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Internet Small Computer System Interface (iSCSI) SCSI Features Update

Abstract

Internet Small Computer System Interface (iSCSI) is a SCSI transport protocol that maps the SCSI family of protocols onto TCP/IP. The iSCSI protocol as specified in RFC 7143 (and as previously specified by the combination of RFC 3720 and RFC 5048) is based on the SAM-2 (SCSI Architecture Model - 2) version of the SCSI family of protocols. This document defines enhancements to the iSCSI protocol to support certain additional features of the SCSI protocol that were defined in SAM-3, SAM-4, and SAM-5.

This document is a companion document to RFC 7143.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <http://www.rfc-editor.org/info/rfc7144>.

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1. Introduction

The original iSCSI protocol [RFC3720] was built based on the [SAM2] model for SCSI. Several new features and capabilities have been added to the SCSI Architecture Model in the intervening years (at the time of publication of this document, SAM-5 was the current version of the SCSI Architecture Model). This document is not a complete revision of [RFC3720]. Instead, this document is intended as a companion document to RFC 7143; this document may also be used as a companion document to the combination of [RFC3720] and [RFC5048], although both of those RFCs have been obsoleted by [RFC7143].

For more information on the SCSI Architecture Model and SCSI Primary Commands - 4, contact the INCITS T10 Technical Committee for SCSI Storage Interfaces at <<http://www.t10.org>>.

2. Definitions, Acronyms, and Document Summary

2.1. Definitions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2.2. Acronyms

| | |
|-------|--|
| ACA | Auto Contingent Allegiance |
| AHS | Additional Header Segment |
| ISID | Initiator Session Identifier |
| LU | Logical Unit |
| PDU | Protocol Data Unit |
| SAM-5 | SCSI Architecture Model - 5 (see [SAM5]) |
| TSIH | Target Session Identifying Handle |

2.3. New Semantics

This document specifies new iSCSI semantics. This section summarizes the contents of the document.

Section 3: The mapping of iSCSI objects to SAM-5 objects
The iSCSI node may contain both initiator and target capabilities.

Section 4: New feature use
New features need negotiation for use. The negotiation may have an impact on standard INQUIRY data.

Section 5: New command operations

The PRI field for SCSI command priority has been added to the SCSI Command PDU (see Section 5.1.1). The Status Qualifier field has been added to the SCSI Response PDU (see Section 5.2.1). Sense data may be returned (via Autosense) for any SCSI status, not just CHECK CONDITION (see Section 5.2.2).

Section 6: New task management functions

Four new task management functions (QUERY TASK, QUERY TASK SET, I_T NEXUS RESET, and QUERY ASYNCHRONOUS EVENT) have been added (see Section 6.3). A new "Function succeeded" response has been added (see Section 6.4.2).

Section 7: New negotiation key

A new negotiation key has been added to enable the use of the new features in Sections 5 and 6.

