SCSI Protocol Service Model

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Purpose of the Reference Model

- To define a structure for specifying requirements.
- To provide a standard interface between SAM and the protocol standards.
- To eliminate inconsistencies among specifications.
- To specify requirements in a manner that:
  - Make it easier to design portable applications and microcode.
  - Can be easily translated to an implementation.
    - Implementation behavior must comply with the requirements. However...
    - Implementation designs are not required to conform to the model.
Parts of the Protocol Service Reference Model:

- Service Delivery Primitives - A set of protocol-independent primitives available at the service delivery interface.
  - Behavior is defined in SAM.
  - Mapping to a specific SCSI protocol is specified in the protocol standard.
- A standard set of layers.
- A model for service and protocol transactions.
  - A uniform model for the service interface between layers.
  - May be applied to all layers.
Reference Model for Architecture and Protocols

SCSI Application Layer

SCSI Application

SCSI Application Protocol

Service Delivery Interface

SCSI Protocol Layer

SCSI Protocol

Physical Interconnect Service Interface

Physical Interconnect Layer

Physical Interconnect Services

SCSI Protocol Services

Service Delivery Primitives (Defined by SAM)

SAM

SCSI Protocol Standard

Physical Interconnect Standard

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Definitions

- Upper Level Protocol (ULP) - A protocol executed through services provided by a lower protocol layer.
- Lower Level Protocol (LLP) - A protocol used to carry the data representing upper level protocol transactions.
- Request - A call to the LLP from the ULP layer to begin a service transaction.
- Indication - A spontaneous signal from the LLP service layer notifying the ULP that a peer-to-peer protocol transaction has been received.
- Response - A peer-to-peer reply from the ULP which is sent to the LLP service layer for delivery.
- Confirmation - A signal from the LLP notifying the upper layer that a peer response has been received.
SCSI Application Protocol Semantics

- SAM application protocol is based on client-server model.
- Client-server interactions are modelled as remote procedure calls from application client to device server or task manager.

i.e.,

Server Response = Procedure Name (Inputs... || Outputs....)
Types of Service Provided by LLP

- Peer-to-Peer Service - A service invoked by an upper level protocol layer to exchange information with its peer.
- Lower Layer Service - A service provided by the LLP which does not result in an exchange of information between ULP peers.
- Confirmed Service - A service requiring completion confirmation.
- Unconfirmed Service - A service not requiring confirmation.
Service Interface Model:
Peer-to-peer, Confirmed

1. Request
2. Indication
3. Response
4. Confirmation
Service Interface Model:
Peer-to-peer,
Unconfirmed

ULP Implementation

Request 1

ULP Implementation

Upper Level Protocol

Indication 2

LLP Services

Lower Level Protocol

LLP Services
Service Interface Model:
Lower Layer, Confirmed
Service Interface Model:
Lower Layer, Unconfirmed

ULP Implementation

Request

LLP Services

LLP Services
Model for Buffered Data Transfers

Initiator Data Buffer

Target Data Buffer

Offset

Total Byte Count

Requested Byte Count
SAM Service Primitives

Command Execution Service

Service Type: Peer-to-peer Confirmed.
Requestor: Application Client

Request:
Send SCSI Command(Task Identifier, Task Attribute, Command Descriptor,
    [Data-Out Buffer Pointer] || [Data-In Buffer Pointer],
    [Autosense Buffer Pointer], Status)

Indication received by Device Server:
SCSI Command Received(Task Identifier, Task Attribute, Command Descriptor,
    Autosense flag)

Response from Device Server:
Send Command Complete(Task Identifier, Pointer to Autosense Data,
    Autosense flag, Status)

Autosense flag set if sense data is to be sent to application client.

Confirmation received by Application Client:
Command Complete Received(Task Identifier, Status)

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SAM Service Primitives

Data Delivery Services

Inbound Data Transfer

Service Type: Lower Level Confirmed.
Requestor: Device Server

Request from Device Server:
Send Inbound Data (Task Identifier, Device Server Buffer Pointer,
   Application Client Buffer Offset, byte count)

Confirmation:
Data Delivered(Task identifier)
Description:
Input data was successfully delivered to the initiator's LLP service layer.
SAM Service Primitives

Data Delivery Services

Outbound Data Transfer

Service Type: Lower Level Confirmed.
Requestor: Device Server

Request from Device Server:
Receive Outbound Data (Task Identifier, Device Server Buffer Pointer,
Application Client Buffer Offset, byte count)

Confirmation:
Data Received(Task identifier)
Description:
Outbound data was successfully transferred to the device server's buffer.
SAM Service Primitives

Task Management Service Primitives

Service Type: Peer-ro-peer, Confirmed.
Requestor: Application Client

Request from Application Client:
Send Task Management Request (Object Identifier, Function Identifier)

Indication received by task manager:
Task Management Request Received(Object Identifier, Function Identifier)

Responses from Task Manager:
One of the following:
Send Task Management Function Completed(Object identifier)
Send Task Management Function Rejected(Object Identifier)

Confirmations to application client:
One of the following:
Received Task Management Function Completed(object identifier)
Received Task Management Function Rejected(object identifier)