USB Device Descriptor Generator User's Guide

Version 1.20

For use with the USB Device Base Package Versions 3.13 and above

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1 System Overview

1.1 Introduction

This guide is for those who want to create USB descriptor files for inclusion in a project using HCC's Embedded USB Device (EUSBD) stack.

USB is a host-controlled bus system. Each USB device should offer one or more device configurations to the host at startup. The host selects a configuration and then “enumerates” the USB device using that configuration. Logically the device’s configuration, termed a set of USB descriptors, is a table of all the configuration settings of the device. This describes the elements which are available, including interfaces, class drivers, endpoint assignments, and device product information.

Creating USB descriptors for USB devices manually is a complicated process. The USB Device Descriptor Generator simplifies this, allowing you to use an XML editor to create USB descriptor files. The normal method is to base any changes on a **<project>.xml** template file provided by HCC and use the generator to make simple modifications to the configuration. The generator produces source code for the descriptors from the templates.

You can also use the generator to create completely new configurations, though this requires expert knowledge of USB.

1.2 Packages and Documents

Packages

The table below lists the packages which you need in order to use the generator:

Package	Description
hcc_base_doc	This contains the two guides that will help you get started.
usbd_base	The USB device base system package. The USB Device Descriptor Generator is part of this.

Documents

Readers should note the points in the HCC Documentation Guidelines on the HCC documentation website.

HCC Firmware Quick Start Guide

This document describes how to install packages provided by HCC in the target development environment. Also follow the *Quick Start Guide* when HCC provides package updates.

HCC Source Tree Guide

This document describes the HCC source tree. It gives an overview of the system to make clear the logic behind its organization.

HCC USB Device Base System User's Guide

This document defines the USB device base system upon which the complete USB stack is built.

HCC USB Device Descriptor Generator User's Guide

This is this document.

2 Source Files

The USB Device Descriptor Generator is located within the base package at **usbd_base_xxx/hcc/util/configtool**. The following sets of files are provided with the package.

> **Note:** Do not modify any of these files.

2.1 Application

The file **hccCompile.bat** is the batch file for generating **config_usbd_config.c** and **config_usbd_config.h** files from XML.

2.2 HCC Files

The following files are in the folder **hcc/util/configtool**.

File	Description
AxsltTest.js	Java script for processing XML.
HccAudioSrc.xsl	HCC XSL stylesheet for audio class drivers.
HccCdcSrc.xsl	HCC XSL stylesheet for CDC-xxx class drivers.
HccDescToHdr.xsl	HCC XSL stylesheet.
HccDescToSrc.xsl	HCC XSL stylesheet.
HccFunctions.xsl	HCC XSL stylesheet.
HccHidSrc.xsl	HCC XSL stylesheet for HID class drivers.
HccUsbDesc.xsl	HCC XSL stylesheet for descriptors.

2.3 Output Files

These files are generated by the **hccCompile.bat** program from the XML.

File	Description
config_usbd_config.c	Created source file.
config_usbd_config.h	Created header file.

2.4 Sample Files

These files are in the folder **hcc/util/configtool/samples**. You should be able to base your project on one of these sample files: make a copy of the relevant file, copy it to the **hcc/util/configtool** folder, then modify it.

File	Class Driver
AudioMic.xml	Audio with a microphone.
AudioSpk.xml	Audio with a speaker.
AUnitTest.xml	Audio Unit test.
Cdc_Mtp.xml	Media Transfer Protocol (MTP).
CDCecm.xml	Communications Device Class - Ethernet Control Module (CDC-ECM) subclass.
CDCrndis.xml	Remote Network Driver Interface Standard (RNDIS).
CDCrndis-cdcser.xml	Communications Device Class - Abstract Control Model (CDC-ACM) and RNDIS composite device.
cdc-acm-fs.xml	CDC-ACM subclass full speed USB.
cdc-acm-fs-mi.xml	CDC-ACM full speed USB.
cdc-acm-fs-hs.xml	CDC-ACM full speed/high speed USB.
cdc-acm-fs-mst.xml	CDC-ACM full speed and USB Mass Storage composite device.
cdc-acm-fs-mst-hs .xml	CDC-ACM full speed and high speed Mass Storage composite device.
DevMSt.xml	Mass Storage.
DevVendor2bulk.xml	Vendor bulk.
Hid_kbd.xml	HID keyboard.
Hid_kbd-mst.xml	HID keyboard and Mass Storage composite device.
Hid_multi.xml	HID generic device.
mst-fs.xml	Full speed Mass Storage.
mst-hs.xml	High speed Mass Storage.

