QSG166: WF200 Wi-Fi Development Kit Quick Start Guide

The WF200 Wi-Fi Development Kit is an excellent way to get started with WF200 Wi-Fi transceiver IC to achieve performance evaluation and software development.

It supports various hardware and software use cases, as described below.

Two versions of devkits are available:

- SLEXP8022A contains WF200 development board (BRD8022A), that can be connected to Silicon Labs EFM32 or EFR32 Starter kits or to a Raspberry Pi for the Linux case. It also contains a micro-SD card allowing fast startup with a Raspberry Pi.
- SLEXP8022B is a superset of SLEXP8022A with a Raspberry Pi 2 model V1.2 included.

This document described the first steps to get a Wi-Fi connection for the Linux case (Raspberry Pi), Silicon Labs MCUs, as well as a case with a 3rd party MCU.

Note: Refer to UG379 for more details about the board.

KEY CONTENTS

- Expansion Board with the WF200 Wi-Fi transceiver IC onboard.
- Direct connection to Silicon Labs EFM32 and EFR32 hosts (20 pin EXP)
- Direct connection to Raspberry Pi for the Linux use case
- Support of 3rd party MCUs
- Selectable SPI or SDIO host interface

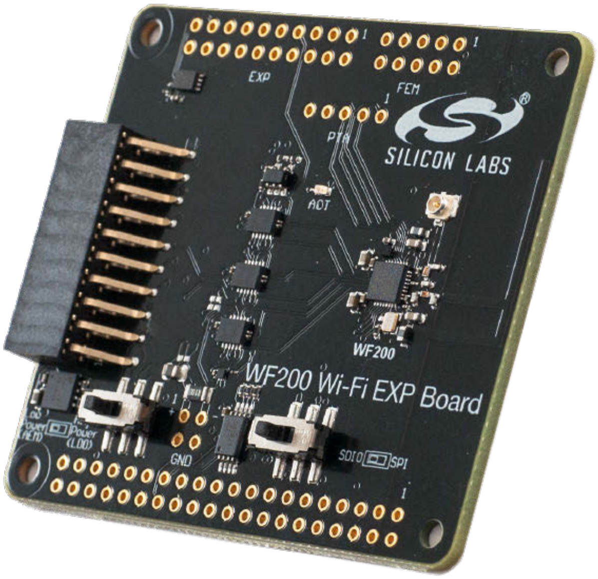


Table of Contents

1. Getting Started with Raspberry Pi and Linux

1.1 Requirements

1.1.1 Hardware

To use this guide, the following components are needed:

- Raspberry Pi board
  - Versions supported: Pi2 model B V1.2 or Pi3 model B.

    Note: Pi3 model B+ is not supported.

- Raspberry Pi power supply
- WF200 devkit (BRD8022A)
- Silabs SD card
- Network cable

1.1.2 Software

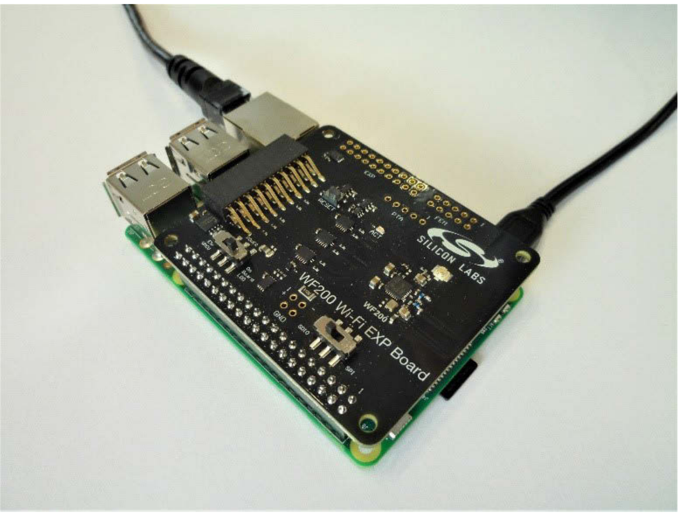
To remotely access the Raspberry Pi from a Windows machine, some tools need to be installed:

- To enable ssh access with X11 support, download and install MobaXterm Home Edition from https://mobaxterm.mobatek.net/
- To enable multicast name resolution (mDNS), download and install Apple Bonjour from https://support.apple.com/kb/DL999

Note: During Bonjour installation, we recommend that you uncheck all options.

