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Top 10 common storage management problems and how to handle them on z/OS

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IBM System z Storage Solution

Unified Suite of Tightly Integrated Products

Agenda:

Introduction

How zStorage Issues Affect the Organization

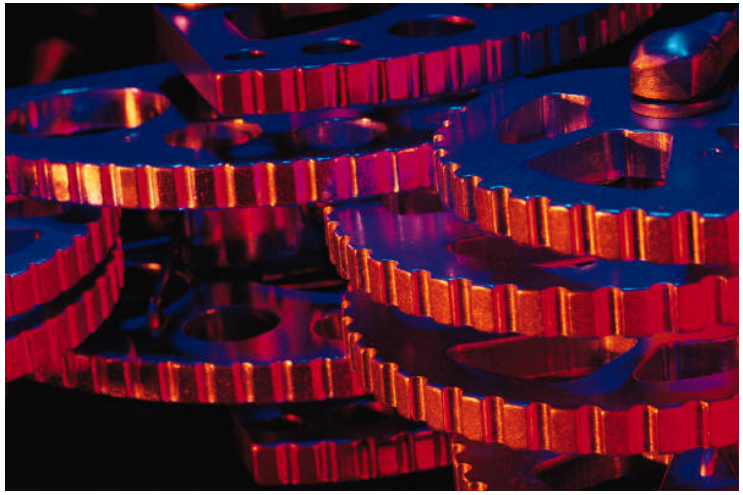
Top 10 zStorage issues

IBM Tivoli System z Storage Management

Q&A

How Does Storage Management Affect the Organization?

- **Storage affects many key operational aspects of your organization**
  - **Application performance, throughput, and availability**
  - **Effective and Efficient Storage Device Utilization**
  - **CPU Utilization & Batch Processing**
  - **DR Planning: Backup & Recovery, Data loss, Regulatory Compliance**



How Does Storage Management Affect the Organization?

- **Effects of Storage Issues can be easily masked or overlooked**
  - **Performance impacts related to storage issues**
  - **Growing requirements for CPU, storage devices and media: "cost of doing business"**
  - **Planned outages (e.g. ICF Catalog maintenance) are a "necessary evil"**
  - **Hidden problems that can cause unplanned outages or application failures**
  - **Data Integrity - Failing/struggling DR exercises**

How Does Storage Management Affect the Organization?

- **Storage Administration Staff Stretched to Keep Up**
  - **Monitoring daily/weekly/monthly activity**
  - **Device management**
  - **"Process of elimination" problem resolution**
  - **Wasted time on repetitive tasks**
  - **Lack of time to research what's going on in the system**
  - **Labor intensive activities such as backup & recovery**
  - **Learning Curve**

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What are the 10 common zStorage management problems

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So what are these problems?

- **All sites have different configurations and unique expectations**
  - **Application Tracking**
  - **Space Problems**
  - **Maximizing Resources**
  - **DFSMShsm Problems**
  - **Catalog Integrity**
  - **Data Integrity**
  - **Tape Management**
  - **Identifying Complex Problems**
  - **Maximizing Storage Personnel**
  - **Breaking down the Silos**

Monitoring Storage for Application or Address Space

- **Application Tracking**
- **Space Problems**
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- **Data Integrity**
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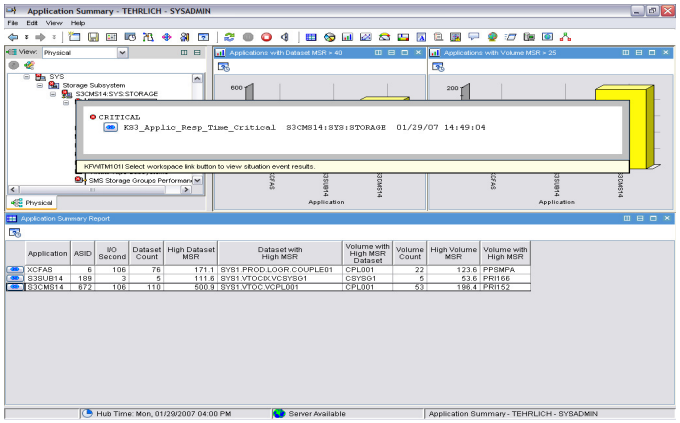
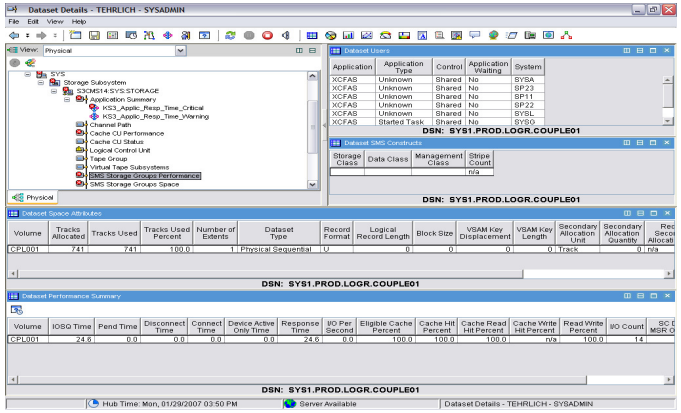
- **Breaking down the Silo**

- How do you know if an application is having a problem due to it's zStorage activity?
- M/F subsystem I/O resources become congested, affecting application performance, availability – and cost!

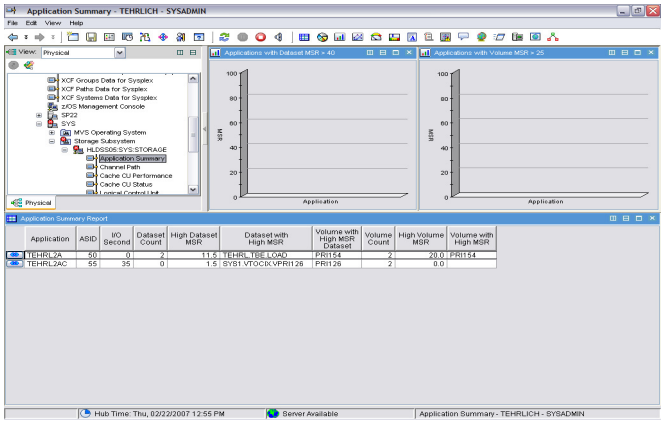
Ability to Focus on Workload Performance



Application Response Time Unsatisfactory - Hover on situation icon and navigate to situation event workspace.



Data set details - Notice access across all systems



Easily define a z/OS address space and identify all data sets being accessed and associated information to determine the health of that ASID's I/Os

Processing Delayed Due to Space Problem?

- Application Tracking
- Space Problems
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- DFSMShsm Problems
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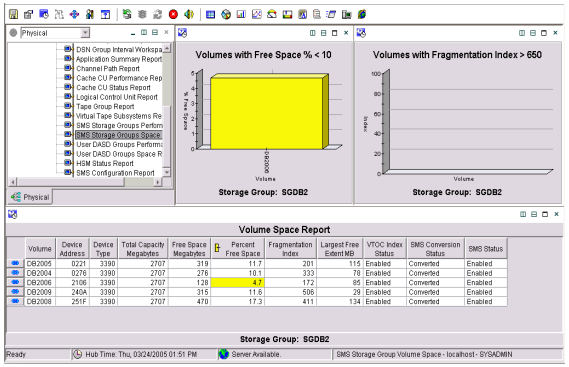
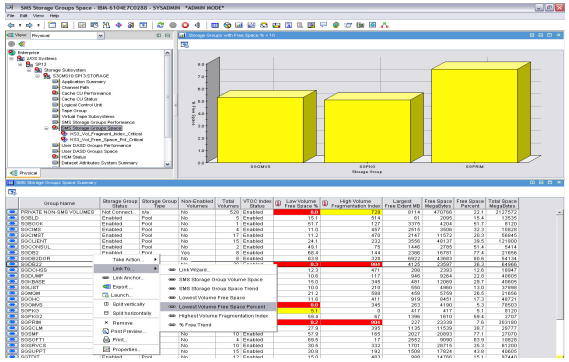
- How do you know how much space you have in your storage environment?
- From the data set to volume to storage group … are your allocations both adequate and efficient?

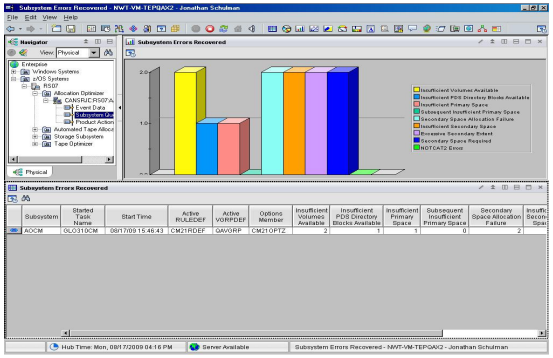
Avoid Costly Space Problems



Set up alerts on various space conditions, make sure alerts provide enough warning before impacting applications or users

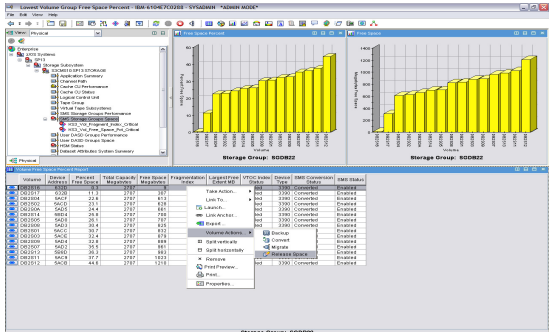


Quickly determine the constrained storage area



Prevent X37 type of abends and NOTCAT2s

….Identify repeat offenders to correct underlying allocation issues



Identify root issues quickly and respond seamlessly, (automatically where possible) from single solution

Slow Processing..Think it may be because of resources?

