

To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
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Subject: 03-348r0 SBC-2 4-byte LBA commands on 8 byte capable drives

Revision history

Revision 0 (11 October 2003) First revision

Related documents

sbc2r10 - SCSI Block Commands - 2 revision 10

Overview

In a logical unit supporting 8-byte LBAs, 4-byte LBA commands are still allowed to be used to access the lower part of the disk. If:

- a) a 4 byte LBA command is used;
- b) the length field crosses the 4-byte LBA boundary (LBA > FFFFFFFFh);
- c) the old fixed format sense data format is being used; and
- d) the command fails (e.g. an unrecoverable bad block),

then the LBA returned in the sense data INFORMATION field would be incorrect - probably carrying just the low 4 bytes of the LBA or saturating at FFFFFFFFh. This would confuse the application which issued the command. In many cases, it simply should not have done so; however, some commands use a length of 0 to mean "the rest of the disk."

A check is already mandated for commands not exceeding the capacity of the medium (ILLEGAL REQUEST/LOGICAL BLOCK ADDRESS OUT OF RANGE). A similar check is proposed to keep these commands from straying past their native addressible range.

Similarly, a check against FFFFFFFF FFFFFFFFh is included for 8-byte LBA commands (although their capacities won't exceed that and the capacity check will take effect first).

Table 1 shows affected commands and field names.

Table 1 — Possible affected commands

Command	Possibly affected field	Notes
LOCK UNLOCK CACHE (10)(16)	NUMBER OF BLOCKS	0 means “all remaining”
PRE-FETCH (10)(16)	PREFETCH LENGTH	0 means “all remaining”
READ (6)(10)(12)(16)	TRANSFER LENGTH	
READ LONG	(BYTE TRANSFER LENGTH)	Command limited to one block, so byte transfer length is actually not an issue. There is no READ LONG (16).
REBUILD (16)(32)	REBUILD LENGTH	
REGENERATE (16)(32)	REGENERATE LENGTH	
SEEK (10)	none	There is no SEEK (16).
SET LIMITS (10)(12)	don't care	03-335 proposes obsoleting.
SYNCHRONIZE CACHE (10)(16)	NUMBER OF BLOCKS	
VERIFY (10)(12)(16)	VERIFICATION LENGTH	
WRITE (6)(10)(12)(16)	TRANSFER LENGTH	
WRITE AND VERIFY (10)(12)(16)	TRANSFER LENGTH	
WRITE LONG	(BYTE TRANSFER LENGTH)	Command limited to one block, so byte transfer length is actually not an issue. There is no WRITE LONG (16)
WRITE SAME (10)(16)	NUMBER OF BLOCKS	
XDREAD (10)(32)	TRANSFER LENGTH	
XDWRITE (10)(32)	TRANSFER LENGTH	
XDWRITEREAD (10)(32)	TRANSFER LENGTH	
XDWRITE EXTENDED (16)(32)(64)	TRANSFER LENGTH	
XPWRITE (10)(32)	TRANSFER LENGTH	
ERASE (10)(12)	ERASE ALL (ERA) BIT, ERASE LENGTH	There is no ERASE (16).
MEDIUM SCAN	(in parameter data) NUMBER OF BLOCKS REQUESTED and NUMBER OF BLOCKS TO SCAN	There is no MEDIUM SCAN (16).

Not all detailed changes are provided when the changes are very similar to a previous command.

Suggested changes

4.2.1.3 Logical blocks

Blocks of data are stored on the medium along with additional information that the medium controller uses to manage the storage and retrieval. The format of the additional information is defined by other standards or is vendor-specific and is hidden from the application client during normal read or write operations. This additional information may be used to identify the physical location of the blocks of data and the address of the logical block, and to provide protection against the loss of user data.

The address of the first logical block is zero. The address of the last logical block is [n-1], where [n] is the number of logical blocks available to the application client on the medium. A READ CAPACITY command may be issued to determine the value of [n-1]. If a command is issued that requests access to:

- a) a logical block not within the capacity of the medium; or
- b) a logical block not within the addressable range of the command (i.e., a logical block address greater than FFFFFFFFh for a command with a 4 byte logical block address)

the command ~~is~~ shall be terminated with CHECK CONDITION status and the sense key is set to ILLEGAL REQUEST with the additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

The number of bytes of data contained in a logical block is the block length. Each logical block has a block length associated with it. The block descriptor in the MODE SENSE data describes the block lengths that are used on the medium. The FORMAT UNIT command (see 5.2.2) may be required to change the block length of block devices that support variable block lengths.

