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Introduction to Packetized SCSI

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Goals

- General upward compatibility with SCSI-2.
  - ie: No gratuitous changes
- Extend SCSI-2 Model to include packetized interconnects.
- Define behavior in an implementation-neutral way
- Facilitate implementation using a common code and hardware base that can be ported to different kinds of physical interconnects.

Goals (cont)

- Suitable for any interconnect technology that:
  - provides "message" class delivery services.
    - > ie: Sequenced delivery, free of corruption, loss or duplicate data
  - Supports "SCSI domain" topology
- Allow use of heterogeneous interconnect technology within a SCSI network.
  - Define payloads that are common to all packetized interconnects

Differences between packetized and interlocked protocols

- Interlocked Protocol
  - Target and initiator states are synchronized via bus control signals (phases).
  - Control, command and I/O data is distinguished by the phase in effect when the data was received.
- Packetized Protocol
  - Use of bus signals for state synchronization is impractical. ie: no bus phases. Synchronization must be based on packet type.
  - Control, command and I/O data is distinguished by "packet type"

Differences (cont)

- Interlocked Protocol defines behavior in terms of bus phases and data exchanged during each phase.
- Packetized protocol defines behavior in terms of packets passed between cooperating entities.
- Packetized behavior described by:
  - Objects 
  - Functions 
  - Protocols 

Architecture Components

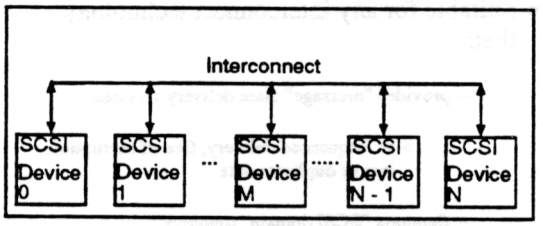
- Objects:
  - Can perform functions
  - Can define standard data types. e.g.: SCSI device address, Logical Unit Number.
  - May contain other objects
- Function - An interface between two objects residing on the same SCSI device
- Protocol - An interface between cooperating objects on different SCSI devices.

SAM Scope

- Defines:
  - Hierarchy of objects (includes data objects)
  - Protocols
  - Functions
- Standardizes:
  - Object types.
  - Object behavior specified by function and protocol semantics.
  - For objects within the scope of SAM, protocols between objects
- Avoids introducing a new 'object' when an existing SCSI-2 object can be extended or modified.

SCSI Objects

SCSI Domain



SCSI Domain - Set of SCSI Devices that can be accessed from an SCSI port. View of the network provided by a single SCSI Port

Interconnect - Pathway for the transfer of Commands and data, which provides sequenced, loss-free, duplicate-free transfers without data corruption.

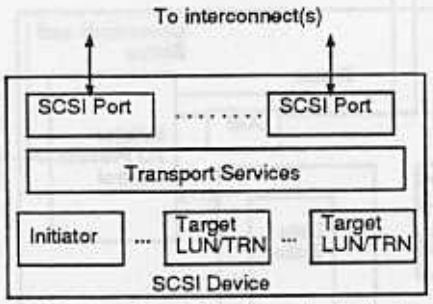
Interconnect may be comprised of heterogeneous physical interconnects.

Each SCSI device has the same view of the domain.

Each SCSI device address references a unique physical device.

SCSI Objects

SCSI Device



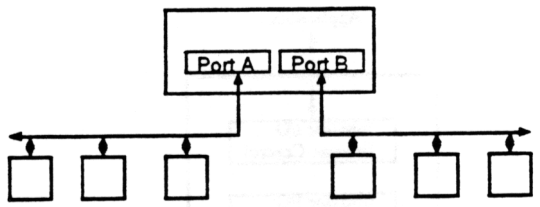
SCSI Device - Physical device attached to the interconnect and referenced via a unique device address.

Each SCSI Device must have one or more SCSI ports, optional transport services and at least one of the following:

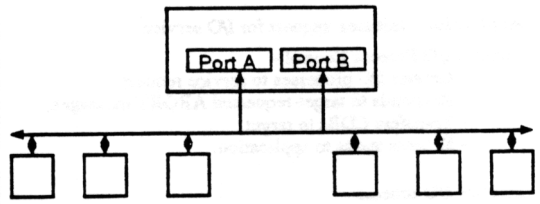
- One Initiator Object
- A Target LUN/TRN

