STM32WB Networking

BLE MESH

June 2019

Agenda

- BLE Mesh basics
- Hands-on: BLE MESH Lightning demo

What tools do we need?

- STM32WB55 Nucleo Pack
  - including a Nucleo board and an USB Dongle both powered by a STM32WB55
- 1x micro USB micro cable
- Hands-on is carried out with binary. Source are included in the package
- PC tools
  - STM32CubeProgrammer
  - Terminal
  - ST Virtual COM port drivers
- Mobile app
  - ST BLE Mesh

Extending Bluetooth Capabilities

Connection
one-to-one

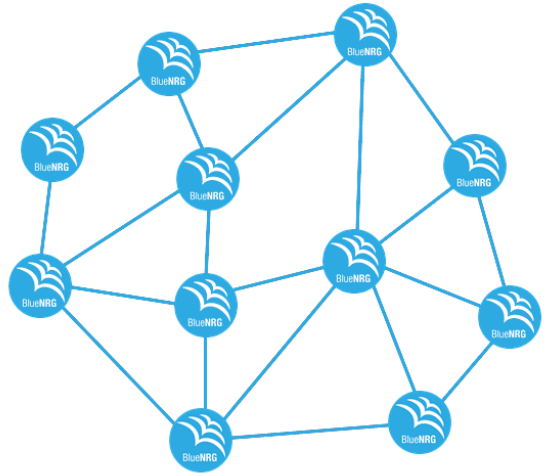
1 MASTER with
Up to 8 SLAVEs

DATA TRANSFER
- Sports & fitness devices
- Health and wellness devices
- Peripherals and accessories

Advertising
one-to-many

LOCALIZED INFORMATION
- Point of interest beacons
- Item finding beacons
- Way finding beacons

