WICED™ DCT

(Device Configuration Tables)

5300 California Avenue • Irvine, California, 92677 • Phone: 949-926-5000 • Fax: 949-926-5203

Revision History

Revision	*Date*	*Change Description*
WICED-DCT 0.2	June 20, 2016	Clean up
WICED-DCT 0.1	June 7, 2016	Initial Doc.

Broadcom Limited
5300 California Avenue
Irvine, CA 92617

Table of Contents

1 About this Document

1.1 Purpose and Scope

This document provides instructions for how to use the WICED DCT data area to provide persistent storage for system information and application data. Using the sample Applications, and API's, you will be able to save data between power cycling your device.

Note: This document applies to **WICED SDK 3.7.0** 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.
DCT	Device Configuration Tables – Data stored to FLASH, both System DCT information and Application information.
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.

3 DCT Description & Overview

The DCT stores System and Application data persistently so that the device can use the information between power cycles. The layout of the data is extremely important, and may change between SDKs.

Using the OTA facility (described in another Application Note), an Application can be updated, and it is important that the DCT is still usable. Upgrading an Application using the same SDK as the original Application (with no changes to the System DCT area) ensures a smooth update.

Starting with Wiced-SDK-3.7.0, it is possible to upgrade to a new SDK and upgrade the DCT layout so that the part of the DCT layout that matches what is used by the Bootloader of the original SDK is intact, and there will be no problems.

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.

There is one portion of the DCT that the Bootloader uses: the sub-structure `platform_dct_header_t`, which is always at the start of the DCT area of the FLASH.

5 Two DCT Areas

There are two DCT areas defined in the FLASH, designated as DCT1 and DCT2. When there are changes to the DCT, we use these in a flip-flop arrangement, copying the “current” DCT to the opposite area with the changes requested, then indicating that the “new” area is the “current” area. Then we mark the “old” area as not in use. This ensures that if power is lost in any part of the update procedure, there is a viable DCT area upon power up.

6 DCT Layout Importance

It is extremely important that the DCT Layout change as little as possible. Consider this structure layout and change:

```
typedef struct my_struct_1_s
{
        Uint16  data1;
        Uint16  signature;
} my_struct_1_t;

typedef struct my_struct_2_s
{
        Uint16  data1;
        Uint16  data2;
        Uint16  signature;
} my_struct_2_t;
```

In structure 1, the offset for data1 from the beginning of the structure is 0x00. That is, if you start at the memory address of the start of the structure, the first 2 bytes (Uint16) will be data1. And the offset of the signature is 0x02.

In structure 2, the offset of the signature has moved, and is now 0x04.

If you write data to the FLASH DCT area using structure 1, and then change the code to use structure 2, when you go to verify the data integrity by looking at the signature, the code will fail. The code is now looking 0x04 bytes from the start of the structure for the signature. But the old code wrote the signature with an offset of 0x02 bytes. The new code will find this an invalid data structure. Therefore it is important to consider the structures when updating the SDK and developers should always maintain a backward compatible version of the common platform DCT structures.

6.1 Defining the SDK used by the Bootloader

When building an Update Application, knowledge of the SDK that the Bootloader was built with needs to be passed to the make system so that the System DCT can be written in such a way as to be compatible with the Bootloader. To do this, designate the SDK of the Bootloader on the make command line:

```
<application_name>-<platform_name> UPDATE_FROM_SDK=<bootloader_sdk>
```

Where `<bootloader_sdk>` is one of:

```
3_1_2
3_3_0
3_3_1
3_4_0
3_5_1
3_5_2
3_6_0
3_6_1
3_6_2
```

6.2 Defining the use of optional structures

There were optional structures in the System DCT that are now always included. They are the Bluetooth (BT), Peer to Peer (P2P) and Over The Air 2 (OTA2) sub-structures. This information must also be specified so that the code knows which (if any) of the optional structures were used in the original application build. This is supported with the following additions to the make command line:

```
<application_name>-<platform_name> <optional_struct> <optional_struct> <optional_struct>
```

Where `<optional_struct>` is one of:

```
APP_USED_BT=1
APP_USED_P2P=1
APP_USED_OTA2=1
```

7 DCT Layout History

In <Wiced-SDK>/WICED/platform/include/platform_dct_old_sdk.h, there are defines for each change to the System DCT structures that are used when building an update Application to run with an older Bootloader (built with an older SDK).

