IBM Tivoli Storage Productivity Center 4.1 (TPC)

Technical Overview

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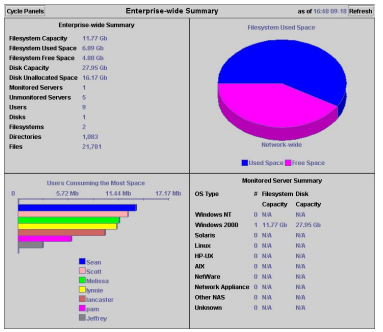
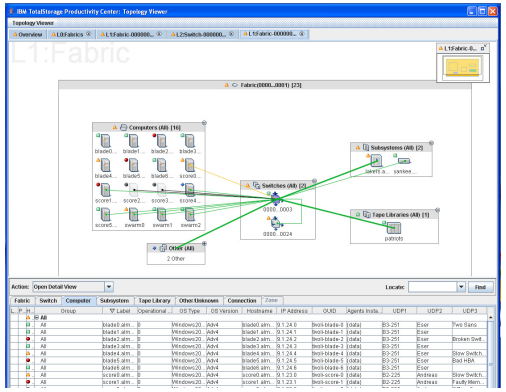
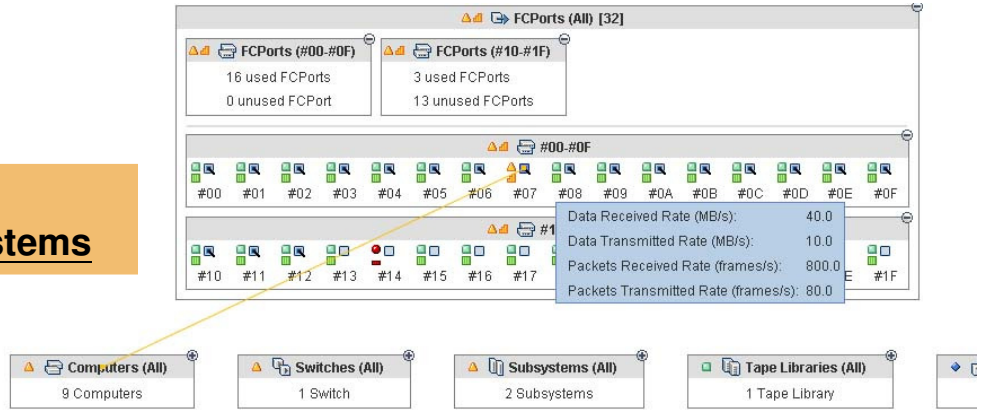
IBM Tivoli Storage Productivity Center

End to End Storage Management

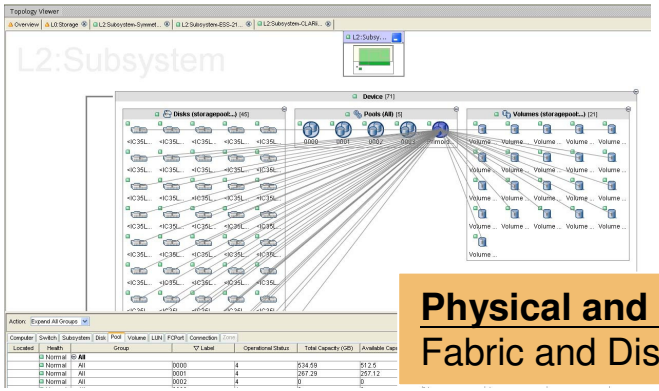




Automated identification of the storage resources in an infrastructure and **analysis** of how effectively those resources are being used.



Centralized Management of multivendor SAN and Disk Systems



Physical and Logical views of Fabric and Disk

Automated control through policies that are customizable with actions that can include centralized alerting, distributed responsibility and fully automated response.

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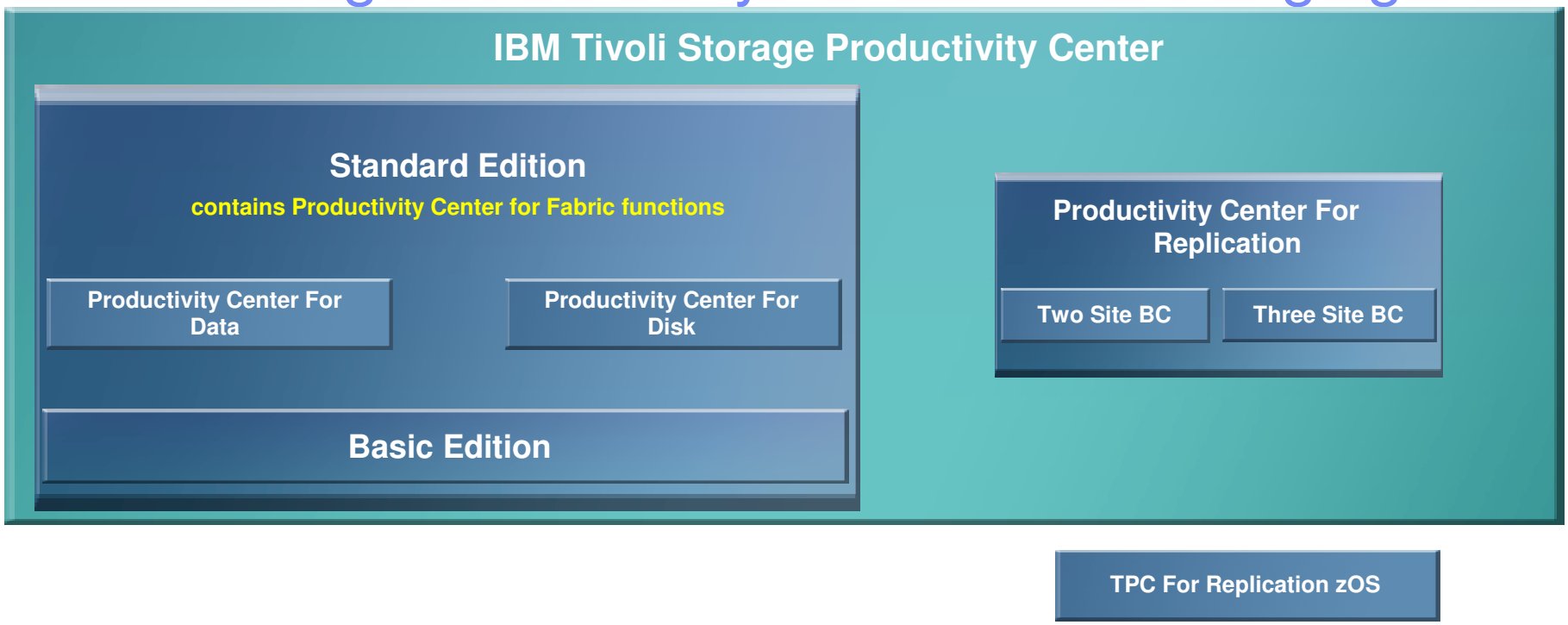
Tivoli Storage Productivity Center 4.1 Packaging



- TPC for Fabric is no longer separately orderable
- Features and Functions specific to TPC for Fabric are now available only through a TPC Standard Edition license

- TPC for Replication is always installed with any version of TPC 4.1 (With the exception of TPC-R zOS)
- TPC for Replication can be launched from TPC GUI
- Use of TPC for Replication still requires a separate license

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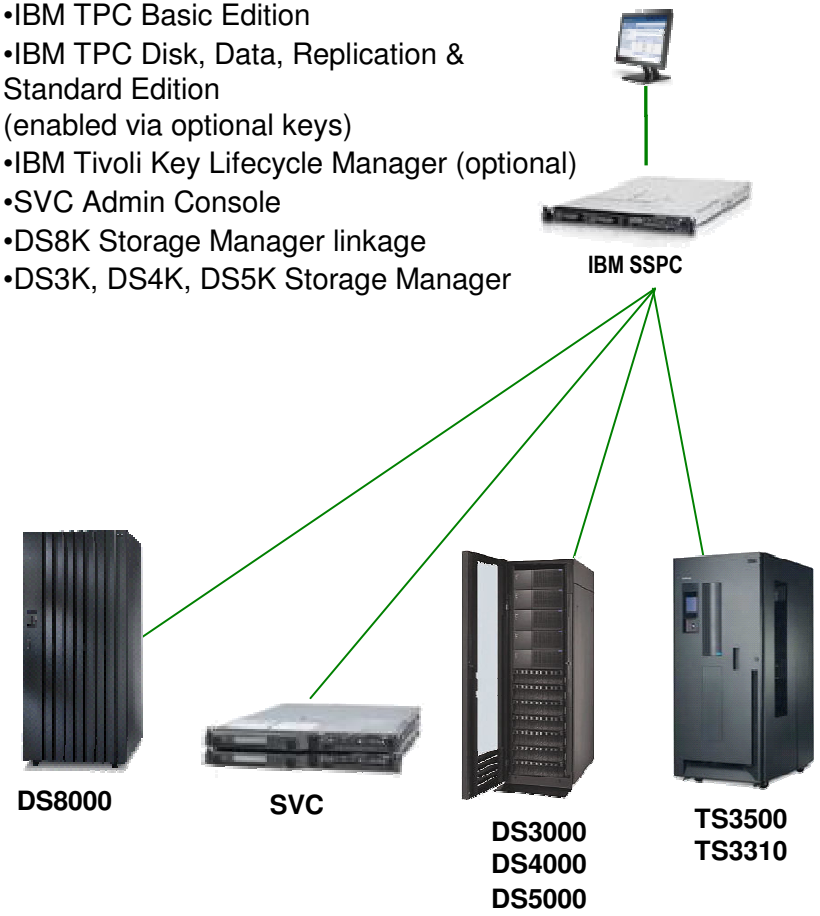
System Storage Productivity Center 1.4 (SSPC)

- **Storage appliance** for simplified configuration & management
- **Centralized server** reduces the need to install, manage & administer multiple servers
- **Usability enhancements** to decrease deployment time and simplify management operations:
  - New hardware model with improved performance capabilities
    - Quad-Core E5530 2.4GHz, 8 GB RAM, 2 x 146GB Disks
  - Windows 2008 platform improves security and performance
  - Server Recovery CD to enables customer to rebuild server to factory default
  - New security interface allows administrator to reset all system passwords
  - New publications provide concise instructions for deployment and operations

- **Administrator points browser at SSPC for enterprise storage view of multiple devices**

Pre-loaded Software:

•IBM TPC Basic Edition
•IBM TPC Disk, Data, Replication & Standard Edition
(enabled via optional keys)
•IBM Tivoli Key Lifecycle Manager (optional)
•SVC Admin Console
•DS8K Storage Manager linkage
•DS3K, DS4K, DS5K Storage Manager



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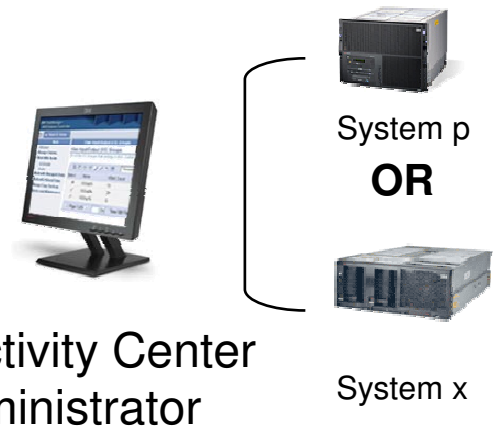
IBM Tivoli Storage Productivity Center Server Platforms

- AIX 5.3, 6.1
- RedHat Enterprise Linux Advanced Server 4, 5 on Intel
- Windows 2003 SE or EE, Windows 2008 on Intel



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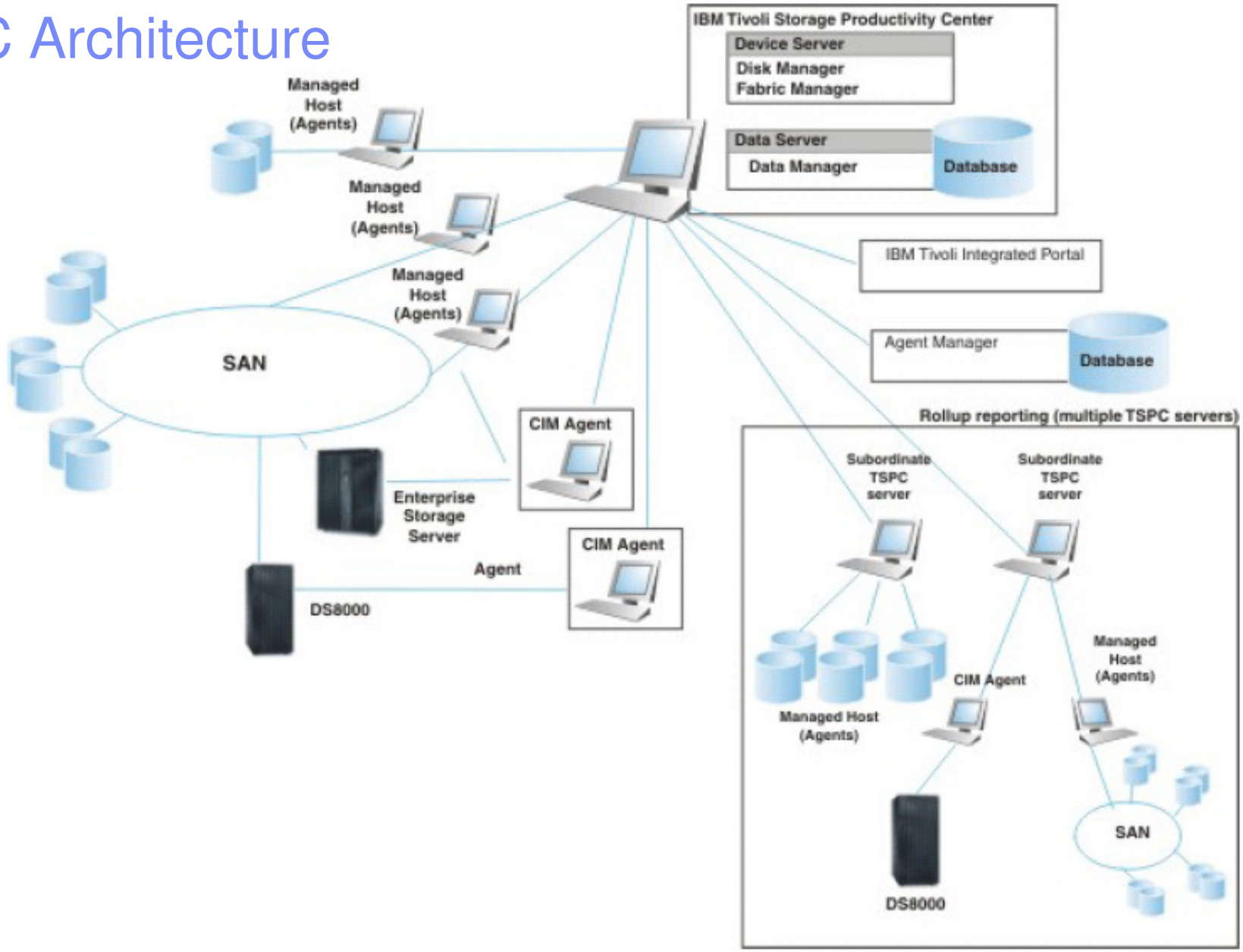
TPC Architecture



