Tivoli Storage, IBM Software Group

Potential Future Enhancements in Tivoli Storage Manager

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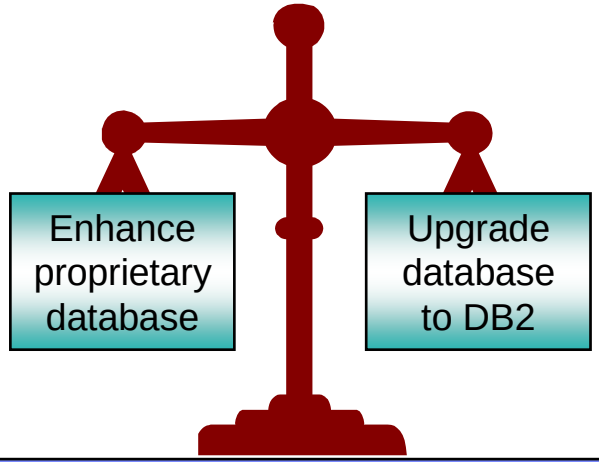
Disclaimer

- This presentation describes potential future enhancements to the IBM Tivoli Storage Manager family of products
- All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only
- 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 product plans, features, and delivery schedules according to business needs and requirements
- This presentation uses the following designations regarding availability of potential product enhancements
  - Next Release Candidate: Candidate for delivery in the next release after v5.5
  - Future Candidate: Candidate for delivery in future release

Topics

- Database enhancement
- Management of stored data
- Administration
- Security/compliance

Database Evaluation and Decision Criteria



- Assessment of customer value
- Performance evaluation and optimization using prototype TSM servers with DB2
- Interviews and other customer input
- Experience from integration of other IBM products with DB2
- Extensive collaboration with DB2 teams and IBM Research

Primary Evaluation Criteria Based on Customer Value

Server Availability	Scalability	Performance	Ease of Administration

Other Considerations

Total Cost of Ownership	Reporting & Monitoring	Impact of Upgrade	Development Cost

Evaluation Result: Decision to upgrade proprietary database to DB2

Upgrade of TSM Database to DB2

- TSM server will require use of DB2 as database
- Continue ongoing maintenance of prior releases with proprietary database
- Consider extending support time for previous release to allow time for customers to upgrade to release with DB2
- Ongoing, active consultation with TSM customers

Increased availability and scalability of TSM server

Next Release Candidate

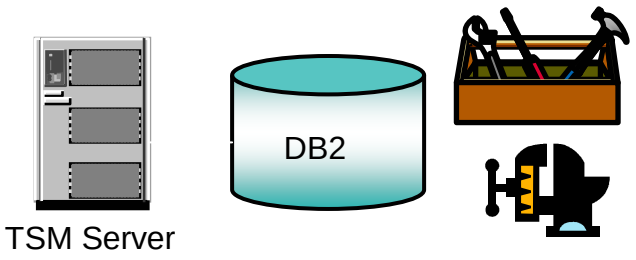
DB2 TSM Server Availability

Goals

- Online, automated reorganization of database while server operations continue
- Eliminate or greatly reduce need for offline database repair through exploitation of online integrity checks and repair

Plans

- Exploit existing online reorganization capability in DB2 (will consume available CPU cycles)
- Exploit DB2 capabilities for real-time integrity validation
  - Foreign-key relationships for referential integrity
  - Constraints and triggers
  - Type checking
- Implement alternate indices to avoid out-of-synch conditions between base tables
- If integrity errors are detected, automatically take corrective action without offline database audit
- Customers can optionally use DB2 HADR (High Availability and Disaster Recovery) to reduce impact of planned and unplanned outages



Online database repair or reorganization (compaction)

Backup of TSM DB2 Database

- Database and recovery log will be backed up directly to sequential media (equivalent to TSM database backup today)
- Backup types equivalent to those with proprietary database, plus additional differential type
  - Full
  - Incremental (non-cumulative changes since last full backup)
  - Differential (cumulative changes since last full backup)
  - Snapshot

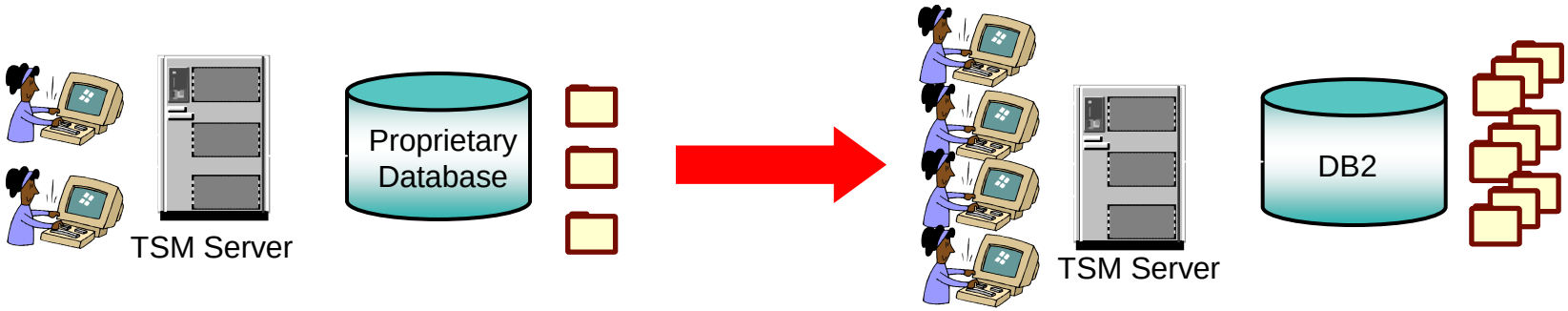
DB2 Scalability

Goals

- Improve ability to support concurrent operations
- Increase maximum number of objects that can be managed by a TSM server
- Satisfy current TSM requirements for concurrency and management of large amounts of data, while positioning TSM to meet future requirements
- Reduce required number of TSM servers (total cost of ownership)

Plans

- Exploit DB2 archive recovery logging
  - Supports roll-forward recovery
  - 256 GB maximum log size allows greater concurrency (13 GB maximum for proprietary database)
- Maximum size for DB2 much higher than for proprietary database (practical size limitations to be determined)



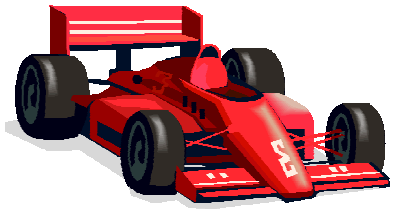
DB2 Performance and Resource Utilization

Goals

- In first release with DB2, performance should be at least comparable to that with the proprietary database for mainline TSM operations (backup, recovery, expiration)
- Utilization of resources (memory, CPU) should not increase significantly

Plans

- Iteratively profile, analyze and optimize TSM performance using DB2
- Extensively restructure TSM table schema and application code to optimize for DB2



Incremental backup to TSM servers on open-system platforms now has better performance with DB2 than proprietary database

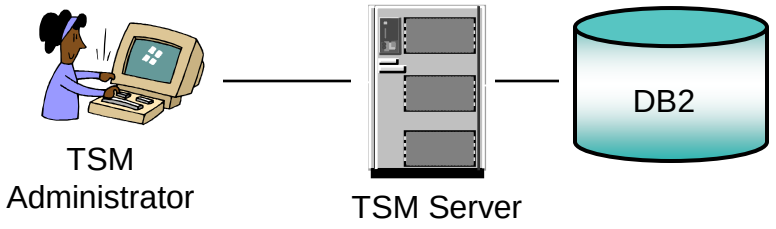
DB2 Administration (UNIX, Linux, Windows)

Goals

- Customers should not need to hire a DB2 DBA to administer TSM (total cost of ownership)
- DB2 should be hidden so TSM administrator does not need to manage DB2 directly
- Database backup/recovery and other maintenance operations should be as easy as with proprietary database

Plans

- Package, install, and service DB2 embedded with TSM
- Drive DB2 management operations, including backup/recovery, from TSM administrative interface
- Commands for database operations will change, but should not be more complex
- Exploit evolution of DB2 toward autonomic self-administration



