

To: T10 Technical Committee
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Subject: SAT-2 Translation of Large Physical Blocks

Revision History

Revision 0 (May 3, 2007) First revision

Revision 1 (June 12, 2007) Comments made during May SAT meeting

Related Documents

sat-r09 - SCSI/ATA Translation (SAT) revision 9

SAT-2r01 - SCSI/ATA Translation (SAT-2) revision 0

sbc3r09 - SCSI Block Commands - 3 (SBC-3) revision 9

ata8-acs-r4a - AT Attachment 8 - ATA/ATAPI Command Set (ATA8-ACS) revision 4a

Overview

ATA8-ACS defines how an ATA device reports its geometry of logical and physical sectors. SBC-3 defines how a SCSI device server reports similar information. This proposal describes how to map these geometry parameters between ATA and SCSI.

Some additional text in SAT is cleaned-up, and SBC-3 replaces SBC-2 as the reference document.

Suggested Changes

2.2 Approved references

~~ISO/IEC 14776-322, SCSI Block Commands - 2 (SBC-2) [ANSI INCITS 405-2005]~~

2.3 References under development

At the time of publication, the following referenced standards were still under development. For information on the current status of the document, or regarding availability, contact the relevant standards body or other organization as indicated.

[ISO/IEC 14776-323, SCSI Block Commands - 3 \(SBC-3\) \[T10/1799-D\]](#)

Editor's Note 1: Update all SBC-2 references to SBC-3. Include editor's notes wherever new fields are defined in SBC-3 that need to be considered in SAT-2.

Add these definitions

3.1.XX ATA logical sector alignment: The logical sector offset within the first physical sector where the first logical sector is placed in an ATA device. If word 209, bit 15 is set to zero and bit 14 is set to one, this is returned in ATA IDENTIFY DEVICE data word (209), bits 13:0; otherwise, it is zero. See 9.9.

3.1.YY ATA logical sectors per physical sector exponent: The power of two exponent of the number of logical sectors per physical sector in an ATA device. If word 106 bit 15 is set to zero, bit 14 is set to one, and bit 13 is set to one, this is returned in ATA IDENTIFY DEVICE data word (106) bits 3:0; otherwise, it is zero. See 9.9.

3.1.ZZ ATA logical sectors per physical sector: The number of logical sectors per physical sector in an ATA device (i.e., $2^{(\text{ATA logical sectors per physical sector exponent})}$). See 9.9.

9 SCSI Block Commands (SBC) mapping

9.1 Translating LBA and transfer length and ATA command use constraints

9.1.1 Overview

A SATL may implement:

- a) a direct [logical](#) block mapping of ATA logical sectors to SCSI logical blocks (see 9.1.2);
[or](#)
- b) indirect [logical](#) block mapping translation (see 9.1.3).

9.1.2 Direct [logical](#) block mapping model

If the SATL implements direct [logical](#) block mapping (see 3.1.33), the logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.8.2 and 9.9.2) shall equal the ATA logical sector Size (see 3.1.15). The ATA LBA of an ATA logical sector shall equal the logical block address of the corresponding SCSI logical block.

9.1.3 Indirect [logical](#) block mapping model

If the SATL implements indirect [logical](#) block mapping (see 3.1.38), the constraints of the direct [logical](#) block mapping model do not apply. The logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.8.2 and 9.9.2) may not equal the ATA logical sector size (see 3.1.15) (e.g., SCSI logical block size of 520 bytes with an ATA Logical Sector Size of 512 bytes). The SATL translates between the SCSI LOGICAL BLOCK ADDRESS field and the ATA LBA in a vendor-specific manner. The result of a logical block address translated in one direction and then translated in the reverse direction shall yield the original logical block address.

Editor's Note 2: Globally change "direct block mapping" to "direct logical block mapping" and "indirect block mapping" to "indirect logical block mapping"

9.8 READ CAPACITY (10) command

9.8.1 READ CAPACITY (10) command overview

The READ CAPACITY (10) command (see SBC-23) requests that the device server transfer eight bytes of parameter data describing the capacity and medium format of the direct-access block device to the application client. Table 34 shows the translation for fields specified in the READ CAPACITY (10) CDB.

