



IBM STG Europe Software Development Mainz

Enterprise Tape Management

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Disclaimer

- This presentation describes potential further enhancements of IBM Enterprise Removable Media Manager (eRMM) and DFSMSrmm.
- Information in this presentation does not constitute a commitment to deliver the described enhancements or to do so in a particular timeframe.
- IBM reserves the right to change plans, features and delivery schedules according to business needs and requirements.

Agenda

- **The Tape Management Challenge**
- **Tape Management for Open Systems (eRMM)**
- **Simplified Tape Management for TSM (eRMM & TSM)**
- **Enterprise Tape Management (eRMM & DFSMSrmm)**
- **Summary**

Wasn't tape supposed to be dead ?

- **With steadily declining prices and cheaper disk storage why do we still need tape ?**
- **Considering TCO, tape is still cheaper than disk**
 - Cost per GB is less on tape (1/10th)*
 - Tape consumes less energy for power and cooling (1/10th)
 - Tape consumes less floor space (1/6th)
- **Data on tape can easily be moved to offsite locations (vaults) for disaster recovery or archival** (now even with encrypted data)
- **New regulatory compliances require long term storage of data and data archival requirements increase year to year**
 - In the communications industry, mobile phone providers will be required by European law to store everyone's call records for at least three years
 - In the medical sector, US hospitals are now legally required to store every single MRI scan for the duration of a patient's life

* Source: Data Mobility Whitepaper "Is Tape Really Cheaper Than Disk ?", October 2005

“Tape has been, is, and will continue to be the recovery and archive medium of choice” Clipper Analyst Group (Dec, 2006)

Tape is alive and growing . . . more than ever

- **Some of the recent tape technology advancements and trends**

- Tape drive based encryption (TS1120)
- IBM recently set a new tape density record with the TS1120. This provides 700 gigabytes uncompressed capacity per cartridge, the equivalent of eight million books on every single cartridge
- IBM recently demonstrated an eight terabyte magnetic tape cartridge. A tape cartridge with a capacity of 100 terabytes is currently being researched.

- **Joint tape/disk solutions are the most efficient and cost-effective storage solution available** (these are complementing not competing technologies)

- **Bottom Line:**

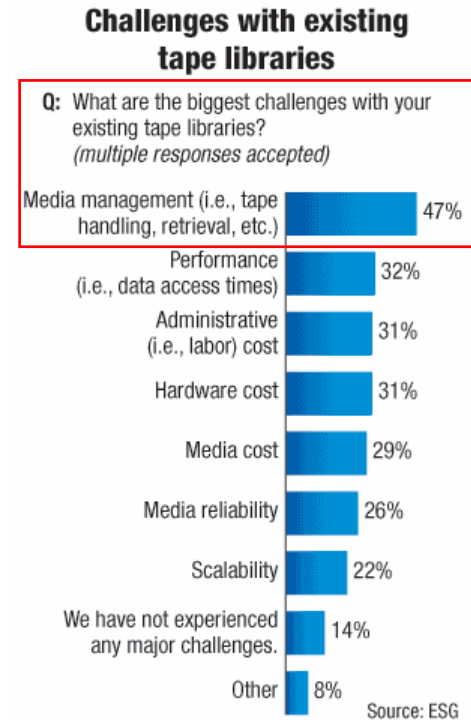
“Tape will be around for many years to do what it does best: protect data on removable media” *

“Unlike other technologies hyped in the trade press, it’s here, it’s now, and it works.”

* Quote taken from the article “Debunking the seven myths of tape”, Data Mobility Group DMG, 2003

Customer pain points

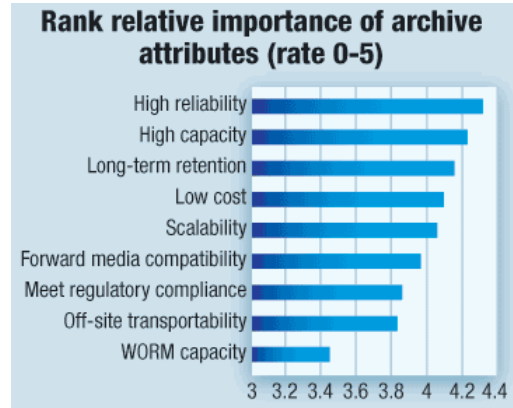
- According to customer surveys management of removable media is a major challenge in the enterprise
 - Example: There are customers that have to manage data on millions (!) of tape cartridges
 - Customer requirements stress the importance of effective management of removable media in order to reduce complexity, increase utilization and lower cost.



“Tape and media management is starting to become a problem in the distributed space, and customer requirements are extending beyond the simple tools available in the backup products today.”

“Dynamic device sharing capabilities replace the practice of each backup server owning its own devices and support dynamic assignment of specific drives to applications as they are needed.”

Source: Gartner (2003)



Tape Management Requirements

- **Customer Wants and Needs**
 - Consolidated removable media management for heterogeneous storage environments
 - Provide a single view and point of control of removable media resources across the enterprise
 - Support common management across heterogeneous storage environments
 - Make communication between heterogeneous systems and applications as seamless as possible
 - Utilize and share the same resources in a dynamic fashion

Agenda

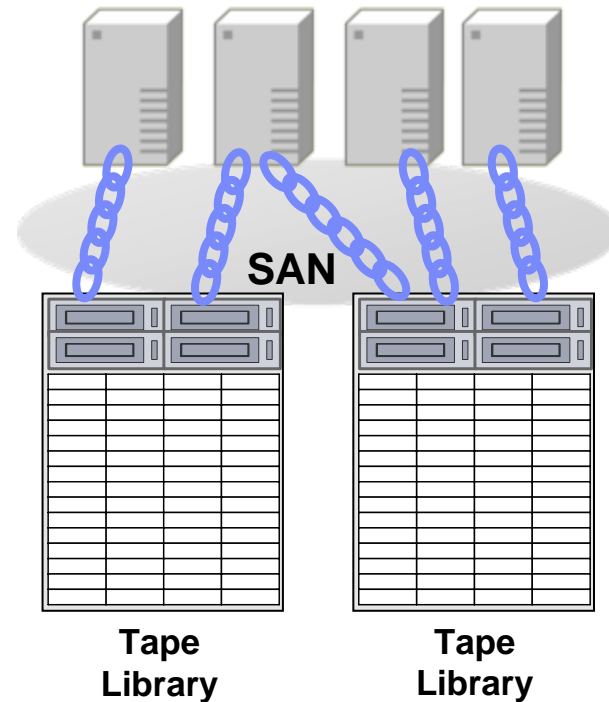
- 👉 **The Tape Management Challenge**
- 👉 **Tape Management for Open Systems (eRMM)**
- 👉 **Simplified Tape Management for TSM (eRMM & TSM)**
- 👉 **Enterprise Tape Management (eRMM & DFSMSrmm)**
- 👉 **Summary**

eRMM in a Nutshell

- **For mainframe folks:**
eRMM provides features known from DFSMSrmm for the open system world.
- **For open systems folks:**
eRMM complements SVC, GPFS, TSM, and TPC to provide storage virtualization and advanced storage management for removable media.

eRMM – Customer issues with tape

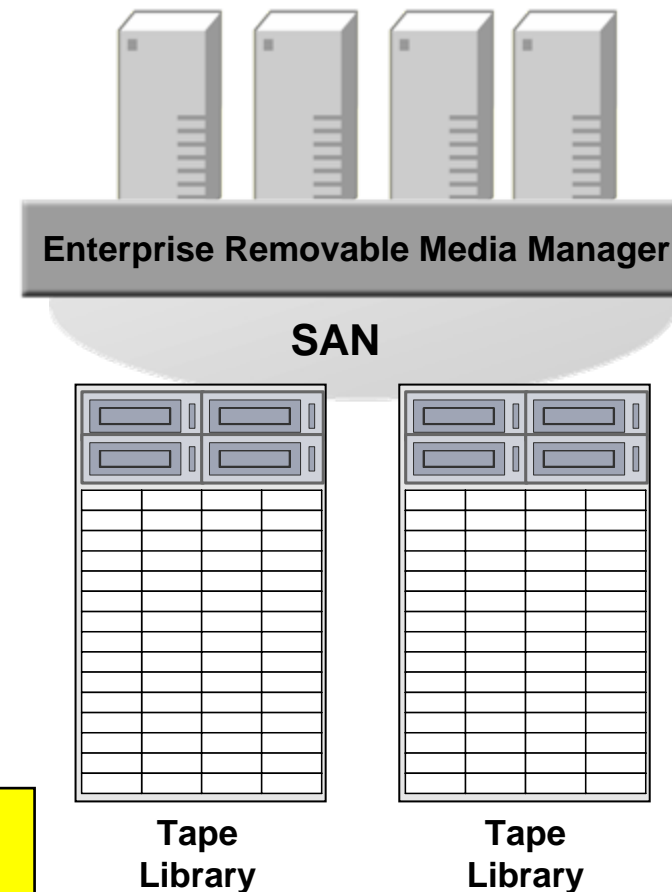
- **Tape resources are statically linked to applications**
- **Limited resource sharing in heterogeneous and even in large homogeneous configurations**
- **Adding or changing hardware requires changes of all applications**
- **Cartridge management has to be done by each application (no single control)**
- **Multitude of media changer interfaces (SCSI, IBM 3494, STK ACSLS)**
- **Lack of centralized management and monitoring: ‘I do not know what my library is doing and when!’**



eRMM – Benefits

- **eRMM decouples tape resources and applications** (tape library virtualization)
- **eRMM simplifies the sharing of resources** (even in heterogeneous configurations)
- **eRMM allows to change the hardware without changing all applications**
- **eRMM enables policy-based cartridge management**
- **eRMM virtualizes the media changer interface** (IEEE 1244 or IBM 3494)
- **eRMM provides centralized management, monitoring and reporting**

eRMM reduces the TCO for data stored on tape by improving its access and its management across heterogeneous application, server, and tape library boundaries.



eRMM – Strategic fit & positioning

■ Infrastructure Simplification

- Automated detection and configuration of drives and paths for TSM
- Provisioning and simplified sharing of drives and cartridges to TSM (could be used to simplify Service Level Agreements for tape usage and client charging)
- Policy based drive and cartridge utilization (such as dynamic load balancing of scratch mounts between libraries)
- Policy based cartridge management
- Virtualization of the libraries' media changer interface

