检查您对此课程的准备：

1. 确保您的浏览器满足 ARM mbed 要求：

   bit.ly/supported-browsers

2. 请下载 nRF Connect 应用程序，并确保将其安装在您的智能手机或平板电脑上
3. 请确保已经登录ARM Mbed平台，网址：https://os.mbed.com/

#BluetoothAsia2018#

BluetoothAsia
探索、创新、开拓

Bluetooth® 与beacon

演讲者：任凯，开发者关系经理，蓝牙技术联盟

微信：kaiser-tech

微信

Bluetooth®

音频传输

- 耳机
- 音箱
- 车载音频系统

点对点

1:1

数据传输

- 运动健身设备
- 健康健护设备
- 外设及附件

点对点

1:1

定位服务

- 信息推送
- 定位与导航
- 资产跟踪

广播

1:m

设备网络

- 控制系统
- 监控系统
- 自动化系统

mesh m:m

Bluetooth BR/EDR

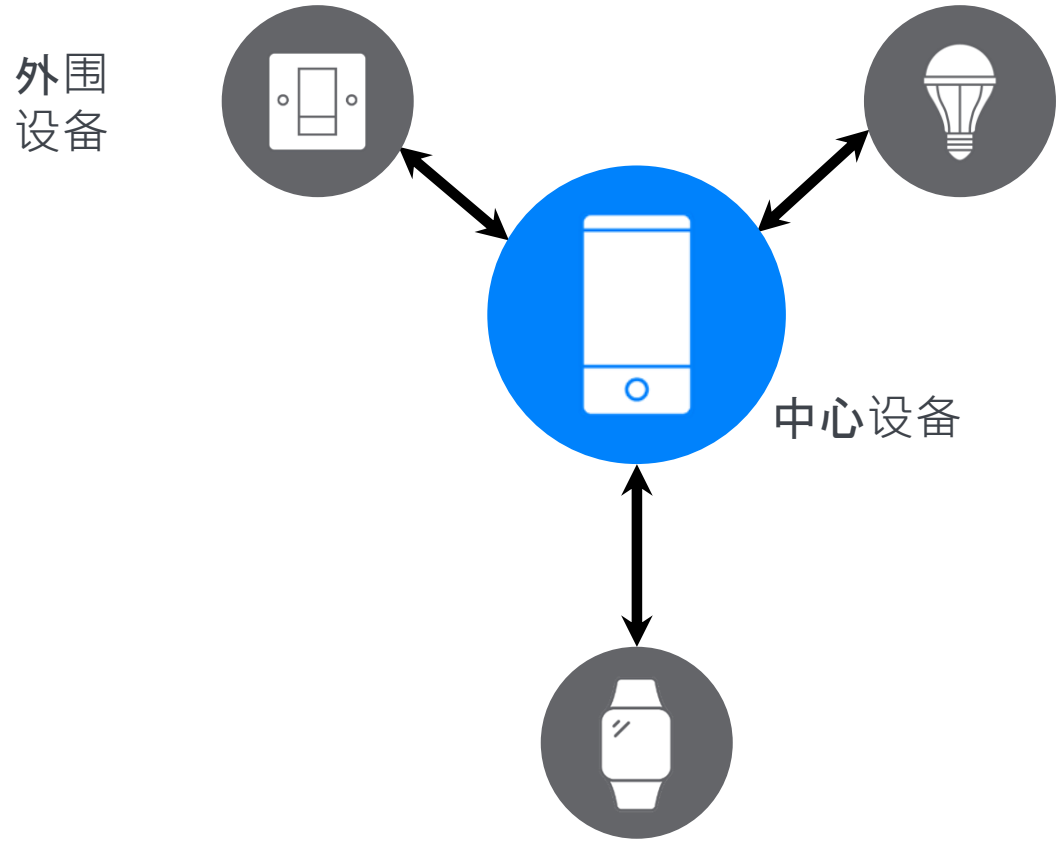
Bluetooth Low Energy (LE)

GAP – 广播

主要职责：

- **广播**
- 设备探索
- **建立**连接

在 GAP 层进行广播



低功耗蓝牙帧格式与 PDU

前导码 4 octets	接入地址 4 octets	帧数据单元 0 ~ 39 octets	CRC 3 Octets

帧头 2 Octets	帧负载 0 ~ 37 Octets

AdvA 6 Octets	AdvData 0 ~ 31 Octets

AD Structure 0	AD Structure 1	. . .

长度 1 octet	AD 类型 N octets	AD 数据 (长度 – N) octets

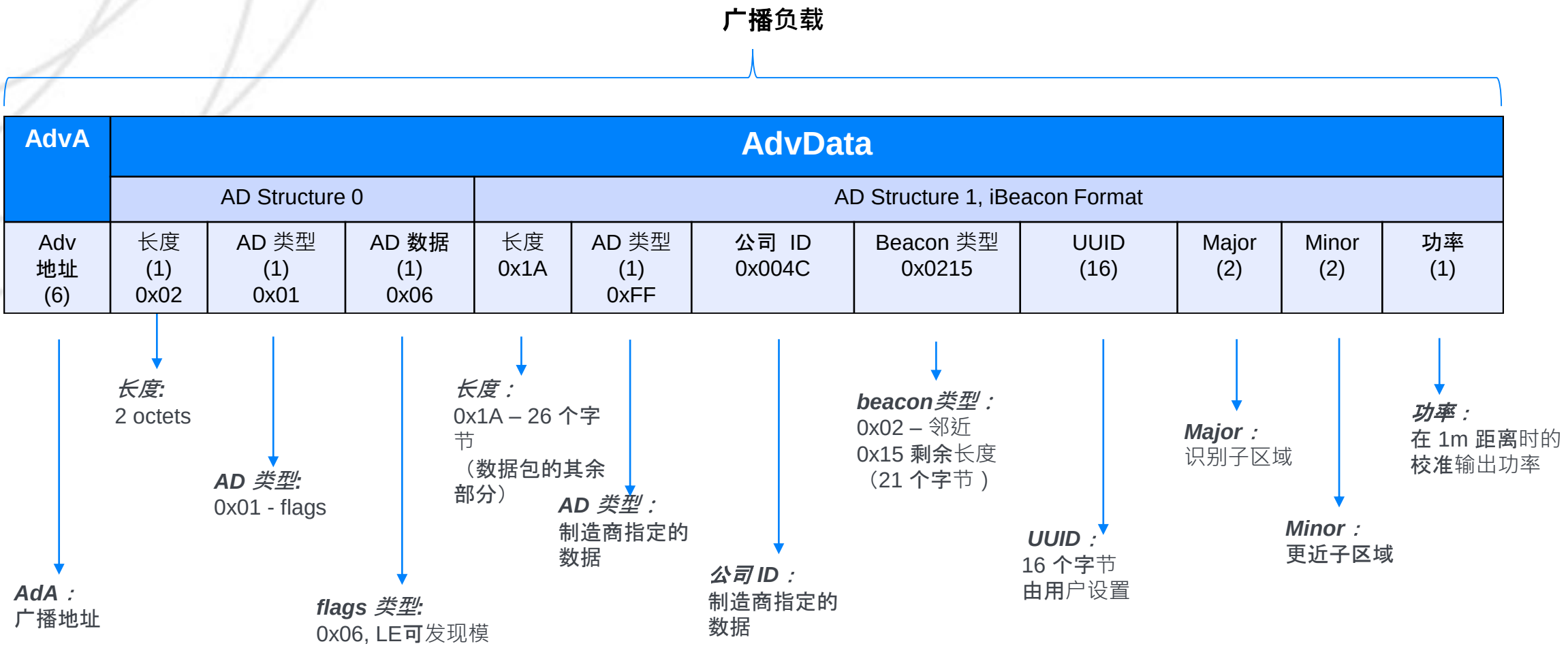
Beacon协议

联盟官网 ->
s Profile ->

Core Specification Supplement
(CSS v7, Dec 2016)
Part A, Section 1

参考条件: Bluetooth LE Uncoded PHY, 1M

iBeacon 数据帧



https://www.bluetooth.com/specifications/assigned-numbers/16-bit-uuids-for-members

76	0x004C	Apple, Inc.

