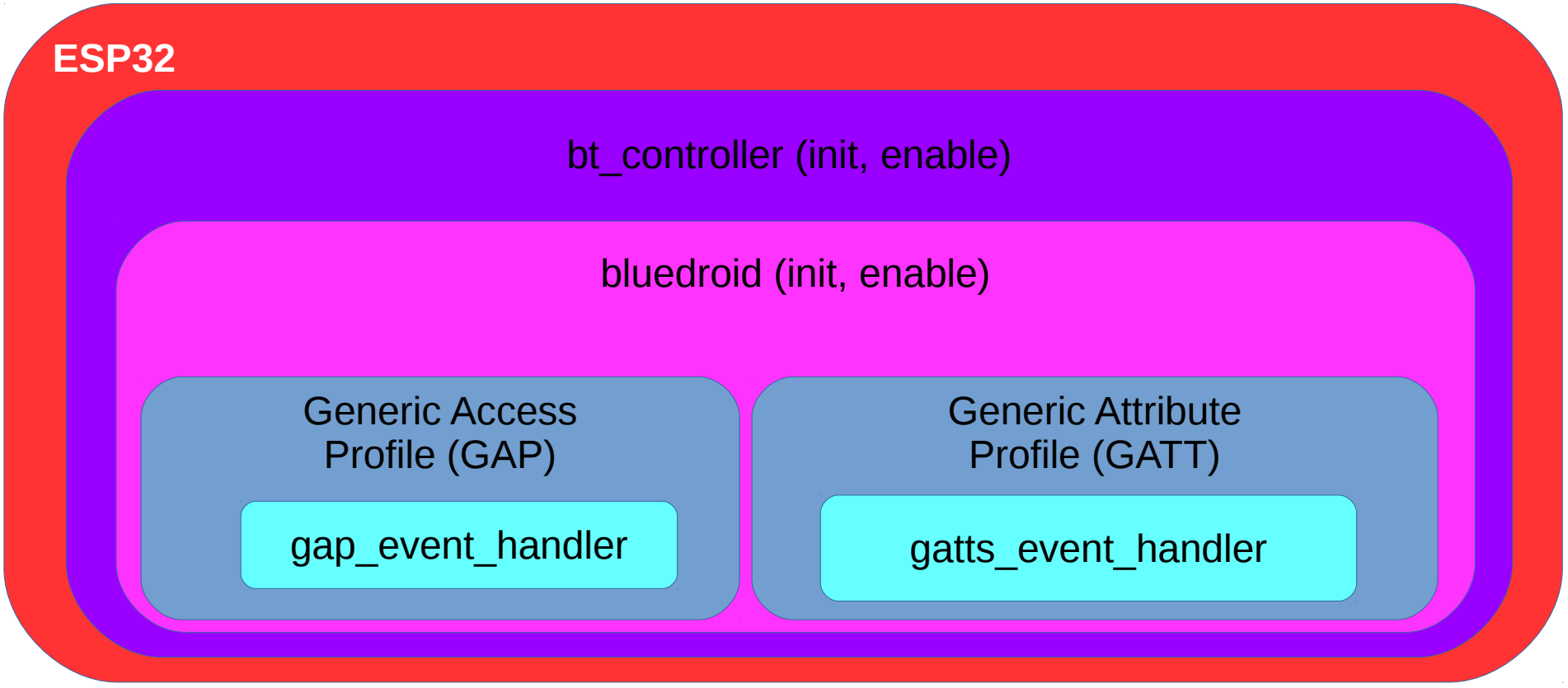
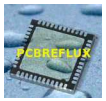
