To: T10 Technical Committee
From: Mark A. Overby (moverby@nvidia.com), NVIDIA Corporation
Date: 12 January 2004
Subject: T10/04-397 SAT ATA control mode page proposal

Revision History

Revision	Date	Author	Revision Notes
0	10 November 2004	Mark Overby	Initial draft
1	20 February 2005	Mark Overby	Changed references for mode pages to sub pages. Changed all references to protocol specific port pages to control mode sub pages. Replaced Table 2 with a new table for control mode sub page. Removed references to deleted fields from table2 and described how changeable mode sense requests are used to indicate support for a given mode. Revised table names. Removed references to application client "shall not" actions. Deleted references to removed fields. Changed references from SPC-3 to SPC-4. Removed MSB / LSB on reserved fields. Added definitions for ASC for SAT (75h) and ASCQ for general ATA error and timing mode errors. Replaced generic "shall return an error' with specific error return guidance. Overhauled entire SATA section

Related Documents

SPC-4 (1729-D)
SAT (1711-D r1)

Overview

In order to successfully communicate with ATA drives certain timing mode parameters must be set on both the device and the host. For serial ATA environments, speed negotiation happens automatically at the PHY layer. However, for parallel ATA it is the responsibility of the host to correctly initialize both the device and the host for the appropriate DMA and/or PIO timing modes.

In the T10 SCSI architecture model there is no current mechanism that models the necessary communication that the ATA host undergoes in a traditional ATA-only environment. This proposal addresses this need for SATL's that need to deal with ATA hosts to set and maintain timing modes. It also gives the application client an opportunity to control physical data transfer rates for diagnostic, test, error handling, or other environmental-specific reasons.

Proposed Changes

Annex D.6 in SPC-4, Table D.12

- Add entries for mode page 0Ah, new sub page codes F1h and F2h. These mode pages would correspond to a protocol specific port entry for parallel and serial ATA respectively.
- Add a new column to this table that indicates these mode pages are only used in the context of SAT. Recommend a new column with a header of S that references SAT 1.0 (1711D).

Annex D.2 in SPC-4, Table D.1

- Add an entry for ASC 75h, ASCQ 00h to indicate UNSPECIFIED ATA ERROR.   **Formatted:** Bullets and Numbering
- Add an entry for ASC 75h, ASCQ 01h to indicate UNSUPPORTED TRANSFER RATE REQUEST

SAT 1.0 (1711D r1)

- Move current section 10.3 to 10.4
- Create new section 10.3 entitled SCSI – ATA Translation Specific Mode Pages. The wording style below is purely suggestive and the editor should edit the content as necessary to conform to the style of the SAT document.

10.3 SCSI – ATA Translation Specific Mode Pages

This section describes mode pages that the SATL may implement that are unique to the SCSI – ATA translation environment. These mode pages are for use by the SATL and are shown in Table 1 and described in this section. A SATL may support zero, one, or both of the mode pages described in this section. A SATL should support the appropriate mode page for the attached ATA environment (e.g. Serial ATA).

Table 1 SCSI - ATA Translation Specific Mode Pages

Mode Page		
Page Code	Sub Page Code	Page Name
0Ah	F1h	Parallel ATA Control Sub Page
0Ah	F2h	Serial ATA Control Sub Page

10.3.1 Parallel ATA Port Specific Sub Page (Page 0Ah, Sub Page F1h)

The Parallel ATA control mode sub page provides parallel ATA specific controls for a SATL to configure the underlying ATA host as well as understand what parameters are communicated to the ATA device to ensure proper communication for specific transfer rates. This mode page uses the sub_page format as described in SPC-4. The control mode page itself is described in SPC-4. This document describes the mode parameters that are provided for this sub page. See Table 2 for the format of this mode sub page.

SATL implementations that support the attachment of parallel ATA devices shall support this mode sub page when requested through mode sense. SATL

implementations should allow application clients to configure alternate parallel ATA timings through mode select using this mode sub page.

