Chapter 1: Survey of WICED Wi-Fi

Time 1 Hour

After completing Chapter 1 (this chapter) you will understand a top level view of all of the components of the WICED ecosystem including the chips, modules, software, documentation, support infrastructure and development kits. You will have WICED Studio installed and working on your computer and will understand how to program an existing project into a kit.

1.1 Survey of WICED Studio SDK

1.1.1 First Look

The WICED software tool is called "WICED Studio" and it is based on Eclipse.

WICED Studio is installed, by default, in *C:/Users/<UserName>/AppData/Local/WICED.* As a part of installing WICED Studio, an SDK Workspace is created, by default, in *C:/Users/<UserName>/My Documents/WICED-Studio-<version>/43xxx_Wi-Fi*. The SDK Workspace is where you will create your projects. Note that a new set of SDK Workspace files is created for each version of WICED Studio that you install. If you install a newer version of WICED Studio, your projects from the previous version will still be available in the SDK Workspace location associated with that previous version of WICED Studio. You must copy them over manually if you want to access them in the new version.

Once installed, WICED Studio will show up in Windows under Start > All Programs > Cypress > WICED-Studio. The first time you open WICED Studio, you will be asked for which platform you want to use. We will use *43xxx_Wi-Fi* for this class, but if you used a different selection don't worry – you can change it easily from inside the tool using the dropdown menu.
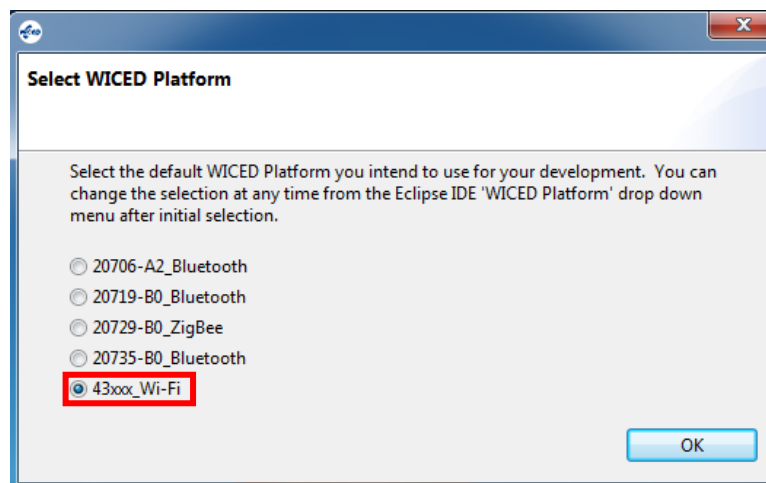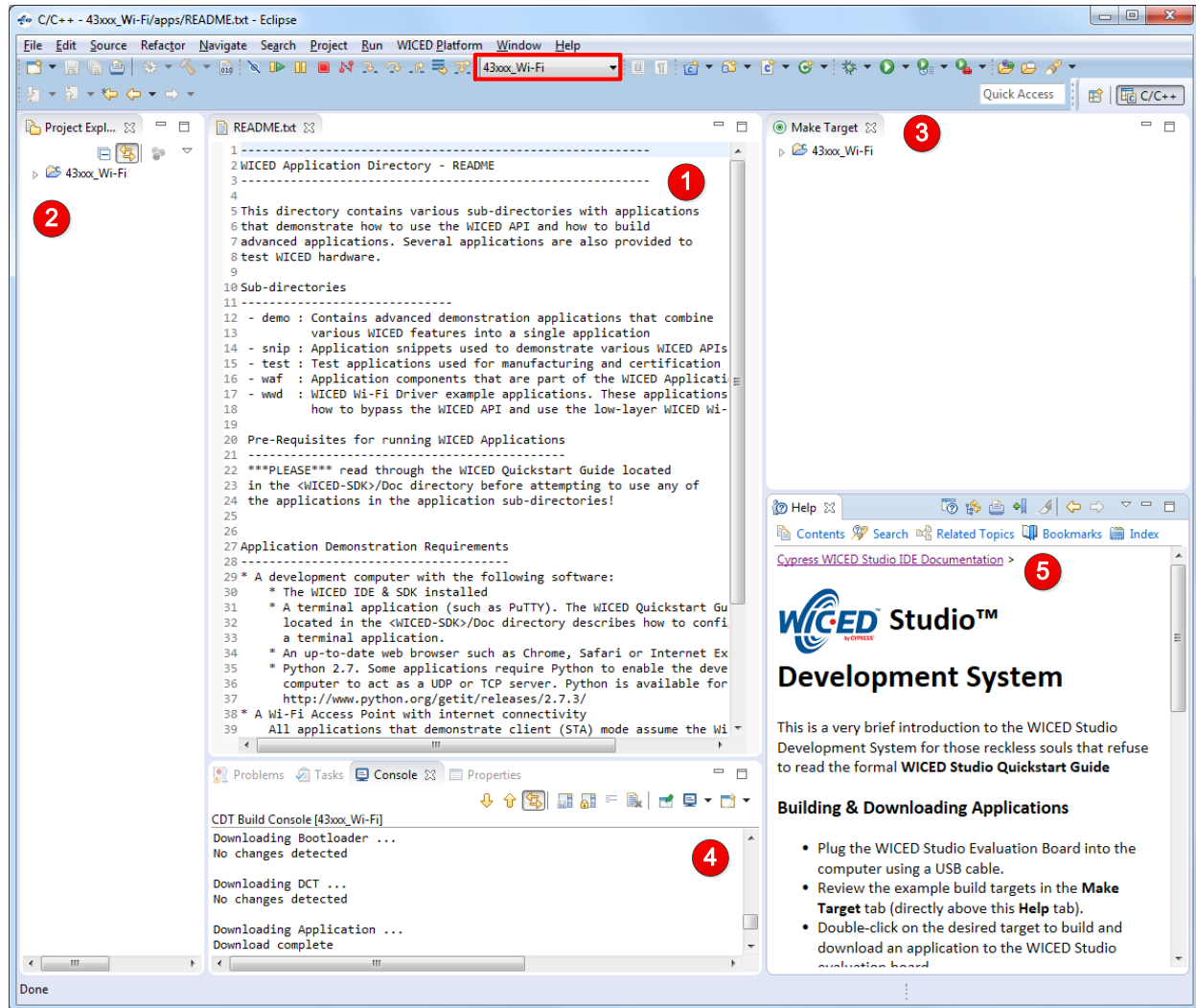
The major windows are:

