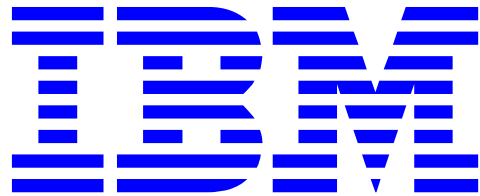To: INCITS Technical Committee T10

From: Kevin Butt

Date: March 3, 2007 7:08 am

Document: T10/06-138r3

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.

3) Corrected math in Degredation Indicator

4) Incorporated changes suggested in the January working group. I have completed scrubbing the device information fields. I have not completed scrubbing the medium information fields, but there has been significant work done so I wanted to get this out to let other eyes have time to look at it. Since the work has been so extensive I have not carried foward markings for all the strikeouts and additions.

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

Add new log pages to log page support table and make optional.

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	Tapealert Flag Information descriptor on page 12
02h	Write Warning	O	Start of next medium load	Tapealert Flag Information descriptor on page 12
03h	Hard Error	M	Start of next medium load[a]	
04h	Media	M	Start of next medium load[a]	Tapealert Flag Information descriptor on page 12
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	Tapealert Flag Information descriptor on page 12
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	
Type Key:				
M=Mandatory				
O=Optional				
5) 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)**
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	
13h	Nearing media life	O	Start of next medium load	Tapealert Flag Information descriptor on page 12
14h	Cleaning required	O	After successful cleaning or cause resolved	Tapealert Flag Information descriptor on page 12
15h	Cleaning requested	O	After successful cleaning	Tapealert Flag Information descriptor on page 12
16h	Expired cleaning media	O	Start of next medium load	Tapealert Flag Information descriptor on page 12
17h	Invalid cleaning tape	O	Start of next medium load	
18h	Retension Requested	O	After successful retention	
19h	Multi-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	Tapealert Flag Information descriptor on page 12
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	Tapealert Flag Information descriptor on page 12
Type Key: M=Mandatory O=Optional 5) 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)**
24h	Drive temperature	O	After temperature returns to within specification	Tapealert Flag Information descriptor on page 12
25h	Drive voltage	O	After voltage returns to within specification	Tapealert Flag Information descriptor on page 12
26h	Predictive failure	O	After service resolution	
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	
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 5) 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 (0)	PAGE CODE (2Dh)					
1	SUBPAGE CODE (00h)							
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 DS, SPF, PAGE CODE, SUBPAGE CODE, 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	Obsolete	TSD	ETC (0b)	TMC (00b)		FORMAT AND LINKING (01b)	
3	PARAMETER LENGTH (t-3)							
4	Device Information Descriptor (see Table x3)							
r								
r+1	Medium Information Descriptor (see Table x7)							
s								
s+1	TapeAlert Flag Specific Information Descriptor (see Table x11)							
t								

See SPC-4 for a description of the DU bit, TSD bit, ETC bit, TMC field, and the FORMAT AND LINK-
ING field. The ETC bit, TMC bit, and FORMAT AND LINKING field shall be set to the value specified
in Table x2.

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 parameters shall be returned in reverse order (i.e. the parameter relating to the least
recently asserted TapeAlert flag shall be returned first.)

8.2.a.1 Device Information Descriptor

Table x3 describes the Device Information Descriptor format. The device information descriptor is returned when the cause of the TapeAlert flag relating to the parameter may be related to device.

TABLE x3. Device Information Descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	DEVICE INFORMATION LENGTH (r)							
1	DEVICE COMPONENT CODE							
2	DEVICE SEVERITY CODE							
3	NUMBER OF DEVICE REQUESTED RECOVERIES							
4	DEVICE REQUESTED RECOVERY (first)							
	:							
x	DEVICE REQUESTED RECOVERY (first)							
x+1	(MSB)			ADDITIONAL VENDOR-SPECIFIC DEVICE INFORMATION				
r								(LSB)

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

The DEVICE COMPONENT CODE is defined in Table x4

TABLE x4. DEVICE COMPONENT CODE definition

Value	Description
00h	No message
01h-0Fh	Reserved
10h	Device Data Path (General)
11h	Read/Write Head
12h	Compresson Core
13h	Cryptographic Core
14h	Data Buffer
15h	ASIC
16h-1Bh	Reserved
1Ch-1Fh	Vendor-Specific
20h	Mechanical (General)
21h	Reel Motor
22h	Servo
23h	Head Actuator
24h	Loader

TABLE x4. DEVICE COMPONENT CODE definition

Value	Description
25h	Threader
26h	Door
27h-2Bh	Reserved
2Ch-2Fh	Vendor-Specific
30h	External Interface (General)
31h	Automation Interface Hardware
32h	Automation Interface Memory
33h	Primary Interface Hardware
34h	Primary Interface Memory
35h	Primary Interface Transceiver
36h	Panel Hardware
37h	Panel Memory
38h-3Bh	Reserved
3Ch-3Fh	Vendor-Specific
40h	Electronic Components (General)
41h	Nonvolatile Data Store
42h	Nonvolatile Microcode Store
43h	RAM
44h	Master CPU
45h	Slave Processor(s)
46h-4Bh	Reserved
4Ch-4Fh	Vendor-Specific
50h	Microcode (General)
51h	Master Code Image
52h	Servo Code Image
53h	Interface Code Image
54h	Slave Code Image
55h-5Bh	Reserved
5Ch-5Fh	Vendor-Specific
60h-FFh	Reserved

EDITORS NOTE: The device severity code field is intended to replace the existing TapeAlert flags severity

The DEVICE SEVERITY CODE is defined in Table x5.