- Application Tracking
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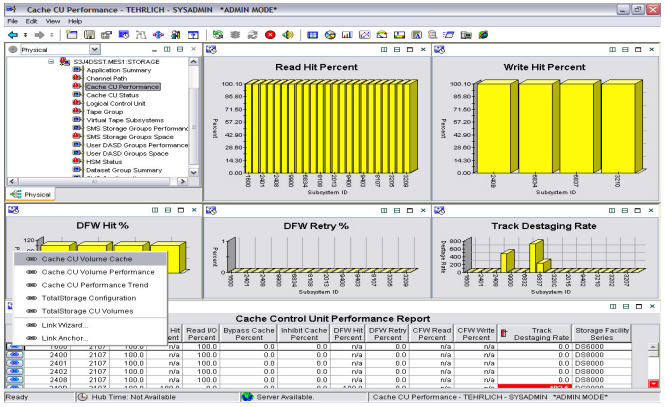
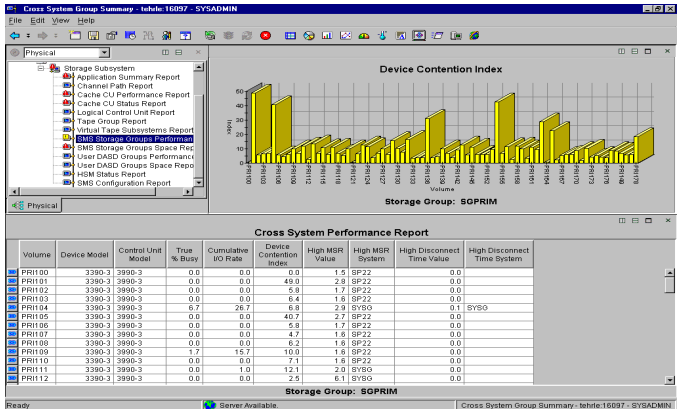
- Slow batch cycle last night, was caching doing what it was supposed to?
- In our shared DASD environment, are other LPARs affecting performance?
- Are our DS8000's running the way they should be?

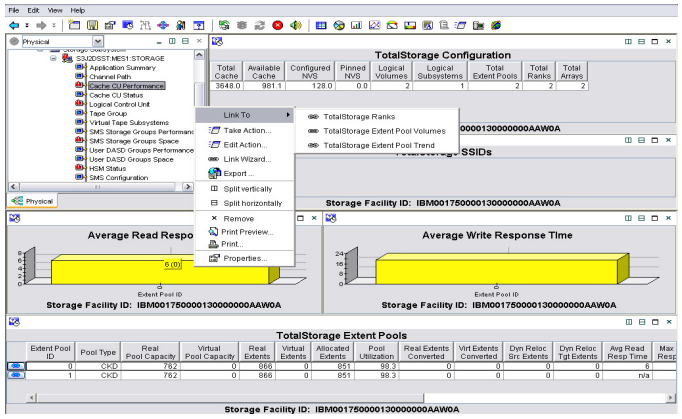
Need to get the most out of our resources



From from CU Cache, to volume and down to data set level, ensure correct resources are deployed to meet service level agreements (SLA)

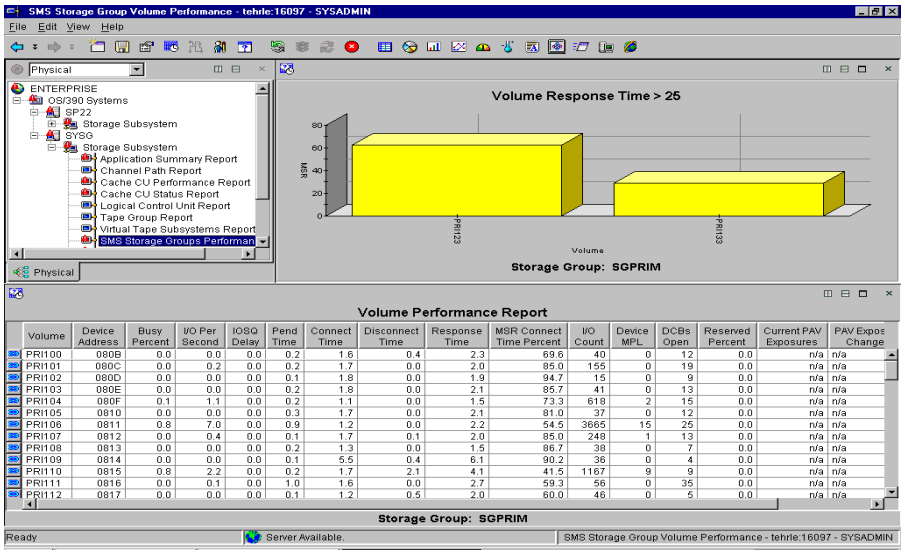
How can I tell what impact any one LPAR has on a shared device?





How are may DS800s performing?

What is Impacting Overall I/O Subsystem Performance?

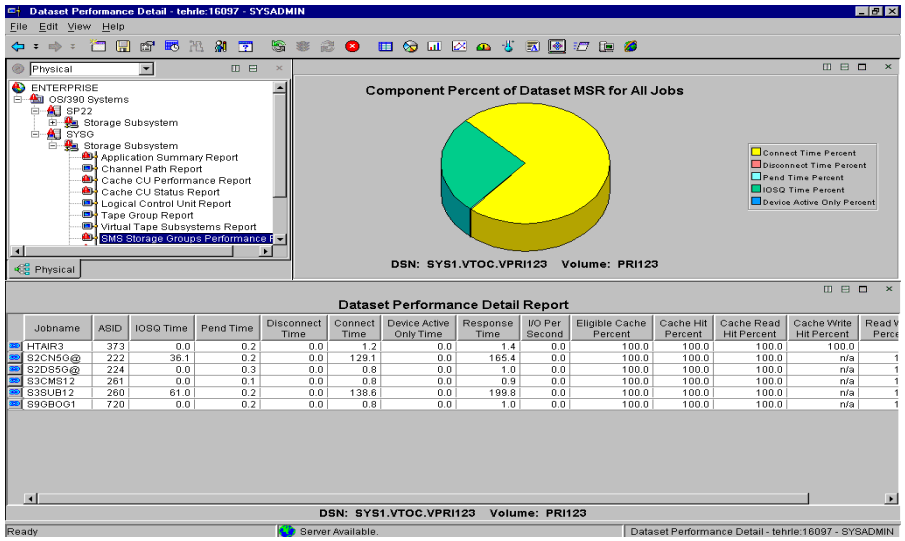


Analyze DASD performance, from both real-time and historical perspectives to identify issues affecting performance

Some times simple volume-level information just isn't good enough….

Dataset-level analysis can provide deeper insight to where problems may be occurring.

Dataset thresholds and alerts for critical workloads being serviced by your system can quickly pinpoint problems impacting performance



Is HSM Driving Hidden Costs or Problems?

- Application Tracking
- Space Problems
- Maximizing Resources
- **DFSMShsm Problems**
- Catalog Integrity
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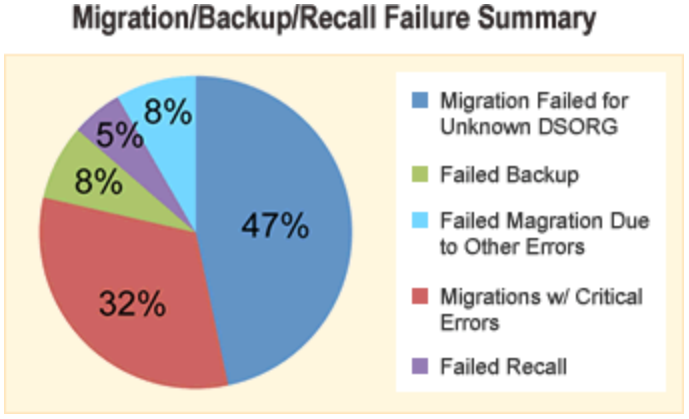
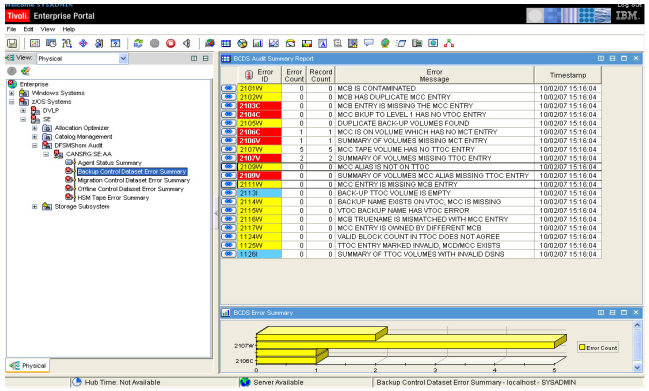
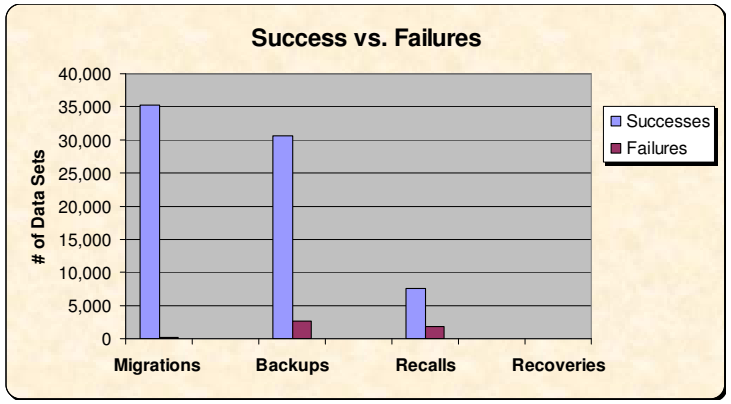
- How did last nights HSM processing go?
- Are repetitive migration failures affecting performance daily?
- Are HSM migration policies in tune with the current business environment, or are they draining CPU resources and wasting DASD?



