

# QSG145: WGM110 SLEXP4320 Wi-Fi Expansion Kit Quick-Start Guide



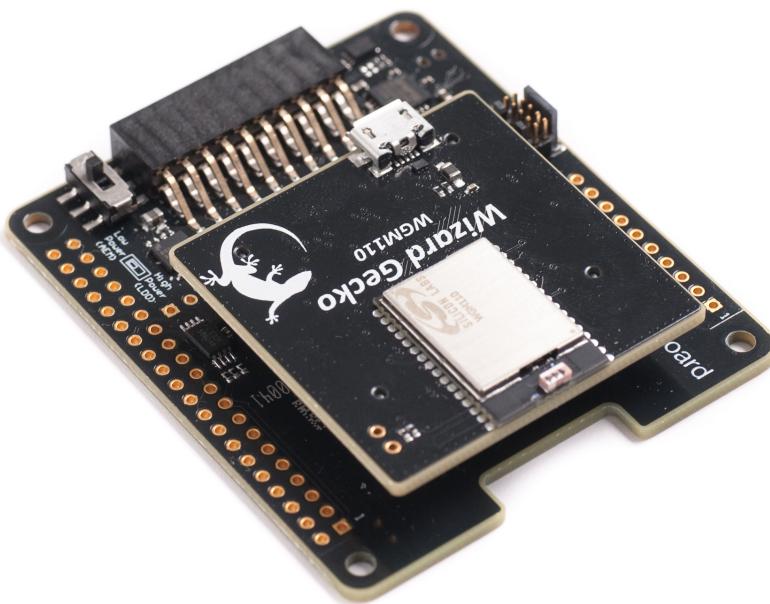
The WGM110 Wi-Fi Expansion Kit is an excellent way to get started with Wi-Fi connectivity for Silicon Labs MCUs.

The kit contains an expansion board that can be connected to one of 3 MCU starter-kits, listed below. The expansion board allows the EFM32 MCU to connect to a WGM110 Wi-Fi module, which can connect to Wi-Fi networks, but also be an access point to which other devices can connect. The expansion kit works with the following Silicon Labs MCU Starter kits:

- EFM32 Pearl Gecko PG12 Starter Kit – SLSTK3402A
- EFM32 Pearl Gecko PG1 Starter Kit – SLSTK3401A
- EFM32 Giant Gecko GG11 Starter Kit – SLSTK3701A

## KIT CONTENTS

- Expansion board with radio board socket
- WGM110 radio board
- Getting Started card



## 1. Getting Started

### Required Components

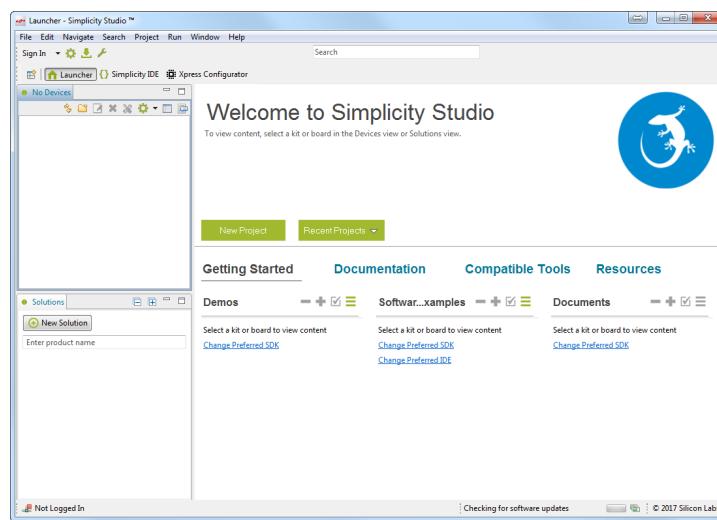
The WGM110 Wi-Fi Expansion Kit contains a Wi-Fi module. To use the kit, an MCU starter-kit is required, where the MCU will be the host that communicates and controls the Wi-Fi module. Supported Starter Kits are listed below. Click the link to see a description of the kit and associated MCU, and ensure one of these kits is available:

- EFM32 Pearl Gecko PG12 Starter Kit – SLSTK3402A  
<https://www.silabs.com/products/development-tools/mcu/32-bit/efm32-pearl-gecko-pg12-starter-kit>
- EFM32 Pearl Gecko PG1 Starter Kit – SLSTK3401A  
<https://www.silabs.com/products/development-tools/mcu/32-bit/efm32-pearl-gecko-starter-kit>
- EFM32 Giant Gecko GG11 Starter Kit – SLSTK3701A  
<https://www.silabs.com/products/development-tools/mcu/32-bit/efm32-giant-gecko-gg11-starter-kit>

### Install Simplicity Studio

Simplicity Studio is a free software suite needed to start developing your application.

