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Certification Guide Series: Tivoli Storage Productivity Center V4.1

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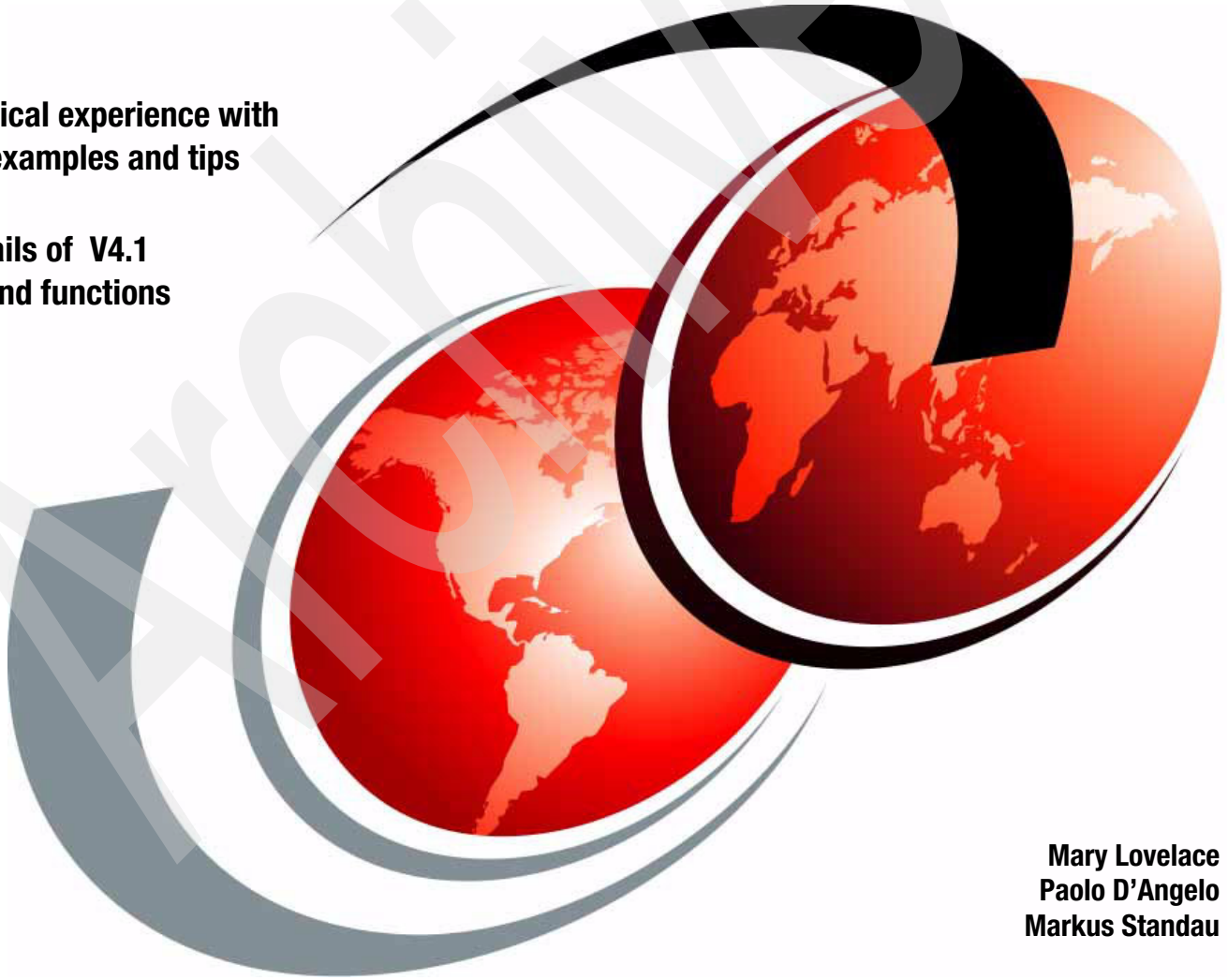

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Certification Guide Series: Tivoli Storage Productivity Center V4.1

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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

First Edition (January 2010)

This edition applies to Version 4, release 1, modification 0 of IBM Tivoli Storage Productivity Center (product numbers 5608-WB1, 5608-WC0, 5608-WC3, and 5608-WC4).