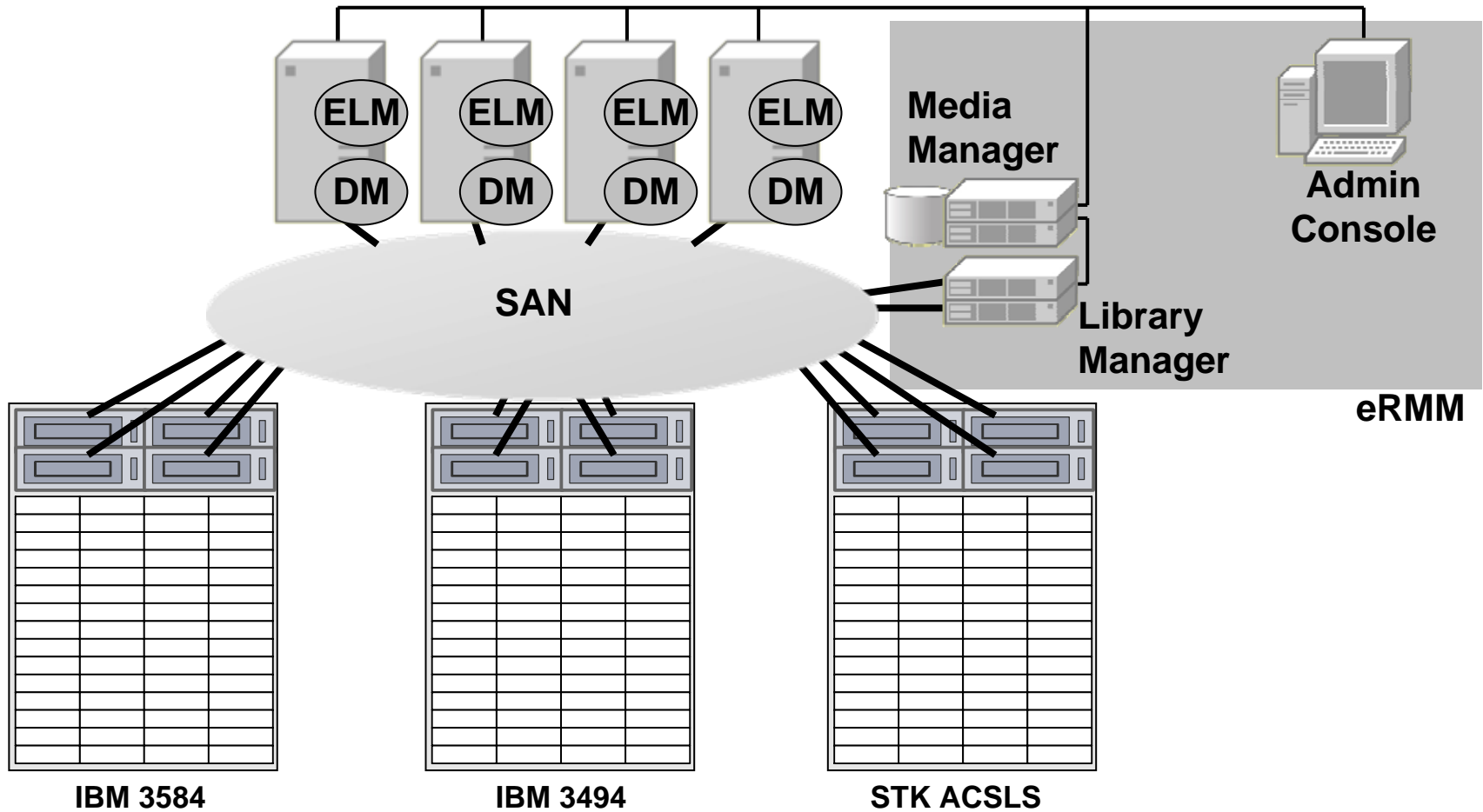
■ Business Continuity

- High available library sharing for TSM on all open system platforms (Note: The high availability of TSM Library Sharing is limited to AIX)
- High available provisioning of scratch cartridges to TSM

■ Information Life Cycle Management

- Policy based vaulting for tiered storage management
- Audit trails and statistical data of complete cartridge lifecycle for regulatory compliance and for tape quality management

eRMM Architecture



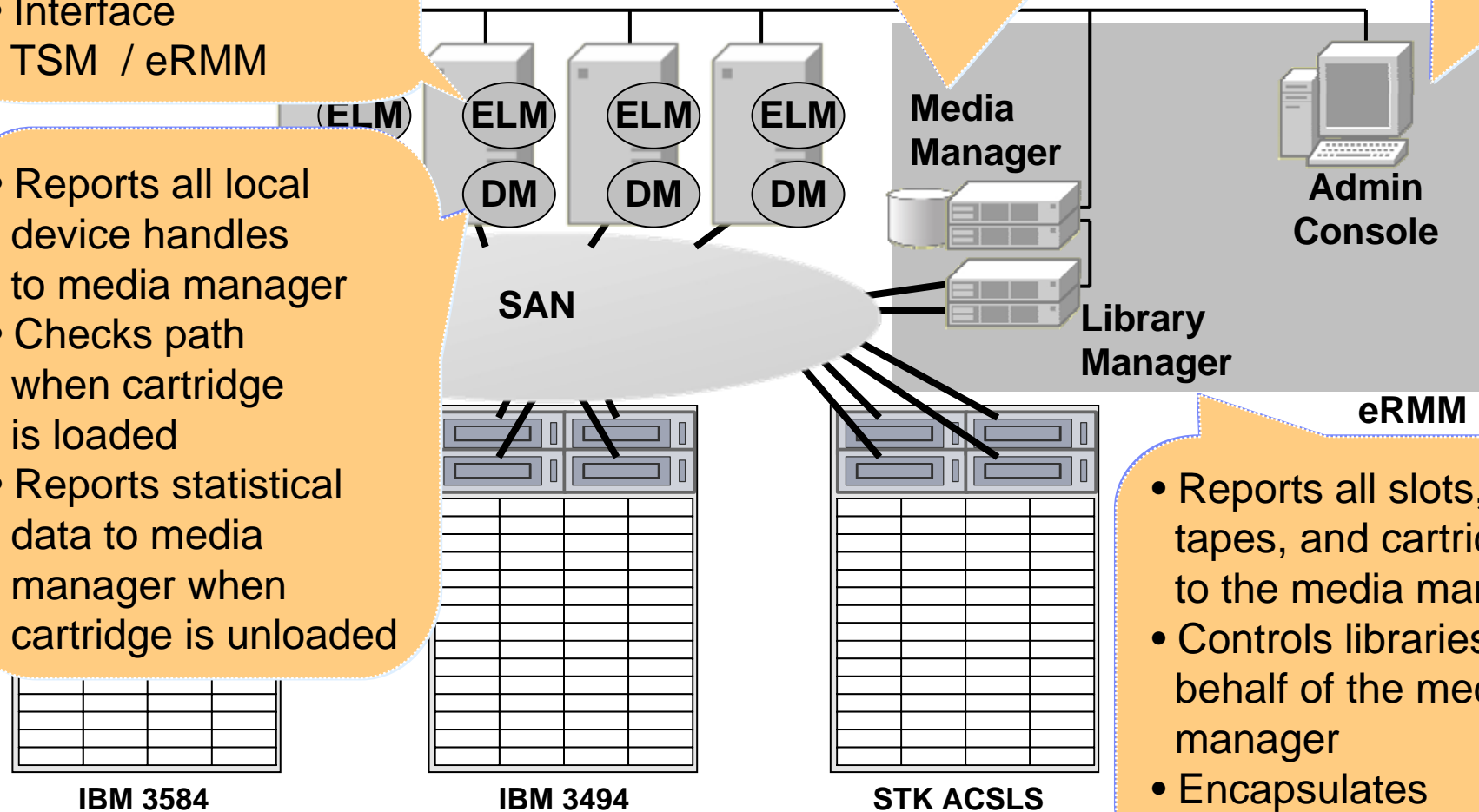
eRMM Architecture

- Interface TSM / eRMM

- Reports all local device handles to media manager
- Checks path when cartridge is loaded
- Reports statistical data to media manager when cartridge is unloaded

- Coordinates access to drives and cartridges
- Central repository
- Logs all activities

- Command line interface and GUI



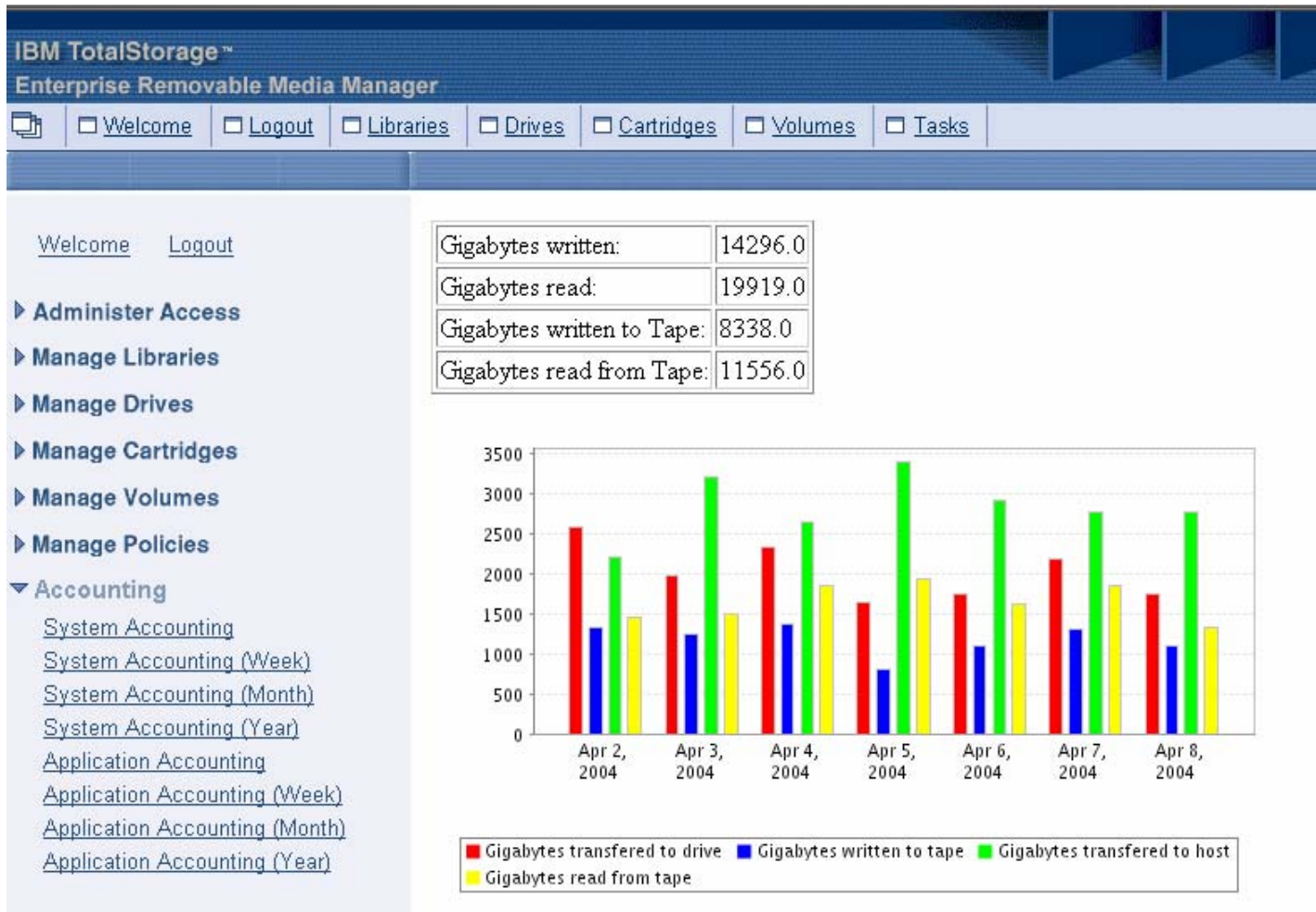
- Reports all slots, tapes, and cartridges to the media manager
- Controls libraries on behalf of the media manager
- Encapsulates library hardware

Statistical data for each mount request

ApplicationName: TSM-5.2.2@AIX
CartridgeID: 66b1a81c-871c-11d8-8522-0004ace4c83a
CartridgePCL: HJK030L2
CleanNow: 0
CleanPeriodic: 0
CleaningMedia: 0
CleaningRequired: 0
DMName: DM-LTO263@arthur
DiagnosticsRequired: 0
DownloadFault: 0
DriveCartridgeAccessByteReadCount: 720
DriveCartridgeAccessByteWriteCount: 1391461267
DriveCartridgeAccessHardReadErrorCount: 0
DriveCartridgeAccessHardWriteErrorCount: 0
DriveCartridgeAccessID: 3acdf3e-87c2-11d8-8522-0004ace4c83a
DriveCartridgeAccessSoftReadErrorCount: 0
DriveCartridgeAccessSoftWriteErrorCount: 0
DriveCartridgeAccessTimeMount: 2004 04 06 11 58 40 378
DriveCartridgeAccessTimeUnmount: 2004 04 06 12 02 08 739
DriveHumidity: 0
DriveName: LTO263

PredictiveFailure: 0
ReadDataBytesSentAfterCompression: 1414694
ReadFailure: 0
SideName: Side 1
TapeDirectoryCorrupted: 0
ThreadCount: 113
TotalDataSetsRead: 293681
TotalDataSetsWritten: 87669
TotalFatalSuspendedReads: 0
TotalFatalSuspendedWrites: 0

