STR7 - STM32 F4-Series implementation

This course covers STM32F405, STM32F407, STM32F415, STM32F417 ARM-based MCU family

Objectifs

- This course has 5 main objectives:
  - Describing the hardware implementation and highlighting the pitfalls
  - Describing the ARM Cortex-M4F core architecture
  - Becoming familiar with the IDE and low level programming
  - Describing the units which are interconnected to other modules, such as clocking, interrupt controller and DMA controller, because the boot program generally has to modify the setting of these units
  - Describing independent I/O modules and their drivers.
- Note that this course has been designed from the architecture of the most complex STM32 F4-series device, the STM32F417.
- Consequently, a chapter has been designed by Acsys for each possible integrated IP.
  - According to the actual reference chosen by the customer, some chapters may be removed.
- Products and services offered by ACSYS:
  - ACSYS is able to assist the customer by providing consultancies. Typical expertises are done during board bringup, hardware schematics review, software debugging, performance tuning.
  - ACSYS has also an expertise in FreeRTOS porting and uIP /LWIP stack or Interniche stack integration.

This document is necessary to tailor the course to specific customer needs and to define the exact schedule.

Prerequisites and related courses

- This course provides an overview of the ARM Cortex-M3 core. Our course reference RM2 - Cortex-M3 implementation course details the operation of this core.
- The following courses could be of interest:
  - USB Full Speed High Speed and USB On-The-Go, reference IP2 - USB 2.0course
  - Ethernet and switching, reference N1 - Ethernet and switchingcourse
  - IEEE1588, reference N2 - IEEE1588 - Precise Time Protocolcourse
  - CAN bus, reference IA1 - CAN buscourse
  - SD / MMC, reference IS2 - eMMC 5.0course

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.
- 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 by quizzes offered at the end of various sections to verify that 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

ARCHITECTURE OF STM32F4 MCUs

- ARM core based architecture
- Description of STM32F40X and STM32F41X SoC architecture
- Clarifying the internal data and instruction paths: AHB-lite interconnect, peripheral buses, AHB-to-APB bridges
- Private Peripheral Bus (PPB)
- Integrated memories
- SoC mapping

THE ARM CORTEX-M4F CORE

- V7-M core family
- Core architecture
- Programming
- Exception behavior, exception return
- Basic interrupt operation, micro-coded interrupt mechanism
- Floating Point unit and DSP instructions

BECOMING FAMILIAR WITH THE IDE

- Acsys covers 3 IDEs: Keil, IAR and GCC / Lauterbach
- Thus the customer has just to indicate which one he has chosen
- Getting started with the IDE
- Parameterizing the compiler / linker
- Creating a project from scratch
- C start program

PROGRAMMING AND DEBUGGING

- Debug interface
- Programming

RESET, POWER AND CLOCKING

- Power control
- Reset
- Clocking
- Low power modes

INTERNAL INTERCONNECT

- Bus matrix
- DMA

HARDWARE IMPLEMENTATION

- Power pins
- Pinout
- GPIO module
- System configuration controller
- External Interrupts

INTEGRATED MEMORIES

- Embedded flash memory
- Internal SRAMs

MEMORY INTERFACE

- SDIO
- Flexible Static Memory Controller

TIMERS

- Advanced-control timers TIM1 and TIM8
- General-purpose timers (TIM2 to TIM5)
- General-purpose timers (TIM9 to TIM14)
- Basic timers (TIM6 and TIM7)
- Real Time Clock
- Independent Watchdog
- Window Watchdog

ANALOG MODULES

- 12-bit Analog-to-Digital Converter and Programmable Gain Amplifier
- 12-bit Digital-to-Analog Converter

SECURITY AND INTEGRITY

- CRC calculation unit
- Random Number Generation
- Hash processor
- Cryptographic processor
- Device Electronic Signature

CONNECTIVITY AND COMMUNICATION

- SPI
- SPI in I2S mode
- UART
- I2C
- bxCAN modules
- USB FS
- USB HS
- Fast ethernet with IEEE1588
- ISO7816 smartcard interface

USER INTERFACES

- Digital camera interface

Renseignements pratiques

Duration : **4 days**
Cost : **2610 € HT**