Get the most out of your HSM

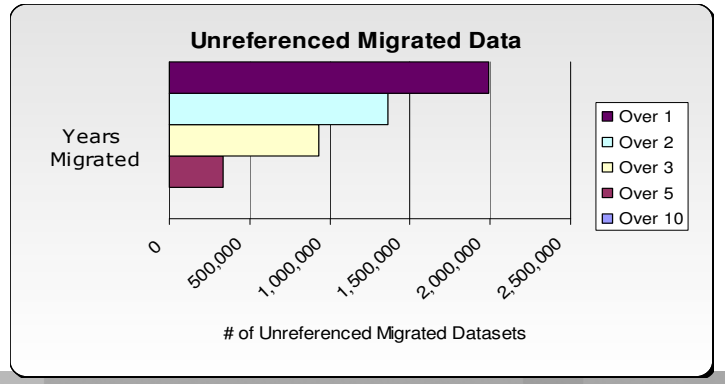
- Nightly execution cycles can churn on errors that are lost in the “haystack” of work
- Pinpoint and where possible automatically correct the underlying issues that cause the failures that sap CPU resources.





- Aggressive or outdated migration policies can result in overhead that can actually make life cycle management more expensive than doing nothing at all!
- Identify and correct these issues, using what-if analysis to preview migration policy changes before committing them.
- Improve batch job execution by optimizing migration – reduce data recall wait-time

- Over time HSM processing can result in huge quantities of old, unreferenced data being managed by DFSMShsm
- This old, unreferenced data can be eliminated, freeing up storage resources!



Ever Experienced a Catalog Problem?

- Application Tracking
- Space Problems
- Maximizing Resources
- DFSMShsm Problems
- **Catalog Integrity**
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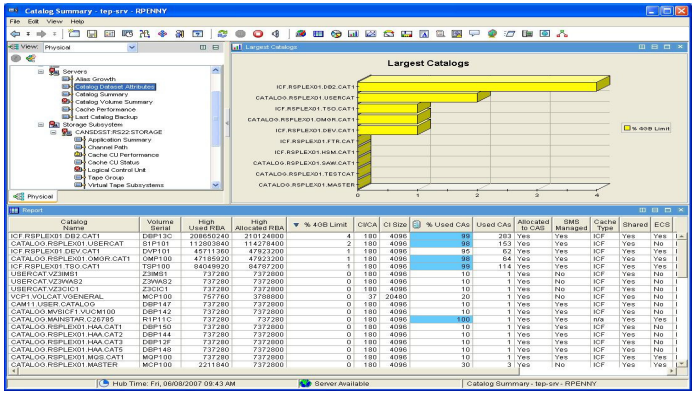
- Catalog Issues can cause outages
  - Catalog Failures – rare but deadly
  - Needed Catalog maintenance (merge, split, reorg, etc) can cause application downtime
  - Recovery delays can be costly

Common Catalog Scenario

	# Data Sets	% of Total	Cumulative %	# Aliases
SYS1.USR2.DEV.CATALOG	683,027	43%	43%	51
SYS1.TST1.DEV.CATALOG	274,644	17%	60%	293
SYS1.TST3.DEV.CATALOG	193,212	12%	72%	222
SYS1.PRD1.DEV.CATALOG	118,877	8%	80%	665
SYS1.DBNT.DEV.CATALOG	84,756	5%	85%	78
SYS1.DBTD.DEV.CATALOG	65,727	4%	89%	206
SYS1.DEV.PXCJ	39,841	3%	92%	11
SYS1.TST2.DEV.CATALOG	35,037	2%	94%	230
SYS1.GRP.DEV.CATALOG	30,174	2%	96%	33
SYS1.ENV.DEV.CATALOG	29,173	2%	98%	15
SYS1.USR4.DEV.CATALOG	10,336	1%	. . .	2,898
SYS1.USR3.DEV.CATALOG	7,242	1%	. . .	1,807
SYS1.USR1.DEV.CATALOG	6,484	<1%	. . .	980
SYS1.DRD.CATALOG	2,099	<1%		23
SYS1.DFHSM.DEV.CATALOG	1,595	<1%		1
SYS1.CADISK1.DEV.CATALOG	355	<1%		3
SYS1.LOGR.DEV.CATALOG	187	<1%		5
SYS1.DEV.CPYCROSS	137	<1%		1
SYS1.PLEX.DEV.CATALOG	48	<1%		2
SYS1.CADISK2.DEV.CATALOG	5	<1%		2

Largest Catalogs	Top 2	Top 5
Total data sets:	957,671	1,354,516
% of total data sets:	60%	85%
Total aliases:	44	1,309



- Common scenario – a few key catalogs affect the vast majority of applications
  - Improperly protected catalogs cause widespread outages
  - Backup & reliable, *fast* forward recovery are imperative
  - Health monitoring of catalog's complex structural integrity can prevent problems
  - Alerts identify problems *before* they cause outages
  - Catalog maintenance-while-open can reduce application downtime
  - What-if simulation previews the effects of actions

How Do You Ensure the Integrity of Your Backups?

- Application Tracking
- Space Problems
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- DFSMShsm Problems
- Catalog Integrity
- **Data Integrity**
- Tape Management
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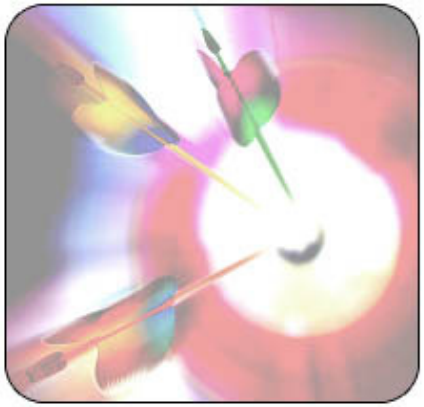
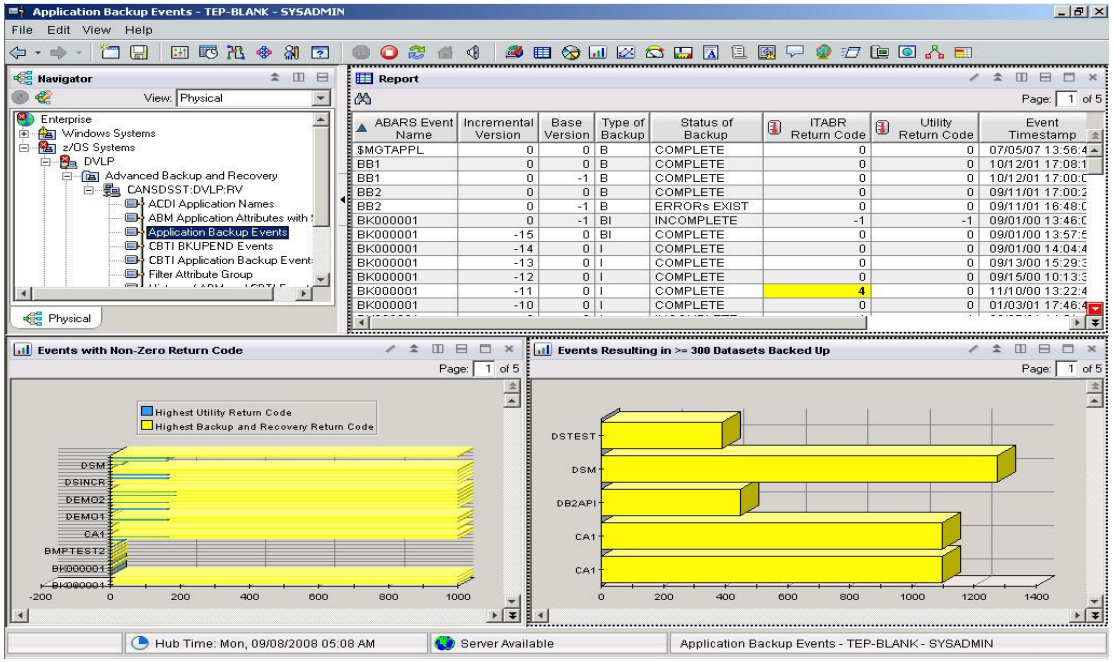
- Automatically identify what needs backup
- Automatically track backups & recovery processes
- Share resources
- Getting the most out of your physical tapes



Backup and Recovery Management



- Importance of Readiness
  - Impact and cost of outages
  - Regulatory Compliance
  - Internal Audit Controls
  - Security

- Effective DR depends on several factors
  - Automatically and accurately identify what needs to be preserved
  - Backup/Copy only what needs to be preserved
  - Validate data capture and eliminate redundancy; Alert for data *NOT* backed up
  - Automate recovery processes to reduce required manual data manipulation
  - Faster recovery time reduces business impact
  - Mirrored environments still require point-in-time backups

Are you managing your offline storage ?

- Application Tracking
- Space Problems
- Maximizing Resources
- DFSMShsm Problems
- Catalog Integrity
- Data Integrity
- **Tape Management**
- Identifying Complex Problems
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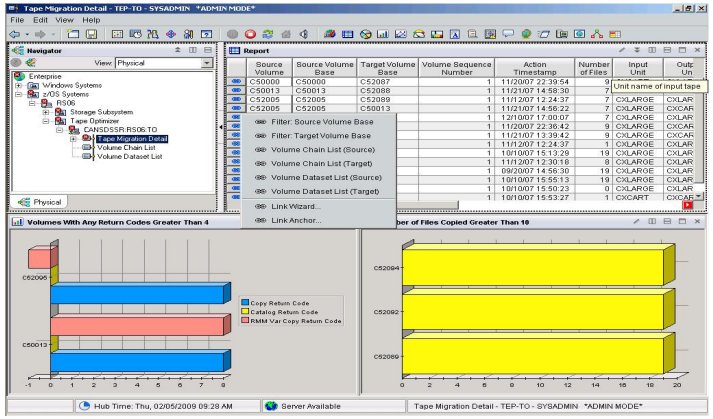
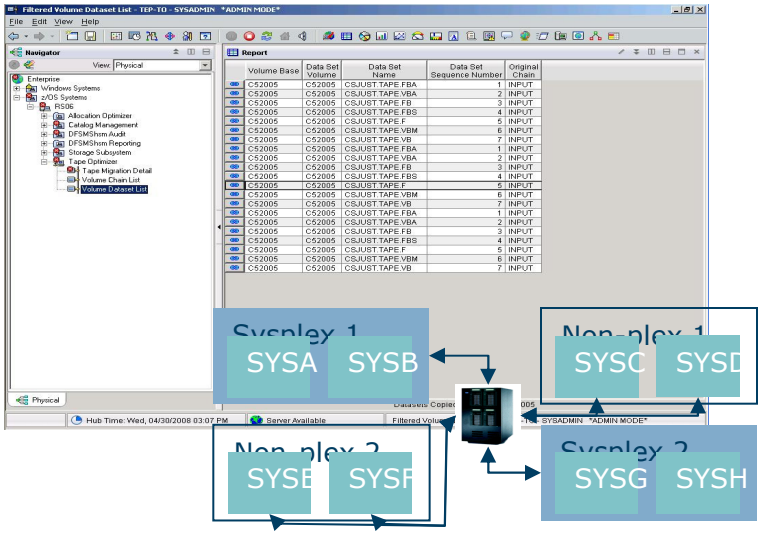
- Improve resource utilization
- How much gas do you have? ……. "That's within your physical tapes!"
- Monitor your tape drives and DFSMSrmm

What can be done with offline storage?

