

## MPC 8641D IMPLEMENTATION

Ref : 003771A

Duration : 5 days

### OBJECTIVES

- The course clarifies the architecture of the MPC8641D, particularly the operation of the coherency module that interconnects the e600s to memory and high-speed interfaces
- Cache coherency protocol is introduced in increasing depth
- The e600 core is viewed in detail, especially the AltiVec units that enable vector processing
- The boot sequence and the clocking are explained
- The course focuses on the hardware implementation of the MPC8641D
- A long introduction to DDR SDRAM operation is done before studying the DDR SDRAM controller
- An in-depth description of the RapidIO port and the PCI-Express port is done
- The course highlights both hardware and software implementation of gigabit / fast / Ethernet controllers

### RELATED COURSES

- C language for Embedded Applications (reference 002603A)
- Gigabit Ethernet (reference 003367A)
- RapidIO (reference 002602A)
- PCI Express (reference 003279A)
- Note that MVD can tailor the course to your needs by mixing a processor course and high speed bus courses

Next sessions, see : <http://www.mvd-fpga.com/en/formationsCalend.html>

### PREREQUISITES

- Experience of a 32-bit processor or DSP is recommended
- Knowledge of the RapidIO and PCI Express bus is recommended

### PARTNERS

- This training course is approved by FREESCALE

**WIND RIVER****NeoMore**

### Contact

Tel : 05 62 13 52 32  
Fax : 05 61 06 72 60  
[training@mvd-fpga.com](mailto:training@mvd-fpga.com)

Course also available  
customized

### TOPICS

#### MPC 8641D OVERVIEW

- e600 core, usage of a dual core device
- Coherency Module
- Examples of data flow through the MPC8641D
- Address map, local access windows
- Outbound and inbound address translation windows

#### e600 CORE

##### PIPELINE

- Pipeline basics
- Introduction to e600 pipeline
- e600 pipeline implementation
- Execution serialization, purpose of the isync instruction
- Branch management
- Guarded memory
- Coding guidelines
- Performance monitor

#### INTERNAL DATA FLOWS

- L1 and L2 cache loading, hit under miss
- The MSS [Memory Sub System]
- The load fold queue
- The store miss merging advantage when several vectors must be stored
- The BIU [Bus Interface Unit]
- Purpose of sync and eieio instructions

#### L1 AND L2 CACHES

- Cache basics
- e600 L1 cache : PLRU algorithm, HID0/ICTRL programming interface, way locking
- Hardware vs software L1 data cache flush
- Transient load instructions benefits
- L2 cache organization
- L2 replacement algorithm selection, L2 locking

- Cache coherency basics
- MESI snooping sequences involving 2 e600s and a PCI Express master

#### e600 PROGRAMMING

- User and supervisor registers
- The system call communication path between applications and RTOS
- Integer load / store instructions, boolean semaphore management
- IEEE754 basics
- FPU operation : FPSCR register, IEEE vs non-IEEE mode
- The EABI
- Code and data sections, small data areas benefits

#### ALTIVEC

- AltiVec introduction, SIMD processing
- Intra vs inter element instructions
- AltiVec registers, VSCR initialization
- ANSI C extension to support vector operators, new C types, new castings, vector declaration and initialization
- AltiVec implementation on the e600 : the VALU and the VPU execution units
- Data streams management
- EABI extension to support AltiVec

#### THE MEMORY MANAGEMENT UNIT

- MMU goals
- Enabling 4 additional BATs
- 32-bit or 36-bit real address size selection
- WIMG attributes definition, page and block access rights definition
- Page protection through VSID selection
- TLB organization, TLB software management
- Page translation : PTEG selection, tablesearch, PTE content
- Software vs hardware TLB reload
- MMU implementation in real-time sensitive applications

**THE EXCEPTION MECHANISM**

- Exception state saving and restoring through SRR0/SRR1 registers
- Exception management
- Recoverable vs non recoverable interrupts
- Requirements to support exception nesting
- Performance monitor

**MPC 8641D INFRASTRUCTURE****RESET AND CLOCKING**

- Platform clock
- RapidIO transmit clock source selection
- Power-on reset sequence, use of the I2C interface to access a serial ROM
- Power-on reset configuration
- Boot page translation

**MPX COHERENCY MODULE**

- I/O arbiter
- MPX arbiter
- Transaction queue
- Global data multiplexor
- MPX interface

**MULTIPROCESSOR PERIPHERAL INTERRUPT CONTROLLER**

- Open PIC architecture compatibility
- Interrupt nesting
- Description of the 4 timers / counters
- Message interrupts
- e600-to-e600 interrupt capability

**DDR-SDRAM MEMORY CONTROLLER**

- DDR2 operation
- Command truth table
- Hardware interface
- Refresh types
- Bank activation, read, write and precharge timing diagrams, page mode
- ECC error correction
- Introduction to the DDR-SDRAM controller
- Initial configuration following Power-on-Reset
- Address decode
- Timing parameters programming
- FCRAM interface commands

**LOCAL BUS CONTROLLER**

- Multiplexed 32-bit address and data transfers
- Burst support

**DOCUMENTATION**

- Training manuals will be given to attendees during training in print.

- Dynamic bus sizing
- GPCM, UPMs and SDR SDRAM states machines

**INTEGRATED DMA CONTROLLER**

- Priority between the 4 channels
- Support for cascading descriptor chains
- Scatter / gathering
- Selectable hardware enforced coherency
- Ability to start DMA from external 3-pin interface

**PCI EXPRESS INTERFACE**

- Modes of operation, Root Complex / Endpoint
- Byte swapping
- Transaction ordering rules
- Programming inbound and outbound ATMUs
- Configuration, initialization

**PERFORMANCE MONITOR AND DEBUG FEATURES**

- Event counting
- Threshold events
- Watchpoint facility
- Trace buffer

**MPC 8641D IMPLEMENTATION****THE ETHERNET CONTROLLERS**

- 802.3 specification fundamentals : the 3 layers PHY, MAC and control
- Frame format with and without VLAN option
- Address recognition, pattern matching
- Buffer descriptors management
- The enhanced three-speed Ethernet controllers (eTSECs)
- Physical interfaces : GMII, MII, TBI or RGMII
- Buffer descriptor management
- Layer 2 acceleration accept or reject on address or pattern match
- 256-entry hash table for unicast and multicast
- IPv4, TCP and UDP checksum verification and generation
- Quality of service support

**I2C CONTROLLERS**

- I2C protocol fundamentals : addressing, multimaster operation
- Transmit and receive sequence

**SERIAL INTERFACE**

- Introduction to UART protocol
- Description of the NS16450/16550 compliant Uarts
- Flow control signal management