WICED™ by BROADCOM.

Wireless Internet Connectivity for Embedded Devices

Wi-Fi Easy Setup Application Note

April 2013

Contents

Information presented in this Application Note covers :

- **Wi-Fi Setup Problem Statement**
- **A Review of Wi-Fi Setup Methods supported by the WICED SDK**
- **Implementation Overview of Setup Methods**
- **A Use Case Comparison of Setup Methods**
- **An Introduction to the Future of Wi-Fi Setup in WICED**
  - **Wi-Fi Easy Setup**

The Wi-Fi Setup Problem

- **All Wi-Fi clients require setup information to**
  - Connect to a Wi-Fi access point : AP Name / AP Password
  - Find devices and advertise services on a network (once connected)
- **Sophisticated clients (phones, tablets, laptops)**
  - Great user interface (keyboard, display) to enter AP Name / AP Password
  - Lots of memory to run a network discovery protocol eg. mDNS/Bonjour
- **Deeply Embedded WICED Devices**
  - Minimal user interface (buttons, LEDs)
  - Low memory (typically ≤128kB)

PROBLEM STATEMENT

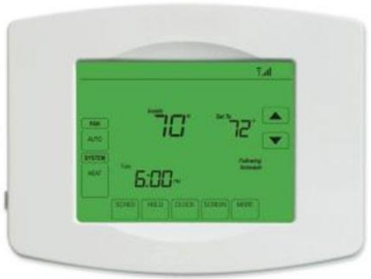
How does a user enter an AP Name / AP Password into a WICED device easily, and then how does the device find other devices or advertise services on the network?

How Does a User See the Problem?

- My Phone can connect to the home Wi-Fi network
- I know the password for the home network
- How do I enter this information into the device?

AP Name
AP Password

AP Name
AP Password



Huh? No keypad!?!

Wi-Fi Setup Methods

Setting up the Wi-Fi connection

Method	Pros	Cons

softAP
+ App **OR**
+ webserver
	• Direct connection
	• Secure setup
		• User experience issues:
		  • User must remember AP Password
		  • Multiple steps may be confusing

WPS	• Existing Standard • Secure connection	• Lack of user awareness • May not be available on all APs • Inconvenient: device vs. AP location • User experience issue: no feedback
Apple MFi iAP	• Great user experience • Secure connection	• Only works with Apple iOS • More expensive & needs Bluetooth

Finding the WICED device on the network (after connecting)

Methods	Pros	Cons

• mDNS
  • Apple Bonjour
  • Linux Avahi
• Windows uPnP
	• Mature protocol
	• Standard: Zeroconf
		• Some versions use lots of memory (>30kB) requiring larger, more expensive MCU

Wi-Fi Setup Methods in WICED

- **Wi-Fi Setup**
  - softAP: **`configure_device()`** API
    - Blocking API : Starts open softAP + HTTPS webserver, runs to completion
    - Provides a webpage to configure application-specific items/variables
    - Provides a webpage to setup Wi-Fi: scan & select an AP **OR** select WPS
    - WICED Example Apps: snip/config_mode, demo/appliance
    - NOTE:
      - Webserver may be replaced by a TLS server that works with a mobile App
  - Wi-Fi Protected Setup (WPS) : **`wiced_wps_enrollee()`** API
    - Blocking API : waits for the WPS enrollee process to complete (or timeout)
    - Both PIN & Push-button mode supported
  - MFi iAP library (available directly from Apple)
    - iAP daemon : communicates with Bluetooth & Apple Authentication Chip
    - Daemon may be started/stopped at any time
    - Wi-Fi credentials received via Bluetooth are saved to the DCT
- **Network Discovery**
  - Gedday: lightweight IPv4 mDNS library from Broadcom
  - Bonjour: full-featured IPv4 & IPv6 mDNS library (avble directly from Apple)

Use Case Comparison

softAP + Webserver*

1. Power on the "New Device"

Using a smartphone or PC ...

2. User presses Settings
3. User presses Wi-Fi
4. User selects "New Device"
5. User points web browser to https://mydevice.com

All steps from here are guided.

6. Webpage:
   Setup Application
7. Webpage:
   Enter AP Password and select home AP to join OR select WPS

(the device now joins to the home AP)

The device can be found on the network using an mDNS browser eg. a mobile App

WPS Push Button + App

1. Power on the "New Device"
2. User presses WPS button on home AP
3. User presses button on "New Device" and waits until an LED stop blinking?

(the device is now joined to the home AP)

4. User downloads an App to a mobile device

The App uses mDNS to find the device on the network

All steps from here are guided.

5. Prompt:
   "New Device" found, setup now?

Apple MFi iAP + App

1. Power on the "New Device"
2. User connects iOS Device (iPhone/iPad/iPod) to home AP
3. User presses Settings
4. User presses Bluetooth
5. User selects "New Device"

All steps from here are guided.

6. Prompt:
   Share Wi-Fi settings?

(the device is now joined to the home AP)

7. Prompt:
   Download App?

The App uses mDNS to find the device on the network

8. Prompt:
   "New Device" found, setup now?

* An Android app can be used to replace the webserver, however WICED does not provide a softAP+Android app example

SDK-2.3.0 Wi-Fi Setup Summary

- **WICED provides three options to setup a new device**
  - softAP + webserver
  - WPS
  - Apple MFi iAP
- **API usage depends on which option is chosen**
- **MFi iAP is the only option that runs as a daemon**
  - Can be asynchronously started/stopped
- **SoftAP & WPS have blocking APIs**
  - Must run to completion (or timeout) which may add latency

A great start, but could be more flexible.
In the next SDK the API will be improved to be more consistent and very easy to use ...

Making Wi-Fi Setup … Easy!

Wi-Fi Easy Setup : Next SDK release …

- **All setup methods will be non-blocking**
  - Can be started/stopped at any time
- **All setup methods will be available concurrently**
  - Developers choose which methods the device will use
- **API will be consistent to make it easy for developers**

… and …

- **A new setup method will be introduced**
  - Wi-Fi Easy Setup – Cooee™
- **SDK-2.3.0 includes Easy Setup – Cooee (BETA)**
  - Example WICED Device App: snip/easy_setup
  - Example Setup Client : snip/easy_setup/cooee_setup_client.exe

Cooee™ : Futher Information …

- The Cooee™ protocol enables a setup client, such as a smartphone or computer, to broadcast AP and networking credentials to a WICED device.
- Detailed information about Cooee™ is available in the Cooee Application Note in the following directory **`<WICED-SDK>/doc`**

***** IMPORTANT NOTE *****

If you plan to use Cooee in your application, it is essential you read and understand the Cooee documentation referenced above. Cooee has a number of practical restrictions and incorrect use may introduce security vulnerabilities to the configuration process!

Thank you