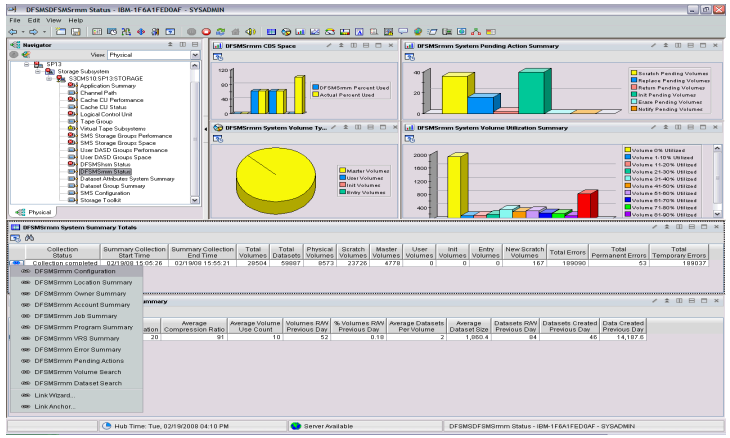
Reduce “gas” within physical tapes in an RMM environment, target data sets by criteria like expiration date, access frequency, etc.





Leverage resources by sharing tape hardware between Sysplex and non-Sysplexed environments

How is RMM or VTS performing? Monitor, report and control (i.e. the ability to issue RMM commands) tape storage functions



Is Anything Simple Anymore?

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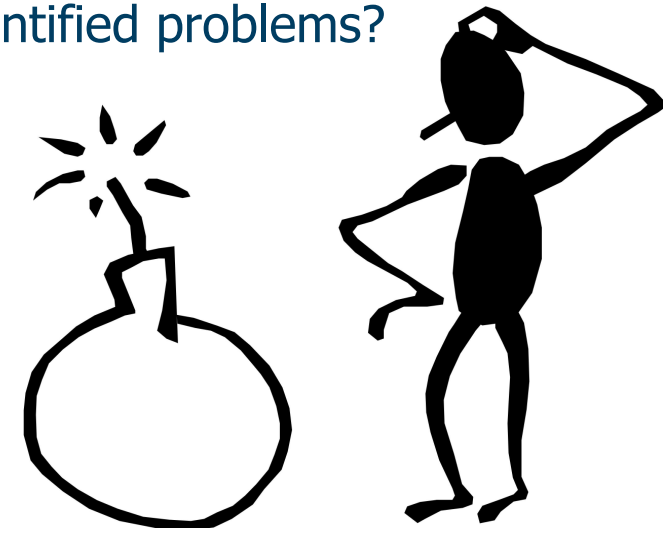
- How do you pinpoint problems in your environment?
- Quickly determine the problem?
- Do you need more than just a simple threshold alert?
- How do you respond quickly to identified problems?



Make zStorage Problem Identification Easier

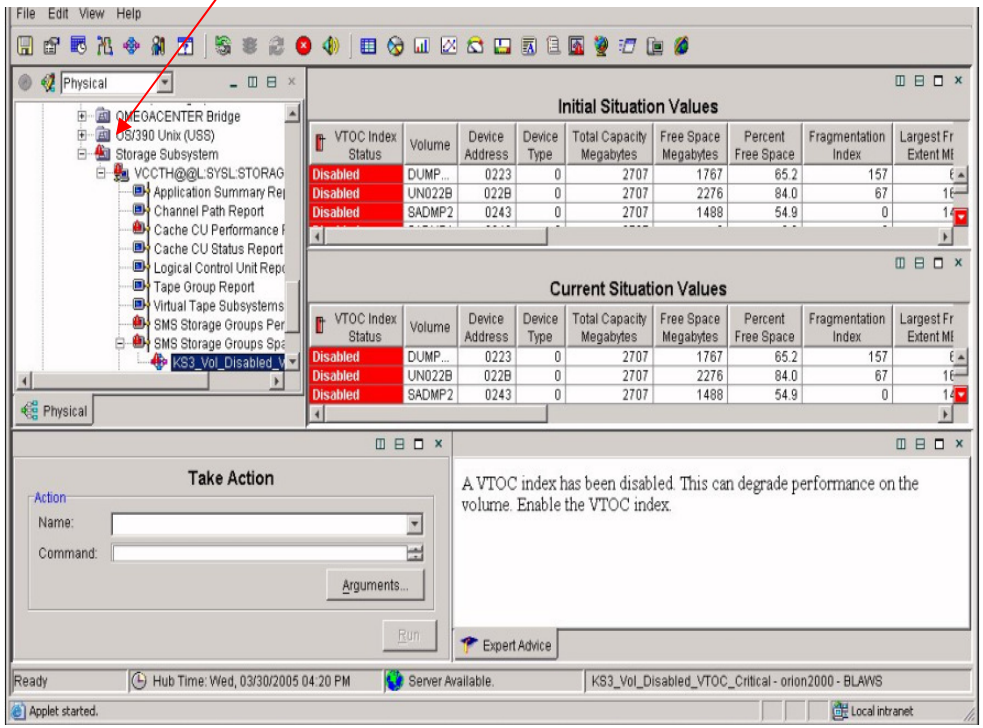
Situations: What are they?

*A **situation*** is an intelligent alert that can utilize and/or logic to *monitor* a condition or set of conditions that you want to be notified about, which would indicate a potential problem with an identified workload and/or resource

Situations: Why use them?

- Proactively detect and resolve problems before end users report impact.
- Minimize time determining root cause (Alert if stor class=PRILRG and free space < 10% or largest free space < X MBs)
- Create alerts based on multiple conditions ranging from simple to complex
- Customize for specific conditions and environment
- Automate problem resolution using Take Action (reflex automation)

Situation "fires" and you quickly navigate to what triggered the alert



How do I Squeeze More Productivity from the Way I Work?

- Application Tracking
- Space Problems
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- DFSMShsm Problems
- Catalog Integrity
- Data Integrity
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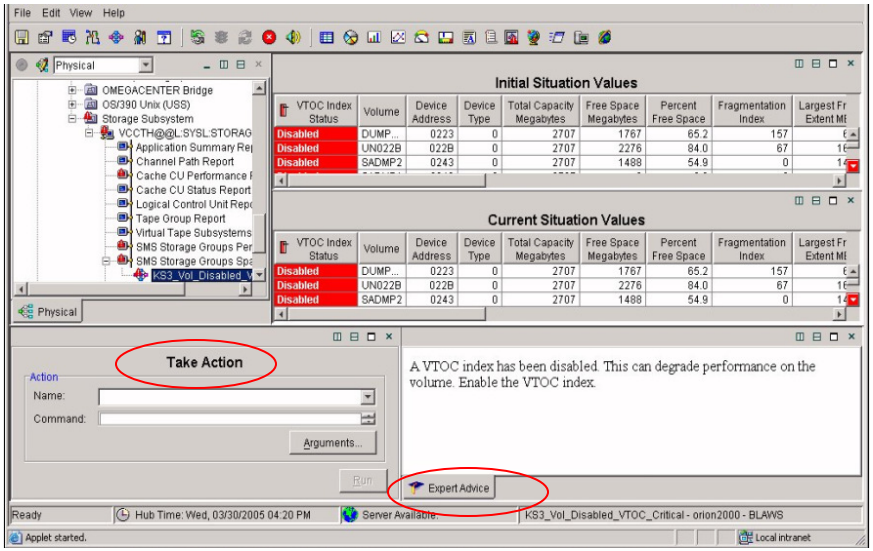
- Identifying Complex Problems
- Storage Staff Efficiency
- Breaking down the Silo

- Manage by exception
- Common Tools and Processes
- Create collaboration through tool integration
- Efficiency in doing the day to day management of your zStorage
  - Link actions to situations
  - Automate problem responses
  - Capture expert knowledge

VISIBILITY **CONTROL** **AUTOMATION**



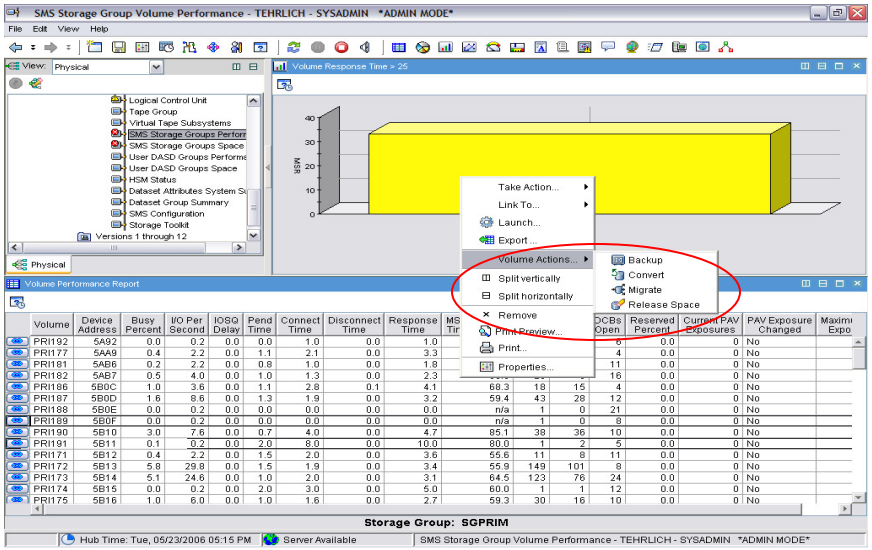
Focus Visibility and Control to Key Areas



