

# ***MEMRI***<sup>TM</sup>

*Media Error Monitoring, Reporting and Information*

*presented by Joe Straub*

***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 MEMRI***<sup>TM</sup>

## ■ ***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***<sup>TM</sup>

- 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.

# LOTS Technology Inc.

1274 Geneva Drive

Sunnyvale, CA 94089-1122USA

408-747-1111

Fax 408-747-0245

lots@ix.netcom.com

<http://www.lasertape.com/>