To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 2 September 2008
Subject: 08-344r0 SAT-2 ATA PASS-THROUGH sense data format

Revision history

Revision 0 (2 September 2008) First revision

Related documents

sat2r06 - SCSI/ATA Translation - 2 (SAT-2) revision 6

Overview

(this is a SAT-2 letter ballot comment)

SAT-1 and SAT-2 define that the ATA PASS-THROUGH commands always return descriptor format sense data and never return fixed format sense data.

1. This violates the basic SPC-4 definitions of sense data formats, which dictate that the sense data format is controlled by the D_SENSE bit in the Control mode page. Returning descriptor format for these commands when all other commands are returning fixed format can confuse legacy software stacks that don't understand descriptor format sense data (e.g., they might expect byte 2 to contain a sense key, byte 7 to contain a length field, and bytes 12-13 to contain an additional sense code).

2. The sense data returned is typically 22 bytes long (if only the ATA Return descriptor is included, 8+14=22). Legacy software stacks often only support 18 bytes of sense data (or possibly 20 bytes, if they use a dword boundary), truncating the last bytes. Unfortunately, the last bytes contain very important fields - the DEVICE and STATUS fields.

SAT-2 should comply with SPC-4 and return fixed format sense data when appropriate. All the fields for 28-bit commands fit; for 48-bit commands, bits are proposed to indicate zero vs. non-zero for the fields that do not fit.

Editorially, "ATA Return descriptor" should be "ATA Status Return descriptor" to match other references in SAT-2 and also in SPC-4.

Suggested changes

8.8 REQUEST SENSE command

8.8.1 REQUEST SENSE command overview

The REQUEST SENSE command requests any available sense data to be returned to the application client. If the SCSI transport protocol for the SATL supports autosense (see 3.1.29), the SATL shall return sense data using autosense. Otherwise, the SATL shall return sense data in response to the REQUEST SENSE command (see SAM-2).

The SATL shall determine if there is sense data to return to the application client. To determine if there is power condition sense data to return, the SATL shall send the ATA CHECK POWER MODE command to the ATA device. If the ATA CHECK POWER MODE command does not complete with success then no power condition sense data shall be returned. If the SATL has no sense data to return, then the SATL shall complete the REQUEST SENSE command with GOOD status with the sense key set to NO SENSE and the additional sense code set to NO ADDITIONAL SENSE DATA (see SPC-3). Table 20 lists examples of conditions where the SATL has sense data to return.

...

Editor's Note 1: Option A (preferred) is to fix SAT-2 and leave the old behavior defined in SAT-1 only (defined as "obsolete" in SAT-2). Option B defines both behaviors in SAT-2, marking the old behavior as "should not" and adding a note that the old behavior may become obsolete in future versions of this standard.

[Option A (preferred):]

Table 21 shows the fields in the REQUEST SENSE CDB.

Table 21 — REQUEST SENSE CDB field translations

Field	Descriptor or reference
OPERATION CODE	Set to 03h. The SATL shall return any available sense data to the application client.
DESC ~~A~~ [b]	~~If the SATL supports the ATA PASS-THROUGH command (see 12.2), then the SATL shall support returning descriptor format sense data (i.e., specified by the DESC bit set to one) otherwise this field is unspecified (see 3.4.2).~~ Unspecified (see 3.4.2)
ALLOCATION LENGTH	Unspecified (see 3.4.2)
CONTROL	6.5

~~a~~ ~~If the SATL supports the ATA PASS-THROUGH command (see 12.2), then the SATL shall support returning descriptor format sense data (i.e., specified by the DESC bit set to one).~~

b SATLs compliant with previous versions of this standard return descriptor format sense data for the ATA PASS-THROUGH commands regardless of the value of the DESC bit.

[Option B:]

Table 21 shows the fields in the REQUEST SENSE CDB.