Eddystone 帧格式

广播数据帧

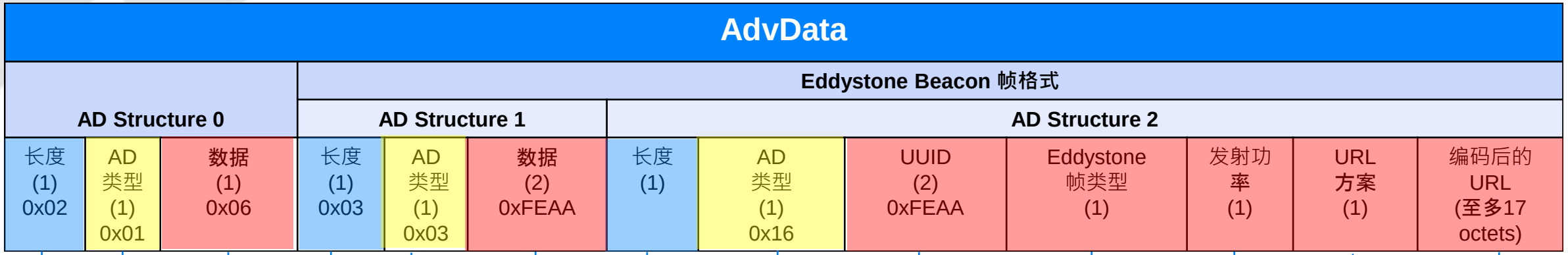
标题	负载											
				Eddystone 信标格式								
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	帧特定格式				
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	URL 方案 (1)	编码的 URL （最多 17 个字节）		
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	NID (10)		BID (6)	RFU (2)
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	TLM (1)	VBATT (2)	TEMP (2)	ADV_CNT (4)	SEC_CNT (4)

URL – 网址

UID – 广播唯一信标 ID

TLM – 广播遥测（运行状况与状态）

Eddystone帧格式 - URL



长度:
2 octets

AD 类型:
0x01 - flags

Flag 类型:
0x06, 0x06, LE可发现模式&不支持BR/EDR

长度:
3 octets

AD 类型:
0x03,Complete List of 16-bit Service Class UUID

16-bit UUID:
Service UUID, 0xFEAA
谷歌申请的UUID

长度:
变长

Type:
0x16, Service Data - 16-bit UUID

16-bit UUID:
Service UUID, 0xFEAA,
谷歌申请的UUID

帧类型:
0x00 – Eddystone UID
0x10 – Eddystone URL
0x20 – Eddystone TLM
0x30 – Eddystone EID

发射功率:
在 0 米处测量
（以 dBm 为单位）

URL 方案:
0x00 http://www.
0x01 https://www.
0x02 http://
0x03 https://

编码的 URL：
最多 17 个字节的 ASCII 编码

扩充代码：
0x00 - .com/
0x01 - .org/
.
.
.
0x0D - .gov/
0x7F-0xFF – 保留供将来使用

https://www.bluetooth.com/specifications/assigned-numbers/16-bit-uuids-for-members

65194	0xFEAA	Google Inc.	12-Mar-2015

Beacon帧格式对比

广播数据帧

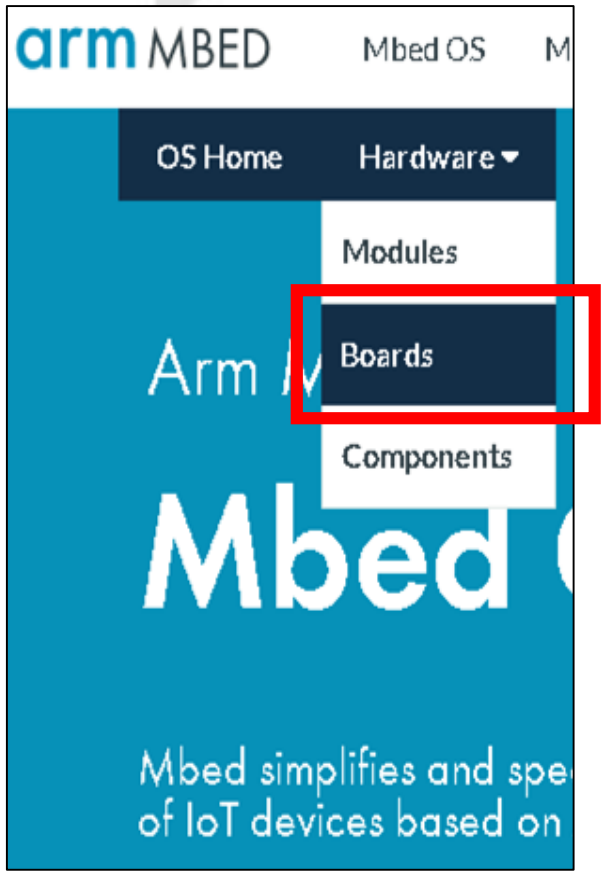
标题	负载									
			iBeacon 格式							
	AdvA (6)	Ad 标志 0X020106	长度 0x1A	AD 类型 0xFF	公司 ID 0x4C00	信标类型 0x0215	UUID (16)	Major (2)	Minor (2)	功率 (1)

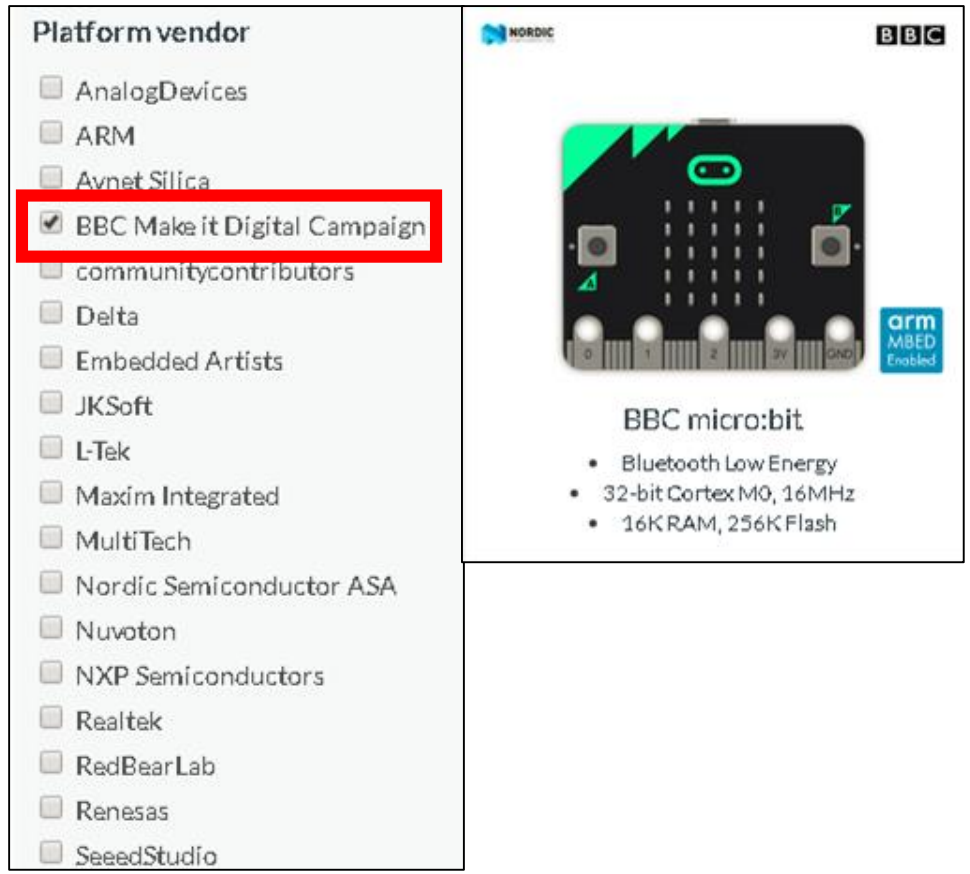
			Eddystone 信标格式								
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	帧特定格式			
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	URL 方案 (1)	编码的 URL （最多 17 个字节）	
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	NID (10)	BID (6)	RFU (2)
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	TLM (1)	VBATT (2)	TEMP (2)	ADV_CNT (4)	SEC_CNT (4)

