

# ENDL TEXAS

Date: 2 April 2003  
 To: T10 Technical Committee  
 From: Ralph O. Weber  
 Subject: Remove ULP and LLP from SAM-3

SAM-2 Letter Ballot comment HP 71 expressed a concern long held by the SAM-2/3 editor, to wit:

"The entire reference to ULP and LLP should be dropped, to avoid using multiple names for the same layer - which the current discussion does. I would have understood if ULP is used to simply indicate a higher layer wrt the one below (generically to represent either application-to-protocol, or protocol-to-interface), but defining ULP=application seems inviting redundancy for no reason."

The response recorded for HP 71 in 02-155r6 defers changes to SAM-3. A review of the front matter in SAM-3 r04 will evidence my long standing desire to eliminate the use of LLP as an acronym for SCSI Transport Protocol Layer and ULP as an acronym for SCSI Application Layer. This proposal describes the specific changes necessary to accomplish that end.

## Revision History

- r0 Initial proposal
- r1 Revise as requested by March CAP working group

## Discussion of Client and Server

At one point during the March CAP discussion of this proposal, it was mentioned that SAM has:

- Only 1 client, the Application Client; and
- Only 1 server, the Device Server.

While the first of these assertions is true, the second is false. SAM has two servers, the Device Server and the Task Manager. Both the Device Server and the Task Manager process (i.e., service) requests from the Application Client.

It was suggested that all uses of 'client' be changed to 'application client' and that of 'server' be changed to 'device server' that change cannot be made on a global basis. This proposal includes that change wherever it can be made.

An example of a phrase that has not been changed is, 'the client sends a request to the server.' While 'client' could be changed 'application client', 'server' cannot be changed to 'device server' because an application client requesting a task management function is an equally valid example of what the phrase is trying to state. Since changing only half of the phrase results in a lopsided reading, neither 'client' nor 'server' has been changed.

## Specific Changes

All references are to SAM-3 r06.

Change bars identify differences between r0 and r1 of this proposal. However, differences relating only to subclause number changes between SAM-3 r04 and SAM-3 r06 are not marked.

**Change 1 [Glossary 'client' and 'server']:** The working group should chose one from each of the following two proposed changes in 3.1.

**3.1.11 client:** An entity that requests a service from a server. ~~This standard defines only one client, the application client.~~

**3.1.11 client:** An entity that requests a service from a server (i.e., the application client).

**3.1.107 server:** An entity that performs a service on behalf of a client. ~~This standard defines two servers, the device server and the task manager.~~

**3.1.107 server:** An entity that performs a service on behalf of a client (i.e., the device server and the task manager).

**Change 2 [Glossary & Acronyms]:** Modify the following glossary entries in 3.1 as shown:

**3.1.17 confirmation:** A response returned to ~~a~~ ~~an~~ application client or device server that signals the completion of a service request.

~~**3.1.62 lower level protocol (LLP):** A protocol used to carry the information representing upper level protocol transactions.~~

**3.1.84 SCSI application layer (SAL):** The protocols and procedures that implement or issue SCSI commands and task management functions by using services provided by a SCSI transport protocol layer.

**3.1.99 SCSI transport protocol layer (STPL):** The protocol and services used by a SCSI application layer to transport data representing a SCSI application protocol transaction.

**3.1.100 SCSI transport protocol service confirmation:** A ~~signal procedure call~~ from the ~~lower level SCSI transport protocol layer~~ STPL notifying the ~~upper layer~~ SAL that a SCSI transport protocol service request has completed.

**3.1.101 SCSI transport protocol service indication:** A ~~signal procedure call~~ from the ~~lower level SCSI transport protocol layer~~ STPL notifying the ~~upper level~~ SAL that a SCSI transport protocol transaction has occurred.

**3.1.102 SCSI transport protocol service request:** A ~~procedure call~~ to the ~~lower level SCSI transport protocol layer~~ STPL to begin a SCSI transport protocol service transaction.

**3.1.103 SCSI transport protocol service response:** A ~~procedure call to the~~ STPL containing a reply from the ~~upper level protocol layer~~ SAL in response to a SCSI transport protocol service indication.