DB2 embedded and managed via TSM administrative interface

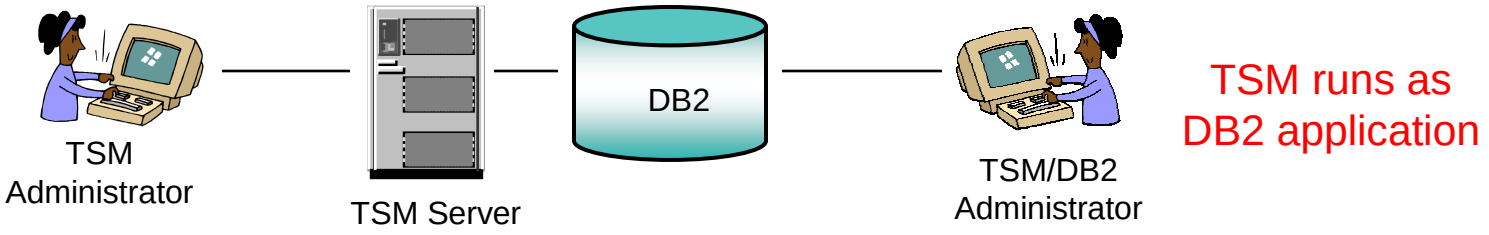
DB2 Administration (z/OS)

Goals

- Customers who do not already have a DB2 DBA should not need to hire one to administer TSM (total cost of ownership)
- DB2 administration should fit a model that is familiar to most z/OS customers

Plans

- Design TSM z/OS server to run as a DB2 application, rather than encapsulating with the TSM z/OS server
  - Familiar model to most z/OS customers
  - Many z/OS customers already have a DB2 DBA who would manage DB2 separately from TSM
- Drive DB2 management operations, including backup/recovery, from TSM administrative interface
- Commands for database operations will change, but should not be more complex
- Exploit evolution of DB2 toward autonomic self-administration



Server Externals Changes (UNIX, Linux, Windows)

Eliminated commands

- DBBACKUPTRIGGER commands
- DBVOL commands
- DSMSERV DUMPDB/UNLOADDB
- ESTIMATE DBREORGSTATS
- EXTEND/REDUCE DB
- QUERY DBVOL
- DEFINE/DELETE LOGVOL
- DSMSERV DISPLAY LOGVOLUMES
- DSMSERV EXTEND LOG
- EXTEND LOG
- QUERY LOGVOL
- REDUCE LOG
- SET LOGMODE
- RESET BUFPOOL
- RESET DBMAXUTILIZATION
- RESET LOGCONSUMPTION
- RESET LOGMAXUTILIZATION
- CONVERT ARCHIVE
- UNDO ARCHCONVERSION
- UPDATE ARCHIVE

Analyst privilege class eliminated

New commands

- DSMSERV DISPLAY DBSPACE
- EXTEND DBSPACE
- QUERY DBSPACE
- DSMSERV DISPLAY LOG

Changed commands

- BACKUP DB
- DSMSERV RESTORE DB
- DEFINE/DELETE DBCOPY
- DSMSERV AUDITDB
- QUERY DB
- DEFINE/DELETE LOGCOPY
- QUERY LOG
- VOLHISTORY commands
- SPACETRIGGER commands
- DSMFMT
- DSMSERV FORMAT
- QUERY OPTION
- SETOPT
- QUERY STATUS
- GRANT/REVOKE AUTHORITY
- QUERY ADMIN

Eliminated options

- BUFPOOLSIZE
- DBPAGE SHADOW
- DB PAGESHADOWFILE
- LOGPOOLSIZE
- LOGFULLWARNPERCENT
- MIRRORREAD
- MIRRORWRITE
- SELFTUNEBUFPOOLSIZE

New options

- ACTIVELOGSIZE
- ACTIVELOGDIRECTORY
- MIRRORLOGDIRECTORY
- FAILARCHLOGDIRECTORY
- OVERFLOWLOGDIRECTORY
- DBMEMPERCENT

Changes due to

- Self-administration by DB2
- Different functionality of DB2

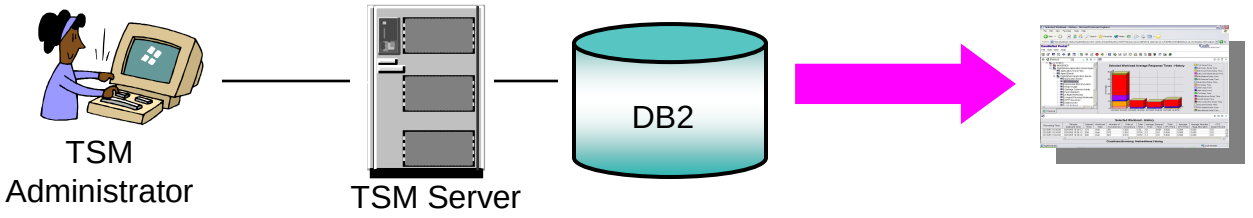
DB2 Reporting and Monitoring

Goals

- Preserve externalized TSM SQL schema so customer-developed queries and automation continue to work
- Complete SQL function
- Improved performance for standard, built-in TSM query functions
- Compatibility with reporting tools based on ODBC or JDBC

Plans

- Provide DB2 views for virtual tables currently available in TSM
- Exploit existing DB2 capabilities for SQL, ODBC, JDBC
- Encourage ISVs who offer TSM reporting/monitoring tools to integrate with TSM using DB2



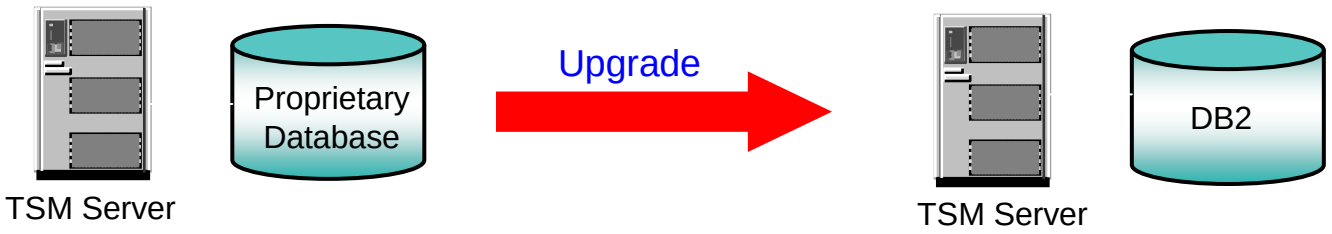
Upgrade of Proprietary Database to DB2

Goals

- Accurate upgrade
- Minimal administrator intervention
- Minimal TSM downtime

Plans

- Develop automated, offline upgrade utility to extract records from TSM proprietary database and load into DB2
- Perform extensive testing using error injection and as many customer databases as possible
- Offer programs for early customer evaluation (technology preview, alpha, beta)