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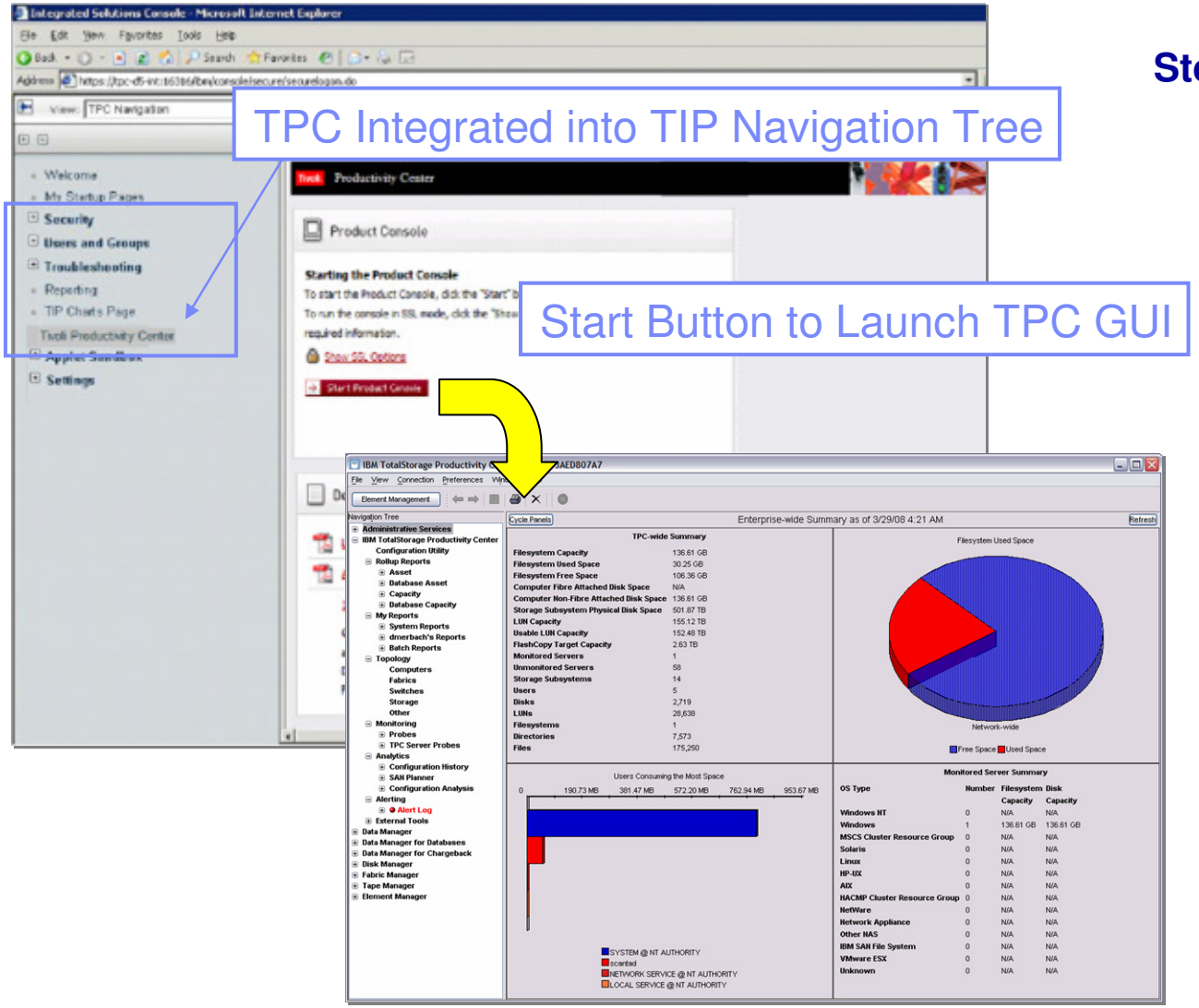
Storage Administration Portal



Storage Administration Portal

- **Tivoli Integration Portal (TIP)** integration enables single management dashboard for many Tivoli products
- **Common security** enables role-based authorization across products
- **Common reporting** interface provides ability to generate custom reports merging data from multiple products

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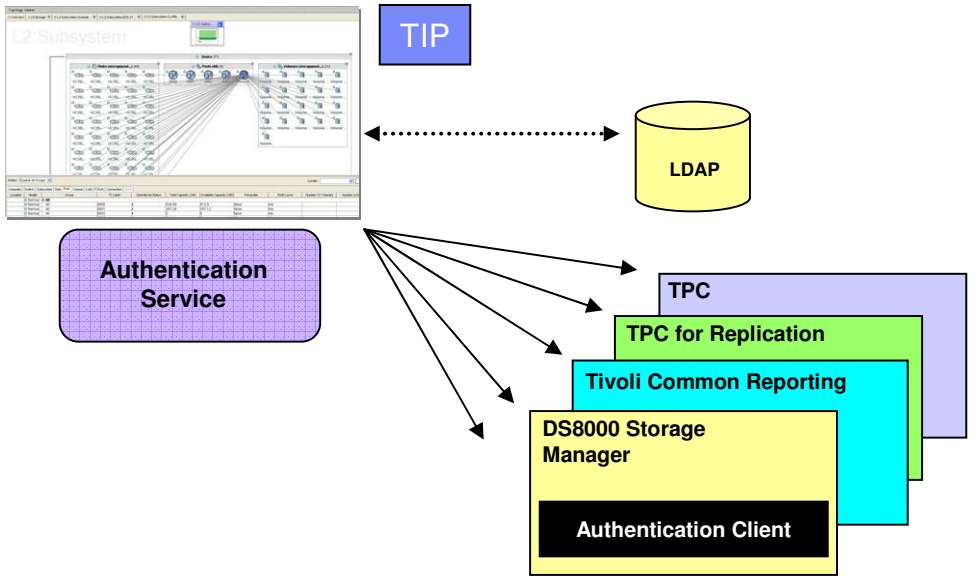
Single Sign-On & Launch-in-Context

- **Basic (OS) and enterprise level (LDAP) authentication**
  for element managers and other applications that plug in to TPC and System Storage Productivity Center (SSPC)
- **Enables single sign-on**
  for element managers and other applications that plug in to TPC and SSPC **Credentials**
  are automatically passed between applications via LTPA tokens and validated by ESS Server
- **Enables launch-in-context**
  to and from other applications



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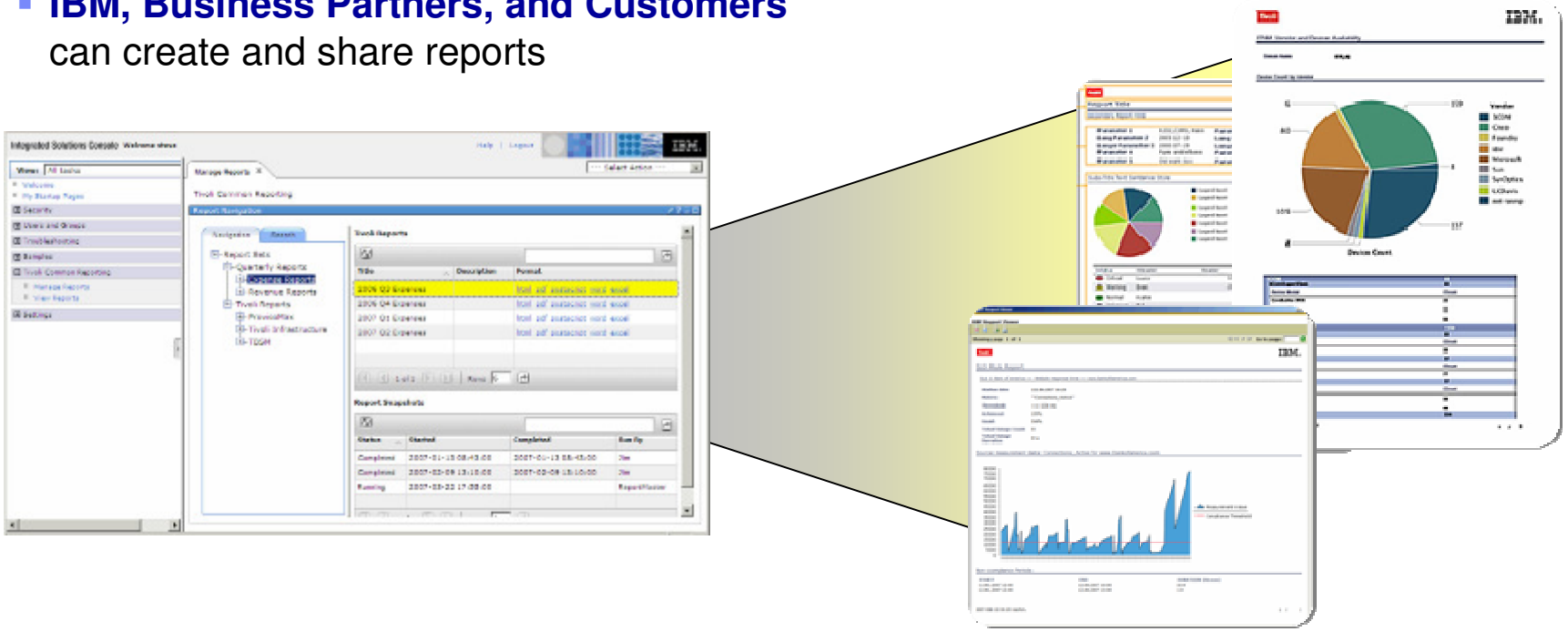
Custom Reporting – Executive Level Reports

- **Enhanced reporting capabilities**
  providing unlimited combinations and views of capacity, performance, and asset reports derived from TPC data
- **Downloadable Best Practices Reports**
  can be plugged in, including cross-product reports using data joins
- **IBM, Business Partners, and Customers**
  can create and share reports



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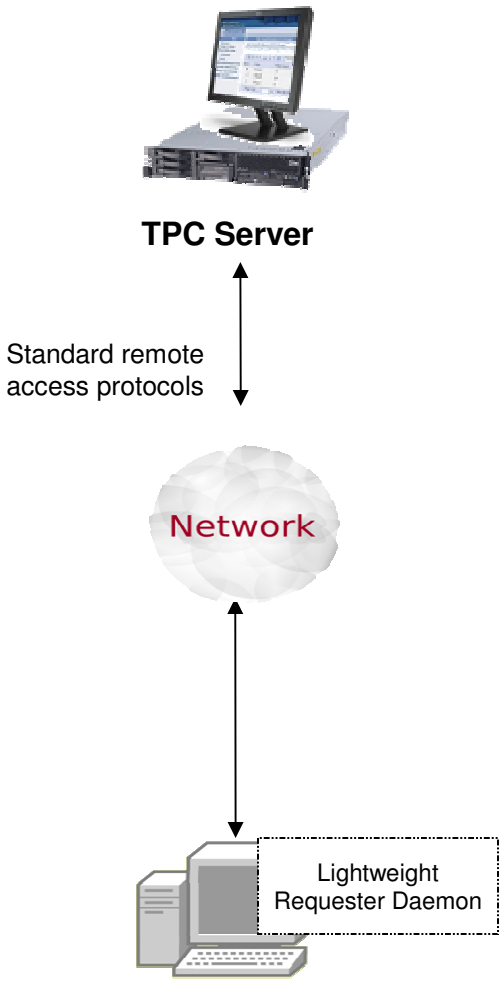
Lightweight Storage Resource Agents – Set it, Forget it



- **Collect asset and capacity data** from supported servers without manually installing an agent on the target server
- **Lightweight native code** remotely pushed to servers for data collection and quiesced at completion
- **Improved performance and memory footprint** of local process, consuming less than 10 MB of memory when in use
- **Simplifies server data collection** and reduces administrator burden of managing and monitoring agents. Agents are automatically updated from the TPC server when a new version is available

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IBM Tivoli Storage Productivity Center Master Console

- **Single Management Server**
- **Single Database**
- **Single Management Interface**
- **Single Point of Control**
- **Master Console**
  - Robust SAN and Storage topology viewer
  - Role based administration
- **Leading edge Topology Viewer**
  - Allows for layered drill down capabilities without complexity
  - Relationships between hosts, fabric components and storage systems

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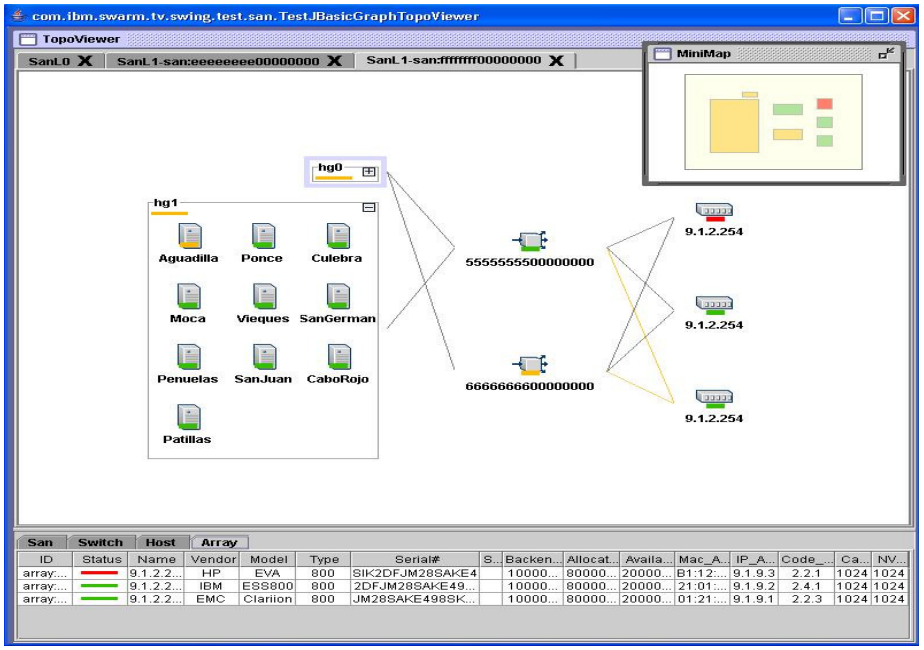
TPC Topology Viewer

- **Role based Administration**
- **Multiple topology views with drill up/down**
  - Server
  - SAN Fabric
  - Storage Subsystem
- **Synchronized Graphical and Tabular views**
- **Minimap for overall context**
- **Progressive Information Disclosure on demand reduces complexity**
- **Semantic zooming (drill down and expand in place)**
  - Allows navigation while maintaining task, situational and spatial orientation
  - Reveals, hides or aggregates details rather than simply scaling objects
  - Provides effective scaling
- **Health, Zoning and Performance Overlays**



Designed for 5 scenario sets:

1. **Planning** (anticipate problem areas, trends)
2. **Configuration** (allocation, zoning, masking)
3. **Monitoring** (visualization, assess health at a glance, logs)
4. **Reporting** (capacity, utilization, performance)
5. **Problem determination** (aggregated status, drill down, impacted resources identified)

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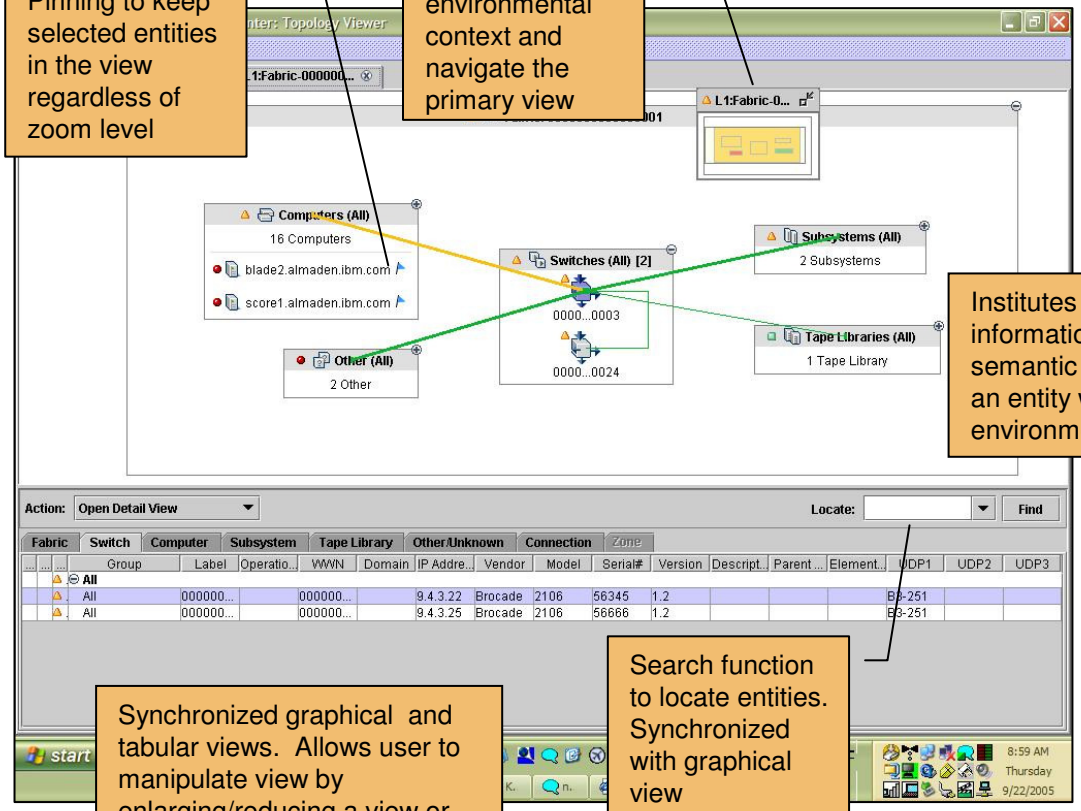
TPC Topology Viewer

