FCC1 - e500mc implementation

This course covers the e500mc core present in 32-bit QorIQ SoCs

Objectives

- This course provides a detailed description of the e500mc internal architecture as well as the associated low level routines.
- Coherency mechanisms required in multiple e500mc platforms are explained through sequences.
- All mechanisms required in a multiple core system are described: atomic sequence through lwarx/stwxc. instruction pair, doorbell interrupts.
- The course focuses on the benefits of the hypervisor: running several operating systems, partitioning, load balancing and virtualization.
- The operation of the MMU is studied, particularly the TLB software reload routines.
- The course details the interrupt proxy unit and provides guidelines to implement nesting.
- Note that for on-site course, the contents can be tailored to specific customer needs.

- This course has been designed in collaboration with NXP

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

Prerequisites

- Experience of a 32-bit processor or DSP is mandatory.

Exercise: *The environment used to build and debug software labs are based on the GNU compiler / linker and the debugger from Lauterbach*

Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version.
  - 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

CORE ARCHITECTURE

- Block diagram
- CoreNet interface
- Highlighting differences between e500 and e500mc

HYPERVISOR

- Privilege levels: user, guest supervisor, hypervisor
- Logical partition
- Hypervisor call instruction
- Bare-metal operation

PIPELINE

- e500mc pipeline implementation
- Issue queue resource requirements
- Execution model
- Branch management: dynamic prediction
- Guarded memory

INTERNAL DATA / INSTRUCTION PATHS

- L1 and L2 cache loading, hit under miss, miss under miss
- The load miss queue
- The store miss merging mechanism
- Clarifying the difference between msync and lwsync

e500mc USER LEVEL PROGRAMMING

- Implementing atomic sequences in multiple core systems, mdors instruction
- Decorated load and store instructions
- Integer arithmetic and logic instructions
- FPU operation : FPSCR register, IEEE vs non-IEEE mode
- Float load / store instructions
- Float arithmetic instructions
- Convert instructions
- The EABI

SUPERVISOR / HYPERVISOR LEVEL PROGRAMMING

- Accessing special registers, understanding the required synchronizations
- Implementing low power modes, wait instruction
- Core timers

THE EXCEPTION MECHANISM

- Exception management: building the handler table through IVPR,IVOR registers
- Finding the exact exception cause through syndrome registers
- New machine check features
- Interrupt proxy
- Doorbell interrupts

THE MEMORY MANAGEMENT UNIT

- 4 GB effective address space, 64 GB real address space

- Address translation, understanding the interim 48-bit virtual address
- WIMGE attributes
- Two-level MMU architecture
- Software TLB reload
- Managing a page descriptor table in a SMP system
- Virtualization fault
- External PID load and store instructions

L1 AND L2 CACHES, SNOOPING

- Cache basics
- L1 data cache flush
- L2 cache organization
- Cache coherency basics
- The MESI L1 data line states
- MESI snooping sequences involving two e500mc and a PCI Express master
- Cache-to-cache transactions
- Cache related instructions
- Cache entry locking
- Stashing capability
- L1 and L2 error checking and correction, L2 cache error injection
- Write shadow mode

DEBUG

- Performance monitor
- Nexus debug unit
- Instruction and data breakpoints
- Debug data acquisition message

Renseignements pratiques

Duration : 3 days
Cost : 1650 € HT