The location of a logical block on the medium is not required to have a relationship to the location of any other logical block. However, in a typical block device the logical blocks are located in an ascending order. The time to access the logical block at address [x] and then the logical block at address [x+1] need not be less than time to access [x] and then [x+100]. The READ CAPACITY issued with a PMI bit of one may be useful in determining where longer access times occur.

5.2.3 LOCK UNLOCK CACHE (10) command

...

The NUMBER OF BLOCKS field specifies the ~~total~~ number of contiguous logical blocks within the range. If the logical block address plus the number of blocks exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. A NUMBER OF BLOCKS field of zero indicates that all remaining logical blocks on the block device not exceeding FFFFFFFFh shall be within the range.

5.2.3 LOCK UNLOCK CACHE (16) command

...

See 4.2.1.9 for reservation requirements for this command. See the LOCK UNLOCK CACHE (10) command (see 5.2.3) for a description of the fields in this command other than the NUMBER OF BLOCKS field.

The NUMBER OF BLOCKS field specifies the number of contiguous logical blocks within the range. If the logical block address plus the number of blocks exceeds the capacity of the medium or FFFFFFFF FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. A NUMBER OF BLOCKS field set to zero specifies that all remaining logical blocks on the block device not exceeding FFFFFFFF FFFFFFFFh shall be within the range.

5.2.5 PRE-FETCH (10) command

...

The PREFETCH LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred to the block device's cache memory from the medium. If the logical block address plus the prefetch length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. A PREFETCH LENGTH ~~of field set to zero indicates~~ field set to zero ~~indicates~~ specifies that ~~the contiguous all remaining~~ logical blocks up to and including the last logical block of the block device not exceeding FFFFFFFFh shall be transferred to the block device's cache memory. ~~Any other value indicates the number of logical blocks that shall be transferred.~~ The device server ~~may elect to not~~ need not transfer logical blocks that already are contained in the cache memory.

5.2.6 PRE-FETCH (16) command

...

See 4.2.1.9 for reservation requirements for this command. See the PRE-FETCH (10) command (see 5.2.5) for a description of the fields in this command other than the PREFETCH LENGTH field.

The PREFETCH LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred to the block device's cache memory from the medium. If the logical block address plus the prefetch length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. A PREFETCH LENGTH field set to zero that all remaining logical blocks not exceeding FFFFFFFFh shall be transferred to the block device's cache memory. The device server need not transfer logical blocks that already are contained in the cache memory.

5.2.7 READ (6) command

...

The TRANSFER LENGTH field specifies the number of contiguous logical blocks of data to be transferred. A TRANSFER LENGTH of zero ~~indirectly indicates~~ specifies that 256 logical blocks shall be transferred. Any other value directly ~~indicates~~ specifies the number of logical blocks that shall be transferred. If the logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

...

NOTE 9 - For the READ (10), READ (12), and READ (16) commands, a transfer length of zero indicates that no logical blocks are transferred.

5.2.8 READ (10) command

...

The TRANSFER LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred. A TRANSFER LENGTH of zero ~~indicates~~ specifies that no logical blocks shall be transferred. This condition shall not be considered an error. Any other value indicates the number of logical blocks that shall be transferred. If the logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

5.2.9 READ (12) command

...

See 4.2.1.9 for reservation requirements for this command. See the READ (10) command (see 5.2.8) for a complete description of the fields in this command other than the TRANSFER LENGTH field.

The TRANSFER LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred. A TRANSFER LENGTH of zero specifies that no logical blocks shall be transferred. This condition shall not be considered an error. Any other value indicates the number of logical blocks that shall be transferred. If the logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

5.2.10 READ (16) command

...

See 4.2.1.9 for reservation requirements for this command. See the READ (10) command (see 5.2.8) for a description of the fields in this command other than the TRANSFER LENGTH field.

