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

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 traineein 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

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 : 2490 € HT