To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 15 September 2006
Subject: 06-411r1 SAM-4 SPC-4 Clear REPORTED LUNS DATA HAS CHANGED on any command

Revision history
Revision 0 (7 September 2006) First revision
Revision 1 (15 September 2006) Incorporated comments from September 2006 CAP WG

Related documents
sam4r04 - SCSI Architecture Model - 4 (SAM-4) revision 4
spc4r06 - SCSI Primary Commands - 4 (SPC-4) revision 6
99-144r1 Suggested changes to REPORT LUNS command for SPC-2 (Bob Snively, Sun)
04-313r1 Mandatory REPORT LUNS support (Dave Peterson, CNT)

Overview
When the logical unit inventory changes, each logical unit in the SCSI target device establishes a unit attention condition with an additional sense code of REPORTED LUNS DATA HAS CHANGED. This remains in effect for an I_T nexus until that I_T nexus runs the REPORT LUNS command to any logical unit in the SCSI target device. Processing that command crosses logical unit boundaries and erases any pending unit attentions with additional sense codes of REPORTED LUNS DATA HAS CHANGED in all the logical units. (99-144r1 apparently added this cross-logical unit feature)

This helps filter out a lot of redundant unit attentions; however, it still lets quite a few be reported before an application client is able to respond to one of them and send a REPORT LUNS command.

This proposal has the SCSI target device report the unit attention condition for an I_T nexus exactly only one time. Whichever logical unit is first to receive a command after the unit attention condition is established would report it; the target device would then clear it all logical units (without waiting for a REPORT LUNS command). This new behavior is indicated in a new bit in the Extended INQUIRY Data VPD page.

Suggested changes to SAM-4

3.1.59 logical unit inventory: The list of the logical unit numbers reported by a REPORT LUNS command (see SPC-3).

4.7.3 SCSI target device

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A logical unit is the object to which commands are sent. One of the logical units within the SCSI target device shall be accessed using the logical unit number zero or the REPORT LUNS well-known logical unit number. See 4.8 for a description of the logical unit.

If the logical unit inventory changes for any reason (e.g., completion of initialization, removal of a logical unit, or creation of a logical unit), then the device server shall establish a unit attention condition (see 5.8.7) for the initiator port associated with every I_T nexus, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.

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4.7.4 SCSI target/initiator device

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If the logical unit inventory changes for any reason (e.g., completion of initialization, removal of a logical unit, or creation of a logical unit), then the device server shall establish a unit attention condition (see 5.8.7) for the initiator port associated with every I_T nexus, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.

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4.13.3 Multiple port SCSI target device structure

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Two-way communications shall be possible between all logical units and all SCSI target ports, however, communications between any logical unit and any SCSI target port may be inactive. Two-way communications shall be available between each task manager and all task routers. Each SCSI target port shall accept commands sent to LUN 0 or the REPORT LUNS well-known logical unit and the task router shall route them to a device server for processing. The REPORT LUNS commands (see SPC-3) shall be accepted by the logical unit with the logical unit number zero or the REPORT LUNS well-known logical unit from any SCSI target port and shall return the logical unit inventory available via that SCSI target port. The availability of the same logical unit through multiple SCSI target ports is discovered by matching logical unit name values in the INQUIRY command Device Identification VPD page (see SPC-3).

4.13.5 Multiple port SCSI target/initiator device structure

Two-way communications shall be possible between all logical units and all SCSI target/initiator ports, however, communications between any logical unit and any SCSI target/initiator port may be inactive. Two-way communications shall be possible between an application client and its associated SCSI target/initiator port. Each SCSI target/initiator port shall accept commands sent to LUN 0 or the REPORT LUNS well-known logical unit and the task router shall route them to a device server for processing. The REPORT LUNS commands (see SPC-3) shall be accepted by the logical unit with the logical unit number zero or the REPORT LUNS well-known logical unit from any SCSI target/initiator port and shall return the logical unit inventory available via that SCSI target/initiator port. The availability of the same logical unit through multiple SCSI target/initiator ports is discovered by matching logical unit name values in the INQUIRY command Device Identification VPD page (see SPC-3).