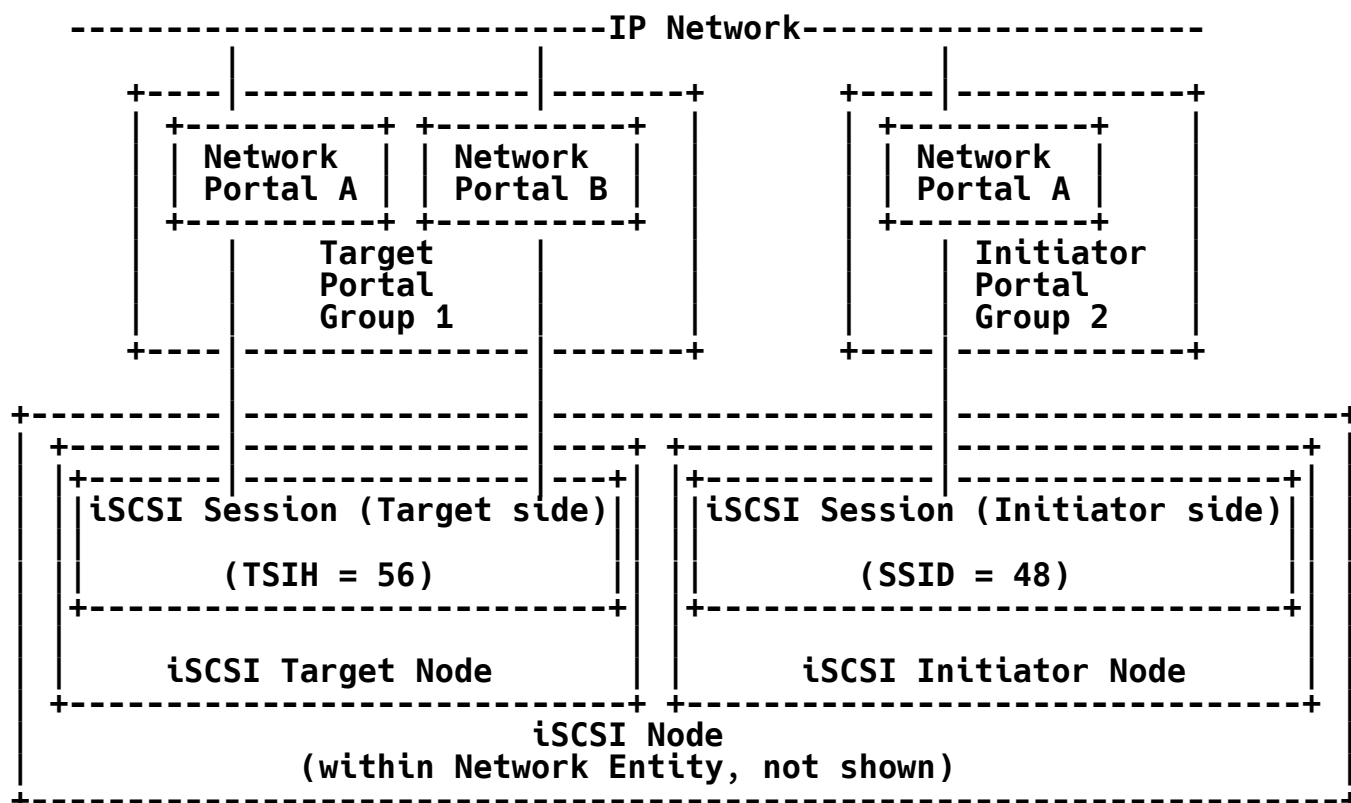
3. Terminology Mapping

The iSCSI model (defined in [RFC7143]) uses different terminology than the SCSI Architecture Model. In some cases, iSCSI uses multiple terms to describe what in the SCSI Architecture Model is described with a single term. The iSCSI terms and SAM-5 terms are not necessarily equivalent, but rather, the iSCSI terms represent examples of the objects or classes described in SAM-5 as follows:

| Terminology in RFC 7143 | Terminology in SAM-5 |
|---|--------------------------------|
| Network Entity | none |
| iSCSI Node | SCSI Device |
| iSCSI Name | SCSI Device Name |
| iSCSI Node Name | SCSI Device Name |
| iSCSI Initiator Node | SCSI Initiator Device |
| iSCSI Initiator Name | SCSI Device Name |
| iSCSI Initiator Port Identifier; (i.e., iSCSI Node Name + ,,i, + ISID)** | SCSI Initiator Port Identifier |
| iSCSI Initiator Port Name; (i.e., iSCSI Node Name + ,,i, + ISID)** | SCSI Initiator Port Name |
| iSCSI Target Node | SCSI Target Device |
| iSCSI Target Name | SCSI Device Name |
| iSCSI Target Port Identifier; (i.e., iSCSI Node Name + ,,t, + Target Portal Group Tag)** | SCSI Target Port Identifier |
| iSCSI Target Port Name; (i.e., iSCSI Node Name + ,,t, + Target Portal Group Tag)** | SCSI Target Port Name |
| iSCSI Target Portal Group | SCSI Target Port |
| iSCSI Initiator Name + ',i,' + ISID + iSCSI Target Name + ',t,' + Target Portal Group Tag | I_T Nexus Identifier |
| Target Portal Group Tag | Relative Port ID |

** The text encoding of the ISID value and the Target Portal Group Tag value includes an initial ,,0X or ,,0x (see [RFC7143]).

The following diagram shows an example of a combination target device and initiator device. Such a configuration may exist in a target device that implements a SCSI Copy Manager. This example shows how a session that shares Network Portals within a Portal Group may be established (see Target Portal Group 1). In addition, this example shows the initiator using a different portal group than the target portal group, but the initiator portal group sharing Network Portal A with the target portal group.



