Robomow SW design

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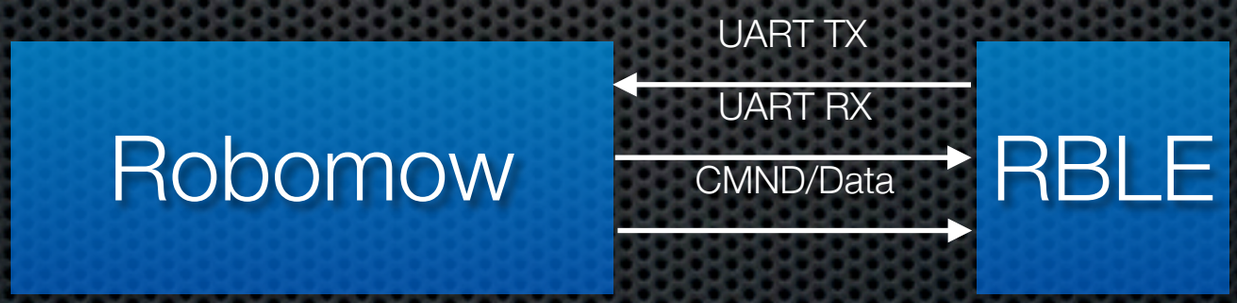
v 0.3

System Description

- The BLE module is fully controlled by the host MCU (i.e. robot)
- RBLE modes transition is triggered by the Robot over the UART commands as defined in the “Bluetooth BLE Device Protocol”
- RBLE communication is possible only when the Command/ Data Mode PIO is in low state (command mode)



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RBLE Modes definition

- The following are allowable states for the RBLE:
  - Power Up
  - MD - marker detection
  - CR - cable replacement
  - Automatic mode.

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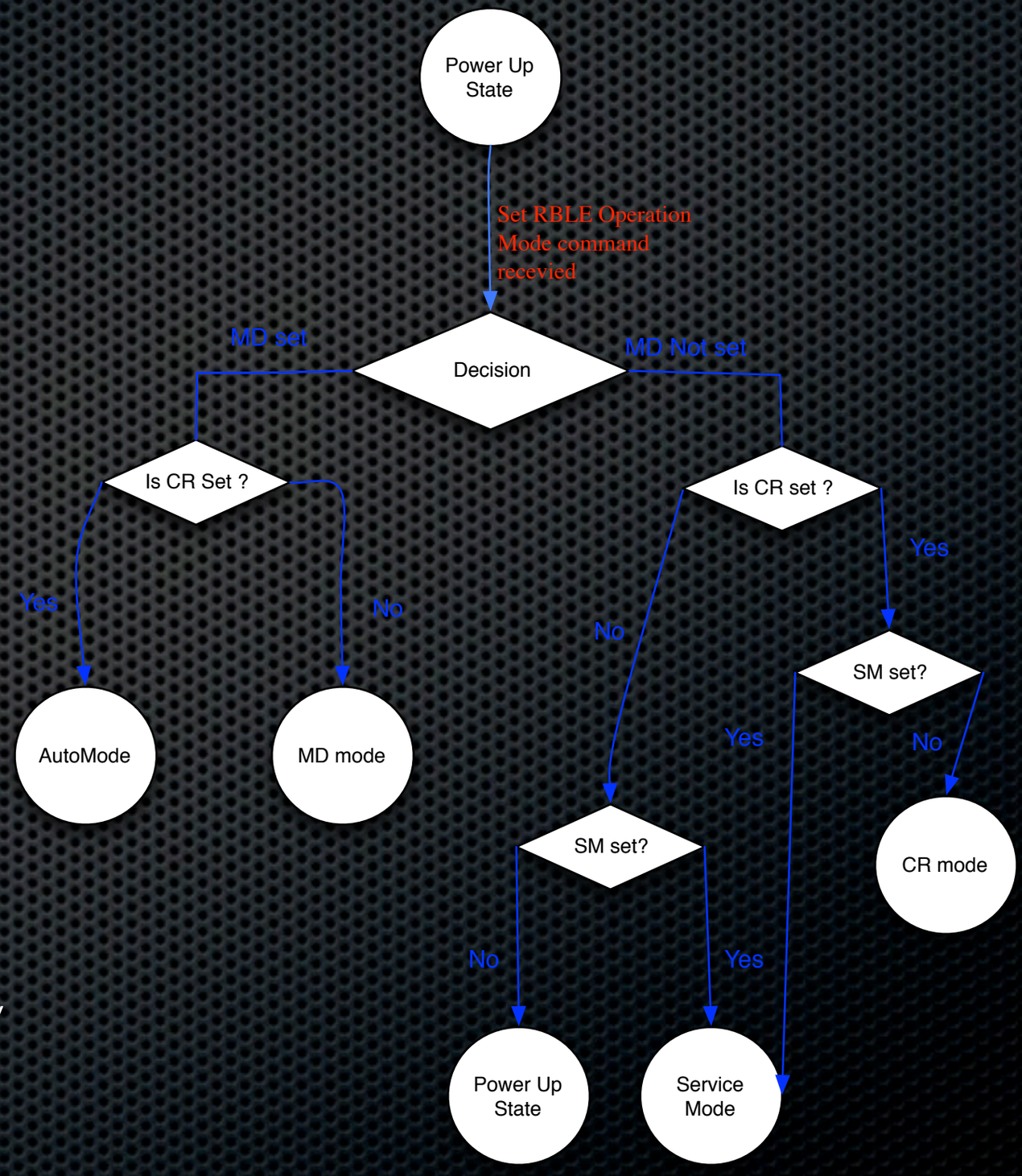
RBLE States description - General