5.8.7 Unit Attention condition

Each logical unit shall generate a unit attention condition whenever one of the following events occurs:

a) A hard reset (see 6.3.2), logical unit reset (see 6.3.3), or I_T nexus loss (see 6.3.4) occurs;
b) A removable medium may have been changed;
c) The mode parameters associated with this I_T nexus have been changed by a task received on another I_T nexus (i.e., initiator ports share mode parameters, see SPC-3);
d) The log parameters associated with this I_T nexus have been changed by a task received on another I_T nexus (i.e., initiator ports share log parameters, see SPC-3);
e) The version or level of microcode has been changed (see SPC-3);
f) Tasks received on this I_T nexus have been cleared by a task or a task management function associated with another I_T nexus and the TAS bit was set to zero in the Control mode page associated with this I_T nexus (see SPC-3);
g) INQUIRY data has been changed (see SPC-3);
h) The logical unit inventory has been changed ~~(see SPC-3)~~(see 4.7.3 and 4.7.4);
i) The mode parameters in effect for the associated I_T nexus have been restored from non-volatile memory (see SPC-3); or
j) Any other event requiring the attention of the SCSI initiator device.

Logical units may queue unit attention conditions. After the first unit attention condition is cleared, another unit attention condition may exist (e.g., a unit attention condition with an additional sense code set to POWER ON OCCURRED may be followed by one with an additional sense code set to MICROCODE HAS BEEN CHANGED).

A unit attention condition shall persist on the logical unit for the SCSI initiator port associated with each I_T nexus until the SCSI initiator port associated with the I_T nexus clears the condition. Unit attention conditions are affected by the processing of commands as follows: ~~as described in the remainder of this subclause.~~[the remaining paragraphs in this section are converted into an a)b)c)d) list]

a) If an INQUIRY command enters the enabled task state, the ~~logical unit~~device server shall perform the INQUIRY command and shall neither report nor clear any unit attention condition~~.~~;

b) If a REPORT LUNS command enters the enabled task state, the ~~logical unit~~device server shall perform the REPORT LUNS command and shall not report any unit attention condition. [new paragraph break]

If the UA_INTLCK_CTRL field in the Control mode page is set to 00b (see SPC-3), ~~For each logical unit accessible by the I_T nexus on which the REPORT LUNS command was received,~~ the SCSI target device shall clear any pending unit attention condition with an additional sense code of REPORTED LUNS DATA HAS CHANGED established for the initiator port associated with that I_T nexus ~~as a result of a change in the logical unit inventory shall be cleared~~ in each logical unit accessible by the I_T nexus on which the REPORT LUNS command was received. [join] Other pending unit attention conditions shall not be cleared. [new paragraph break]

If the UA_INTLCK_CTRL field in the Control mode page is not set to 00b, the SCSI target device shall not clear any unit attention condition(s):

c) If a REQUEST SENSE command enters the enabled task state while a unit attention condition exists for the SCSI initiator port associated with the I_T nexus on which the REQUEST SENSE command was received, then the ~~logical unit~~device server shall return GOOD status and either:
   A) Report any pending sense data as parameter data and preserve all unit attention conditions on the logical unit; or~~,~~
   B) Report a unit attention condition as parameter data for the REQUEST SENSE command to the SCSI initiator port associated with the I_T nexus on which the REQUEST SENSE command was received.

   The logical unit may discard any pending sense data and shall clear the reported unit attention condition for the SCSI initiator port associated with that I_T nexus. If the unit attention condition has an additional sense code of REPORTED LUNS DATA HAS CHANGED, the SCSI target device shall clear any pending unit attention conditions with an additional sense code of REPORTED LUNS DATA HAS CHANGED established for the I_T nexus on which the command was received in each logical unit accessible by that I_T nexus.

