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Subject:     Suggested changes to REPORT LUNS command for SPC-2

# 1 Introduction

Today's RAID devices and Fibre Channel bridge devices have a very large logi-
cal unit address space and potentially large numbers of logical units actually im-
plemented. The REPORT LUNS command has become a necessary tool for
probing for the presence of logical units in that large logical unit address space.
Use of the command by operating systems and applications is very similar to the
use of the INQUIRY command during the probe process, and is usually required
before the INQUIRY command can be executed. For this reason, the REPORT
LUNS command's definition should be modified to behave like an INQUIRY
command with respect to reservations, Unit Attention conditions, and other sim-
ilar functions that may inadvertently interfere with the required configuration
probing functions.

SPC-2, revision 8, has now defined the ASC/ASCQ of REPORTED LUNS DATA
HAS CHANGED, 3Fh 0Eh, for all devices. This is the expected Unit Attention
to warn that a LUN has either come into existence, changed type, or been de-
stroyed. Since EPI revision 16 is vague about how the Unit Attention shall be of-
fered, a proposal for that mechanism is also included in this document.

The following changes in SPC-2, revision 8, and SAM-2, revision 9, are re-
quired to support the proposed behavior.

# 2 Changes required in SPC-2, revision 8.

The text of section 7.19, REPORT LUNS (pdf page 100 and 101) needs to be modified
as shown below to include the requirement that the REPORT LUNS command be able
to execute in the presence of check conditions and unit attention conditions. The text is
similar to section 7.4 (pdf pages 62 and 63), describing the INQUIRY command.

## 7.19 REPORT LUNS command

The REPORT LUNS command (see table 60) requests that the peripheral device
logical unit numbers of known logical units in the target be sent to the application
client. The REPORT LUNS command shall return information about only those
logical units to which commands may be sent. When the HISUP bit is one (see
7.4.1), the device server shall support the REPORT LUNS command. A SCSI de-
vice that is capable of supporting a LUN address other than zero shall should sup-
port the REPORT LUNS command on logical unit zero.

The allocation length shall be at least 16 bytes. If the allocation length is less than 16 bytes, the device server shall return CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense data shall be set to INVALID FIELD IN CDB.

~~The~~ If the allocation length is not sufficient to contain the logical unit number values for all configured logical units, the device server shall report as many logical unit number values as will fit in the specified allocation length. This shall not be considered an error.

The device server shall report the logical unit numbers of configured logical units using the format shown in table 61.

The LUN LIST LENGTH field shall contain the length in bytes of the LUN list that is available to be transferred. The LUN list length is the number of logical unit numbers reported multiplied by eight. If the allocation length in the command descriptor block is too small to transfer information about all configured logical units, the LUN list length value shall not be adjusted to reflect the truncation.

The REPORT LUNS command shall return CHECK CONDITION status only when the device server cannot return the requested report of the logical units.

If a REPORT LUNS command is received from an initiator 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. If the unit attention condition was established because of a change in the inventory of logical units, the unit attention condition shall be cleared for that initiator by the REPORT LUNS command. In all other cases, the REPORT LUNS command shall not clear the unit attention condition (see SAM-2).

The report of the logical units should be returned even though the device server is not ready for other commands. To minimize delays after a hard reset or power-up condition, the default report of the logical units should be available without incurring any media access delays. The default logical unit report shall contain at least LUN 0. If the device server modifies the report of the logical units during its initialization sequence, the device server shall generate a unit attention command for all initiators (see SAM-2). The device server shall set the additional sense code to REPORTED LUNS DATA HAS CHANGED.

The execution of a REPORT LUNS command to valid and installed logical unit may clear the unit attention for all logical units of that target to the requesting initiator. A valid and installed logical unit is one having a peripheral qualifier of 000 if the INQUIRY command were executed.

## 3  Changes required in SAM-2, revision 9

Section 5.6.5 on pdf pages 72 and 73 needs to be modified in the following manner. The modifications clarify when a unit attention may be caused and how it interacts with the REPORT LUNS command.

## 5.6.5 Unit Attention condition

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Each logical unit shall generate a unit attention condition whenever the logical unit has been reset as described in 5.6.6 or by a power-on reset. In addition, a logical unit shall generate a unit attention condition for each initiator whenever one of the following events occurs:

a) A removable medium may have been changed;

b) The mode parameters in effect for this initiator have been changed by another initiator;

c) The version or level of microcode has been changed;

d) Tasks for this initiator were cleared by another initiator;

e) INQUIRY data has been changed;

f) The mode parameters in effect for the initiator have been restored from non-volatile memory;

g) A change in the condition of a synchronized spindle; or

h) Any other event requiring the attention of the initiator.

Logical units may queue unit attention conditions. After the first unit attention condition is cleared, another unit attention condition may exist (e.g., a power on condition followed by a microcode change condition).

A unit attention condition shall persist on the logical unit for each initiator until that initiator clears the condition as described in the following paragraphs.

If an INQUIRY or a REPORT LUNS command is received from an initiator to a logical unit with a pending unit attention condition (before the logical unit generates the auto contingent allegiance or contingent allegiance condition), the logical unit shall perform the ~~INQUIRY~~ command. If the unit attention condition was established because of a change in the inventory of logical units, the unit attention condition shall be cleared for that initiator by a REPORT LUNS command. In all other cases, the INQUIRY or REPORT LUNS command ~~and~~ shall not clear the unit attention condition.

If a request for sense data is received from an initiator with a pending unit attention condition (before the logical unit establishes the auto contingent allegiance or contingent allegiance condition), then the logical unit shall either:

a) Report any pending sense data and preserve the unit attention condition on the logical unit; or,

b) Report the unit attention condition.

If the second option is chosen (reporting the unit attention condition), the logical unit may discard any pending sense data and may clear the unit attention condition for that initiator.

If the logical unit has already generated the auto contingent allegiance or contingent allegiance condition for the unit attention condition, the logical unit shall perform the second action listed above. If NACA for the REQUEST SENSE command is zero and the command is untagged the contingent allegiance condition shall be cleared.

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If an initiator issues a command other than INQUIRY, REPORT LUNS, or RE-QUEST SENSE while a unit attention condition exists for that initiator (prior to generating the auto contingent allegiance or contingent allegiance condition for the unit attention condition), the logical unit shall not perform the command and shall report ACA ACTIVE (NACA=1, see 5.1.2) or BUSY (NACA=0) status.

If a logical unit successfully sends an asynchronous event report informing the initiator of the unit attention condition, then the logical unit shall clear the unit attention condition for that initiator on the logical unit (see 5.6.4.1).

## 4  Additional problems identified during study of this proposal

### 4.1  Incomplete definition of task completion, SAM-2 revision 9

Section 5.4 of SAM-2 (pdf page 65) indicates that one of the conditions marking the end of a task is:

b) A unit attention condition with one of the following additional sense codes:

   a) COMMANDS CLEARED BY ANOTHER INITIATOR (if in reference to the task set containing the task);

   b) POWER ON;

   c) RESET; or

   d) TARGET RESET.

This is really incomplete. Other text in this section indicates that service responses of task complete (including GOOD status or CHECK CONDITION status) for the referenced task indicate task completion. However, it is not made explicit that the case described above is for any unit attention for any task for any initiator. I would propose that item b) be changed to read:

b) A unit attention condition to any initiator for any task containing with one of the following additional sense codes:

   a) COMMANDS CLEARED BY ANOTHER INITIATOR (if in reference to the task set containing the task);

   b) POWER ON;

   c) RESET; or

   d) TARGET RESET.

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