

File Storage Management Systems (FSMS) and ANSI/AIIM MS66

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Outline

- File Storage Management Systems (FSMS)
- Migration of a tape archive from one FSMS to another
- Development of standard metadata for interchange of files on sequential storage media between FSMS
- Association for Information and Image Management (AIIM) International Technical Committee C21
- ANSI/AIIM MS66, "Metadata for Interchange of Files Between File Storage Management Systems"
- Conclusions
 - User's perspective
 - Industry perspective

File Storage Management Systems

- *A File Storage Management System (FSMS) is a software system that manages a collection of files.*
- *Examples of FSMS include Hierarchical Storage Management Systems (HSMS) and systems that manage large storage archives.*
- *One of the responsibilities of the FSMS might be to move files between different kinds of media (e.g., magnetic disks, sequential storage media, or other media) to optimize performance and cost.*

File Storage Management Systems (Cont.)

- *Files may be scattered over several magnetic tapes. The information required to reconstruct the files is likely to be stored on disks, separate from the tapes on which the files reside.*
- *Some **metadata** about the files may be embedded in headers or trailers on each block or file stored on the tapes.*

Migration of a Tape Archive From one FSMS to Another

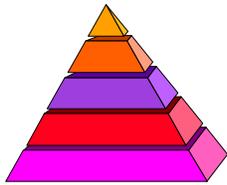
- *Extremely large data systems such as NASA's Earth Observing System Data and Information Systems (EOSDIS), rely on FSMS to stage files to a disk as required for fast access, and to migrate files to tapes for economical storage, when there is no requirement to keep them on disk.*

Migration of a Tape Archive From one FSMS to Another (Cont.)

- *Current FSMS write files to tapes in **proprietary formats**.*
 - Not all tape marks represent end of file
 - Not all files end with a tape mark
 - Files broken up into file segments
 - Control blocks embedded in the file segments
- *Until now, migrating from one FSMS to another required that the files be copied to a standard format and then ingested by the new FSMS!*

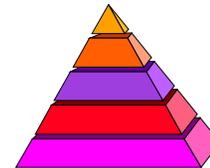
Migration of a Tape Archive From one FSMS to Another

Replacement of one FSMS (tapes to reside in the same robotic silos) or transfer of a tape archive from one facility to another:



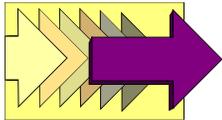
FSMS1

(Proprietary File-Level Metadata)

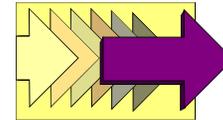


FSMS2

(Proprietary File-Level Metadata)



The files in the tape archive must be re-written to the FSMS2 format (this may be million of files stored on several hundred thousand tapes)



History

- September 1995:

Joel Williams, SES Inc. presented to various organizations (14th IEEE Symposium on Mass Storage, ANSI X3B5, and THIC) a Straw Man Proposal for a Standard Tape Format. This work was sponsored by NASA Goddard Space Flight Center.

- April 1996:

AIIM forms File-Level Metadata for Portability of Sequential Storage Media (FMP) Study Group (SG) to discuss this issue. FMP SG decides to write a metadata specification rather than a file format specification.

- December 1996:

AIIM FMP SG completes a prototype metadata specification. Recommends formation of a Subcommittee to develop a formal ANSI standard.

History (Cont.)

- February 1997:
 - AIIM forms C21.1 (FSMS), a Subcommittee of AIIM C21 Committee, “Advanced Data Storage Subsystems” to develop the standard (*ANSI/AIIM MS66*). C21.1 starts development of the standard.
- June 1998:
 - C21.1 approves ANSI/AIIM MS66 as a proposed standard and submits it to AIIM for further standardization.
- July 1998:
 - C21.1 starts a related project: *to develop a standard for compliance testing.*
- April 1999:

990705- **ANSI approves ANSI/AIIM MS66!**

AIIM C21.1 (FSMS) Subcommittee

Member Organizations

ADIC

AT&T Laboratories

BDM Inc.

Berg Software Design

Datatape Inc.

High Performance Storage Systems

Hughes STX Corp.

IBM Corp.-Tucson

Library of Congress

LOTS Technology

LSC Inc.

NASA Goddard Space Flight Center

NASA/Langley Research Center

National Media Lab

Information Technology Lab, NIST

NOAA/NWS

Performance Group

Red Cape Software

Silicon Graphics

Storage Technology Corp.

