What's my heart rate?

An introduction to the awesomeness of Bluetooth 4 and iOS

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What we're covering

- Bluetooth 4 - briefly
- The specs related to our heart rate demo
- iOS Core Bluetooth
- A demo application

Bluetooth

- Bluetooth specifications are defined and promoted by the Bluetooth SIG (bluetooth.com & bluetooth.org)

- Bluetooth 4.2 is the latest version of the core specification (December of 2014)

- Bluetooth 4.0 is the specification that first included a “Low Energy” core configuration

- Bluetooth Smart is the official branding term for the low energy aspect

Bluetooth 4 (low energy)

- L2CAP (Logical Link Control and Adaptation Protocol) - transport, QOS, packets, multiplexing …

- GAP (Generic Access Profile) - device discovery, link management, security…

- ATT (Attribute Protocol) - discover/read/write attributes

- GATT (Generic Attribute Profile) - discover services, read/write characteristics

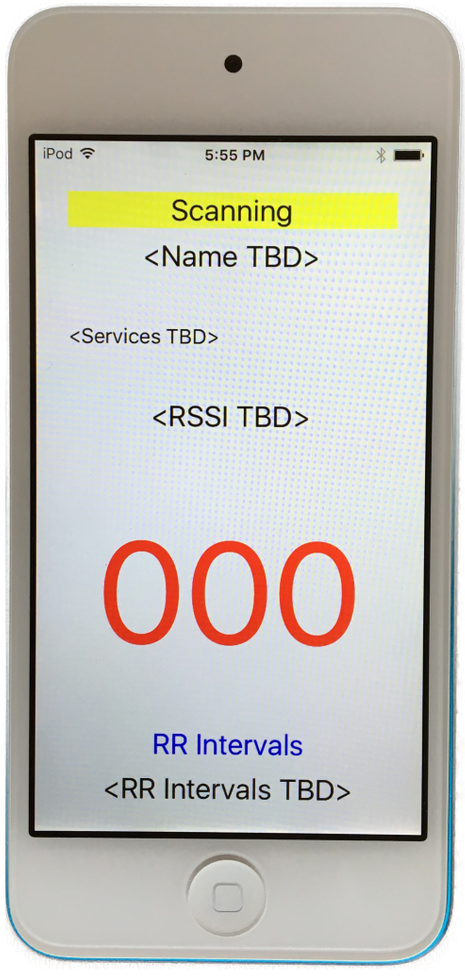
- SM (Security Manager) - pairing, authentication, encryption

General operation

- Scanning for Advertising devices
- Connecting
- Communicating
- Terminating connection

iOS Core Bluetooth

Central



Peripheral

Services (e.g. Heart Rate)