- All the states are entered upon reception of the command from the robot
  - The only exception is a Power Up mode, which is entered automatically upon exit from reset.
- The state transition can occur only as a result of the host command.
- The host can generate a command only in case the CMND/ Data line is low - i.e. in command mode.



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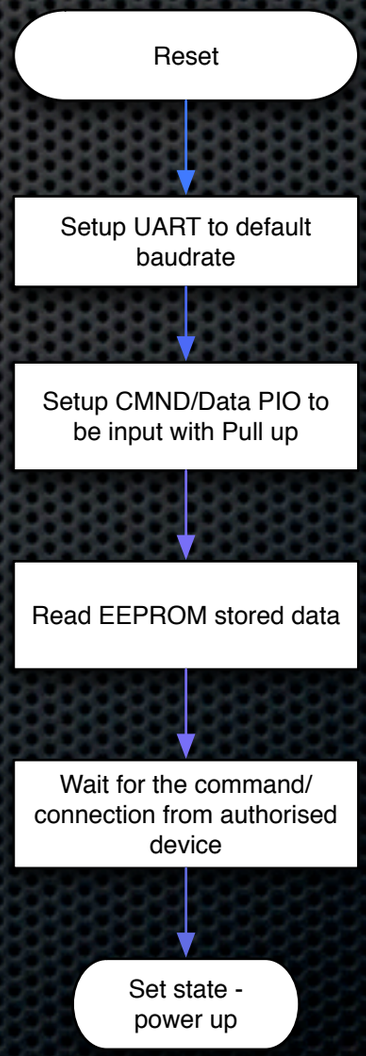
RBLE States description - Power Up

- Upon exit from reset the device initializes default baud rate to 19200
- Configures control PIO for command/ data mode selection
- Reads stored data like peered devices list, serial number of robot,... into RAM
- At the end of power up process, the device (RBLE) moves automatically into the Cable Replacement (CR) mode



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RBLE States description - MD state

- Upon entry into the state, the device starts scanning.
  - The scan parameters are set to be twice as fast as that of the Advertising, which will be determined further on.
  - The scan interval is configurable via PS TOOL.
- The scan type will be set to passive scanning.
- The GAP role will be non-discoverable, non-connectable observer.

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RBLE States description - Service Mode state

- Upon entry into the state, the device starts advertising.
  - The connectable un-direct advertising will be used.
- Any connection will be accepted in the mode.
- No authentication will be required in this mode from the peer device and peer MAC address will not be stored into the authenticated device list
- The state diagram will be described further on.