1.2 Hardware Setup

1. Insert Silabs SD card in Raspberry Pi
2. Plug the WF200 devkit on top of the Raspberry Pi (*WARNING : make sure the devkit does not touch HDMI connector on Raspberry Pi*)
3. Configure the switches on WF200 devkit:
   - Left switch (power): “On Board LDO”
   - Right switch: “SDIO”
4. Connect the Raspberry Pi directly to a computer with an Ethernet cable.
5. Power the Raspberry Pi



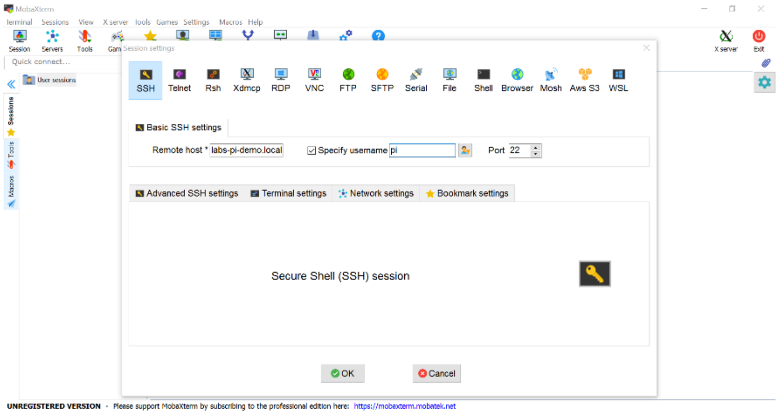
Note: Wait 60 seconds for the Raspberry to start before proceeding.

1.3 SSH Connection

With MobaXterm, create and open a `ssh` session to the Raspberry Pi with the following parameters:

- Host: **silabs-pi-demo.local**
- Username: **pi**
- Password: **default_password**

All the following commands will be entered in the newly open ssh console.



Basic SSH settings

Remote host * labs-pi-demo.local ☑ Specify username pi Port 22

Secure Shell (SSH) session

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net

Figure 1.1. SSH Console

1.4 Wi-Fi Demos

The SD card includes demos for the two supported modes: station and access point.

Note: On first version of the SD cards, the driver must be loaded first with the following command:

```
sudo wfx_driver_reload
```

1.4.1 Station Demo

This demo configures the Raspberry Pi and WF200 to work as a Wi-Fi station which can connect to an access point. To start it run:

```
sudo wfx_demo_station
```

This will launch a graphical tool named “wpa_gui” which support the following actions:

1. Scan.
2. Select the desired Wi-Fi access point.
3. Enter credentials if need be, and then add.

Once connected, it is possible to perform some traffic:

```
ping silabs.com
```

Note: With keyboard, mouse, and screen attached to the Raspberry Pi, it is possible to launch a browser by clicking the “Silicon Labs website” icon on the desktop.

1.4.2 Access Point Demo

This demo configures the Raspberry Pi and WF200 to work as a Wi-Fi access point which can accept stations. To start it, run:

```
sudo wfx_demo_ap
```

Once the access point is started, it is possible to connect to the Raspberry Pi using a Wi-Fi capable device and the following credentials:

- SSID: **silabs-pi-demo**
- Passphrase: **default_password**

On the device, use a browser to open http://silabs-pi-demo.wlan/.

1.5 Update SD Card

To download and install an SD card image, go to https://github.com/SiliconLabs/wfx-linux-tools/blob/master/RELEASES.md

1.6 Software Repositories

For development purposes, software can be found in the locations listed below:

- WF200 firmware is available in https://github.com/SiliconLabs/wfx-firmware
- The Linux driver is available in https://github.com/SiliconLabs/wfx-linux-driver

2. Getting Started with STM32 MCU, with FreeRTOS, and LwIP

2.1 Requirements

2.1.1 Hardware

To use the WF200_driver_F429ZI_FreeRTOS project, a user will need the following list:

- A WF200 Wi-Fi expansion board BRD802XX
- A NUCLEO-F429ZI board with the associated micro-USB cable
- A hardware interposer to connect the Silicon Labs expansion board to the NUCLEO board
- A PC where to install the following software prerequisites
- A Wi-Fi access point

2.1.2 Software

In addition to the previous hardware, a user will need software listed below:

- Get the software example (WF200_driver_F429ZI_FreeRTOS-LwIP) in https://github.com/SiliconLabs/wfx-fullMAC-tools and open it on IAR or TrueSTUDIO
- Licensed IAR Embedded Workbench IDE for ARM installed or Atollic TrueSTUDIO for STM32 IDE available from the this link: https://atollic.com/truestudio/
- ST-link driver either installed during IDE installation or through the following link: https://www.st.com/content/st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-utilities/stsw-link009.html
- A UART console. For example, Tera Term:https://osdn.net/projects/ttssh2/releases/
- The FMAC driver source code is available in https://github.com/SiliconLabs/wfx-fullMAC-driver

2.2 Hardware Setup

Mount the WF200 expansion board on top on the NUCLEO board using the hardware interposer as shown on the figure below. **Make sure the power switch is on the “on Board LDO” position and the bus switch on the “SPI” one.**

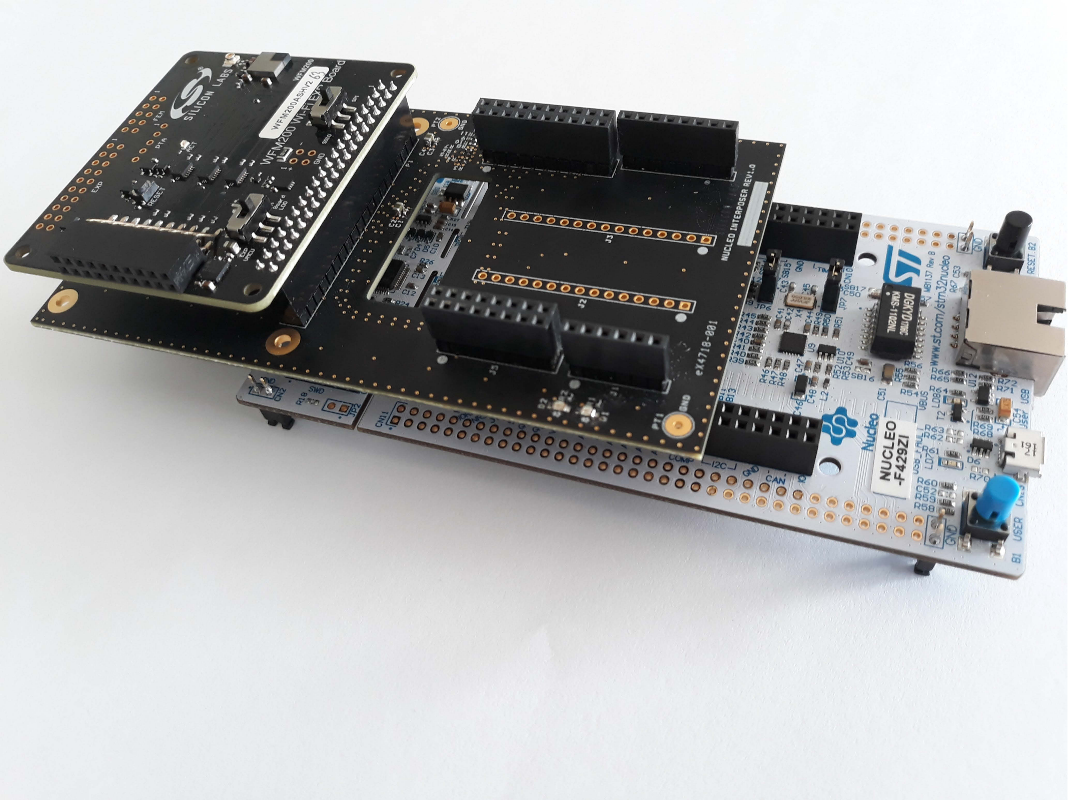


Figure 2.1. WF200 Expansion Board Mounted on a NUCLEO Board

Connect the NUCLEO board to your PC with the micro-USB cable. **Make sure to connect your PC to the correct end as shown below**. The NUCLEO-144 has two different USB-micro ports. If detected correctly, it should appear as USB storage with the name “NODE_F429ZI”.