~~**3.1.131 upper level protocol (ULP):** An application specific protocol processed through services provided by a lower level protocol.~~

Add and remove the following acronyms entries in 3.2 as shown:

LLP	<del>Lower Level Protocol (see 3.1.66)</del>
SAL	SCSI application layer (see 3.1.84)
STPL	SCSI transport protocol layer (see 3.1.99)
ULP	<del>Upper Level Protocol (see 3.1.137)</del>

**Change 3 [5.4.3.1 Data transfer SCSI transport protocol services introduction]:** Modify the second to last paragraph in the subclause as follows:

The **LLP STPL** confirmed services specified in 5.4.3.2 and 5.4.3.3 are used by the device server to request the transfer of command data to or from the application client. The SCSI initiator device SCSI transport protocol service interactions are unspecified.

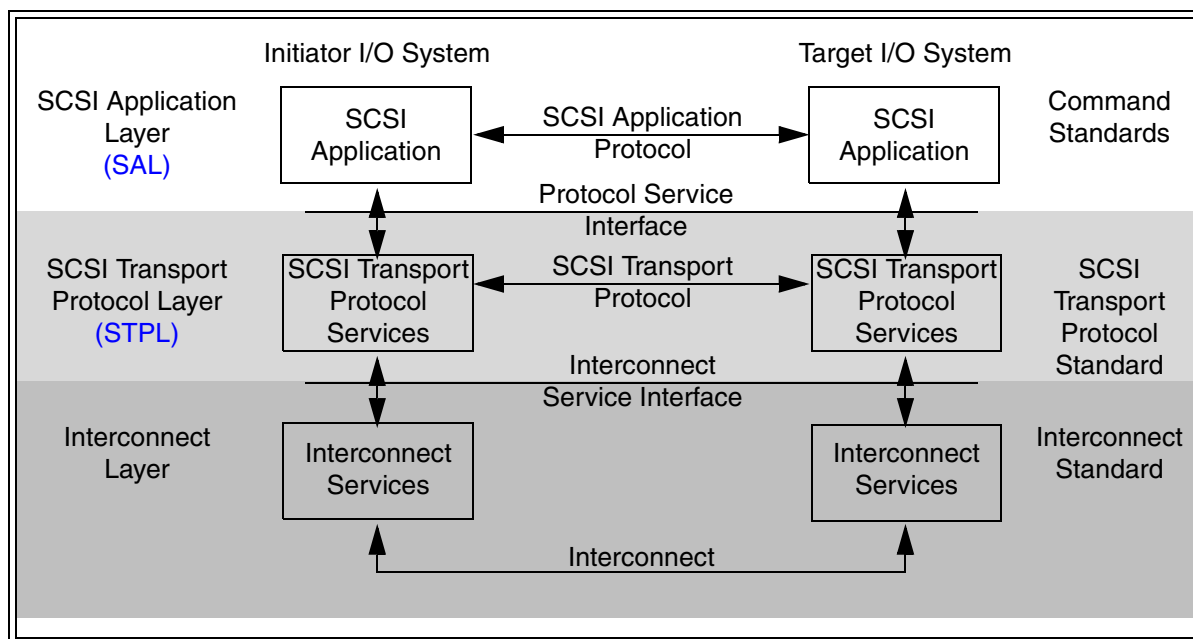
**Change 4 [8.4.2 Enabled task state]:** Modify the second paragraph of the enabled task state as follows:

Except for the use of resources required to preserve task state, a task shall produce no effects detectable by the application client before the task's first transition to the enabled task state. Although, before entering this state for the first time, the task may perform other activities visible ~~to lower layers at the STPL~~ – such as pre-fetching data to be written to the media – this activity shall not result in a detectable change in state as perceived by an application client. In addition, the behavior of a completed task, as defined by the commands it has processed, shall not be affected by the task's states before it enters the enabled task state.

**Change 5 [4.15 The SCSI model for distributed communications]:** Revise the entire subclause as follows:

## 4.15 The SCSI model for distributed communications

The SCSI model for communications between distributed objects is based on the technique of layering as shown in figure 25.



**Figure 25 — Protocol service reference model**

The layers comprising this model and the specifications defining the functionality of each layer are denoted by horizontal sequences. A layer consists of peer entities that communicate with one another by means of a protocol. Except for the interconnect layer, such communication is accomplished by invoking services provided by the adjacent ~~lower~~ layer. ~~By convention, the layer from which a request for service originates is called the upper level protocol layer or ULP layer. The layer providing the service is referred to as the lower level protocol layer or LLP layer.~~ The following layers are defined.