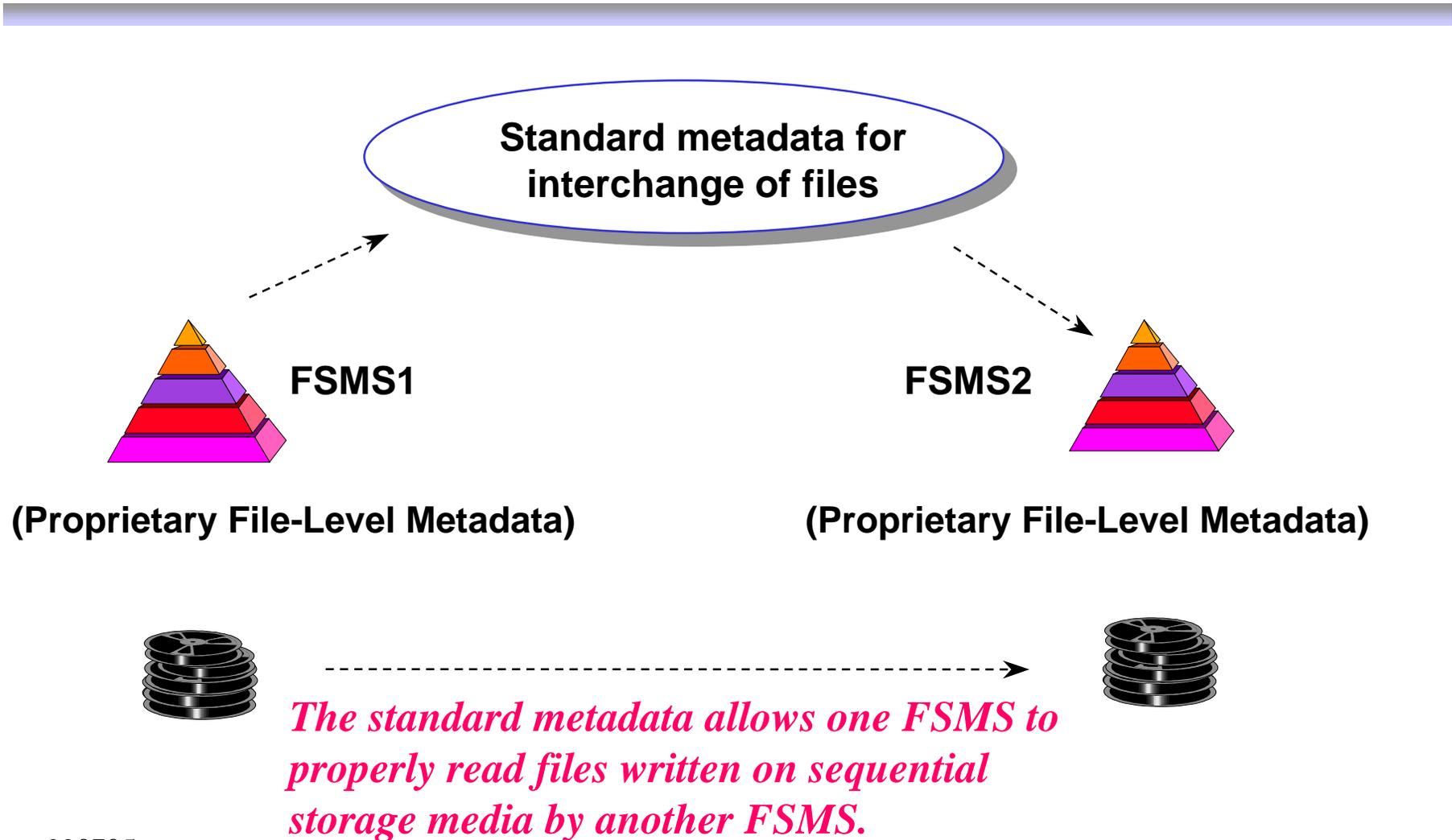
Systems Engineering & Security, Inc.

Terabank Systems

UniTree Software, Inc.

Veritas Software

Interchange of a Tape Archive Between Two Different FSMS Utilizing Standard File-Level Metadata



ANSI/AIIM MS66, “Metadata for Interchange of Files Between File Storage Management Systems”

- Purpose:
 - To specify a way of describing the additional information added by one FSMS, together with sufficient other information, to allow another FSMS to read what the first FSMS wrote and reconstruct the original files as seen by the original application program.
- Benefit:
 - data migration cost savings
 - reduced need for additional computing capacity required to support the copy operations.

ANSI/AIIM MS66

- Features:
 - Provides a standard, non-proprietary way of representing the proprietary format of an FSMS, so as to avoid the copy and ingest operations when changing FSMS vendors.
 - Provides in addition, a representation of the directory and file structure, so that it may be transferred also.