Table 21 — REQUEST SENSE CDB field translations

Field	Descriptor or reference
OPERATION CODE	Set to 03h. The SATL shall return any available sense data to the application client.
DESC [A]	~~If the SATL supports the ATA PASS-THROUGH command (see 12.2), then the SATL shall support returning descriptor format sense data (i.e., specified by the DESC bit set to one) otherwise this field is unspecified (see 3.4.2).~~ The SATL shall support this bit as defined in SPC-4 with the following exception: a) if the DESC bit is set to zero (i.e., requesting fixed format sense data), the SATL may but should not return descriptor format sense data for the ATA PASS-THROUGH commands. [a]
ALLOCATION LENGTH	Unspecified (see 3.4.2)
CONTROL	6.5

~~a~~ ~~If the SATL supports the ATA PASS-THROUGH command (see 12.2), then the SATL shall support returning descriptor format sense data (i.e., specified by the DESC bit set to one).~~

b SATLs compliant with previous versions of this standard return descriptor format sense data for the ATA PASS-THROUGH commands regardless of the value of the DESC bit. Future versions of this standard may require that the D_SENSE bit be honored for the ATA PASS-THROUGH commands.

[end of Option A vs Option B]

...

10.1.5 Control mode page

10.1.5.1 General translation

[Option A (preferred:)]

The Control mode page provides controls and information about behavior of the emulated SCSI device.

Table 69 — Control mode page fields

Field	Changeable	Descriptor or reference
...		...
D_SENSE	Unspecified	~~A SATL shall support a D_SENSE bit set to zero indicating that the logical unit returns the fixed sense data format, and a SATL may support a D_SENSE bit set to one indicating logical unit returns the descriptor sense data format.~~ ~~The SATL shall return sense data in the format indicated when returning CHECK CONDITION status for any commands except the ATA PASS-THROUGH (12) command and the ATA PASS-THROUGH (16) command. The SATL shall return sense data for a CHECK CONDITION status returned by an ATA PASS-THROUGH (12) command or an ATA PASS-THROUGH (16) command in the descriptor format.~~ Unspecified (see 3.4.2)
...		...

[a] SATLs compliant with previous versions of this standard return descriptor format sense data for the ATA PASS-THROUGH commands regardless of the value of the D_SENSE bit.

[Option B:]

The Control mode page provides controls and information about behavior of the emulated SCSI device.

Table 69 — Control mode page fields

Field	Changeable	Descriptor or reference
...		...
D_SENSE	Unspecified	~~A SATL shall support a D_SENSE bit set to zero indicating that the logical unit returns the fixed sense data format, and a SATL may support a D_SENSE bit set to one indicating logical unit returns the descriptor sense data format.~~ ~~The SATL shall return sense data in the format indicated when returning CHECK CONDITION status for any commands except the ATA PASS-THROUGH (12) command and the ATA PASS-THROUGH (16) command. The SATL shall return sense data for a CHECK CONDITION status returned by an ATA PASS-THROUGH (12) command or an ATA PASS-THROUGH (16) command in the descriptor format.~~ The SATL shall support this bit as defined in SPC-4 with the following exception: a) if the D_SENSE bit is set to zero (i.e., fixed format sense data), the SATL may but should not return descriptor format sense data for the ATA PASS-THROUGH commands. [a]
...		...

[a] SATLs compliant with previous versions of this standard return descriptor format sense data for the ATA PASS-THROUGH commands regardless of the value of the D_SENSE bit. Future versions of this standard may require that the D_SENSE bit be honored for the ATA PASS-THROUGH commands.

[end of Option A vs Option B]

...

12.2 ATA PASS-THROUGH commands

12.2.1 ATA PASS-THROUGH commands overview

ATA PASS-THROUGH commands provide a method for:

a) an application client to transmit an ATA command to an ATA device;
b) optionally, transferring data between an application client and an ATA device; and
c) an ATA device to transfer completion status through the SATL.

This is accomplished by defining:

a) CDBs containing ATA command information (see 12.2.2 and 12.2.3); and
b) specific SCSI status and sense data usage for returning the results of an ATA command (see 12.2.5 and 12.2.6).