TABLE x5. DEVICE SEVERITY CODE definition

Value	Description
00h	Reserved
01h	Informational - The condition should be logged and/or the operator informed. No guidance about continued operation without corrective action is given by this standard.
02h	Retryable - The event that generated this Device Information may be retried.
03h	Manual intervention required - If this condition is not corrected, a data loss failure may occur. Continued operation without corrective action may cause a failure. The condition should be logged and/or an operator informed.
04h	Critical - Call service Either a failure has already occurred or a failure is likely to occur immediately. Continued operation without corrective action is likely to cause a failure. The condition should be logged and/or an operator informed.
05h - FFh	Reserved

Make this field a "What operator should do" by turning this into a list of messages in a prioritized list of operator sequences similar to ADC Requested Recovery. This makes sense even if multiple tapealerts are returned because the parameters are supposed to be returned in oder of earliest assertion. I think this is the best we can do on creating actions for the root cause.

The NUMBER OF DEVICE REQUESTED RECOVERIES specifies the number of DEVICE REQUESTED RECOVERIES that follow.

The DEVICE REQUESTED RECOVERY values are defined in Table x6

TABLE x6. DEVICE RECOVERIES REQUESTED definition

Value	Description
00h	No recovery requested
01h	Retrieve device debug logs
02h	Clean device
03h	Update microcode
04h	Power off device and call service
05h	Leave the device in current state and call service
06h	Remove power from the device then apply power
07h - FFh	Reserved

8.2.a.2 Medium Information Descriptor

Table x7 defines the Medium Information Descriptor format. This descriptor is returned when the cause of the TapeAlert flag associated with the parameter may be related to the medium.

TABLE x7. Medium Information Descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	MEDIUM INFORMATION LENGTH (s)							
1	MEDIUM INFORMATION CODE							
2	MEDIUM EXCEPTION MESSAGE							
3	MEDIUM SEVERITY CODE							
	Medium Identification Descriptor(s)							
4	MEDIUM IDENTIFICATION LENGTH (n-5)							
5	Medium Identification Descriptor (first)							
x								
y	Medium Identification Descriptor (last)							
n								
m	(MSB)	ADDITIONAL VENDOR-SPECIFIC MEDIUM INFORMATION						
s								(LSB)

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

The MEDIUM INFORMATION CODE is defined in Table x8

TABLE x8. 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
08h - FFh	Reserved

The MEDIUM EXCEPTION MESSAGE is defined in Table x9

TABLE x9. 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
06h - FFh	Reserved

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
05h - FFh	Reserved

The MEDIUM IDENTIFICATION LENGTH field specifies the length of the following Medium Identification Descriptors.

The Medium Identification Descriptor format is identical to the MAM ATTRIBUTE format for medium auxiliary memory (see SPC-4). If the Medium Information Descriptor is returned and:

1) a MAM attribute exists for the volume identifier parameter of the device type attributes (i.e., set by the SMC device), then this attribute shall be returned as a Medium Identification Descriptor;

2) a MAM attribute exists for the barcode parameter of the host type attributes (i.e., set by an application client), then this attribute shall be returned as a Medium Identification Descriptor;

3) a MAM attribute exists for the medium serial number parameter of the medium type attributes (i.e., set by the manufacture), then this attribute shall be returned as a Medium Identification Descriptor;

4) a vendor-specific medium indentifier exists, then the vendor-specific medium identifier shall be returned in a Medium Identification Descriptor using the MAM attribute format and one of the vendor-specific ATTRIBUTE IDENTIFIERS (see SPC-4).

Vendor-specific information may be returned in the ADDITIONAL VENDOR-SPECIFIC MEDIUM INFORMATION field.

8.2.a.3 *Tapealert Flag Information Descriptor*

Table x11 describes the Tapealert Flag Information descriptor format. Table 9 specifies for which flags this descriptor is returned.

TABLE x11. Tapealert Flag Information descriptor

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

The CURRENT PERCENTAGE field returns a signed percentage indicating how close to operating limits the item is. The value returned is the signed percentage * 16384. If the magnitude of the percentage is less than or equal to 100%, then the device is operating within specification. If the magnitude is greater than 100% then the device is outside the operating specifications. The equation that shall be used is

$$\frac{measuredValue - \left[\frac{(upperLimit - lowerLimit)}{2} + lowerLimit\right]}{upperLimit - \left[\frac{(upperLimit - lowerLimit)}{2} + lowerLimit\right]} \times 16384$$

(e.g. The power specification states the operating range is between 4.78 V and 5.32 V and the measured voltage is 4.70 V, then the value returned would be determined by the equation

$$\frac{4.7 - \left[\frac{(5.32 - 4.78)}{2} + 4.78\right]}{5.32 - \left[\frac{(5.32 - 4.78)}{2} + 4.78\right]} \times 16384 = -21239$$

and the value AD09h would be returned.

Alternately, if the media life is specified to be 260 full backups and the media has had 234 backups performed. Then the value returned would be determined by the equation

$$\frac{234 - \left[\frac{(260 - 0)}{2} + 0\right]}{260 - \left[\frac{(260 - 0)}{2} + 0\right]} \times 16384 = 13107$$

and a value of 3333h would be returned.)