1. File Editor
2. Project Explorer
3. Make Target
4. Console
5. Help

If you close a window unintentionally, you can restore the original set of windows using the following procedure:

1. Select Window > Reset Perspective
   a. Note: the perspective shown is *C/C++.* You can open other perspectives by clicking the icon near the top right corner of the screen or by using Window > Open perspective.
2. Select Window > Show View > Make Target

3. Select Window > Show View > Other… > Help > Help
4. Drag window edges or window tabs around as desired.

1.1.2 Project Explorer

If you expand 43xxx_Wi-Fi from the Project Explorer window you will see the following:
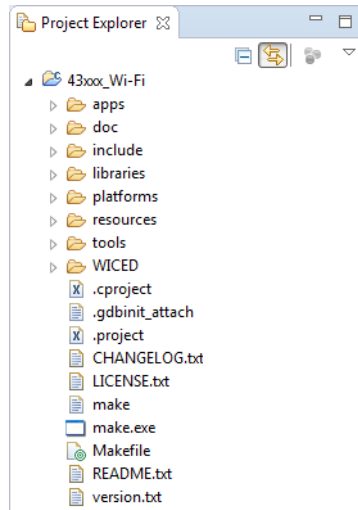
The README.txt file provides basic information about the SDK. This file is open by default in the editor window when the SDK is first opened. The file version.txt contains details of the version of WICED Studio that you have open. Other folders of interest in the Project Explorer are:

Apps

The *apps* folder is where all the example projects reside as well as where you will put your own projects. The SDK Workspace includes a wealth of example projects. These are broken into categories by folder name. A few of the useful ones are:
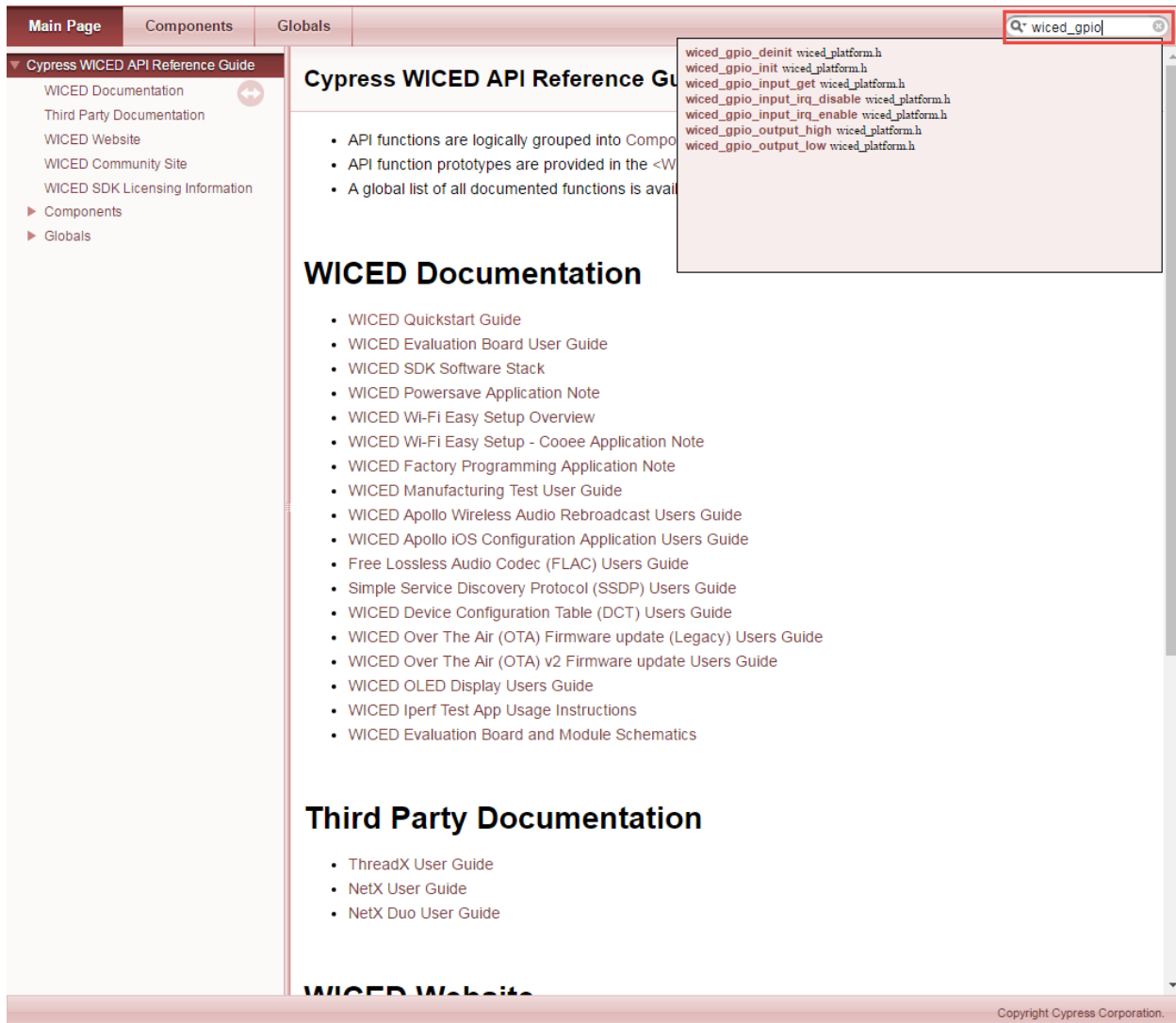
1. *snip*: Short examples that typically demonstrate one feature. For example:
   a. *snip/gpio* demonstrates GPIO use by reading buttons and blinking LEDs.
   b. *snip/scan* scans for Wi-Fi access points every 5 seconds and displays the results to a terminal window.
2. *demo*: More complex and complete demonstrations. For example:
   a. *demo/temp_control* demonstrates an application for controlling and reporting temperatures.
   b. *demo/bt_smartbridge* demonstrates a Bluetooth to Wi-Fi bridge.
3. *test*: Test and utility programs.For example:
   a. *test/console* provides a console application on a terminal window. Type "help" in the console for a list of all supported commands such as scanning for and connecting to Wi-Fi access points.

Doc

The doc folder contains the documentation for the SDK Workspace. Of particular interest is the API.html file which documents all of the WICED API functions. It is usually easier to use that file if you open it in a web browser of your choice rather than from inside WICED Studio. You can do this from WICED Studio by right clicking on API.html and choosing "Open With > System Editor". Depending on your web browser and settings, you may have to tell it to allow ActiveX controls to see the menus.

