Proposal for Storage and Access of Data on Auxiliary Memory T10/99-148r2

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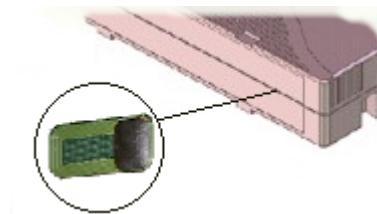## 15 September 1999

Driving Need …
The Technology

■ Tape cartridges are incorporating E2PROM

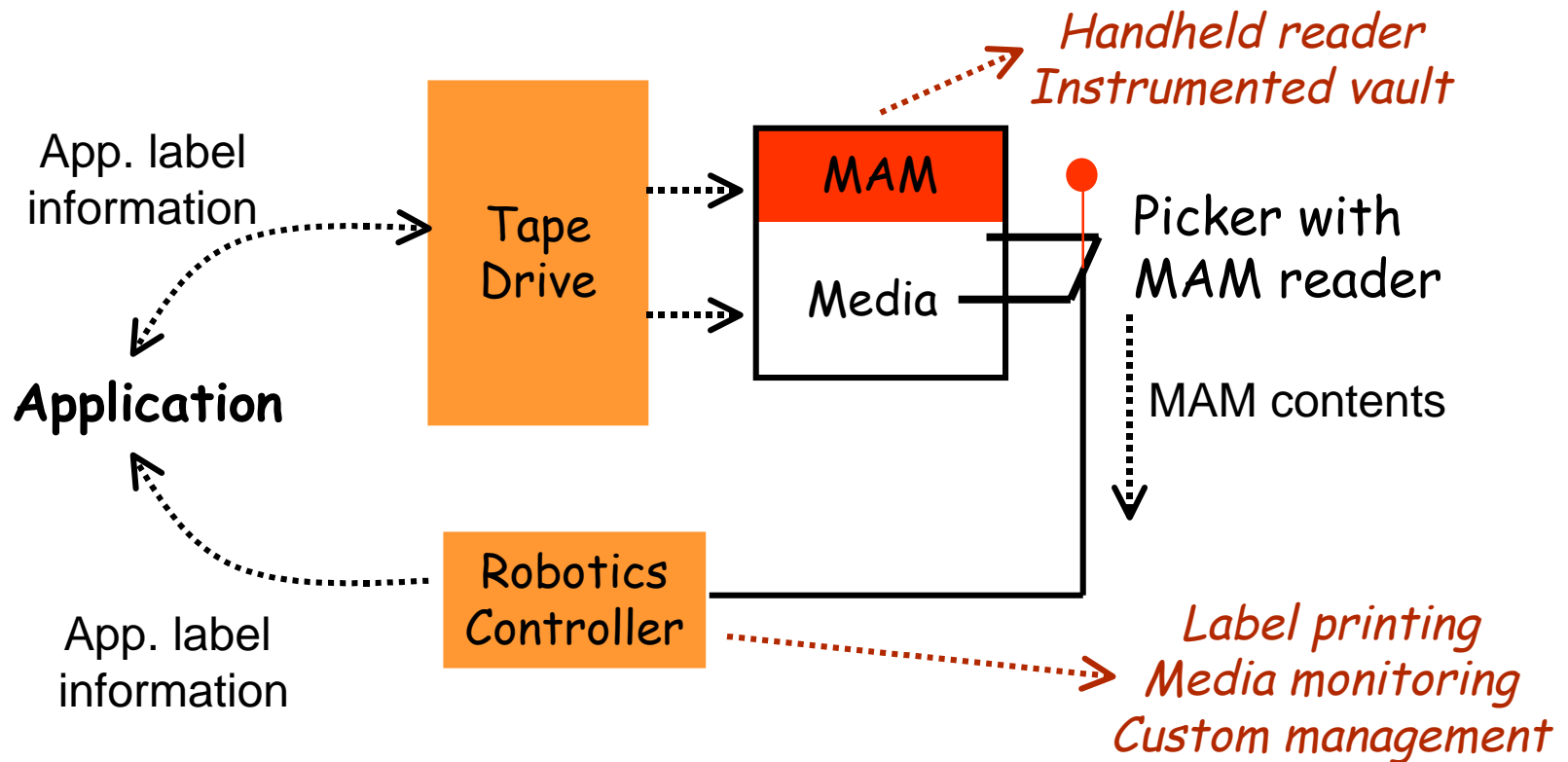*Sony AIT-MIC*   *HP/IBM/Seagate LTO-CM*   *Others to come...*

■ "Media Auxiliary Memory" is generic term

■ Primary purpose is to speed up drive internal operations e.g. load/unload, spacing - transparent to host

Driving Need ...
MAM in Libraries

App. label information

Handheld reader
Instrumented vault

MAM

Media

Picker with
MAM reader

Tape
Drive

Application

MAM contents

Robotics
Controller

App. label information

Label printing
Media monitoring
Custom management

- ☑ Library & drive aware of application level information
- ☑ No human interaction ➔less errors
- ☑ Enables extended applications ➔ e.g. label printer
- ☒ ISV support needed ➔needs standards!

