



Quick Start Guide

WICED™

WICED™ Development System



Revision History

<i>Revision</i>	<i>Date</i>	<i>Change Description</i>
WICED-QSG204-R	September 18, 2015	Update for WICED-SDK-3.4.0
WICED-QSG203-R	July 21, 2015	Update for WICED-SDK-3.3.1
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1 About this Document

1.1 Purpose and Scope

This document provides detailed instructions to set up the Broadcom® Wireless Internet Connectivity for Embedded Devices (WICED™; pronounced “wicked”) development system.

The WICED development system supports application development using a WICED evaluation board. The development system is compatible with Windows®, Mac OS X and Linux. This document describes the software components included in the WICED development system and provides instructions for compiling WICED sample applications in Windows® using the WICED integrated development environment (IDE).

The instructions in this document must be completed before the WICED SDK and WICED evaluation board can be used.



Note: This document applies to **WICED SDK 3.4.0**.

1.2 Audience

This document is for software developers who are using the WICED Development System to create applications for secure embedded wireless networked devices.

1.3 Document Conventions

The following conventions may be used in this document:

<i>Convention</i>	<i>Description</i>
Bold	Buttons, tabs, lists and other GUI items: click Next , select the Startup tab
Monospace	Command lines and application outputs: <code>snip.scan-BCM943362WCD4 download run</code>
<>	Placeholders for <i>required</i> elements: <WICED-SDK>
“ ”	Application Names, Configuration Parameters: ‘YOUR_AP_SSID’

1.4 Technical Support

Broadcom provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates through its Customer Support Portal (CSP). For a CSP account, contact your Broadcom® Sales or Engineering support representative.

General WICED support is available on the Broadcom Community site at the URL shown below. Register to join the Community and gain access to the forum to find answers to questions about WICED and ask for help.

<http://community.broadcom.com/welcome>

2 WICED Development System

The WICED development system is composed of a WICED evaluation board, the WICED software development kit (SDK) and the WICED Integrated Development Environment (IDE).

2.1 Evaluation Board

The Broadcom® WICED evaluation board (Figure 1) incorporates a WICED module and circuitry to enable the programming and debugging of applications on the module.

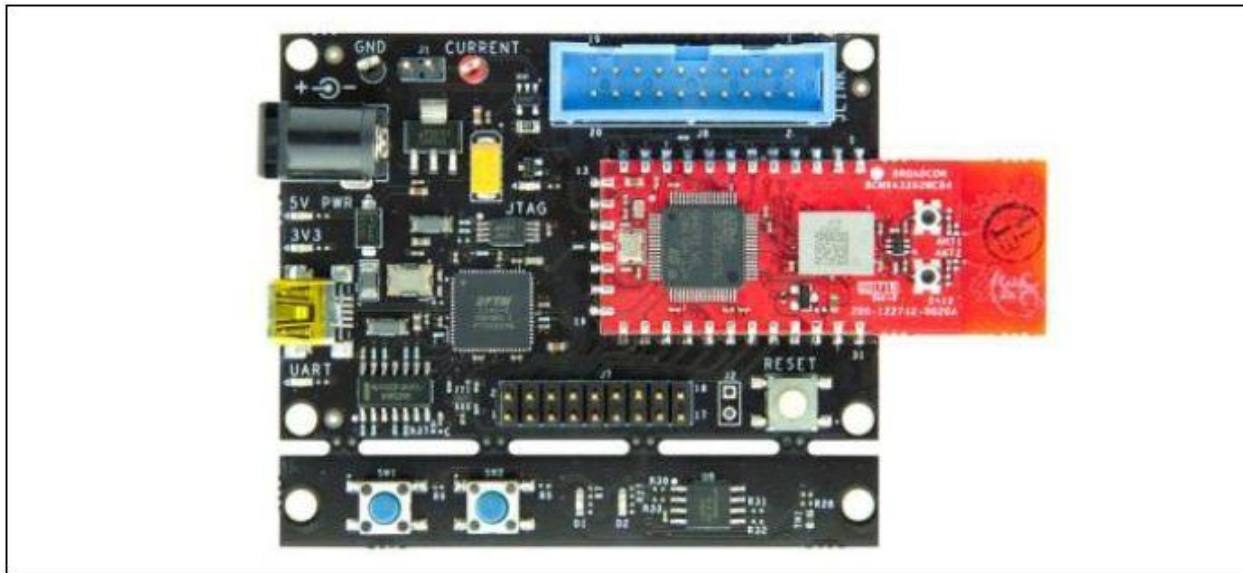


Figure 1: WICED Evaluation Board with BCM943362WCD4 WICED Module

2.2 Software Development Kit

The WICED SDK includes:

- WICED software development tools:
 - Utilities and OS drivers to support development in the Windows® environment
 - WICED software stack, development tools and demonstration applications
 - ThreadX and FreeRTOS Real-Time Operating Systems (RTOS), and NetX/NetXDuo IPv4/IPv6 and LwIP IPv4 TCP/IP network stack implementations.
 - Embedded securities libraries including TLS & HTTPS
 - A WICED Wi-Fi driver and API
 - WICED Application Framework (WAF)
 - Manufacturing test and Iperf applications to enable system performance testing
- WICED API Documentation, (this) Quickstart Guide and related documents

2.3 Directory Structure

Table 1 is an overview of the top-level directory of the WICED SDK.