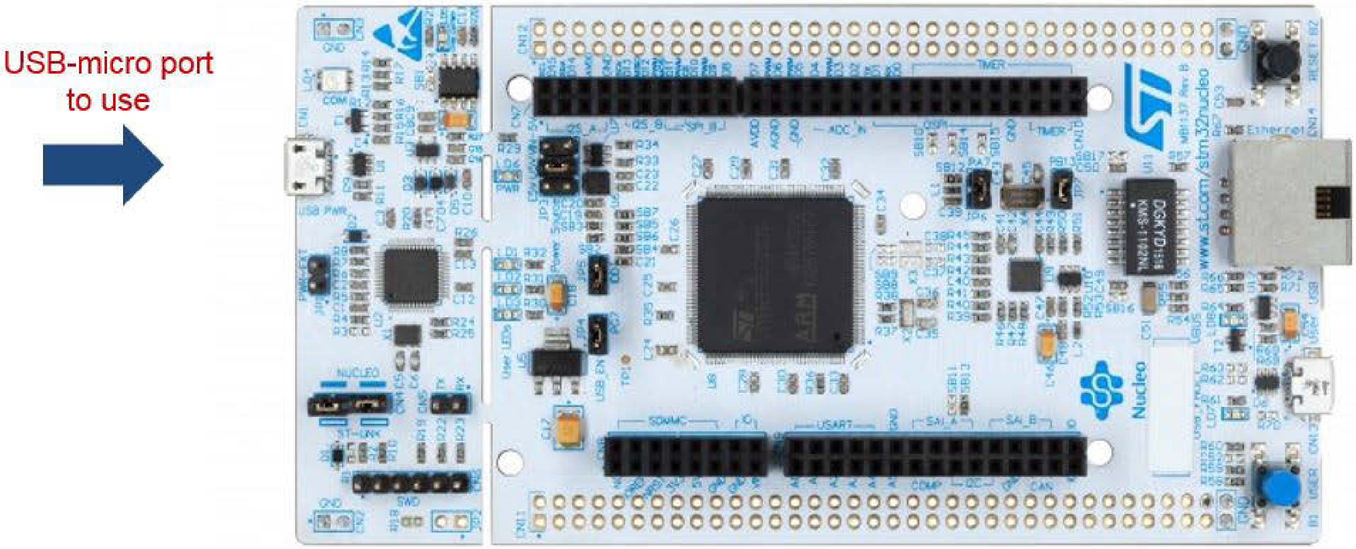

USB-micro port
to use

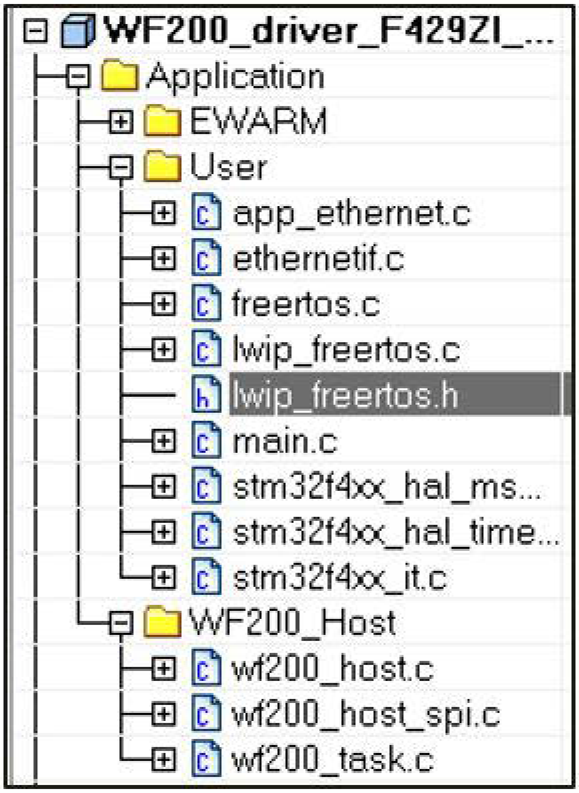
Figure 2.2. NUCLEO-144 Board

2.3 Getting Started

2.3.1 Flashing the STM32 Using IAR

1. Open the IAR project “Project.eww” located in the path **\WF200_driver_F429ZI_FreeRTOS-LwIP\EWARM**.

2. In IAR Workspace view, open the header file “lwip_freertos.h”. The project workspace is shown in the



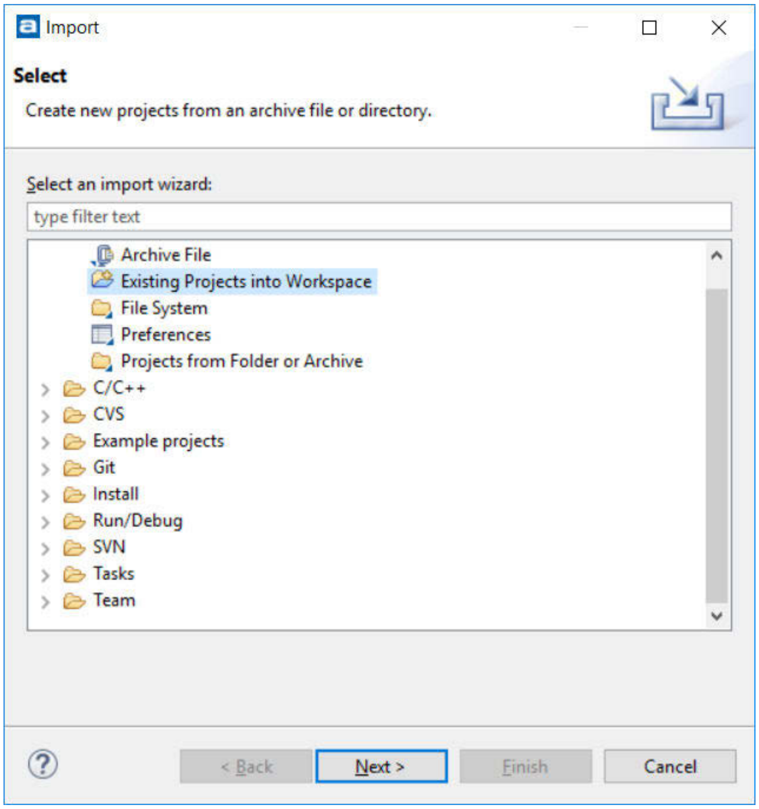
```
⊟ WF200_driver_F429ZI_...
├⊟ Application
│ ├⊞ EWARM
│ ├⊟ User
│ │ ├⊞ app_ethernet.c
│ │ ├⊞ ethernetif.c
│ │ ├⊞ freertos.c
│ │ ├⊞ lwip_freertos.c
│ │ ├── lwip_freertos.h
│ │ ├⊞ main.c
│ │ ├⊞ stm32f4xx_hal_ms...
│ │ ├⊞ stm32f4xx_hal_time...
│ │ └⊞ stm32f4xx_it.c
│ └⊟ WF200_Host
│   ├⊞ wf200_host.c
│   ├⊞ wf200_host_spi.c
│   └⊞ wf200_task.c
```

Figure 2.3. IAR Project Workspace