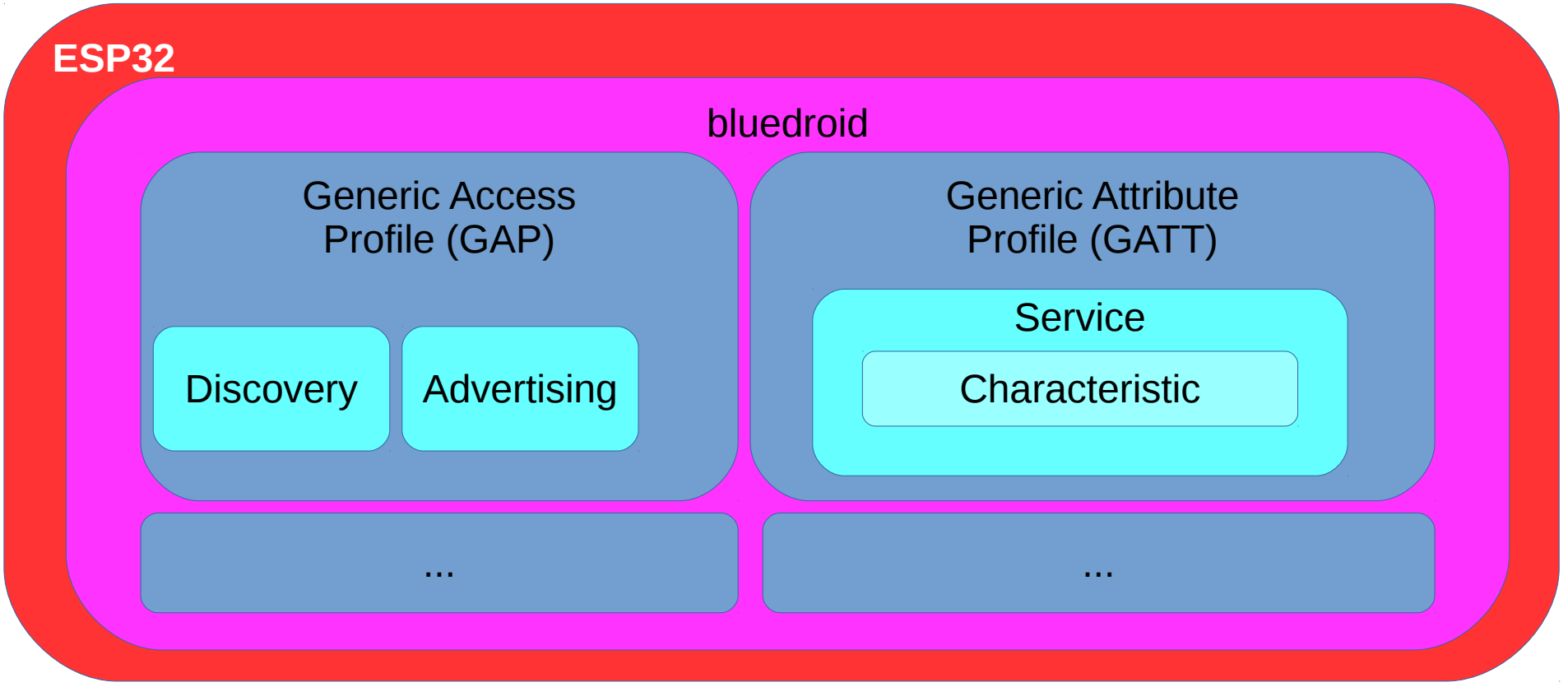
ESP32 + Bluetooth Low Energy Server

