

## AT3 - AT91RM9200 microcontroller implementation

This course covers AT91RM9200 ARM-based MCU family

### Objectives

- The course details the hardware implementation of the AT91RM9000.
- The ARM920T operation is detailed, particularly cache and MMU.
- The boot sequence and the clocking are explained.
- Practical labs on integrated peripherals are based on I/O functions provided by Atmel.
- The course provides examples of internal peripheral software drivers.
  
- Note that ACSYS does not sell emulation probes and IDEs. Consequently this course has not been designed to convince attendees to buy a particular IDE. The unique objective consists in providing sufficient knowledge to attendees so that they can successfully design a system based on AT91RM9200.
  
- This course has been delivered several times to companies developing embedded systems, such as medical equipments.
  
- Note that an additional day on Linux porting onto an AT91RM9200 board may be appended.

*A lot of programming examples have been developed by ACSYS to explain the boot sequence, the vector table and the operation of embedded peripherals.*

- *They have been developed with 2 different IDEs : Keil and IAR.*
- *Consequently for on site course, it is up to the customer to select the IDE under which labs will be run.*

*A more detailed course description is available on request at [formation@ac6-formation.com](mailto:formation@ac6-formation.com)*

### Prerequisites and related courses

- This course provides an overview of the ARM920T core. Our course reference cours [R1 - ARM7/9 implementation](#) details the operation of this core.
- The following courses could be of interest:
  - USB Full Speed High Speed and USB On-The-Go, reference cours [IP2 - USB 2.0](#)
  - Ethernet and switching, reference cours [N1 - Ethernet and switching](#)
  - CAN bus, reference cours [IA1 - CAN bus](#)

### Environnement du cours

- Cours théorique
  - Support de cours imprimé et au format PDF (en anglais).
  - Le formateur répond aux questions des stagiaires en direct pendant la formation et fournit une assistance technique et pédagogique.
- Au début de chaque demi-journée une période est réservée à une interaction avec les stagiaires pour s'assurer que le cours répond à leurs attentes et l'adapter si nécessaire

### Audience visée

- Tout ingénieur ou technicien en systèmes embarqués possédant les prérequis ci-dessus.

### Modalités d'évaluation

- Les prérequis indiqués ci-dessus sont évalués avant la formation par l'encadrement technique du stagiaire dans son entreprise, ou par le stagiaire lui-même dans le cas exceptionnel d'un stagiaire individuel.

- Les progrès des stagiaires sont évalués par des quizz proposés en fin des sections pour vérifier que les stagiaires ont assimilé les points présentés
- En fin de formation, une attestation et un certificat attestant que le stagiaire a suivi le cours avec succès.
  - En cas de problème dû à un manque de prérequis de la part du stagiaire, constaté lors de la formation, une formation différente ou complémentaire lui est proposée, en général pour conforter ses prérequis, en accord avec son responsable en entreprise le cas échéant.

## Plan

### INTRODUCTION TO AT91RM9200

#### Overview

- ARM core based architecture, AMBA buses
- The main three blocks : platform, core and input / output peripherals

### THE PROCESSOR CORE

#### THE ARM920T CORE

- Presentation of the core, architecture and programming model
- Operating modes : user, system, super, IRQ, FIQ, undef and abort
- ARM vs Thumb instruction sets, interworking
- Access to memory-mapped locations, addressing modes
- Stack management
- C-to-Assembly interface
- Exception mechanism, handler table
- MMU, format of page descriptor tables
- Cache operation
- Debug facilities

### PLATFORM

#### INFRASTRUCTURE

- Power supplies, internal regulator
- Power-on sequence
- Clock generator, on-chip oscillator, PLL
- Boot program
- Memory controller
- Internal high-speed flash
- External Bus Interface
- Power management controller
- Advanced interrupt controller
- Parallel input / output controller
- Peripheral DMA controller

### INTEGRATED I/Os

#### TIMERS

- Periodic Interval Timer
- Windowed Watchdog

- Real-time timer
- 3-channel timer / counter

## COMMUNICATION CONTROLLERS

- 2-wire interface
  - I2C protocol basics
  - Transmit and receive sequences
- SPI
  - Master / slave operation
  - External chip-select
  - Transfer sequence
- USART
  - Individual baud rate generators
  - IrDA modulation / demodulation
  - RS485 support
  - Flow control
- Synchronous Serial Controller
  - I2S analog interface support
  - Time Division Multiplexed support
  - High speed continuous data stream capabilities
- Ethernet MAC
  - Full duplex vs half duplex operation
  - Accessing PHY registers, auto-negotiation
  - Receive and Transmit buffer management, buffer descriptors
  - Incoming frame filtering
- USB device
  - Full speed operation
  - Endpoint configuration
- USB host
  - Overview of the OHCI specification
  - Understanding how USB packets are prepared and scheduled for transmission, transfer descriptor
- Multimedia Card Interface (on demand)
  - MMC and SD card basics
  - Command / response protocol
  - Read sequence
  - Write sequence
  - Related interrupts

## Renseignements pratiques

**Durée : 4 jours**  
**Prix : 1500 € HT**