The first window you will see when you open the API.html file is shown below. You can enter search strings in the box in the upper-right corner. The list will filter dynamically as you type. For example, if you enter "wiced_gpio" you will see a list of all WICED APIs that are used for controlling IOs.

Note: sometimes the search feature stops working. If this happens, close the browser page and reopen it.

Platforms

The platforms folder contains information on different kits (i.e. hardware platforms). These files are necessary in order to program a given project into specific hardware. In our case, the kit we are using is called CYW943907AEVAL1F. That kit has a platform folder, but since we are also using a shield attached to it, we will use a custom set of platform files that also includes the peripherals on the shield. You will have to copy over the custom platform files before using the shield and kit (this will be the first exercise in Chapter 2). You can even create platform files for your own custom hardware that you design. We'll discuss the platforms folder in more detail in Chapter 2.

Libraries

The libraries folder contains various sets of library function files. For example, there are libraries for working with file systems (in the filesystems folder), for using U8G graphics displays (in the graphics folder), and for reading JSON (in the utilities folder). We will discuss the libraries folder in more detail in Chapter 4.
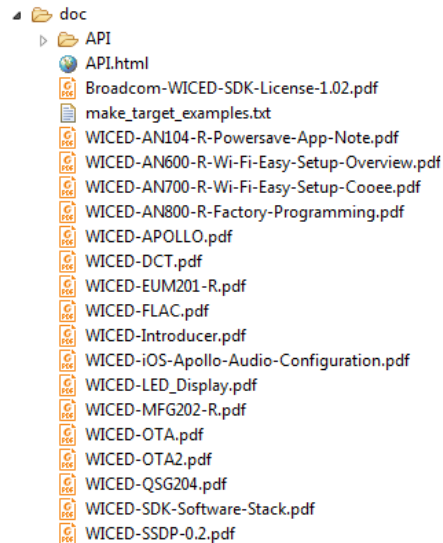
Resources

The resources folder is where you store files that are required by your application. For example, if your application contains a web server, the html files for the server would be in the resources folder under *apps/https_server*. As another example, security certificates also go in the resources folder.

1.2   Tour of Documentation

1.1.3 In the SDK Workspace

As discussed previously, the doc folder in the SDK Workspace contains various documents. The most important of these is the API guide but the folder also contains other useful documents such as the QSG (Quick Start Guide), how to use DCT (Device Configuration Tables), FLAC (Free Lossless Audio Compression), and OTA (Over the Air) Updates. The list of files in the doc directory looks like this:

```
doc
  API
  API.html
  Broadcom-WICED-SDK-License-1.02.pdf
  make_target_examples.txt
  WICED-AN104-R-Powersave-App-Note.pdf
  WICED-AN600-R-Wi-Fi-Easy-Setup-Overview.pdf
  WICED-AN700-R-Wi-Fi-Easy-Setup-Cooee.pdf
  WICED-AN800-R-Factory-Programming.pdf
  WICED-APOLLO.pdf
  WICED-DCT.pdf
  WICED-EUM201-R.pdf
  WICED-FLAC.pdf
  WICED-Introducer.pdf
  WICED-iOS-Apollo-Audio-Configuration.pdf
  WICED-LED_Display.pdf
  WICED-MFG202-R.pdf
  WICED-OTA.pdf
  WICED-OTA2.pdf
  WICED-QSG204.pdf
  WICED-SDK-Software-Stack.pdf
  WICED-SSDP-0.2.pdf
```

Each of the files in the doc folder can be accessed either from within the WICED Studio (the Project Explorer pane) or from Windows Explorer.

1.1.4 On the Web

Navigating to "www.cypress.com > Design Support > Community" will take you to the following site (the direct link is https://community.cypress.com/welcome):

Clicking on WICED Wi-Fi will take you to the community page as shown below. From this page, you can download WICED Studio, purchase kits, search for answers, ask questions, etc.