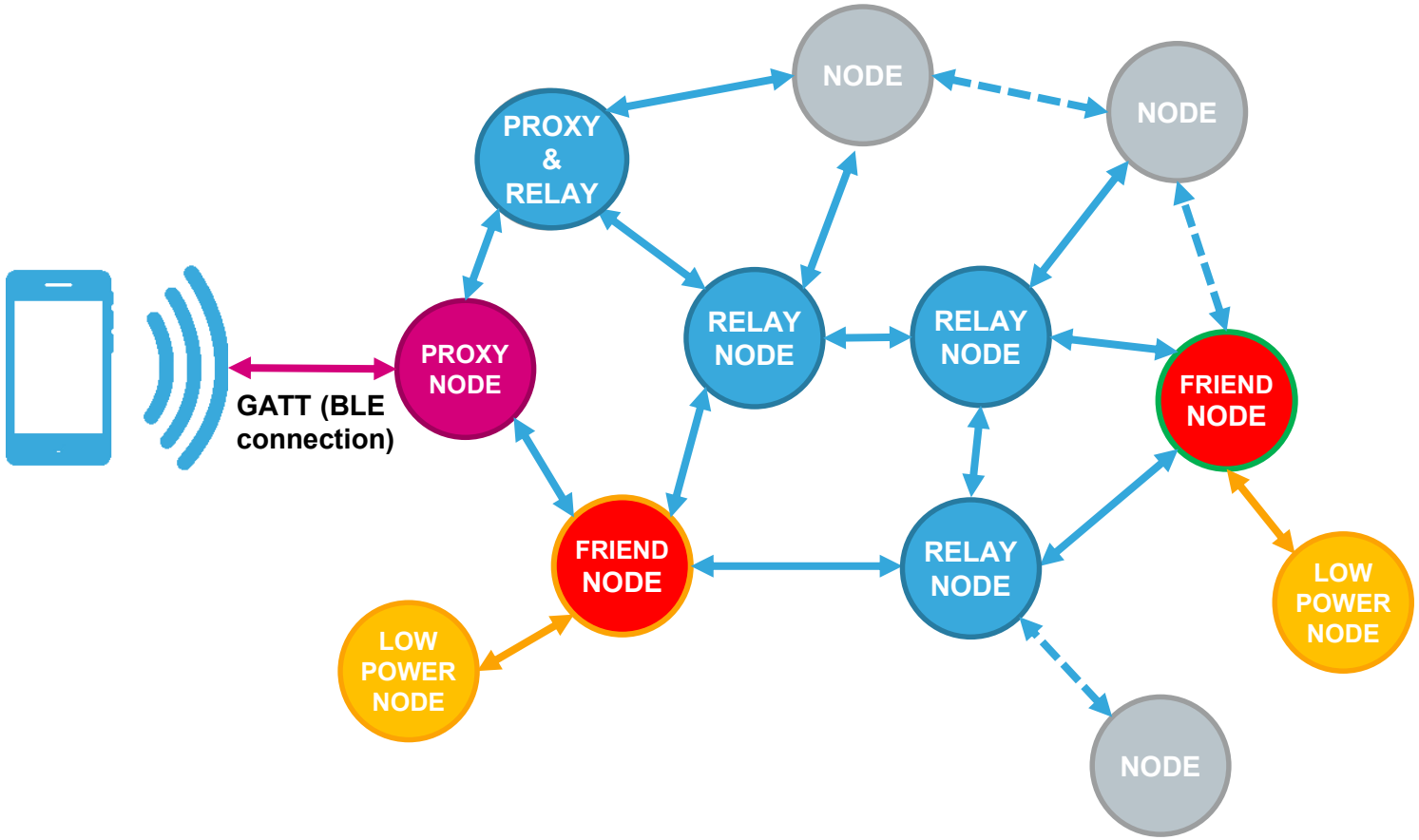
MESH
many-to-many



LARGE DEVICE NETWORKS
- Building automation
- Wireless sensor networks
- Asset tracking

Bluetooth® Mesh Topology
Nodes Features

The Bluetooth Mesh working group chose for mesh network mechanism a **flooding protocol**.
Compared to routed protocols, it is **much more simpler** to deploy.
To stay efficient, the BLE Mesh take advantage of a **managed flooding network**.



PROXY NODE
- Expose the interface for Smartphone/Tablet to interact with a mesh network

NODE
- Simple leaf node which cannot relay messages (Legacy nodes or Resource constrained nodes)

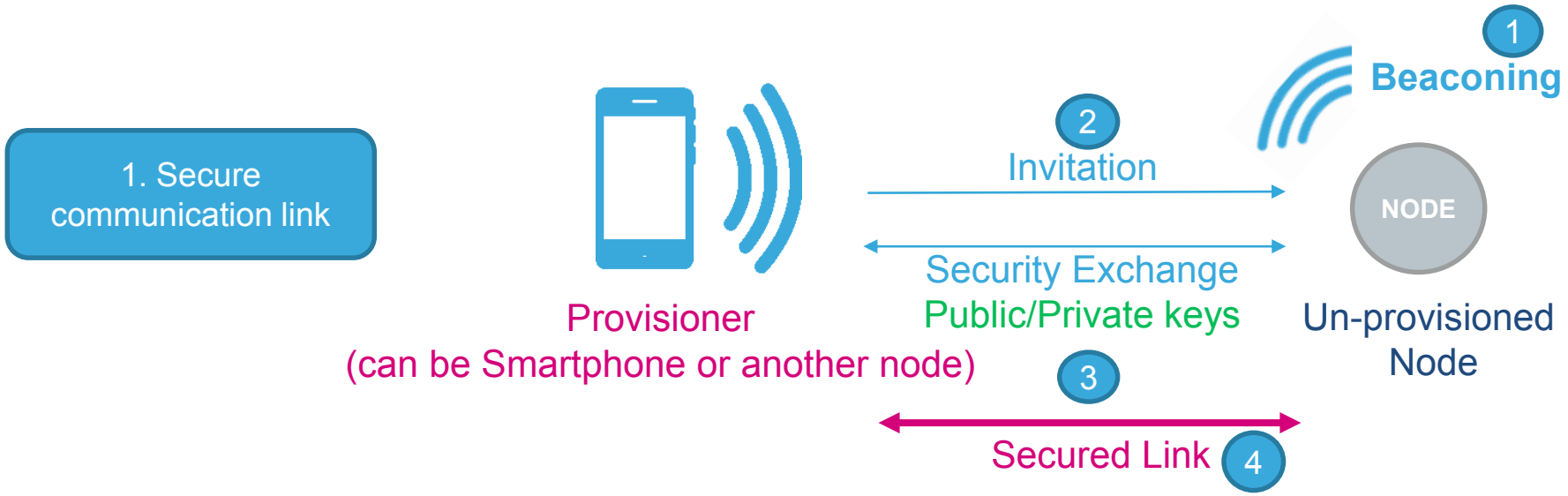
RELAY NODE
- Able to retransmit received messages
- Enable multiple “hops” in the network

LOW POWER NODE
- Battery operated devices
- Primarily send messages Rarely receive messages
- No need of 100% duty cycle

