



## IC6 - HyperTransport 3.0

**This course covers the HyperTransport 3.0 high-speed interconnect**

### Objectives

- Point-to-point interconnect benefits compared to shared busses are highlighted
- The hardware implementation is described
- The course focuses on the packet ordering rules
- The course describes the discovery sequence required to initialize the HyperTransport chain

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

### Prerequisites

- Experience of a high speed digital bus.

### Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - 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 trainee in 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

### OVERVIEW

- Topology of a HyperTransport based board : cavern devices, tunnel devices and bridges
- Point-to-point interconnect approach
- Benefits of HyperTransport in comparison with PCI
- Key features of HyperTransport protocol

## THE HARDWARE INTERFACE

- LVDS differential pairs
- Double Data Rate clocking
- Signal groups
- Impedance requirements
- Link transfer timing characteristics
- Detailed transfer timing budget
- FIFO sizing

## LINK INITIALIZATION

- PWROK and RESET# shared signals
- IO chain initialization, finding the firmware ROM
- Scalable performance
- Determination of the link width
- Link frequency initialization

## PACKET STRUCTURE

- Control packets : Request, Response and Information
- Objective of the Flush and Fence packets
- Data packets

## TRANSFER PROTOCOL

- Objectives of ordering rules
- IO streams, host ordering requirements, downstream IO ordering
- Virtual channels

## FLOW CONTROL MECHANISM

- Use of NOP packets
- Insertion of information packets within data packets
- Initialization and use of the counters

## TRANSACTION EXAMPLES

- Routing packets
- Addressing, memory mapping
- Transfer of a Read Request packet and associated Read Response packet
- Transfer of a Posted Write packet
- Transfer of a broadcast packet
- Transfer of Flush and Fence packets
- Boolean semaphore management

## CONFIGURATION ACCESSES

- Configuration type cycles, what is new compared to PCI
- The HyperTransport structure present in the capability list
- Use of these registers by the configuration software
- System management, command mapping, special cycles
- Interrupt management

## DOUBLE-HOSTED CHAINS

- Sharing double-hosted chain vs Non-Sharing double-hosted chains
- Breaking the chain through software in the Non-sharing case

**POWER MANAGEMENT**

- Reporting power management events to the host bridge
- Signalling wakeup
- Determination of upstream and downstream directions

**ERROR DETECTION AND HANDLING**

- CRC calculated over 512 bit-times on link, CRC window
- Error conditions
- Error reporting
- Sync flooding

**ISOCRONOUS TRAFFIC**

- Requirements for devices when they support isochronous packets
- Isochronous flow control

**THE EIGHTH-GENERATION OPTERON PROCESSOR FROM AMD**

- Integration of a DDR-SDRAM controller
- Building a SMP platform through HyperTransport links
- HyperTransport PCI-X tunnel
- HyperTransport IO hub cave

**TEST OF A HYPERTRANSPORT PLATFORM**

- Value provided by adding a connector into the design
- Check lists for electrical and protocol compliance
- PCB design considerations
- Benefits of analysis probe through the FuturePlus solution

**Renseignements pratiques**

**Duration : 2 days**

**Cost : 1350 € HT**