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To: T10 SAT Working Group
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Subject: SAT, START STOP UNIT command mapping

1 Related documents

SCSI / ATA Translation (SAT) draft, revision 04.

2 Introduction

The following proposes how to map the functionality of the START STOP UNIT command using ATA commands.

The following list includes some additional comments about this proposal relative to what is in the latest SAT draft:

- a) Since SCSI implementations only use the IMMED, LOEJ, and START bits in the CDB to control a target device, this proposal is limited to defining the functionality associated with those bits;
- b) The mechanism for spinning a device up from Sleep mode has been removed, as there is no way that a device could get into this condition without the SATL having issued a SLEEP command, which the SATL should never do;
- c) The POWER CONDITIONS field has been made "U" as this functionality is not used by SCSI applications today; and
- d) The features of the POWER CONDITIONS field and their functionality could be added by a subsequent proposal at a later date if someone actually found a use for them.

Revision 1 of this proposal includes input from the June SAT working group meeting in San Jose.

Revision 2 of this proposal includes input from the July SAT working group meeting in Colorado Springs.

Revision 3 of this proposal includes input from the September SAT working group meeting in Vancouver, BC. The first part of the proposal shows changes from the previous proposal, the second part has the changes accepted.

3 Proposal

Change the relevant clauses to be as follows:

9.7 START STOP UNIT command (1Bh)

9.7.1 Command summary

The START STOP UNIT command provides a method for controlling the power state of a logical unit.

Table 1 — START STOP UNIT command CDB fields

Field	SATType	Description or reference
OPERATION CODE	E	Commands issued to the attached ATA device depend upon the other values in the CDB as described in 9.7.2.
IMMED	I	The SATL shall implement this field as defined in 9.7.2.
POWER CONDITIONS	U	The SATL shall ignore this field.
LOEJ	I	The SATL shall implement this field as defined in 9.7.2.
START	I	The SATL shall implement this field as defined in 9.7.2.
CONTROL	I	(see 6.4)

[If a SATL receives a command other than a START STOP UNIT command for a device that is in the Stopped state \(see SBC-2\), then the SATL shall return CHECK CONDITION status, with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED.](#)

9.7.2 START STOP UNIT CDB field options

The SATL shall perform the actions shown in table 2 in response to a START STOP UNIT command received depending on the values of the IMMED, LOEJ, and START bits.

Table 2 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 1 of 3)

IMMED	LOEJ	START	Definition
0	0	0	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Issue a FLUSH CACHE or FLUSH CACHE EXT command to the attached ATA device; 2) If the FLUSH CACHE or FLUSH CACHE EXTENDED command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; 3) If the FLUSH CACHE or FLUSH CACHE EXT command completes with no error, then issue a STANDBY command to the attached ATA device with a value of zero in Sector Count; 4) If the STANDBY command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and 5) If the STANDBY command completes with no error^a, then return GOOD status^b.
			<p>^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.</p> <p>^b After returning GOOD status for a START STOP UNIT command with the START bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).</p> <p>^c After returning GOOD status for a START STOP UNIT command with the START bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).</p> <p>^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.</p>

Table 2 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 2 of 3)

IMMED	LOEJ	START	Definition
1	0	0	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status^b; 2) Issue a FLUSH CACHE or FLUSH CACHE EXT command to the attached ATA device; 3) If the FLUSH CACHE or FLUSH CACHE EXTENDED command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; 4) If the FLUSH CACHE or FLUSH CACHE EXT command completes with no error, then issue a STANDBY command to the attached ATA device with a value of zero in Sector Count^a; and 5) If the STANDBY command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR.
0	0	1	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Issue an an READ VERIFY SECTOR(S) ATA verify command (see [definitions entry]) to the attached ATA device with a value of zero in LBA and one in Sector Count and a value in LBA from zero to the maximum LBA supported by the device in its current configuration^d; 2) If the READ VERIFY SECTOR(S) command completes with any error, then return CHECK CONDITION status, with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING-COMMAND REQUIRED; and 3) When command completion is received for if the READ VERIFY SECTOR(S) ATA verify command (see [definitions entry]) completes with no error, then return GOOD status^c.
1	0	1	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status^c; and 2) Issue an an READ VERIFY SECTOR(S) ATA verify command (see [definitions entry]) to the attached ATA device with a value of zero in LBA and one in Sector Count and a value in LBA from zero to the maximum LBA supported by the device in its current configuration^d; and 3) If the READ VERIFY SECTOR(S) command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING-COMMAND REQUIRED.
<p>^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.</p> <p>^b After returning GOOD status for a START STOP UNIT command with the START bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).</p> <p>^c After returning GOOD status for a START STOP UNIT command with the START bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).</p> <p>^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.</p>			

Table 2 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 3 of 3)

IMMED	LOEJ	START	Definition
0	1	0	<p>If the attached ATA device supports the Removable Media feature set, then the SATL shall:</p> <ol style="list-style-type: none"> 1) Issue a MEDIA EJECT command to the attached ATA device; 2) If the MEDIA EJECT command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to MEDIA LOAD OR EJECT FAILED; and 3) If the MEDIA EJECT command completes with no error, then return GOOD status. <p>If the attached ATA device does not support the Removable Media feature set, then the SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.</p>
1	1	0	<p>If the attached ATA device supports the Removable Media feature set, then the SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status; 2) Issue a MEDIA EJECT command to the attached ATA device; and 3) If the MEDIA EJECT command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to MEDIA LOAD OR EJECT FAILED. <p>If the attached ATA device does not support the Removable Media feature set, then the SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN CDB.</p>
0 or 1	1	1	<p>The SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, with the additional sense code set to INVALID FIELD IN CDB.</p>
<p>^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.</p> <p>^b After returning GOOD status for a START STOP UNIT command with the START bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).</p> <p>^c After returning GOOD status for a START STOP UNIT command with the START bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).</p> <p>^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.</p>			

9.7 START STOP UNIT command (1Bh)

9.7.1 Command summary

The START STOP UNIT command provides a method for controlling the power state of a logical unit.

