FM4 - MPC5200 implementation

This course covers the MPC5200 NXP MCU

Objectives

- The course explains how to design a MPC5200 board.
- DDR SDRAM operation is described in order to understand the memory controller programming.
- The 603e core is studied in detail, especially the MMU.
- The course provides examples of internal peripherals software drivers.
- Fast Ethernet controller is viewed in detail.
- The training highlights data paths between PCI and DDR SDRAM.

- This course has been delivered several times to companies developing embedded multimedia equipments.

A lot of programming examples have been developed by ACSYS to explain the boot sequence and the operation of complex peripherals, such as BestComm and Fast Ethernet.

- *They have been developed with Diab Data compiler and are executed under Lauterbach debugger.*

A more detailed course description is available on request at training@ac6-training.com

Prerequisites and related courses

- Experience of a 32-bit processor or DSP is mandatory.
- The following courses could be of interest:
  - Ethernet and switching, reference cours N1 - Ethernet and switching
  - PCI, reference cours IC1 - PCI 3.0
  - USB Full Speed High Speed and USB On-The-Go, reference cours IP2 - USB 2.0

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.

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 MPC5200

Overview

- Innovative IO subsystem
- Dual external bus architecture : SDRAM bus and LocalPlus bus
- Bestcomm features
- Memory map, internal register space

PROCESSOR CORE

603e CORE

- 603e pipeline
- Branch management : static prediction
- Guarded memory
- 603e L1 cache : LRU algorithm, HID0 programming interface
- Software L1 data cache flush
- Cache coherency basics
- JTAG debugger, hardware breakpoint vs software breakpoints
- Branch instructions
- The system call communication path between applications and RTOS
- FPU operation
- The EABI
- Code and data sections, small data areas benefits
- Cache related instructions
- PowerPC timers : TB and DEC
- MMU goals
- The PowerPC address processing
- WIMG attributes definition, page and block access rights definition
- Process protection through VSID selection
- TLB organization, TLB software management
- MMU implementation in real-time sensitive applications
- Exception management
- Requirements to support exception nesting

PLATFORM

SYSTEM INTEGRATION UNIT

- Interrupt Controller routing scheme
- General purpose IO, pin multiplexing
- General purpose Timers
- Slice timers, generation of periodic interrupts
- · Real-Time Clock

HARDWARE IMPLEMENTATION

- Reset configuration
- Clock domains
- Power management
- DDR SDRAM basics

- The DDR SDRAM controller, pinout
- Power-up initialisation, use of the I2C interface
- Initialization of memory controller registers according to a micron DDR SDRAM devices
- External bus interface, modes of operation muxed or non muxed
- Connection to ATA and PCI compliant devices as well as memory-mapped devices
- Chip select programming
- Dynamic bus sizing
- DMA interface
- XLB arbiter, prioritisation, bus grant mechanism

BESTCOMM

- SmartDMA modules, local buffer memory
- Servicing many data streams with individual latency and processing requirements
- Chaining scatter / gather capability
- Task descriptor table
- Function descriptor table

PCI CONTROLLER

- Supported clock ratios
- PCI commands supported as a target and as a master
- XL bus initiator interface
- Endian translation
- XL bus target interface
- Multi-channel DMA transmit interface
- Multi-channel DMA receive interface
- Access to the configuration space
- Programming of inbound and outbound windows
- PCI agent vs PCI host operation mode

INTEGRATED I/Os

USB CONTROLLER

- Data transfer types
- Host Controller interface
- OHCI specification, communication channels
- Root hub partition

CAN CONTROLLER

- The MSCAN controllers, clock system
- Message buffers structure
- ID bit masking
- Arbitration
- Timing and synchronization
- Error management
- Interrupt driven operation

SPI CONTROLLER

- Baud rate selection, transfer delays
- Double-buffered operation
- Transmit and receive sequences

ATA CONTROLLER

- Asynchronous ATA basics, overview of ATA standards

- ATA host controller operation
- Signals and connections
- Sector addressing
- Ultra DMA protocol

FAST ETHERNET CONTROLLER

- MII transfers
- FIFO interface
- Address recognition
- Full and half duplex operation
- Initialization sequence
- MIB block counters

PROGRAMMABLE SERIAL CONTROLLERS

- PSC in UART mode
- PSC in Codec mode
- PSC in AC97 mode
- PSC in Infrared SIR, MIR or FIR mode
- FIFO system

I2C CONTROLLER

- I2C protocol basics
- Transfer timing diagrams, SCL and SDA pins
- Clock synchronization and arbitration
- Transmit and receive sequences

Renseignements pratiques

Renseignements : 5 jours