Table 1: Overview of the WICED SDK Top-Level Directory

WICED-SDK Directories	Directory Contents
apps	Example & Test Applications
doc	API & Reference Documentation
include	WICED API, constants, and defaults
libraries	Bluetooth, daemons, drivers, file systems, inputs and protocols
platforms	Evaluation board support package, incl. Eval Board and module schematics
resources	Binary and test based objects including scripts, images and certificates
tools	Build tools, compilers, debugger, makefiles, programming tools etc.
Tools/drivers	Drivers for WICED evaluation boards
WICED	WICED core components: RTOS, TCP stack, Security & Platform definitions
WICED/WWD	The WICED Wi-Fi Driver

2.3.1 Hardware and Software Requirements

- The WICED SDK runs on 32- and 64-bit versions of Microsoft Windows® XP and Win7, Mac OS X 10.5 or later, and 32/64-bit Linux.
- The SDK is distributed as a standalone 7zip zipfile suitable for all operating systems, and bundled together with the WICED Integrated Development Environment as an executable installer. The installer is only provided for Windows® and OS X operating systems.
- The development computer requires a single USB port to connect to the WICED evaluation board.
- A terminal emulation application such as PuTTY (Windows®) or CoolTerm (OS X).



Note: The 7zip extraction utility is available from 7-zip.org. 7zip is needed if you plan to extract the standalone WICED SDK 7zip archive. The standard Windows® zipfile extraction utility may silently corrupt the SDK archive during the extraction process, do **NOT** use it!

3 Setting Up the WICED SDK

The WICED SDK is available for download from the Broadcom® WICED website or from the Broadcom® Customer Support Portal.

To use the SDK, the following steps must be performed:

1. Download and install the WICED SDK and IDE
2. Choose and compile an application
3. Load the application into the WICED module on the WICED evaluation board
4. Run the application
5. Debug the application

This section provides instructions for Step 1 for Windows®. Steps 2-5 are discussed in Section 4.

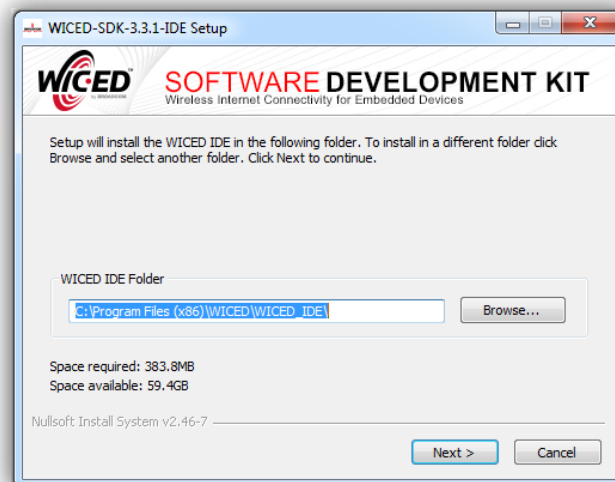


Note: DO **NOT** PLUG THE WICED EVALUATION BOARD INTO THE DEVELOPMENT COMPUTER PRIOR TO INSTALLING THE WICED DEVELOPMENT SYSTEM. DOING SO MAY CAUSE THE INCORRECT DRIVER TO LOAD!

3.1 Instructions for Windows® XP / Windows® 7

3.1.1 Install the WICED SDK and IDE

The WICED SDK is provided as a self-installing executable file. Double-click the **Wiced-SDK-3.4.0-IDE-Installer.exe** file to begin the installation. A Setup window similar to the following appears.



Choose the installation folder for the WICED IDE and click **Next**, then choose the installation workspace folder for the WICED SDK and click **Install**. Once the installation completes, click **Finish** to immediately start the WICED IDE, or deselect the **Start WICED IDE now** checkbox and click **Finish** to exit.

3.1.2 Connect the WICED Evaluation Board

The USB interface connects the WICED evaluation board to the PC. The USB interface provides +5V power as well as individual programming/debug and UART interfaces to the microcontroller on the WICED module. A separate +5V power supply is NOT needed.