Multiport SCSI Devices

Multiple Domain

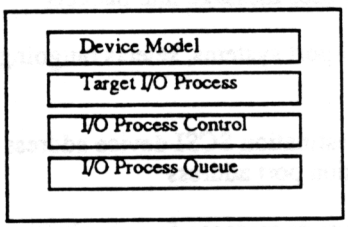


Single Domain



SCSI Objects

Target LUN/TRN



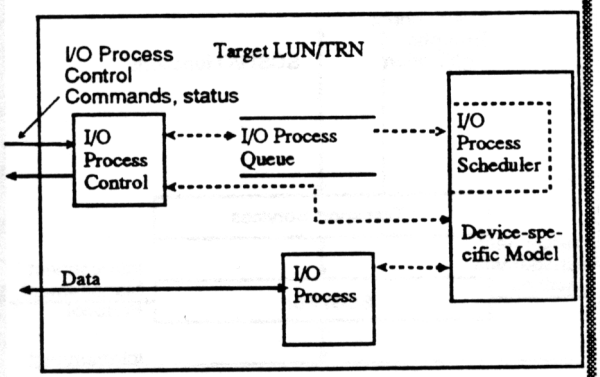
Device Model - Conforms to one of the models described in the SBC, SSC or SCC specification.

Target I/O Process - Object which performs the SCSI I/O operation.

Target I/O Process Control- Creates, deletes and queues I/O processes

I/O Process Queue - Queue of uncompleted I/O Processes.

Target LUN/TRN

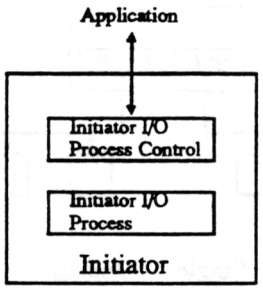


I/O Process Scheduler - Implementation-specific rules for selecting and executing I/O processes.

- Must observe the SCSI queueing model constraints and any other constraints imposed by the device model.

SCSI Objects

Initiator

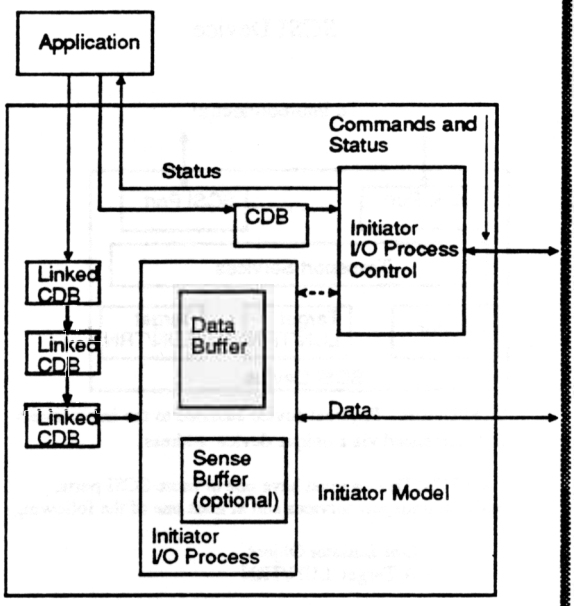


Application - Initiates request for I/O service.

Initiator I/O Process Control -
- Creates I/O processes to service requests
- Responds to target-requested ABORT messages,
- Transfers CDBs to target,
- Returns status to application.

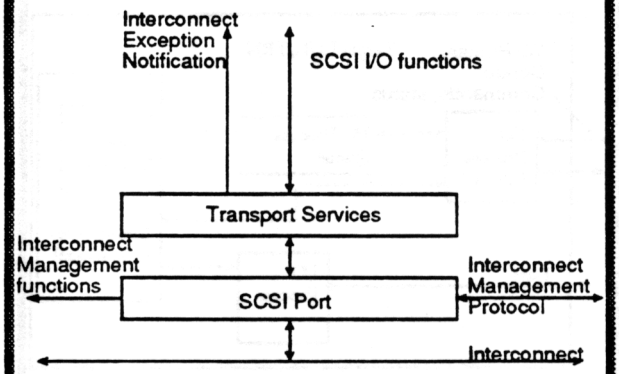
Initiator I/O process -
- Performs data transfers as directed by target
- Optionally, receives "autosense" data.

Initiator Model



SCSI Objects

SCSI Transport Service and Port Objects



Interconnect Management functions - Specific to each interconnect type.

SIP Examples - BUS RESET, Synchronous and Wide Mode negotiation, Disconnect-Reconnect Mode select, Save/Restore Pointers, etc.

P1394 - Isochronous mode negotiation.

