To: T10 Membership
From: Paul Suhler, Seagate Technology
Subject: Proposal for SPC Support for Partial Loading & Unloading (T10/99-347r3)
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1   General

This document proposes changes to the SCSI Primary Commands standard to provide support in removable medium devices for accessing Medium Auxiliary Memory (MAM) without the overhead of making the device ready for access to the primary medium. There are three components to this proposal: a new definition, a new field in the Control mode page, and four new ASC/ASCQ combinations.

This document is based upon discussions in the SCSI Protocol working group in November 1999 and January 2000 and upon comments posted to the T10 reflector.

2   Justification

2.1   THE CASE FOR SPLITTING LOAD

Some tape technologies – e.g., AIT and LTO – use cartridges equipped with Medium Auxiliary Memory (MAM), a non-volatile memory used to record medium identification and usage information. This is typically accessed via an RF interface and does not require reading the tape itself. In a library not equipped with a mobile MAM reader, it is necessary to load the cartridge into the drive to read the MAM via the drive's MAM reader.

The current Load command will not only move the cartridge into the drive, but will also prepare the tape for access by threading, adjusting tension, etc. This takes much longer than is required to read the MAM, greatly increasing the time to scan a series of cartridges.

By issuing one command to move the cartridge into the drive and another to prepare the tape for access, the drive operation becomes much more flexible and avoids unnecessary delays.

2.2   THE CASE FOR SPLITTING UNLOAD

It is a requirement of some tape library systems that preparation of a tape cartridge for ejection be done separately from the actual ejection. These devices require that the robot arm (medium transport element – MTE – in SMC terminology) must be positioned at the drive before the command to eject the cartridge is issued. It currently must wait there throughout the process of preparing the tape for ejection. For dual-reel media, this preparation may include retensioning and/or positioning to BOT or EOT; for single-reel media, this preparation means rewinding and unthreading the tape and winding the tape leader into the cartridge.

The difficulty with the present LOAD UNLOAD command is that it specifies both unthreading and ejection, with no way to separate the two operations. Workarounds include having the MTE wait at the drive throughout the entire process, or implementing a vendor-unique unthread operation usually commanded over the drive's serial interface.

By issuing one command to prepare the cartridge for ejection and another to perform the actual ejection, the MTE can service other requests while the tape is prepared for ejection. Only when

the tape is actually ready to be ejected will the MTE be moved to the drive. The sequence would be:

1. Issue modified Unload; cartridge is prepared for ejection.

2. Move MTE to drive.

3. Issue standard Unload; cartridge is immediately ejected.

4. Move medium to desired location.

3 Proposed Changes

A change to the SSC LOAD UNLOAD command has been accepted by the SSC working group in revision 22. To make use of this command's new features, the following changes are required in SPC. Changes are indicated in red.

3.1 DEFINITIONS

Add the following definition:

Medium Auxiliary Memory: An auxiliary memory residing on a medium that is accessible to the device server (e.g., a tape cartridge). Medium auxiliary memory may be non-volatile and independent of the main function of the device server.

3.2 AUTOLOAD CONTROL

3.2.1 Discussion

When a medium is inserted into a drive, many drives simply load the cartridge and prepare the medium for access. However, some customers do not want this. Given the above discussion of loading and unloading to a MAM-accessible point, there are three options:

1. Do not load; wait for Load command..

2. Load only until MAM is accessible.

3. Load until primary medium is ready. This is the usual behavior for stand-alone drives.

The current device's behavior should be readable and settable via a mode page in SPC, as this behavior would apply to at least three different command sets. The default behavior could be specified via external jumpers or by NVRAM configuration at manufacturing time.

3.2.2 Proposal

Add a three-bit field named "AUTOLOAD MODE" to the Control Mode Page:

Table 158 -- Control Mode Page

Bit Byte	7	6	5	4	3	2	1	0
0	PS	Reserved	PAGE CODE (0Ah)					
1	PAGE LENGTH (0Ah)							
2	TST			Reserved			GLTSD	RECL

3	QUEUE ALGORITHM MODIFIER			Reserved	QErr		DQue
4	Reserved	RAC	Reserved	SWP	RAERP	UAAERP	EAERP
5	Reserved				AUTOLOAD MODE		
6	MSB						
7	READY AER HOLDOFF PERIOD						LSB
8	MSB						
9	BUSY TIMEOUT PERIOD						LSB
10	MSB						
11	EXTENDED SELF-TEST COMPLETION TIME						LSB

Add the following paragraph and table immediately before the paragraph describing the READY AER HOLDOFF PERIOD field. (This will require renumbering of subsequent tables.)

The AUTOLOAD MODE field specifies the action to be taken by a removable medium device server when a medium is inserted. For devices other than removable medium devices, this field is reserved.

Table 162 -- Autoload mode field

Value	Definition
000b	Medium shall be loaded for full access.
001b	Medium shall be loaded for medium auxiliary memory access only.
010b	Medium shall not be loaded.
011b - 111b	Reserved

3.3 STATUS REPORTING

3.3.1 Discussion

There are several cases in which status reporting is useful, as pointed out by the T11.3/T10 WG, Jesionowski, et al.:

- An event not initiated by a command to the device has changed the device state, such as an operator or medium changer inserting a medium. These should be reported by setting check condition with SK/ASC/ASCQ of UNIT ATTENTION/MEDIUM LOADABLE (3Fh/10h) or MEDIUM AUXILIARY MEMORY ACCESSIBLE (3Fh/11h), as appropriate. These *may* also be used when a command has placed the medium in either of these states, e.g. by a LOAD command with HOLD set or by an UNLOAD command.

- An attempt to access the primary medium when it is in either the loadable or Hold (MAM Accessible) position. This should be reported by setting a check condition with SK/ASC/ASCQ of NOT READY/MEDIUM NOT PRESENT – LOADABLE (3Ah/03h) or NOT READY/MEDIUM NOT PRESENT – MEDIUM AUXILIARY MEMORY ACCESSIBLE (3Ah/04h). These new ASC/ASCQs are more precise than the existing LOGICAL UNIT NOT READY, INITIALIZING CMD. REQUIRED.

- An attempt to access the MAM when the medium has been inserted but not loaded. These should result in a Check Condition with SK/ASC/ASCQ of NOT READY/MEDIUM NOT PRESENT – LOADABLE (3Ah/03h).

- An attempt to access the MAM when no medium is present or when it is not accessible for an indeterminate reason. These are addressed by the latest "**Proposed Addition of Read and Write Attribute Commands to SPC-2**," (99-148r4).

The SCSI Protocol Working Group decided not to include guidance on the use of these codes in SPC-2. The ASCQs for ASCs 3Ah and 3Fh are different in order to avoid sparse codes, i.e., having 3Ah/03h – 0Fh unassigned.

3.3.2   Proposal

Add the following lines to Tables 113 and C.1, "ASC and ASCQ Assignments":

ASC	ASCQ	D	T	L	P	W	R	S	O	M	C	A	E	B	K	Description
3Ah	03h	D	T			W	R		O	M				B		MEDIUM NOT PRESENT - LOADABLE
3Ah	04h	D	T			W	R		O	M				B		MEDIUM NOT PRESENT - MEDIUM AUXILIARY MEMORY ACCESSIBLE
3Fh	10h	D	T			W	R		O	M				B		MEDIUM LOADABLE
3Fh	11h	D	T			W	R		O	M				B		MEDIUM AUXILIARY MEMORY ACCESSIBLE