Hardware Hacking:

A Brief Primer on Reverse Engineering Bluetooth Transmissions

Edward Warren

Overview

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III. OSINT Resources for Bluetooth & IoT devices
IV. A Brief History of Bluetooth
V. Select Tools for Bluetooth IoT Analysis
VI. Select Tools for Bluetooth Sniffing
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IX. Reverse Engineering BLE Transmissions
X. Android Application Secrets
XI. Conclusions

#:whoami

- Jr. Security Analyst @ SEDARA™
- Former Managed Wi-Fi Technical Support Rep III at Spectrum Business
- A dude who likes more than *software* bugs
- From Buffalo, NY

(Actual footage of my Fence)

Getting Started

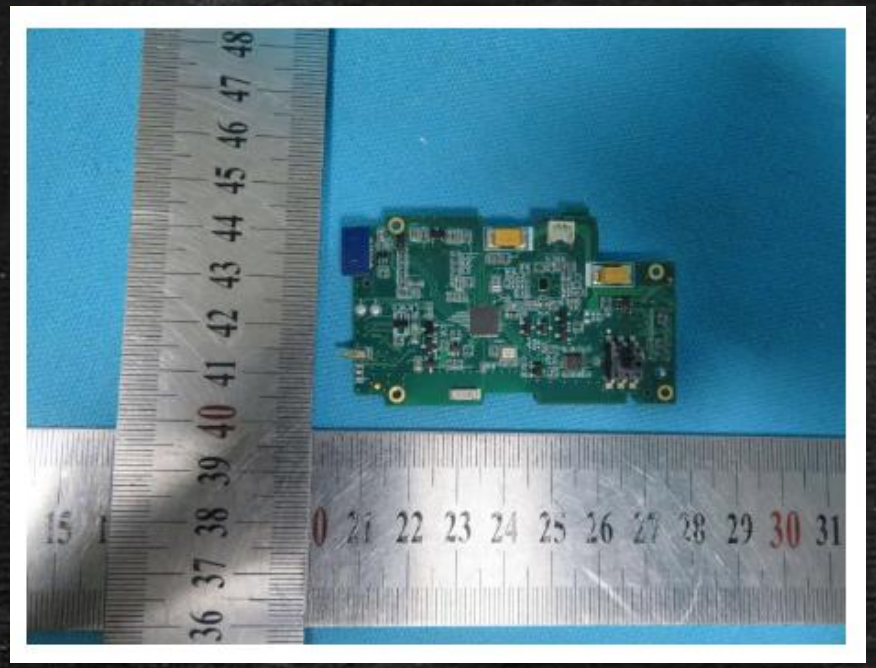
- Recon the attack surface of the device or application
- Utilize Open Source Intelligence (OSINT)
- Have a clear mission or objective

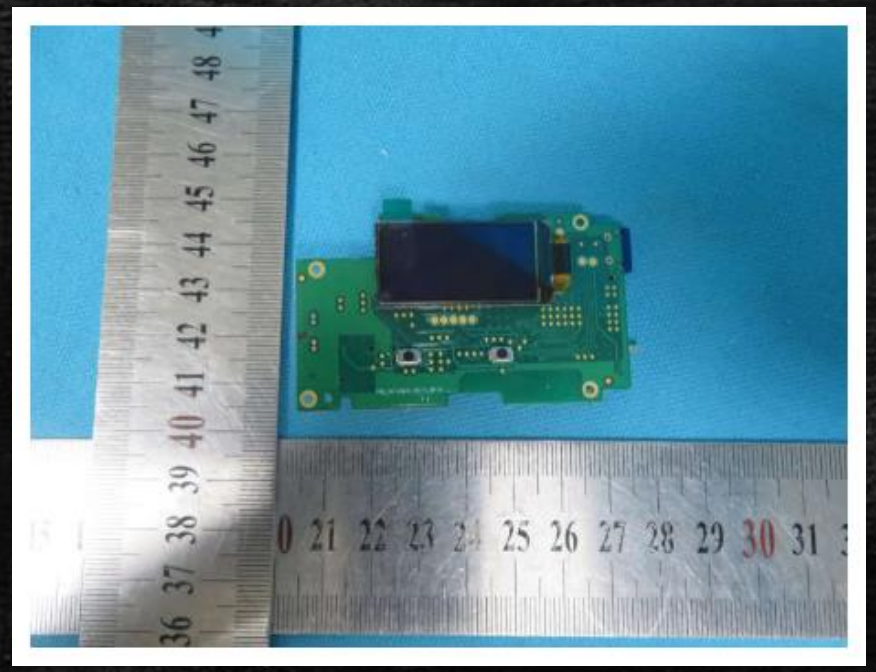
OSINT Resources For Bluetooth & IoT Devices

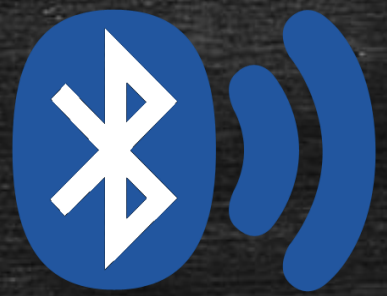
FCC IDs are required for all wireless emitting devices sold in the USA.

