



## **N1 - Ethernet and switching**

**This course covers both IEEE802.3 (10, 100, 1000 Mbps) and IEEE802.1D/802.1Q**

### **Objectives**

- The course covers the following standards: 10BASE-T, 100BASE-TX, 1000BASE-X, 1000BASE-T and 1000BASE-KX.
- An architectural view of an Ethernet network is provided, highlighting the differences between repeaters, switches and routers.
- The Synopsys MAC is studied as an implementation example of a MAC.
- The course explains how the spanning tree algorithm works.
- Quality of Service through the VLAN tag is explained.
- The course details the operation of the PHY-to-MAC bus and the management interface.
- The course describes the transmission protocol according to the medium.
- Layer 3 and 4 TCP-UDP/IP protocols are studied through packet capture.
- Ethernet related standards, such as PoE and EEE are included in this course.
  
- Note that AC6 offers a separate course on 10G Ethernet.
  
- This course has been delivered several times to companies implementing Ethernet in embedded systems, such as defense systems, railway equipments and avionics systems.

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

### **Plan**

#### ***Introduction to Ethernet***

- Protocol layers
- Topology, equipments: hub, switch and router
- Collisions, backoff algorithm
- Flow control mechanisms (back pressure and pause packet)

#### ***MAC Layer***

- Ethernet frame
- Addressing
- Transmit and receive errors detected by the MAC layers
- Description of Synopsys Ethernet IP

#### ***Management Layer***

- RMON registers

- Simple Network Management Protocol

### **10 Mbps Networks**

- Differential mode transmission
- AUI operation, differential Manchester coding
- 10Base-T
- Repeater

### **100 Mbps Networks**

- Media Independent Interface
- Clause 22 and Clause 45 interfaces
- 4b/5b coding
- Scrambling
- 100Base-TX, MLT-3 modulation
- Auto-negotiation

### **1000 Mbps Networks**

- Medium types
- Gigabit Media Independent Interface

#### **1000Base-T**

- Convolutional encoder
- Trellis, Viterbi decoder
- 4D-PAM5, constellations
- PMA layer, PAM-5 modulation,
- Electrical interface, testing transmitter and receiver

#### **1000Base-X**

- PCS layer
- Scrambling
- PMA layer
- Auto-negotiation

### **Power over Ethernet**

- Operation
- Protocol
- Software aspects

### **Precision Time Protocol**

- PTP summary
- PTP in the Ethernet MAC layer
- PTP in switches

### **Switch Operation, 802.1D and 802.1Q**

- Switch architecture
- Filtering services
- Spanning tree
- Rapid Spanning Tree Protocol
- Management protocol

- Port mirroring
- Multiple Spanning Tree Protocol
- Frame tagging
- Quality of Service

### **Introduction to TCP/IP**

- The TCP/IP protocol stack
- IP
- ARP
- RARP
- ICMP
- UDP
- TCP
- DOS/UNIX TCP/IP commands

### **Energy Efficient Ethernet**

- Studying the sequence to enter LPI
- Studying the wake-up sequence

## **Renseignements pratiques**

**Duration : 4 days**  
**Cost : 2270 € HT**