3. In “lwip_freertos.h”, change the WLAN_SSID, WLAN_PASSKEY and WLAN_SECURITY defines to the values of the access point you want to use.
4. Open Tera Term and connect to the STLink Virtual COM port of the NUCLEO board. In the “Setup\Serial Port” panel, select 115200 for the speed.
5. “Make” the project by clicking on the appropriate icon.
6. “Download and Debug” the project by clicking on the associated icon.
7. Wait for the project to be flashed in the STM32 .
8. Once in debug mode, click on the "GO" icon.

2.3.2 Flashing the STM32 using TrueSTUDIO

1. Import the project by opening the File menu and choosing **"Import…"**. You will see the dialog box below.



Import

Select

Create new projects from an archive file or directory.

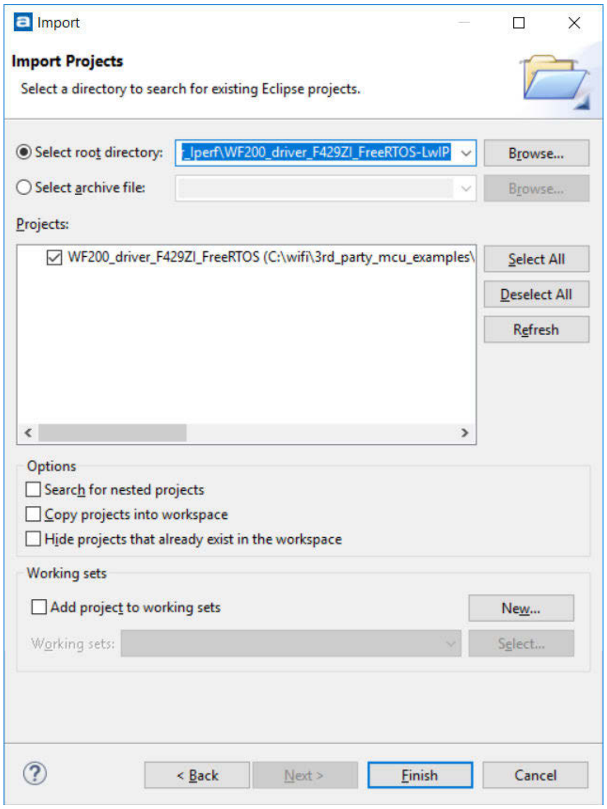
Select an import wizard:

