



STR3 - STR91X implementation

This course covers STR9 ARM-based MCU family

Objectives

- The course details the hardware implementation of the STR91x microcontrollers.
- The boot sequence and the clocking are explained.
- The course focuses on the low level programming of the ARM966 CPU.
- Practical labs on integrated peripherals are based on I/O functions provided by ST.

- 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 STR9.

- This course has been delivered several times to companies developing embedded systems, such as industrial equipments.

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 training@ac6-training.com

Prerequisites and related courses

- This course provides an overview of the ARM966 core. Our course reference cours [R1 - ARM7/9 implementation](#) detail s 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 au format PDF (en anglais) et une version imprimée lors des sessions en présentiel
 - Cours dispensé via le système de visioconférence Teams (si à distance)
 - 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.

Plan du cours

INTRODUCTION TO STR91XF

Overview

- ARM core based architecture
- Features of AHB and APB buses
- The main three blocks : platform, core and input / output peripherals

THE PROCESSOR CORE

THE ARM966E-S CPU

- Operating modes : user, system, super, IRQ, FIQ, undef and abort
- Pipeline, calculation of the CPI
- Branch cache
- Clarifying the data path
- Tightly Coupled Memories
- ARM vs Thumb instruction sets, interworking
- Stack management
- Benefits of condition set capability in ARM state
- C-to-Assembly interface
- Exception mechanism, handler table
- Debug facilities

PLATFORM

INFRASTRUCTURE

- AHB/APB Bridges, split transactions, error handling
- Internal 96 KB SRAM,
- Flash memory
- Program and erase sequences
- VIC Interrupt controller
- Wake-up / interrupt unit
- System timers : Real Time Clock, Watchdog timer

HARDWARE IMPLEMENTATION

- Low voltage detectors
- Clocking
- Reset causes
- Start-up sequence, fetch of the first instruction
- Low power modes
- External Memory Interface
- I/O Ports

INTEGRATED I/Os

NON COMMUNICATION ORIENTED INPUT / OUTPUT PERIPHERALS

- Timers
 - Output compare and input capture capabilities, force compare modes
 - One pulse mode
 - Output PWM mode, on-the-fly modification of the duty cycle
 - Input PWM mode, pulse measurement
- DMA controller
 - Request priority management between the 16 channels
 - Scatter / gather operation, transfer descriptor chaining
 - Error management
- Analog-to-Digital Converter
 - One-shot or continuous conversion
 - Analog watchdog with interrupt generation
- 3-phase induction motor controller
 - Tacho counter operating modes
 - Rotor speed measurement
 - Dead time generator

COMMUNICATION CONTROLLERS

- I2C interface
 - I2C protocol basics
 - Slave mode vs master mode
 - Support for DMA
- Synchronous Serial Peripheral [SSP]
 - SPI protocol basics
 - Queue mode operation
 - Transfer sequence
- UART
 - Queue operation mode
 - Hardware flow control
 - IrDA mode
 - Support for DMA
- CAN controller
 - CAN protocol basics
 - CAN controller organization
 - Message objects
 - Filtering of received messages
 - FIFO mode management
- USB slave interface
 - USB protocol basics
 - Buffer description block, buffer descriptor table
 - DMA controller used to move data between buffers and EndPoints
 - Endpoint initialization
- Fast Ethernet controller
 - 802.3 MAC basics
 - Connection to the PHY : MII bus
 - Management interface, auto-negotiation
 - DMA controller operation
 - Frame filtering
 - VLAN support
 - Error management