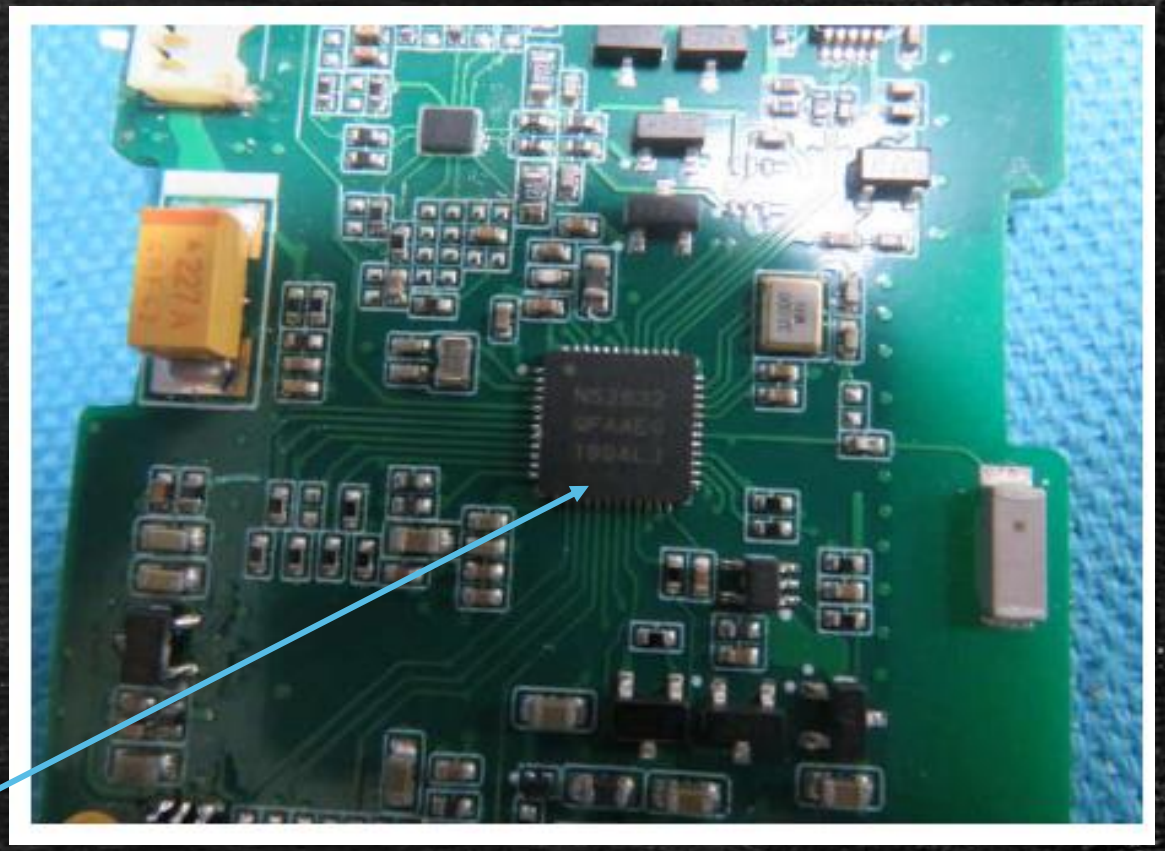
By searching an FCC ID, you can find details on the wireless operating frequency (including strength), photos of the device, user manuals for the device, and reports on the wireless emissions ect.

Federal Communications Commission









fcc.io

NRF52832, Bluetooth SoC supporting Bluetooth Low Energy, Bluetooth mesh & NFC

(https://www.nordicsemi.com/-/media/Software-and-other-downloads/Product-Briefs/nRF52832-product-brief.pdf)

A Brief history of Bluetooth

What is Bluetooth? It's not an acronym and doesn't stand for anything. So what does it mean?

The name dates back to the Viking era, specifically King Harald Gormsson, who earned the nickname Bluetooth due a dead tooth which had an apparently distinct blue color.

He is also known for unifying Denmark and Norway in 958 AD. The Bluetooth logo is a combination of two runes, Hagall (ᚼ) and Bjarkan (ᛒ), which form the initials of Harald Bluetooth.

Bluetooth®

(https://www.bluetooth.com/about-us/bluetooth-origin)

A Brief history of Bluetooth Continued...

Bluetooth Classic is better suited for applications that require high data transfer rates and longer range,

whereas BLE is better suited for applications that require low power consumption and intermittent communication.

Select Tools for Bluetooth IoT Analysis

github.com/skylot/jadx

www.bettercap.org

gitlab.com/AuroraOSS/AuroraStore

www.wireshark.org

Handles	Service > Characteristics	Properties	Data
0001 → 0007	Generic Access (1800)		Generic Speaker
0003	Device Name (2a00)	READ, **WRITE**	
0005	Appearance (2a01)	READ	Unknown
0007	Peripheral Preferred Connection Parameters (2a04)	READ	Connection Interval: 20 → 36 Slave Latency: 0 Connection Supervision Timeout Multiplier: 200
0008 → 000b	Generic Attribute (1801)		
000a	Service Changed (2a05)	INDICATE	
000c → 0011	1910		
000e	fff4	NOTIFY	
0011	fff2	**WRITE**	
0012 → 0015	Battery Service (180f)		
0014	Battery Level (2a19)	READ, NOTIFY	
0016 → 001e	Device Information (180a)		
0018	Manufacturer Name String (2a29)	READ	Generic Tech co.
001a	Model Number String (2a24)	READ	
001c	Hardware Revision String (2a27)	READ	
001e	Firmware Revision String (2a26)	READ	
001f → 0022	7363191269656e657269736669727374		
0021	73632b1269656e657269736669727374	READ, **WRITE**, NOTIFY	000000

In Bluetooth GATT or (Generic Attribute Profiles) is a protocol that defines how data is exchanged between Bluetooth devices. GATT is a client-server protocol, where a GATT server stores attribute data and provides access methods to a remote client.

`ble.show.limit`	`0`	If greater than zero, defines limit for `ble.show`.

Examples

Connect, enumerate and read characteristics from the BLE device `04:52:de:ad:be:ef` (requires `ble.recon on` first):

```
> ble.enum 04:52:de:ad:be:ef
```

Write the bytes `ff ff ff ff ff ff ff ff` to the BLE device `04:52:de:ad:be:ef` on its characteristics with UUID `234bfbd5e3b34536a3fe723620d4b78d` (requires `ble.recon on` first):