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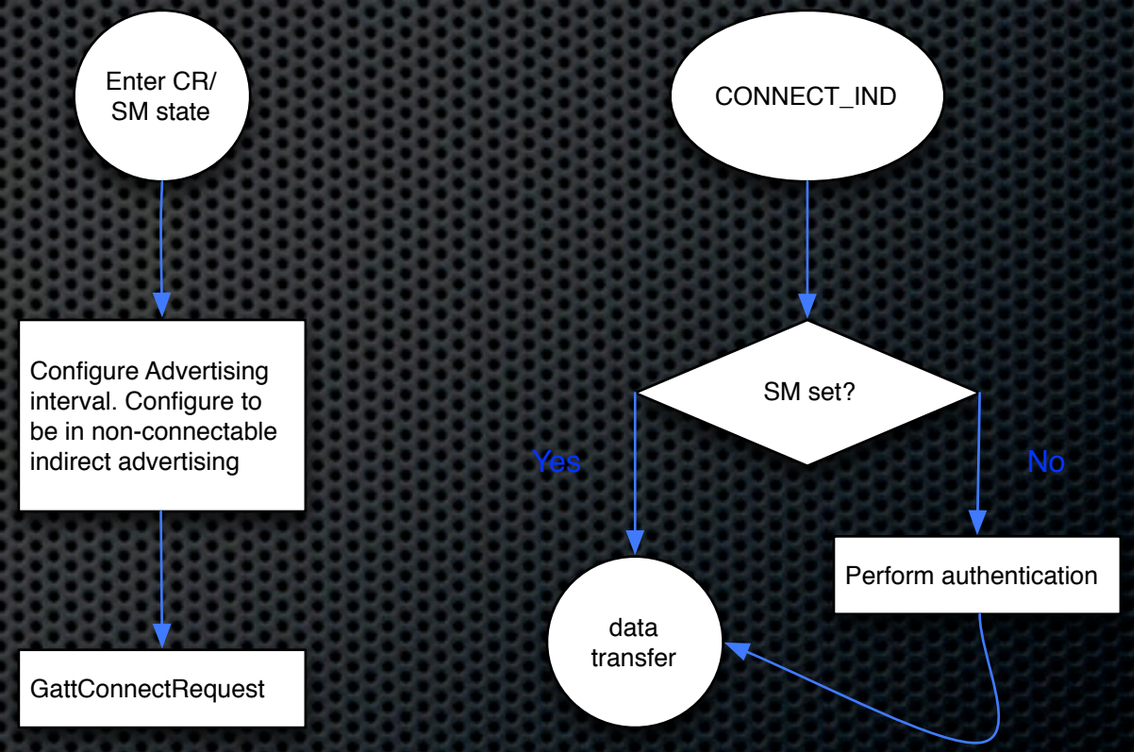
RBLE States description - Cable Replacement state

- Upon entry into the state, the device starts advertising.
  - The connectable un-direct advertising will be used.
- After the connection establishment an authentication process will be performed
  - In case of successful authentication while the “Trusted Device List” is full, an error message will be returned to the peer device indicating “Queue full” while the connection will be sustained (without storing a MAC address)
  - In case data is received from the peer device while RBLE is in command mode, the error message indicating this will be sent to peer device.



RBLE States description - Auto Mode

- Upon entry into the state, the device starts passive non-connectable scanning.
- On each advertisement received, it will be passed to the host
- As soon as bonded device detected, RBLE will start un-direct connectable scanning with the white list defined to be a MAC address of the device for TBD timeout
  - If during the timeout the connection was not established, the device returns to the passive non-connectable scanning.

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RBLE Authentication process

- After the connection is established an RBLE awaits for the authentication from the peer device if not in SM mode.
- The authentication process will occur only once per lifecycle of peer device.
- The authentication will be performed as follows:
  - Robomow GATT service will have an attribute called Device Information (UUID will be provided).
  - Upon BLE connection established, the RBLE will wait for write to the attribute for some timeout time(TBD)
  - Upon “write access” the written value will be compared with the already stored serial number and in case of match further communication will be possible otherwise - disconnect the connection