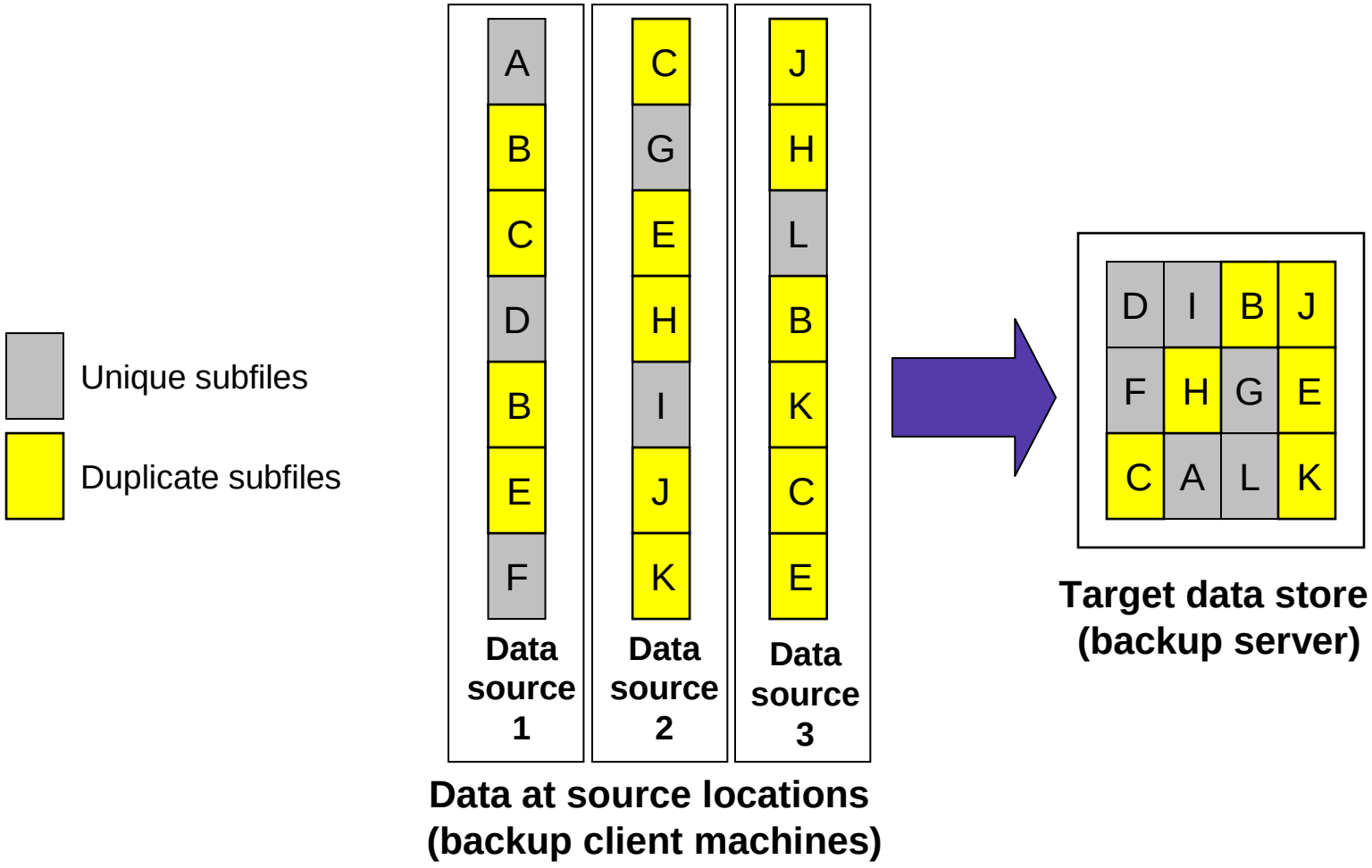
Database Upgrade Utility

- TSM server will be offline during the upgrade
- Utility will extract records from v5.5 proprietary database and load into DB2 database
- Source and target databases must be on the same platform, but not necessarily the same system
- Data transfer can be either via network or using intermediate media
- Where TSM table schema have changed for DB2, data will be loaded using the new schema
- Utility will exploit pipelining and/or parallel processing to reduce upgrade time

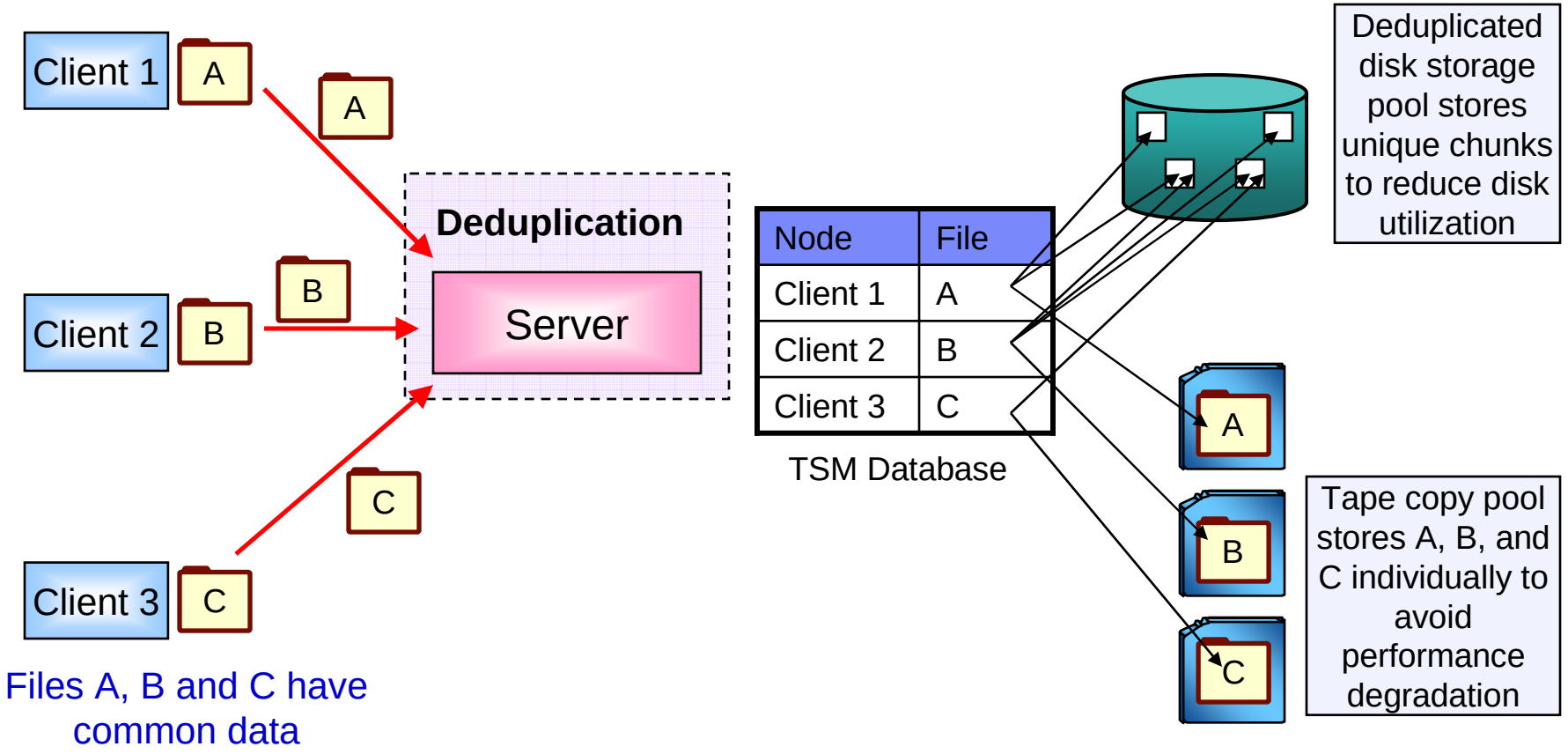
Topics

- Database enhancement
- Management of stored data
- Administration
- Security/compliance

Deduplication Concept



TSM Deduplication Overview



Allows more objects to be stored on disk for fast access

Next Release Candidate

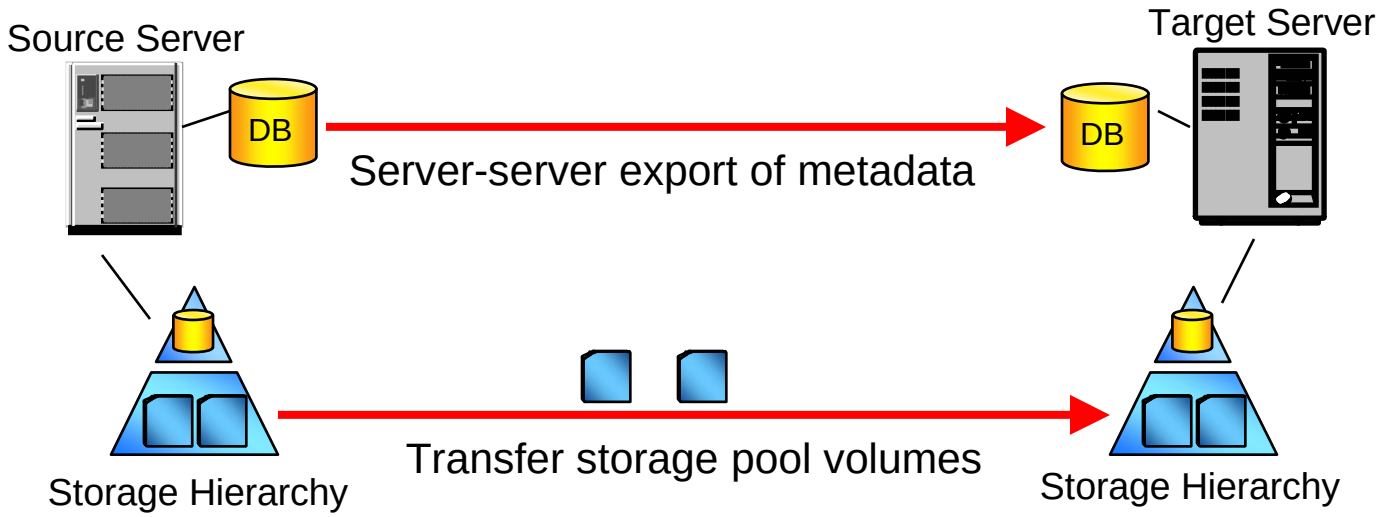
Expected Deduplication Behavior

- Disk storage requirement reduced via optional data deduplication for FILE storage pools
- Deduplication processing performed on TSM server and tracked in database
- Reduced redundancy for
  - Identical objects from same or different client nodes (even if names are different)
  - Common data chunks (subfiles, extents) in objects from same or different nodes
- Post-ingestion (out-of-band) detection of duplicate data on TSM server to minimize impact to backup windows
- Space occupied by duplicate data will be removed during reclamation processing
- Allowed for all data types: backup, archive, HSM, TDP, API applications
- Transparent client access to deduplicated objects