12.2.2 ATA PASS-THROUGH (12) command

Table 100 shows the CDB for the ATA PASS-THROUGH (12) command.

...

The PROTOCOL field specifies the protocol to use when the ATA device executes the command. ATA8-AAM defines the meaning of protocol values ranging from 0 to 11.

If the PROTOCOL field specified is in the range from 3 to 12, the SATL shall send an ATA command to the ATA device.

If the PROTOCOL field contains 15 (i.e., Return Response Information), then the SATL shall:

a) if the transport is SATA, read the current Shadow Command Block registers; or
b) if the transport is PATA, read the current Command Block registers;

and return the contents in the ATA Status Return Descriptor as defined in 12.2.6. The SATL shall ignore all other fields in the CDB.

If the value in the PROTOCOL field is inappropriate for the command specified in the COMMAND field (see ATA8-ACS), then the SATL may lose communication with the ATA device. This standard does not specify the SATL behavior if this occurs.

If the value in the PROTOCOL field is set to zero (i.e., ATA Hardware Reset) and the device is a PATA device, then the SATL shall assert RST- (see ATA8-APT). If the value in the PROTOCOL field is set to zero (i.e., ATA Hardware Reset) and the device is a SATA device, then the SATL shall send a COMRESET to the SATA device. When this protocol is selected, only the PROTOCOL field and the OFF_LINE field are valid. The SATL shall ignore all other fields in the CDB.

If the PROTOCOL field is set to one, then the SATL shall send a software reset to the ATA device (see ATA8-AAM). When this protocol is selected, only the PROTOCOL field and the OFF_LINE field are valid. The SATL shall ignore all other fields in the CDB.

If the value in the PROTOCOL field requests the SATL to send a command to the ATA device, then the SATL shall set the fields in the ATA command using fields in the ATA PASS-THROUGH CDB as shown in table 105.

The SATL shall determine if a data transfer is necessary and how to perform the data transfer by examining values in the MULTIPLE_COUNT field, PROTOCOL field, OFF_LINE field, T_DIR bit, BYTE_BLOCK bit, and T_LENGTH field. The SATL shall ignore the COMMAND field in the CDB except to copy the COMMAND field in the CDB to the Command field in the Register – Host to Device FIS or to the ATA Command register. If the ATA command completes with an error, then the SATL shall return the Error Output fields (see ATA8-ACS) in the ~~ATA Return descriptor (see 12.2.6)~~sense data.

The SATL shall configure the ATA host and the ATA device for the PIO, DMA, and UDMA transfer rates that both the SATL and ATA device support. The SATL should set the transfer rates to the maximum supported by both the SATL and the ATA device. The COMMAND field of the CDB may specify the ATA SET FEATURES command. The ATA PASS-THROUGH (12) command should not be used to send an ATA SET FEATURES command that changes the PIO/DMA/UDMA or other transfer modes of the ATA device. The result of a SET FEATURES command that changes the PIO/DMA/UDMA or other transfer modes of the ATA device is outside the scope of this standard and may cause communication to be lost with the ATA device; preventing the SATL from performing any action based on the contents of the CDB.

The BYTE_BLOCK (Byte/Block) bit specifies whether the transfer length in the location specified by the T_LENGTH field specifies the number of bytes to transfer or the number of blocks to transfer. If the value in the BYTE_BLOCK bit is set to zero, then the SATL shall transfer the number of bytes specified in the location specified by the T_LENGTH field. If the value in the BYTE_BLOCK bit is set to one the SATL shall transfer the number of blocks specified in the location specified by the T_LENGTH field. The SATL shall ignore the BYTE_BLOCK bit when the T_LENGTH field is set to zero.

The CK_COND (Check Condition) bit may be used to request the SATL to return a copy of ATA register information in the sense data upon command completion. If the CK_COND bit is set to one the SATL shall return a status of CHECK CONDITION when the ATA command completes, even if the command completes successfully, and return the ATA Normal Output fields (see ATA8-ACS) in the sense data ~~using the ATA Return descriptor (see 12.2.6)~~. If the CK_COND bit is set to zero, then the SATL shall terminate the command with CHECK CONDITION status only if an error occurs in processing the command. See clause 11 for a description of ATA error conditions.