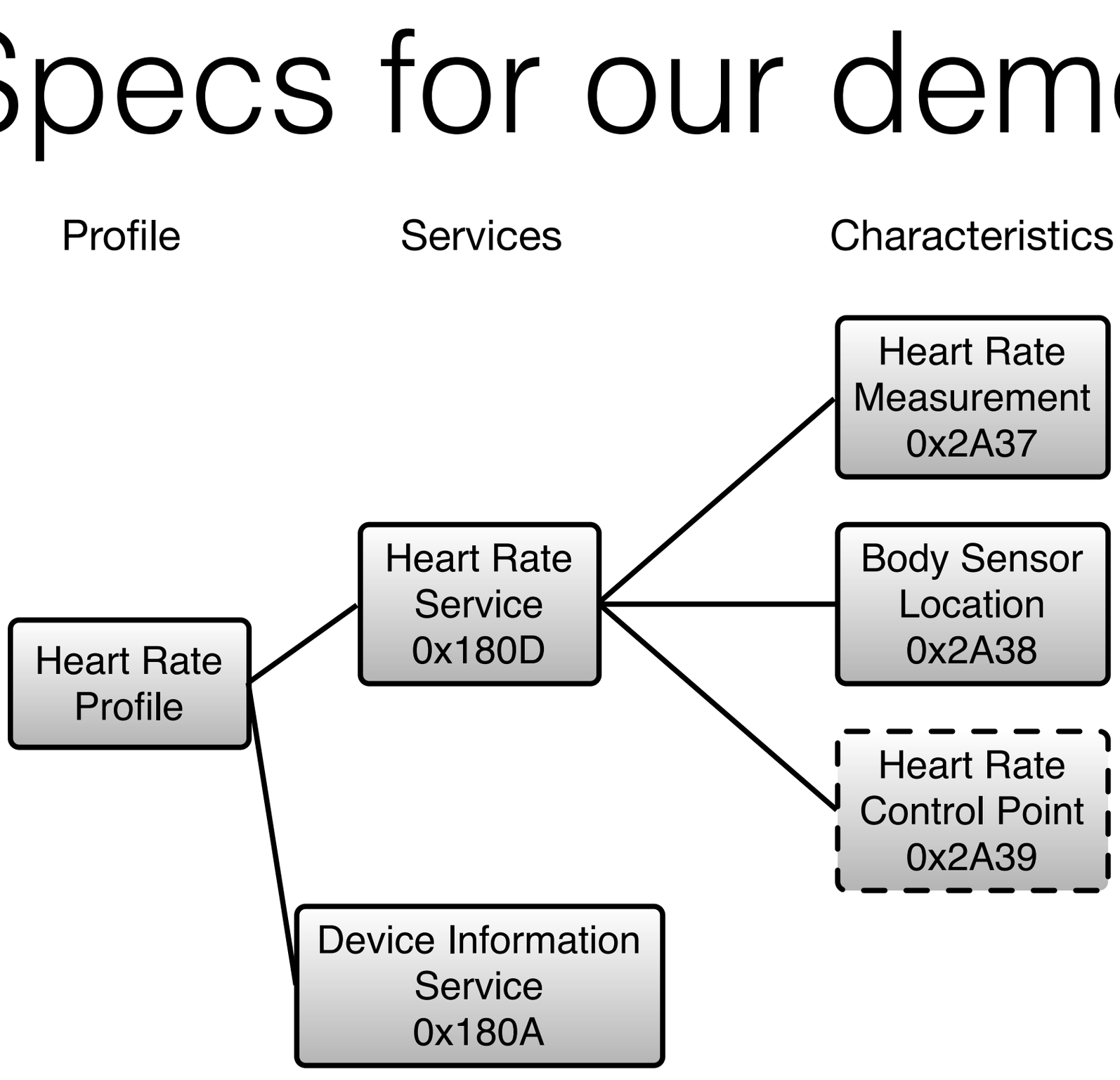
Characteristics

(e.g. Heart Rate Measurement)

Demo won't cover

- Control points
- Background mode
- Multiple CBCentralManagers
- Saving devices and restoring them
- iOS device as a peripheral

Specs for our demo



Profile: Heart Rate

type: org.bluetooth.heart_rate

Role: Heart Rate Sensor

Service	Requirement
org.bluetooth.service.heart_rate	Mandatory
org.bluetooth.service.device_information	Mandatory