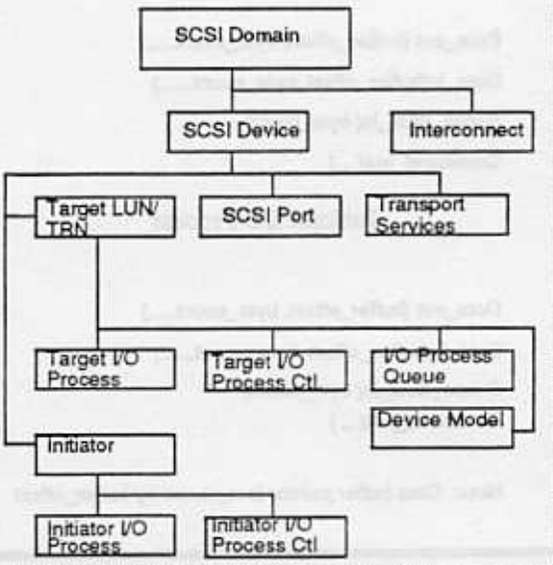
Transport Services

- Perform Object-to-Object Communications
- Decomposes message into packets
- In multi-port systems, selects outgoing port.
- Maps destination SCSI device address to destination port address
- Reconstructs message from packets
- Delivers Common Exchange Blocks, preserving the order in which they were received from the sender.

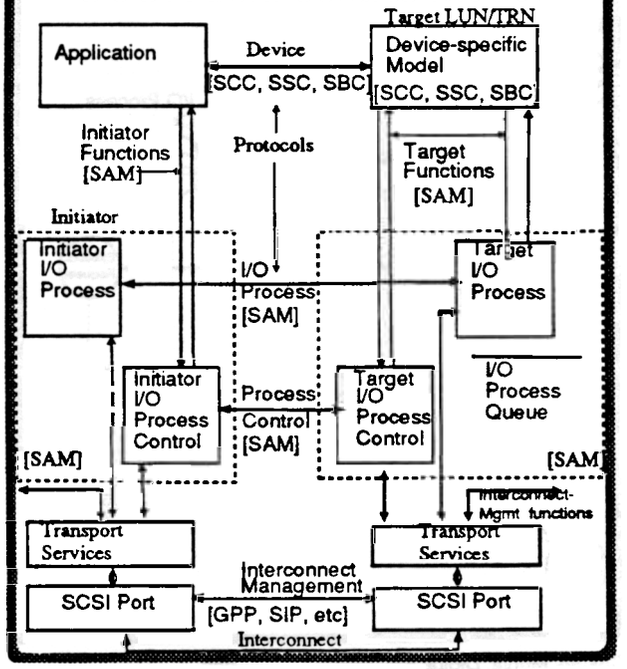
SCSI Port

- Point of attachment to the phyical interconnect.
- Decomposes packets into bit stream for transmission over the physical interconnect
- Recovers from transmission errors.
- Converts incoming bit stream into packets in memory free of detectable errors.

Object Hierarchy



SCSI Architectural Model



Functions

Initiator I/O Process Control

Create_I/O_Process (IOP_Address, CDB, Data_buffer, Data_type, Transfer_direction, Queue_tag_type, DB_len, [, Sense_buffer, SB_len])

(IOP_address contains queue tag.)

Abort_I/O_Proces(...)

Terminate_I/O_Process(...)

Clear_Queue(...)

Bus_Device_Reset(...)

Target I/O Process Control

Abort_I/O_Process(...)

Status_In(...)

Functions

Target I/O Process

Data_out (buffer_offset, byte_count.....)

Data_in(buffer_offset, byte_count.....)

Sense_data_in(byte_count)

Command_out(...)

Initiator I/O Process

Data_out (buffer_offset, byte_count.....)

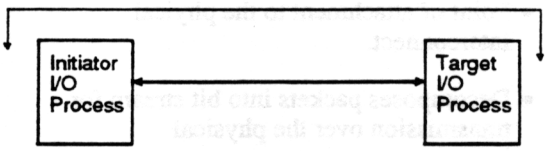
Data_in(buffer_offset, byte_count.....)

Sense_data_in(byte_count)

Command_out(...)

Note: Data buffer pointer is replaced by buffer_offset

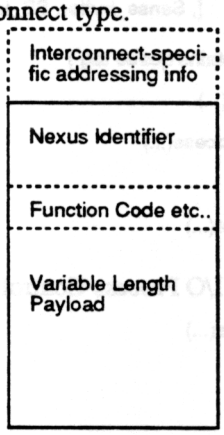
Nexus



Nexus - An association between cooperating initiator and target I/O processes that begins when a command descriptor is sent and ends when one of the processes terminates

SPP Protocols

- Command - Response
- Protocol uses common Exchange Control Block
- Exchange block format is independant of interconnect type.



Exchange Control Block format is TBD.

I/O Transaction Example