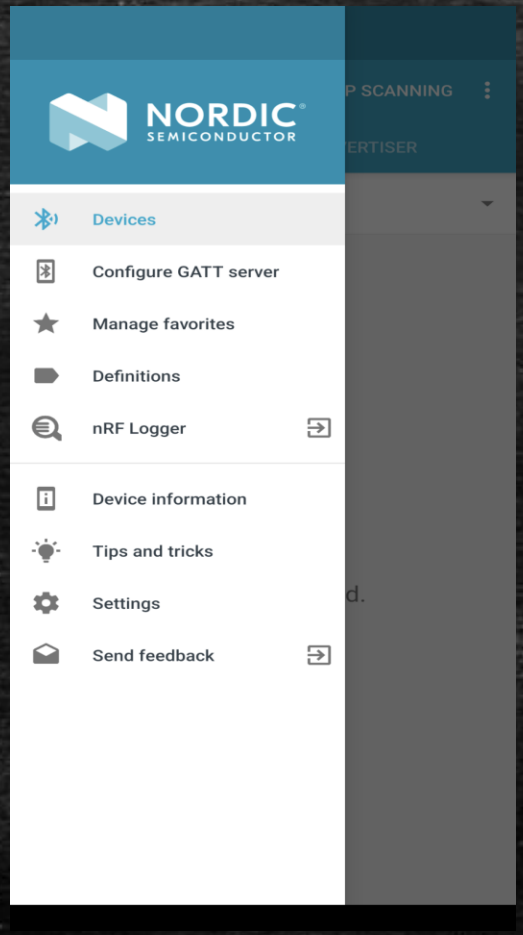
```
> ble.write 04:52:de:ad:be:ef 234bfbd5e3b34536a3fe723620d4b78d ffffffffffffffff
```

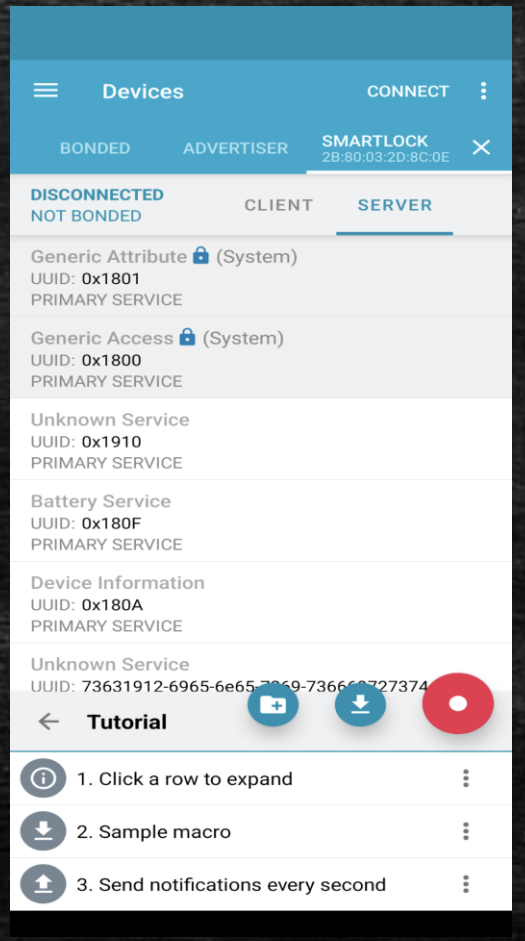
Hacking a Loccess smartlock using bettercap:

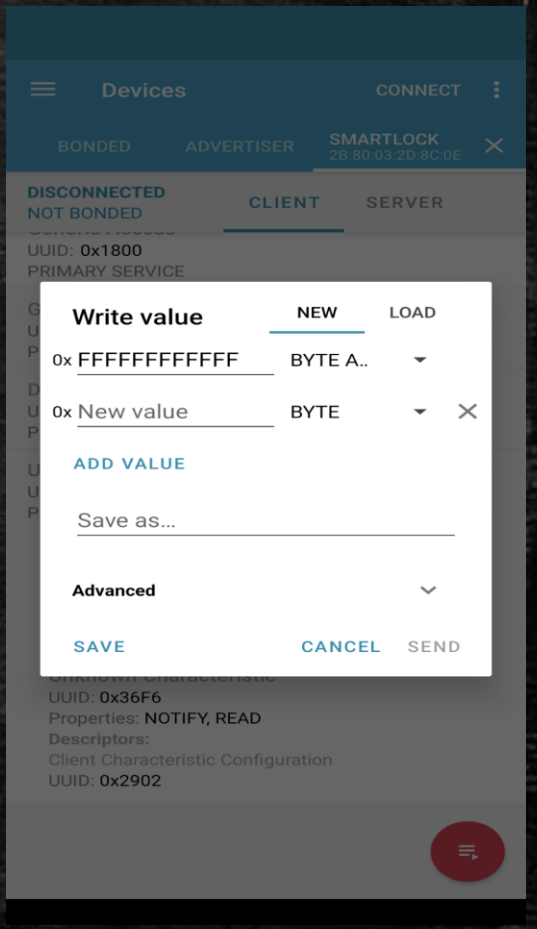
Honorable Mention

nRF Connect

A NORDIC SEMICONDUCTOR PRODUCT







Select Tools for Bluetooth Sniffing

nrf52840 sniffer

~25$

Ubertooth One

~125$

Ellisys Bluetooth Explorer

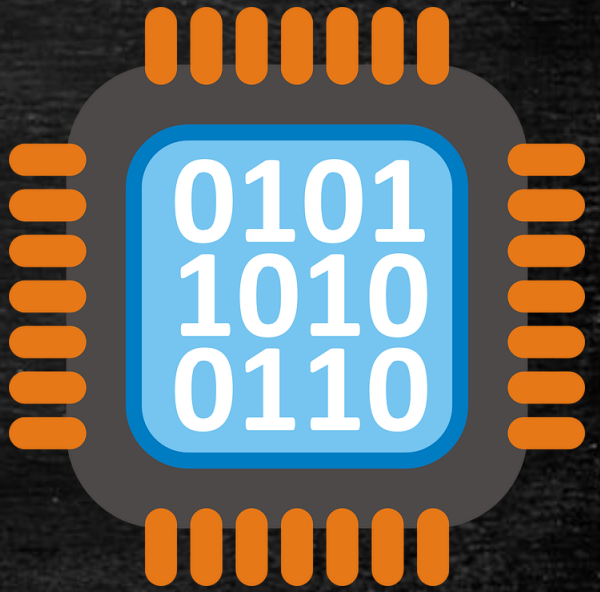
~25,000$

HOST

INTERFACE

CONTROLLER

HCI



Find . -name "Random Bluetooth Blood Pressure Monitor"