Expected Deduplication Behavior

- Deployment of new clients or API applications not required
- Legacy data stored in or moved to enabled FILE storage pools can be deduplicated
- Data migrated or copied to tape will be reduplicated to avoid excessive mounting and positioning during subsequent access
- Ability to control number, duration and scheduling of CPU-intensive background processes for identification of duplicate data
- Reporting of space savings in deduplicated storage pools
- Deduplication will not be effective for client-encrypted data, but should work with storage-device encryption
- Native TSM implementation, with no dependency on specific hardware

Server-Server Storage Pool Volume Transfer



- Metadata transferred between servers using export/import
- Removable storage pool volumes physically moved to the target server
- Especially attractive when used with shared libraries
- Could be used for
  - Splitting/balancing servers
  - Consolidating servers, especially after upgrade to DB2

Reduced time and bandwidth consumption for export/import of object data

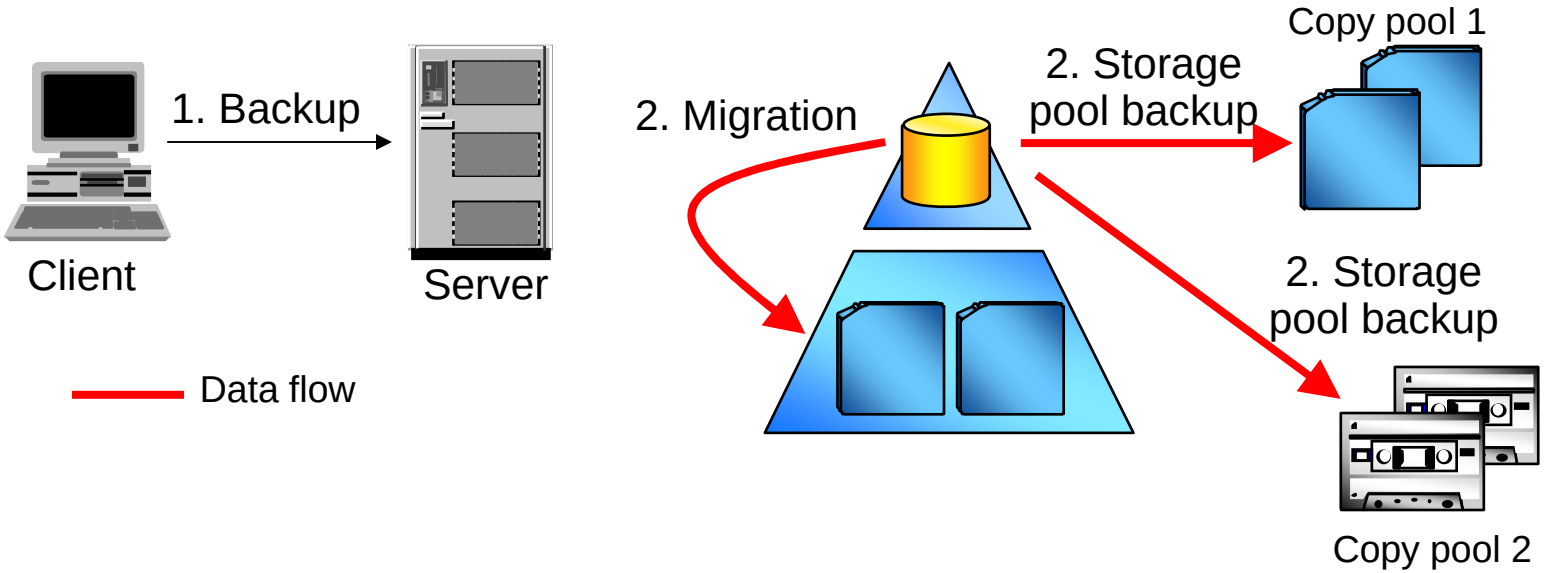
Future Candidate

Expiration Enhancements

- Expiration can be initiated for specified
  - Nodes
  - Node group
  - Policy domain
  - Data types (backup, archive)
- Increased parallelism in expiration processing
- Administrator can control resources used for expiration processing
- Statistics reported as expiration processing completes for each node

Next Release Candidate

Simultaneous Migration and Storage Pool Backup



- Can reduce client backup window as compared to simultaneous write to primary and copy storage pools during backup operation
- Combines windows for migration and storage pool backup
- Periodic storage pool backup required to ensure all data copied

Reduced total time for migration plus storage pool backup

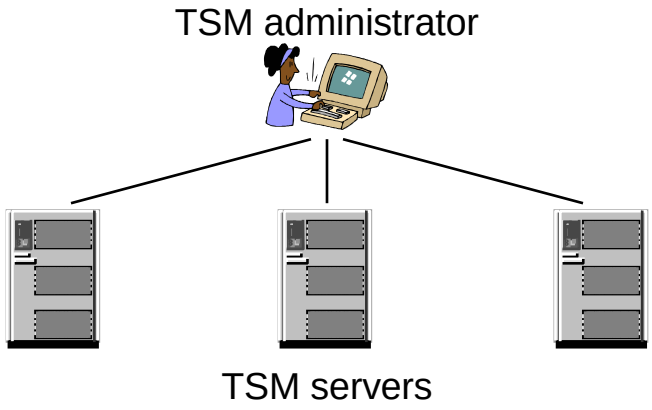
Future Candidate

Topics

- Database enhancement
- Management of stored data
- Administration
- Security/compliance

Administration Center: Infrastructure Improvements

- Upgrade to new, lighter-weight version of Integrated Solutions Console (ISC) infrastructure
  - Significant reduction in footprint
  - Faster installation
- Improved response time to administrator actions
  - Reduced time for initial page load and page switches
  - Enhanced processing of large queries
  - Progress indicators
  - Use of AJAX technology



