



Health Device Profile Whitepaper

HEALTH DEVICE PROFILE—WHITE PAPER

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Revision History

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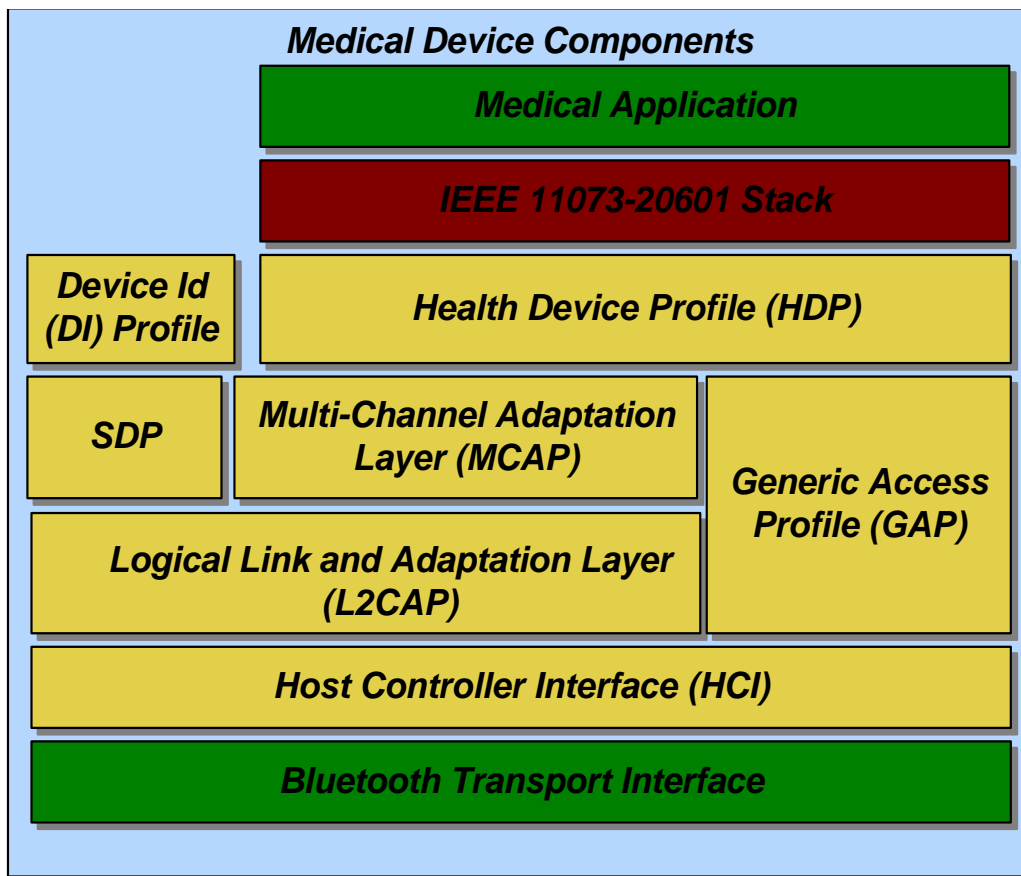
Introduction

This document is designed to illustrate how the Bluetooth Health Device Profile (HDP) can be added to a new or existing medical device. The iAnywhere HDP SDK offering will be discussed in detail in order to provide an example of how this process will occur.

Health Device Profile

Health Device Profile Component Diagram

The diagram below identifies the major components in a Medical Device using the Health Device Profile over Bluetooth. iAnywhere provides all of the portable components shown in “yellow” while the components shown in “green” are provided using example code by iAnywhere, but are expected to require at least some level of integration by the developer. The component shown in “red” may be obtained from the Continua Health Alliance, or created separately by the developer.



Each component will be discussed in detail below:

Medical Application – This component describes the actual medical device application, including its user interface, application behavior, and integration layer to the associated IEEE 11073-20601 stack implementation. iAnywhere provides a sample application that interacts with the IEEE stack API provided by the Continua Health Alliance.

