The Wi-Fi Technical Advisor (WTA) is responsible for balancing the wireless load across available channels and identifying and resolving wireless related issues including Wi-Fi and non-Wi-fi interference, and malicious attacks in the wireless environment. The WTA should help plan the event in advance and to monitor the wireless spectrum during event to make sure the Wi-Fi channels stay relatively clear of noise and interference. The WTA should also help identify and troubleshoot more in-depth technical issues and should be able to act as a technical expert to the FTAs, CSAs, and the Tournament Director. The WTA is an important technical position that is vital for larger events. However, not every event requires a WTA. At smaller events with a lower number of teams (scrimmages, small qualifying events, etc.) the functions of the WTA might not be required and a qualified CSA should be able to handle most of the technical issues encountered in a small event setting.

The WTA should have the following skills:
1. Expert knowledge of networking concepts.
2. Expert knowledge of Wi-Fi (802.11) and related technology.
3. Expert knowledge of wireless measurement tools
    including:
    a. Wi-Fi Analyzer (Android app)
    b. Fluke AirCheck or NETSCOUT AirCheck^tm G2 meter
    c. MetaGeek inSSIDer
    d. aircrack-ng
    e. Wireshark

4. Working knowledge of Mac OS or Linux operating systems.
5. Working knowledge of writing Linux shell scripts.
   6. Working knowledge of Android operating system and related tools (including ADB).

The WTA should have good problem-solving skills and be a good communicator as they might be required to work with the event venue's IT staff as well as key volunteer positions at the event to ensure that the wireless environment will be clear and accessible for teams. An exemplary WTA is persistent and gracious under pressure.

Wireless Event Checklist

There is a set of recommended steps that a Tournament Director can take before and during an event to ensure a smooth wireless environment for a competition. The steps are listed in a worksheet called the _Wi-Fi Event Checklist._ The Tournament Director can work with a technical volunteer such as the FTA, the CSA or the WTA to follow the steps in the checklist prior to and during an event. Even for small events, it is important to try and follow these steps to ensure that there aren't any sources of interference (such as audio/video public announcement systems or Wi-Fi suppressors) operating in the venue. The _Wi-Fi Event Checklist_ has timeline tasks that begin at least 6 weeks in advance of an event, at least 4 weeks in advance of an event, and day of the event. It is important to review the checklist well in advanced of an official *FIRST* Tech Challenge competition and ensure a seamless and professional event.

Getting Additional Help

If you have technical questions about the *FIRST* Tech Challenge control system and how it relates to your event, you can visit the _FIRST Tech Challenge Technology Forum_ and search for related posts or post your own questions.

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Appendix A – Resources

Game Forum Q&A
https://ftc-qa.firstinspires.org/

Anyone may view questions and answers within the *FIRST*® Tech Challenge game Q&A forum without a password. To submit a new question, you must have a unique Q&A system user name and password for your team.

Volunteer Forum
Volunteers can request access to role specific volunteer forums by emailing FTCTrainingSupport@firstinspires.org. You will receive access to the forum thread specific to your role.

FIRST Tech Challenge Game Manuals
Part 1 and 2 - https://www.firstinspires.org/resource-library/ftc/game-and-season-info

FIRST Headquarters Pre-Event Support
Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

FIRST Tech Challenge Event On-Call Support
The on call event support number is available for event personnel only. Please **do not** call these numbers if you are a team looking for a ruling, a decision, or assistance. We trust that you will not misuse this resource.

Day of event robot control system and scoring system support: 603-206-2450
All other day of event support: 603-206-2412

FIRST Websites
FIRST homepage – www.firstinspires.org

FIRST Tech Challenge Page – For everything *FIRST* Tech Challenge.

FIRST Tech Challenge Volunteer Resources – To access public volunteer manuals.

FIRST Tech Challenge Event Schedule – Find *FIRST* Tech Challenge events in your area.

FIRST Tech Challenge Social Media
FIRST Tech Challenge Twitter Feed - If you are on Twitter, follow the *FIRST* Tech Challenge Twitter feed for news updates.

FIRST Tech Challenge Facebook page - If you are on Facebook, follow the *FIRST* Tech Challenge page for news updates.

FIRST Tech Challenge YouTube Channel – Contains training videos, game animations, news clips, and more.

FIRST Tech Challenge Blog – Weekly articles for the *FIRST* Tech Challenge community, including outstanding volunteer recognition!

FIRST Tech Challenge Team Email Blasts – contain the most recent *FIRST* Tech Challenge news for teams.

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!