Improved administrative experience

Next Release Candidate

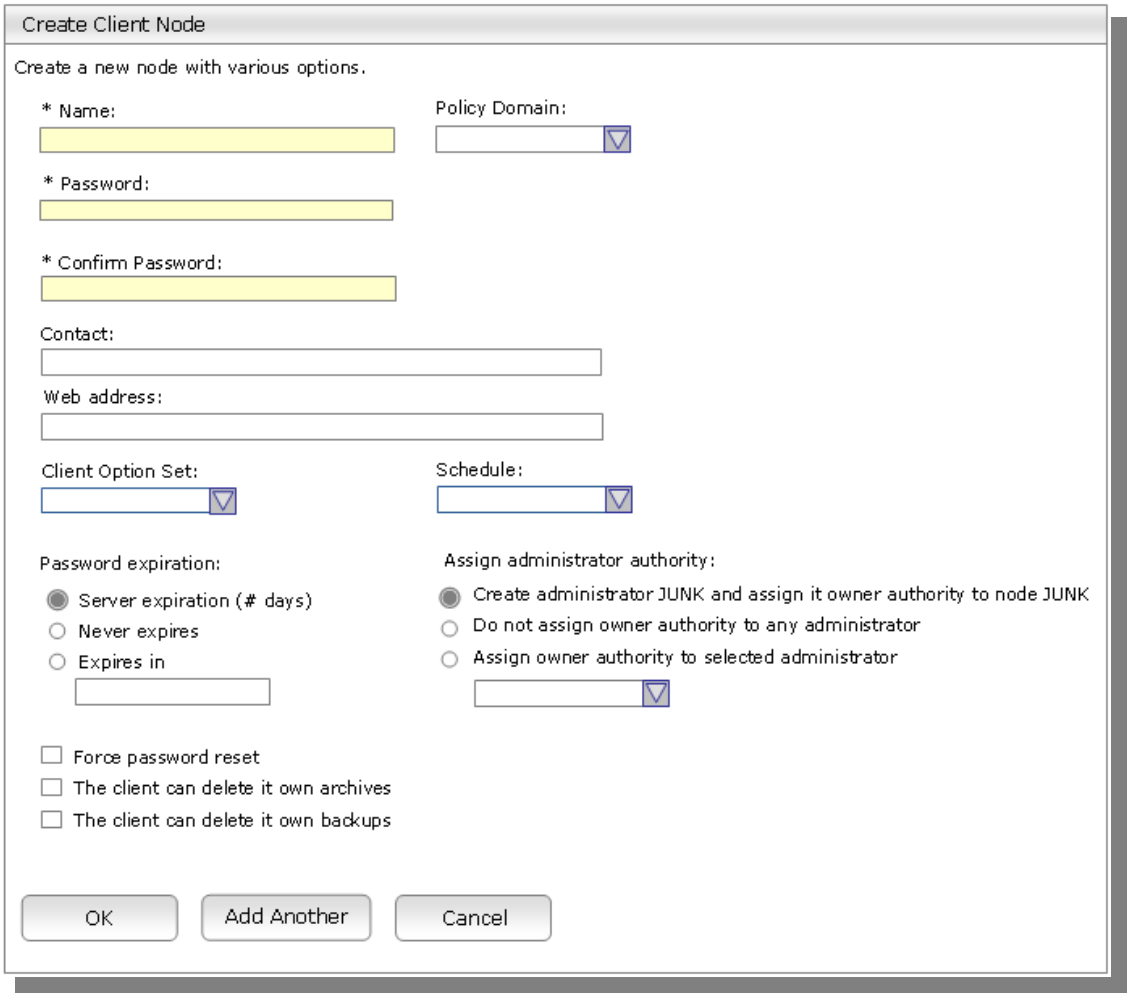
Administration Center: Functional Enhancements

- Enhanced navigation, especially for tasks involving client nodes
- Use of saved, customized values for repetitive creation of multiple nodes
- Basic and advanced dialogs for creation of maintenance plan
- For enterprise configuration, show relationships between managing and managed servers
- Enhancements to health monitor and policy domain
- Hyperlink to message help from messages displayed in Administration Center
- Hover help to show default action for hyperlinks
- Add support for backup set enhancements

Improved administrative experience

Next Release Candidate

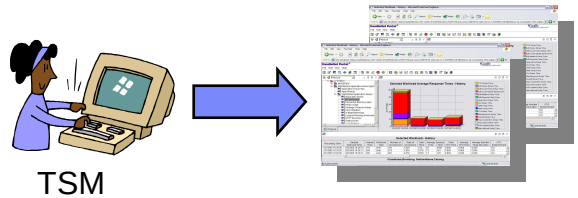
Forms for Node Registration



Allows values to be customized and saved for repetitive registration of nodes

Reporting/Monitoring Overview

- Improved capability for out-of-the-box historical reporting and operational monitoring
- Graphical representation of trends and current status
- Ability to run on all open platforms supported by TSM server
- Complement and integrate with the Administration Center (staged)
- Sufficiently lightweight for managing one TSM server
- Scalable to allow management of many TSM servers (potentially hundreds) within an enterprise
- Allow administrators to define their own reports
- Integration with reporting tools from other IBM products

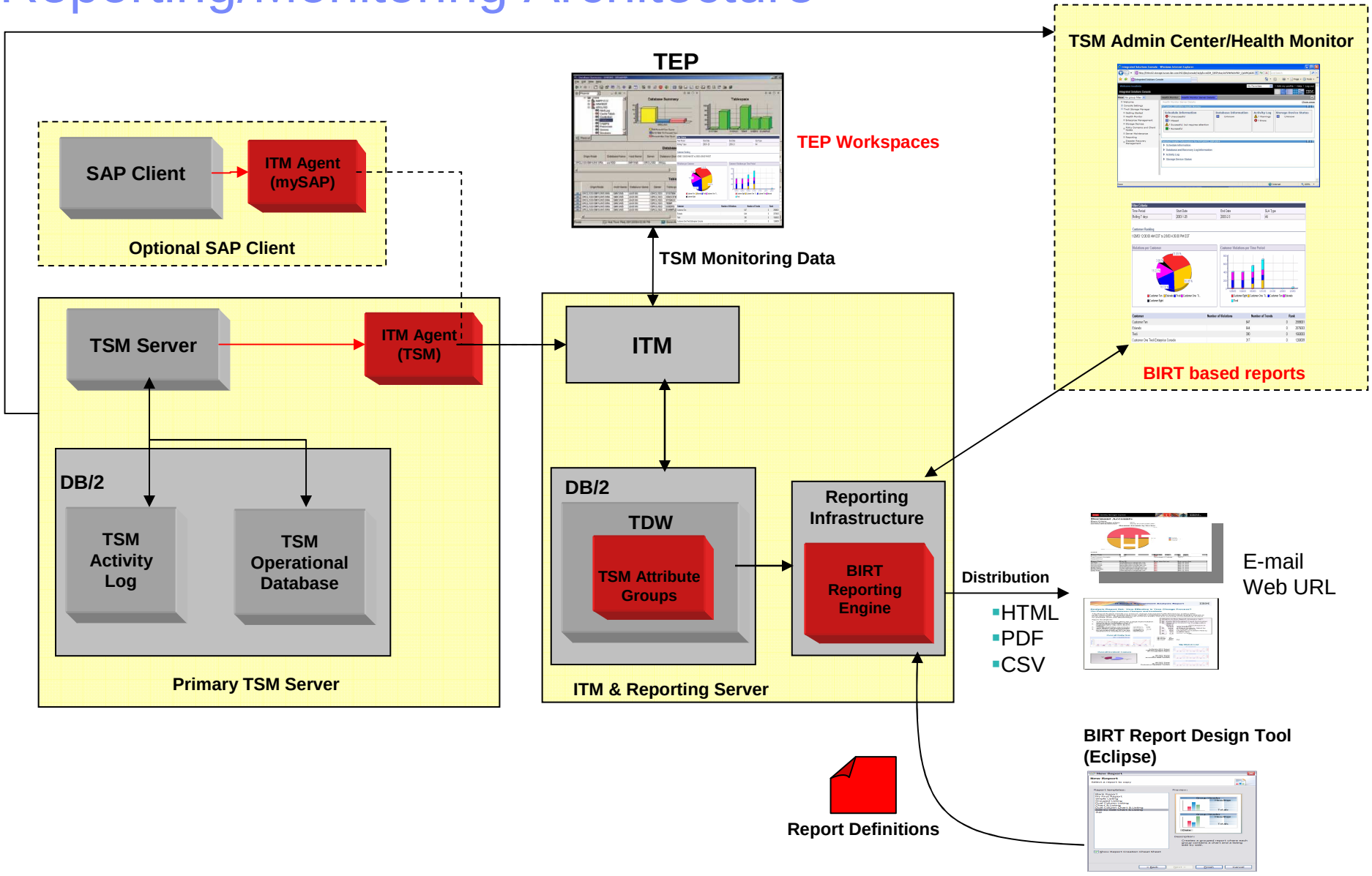


TSM Administrator

Improved reporting and analysis

Next Release Candidate

Reporting/Monitoring Architecture



Predefined Reports

Client reports

- Client job status
- Client backup currency
- Storage capacity protected
- Backup details
- Top 10 backups
- Backup missed files
- Backup history
- Restore details
- Top 10 restores
- Restore history
- Archive details
- Top 10 archives
- Archive history
- Retrieve details
- Top 10 retrieves
- Retrieve history