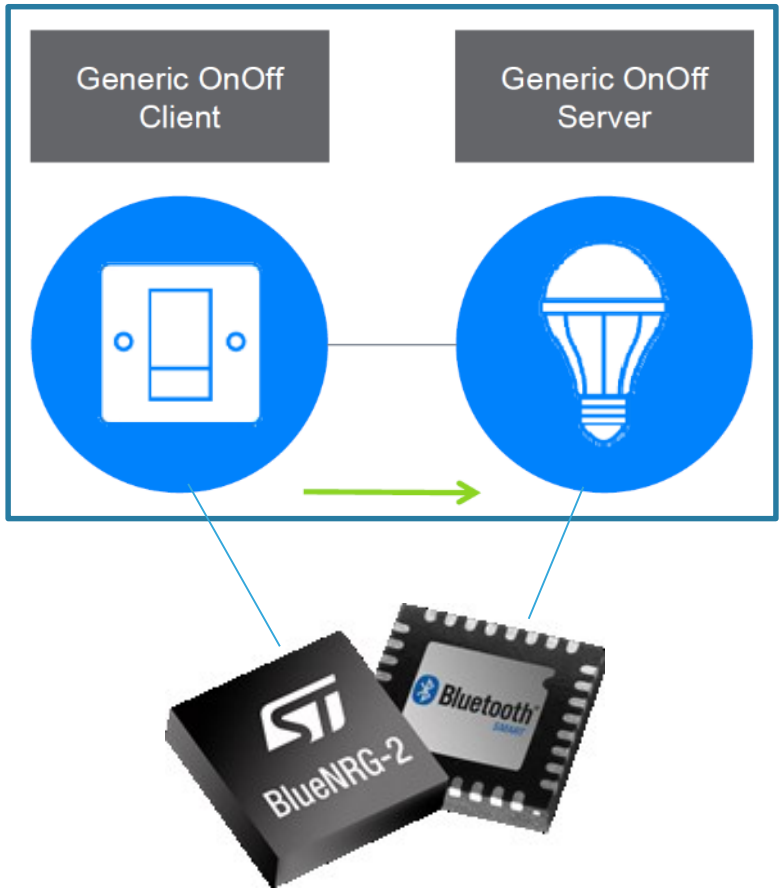
FRIEND NODE
- Stores messages addressed to LPNs and delivers to them whenever the LPN polls for “waiting messages”

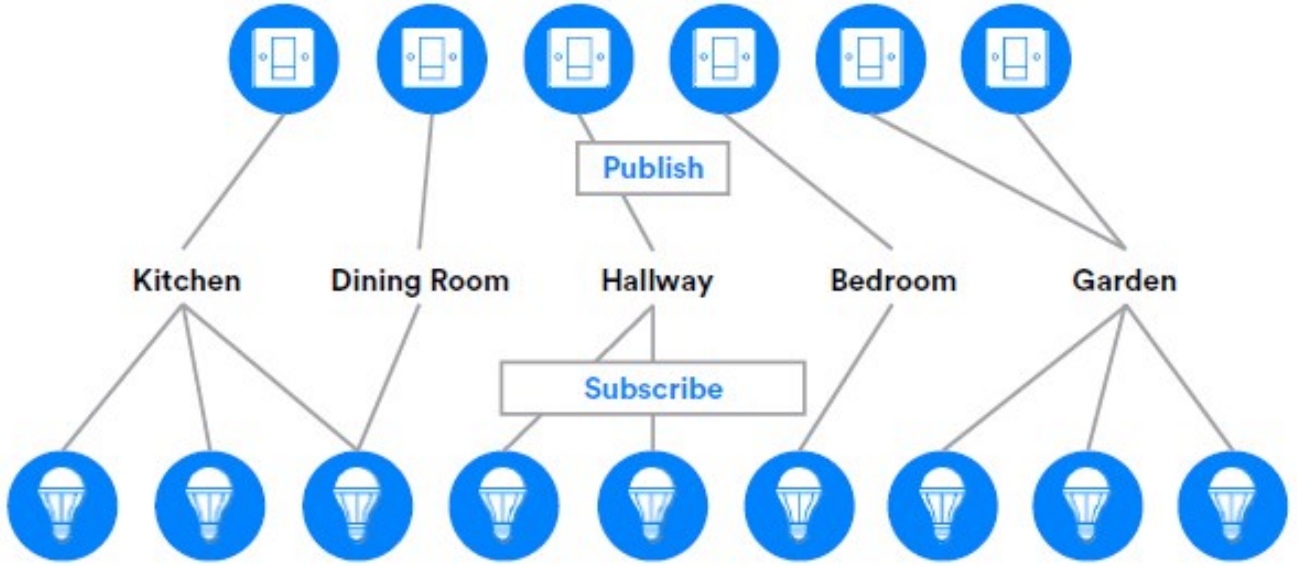
…Adding a node to BLE Mesh Network

- What is Provisioning ?
  - This is a process of authenticating an un-provisioned a node and bringing it into the BLE Mesh network
  - This process is deeply defined in the BT Mesh Specification trough specific workflow