btatt

No.	Time	Source	Destinati	Proto	Lengt	Value	Info
3275	565…	Goog…	cf:4f…	ATT	24	a5f30c00530400000000000092	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3277	565…	cf:4…	Googl…	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3278	565…	cf:4…	Googl…	ATT	16	2a004800	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3279	565…	cf:4…	Googl…	ATT	32	5b0000000000000000000000000000000000000000	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3280	565…	cf:4…	Googl…	ATT	14	0045	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3281	565…	Goog…	cf:4f…	ATT	20	a5f40b005400002a	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3283	565…	cf:4…	Googl…	ATT	20	a5f40b015400003c	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3284	565…	Goog…	cf:4f…	ATT	32	a5f20d00551400323032333031313231393231 33	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3285	565…	Goog…	cf:4f…	ATT	20	340000000000004f	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3287	565…	cf:4…	Googl…	ATT	24	a5f20d0155040026000000e6	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3288	565…	Goog…	cf:4f…	ATT	24	a5f30c00560400000000000038	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3290	566…	cf:4…	Googl…	ATT	32	a5f30c015626000101be5dc06300000000007400	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3291	566…	cf:4…	Googl…	ATT	32	43005900530000000000000000000000000000000	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)
3292	566…	cf:4…	Googl…	ATT	18	0000000000f5	Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)

```
Frame 3275: 24 bytes on wire (192 bits), 24 bytes captured (192 bits)
    Encapsulation type: Bluetooth H4 with linux header (99)
    Arrival Time: Jan 12, 2023 19:22:24.745082000 Eastern Standard Time
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1673569344.745082000 seconds
    [Time delta from previous captured frame: 0.007288000 seconds]
    [Time delta from previous displayed frame: 0.007288000 seconds]
    [Time since reference or first frame: 565.760201000 seconds]
    Frame Number: 3275
    Frame Length: 24 bytes (192 bits)
    Capture Length: 24 bytes (192 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    Point-to-Point Direction: Sent (0)
    [Protocols in frame: bluetooth:hci_h4:bthci_acl:btl2cap:btatt]
> Bluetooth
> Bluetooth HCI H4
> Bluetooth HCI ACL Packet
> Bluetooth L2CAP Protocol
v Blue
  v Op
  v Ha
    Value: a5f30c00530400000000000092
```

Sent Write Command, Handle: 0x0017 (Unknown: Unknown)

Rcvd Handle Value Notification, Handle: 0x0019 (Unknown: Unknown)

```
0000  02 02 00 13 00 0f 00 04  00 52 17 00 a5 f3 0c 00   ........ .R......
0010  53 04 00 00 00 00 00 92                            S.......
```

btsnoop_hci.log

Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

	Time	Source	Destination	Protocol	Length	Value	Info
3273	565.723507	controller	host	HCI_EVT	8		Rcvd Number of Completed Packets
3274	565.752913	cf:4f:fd:27:dd:5…	Google_67:84:84 (Pixel 4a)	ATT	24	a5f20d0152040026000000f5	Rcvd Handle Value Notification, Handle: 0x0019 (Unknow
3275	565.760201	Google_67:84:84 …	cf:4f:fd:27:dd:5b (BP2T 0802)	ATT	24	a5f30c005304000000000092	Sent Write Command, Handle: 0x0017 (Unknown: Unknown)
3276	565.783067	controller	host	HCI_EVT	8		Rcvd Number of Completed Packets
3277	565.813239	cf:4f:fd:27:dd:5…	Google_67:84:84 (Pixel 4a)	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd Handle Value Notification, Handle: 0x0019 (Unknow
3278	565.813766	cf:4f:fd:27:dd:5…	Google_67:84:84 (Pixel 4a)	ATT	16	2a004800	Rcvd Handle Value Notification, Handle: 0x0019 (Unknow
3279	565.843051	cf:4f:fd:27:dd:5…	Google_67:84:84 (Pixel 4a)	ATT	32	5b0000000000000000000000000000000000000000	Rcvd Handle Value Notification, Handle: 0x0019 (Unknow
3280	565.843571	cf:4f:fd:27:dd:5…	Google_67:84:84 (Pixel 4a)	ATT	14	0045	Rcvd Handle Value Notification, Handle: 0x0019 (Unknow

```
Frame 3278: 16 bytes on wire (128 bits), 16 bytes captured (128 bits)
Bluetooth
    [Source: cf:4f:fd:27:dd:5b (cf:4f:fd:27:dd:5b)]
    [Destination: Google_67:84:84 (58:24:29:67:84:84)]
Bluetooth HCI H4
Bluetooth HCI ACL Packet
Bluetooth L2CAP Protocol
Bluetooth Attribute Protocol
> Opcode: Handle Value Notification (0x1b)
v Handle: 0x0019 (Unknown: Unknown)
      [Service UUID: 14839ac47d7e415c9a42167340cf2339]
      [UUID: 0734594aa8e74b1aa6b1cd5243059a57]
  Value: 2a004800
```

```
0000  02 02 20 0b 00 07 00 04  00 1b 19 00 2a 00 48 00   ·· ·
```