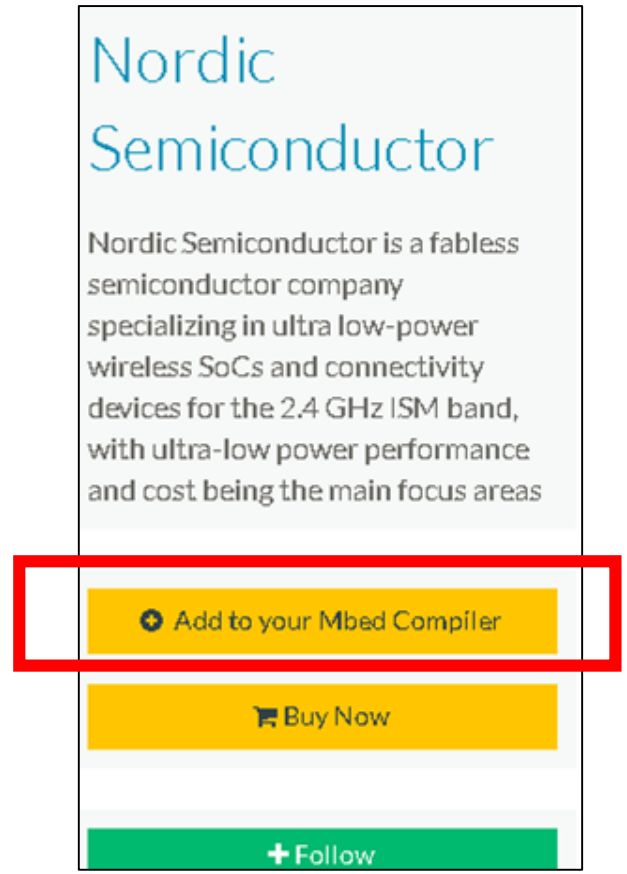
实际动手操作

加载micro:bit开发板

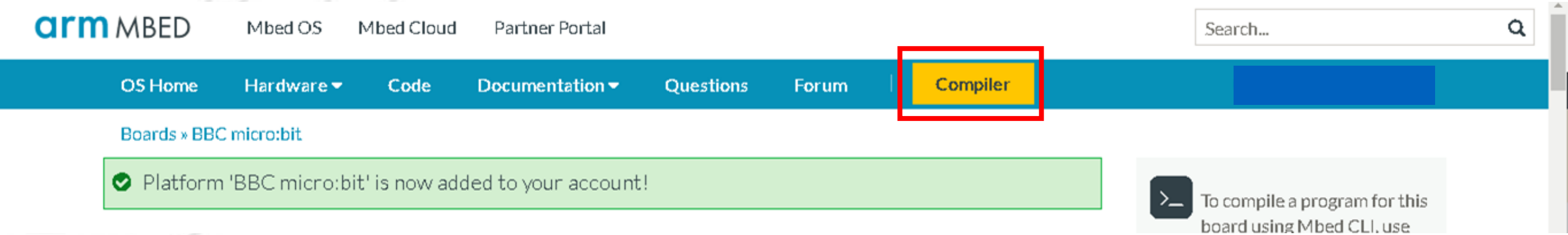
https://os.mbed.com/

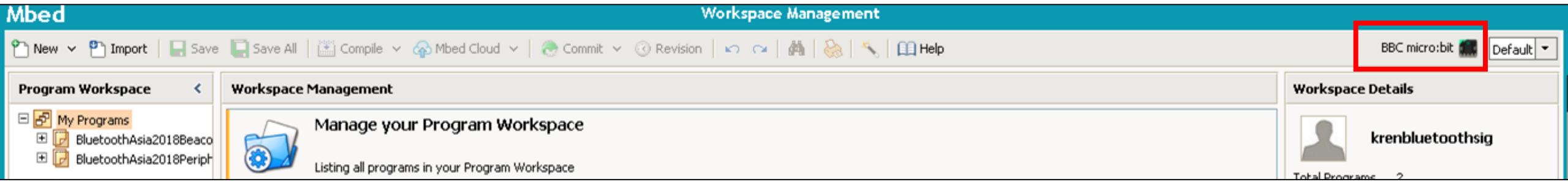






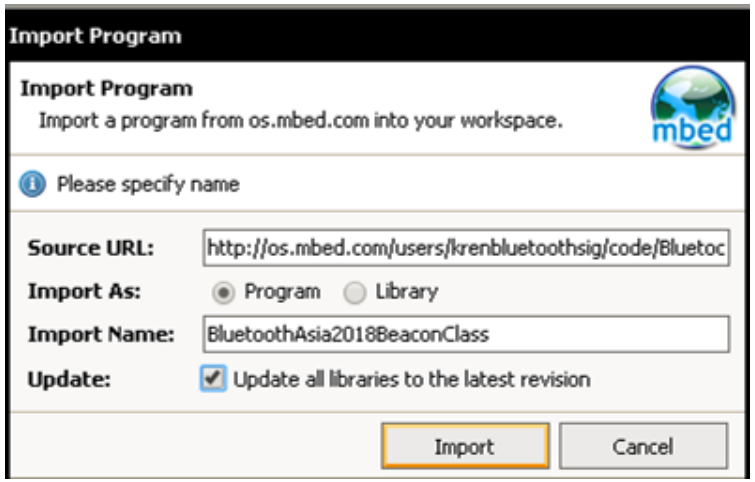
加载micro:bit开发板

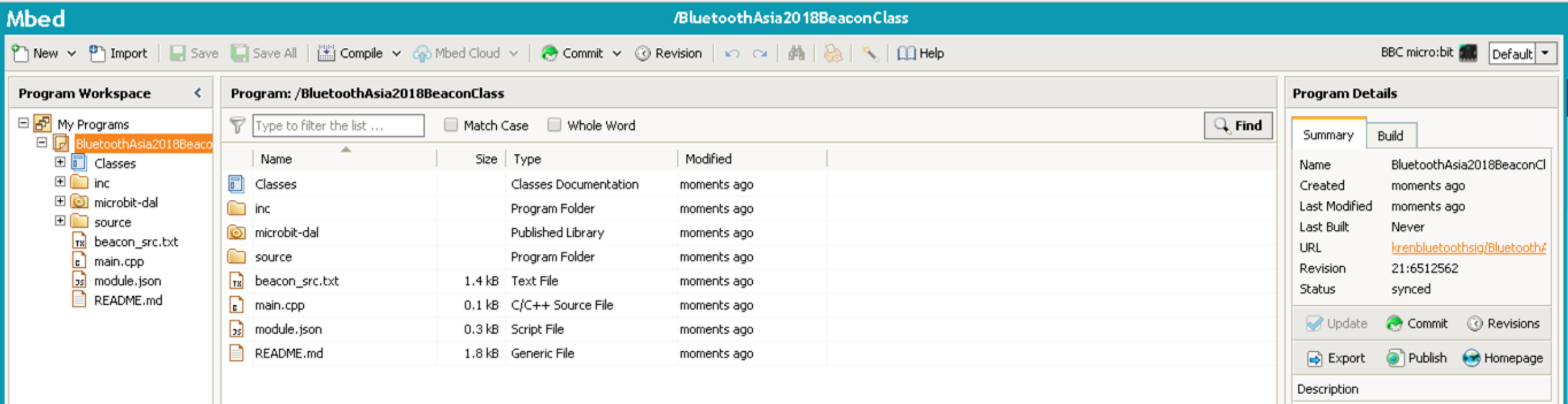




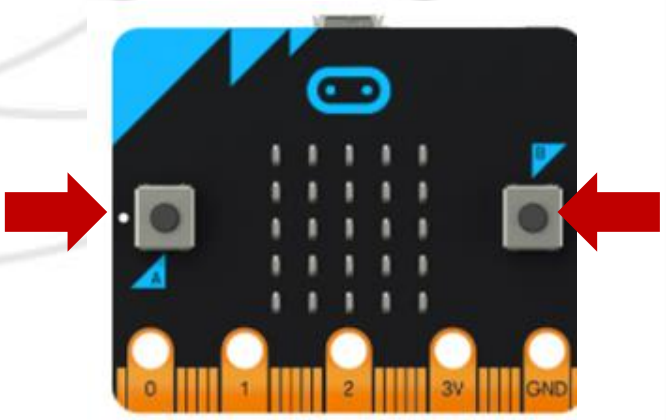
加载beacon工程

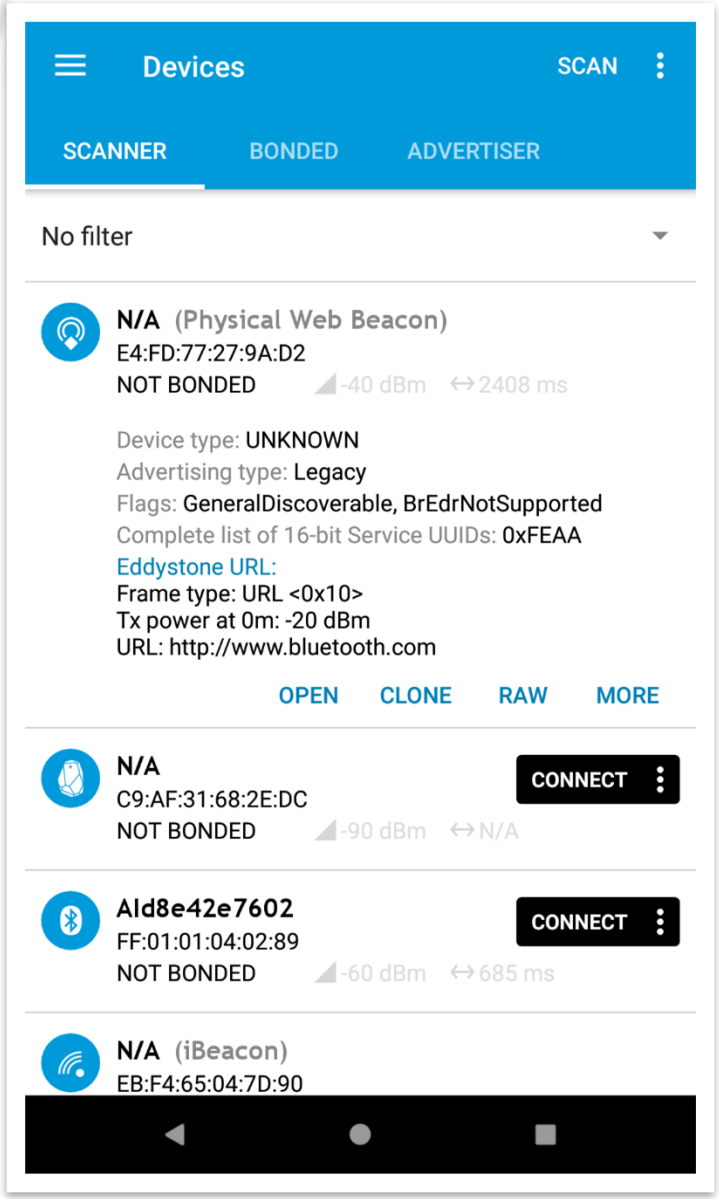
Type url in your browser, http://t.cn/RnwPyb9


Import Program
Import Program
Import a program from os.mbed.com into your workspace.
mbed
Please specify name
Source URL:
http://os.mbed.com/users/krenbluetoothsig/code/Bluetoc
Import As:
Program
Library
Import Name:
BluetoothAsia2018BeaconClass
Update:
Update all libraries to the latest revision
Import
Cancel


Mbed
/BluetoothAsia2018BeaconClass
New
Import
Save
Save All
Compile
Mbed Cloud
Commit
Revision
Help
BBC micro:bit
Default
Program Workspace
My Programs
BluetoothAsia2018Beaco
Classes
inc
microbit-dal
source
beacon_src.txt
main.cpp
module.json
README.md
Program: /BluetoothAsia2018BeaconClass
Type to filter the list ...
Match Case
Whole Word
Find
Name
Size
Type
Modified
Classes
Classes Documentation
moments ago
inc
Program Folder
moments ago
microbit-dal
Published Library