ANSI/AIIM MS66

Description of the Metadata Export

- Supports any type of magnetic and optical sequential storage removable media.
- The standard specifies the format of a series of metadata records and a set of fields per record:
 - First field: record name
 - Other fields: name fields or information fields.
- The general record format defined in the standard allows vendors to define additional records that accommodate virtually any practice.
 - Vendor-specific or site-specific records or fields are easy to add.

ANSI/AIIM MS66

Description of the Metadata Export (Cont.)

- MS66 specifies the metadata for interchange of files (the metadata export) in four sections:
 - the format of the records of the metadata export;
 - the metadata that refers to the cartridges;
 - the metadata that refers to a file segments on the cartridges;
 - the metadata that refers to the directory and file structure of the export set.



ANSI/AIIM MS66

Description of the Metadata Export (Cont.)

- It includes a collection of records, in Unicode or ASCII each named, and with named fields in some cases.
- Some records are selectable, and not all record types apply to all implementations.
- Using named records and named fields makes it easy to add additional records to extend the metadata to cover some practice that may be implemented in the future.

Metadata Export Records, Part 1

- These records give the context in which the export was written:
 - Export Version
 - Export Hardware System (for the export, not the FSMS)
 - Export Operating System (for the export, not the FSMS)
 - Export Time
 - Export FSMS name

Metadata Export Records, Part 2 (1)

- These records describe the removable media being exported. Records repeat for each cartridge.
- Metadata that refers to the cartridges:
 - Cartridge Identifier
 - Cartridge Info
 - Media type
 - Physical recording format
 - Cartridge drive type
 - Cartridge layout
 - No. Partitions
 - Side No, Partition No, Label type, Internal label size, Free space (MB)

Metadata Export Records, Part 2 (2)

- Metadata that refers to the cartridges (Cont.):
 - Cartridge No. Blocks between Tape Marks
 - Cartridge No. Bytes after Tape Marks
 - Cartridge Block Size
 - Cartridge Family
 - Cartridge Billing ID
 - Cartridge Volume Group
 - Name, Blocksize, Compression Allowed?
 - Cartridge Location (this is in case the FSMS is being changed, but the cartridges are staying put)
 - Library, Location (slot, shelf, etc.)
 - Cartridge Lot

Metadata Export Records, Part 2 (3)

- Metadata that refers to the cartridges (Cont.):
 - Cartridge Statistics
 - No. Mounts, Last Mount
 - Creation Time, Modified Time
 - No. Errors
 - Cartridge Byte Order (big/little endian)
 - Cartridge Block Structure
 - Block Length, Data Block Length
 - Header Length, Trailer Length
 - Cartridge Recording FSMS

Metadata Export Records, Part 3

- These records describe the file segments on the cartridges. These records repeat for each file segment.
 - File UID - Unique (within the export) ID for the file
 - File Name (fully qualified)
 - File Segment Number
 - File Segment Copy Number
 - File Segment Info: Striping Information, address on the cartridge
 - File Segment Header
 - File Segment Trailer

Metadata Export Records, Part 4 (1)

- This section describes the Directory and File structure. For each file there is the following information:
 - Attribute List:
 - UID - matching the UID in Part 3
 - Name - matching the name in Part 3
 - Object type: Directory, File, Container, Symbolic Link
 - Permissions
 - Owner ID
 - Group ID
 - File Length
 - Creation, access, and modification time

Metadata Export Records, Part 4 (2)

- Attribute List (Cont.)
 - Billing ID
 - Family ID
 - Container type, e. g. tar
 - Symbolic link contents
- Contents List, if the file is a container file.

Conclusion - User's Perspective

- Prior to MS66, there was no uniform method of describing tape archive formats.
- A description of these formats was never available to end users.
- Users could never be assured of the long term viability of their data archive holdings.
- With MS66 -- and a subsequent conformance standard that is also being developed -- users will be able to require MS66-compliant FSMS, thus assuring that their tape archives will not be 'lost' if the FSMS vendor cannot support the product anymore or should the user wants to migrate to other FSMS product.

Conclusion - Industry Perspective

- MS66 was developed with full cooperation from the major FSMS vendors.
- MS66 is expected to give a tremendous boost to the File Storage Management Systems (FSMS) industry.
- MS66 allows vendors to define proprietary tape formats in order to meet specific performance and reliability requirements while still providing a method for tape interchange.
- The adoption of MS66 by leading storage management vendors is the next critical step in its success. This will substantially increase user's confidence in FSMS.

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