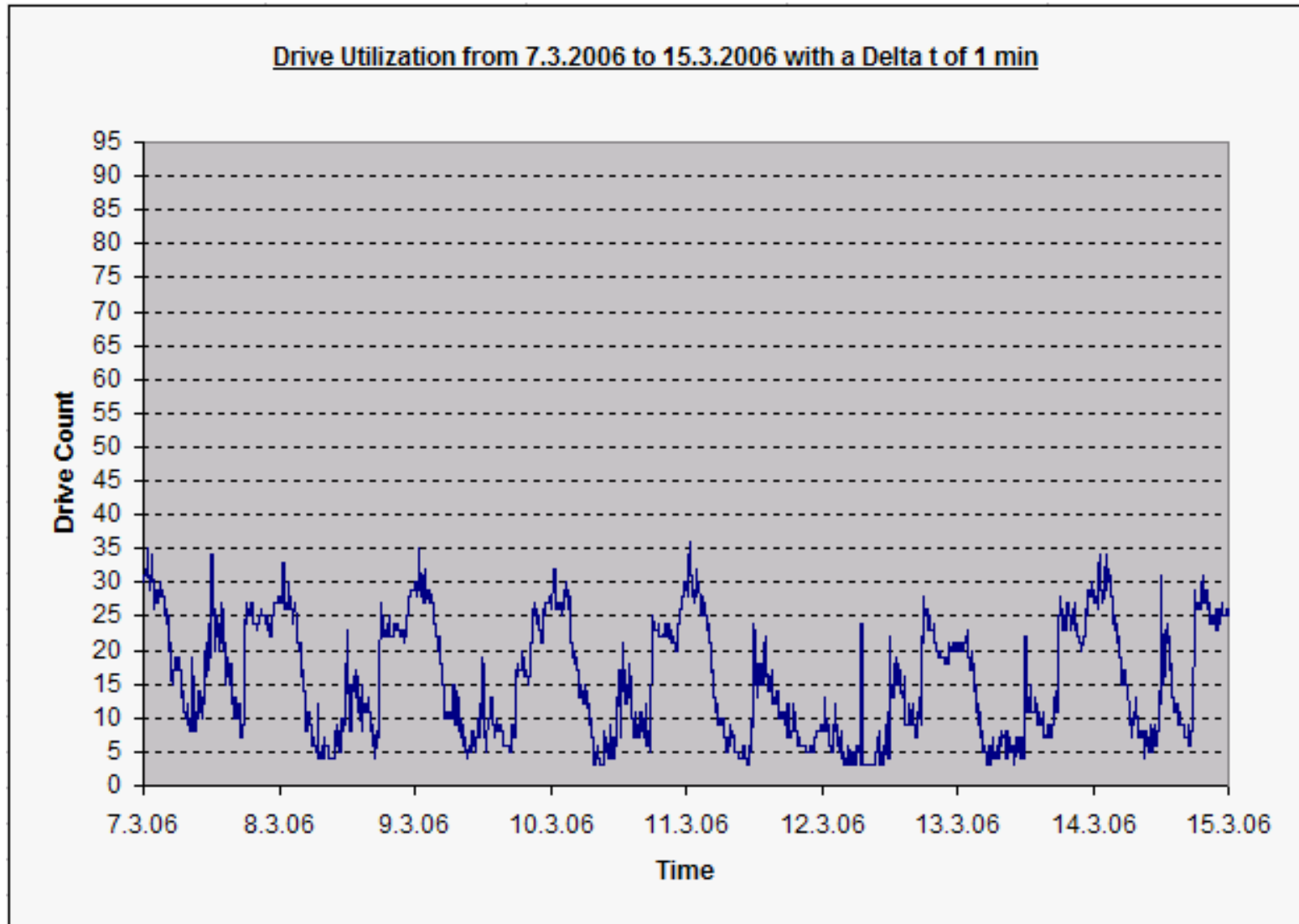
Advanced Reporting – Total throughput by day



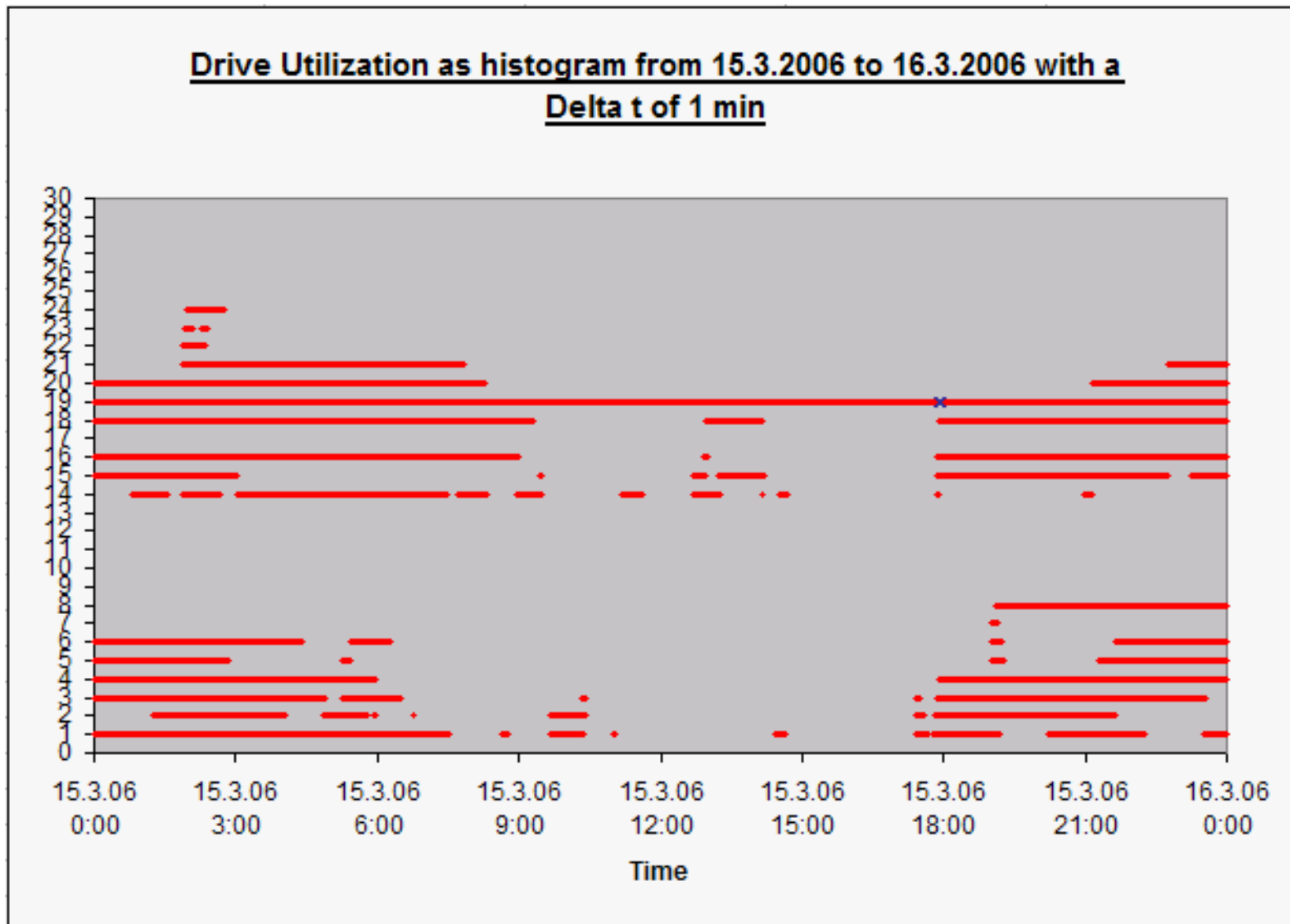
- Is there a cartridge with degraded performance?
- Is there a drive with degraded performance?
- Is there an HBA with degraded performance?
- Is there a server with degraded performance?

Source: Screenshot from a working prototype

Advanced Reporting – Drive Utilization



Advanced Reporting – Drive Histogram



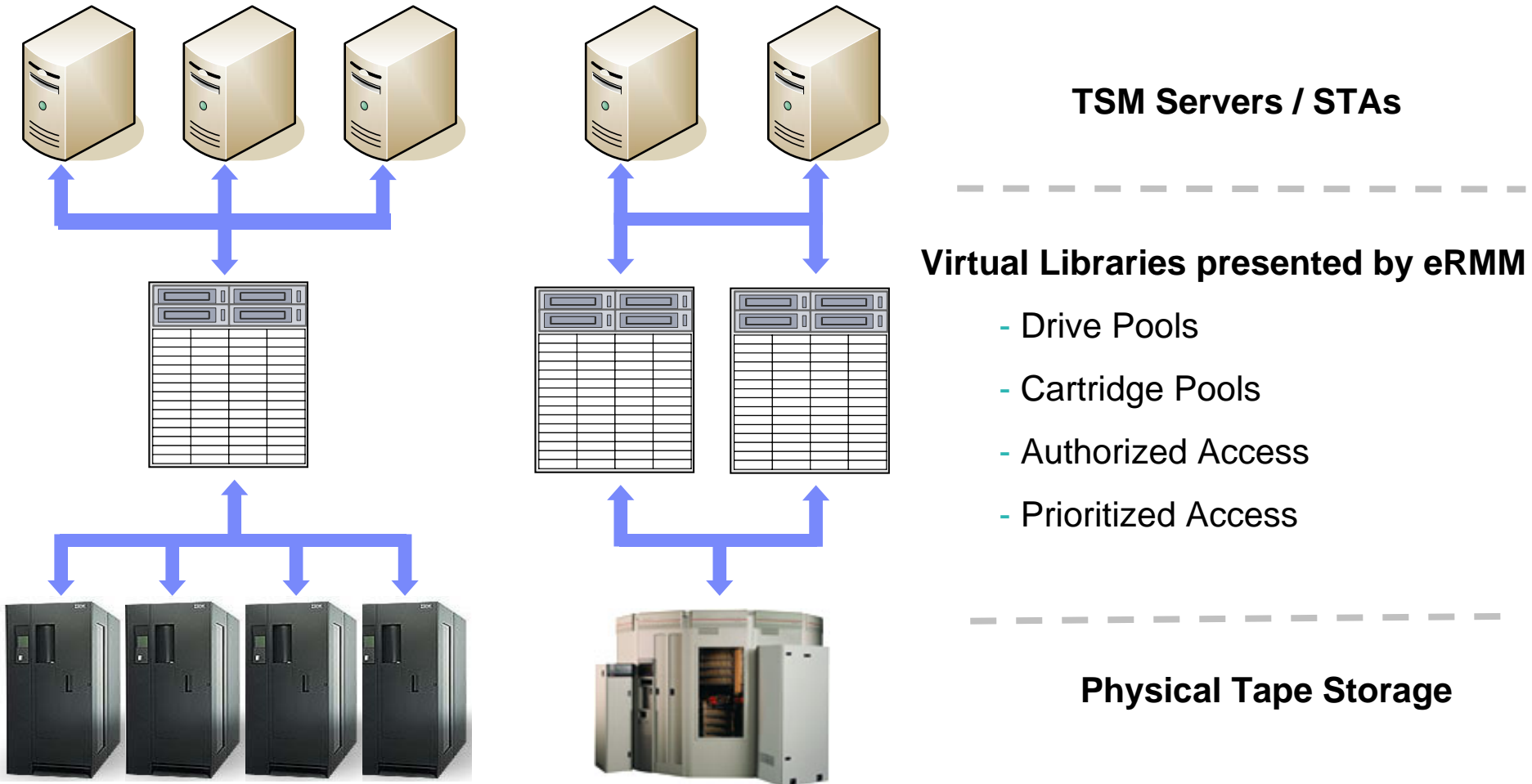
eRMM – Summary

- **Mature technology**
- **Currently a GTS Service Offering**
- **Currently running in production at customers in the transport, insurance, financial and automobile industry (2 reference customers)**
- **Available for Linux on Systems z, Linux on Systems x, AIX, SUN Solaris, HP-UX and Windows**
- **Support of various IBM and StorageTek (SUN/STK) tape libraries**
- **Significant reduces complexity in TSM environments (automated drive path discovery, tape resource sharing and management)**
- **Unique tape library virtualization and media management solution for heterogeneous open systems environments**