1.3   Reporting Issues
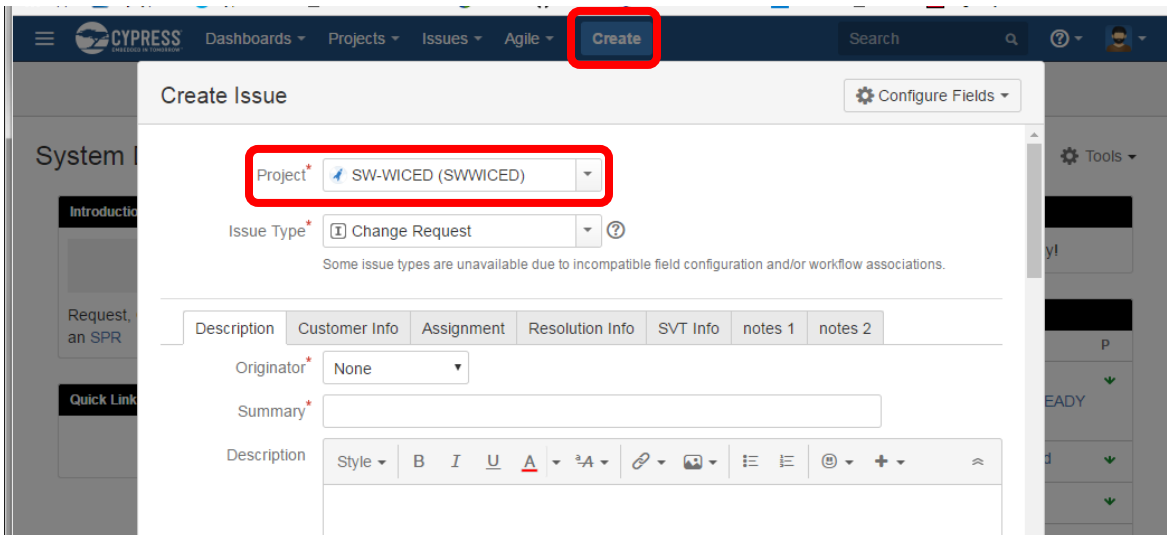
If you find an issue in WICED Studio (bug, missing or confusing documentation, enhancement request), please use a "JIRA" to report it:
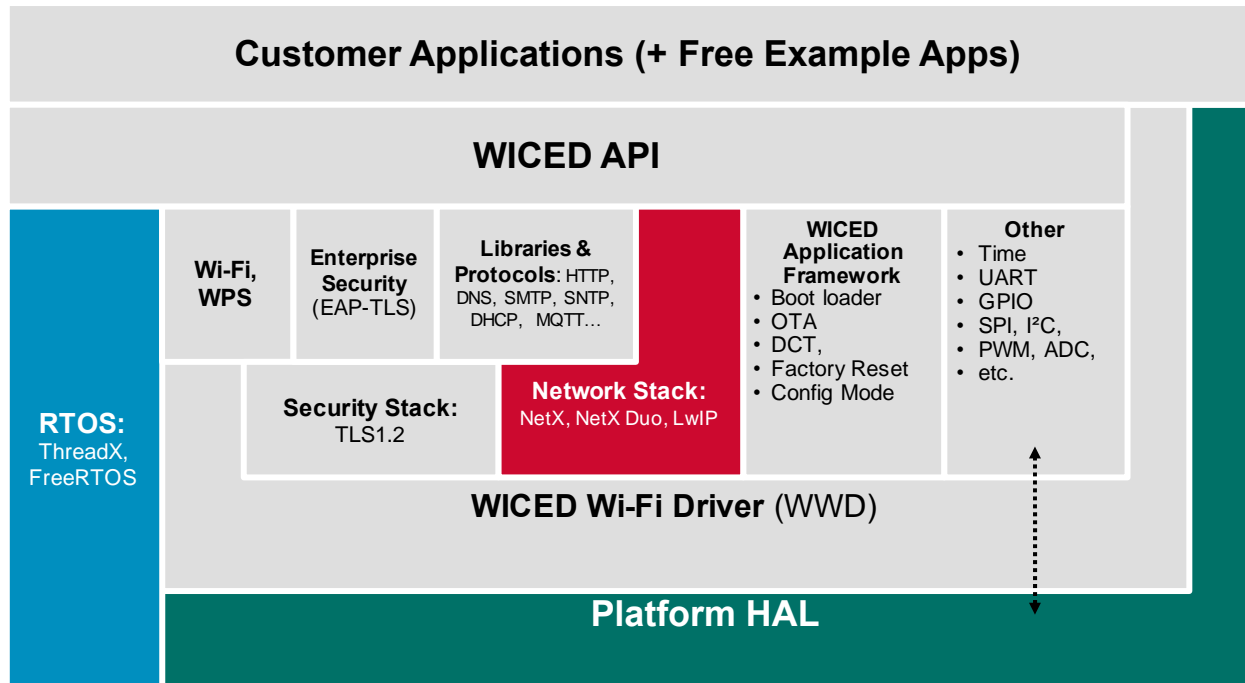
jira.cypress.com

Click on Create to start submitting a JIRA. Use the project type of SW-WICED and fill in as many details as you can to report the issue. If you are reporting an issue with a kit, use "KITS:" as a prefix to the summary.