1. Download the latest version of Simplicity Studio from the Silicon Labs website: <http://www.silabs.com/simplicity-studio>.



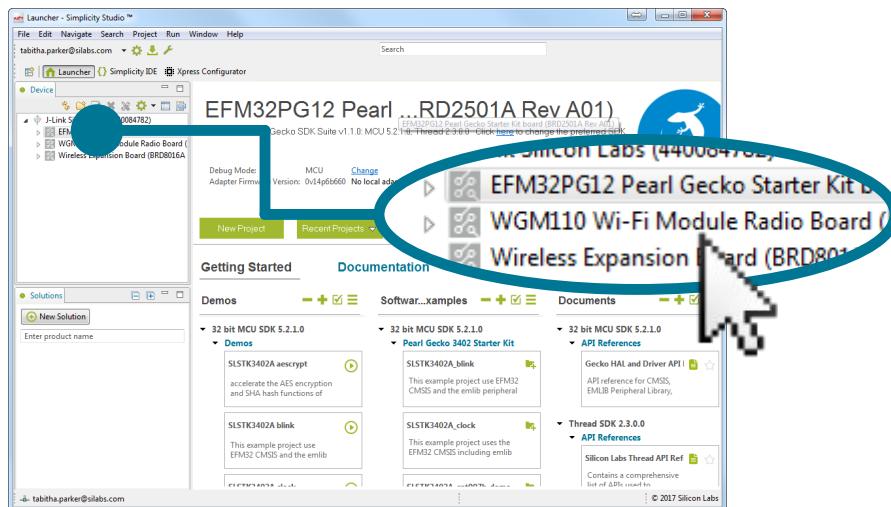
## Set Up Your Kit

1. Connect the Expansion Kit to the MCU Starter Kit.
2. Provide power to the board by connecting the [DBG] USB connector to the PC using the provided USB cable.
3. Ensure that the power selector switch on the STK is in the [AEM] position.
4. Ensure that the power selector switch on the Wireless Expansion Board is in the [High Power (LDO)] position.



## Detect Your Device

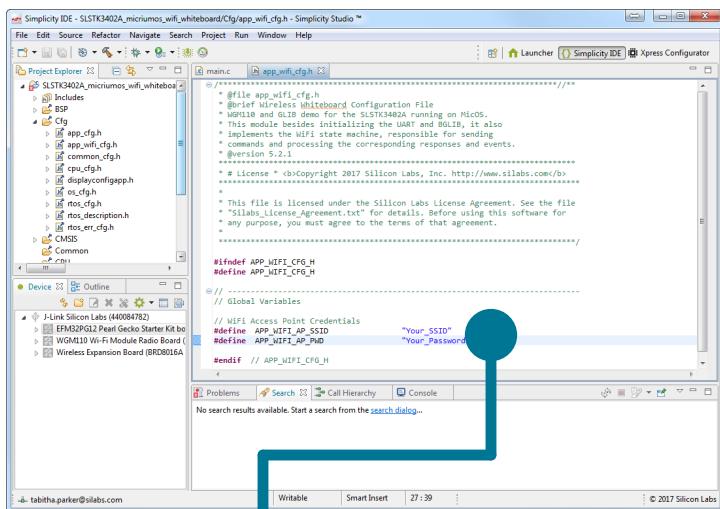
1. Click [Refresh] button if your device does not show up in the [Device] view in the Simplicity Studio Launcher. The board might take some time to appear due to driver installations for the debug adapter.
2. Once an item with a name that starts with [J-Link Silicon Labs] appears, expand it by clicking the arrow, and verify that the detected device matches your kit.



## Set Up Your Wi-Fi Access Point

Before playing with the demo, the demo needs to know what Wi-Fi access point it should connect to. To keep things simple, these are hard-coded in a file called `app_wifi_cfg.h`. In an end-application, these could be obtained through presenting a UI to the user, or by setting up an access point on the WGM110 and leveraging the built-in web-server to allow a cell phone or computer to connect to the WGM110 in order to configure it.

1. Select the MCU Starter Kit in the [Device] area.
2. Under [Getting Started] in the Launcher, scroll down in the [Software Examples] column until you find [**micriumos\_wifi\_whiteboard**] and click it.
3. Answer [Yes] when a dialog opens asking you whether you want to switch to the IDE perspective and create the example project.
4. In the Simplicity IDE, locate the [Project Explorer] and expand the new project that was created. Go into the [Cfg] folder and open `app_wifi_cfg.h`.
5. In `app_wifi_cfg.h`, change the value of `APP_WIFI_AP_SSID` and `APP_WIFI_AP_PWD` to the values of the Wi-Fi access point you want to connect to.



