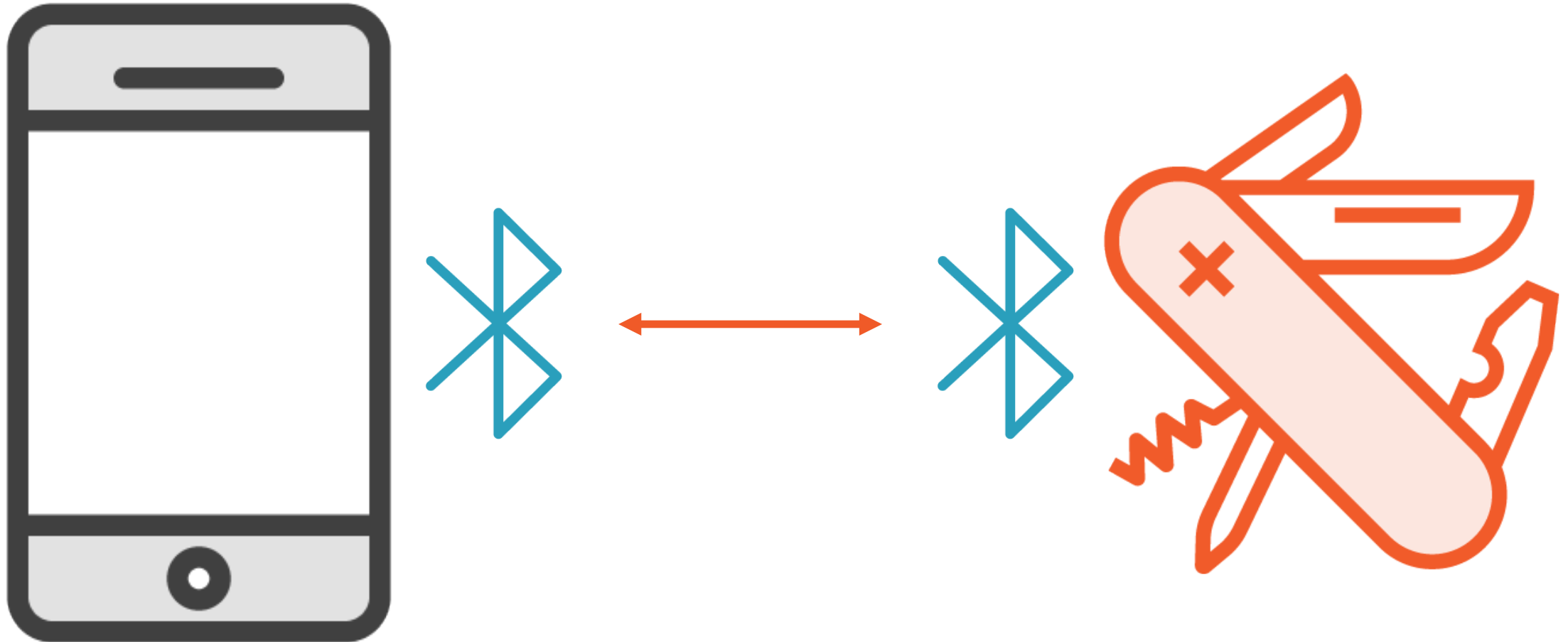


# Scenario: Building a Sensor Companion App



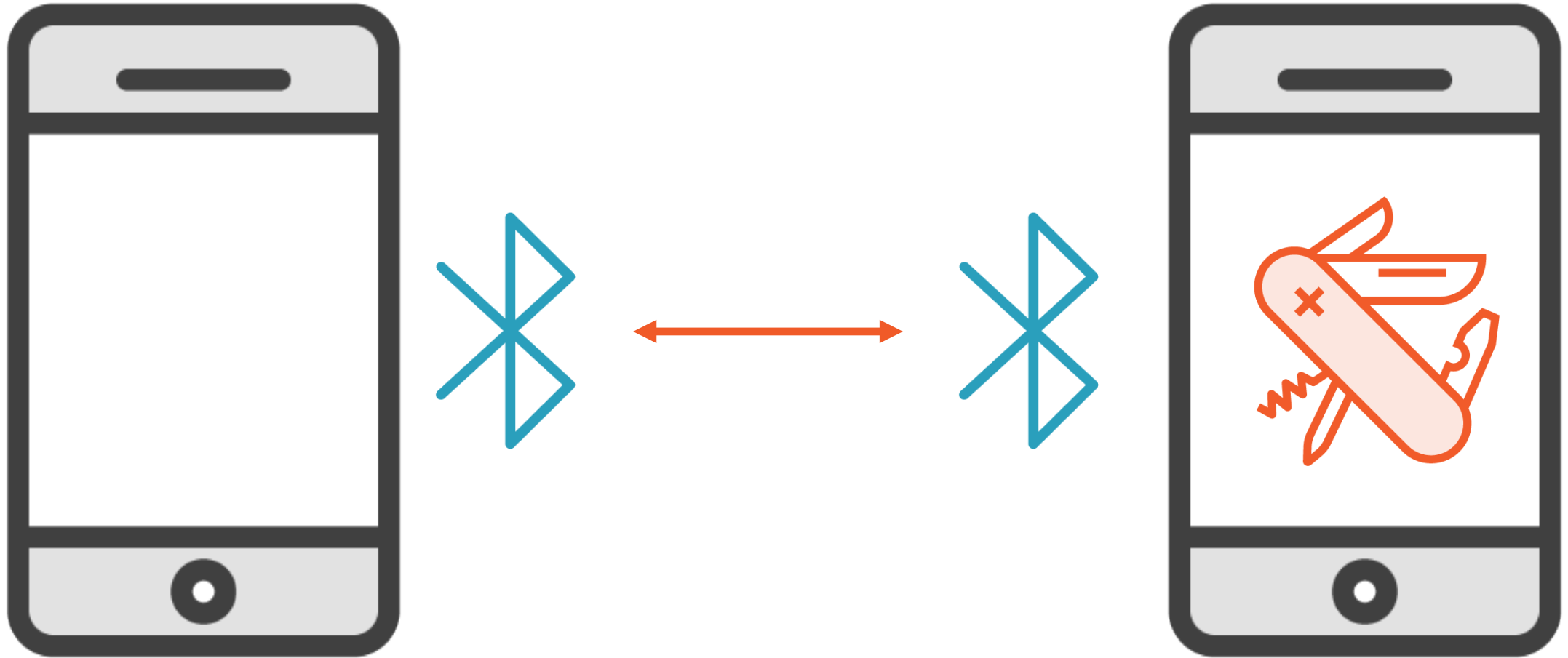
# Scenario: Building a Sensor Companion App



?



