STR20 - STM32WB (BLE/Thread/Zigbee)

This course describe the STM32 WB architecture and practical examples

Objectives

- Understand dual-core WB: CM4 (app) + CM0+ (wireless coprocessor).
- Install/verify FUS and wireless stack images (BLE/Thread/Zigbee).
- Use IPCC/TL/ACI to drive the stack; handle events and errors.
- Build BLE GAP/GATT apps (services, security, notifications).
- Bring up Thread or Zigbee nodes (commissioning, messaging).
- Explore multiprotocol (BLE + 802.15.4) basics and constraints.
- Apply low-power with RF, measure impact, and set TX power.
- Prepare OTA/DFU, NVM/bonding data, and a production checklist.

Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- Practical activities
  - Practical activities represent from 40% to 50% of course duration.
  - Code examples, exercises and solutions
  - For remote trainings:
    - One Online Linux PC per trainee for the practical activities.
    - The trainer has access to trainees' Online PCs for technical and pedagogical assistance.
    - QEMU Emulated board or physical board connected to the online PC (depending on the course).
    - Some Labs may be completed between sessions and are checked by the trainer on the next session.
  - For face-to-face trainings:
    - One PC (Linux ou Windows) for the practical activities with, if appropriate, a target board.
    - One PC for two trainees when there are more than 6 trainees.
  - For onsite trainings:
    - An installation and test manual is provided to allow preinstallation of the needed software.
    - The trainer come with target boards if needed during the practical activities (and bring them back at the end of the course).
- Downloadable preconfigured virtual machine for post-course practical activities
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

Evaluation modalities

- The prerequisites indicated above are assessed before the training by the technical supervision of the traineein his company, or by the trainee himself in the exceptional case of an individual trainee.
- Trainee progress is assessed in two different ways, depending on the course:
  - For courses lending themselves to practical exercises, the results of the exercises are checked by the trainer while, if necessary, helping trainees to carry them out by providing additional details.

  - Quizzes are offered at the end of sections that do not include practical exercises to verifythat the trainees have assimilated the points presented
- At the end of the training, each trainee receives a certificate attesting that they have successfully completed the course.
  - In the event of a problem, discovered during the course, due to a lack of prerequisites by the trainee a different or additional training is offered to them, generally to reinforce their prerequisites,in agreement with their company manager if applicable.

Plan

Day 1

Dual-core & wireless stack overview

- CM4 app vs CM0+ network.
- FUS role and lifecycle.
- Stack images (BLE/Thread/Zigbee).
- Flash/NVM partitions.
- RF basics: SMPS/VDDPA/TX power.

Exercise: *Stack check*

Transport layers: IPCC / TL / ACI

- IPCC channels & mailboxes.
- TL scheduler & queues.
- ACI/SHCI command flow.
- Event callbacks pattern.
- Error & reset handling.

Exercise: *Event logger*

Project bring-up (CubeWB/CubeMX)

- Clocking for RF (HSE/LSE).
- GPIO/LED/Button/UART.
- BD_ADDR selection policy.
- Minimal main loop + TL task.
- Build & debug checklist.

Exercise: *App skeleton*

BLE basics: GAP/GATT

- Roles: peripheral/central.
- Advertising & scanning.
- GATT services/chars/UUIDs.
- CCCD & properties.
- Conn params (interval/latency).

Exercise: *Custom service*

BLE security & power

- Pairing/bonding basics.
- Passkey/Numeric compare.
- Privacy (RPA) overview.
- Adv interval vs current.
- TX power vs range.

Exercise: *Pair & measure*

Day 2

BLE notifications & throughput

- Notify vs indicate.
- ATT_MTU & data length.
- App buffer strategy.
- Flow control tips.
- Error stats & retries.

Exercise: *Notify demo*

BLE central role (scan/connect)

- Filtered scanning.
- Auto-connect policy.
- GATT client reads/writes.
- Service discovery.
- Multi-link notes.

Exercise: *Simple central*

802.15.4 & Thread (track A)

- PHY/MAC channels.
- OpenThread roles.
- Network dataset.
- CoAP/UDP quick use.
- Commissioning steps.

Exercise: *Thread pair*

Zigbee (track B)

- Coordinator/Router/EndDev.
- Clusters & endpoints.
- On/Off cluster basics.
- Binding/groups.
- Commissioning flow.

Exercise: *Zigbee on/off*

Multiprotocol overview

- Time-sliced scheduling.
- BLE + 802.15.4 co-exist.
- Radio timeslots & limits.
- NVM sharing & keys.
- Typical use cases.

Exercise: *Dual-role demo*

Day 3

OTA/DFU & FUS workflows

- App OTA over BLE.
- Image slots & versioning.
- FUS stack updates.
- Rollback basics.
- Failure recovery plan.

Exercise: *OTA update*

NVM, bonding & data model

- Bond store format.
- Keys & privacy data.
- App params in Flash.
- Wear considerations.
- Backup/erase policy.

Exercise: *Bond persist*

RF & hardware design notes

- Antenna types/keep-outs.
- Match network hints.
- Crystal accuracy (HSE/LSE).
- TX power/regulatory.

Exercise: *RSSI sweep*

Low-power with RF

- Sleep while RF runs.
- Stop/Standby limits.
- Wake sources & latencies.
- Adv/conn current trade-offs.
- Measurement method.

Exercise: *LP profiles*

Production checklist (wrap-up)

- Stack/FUS versions fixed.
- BD_ADDR policy set.
- Bond/NVM procedure.
- RF test/Tx power notes.
- App version/CRC tags.

Exercise: *Self-audit*

Renseignements pratiques

Inquiry : 3 days