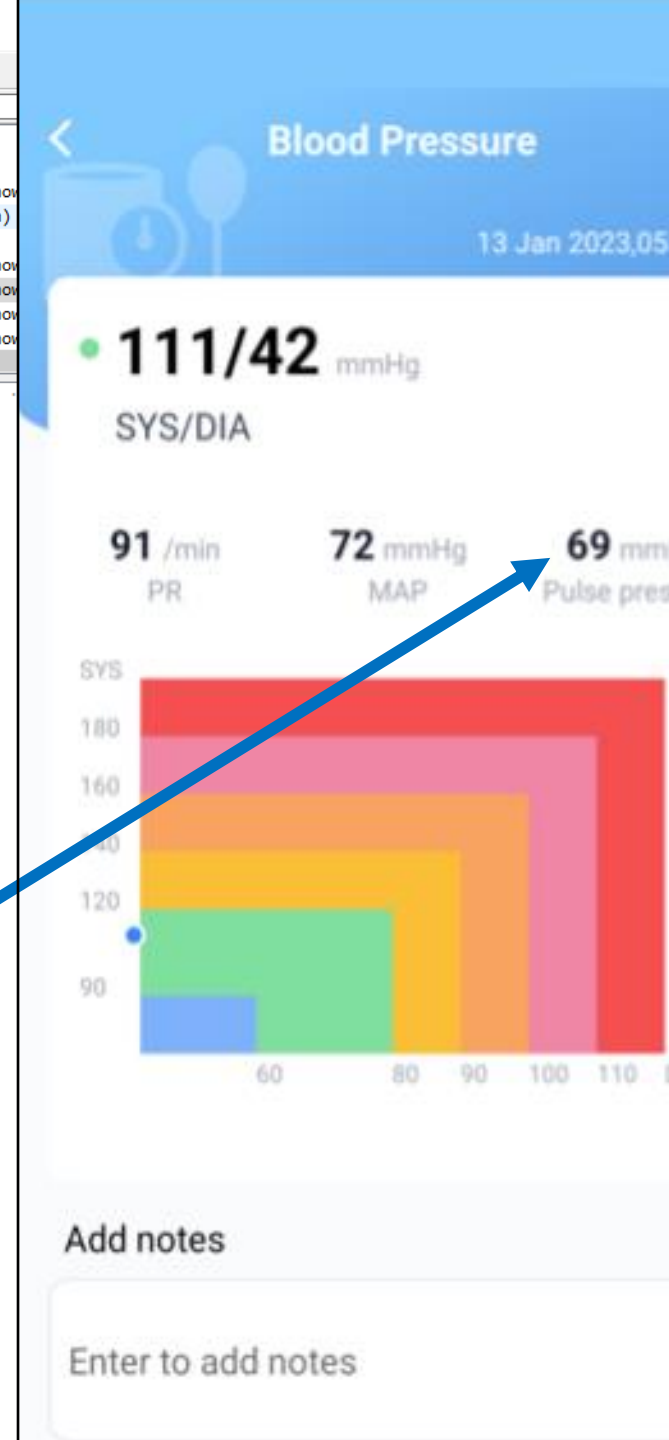
a5f30c01532600010167ebc06300000000006f00