Manage by exception – monitor key applications and limit visible information to what is needed

When situations “fire” quickly see what caused the alert, and compare current status of the situation to the initial condition that caused this alert

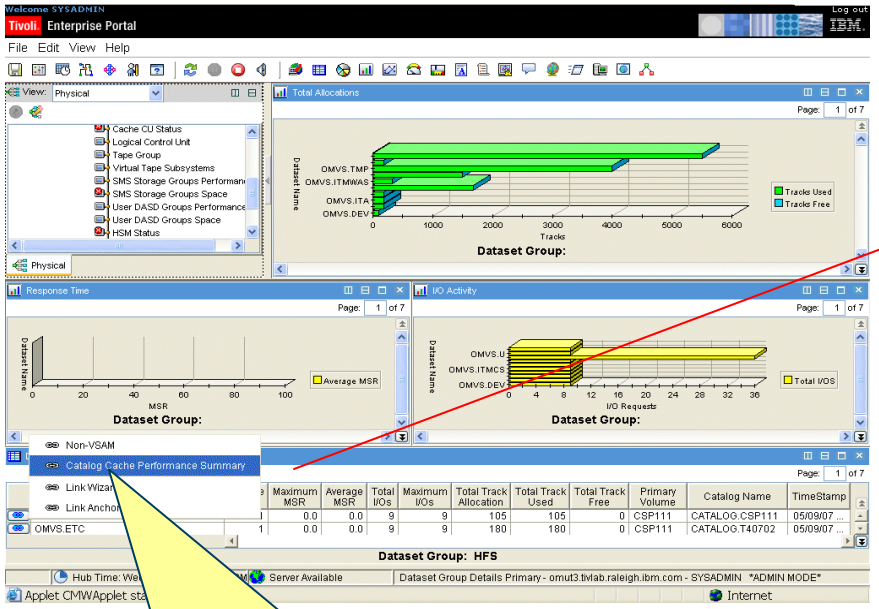
Pre-programmed actions can respond automatically to situations – or - Take Action by issuing commands

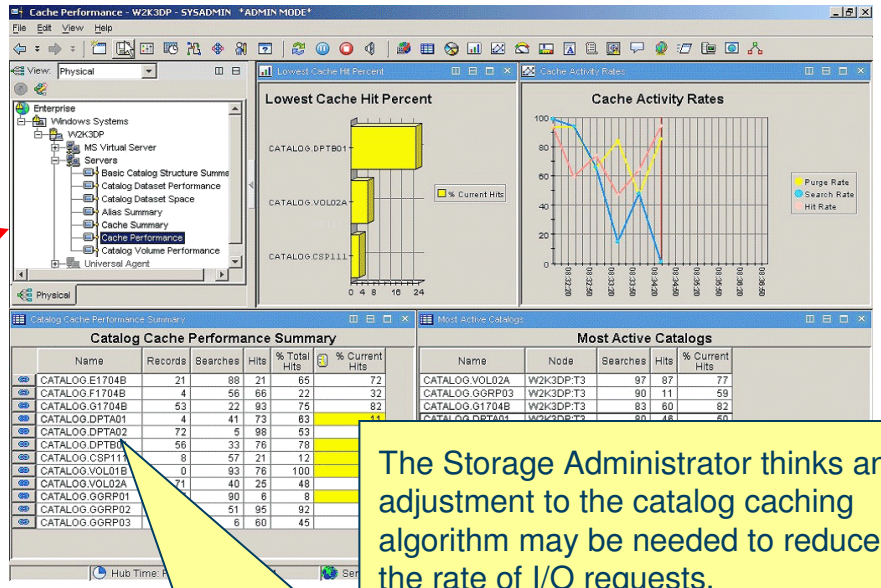


From monitoring HSM, DSS, IDCAMs, ICKDSF, RMM and JCL, use the Toolkit to generate automated or manual batch job responses directly from your monitoring activity

Improve Staff Efficiency with Tool and Process Integration

Seamless integration among tools provides synergy, makes collaboration easy in problem solving and other day-to-day administrative activities





The Storage Administrator links to the Advanced Catalog Management Catalog Cache Performance Summary workspace

The Storage Administrator thinks an adjustment to the catalog caching algorithm may be needed to reduce the rate of I/O requests.

The Advanced Catalog Management Catalog Cache Performance Summary workspace indicates that the cache hit ratio for the user catalog residing on the badly performing logical volume is very low.

The bigger picture?

- Application Tracking
- Space Problems
- Maximizing Resources
- DFSMShsm Problems
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- Data Integrity
- Tape Management
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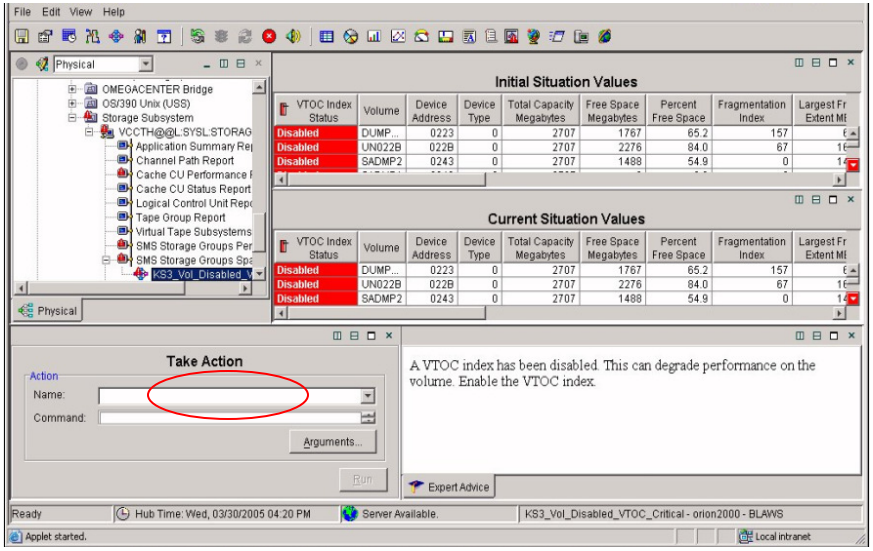
- Breaking down the Silo

- Storage is a common denominator for workloads running on z/OS
- Is your environment managed by different teams that do not regularly work together?
- When there is a problem, do you have to meet or gather information from multiple people to identify the root cause (war room)?

Fostering Teamwork and Efficiency



Storage is a common entity with any z/OS workload, regardless spanning CICS, DB2, IMS, middleware, networking and z/OS operating system information

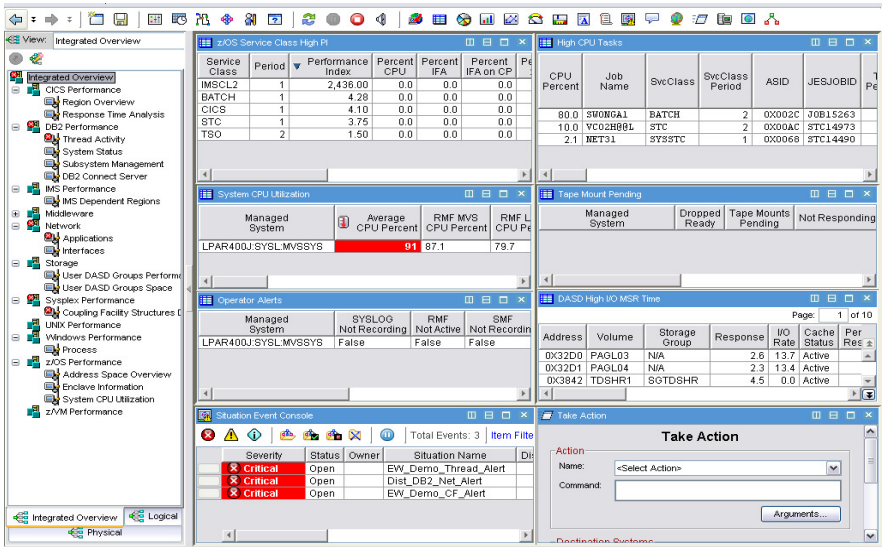
Integration at this level:

- Increases ability to identify and address problems
- Fosters greater communication
- Prevents issues from impacting service levels
- Reduces down time and business impact from issues

Quickly identify the problem, exploit Expert Advice, and Take action to reduce meantime–to-resolution and knowledge transfer

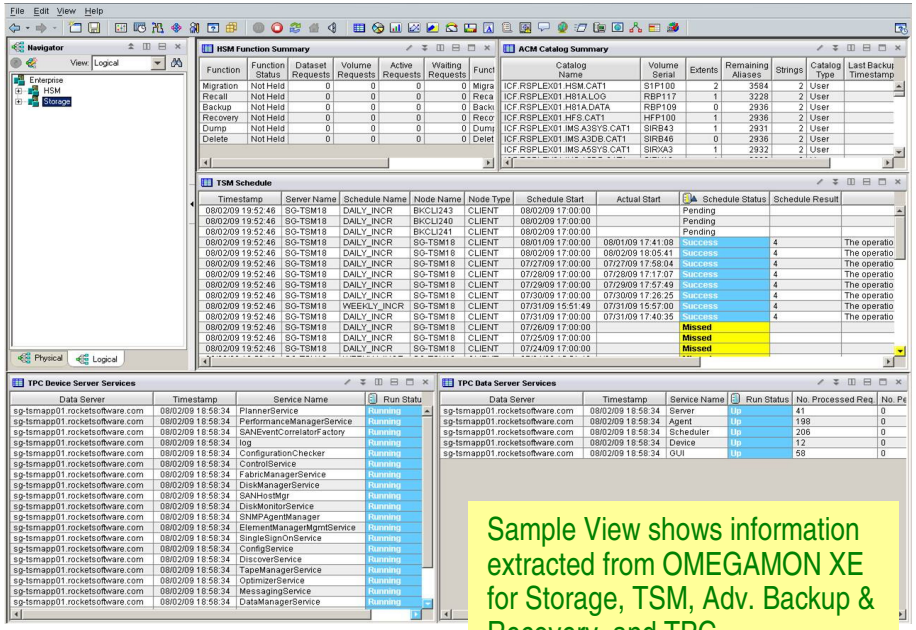
Separate teams using common tools and processes can collaborate easily on problem determination and resolution, breaking down the silos

Intelligent tooling and knowledge capture reduces 24x7 reliance on experienced “gurus”.