type filter text

- Archive File
- Existing Projects into Workspace
- File System
- Preferences
- Projects from Folder or Archive
- C/C++
- CVS
- Example projects
- Git
- Install
- Run/Debug
- SVN
- Tasks
- Team

Figure 2.4. TrueSTUDIO Import Dialog

2. Choose “Existing Projects into Workspace” and then select the path **\WF200_driver_F429ZI_FreeRTOS-LwIP\TrueSTUDIO**. You will see the follow-ing result:



Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: _Iperf\WF200_driver_F429ZI_FreeRTOS-LwIP

○ Select archive file:

Projects:

☑ WF200_driver_F429ZI_FreeRTOS (C:\wifi\3rd_party_mcu_examples\

Options

☐ Search for nested projects

☐ Copy projects into workspace

☐ Hide projects that already exist in the workspace

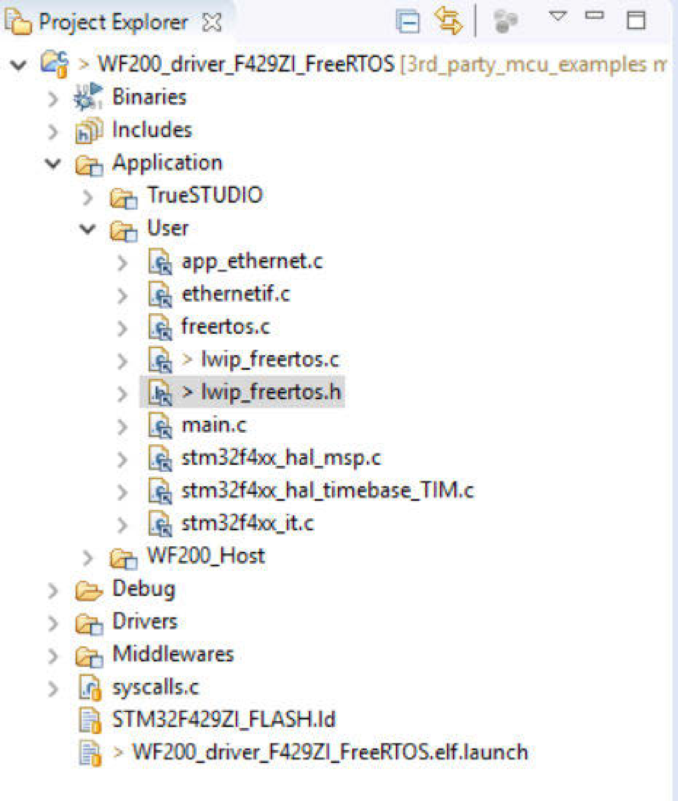
Working sets

☐ Add project to working sets

Working sets:

Figure 2.5. TrueSTUDIO Import Projects Dialog

3. In the project explorer, you will find "lwip_freertos.h" under *Application\User*.



```
Project Explorer
> WF200_driver_F429ZI_FreeRTOS [3rd_party_mcu_examples m
    Binaries
    Includes
    Application
        TrueSTUDIO
        User
            app_ethernet.c
            ethernetif.c
            freertos.c
            > lwip_freertos.c
            > lwip_freertos.h
            main.c
            stm32f4xx_hal_msp.c
            stm32f4xx_hal_timebase_TIM.c
            stm32f4xx_it.c
        WF200_Host
    Debug
    Drivers
    Middlewares
    syscalls.c
    STM32F429ZI_FLASH.ld
    > WF200_driver_F429ZI_FreeRTOS.elf.launch
```