4. New Feature Use

4.1. Negotiation of New Feature Use

The `iSCSIProtocolLevel` operational text key (see Section 7.1.1) containing a value of "2" MUST be negotiated to enable the use of features described in this RFC.

This is an iSCSI negotiation mechanism that enabled iSCSI support for corresponding SCSI capabilities (see [SAM5] and [SPC4]). For this reason, negotiation of this key to a value of "2" is necessary but not sufficient for use of the SCSI capabilities enabled by the iSCSI features in this RFC.

For example, an iSCSI implementation may negotiate this new key to "2" but respond to the new task management functions (see Section 6.3) with "Task management function not supported" (which indicates a SCSI error that prevents the function from being performed). In contrast, if the key is negotiated to "2", an iSCSI implementation **MUST NOT** reject a Task Management Function Request PDU that requests one of the new task management functions (as such a reject would report an iSCSI protocol error).

4.2. Impact on Standard INQUIRY Data - iSCSI Version Descriptors

The negotiated value of the `iSCSIProtocolLevel` key is an increment from the base iSCSI version descriptor value (0960h); see [SPC4]. If the SCSI device server returns an iSCSI version descriptor in the standard INQUIRY data, then the value returned in that iSCSI version descriptor **MUST** be set to the sum of the base value (0960h) plus the negotiated value of the `iSCSIProtocolLevel` key. (For example, if the negotiated `iSCSIProtocolLevel`=2, then if an iSCSI version descriptor is returned in the standard INQUIRY data, it is set to 0962h.)

In support of this functionality, INCITS Technical Committee T10, which is responsible for SCSI standards, has assigned SCSI version descriptor codes 0961h-097Fh to RFC 7144 for IANA to manage via the values 1-31 of the `iSCSIProtocolLevel` key; see Section 9. The "No version claimed" description for the value 0 of the `iSCSIProtocolLevel` key corresponds to the existing T10 assignment of the 0960h SCSI version descriptor code to "iSCSI (no version claimed)" -- for this reason, the assignment of the value 0 in the IANA registry for the `iSCSIProtocolLevel` key must not be changed.

5.1. SCSI Command Additions

| Byte/ | 0 | | | | | | | | 1 | | | | | | | | 2 | | | | | | | | 3 | | | | | | | |
|-------|--|---|---|---|---|---|---|---|----------------------|---|---|---|---|---|---|---|-----|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 | . I 0x01 | | | | | | | | F R W . ATTR | | | | | | | | PRI | | | | | | | | Reserved | | | | | | | |
| 4 | TotalAHSLength | | | | | | | | DataSegmentLength | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Logical Unit Number (LUN) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | Initiator Task Tag | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | Expected Data Transfer Length | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | CmdSN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | ExpStatSN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | SCSI Command Descriptor Block (CDB) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 48 | AHS (Optional) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| x | Header Digest (Optional) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| y | (DataSegment, Command Data) (Optional) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| z | Data Digest (Optional) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

5.1.1. Command Priority (Byte 2)

The Command Priority (PRI) is a four-bit field that specifies the relative scheduling importance of this command in relation to other commands already in the task set with SIMPLE task attributes (see [SAM5]).

Section 11 ("iSCSI PDU Formats") of [RFC7143] requires that senders set this field to zero. A sender **MUST NOT** set this field to a value other than zero unless the `iSCSIProtocolLevel` text key defined in Section 7.1.1 has been negotiated on the session with a value of "2".

This field **MUST** be ignored by iSCSI targets unless the `iSCSIProtocolLevel` text key with a value of "2" as defined in Section 7.1.1 was negotiated on the session.

See [SAM5] for additional considerations on the use of the Command Priority field.

5.2. SCSI Response Additions

The format of the SCSI Response PDU is:

| Byte/ | 0 | 1 | 2 | 3 |
|-------|---|-------------------------------|-----------------|-----------------|
| / | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 |
| 0 | . . 0x21 | 1 . . o u 0 U . | Response | Status |
| 4 | TotalAHSLength | DataSegmentLength | | |
| 8 | Status Qualifier | Reserved | | |
| 12 | Reserved | | | |
| 16 | Initiator Task Tag | | | |
| 20 | SNACK Tag or Reserved | | | |
| 24 | StatSN | | | |
| 28 | ExpCmdSN | | | |
| 32 | MaxCmdSN | | | |
| 36 | ExpDataSN or Reserved | | | |
| 40 | Bidirectional Read Residual Count or Reserved | | | |
| 44 | Residual Count or Reserved | | | |
| 48 | Header-Digest (Optional) | | | |
| / | Data Segment (Optional) | | | / |
| + | / | | | / |
| | Data-Digest (Optional) | | | |

The SCSI Response PDU above is duplicated from [RFC7143] for reference to show the Status Qualifier field. For any field other than the Status field, the Status Qualifier field, and the Data Segment - Sense and Response Data Segment field, the text in [RFC7143] supersedes the text in Section 5.2 of this document in the event the two documents conflict.