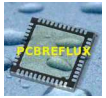




ESP32 + Bluetooth Low Energy Server



pcbreflux



[redacted] + Bluetooth Low Energy Server

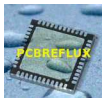
- Device Address[1] (unique for every ESP32 i.e. BLE Chip)
  BD_ADDR: 24:0A:C4:01:D1:CA

Advertising Package (GAP)

- Device Name[2] (unique for every Device of the same type)
  ESP32_ECC_SERVER

- Device Type[2] (unique for every Device of the same type)
  ESP_BLE_ADV_FLAG_GEN_DISC

1 BLUETOOTH SPECIFICATION Version 4.2 [Vol 2, Part B] , 1.2 BLUETOOTH DEVICE ADDRESSING
2 BLUETOOTH SPECIFICATION Version 4.2 [Vol 3, Part C] , 12.1 DEVICE NAME CHARACTERISTIC
3 BLUETOOTH SPECIFICATION Version 4.2 [Vol 3, Part C] , 9 OPERATIONAL MODES AND PROCEDURES – LE PHYSICAL TRANSPORT



+ Bluetooth Low Energy Server

Generic Attribute Profile (GATT)

Service

Include

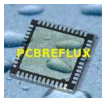
Characteristic

Properties

Value

Descriptor

pcbreflux



+ Bluetooth Low Energy Server

Generic Attribute Profile (GATT)

Service

Include

Include

Include

Characteristic

Properties

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Descriptor

...

Descriptor

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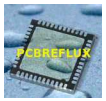
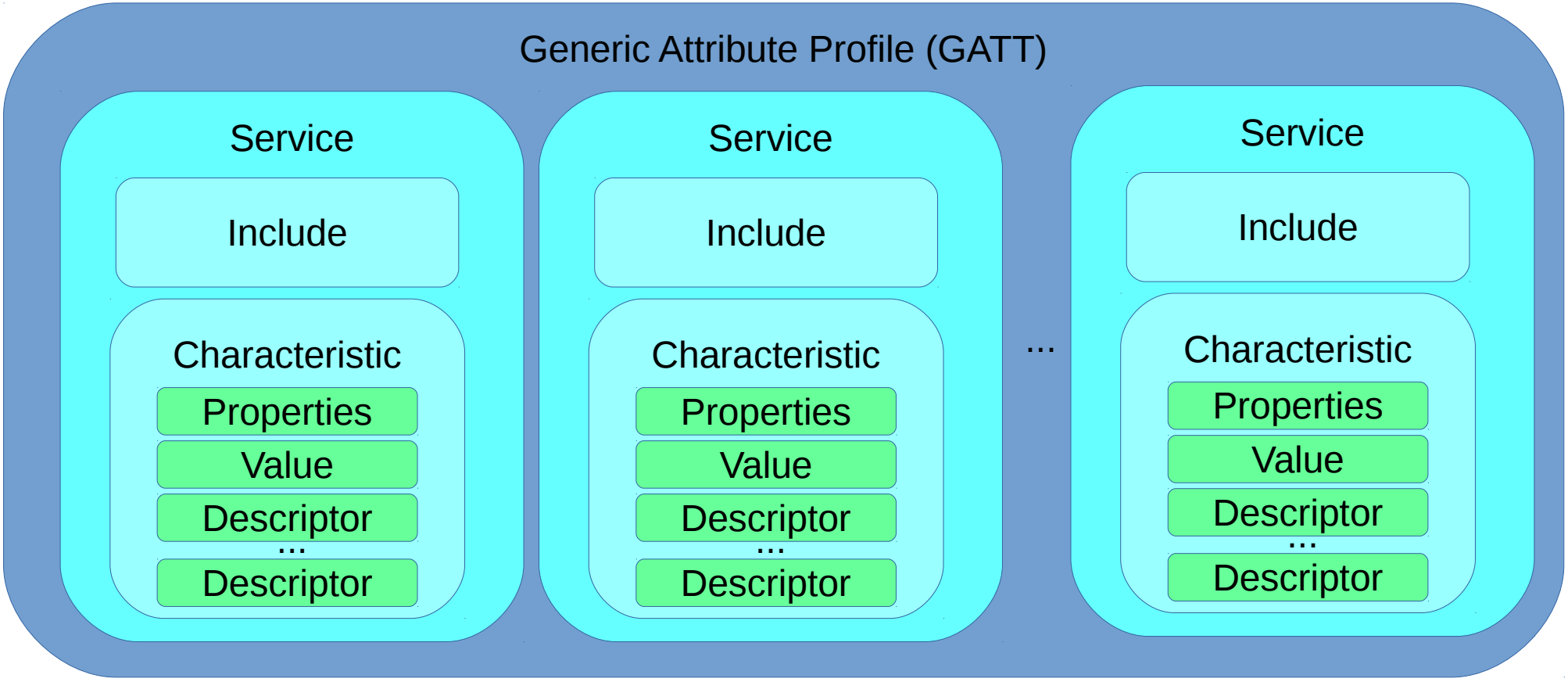
...