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eRMM – Tape Library Virtualization



TSM Servers / STAs

Virtual Libraries presented by eRMM

- Drive Pools
- Cartridge Pools
- Authorized Access
- Prioritized Access

Physical Tape Storage

Infrastructure Simplification for TSM

How to define eRMM managed resources:

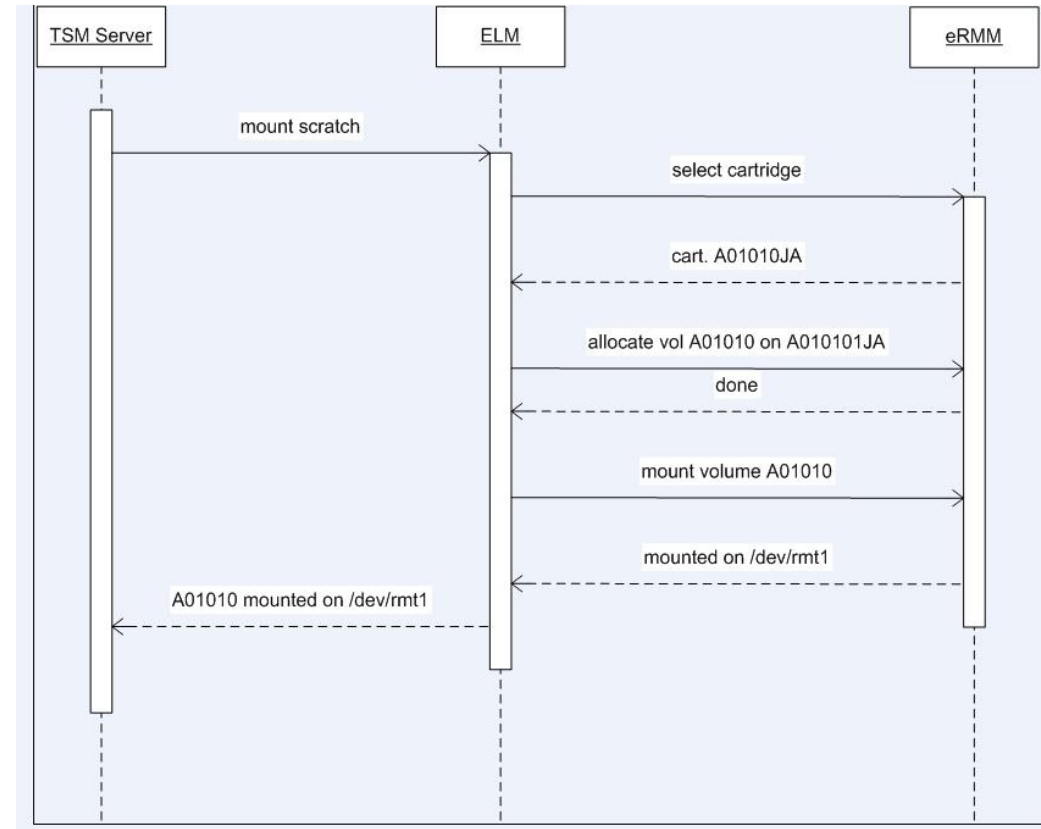
```

1.define library <libname>
  libtype=external

2.define path <servername> <libname>
  srctype=server desttype=library
  externalmanager=/opt/IBM/ermm/client/
  tsm/elm

3.define devclass <devclassname>
  library=<libname> devtype=3592
  mountretention=5 mountlimit=20

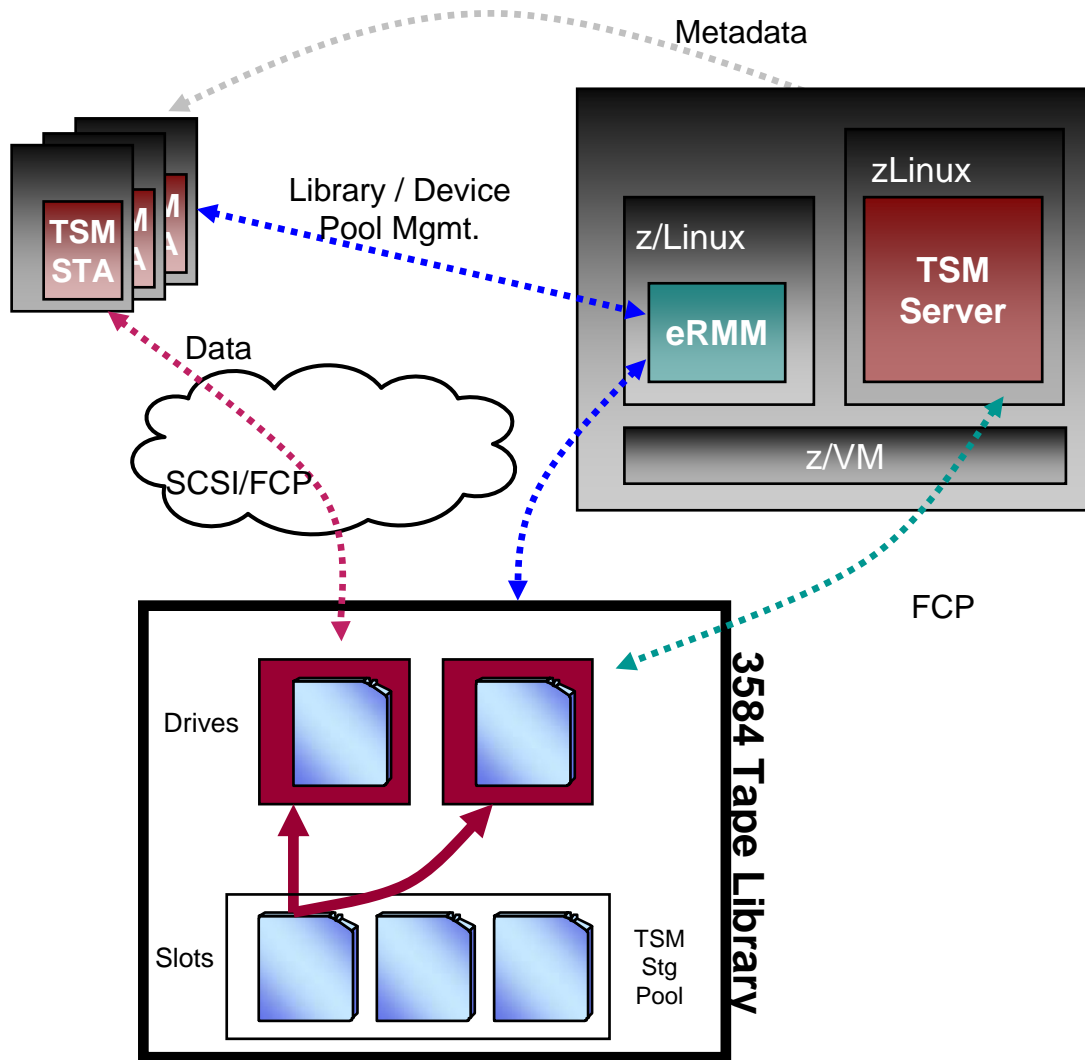
4.define stgpool <stgpoolname>
  <devclassname> maxscratch=500
  
```



- That's all !
- You don't have to define drives and drive paths!
- Changes in the configuration are automatically handled by eRMM (such as new Tape Drives)

eRMM Customer Setup #1:

TSM & eRMM on zLinux for backup consolidation on zLinux



eRMM provides:

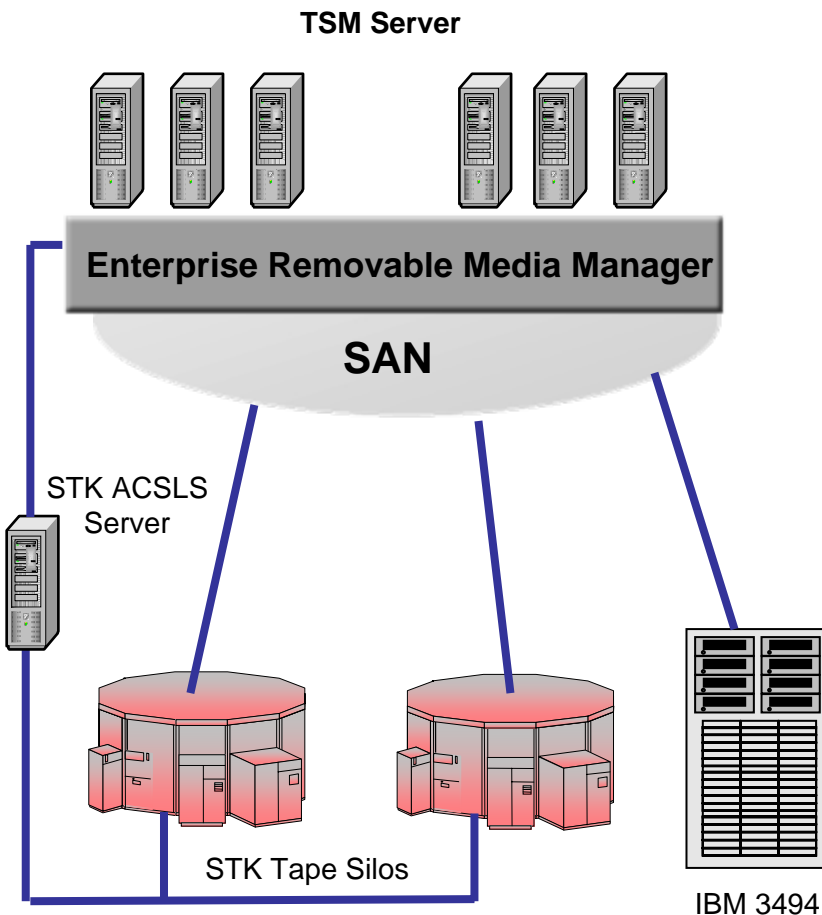
- highly scalable TSM Library Manager
- advanced drive and cartridge management for TSM
- advanced tracking, monitoring and reporting which is not available in TSM-only environment
- features including mount request queuing, scratch pool management, central reporting, monitoring and access control, scratch- pool management

eRMM Customer Setup #2:

Central management of IBM and STK tape infrastructure

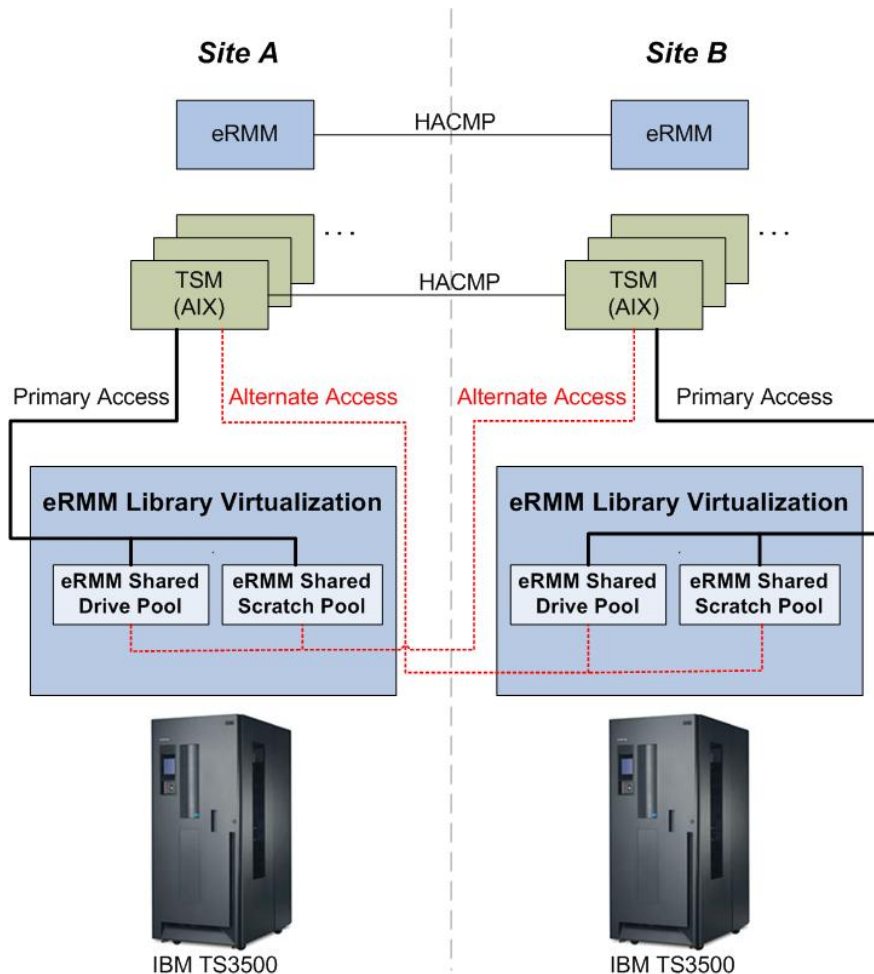
eRMM provides:

- Management and virtualization of IBM and STK tape infrastructure from a single point of control
- Automated management and provisioning of TSM drive handles (+10.000)
- Centralized repository, monitoring and reporting (+18.000 cartridges)
- Provides security mechanisms to prevent / grant application access to cartridge groups and drive groups
- Easy and flexible reconfiguration of pools and access for applications
- Enables to exchange HW technology without changing infrastructure (select BOB HW, no “vendor lock in”)
- eRMM allows for drive overcommitment (mount request queueing) with enhanced queue management (prioritize jobs, cancel jobs, etc.)



eRMM Customer Setup #3:

Setup at GAD, Muenster (eRMM Reference Customer)

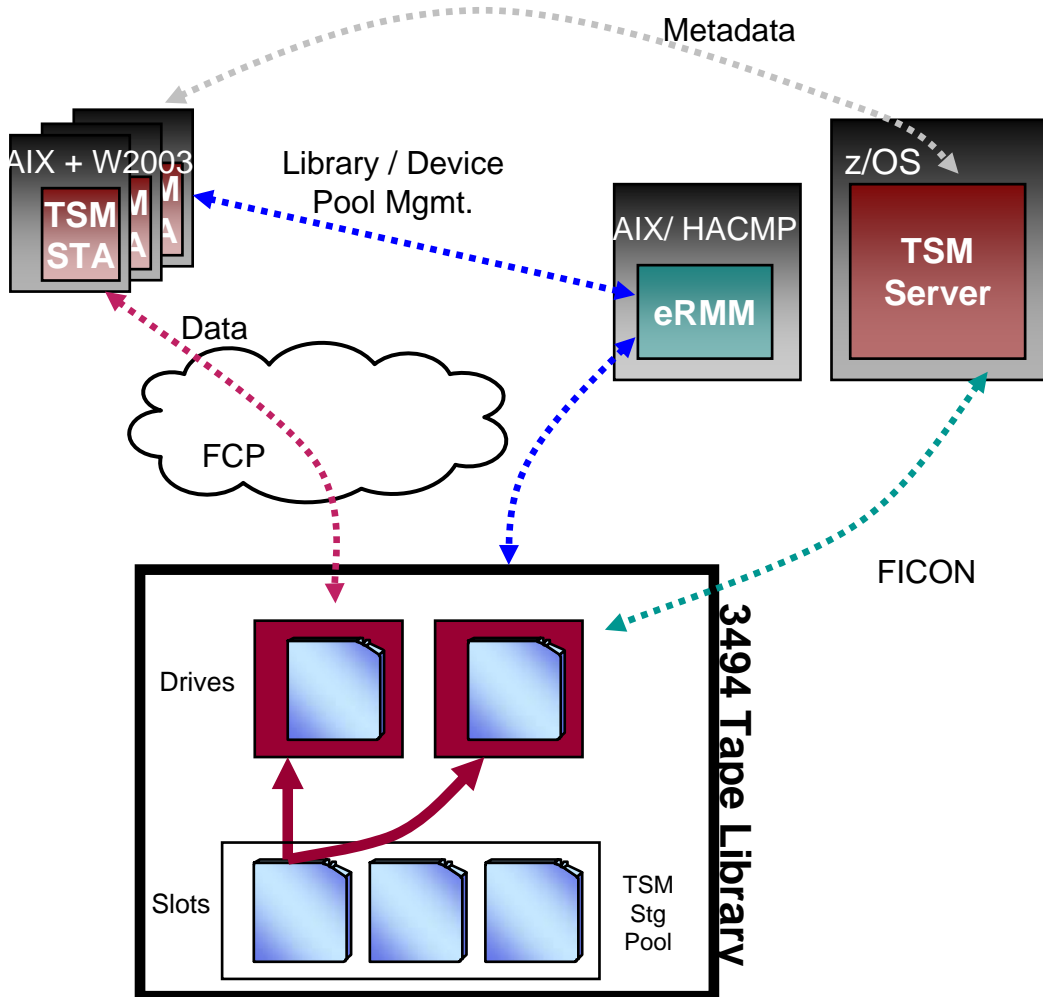


Note: Simplified setup for illustration of concept

Highlights:

- *Project*
 - Pilot in 08/2006
 - In production since 11/2006
 - Reference customer since 01/2007
- *Customer Requirements*
 - Undisrupted Backup Services even in cases of library failures/loss
 - Simplified management of growing TSM environment (reduce complexity).
 - Traceability for cartridge movement
 - Dynamically manage drive capacity vs demand
- *Achieved Benefits:*
 - flexible and dynamic sharing and pooling of tape resources
 - access control and prioritized access to resource pools
 - automatically configures new libraries, drives and cartridges into the running system
 - complete history information and audit trail available

eRMM Customer Setup #4: Setup at HUK Coburg (eRMM Reference Customer)



eRMM at HUK:

- Successful pilot in 1/2005
- In production since 11/2005
- eRMM reference customer since 12/2005
- Customer wanted DFSMSrmm like tape management for open systems
- eRMM works on behalf of TSM on z/OS to provide resources for open system LAN-free clients (TSM client on z/OS only for USS)
- Dramatically increases admin productivity:
 - TSM setup becomes much easier (no drive assignment needed)
 - eRMM provisions scratch cartridges and drives “on demand”
 - Complete history information (hard/soft errors, tape alert, MB read/written, compression ratio) available, even if TSM releases the volume
 - Customer generates reports for tape and drive usage in SAS for proactive management

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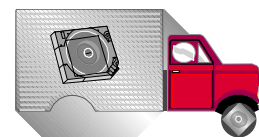
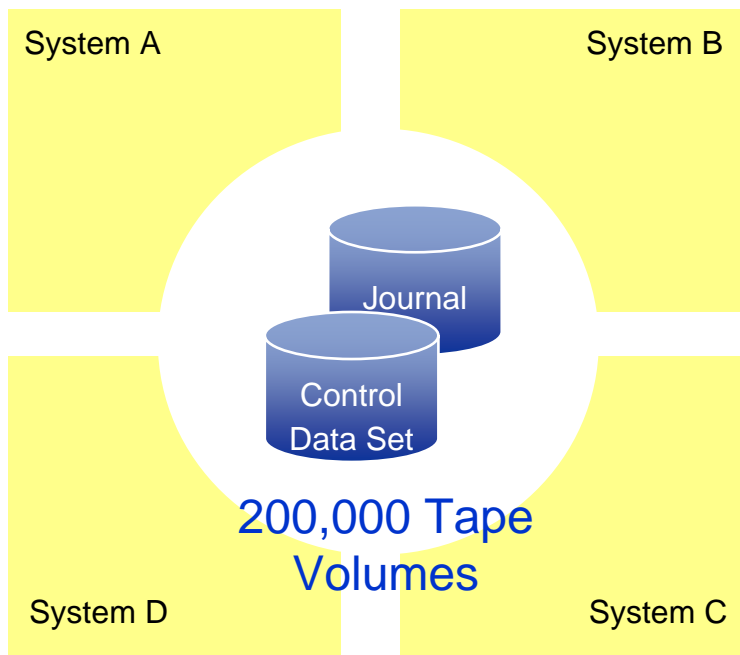
Integration eRMM & RMM – Benefits

- **Media Management objectives are usually alligned to high level business goals** (independant of underlying technology or platforms)
- **An integrated media management solution permits:**
 - A consolidated view on ALL tape resources in the enterprise across open systems and the mainframe
 - Centralized retention, movement and vaulting capabilities. The same policies can be used for ALL tape cartridges whether they contain open systems or mainframe data
 - Centralized reporting. The same reporting tools and methods can be used for ALL tape resources in the enterprise
- **Without an integrated solution different people, skill and tools are needed for all these tasks which increases complexity and cost**

DFSMsrmr Customer Scenario

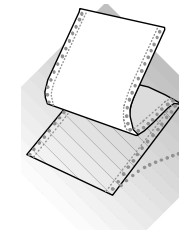


RMMPLEX



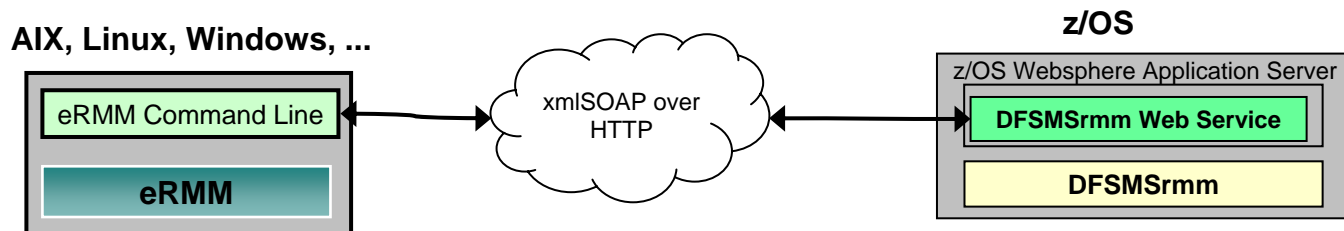
Storage Location

- **Daily Inventory Management runs**
 - expiration and vital records processing
 - storage location management
 - backup processing and reporting
- **Vital record policies for retention and movement**
- **Inventory, Movement, Scratch reports**



Integration eRMM & RMM – Strategy

- **DFSMSrmm exposes all functionality via the Web Services interface**
- **eRMM uses the DFSMSrmm Web Services interface to synchronize the eRMM / RMM repositories** (xmlSOAP over HTTP)
 - This permits a common view off ALL tape resources in the enterprise



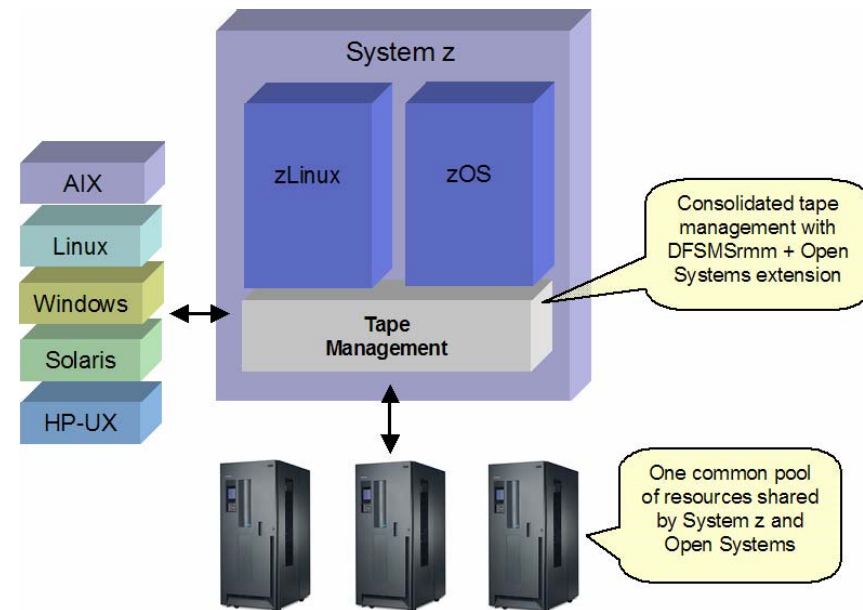
```
ermntool> lsrmvol -s 9.11.214.154
Volume  Type  Owner  State  HLOC  Voltype
-----
A00001  ETC    RMM    USER  SHELF  PHYSICAL
A00003  ETC    RMM    USER  SHELF  PHYSICAL
483AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
485AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
486AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
488AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
490AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
491AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
495AFQ  ETC    ERMM   USER  SHELF  PHYSICAL
```

```
DFSMSrmm Volumes (Page 1 of 2) Row 1 to 9 of 9
Command ==> Scroll ==> PAGE
Enter HELP or PF1 for the list of available line commands
Use the RIGHT command to view other data columns
Volume      Assigned  Expiration  S  Dest-  Tr-  Data
S serial Owner   date       date       R Status Location ination ans sets
-----
--- A00001  RMM      2006/116   2006/121   USER  SHELF  N  0
--- A00003  RMM      2006/116   2006/121   USER  SHELF  N  0
--- 483AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 485AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 486AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 488AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 490AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 491AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
--- 495AFQ  ERMM     2006/116   2006/121   USER  SHELF  N  0
***** Bottom of data *****
```