5.2.1. Status Qualifier

The Status Qualifier provides additional status information (see [SAM5]).

As defined in Section 11 ("iSCSI PDU Formats") of [RFC7143], compliant senders already set this field to zero. Compliant senders **MUST NOT** set this field to a value other than zero unless the iSCSIProtocolLevel text key with a value of "2" as defined in Section 7.1.1 was negotiated on the session.

This field **MUST** be ignored by receivers unless the iSCSIProtocolLevel text key with a value of "2" as defined in Section 7.1.1 was negotiated on the session.

5.2.2. Data Segment - Sense and Response Data Segment

Section 11.4.7 of [RFC7143] specifies that iSCSI targets **MUST** support and enable Autosense. If Status is CHECK CONDITION (0x02), then the Data Segment **MUST** contain sense data for the failed command. While [RFC7143] does not make any statements about the state of the Data Segment when the Status is not CHECK CONDITION (0x02) (i.e., the Data Segment is not prohibited from containing sense data when the Status is not CHECK CONDITION), negotiation of the iSCSIProtocolLevel text key with a value of "2" as defined in Section 7.1.1 explicitly indicates that the Data Segment **MAY** contain sense data at any time, no matter what value is set in the Status field.

6. Task Management Functions

6.1. Task Management Function Request PDU

| Byte/ / | 0 | | | | | | | | 1 | | | | | | | | 2 | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | |
|------------|-----------------------------------|---|---|---|---|---|---|---|-------------------|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | | | | | | | | | | |
| 0 | . I 0x02 | | | | | | | | 1 Function | | | | | | | | Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | TotalAHSLength | | | | | | | | DataSegmentLength | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Logical Unit Number (LUN) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | Initiator Task Tag | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | Referenced Task Tag or 0xffffffff | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | CmdSN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | ExpStatSN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | RefCmdSN or Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 36 | ExpDataSN or Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | / | | | | | | | |
| 48 | Header-Digest (Optional) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

The Task Management Function Request PDU above is duplicated from [RFC7143] for reference only. [RFC7143] supersedes the text in Sections 6.1 and 6.2 of this document in the event the two documents conflict.

6.2. Existing Task Management Functions

Section 11.5 of [RFC7143] defines the semantics used to request that SCSI task management functions be performed. The following task management functions are defined:

- 1 - ABORT TASK
- 2 - ABORT TASK SET
- 3 - CLEAR ACA
- 4 - CLEAR TASK SET
- 5 - LOGICAL UNIT RESET
- 6 - TARGET WARM RESET
- 7 - TARGET COLD RESET
- 8 - TASK REASSIGN

6.3. Task Management Function Additions

Additional task management function codes are listed below. For a more detailed description of SCSI task management, see [SAM5].

- 9 - QUERY TASK - determine if the command identified by the Referenced Task Tag field is present in the task set.
- 10 - QUERY TASK SET - determine if any command is present in the task set for the I_T_L Nexus on which the task management function was received.
- 11 - I_T NEXUS RESET - perform an I_T nexus loss function (see [SAM5]) for the I_T nexus on which the task management function was received.
- 12 - QUERY ASYNCHRONOUS EVENT - determine if there is a unit attention condition or a deferred error pending for the I_T_L nexus on which the task management function was received.

These task management function requests **MUST NOT** be sent unless the `iSCSIProtocolLevel` text key with a value of "2" as defined in Section 7.1.1 was negotiated on the session.

Any compliant initiator that sends any of the new task management functions defined in this section **MUST** also support all new task management function responses (as specified in Section 6.4.2).

For all of the task management functions detailed in this section, the Task Management Function Response **MUST** be returned as detailed in Section 6.4.

The iSCSI target **MUST** ensure that no responses for the commands covered by a task management function are sent to the iSCSI initiator port after the Task Management response except for commands covered by a TASK REASSIGN, QUERY TASK, or QUERY TASK SET.