Table 2 Parallel ATA Control Mode Sub Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS	SPF(1b)	PAGE CODE (0AH)					
1	SUBPAGE CODE (F1H)							
2	(MSB)	PAGE LENGTH (28H)						
3								(LSB)
4	RESERVED	MWD2	MWD1	MWD0	RESERVED		PIO4	PIO3
5	RESERVED	UDMA6	UDMA5	UDMA4	UDMA3	UDMA2	UDMA1	UDMA0
6	RESERVED							
32								

For the behavior and meaning of the PS bit, see clause 7.4.5 of SPC-4. SATL implementations may save the state of the timing parameters defined in this mode page. However SATL implementations shall not use any saved parameters to configure the ATA host timing modes into an illegal configuration for the attached device.

In general application clients may use the MODE SENSE command for changeable values to determine the underlying ATA host support for a given ATA timing mode. The SATL shall support changeable mode parameters for this sub page.

PIO modes are obtained and controlled through the PIO3 and PIO4 fields. The PIO3 and PIO4 fields are collectively referred to as the PIO fields. For a MODE SENSE command for current values, PIO3 shall be set to 1 by the SATL when the ATA host is configured to use mode 3 PIO transfers. If PIO3 is set to 1, PIO4 shall be 0. PIO4 shall be set to 1 by the SATL when the ATA host is configured to use mode 4 PIO transfers. If PIO4 is set to 1, PIO3 shall be zero. When changeable values are requested, PIO3 and pio4 indicate if the underlying ATA host supports those transfer modes. PIO3 shall be set to 1 if the ATA host support PIO mode 3. PIO4 and PIO3 shall be set to 1 if the ATA host supports PIO mode 4.

When the SATL receives a MODE SELECT command and the PIO field indicates a change from the current setting, the SATL shall configure the host to use the new PIO transfer rate, if supported. The application client shall not request a PIO mode setting that the ATA device cannot support and the SATL shall return a CHECK CONDITION status with a sense key of ILLEGAL REQUEST and an additional sense code of UNSUPPORTED TRANSFER RATE REQUEST if the application client attempts such an operation.

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MWD0, MWD1, and MWD2 are collectively referred to as the MWDMA active fields.

If the underlying ATA host is currently configured to use multi word DMA (MWDMA) the MWDMA fields are used to determine what mode is currently being used, what modes are supported by the ATA host, and control of the MWDMA modes.

For a MODE SENSE command for current values, MWD0 shall be set to 1 by the SATL when the host and device are configured to use multiword DMA mode 0. MWD1 shall be set to 1 by the SATL when the host and device are configured to use multiword DMA mode1. MWD2 shall be set to 1 by the SATL when the host and device are configured to use multiword DMA mode 2. For a MODE SENSE command for changeable values, MWD0 shall be set to 1 if the ATA host supports MWDMA mode 0. MWD1 and MWD0 shall be set to 1 if the ATA host supports MWDMA mode 1. MWD2, MWD1, and MWD0 shall be to set to 1 if the ATA host supports MWDMA mode 2.

When the SATL receives a MODE SELECT command and the MWDMA field indicates a change from the current settings, the SATL shall issue a SET FEATURES command, sub-command code 03h (Set Transfer Mode), to the ATA device. If the SET FEATURES command completes without error, the SATL shall then configure the ATA host to use the new MWDMA timing mode for DMA operations. If the SET FEATURES command completes with an error, the SATL shall return a CHECK CONDITION status with a sense key of ABORTED COMMAND. The SATL shall return a CHECK CONDITION status with a sense key of ILLEGAL REQUEST with an additional sence code of UNSUPPORTED TRANSFER RATE REQUEST if the application client attempts to set a MWDMA mode that is not supported by the ATA host environment.

UDMA0, UDMA1, UDMA2, UDMA3, UDMA4, UDMA5, and UDMA6 are collectively referred to as the Ultra DMA (UDMA) fields and are used to determine support for, current use of, and control of UDMA timings on the ATA host and device. The SATL shall determine the highest UDMA supported as being the lower of the ATA host maximum transfer mode and the device maximum transfer mode. The device reports the UDMA transfer mode from the IDENTIFY DATA, word 88, bits 6:0. For a MODE SENSE request for changeable parameters, the UDMA fields shall be set according to Table 3.