**Wi-Fi Access Point Credentials**

```
#define APP_WIFI_AP_SSID "Your_SSID"
#define APP_WIFI_AP_PWD "Your_Password"
```

### Note:

If the `app_wifi_cfg.h` file is not visible in the [Cfg] folder, you can find the file in one of three ways:

1. Pressing [F3] when the cursor hovers over any of the configuration macros like `APP_WIFI_AP_SSID`.
2. Expanding the includes tree to find the `app_wifi_cfg.h` file.
3. Navigating to the project. In Windows, this would typically be located in `c:\Users\<username>\SimplicityStudio\<workspace>\<demo name>`.

## Start the Example

1. Click the [Debug]  button to compile and download the demo to the MCU. Once downloaded, click the [Resume]  button. The demo will show several messages as it attempts to connect to the Wi-Fi network and then the AWS service that serves the demo.
2. Press [BTN1] and verify that the display shows a MAC Address status message:



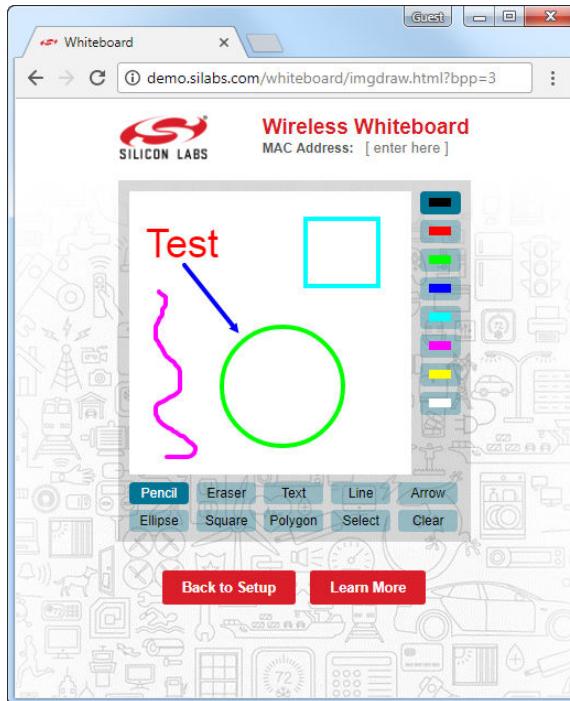
3. In case the application does not display the status message and instead remains in one of the other status messages, try the following troubleshooting tips:
  - a. Confirm that your Wireless Access Point's SSID and Password match those configured in `app_wifi_cfg.h`.
  - b. Confirm that the WGM110 is running the latest firmware from the Wizard Gecko Wi-Fi SDK. To do this, download <http://www.silabs.com/products/development-tools/software/wizard-gecko-wi-fi-sdk> and upgrade the device firmware using BGTool in the `bin` folder and the `production.bin` firmware image in the `example/production` folder.
  - c. Confirm that the Wireless Access Point has access to the Internet and that your Internet Provider's DNS can resolve [demo.silabs.com](http://demo.silabs.com).

## Draw on the Wireless Whiteboard

1. The whiteboard supports black and white and colored drawings depending on the LCD onboard the Starter Kit.
2. Open your favorite Internet browser, go to the page at <http://demo.silabs.com/whiteboard>, and select the Wireless Whiteboard Demo for the Starter Kit.



3. After selecting the correct board, enter the board's [MAC address] in the top-right corner of the web page and start drawing. The MAC address is displayed on the display of the Starter Kit.
4. Draw something in the view.



5. The drawing will appear on the kit display. Use the kit buttons [BTN0] and [BTN1] to switch between screens.
6. Keep drawing. The image drawn on the whiteboard is dynamically transferred to the kit display.

## 2. How the Example Works

The embedded application in the host MCU runs on MicriumOS, and the Wi-Fi module is connected to the Host MCU via a UART interface. The LCD screen is connected via an SPI interface on the Host MCU.