Table 3 — START STOP UNIT command CDB fields

Field	SATType	Description or reference
OPERATION CODE	E	Commands issued to the attached ATA device depend upon the other values in the CDB as described in 9.7.2.
IMMED	I	The SATL shall implement this field as defined in 9.7.2.
POWER CONDITIONS	U	The SATL shall ignore this field.
LOEJ	I	The SATL shall implement this field as defined in 9.7.2.
START	I	The SATL shall implement this field as defined in 9.7.2.
CONTROL	I	(see 6.4)

If a SATL receives a command other than a START STOP UNIT command for a device that is in the Stopped state (see SBC-2), then the SATL shall return CHECK CONDITION status, with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED.

9.7.2 START STOP UNIT CDB field options

The SATL shall perform the actions shown in table 2 in response to a START STOP UNIT command received depending on the values of the IMMED, LOEJ, and START bits.

Table 4 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 1 of 3)

IMMED	LOEJ	START	Definition
0	0	0	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Issue a FLUSH CACHE or FLUSH CACHE EXT command to the attached ATA device; 2) If the FLUSH CACHE or FLUSH CACHE EXTENDED command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; 3) If the FLUSH CACHE or FLUSH CACHE EXT command completes with no error, then issue a STANDBY command to the attached ATA device with a value of zero in Sector Count; 4) If the STANDBY command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and 5) If the STANDBY command completes with no error^a, then return GOOD status^b.
<p>^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.</p> <p>^b After returning GOOD status for a START STOP UNIT command with the start bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).</p> <p>^c After returning GOOD status for a START STOP UNIT command with the start bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).</p> <p>^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.</p>			

Table 4 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 2 of 3)

IMMED	LOEJ	START	Definition
1	0	0	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status^b; 2) Issue a FLUSH CACHE or FLUSH CACHE EXT command to the attached ATA device; 3) If the FLUSH CACHE or FLUSH CACHE EXTENDED command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; 4) If the FLUSH CACHE or FLUSH CACHE EXT command completes with no error, then issue a STANDBY command to the attached ATA device with a value of zero in Sector Count^a; and 5) If the STANDBY command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR.
0	0	1	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Issue an ATA verify command (see [definitions entry]) to the attached ATA device with one in Sector Count and a value in LBA from zero to the maximum LBA supported by the device in its current configuration^d; and 2) When command completion is received for the ATA verify command (see [definitions entry]) return GOOD status^c.
1	0	1	<p>The SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status^c; and 2) Issue an ATA verify command (see [definitions entry]) to the attached ATA device with one in Sector Count and a value in LBA from zero to the maximum LBA supported by the device in its current configuration^d.
0	1	0	<p>If the attached ATA device supports the Removable Media feature set, then the SATL shall:</p> <ol style="list-style-type: none"> 1) Issue a MEDIA EJECT command to the attached ATA device; 2) If the MEDIA EJECT command completes with any error, then return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to MEDIA LOAD OR EJECT FAILED; and 3) If the MEDIA EJECT command completes with no error, then return GOOD status. <p>If the attached ATA device does not support the Removable Media feature set, then the SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.</p>
<p>^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.</p> <p>^b After returning GOOD status for a START STOP UNIT command with the start bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).</p> <p>^c After returning GOOD status for a START STOP UNIT command with the start bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).</p> <p>^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.</p>			

Table 4 — Definition of IMMED, LOEJ, and START bits in the START STOP UNIT CDB (part 3 of 3)

IMMED	LOEJ	START	Definition
1	1	0	<p>If the attached ATA device supports the Removable Media feature set, then the SATL shall:</p> <ol style="list-style-type: none"> 1) Return GOOD status; 2) Issue a MEDIA EJECT command to the attached ATA device; and 3) If the MEDIA EJECT command completes with any error, then return CHECK CONDITION status as a deferred error (see SPC-3) with the sense key set to ABORTED COMMAND and the additional sense code set to MEDIA LOAD OR EJECT FAILED. <p>If the attached ATA device does not support the Removable Media feature set, then the SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN CDB.</p>
0 or 1	1	1	The SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST, with the additional sense code set to INVALID FIELD IN CDB.

^a A device may return command completion for a STANDBY command before the device may be removed from a system without damage.

^b After returning GOOD status for a START STOP UNIT command with the start bit set to zero, the SATL shall consider the drive to be in the Stopped power state (see SBC-2).

^c After returning GOOD status for a START STOP UNIT command with the start bit set to one, the SATL shall consider the drive to be in the Active power state (see SBC-2).

^d A medium access occurs when an LBA is specified whose data is not contained in cache memory. If a value in LBA is specified for an ATA verify command where the data is contained in cache memory, then a device may not be in the Active power mode (see ATA/ATAPI-7) after completion of the ATA verify command.