

Documentation projet étude du BLE

Stage Master 1

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1 Dashboard

The interface is quite simple, it consists of controls to start/stop scans at the top left, a map of located devices, logs from Mirage execution in back-end and last but no least the list of found devices as well as connections. Each row contain informations who can later be used to launch attacks from the CLI using Mirage.

The map scales to the farthest device found, other distances are scaled relatively to it. In the picture below we can see the map is using the blue circle having a radius of 5.62 meters as it's scale. The nearest device, yellow one, only at 79 cm is much smaller and close to our point, which is the centered black spot.

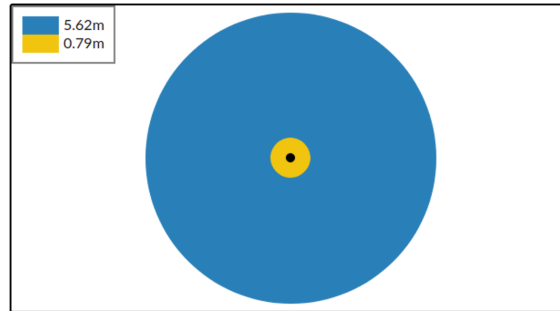


Figure 1: Map of located devices

2 Locate

This module uses the BCC `micro:bit`, make sure it's plugged in your PC.

Module `ble_locate` at `src/modules/ble_locate.py`, locate nearby BLE devices and sniff connections.

The localisation is based on the presence of `TxPower` in the advertisement, even if it's possible de sometimes find `TxPower` in the *GATT*, I choose not to connect to the target device if it's missing from the *GAP* because it's supposed to be a stealth attack.

2.1 Parameters

| Parameter | default value | possible value | description |
|----------------------------------|------------------------|------------------------|---|
| <code>ENVIRONMENT_FACTOR</code> | | 0 to 4 | losses due to environment, 0 is space, 4 is confined |
| <code>INTERFACE</code> | <code>microbit0</code> | <code>microbitX</code> | micro:bit board to use |
| <code>TIME</code> | 5 | | Scan duration |
| <code>DEVICE_CALLBACK</code> | <code>None</code> | <code>print</code> | callback to use for periodic updates during scan |
| <code>CONNECTION_CALLBACK</code> | <code>None</code> | <code>print</code> | callback to use for periodic updates during scan |
| <code>WINDOW</code> | 20 | | size of RSSI samples on which sum is calculated to obtain actual RSSI |
| <code>SCAN_TYPE</code> | all | devices, connections | scan realised, micro:bit can only sniff wether devices or connections at a time |

Use mirage CLI entrypoint to issue commands:

```
libs/mirage/mirage_launcher ble_locate
```

3 Man In The Middle

Available from `ble_mitm` as an integrated Mirage module. As detailed in the documentation¹ this module relies heavily on `scenarios`² to achieve on the fly packet modification, otherwise it will display then retransmit the traffic.

The module needs 2 `hci` devices such as CSR8510 in order to function properly.

3.1 Parameters

`INTERFACE1` will clone then maintain the connection to the target peripheral, after what `INTERFACE2` will spoof and wait for the central to connect. Once it's connected, the traffic is retransmitted between `INTERFACE1` and `INTERFACE2`.

By default, Mirage will spoof both the central and the peripheral by setting `INTERFACE1` and `INTERFACE2` to their BD address.

`ble_mitm` can deal with encryption using `ble_crack`, for more information refer to the documentation³.

Use mirage CLI entrypoint to issue commands:

```
# spoof XX:XX:XX:XX:XX
libs/mirage/mirage_launcher ble_mitm INTERFACE1=hci0 INTERFACE2=hci1
    TARGET=XX:XX:XX:XX:XX
# crack the encryption
libs/mirage/mirage_launcher ble_mitm TARGET=XX:XX:XX:XX:XX
    MASTER_SPOOFING=yes
```

¹<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#ble-mitm>

²<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#id113>

³<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#id119>

4 Hijack

This module uses the BCC `micro:bit`, make sure it's plugged in your PC.

As explained in the corresponding documentation⁴, this integrated Mirage module named `ble_hijack` allows to:

sniff an established connection, synchronize to it and jam the packet emitted by the slave. As a consequence, if the master reaches its timeout value, it disconnects from the slave device and the attacker is able to communicate with the slave device instead of him..

Also, the module is based on `ble_sniff` to identify target connection and only hijacks the connection, as stated in the documentation:

this module needs `ble_sniff`, and cannot be used alone. Indeed, when the connection is hijacked, the module terminates its execution, allowing to run another module, such as `ble_master` or `ble_discover`.

The module can wait for new connections to be created in order to sniff connection parameters required to follow the connection (sniffing mode new connections⁵) or try to synchronize with an existing connection by recovering connection parameters over time (sniffing mode existing connections⁶).

4.1 Parameters

An interesting parameter is that you can provide a `pcap` file to capture the attack and analyze it later using *Wireshark*. In order to be able to capture the traffic pass `PCAP_FILE=/path/to/file.pcap` where `/path/to/file.pcap` is an absolute path to a non-existent file.

For all possible parameters, refer to the module documentation⁷.

Use mirage CLI entrypoint to issue commands:

```
# Hijack then capture connection with a shell as master
libs/mirage/mirage_launcher "ble_hijack|ble_master"
HIJACKING_MODE=existingConnections
# equivalent to launching ble_hijack directly
libs/mirage/mirage_launcher "ble_sniff|ble_master" INTERFACE=microbit0
SNIFFING_MODE=existingConnections HIJACKING=yes
```

4.2 Troubleshooting

It can take some time to discover a connection, and may never be able to find anything sometimes, because of *channel hopping*. The `micro:bit` changes channel frequently but so does the connections, so it's a matter of time and luck until it crosses a used channel.

⁴<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#id87>

⁵<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#hijacking-a-new-connection>

⁶<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#hijacking-an-existing-connection>

⁷<https://homepages.laas.fr/rcayre/mirage-documentation/blemodules.html#id95>

5 Tests

The project provide a test network mocking a slave and BLE master based on Mirage `ble_slave` and `ble_master` modules. Those modules are customised using scenarios `MockMaster` and `MockSlave` found in `poc/src/scenarios`. The scenarios add CLI parameters to modify their behaviors besides those used by their modules.

5.1 MockSlave

| Parameter | default value | possible value | description |
|-----------|---------------|----------------|---|
| INTERFACE | hci0 | hciX | hci device to use |
| SCENARIO | MockSlave | | scenario to use |
| NAME | Test Slave | | local name emitted in the advertisement |
| PAIRING | yes | | enable pairing |
| TXPOWER | -55 | | signal strength measured 1 meter away from device |

5.2 MockMaster

| Parameter | default value | possible value | description |
|-----------|----------------|----------------|---|
| INTERFACE | hci1 | hciX | hci device to use |
| SCENARIO | MockMaster | | scenario to use |
| NAME | Test Slave | | local name used to identify target slave |
| PAIRING | yes | | enable pairing |
| TARGET | scan for slave | BD address | slave BD address, scan devices if empty |
| REQUESTS | 10 | | number of requests issued to slave device during the connection |
| INTERVAL | 3 | | time in seconds between each request to slave |

Use mirage CLI entrypoint to issue commands:

```
# start slave
libs/mirage/mirage_launcher ble_slave
# start master
libs/mirage/mirage_launcher ble_master
```

Use `--debug` switch to activate debug mode and see exception traces.

Be aware that mirage will stay in foreground while executing thus blocking the CLI until it finishes, use `&` parameter to start a task in background, even if it's recommended to start each mirage task in it's own shell for output readability.