Pinning to keep selected entities in the view regardless of zoom level

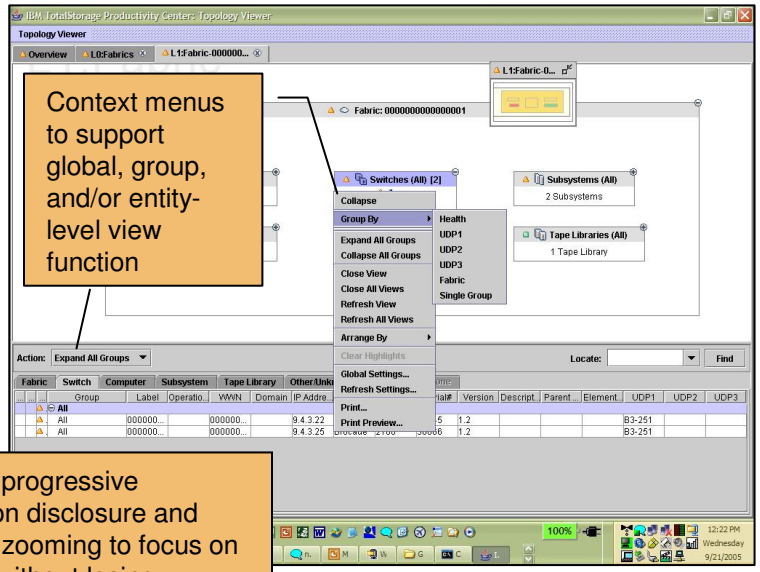
Minimap to provide environmental context and navigate the primary view



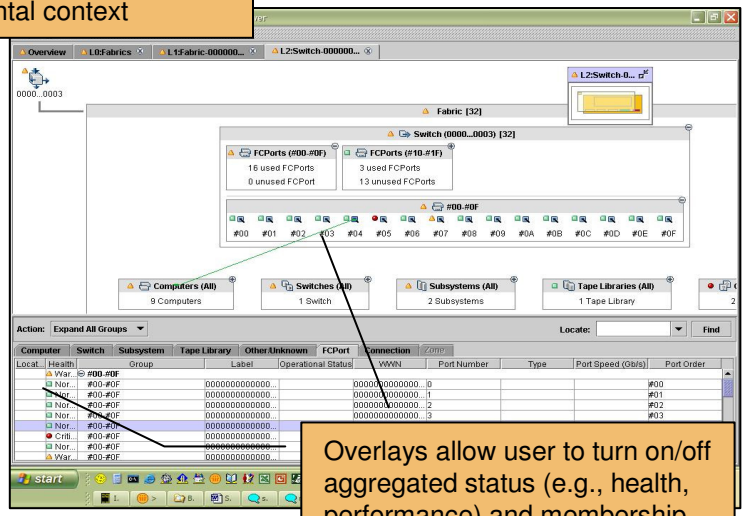
Synchronized graphical and tabular views. Allows user to manipulate view by enlarging/reducing a view or closing one of the views

Search function to locate entities. Synchronized with graphical view

Context menus to support global, group, and/or entity-level view function



Institutes progressive information disclosure and semantic zooming to focus on an entity without losing environmental context



Overlays allow user to turn on/off aggregated status (e.g., health, performance) and membership (e.g., zone, zone set) information

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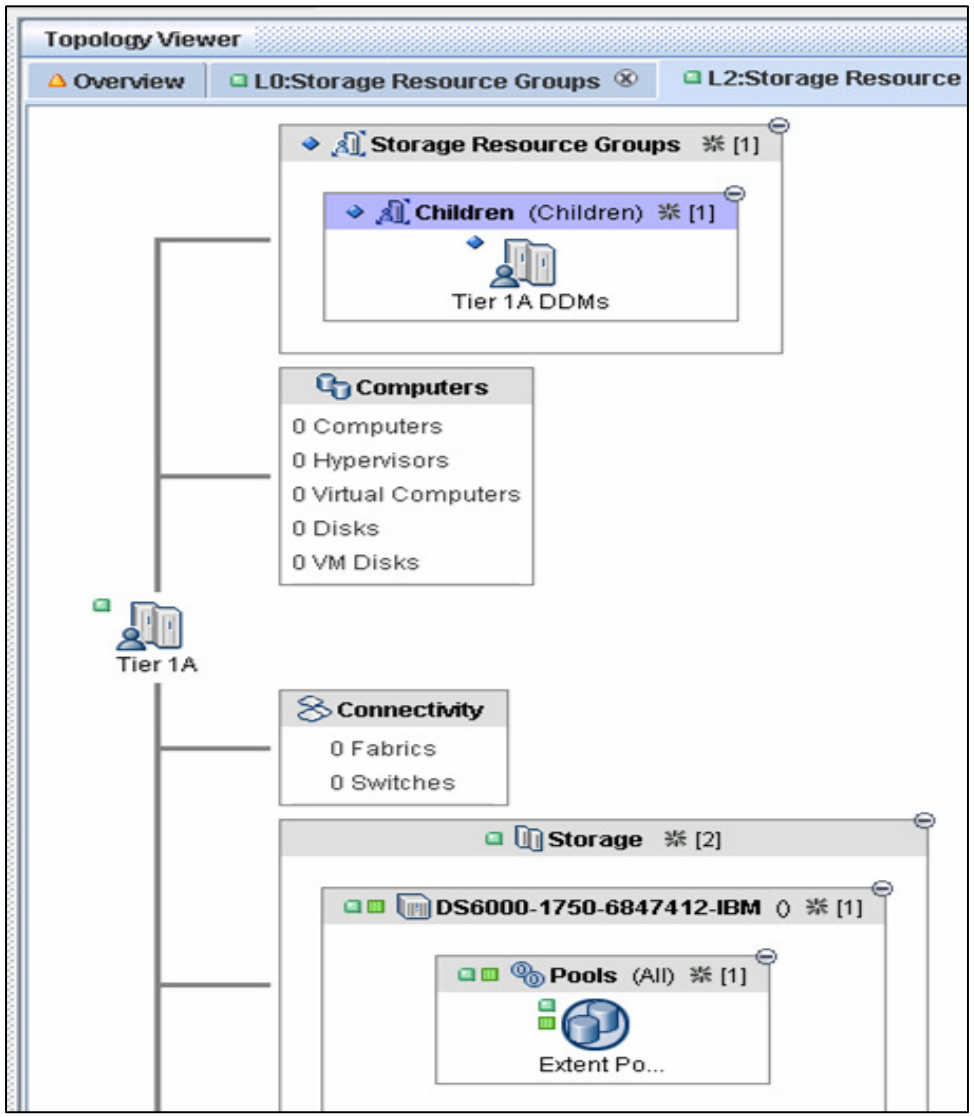
Storage Resource Groups – Select Your IT Favorites



- **Group storage resources by application,** line of business, or any other user-defined way
- **Map storage resources to organizational structure** by creating hierarchies of SRGs
- **Monitor SRG health, performance & alerts** to ensure application availability
- **Debug application connectivity & performance issues** easily by looking at SRG view in topology viewer

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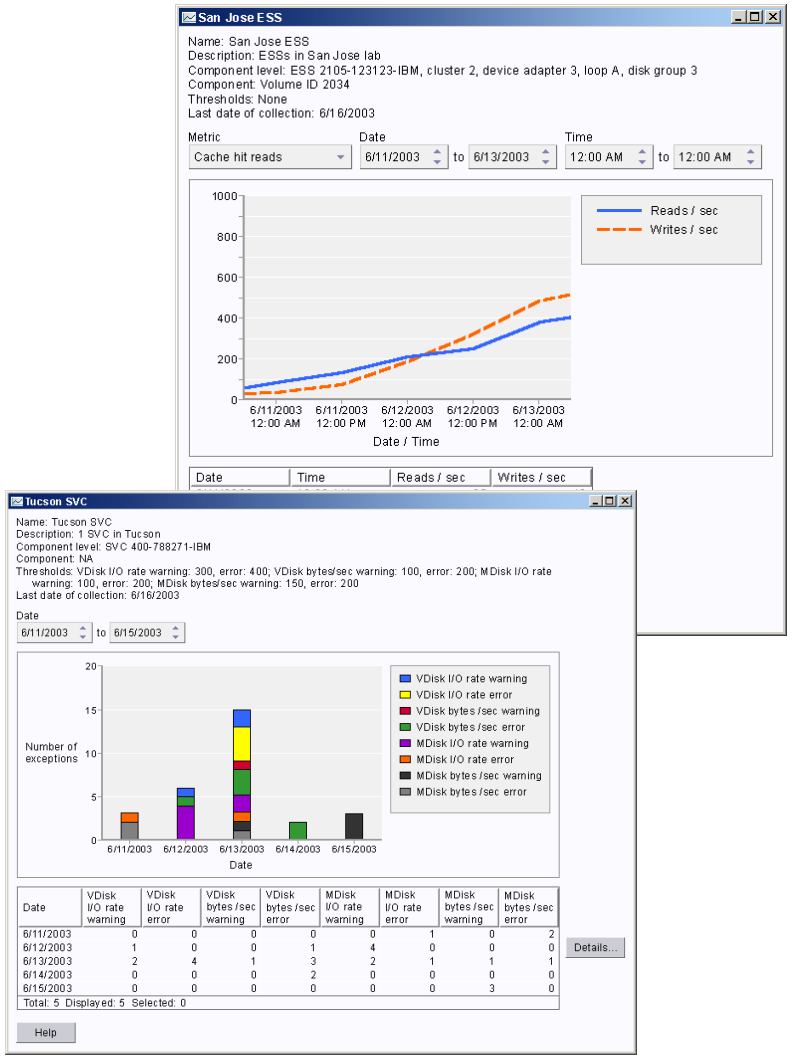
IBM Tivoli Storage Productivity Center for Disk

Key Capabilities

- **Configure multiple storage devices from a single console to improve productivity**
- **Monitor and track performance of storage devices to optimize the SAN performance**
- **Volume Planner recommends changes within your SAN storage based on existing performance workload**

Performance Management

- Collects, stores, alert on performance metrics
- Monitors and helps to tune storage



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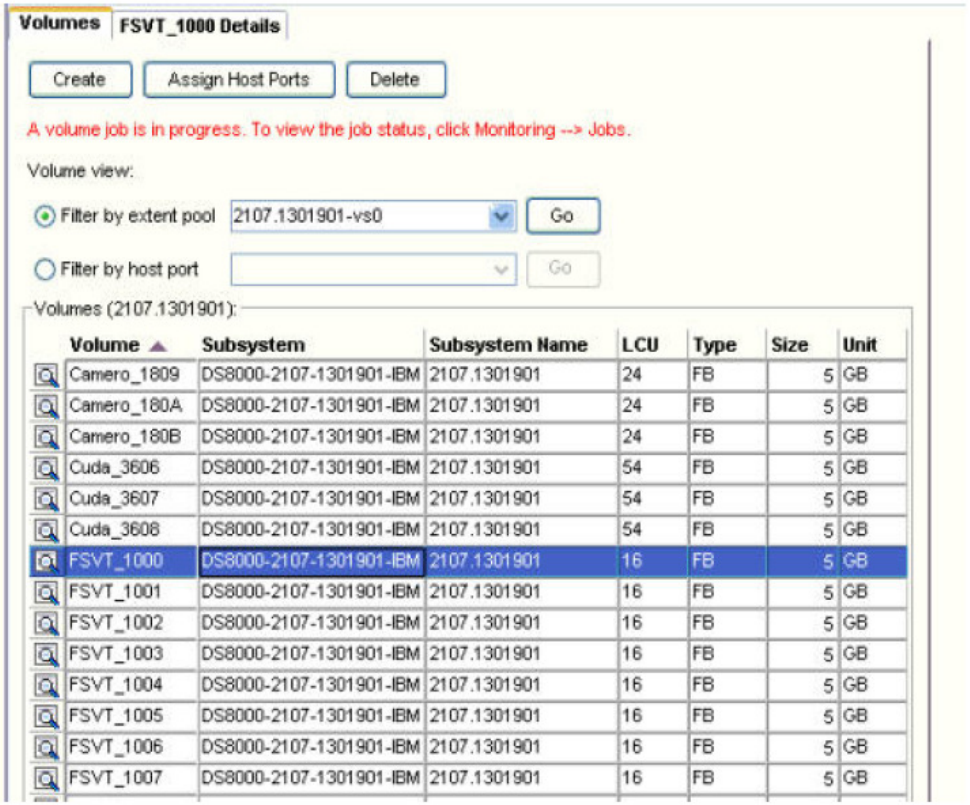
Creating Volumes with Productivity Center

- **Storage Configuration**
  - Assign Host Ports
  - Assign Volumes to Subsystem Ports
  - Create/Assign Fabric Zone
  - Define RAID Level
  - Create/Delete Volumes
  - Label Volumes



Volume	Subsystem	Subsystem Name	LCU	Type	Size	Unit
Camero_1809	DS8000-2107-1301901-IBM	2107.1301901	24	FB	5	GB
Camero_180A	DS8000-2107-1301901-IBM	2107.1301901	24	FB	5	GB
Camero_180B	DS8000-2107-1301901-IBM	2107.1301901	24	FB	5	GB
Cuda_3606	DS8000-2107-1301901-IBM	2107.1301901	54	FB	5	GB
Cuda_3607	DS8000-2107-1301901-IBM	2107.1301901	54	FB	5	GB
Cuda_3608	DS8000-2107-1301901-IBM	2107.1301901	54	FB	5	GB
FSVT_1000	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1001	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1002	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1003	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1004	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1005	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1006	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB
FSVT_1007	DS8000-2107-1301901-IBM	2107.1301901	16	FB	5	GB

Productivity Center Administrators can directly allocate storage, zone the fabric switches and assign the host ports

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Performance Management Process

- **Collect Performance Data**
  - long running job that collects performance data from the selected subsystems
- **Create Performance Reports**
  - User controls which volumes are included in the report
    - from multiple subsystems if desired
  - The report mechanism is inherently multi-component
  - Drill-up/drill-down mechanism
    - e.g. from disk array to disk volume in array
  - Display multiple metrics per component
  - View different chart presentations -- history charts or current data charts
- **Create Alerts for Threshold Violations**

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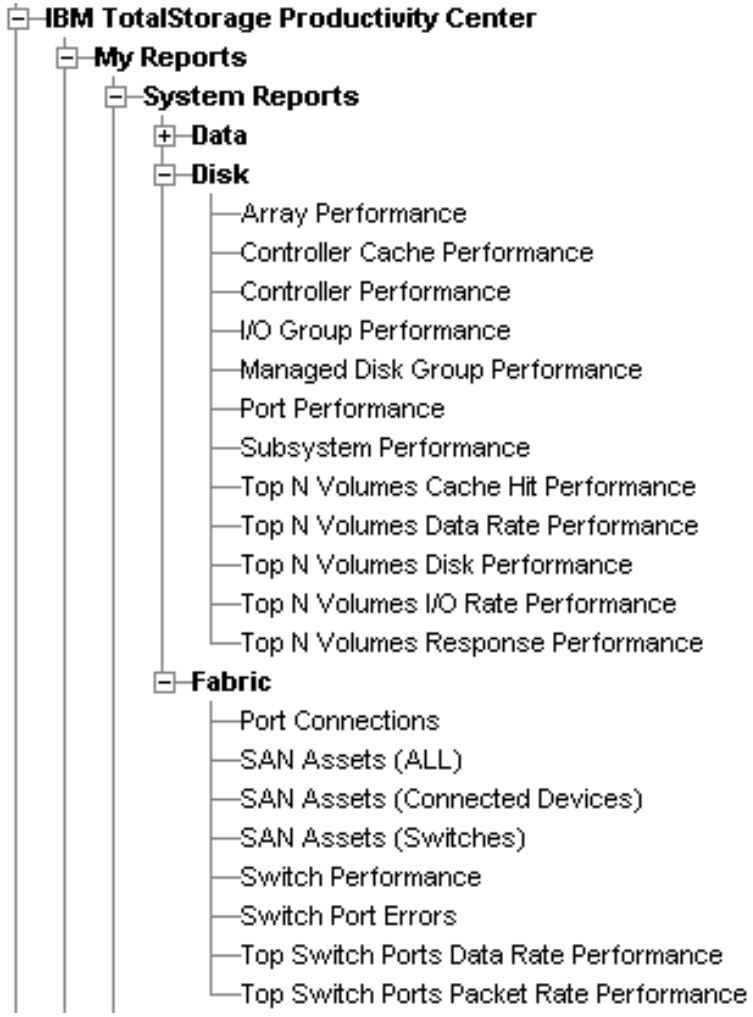
System Defined Performance Reports