The mesh messaging model
Publish and Subscribe

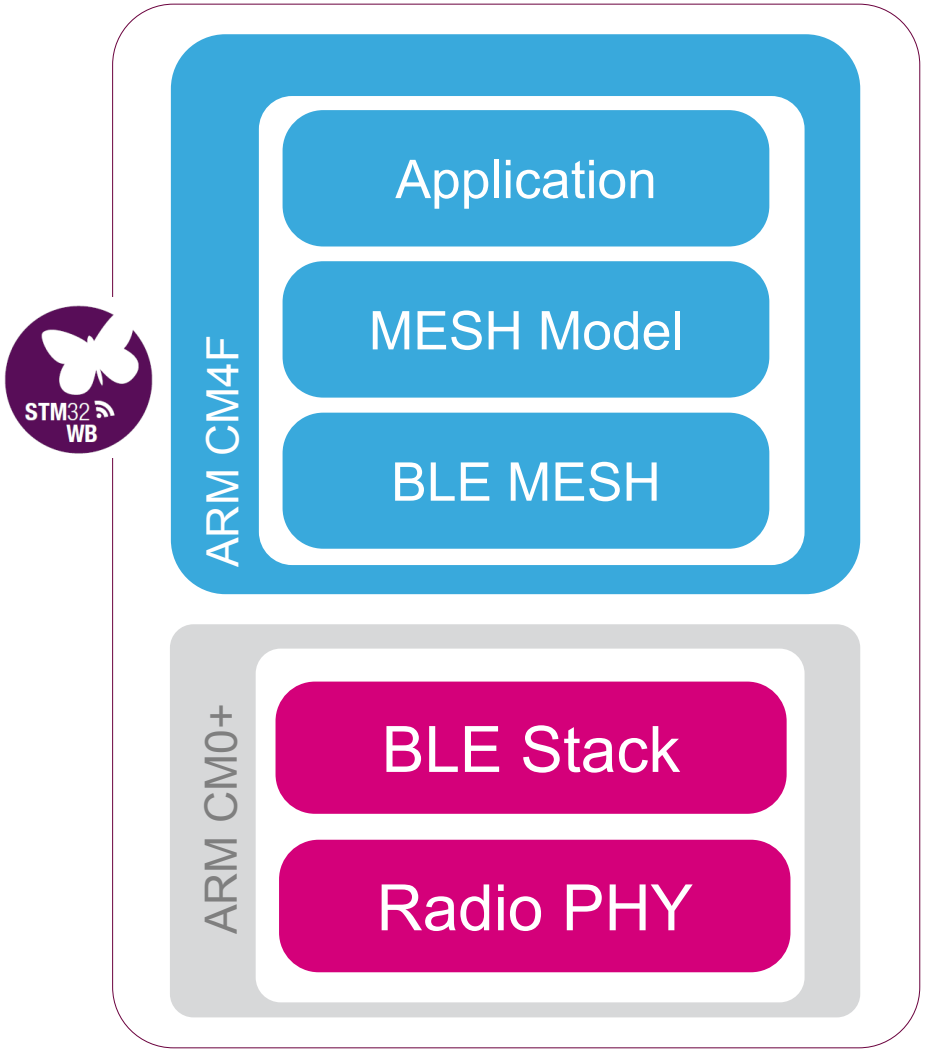


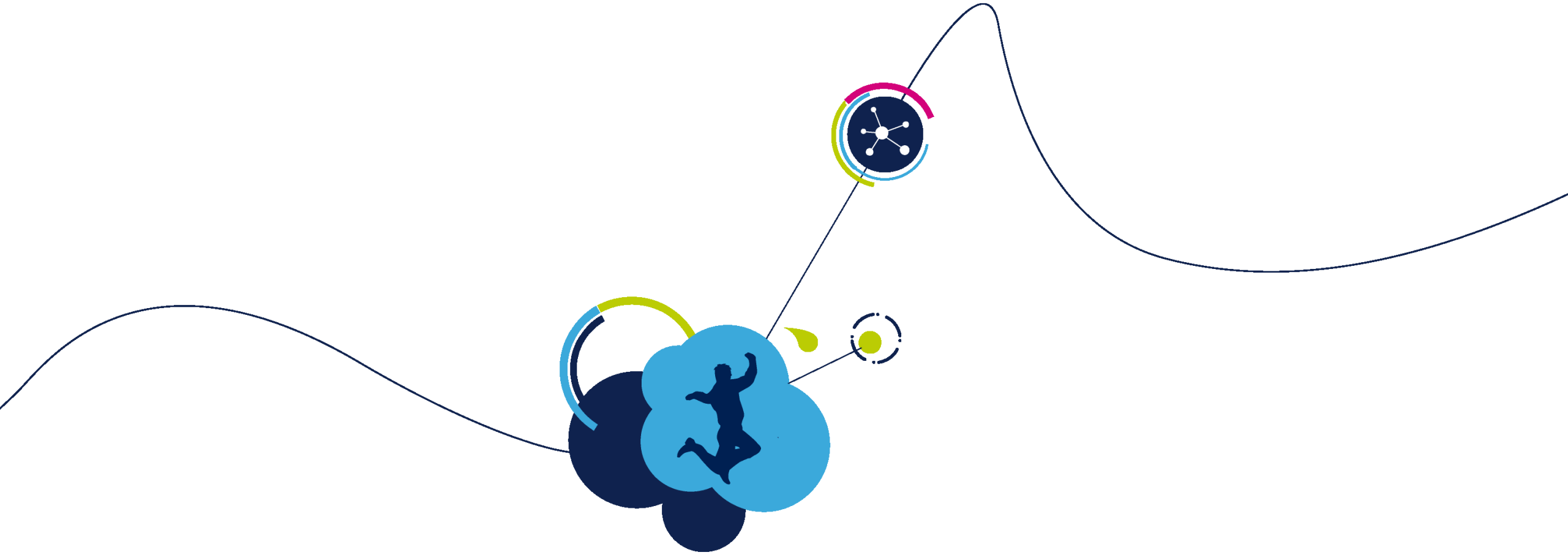


Example: **client device** (switch) can post messages and **server device** (light bulb) can be notified about new command arrival.