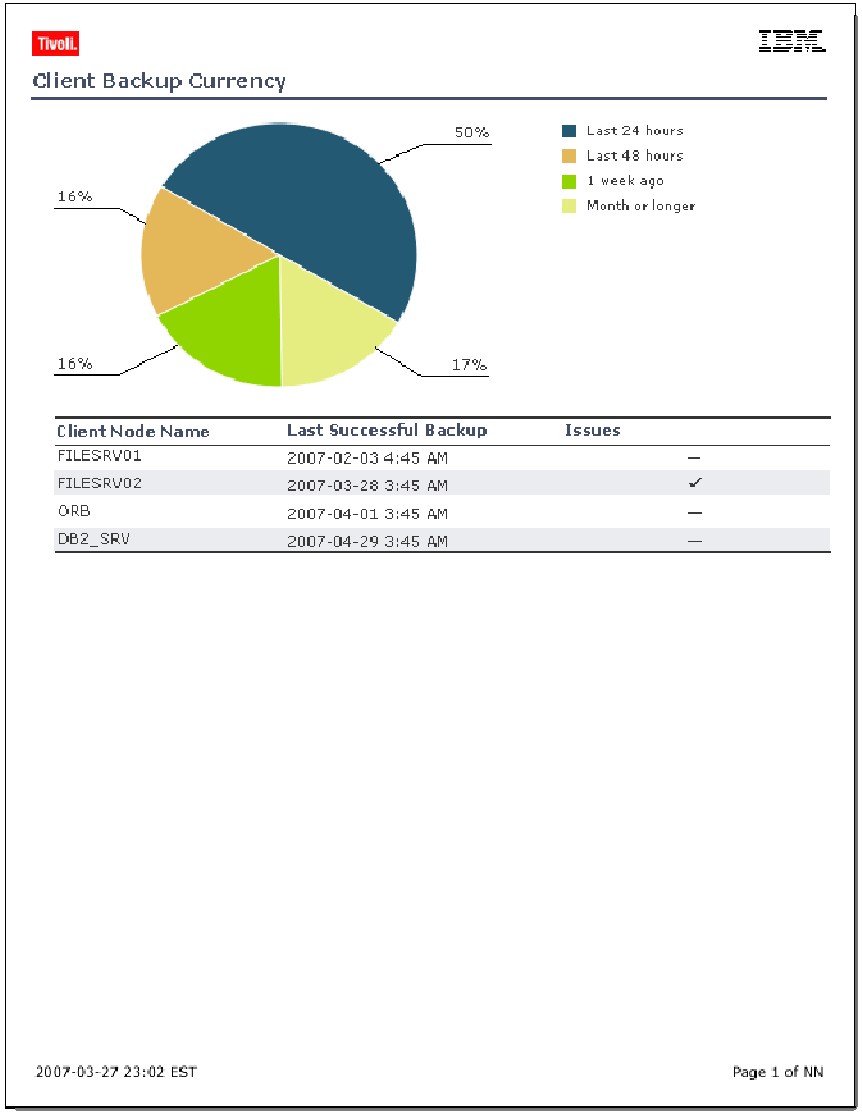
Server reports

- Server job status
- Server throughput
- Server resource usage
- Database details
- Disk usage
- Tape usage
- Other storage usage
- Tape volume usage analysis
- Tape capacity analysis
- Tape device errors
- Device usage history
- Server machine utilization

Operational Monitoring

- Scheduled client events
- Scheduled server events
- Current client activity
- Current server activity
- Current failures
- TSM database status
- Tape device status
- Storage pool status
- Client backup status

Client Backup Currency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IBM

Client Backup Currency

Client Node Name	Last Successful Backup	Issues
FILESRV01	2007-02-03 4:45 AM	–
FILESRV02	2007-03-28 3:45 AM	✓
ORB	2007-04-01 3:45 AM	–
DB2_SRV	2007-04-29 3:45 AM	–

2007-03-27 23:02 EST

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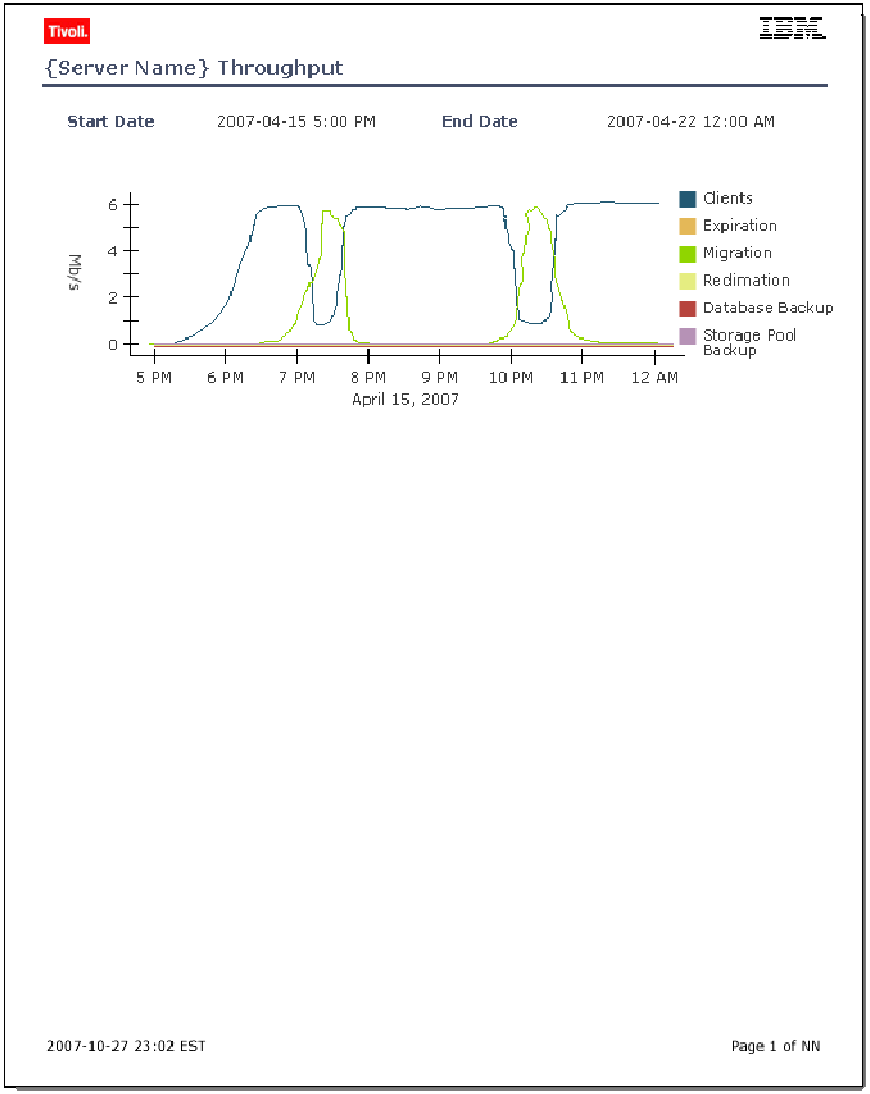
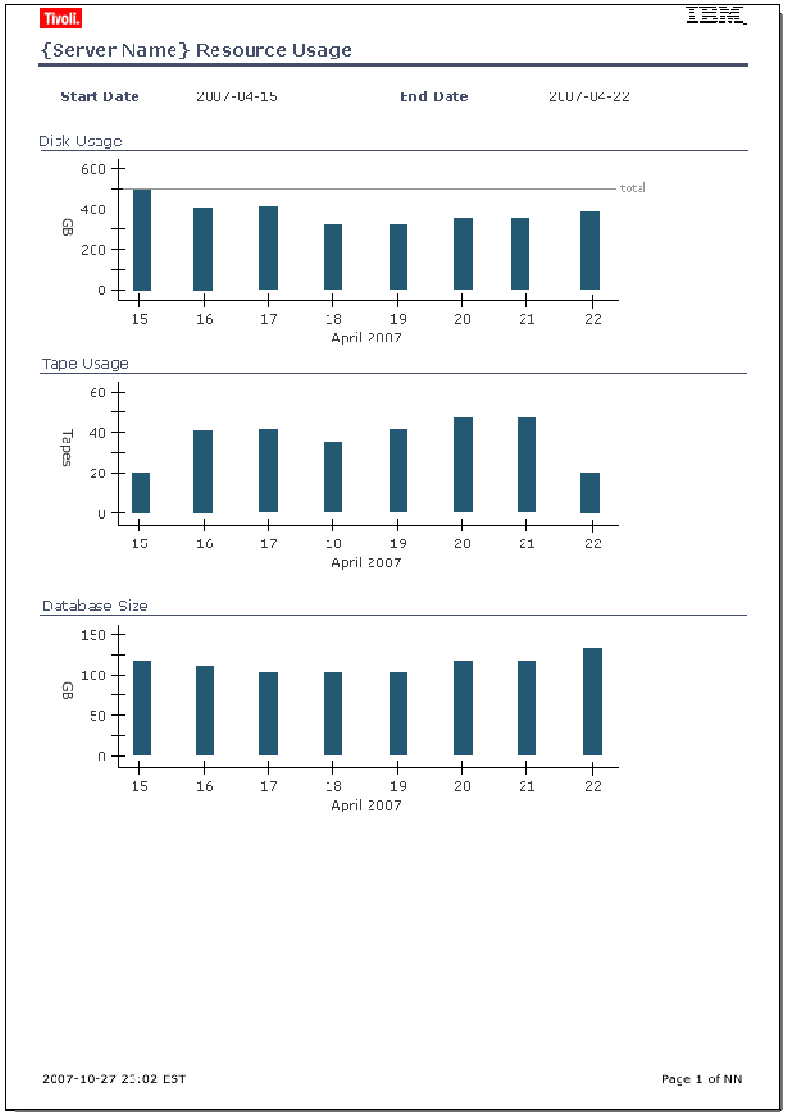
Time since last successful backup, by client node