3 Downloading the XML Editor

To use the USB Device Descriptor Generator, you require an XML editor. Microsoft's XML Notepad 2007 editor is recommended as its use has been tested by HCC.

XML Notepad 2007 can be downloaded from the following Microsoft website:

http://www.microsoft.com/downloads/details.aspx?familyid=72d6aa49-787d-4118-ba5f-4f30fe913628&displa

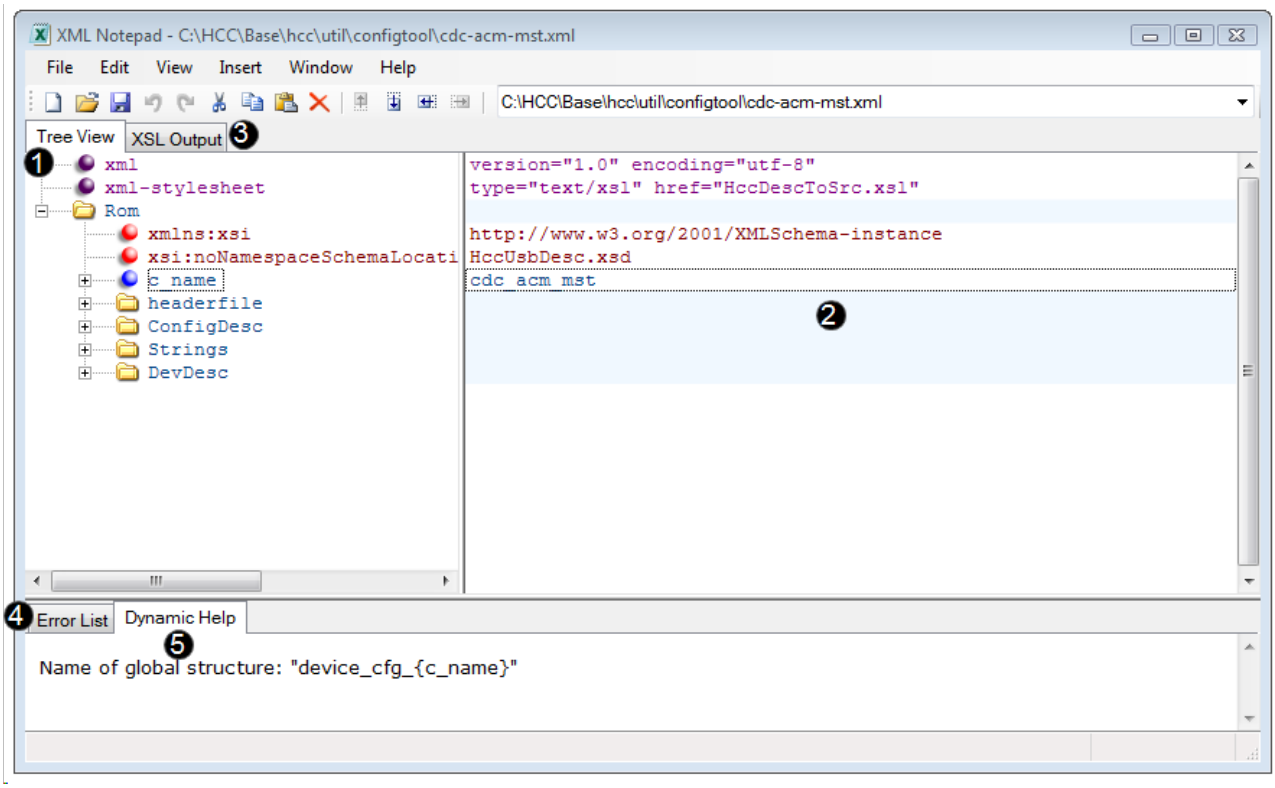
Follow the instructions at the above site to install XML Notepad 2007.