Bluetooth MESH vs BLE Stack

- WB is dual core architecture
- BLE Mesh is provided by ST as linkable library
- BLE Mesh lib is running on Application core (Cortex M4)





Hands-On

BLE MESH Lightning demo

Hands-On: BLE MESH Lightning demo

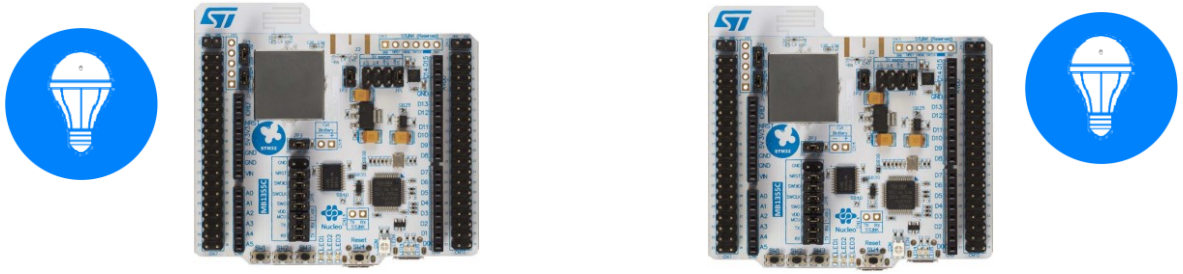
Goal

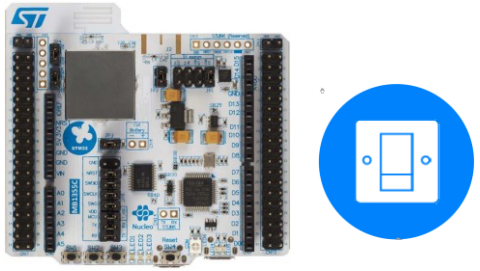
- Set up simple Mesh network with mobile Phone and multiple WB devices

ST BLE Mesh

Download on the App Store

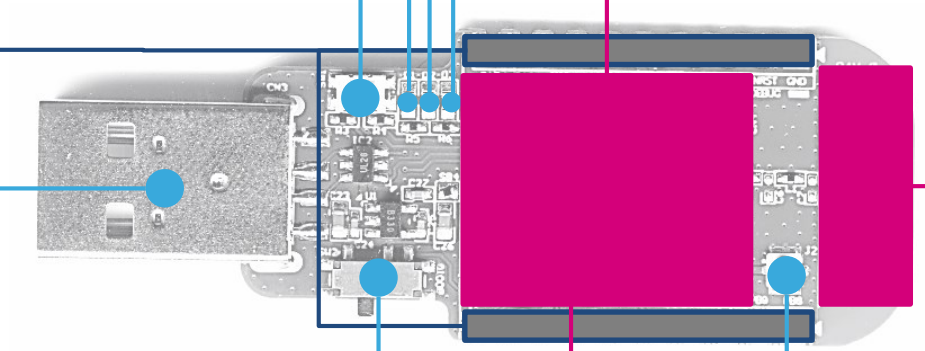
GET IT ON Google Play





STM32WB dev kit bundle

STM32WB USB dongle



1x User Button

GPIO access
(including SWD pins)

User USB FS Device
Connector (A)