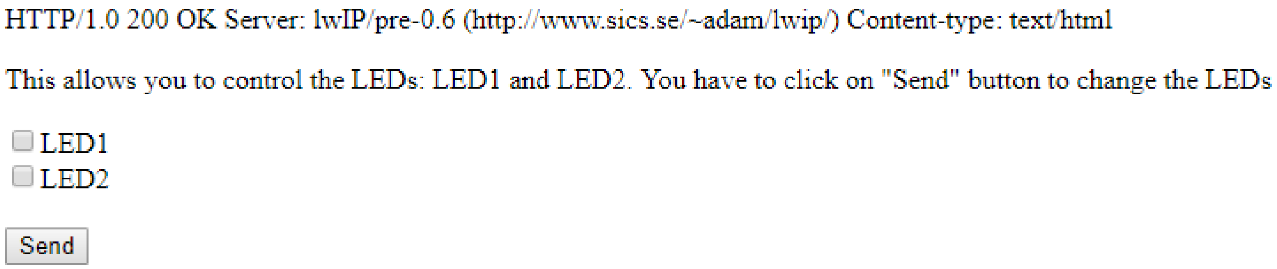
Figure 2.6. TrueSTUDIO Project Explorer

4. In “lwip_freertos.h”, change the WLAN_SSID, WLAN_PASSKEY, and WLAN_SECURITY defines to the values of the access point you want to use.
5. Open Tera Term and connect to the STLink Virtual COM port of the NUCLEO board. In the “Setup\Serial Port” panel, select **115200** for the speed.
6. Press **F11** to build and then run the debugger
7. Once the STM32 has been flashed, and the debugger reaches the beginning of `main()`, press **F8** to run the demo

2.4 Using the Demo

1. In the terminal window, you should see the text below, where xxx.xxx.xxx.xxx is replaced with the STM32 IP address

   WF200 init successful
   Connected
   IP address: xxx.xxx.xxx.xxx
2. You can now use the webserver or the Iperf TCP server embedded in the STM32.
3. In a web browser, enter the displayed IP address. You should see the webpage below.



HTTP/1.0 200 OK Server: lwIP/pre-0.6 (http://www.sics.se/~adam/lwip/) Content-type: text/html

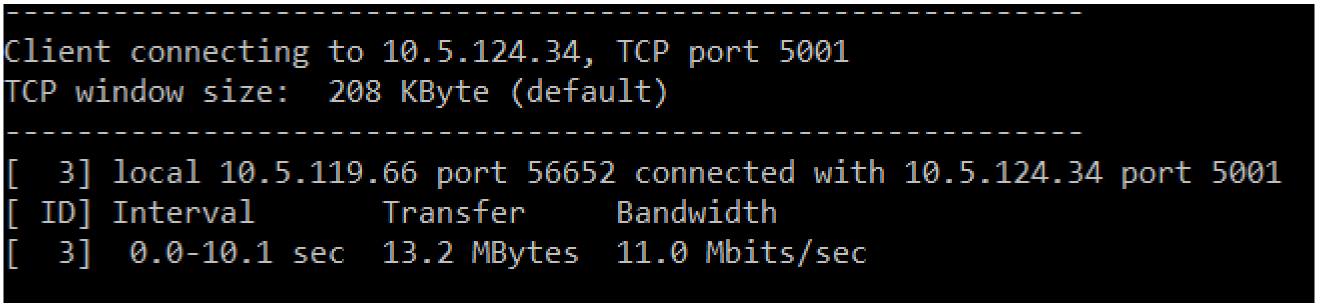
This allows you to control the LEDs: LED1 and LED2. You have to click on "Send" button to change the LEDs

☐ LED1
☐ LED2

Figure 2.7. Webpage Hosted by the STM32

Note: The webpage can be used to drive the two LEDs onboard the NUCLEO board.