Enterprise Storage Integration:

- Newer SOA workloads introduce the need for enterprise-wide (cross-platform) management of storage issues which can impact business applications
  - Today using OMEGAMON Dashboard Edition (DE) we can create views of storage information that span both System z and Distributed storage encompassing:
    - OMEGAMON XE for Storage
    - Advanced Catalog Management
    - Tivoli Storage Manager (TSM)
    - Tivoli Productivity Center (TPC)
    - Advanced Backup & Recovery for z/OS
    - Advanced Audit for DFSMShsm
    - Netview
    - IBM Tivoli Monitoring (distributed)
    - Tivoli System Automation (TSA)
    - and more….



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IBM Tivoli System z Storage Management

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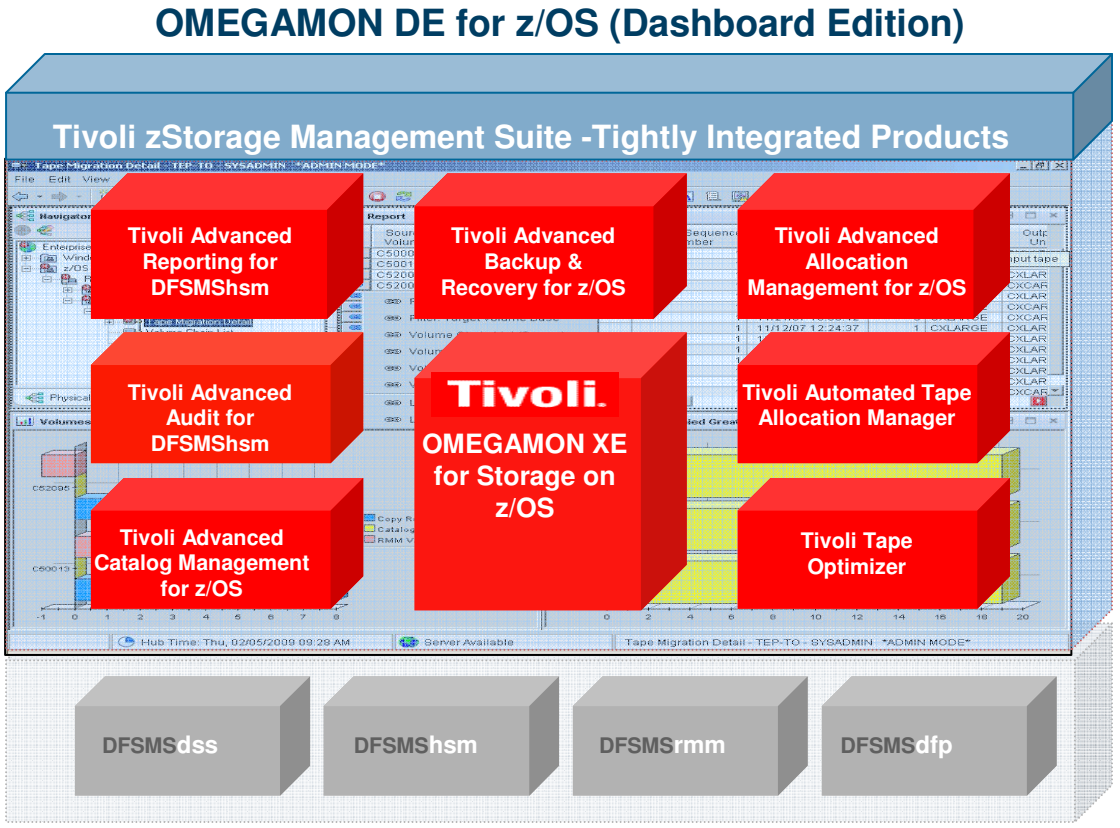
IBM Tivoli System z Storage Management Solution

- **Robust Tools to monitor and manage *heterogeneous* System z Storage from an application basis as well as physical devices**
- **Powerful Integration of System z Storage information via Tivoli Enterprise Portal (TEP)**
- **Link dynamically across products**
- **Take action directly from TEP and automate tasks and preplanned corrective actions.**
- **Flexible real-time and historical reporting options**
- **Simple maintenance & upgrade**
- **Reduce resource usage and energy consumption!**
- **Standardize System z Storage Tools - Reduce dependency on 'gurus'**
- **Increase staff productivity and learning curves**



IBM Tivoli System z Storage Management

- IBM Tivoli Solution Addresses Key Storage Management Issues:
  - Application Performance
  - Efficient Device Management
  - CPU & Storage Cost
  - Storage-Related Outages
  - Data Integrity
  - Storage Administration Productivity
- Easy to use GUI interface shared with other System Management tools
  - Improves efficiency
  - Provides visibility into your storage environment
  - Gives you the control you need to manage
  - Automates repetitive or programmable actions
  - Fosters integrated management methodology (breaking down organizational silo's)
  - Reduces learning curve

System z Storage Management Solutions

Tivoli zStorage Management Suite -Tightly Integrated Products

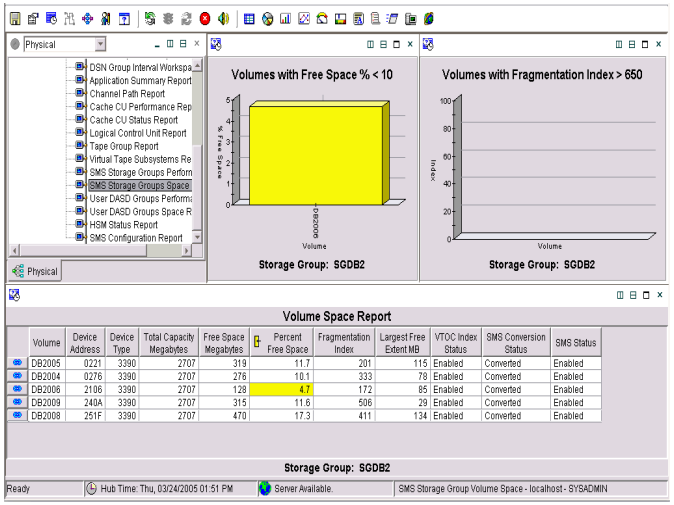
Set of tools needed by a storage administrators to monitor, automate, and tune for the day-to-day management of a complex environment

- **IBM Tivoli OMEGAMON XE for Storage on z/OS**
- **IBM Tivoli Advanced Reporting and Management for DFSMShsm**
- **IBM Tivoli Advanced Audit for DFSMShsm**
- **IBM Tivoli Advanced Catalog Management for z/OS**
- **IBM Tivoli Advanced Backup & Recovery for z/OS**
- **IBM Tivoli Advanced Allocation Management for z/OS**
- **IBM Tivoli Automated Tape Allocation Manager**
- **IBM Tivoli Tape Optimizer**

- IBM Tivoli OMEGAMON XE for Storage on z/OS
  - Monitor and manage in both real-time and historical space, performance, offline storage, DFSMShsm activity, DFSMSdss, track applications (ASIDs), take actions and expert advise minimizing and avoiding outages while improving efficiency
  - Integration with other solutions via TEP, cornerstone in a storage management tool box
- IBM Tivoli Advanced Reporting and Management for DFSMShsm
  - Provides deep dive reporting of DFSMShsm logs, identify inefficient HSM migrations, maximize the efficiency of your DFSMShsm day to day activity and environment
- IBM Tivoli Advanced Audit for DFSMShsm
  - Ability to quickly audit, identify and correct DFSMShsm errors that cause costly outages, waste of resources, and time
- IBM Tivoli Advanced Catalog Management
  - Provides the capability to manage your ICF Catalogs, audit alias, view structures, and make sure that your ICF catalogs and tape environments are backed up appropriately for forward recovery, preventing costly outages
- IBM Tivoli Advanced Back and Recovery for z/OS
  - Identify critical application data. track & validate Backups, recover ***Fast*** from Disasters or Local Outages
- IBM Tivoli Advanced Allocation Management
  - Ensures no costly space allocation problems by avoiding X37 abends & NOTCAT2 conditions
- IBM Tivoli Automated Tape Allocation Manager
  - Share tape resources in across sysplexes, or in a non-sysplex environment, maximizing your investment
- IBM Tivoli Tape Optimizer
  - Tape copy and stacking solution for data residing on tape storage devices (DFSMSrmm environments)

OMEGAMON XE for Storage on z/OS v420

- **A mainframe STORAGE monitor, real-time and historical**
- **Powerful alerting and "Take Action" capability**
- **Daily Storage management capability and functions**
- **A wide breadth of mainframe storage information:**
  - **Space and Performance management (storage groups all the way down to data set groups, define your own for reporting)**
  - **Tape / VTS**
  - **Channels (FICON), Control Units, CACHE**
  - **DFSMShsm (View and administer your active HSM queues, control Datasets, etc.)**
  - **DFSMShsm / DFSMSdss / ICKDSF / IDCAMS online toolkit**
  - **Batch JCL creation from toolkit – any JCL**
  - **SMS constructs**
  - **DS8000 support**
  - **Ability to see all logical volumes on a physical disk**
  - **Powerful applications view**
  - **Powerful dataset view and action capability**
  - **Integration capabilities from TEP interface to**