- **Storage Subsystem Performance**
- **Storage Subsystem Controller Performance**
- **Storage Subsystem Controller Cache Performance**
- **I/O Group Performance**
- **Array Performance**
- **Managed Disk Group Performance**
- **Port Performance**
- **Top 25 Volumes I/O Rate**
- **Top 25 Volumes Data Rate**
- **Top 25 Volumes Cache Hit**
- **Top 25 Volumes Response Time**
- **Top 25 Volumes Disk**
- **SAN Switch Report**
- **Switch Port Error Report**
- **Top 25 Switch Ports Ops Rate Report**
- **Top 25 Switch Ports Data Rate Report**

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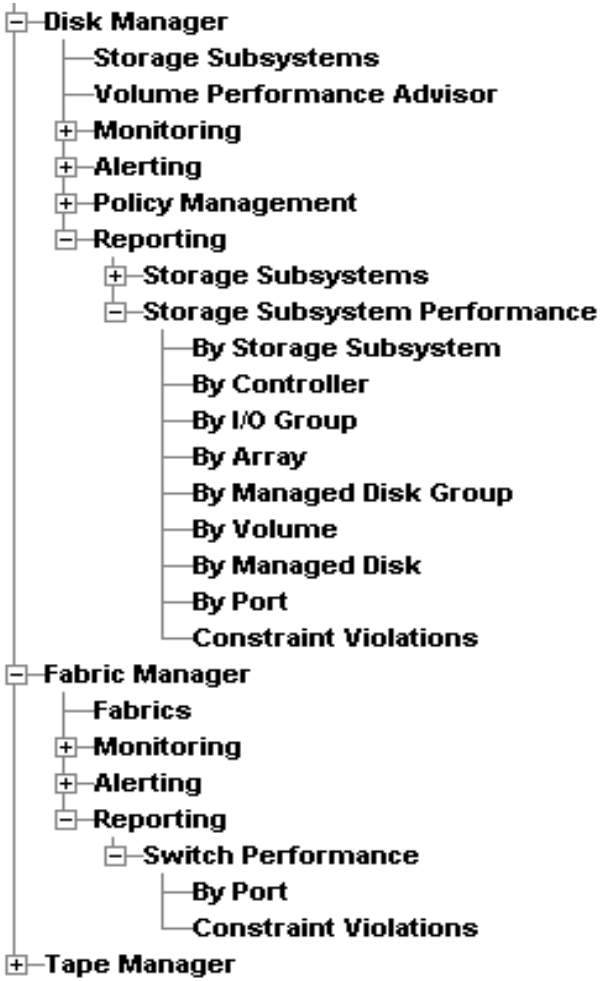
User Defined Reports



- Each user-defined report has all possible metrics available
- Report customization includes: selecting components, columns/metrics to include, what order to show, etc.
- Scheduled report run
- Generate reports in HTML or other format output files

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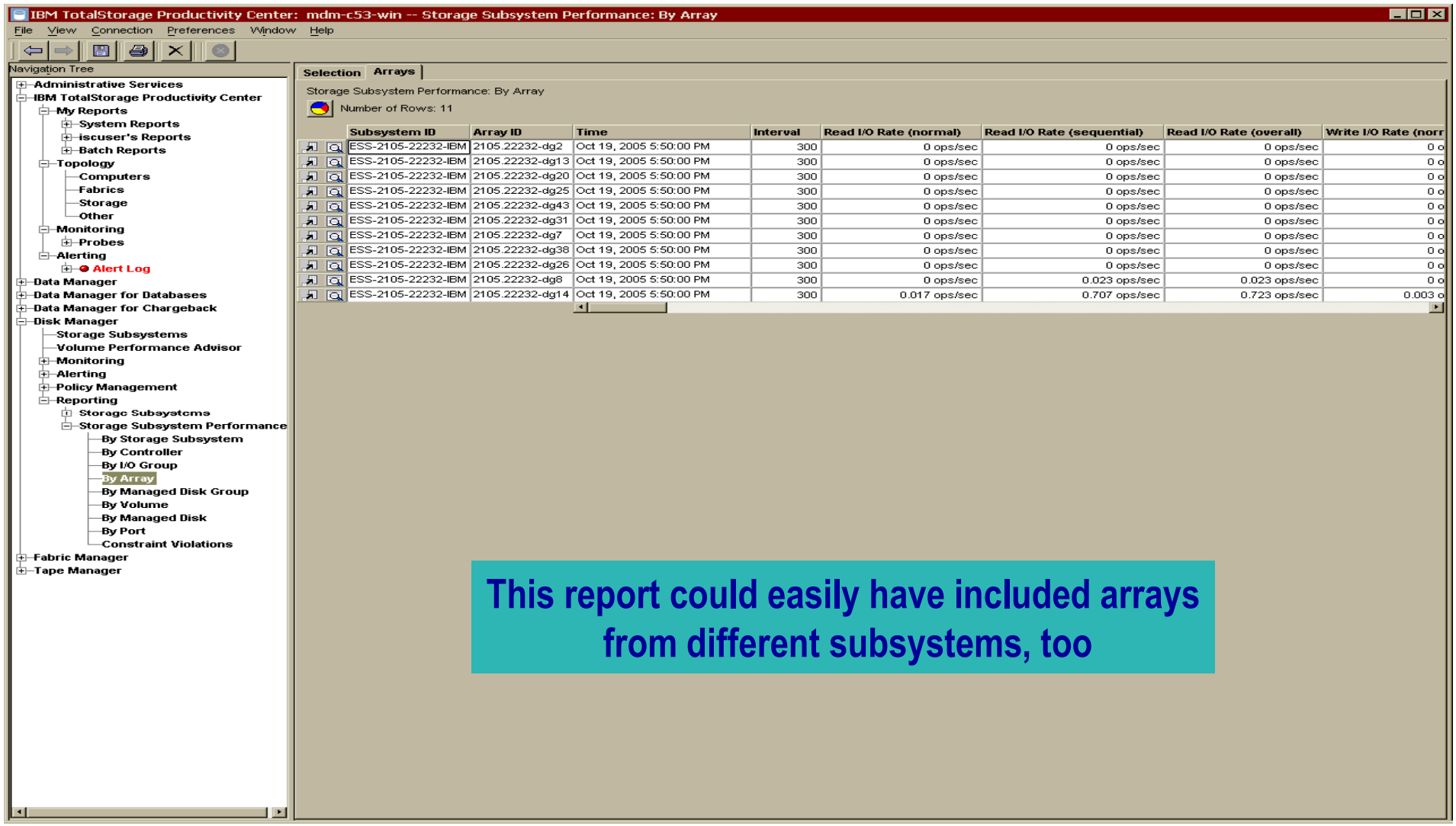
By Array Report (11 arrays on 1 Storage Subsystem)



Subsystem ID	Array ID	Time	Interval	Read I/O Rate (normal)	Read I/O Rate (sequential)	Read I/O Rate (overall)	Write I/O Rate (norr
ESS-2105-22232-IBM	2105.22232-dg2	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg13	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg20	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg25	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg43	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg31	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg7	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg38	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg26	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0 ops/sec	0 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg8	Oct 19, 2005 5:50:00 PM	300	0 ops/sec	0.023 ops/sec	0.023 ops/sec	0 o
ESS-2105-22232-IBM	2105.22232-dg14	Oct 19, 2005 5:50:00 PM	300	0.017 ops/sec	0.707 ops/sec	0.723 ops/sec	0.003 o

This report could easily have included arrays from different subsystems, too

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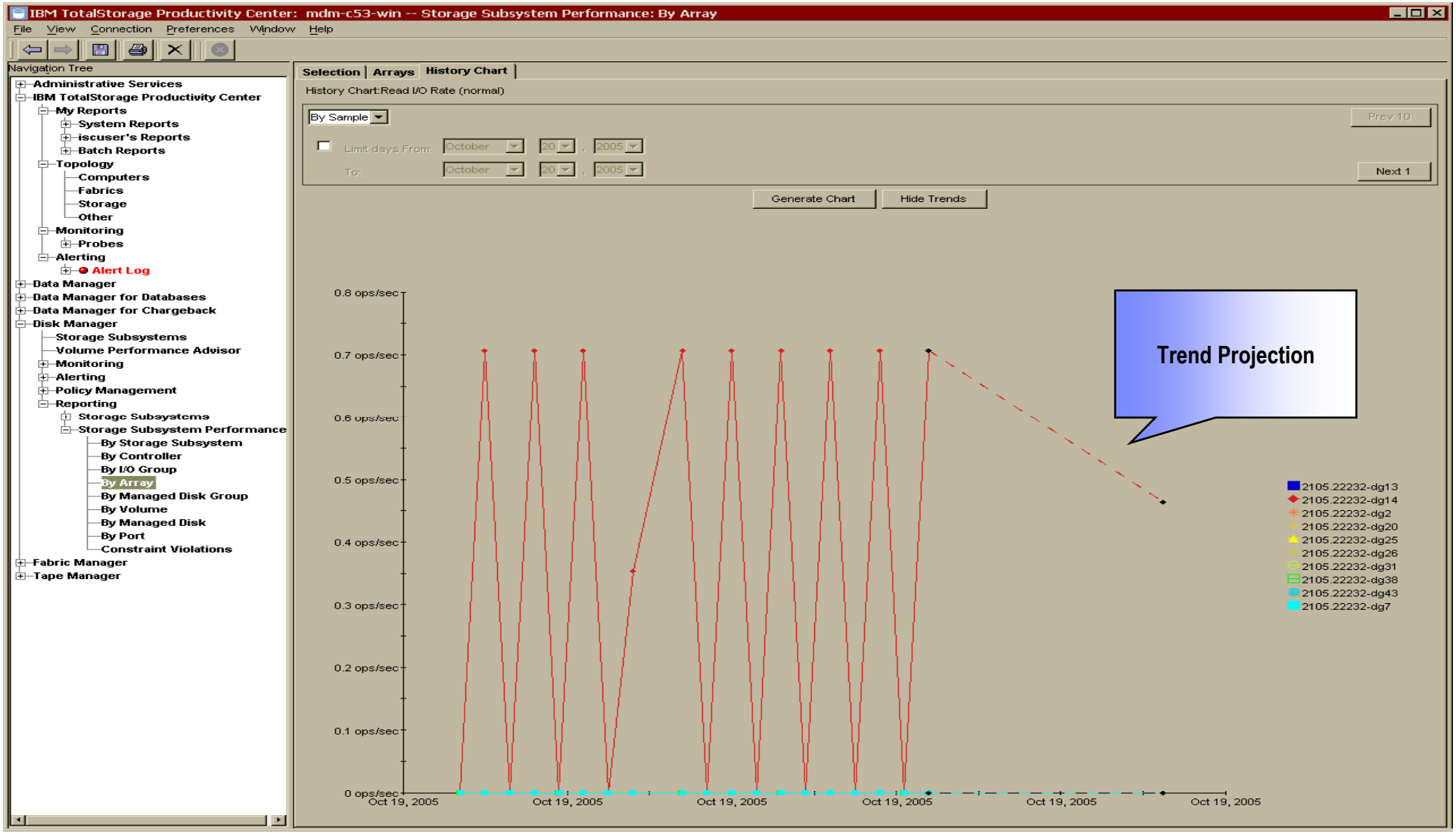
History chart: it shows a single metric (Read I/O Rate, Normal) over time, for multiple components



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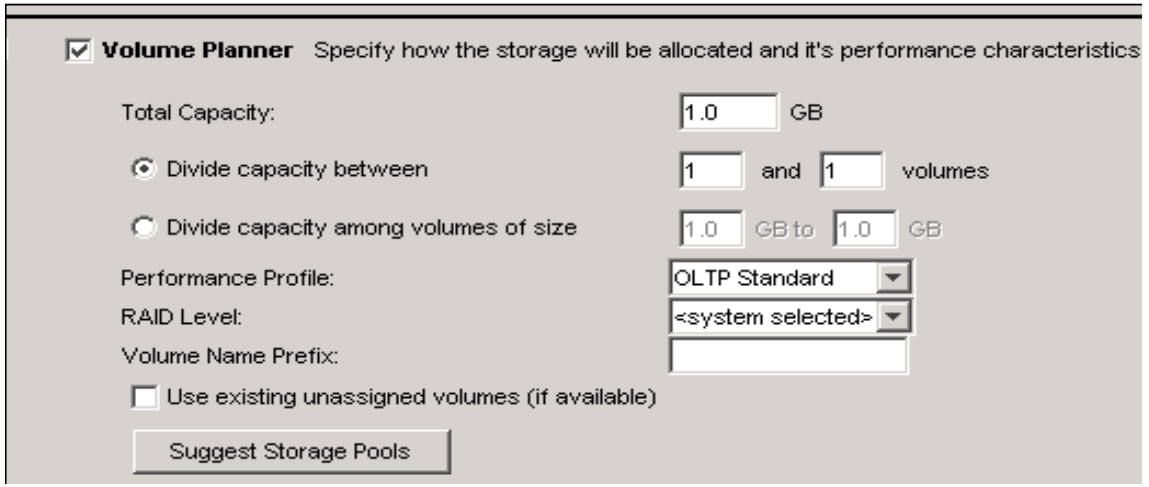
Storage Configuration Planner – Volume Planner

Volume Planner enhances support for Volume Performance Advisor to include the DS8000 and DS6000

- The new Volume Planning Wizard is added to the TPC typology viewer
- Volume Planner recommends changes within your SAN storage based on existing performance workload
- The Volume Planner is designed to:
  - Provide Volume Performance Advisor functions for ESS 800, DS6000 and DS8000
  - Provide planning guidance for heterogeneous controllers and RAID levels
  - Provide a GUI interface for updating above functions



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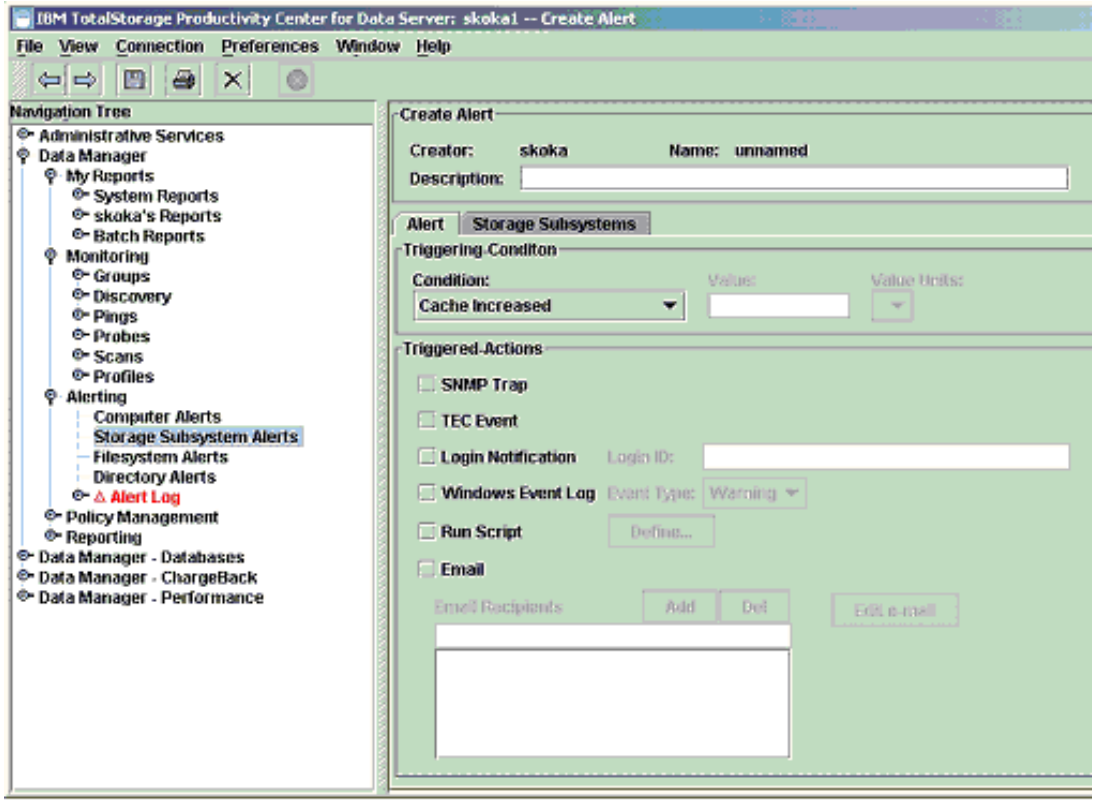
Threshold Violations Alerts