BOOT0 switch

3x User LED

Target MCU Area

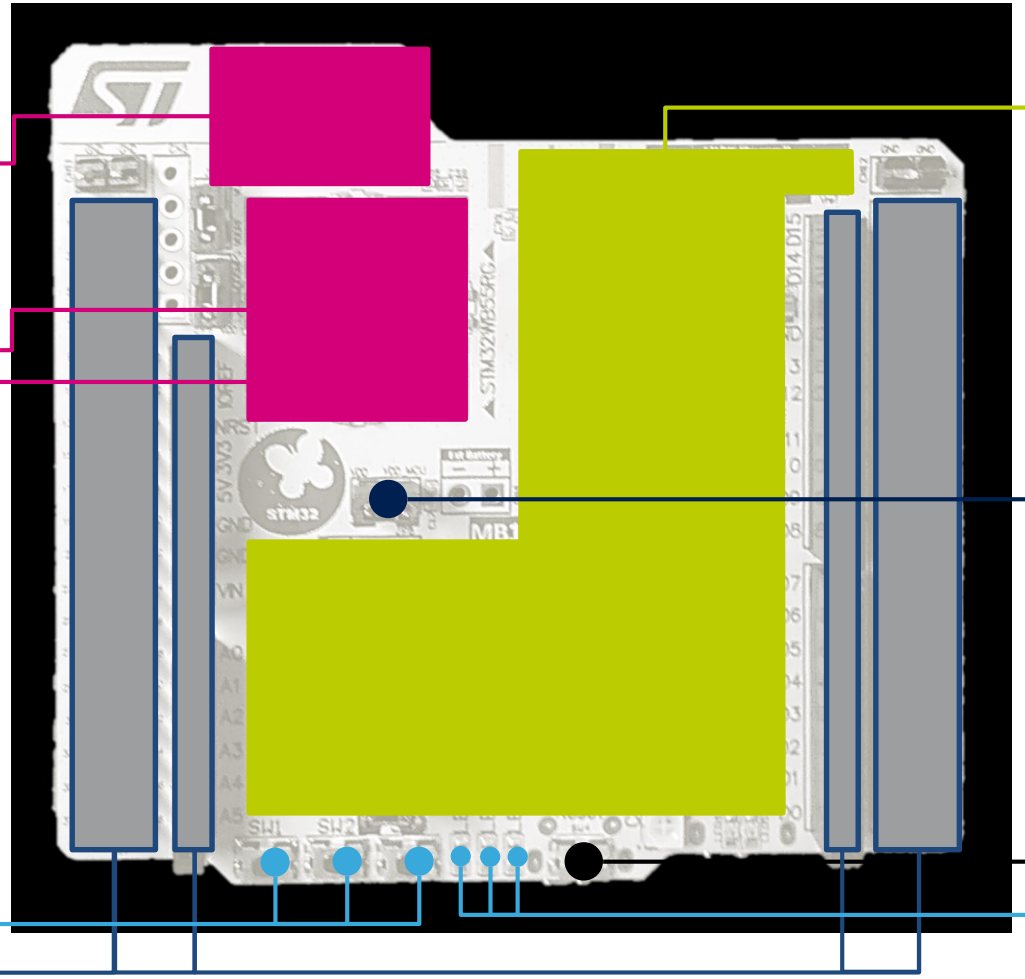
2.4GHz PCB antenna

External antenna
connector

STM32WB55CGC6
(UQFPN48)

STM32WB Nucleo kit

TOP SIDE



2.4GHz PCB antenna

STM32WB55RGV6
(VQFPN68)

Target MCU area

GPIO access

3x User Button

ST-Link/V2-1
(for programming and debugging)

