Exception Recovery Mechanism for Non-Interlocked, Full Duplex SCSI Channel Interconnects

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• 'Normal' case
  - What the application client sees:
    - Commands Pending
  - What the application client can't see:
    - Location of each command in the pipeline-- Waiting to be sent,-- In flight,-- In the task set,-- Being executed,-- Status in transit.
    - Initiator's protocol layer retains a list of pending commands in the order they were sent by the application clients.
  - A command is removed from the pending list:
    - When status is received,
    - When the command is aborted by the application client.
Exception
(ACA not implemented)

- Scenario
  - Command completes with exception status
  - Logical unit continues to receive and execute commands
- What the application client sees:
  - Normal status
- What the application client can't see
  - Exception status in transit
Based on CAM error recovery model.
- For each Initiator-logical unit pair the target's protocol layer implements command and status' gates'.
- The gates are closed whenever an exception status is sent to the initiator.
- While the gates are closed:
  - The target suspends the return of status from the logical unit to the faulted initiator.
  - The next incoming command from the faulted initiator is returned by the target's protocol layer.
  - Subsequent incoming commands from the faulted initiator are discarded.
  - Commands to other logical units or from other initiators are unaffected.
The initiator's protocol layer, on receiving the exception status:
- Sends an 'Open Gate' request to the target.
- Forwards the exception status to the application client.
- Stops sending commands to the faulted LUN.
- On receiving the 'returned command', all pending commands between it and the 'Open Gate' request are marked by the protocol layer for resend.
- Open Gate requests are handled totally within the protocol layers.
- The exception condition is not affected by the Open Gate request. E.g., Contingent Allegiance (if set) remains in effect.
What the Application client sees:

- Behavior is identical to parallel SCSI.
- Command Queue frozen as for CAM.
  - No out-of-order command execution.
- Contingent Allegiance
  - Sense data automatically preserved.
- Application Client interface for manipulating the queue of unsent SCSI commands is implementation-specific but protocol independent.

What the application client doesn't see:

- "Open Gate" request and response.
- "Returned command".
- Management of 'pending command list' by protocol layer.
Changes required
  - SAM
    • Specify CAM-like behavior for pending commands when an exception occurs.
  - Protocol Standards
    • Specify required behavior for SAM compliance.

Issues:
  - LUN behavior for RESERVATION CONFLICT, TASK SET FULL and BUSY statuses is not fully defined and needs to be addressed.