The WICED evaluation board has two logical USB devices: a USB-JTAG device and a USB-UART device. A driver for the WICED evaluation board was automatically installed during the SDK installation process.

Plug the WICED evaluation board into the development PC with a USB cable, the driver automatically loads.

3.1.3 Verifying Driver Installation

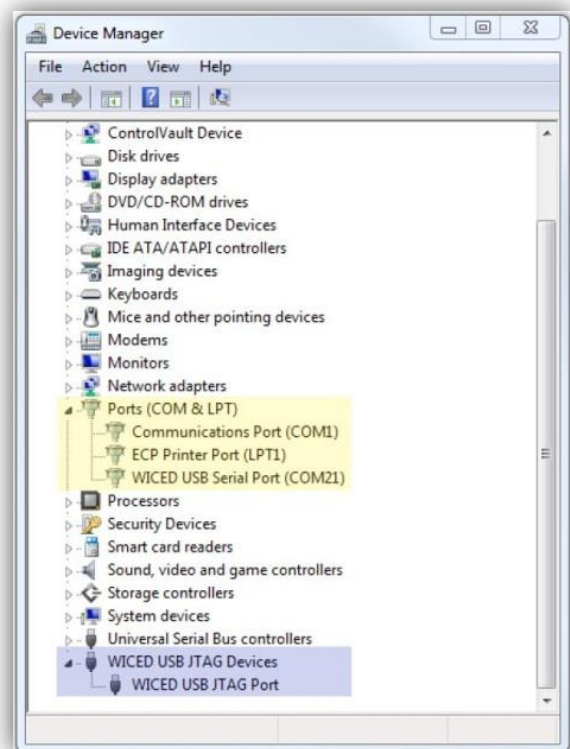
To verify that driver installation has completed successfully, do the following:

1. Open the **Device Manager** (right-click **My Computer**, select **Properties**).
2. In the **System Properties** window, select **Device Manager**.
 - a. The **WICED USB Serial Port** is listed under **Ports (COM & LPT)** as shown in the adjacent screen capture (shaded yellow).
 - b. The **WICED USB JTAG Port** is listed under **WICED USB JTAG Devices** as shown in the adjacent screen capture (shaded blue).

In the screen capture, the **Device Manager** window identifies the WICED USB Serial COM port as **COM21**. The assigned port number varies between systems.

Troubleshooting

If an error occurred during the automatic driver installation process, the driver may be manually installed from the <WICED-SDK>\tools\drivers directory.



If the WICED evaluation board still does not appear in the **Device Manager**, verify the 3V3 LED is turned ON and/or replace the USB cable.

4 Using the WICED IDE

4.1 Build and Download a Sample Application

On a Windows® PC, start the WICED IDE by selecting **START > All Programs > Broadcom > WICED IDE**. After startup, the WICED IDE looks similar to the screen capture shown in Figure 2.