- Threshold violations logged in TPC database
  - Kept in alert log
  - Exception report generation
    - Drill-down to details of individual exceptions
  - User defined alerts
  - Automatic actions on alerts
    - send SNMP traps, email message, running scripts on the server, etc



Storage events can be sent to an enterprise system management console, emailed to the administrators, and/or a script can be driven

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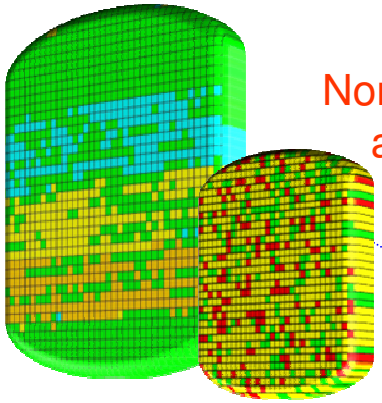
Disk Performance Optimization

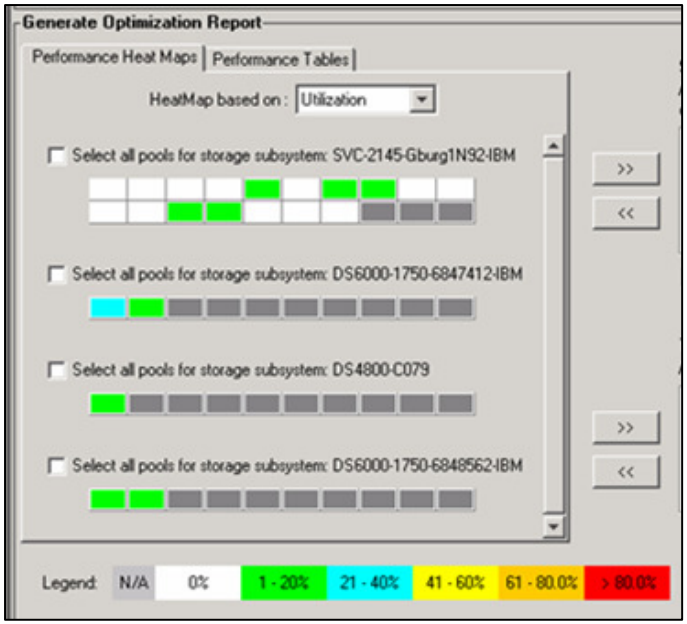


Non-intrusive analysis

Reports & Recommendations

- **Out-of-band storage optimization** engine that lays out a process for optimal storage allocation, migration, and consolidation
- **Automatically identifies hot spots** on the disk controller and **provides recommendations** to improve disk efficiency

Output



- **Can reduce service-level times** of resource-constrained applications by an average of 48% up to 90%
- **Integrates directly with DS8000, DS6000, DS5000, DS4000, & SVC** to enable migration of storage pools to optimize data throughput.

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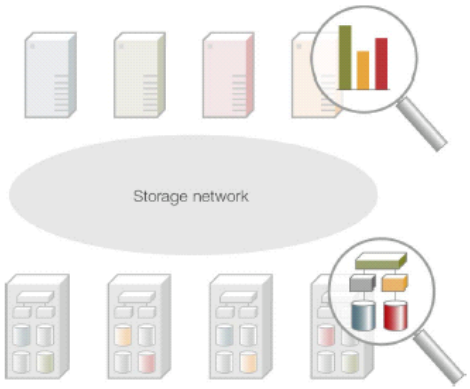
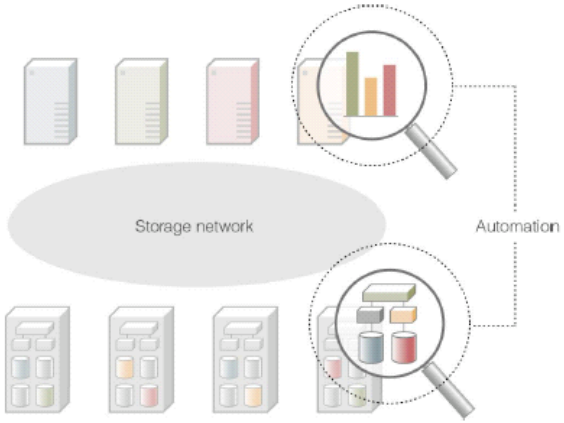
Tivoli Storage Productivity Center for Data



Automated identification of the storage resources in an infrastructure and **analysis** of how effectively those resources are being used, on file and database system.

File-system and file-level evaluation uncovers categories of files that, if deleted or archived, can potentially represent **significant reductions in the amount of data** that must be stored, backed up and managed.

Automated control through policies that are customizable with actions that can include centralized alerting, distributed responsibility and fully automated response. This includes deletion of unnecessary data.



Predict future growth and future at-risk conditions with historical information.

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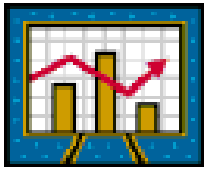
Today's Challenge – Finding Answers Quickly

- **WHAT** is your current utilization?
- **WHY** is storage growing?
- **HOW** will growth be accurately forecasted?
- **HOW MUCH** worthless data is being stored?
- **WHICH** systems will be migrated to new technology?
- **HOW** can storage inventories be kept up-to-date?
- **HOW MUCH** downtime is storage-related?
- **HOW** will storage policies be audited or enforced?



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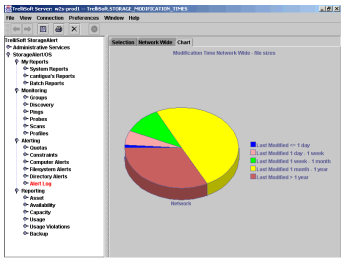
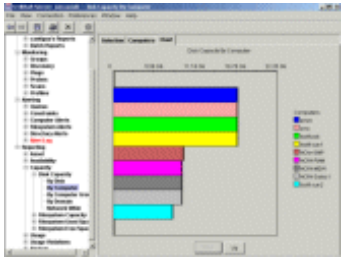
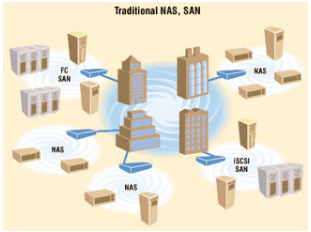
Tivoli Storage Productivity Center for Data - Components

Tivoli Storage Productivity for Data

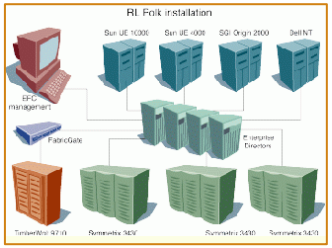




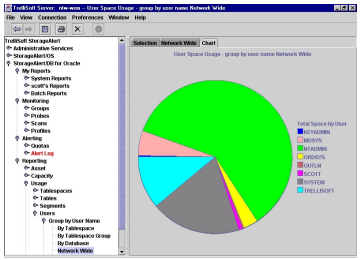
systems



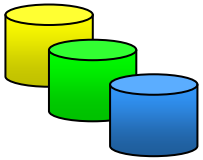
SAN, NAS & DAS



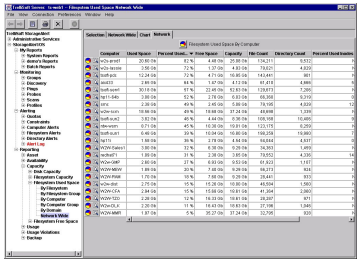
TPC for Data Database



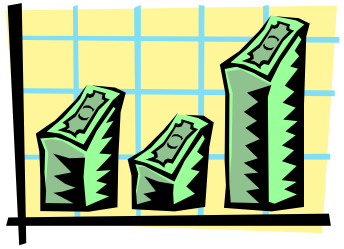
Application, Database



TPC for Data Chargeback



Chargeback



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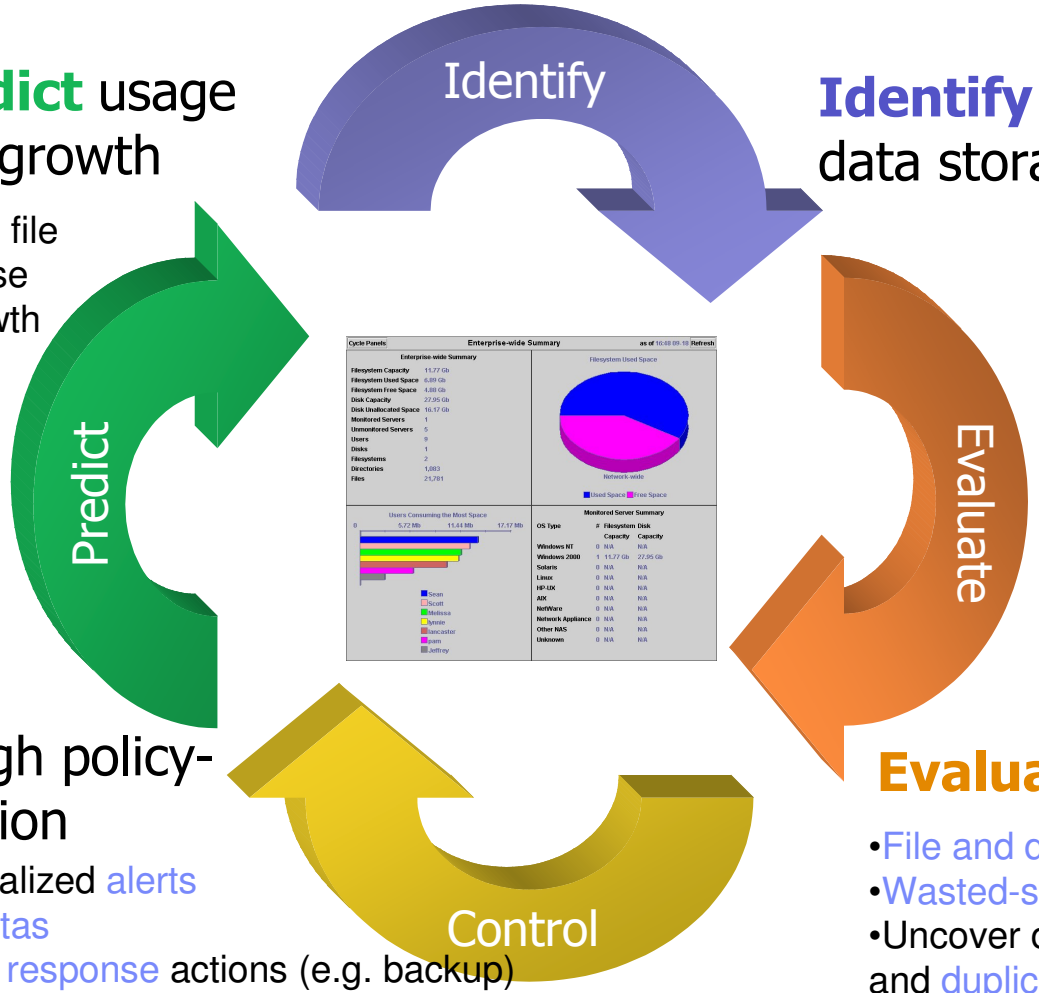
TPC for Data - Storage Resource Management Lifecycle



Predict usage and growth

- Identify fast growing file systems and database
- Forecast future growth
- Publish capacity planning metrics

Identify enterprise data storage

- What storage assets?
- Current utilization?
- Any at-risk file-systems?
- Any allocated by unused database space?

Control through policy-based automation

- Establish centralized alerts
- Implement quotas
- Set automated response actions (e.g. backup)
- Automate activity with batch reporting
- Automated LUN provisioning for monitored filesystems

Evaluate your data

- File and directory-level analysis
- Wasted-space analysis
- Uncover orphan, obsolete, misused and duplicate files
- End-to-end report from Disksystem to Filesystem

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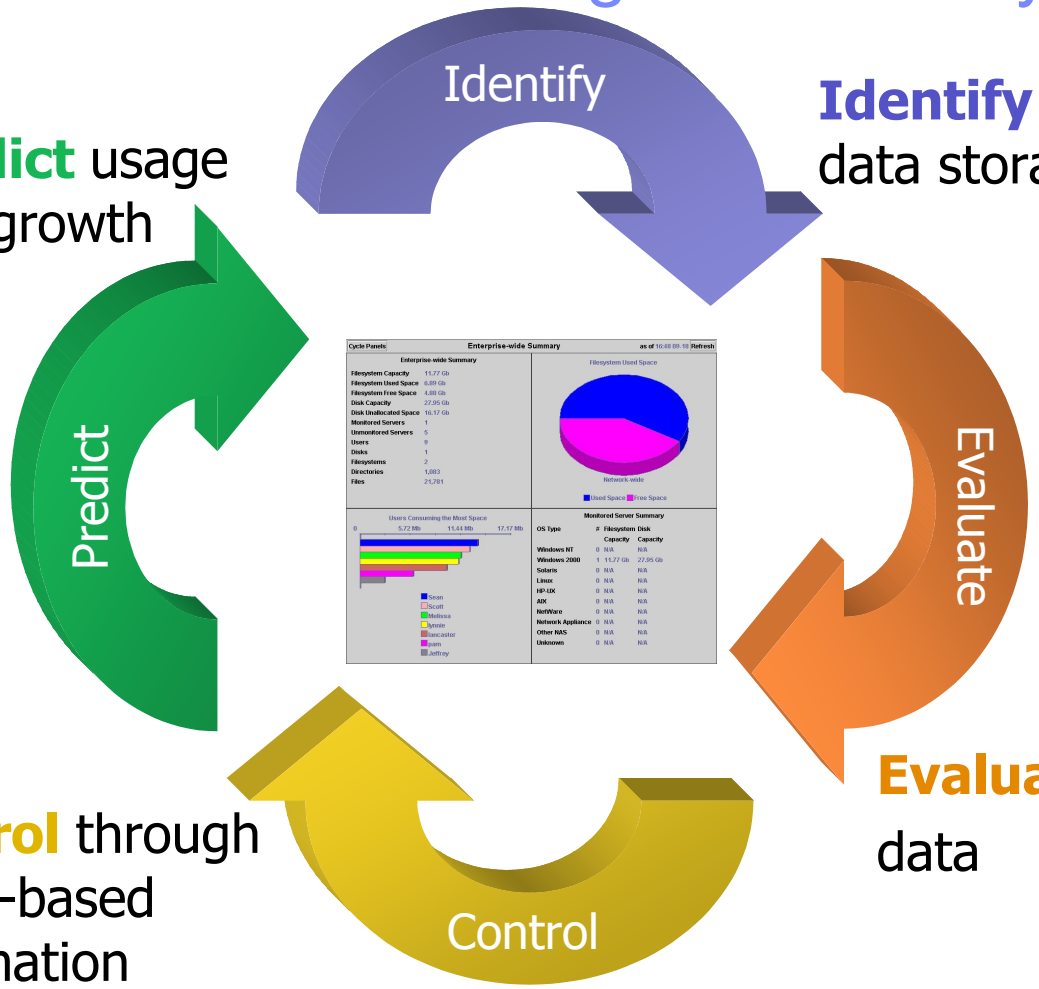
Storage Resource Management Lifecycle