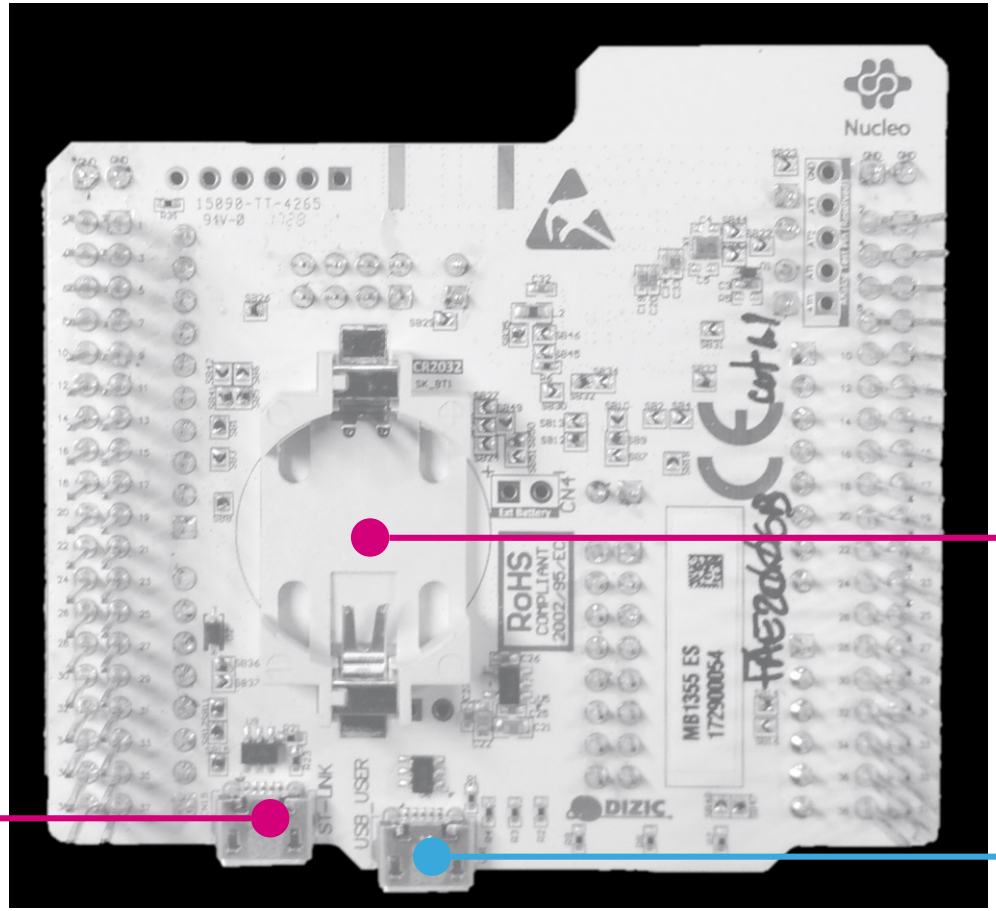
I_{DD} jumper

Reset Button

3x User LED

STM32WB Nucleo kit

BOTTOM SIDE



ST-Link USB Connector (micro)

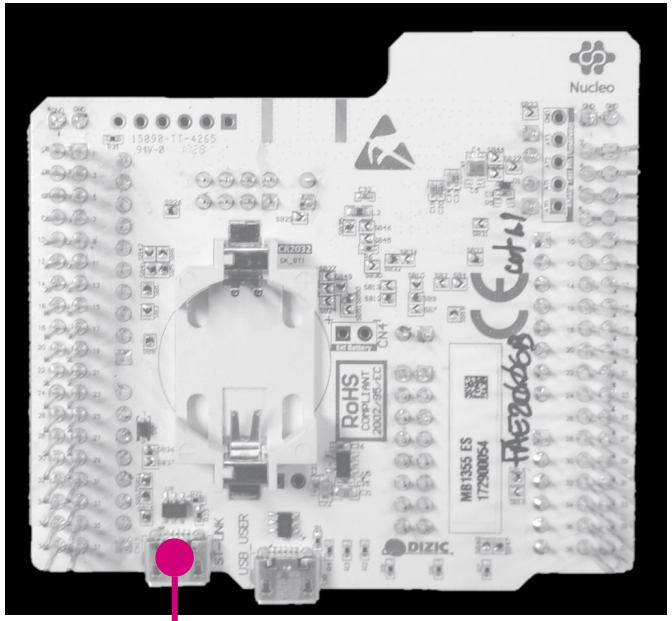
CR2032 socket

User USB FS Device connector (micro)

BLE MESH Lightning demo

- Connect to Nucleo via ST-LINK
- *The example is part of official Cube package for WB*

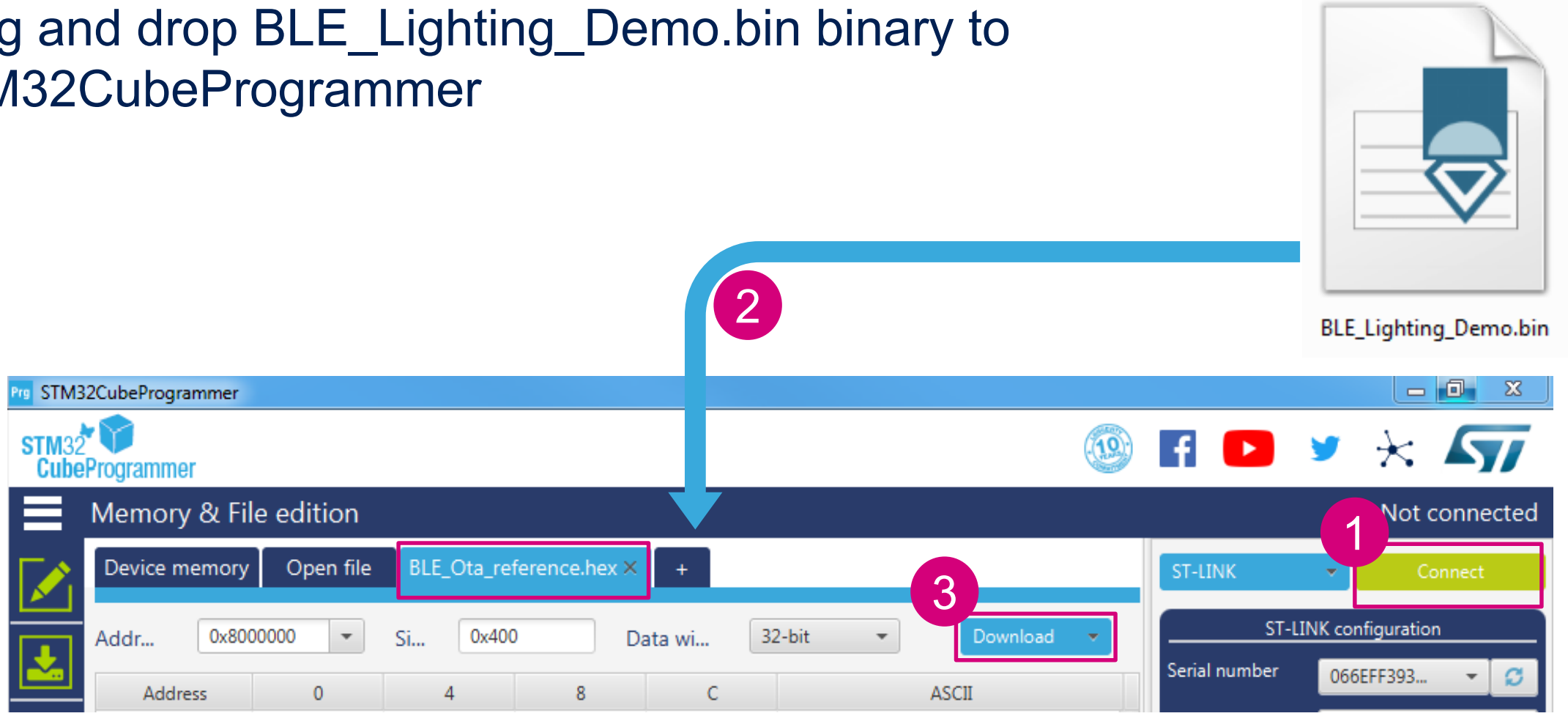
\STM32Cube_FW_WB_V1.x.x\Projects\
P-NUCLEO-WB55.Nucleo\
Applications\BLE\
BLE_MeshLightingDemo



