



## PC1 - PPC750CXe/FX/FM/GX/GL implementation

**This course covers the IBM Power 750CXe, 750FX, 750FM, 750GX and 750GL Power G3 CPUs**

### Objectives

- A focus is done on the PowerPC EABI which is fundamental when C programs are to be interfaced with assembly routines.
- The pipeline is viewed in detail in order to infer instructions scheduling guidelines.
- Many Diab Data PowerPC specific compiler options are studied.
- A flush routine is used to explain data flows between L1 data cache, L2 cache and SDRAM main memory.
- The course details the segmentation / pagination mechanism used to protect process.
- A generic exception handler is described.
- The hardware implementation is also covered.
- The course emphasizes differences between 750CXe, 750FX and 750GX.
  
- This training has been delivered several times to companies developing avionics and defence equipments.
- ACSYS also offers trainings on Marvell Discovery host bridges that can be used as companion chips for IBM G3 CPUs.

*Labs are compiled with Diab Data compiler and run under Lauterbach Trace32 debugger.*

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

### Prerequisites

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

### Plan

#### THE INSTRUCTION PIPELINE

- 750 implementation : superscalar operation, out-of-order execution, register renaming, serializations, isync instruction
- Branch processing unit : BTIC, guarded memory
- Branch instructions
- Coding guidelines

#### DATA PATHS

- Load / store architecture
- Data path between L1 and L2
- Load / store buffers
- Sync and eieio instructions

- Store gathering mechanism

## CACHES

- Cache basics
- L1 caches : PLRU algorithm
- Miss under miss operation
- Shared resource management
- Cache coherency mechanism, snooping, related signals
- The MEI state machine
- Management of cache enabled pages shared with PCI DMAs
- Reservation coherency
- Cache related instructions
- Cache flush routine
- The L2 cache, organization, replacement algorithm
- L2 cache locking by way (750FX/FL, 750GX/GL)

## SOFTWARE IMPLEMENTATION

- PowerPC architecture specification, the 3 books UISA, VEA and OEA
- Addressing modes
- Integer instructions
- IEEE754 basics, floating points numbers encoding
- Floating point arithmetical instructions
- Improvements implemented in the 750FX/FL/GX/GL : additional reservation station and quicker reciprocal estimates
- The PowerPC EABI
- Linking an application with Diab Data

## THE MMU

- Thread vs process
- Introduction to real, block and segmentation / pagination translations
- Memory attributes and access rights definition
- Virtual space benefit, page protection through segmentation
- TLBs organization
- Segmentation : process ID definition
- Pagination : PTE table organization
- Explanation of hash value and API field
- MMU implementation in real-time sensitive applications

## THE EXCEPTION MECHANISM

- Save / restore registers SRR0/SRR1, rfi instruction
- Exception management mechanism
- Requirements to allow exception nesting
- PowerPC timers TB and DEC

## HARDWARE IMPLEMENTATION

- Hreset vs Sreset
- Clocking
- Bus operation
- Address phase
- Data phase
- Address decode logic design
- Timing analysis
- Minimal implementation

- Low power modes
- Power, dual PLLs for seamless frequency switching (750FX/FL, 750GX/GL)

## THE PERFORMANCE MONITOR

- Objectives of the performance monitor
- Event counting
- Programming interface

## THE DEBUG PORT

- JTAG emulation
- Real time trace requirements
- Code instrumentation
- Hardware breakpoints

## Renseignements pratiques

**Duration : 5 days**  
**Cost : 2100 € HT**

