To: INCITS Technical Committee T10

From: Kevin Butt, IBM

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Subject: SSC-3: TapeAlert Delineation

1. Revisions

1. Incorporated feedback from SSC Working Group. Complete rewrite.
2. Reworked to meet comments from Sept 2006 SSC-3 WG. Move to a new log page that will have multiple pieces of information. The intent is that each of these log pages can be expanded with information specific to the TapeAlert (or error). In doing this, I thought it prudent to use a common structure for all specific flags.

2. Introduction

In response to the ISV Feedback this is a proposal for how to modify the TapeAlerts and specify which are hardware, which are media, and which are firmware. Additionally since this is being approached there have been many suggestions for how to greatly improve the useability and usefulness of this information. I have attempted to incorporate many of these suggestions.

3. Proposal

3.1 Add a new Service Information log page

4.2.15.1 TapeAlert introduction

TapeAlert provides an application client with the capability to receive notification of various events and conditions arising in the target device. This standard defines 64 unique TapeAlert flags for a sequential-access device. A Service information log page (see 8.2.3x) is also defined that for each flag provides information necessary for an application client to decide appropriate error recovery procedures. ~~Other standards (e.g., SMC-3) may define other TapeAlert flags.~~

~~TapeAlert flags fall into three categories of severity (see table 8).~~

~~<< Table 8 >>~~

Table 9 specifies the 64 TapeAlert flags for a sequential-access device. See Annex A for additional information about each TapeAlert flag.

TABLE 9. TapeAlert log page parameter codes

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
01h	Read Warning	O	Start of next medium load	Degradation Indication, Section 8.2.a.1 on page 10
02h	Write Warning	O	Start of next medium load	Degradation Indication, Section 8.2.a.1 on page 10
03h	Hard Error	M	Start of next medium load[a]	
04h	Media	M	Start of next medium load[a]	Degradation Indication, Section 8.2.a.1 on page 10
05h	Read Failure.	M	Start of next medium load[a]	
06h	Write Failure.	M	Start of next medium load[a]	
07h	Media Life	O	Start of next medium load	Outside Specified Limits, Section 8.2.a.2 on page 10
08h	Not data grade	O	Start of next medium load	
09h	Write protect	O	Start of next medium load or removal of write protect	
0Ah	Media Removal Prevented	O	After medium removal allowed	
0Bh	Cleaning media	O	Start of next medium load	
0Ch	Unsupported format	O	Start of next medium load or format change	
0Dh	Recoverable mechanical cartridge failure	O	Start of next medium load	
0Eh	Unrecoverable mechanical cartridge failure	O	After service resolution	
0Fh	Memory chip in cartridge failure	O	Start of next medium load	
10h	Forced eject	O	Start of next medium load	
11h	Read only format	O	Start of next medium load or format change	
12h	Tape directory corrupted on load	O	Start of next medium load	Degradation Indication, Section 8.2.a.1 on page 10

Type Key:

M=Mandatory

O=Optional

a) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

TABLE 9. TapeAlert log page parameter codes

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
13h	Nearing media life	O	Start of next medium load	Outside Specified Limits, Section 8.2.a.2 on page 10
14h	Cleaning required	O	After successful cleaning or cause resolved	Outside Specified Limits, Section 8.2.a.2 on page 10
15h	Cleaning requested	O	After successful cleaning	Outside Specified Limits, Section 8.2.a.2 on page 10
16h	Expired cleaning media	O	Start of next medium load	Outside Specified Limits, Section 8.2.a.2 on page 10
17h	Invalid cleaning tape	O	Start of next medium load	
18h	Retension Requested	O	After successful retention	
19h	Dual-port interface error on a primary port	O	After interface returns to operation	
1Ah	Cooling Fan Failure	O	After service resolution	
1Bh	Power Supply Failure	O	After service resolution	
1Ch	Power Consumption	O	After power consumption returns to within specification	Outside Specified Limits, Section 8.2.a.2 on page 10
1Dh	Drive Preventive Maintenance Required	O	After service resolution	
1Eh	Hardware A	O	After service resolution	
1Fh	Hardware B	M	At power on event	
20h	Primary Interface	O	After interface returns to operation	
21h	Eject media	O	Start of next medium load	
22h	Microcode update fail	O	Start of next microcode update	
23h	Drive humidity	O	After humidity returns to within specification	Outside Specified Limits, Section 8.2.a.2 on page 10
24h	Drive temperature	O	After temperature returns to within specification	Outside Specified Limits, Section 8.2.a.2 on page 10
25h	Drive voltage	O	After voltage returns to within specification	Outside Specified Limits, Section 8.2.a.2 on page 10
26h	Predictive failure	O	After service resolution	