If the logical unit has already generated the ACA condition (see 5.8.2) for a unit attention condition, the logical unit shall report the unit attention condition (i.e., option ~~b)~~ B) above)~~.~~; and

d) If a command other than INQUIRY, REPORT LUNS, or REQUEST SENSE enters the enabled task state while a unit attention condition exists for the SCSI initiator port associated with the I_T nexus on which the command was received, the ~~logical unit~~device server shall terminate the command with a CHECK CONDITION status. The ~~logical unit~~device server shall provide sense data that reports a unit attention condition for the SCSI initiator port that sent the command on the I_T nexus.

If a ~~logical unit~~device server reports a unit attention condition with a CHECK CONDITION status and the UA_INTLCK_CTRL field in the Control mode page contains 00b (see SPC-3), then the ~~logical unit~~device server shall clear the reported unit attention condition for the SCSI initiator port associated with that I_T nexus on the logical unit. If the unit attention condition has an additional sense code of REPORTED LUNS DATA HAS CHANGED, the SCSI target device shall clear any pending unit attention conditions with an additional sense code of REPORTED LUNS DATA HAS CHANGED established for the I_T nexus on which the command was received in each logical unit accessible by that I_T nexus. If the UA_INTLCK_CTRL field contains 10b or 11b, the ~~logical unit~~device server shall not clear unit attention conditions reported with a CHECK CONDITION status.

Suggested changes to SPC-4

3.1.59 logical unit inventory: The list of the logical unit numbers reported by a REPORT LUNS command (see 6.20).

5.2.4 Using the REPORT LUNS command

The REPORT LUNS command (see 6.20) may be used by an application client to discover the logical unit inventory (see 3.1.59) that is accessible to the I_T nexus on which the command is sent.

Editor's Note 1: 04-313r1 made REPORT LUNS mandatory for all LUNs, not just LUN 0. The "(for

5.8.2.4.4 Standby state

When being accessed through a target port in the standby target port asymmetric access state, the device server shall support those of the following commands that it supports while in the active/optimized target port asymmetric access state:

a) INQUIRY;
b) LOG SELECT;
c) LOG SENSE;
d) MODE SELECT;
e) MODE SENSE;
f) REPORT LUNS (for LUN 0);
g) RECEIVE DIAGNOSTIC RESULTS;
h) ...

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5.8.2.4.5 Unavailable state

While in the unavailable target port asymmetric access state, the device server shall support those of the following commands that it supports while in the active/optimized state:

a) INQUIRY (the peripheral qualifier (see 6.4.2) shall be set to 001b);
b) REPORT LUNS (for LUN 0);
c) REPORT TARGET PORT GROUPS;
d) SET TARGET PORT GROUPS;
e) REQUEST SENSE;
f) Echo buffer modes of READ BUFFER;
g) Echo buffer modes of WRITE BUFFER; and
h) Download microcode mode of WRITE BUFFER.

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5.8.2.5 Transitions between target port asymmetric access states

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During a transition between target port asymmetric access states the device server shall respond to a command in one of the following ways:

a) If during the transition the logical unit is inaccessible, then the transition is performed as a single indivisible event and the device server shall respond by either returning BUSY status, or returning CHECK CONDITION status, with the sense key set to NOT READY, and an the sense code set to LOGICAL UNIT NOT ACCESSIBLE, ASYMMETRIC ACCESS STATE TRANSITION; or
b) If during the transition the target ports in a target port group are able to access the requested logical unit, then the device server shall support those of the following commands that it supports while in the active/ optimized asymmetric access state:
    A) INQUIRY;
    B) REPORT LUNS (for LUN 0));
    C) REPORT TARGET PORT GROUPS;
    D) REQUEST SENSE;
    E) Echo Buffer modes of READ BUFFER; and
    F) Echo Buffer modes of WRITE BUFFER.