...

12.2.5 ATA PASS-THROUGH status return

Table 107 shows the possible results of ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command processing depending on the value of the CK_COND bit in the CDB, as reflected in the ERR bit and the DF bit in the ATA Status field.

Table 107 — ATA command results

Status field		Sense data returned
ERR	DF	
0	0	No error, successful completion or command in progress. The SATL shall respond to a REQUEST SENSE command and shall return sense data with the sense key set to NO SENSE with the additional sense code set to NO ADDITIONAL SENSE INFORMATION.
		No error, successful completion or command in progress. The SATL shall terminate the command with CHECK CONDITION status with the sense key set to RECOVERED ERROR with the additional sense code set to ATA PASS-THROUGH INFORMATION AVAILABLE (see SPC-4). ~~The~~Descriptor format sense data shall include the ATA Status Return Descriptor (see 12.2.5)[a] .
n/a	1	The ATA command completed with an error. The SATL shall terminate the command with CHECK CONDITION status with the sense key and additional sense code set as described in clause 11~~ and the~~. Descriptor format sense data shall include the ATA Status Return Descriptor (see 12.2.6).
1	0	

[a] This capability allows the host to retrieve the ATA register or field information with successful command completion by returning data in the ATA registers or fields.

ATA commands may return information in the ATA registers or the Shadow Command Block. The current ATA register information may be retrieved by requesting the ATA Status Return Descriptor issuing the ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command with the PROTOCOL field set to 15 (i.e., Return Response Information).

12.2.6 ATA Status Return descriptor

Table 108 shows the format of the ATA Status Return descriptor. The ATA Status Return descriptor is:

a) returned in the descriptor format sense data (see SPC-3 and SAM-4)~~.~~; and
b) ~~The SATL shall return the ATA Return descriptor~~ returned as parameter data if the PROTOCOL field in the ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command is set to 15 (i.e., Return Response Information).

~~The SATL shall support the ATA Status Return descriptor if the SATL supports the ATA PASSTHROUGH (12) command or the ATA PASS-THROUGH (16) command.~~ Each time the ATA Status Return descriptor is requested~~:~~, the SATL shall read the ATA registers and return those values in the sense data as shown in table 108. If the sense data is for an ATA PASS-THROUGH (12) command or for the ATA PASS-THROUGH (16) command with the EXTEND bit set to zero, then the SATL shall return the 28-bit extended status and shall set the EXTEND bit to zero.

If the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to one, then the SATL shall return the 48-bit extended status and shall set the EXTEND bit to one.

Table 108 — ATA Return descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	DESCRIPTOR CODE (09h)							
1	ADDITIONAL DESCRIPTOR LENGTH (0Ch)							
2	Reserved							**EXTEND**
3	ERROR							
4	SECTOR_COUNT (15:8)							
5	SECTOR_COUNT (7:0)							
6	LBA_LOW (15:8)							
7	LBA_LOW (7:0)							
8	LBA_MID (15:8)							
9	LBA_MID (7:0)							
10	LBA_HIGH (15:8)							
11	LBA_HIGH (7:0)							
12	DEVICE							
13	STATUS							

An EXTEND bit set to one indicates that the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to one. An EXTEND bit set to zero indicates that the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to zero or for an ATA PASS-THROUGH (12) command.

If the EXTEND bit is set to one, then the SECTOR_COUNT (15:8) field, the LBA_LOW (15:8) field, the LBA_MID (15:8) field; and the LBA_HIGH (15:8) field are not able to be returned in fixed format sense data.

If the EXTEND bit is set to one, then the SECTOR_COUNT (7:0) field and SECTOR_COUNT (15:8) field ~~specify~~indicate the ATA Sector Count. If the EXTEND bit is set to zero, then the SECTOR_COUNT (7:0) field ~~specifies~~indicates the ATA Sector Count and SECTOR_COUNT (15:8) field shall be ignored.