If a QUERY TASK is issued for a task created by an immediate command, then RefCmdSN **MUST** be that of the Task Management request itself (i.e., CmdSN and RefCmdSN are equal); otherwise, RefCmdSN **MUST** be set to the CmdSN of the task to be queried (lower than CmdSN).

If the connection is still active (it is not undergoing an implicit or explicit logout), QUERY TASK **MUST** be issued on the same connection to which the task to be queried is allegiant at the time the Task Management request is issued. If the connection is implicitly or explicitly logged out (i.e., no other request will be issued on the failing connection and no other response will be received on the failing connection), then a QUERY TASK function request may be issued on another connection. This Task Management request will then establish a new allegiance for the command being queried.

At the target, a QUERY TASK function **MUST NOT** be executed on a Task Management request; such a request **MUST** result in Task Management response of "Function rejected".

For the I_T NEXUS RESET function, the target device **MUST** respond to the function as defined in [SAM5]. Each logical unit accessible via the receiving I_T NEXUS **MUST** behave as dictated by the I_T nexus loss function in [SAM5] for the I_T nexus on which the task management function was received. The target device **MUST** drop all connections in the session over which this function is received. Independent of the DefaultTime2Wait and DefaultTime2Retain values applicable to the session over which this function is received, the target device **MUST** consider each participating connection in the session to have immediately timed out, leading to FREE state. The resulting timeouts cause the session timeout event defined in [RFC7143], which in turn triggers the I_T nexus loss notification to the SCSI layer as described in [RFC7143].

6.3.1. LUN Field

This field is required for functions that address a specific LU (i.e., ABORT TASK, CLEAR TASK SET, ABORT TASK SET, CLEAR ACA, LOGICAL UNIT RESET, QUERY TASK, QUERY TASK SET, and QUERY ASYNCHRONOUS EVENT) and is reserved in all others.

6.3.2. Referenced Task Tag

The Reference Task Tag is the Initiator Task Tag of the task to be aborted for the ABORT TASK function, reassigned for the TASK REASSIGN function, or queried for the QUERY TASK function. For all other functions, this field **MUST** be set to the reserved value 0xffffffff.

6.3.3. RefCmdSN

If a QUERY TASK is issued for a task created by an immediate command then RefCmdSN **MUST** be that of the Task Management request itself (i.e., CmdSN and RefCmdSN are equal).

For a QUERY TASK of a task created by non-immediate command RefCmdSN **MUST** be set to the CmdSN of the task identified by the Referenced Task Tag field. Targets must use this field as described in section 11.6.1 of [RFC7143] when the task identified by the Referenced Task Tag field is not in the task set.

6.4. Task Management Function Responses

6.4.1. Task Management Function Response PDU

| Byte/ | 0 | 1 | 2 | 3 |
|-------|------------------------------------|-----------------|-----------------|-----------------|
| / | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 | 0 1 2 3 4 5 6 7 |
| 0 | . . 0x22 | 1 Reserved | Response | Reserved |
| 4 | TotalAHSLength DataSegmentLength | | | |
| 8 | Additional Response Information | | | Reserved |
| 12 | Reserved | | | |
| 16 | Initiator Task Tag | | | |
| 20 | Reserved | | | |
| 24 | StatSN | | | |
| 28 | ExpCmdSN | | | |
| 32 | MaxCmdSN | | | |
| 36 | Reserved | | | |
| 48 | Header-Digest (Optional) | | | |

Section 11.6 of [RFC7143] defines the semantics used for responses to SCSI task management functions. The following responses are defined in [RFC7143]:

- 0 - Function Complete
- 1 - Task does not exist
- 2 - LUN does not exist
- 3 - Task still allegiant
- 4 - Task allegiance reassignment not supported
- 5 - Task management function not supported
- 6 - Function authorization failed
- 255 - Function rejected

The Task Management Function Response PDU above and the list of task management function responses above are duplicated from [RFC7143] for reference only. [RFC7143] supersedes the text in section 6.4.1 of this document in the event the two documents conflict.

Responses to new task management functions (see Section 6.4.2) are listed below. In addition, a new task Management response is listed below. For a more detailed description of SCSI task management responses, see [SAM5].

For the functions QUERY TASK, QUERY TASK SET, I_T NEXUS RESET, and QUERY ASYNCHRONOUS EVENT, the target performs the requested Task Management function and sends a Task Management response back to the initiator.