Type Key:

M=Mandatory

O=Optional

a) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

TABLE 9. TapeAlert log page parameter codes

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
27h	Diagnostics required	O	After service resolution	
28h - 2Eh	Obsolete	O		
2Fh - 31h	Reserved	O		
32h	Lost statistics	O	Start of next medium load	
33h	Tape directory invalid at unload	O	Start of next medium load	Degradation Indication, Section 8.2.a.1 on page 10
34h	Tape system area write failure	O	Start of next medium load	
35h	Tape system area read failure	O	Start of next medium load	
36h	No Start of Data	O	Start of next medium load	
37h	Loading or threading Failure	O	Start of next medium load	
38h	Unrecoverable unload failure	O	After service resolution	
39h	Automation interface failure	O	After service resolution	
3Ah	Microcode failure	O	After service resolution	
3Bh	WORM Medium - Integrity Check Failed	O	Start of next medium load	
3Ch	WORM Medium - Overwrite Attempted	O	Start of next medium load	
3Dh - 40h	Reserved	O	Start of next medium load	

Type Key:

M=Mandatory

O=Optional

a) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

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EDITORS NOTE: Everything beyond this note is new.

8.2.a Service Information log page

The Service Information log page (see Table x1) defines information used for detailed device diagnostics and management.

TABLE x1. Service Information log page

Bit Byte	7	6	5	4	3	2	1	0
0	DS	SPF (1)	PAGE CODE (2Eh)					
1	SUBPAGE CODE(01h)							
2	(MSB)	PAGE LENGTH (n-3)						
3								(LSB)
	Service Information log parameter(s)							
4	Service information log parameter (first)							
x								
y	Service information log parameter (last)							
n								

See SPC-4 for a description of the PAGE CODE, SUBPAGE CODE, DS, SPF and PAGE LENGTH fields.

Table x2 specifies the format of a Service Information log parameter.

TABLE x2. Service Information parameter format

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)	PARAMETER CODE						
1								(LSB)
2	DU	DS(1)	TSD(1)	ETC(0)	TMC		LBIN(0)	LP(0)
3	PARAMETER LENGTH							
	Device Information							
4	DEVICE INFORMATION LENGTH (k-4)							
5	DEVICE INFORMATION CODE							
6	DEVICE EXCEPTION MESSAGE							
7	DEVICE SERVICE MESSAGE							
8	DEVICE SEVERITY CODE							
9	(MSB)	T10 VENDOR IDENTIFICATION						
10								(LSB)

TABLE x2. Service Information parameter format

Bit Byte	7	6	5	4	3	2	1	0
17	(MSB)							
32				PRODUCT IDENTIFICATION				(LSB)
33	(MSB)							
36				PRODUCT REVISION LEVEL				(LSB)
37				PRODUCT SERIAL NUMBER LENGTH (t-37)				
38	(MSB)							
t				PRODUCT SERIAL NUMBER				(LSB)
s				ADDITIONAL DEVICE INFORMATION LENGTH (r-s)				
s+1	(MSB)							
r				ADDITIONAL DEVICE INFORMATION				(LSB)
				Medium Information				
q				MEDIUM INFORMATION LENGTH (n-q)				
q+1				MEDIUM INFORMATION CODE				
q+2				MEDIUM EXCEPTION MESSAGE				
q+3				MEDIUM IDENTIFICATION TYPE				
q+4				MEDIUM SEVERITY CODE				
q+5	(MSB)							
q+36				MEDIUM IDENTIFICATION				(LSB)
p				ADDITIONAL MEDIUM INFORMATION LENGTH (n-p)				
p+1	(MSB)							
n				ADDITIONAL MEDIUM INFORMATION				(LSB)
				TapeAlert Flag Specific Information Descriptor				
m				TAPEALERT FLAG SPECIFIC INFORMATION LENGTH (k-m)				
m+1	(MSB)							
k				TAPEALERT FLAG SPECIFIC INFORMATION				(LSB)