Service: Heart Rate

Assigned Number: 0x180D

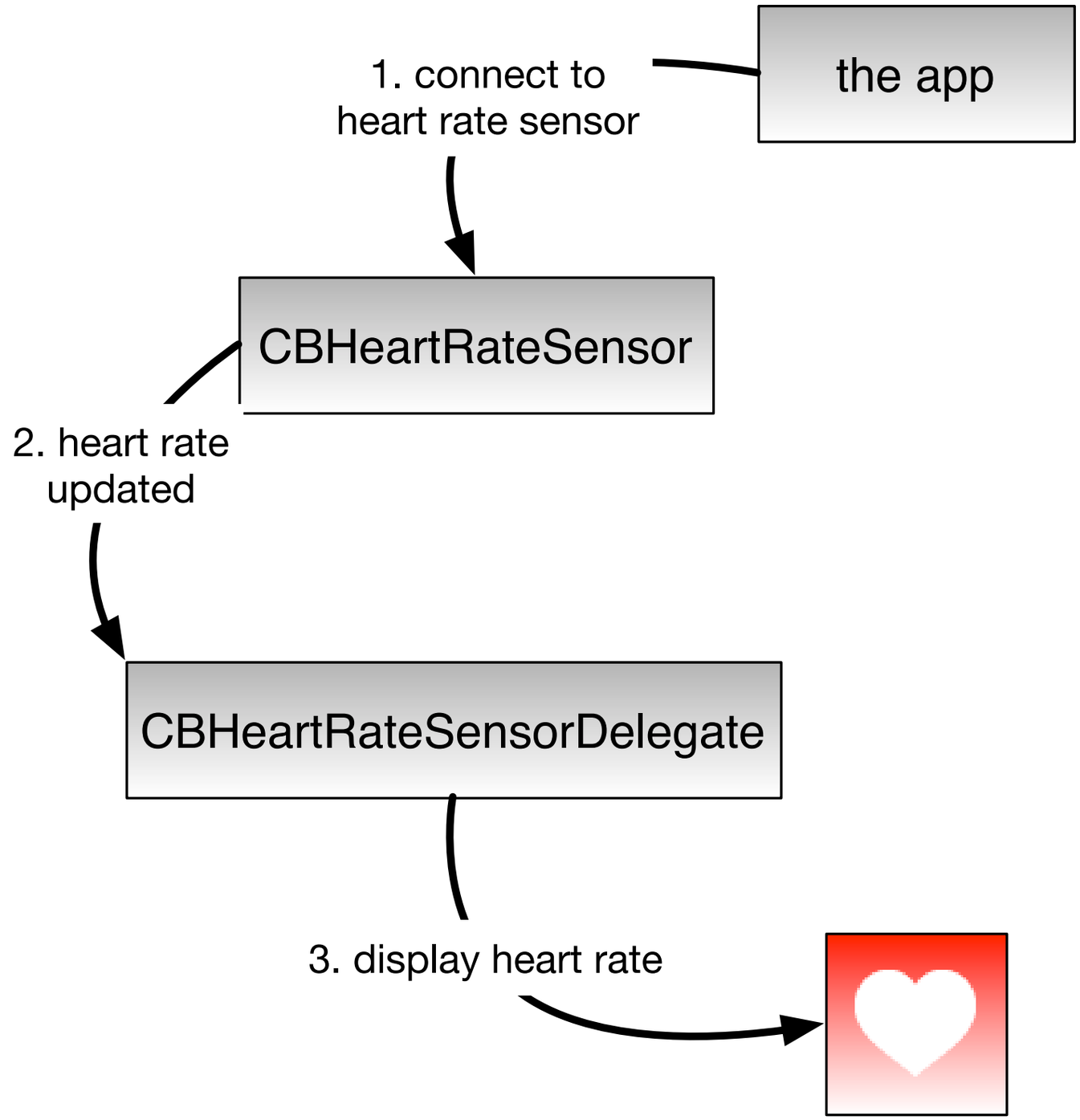
Service Characteristics	Properties
Heart Rate Measurement	Notify
Body Sensor Location	Read
Heart Rate Control Point (conditional: mandatory if Energy Expended feature is supported, otherwise excluded)	Write