moments ago
source
Program Folder
moments ago
beacon_src.txt
1.4 kB
Text File
moments ago
main.cpp
0.1 kB
C/C++ Source File
moments ago
module.json
0.3 kB
Script File
moments ago
README.md
1.8 kB
Generic File
moments ago
Program Details
Summary
Build
Name
BluetoothAsia2018BeaconCl
Created
moments ago
Last Modified
moments ago
Last Built
Never
URL
krenbluetoothsig/BluetoothA
Revision
21:6512562
Status
synced
Update
Commit
Revisions
Export
Publish
Homepage
Description

Our Project:

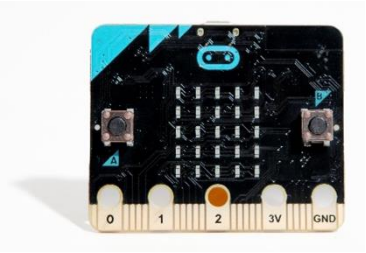

0
1
2
3V
GND


Devices
SCAN
SCANNER
BONDED
ADVERTISER
No filter
N/A (Physical Web Beacon)
E4:FD:77:27:9A:D2
NOT BONDED
-40 dBm
2408 ms
Device type: UNKNOWN
Advertising type: Legacy
Flags: GeneralDiscoverable, BrEdrNotSupported
Complete list of 16-bit Service UUIDs: 0xFEAA
Eddystone URL:
Frame type: URL <0x10>
Tx power at 0m: -20 dBm
URL: http://www.bluetooth.com
OPEN
CLONE
RAW
MORE
N/A
C9:AF:31:68:2E:DC
NOT BONDED
-90 dBm
N/A
CONNECT
Ald8e42e7602
FF:01:01:04:02:89
NOT BONDED
-60 dBm
685 ms
CONNECT
N/A (iBeacon)
EB:F4:65:04:7D:90

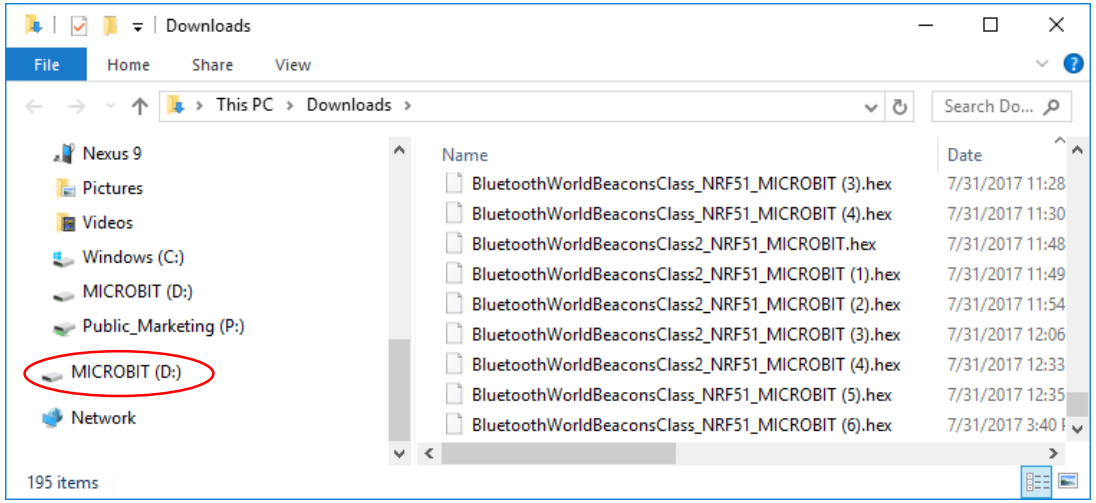

https://www.bluetooth.com/zh-cn
Bluetooth
帮助&支持
免费加入 SIG
以蓝牙促开发
随时使用开发人员资源和工具打造
蓝牙产品