2a004800

5b0000000000000000000000000000000000000000

0045

6F 2A 48 5B 45 ⇒ 111 42 72 91 69

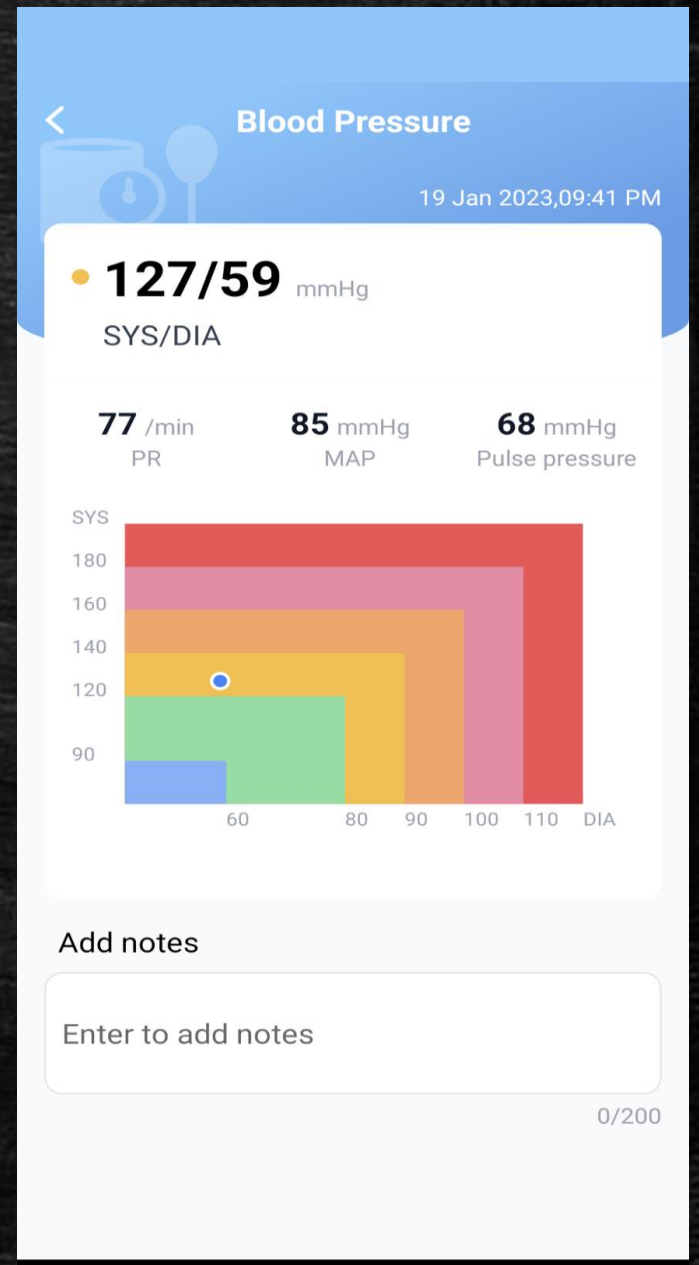


Trial && ERROR

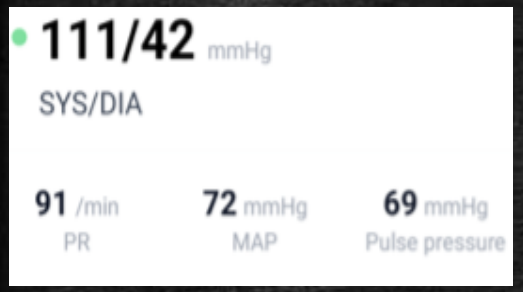
7F/127 3B/59 55/85 4D/77

Googl…	cf:4f…	ATT	20	a508f700210000c6		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a0020000040		Rcvd
cf:4f…	Googl…	ATT	32	a508f70120200005002aa10e6300000001003a00		Rcvd
Googl…	cf:4f…	ATT	20	a508f700200000ad		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a00200000d6		Rcvd
cf:4f…	Googl…	ATT	32	a508f7011f200005002aa10e6300000001003a00		Rcvd
Googl…	cf:4f…	ATT	20	a508f7001f00000b		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a002000007d		Rcvd
cf:4f…	Googl…	ATT	32	a508f7011e200005002aa10e6300000001003a00		Rcvd
Googl…	cf:4f…	ATT	20	a508f7001e000060		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a0020000087		Rcvd
cf:4f…	Googl…	ATT	32	a508f7011d200005002aa10e6300000001003a00		Rcvd
Googl…	cf:4f…	ATT	20	a508f7001d0000dd		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a002000002c		Rcvd
cf:4f…	Googl…	ATT	32	a508f7011c200005002aa10e6300000001003a00		Rcvd
Googl…	cf:4f…	ATT	20	a508f7001c0000b6		Sent
cf:4f…	Googl…	ATT	32	7f003b0055004d0000783a0020783a0020000074		Rcvd
cf:4f…	Googl…	ATT	32	a508f7011b200005002aa10e6300000001003a00		Rcvd

Pulse Pressure



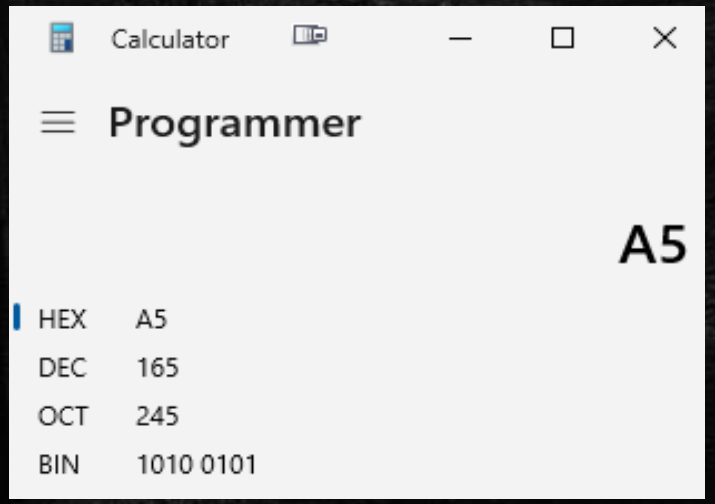
```
public final class BleService extends Service {
    public static final Companion Companion = new Companion(null);
    private boolean connected;
    private Observable<RxBleConnection> connectionObservable;
    private RxBleDevice device;
    private int deviceType;
    private boolean isConnecting;
    private boolean isScanning;
    private Disposable loopDis;
    private byte[] pool;
    private RxBleClient rxbleClient;
    private Disposable scanDisposable;
    private Disposable state;
    private final UUID write_uuid = UUID.fromString("8B00AC[redacted]6E1A3");
    private final UUID notify_uuid = UUID.fromString("073459[redacted]59A57");
    private CompositeDisposable connectionDisposable = new CompositeDisposable();
    private final Lazy checkReconnectBleCount$delegate = LazyKt.lazy(BleService$checkReconnectBleCount$2.INSTANCE);
    private String currentMarAddress = "";
    private final BleBinder binder = new BleBinder();
    private final Lazy receiveListener$delegate = LazyKt.lazy(new BleService$receiveListener$2(this));
```



6F	2A	48	5B	45
111	42	72	91	69

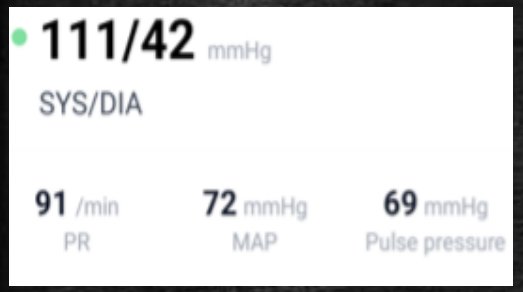
Source	Destination	Proto	Lengt	Value	Info
Google_67…	cf:4f:fd…	ATT	24	a5f30c00530400000000000092	Sent
controller	host	HCI…	8		Rcvd
cf:4f:fd:…	Google_6…	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd
cf:4f:fd:…	Google_6…	ATT	16	2a004800	Rcvd
cf:4f:fd:…	Google_6…	ATT	32	5b0000000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

```
01011011 = 91
10100101 =-91
```



Hex	A5	F3	0C	00	53	04
Dec	165	243	12	0	83	4
Byte Array Position	0	1	2	3	4	5

```
private static byte[] getReq(int i, byte[] bArr) {
    int length = bArr.length;
    int i2 = length + 8;
    byte[] bArr2 = new byte[i2];
    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```



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111	42	72	91	69

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controller	host	HCI…	8		Rcvd
cf:4f:fd:…	Google_6…	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd
cf:4f:fd:…	Google_6…	ATT	16	2a004800	Rcvd
cf:4f:fd:…	Google_6…	ATT	32	5b000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

Hex	A5	F3	0C	00	53	04
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    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
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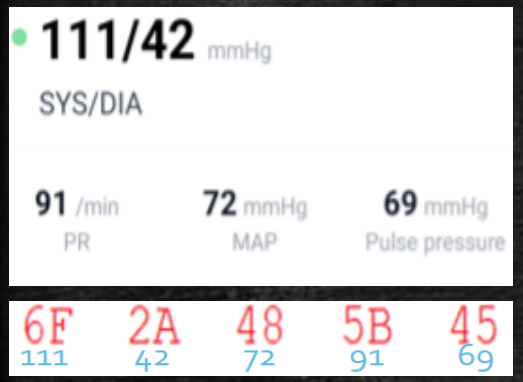
}
```