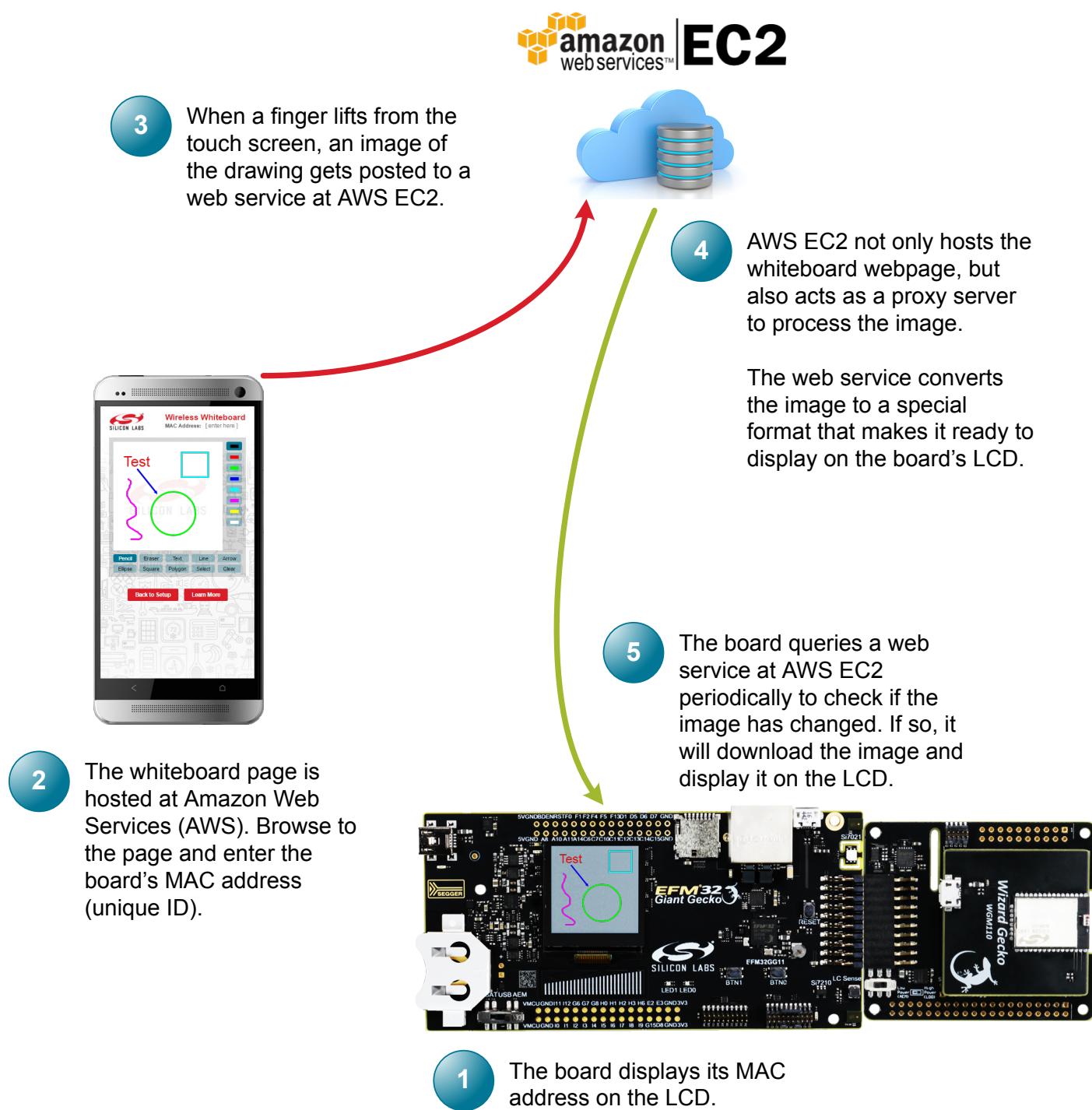


Figure 2.1. System Overview

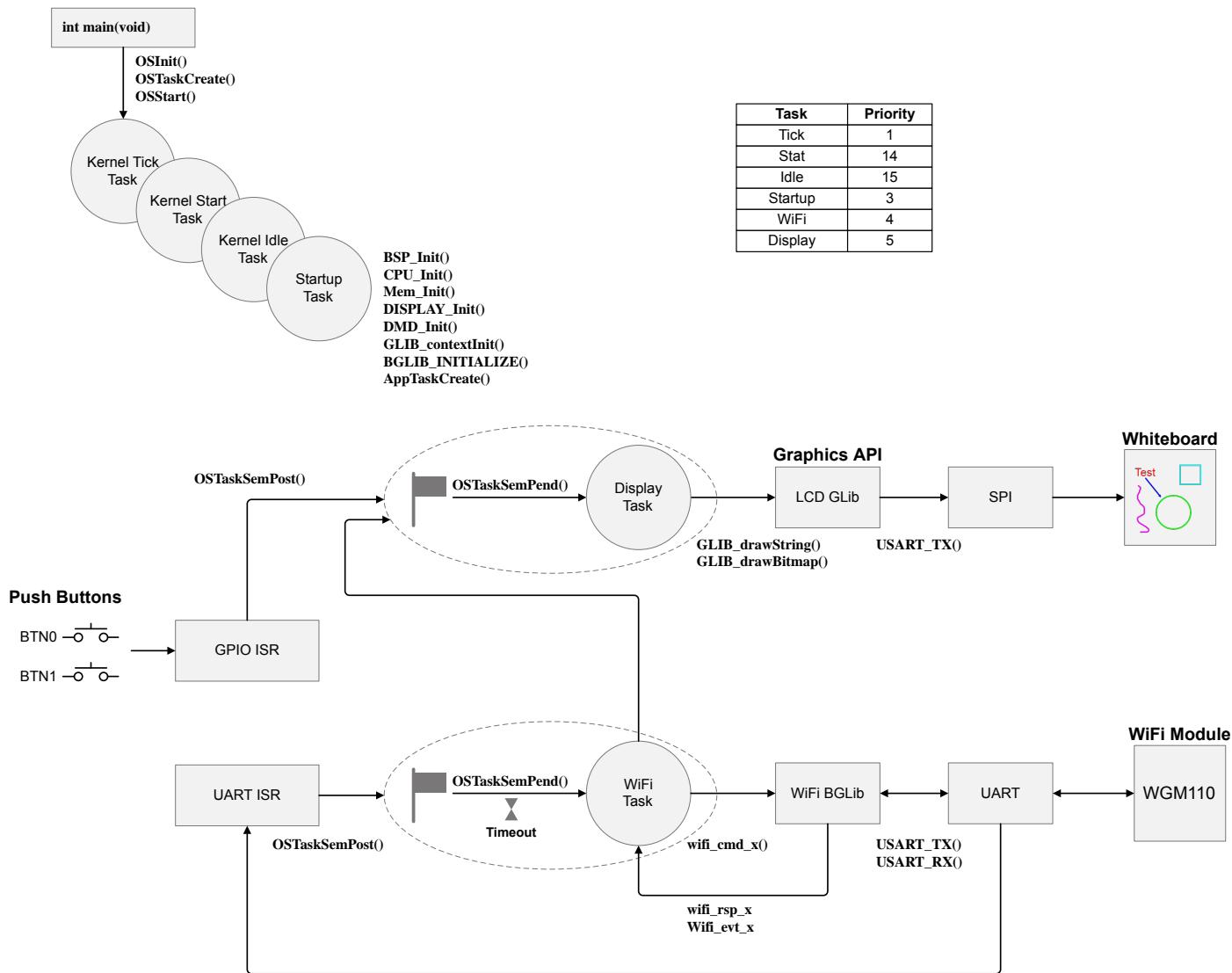


Figure 2.2. Software System Overview

1. The `main()` function starts by initializing MicriumOS Kernel through a call to `osInit()`, which in turn creates the following internal tasks:

- Tick Task—`os_TickTask()` is used by the Kernel to keep track of tasks waiting for time to expire or for tasks that are pending on kernel objects with a timeout. `os_TickTask()` is a periodic task that waits for signals from the tick ISR.
- Statistics Task—`os_StatTask()` is used by the Kernel to calculate run-time statistics such as CPU usage.
- Idle Task—`os_IdleTask()` is used by the Kernel to run whenever there are no other tasks that are ready to run.

`main()` continues by creating the Startup Task and starting the multi-tasking process by calling `osStart()`.

2. The Startup Task is used to initialize various hardware and software modules, including the Memory LCD and the WGM110 Wi-Fi module interface. The Startup Task finishes the startup process by creating the rest of application tasks as follows:

- Display Task—the application uses this task to process commands to display something on the LCD, including status messages and the image drawn by the user. It is also responsible to process the push button interrupts. The task simply waits for a signal to its own semaphore from either the GPIO Interrupt Service Routine or the Wi-Fi task to process the different commands.
- WiFi Task—the application uses this task to process the responses and events from the Wi-Fi module. The task waits for a signal from the UART ISR before processing each command.

