

To: INCITS T10 Committee

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Date: 8 September 2003

Document: T10/03-286r1

Subject: SCSI Application Layer clause for ADT.

1 Revision History

Revision 0:
Posted to the T10 web site 14 April 2003.

Revision 1:
Updated proposal after review in the September Working Group meeting.

2 General

This proposal adds contents to clause 8, Application Layer, in ADT.

3 Proposal

Replace the current, empty clause 8 in ADT with the following:

8 SCSI Application Layer

8.1 *SCSI Transport protocol services overview*

An application client requests the processing of a SCSI command by invoking SCSI transport protocol services, the collective operation of which is conceptually modeled in the following remote procedure call (see SAM-2):

Service response = Execute Command (IN (I_T_L_x Nexus, CDB, [Task Attribute], [Data-In Buffer Size], [Data-Out Buffer], [Data-Out Buffer Size], [Autosense Request]), [Command Reference Number]),
OUT ([Data-In Buffer], [Sense Data], Status))

ADT defines the transport protocol services required by SAM-2 in support of this remote procedure call. See 8.2

An application client requests the processing of a SCSI task management function by invoking SCSI transport protocol services, the collective operation of which is conceptually modeled in the following remote procedure calls (see SAM-2):

- a) Service Response = ABORT TASK (IN (I_T_L_Q Nexus));
- b) Service Response = ABORT TASK SET (IN (I_T_L Nexus));
- c) Service Response = CLEAR ACA (IN (I_T_L Nexus));
- d) Service Response = CLEAR TASK SET (IN (I_T_L Nexus));
- e) Service Response = LOGICAL UNIT RESET (IN (I_T_L Nexus));
- f) Service Response = QUERY TASK (IN (Nexus)); and
- g) Service Response = TARGET RESET (IN(I_T Nexus)).

ADT defines the transport protocol services required by SAM-2 in support of these remote procedure calls. See 8.3

Table 1 describes the mapping of the remote procedure calls to transport protocol services and the ADT implementation of each transport protocol service.

Table - 1 Remote procedure call mapping

| Remote procedure call | Type of transport protocol service | Transport protocol service interaction | Transport protocol service | I/T | ADT implementation |
|---|------------------------------------|--|---|-----|---|
| Execute Command | Request/ Confirmation | Request | Send SCSI Command | I | SCSI Request IU |
| | | Indication | SCSI Command Received | T | Acknowledgement of SCSI Request IU |
| | | Response | Send Command Complete | T | SCSI Response IU |
| | | Confirmation | Command Complete Received | I | Acknowledgement of SCSI Response IU |
| | Data Transfer | Request | Send Data-In | T | SCSI Data IU |
| | | Indication | Data-In Delivered | T | Acknowledgement of SCSI Data IU |
| | | Response | Receive Data-Out | T | SCSI Transfer Ready IU |
| | | Confirmation | Data-Out Received | T | Acknowledgement of SCSI Transfer Ready IU |
| ABORT TASK, ABORT TASK SET, CLEAR ACA, CLEAR TASK SET, LOGICAL UNIT RESET, and QUERY TASK | Request/ Confirmation | Request | Send Task Management Request | I | SCSI Request IU |
| | | Indication | Task Management Request Received | T | Acknowledgement of SCSI Request IU |
| | | Response | Task Management Function Executed | I | SCSI Response IU |
| | | Confirmation | Receive Task Management Function-Executed | T | Acknowledgement of SCSI Response IU |

8.2 Transport Layer Protocol Services to Support Execute Command

8.2.1 Send SCSI Command transport protocol service

An application client uses the Send SCSI Command transport protocol service to request that an ADT initiator port transmit a SCSI Request IU containing a SCSI command.

Send SCSI Command (IN (I_T_L_x Nexus, CDB, [Task Attribute], [Data-In Buffer Size], [Data-Out Buffer], [Data-Out Buffer Size], [Autosense Request], [Command Reference Number]))

Table 2 shows how the arguments to the Send SCSI Command transport protocol service are used in the generation of a SCSI Request IU.