Source: Screenshots from a working prototype

Integration eRMM & RMM – Future Outlook

- Enables existing DFSMSrmm customers to extend their existing tape management procedures and policies to manage open systems
- Allows z/OS as well as open systems tape to be managed from a single point of control
- Extend DFSMSrmm functionality to open systems (vaulting, retention, retirement, ...)
- Due to the synchronization of both repositories a shared scratch pool and shared tape resource utilization between z/OS and open systems can be realized



Note: These are statements of direction and no product commitments (subject to change)

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- 👉 **Summary**

Summary and key points to remember

- **Tape is and continues to be an important technology in the enterprise and is strategic for customers and IBM**
- **Removable Media Management is a very important, if not the most important, challenge of enterprise tape environments**
- **eRMM is the premier IBM Solution for tape library virtualization and media management for open system**
- **eRMM simplifies the tape management for large TSM installations**
- **DFSMSrmm is the premier IBM product for media management on the mainframe**
- **The integration of eRMM and DFSMSrmm permits an consolidated solution for media management across open systems and the mainframe**

Contacts & Further Reading

- **eRMM Business Development:**

Contact: Detlef Krause (eRMM Business Development)

Mail: dkrause@de.ibm.com

Mobile: +49 171 3 33 87 41

- **Overview of eRMM in Systems Solution Redbook**

Chapter 13.3 'Enterprise Removable Media Manager' in
Charlotte Brooks, et.al.: "IBM Systems Storage Solutions
Handbook,,

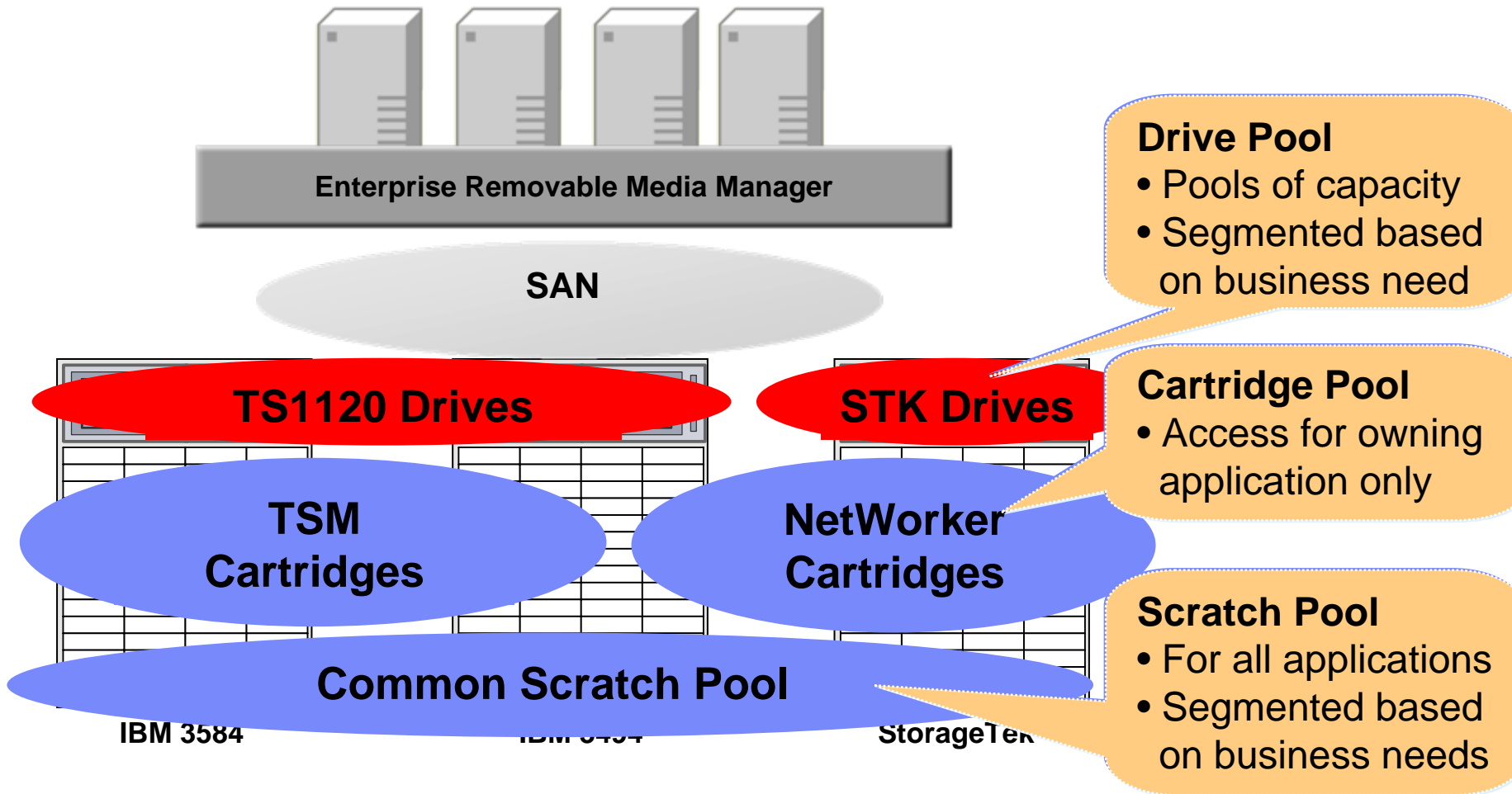
<http://www.redbooks.ibm.com/abstracts/sg245250.html?Open>

Questions and Answers ...

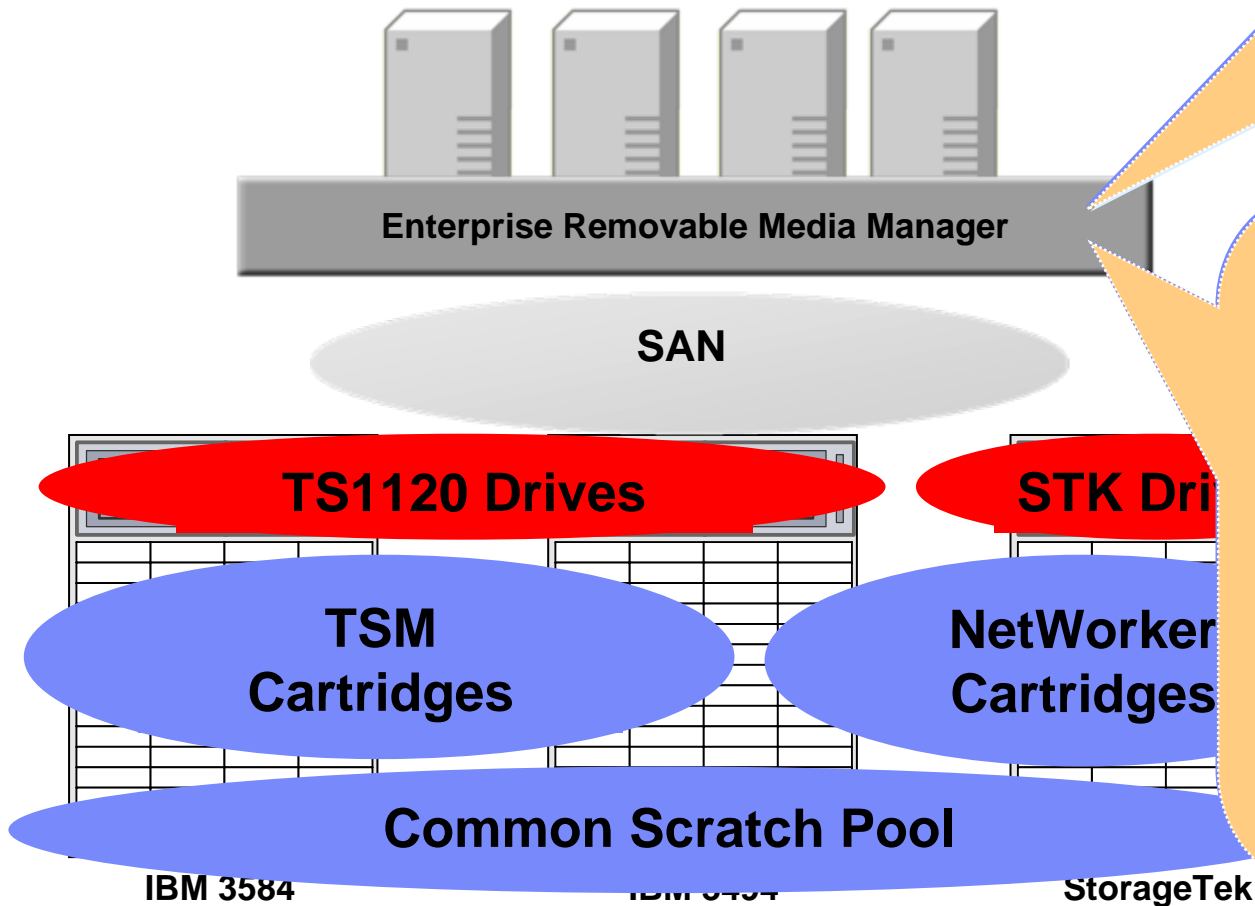
Thank you !

Backup Slides ...