实际动手操作

Beacon - micro:bit

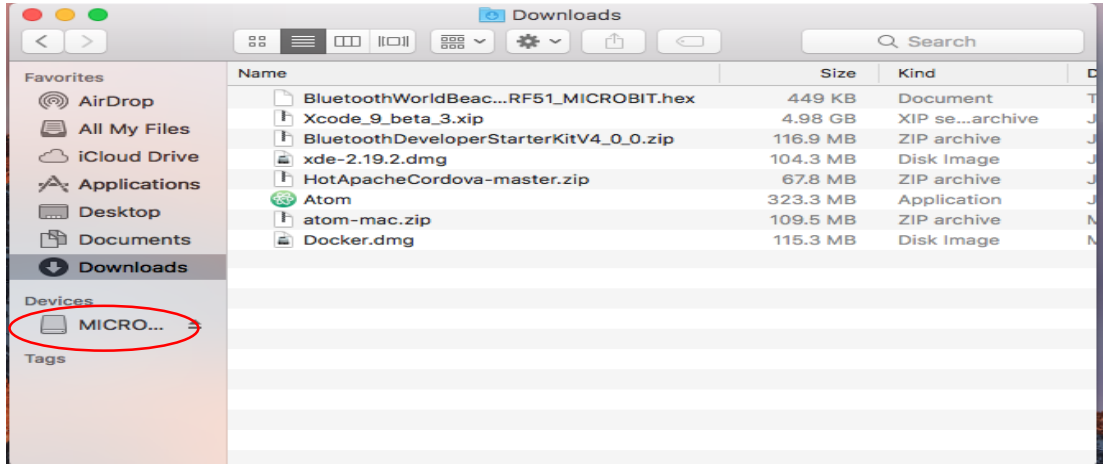


USB 大容量存储设备



Windows

盘符（例如 D:\）



macOS

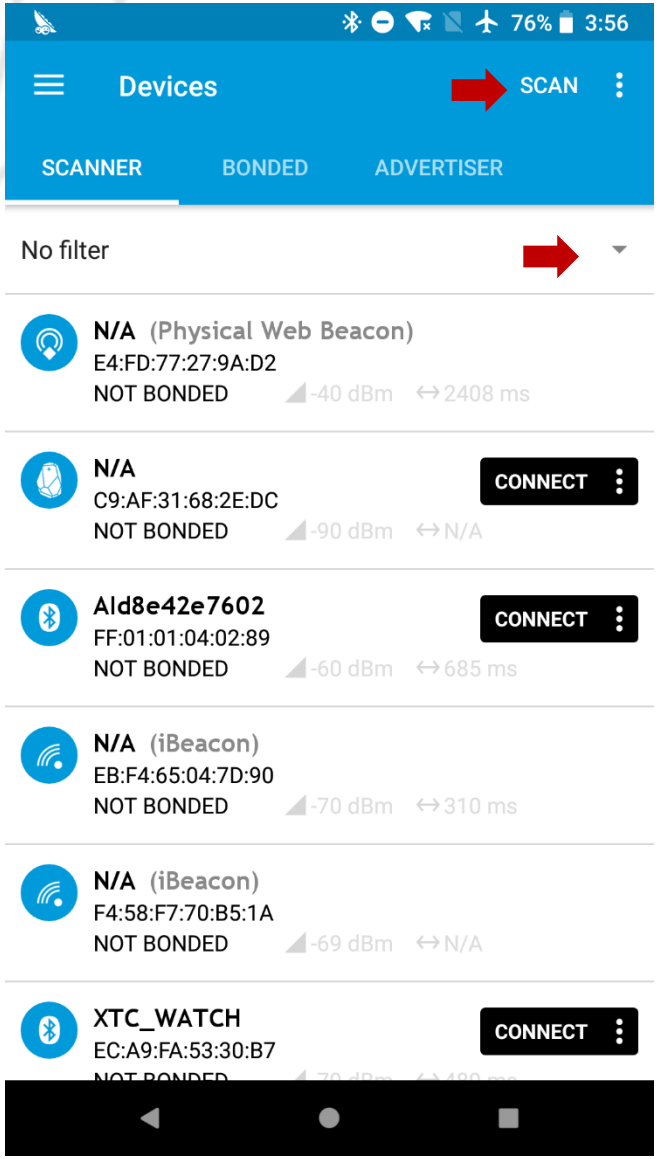
显示在“查找工具设备 (Finder Devices)”部分中

装载位置 /Volumes/MICROBIT

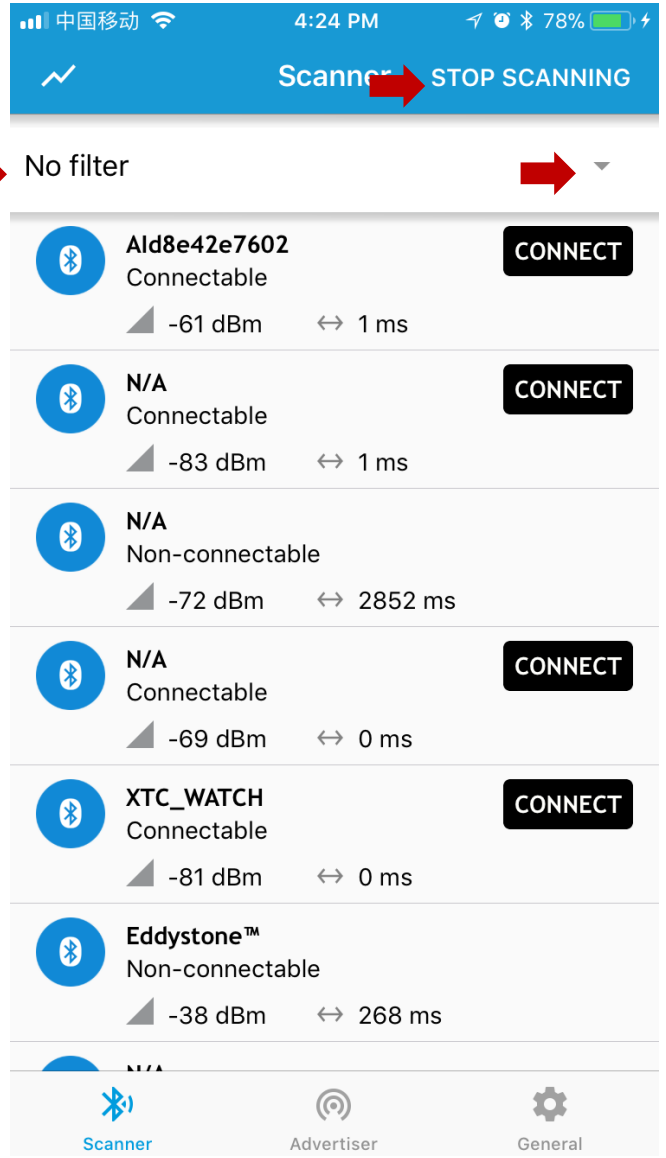
实际动手操作

扫描 – 多个设备

Android

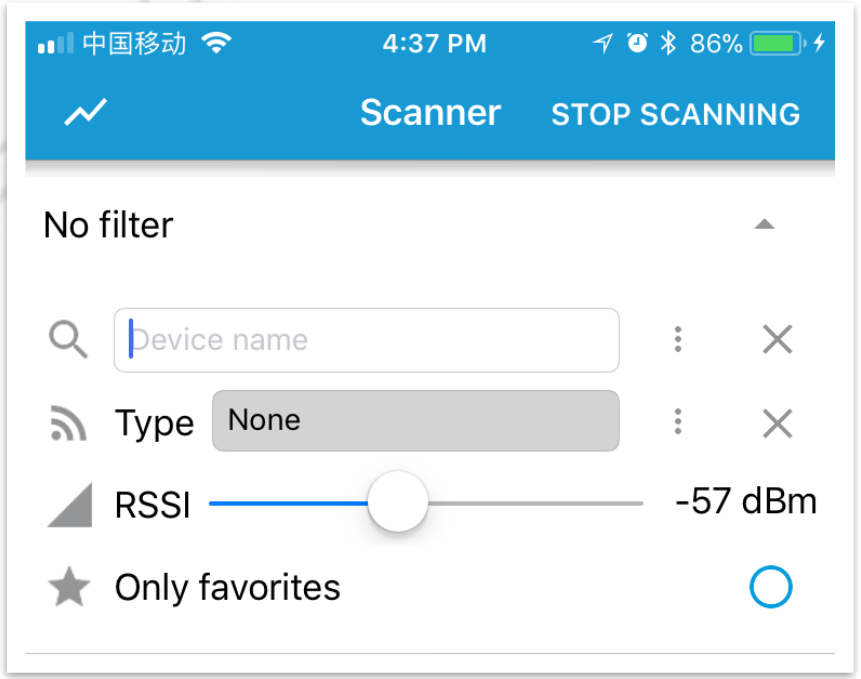


iOS

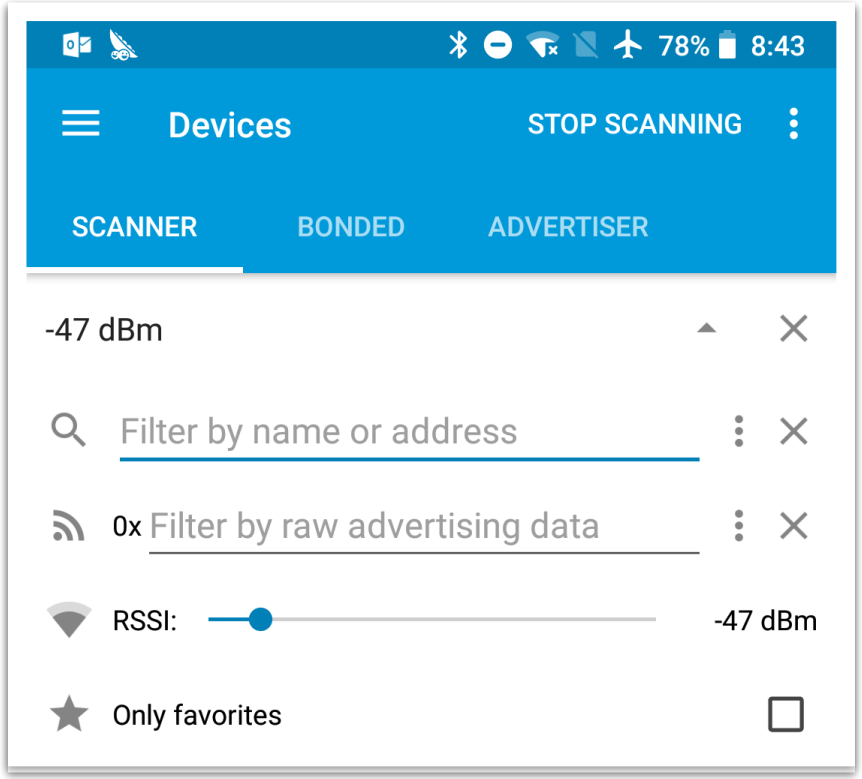


筛选设备

iOS

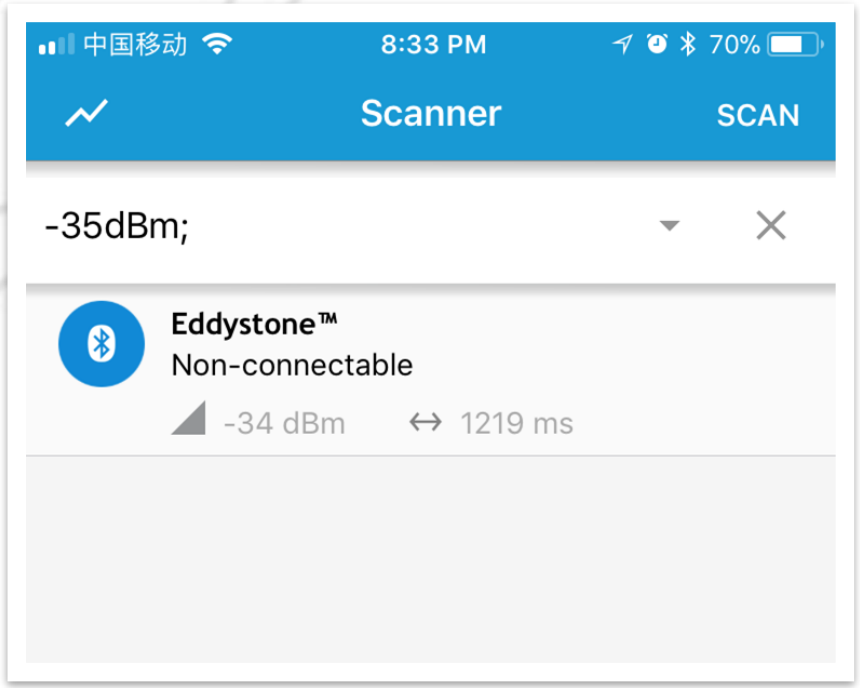


Android

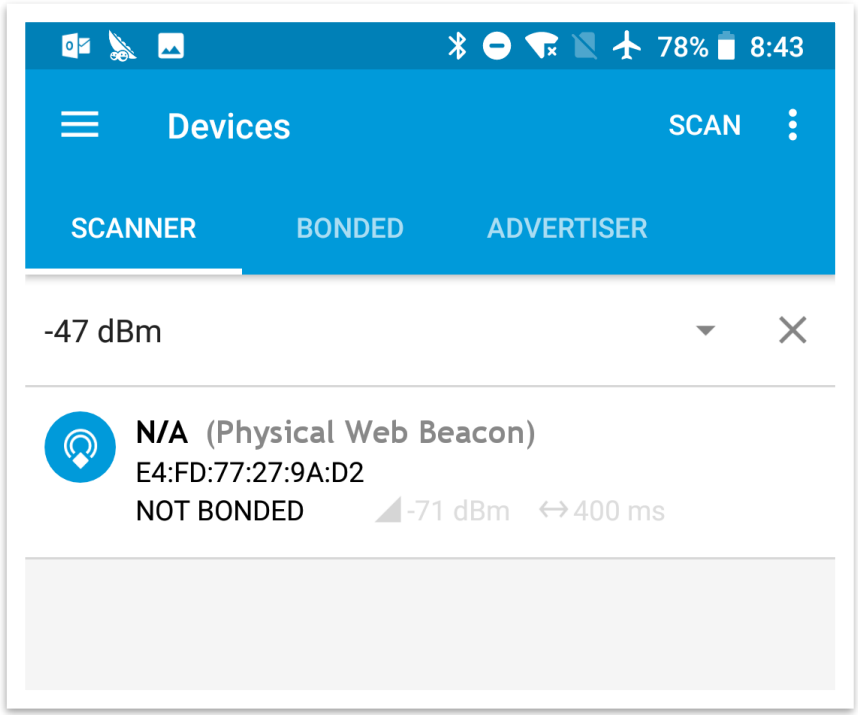


第一个信标 – 自定义 – 显示设备名称

iOS

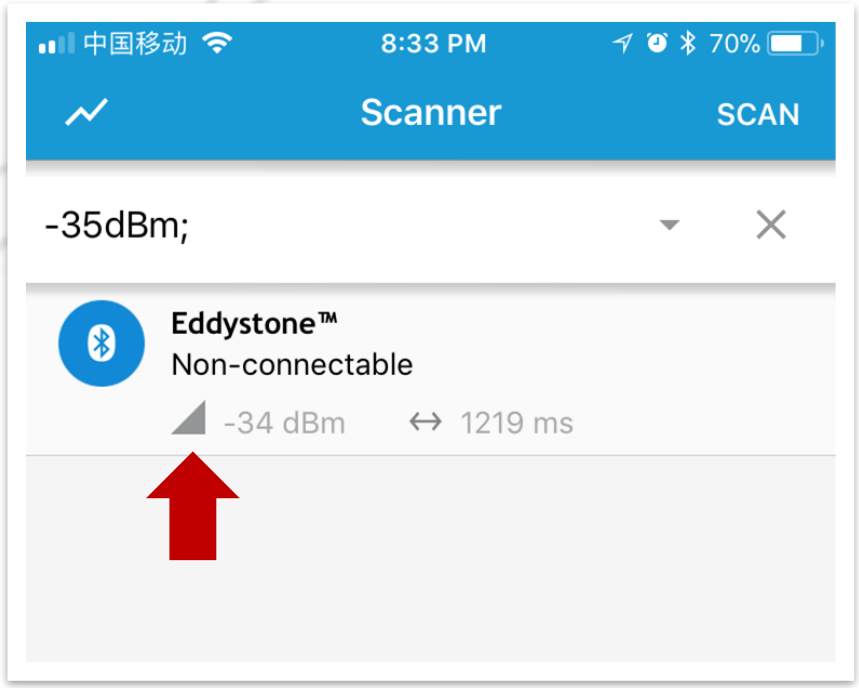


Android

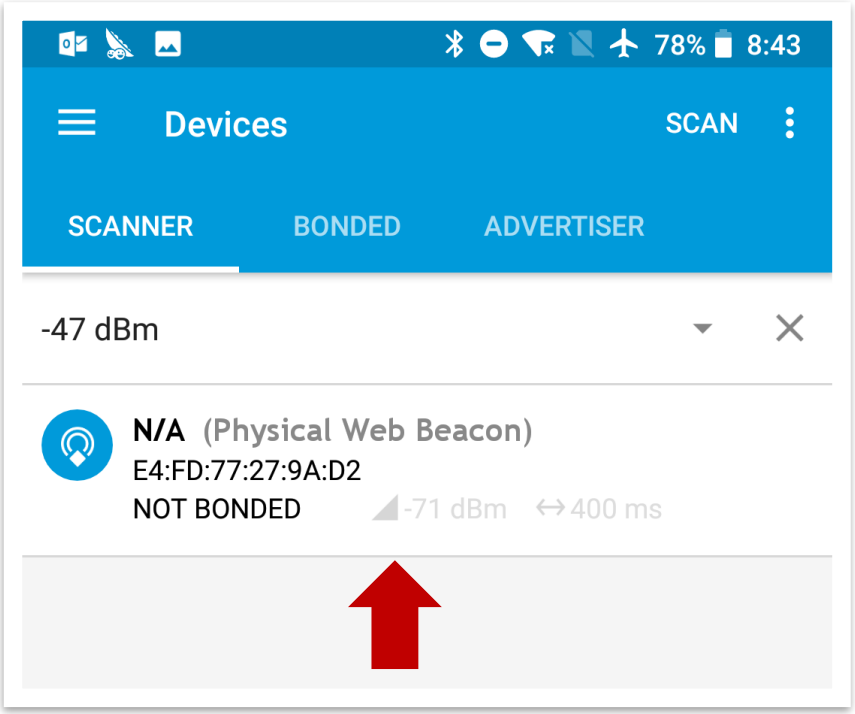


第二个信标 - Eddystone 信标

iOS

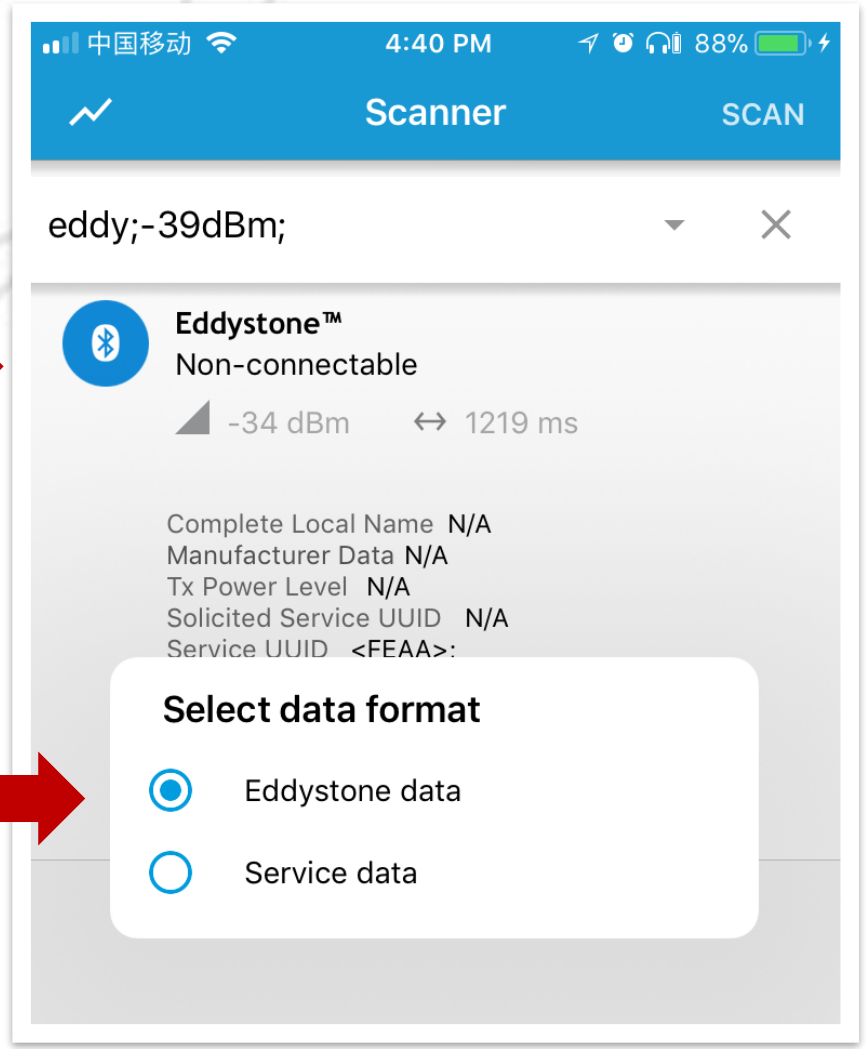


Android

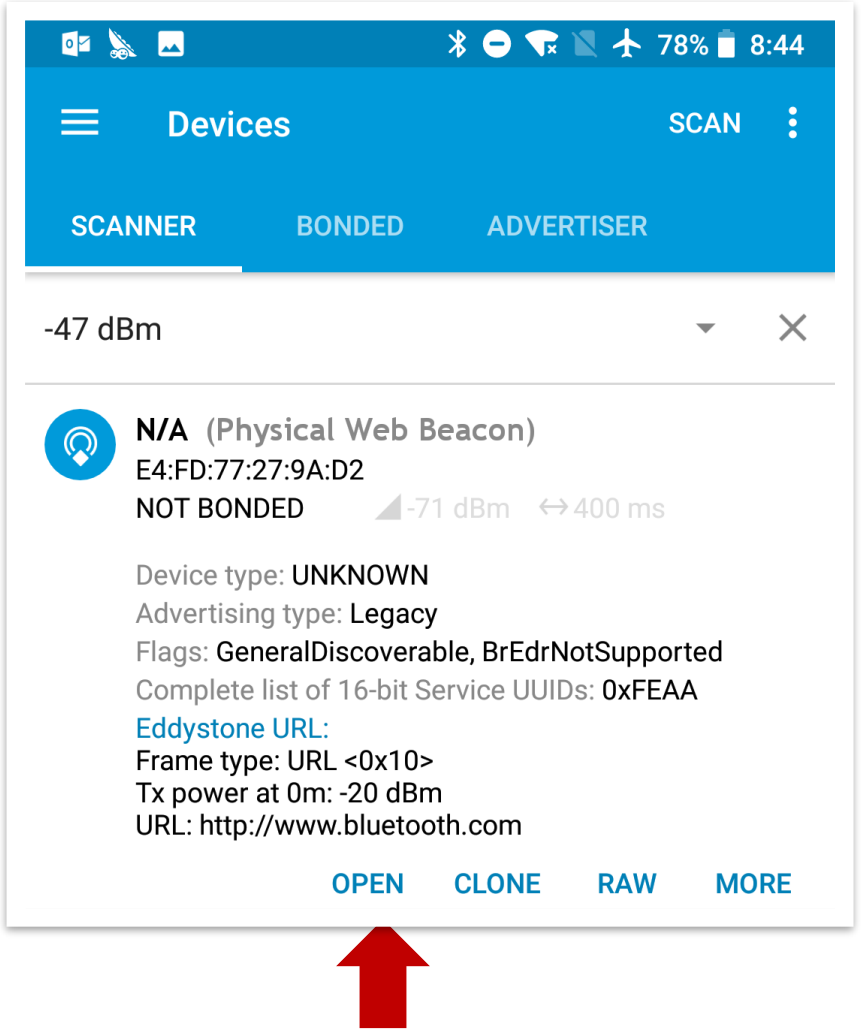


展开图 - Eddystone 数据

iOS



Android



#BluetoothAsia2018#

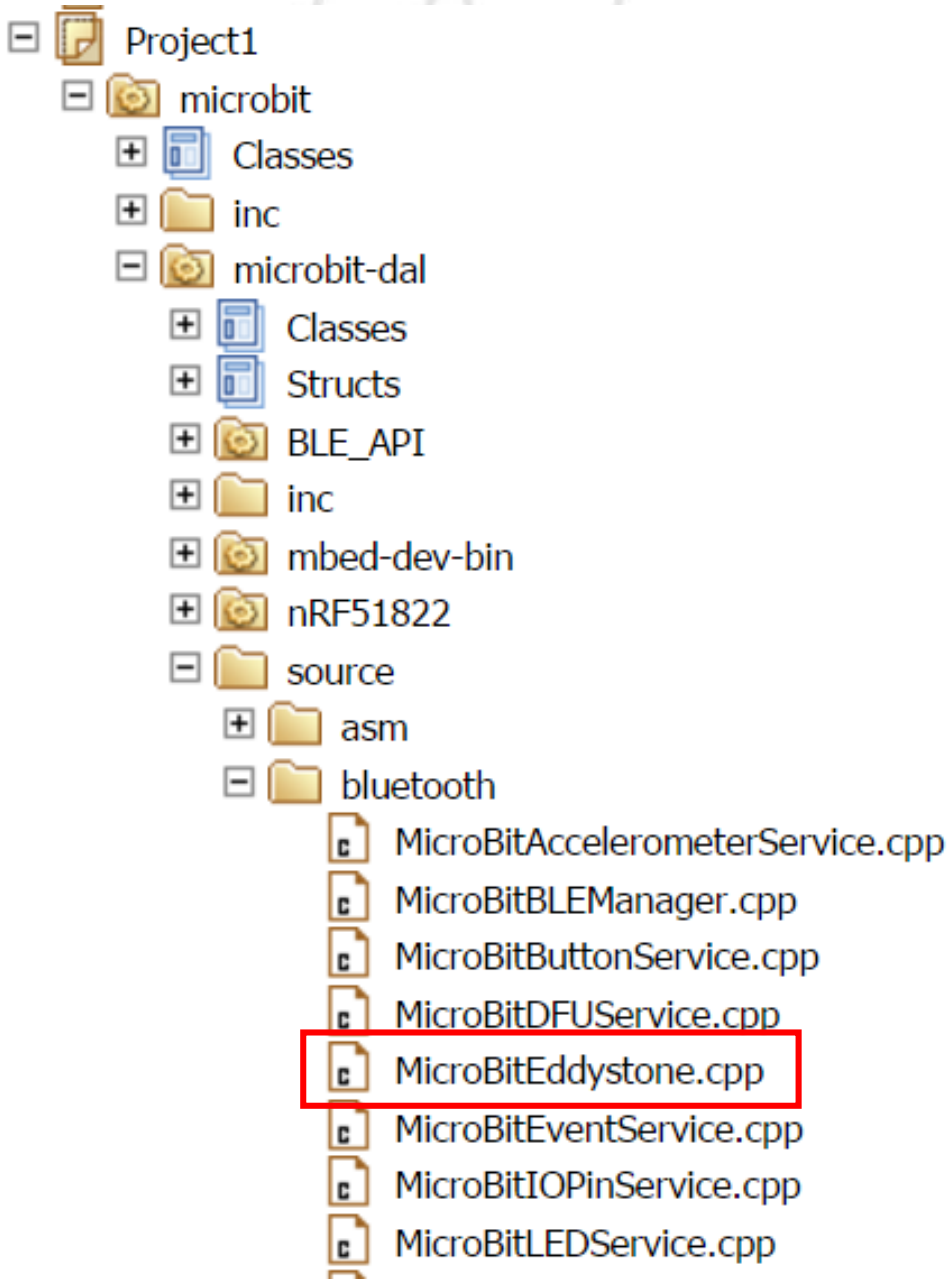
探索、创新、开拓

第一次公告 – 自定义信标

Main.cpp

```
55    uBit.init();
61    uBit.bleManager.advertise();  //First Advertisment, adv name only
```

```
146  void MicroBitBLEManager::init(ManagedString deviceName, ManagedString serialNumber,