Server Throughput



Throughput of server operations by time

Server Resource Usage

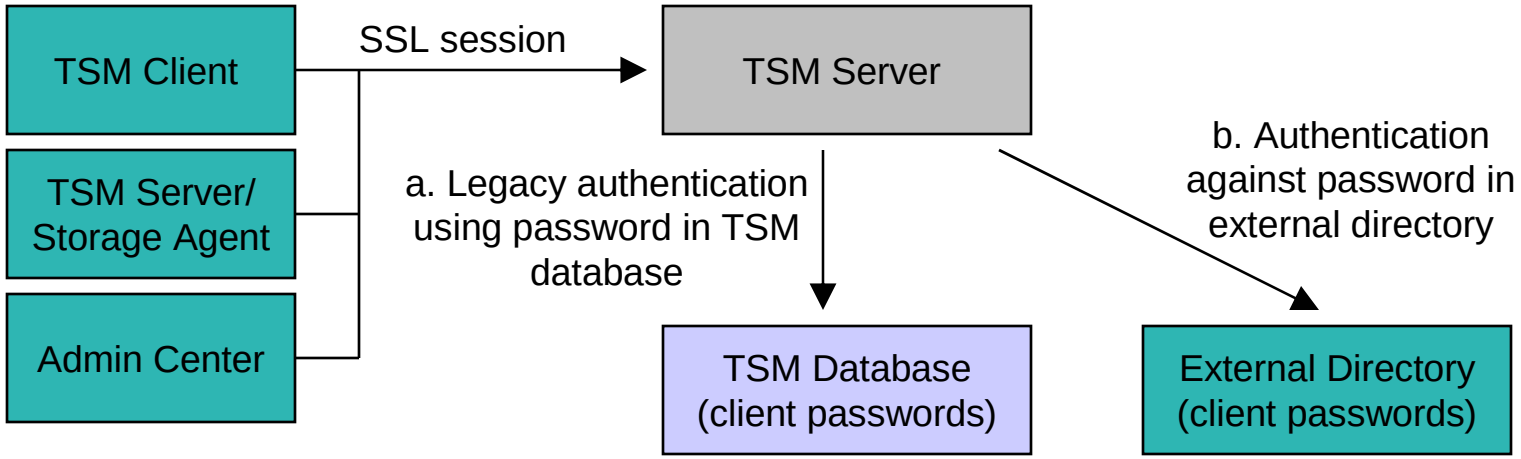


Utilization of disk, tape and database resources by time

Topics

- Database enhancement
- Management of stored data
- Administration
- Security/compliance

Authentication via External User Directory

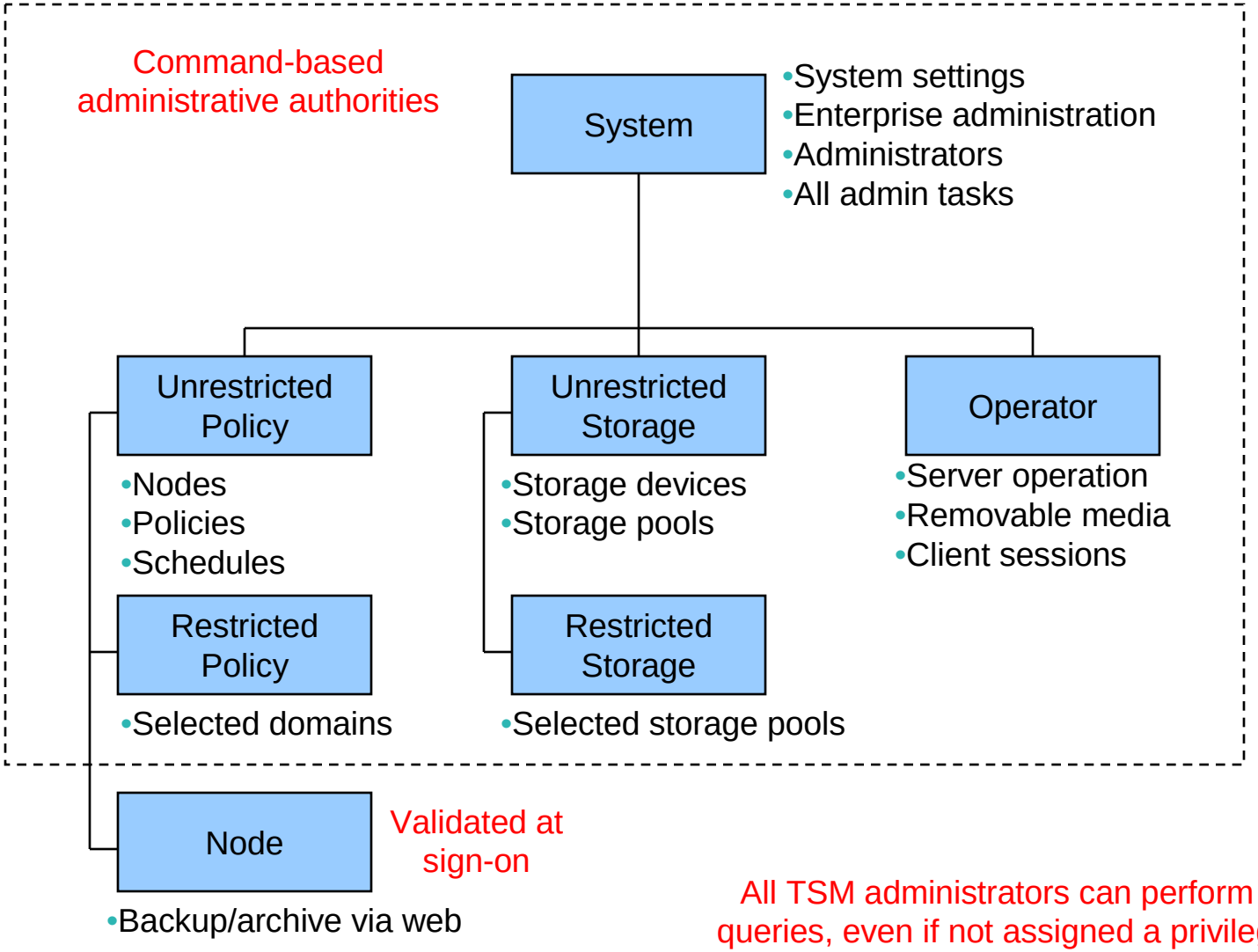


- Option to store selected TSM user information, including passwords, in external directory (e.g., LDAP, Tivoli Access Manager)
- TSM would provide following authentication options
  a. Legacy authentication using password stored in TSM database
  b. Authentication against password stored in external directory
- Allows enforcement of strong password rules