4 Using the XML Editor

This section describes how to use Microsoft's XML Notepad 2007 editor. Copy the sample file you want to use from the **Samples** folder into the **Configtool** folder and name it as your **<project>.xml** file.

4.1 Components of the Editor

When you open one of the sample device **.xml** files in the editor, it is displayed as shown below (this example shows a CDC-ACM file):

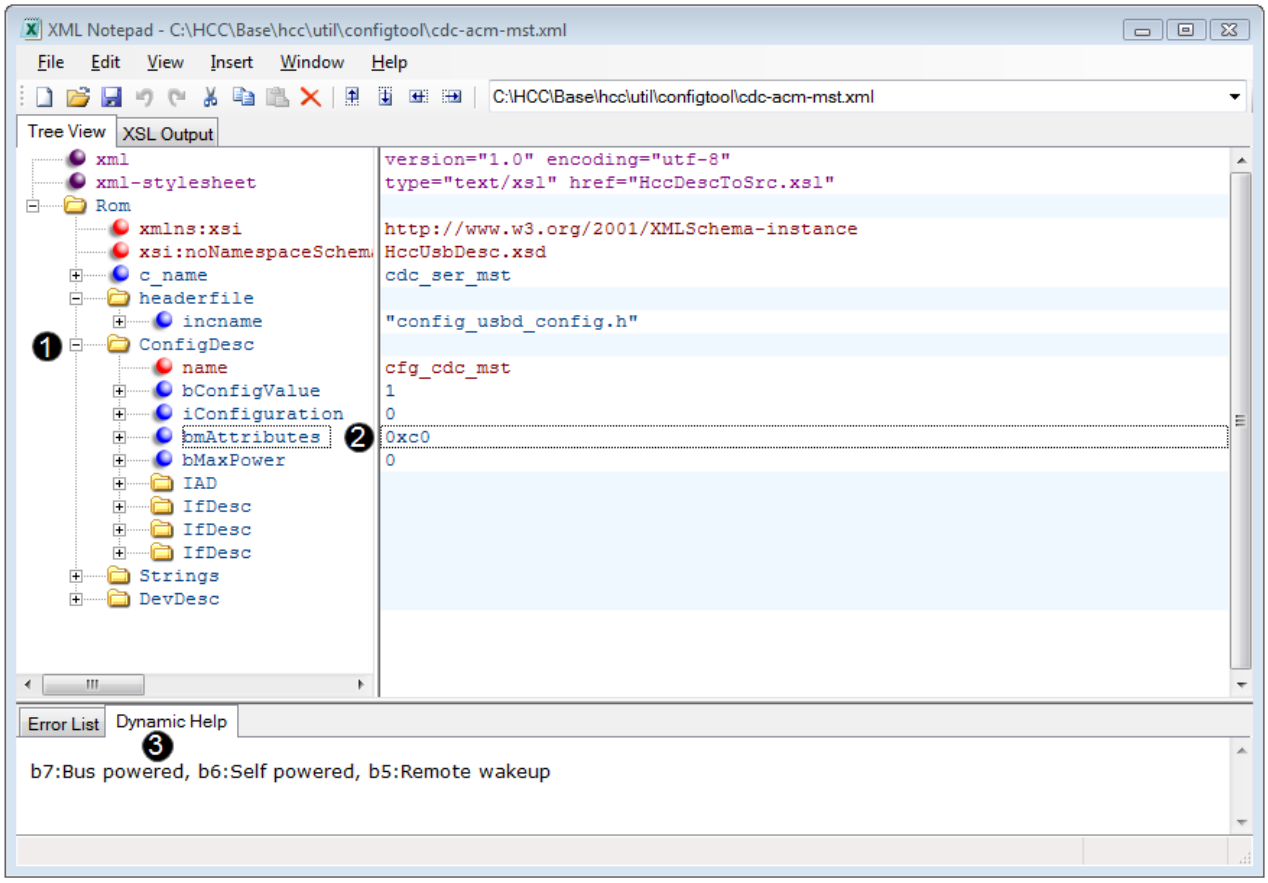


The main components are numbered in the graphic, as follows:

1. **Tree View** tab – the main working tab, this has two panes. The left-hand pane shows the tree structure, the right-hand pane is the Strings pane.
2. **Strings** pane – this shows the full details of items in the Tree View. When you select an item in the tree, it is highlighted in this pane. Some items are permanently displayed in this pane, others only appear here when you select them in the **Tree View** tab.
3. **XSL Output** tab – this tab shows the EXtensible Stylesheet Language (XSL), a style sheet language for XML documents. You should not need to refer to this.
4. **Error List** tab – if an error occurs, it is described here. The file responsible is shown.
5. **Dynamic Help** tab – after you select most configurable elements, the **Dynamic Help** tab shows help text describing the element. In the above example, the *c_name* is selected and the tab is showing information on this structure.

4.2 The Tree View Tab

You use the **Tree View** tab to modify a device configuration, including the descriptors. This example shows the tab for a CDC-ACM MST file:

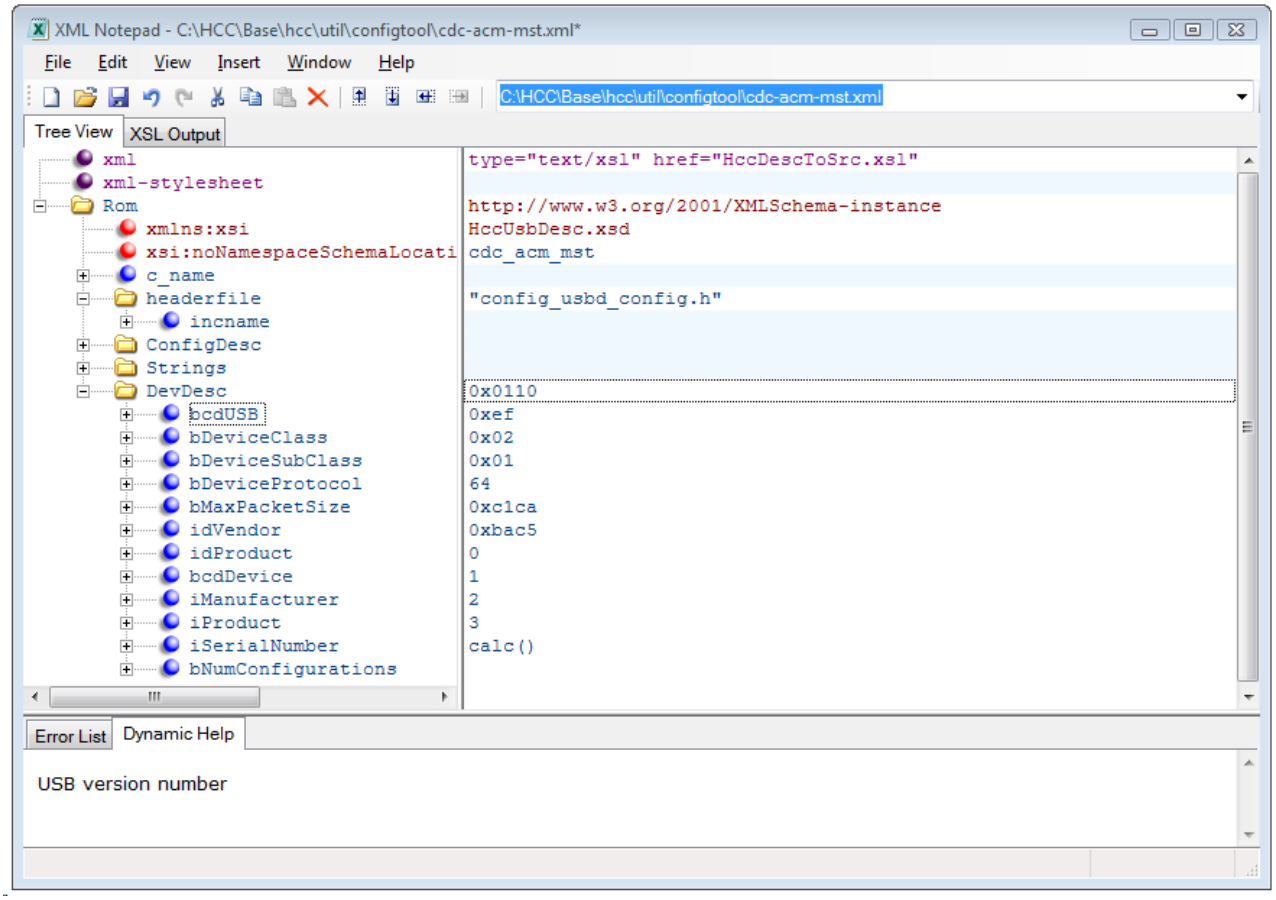


This shows the following:

1. When you click on a node, it expands in the tree to show its contents. In this example, the user clicked on the *ConfigDesc* node to expand it.
2. When you select an element in the tree, it is highlighted in the **Strings** pane. In the above example the user has selected *bmAttributes* in the tree and its value, 0xc0, is selected in the **Strings** pane. You can enter a new entry for an item by clicking on it in the **Strings** pane then inserting a new value.
3. The **Dynamic Help** tab shows information on the selected item.

4.3 Device Descriptor Components

The device descriptor appears in the **Tree View** tab as DevDesc. This graphic shows it with all its components on view:



Note the following:

- The structure of the elements displayed reflects the structure of the descriptors.
- String descriptors have their own indexed section of strings. When a descriptor field refers to a string, it just refers to the index in the string section.
- When you configure a high speed device there are two configuration descriptors, one for high speed and one for full speed. It is necessary to keep these two descriptors synchronized, if this is required.
- A HID descriptor must be inserted into the configuration manually (see the file **samples/hid_kbd.xml** for reference). To generate HID descriptors, the following freely available tool can be used: http://www.usb.org/developers/hidpage/dt2_4.zip. For information on HID, go to http://www.usb.org/developers/hidpage.