See SPC-4 for a description of the DU bit, DS bit, TSD bit, ETC bit, TMC field, LBIN bit, and LP bit. The DS bit, TSD bit, LBIN bit, and LP bit shall be set to the value specified in table 59.

The value in the PARAMETER CODE field shall be set to the value of the TapeAlert flag for which the information applies. Only parameters relating to a TapeAlert flag field set to one shall be returned.

The DEVICE INFORMATION LENGTH field specifies the length of the information related to the device.

The DEVICE INFORMATION CODE is defined in Table x3

TABLE x3. DEVICE INFORMATION CODE definition

Value	Description
00h	No message
01h	Device degraded
02h	Device hardware failure - call for service
03h	Service circuit failed, operations not affected. Call for service
04h	Microcode failed
05h	Drive needs cleaning. Load cleaning cartridge
06h	Drive has been cleaned

The DEVICE EXCEPTION MESSAGE is defined in Table x4

TABLE x4. DEVICE EXCEPTION MESSAGE definition

Value	Description
00h	Reserved
01h	Effect of failure is unknown
02h	Device exception no performance impact
03h	Exception on primary interface
04h	Device exception on automation drive interface
05h	Device exception on operator panel
06h	Device exception on tape path
07h	Device exception in drive
08h	Error occured due to microcode
09h	Cleaning required
0Ah	Cleaning done

The DEVICE SERVICE MESSAGE is defined in Table x5

TABLE x5. DEVICE SERVICE MESSAGE definition

Value	Description
00h	Reserved
01h	Repair Impact is Unknown
02h	Repair will disable access to the device specified in the PRODUCT SERIAL NUMBER field.
03h	Clean device
04h	Device cleaned
05h	Device cleaning for performance reasons is required
06h	Update microcode

The DEVICE SEVERITY CODE is defined in Table x6

TABLE x6. DEVICE SEVERITY CODE definition

Value	Description
00h	
01h	Informational
02h	Retryable - The event that generated this Device Information may be retried.
03h	Manual intervention required
04h	Critical - Call service

See SPC-4 for a description of the T10 VENDOR IDENTIFICATION, PRODUCT IDENTIFICATION, PRODUCT REVISION LEVEL, and PRODUCT SERIAL NUMBER fields.

The MEDIUM INFORMATION LENGTH field specifies the length of the information related to the medium.

The MEDIUM INFORMATION CODE is defined in Table x7

TABLE x7. MEDIUM INFORMATION CODE definition

Value	Description
00h	No message
01h	WORM medium - Read Only Permitted at this logical position
02h	Encrypted medium - Encryption key required
03h	Bad Medium - Read Only Permitted
04h	Rewrite Medium if Possible
05h	Tape Directory Invalid. Re-read Medium if possible
06h	Bad Medium-Cannot Read or Write
07h	Replace Cleaning Cartridge

The MEDIUM EXCEPTION MESSAGE is defined in Table x8

TABLE x8. MEDIUM EXCEPTION MESSAGE definition

Value	Description
00h	Reserved
01h	Data Degraded
02h	Medium Degraded
03h	Block 0 Error
04h	Medium Exception
05h	Medium auxiliary memory error

The MEDIUM IDENTIFICATION TYPE is defined in Table x9

QUESTION: Is only one type useful or would it be better to return all known types?

