



## IP1 - FireWire

*This course covers IEEE1394, IEEE1394a, IEEE1394b and DV specification*

### Objectives

- Differential transmission advantages are highlighted.
- The course explains the bus initialization process.
- Packet format and subaction transactions are described with the assistance of the Lecroy FireInspector
- 1394a arbitration enhancements are emphasized.
- The course describes the new 1394b beta signalling.
- After having introduced digital camera fundamentals, isochronous traffic is analysed.
- The OHCI specification and especially the management of transfer descriptors is also handled in this course.

A Lecroy FireWire analyser was used to capture and display FireWire traffic.

- A lot of traces are included in the material.

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

### Prerequisites

- Experience of a digital bus is mandatory.

### 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.

## Course Outline

### 1394-1995 OVERVIEW

- Bus creation and history
- 1394 bus architecture
- Technical introduction : time-slicing
- Support of asynchronous and isochronous transactions
- Protocols stack : AVC, SBP-2, 1883, HAVI, IP

### LAYER MODEL

- Unified transactions
- The transaction layer
- The link layer
- The physical layer

- The management layer
- Protocol implementation, highlighting the separation between software and hardware domains

## **HARDWARE IMPLEMENTATION**

- LVDS technology basics
- Data and strobe encoding
- Line states for arbitration, configuration and reset
- Decoding rules
- Idle bus delays to enable arbitration requests : the gaps
- Power Classes
- Suspend / Resume mechanism

## **SOFTWARE INTERFACE**

- IEEE1212 address definition and node mapping
- Link layer Control & Status Registers
- Link layer configuration ROM organization
- PHY layer registers
- TI 12LV22 programming interface to access local PHY registers

## **BUS INITIALIZATION**

- Reset causes
- Initialization steps
- Tree building, contention resolution
- Self-ID process, Self-ID packet format
- Software configuration : cycle master enabling, IRM identification, Bus Manager select

## **1394/1394a ARBITRATION**

- Geographic priority
- Arbitration for asynchronous transfers
- Arbitration for synchronous transfers
- Inefficiency of gaps when data rate increases
- 1394a optimizations : accelerated and fly-by arbitrations

## **ASYNCHRONOUS TRANSACTIONS**

- Read and Write REQ/RESP packet format
- Resource locking
- Retry goals
- Single-phase retry
- Transaction errors management

## **1394-BASED DIGITAL CAMERA SPECIFICATION**

- Digital camera control command registers
- Camera initialize register
- Isochronous packet format for VGA non compressed format (Format\_0)
- Video data payload structure

## **ISOCRONOUS TRANSACTIONS**

- Talker and listeners
- Channel number and bandwidth allocation
- Real time data flows requirements
- Packet format

## PHY-LINK INTERFACE

- Pinout
- PHY register access
- Status information transmission from PHY to Link
- Packet transmission timing diagram
- Packet receipt timing diagram

## 1394b OVERVIEW

- New transmission media
- Bilingual ports
- Compatibility with 1394/1394a specifications

## BETA SIGNALLING

- Optic transmission fundamentals
- Full duplex communication
- Scrambler / Descrambler operation
- Benefits of 8b/10b encoding
- Training sequence

## 1394b ARBITRATION

- Symbol use instead of gaps
- Bus requests pipelining, arbitration phases
- Arbitration in a hybrid tree including DS ports and Beta ports

## CONNECTION MANAGEMENT

- Tones usage
- Auto-negotiation
- Standby / Restore mechanism
- Loop removing

## 1394b PHY-LINK INTERFACE

- Enhancement of the 1394a PHY-LINK interface to support S800
- New PIL-FOP interface to support higher data rates
- Point-to-point packet protocol between the PIL and the FOP

## OPEN HOST CONTROLLER INTERFACE

- SelfID receive
- Asynchronous transmit DMA
- Asynchronous receive DMA
- Isochronous transmit DMA
- Isochronous receive DMA
- Physical requests
- Error management