The components of the device descriptor are as follows:

Field	Description
bcdUSB	The USB version number, the USB Specification release number the device complies with.
bDeviceClass	Class code. A zero value means each interface specifies its own class information.
bDeviceSubClass	Subclass code. If you reset *bDeviceClass* to 0, you must set this to 0 as well.
bDeviceProtocol	Protocol code. If this is 0, the device as a whole does not support class-specific protocols, but its interfaces may do.
bMaxPacketSize	Maximum packet size for endpoint 0 (either 8, 16, 32, or 64).
idVendor	Vendor ID.
idProduct	Product ID.
bcdDevice	Device release number.
iManufacturer	Index of the string descriptor which describes the manufacturer.
iProduct	Index of the string descriptor which describes the product.
iSerialNumber	Index of the string descriptor which describes the device serial number.
bNumConfigurations	The number of possible configurations. "calc()" means that this is calculated.

5 Creating USB Descriptor Files

This section describes the steps you need to follow to build your descriptor files.

5.1 Creating the Initial Project Files

Do the following:

1. Copy the appropriate sample file from the **Samples** folder into the **Configtool** folder and name it as your **<project>.xml** file.
2. Open a Command Prompt window and go to the **Configtool** folder.
3. Enter the command: "hccCompile <project>.xml".
   This generates the **config_usbd_config.c** and **config_usbd_config.h** files. This gives you the basic set of files you need.
4. Open the **<project>.xml** file with the XML editor. You can now modify the **.xml** file as required; this is described below.

> **Note:** Changes made with the XML editor take immediate effect, so you can run **hccCompile** without having to save the **.xml** file.

5.2 Editing the Project File

This quick example shows how to change the product ID:

1. Open the **<project>.xml** file in the XML editor.
2. In the **Tree View** tab, expand the Device Descriptor (DevDesc) node.
3. Select the **idProduct** element. This selects the index in the string table for the Product Name string.
4. In the **Strings** pane, click on the **idProduct** string and enter the required name.
5. Unless one is already open, open a Command Prompt window and go to the **Configtool** folder.
6. Enter the command: "hcc_compile <project>.xml". This updates the **config_usbd_config.c** file with the new string descriptor.

Follow the same procedure to change any other element.