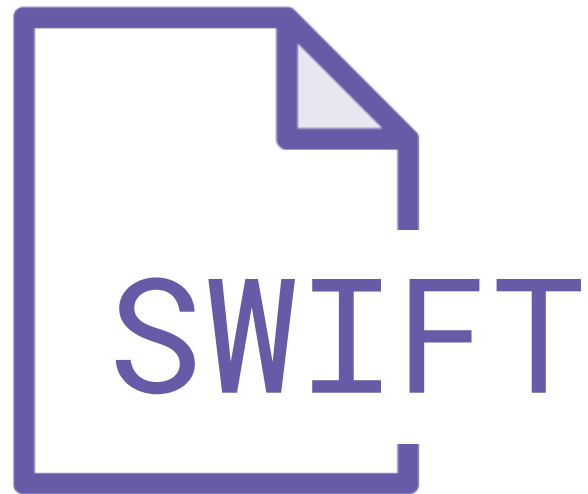
# Use Core Bluetooth to Mock Peripheral



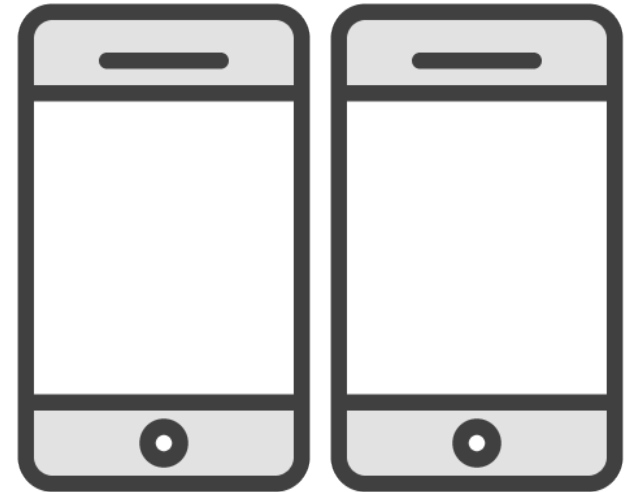
# Requirements



Xcode 10  
iOS 12



Swift 5.0



iOS Device (x2)