Driving Need ... Opportunities and Benefits

- **Free space in MAM can be used by host software for solution value-add**
  - **Fast** library inventory via picker arm-mounted MAM readers
  - Independent label printers
  - Handheld readers and instrumented media vaults
  - Security information and encryption keys
  - Correlation of media condition and drive load history
  - Improved media tracking in the enterprise
  - Enables/safeguards media sharing in Storage Area Networks
  - Anything else software vendors can think of...

Need for a common access method

- Application software vendors
  - Require standard methods for accessing device features.
- Auxiliary Memory used elsewhere
  - e.g. non-volatile information on drives
  - New uses may appear
- Hewlett Packard is proposing some new commands to directly support these functions and provide a route for future enhancements.

Overview of Proposal

Add two new commands to SPC-2:

- Write Attribute (8Ah)
  - Allows attributes for a specified element to be written.
  - Individual elements are addressable:
    - element type, element address, volume number, partition number
- Read Attribute (8Bh)
  - Allows a list of attribute values to be retrieved from a specified element.
  - Includes a discovery mechanism allowing host to 'walk' a tree of information

Overview of Proposal

Other additions to SPC-2 to support media auxiliary memory:

- Inquiry VPD page 84h - 'Media Auxiliary Memory' page
  - Allows media detection in SANs where devices may be reserved by other hosts
- Define Attribute Set for Media Auxiliary Memory
  - See end of slideset or proposal
  - Since data will be able from multiple paths (library or drive) SPC is appropriate place.

Other slides

T10/99-223r2

Write Attribute (0x8A)

Byte	7	6	5	4	3	2	1	0
0	Opcode (8A)							
1	Reserved(0)				Element Type Code			
2	Element Address							
3								
4	Reserved(0)							
5	Volume Number							
6								
7	Partition Number							
8	Reserved(0)							
9								
10								
11	Allocation Length							
12								
13								
14								

Read Attribute (0x8B)

Byte	7	6	5	4	3	2	1	0
0	Opcode (8B)							
1	ReptTypes	ReptElmts	ReptVols	ReptParts	Element Type Code			
2	Element Address							
3								
4	Reserved(0)							
5	Volume Number							
6								
7	Partition Number							
8	Reserved(0)							
9	First Attribute ID							
10								
11	Allocation Length							
12								
13								
14								

Discovery Mechanism

Reporting Flags				Address Fields				Data Reported
Rept Types	Rept Elmts	Rept Vols	Rept Parts	ELEMENT TYPE CODE	ELEMENT ADDRESS	VOLUME NUMBER	PARTITION NUMBER	
1	0	0	0	X	X	X	X	Element Type info
0	1	0	0	as specified	X	X	X	Element Address info
0	0	1	0	as specified	as specified	X	X	Volume Number info
0	0	0	1	as specified	as specified	as specified	X	Partition Number info
0	0	0	0	as specified	as specified	as specified	as specified	Attribute Sets

X = don't care (field ignored)

MAM Attributes (1)

- Data represented as logical attributes - physical MAM format irrelevant to host software

- Attributes are device class specific (e.g. tape)

- Attributes grouped into areas to signify source of changes, and whether mandatory or optional

Parameter IDs	Area Name	Support multi-partition media	Support in single-partition media
0000h - 01FFh	Multi-partition area	Optional	Optional
0200h - 03FFh	Media Mandatory area	Mandatory	Mandatory
0400h - 04FFh	Device Mandatory area	Mandatory	Mandatory
0500h - 05FFh	Host Mandatory area	Mandatory	Mandatory
0600h - 06FFh	Media Vendor Unique area	Optional	Optional
0700h - 09FFh	Device Vendor Unique area	Optional	Optional
0A00h - FFFFh	Host Vendor Unique area	Optional	Optional

MAM Attributes (2)

- **Multi-partition Area (optional)**
  - Provided for compatibility with Sony's existing MIC format for AIT media,
  - Can be used by other multi-partition drives that wish to follow the AIT model.
  - Non-AIT drives can use if needed for application compatibility

- **Media Mandatory Area**
  - Hardcoded at media manufacture time - read-only
  - Allows host to determine physical media characteristics, manufacture date, unique serial number, etc.

MAM Attributes (3)

- **Device Mandatory Area**
  - Maintained by device
  - Allows host to determine current media status, e.g. remaining tape capacity, remaining MAM capacity and media history e.g. load count, TapeAlert flags, drive load history

- **Host Mandatory Area**
  - Maintained by software applications
  - Allows host to write basic ownership information e.g. application vendor, name and version; media text label; date and time last written

MAM Attributes (4)

- **Media Vendor Unique Area (optional)**
  - Placeholder for future media vendor usage
- **Device Vendor Unique Area (optional)**
  - Device technology-specific usage, e.g. extended multi-partition information, ECC/retry rates
- **Host Vendor Unique Area (optional)**
  - Software application value-add, e.g. backup session information, disaster recovery information
- **Limitations**
  - Typical 4kbyte MAM only leaves ~1.5kbytes for host usage. Not enough for a complete file catalog at the moment, but sizes will increase with time