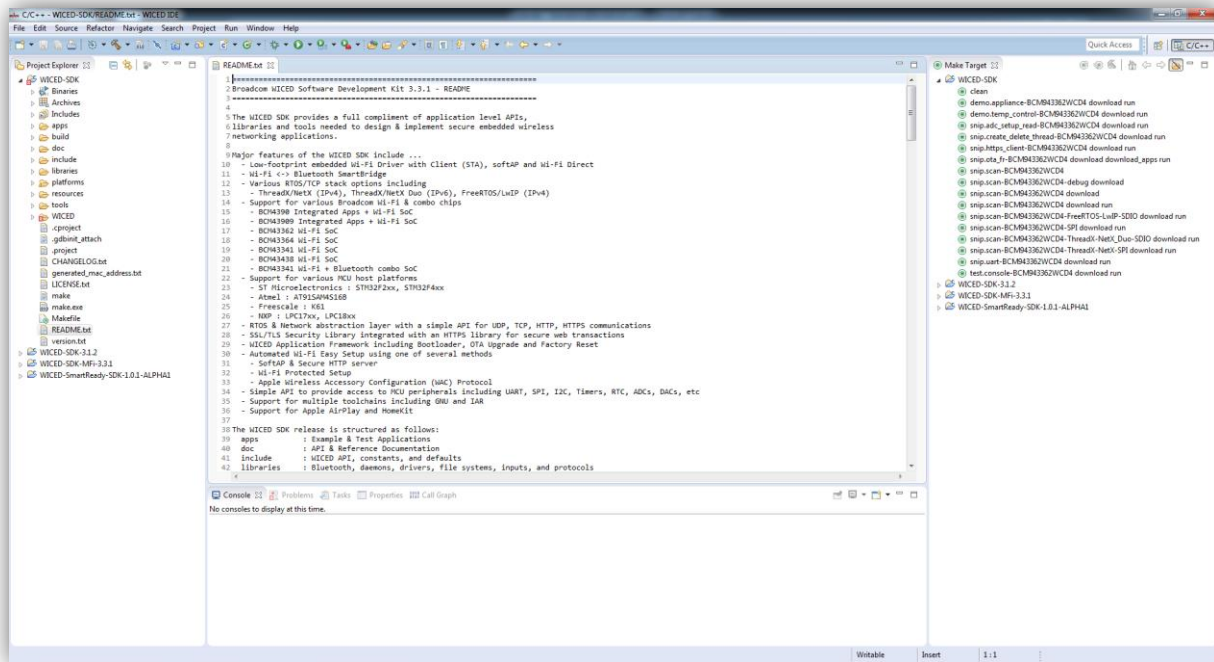


Figure 2. The WICED Integrated Development Environment

The **Help** tab to the right of the WICED IDE window describes how to build and download the sample applications shown in the **Make Target** tab (located above the **Help** tab). Multiple build targets are pre-configured for a number of sample applications and at least two WICED hardware platforms including 'BCM943362WCD4' and 'BCM9WCDUS109'.

For this example, we will build and download the 'scan' application for the 'BCM943362WCD4' WICED module on the WICED Evaluation Board. If the module on your evaluation board is different, follow the instructions to modify or copy on of the 'scan' build targets to match your hardware platform.

Double click the **snip.scan-BCM943362WCD4** target to build the scan application; the IDE console window displays the build progress. The build target is appended with the 'download' and 'run' options, these options tell the toolchain to download the firmware and run the application after the build completes.

The build output looks similar to the following:

```
**** Build of configuration Default for project WICED-SDK-3.4.0 ****

make snip.scan-BCM943362WCD4 download run
Making config file for first time
+-----+
| IMPORTANT NOTES
|
+-----+
| Wi-Fi MAC Address
|
| The target Wi-Fi MAC address is defined in <WICED-
SDK>/generated_mac_address.txt
| Ensure each target device has a unique address.
|
+-----+
| MCU & Wi-Fi Power Save
|
| It is *critical* that applications using WICED Powersave API functions
connect an accurate 32kHz |
| reference clock to the sleep clock input pin of the WLAN chip. Please
read the WICED Powersave |
| Application Note located in the documentation directory if you plan to
use powersave features. |
+-----+
Building Bootloader
Finished Building Bootloader

Processing resources
Creating security credentials
Making DCT image
Compiling App_Scan
Compiling Platform_BCM943362WCD4
Compiling NetX_Duo
Compiling WICED
Compiling Lib_SPI_Flash_Library_BCM943362WCD4
Compiling WWD_ThreadX_Interface
Compiling WICED_ThreadX_Interface
Compiling WWD_NetX_Duo_Interface
Compiling WICED_NetX_Duo_Interface
Compiling SupPLICANT_BESL
Compiling Lib_DNS
Compiling WWD_for_SDIO_ThreadX
Compiling Lib_Wiced_RO_FS
Compiling STM32F2xx
Compiling Lib_DHCP_Server
Compiling Lib_Linked_List
Compiling Lib_base64
Compiling Lib_TLV
Compiling Lib_crypto_open
Compiling common_GCC
Compiling STM32F2xx_Peripheral_Drivers
Compiling Lib_Ring_Buffer
```

Compiling STM32F2xx_Peripheral_Libraries
 Making snip_scan-BCM943362WCD4.elf

Making snip_scan-BCM943362WCD4.bin
 snip_scan-BCM943362WCD4

Module	Flash	Static RAM
App	394	8
Host MCU-family library	12292	2740
Interrupt Vectors	424	0
libc	23595	3064
Networking	710	7822
NetX	3208	92
NetX-Duo - Interfaces & Stacks	0	12
Packet Buffers	0	23142
platform	1008	168
RAM Initialisation	2260	0
resources	16	0
Ring_Buffer	92	0
Startup Stack & Link Script fill	0	4
SupPLICant - BESL	68	12
ThreadX	8260	396
Wi-Fi Firmware	210412	0
WICED	3425	828
WWD	11748	1076
TOTAL (bytes)	275652	39364

Downloading Bootloader ...
 No changes detected
 Downloading DCT ...
 Download complete
 Downloading Application ...
 Download complete
 Resetting target
 Target running
 Build complete

During firmware download, a blue LED labeled 'JTAG' on the WICED evaluation board illuminates to indicate that a JTAG firmware download is in process.