7.1 DCT Changes Between SDK Versions

SDK change	Field(s) Added	Field(s) Changed / Moved within struct	Field(s) Removed
3.1.0 → 3.1.1	▪platform_dct_header_t added apps_locations[DCT_MAX_APP_COUNT]		
3.1.1 → 3.1.2	▪platform_dct_header_t added padding ▪platform_dct_bt_config_t New **OPTIONAL** struct		
3.1.2 → 3.3.0	▪platform_dct_ethernet_config_t New structure ▪platform_dct_network_config_t New structure		
3.3.0 → 3.3.1		▪platform_dct_network_config_t ▪changed char hostname[HOSTNAME_SIZE + 1]; ▪to wiced_hostname_t hostname;	
3.3.1 → 3.4.0	▪platform_dct_bt_config_t ▪added bluetooth_device_class ▪changed padding		
3.4.0 → 3.5.1	▪platform_p2p_config_t ▪New OPTIONAL struct		
3.5.1 → 3.5.2	▪platform_dct_header_t ▪added CRC, sequence number, initial_write ▪platform_dct_ota2_config_t ▪New OPTIONAL struct	▪platform_dct_header_t ▪moved magic_number, write_incomplete	▪platform_dct_header_t ▪removed is_current_dct
3.5.2 → 3.6.0		▪platform_dct_ota2_header_t ▪changed padding[1] to	

SDK change	Field(s) Added	Field(s) Changed / Moved within struct	Field(s) Removed
		force_factory_reset ▪structure size unchanged	
3.6.0 → 3.6.1			
3.6.1→ 3.6.2			
3.6.2 → 3.6.3			
3.6.3→ 3.7.0	▪platform_dct_header_t remove CDC, sequence_number, initial_write (added in SDK 3.5.2) ▪platform_dct_version_t ▪New structure ▪Make all structs **non-OPTIONAL**	▪platform_dct_header_t ▪move magic_number and write_incomplete ▪(back to locations in pre-SDK-3.5.2)	▪platform_dct_header_t ▪add is_current_dct ▪(as in pre-SDK-3.5.2)