Table 2 – Send SCSI Command transport layer protocol service arguments

| Argument | ADT Implementation |
|------------------------|---|
| I_T_L_x nexus | I_T_L_Q nexus, where: a) I_T is used to set the X_ORIGIN field. b) L is used to set the LUN field. c) Q is set by the transport layer. |
| CDB | Used to set the CDB field. |
| [Task Attribute] | Not used. |
| [Data-In Buffer Size] | Maximum of $2^{32}-1$ |
| [Data-Out Buffer] | Buffer of data to send |
| [Data-Out Buffer Size] | Maximum of $2^{32}-1$ |
| [Autosense Request] | True |
| [CRN] | Not used. |

8.2.2 SCSI Command Received transport protocol service

An ADT target port uses the SCSI Command Received transport protocol service to notify a device server that it has received a SCSI Request IU with a TASK MANAGEMENT FUNCTION field value of 0.

SCSI Command Received (IN (I_T_L_x Nexus, CDB, [Task Attribute], [Autosense Request], [Command Reference Number]))

Table 3 shows how the arguments to the SCSI Command Received transport protocol service are used.

Table 3 – SCSI Command Received transport layer protocol service arguments

| Argument | ADT Implementation |
|---------------------|---|
| I_T_L_x nexus | I_T_L_Q nexus, where: a) I_T is indicated by the X-Origin field. b) L is indicated by the LUN field. c) Q is indicated by the exchange id field in the frame header. |
| CDB | From the CDB field in the SCSI Request IU |
| [Task Attribute] | Not used. |
| [Autosense Request] | True |
| [CRN] | Not used. |

8.2.3 Send Command Complete transport protocol service

A device server uses the Send Command Complete transport protocol service to request an ADT target port to transmit a SCSI Response IU.

Send Command Complete (IN (I_T_L_x Nexus, [Sense Data], Status, Service Response))

Table 4 shows how the arguments to the Send Command Complete transport protocol service are used in the generation of a SCSI Response IU.

Table 4 – Send Command Response transport layer protocol service arguments

| Argument | ADT Implementation |
|------------------|---|
| I_T_L_x nexus | Used to set the X_ORIGIN and EXCHANGE ID fields in the frame header. |
| [Sense Data] | Used to set the AUTOSENSE DATA field. |
| Status | Used to set the SCSI STATUS field. |
| Service Response | Used to set the RESPONSE CODE and STATUS fields: a) The response code field is set to Command or task management function complete and the STATUS field is set to a value other than INTERMEDIATE or INTERMEDIATE-CONDITION MET; b) LINKED COMMAND COMPLETE: The response code field is set to Command or task management function complete and the STATUS field is set to INTERMEDIATE or INTERMEDIATE-CONDITION MET; or c) SERVICE DELIVERY OR TARGET FAILURE: RESPONSE CODE field is set to Service delivery failure. |

8.2.4 Command Complete Received transport protocol service

An ADT initiator port uses the Command Complete Received transport protocol service to notify an application client that it has received a response for a SCSI Request IU initiated by a Send SCSI Command transport protocol service (e.g., a SCSI Response IU or a NAK IU).

Command Complete Received (IN (I_T_L_x Nexus, [Data-In Buffer], [Sense Data], Status, Service Response))

Table 5 shows how the arguments to the Command Complete Received transport protocol service are determined.

Table 5 – Send Command Complete Received transport layer protocol service arguments

| Argument | ADT Implementation |
|------------------|---|
| I_T_L_x nexus | I_T_L_Q nexus, where: a) I_T is indicated by the connection. b) L is indicated by the LUN field in the original SCSI Request IU. c) Q is indicated by the X_ORIGIN and EXCHANGE ID fields in the frame header. |
| [Data-In Buffer] | Pointer to a buffer containing command specific information returned by the logical unit on command completion. |
| [Sense Data] | From the SCSI Response IU SCSI AUTOSENSE DATA field |
| Status | From the SCSI Response IU SCSI STATUS field |
| Service Response | From the SCSI Response IU RESPONSE CODE and STATUS field, or from a NAK on the SCSI Request IU: a) TASK COMPLETE: The response code field is set to Command or task management function complete and the STATUS field is set to a value other than INTERMEDIATE or INTERMEDIATE-CONDITION MET; b) LINKED COMMAND COMPLETE: The response code field is set to Command or task management function complete and the STATUS field is set to INTERMEDIATE or INTERMEDIATE-CONDITION MET; or c) SERVICE DELIVERY OR TARGET FAILURE: RESPONSE CODE field is set to Service delivery failure. |

8.2.5 Send Data-In transport protocol service

A device server uses the Send Data-In transport protocol service to request that an ADT target port transmit data to an initiator port using one or more SCSI Data IUs.