6.4.2. Task Management Function Response Additions

The new response is listed below:

7 - Function succeeded

In symbolic terms Response value 7 maps to the SCSI service response of FUNCTION SUCCEEDED in [SAM5].

The Task Management Function Response of "Function succeeded" MUST be supported by an initiator that sends any of the new task management functions (see Section 6.3).

For the QUERY TASK function, if the specified task is in the task set, then the logical unit returns a Response value of "Function succeeded", and additional response information is returned as specified in [SAM5]. If the specified task is not in the task set, then the logical unit returns a Response value of "Function complete".

For the QUERY TASK SET function, if there is any command present in the task set from the specified I_T_L nexus, then the logical unit returns a Response value of "Function succeeded". If there are no commands present in the task set from the specified I_T_L nexus, then the logical unit returns a Response value of "Function complete".

For the I_T NEXUS RESET function, after completion of the events described in Section 6.3 for this function, the logical unit returns a Response value of "Function complete". However, because the target drops all connections, the Service Response (defined by [SAM5]) for this SCSI task management function may not be reliably delivered to the issuing initiator port.

For the QUERY ASYNCHRONOUS EVENT, if there is a unit attention condition or deferred error pending for the specified I_T_L nexus, then the logical unit returns a Response value of "Function succeeded", and additional response information is returned as specified in [SAM5]. If there is no unit attention or deferred error pending for the specified I_T_L nexus, then the logical unit returns a Response value of "Function complete".

6.5. Task Management Requests Affecting Multiple Tasks

Section 4.1 of [RFC5048] defines the notion of "affected tasks" in multi-task abort scenarios. This section adds to the list included in that section by defining the tasks affected by the I_T NEXUS RESET function.

I_T NEXUS RESET: All outstanding tasks received on the I_T nexus on which the function request was received for all logical units accessible to the I_T nexus.

Sections 4.1.2 and 4.1.3 of [RFC5048] identify semantics for task management functions that involve multi-task abort operations. If an iSCSI implementation supports the I_T NEXUS RESET function, it **MUST** also support the protocol behavior as defined in those sections and follow the sequence of actions as described in those sections when processing the I_T NEXUS RESET function.

7. Login/Text Operational Text Keys

7.1. New Operational Text Keys

7.1.1. iSCSIProtocolLevel

Use: L0, IO
Irrelevant when: SessionType = Discovery
Senders: Initiator and Target
Scope: SW

iSCSIProtocolLevel=<numerical-value-from-0-to-31>

Default is 1.
Result function is Minimum.

This key is used to negotiate the use of iSCSI features that require different levels of protocol support (e.g., PDU formats, end-node semantics) for proper operation.

Negotiation of the `iSCSIProtocolLevel` key to a value corresponding to an RFC indicates that both negotiating parties are compliant to the RFC in question and agree to support the corresponding PDU formats and semantics on that iSCSI session. Features using this key are expected to be cumulative.

An `iSCSIProtocolLevel` key negotiated to "0" indicates that the implementation does not claim a specific iSCSI protocol level.

An `iSCSIProtocolLevel` key negotiated to "1" indicates that the implementation claims compliance with [RFC7143].

An `iSCSIProtocolLevel` key negotiated to "2" is required to enable use of features defined in this RFC.

If the negotiation answer is ignored by the acceptor, or the answer from the remote iSCSI end point is `key=NotUnderstood`, then the features defined in this RFC, and the features defined in any RFC requiring a key value greater than "2", MUST NOT be used.

8. Security Considerations

Command priorities are relative values, not absolute values (see [SAM5], and affect collections of commands, not necessarily individual commands (see [SAM5])). If command priority is supported, it should be implemented in a fashion that avoids unwanted reduction or denial of service.

All the iSCSI-related security text in [RFC3723] is directly applicable to this document. The security text in [RFC7143] is directly applicable as well.

9. IANA Considerations

This document modifies or creates a number of iSCSI-related registries.

The following iSCSI-related registries are modified.

1. iSCSI Task Management Functions Codes

Name of the existing registry: "iSCSI Task Management Function Codes"

The following entries have been added:

- 9 - QUERY TASK, RFC 7144
- 10 - QUERY TASK SET, RFC 7144
- 11 - I_T NEXUS RESET, RFC 7144
- 12 - QUERY ASYNCHRONOUS EVENT, RFC 7144
- 13-127 - Unassigned

2. iSCSI Login/Text Keys

Name of the existing registry: "iSCSI Login/Text Keys"

Fields to record in the registry: Assigned value and its associated RFC reference.