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6.20 REPORT LUNS command

The REPORT LUNS command (see table 147) requests that the peripheral device logical unit inventory accessible to the I_T nexus be sent to the application client. The logical unit inventory is a list that shall include the logical unit numbers of all logical units having a PERIPHERAL QUALIFIER value of 000b (see 6.4.2). Logical

unit numbers for logical units with PERIPHERAL QUALIFIER values other than 000b and 011b may be included in the logical unit inventory. Logical unit numbers for logical units with a PERIPHERAL QUALIFIER value of 011b shall not be included in the logical unit inventory.

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The REPORT LUNS command shall return CHECK CONDITION status only when the device server is unable to return the requested report of the logical unit inventory.

If a REPORT LUNS command is received from an I_T nexus with a pending unit attention condition (i.e., before the device server reports CHECK CONDITION status), the device server shall perform the REPORT LUNS command (see SAM-4).

~~If the unit attention condition was established because of a change in the logical unit inventory , that unit attention condition shall be cleared for the initiator port associated with that I_T nexus by the REPORT LUNS command.~~

~~Unit attention conditions established for other reasons shall not be cleared by the REPORT LUNS command (see SAM-4).~~

The REPORT LUNS parameter data should be returned even though the device server is not ready for other commands. The report of the logical unit inventory should be available without incurring any media access delays.

If the device server is not ready with the logical unit inventory or if the inventory list is null for the requesting I_T nexus and the SELECT REPORT field set to 02h, then the device server shall provide a default logical unit inventory that contains at least LUN 0 or the REPORT LUNS well known logical unit (see 8.2). A non-empty peripheral device logical unit inventory that does not contain either LUN 0 or the REPORT LUNS well known logical unit is valid.

If a REPORT LUNS command is received for a logical unit that the SCSI target device does not support and the device server is not capable of returning the logical unit inventory, then the command shall be terminated with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to LOGICAL UNIT NOT SUPPORTED.

~~If the logical unit inventory changes for any reason (e.g., completion of initialization, removal of a logical unit, or creation of a logical unit), then the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.~~

Editor's Note 2: the above sentence belongs in SAM-4 since it is not related to REPORT LUNS command processing

~~The processing of a REPORT LUNS command that returns the logical unit inventory by any logical unit shall clear the REPORTED LUNS DATA HAS CHANGED unit attention condition for all logical units accessible to the the I_T nexus on which the command was received~~

Editor's Note 3: the above sentence moves to SAM-4 since it is not unique to the REPORT LUNS command any more

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7.6.4 Extended INQUIRY Data VPD page

The Extended INQUIRY Data VPD page (see table 347) provides the application client with a means to obtain information about the logical unit.

[Add Byte 7 bit 0 LUICLR bit]

An LUICLR bit set to one indicates the SCSI target device clears any unit attention condition with an additional sense code of REPORTED LUNS DATA HAS CHANGED in each logical unit accessible to an I_T nexus after reporting it on any logical unit over that I_T nexus (see SAM-4). An LUICLR bit set to zero indicates the SCSI target device clears unit attention conditions according to a previous version of this standard. The LUICLR bit shall be set to one.

8.3.3.3 DISABLE ACCESS CONTROLS service action

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In response to an ACCESS CONTROL OUT command with DISABLE ACCESS CONTROLS service action with correct management identifier key value the access controls coordinator shall:

a) Disable access controls;
b) Clear the ACL (see 8.3.1.3);
c) Place all initiator ports into the not-enrolled state (see 8.3.1.5.1);
d) Set the management identifier key to zero (see 8.3.1.8);
e) Set the override lockout timer to zero (see 8.3.1.8.2.2);
f) Set the initial override lockout timer value to zero (see 8.3.1.8.2.2);
g) Clear the access controls log, including resetting the events counters to zero, with the exception of the key overrides portion of the access controls log (see 8.3.1.10);
h) Allow all initiator port's access to all logical units at their default LUN value;
i) Optionally, set the DLgeneration counter to zero (see 8.3.1.4.4); and
j) Establish a unit attention condition for the initiator port associated with every I_T nexus in each logical unit in the SCSI target device, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.