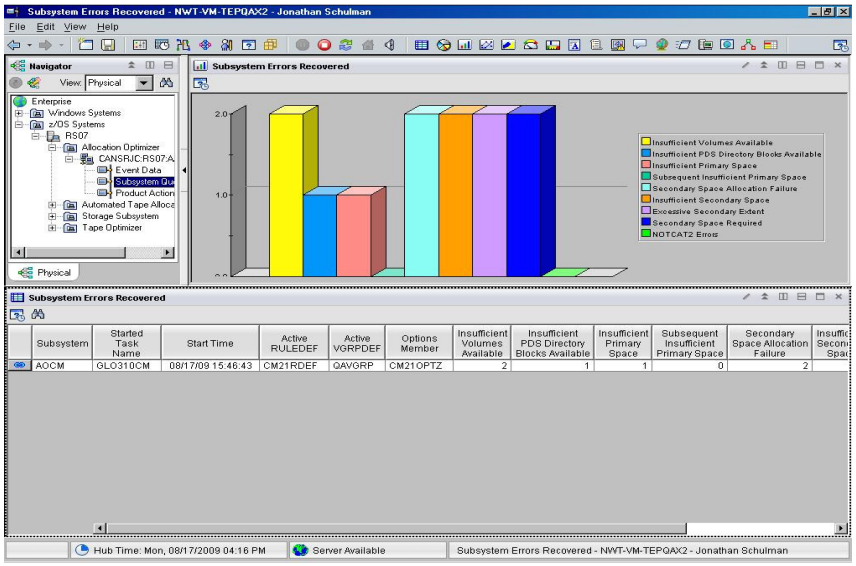
- **Dynamic Workspace Linking to:**
  - IBM Tivoli Advanced DFSMShsm Reporter (ITAARD)
  - IBM Tivoli Advanced DFSMShsm Audit (ITAAD)
  - IBM Tivoli Advanced Catalog Management (ITACM)
  - IBM Tivoli Advanced Backup and Recovery (ITABR)
  - IBM Tivoli Advanced Allocation Manager (ITAAM)
  - IBM Tivoli Tape Optmizer (ITTO)
  - IBM Tivoli Automated Tape Allocation Manager (ATAM)
- **DFSMSrmm reporting and toolkit functions**

Cornerstone for every zStorage management Tool box!

Advanced Allocation Management for z/OS

Formerly Tivoli Allocation Optimizer:

- Enables users to avoid and recover from X37 type abends such as B37, D37, and E37 abends and NOTCAT2 situations
- Provides ability to simulate changes before implementing
- Handles all DASD data sets, both SMS and non SMS-managed (VSAM and non-VSAM). Used with SMS, ***all*** unsuccessful DASD allocations are eligible for recovery
- Maximizes use of the current volume before attempting to allocate additional volumes - dynamically adjusting catalog and control blocks only when an extent is needed
- Limits fragmentation of a data set on a single volume and across multiple volumes, preserving valuable catalog space and memory-based control block storage
- TEP integration and take-action makes it easy to see issues and intervene

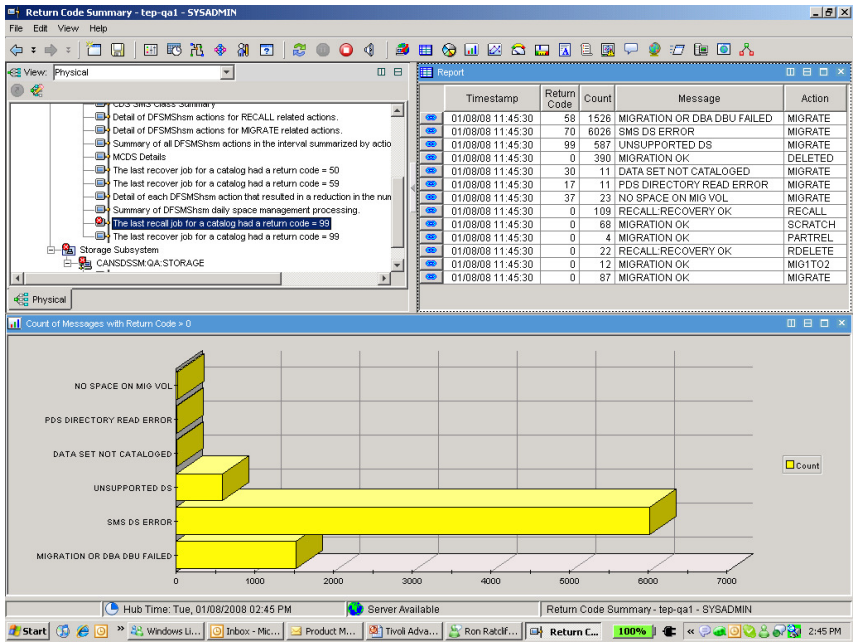


New in V3.1 - Overall Control of Allocation

- Greater control with SMS and non-SMS
- Non-SMS volume group definition
- Re-direction of unit type
- Allocation based on variety of variables
- Non-SMS placement based on resource metrics
- Set or override over 50 allocation attributes
- Make DATACLAS, override JCL

Advanced Reporting and Management for DFSMShsm

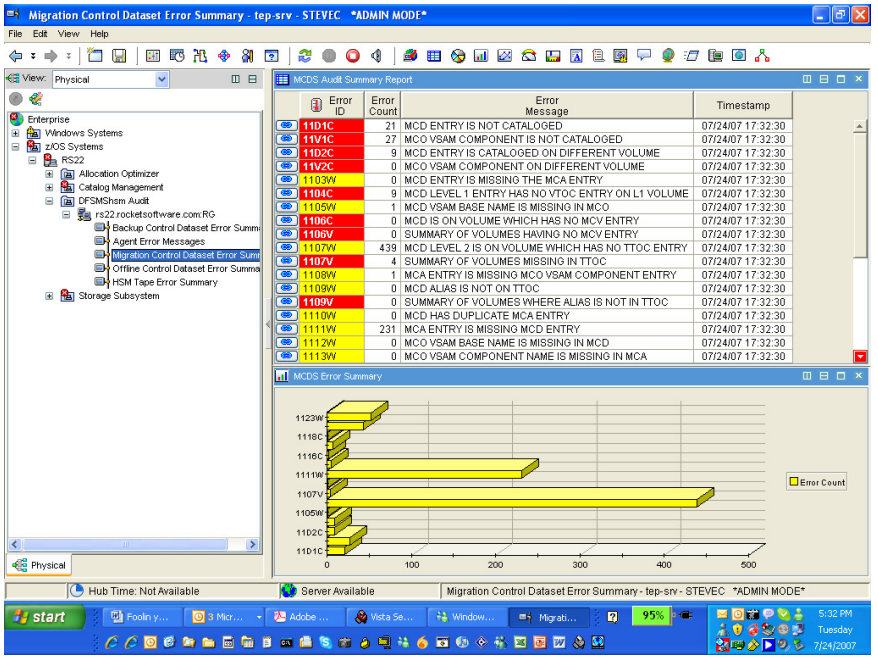
- **Provides Detailed HSM Reporting Capability**
  - Daily Health Reports
    - Provides reports for:
      - DFSMS Mounted Volumes
      - DFSMShsm Managed Volumes
      - DFSMShsm Space Management
      - DFSMShsm Automatic Backup
      - DFSMShsm Autodump Activities
    - Automatic Spreadsheet Charting
  - Ad-hoc reports
    - Fast and highly interactive
    - Easily find areas of concern
      - Drive the view to the area of concern
      - Look around, Act on what you see
  - Perform "what-if" analysis
    - Migration thresholds
    - Recycle percent valid
  - "Plans" Feature makes new reports simple to create and save
    - Provides filtering logic so you can drill down
  - Automated command generation
    - Allows wrapping action commands around listed data sets
    - Go from "Now I know what to do" to "I've already done it"
    - Add your own customized commands to the command library



- **TEP Interface makes it much easier to detect and diagnose problems – even linking to other products, and supports key take-action commands issued from the TEP**
- **Easy-to-Use ISPF User Interface**

IBM Tivoli Advanced Audit for DFSMShsm

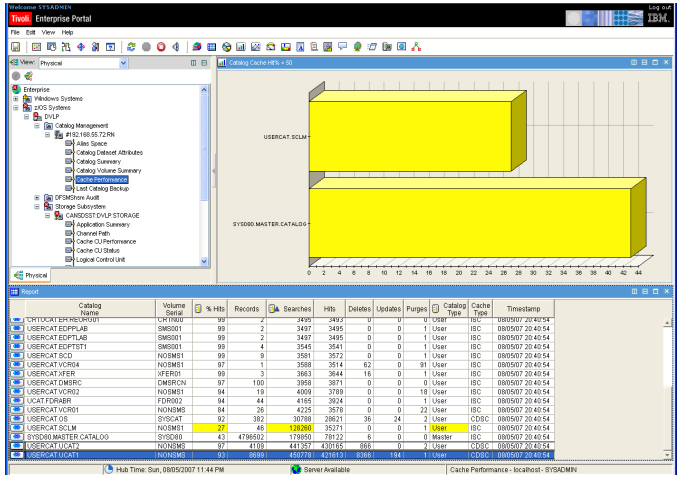
- Audits, repairs, and ensures integrity of the DFSMShsm environment, including tape.
- Automates data collection and corrective actions
- Proactive notification and alerts to critical problems which can be expertly resolved before a system outage occurs
- Finds and can correct 100% of DFSMShsm errors
- Prove integrity of DFSMShsm environment
- Operates many times faster than native DFSMShsm commands, without performance impact on DFSMShsm
- Ease-of-Use and performance permits regular rather than periodic audits
- TEP Interface makes it much easier to detect, drill down, and diagnose problems – even linking to other products, and allowing key actions to be intitiated from the TEP in response to situations

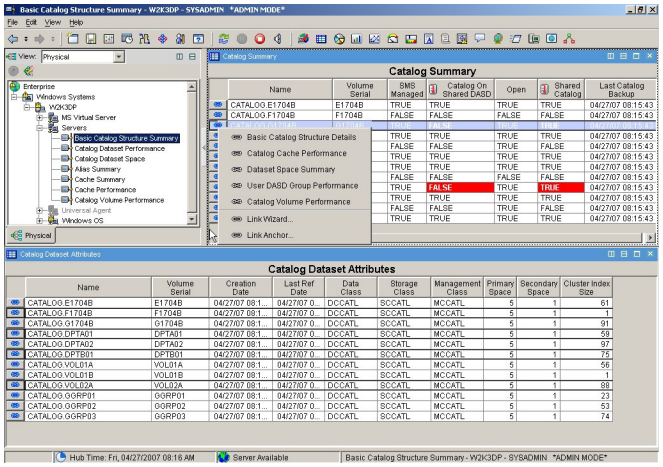


Regular HSM audits help Maintain the complex data structure of the DFSMShsm Control Datasets (CDS) to prevent outages and improve efficiency