ST-Link USB Connector

Load binary over ST-Link

- Drag and drop BLE_Lighting_Demo.bin binary to STM32CubeProgrammer



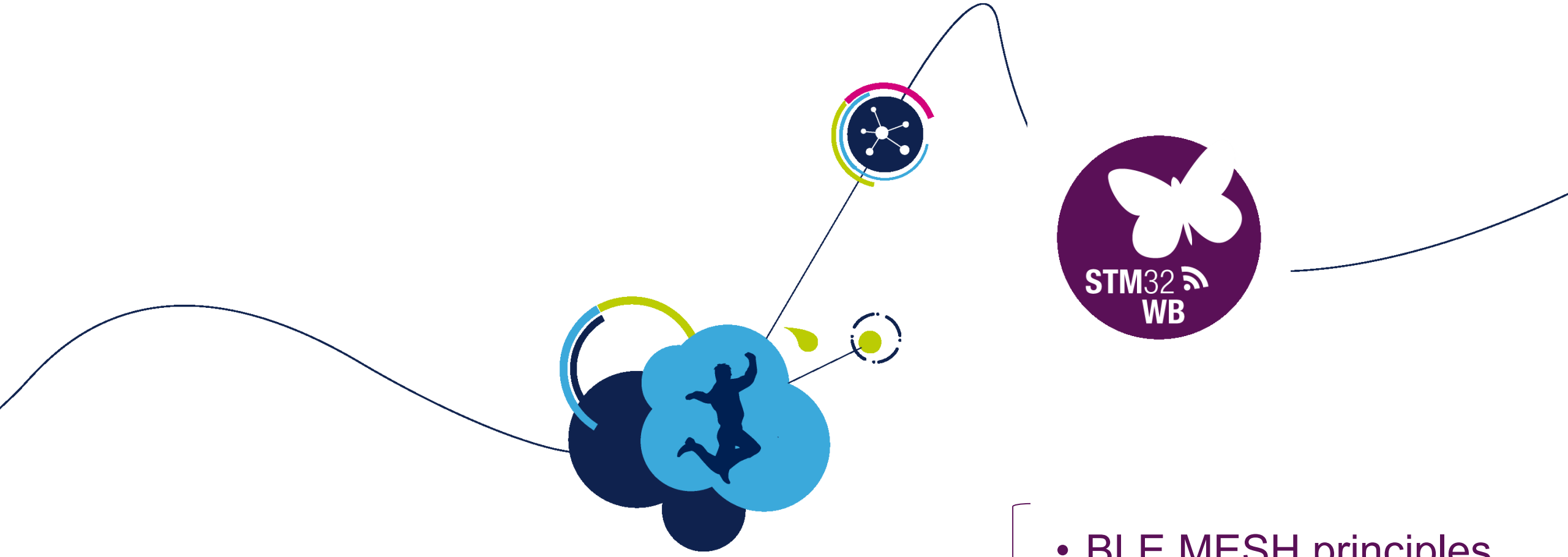
USART logs

- ST-LINK enumerates also as VCOM
- 115200 Baud/s
  No parity
  8 bits
- To better understand the flow observe the application LOGs in terminal window

```
[mesh.c][MESH_Init][152] BLE-Mesh Lighting Demo v1.09.000
[mesh.c][MESH_Init][153] BLE-Mesh Library v01.09.000
[mesh.c][MESH_Init][156] MAC Address = [80]:[e1]:[26]:[00]:[b6]:[f1]
```

Related documentations

- Application notes
  - AN5292 How to build a Bluetooth® Low Energy mesh application for STM32WBx5 microcontrollers



What we have learned?

- BLE MESH principles
- Hands on example