Source	Destination	Proto	Lengt	Value	Info
Google_67…	cf:4f:fd…	ATT	24	a5f30c00530400000000000092	Sent
controller	host	HCI…	8		Rcvd
cf:4f:fd:…	Google_6…	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd
cf:4f:fd:…	Google_6…	ATT	16	2a004800	Rcvd
cf:4f:fd:…	Google_6…	ATT	32	5b0000000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

```java
public class Bp2BleCmd {
    public static final int FACTORY_RESET = 227;
    public static final int FACTORY_RESET_ALL = 238;
    public static final int FILE_READ_END = 244;
    public static final int FILE_READ_PKG = 243;
    public static final int FILE_READ_START = 242;
    public static final int GET_CONFIG = 0;
    public static final int GET_FILE_LIST = 241;
    public static final int GET_INFO = 225;
    public static final int GET_PHY_STATE = 14;
    private static final int HEAD = 165;
    public static final int MSG_TYPE_INVALID = -1;
    public static final int RESET = 226;
    public static final int RT_DATA = 8;
    public static final int RT_STATE = 6;
    public static final int SET_CONFIG = 11;
    public static final int SET_PHY_STATE = 15;
    public static final int SET_TIME = 236;
    public static final int SWITCH_STATE = 9;
    private static final int TYPE_NORMAL_SEND = 0;
    private static int seqNo;
```

Hex	A5	F3	0C	00	53	04
Dec	165	243	12	0	83	4
Byte Array Position	0	1	2	3	4	5

```java
private static byte[] getReq(int i, byte[] bArr) {
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    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```
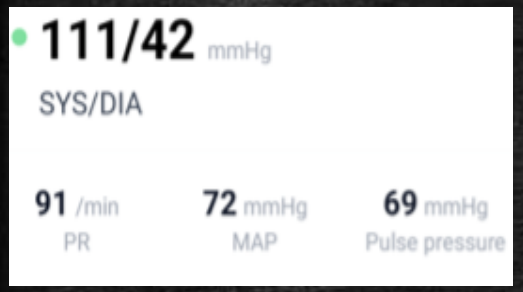



Source	Destination	Proto	Lengt	Value	Info
Google_67…	cf:4f:fd…	ATT	24	a5f30c00530400000000000092	Sent
controller	host	HCI…	8		Rcvd
cf:4f:fd:…	Google_6…	ATT	32	a5f30c01532600010167ebc06300000000006f00	Rcvd
cf:4f:fd:…	Google_6…	ATT	16	2a004800	Rcvd
cf:4f:fd:…	Google_6…	ATT	32	5b0000000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

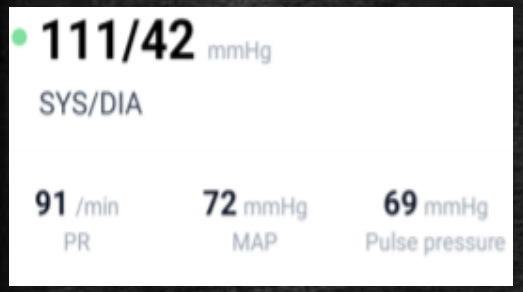
```java
public class Bp2BleCmd {
    public static final int FACTORY_RESET = 227;
    public static final int FACTORY_RESET_ALL = 238;
    public static final int FILE_READ_END = 244;
    public static final int FILE_READ_PKG = 243;
    public static final int FILE_READ_START = 242;
    public static final int GET_CONFIG = 0;
    public static final int GET_FILE_LIST = 241;
    public static final int GET_INFO = 225;
    public static final int GET_PHY_STATE = 14;
    private static final int HEAD = 165;
    public static final int MSG_TYPE_INVALID = -1;
    public static final int RESET = 226;
    public static final int RT_DATA = 8;
    public static final int RT_STATE = 6;
    public static final int SET_CONFIG = 11;
    public static final int SET_PHY_STATE = 15;
    public static final int SET_TIME = 236;
    public static final int SWITCH_STATE = 9;
    private static final int TYPE_NORMAL_SEND = 0;
    private static int seqNo;
```

```java
public Er2RequestPkg build()
    int length = this.data.l
    byte[] bArr = new byte[l
    this.buf = bArr;
    int i = 0;
    bArr[0] = -91;
    bArr[1] = this.cmd;
    bArr[2] = this._cmd;
    bArr[3] = 0;
    bArr[4] = this.pkgNo;
```

```java
public Er2BleResponse(byte[] bArr) {
    this.buf = bArr;
    this.head = bArr[0];
    this.cmd = bArr[1];
    this._cmd = bArr[2];
    this.pkgType = bArr[3];
    this.pkgNo = bArr[4];
```

Hex	A5	F3	0C	00	53	04
Dec	165	243	12	0	83	4
Byte Array Position	0	1	2	3	4	5

```java
private static byte[] getReq(int i, byte[] bArr) {
    int length = bArr.length;
    int i2 = length + 8;
    byte[] bArr2 = new byte[i2];
    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```



6F	2A	48	5B	45
111	42	72	91	69

Source	Destination	Proto	Lengt	Value	Info
Google_67…	cf:4f:fd…	ATT	24	a5f30c00530400000000000092	Sent
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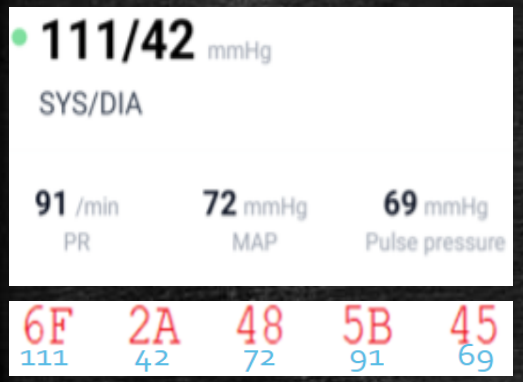
cf:4f:fd:…	Google_6…	ATT	32	5b000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

```
11110011 = 243
00001100 = 12
```

Hex	A5	F3	0C	00	53	04
Dec	165	243	12	0	83	4
Byte Array Position	0	1	2	3	4	5

```java
public static byte[] fileReadPkg(int i) {
    return getReq(243, new byte[]{(byte) i, (byte) (i >> 8), (byte) (i >> 16), (byte) (i >> 24)});
}
```

```java
private static byte[] getReq(int i, byte[] bArr) {
    int length = bArr.length;
    int i2 = length + 8;
    byte[] bArr2 = new byte[i2];
    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```



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    public static final int MSG_TYPE_INVALID = -1;
    public static final int RESET = 226;
    public static final int RT_DATA = 8;
    public static final int RT_STATE = 6;
    public static final int SET_CONFIG = 11;
    public static final int SET_PHY_STATE = 15;
    public static final int SET_TIME = 236;
    public static final int SWITCH_STATE = 9;
    private static final int TYPE_NORMAL_SEND = 0;
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```java
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    bArr[2] = this._cmd;
    bArr[3] = 0;
    bArr[4] = this.pkgNo;
```

```java
public Er2BleResponse(byte[] bArr) {
    this.buf = bArr;
    this.head = bArr[0];
    this.cmd = bArr[1];
    this._cmd = bArr[2];
    this.pkgType = bArr[3];
    this.pkgNo = bArr[4];
```