Advanced Catalog Management for z/OS

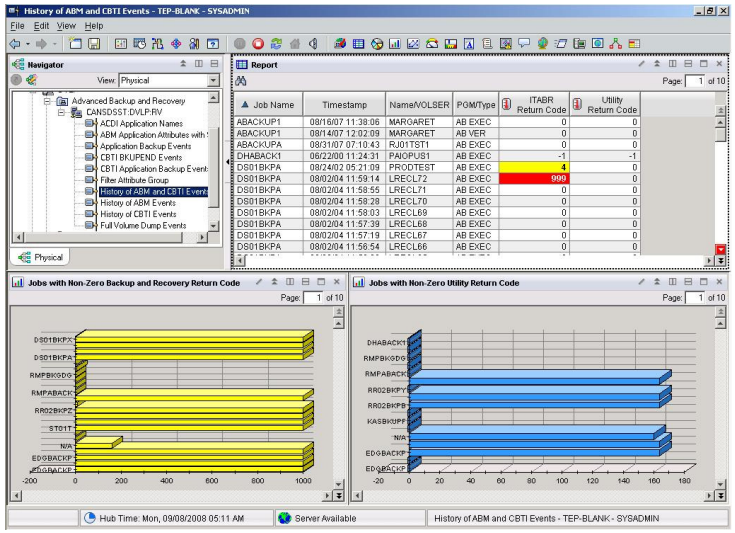
- Provides powerful, safe, reliable, and easy ICF catalog and VSAM backup and *fast* forward recovery
- Protects a catalog's complex structural integrity, alerts for potential errors, and reduces recovery time
- Helps meet Service Levels: reduces application down-time by permitting catalog maintenance while open
- New Merge-while-open capability is key for Customers who are undergoing merger activity or datacenter consolidation
- Allows "what-if" simulation to preview effects of actions
- Easy-to-use interface improves staff productivity
- TEP Integration and Take-Action capability makes it easier to detect, drill down, diagnose, and correct problems involving catalogs – even linking seamlessly to other products like OMEGAMON XE for Storage.

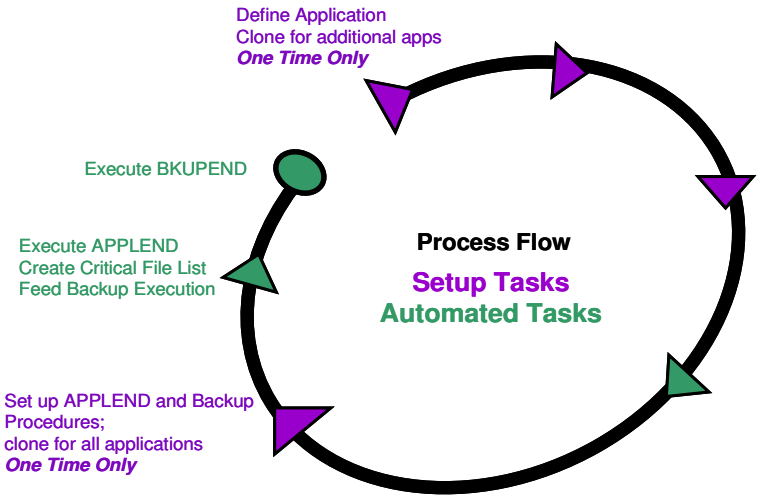




Advanced Backup & Recovery for z/OS

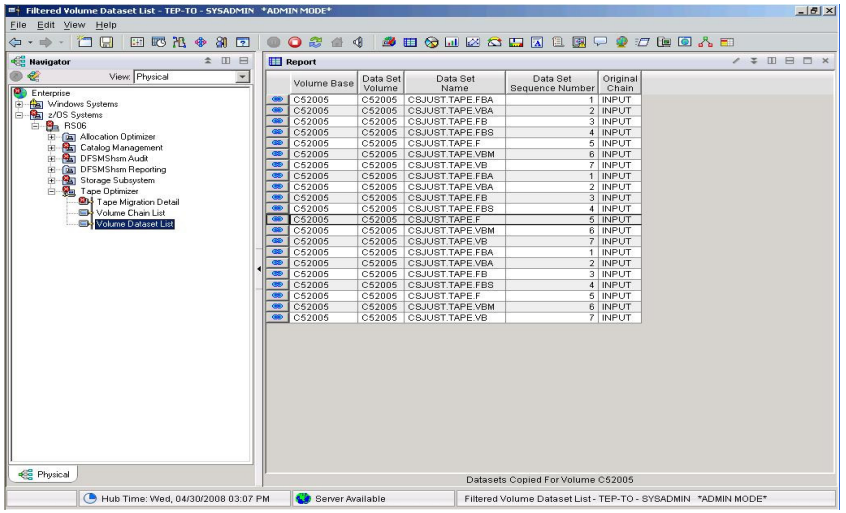
- **Single Toolset to automatically**:
  - Identify critical application data
  - Track & Validate Backups
    - Where they are
    - Currency
    - Support removable or non-removable media types
  - Recover ***Fast*** from Disasters or Local Outages
    - Either at Local or DR site
    - From one central location
    - With one simple process
  - Eliminates guesswork and manual processes
  - Eliminate duplicate backups
  - Comply with governance requirements – always be audit-ready!
  - Easy to use TEP interface makes it easy to stay on top of backup status and spot problems before they cause outages!

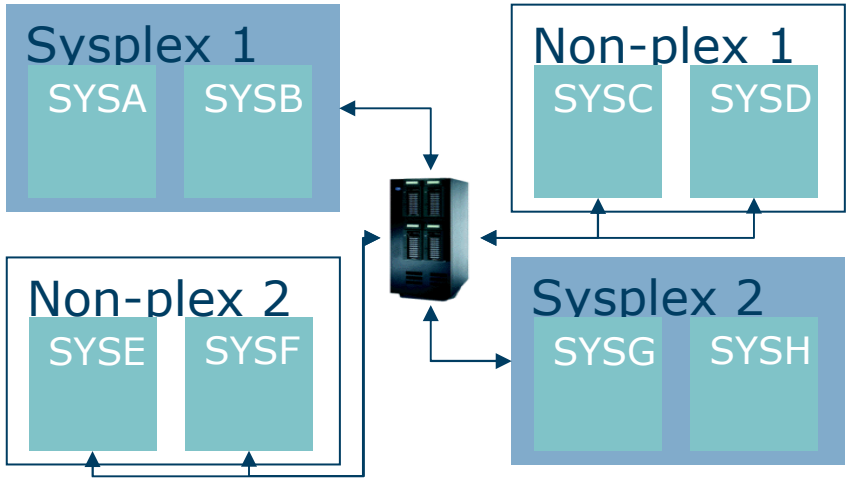




Automated Tape Allocation Manager for z/OS

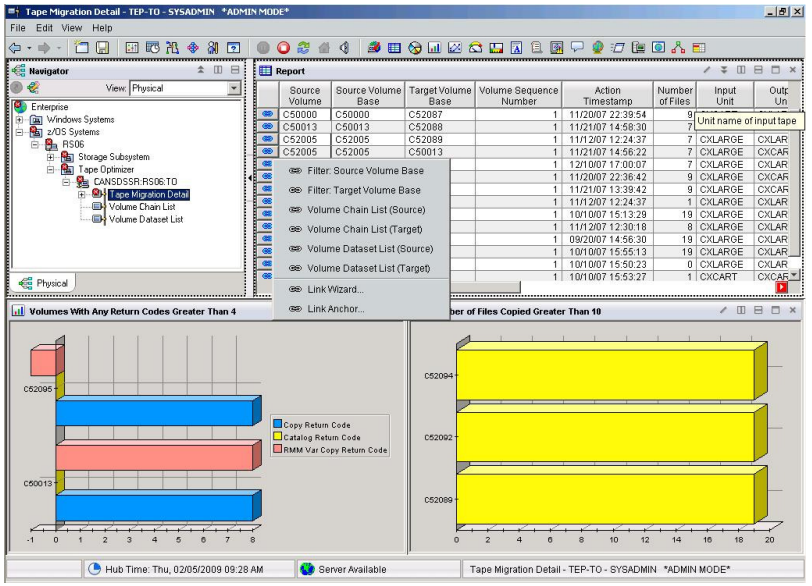
- **Automated Tape Allocation Manager (ATAM):**
  - Share tape devices between multiple images: sysplex, nonplex, multiple standalone in any combination - even legacy devices such as 3420
- **Improves Operational Efficiency:**
  - Maximize the use of existing tape devices
  - Reduce operational overhead
  - Minimize backlogs of job requests
  - Improve ROI on tape hardware investments
  - Support hardware acquisition decisions
  - Single Point of Control without the Single Point of Failure – no shared control file to fail
  - Responds automatically and directly to user/job resource requests at "machine speed" instead of "operator speed"
  - Real-time and historical reporting – built-in
  - TEP Integration and Take-Action capability makes it easier to detect, drill down, diagnose, and correct problems – even linking seamlessly to other products as needed





Tivoli Tape Optimizer

- Copy individual tape data sets by name, expiration date, catalog status, and many other filter criteria
- Optionally rename tape data sets during copy operations
- Support for 3592 tape drives and high-capacity tape media
- Optionally continue copy processing after certain types of failures or errors, such as tape I/O errors
- Uses relative generation data group (GDG) catalog entries to help identify generation data sets for a copy request
- Edit copy options for requests pending restart
- Run multiple, concurrent copy tasks for a copy request
- Reporting for stacked tapes
- TEP Integration and Take-Action capability makes it easier to detect, drill down, diagnose, and correct problems – even linking seamlessly to other products as needed



- Use Full Tape Media Capacity – reduce waste
- Automatically updates DFSMSrmm
- Ensures system catalog accuracy

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