Descriptor

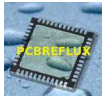
pcbreflux



[redacted] + Bluetooth Low Energy Server



pcbreflux



[redacted] + Bluetooth Low Energy Server

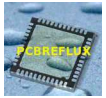
Generic Attribute (GATT - > GATTS)

- 16-bit Service Class UUIDs[1] (unique for every Service)
  - > for members of Bluetooth SIG (A fee of $2,500 per UUID will be charged for each)

- 32-bit Service Class UUIDs (unique for every Service)
  - > ?

- 128-bit Service Class UUIDs (unique for every Service)
  - > generate a random one (uuidgen -r)

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



[redacted] + Bluetooth Low Energy Server

Generic Attributes - GATT Services[1]

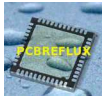
- Generic Access[2] (0x1800)
  - > Device Name (0x2A00)
  - > Appearance (0x2A01)

- Gereric Attribute[2] (0x1801)
  - > Service Changed

- Predefined Services[1]
  Battery Service (0x180F), Human Interface Device (0x1812), ...

- Your Services (i.e. 128 Bit UUID)
  - > one or more Characteristics

1 https://www.bluetooth.com/specifications/gatt/services
2 https://www.bluetooth.com/specifications/gatt/characteristics



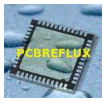
[redacted] + Bluetooth Low Energy Server

GATT Characteristics

- Predefined Characteristics[1]
  Battery Level (0x2A19), Temperature (0x2A6E), Humidity (0x2A6F)

- Your Characteristics (i.e. 128 Bit UUID)
  - > one or more Characteristics

1 https://www.bluetooth.com/specifications/gatt/characteristics



+ Bluetooth Low Energy Server

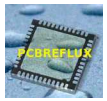
Generic Access Profile (GAP)

Events

event

parameter

pcbreflux



ESP32 + Bluetooth Low Energy Server

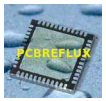
Generic Access Profile (GAP)

Events

ESP_GAP_BLE_ADV_DATA_SET_COMPLETE_EVT - > start_advertising

ESP_GAP_BLE_ADV_STOP_COMPLETE_EVT - >

...



+ Bluetooth Low Energy Server

Generic Attribute Profile (GATT)

