In Depth Exploration of Serial SCSI

Solution Technology

In-depth Exploration of Serial Attach SCSI (SAS)

This course provides students with a comprehensive insight into the operation of the Serial Attached SCSI interface. It explores in detail the operation of Serial Attached SCSI at all architectural levels, from details of signaling and cabling, right up to mode pages and expander addressing. The class concludes with a study of new application areas in which Serial SCSI will be deployed. Protocol analyzer traces are used as an aid to understanding.

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Introduction
Parallel SCSI Overview:
• Physical Interface, Protocol, and Command Language
• SCSI-3 Architectural Model
Architecture:
• Physical links and phys
• Ports (narrow and wide ports)
• SAS devices: Initiators, Targets, and Expanders
• Domains
• Expander device topologies
• Connections and Pathways
Names and identifiers:
• SAS addresses
• Port names and identifiers
• Phy identifier
• State machines
• Transmit data path
• Resets
• Expander device model

Physical layer
SATA and SAS cables and connectors
Backplanes
Driver and receiver electrical characteristics
Eye masks
Transmitted & Received signal characteristics
Jitter & Jitter tolerance
Impedance specifications
Electrical TxRx connections
Driver & Receiver characteristics

Phy layer
Encoding (8b10b)
Character encoding and decoding
Out of band (OOB) signals
Phy reset sequences
SAS phy (SP) state machine
SAS phy dword synchronization (DWS) state machine
Spin-up

Link layer
Primitives overview and summary
Primitive sequences
SAS, SSP, and STP primitives
CRC
Scrambling
Address frames
Fanout expander device specific rules
Power management
Connections
Arbitration fairness
Expander devices and connection requests
Abandoning, Breaking, and Closing connection requests
SAS link layer state machine for initiator phys and target phys (SL)
SAS link layer state machine for expander phys (XL)
Error handling
Rate matching
SSP link layer:
• Opening an SSP connection
• SSP frame transmission and flow control
• Closing an SSP connection
• SSP link layer (SSP) state machines
STP link layer:
• STP frame transmission and flow control
• Closing an STP connection
• STP link layer (STP) state machines
SMP link layer:
• SMP frame transmission and flow control
• Closing an SMP connection
• SMP link layer (SMP) state machines

Transport layer
SSP transport layer
SSP frame format
Information units:
COMMAND, TASK, DATA, XFER_RDY, and RESPONSE
Frame sequences:
COMMAND, TASK, DATA XFER_RDY, and RESPONSE frame rules
SSP transport layer handling of link layer errors
SSP transport layer error handling
SSP transport layer state machines
transport layer state machines
STP transport layer:
• SATA tunneling
• STP transport layer (TT) state machines
SMP transport layer:
• SMP_REQUEST frame
• SMP_RESPONSE frame
• SMP transport layer state machines
• Initiator, Expander, and target device state machines

Application layer
SCSI application layer:
• SCSI mode parameters
• Protocol-Specific Port mode page
• Protocol-Specific Logical Unit mode page
• SCSI log parameters
• SCSI commands
• ATA application layer
Management application layer
SMP functions:
REPORT GENERAL
REPORT SATACA PABILITIES
REPORT MANUFACTURER INFORMATION,
REPORT ROUTE INFORMATION DISCOVER
REPORT PHY ERROR LOG
REPORT PHY SATA
REPORT PHY MARGIN SETTINGS
CONFIGURE ROUTE INFORMATION
PHY CONTROL
PHY MARGIN CONTROL

SCSI architecture mapping
Names and identifiers
Protocol services:
Send SCSI Command, SCSI Command Received, Send Command Complete, Command Complete Received, Send Data-In, Data-In Delivered, Receive Data-Out, Data-Out Received, Send Task Management Request, Task Management Request Received, Task Management Function Executed, Received Task Management Function-Executed

Who should attend: This in-depth technical class is targeted towards engineers involved in the design, development, integration, deployment and maintenance of Serial Attached SCSI storage devices and systems.

Prerequisites: Should be familiar with computing and storage concepts. The In-depth Exploration of SCSI course will benefit the student to understand this technology.

Course length: 3 days