1.4   Tour of WICED SDK Structure

Customer Applications (+ Free Example Apps)						

WICED API

RTOS: ThreadX, FreeRTOS

Wi-Fi, WPS	**Enterprise Security** (EAP-TLS)	**Libraries & Protocols**: HTTP, DNS, SMTP, SNTP, DHCP, MQTT…		**WICED Application Framework** • Boot loader • OTA • DCT, • Factory Reset • Config Mode	**Other** • Time • UART • GPIO • SPI, I²C, • PWM, ADC, • etc.
	Security Stack: TLS1.2	**Network Stack:** NetX, NetX Duo, LwIP		

WICED Wi-Fi Driver (WWD)

Platform HAL

1.5   Tour of Wi-Fi

IEEE Standard	Mbits/s	Freq GHz	# Chan	Chan Width MHz	MIMO	Comment
802.11	2	2.4	14	22	-	
802.11b	11	2.4	14	22	-	Same as 802.11 with new coding scheme
802.11a	54	5	22	20	-	New coding scheme OFDM + 5GHz
802.11g	54	2.4	14	22	-	New coding scheme OFDM
802.11n	600	2.4 5	14 22	20/40	4	MIMO=Multiple Antennas 4 streams of 150Mbits/s
802.11ac	3600	2.4 5	22 10 5 1	20 40 80 160	8	433Mbits/s per stream Beam forming directional

1.6 Tour of Chips

Device	Key Features	Notes
BCM43362	- Single band 2.4GHz 1x1 11n - Modules paired w/ STM32F205 and STM32F411	Recommend new designs with 43364
BCM4390	- Single band 2.4GHz 1x1 11n	Recommend new designs with BCM43903/7 Black Box Only
BCM43340	- Dual band combo 2.4GHz and 5GHz, 1x1 11n - BT4.1/BLE	Currently only production dual band combo in single chip for WICED RTOS SDK
BCM43364	- Single band 2.4GHz, 1x1 11n - Next Gen BCM43362	Lower power and cost compared to BCM43362
BCM4343W	- Single band combo 2.4GHz - BT4.1/BLE	Lower cost and power compared to BCM43340
BCM43903	- Single band 2.4GHz , 1x1 11n - SOC w/ ARM CR4 160Mhz 1MB on chip RAM - Secure OTP and HW crypto engine	Lower cost solution for White Box High end Black Box features
BCM43907	- Dual band 2.4 and 5GHz, 1x1 11n - SOC w/ ARM CR4 320Mhz 2MB on chip RAM - Secure OTP and HW crypto engine	Ideal solution for White Box Multiple low power modes

1.7 Tour of Partners

Partner Model

Module Makers — Design, build and sell RF Modules with very limited software and hardware certification support

Technology Partners — Provide cloud-, mobile- and middleware-related engineering services

Value Added Resellers (VARs) — Provide certified, ready-to-use modules with integrated software and custom services

Original Device Manufacturers (ODMs) — Integrate modules, software and plastics into a finished product with branding & customization options

A global partner ecosystem enables you to get the level of support you need for your IoT application

An IoT Selector Guide including partner modules available can be found in the Community at:

https://community.cypress.com/docs/DOC-3021

1.8   Tour of Development Kits

1.1.5 Cypress CYW943907AEVAL1F

- Dual band 2.4 and 5GHz WiFi, 1x1 11n
- Ethernet
- SOC w/ ARM CR4 320Mhz
- 2MB on chip RAM
- Secure OTP and HW crypto engine
- USB JTAG Programmer/Debugger