Events

event

gatt_if

parameter

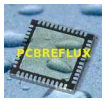
pcbreflux

+ Bluetooth Low Energy Server

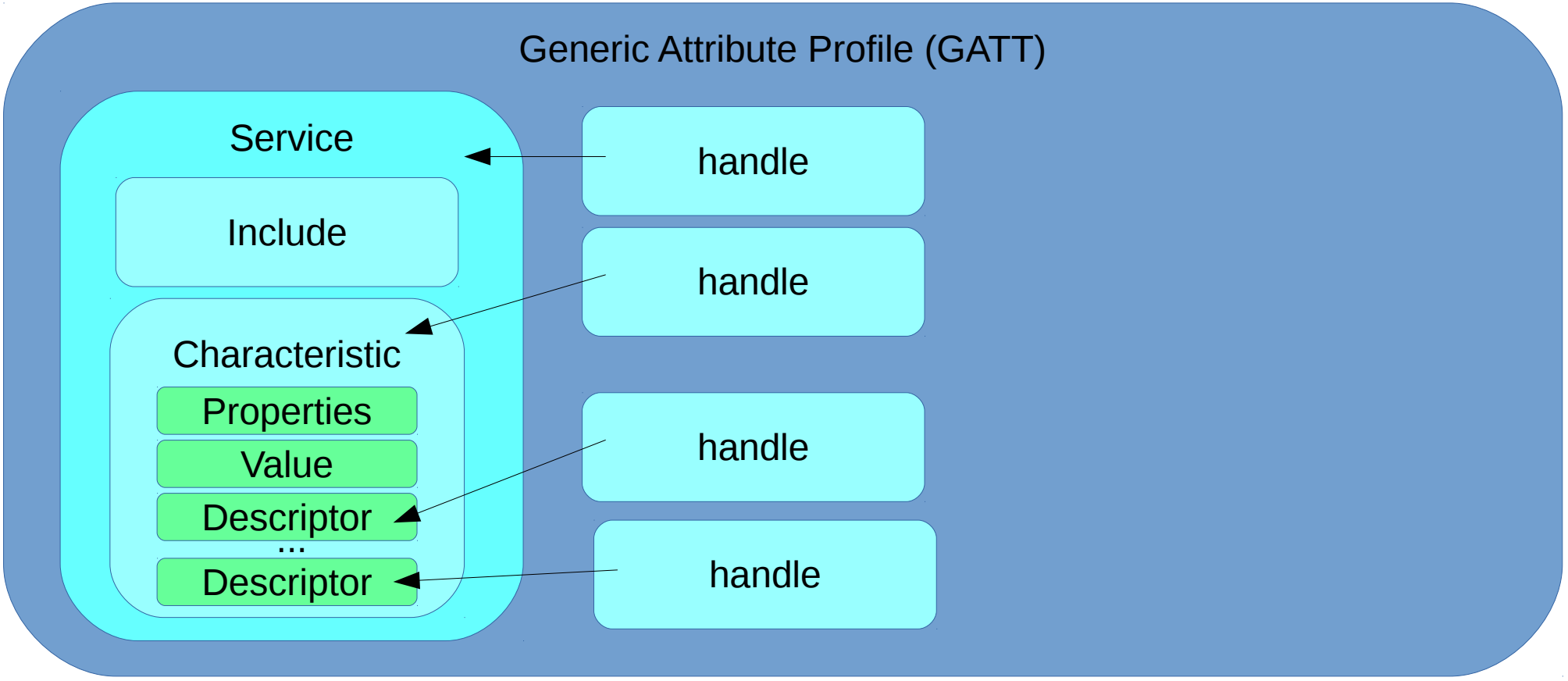
Generic Attribute Profile (GATT)

Events (startup)

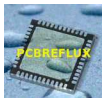
- ESP_GATTS_REG_EVT - > config_adv_data, create_service
- ESP_GATTS_CREATE_EVT - > start_service, add_char
- ESP_GATTS_START_EVT - >
- ESP_GATTS_STOP_EVT - >
- ESP_GATTS_ADD_CHAR_EVT - > add_char_descr
- ESP_GATTS_ADD_CHAR_DESCR_EVT - > more add_char



+ Bluetooth Low Energy Server



pcbreflux



+ Bluetooth Low Energy Server

Generic Attribute Profile (GATT)

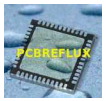
Events (connect)

ESP_GATTS_CONNECT_EVT - > store connection

ESP_GATTS_DISCONNECT_EVT - > start_advertising

ESP_GATTS_OPEN_EVT - >

ESP_GATTS_CLOSE_EVT - >



+ Bluetooth Low Energy Server

Generic Attribute Profile (GATT)

Events (I/O)

ESP_GATTS_READ_EVT - > get_data, send_response

ESP_GATTS_WRITE_EVT - > set_data, send_response

ESP_GATTS_EXEC_WRITE_EVT - > set_data, send_response