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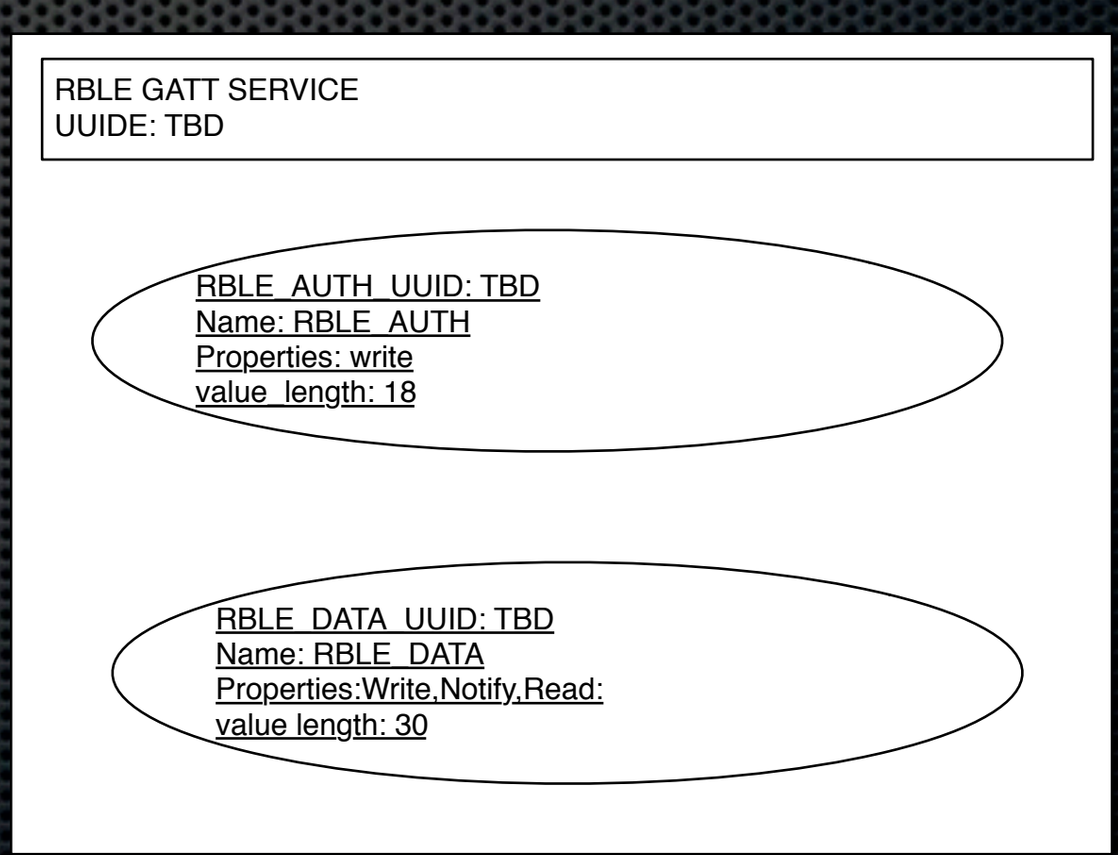
RBLE GATT service definition

- The RBLE GATT service is defined as follows:

- The RBLE service will be advertised with 2 characteristics:
  - Authentication characteristic: the peer will write into it 18-byte (zero padded) serial number of the board and will or will not be authenticated for further communication
  - Data characteristic: will be used for data exchange. Upon write access to it the data will be passed to the MCU or processed internally (in case of internal command).Notification will mean that the new data was passed from MCU to the peer device.



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RBLE GATT service data format

- The RBLE <-> client data packet is defined as follows:

SYNC	Type	Length	Data

- SYNC- 1 byte value 0xAA
- Type - 1 byte value of: 0x1 data, 0x2 Command
- Length - 1 byte. The length of the data field of the message
- Data - Length bytes of data

RBLE GATT service data format (cont)

- Upon write access to the RBLE_AUTH characteristic, the Length field is set to 15 while the Type is set to 0x2.
- Upon write access to the RBLE_DATA characteristic, for data transfer the Type is set to 0x1 otherwise it is set to 0x1.
  - The list of commands that can be sent from remote device to the RBLE yet to be defined and reviewed.

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RBLE Host Interface Definition

- During all the states the control PIO indicates wether the MCU is capable to receive new data or not
  - As soon as the PIO is low - indication of command mode, during which all the UART data is processed as commands and all the over the air data is through away.
  - As soon as the PIO is high - all the UART data is written to the peer device, while all the over the air data is sent to the UART as is.
    - Note that in case the connection is lost or not established yet all the UART data is through away.
- The data format for the MCU to RBLE communication is specified in the “Bluetooth BLE Device API Protocol” document.