If the WICED evaluation board is not recognized by the programming tools, it may be necessary to disconnect and then reconnect the board to the computer before trying again. The following message indicates there was an error with the download process:

```
***** OpenOCD failed - ensure you have installed the driver from the
drivers directory, and that the debugger is not running ***** In Linux
this may be due to USB access permissions. In a virtual machine it may
be due to USB passthrough settings *****
Resetting target
Make: *** [run] Error 1
```

4.2 Run an Application

This section assumes you have successfully completed section 4.1, and the scan application is running on the WICED module.

Several methods are available to verify the scan application is working. After power-on-reset, the scan application prints status messages to the USB UART of the WICED evaluation board.

To verify printing, follow the instructions in Appendix A to setup a terminal application such as PuTTY. Start the terminal application and connect the WICED evaluation board then press the reset button on the board. Text similar to the following appears:

```
Starting WICED v3.4.0
Platform BCM943362WCD4 initialised
Started ThreadX v5.6
Initialising NetX_Duo v5.7_sp2
Creating Packet pools
WWD SDIO interface initialized
WLAN MAC Address   : 44:39:C4:31:14:83
WLAN Firmware      : wl0: Nov 7 2014 16:03:45 version 5.90.230.12 FWID
01-c9b809b5
Waiting for scan results...

#  Type  BSSID                RSSI   Rate  Chan  Security  SSID
-----
0  Infra  44:39:C4:31:12:15      -60    65.0    1   WPA2 AES  WICED Device
1  Infra  B8:BE:BF:15:AF:B0      -37    54.0    1   WPA2 AES  BRCMGUEST
...
Scan complete in 1177 milliseconds
```



Note: A description of the scan application is provided in the header comments of the scan.c source file located in the WICED SDK at <WICED-SDK>/apps/snip/scan/scan.c.

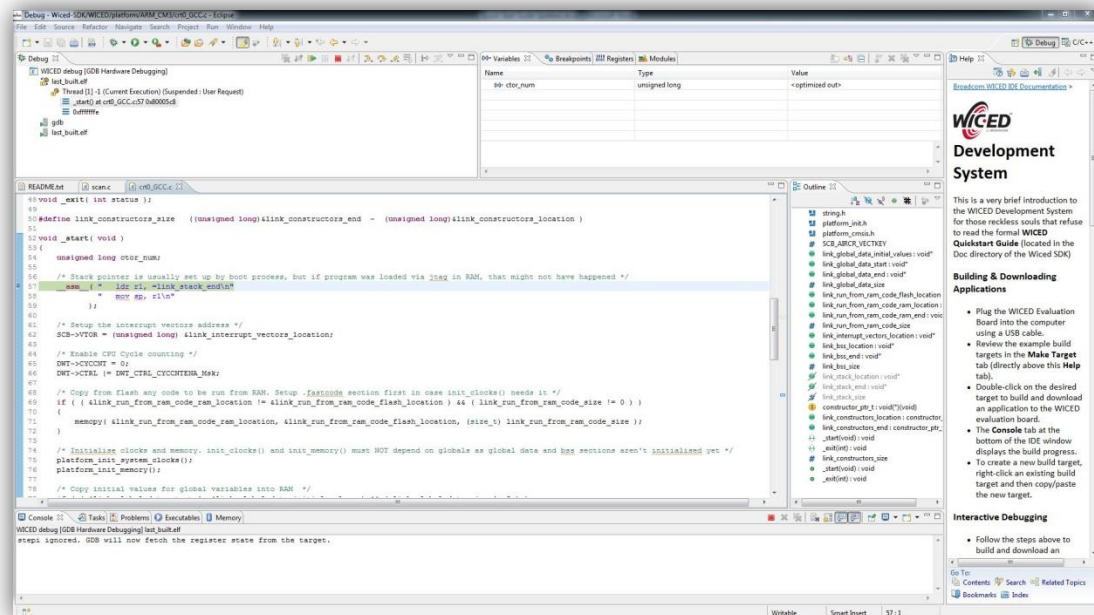
4.3 Debug an Application

The WICED development system supports single-step thread-aware interactive application debugging with WICED IDE. Brief instructions to start debugging an application are provided in the WICED IDE **Help** tab. The following example demonstrates how to start debugging the 'scan' application.