# A Quick Introduction to Bluetooth and BLE

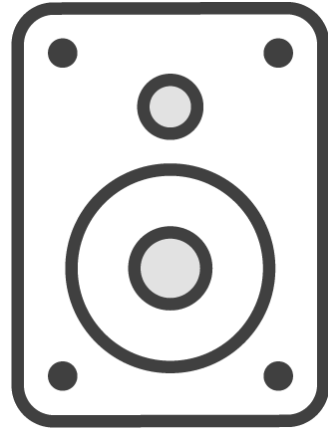
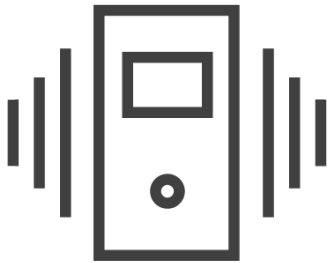
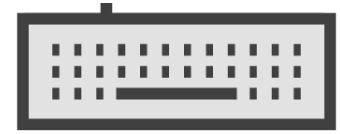
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# Wireless Communication

Transfer of information or power between two or more points that are not connected by an electrical conductor

# Bluetooth Is for Short-Range Device Communication



# Bluetooth Radio



2.4 GHz ISM band  
Frequency Hopping Spread Spectrum  
Prevents interference with Wi-Fi



# Bluetooth low energy technology

a.k.a. Bluetooth Smart, Bluetooth Low Energy, BLE

# Classic Bluetooth vs. Bluetooth Low Energy

## Classic Bluetooth (BR/EDR)

Streaming (Audio/Video applications)

79 channels (1 MHz spacing)

High Data Rate (1 Mb/s to 3 Mb/s)

High Power Consumption

Point-to-Point network topology

Standard Bluetooth Profiles  
(SPP, DUN, PAN)

## Bluetooth Low Energy (BLE)

Short bursts (Sensor applications)

40 channels (2 MHz spacing)

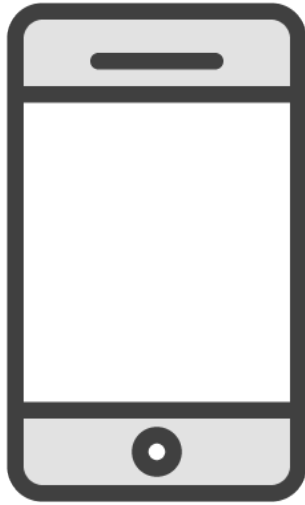
Low data rate (125 Kb/s to 2 Mb/s)

Low power consumption (~0.01x to 0.5x)

Point-to-point, Broadcast, Mesh network  
topologies

GATT (Generic Attribute) Profile

# Dual Mode Devices

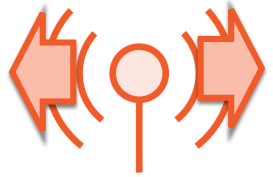


Support both Classic Bluetooth and BLE connections

# Generic Access Profile (GAP)

A base profile which all Bluetooth devices implement, defining the basic requirements of a Bluetooth device.

# BLE GAP Roles



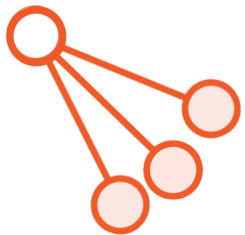
**Broadcaster** - Optimized for transmitter only applications (no connections). Uses advertising to broadcast data



**Observer** - Optimized for receiver only applications (no connections). Receives broadcast data contained in advertisements.



**Peripheral** - Optimized for devices that support a single connection. Require Controllers that support Controller's slave role.



**Central** - Supports multiple connections, initiates all connections with peripherals. Require Controller that supports Controller's master role.