Enterprise Removable Media Manager



Enterprise Removable Media Manager



Policies

- Drive and cartridge allocation based on priorities
- Cartridge movement
- Cartridge life-cycle management

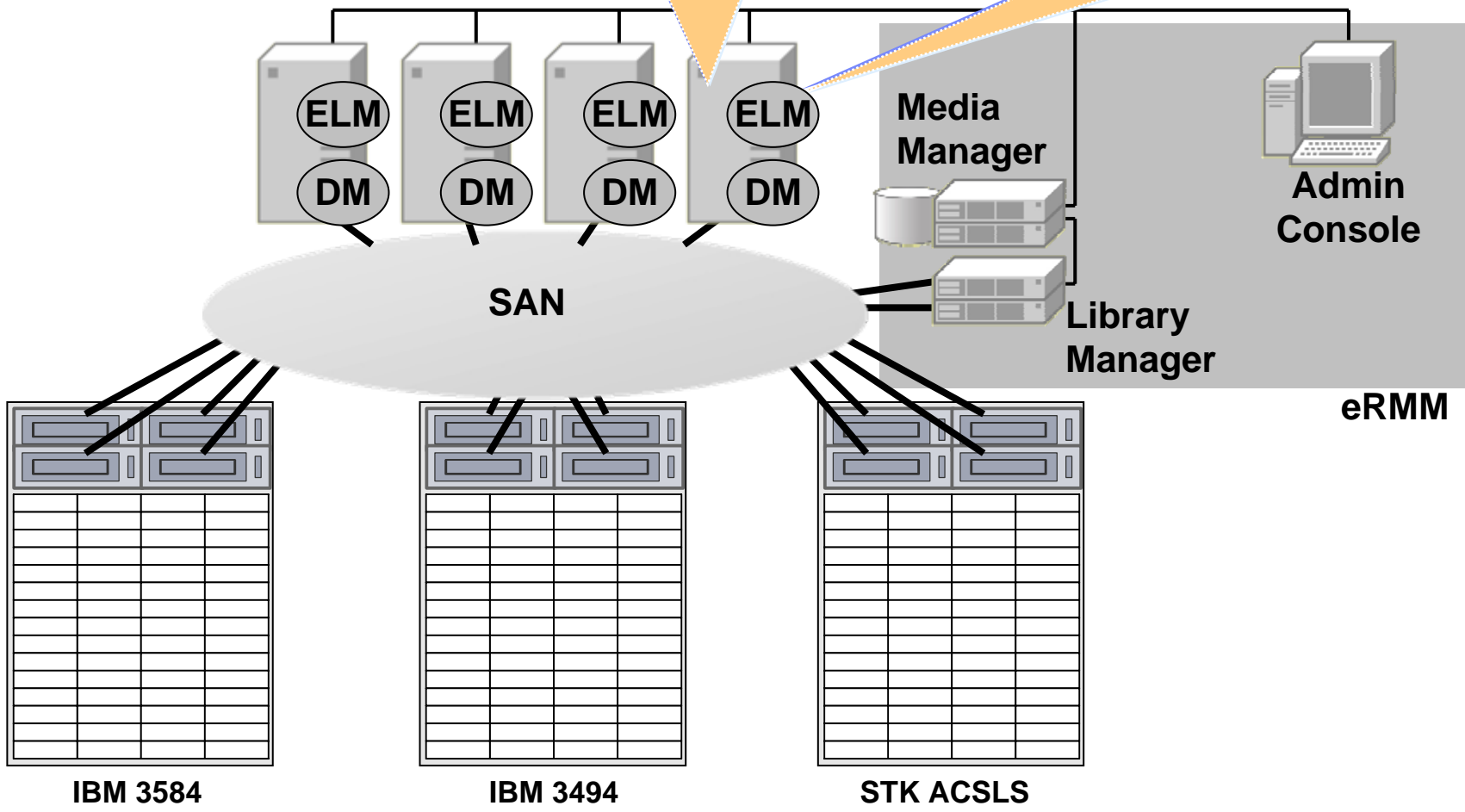
New Efficiencies

- Cross application drive sharing
- Cross application scratch pool
- Mount request queuing
- Centralized reporting
- Audit trails
- Cartridge and drive quality management
- Integrated vaulting

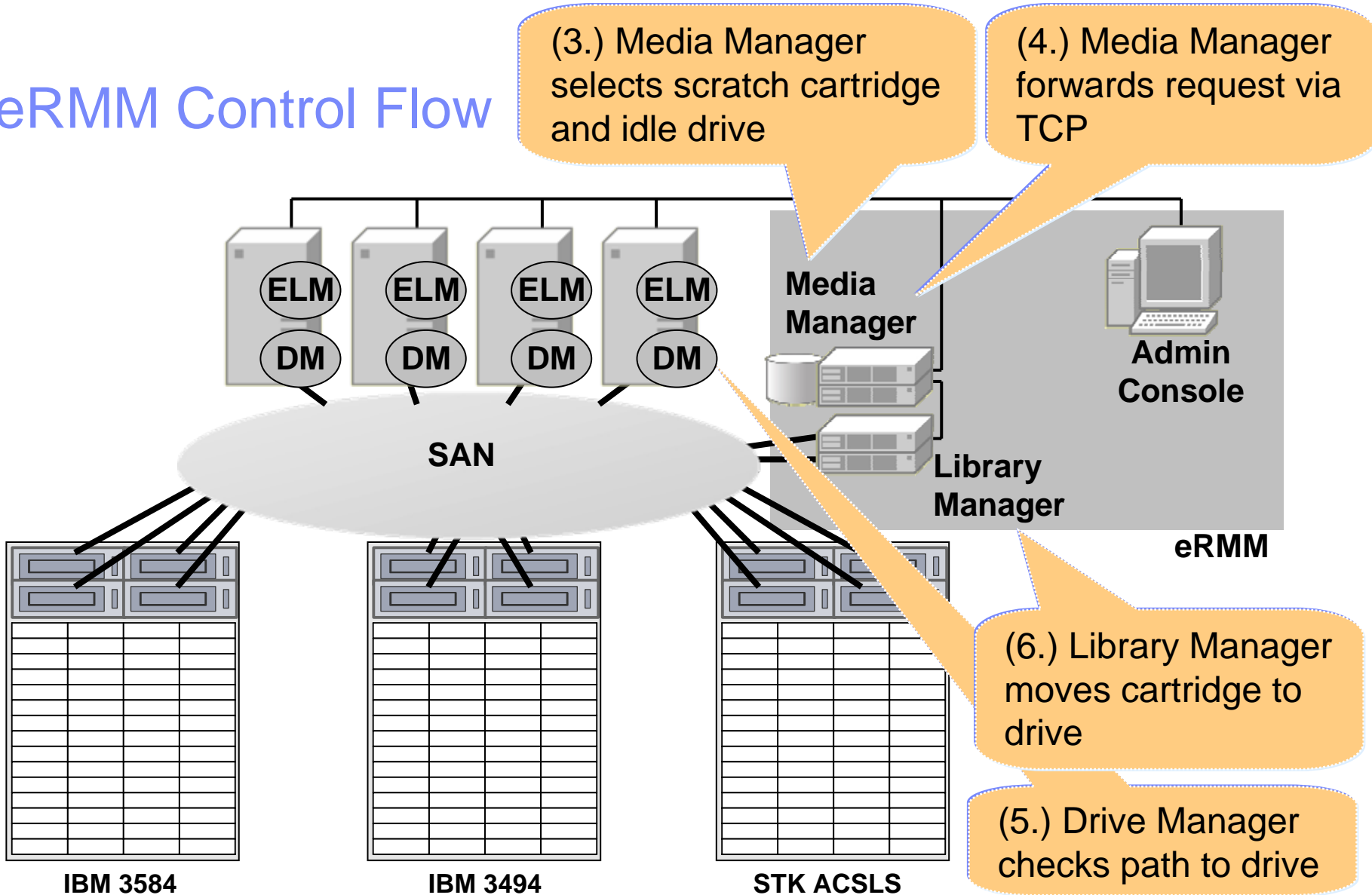
eRMM Control Flow

(1.) TSM Server wants to mount a scratch tape

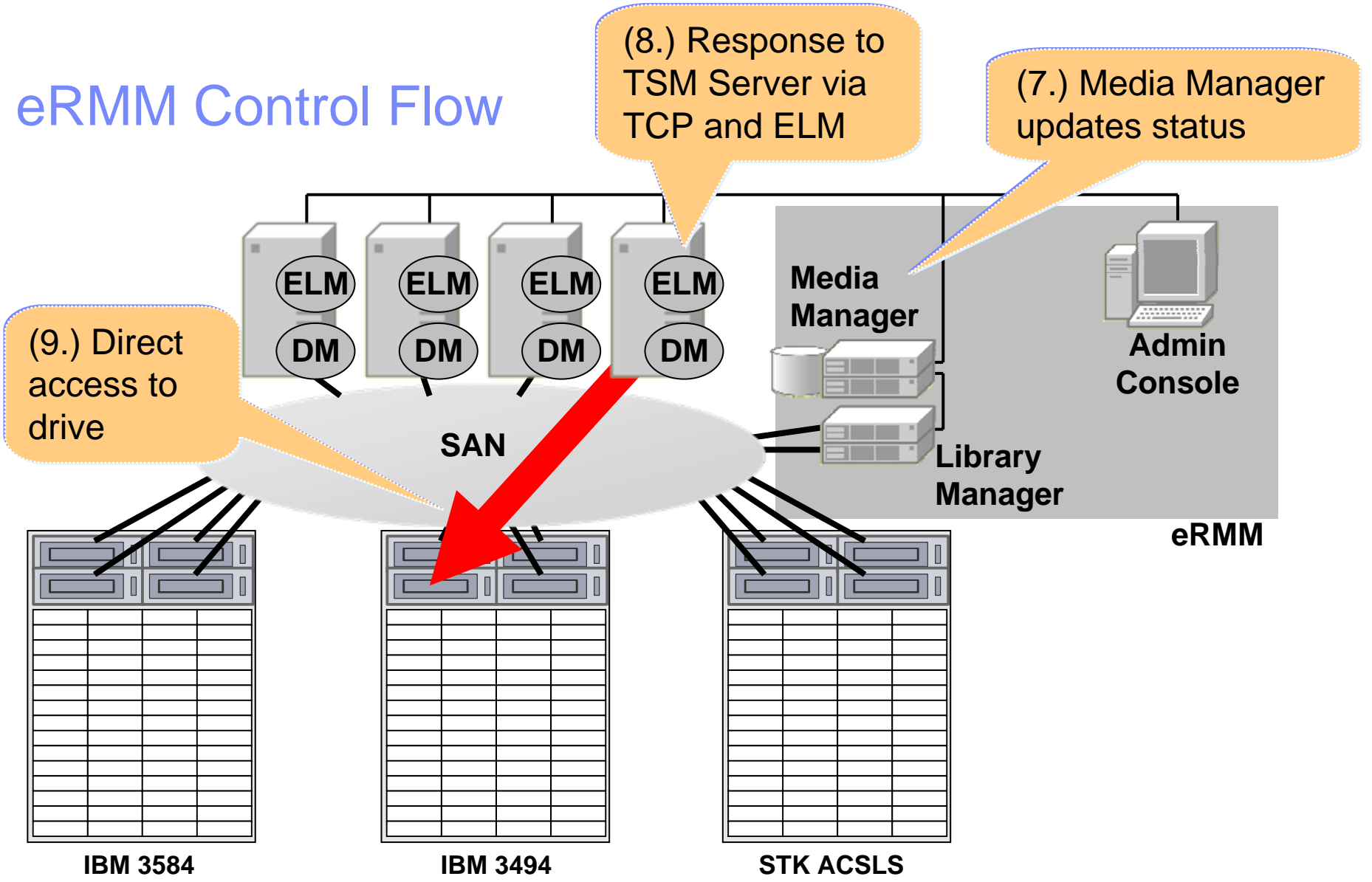
(2.) TSM ELM sends request to Media Manager via TCP