Specless

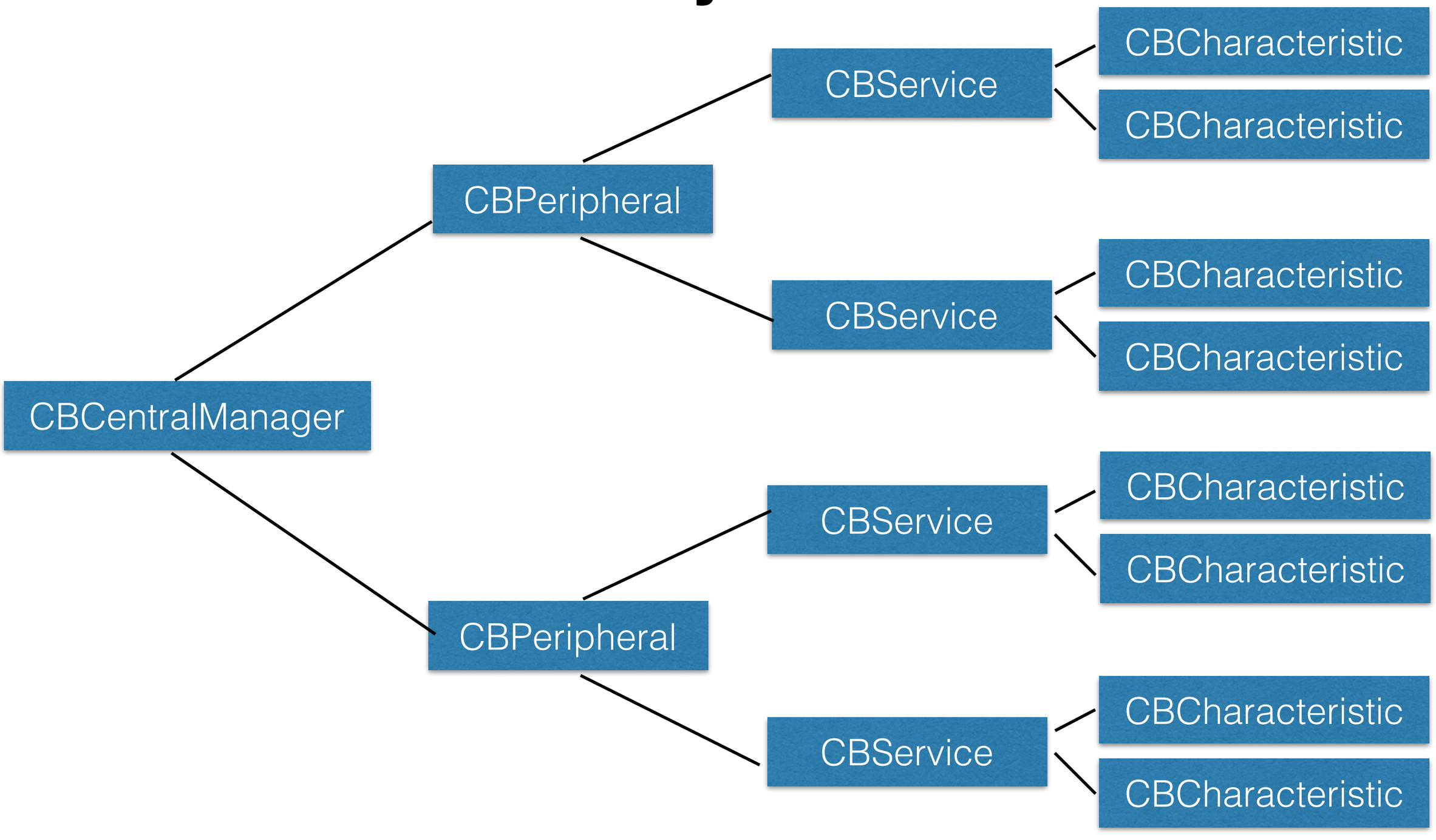
- Use Bluetooth 4 but don't have a published specification for profiles/services/characteristics
- Use self-assigned numbers - 128 bit UUIDs
- Some devices may publish according to a spec and then supplement with additional custom characteristics and control points
- Vendors do one of three things - no access to their data or device, access to their data via REST