IEEE 11073-20601 Stack – This component performs the building, transmission, reception, and parsing of IEEE PDU packets for the associated agent/manager being developed. This component will directly link to a transport, which in this case is the iAnywhere HDP SDK.

Device Id (DI) Profile – This component is a Bluetooth profile designed to provide device specific information through use of the Service Discovery Protocol (SDP). If vendor specific information is required as part of a particular Medical Device, this profile provides specific behavior to acquire this information. The iAnywhere HDP implementation offers API's to register and query for such vendor specific information. These API's can then be integrated directly into the Medical Application.

Health Device Profile (HDP) – This component is the core Bluetooth profile designed to facilitate transmission and reception of Medical Device data. iAnywhere provides a full-featured set of API's for this profile. These API's interact with the lower level MCAP layer, but also perform SDP behavior to connect to remote HDP devices.

SDP – This component is the Service Discovery Protocol (SDP) used by all Bluetooth profiles to register and/or discover available services on remote devices so that connections over L2CAP can be established.

Multi-Channel Adaptation Layer (MCAP) – This component is used by HDP and facilitates the creation of a Communications Link (MCL) for exchanging generic commands, and also one or more Data Links (MDL) to transfer actual Medical Device data.

Generic Access Profile (GAP) – This component describes the required features of all core Bluetooth profiles. These features include inquiry, connection, and authentication procedures.

Logical Link and Adaptation Layer (L2CAP) – This component supports protocol multiplexing, packet segmentation and reassembly, quality of service, retransmission, and flow control for the Bluetooth packets transmitted through MCAP.

Host Controller Interface (HCI) – This component describes the commands and events that all Bluetooth hardware implementations (controllers) can understand. The iAnywhere SDK components act as the host and use this HCI interface to send Bluetooth data down to the controller.

Bluetooth Transport Interface – This component describes the UART, USB, SDIO, 3-wire, ABCSP, etc. transport interface to the actual Bluetooth hardware components being used. Typically, UART and USB are the most widely used transports.

Health Device Profile Source

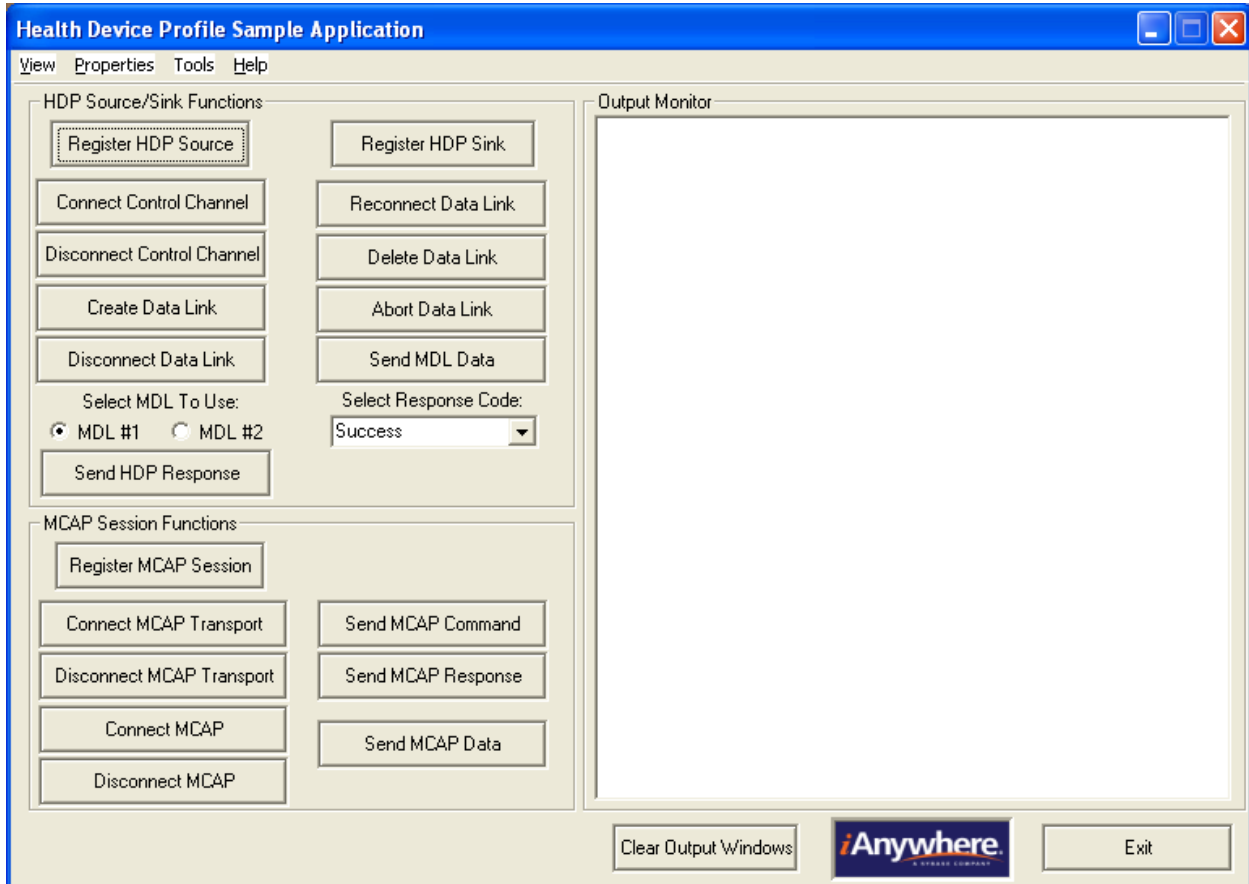
iAnywhere Health Device Profile source code is included in the `\hdp\profiles\hdp` folder. The header file `\hdp\inc\hdp.h` specifies both the HDP Source and HDP Sink API. The Source and Sink roles can be built independently with compile time options listed in this file.