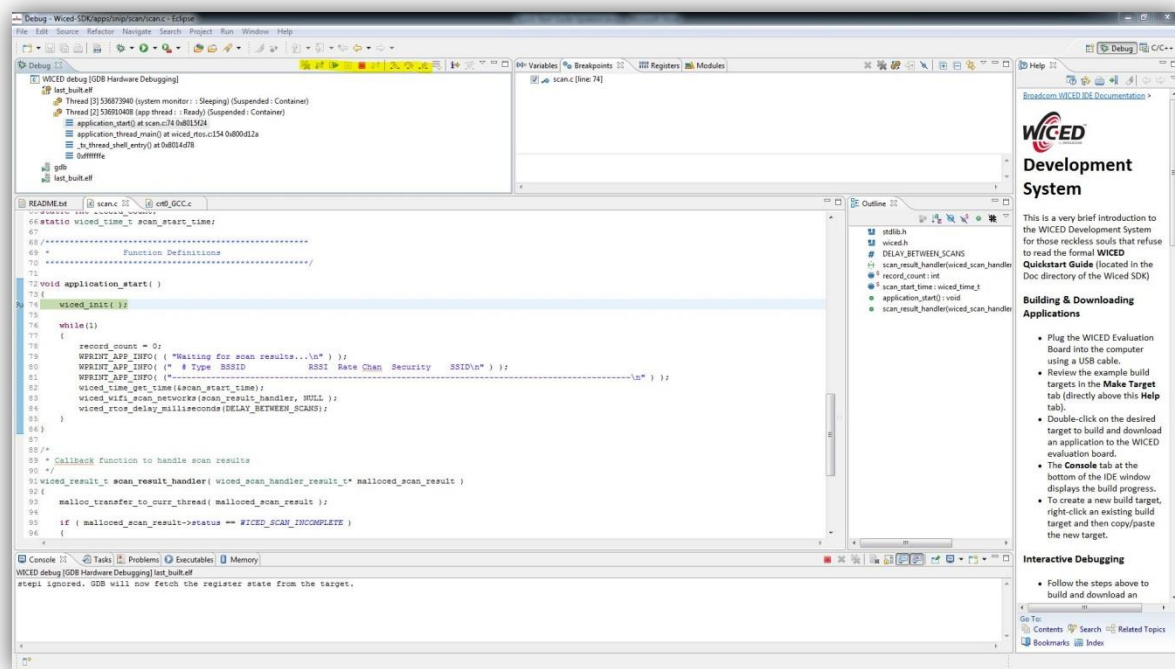
1. Setup a breakpoint:
 - a. Using the **Project Explorer** tab on the left of the IDE, navigate to the '<WICED-SDK>/apps/snip/scan' directory. Double-click on 'scan.c' to open the source file in the WICED IDE editor window.
 - b. Scroll to the 'application_start' function and locate the call to 'wiced_init' (at approximately line 74)

- c. Double-click in the column to the left of the 'wiced_init' function to place a break point at this function (alternately right-click in the column and select 'Toggle Breakpoint'). A blue dot appears in the column.
2. Setup the 'scan' debug build target: In the WICED IDE **Make Target** tab, right click on the 'snip.scan-BCM943362WCD4 download run' build target and click **New** (alternately, right click and click Edit or copy-paste and then edit a new build target). Change the build target to 'snip.scan-BCM943362WCD4-debug download'.
3. Build and download the debug firmware image: Double-click the newly created 'scan' debug target, the debug firmware image builds and downloads to the 'BCM943362WCD4' module on the WICED evaluation board.
4. Launch the debugger: Click the green bug icon on the WICED IDE toolbar (or press F11 on Windows® systems). The debugger starts. If the WICED IDE displays a **Confirm Perspective Switch** dialogue box, click **Yes** to show the debug view.

To confirm the debugger is running, verify the blue JTAG LED on the WICED evaluation board is flashing, and that the WICED IDE looks similar to the following screen capture.



5. Run to a breakpoint: To run the application to the 'wiced_init' breakpoint configured in Step 1, click the yellow/green pause/play button in the **Debug** tab. The **Debug** tab control buttons are highlighted in yellow in the following screen capture.



6. View a breakpoint: when the debugger halts at a breakpoint, the WICED IDE does not automatically switch to the current thread as the context for the debugger. It is necessary to manually check the current task in the running thread is selected before analyzing debug information.

To find the breakpoint, click on the 'application_start()' function under Thread[2] in the **Debug** tab. The 'scan.c' source file opens and the wiced_init function is highlighted in green to show where the program halted.

7. Step program execution: Step Into, Step Over and Step Return options are available in the WICED IDE **Run** menu. Alternately, Step shortcut icons are provided in the **Debug** tab, and on Windows® Systems, by pressing **F5**, **F6** and **F7**, respectively.
8. Stop debugging: To stop debugging, click the square red stop button in the **Debug** tab.



Note: If the debugger fails to launch, it may be necessary to terminate an existing debug process. On Windows®, press Ctrl-Alt-Delete to open the Windows® **Task Manager**, then select the **Processes** tab. Search for, and terminate, all 'arm-none-eabi-gdb' processes.