Identify enterprise data storage

Evaluate your data

Control through policy-based automation

Predict usage and growth

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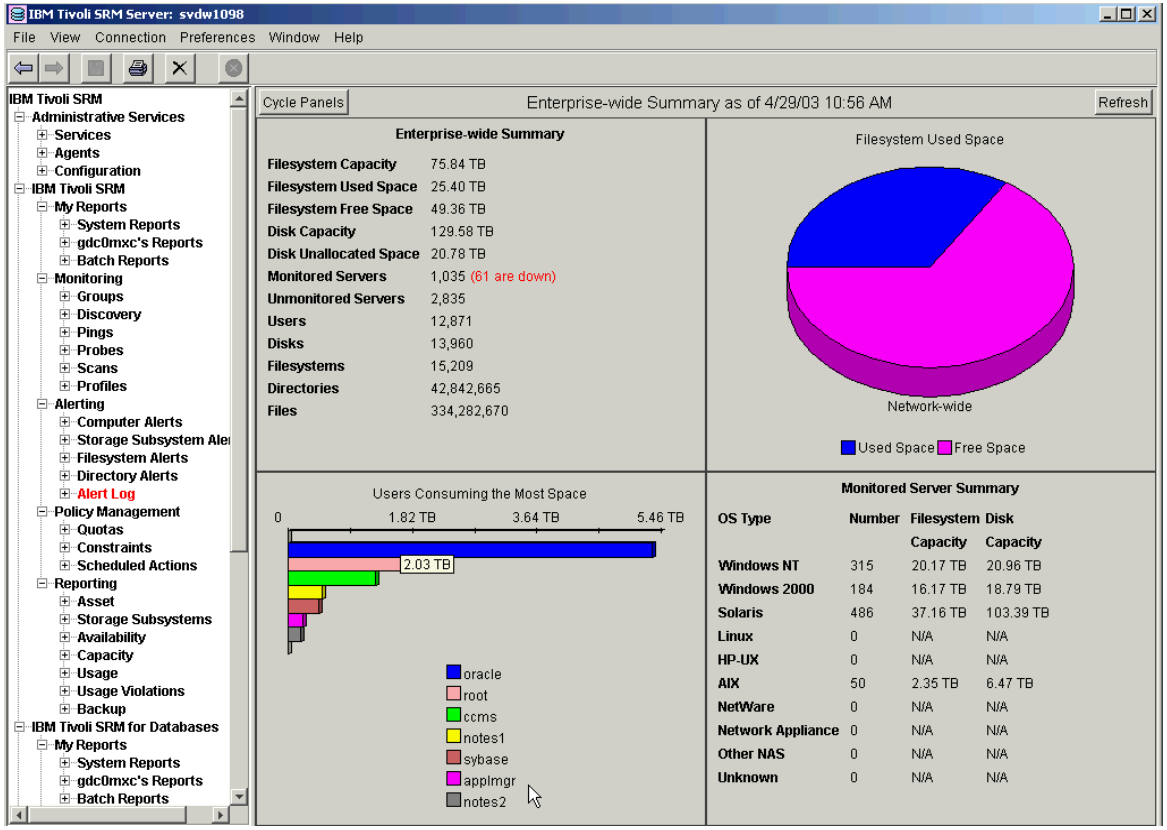
TPC Data Management
Data Life Cycle

- **Identify**
  - What are your storage assets?
  - Do your allocations match expectations?
  - What is your current utilization?
  - Do you have at-risk file-systems?
  - Do you have allocated, but unused database space?



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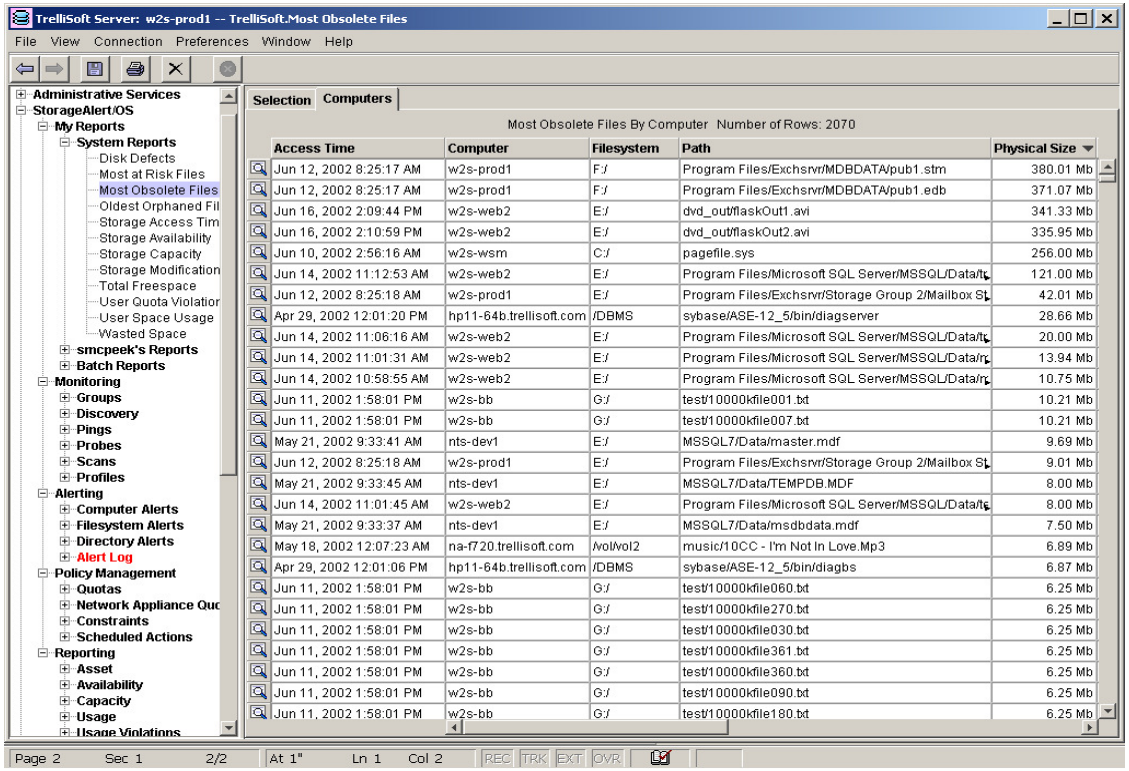
TPC Data Management
Data Life Cycle

- **Evaluate**
  - Find out what storage consumers are doing
  - Conduct file and directory-level analysis
  - Perform a wasted-space analysis
  - Uncover orphan, obsolete, misused and duplicate files
  - End-to-end report from Disksystem to Filesystem
  - Backup calculation



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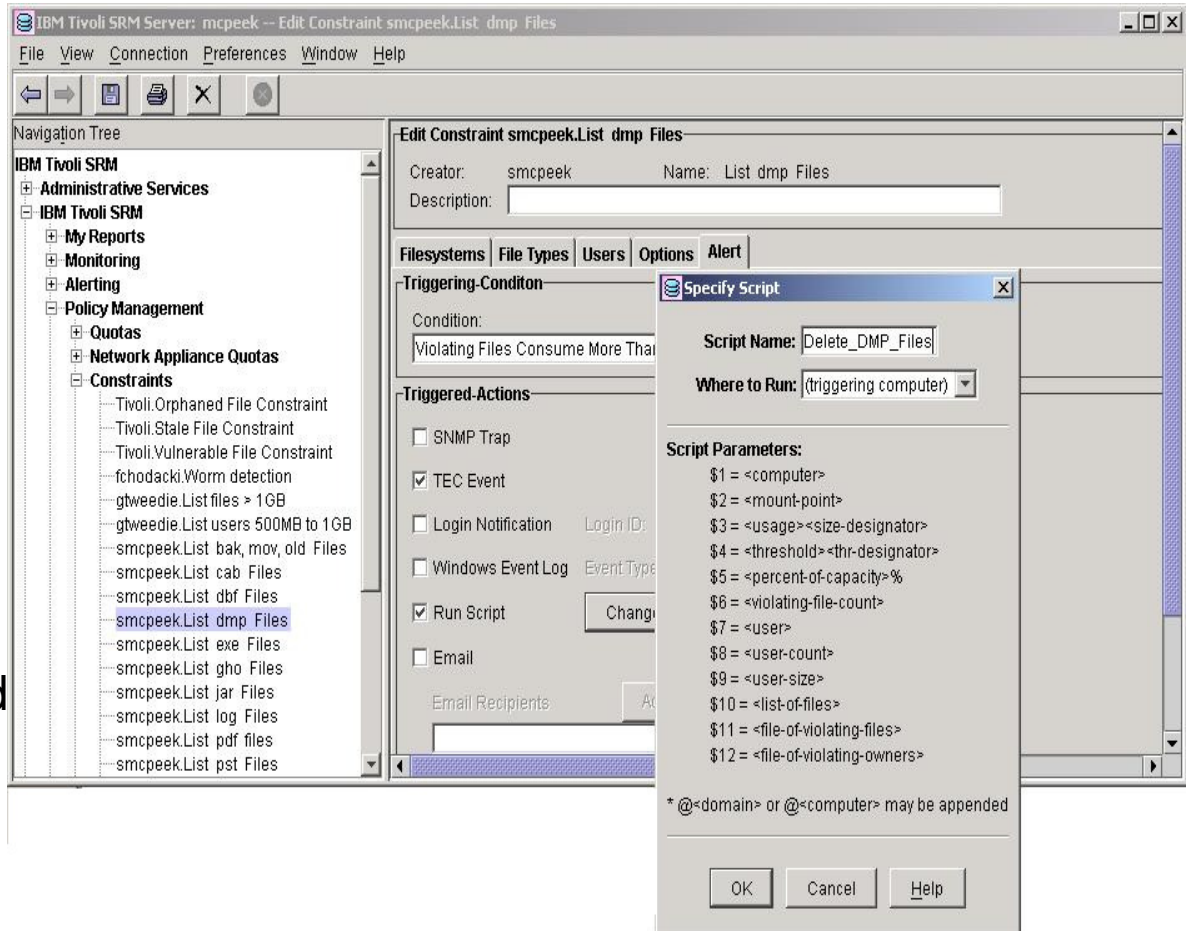
TPC Data Management
Data Life Cycle

- **Control**
  - Establish centralized alerts
  - Implement quotas
  - Granular Constraints
  - Set automated response actions (e.g. TSM)
  - Automate activity with batch reporting
  - Automated LUN provisioning for monitored filesystems



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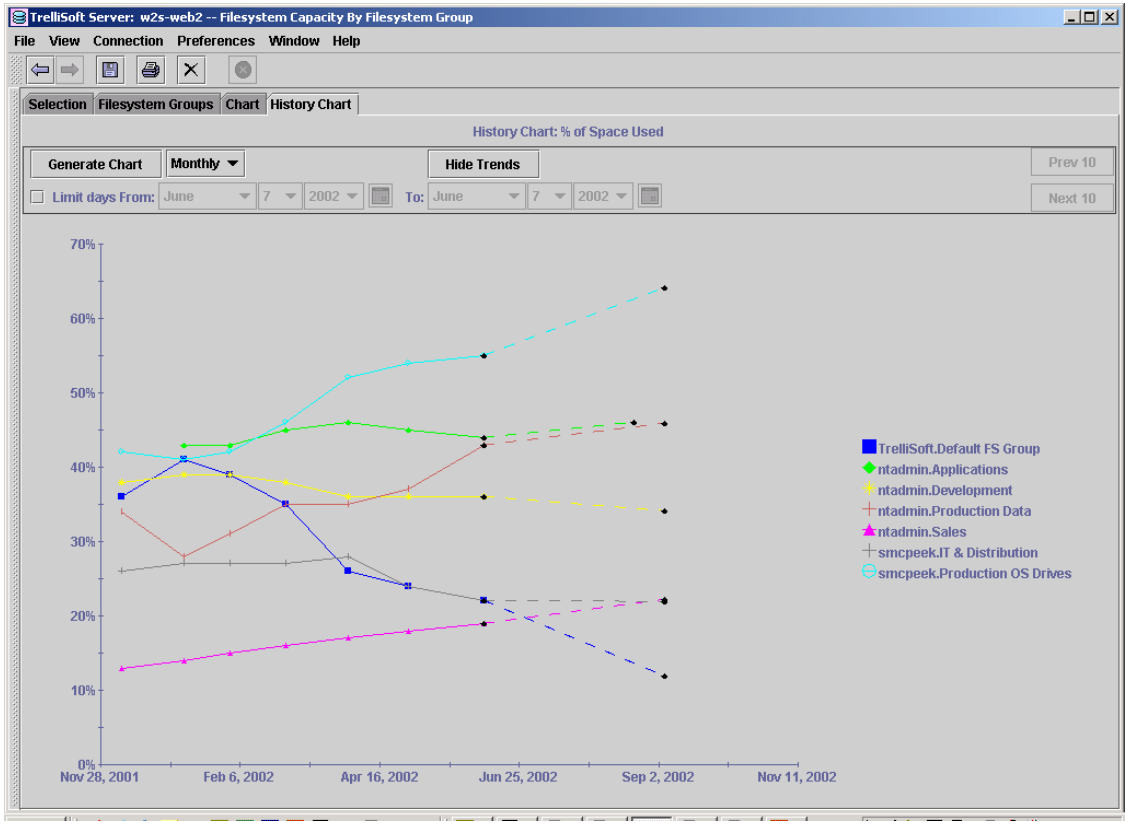
TPC Data Management
Data Life Cycle

- **Predict**
  - Identify the fastest growing users, file systems and database tables
  - Forecast future growth and at-risk situations
  - Publish capacity planning metrics



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For Databases

- **Prevent database downtime**
  - Predict tablespace failure due to space allocation problems.
- **Reduce unnecessary space usage**
  - Find allocated, but unused space
- **Perform capacity planning**
  - Trend storage growth of specific objects
- **Plan network migration or SAN implementation**
  - Identify the fastest-growing databases

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For Chargeback

- **Generate Invoices**
  - Users, Departments, Database Instances/Users
  - Automatic total roll up
- **Invoice Flexibility**
  - File Systems
  - Databases
  - User Usage
  - Computer Capacity
  - Tablespace Capacity

- **Special format for import into CIMS**

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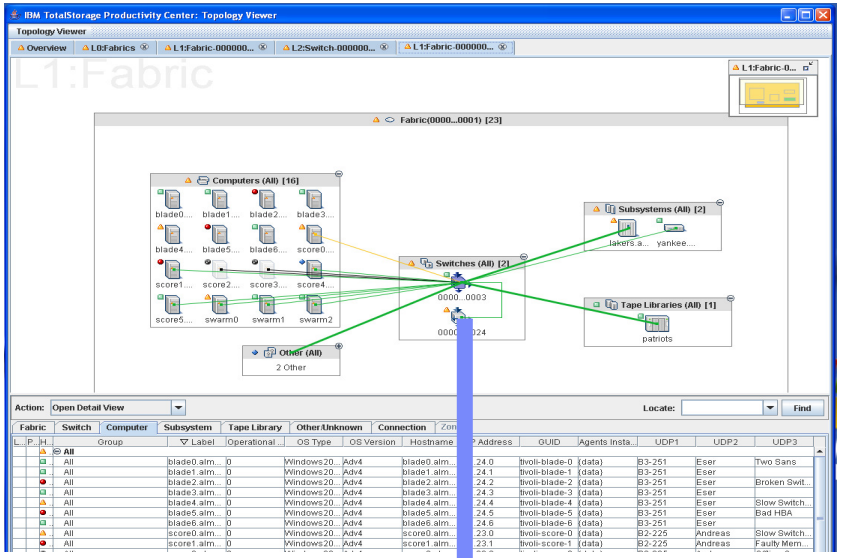
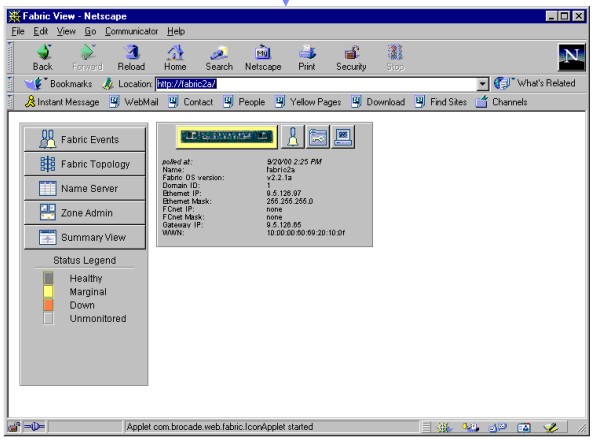
IBM Tivoli Storage Productivity Center Standard Edition – Fabric Component