7.2 DCT sizes and offsets:

```
* SDK-3.0.1:
 * Starting WICED v3.0.1
 * DCT                              offset   size
 * platform_dct_data_t            :          0x1c5c
 * platform_dct_header_t          :  0x0000  0x0064
 * platform_dct_mfg_info_t        :  0x0064  0x009c
 * platform_dct_security_t        :  0x0100  0x1810
 * platform_dct_wifi_config_t     :  0x1910  0x034c
 *
 * SDK-3.1.0:
 * Starting WICED v3.1.0
 * DCT                              offset   size
 * platform_dct_data_t            :          0x1c5c
 * platform_dct_header_t          :  0x0000  0x0064
 * platform_dct_mfg_info_t        :  0x0064  0x009c
 * platform_dct_security_t        :  0x0100  0x1810
 * platform_dct_wifi_config_t     :  0x1910  0x034c
 *
 * SDK-3.1.1:
 * Starting WICED v3.1.1
 * DCT                              offset   size
 * platform_dct_data_t            :          0x1d7c
 * platform_dct_header_t          :  0x0000  0x0184 ** new fields
 * platform_dct_mfg_info_t        :  0x0184  0x009c
 * platform_dct_security_t        :  0x0220  0x1810
 * platform_dct_wifi_config_t     :  0x1a30  0x034c
 *
 * SDK-3.1.2:
 * Starting WICED v3.1.2
 * DCT                              offset   size
 * platform_dct_data_t            :          0x1e80
 * platform_dct_header_t          :  0x0000  0x0184 ** optional padding added
```

```
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_security_t          :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_bt_config_t         :  0x1d7c  0x0101  ** new struct
*
* SDK-3.3.0:
* Starting WICED v3.3.0
* DCT                              offset   size
* platform_dct_data_t              :         0x1eac
* platform_dct_header_t            :  0x0000  0x0184
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_security_t          :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_ethernet_config_t   :  0x1d7c  0x0008 ** new struct
* platform_dct_network_config_t    :  0x1d84  0x0024 ** new struct
* platform_dct_bt_config_t         :  0x1da8  0x0101
*
* SDK-3.3.1:
* Starting WICED v3.3.1
* DCT                              offset   size
* platform_dct_data_t              :         0x1eac
* platform_dct_header_t            :  0x0000  0x0184
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_security_t          :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_ethernet_config_t   :  0x1d7c  0x0008
* platform_dct_network_config_t    :  0x1d84  0x0024 ** field change, size is the same
* platform_dct_bt_config_t         :  0x1da8  0x0101
*
* SDK-3.4.0:
* Starting WICED v3.4.0
* DCT                              offset   size
* platform_dct_data_t              :         0x1eb0
* platform_dct_header_t            :  0x0000  0x0184
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_security_t          :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_ethernet_config_t   :  0x1d7c  0x0008
* platform_dct_network_config_t    :  0x1d84  0x0024
* platform_dct_bt_config_t         :  0x1da8  0x0105 ** added field
*
* SDK-3.5.1:
* Starting WICED v3.5.1
* DCT                              offset   size
* platform_dct_data_t              :         0x1f24
* platform_dct_header_t            :  0x0000  0x0184
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_security_t          :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_ethernet_config_t   :  0x1d7c  0x0008
* platform_dct_network_config_t    :  0x1d84  0x0024
* platform_dct_bt_config_t         :  0x1da8  0x0105
* platform_dct_p2p_config_t        :  0x1eb0  0x0074 ** new struct
*
* SDK-3.5.2:
* Starting WICED v3.5.2
* DCT                              offset   size
* platform_dct_data_t              :         0x1f30
* platform_dct_header_t            :  0x0000  0x018c ** changed fields
* platform_dct_mfg_info_t          :  0x018c  0x009c
* platform_dct_dct_security_t      :  0x0228  0x1810
* platform_dct_wifi_config_t       :  0x1a38  0x034c
* platform_dct_ethernet_config_t   :  0x1d84  0x0008
* platform_dct_network_config_t    :  0x1d8c  0x0024
* platform_dct_bt_config_t         :  0x1db0  0x0105
* platform_dct_p2p_config_t        :  0x1eb8  0x0074
* platform_dct_ota2_config_t       :  0x1f2c  0x0004 ** new struct
*
* Starting WICED v3.6.0
```

```
* DCT                                 offset   size
* platform_dct_data_t              :          0x1f30
* platform_dct_header_t            :  0x0000  0x018c
* platform_dct_mfg_info_t          :  0x018c  0x009c
* platform_dct_dct_security_t      :  0x0228  0x1810
* platform_dct_wifi_config_t       :  0x1a38  0x034c
* platform_dct_ethernet_config_t   :  0x1d84  0x0008
* platform_dct_network_config_t    :  0x1d8c  0x0024
* platform_dct_bt_config_t         :  0x1db0  0x0105
* platform_dct_p2p_config_t        :  0x1eb8  0x0074
* platform_dct_ota2_config_t       :  0x1f2c  0x0004
*
* SDK-3.6.1:
* Starting WICED v3.6.1
* DCT                                 offset   size
* platform_dct_data_t              :          0x1f30
* platform_dct_header_t            :  0x0000  0x018c
* platform_dct_mfg_info_t          :  0x018c  0x009c
* platform_dct_dct_security_t      :  0x0228  0x1810
* platform_dct_wifi_config_t       :  0x1a38  0x034c
* platform_dct_ethernet_config_t   :  0x1d84  0x0008
* platform_dct_network_config_t    :  0x1d8c  0x0024
* platform_dct_bt_config_t         :  0x1db0  0x0105
* platform_dct_p2p_config_t        :  0x1eb8  0x0074
* platform_dct_ota2_config_t       :  0x1f2c  0x0004
*
* SDK-3.6.2:
* Starting WICED v3.6.2-RC1
* DCT                                 offset   size
* platform_dct_data_t              :          0x1f30
* platform_dct_header_t            :  0x0000  0x018c
* platform_dct_mfg_info_t          :  0x018c  0x009c
* platform_dct_security_t          :  0x0228  0x1810
* platform_dct_wifi_config_t       :  0x1a38  0x034c
* platform_dct_ethernet_config_t   :  0x1d84  0x0008
* platform_dct_network_config_t    :  0x1d8c  0x0024
* platform_dct_bt_config_t         :  0x1db0  0x0105
* platform_dct_p2p_config_t        :  0x1eb8  0x0074
* platform_dct_ota2_config_t       :  0x1f2c  0x0004 ** Field changed, size stayed the same
*
* SDK-3.7.0:
* DCT                                 offset   size
* platform_dct_data_t              :          0x1f38
* platform_dct_header_t            :  0x0000  0x0184 ** changed
* platform_dct_mfg_info_t          :  0x0184  0x009c
* platform_dct_dct_security_t      :  0x0220  0x1810
* platform_dct_wifi_config_t       :  0x1a30  0x034c
* platform_dct_ethernet_config_t   :  0x1d7c  0x0008
* platform_dct_network_config_t    :  0x1d84  0x0024
* platform_dct_bt_config_t         :  0x1da8  0x0105
* platform_dct_p2p_config_t        :  0x1eb0  0x0074
* platform_dct_ota2_config_t       :  0x1f24  0x0004
* platform_dct_version_t           :  0x1f28  0x0010 ** new struct
```


BROADCOM Limited
5300 California Avenue
Irvine, California, 92677

Phone : +1-949-926-5000
Fax: +1-949-926-5203
E-mail: info@broadcom.com
Web: www.broadcom.com