**SCSI application layer (SAL):** Contains the clients and servers that originate and process SCSI I/O operations by means of a SCSI application protocol;

**SCSI transport protocol layer (STPL):** Consists of the services and protocols through which clients and servers communicate; and

**Interconnect layer:** Comprised of the services, signaling mechanism and interconnect subsystem needed for the physical transfer of data from sender to receiver. In the SCSI model, the interconnect layer is known as the service delivery subsystem.

The set of **SCSI transport** protocol services implemented by the service delivery subsystem are intended to identify external behavioral requirements that apply to SCSI transport protocol standards. While these **SCSI transport** protocol services may serve as a guide for designing reusable software or firmware that is adaptable to different SCSI transport protocols, there is no requirement for an implementation to provide the service interfaces specified in this standard.

The **SCSI transport** protocol service interface is defined in this standard in representational terms using **SCSI transport** protocol services. The **SCSI transport** protocol service interface implementation is defined in each SCSI transport protocol standard. The interconnect service interface is described as appropriate in each SCSI transport protocol standard.

Interactions between the **ULP SAL** and **LLP STPL** layers are defined with respect to the **ULP SAL** layer and may originate in either layer. An outgoing interaction is modeled as a procedure call invoking an **LLP STPL** service. An incoming interaction is modeled as a **signal sent procedure call invoked** by the **STPL LLP layer that**.

All **procedure calls** may be accompanied by parameters or data. Both types of interaction are described using the notation for procedures specified in 3.6.2. In this model, input arguments are defined relative to the layer receiving an interaction (i.e., an input is a parameter supplied to the receiving layer by the layer initiating the interaction).

The following types of service interactions between layers are defined:

**SCSI transport protocol service request:** A **request procedure call** from the **SAL ULP layer** invoking a service provided by the **STPL LLP layer**.

**SCSI transport protocol service indication:** A **signal procedure call** from the **STPL LLP layer** informing the **SAL ULP layer** that an asynchronous event has occurred (e.g., a reset or the receipt of a peer-to-peer protocol transaction).

**SCSI transport protocol service response:** A **procedure call** to the **STPL LLP layer** invoked by the **SAL ULP layer** in response to a SCSI transport protocol service indication. A SCSI transport protocol service response may be invoked to return a reply from the invoking **ULP SAL** to the **peer SAL ULP peer**.

**SCSI transport protocol service confirmation:** A **signal procedure call** from the **STPL LLP layer** notifying the **SAL ULP layer** that a SCSI transport protocol service request has completed, has been terminated, or has failed to transit the interconnect layer. A confirmation may communicate parameters that indicate the completion status of the SCSI transport protocol service request or any other status. A SCSI transport protocol service confirmation may be used to convey a response from the **ULP SAL peer**.

The services provided by an **STPL LLP layer** are either confirmed or unconfirmed. A **ULP SAL** service request invoking a confirmed service always results in a confirmation from the **STPL LLP layer**.

Figure 26 shows the relationships between the four **SCSI transport** protocol service types.