147                                 EventModel &messageBus, bool enableBonding)
148  {
149      ManagedString BLEName("BBC micro:bit");
150      this->deviceName = deviceName;
151
152      ManagedString namePrefix(" [");
153      ManagedString namePostfix("]");
154      BLEName = BLEName + namePrefix + deviceName + namePostfix;
155
156  // Setup advertising.
157      ble->accumulateAdvertisingPayload(GapAdvertisingData::COMPLETE_LOCAL_NAME,
158                                        (uint8_t *)BLEName.toCharArray(), BLEName.length());
159      ble->setAdvertisingType(GapAdvertisingParams::ADV_CONNECTABLE_UNDIRECTED);
160  }
```


Project1
microbit
Classes
inc
microbit-dal
Classes
Structs
BLE_API
inc
mbed-dev-bin
nRF51822
source
asm
bluetooth
MicroBitAccelerometerService.cpp
MicroBitBLEManager.cpp
MicroBitButtonService.cpp
MicroBitDFUService.cpp
MicroBitEddystone.cpp
MicroBitEventService.cpp
MicroBitIOPinService.cpp
MicroBitLEDService.cpp

Eddystone URL 负载 - 定义

标题	负载									
			Eddystone 信标格式							
	AdvA (6)	Ad 标志 0X020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	URL 方案 (1)	编码的 URL （最多 17 个字节 ）

帧类型：
0x00 – Eddystone UID
0x10 – Eddystone URL
0x20 – Eddystone TLM

URL 方案：
0x00 http://www.
0x01 https://www.
0x02 http://
0x03 https://

*编码的 **URL** ：*
最多 17 个字节的 ASCII 编码

扩充代码：
0x00 - .com/
0x01 - .org/
.
.
.
0x0D - .gov/
0x7F-0xFF – 保留供将来使用

```
51 #if CONFIG_ENABLED(MICROBIT_BLE_EDDYSTONE_URL)
52 const char *EDDYSTONE_URL_PREFIXES[] = {"http://www.", "https://www.", "http://", "https://"};
53 const size_t EDDYSTONE_URL_PREFIXES_LENGTH = sizeof(EDDYSTONE_URL_PREFIXES) / sizeof(char *);
54 const char *EDDYSTONE_URL_SUFFIXES[] = {".com/", ".org/", ".edu/", ".net/", ".info/", ".biz/",
55                                         ".gov/", ".com", ".org", ".edu", ".net", ".info", ".biz", ".gov"};
56 const size_t EDDYSTONE_URL_SUFFIXES_LENGTH = sizeof(EDDYSTONE_URL_SUFFIXES) / sizeof(char *);
57 const int EDDYSTONE_URL_MAX_LENGTH = 18;
58 const uint8_t EDDYSTONE_URL_FRAME_TYPE = 0x10;
59 #endif
```

Eddystone URL - 累积负载

标题	负载									
			Eddystone 信标格式							
