ac6

IS4 - Universal Flash Storage (UFS 2.0)

This course covers UFS 2.0 , which is the enhanced version of MMC standard

OBJECTIVES

- This course explains how SCSI commands are transported over UFS.
- The hardware layer is detailed, including the analog part.
- Using UniPro as a tunnel to transport upper protocols.
- The course explains how command can be queued, enabling multi-threading.
- The course describes the low power modes.
- Secure aspects, such as secure erase and authenticated transfers are explained.
- The UFS Host Controller Interface is also covered.

A more detailed course description is available on request at training@ac6-training.com

Prerequisites

- Experience of mass-storage interface, such as SD/MMC, USB mass storage class or SATA is recommended.

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

- Objectives of UFS specification, relationship with MIPI
- Universal SCSI command set, transport over UFS
- Layered specification
- System model, definition of what is a Logical Unit
- Comparing UFS with MMC, highlighting the differences

M-PHY

- Architecture and operation
- Termination scheme
- Signaling schemes
- Pulse Width Modulation
- Embedding clock into the bitstream, 8b10b coding
- Control symbols
- DC-balancing, running disparity
- PHY state definition
- Transitions between states
- HS-MODE BURST Operation
- Bidirectional SYS-BURST Clocking
- Multilane Operation
- Test modes
- Electrical characteristics, eye-diagrams
- UFS requirements regarding M-PHY attributes

UNIPRO

- Overview of UNIPRO layered protocol
- UNIPRO LINK LAYER
- UNIPRO NETWORK LAYER
- UNIPRO TRANSPORT LAYER

UFS INTERCONNECT

- Clock, reset and power supplies
- Reset, power-up and power-down sequences
- Power modes, relationship with Link power states
- Logical Unit reset

UFS TRANSPORT PROTOCOL (UTP)

- UPIU generic format
- Data pacing on write transactions
- UCS related UPIUs
- Task management related UPIUs
- Query related UPIUs

SCSI COMMANDS

- Command Descriptor Block
- Detailing the INQUIRY Command
- Managing a Block cache in the device
- Detailing the REQUEST_SENSE Command
- Detailing the READ_CAPACITY Command
- READ, WRITE and PRE-FETCH Commands

- SYNCHRONIZE_CACHE Command
- Sequence to write data and verify them
- VERIFY Command
- Thin provisioning, logical block address space vs physical block address space
- UNMAP Command
- FORMAT_UNIT Command

SECURITY

- Secure mode, secure removal, Purge operation
- Device data protection
- Replay Protected Memory Block
- Security protocol commands
- Authenticated read and write sequences

UFS FUNCTIONAL DESCRIPTION

- Data transfer rules with RTT
- Boot Logical Units operation
- Logical Unit management
- Logical block provisioning
- Host device interaction
- Background operation mode
- Dynamic device capability
- Data reliability
- Context management
- System data tag mechanism
- Reporting exception events to the host

UFS DESCRIPTORS

- Descriptor, attributes and flags
- Enumeration
- Accessing descriptors

HOST CONTROLLER INTERFACE

- UTMRD list
- UTRD list, UTP transfer request descriptor, UTP command descriptor
- Implementing DMA transfer through Physical Region Descriptor Table
- UniPro / M-PHY software interface, UIC command
- Interrupt management, aggregation

Renseignements pratiques

Inquiry : 3 days