A device may support multiple LE GAP roles (e.g. an iOS device)

# Generic Attribute Profile (GATT)

Describes a use case, roles, and general behaviors of a Bluetooth low energy device

Built on top of Attribute Protocol (ATT)

# GATT Client and Server Roles

Not necessarily tied to specific GAP roles

## Client

Sends requests, commands and confirmations to server

## Server

Stores data transported over Attribute Protocol

Sends responses to requests

Sends indication and notifications asynchronously to client when events occur

# GATT Hierarchy

## Profile

### Service

Service Ref



Service Ref



Characteristic



Characteristic

### Service

Service Ref



Service Ref

Characteristic



Characteristic

## Characteristic

Type [UUID]

Value

Properties

Permissions

Descriptor



Descriptor

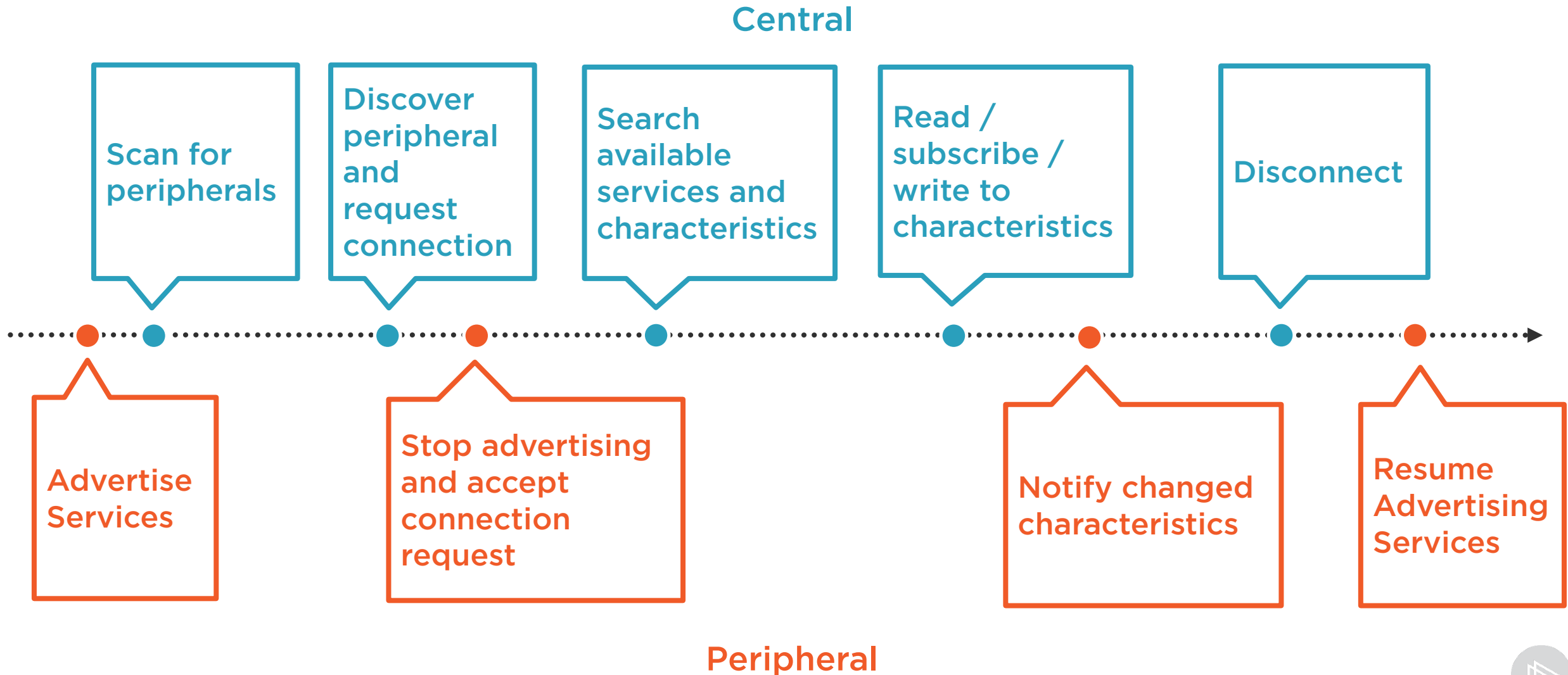


# Demo Outline

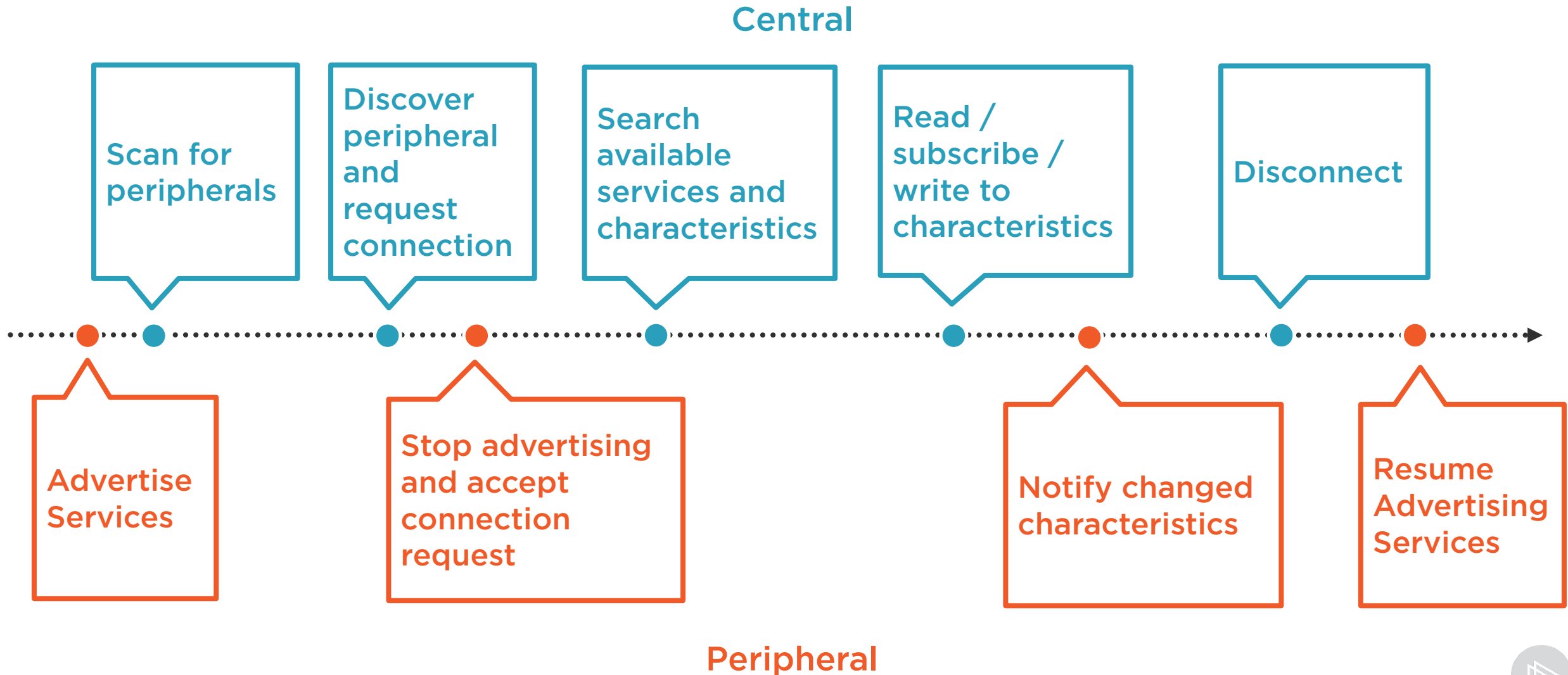
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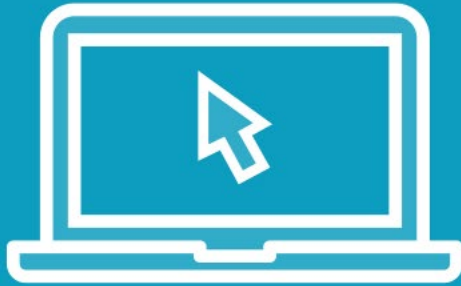
# Typical BLE Connection Flowchart



# Typical BLE Connection Flowchart



# Demo



## Build central

- Unfiltered peripheral discovery
- Display advertisement data in table

## Build peripheral

- Add services and characteristics
- Add Core Motion data

## Connect central to peripheral

- filter discovery
- subscribe to notify events

## Display real-time data as central or peripheral



# Summary



**Introduction to Bluetooth and BLE**

**Identified use case for peripheral application**

**Built central with peripheral discovery**