Send Data-In (IN (I_T_L_x Nexus, Device Server Buffer, Application Client Buffer Offset, Request Byte Count))

A device server shall only call Send Data-In() during a read or bi-directional command.

A device server shall not call Send Data-In() for a given I_T_L_Q nexus after it has called Send Command Complete() for that I_T_L_Q nexus (e.g., a RESPONSE frame with that I_T_L_Q nexus) or called Task Management Function Executed for a task management function that terminates that task (e.g., an ABORT TASK).

Table 6 shows how the arguments to the Send Data-In transport protocol service are used.

Table 6 – Send Data-In transport layer protocol service arguments

| Argument | ADT Implementation |
|----------------------------------|--|
| I_T_L_x nexus | Used to set the X_ORIGIN and EXCHANGE ID fields in the frame(s) header. |
| Device Server Buffer | Pointer to a buffer where the data is located. |
| Application Client Buffer Offset | Used to set the BUFFER OFFSET field in the first SCSI Data IU. The transport layer may use more than one SCSI Data IU to transmit the data. If it does, the BUFFER OFFSET field in each subsequent SCSI Data IU shall be set adjusted by the number of bytes in the previous SCSI Data IU. |
| Request Byte Count | Total number of bytes to transmit. If multiple SCSI Data IUs are used to transmit the data, the total bytes transmitted shall equal the Request Byte Count value. |

8.2.6 Data-In Delivered transport protocol service

An ADT target port uses the Data-In Delivered transport protocol service to notify a device server of the results of transmitting the data associated with a Send Data-In transport protocol service.

Data-In Delivered (IN (I_T_L_x Nexus))

Table 7 shows how the arguments to the Data-In Delivered transport protocol service are determined.

Table 7 – Data-In Delivered transport layer protocol service arguments

| Argument | ADT Implementation |
|---------------|--|
| I_T_L_x nexus | I_T_L_Q nexus value passed to the Send Data-In transport layer protocol service request that initiated the transfer. |

8.2.7 Receive Data-Out transport protocol service

A device server uses the Receive Data-Out transport protocol service to request that an ADT target port transmit a SCSI Transfer Ready IU.

Receive Data-Out (IN (I_T_L_x Nexus, Application Client Buffer Offset, Request Byte Count, Device Server Buffer))

A device server shall only call Receive Data-Out() during a write or bi-directional command.

A device server shall not call Receive Data-Out() for a given I_T_L_Q nexus until Data-Out Received() has completed successfully for the previous Receive Data-Out() call (i.e., no SCSI Transfer Ready IU until all write SCSI Data IUs for the previous SCSI Transfer Ready IU have completed, if any, and has provided link layer acknowledgement for all of the previous SCSI Data IUs for that I_T_L_Q nexus).

A device server shall not call Receive Data-Out() for a given I_T_L_Q nexus after a Send Command Complete() has been called for that I_T_L_Q nexus or after a Task Management Function Executed() has been called for a task management function that terminates that task (e.g., an ABORT TASK).

Table 8 shows how the arguments to the Receive Data-Out transport protocol service are used.

Table 8 – Receive Data-Out transport layer protocol service arguments

| Argument | ADT Implementation |
|----------------------------------|---|
| I_T_L_x nexus | Used to set the X_ORIGIN and EXCHANGE ID fields in the SCSI Transfer Ready IU frame header. |
| Application Client Buffer Offset | Used to set the BUFFER OFFSET field in the SCSI Transfer Ready IU. |
| Request Byte Count | Used to set the BURST LENGTH field in the SCSI Transfer Ready IU. |
| Device Server Buffer | The buffer in the device server to which data is to be transferred. |

8.2.8 Data-Out Received transport protocol service

An ADT target port uses the Data-Out Received transport protocol service to notify a device server of the result of the request to receive data initiated by a call to Receive Data-Out transport layer protocol service request.

Data-Out Received (IN (I_T_L_x Nexus))

Table 9 shows how the arguments to the Data-Out Received transport protocol service are determined.

Table 9 – Data-Out Received transport layer protocol service arguments

| Argument | ADT Implementation |
|---------------|--|
| I_T_L_x nexus | I_T_L_x nexus value passed to the Receive Data-Out transport layer protocol service request that initiated the transfer. |

8.3 Task management protocol services

8.3.1 Send Task Management Request transport protocol service

An application client uses the Send Task Management Request transport protocol service to request that an ADT initiator port transmit a SCSI Request IU requesting a task management function.