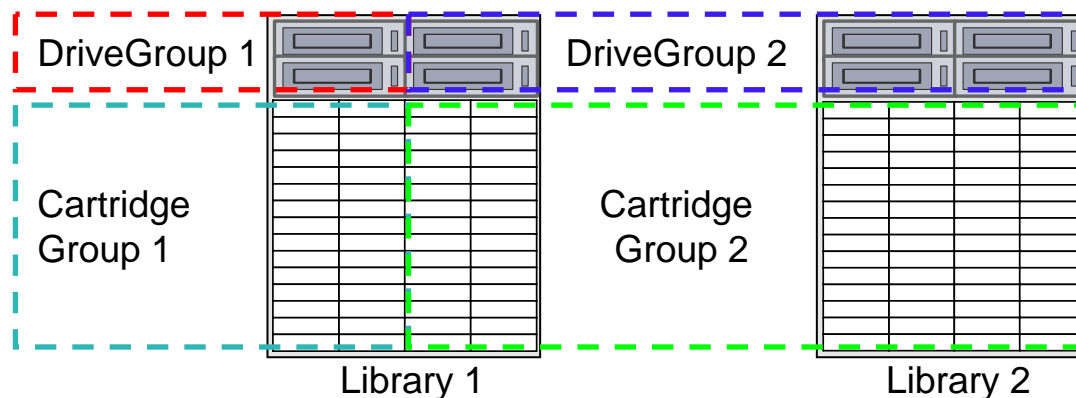
eRMM Control Flow



eRMM Control Flow



Dynamic grouping and pooling of drives and cartridges



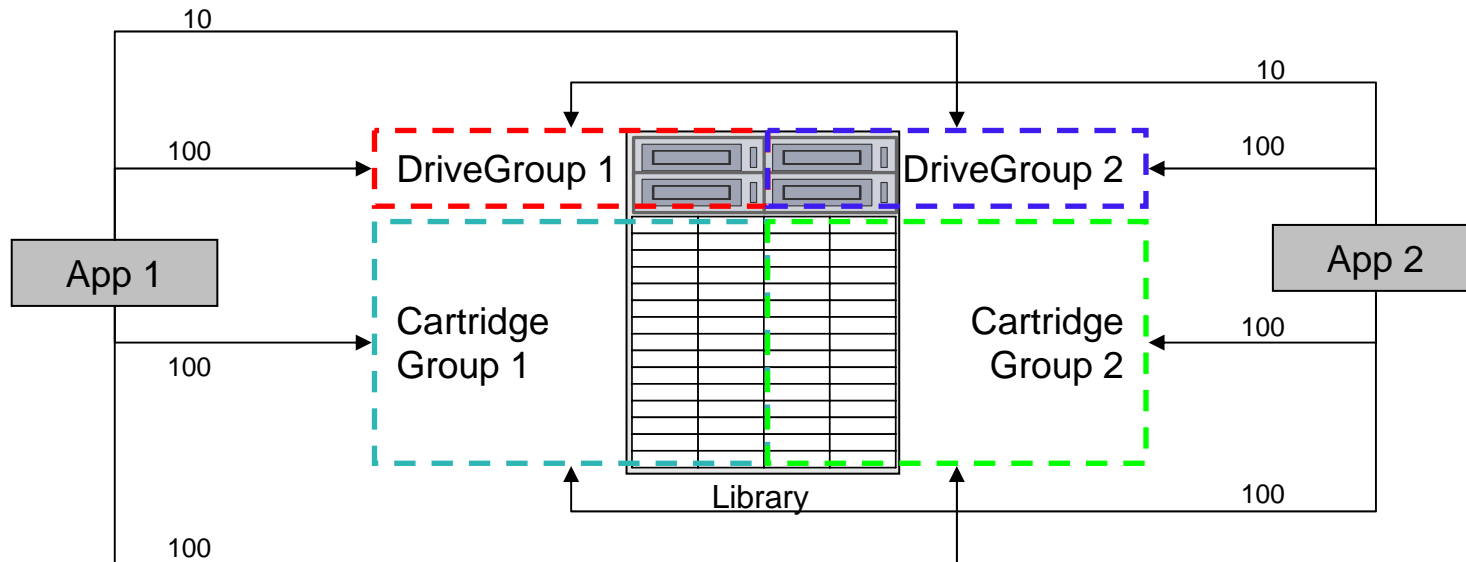
DriveGroups:

- Used to aggregate drives
- Drives can be added and removed dynamically
- Used to implement access permission model and preferential usage policy
- May span multiple libraries

CartridgesGroups:

- Used to aggregate cartridges
- Cartridges can be added and removed dynamically
- Used to implement access permission model and preferential usage policy
- May span multiple libraries

Access Roles and Preferential Usage Policy for DriveGroups and CartridgeGroups



Access Roles:

- Applications are subject to access control
- Two – level access permission model
- Administrative applications may access every drive
- Standard applications may only access drives within DriveGroups which have been assigned to them by an administrative application

Preferential Usage Policy:

- DriveGroup-Application relations have priority attribute
- Drives have priority attribute too
- Priority is used by eRMM to find drive for a mount operation

Audit trail

```

9.155.66.216 - PuTTY
ermmtool> lsdca
Application AI          CartridgePCL Drive      TimeMounted          TimeUnmounted
-----
ERMMSystem  ERMMAAdmin:1  A00017JA      mahl-257  2006-04-10T12:51:23  2006-04-10T12:52:04
ERMMSystem  ERMMAAdmin:1  A00017JA      mahl-257  2006-04-10T12:48:55  2006-04-10T12:50:09
ERMMSystem  ERMMAAdmin:1  A00017JA      mahl-257  2006-04-10T12:44:42  2006-04-10T12:45:38
ERMMSystem  ERMMAAdmin:1  A00017JA      mahl-257  2006-04-10T12:35:38  2006-04-10T12:43:22
dbs2        tsm@dbs2      A00021JA      mahl-257  2006-04-04T09:09:12  2006-04-04T09:19:29
ERMMSystem  ERMMAAdmin:1  A00018JA      mahl-258  2006-04-03T06:55:14  2006-04-03T09:49:30
dbs2        tsm@dbs2      A00019JA      mahl-257  2006-04-03T09:47:12  2006-04-03T09:48:43
ERMMSystem  ERMMAAdmin:1  A00017JA      mahl-257  2006-04-03T06:54:21  2006-04-03T09:46:48
dbs2        tsm@dbs2      A00019JA      mahl-257  2006-03-31T13:09:29  2006-03-31T13:11:22
dbs2        tsm@dbs2      A00018JA      mahl-257  2006-03-31T10:55:33  2006-03-31T11:01:31
dbs2        tsm@dbs2      A00018JA      mahl-257  2006-03-31T10:52:35  2006-03-31T10:55:10
dbs2        tsm@dbs2      A00018JA      mahl-257  2006-03-31T10:38:33  2006-03-31T10:40:14
dbs2        tsm@dbs2      A00018JA      mahl-257  2006-03-31T10:34:31  2006-03-31T10:36:14
dbs2        tsm@dbs2      A00018JA      mahl-257  2006-03-31T10:28:51  2006-03-31T10:30:45
dbs2        tsm@dbs2      A00017JA      mahl-257  2006-03-31T09:07:43  2006-03-31T09:08:31
dbs2-v      tsm@dbs2-v    A00033JA      bies-257  2006-03-31T07:23:34  2006-03-31T07:25:23
dbs2-v      tsm@dbs2-v    A00032JA      bies-257  2006-03-31T06:27:17  2006-03-31T06:28:15
ERMMSystem  ERMMAAdmin:1  A00012JA      bies-257  2006-03-31T06:04:21  2006-03-31T06:05:57
dbs2        tsm@dbs2      A00017JA      mahl-257  2006-03-28T12:19:01  2006-03-28T12:19:47
dbs2        tsm@dbs2      A00017JA      mahl-257  2006-03-28T11:43:49  2006-03-28T11:44:40
ermmtool>

```

Audit trail for a specific cartridge

```
ermmtool> lsdca -cart A00018JA
```

Application	AI	Cartridge	PCL	Drive	TimeMounted	TimeUnmounted
ERMMSystem	ERMMAAdmin:1	A00018JA		mahl-258	2006-04-03T06:55:14	2006-04-03T09:49:30
db2	tsm@db2	A00018JA		mahl-257	2006-03-31T10:55:33	2006-03-31T11:01:31
db2	tsm@db2	A00018JA		mahl-257	2006-03-31T10:52:35	2006-03-31T10:55:10
db2	tsm@db2	A00018JA		mahl-257	2006-03-31T10:38:33	2006-03-31T10:40:14
db2	tsm@db2	A00018JA		mahl-257	2006-03-31T10:34:31	2006-03-31T10:36:14
db2	tsm@db2	A00018JA		mahl-257	2006-03-31T10:28:51	2006-03-31T10:30:45

```
ermmtool>
```


Mount request with tape alert

IBM TotalStorage™
Enterprise Removable Media Manager

Welcome
 Logout
 Libraries
 Drives
 Cartridges
 Volumes
 Tasks

Welcome Logout																																												
<ul style="list-style-type: none"> ▶ Administer Access ▶ Manage Libraries ▶ Manage Drives ▶ Manage Cartridges ▶ Manage Volumes ▶ Manage Policies ▶ Accounting ▼ Error statistics <ul style="list-style-type: none"> Status Page System Read/Write Errors System Read/Write Errors (Week) System Read/Write Errors (Month) System Read/Write Errors (Year) Read / Write Errors by Drive Read/Write Errors by Drive (Week) Read/Write Errors by Drive (Month) Read/Write Errors by Drive (Year) Read / Write Errors by Cartridge Read/Write Errors by Cartridge (Week) Read/Write Errors by Cartridge 	<table border="1"> <tr><td>BYTESREADFROMTAPE</td><td>0</td></tr> <tr><td>MBPROCESSEDSINCELASTCLEANING</td><td>111079177</td></tr> <tr><td>LIFETIMELOADCYCLES</td><td>2577</td></tr> <tr><td>LIFETIMECLEANINGCYCLES</td><td>20</td></tr> <tr><td>LIFETIMEPOWERONTIME</td><td>0</td></tr> <tr><td>MAINPARTITIONREMAININGCAPACITY</td><td>0</td></tr> <tr><td>MAINPARTITIONMAXIMUMCAPACITY</td><td>0</td></tr> <tr><td>READCOMPRESSION</td><td>0</td></tr> <tr><td>WRITECOMPRESSION</td><td>0</td></tr> <tr><td>HardError</td><td>0</td></tr> <tr><td>Media</td><td>0</td></tr> <tr><td>ReadFailure</td><td>0</td></tr> <tr><td>WriteFailure</td><td>0</td></tr> <tr style="background-color: red;"><td>MediaLife</td><td>1</td></tr> <tr><td>NODATAGRADE</td><td>0</td></tr> <tr><td>WriteProtect</td><td>0</td></tr> <tr><td>NoRemoval</td><td>0</td></tr> <tr><td>CLEANINGMEDIA</td><td>0</td></tr> <tr><td>UNSUPPORTEDFORMAT</td><td>0</td></tr> <tr><td>MEMORYINCARTRIDGEFAILURE</td><td>0</td></tr> <tr><td>FORCEREJECT</td><td>0</td></tr> </table>	BYTESREADFROMTAPE	0	MBPROCESSEDSINCELASTCLEANING	111079177	LIFETIMELOADCYCLES	2577	LIFETIMECLEANINGCYCLES	20	LIFETIMEPOWERONTIME	0	MAINPARTITIONREMAININGCAPACITY	0	MAINPARTITIONMAXIMUMCAPACITY	0	READCOMPRESSION	0	WRITECOMPRESSION	0	HardError	0	Media	0	ReadFailure	0	WriteFailure	0	MediaLife	1	NODATAGRADE	0	WriteProtect	0	NoRemoval	0	CLEANINGMEDIA	0	UNSUPPORTEDFORMAT	0	MEMORYINCARTRIDGEFAILURE	0	FORCEREJECT	0	
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Source: Screenshot from a working prototype

Value add in a TSM environment (1/3)

- **Flexible provisioning of drives and cartridges**
 - Simplified setup of TSM LAN-free environments
 - no need to define tape paths inside TSM
 - all tape paths are automatically generated and managed inside eRMM
 - central check whether drive SN is valid and if drive is used by TSM Server or Storage Agent
 - flexible adding and removing of drives to TSM storage pools
 - all changes are handled inside eRMM
 - updates of the TSM servers or other applications are not required
 - sharing of drives with other applications and OS tools (e.g. mksysb, tar)
 - enabling of cross library scratch pools
 - enabling of cross library drive pools
 - automatic labeling of scratch cartridges (can be enabled in config file)

Value add in a TSM environment (2/3)

■ **Advanced reporting and auditing**

- eRMM provides statistics on how many drives were used when by which application.
- eRMM provides statistics on how many data was written during a mount. This data can be aggregated to provide throughput reports for drives, drives groups, applications and libraries.
- eRMM provides statistics on how often a cartridge was mounted and how many data was written/read for the whole cartridge life cycle. TSM loses this information, when a cartridge is returned to the TSM scratch pool.
- The TSM server stores tape alerts in the TSM activity log. In addition to that, eRMM stores all log sense pages in the eRMM database. This additional data can be very useful for error analysis.

Value add in a TSM environment (3/3)

- **Enhanced access control to library resources**
 - In an outsourcing environment eRMM can share the drives across several TSM servers whilst it strictly separates the cartridges of each TSM server.
 - eRMM can also provide a separate scratch pool for each TSM server thus cartridges are not exchanged between the TSM servers.

- **Additional operational benefits**
 - dismount of cartridge when TSM server goes down
 - physical erase of cartridges before return to scratch pool (future)
 - improved cartridge life-cycle management (e.g. threshold for wornout tapes) (future)

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