If the EXTEND bit is set to one, then the LBA_LOW (7:0) field, LBA_MID (7:0) field, LBA_HIGH (7:0) field, LBA_LOW (15:8) field, LBA_MID (15:8) field, and LBA_HIGH (15:8) field specify the ATA LBA. If the EXTEND bit is set to zero, then the LBA_LOW (7:0) field, LBA_MID (7:0) field, and LBA_HIGH (7:0) field ~~specify~~indicate the ATA LBA, and the LBA_LOW (15:8) field, LBA_MID (15:8) field, and LBA_HIGH (15:8) field shall be ignored.

12.2.6 Fixed format sense data [all new]

Table 109 shows the fields returned in the fixed format sense data (see SPC-4) for the ATA PASS-THROUGH commands.

Table 109 — Fixed format sense data fields for the ATA PASS-THROUGH commands

Field	Descriptor or reference
VALID	Unspecified (see 3.4.2)
RESPONSE CODE	Unspecified (see 3.4.2)
FILEMARK	Set to zero
EOM	Set to zero
ILI	Set to zero
SENSE KEY	Unspecified (see 3.4.2)
INFORMATION	Table 110
ADDITIONAL SENSE LENGTH	Unspecified (see 3.4.2)
COMMAND-SPECIFIC INFORMATION	Table 111
ADDITIONAL SENSE CODE	Unspecified (see 3.4.2)
ADDITIONAL SENSE CODE QUALIFIER	Unspecified (see 3.4.2)
FIELD REPLACEABLE UNIT CODE	Unspecified (see 3.4.2)
SKSV	Unspecified (see 3.4.2)
SENSE-KEY SPECIFIC	Unspecified (see 3.4.2)
Additional sense bytes	Unspecified (see 3.4.2)

[a] SATLs compliant with previous versions of this standard return descriptor format sense data for the ATA PASS-THROUGH commands regardless of the setting of the D_SENSE bit.

Table 110 defines the INFORMATION field.

Table 110 — Fixed format sense data INFORMATION field for the ATA PASS-THROUGH commands

Byte\Bit	7	6	5	4	3	2	1	0
0	ERROR							
1	STATUS							
2	DEVICE							
3	SECTOR_COUNT (7:0)							

Table 111 defines the COMMAND-SPECIFIC INFORMATION field.

Table 111 — Fixed format sense data COMMAND-SPECIFIC INFORMATION field for the ATA PASS-THROUGH commands

Byte\Bit	7	6	5	4	3	2	1	0
0	EXTEND	SECTOR_COUNT UPPER NONZERO	LBA UPPER NONZERO	Reserved				
1	LBA_HIGH (7:0)							
2	LBA_MID (7:0)							
3	LBA_LOW (7:0)							

An EXTEND bit set to one indicates that the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to one. An EXTEND bit set to zero indicates that the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to zero or for an ATA PASS-THROUGH (12) command.

If the EXTEND bit is set to one, then the SECTOR_COUNT (15:8) field, the LBA_LOW (15:8) field, the LBA_MID (15:8) field; and the LBA_HIGH (15:8) field are not able to be returned in fixed format sense data.

If the LBA UPPER NONZERO bit is set to one, then one or more of the LBA_LOW (15:8) field, the LBA_MID (15:8) field, and the LBA_HIGH (15:8) field returned by the ATA device were not set to 00h. If the LBA UPPER NONZERO bit is set to zero, then the LBA_LOW (15:8) field, the LBA_MID (15:8) field, and the LBA_HIGH (15:8) field returned by the ATA device were each set to 00h.

If the SECTOR_COUNT UPPER NONZERO bit is set to one, then the SECTOR_COUNT (15:8) field returned by the ATA device was not set to 00h. If the SECTOR_COUNT UPPER NONZERO bit is set to zero, then the SECTOR_COUNT (15:8) field returned by the ATA device was set to 00h.

[end of all-new section]