1.1.6 Cypress BCM94343WWCD1 EVB Evaluation and Development Kit

- Wi-Fi + BLE combo kit (BCM4343W)
- 512kB Flash, 128kB SRAM, 8Mb SPI Flash
- 2 User Buttons, 2 User LEDs
- Thermistor
- USB JTAG Programmer/Debugger
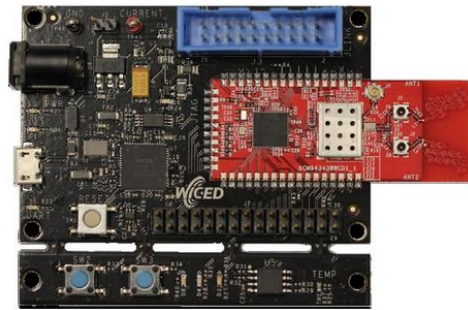
1.1.7 Future Nebula IoT Development Kit

- Murata 1DX module with
- Wi-Fi + BLE combo kit (CYW4343W)
- 2MB Flash, 256kB SRAM, 8Mb Serial Flash
- 2 User Buttons, 2 User LEDs
- Arduino, PMOD, and mikroBus Interfaces
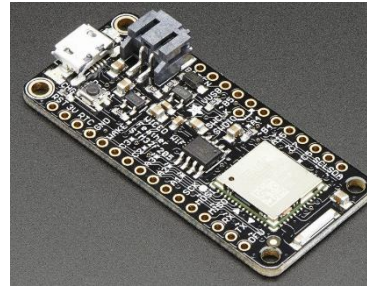

1.1.8 Avnet BCM4343W IoT Starter Kit

- Wi-Fi + BLE combo kit (BCM4343W)
- 512kB Flash, 128kB SRAM, 8Mb SPI Flash
- 1 User Button, 2 User LEDs
- Ambient Light Sensor
- Arduino Compatible Headers
- USB JTAG Programmer/Debugger

1.1.9 Adafruit Feather

- Wi-Fi kit (BCM43362)
- 128kB Flash, 16kB SRAM, 16Mb SPI Flash
- Programmable using Arduino IDE
- USB Bootloader

1.1.10 Electric Imp

- Wi-Fi kit (IMP003- BCM43362, IMP005 – BCM43907)
- Programmable using imp IDE

1.1.11 Inventek

ISM43362-M3G-EVB

- Wi-Fi Kit (BCM43362)
- 2 User Buttons, 2 User LEDs
- Thermistor
- USB JTAG Programmer/Debugger

ISM43340-M4G-EVB

- Wi-Fi & Bluetooth Combo Kit (BCM43340)
- 2 User Buttons, 2 User LEDs
- Thermistor
- USB JTAG Programmer/Debugger

ISMART Arduino Shield

- Wi-Fi, Bluetooth, NFC Combo (BCM43362)
- Arduino stackable shield

ISM43340-L77-EVB

- Wi-Fi & Bluetooth Combo Kit (BCM43340)
- Wi-Fi over SDIO
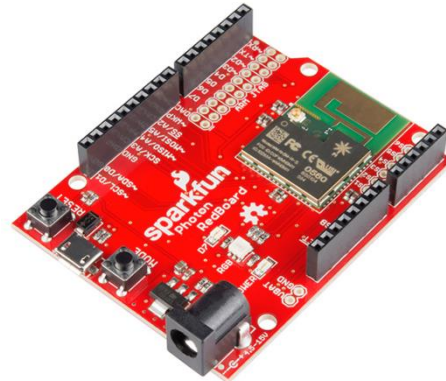- Bluetooth over UART
- Micro-SD Connector

1.1.12 Particle Photon

- Wi-Fi kit (BCM43362)
- 1MB Flash, 128kB SRAM

1.1.13 SparkFun with Particle Photon Module

- Wi-Fi kit (BCM43362)
- 1MB Flash, 128kB SRAM
- Arduino Compatible Headers

1.9   Exercise(s)

Exercise - 1.1 Create a forum account

1. Go to https://community.cypress.com/welcome
2. If you already have an account, click "Log in" from the top right corner of the page.
3. If you do not have an account, click "WICED Community" from the panel on the left and sign up for an account.
4. Once you are logged in, click the "WICED Wi-Fi" icon.
5. Click on the "Forums" button.
6. Browse the existing forum articles or search for a particular topic that interests you.

Exercise - 1.2 Open the documentation

1. Open the API.html document from the WICED Studio Project Explorer or using Windows Explorer in the SDK Workspace *doc* directory.

   Depending on your browser and security settings, you may need to allow ActiveX controls to get the page to display correctly.