Table 34 — READ CAPACITY (10) CDB field translations

Field	Description or reference
OPERATION CODE	Set to 25h. The SATL shall use ATA IDENTIFY DEVICE data to compute the ATA device's maximum user addressable medium capacity of the ATA device.
LOGICAL BLOCK ADDRESS	If the LOGICAL BLOCK ADDRESS field is not set to zero, the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
PMI	If the PMI bit is not set to zero, the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
CONTROL	6.4

[Editor's Note 3: Globally change "This field is otherwise" to "Otherwise, this field" to improve consistency.](#)

[Editor's Note 4: Globally change "Otherwise the XYZ field" to "Otherwise, this field" to improve consistency.](#)

9.8.2 READ CAPACITY (10) parameter data

The SATL shall return READ CAPACITY (10) parameter data as defined by SBC-23. Table 35 describes the translation of fields in the READ CAPACITY (10) parameter data.

Table 35 - READ CAPACITY(10) parameter data

Field	Description or reference
RETURNED LOGICAL BLOCK ADDRESS ^a	<p><u>If the SATL implements direct logical block mapping (see 3.1.33), this field shall contain the lower of:</u></p> <ul style="list-style-type: none"> a) <u>the ATA maximum LBA (see 3.1.16); and</u> b) <u>FFFF_FFFFh.</u> <p>If the value is FFFF_FFFFh, the If the number of logical blocks exceeds the maximum value that is able to be specified in the RETURNED LOGICAL BLOCK ADDRESS field, the device server shall set the RETURNED LOGICAL BLOCK ADDRESS field to FFFFFFFFh. The application client should then issue a READ CAPACITY (16) command (see 9.9) to retrieve the READ CAPACITY (16) parameter data.</p> <p><u>If the SATL implements indirect logical block mapping, this field is</u> This field is otherwise unspecified (see 3.4.2).</p>
<u>LOGICAL</u> BLOCK LENGTH IN BYTES ^a	<p>If the SATL implements direct <u>logical</u> block mapping (see 3.1.33) then the BLOCK LENGTH IN BYTES <u>this</u> field shall contain the ATA logical sector size (see 3.1.15). Otherwise, the BLOCK LENGTH IN BYTES <u>this</u> field is unspecified (see 3.4.2).</p>
<p>^a The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the <u>LOGICAL</u> BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity (see 3.1.49) is less than or equal to the ATA device capacity (see 3.1.9).</p>	

9.9 READ CAPACITY(16) command

9.9.1 READ CAPACITY (16) command overview

The READ CAPACITY (16) command (see SBC-23) requests that the device server transfer **eight bytes-of** parameter data describing the capacity and medium format of the direct-access block device to the application client. Table 36 shows the translation for fields specified in the READ CAPACITY (16) CDB.

Table 36 — READ CAPACITY (16) CDB field translations

Field	Description or reference
OPERATION CODE/ SERVICE ACTION	Set to 9E _h /10 _h . The SATL shall use ATA IDENTIFY DEVICE data to compute the ATA device's maximum user addressable medium capacity of the ATA device.
LOGICAL BLOCK ADDRESS	If the LOGICAL BLOCK ADDRESS field is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. As defined in READ CAPACITY (10) (see 9.8)
PMI	If the PMI bit is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. As defined in READ CAPACITY (10) (see 9.8)
ALLOCATION LENGTH	Unspecified (see 3.4.2)
CONTROL	6.4