Core Bluetooth Interactions

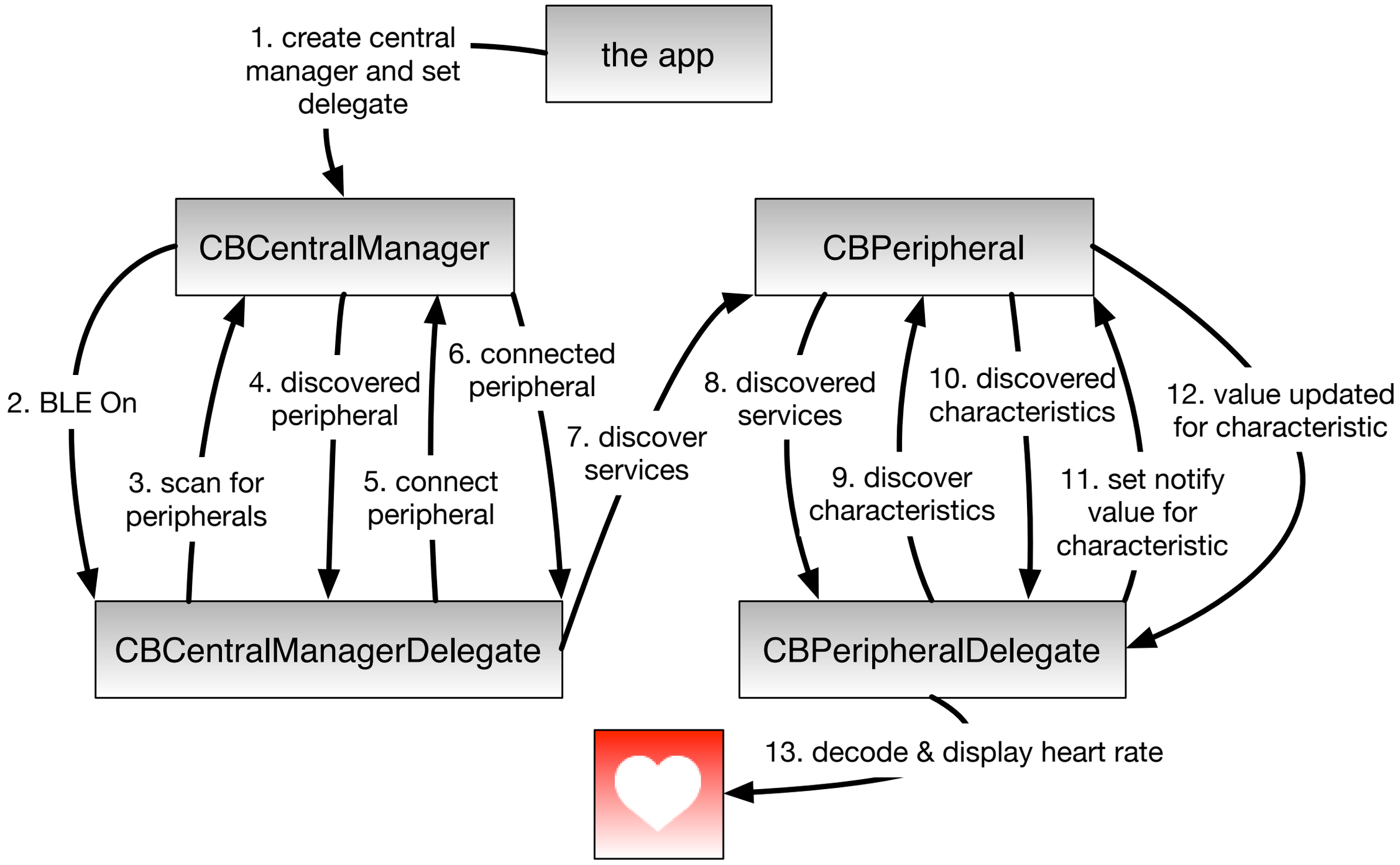
The way we'd like it to be



Objects


CBCentralManager
CBPeripheral
CBService
CBCharacteristic
CBCharacteristic
CBService
CBCharacteristic
CBCharacteristic
CBPeripheral
CBService
CBCharacteristic
CBCharacteristic
CBService
CBCharacteristic
CBCharacteristic

~~Simplicity~~ Reality



Demo Time

Requires: iPhone 4S or later - no simulator support

What could go wrong?

- What can you really screw up when working with Core Bluetooth?

- What's the best thing about your iPhone?

- Same answer: **battery life**

- Improper use has negative battery life impact on both iOS device and bluetooth peripheral

Pointers

Maximize Battery Life

- Be specific about what you scan for
- Scan until you find what you want then stop
- Let the framework filter out duplicate advertising data from same device
- Don’t look for data you don’t need
- Subscribe when appropriate (e.g. HR)
- Unsubscribe when appropriate (e.g. HR sensor not in contact)
- Don’t forget to disconnect when you’re done

Reconnection

Typically go after devices in this order:

1. ask CBCentralManager for devices you know (provide the list of UUIDs)

2. ask CBCentralManager for currently connected devices (probably connected to other apps)

3. Scan for devices

Resources for Learning

- Bluetooth Programming Guide
- 2012 WWDC Bluetooth Sessions
- 2013 WWDC Bluetooth Session

SIG Docs

http://developer.bluetooth.org

https://developer.bluetooth.org/gatt/profiles/Pages/ProfilesHome.aspx

https://developer.bluetooth.org/gatt/profiles/Pages/ProfileViewer.aspx?u=org.bluetooth.profile.heart_rate.xml

https://developer.bluetooth.org/gatt/services/Pages/ServiceViewer.aspx?u=org.bluetooth.service.heart_rate.xml

https://developer.bluetooth.org/gatt/characteristics/Pages/CharacteristicViewer.aspx?u=org.bluetooth.characteristic.heart_rate_measurement.xml