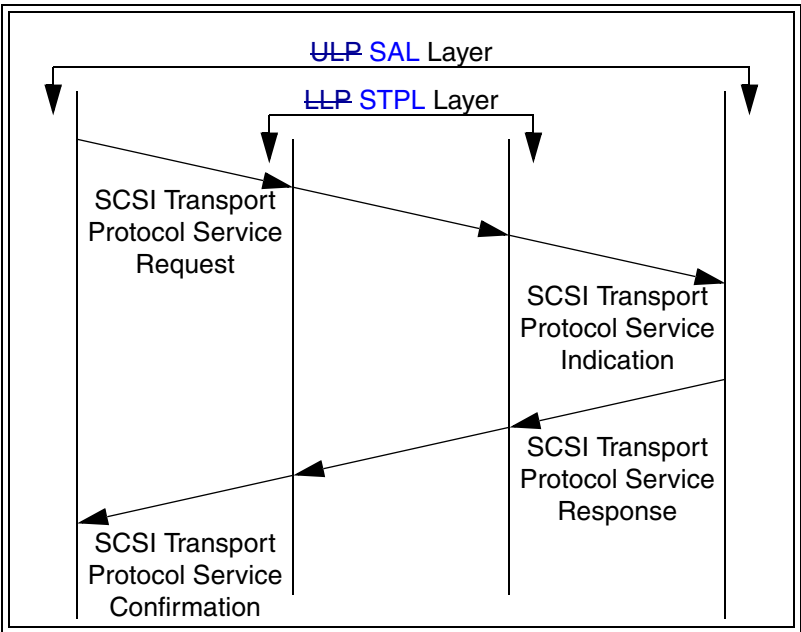


Figure 26 — **SCSI transport** protocol service model

Figure 27 shows how **SCSI transport** protocol services may be used to process a client-server request-response transaction at the SCSI application layer.

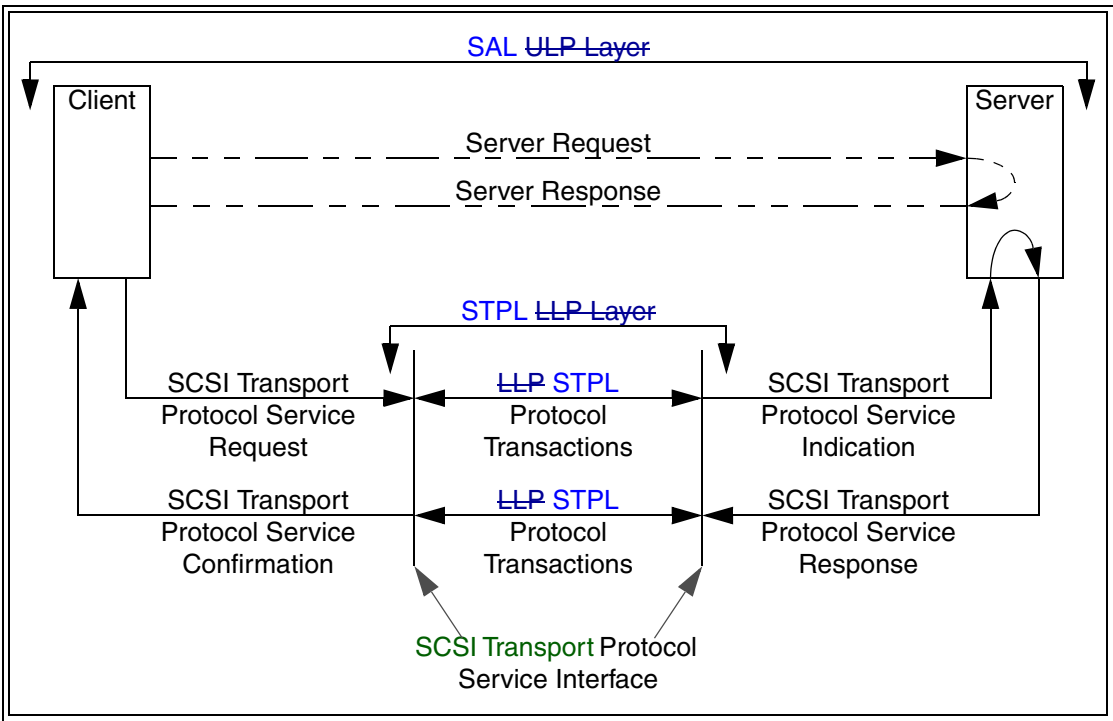
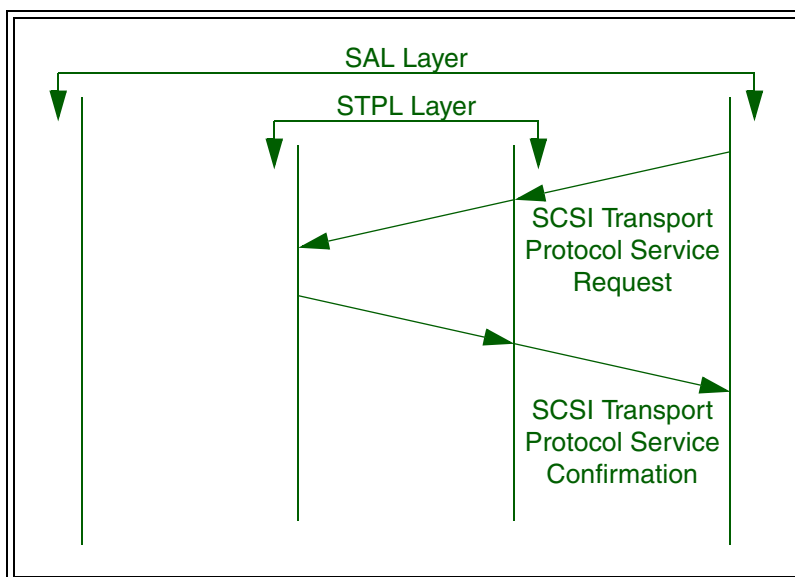