Hex	A5	F3	0C	00	53	04
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Byte Array Position	0	1	2	3	4	5

```java
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    int i2 = length + 8;
    byte[] bArr2 = new byte[i2];
    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```

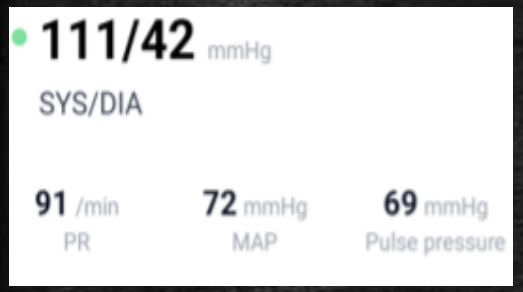

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cf:4f:fd:…	Google_6…	ATT	16	2a004800	Rcvd
cf:4f:fd:…	Google_6…	ATT	32	5b000000000000000000000000000000000000	Rcvd
cf:4f:fd:…	Google_6…	ATT	14	0045	Rcvd

crccalc.com

a5f30c005304000000000

Input: ○ ASCII ◉ HEX

Algorithm	Result
CRC-8	0x92

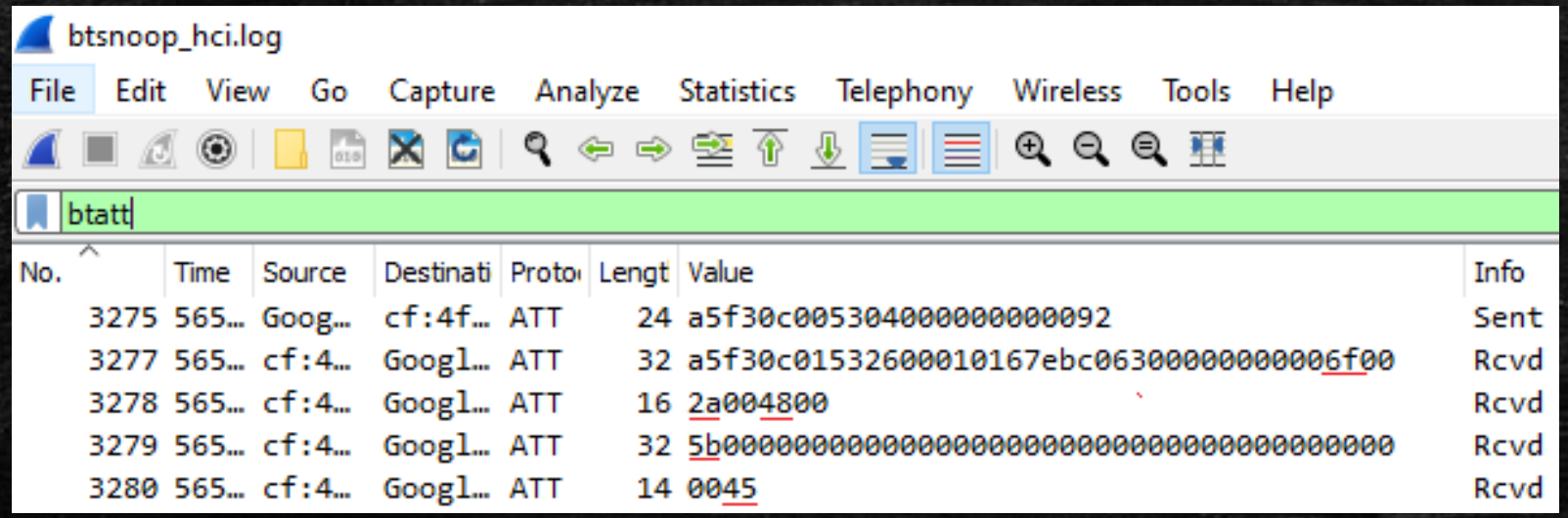
Hex	A5	F3	0C	00	53	04
Dec	165	243	12	0	83	4
Byte Array Position	0	1	2	3	4	5

```
private static byte[] getReq(int i, byte[] bArr) {
    int length = bArr.length;
    int i2 = length + 8;
    byte[] bArr2 = new byte[i2];
    bArr2[0] = -91;
    bArr2[1] = (byte) i;
    bArr2[2] = (byte) (~i);
    bArr2[3] = 0;
    bArr2[4] = (byte) seqNo;
    bArr2[5] = (byte) length;
    bArr2[6] = (byte) (length << 8);
    System.arraycopy(bArr, 0, bArr2, 7, length);
    bArr2[i2 - 1] = BleCRC.calCRC8(bArr2);
    addNo();
    return bArr2;
}
```

Wireshark Search Filter Basic Cheat sheet

Btatt
bthci_cmd.le_long_term_key [BLE]
bthci_cmd.link_key Bluetooth Classic

If neither of the latter two strings are present then the devices aren't using Bluetooth Encryption.



See https://github.com/actuator/bsides/blob/main/BLEMITMPOC.gif

Android App Secrets

```
<string name="google_api_key">[redacted]</string>
<string name="google_app_id">[redacted]:android:[redacted]</string>
```

```
public final class BuildConfig {
    public static final String API_APPID = "[redacted]";
    public static final String API_SECRET = "[redacted]";
    public static final String BUILD_TYPE = "release";
    public static final boolean DEBUG = false;
    public static final String LIBRARY_PACKAGE_NAME = "com.[redacted]";
}
```

Conclusions

- **CWE-311: Missing Encryption of Sensitive Data**
- **CWE-798: Use of Hard-coded Credentials**

- https://cwe.mitre.org/data/definitions/311.html
- /in/edwardwar/
- github.com/actuator/bsides