- Centralized control for SAN configuration
- Automated management
  - Multi-vendor switch zone provisioning
  - SAN, NAS, iSCSI
  - Multi-vendor HBA support
- Visualization of the topology
- Real-time status & performance monitoring
  - Connection and Resource status
  - Switch Performance
- Reporting capabilities
  - SAN Fabric Asset and Performance
- Automated status and problem alerts
  - Integration with Tivoli management
  - Integrated with 3rd party via SNMP



Launch Element Manager



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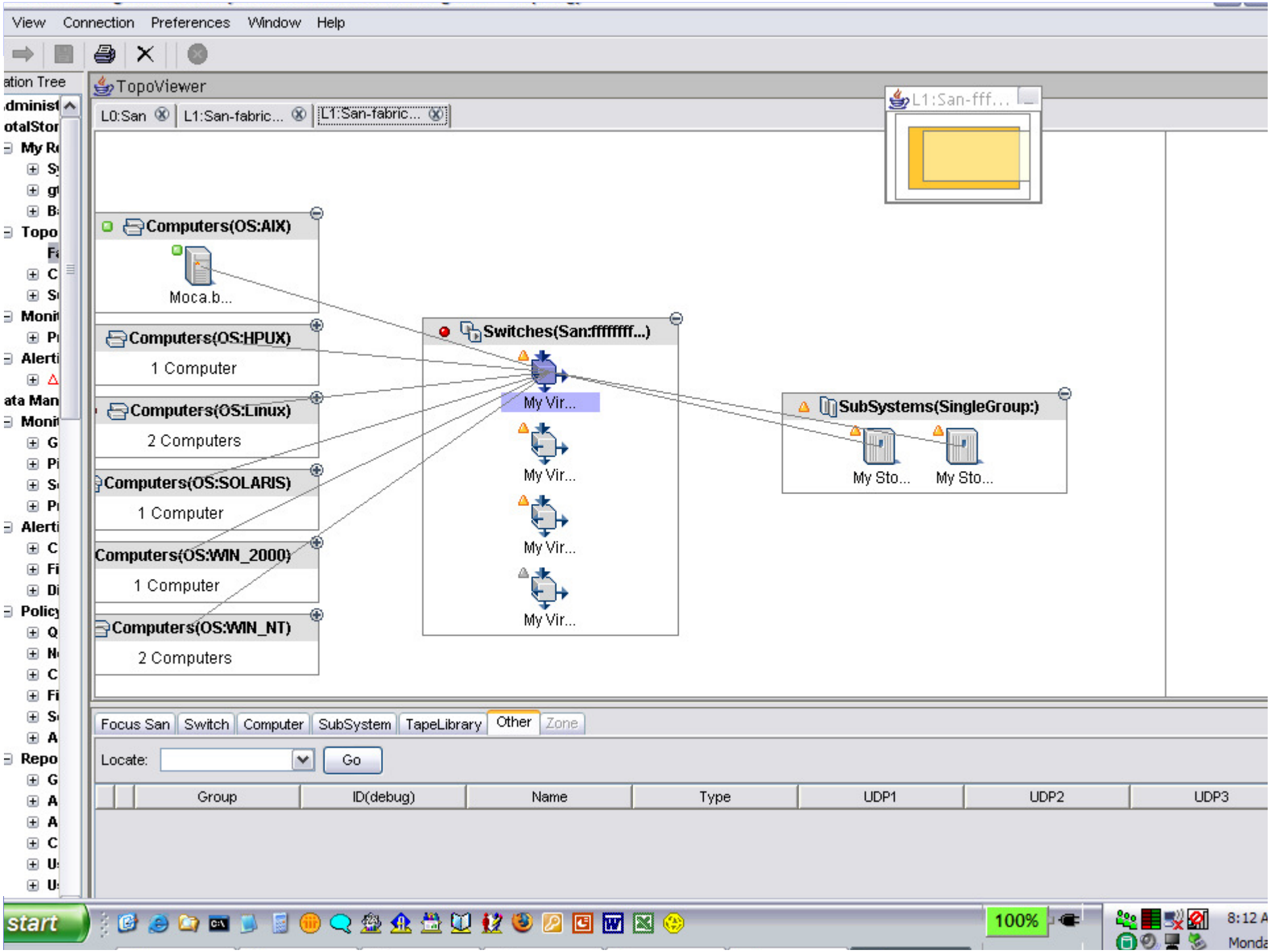
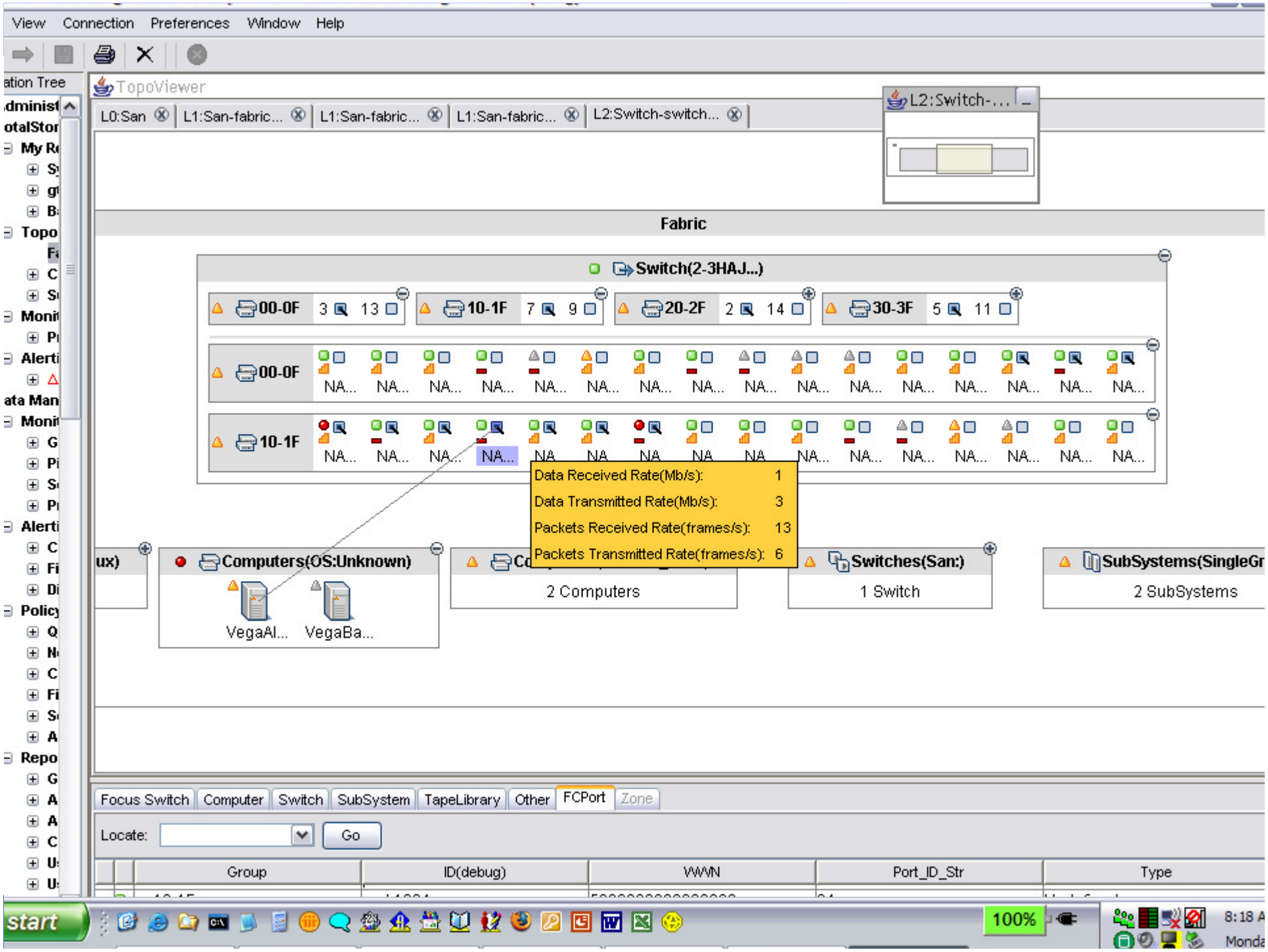
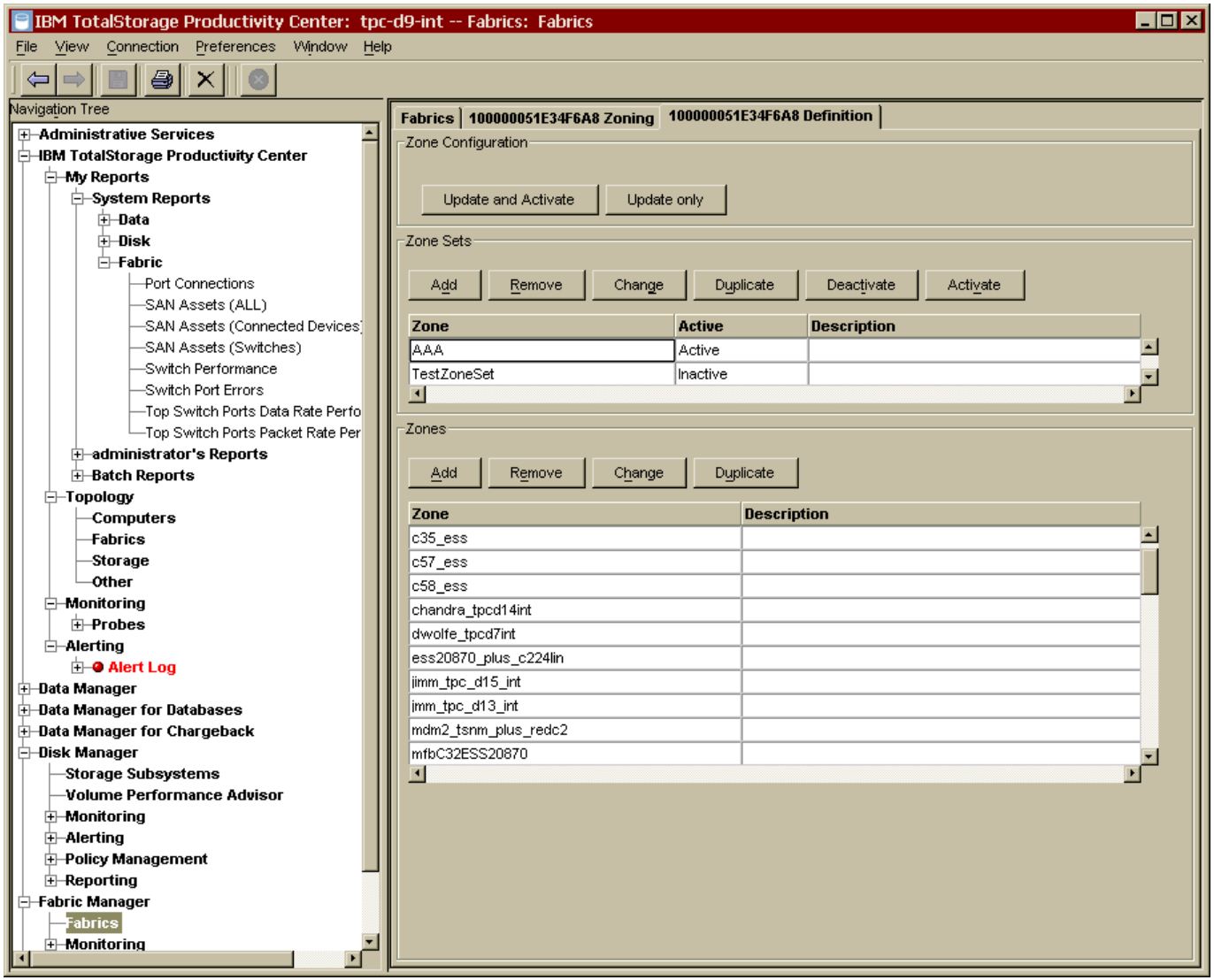

View
Connection
Preferences
Window
Help
TopoViewer
L0:San
L1:San-fabric...
L1:San-fabric...
L1:San-fff...
Computers(OS:AIX)
Moca.b...
Computers(OS:HPUX)
1 Computer
Computers(OS:Linux)
2 Computers
Computers(OS:SOLARIS)
1 Computer
Computers(OS:WIN_2000)
1 Computer
Computers(OS:WIN_NT)
2 Computers
Switches(San:ffffffff...)
My Vir...
My Vir...
My Vir...
My Vir...
SubSystems(SingleGroup:)
My Sto...
My Sto...
Focus San
Switch
Computer
SubSystem
TapeLibrary
Other
Zone
Locate:
Go
Group
ID(debug)
Name
Type
UDP1
UDP2
UDP3
start
100%


View Connection Preferences Window Help
TopoViewer
L0:San
L1:San-fabric...
L1:San-fabric...
L1:San-fabric...
L2:Switch-switch...
L2:Switch-...
Fabric
Switch(2-3HAJ...)
00-0F 3 13
10-1F 7 9
20-2F 2 14
30-3F 5 11
00-0F
10-1F
NA...
Data Received Rate(Mb/s): 1
Data Transmitted Rate(Mb/s): 3
Packets Received Rate(frames/s): 13
Packets Transmitted Rate(frames/s): 6
Computers(OS:Unknown)
VegaAl...
VegaBa...
2 Computers
Switches(San:)
1 Switch
SubSystems(SingleGr
2 SubSystems
Focus Switch
Computer
Switch
SubSystem
TapeLibrary
Other
FCPort
Zone
Locate:
Go
Group
ID(debug)
WWN
Port_ID_Str
Type
start
100%

Fabric Zoning Configuration



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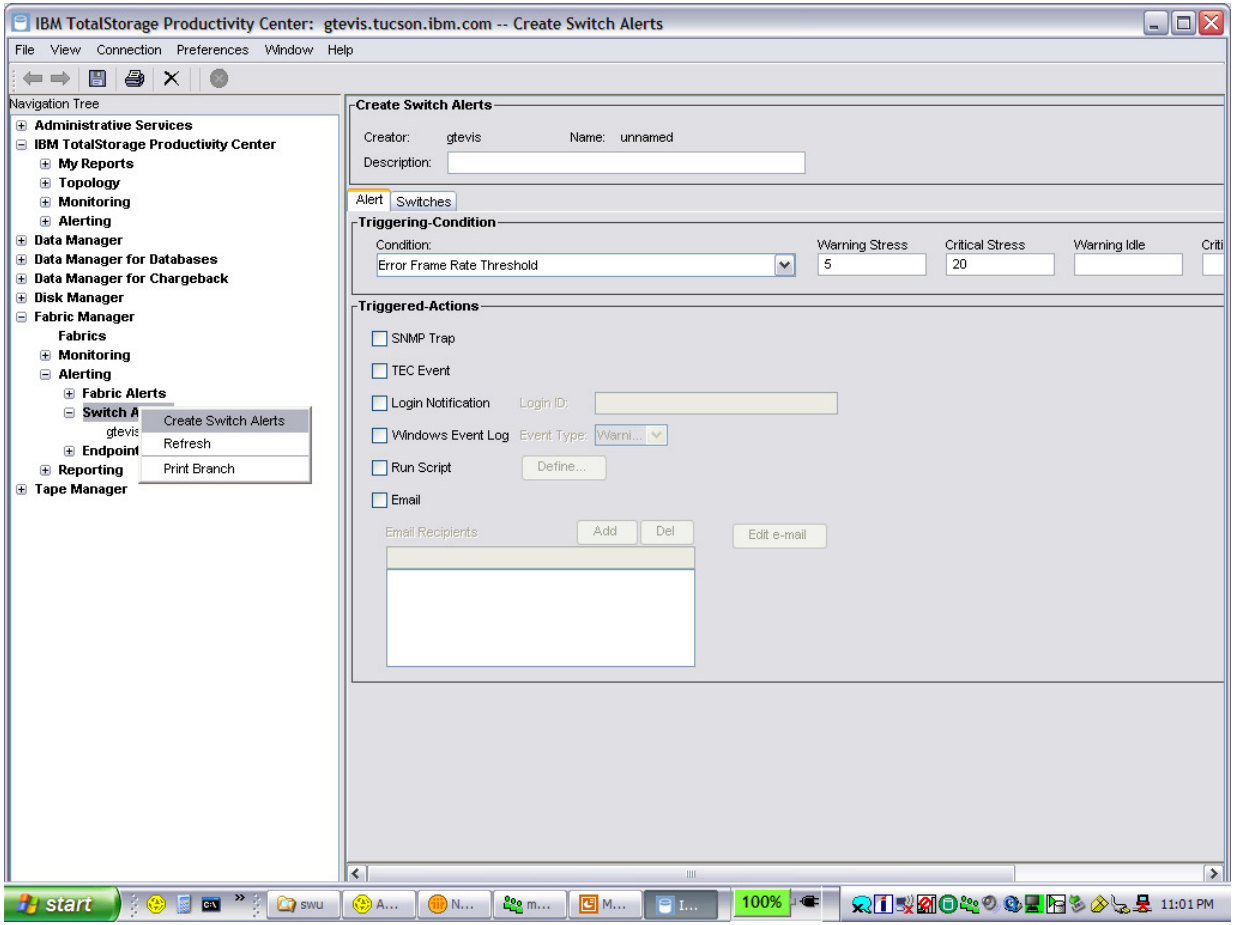
SAN Predictive Fault Monitoring

