Bluetooth® Health Device Profile

Bluegiga Technologies
Topics

- Introduction
- Bluetooth Health Device Profile
- IEEE 11073 – Optimized Exchange Protocol
- iWRAP with HDP
- HDP offering
Introduction
Introduction: Background

- Getting rid of cables is also a trend in the medical field, as it gives patients and healthcare workers more freedom and possibilities.

- Bluetooth as a secure and robust technology is ideal for this purpose and at the moment there are in many medical solutions where Bluetooth has been used as a wireless interface.

- Bluetooth is used in a variety of medical applications as a secure and reliable connection method.

- Typically the implementations have been based on Bluetooth Serial Port Profile (SPP) and manufacturer specific proprietary implementations and protocols.

  Therefore different implementations have had a poor level of interoperability with each other.
Introduction: Example

- Pulse oximeter
- BodyTel: Blood glucose
- RTD Ltd: Tempus IC
- Blood pressure
- Bluetooth headset

8/6/09
**Introduction: Background**

- For this reason the Bluetooth SIG formed the Medical Device Working Group and set a goal to develop a profile that would introduce interoperability between different medical sensors and collecting devices from different manufacturers.

- The work resulted Multi-channel Adaptation Protocol (MCAP) and the Bluetooth Health Device Profile (HDP), which were adopted during 2008.

- First level implementations started to appear early 2009
Introduction: Background

- HDP is mainly targeted to supporting variety of in-home or in-hospital applications.

- The most typical use cases are different portable sensors like ECG transmitters, blood glucose level meters or blood pressure meters that transmit the measurements in the hospital to a monitoring PC.

- In an in-home application the measurements could be transmitted to a gateway device that forwards the information to remote servers for further processing.
Introduction: Use cases
Introduction: Use cases

Sensor (HDP source) (IEEE agent)

Gateway (HDP sink) (optionally IEEE manager)

Internet

Computation engine (optionally IEEE manager)
Introduction: Advantages

- Medical, Healthcare and Fitness Applicability
- Wireless Service Discovery
  Device types and features discovered with SDP
- Reliable Connection-oriented Behavior
  Data flows on top of reliable Bluetooth eL2CAP
- Reliable Control Channel
  Control channel on top of eL2CAP as well
Introduction: Advantages

- **Support for Flexible Data Channel Configurations**
  Manager can handle several devices simultaneously

- **Application-level Interoperability**
  IEEE 11073-xxxxx Personal Health Devices

- **Efficient Reconnection Mechanism**

- **High resolution Clock Synchronization**
  Synchronize data from several sources (ECG for example)

- **Optimized for Devices with Low Resources**
Bluetooth Health Device Profile
Bluetooth Health Device Profile

HDP provides a way to set up:
- A control channel and
- One or multiple reliable data channels
between two devices.

HDP profile also provides optional clock synchronization between the
devices and device type identification.

Source: Acts as a source of the medical data
Sink: Receives the medical data from single or multiple sources
**Bluetooth Health Device Profile**

HDP together with MCAP provides the following:

- Provides a standard structured approach for using a Control Channel to connect and coordinate connection of necessary Data Channels.

**HDP is specialized for health applications and thus has the following advantages over other more generic profiles:**

- Provides strong application level interoperability by operating with the ISO/IEEE 11073-20601 Personal Health Data Exchange Protocol
- Provisions for a standardized method by which the device-type and supported application data-types of a device can be determined wirelessly, using the Bluetooth Service Discovery Protocol (SDP).
- Connection-oriented to ensure more reliable behavior when a Source moves out of range or disconnects (either inadvertently or intentionally), allowing the device to recognize the condition and take appropriate actions.
IEEE 11073 – Optimized Exchange Protocol
IEEE 11073 Optimized Exchange Protocol

- The application level interoperability is provided with ISO/IEEE 11073-xxxx.

- The IEEE 11073-20601 Optimized Exchange Protocol provides a framework of object-oriented information modeling, information access and measurement data transfer suitable to a wide variety of personal health devices.

- Examples of such health devices are as follows: weight scales, thermometers, pulse oximeters, blood pressure monitors, and glucose meters. On addition the protocol is designed to support a range of home health sensors.

- The goal of IEEE 11072-20601 is to enable interoperability between sensors and data management devices to process, display or transfer the specific measurements.

- The ISO/IEEE 11073 specifications contains the 20601 core protocol specification describing the tools to represent and convey data and a set of Device Data Specializations (DDS), which contains details how 20601 is applied to a specific health device.

- At the time of writing this presentation the following DDSs existed:
  - IEEE 11073-10404 – Pulse Oximeter
  - IEEE 11073-10407 – Blood Pressure Monitor
  - IEEE 11073-10408 - Thermometer
  - IEEE 11073-10415 – Weighing Scale
  - IEEE 11073-10417 – Glucose Meter
# IEEE 11073 Optimized Exchange Protocol

<table>
<thead>
<tr>
<th>Data type</th>
<th>MDEP Data type</th>
<th>IEEE 11073</th>
<th>IEEE 11073 Document name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse oximeter</td>
<td>0x1004 (4100 decimal)</td>
<td>11073-10404</td>
<td>Health informatics - Personal health device communication - Device specialization - Pulse oximeter</td>
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<td>Blood pressure monitor</td>
<td>0x1007 (4103 decimal)</td>
<td>11073-10407</td>
<td>Health informatics - Personal health device communication - Device specialization - Blood pressure monitor</td>
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<td>Body thermometer</td>
<td>0x1008 (4104 decimal)</td>
<td>11073-10408</td>
<td>Health informatics - Personal health device communication - Device specialization - Thermometer</td>
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<tr>
<td>Body weight scale</td>
<td>0x100F (4111 decimal)</td>
<td>11073-10415</td>
<td>Health informatics - Personal health device communication - Device specialization - Weighing scale</td>
</tr>
<tr>
<td>Glucose meter</td>
<td>0x1011 (4113 decimal)</td>
<td>11073-10417</td>
<td>Health informatics - Personal health device communication - Device Specialization - Glucose meter</td>
</tr>
</tbody>
</table>
iWRAP with HDP
iWRAP with HDP

iWRAP implements:
• MCAP protocol
• HDP profile
• SDP profile

IEEE data need to be sent in single Bluetooth L2CAP frames -> UART needs to be MUXed

IEEE stack must be implemented by the host at the moment
HDP offering
HDP offering

- **HDP beta**: Now
  - Wireless Service Discovery
  - Reliable Connection-oriented Behavior
  - Reliable Control Channel
  - Support for Flexible Data Channel Configurations
  - Application-level Interoperability
  - Efficient Reconnection Mechanism

- **Beta Bluetooth / IEEE qualified**: Q3-Q4 / 2009
  - ANSI C source code for agent / manager
  - iWRAP handling, MUX handling
  - QT based graphical user interface
  - Source code documentation

- **IEEE 11073-20601**: Now
  - ANSI C source code for agent / manager
  - iWRAP handling, MUX handling
  - QT based graphical user interface
  - Source code documentation

- **Device Data Specializations**
  - IEEE 11073-10417 – Glucose Meter: Later
  - IEEE 11073-10404 – Pulse Oximeter: Later
  - IEEE 11073-10407 – Blood Pressure Monitor: **Now**
  - IEEE 11073-10408 - Thermometer: Later
  - IEEE 11073-10415 – Weighing Scale: Later

- **Project based customization**: Now
  - For example integrating DDS into WTxx.
Thank you