Application Note

WICED™ OTA

WICED™ OTA Update Support

(Over The Air update)

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WICED-OTA
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Revision History

Revision	*Date*	*Change Description*
WICED-OTA 0.3	June 20, 2016	Clean up
WICED-OTA 0.2	June 9, 2016	Additional descriptions & clean up
WICED-OTA 0.1	June 2, 2016	Initial Doc.

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1 About this Document

1.1 Purpose and Scope

This document provides instructions on how to use the WICED OTA application to provide Over The Air Update capability to your application. Using the sample Applications, and API's, you will be able to add application update capability to your IoT device.

Note: This document applies to **WICED SDK 3.3.1** or higher.

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.

2 Terminology

Bootloader	The initial program run when power is applied. Initializes hardware and decides which Application to run.
Current Application	The Currently running Application.
Factory Reset	Returning the product to the state it was in when first manufactured.
LUT	Look Up Table – in the Wiced Multi-Application Framework, this is a simple directory where the system (App, DCT, Resources) is located in FLASH.
SoftAP	Software based Access Point. The device can become an AP so you can connect your WiFi enabled computer to the device to perform updates or for adjusting settings.
Watchdog Timer	Independently running hardware timer used to determine if software has stopped running (application is hung or system crashed). Time is configurable.

3 Over The Air Product Update Description & Overview

This document describes the system software, and reference application snippet which demonstrates OTA capability along with how to enable OTA update in your WICED application. Using this documentation, the developer will learn how to use the WICED libraries for manual updates.

The example program, snip.ota_fr, is written to show how to start a SoftAP and perform a manual upload of a new application to replace the current application. How and where this functionality is used (or expanded upon) is left to the user.

4 Bootloader Application

The Bootloader is a small application that loads any needed system resources and launches the Current Application. It will check for button presses for factory reset operation.

The Bootloader is finalized at shipment and is not updated through the product cycle.

Upon powering up the board, if the reset button is pressed for ~5 seconds:

- Perform a Factory Reset, making the Factory Reset OTA Application be the Current Application.

5 Web Server API

The Web Server API is a small web server library that will allow the user to connect to the product with a standard browser on their PC and upload new software, reset to factory settings, or other functionality as determined by the product. The Web Server supports a RESTful architecture, and can support the customer's customization needs. The general architecture is an embedded server which supports browser based uploads and custom CGI/JS on the WICED device side; these custom CGI's will provide server (device) side update of the main application. The application snip.ota_fr uses this facility to demonstrate the API.

Snip.ota_fr shows both the SoftAP OTA support and Factory Reset support. Some particulars about the SoftAP OTA Support:

- Uses component daemons/ota_server

First, brings the network up (with the device being an AP) and assumes an internal DHCP server:

```
wiced_network_up( WICED_AP_INTERFACE, WICED_USE_INTERNAL_DHCP_SERVER, &device_init_ip_settings );
```

Then, the OTA server is started:

```
wiced_ota_server_start( WICED_AP_INTERFACE );
```

wiced_ota_server_start(), passes the page_database of HTML pages to serve and calls ota_server_start() which creates a socket and thread to listen for incoming packets..

```
    /* Create the TCP socket */
    WICED_VERIFY(wiced_tcp_create_socket( &server->socket, interface ));
    if (wiced_tcp_listen( (wiced_tcp_socket_t*) &server->socket, port ) != WICED_SUCCESS)
    {
        wiced_tcp_delete_socket(&server->socket);
        return WICED_ERROR;
    }

    server->page_database = page_database;
    return wiced_rtos_create_thread(&server->thread, OTA_SERVER_THREAD_PRIORITY, "HTTPserver",
ota_server_thread_main, OTA_SERVER_STACK_SIZE, server);
```

The page database provides the HTML page(s) served to the Web Browser which connects to the device. Through the HTML page(s), the user can choose the file to upload and then execute the upload of the new application.

ota_server_thread_main() takes the incoming packets and processes them.

process_request() serves the page requested.

process_upgrade_chunk() handles the uploading of the new application.

6 FLASH layout and application/DCT regions

The Flash layout will change based on the various sizes of some components:

- Filesystem
- WiFi firmware
- Inclusion of other applications
    - OTA_APP
    - APP0
    - APP1
    - APP2

See <Wiced-SDK>/tools/makefiles/wiced_apps.mk for included files.

External only Flash File System	
Application LUT (Look Up Table)	Entries to point to the Applications and other items listed below.
Bootloader	Starts from power on to: - Check for button presses - Possibly extract Factory Reset application.
Factory Reset Application	Replaces Current application when Factory Reset Button is held down @ power on.
DCT_IMAGE	DCT Image (bank 1 and 2)
OTA_APP	Optional separate application slot for SoftAP (so the application does not have to support the SoftAP – Access to the SoftAP application must be managed by the Application).
FileSystem Image	Files defined as Resources in the makefile. May include the WiFi Firmware as well. Note: This is a Read-only file system.
WiFi Firmware	If included separately (not part of the FileSystem).
APP0	Main Application location.
APP1	Optional alternate application location.

APP2	Optional alternate application location.

6.1 Internal + External FLASH

The Internal FLASH stores the Bootloader and Application, they execute in place. External FLASH holds all other items.