4.4 What Now?

Now you have a basic understanding of how to compile, download and debug a WICED application, we recommend that you try to build and run each of the snippet and demo applications provided in the WICED SDK Applications directory.

Each snippet application provides a relatively simple example demonstrating how to use a particular API or feature of the WICED SDK. The more sophisticated demo applications combine multiple APIs and features to demonstrate advanced functionality.

To help you use the WICED IDE, Appendix B contains some quick hints and tips that will save you time navigating around the WICED code base. Read these now, then move onto trying WICED applications.

We hope you enjoy using the WICED Development System!

-- The WICED Development Team

APPENDIX A – Configuring a Terminal Application

The following instructions describe how to obtain and install a serial terminal application for use on computers running a Windows® operation system. Broadcom recommends using PuTTY for Windows® systems, however other equivalent applications may work equally well.

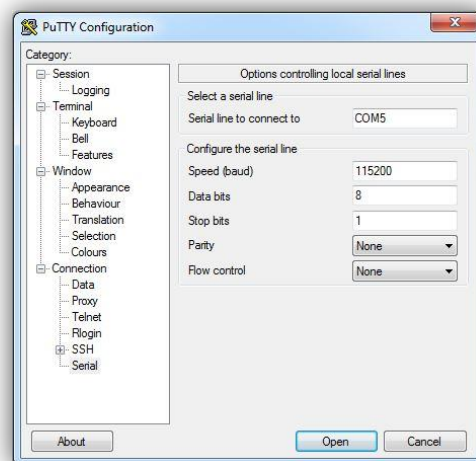
Ensure the WICED Development System is already installed on the computer, then plug the WICED evaluation board into the computer using a USB cable before continuing.

Set Up PuTTY for Windows®

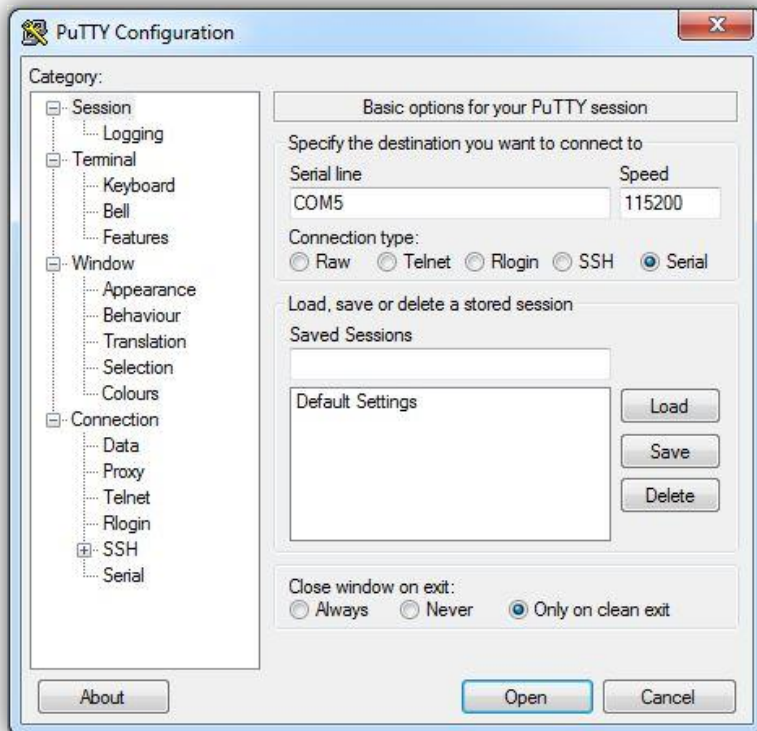
PuTTY is available as a free download from <http://putty.org>. Download and install PuTTY.

The following procedure describes how to establish a UART serial interface between PuTTY and the WICED evaluation board.

1. Start the PuTTY application. The PuTTY Configuration window opens. Set the configuration options as follows:
 - Category: **Serial**
 - Serial line to connect to: *type in the COM port that was assigned after the USB and serial port drivers were installed. Refer to Step 2(a) in Section 3.1.3.*
 - Speed (baud): **115200**
 - Data bits: **8**
 - Stop bits: **1**
 - Parity: **None**
 - Flow Control: **None**