	AdvA (6)	Ad 标志 0x020106	Eddystone ID 0x0303AAFE	长度 (1)	Ad 类型 0x16	UUID 0xAAFE	帧类型 (1)	Tx 功率 (1)	URL 方案 (1)	编码的 URL （最多 17 个字节）

帧类型：
0x00 – Eddystone UID
0x10 – Eddystone URL
0x20 – Eddystone TLM

Tx 功率：
在 0 米处测量
（以 dBm 为单位）

```
137     uint8_t rawFrame[EDDYSTONE_URL_MAX_LENGTH + 4];
138     size_t index = 0;
139     rawFrame[index++] = EDDYSTONE_UUID[0];
140     rawFrame[index++] = EDDYSTONE_UUID[1];
141     rawFrame[index++] = EDDYSTONE_URL_FRAME_TYPE;
142     rawFrame[index++] = calibratedPower;
143     memcpy(rawFrame + index, urlData, urlDataLength);
144
145     ble->accumulateAdvertisingPayload(GapAdvertisingData::COMPLETE_LIST_16BIT_SERVICE_IDS,
146                                       EDDYSTONE_UUID, sizeof(EDDYSTONE_UUID));
147     ble->accumulateAdvertisingPayload(GapAdvertisingData::SERVICE_DATA, rawFrame,
148                                       index + urlDataLength);
```

最佳实践

Beacon设计 – 总结

- Tx 功率
- 广播间隔
- 部署beacon
- 维护
  - 软件更新
  - 电池
  - 重置
- 安全
  - 设备管理功能

社交媒体

#BluetoothAsia2018#

官方微信

官方微博

BluetoothAsia
探索、创新、开拓

questions?

微信