Internal Flash File System	
Bootloader	Starts from power on to: - Check for button presses - Possibly execute Factory Reset Application
Current Application Area	Main Application

External Flash File System	
Application LUT (Look Up Table)	Entries to point to the Applications and other items listed below.
Factory Reset Applicaiton	Replaces Current application when Factory Reset Button is held down @ power on.
DCT_IMAGE	DCT Image (bank 1 and 2)

OTA_APP	Optional separate application slot for SoftAP (so the application does not have to support the SoftAP – Access to the SoftAP application must be managed by the Application).
FileSystem Image	Files defined as Resources in the makefile. May include the WiFi Firmware as well. Note: This is a Read-only file system.
WiFi Firmware	If included separately (not part of the FileSystem).
APP0	Main Application location.
APP1	Optional alternate application location.
APP2	Optional alternate application location.

7 Snip.ota_fr Application

7.1 <Wiced-SDK>/apps/snip/ota_fr example

- Uses bootloader
- Example shows how to start SoftAP & allow manual update of application.

7.2 How to build snip.ota_fr

This example is for BCM943907WAE_1.B0 or BCM943909WCD1_3.B0

Normal OTA example program build:

Build the ota_fr application (includes the SoftAP functionality).

```
snip.ota_fr-<platform_name> download download_apps run
```

8 Testing an OTA update

Build the scan application for showing that the upgrade has changed the current application.

```
snip.scan-<platform_name>
```

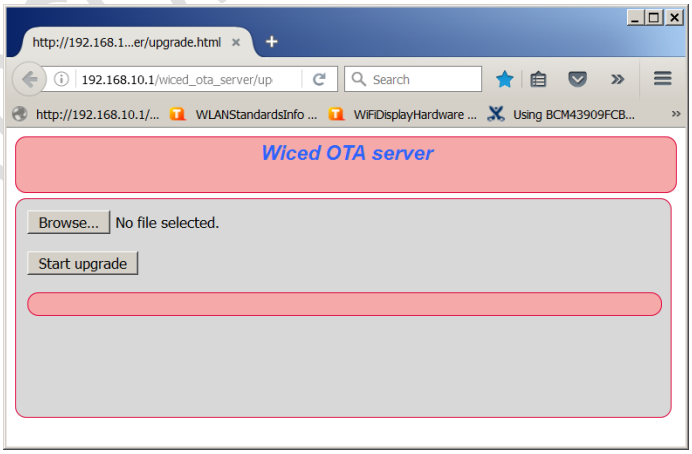
Copy the resulting elf file onto a server accessible through your AP. The server must be open (no password).

```
"cp build/snip.scan-<platform_name>/binary/snip.scan-<platform_name>.stripped.elf"
```

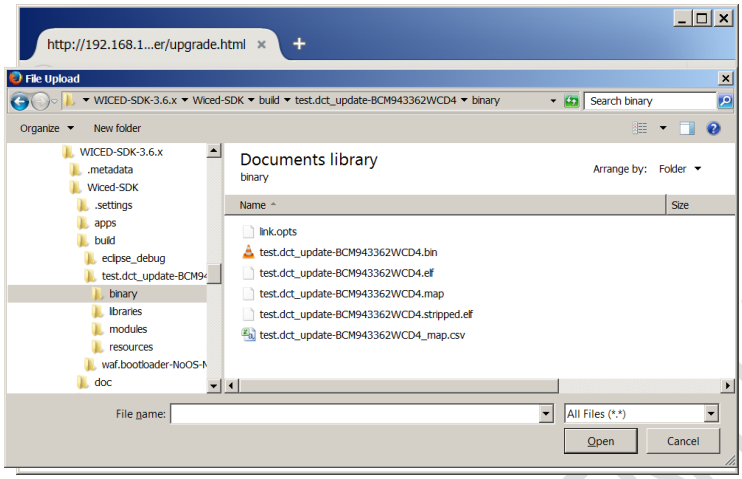
Build the snip.ota_fr application using this command line:

```
snip.ota_fr-<platform_name> download download_apps run
```

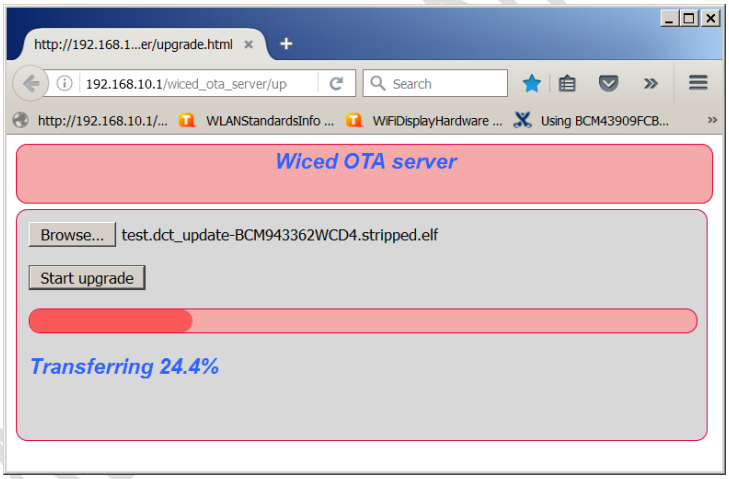
1. Connect your PC to the Wiced Board by WiFi
2. Open a browser window on your PC and point to http://192.168.10.1



3. Click on "Browse", navigate to `the elf file to upload`. Then click on "Start Upgrade".



4. When upload completes, wait ~10-15 seconds for the Wiced board to complete changing to use the new application.



9 Limitations

Feature	
Update main application	Yes
Keep User Settings	DCT untouched

Update All parts of system (except bootloader)	No
Update check can be timed periodically.	No
Update checked with CRC	No
Update system components separately.	Only main application.*

*Current snip.oa_fr application. Customer may expand capabilities.

Note: OTA2 is recommended for all future designs.

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