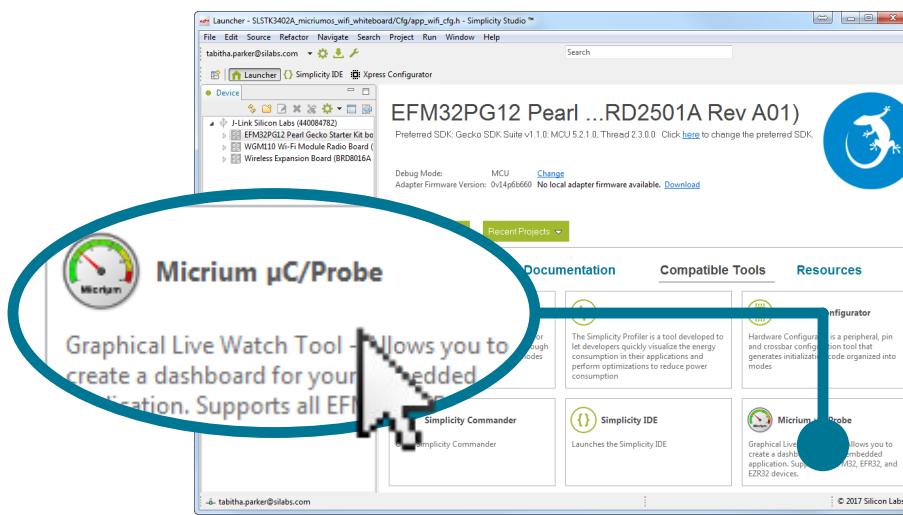
3. To understand how the Wi-Fi connection is managed, read through `app_wifi.c`, which implements the connection and communication aspects of the demo. Use the WGM110 API Reference Manual to see how the BGLIB API works and how to communicate with the WGM110 module. See [4. Additional Resources](#) for more information.

### 3. Extended Debugging

Micrium µC/Probe is an application that allows you to read and write the memory of any embedded target processor during run-time and map those values to a set of virtual controls and indicators placed on a graphical dashboard. In this example application, µC/Probe is used to display during run-time a state machine diagram that shows you the current state of the Wi-Fi module.

µC/Probe is a part of the Simplicity Studio installation and is available if it has been selected during installation.

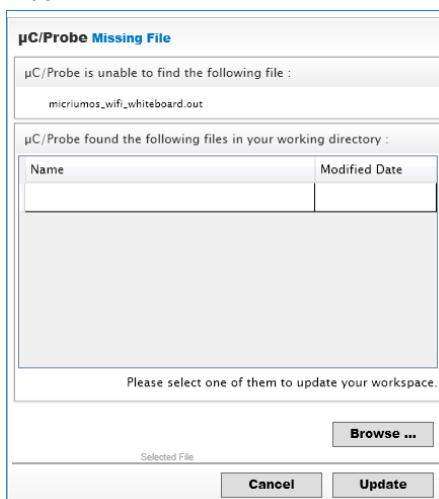
1. To make sure µC/Probe is installed, click the [Help] menu, then [Update Software] or the [Update Software]  button in the [Launcher] view. In the dialog that opens, navigate to the [Tools] tab, find [Micrium uC/Probe] in the list, and verify that it is installed or install it.
2. To launch µC/Probe, navigate to [Compatible Tools] from the [Launcher] and scroll down. Alternatively, click the [µC/Probe]  button in the [Simplicity IDE] view.



**Figure 3.1. Micrium µC/Probe**

The µC/Probe software will initially open with a blank workspace. After opening µC/Probe:

1. Go to [File]>[Open].
2. Browse to the [**micriumos\_wifi\_whiteboard**] project typically located in `C:\Users\<username>\SimplicityStudio\<workspace>\<demo name>` on Windows, and select the `Probe\uCProbe.wspx` file.
3. A [**Missing File**] dialog may be displayed. If so, click the [**Browse...**] button in the dialog. Select the ELF file that is typically located in the following folder: `C:\Users\<username>\SimplicityStudio\<workspace>\SLSTK*_micriumos_wifi_whiteboard\GNU ARM v4.9.3 - Debug\*.axf`. Click [**Update**]. The .axf file contains information about the compiled program, and can also be updated by clicking the [**ELF**] button in the main window.



