

MEMRITM

Media Error Monitoring, Reporting and Information

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LOTS TECHNOLOGY, INC.

Scope of the MEMRI™ Standard

- Defining a means of transporting media error monitors, reports and information in a technology- and interface-independent manner
 - The transport means and the highest-level content are proposed in this document
 - Discussion with industry representatives required to define implementation on particular interfaces
- **Defining the report-level content**
 - Means of transporting proposed
 - Specific content not proposed; to be added to MEMRI™ after discussion with industry representatives to determine:
 - How best to structure the reports
 - Whether the reports must be vendor-specific or can be standardized across a technology
 - If standardized across a technology, defining what constitutes a technology
- **Defining a standard means for describing and transporting vendor-specific details like accumulators and registers**
 - Means of transporting is proposed by this document
 - The specific accumulators and registers are vendor specific and will not be specified by the MEMRI™ standard

User Requirements for a Media Error Monitoring Standard

- A simple high-level summary interface
 - Should the host continue using the media, or should it be copied to fresh media?
 - Many users will have no interest in how the continue using/copy to fresh media decision is made, only that the decision can be relied upon
- Reports backing up the high-level summary
 - Only certain users will be interested in this
 - Graphs, charts, histories describing the media in question
 - Addresses the questions:
 - Why is this media still usable?
 - Why should this media be copied to fresh media?
- Vendor-specific hardware accumulators and registers
 - Few users should require this if the high-level summary and reports described above are available
 - Nevertheless, a standard means of accessing is desirable

Supplier Requirements for a Media Error Monitoring Standard

■ Minimal impact to already-fielded drives

- Minimal effort should be required to bring fielded drives into compliance
 - Should require no hardware changes
 - Changes to drive firmware and or host driver software only
 - Supply continue using/copy to fresh media indicator via the standard, but be able to compute these indicators in a vendor-specific and non-public way

■ Additional compliance

- Reports outlining how the continue using/copy to fresh media indicator was computed
- The contents of the reports are unique to a technology family or to a vendor
- The transport format of the reports is standardized

Supplier Requirements (continued)

- Vendor-specific registers and accumulators can be made available
 - MEMRI™ standard will provide the information structure and transport mechanism
 - Specific breakdown of registers and accumulators remains vendor-specific
- Compliance can be implemented at either a Hardware or a Software interface
 - The drive itself can be compliant
 - The drive plus host driver can be compliant
 - The drive can be compliant to a minimal level, while the drive plus host driver is compliant to a higher level

EXISTING QUALITY FIGURES

■ Existing Quality Figures

- MTBF, Error Rate
- In conflict with quality as experienced by users

■ Empirical Qualification/Monitoring

- Time-consuming and expensive to screen every tape and every drive before delivery

A BETTER SOLUTION

- MTBF and Error Rates are Insufficient as Quality Figures
 - Perfection vs. Disaster is not a measure of Quality
- An additional Quality Figure with more than two levels is needed
 - Must be a continuous measure of quality, not Perfection or Disaster

SMART MEMRITM

■ ***SMART***

- Provides early warning of drive-related failures allowing action to preempt data loss
- Similar to Diagnostic Testing, except that it is continuously running and the results are continuously available to the host system

■ ***MEMRI***TM

- Provides early warning of media-related failures allowing action to preempt data loss
- Proposed Standard for **Media Error Monitoring, Reporting and Information**

MEMRI™ COMMITMENT

■ LOTS Technology

- SMART MEMRI™ will continuously monitor the media, the data it holds, and the drive that accesses it.
- The results will be continuously available to the host driver and higher-level host software as accumulated data, as thresholded warnings or as analyzed information.

MEMRI™ COMMITMENT (*continued*)

■ Industry

- LOTS Technology proposes to cooperatively develop this mechanism as an industry standard.

MEMRI™

■ *Media Type*

- Distinguish Various Optical Media Types from each other and from Non-Optical

■ *Error*

- Media Record and Playback Errors are detected continuously during both Playback and Record.

MEMRI™ *(continued)*

■ *Monitoring*

- Large Defect Timestamping and physical tape location logged
- Small Defects are accumulated into error size bins and tape physical location (“zone”) bins
- Results accumulated per drive, per tape and since reset.

MEMRI™ *(continued)*

■ **Reporting**

- From the LOTS System via SCSI Log Sense or equivalent
- From the Host Driver via a Published and Standardized API

MEMRI™ (*continued*)

■ *Information*

- Transformation of the raw collected data into useful information by LOTS- and Host-system software
 - Threshold-Based Warnings
 - Heuristic Troubleshooting Aids
 - Presentation Reporting and Graphical Monitoring
 - Interface to standard Data Analysis Tools

WHERE IS THIS INFORMATION STORED?

- On Tape (MIC?)
- In the Drive
- In the Host System
- Not A Straightforward Issue
 - All alternatives have advantages/disadvantages
- The MEMRI standard will be flexible enough to allow any of these alternatives

DATA LOG STORAGE ON THE MEDIA

- Data logs are written to a dedicated area of the Media
 - Rewritten on read/write drives
 - Appended or written to a special area on write-once drives written (immediately before eject)
- The data log is intrinsic with the media surface it represents

DATA LOG STORAGE ON THE MEDIA *(continued)*

- No host system management required
 - Host only polls the data when and if it needs it
 - Some hosts might extensively analyze the logs while others completely ignore them
- Requires the capability to write new logs after read operations
 - Not possible with a read-only drive
 - May not be acceptable behavior on a write-protected tape

DATA LOG STORAGE INSIDE THE DRIVE

- Data logs are maintained in non-volatile memory within the drive
 - Non-volatile SRAM
 - Internal Hard Drive
 - Finite Space Available
- Allows read-only drives and write-protected media to be monitored
- No host system management required

DATA LOG STORAGE INSIDE THE DRIVE *(continued)*

- Data logs can easily get separated from their media or split among multiple drives even within a single robotic system
- Media History
 - Full history of a particular media not available as a single entity
 - Separate histories available piecemeal from each drive that ever mounted the media

STORAGE IN THE HOST SYSTEM

- Data logs are maintained on the host
- Data logs can easily get separated from their media, but only if physically moved to another host system
- Requires extensive management of data logs on the host system
- Read-only and write-once media can be monitored

STORAGE IN THE HOST SYSTEM

(continued)

- The data logs for a particular media can be kept unified unless the media is used by multiple hosts
- Full history of media is continuously available
- If the media is moved, its logs can move with it relatively easily on auxiliary storage
 - Floppy disk
 - PCMCIA
 - etc.

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