4. The setup supports also Iperf TCP test. Use a PC with Iperf installed as a client to start an Iperf test with the command “iperf -c xxx.xxx.xxx.xxx” (xxx.xxx.xxx.xxx being the address displayed by the terminal at boot). You should see a result like the one displayed on the Figure below. The test takes 10 seconds by default.



```
------------------------------------------------------------
Client connecting to 10.5.124.34, TCP port 5001
TCP window size:  208 KByte (default)
------------------------------------------------------------
[  3] local 10.5.119.66 port 56652 connected with 10.5.124.34 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0-10.1 sec  13.2 MBytes  11.0 Mbits/sec
```

Figure 2.8. Iperf TCP Test Results

3. Additonal Information

3.1 Additional Resources

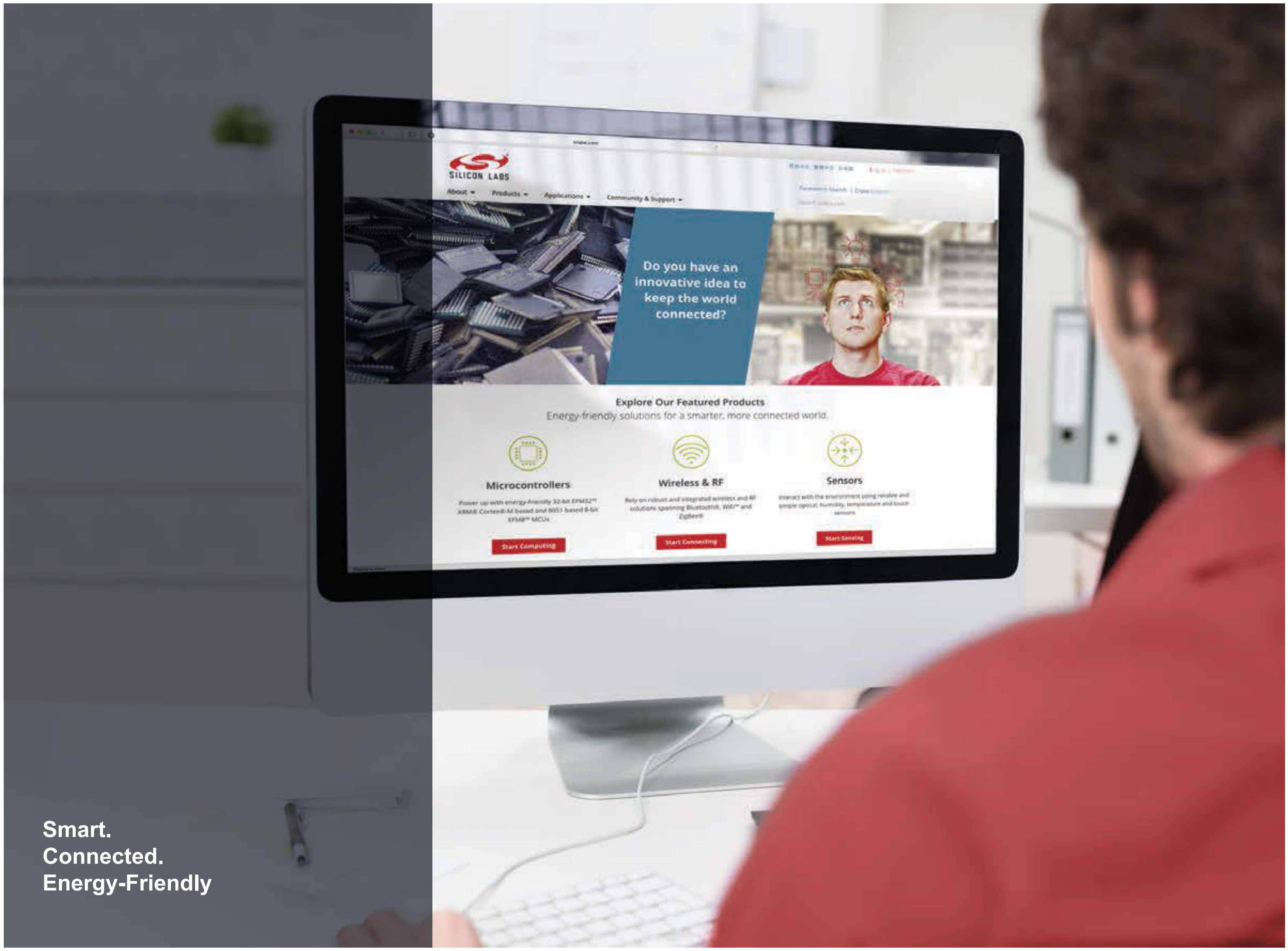
For more information review the following:

- WF200 Wi-Fi Expansion Kit User's Guide
- WF200 Wi-Fi transceiver IC Data Short

3.2 Customer Support

For customer support:

1. Register on https://www.silabs.com/
2. Go to Community & Support → Technical Support → E-mail Support Request.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