The following entry has been added:

iSCSIProtocolLevel, RFC 7144

IANA has created the following iSCSI-related registries.

3. iSCSI Protocol Level

Name of new registry: "iSCSI Protocol Level"

Namespace details: Numerical values from 0 to 31

Information that must be provided to assign a new value: An IESG-approved Standards Track specification defining the semantics and interoperability requirements of the proposed new value and the fields to be recorded in the registry.

Assignment policy:

The assignments of these values must be coordinated with the INCITS T10 committee; therefore, review by an expert that maintains an association with that committee is required prior to IESG approval of the associated specification. After creation of the registry, values are to be assigned sequentially (for example, any value greater than 4 will not be assigned until after the value 4 has been assigned).

Special care must be taken in the assignment of new values in this registry. Compatibility and interoperability will be adversely impacted if proper care is not exercised. Features using this key are expected to be cumulative. For example, since this document explicitly lists only value 2 for the features listed in this document, it is expected that a new RFC assigning value 3 will also have the features listed in this RFC, and therefore such an RFC is expected to either revise or replace this RFC. Assignments that do not follow this policy should be reviewed and approved by the INCITS T10 committee.

3-31: range available to IANA for assignment in this registry.

Fields to record in the registry: Assigned value, description, and its associated RFC reference.

The following entries have been added:

| Value | Description | Reference |
|-------|--------------------|-----------|
| 0 | No version claimed | RFC 7144 |
| 1 | RFC 7143 | [RFC7143] |
| 2 | RFC 7144 | RFC 7144 |
| 3-31 | Unassigned | |

Allocation Policy: Expert Review and Standards Action [RFC5226]

4. iSCSI Task Management Function Response Codes

Name of new registry: "iSCSI Task Management Function Response Codes"

Namespace details: Numerical values that can fit in 8 bits.

Information that must be provided to assign a new value: An IESG-approved specification defining the semantics and interoperability requirements of the proposed new value and the fields to be recorded in the registry.

Assignment policy:

If the requested value is not already assigned, it may be assigned to the requester.

8-254: Range available to IANA for assignment in this registry.

Fields to record in the registry: Assigned value, Operation Name, and its associated RFC reference.

The following entries have been added:

- 0 - Function complete, [RFC7143]
- 1 - Task does not exist, [RFC7143]
- 2 - LUN does not exist, [RFC7143]
- 3 - Task still allegiant, [RFC7143]
- 4 - Task allegiance reassignment not supported, [RFC7143]
- 5 - Task management function not supported, [RFC7143]
- 6 - Function authorization failed, [RFC7143]
- 7 - Function succeeded, RFC 7144
- 8-254 - Unassigned
- 255 - Function rejected, [RFC7143]

Allocation Policy: Standards Action [RFC5226]

10. References

10.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC3723] Aboba, B., Tseng, J., Walker, J., Rangan, V., and F. Travostino, "Securing Block Storage Protocols over IP", RFC 3723, April 2004.
- [RFC5048] Chadalapaka, M., Ed., "Internet Small Computer System Interface (iSCSI) Corrections and Clarifications", RFC 5048, October 2007.
- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, May 2008.
- [RFC7143] Chadalapaka, M., Satran, J., Meth, K., and D. Black, "Internet Small Computer System Interface (iSCSI) Protocol (Consolidated)", RFC 7143, April 2014.
- [SAM2] INCITS Technical Committee T10, "SCSI Architecture Model - 2 (SAM-2)", ANSI INCITS 366-2003, ISO/IEC 14776-412, 2003.
- [SAM5] INCITS Technical Committee T10, "SCSI Architecture Model - 5 (SAM-5)", T10/BSR INCITS 515 rev 04, Committee Draft.
- [SPC4] INCITS Technical Committee T10, "SCSI Primary Commands - 4", ANSI INCITS 513-201x.

10.2. Informative References

- [RFC3720] Satran, J., Meth, K., Sapuntzakis, C., Chadalapaka, M., and E. Zeidner, "Internet Small Computer Systems Interface (iSCSI)", RFC 3720, April 2004.

11. Acknowledgements

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