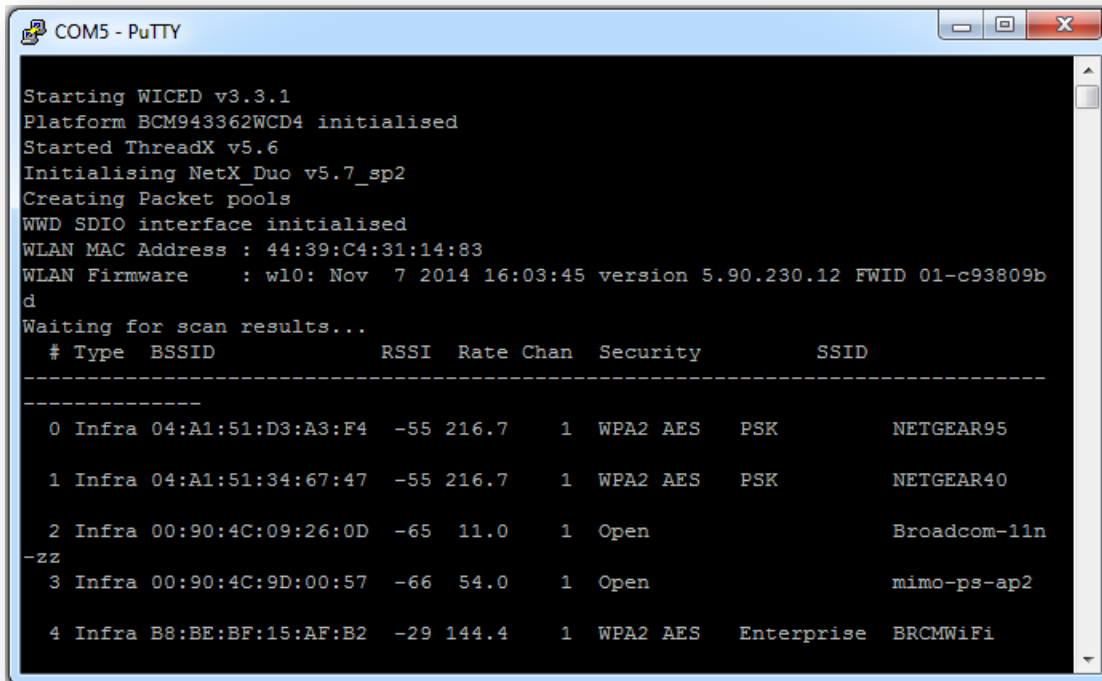
2. In the Category pane, select **Session**.



3. Under the **Connection type**, select the **Serial** option, then click **Open**.
4. A blank terminal window opens with the selected COM port specified in the window title. If the specified COM port is incorrect or unavailable, PuTTY displays an error message as shown in the following screen capture. If this happens, verify the correct COM port has been selected and try again.



5. Assuming the scan application is running on the WICED evaluation board, press the reset button on the board to view application prints during the boot and run process.



```
Starting WICED v3.3.1
Platform BCM943362WCD4 initialised
Started ThreadX v5.6
Initialising NetX_Duo v5.7_sp2
Creating Packet pools
WWD SDIO interface initialised
WLAN MAC Address : 44:39:C4:31:14:83
WLAN Firmware    : wl0: Nov  7 2014 16:03:45 version 5.90.230.12 FWID 01-c93809b
d
Waiting for scan results...
```

#	Type	BSSID	RSSI	Rate	Chan	Security	SSID
0	Infra	04:A1:51:D3:A3:F4	-55	216.7	1	WPA2 AES PSK	NETGEAR95
1	Infra	04:A1:51:34:67:47	-55	216.7	1	WPA2 AES PSK	NETGEAR40
2	Infra	00:90:4C:09:26:0D	-65	11.0	1	Open	Broadcom-11n
3	Infra	00:90:4C:9D:00:57	-66	54.0	1	Open	mimo-ps-ap2
4	Infra	B8:BE:BF:15:AF:B2	-29	144.4	1	WPA2 AES Enterprise	BRCMWiFi

APPENDIX B – WICED IDE Hints & Tips

Hints

1. The **Help** tab (and any other tab) may be click-dragged to any window pane if desired to customize the IDE layout.
2. To revert to the C/C++ perspective (rather than the Debug perspective), click the C/C++ icon in the top-right corner of the window.

Shortcuts

A useful cheat-sheet outlining short cuts for the WICED IDE (Eclipse) can be found online here:

<http://www.cheat-sheets.org/saved-copy/eclipseCDT8.0-cheatsheet.pdf>

Particularly useful keystrokes are listed below.

- General search: to search the WICED-SDK tree for 'my_variable':
 - **Left-click** the root WICED-SDK folder in the Project Explorer pane
 - Press **CTRL-H** (on Windows®)
 - Enter the text 'my_variable' into the File Search tab (regular expressions work too!)
 - Click **Search**
- Search for a 'c' source element (variable, function, enum, etc.)
 - Open a 'c' source file e.g. <WICED-SDK>/apps/snip/scan/scan.c
 - Press **CTRL-SHIFT-T**
 - Start typing an element e.g. 'wiced_time_'
 - Suggestions appear in the popup window