4. Click the [Run] button in the [Home] menu bar to run the visualization.

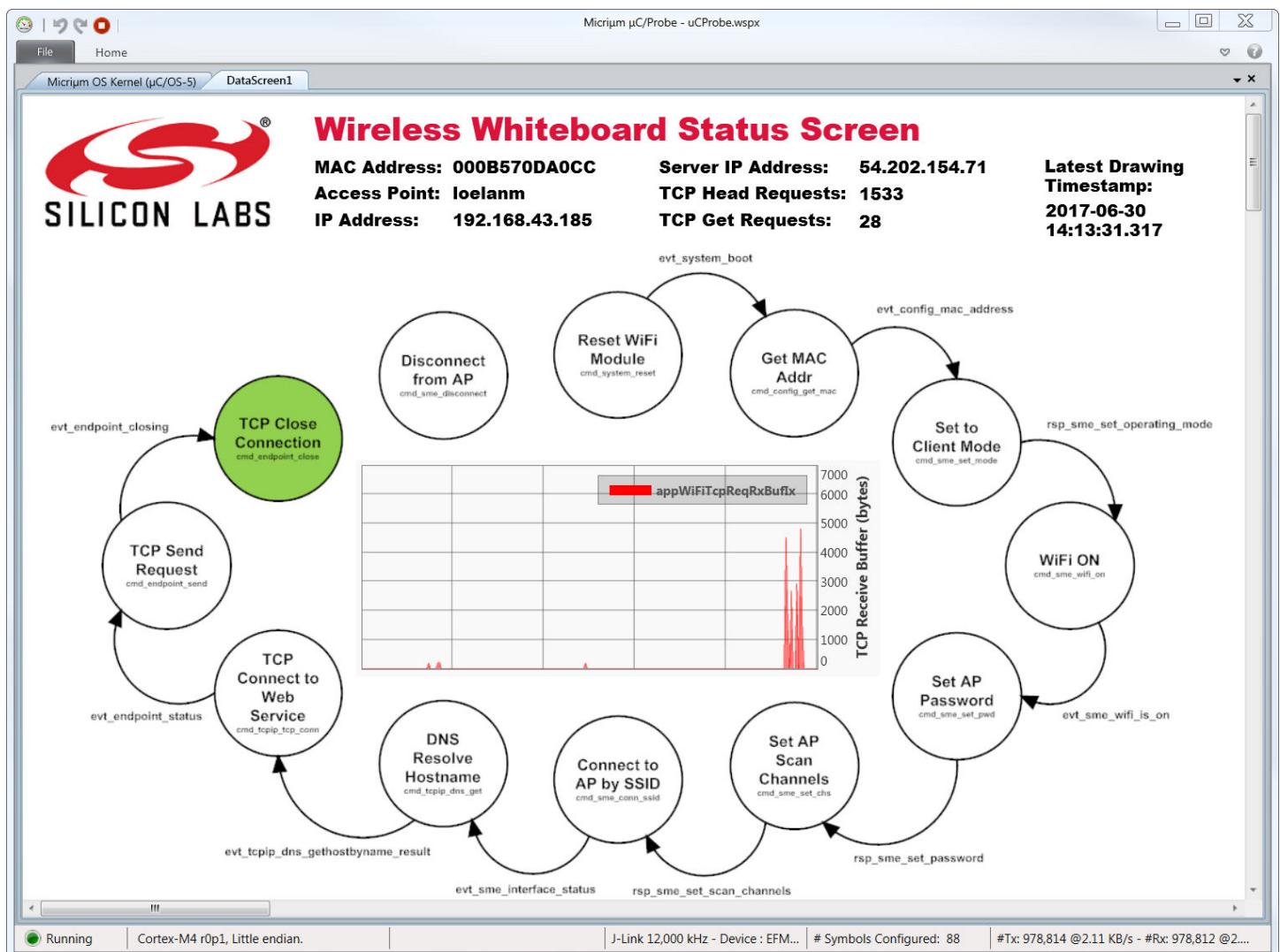


Figure 3.2. Wireless Whiteboard Status Screen

This software can also show a list of MicriumOS tasks, along with their runtime statistics. If this is not available in the visualization as an additional tab, go out of the visualization, find the [Workspace Explorer] on the right-hand side, click the [Screens] menu, and select [Micrium OS Kernel ( $\mu$ C/OS-5)]. Then, click the [Run] button to run the visualization again and select the corresponding tab.