The TRANSFER LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred. A TRANSFER LENGTH of zero specifies that no logical blocks shall be transferred. This condition shall not be considered an error. Any other value indicates the number of logical blocks that shall be transferred. If the

logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFF FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2)..

5.2.15 READ LONG command

...

The BYTE TRANSFER LENGTH field specifies the number of bytes of data that ~~should~~ shall be transferred. If a non-zero BYTE TRANSFER LENGTH does not match the available data length, the device server shall terminate the command with CHECK CONDITION status ~~and with~~ the sense key ~~shall be~~ set to ILLEGAL REQUEST ~~with and~~ the additional sense code set to INVALID FIELD IN CDB. The VALID and ILI bits (see SPC-3) shall be set to one and the INFORMATION field shall be set to the difference (residue) of the requested length minus the actual length in bytes. Negative values shall be indicated by two's complement notation.

A BYTE TRANSFER LENGTH of zero indicates that no bytes shall be transferred and shall not be considered an error.

If the logical block address exceeds the capacity of the medium the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

5.2.17 REBUILD (16) Command

...

The LOGICAL BLOCK ADDRESS field specifies the starting logical block address where the target shall write the XOR result data on its own medium. The REBUILD LENGTH field specifies the number of blocks to be written to the medium. It also specifies the number of blocks that are read from each source.

5.2.18 REBUILD (32) Command

[similar to READ(16) changes]

5.2.19 REGENERATE (16) command

...

The LOGICAL BLOCK ADDRESS field specifies the starting logical block address for the target to read data from its own medium. This data is a source for the regenerate operation.

The REGENERATE LENGTH field indicates the length in logical blocks of the resulting XOR data. It also specifies the length in logical blocks that is transferred from each of the specified sources. If the logical block address plus the regenerate length exceeds the capacity of the source medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

5.2.20 REGENERATE (32) command

[similar to READ (16) changes]

5.2.21 SEEK (10) command

...

The LOGICAL BLOCK ADDRESS field specifies the logical block address to which the block device should seek. If the logical block address exceeds the capacity of the medium the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

5.2.25 SYNCHRONIZE CACHE (10) command

...

The NUMBER OF BLOCKS field specifies the total number of contiguous logical blocks within the range. If the logical block address plus the number of blocks exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an

[additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE](#). A number of blocks of zero indicates that all remaining logical blocks on the block device [not exceeding FFFFFFFFh](#) shall be within the range.

A logical block within the specified range that is not in cache memory is not considered an error.

5.2.26 SYNCHRONIZE CACHE (16) command

[similar to READ (16) changes]

5.2.27 VERIFY (10) command

...

The VERIFICATION LENGTH field specifies the number of contiguous logical blocks of data or blanks that shall be verified. A VERIFICATION LENGTH of zero indicates that no logical blocks shall be verified. This condition shall not be considered as an error. Any other value indicates the number of logical blocks that shall be verified. [If the logical block address plus the verification length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE](#). The VERIFICATION LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

5.2.28 VERIFY (12) command

[similar to READ (12) changes]

5.2.29 VERIFY (16) command

[similar to READ (16) changes]

5.2.30 WRITE (6) command

...

The LOGICAL BLOCK ADDRESS field specifies the logical block where the write operation shall begin.

The TRANSFER LENGTH field specifies the number of contiguous logical blocks of data that shall be transferred.

A TRANSFER LENGTH of zero [indirectly indicates specifies](#) that 256 logical blocks shall be transferred. Any other value [indicates specifies](#) the number of logical blocks that shall be transferred. [If the logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE](#). The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

NOTE 19 - For the WRITE (10), [WRITE \(12\)](#), and [WRITE \(16\)](#) commands, a TRANSFER LENGTH of zero indicates that no logical blocks are transferred.

5.2.31 WRITE (10) command

[similar to READ (10) changes]

5.2.32 WRITE (12) command

[similar to READ (12) changes]

5.2.33 WRITE (16) command

[similar to READ (16) changes]

5.2.34 WRITE AND VERIFY (10) command

[similar to READ (10) changes]

5.2.35 WRITE AND VERIFY (12) command

[similar to READ (12) changes]

5.2.36 WRITE AND VERIFY (16) command

[similar to READ (16) changes]

5.2.37 WRITE LONG command

...