Figure 27 — Request-Response **ULP SAL** transaction and related **LLP STPL** services

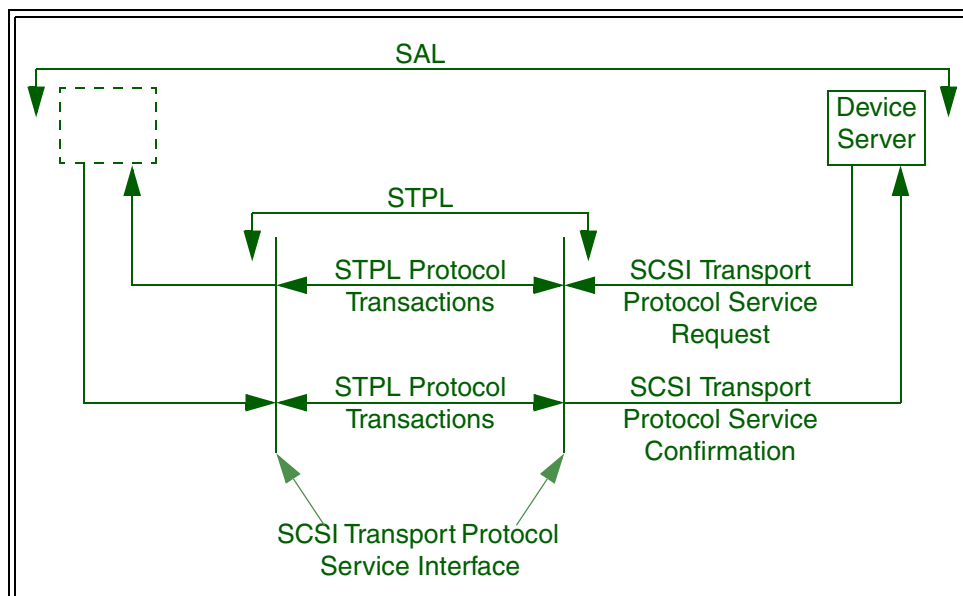
The dashed lines in figure 27 show a SCSI application protocol transaction as it may appear to sending and receiving entities within the client and server. The solid lines in figure 27 show the corresponding SCSI transport protocol services and **LLP STPL** transactions that are used to transport the data.

When a device server invokes a data transfer SCSI transport protocol service, the interactions required to transfer the data do not involve the application client. Only the STPL layer in the SCSI device that also contains the application client is involved. Figure 28 shows the relationships between the SCSI transport protocol service types involved in a data transfer request.



**Figure 28 — SCSI transport protocol service model for data transfers**

Figure 29 shows how SCSI transport protocol services may be used to process a device server data transfer transaction.



**Figure 29 — Device server data transfer transaction and related STPL services**

**Change 6 [4.2 The SCSI distributed service model]:** Modify the first two sentence after figure 5 as follows:

A client-server transaction is represented as a remote procedure call with inputs supplied by the caller (the client). **This standard defines only one client, the application client.** The procedure is processed by the server and returns outputs and a procedure status. **This standard defines two servers, the device server and the task manager.**

Modify the second paragraph after figure 5 as follows **(note that the underlined 'application' appears in SAM-3 r06 and its presence leads to the proposed changes):**

As seen by the **application** client, a request becomes pending when it is passed to the SCSI initiator port for transmission. The request is complete when the server response is received or when a failure notification is sent. As seen by the server, the request becomes pending upon receipt and completes when the response is passed to its service delivery subsystem for return to the **application** client. As a result there may be a time skew between the server and **application** client's perception of request status and logical unit state. All references to a pending command or task management function in this standard are from the application client's point of view.