Table 3 UDMA Field Requirements for changeable MODE SENSE

Highest UDMA supported	UDMA0	UDMA1	UDMA2	UMDA3	UMDA4	UMDA5	UDMA6
UDMA unsupported	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
1	1	1	0	0	0	0	0
2	1	1	1	0	0	0	0
3	1	1	1	1	0	0	0
4	1	1	1	1	1	0	0
5	1	1	1	1	1	1	0
6	1	1	1	1	1	1	1

For a MODE SENSE request for current settings the UDMA fields are set according to Table 4. Only one of the UDMA fields shall bet set to 1 at any time for such a request. If UDMA is not the current DMA transfer mode, all UDMA fields shall be set to 0. If a UDMA transfer mode is being used, all MWDMA fields shall be set to 0.

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[1] The highest UDMA supported shall be the lowest supported speed of the device and host in combination

Table 4 UDMA Fields for current settings

UDMA Active Field	Description
UDMA0	ATA host and device communicating using UDMA Mode 0
UDMA1	ATA host and device communicating using UDMA Mode 1
UDMA2	ATA host and device communicating using UDMA Mode 2
UDMA3	ATA host and device communicating using UDMA Mode 3
UDMA4	ATA host and device communicating using UDMA Mode 4
UDMA5	ATA host and device communicating using UDMA Mode 5
UDMA6	ATA host and device communicating using UDMA Mode 6

When the SATL receives a MODE SELECT command and the UDMA fields indicate a change in the requested UDMA speed in the communications interface. The SATL shall:

1. Issue a SET FEATURES, sub-command 03h, to set the UDMA timing mode on the device to the requested state.
2. Check the status of the SET FEATURES command once completed. If the command completes in error, the SATL shall not change any host timing modes and shall complete the MODE SELECT command with a CHECK CONDITION status, sense key of COMMAND ABORTED. The SATL shall take no further action regarding this timing mode request.
3. Configure the ATA host to communicate with the device at the requested UDMA timing speeds.
4. Complete the MODE SELECT command with the appropriate status code.

The SATL shall return a CHECK CONDITION status, sense key of ILLEGAL REQUEST, and additional sense code of UNSUPPORTED TRANSFER RATE REQUEST if the application client attempts to set a mode that the underlying host or device does not support.

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10.3.2 Serial ATA Control Sub Page (Page 0Ah, Subpage F2h)

The Serial ATA Port Specific mode page provides serial ATA specific controls for a SATL to configure or obtain status of the serial ATA port from the ATA host. This mode page uses the sub_page format as described in SPC-4. The control mode page itself is described in SPC-4. This document describes the data specific to this sub page. See Table 5 for the format of this mode page.

Table 5 Serial ATA Control Mode Subpage

Bit Byte	7	6	5	4	3	2	1	0
0	PS	SPF(1b)	PAGE CODE (0AH)					
1	SUBPAGE CODE (F2H)							
2	(MSB)	PAGE LENGTH (60H)						
3								(LSB)
4	RESERVED				NOTIFY	CONTROL	ERROR	STATUS
5	RESERVED							

6	RESERVED		
7	RESERVED		
8	(MSB)	SSTATUS	
11			(LSB)
12	(MSB)	SERROR	
15			(LSB)
16	(MSB)	SCONTROL	
19			(LSB)
20	(MSB)	SNOTIFICATION	
23			(LSB)
24		RESERVED	
64			

For the behavior and meaning of the PS bit, see clause 7.4.5 of SPC-4. SATL implementations may save the state of the scontrol field to control serial ATA bus timings.

For a MODE SENSE request for current values, STATUS, ERROR, CONTROL, and NOTIFY shall be set to 1 if the SSTATUS, SERROR, SCONTROL, and SNOTIFICATION fields, respectively, contain valid data. For a MODE SENSE request for changeable parameters, the masks for SSTATUS, SERROR, SCONTROL, and SNOTIFICATION fields shall indicate those fields that are read / write as defined in ATA/ATAPI-7, volume 3.

The SSTATUS field contains the serial ATA link status (SSTATUS) register as defined in ATA/ATAPI-7, volume 3.

The SERROR field contains the serial ATA error (SERROR) register as defined in ATA/ATAPI-7, volume 3.

The SCONTROL field contains the serial ATA link control (SCONTROL) register as defined in ATA/ATAPI-7, volume 3.

The SNOTIFICATION field contains the serial ATA command queuing notification register (SNOTIFICATION) as defined in the serial ATA specifications.

[Editors Note: It would appear that the REPORT PHY SATA response in SAS does not contain the necessary information to actually indicate what the state of the SATA link is. Do we need to have a separate proposal to extend that management command?]