Configuration and enforcement of strong password rules

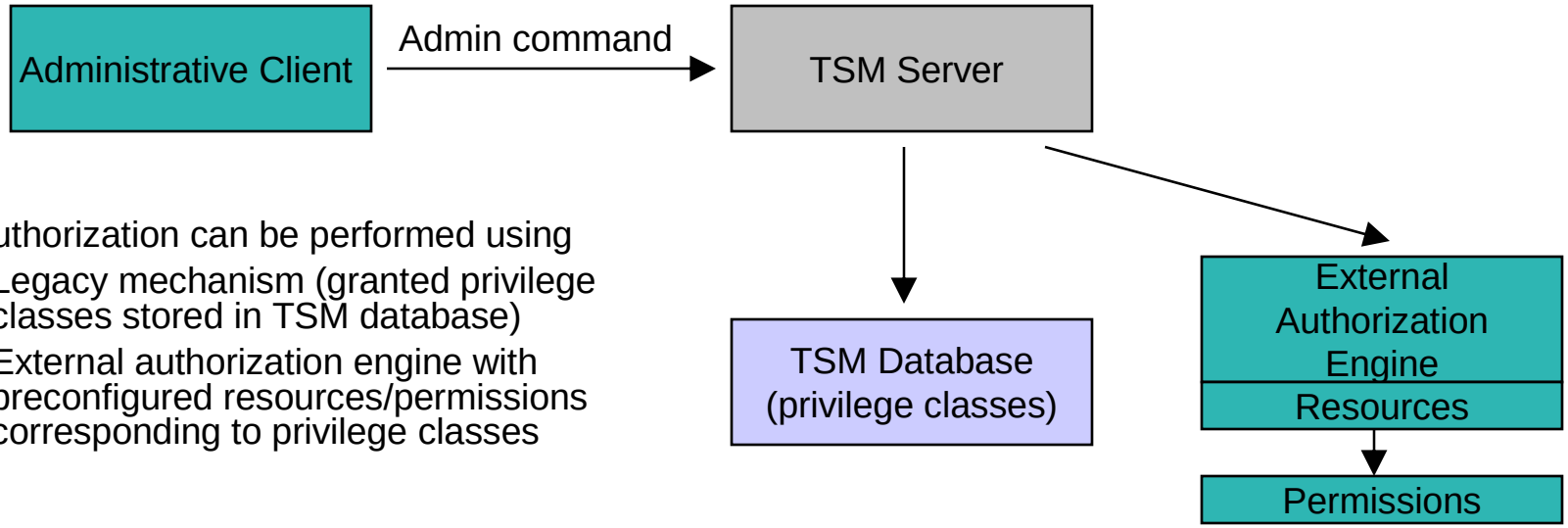
Future Candidate

TSM Privilege Classes After DB2 Release



All TSM administrators can perform server queries, even if not assigned a privilege class

Authorization via External Engine



Authorization can be performed using

- Legacy mechanism (granted privilege classes stored in TSM database)
- External authorization engine with preconfigured resources/permissions corresponding to privilege classes

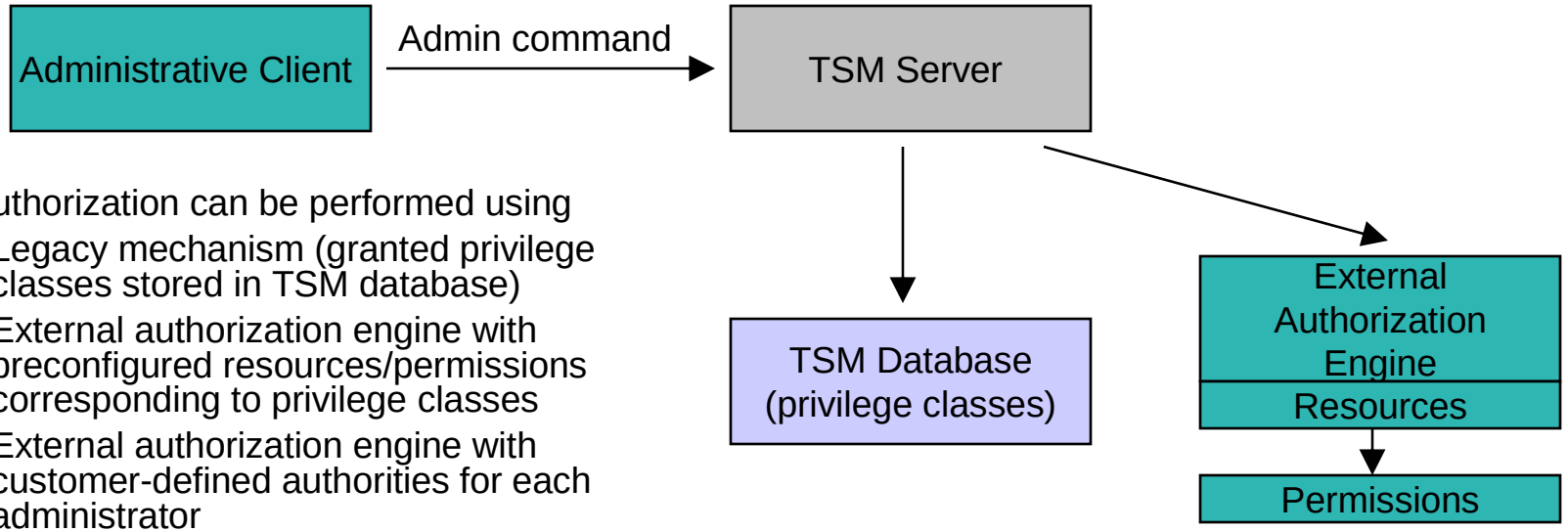
If external authorization (e.g., Tivoli Access Manager) is used as TSM authorization engine

- Engine would be preconfigured with
  - Resource definitions corresponding to current privilege classes (system, policy, storage, etc)
  - Each resource mapped to assigned permissions (operations allowed for that resource)
- Administrator assigns authority to TSM administrators using authorization engine interface
- TSM server checks external authorization engine for authorization
- Restricted authority would require resource entries corresponding to domains/pools

Authorization based on enterprise-wide policies and infrastructure

Future Candidate

Authorization with Customer-Defined Authorities



Authorization can be performed using

- Legacy mechanism (granted privilege classes stored in TSM database)
- External authorization engine with preconfigured resources/permissions corresponding to privilege classes
- External authorization engine with customer-defined authorities for each administrator

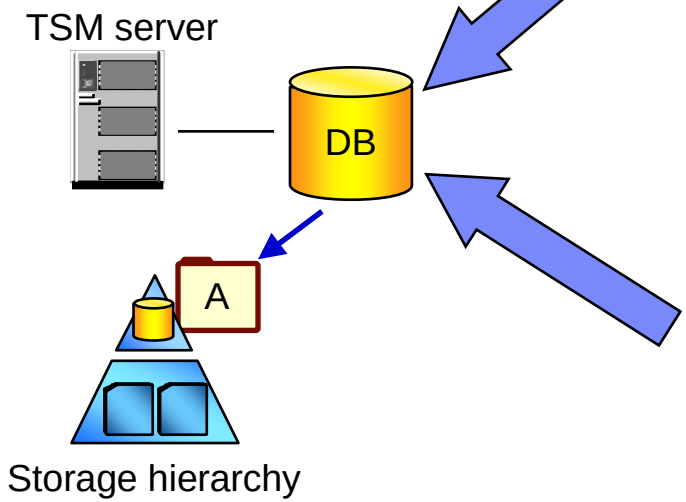
If external authorization engine is used with customer-defined authorities

- Engine would be preconfigured with resource and permission definitions
- Customer could alter, add, or remove resource/permission definitions to achieve desired authorizations for each administrator and command

Flexible, fine-grained assignment of authorities

Future Candidate

Historical Audit Trail: Data Objects



Information regarding initial store of object

- When object was stored
- Who initiated store operation
- How store was initiated (schedule, GUI)
- Initial storage pool / volumes
- Transport mechanism for store (LAN-free)
- Type of encryption
- Client compression
- Initial management class
- Object size

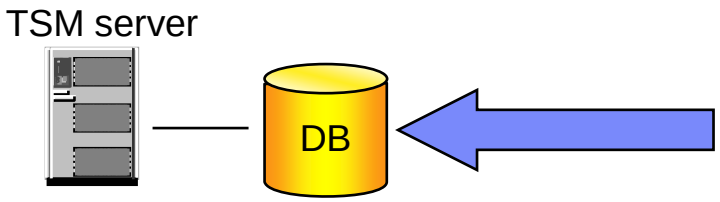
Details of later operations on object

- Client restore/retrieve/recall attempts
- Outcome of client access operations
- Deletion (who/what initiated)
- Move/copy operations
- Management class rebinding

Improved tracking of historical information on data objects

Future Candidate

Historical Audit Trail: Server Configuration



Server configuration history
- New/changed constructs
  - Policy definitions
  - Schedules
  - Storage pools/device classes
  - Nodes
- Set commands
- Changes to server options
- Changes to server level

Improved tracking of historical information on server configuration

Future Candidate

Summary

- This presentation has described a sampling of potential future enhancements to Tivoli Storage Manager

- Topics have included
  - Upgrade to DB2 for improved availability and scalability
  - Enhanced management of data in server storage
  - Increased ease of administration
  - Enhanced security and compliance features