The BYTE TRANSFER LENGTH field ~~should~~ specifies the number of bytes of data that the device server ~~would~~ returns for the READ LONG command. If a non-zero BYTE TRANSFER LENGTH does not exactly match the data length the device server ~~would~~ returns for the READ LONG command, then the device server shall terminate the command with CHECK CONDITION status ~~and with~~ the sense key ~~shall be~~ set to ILLEGAL REQUEST ~~with and~~ the additional sense code set to INVALID FIELD IN CDB. The ILI and VALID bits shall be set to one and the INFORMATION field shall be set to the difference (residue) of the requested length minus the actual length in bytes. Negative values shall be indicated by two's complement notation. A BYTE TRANSFER LENGTH of zero indicates that no bytes shall be transferred and shall not be considered an error. The BYTE TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2). If the logical block address exceeds the capacity of the medium the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

5.2.38 WRITE SAME (10) command

[similar to WRITE (6) changes]

5.2.39 WRITE SAME (16) command

[similar to WRITE (16) changes]

5.2.40 XDREAD (10) command

[no changes needed]

5.2.41 XDREAD (32) command

[no changes needed]

5.2.42 XDWRITE (10) command

...

The LOGICAL BLOCK ADDRESS field specifies the starting logical block address of the data on which an XOR operation shall be performed with the data from the medium.

The TRANSFER LENGTH field specifies the number of logical blocks that shall be transferred to the XDWRITE target and the number of logical blocks on which an XOR operation shall be performed with the data from the medium. If the logical block address plus the transfer length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. The TRANSFER LENGTH field is constrained by the MAXIMUM TRANSFER LENGTH field in the Block Limits VPD page (see 6.1.4.2).

5.2.43 XDWRITE (32) command

[similar to READ (16) changes]

5.2.44 XDWRITEREAD (10) command

[similar to XDWRITE (10) changes]

5.2.45 XDWRITEREAD (32) command

[similar to READ (16) changes]

5.2.46 XDWRITE EXTENDED (16) command

[similar to READ (16) changes]

5.2.49 XPWRITE (10) command

[similar to XDWRITE (10) changes]

5.2.50 XPWRITE (32) command

[similar to READ (16) changes]

5.3.2 ERASE (10) command

...

An erase all (ERA) bit of one indicates that all remaining blocks on the medium shall be erased, not exceeding logical block address FFFFFFFFh. If the ERA bit is one and if the number of blocks is not zero, the device server shall return CHECK CONDITION, and the sense key shall be set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN CDB.

The ERASE LENGTH field specifies the number of contiguous logical blocks that shall be erased when the ERA bit is zero. If the ERA bit is zero an ERASE LENGTH of zero indicates that no blocks shall be erased. This condition shall not be considered an error and no data shall be erased. Any other value indicates the number of logical blocks that shall be erased. If the logical block address plus the erase length exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

5.3.3 ERASE (12) command

[no changes]

5.3.4 MEDIUM SCAN command

...

The PARAMETER LIST LENGTH specifies the length in bytes of the parameter list that shall be transferred during the data-out buffer transfer. A PARAMETER LIST LENGTH of zero indicates that the NUMBER OF BLOCKS REQUESTED field has a value of one, and the NUMBER OF BLOCKS TO SCAN field has a value of zero. This condition shall not be considered an error. The contents of the parameter list are specified in table 90.

...

The NUMBER OF BLOCKS REQUESTED field specifies the number of blocks that meet the specified requirements. The NUMBER OF BLOCKS REQUESTED field, if zero, indicates that the scan shall not take place. This shall not be considered an error condition.

The NUMBER OF BLOCKS TO SCAN field specifies the length in blocks of the area to be scanned on the medium. The NUMBER OF BLOCKS TO SCAN field, if zero, indicates that the scan shall continue for all remaining blocks on the medium or until the scan is satisfied, not exceeding logical block address FFFFFFFFh. If the logical block address plus the number of blocks to scan exceeds the capacity of the medium or FFFFFFFFh the device server shall return CHECK CONDITION status with a sense key set to ILLEGAL REQUEST and an additional sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE. See 4.3.3 for a description of error reporting.