9.9.2 READ CAPACITY(16) parameter data

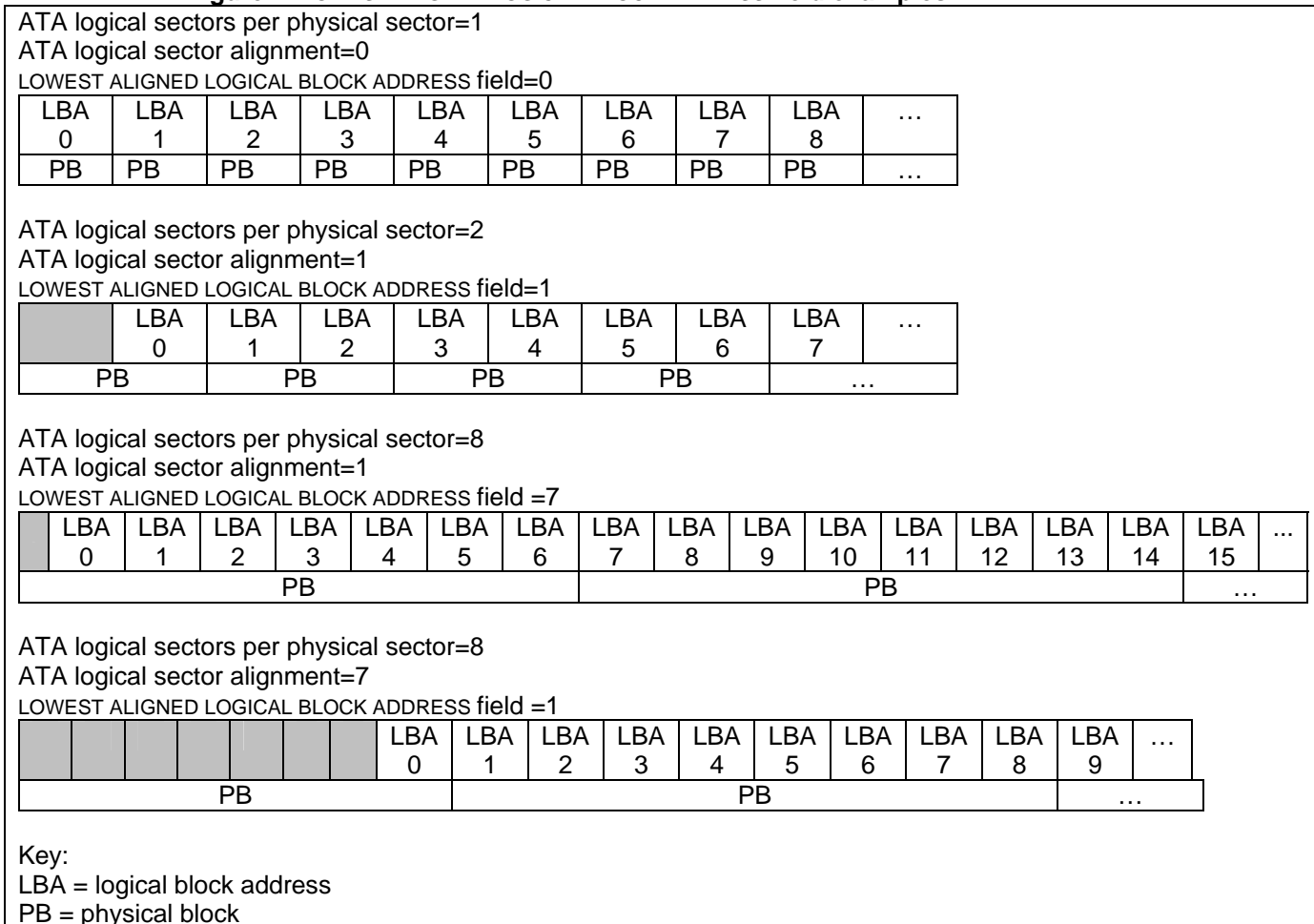
The SATL shall return READ CAPACITY(16) parameter data as defined by SBC-23. describes the translation of fields in the READ CAPACITY (16) parameter data.

Table 37 - READ CAPACITY(16) parameter data

Field	Description or reference
RETURNED LOGICAL BLOCK ADDRESS ^A	If the SATL implements direct logical block mapping (see 3.1.33), this field shall contain the ATA maximum LBA (see 3.1.16). The maximum value that shall be returned in the RETURNED LOGICAL BLOCK ADDRESS field is FFFFFFFF_FFFFFFFEh. This field is otherwise unspecified (see 3.4.2).
LOGICAL BLOCK LENGTH IN BYTES ^A	If the SATL implements direct logical block mapping (see 3.1.33) then the LOGICAL BLOCK LENGTH IN BYTES field shall contain the ATA logical sector size (see 3.1.15). Otherwise, the BLOCK LENGTH IN BYTES this field is unspecified (see 3.4.2). As defined in READ CAPACITY (10) (see 9.8).
RTO_EN	SBC-2: Unspecified (see 3.4.2)
PROT_EN	Unspecified (see 3.4.2)
P_TYPE	Unspecified (see 3.4.2)
LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT	If the SATL implements direct logical block mapping (see 3.1.33) then this field shall contain the ATA logical sectors per physical sector exponent (see 3.1.YY). Otherwise, this field is unspecified (see 3.4.2).
LOWEST ALIGNED LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 3.1.33) then this field shall contain the following value: _____ (a - b) modulo a where: _____ a is the ATA logical sectors per physical sector (see 3.1.xx) _____ b is the ATA logical sector alignment (see 3.1.yy) Otherwise, this field is unspecified (see 3.4.2).
^a The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the LOGICAL BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity (see 3.1.49) is less than or equal to the ATA device capacity (see 3.1.9) .	

[Figure 1 shows examples of LOWEST ALIGNED LOGICAL BLOCK ADDRESS field values for various values of ATA logical sector alignment and ATA logical sectors per physical sector.](#)

Figure 1- LOWEST ALIGNED LOGICAL BLOCK ADDRESS field examples



[Editor's note: Figure must be converted into Visio](#)