Send Task Management Request (IN (Nexus, Function Identifier))

Table 10 shows how the arguments to the Send Task Management Request transport protocol service are used.

Table 10 – Send Task Management Request transport layer protocol service arguments

| Argument | ADT Implementation |
|---------------------|---|
| Nexus | I_T, I_T_L, or I_T_L_Q nexus identifier used to set the X_ORIGIN and EXCHANGE ID fields in the SCSI Request IU frame header. |
| Function Identifier | Used to set the TASK MANAGEMENT FUNCTION field in the SCSI Request IU. Only these task management functions are supported: a) ABORT TASK (Nexus argument specifies an I_T_L_Q Nexus); b) ABORT TASK SET (Nexus argument specifies an I_T_L Nexus); c) CLEAR ACA (Nexus argument specifies an I_T_L Nexus); d) CLEAR TASK SET (Nexus argument specifies an I_T_L Nexus); e) LOGICAL UNIT RESET (Nexus argument specifies an I_T_L Nexus); and f) TARGET RESET (Nexus argument specifies an I_T Nexus). |

8.3.2 Task Management Request Received transport protocol service

An ADT target port uses the Task Management Request Received transport protocol service to notify a device server that it has received a SCSI Request IU frame containing a task management request.

Task Management Request Received (IN (Nexus, Function Identifier))

Table 11 shows how the arguments to the Task Management Request Received transport protocol service are determined.

Table 11 – Task Management Request Received transport layer protocol service arguments

| Argument | ADT Implementation |
|---------------------|---|
| Nexus | I_T, I_T_L, or I_T_L_Q nexus identifier created from the X_ORIGIN, EXCHANGE ID, and LUN fields in the SCSI Request IU frame header. |
| Function Identifier | From the TASK MANAGEMENT FUNCTION field in the SCSI Request IU. |

8.3.3 Task Management Function Executed transport protocol service

A device server uses the Task Management Function Executed transport protocol service to request that an ADT target port transmit a SCSI Response IU with the results of the task management function.

Task Management Function Executed (IN (Nexus, Service Response))

A device server shall only call Task Management Function Executed() after receiving Task Management Request Received().

Table 12 shows how the arguments to the Task Management Function Executed transport protocol service are used.

Table 12 – Task Management Function Executed transport layer protocol service arguments

| Argument | ADT Implementation |
|------------------|--|
| Nexus | I_T, I_T_L, or I_T_L_Q nexus from the Task Management Request Received argument list. |
| Service Response | Used to set the RESPONSE CODE field in the SCSI Response IU: a) FUNCTION REJECTED: The RESPONSE CODE field is set to Task Management function not supported or Invalid field in SCSI Request IU (excludes CDB); b) FUNCTION COMPLETE: The RESPONSE CODE field is set to Command or task management function complete, or c) SERVICE DELIVERY OR SUBSYSTEM FAILURE: The RESPONSE CODE field is set to Task Management function failed. |

8.3.4 Received Task Management Function-Executed transport protocol service

An ADT initiator port uses the Received Task Management Function-Executed transport protocol service to notify an application client that it has received a response to Send Task Management Request transport protocol service request (e.g., received a SCSI Response IU or a NAK IU).

Received Task Management Function-Executed (IN (Nexus, Service Response))

Table 13 shows how the arguments to the Received Task Management Function-Executed transport protocol service are determined.

Table 13 – Received Task Management Function-Executed transport layer protocol service arguments

| Argument | ADT Implementation |
|------------------|--|
| Nexus | I_T, I_T_L, or I_T_L_Q nexus identifier created from the X_ORIGIN, EXCHANGE ID, and LUN fields in the SCSI Response IU frame header. |
| Service Response | Determined from the RESPONSE CODE field in the SCSI Response IU: a) FUNCTION REJECTED: The RESPONSE CODE field is set to Task Management function not supported or Invalid field in SCSI Request IU (excludes CDB); b) FUNCTION COMPLETE: The RESPONSE CODE field is set to Command or task management function complete, or c) SERVICE DELIVERY OR SUBSYSTEM FAILURE: The RESPONSE CODE field is set to Task Management function failed. |