TABLE x9. MEDIUM IDENTIFICATION TYPE definition

Value	Description
00h	MEDIUM IDENTIFICATION field not valid
01h	MEDIUM IDENTIFICATION field is the value of the VOLUME IDENTIFIER parameter of the device type attributes (i.e., set by the SMC device) of medium auxiliary memory (see SPC-4)
02h	MEDIUM IDENTIFICATION field is the value of the BARCODE parameter of the host type attributes (i.e., set by an application client) of medium auxiliary memory (see SPC-4)
03h	MEDIUM IDENTIFICATION field is the value of the MEDIUM SERIAL NUMBER parameter of the medium type attributes (i.e., set by the manufacture) of medium auxiliary memory (see SPC-4)
04h	MEDIUM IDENTIFICATION field is obtained by vendor-specific methods.

The MEDIUM SEVERITY CODE is defined in Table x10

TABLE x10. MEDIUM SEVERITY CODE definition

Value	Description
00h	Reserved
01h	Informational
02h	Moderate - Temporary Read/Write Errors
03h	Serious - Permanent Read/Write Errors
04h	Acute - Medium auxiliary memory error or block 0 error

The TAPEALERT FLAG INFORMATION descriptor general format is shown in Table 25. Specific descriptors are described in the following sections and are referenced in Table 9.

TABLE 25. TAPEALERT FLAG INFORMATION descriptor

Bit Byte	7	6	5	4	3	2	1	0
	TapeAlert Flag Specific Information Descriptor							
m	TAPEALERT FLAG SPECIFIC INFORMATION LENGTH (k-m)							
m+1	(MSB)	TAPEALERT FLAG SPECIFIC INFORMATION						
k								(LSB)

8.2.a.1 Degradation Indication

The Degradation Indication descriptor is returned for those TapeAlert Flags that warn of degraded operation (e.g. degraded performance; degraded capacity). Those flags that use this descriptor are listed in Table 9.

TABLE 26. Degradation Indication descriptor

Bit Byte	7	6	5	4	3	2	1	0
	TapeAlert Flag Specific Information							
0	TAPEALERT FLAG SPECIFIC INFORMATION LENGTH (n)							
1	(MSB)	DEGRADATION INDICATOR						
n								(LSB)

The DEGRADATION INDICATOR field indicates a fractional value of full operation. This value is expressed in $1/2^n$ units.

Example To Be Removed: if n = 16 then one could express 0/65536 - 65535/65536 fractional value of full operation. If the is 400G of tape and write errors are degrading capacity to 375G then 375G/400G = 0.9375 => 0.9375 *65536 = 61140. Return 61140

8.2.a.2 Outside Specified Limits

The Outside Specified Limits descriptor is returned for those TapeAlert Flags that warn of being outside operational limits (e.g., above or below specified humidity, above number of specified mounts, above number of specified full-file passes). Those flags that use this descriptor are listed in Table 9.

TABLE 27. Outside Sepcified Limits descriptor

Bit Byte	7	6	5	4	3	2	1	0
	TapeAlert Flag Specific Information							
0	TAPEALERT FLAG SPECIFIC INFORMATION LENGTH (z)							
1	LIMIT LENGTH (y)							
2	Reserved							
3								
4	(MSB)	LOWER LIMIT						
y								(LSB)
y+1	(MSB)	UPPER LIMIT						
x								(LSB)
x+1	(MSB)	MEASURED VALUE						
z								(LSB)

The LIMIT LENGTH field specifies the length of the LOWER LIMIT field, UPPER LIMIT field, and MEASURED VALUE field.

The LOWER LIMIT field specifies the lower operational limit of the item referred to by the TapeAlert Flag. The Units are vendor-specific but match those of the UPPER LIMIT field and the MEASURED VALUE field.

The UPPER LIMIT field specifies the upper operational limit of the item referred to by the TapeAlert Flag. The Units are vendor-specific but match those of the LOWER LIMIT field and the MEASURED VALUE field.

The MEASURED VALUE field specifies the measured value of the item referred to by the TapeAlert Flag. The Units are vendor-specific but match those of the LOWER LIMIT field and the UPPER LIMIT field.