A sample test application that can act as both a Source and Sink at run time is located in the `\hdp\minios\hdp_app` folder.

Source File/Folder	Description
<code>/hdp/profiles/hdp</code>	Contains source code for the Health Device Profile component
<code>/hdp/profiles/mcap</code>	Contains source code for the Multi-Channel Adaptation Protocol component
<code>/hdp/minios/hdp_app</code>	Contains OS specific source code for the HDP sample application.
<code>/hdp/inc</code>	All external header files required to compile the Health Device Profile
<code>/hdp/inc/sys</code>	All internal include files required to compile the Health Device profile.
<code>/hdp/apps/hdp_app</code>	Contains portable code for the HDP sample application.
<code>/hdp/docs</code>	Contains the HDP documentation

Health Device Profile Test Application

This figure is the main GUI for the HDP test application. The buttons are linked to specific HDP API's which can be used to test against another copy of the HDP test application or any medical device that supports HDP.



This figure shows the GUI component included in the HDP test application, which is used to inquire and select the remote Bluetooth device to connect with.



Integration Requirements

This section describes the requirements to integrate with the iAnywhere HDP SDK for use on a medical device. Overall, the integration requirements are quite minimal.

Medical Application

iAnywhere provides a sample HDP test application (for Windows), which can be leveraged to create an actual medical device application, but most of this work is left up to the medical device experts. iAnywhere is specifically concerned with providing integration and example code for all HDP API's that a medical application might utilize.

IEEE 11073-20601 Stack

The IEEE stack component is typically developed internally by the medical device manufacturer or obtained from a third-party company or organization. iAnywhere provides some sample integration code for the Continua IEEE stack implementation, which can be obtained after membership with the Continua Health Alliance.

Bluetooth Transport Interface

iAnywhere provides UART, ABCSP, 3-wire, and USB transports for many Bluetooth radios and platforms (Windows, Linux, Windows CE, Android). Depending on the transport, platform, and hardware being used, there may be some integration requirements here. Additionally, there are some basic Operating System specific API's included in the iAnywhere SDK's that may need to be modified based on the target platform being used.

Conclusion

The iAnywhere HDP SDK and associated iAnywhere Blue SDK products provide all of the required pieces to integrate a medical device for use with Bluetooth. Most of these pieces are portable and require no modifications, however, the few areas that do require modifications are shown with working examples, much of which can be then leveraged onto a target platform.

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