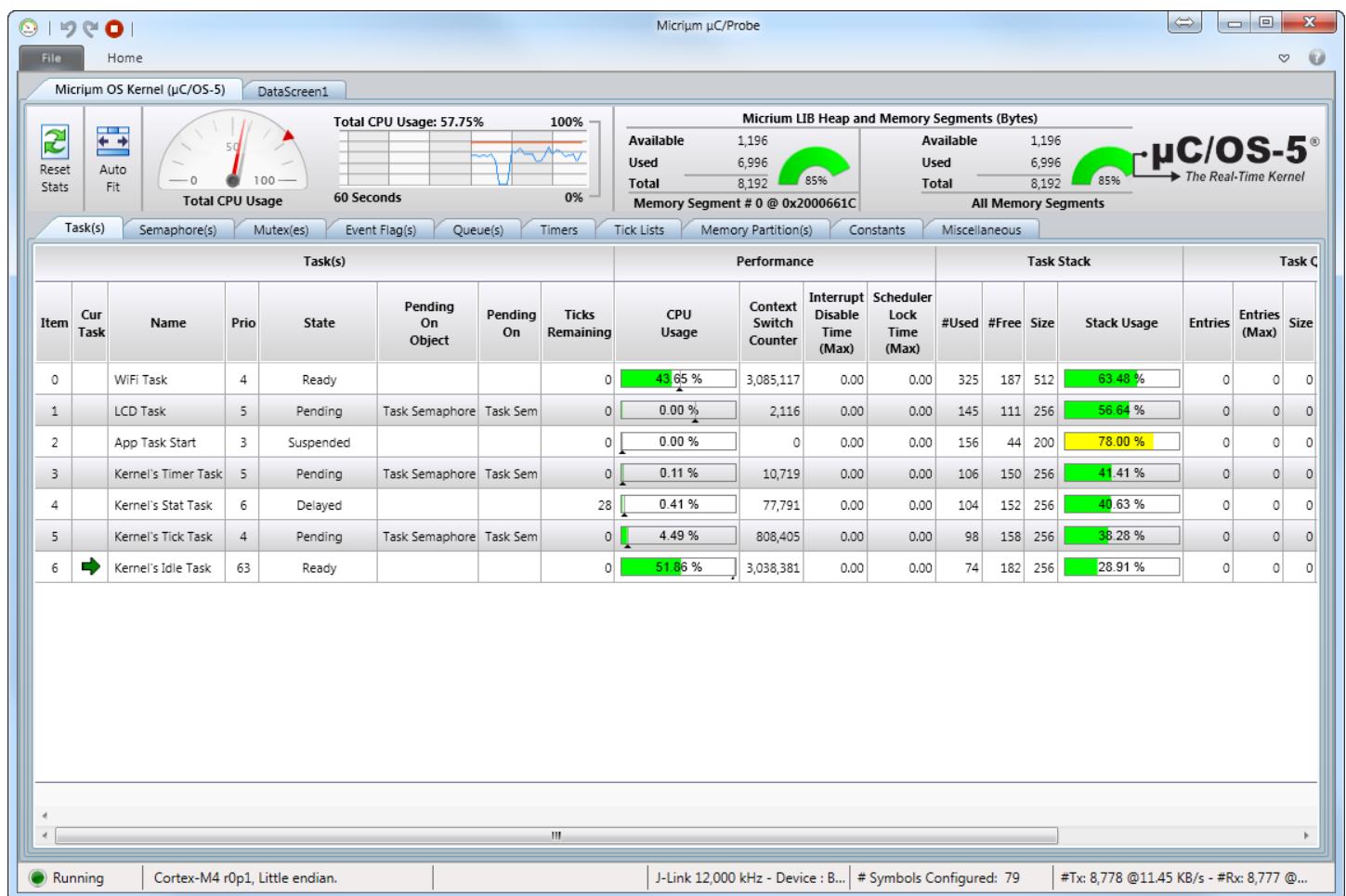


Figure 3.3. Wi-Fi Demo Usage Statistics in Micrium µC/Probe

## 4. Additional Resources

For more information, review the following:

- [WGM110 Wizard Gecko Wi-Fi® Module Data Sheet](#)
- [WGM110 API Reference Manual](#)
- Starter Kit MCU Data Sheet
- Starter Kit MCU Reference Manual



## Simplicity Studio

One-click access to MCU and wireless tools, documentation, software, source code libraries & more. Available for Windows, Mac and Linux!



**IoT Portfolio**  
[www.silabs.com/IoT](http://www.silabs.com/IoT)



**SW/HW**  
[www.silabs.com/simplicity](http://www.silabs.com/simplicity)



**Quality**  
[www.silabs.com/quality](http://www.silabs.com/quality)



**Support and Community**  
[community.silabs.com](http://community.silabs.com)

## Disclaimer

Silicon Labs intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Labs products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Labs reserves the right to make changes without further notice and limitation to product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Silicon Labs shall have no liability for the consequences of use of the information supplied herein. This document does not imply or express copyright licenses granted hereunder to design or fabricate any integrated circuits. The products are not designed or authorized to be used within any Life Support System without the specific written consent of Silicon Labs. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Labs products are not designed or authorized for military applications. Silicon Labs products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons.

## Trademark Information

Silicon Laboratories Inc.®, Silicon Laboratories®, Silicon Labs®, SiLabs® and the Silicon Labs logo®, Bluegiga®, Bluegiga Logo®, Clockbuilder®, CMEMS®, DSPLL®, EFM®, EFM32®, EFR, Ember®, Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Ember®, EZLink®, EZRadio®, EZRadioPRO®, Gecko®, ISOmodem®, Micrium, Precision32®, ProSLIC®, Simplicity Studio®, SiPHY®, Telegesis, the Telegesis Logo®, USBXpress®, Zentri and others are trademarks or registered trademarks of Silicon Labs. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. All other products or brand names mentioned herein are trademarks of their respective holders.



**Silicon Laboratories Inc.**  
400 West Cesar Chavez  
Austin, TX 78701  
USA

<http://www.silabs.com>