- **Most SAN link failures due to deteriorating Fiber Optics**
  - Typically appear as intermittent frame errors long before hard failure



- **TPC provides Error Frame Rate Report that identifies suspect ports**
  - The average number of frames received in error, per second, for specified ports

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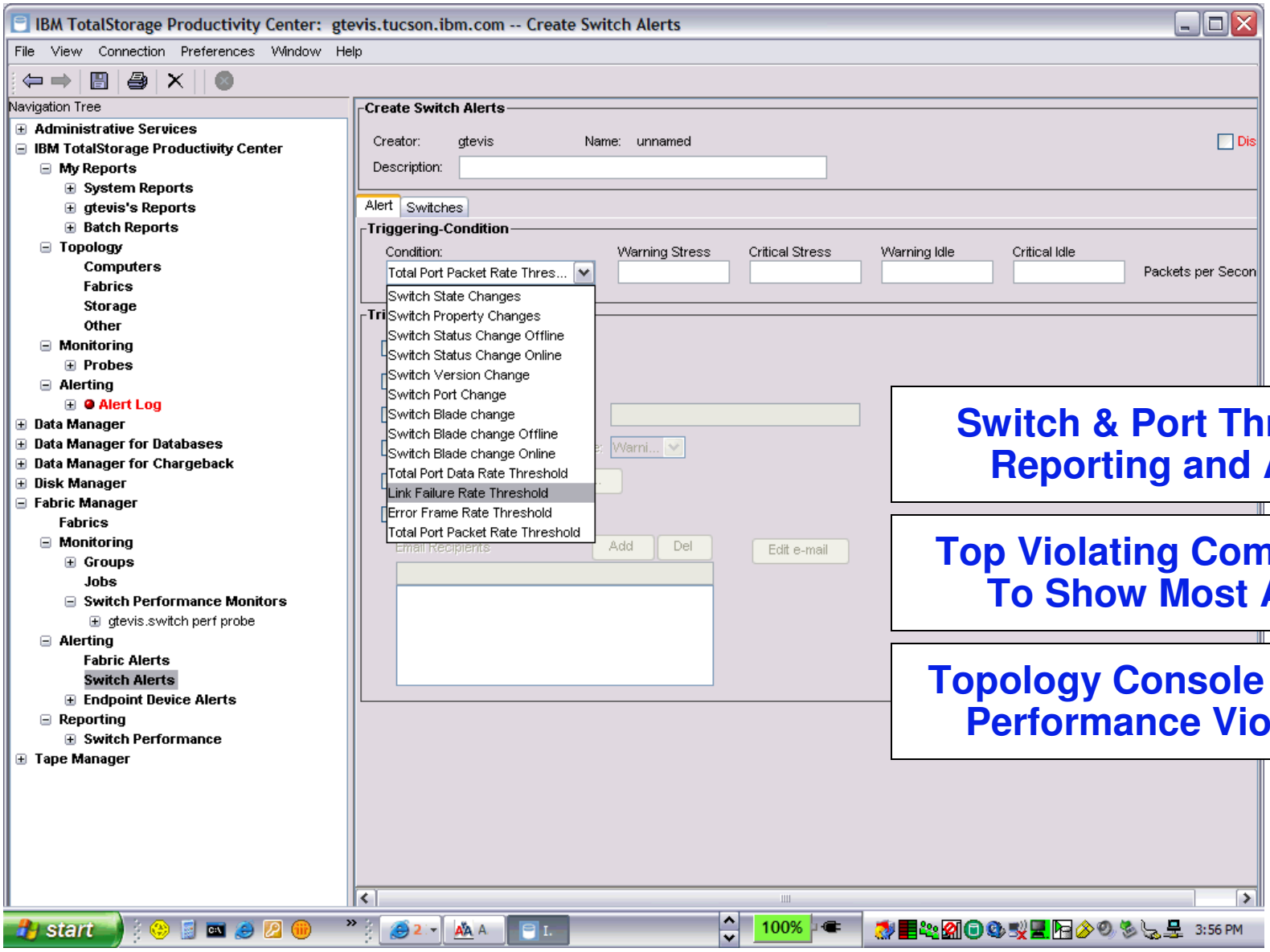

Switch & Port Threshold Reporting and Alerts

Top Violating Components To Show Most Active

Topology Console Displays Performance Violations

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Fabric Reports

- **System SAN Fabric Performance Reports Created**
  - SAN Switch, Switch Port Errors, and Top N reports

- **System SAN Fabric Asset Reports**
  - SAN Assets reports and Port Connections reports
  - OS Type and version: Reporting -> Asset -> By Computer
  - HBA information: Reporting -> Asset -> By Computer->Controllers
  - “Paths”: Reporting -> Asset -> By Computer->Controllers->Disks
  - Firmware revisions for storage subsystems: Reporting -> Asset -> By Storage Subsystems

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Storage Configuration Planners – Path Planner

Path Planner for simplified management of host functions such as HBA and multi-pathing management

- The new Path Planning Wizard is added to the TPC typology viewer
- Path Planner provides policy-based specification of paths between hosts and storage systems during storage provisioning
- The Path Planner is designed to:
  - Provide configuration guidance for your multipart drivers (initial scope is to configure IBM SDD)
  - Allow input of application requirements
  - Convert logical flows into physical flows
  - Provide the wizard functions off of the TPC Topology Console, as well as through a CLI

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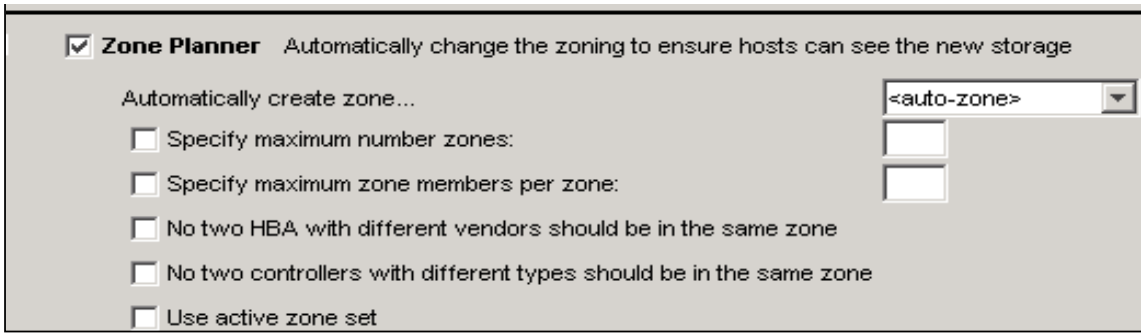
Storage Configuration Planners – Zone Planner

<u>Zone Planner</u> for simplified, wizard-based zone security management

- The new Zone Planning Wizard is added to the TPC typology viewer
- Zone Planner enforces policy-based zone security specifications between hosts and storage systems.
- The Zone Planner is designed to:
  - Determine which hosts can access storage
  - Determine which host ports can see what storage volumes
  - Provide auto-zoning functions
  - Provide zoning based on Best Practices
  - Perform LUN Masking/Mapping assignments automatically based on current customer usage
  - Provide GUI interface for updating the above functions



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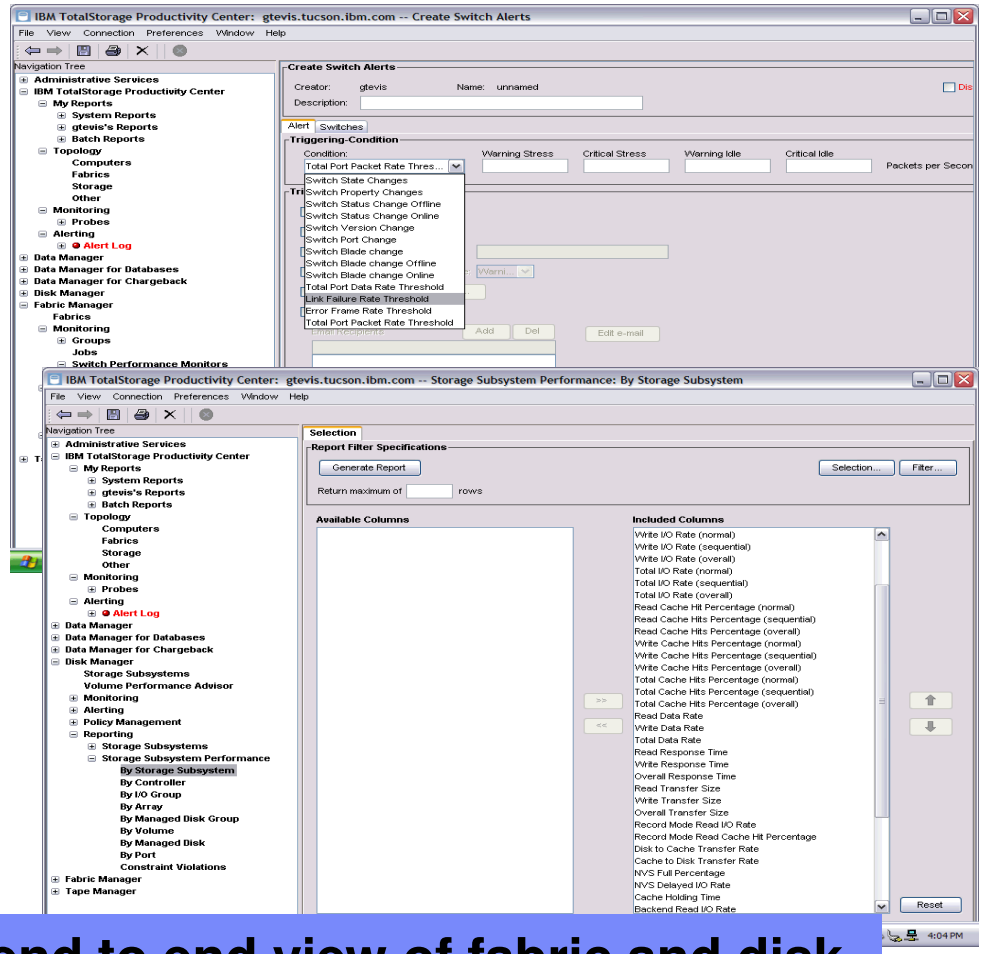
SAN Storage and Fabric Performance Analysis

- **TPC for Disk** monitors disk subsystem ports, subsystem arrays, disk volumes for throughput, I/O and cache rates, as well as for response times
- **TPC Standard Edition Fabric Component** monitors switches and ports for throughput rates and allows you to specify throughput threshold
- Thresholds can be set for these metrics and alerts are generated when thresholds are violated, indicating potential bottlenecks.
- TPC Topology console will show all performance violations and propagate the thresholds events through performance health monitor icons



Storage administrator can see end to end view of fabric and disk subsystem performance and assess business impact and drill into potential or actual problem areas

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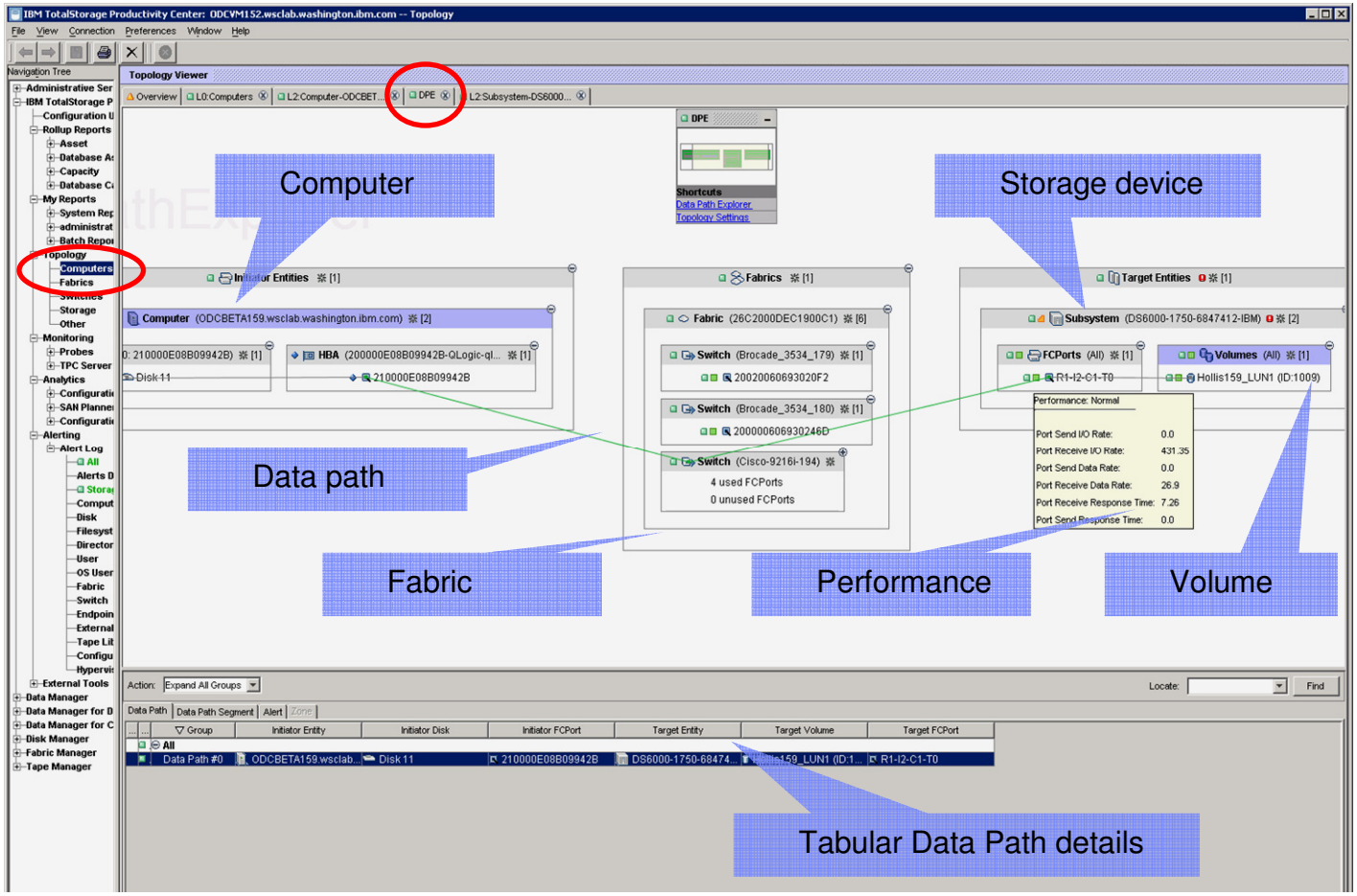
End-to-End view with Performance Status Information (Data Path Explorer)

- **Quickly assess** the performance state of your storage infrastructure
- **End-to-end view** of the entire storage path
- **Reduces time** to problem isolation and resolution



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Value of the IBM Tivoli Storage Productivity Center

- Simplify Storage Infrastructure Management for better availability
  - Predict storage network failures before they happen
  - Prevent out-of-space conditions on file and database systems
  - Meet storage service levels
- Automate planning, management and provisioning of storage
  - Report on storage network and disk subsystem performance
  - Basic provisioning to configure the storage fabric and disk
  - Categorize data by database, file system, directory and file-level analysis
  - Improve service levels for data protection by identifying files not backed up
- Optimize Storage Personnel Productivity and storage ROI
  - Create a single point of control, administration and security for the management of storage networks and disk systems
  - Automate reporting of information and metrics to help administrators make better, more timely decisions
  - Automate responses to policy violations

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Question & Answers

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