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Preface

This IBM® Redbooks® publication is a study guide for IBM Tivoli® Storage Productivity Center Version 4.1. It is targeted for professionals who want to obtain certification as an IBM Certified Deployment Professional - Tivoli Storage Productivity Center V4.1.

This Certification, offered through the Professional Certification Program from IBM, is designed to validate the skills required of technical professionals who perform installation, configuration, administration, and problem determination of IBM Tivoli Storage Productivity Center V4.1, and demonstrates the features and functions of this product to the end user.

This book provides a combination of theory and practical experience necessary for a general understanding of the subject matter. It also provides links to questions that can help in the evaluation of personal progress and provide familiarity with the types of questions that will be encountered in the exam.

This book does not replace practical experience, nor is it designed to be a stand-alone guide for any subject. Instead, it is an effective tool that, when combined with educational activities and experience, can be a useful preparation guide for the exam.

The team who wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, San Jose Center.

The team: Markus, Mary, Paolo

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Thanks to the following people for their contributions to this project:

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Nancy Hobbs
Bill Tuminaro
Miki Walter
Kevin J Webster
Tivoli Storage Productivity Center team

Paul Carroll
TIP Design

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Professional Certification Program overview

In this chapter, we provide an overview of the skill requirements necessary to obtain an IBM Certified Deployment Professional - Tivoli Storage Productivity Center V4.1 certification. The specific topics are designed to provide a comprehensive review for obtaining the certification:

- IBM Professional Certification Program
- IBM Tivoli Storage Productivity Center V4.1 Implementation Certification
- Recommended study resources

While the title of the certification specifies the Tivoli Storage Productivity Center V4.1, the test as well as the study guide relates to Tivoli Storage Productivity Center at the 4.1.0 level. It is not an incremental certification so having been certified at the 3.1 level is not a prerequisite. For the same reason, it is important to understand that this certification does not only deal with the new functions, features, and changes that were introduced with Tivoli Storage Productivity Center V4.1.0, instead all functions and features that are available in Tivoli Storage Productivity Center Standard Edition are included in the certification.

The primary target audience for the certification is IBM business partners and IBM employees. Due to this fact, the study guide (as well as most other documents) refers to the Tivoli Storage Productivity Center hardware and software requirements and environment, respectively, as the customer requirements and customer environment.

This book does not replace practical experience, nor is it designed to be a stand-alone guide for any subject. Instead, it is an effective tool that, when combined with educational activities and experience, can be a useful preparation guide for the exam.

1.1 IBM Professional Certification Program

Having the right skills for the job is critical in the growing global marketplace. To this end, an *IBM Professional Certification*, designed to validate skill and proficiency in the latest IBM solution and product technology, can help provide that competitive edge. The IBM Professional Certification Program Web site is available at:

http://www.ibm.com/certify/

The Professional Certification Program from IBM offers a business solution for skilled technical professionals seeking to demonstrate their expertise to the world.

The program is designed to validate your skills and demonstrate your proficiency in the latest IBM technology and solutions. In addition, professional certification can help you excel at your job by giving you and your employer confidence that your skills have been tested. You might be able to deliver higher levels of service and technical expertise than non-certified employees and move on a faster career track. Professional certification puts your career in your control.

This is a way for skilled IT professionals to demonstrate their expertise to the world. It validates your skills and demonstrates your proficiency in the latest IBM technology and solutions.

The certification requirements are tough, but not impossible. Certification is a rigorous process that differentiates you from everyone else.

The mission of IBM Professional Certification is to:

1. Provide a reliable, valid, and fair method of assessing skills and knowledge.
2. Provide IBM with a method of building and validating the skills of individuals and organizations.
3. Develop a worldwide community of highly skilled certified professionals who recommend, sell, service, support, teach, or use IBM products and solutions.

The Professional Certification Program from IBM has developed certification role names to guide you in your professional development. The certification role names include IBM Certified Specialist, IBM Certified Solutions/Systems Expert, and IBM Certified Advanced Technical Expert for technical professionals who sell, service, and support IBM solutions.

For technical professionals in application development, the certification roles include IBM Certified Developer Associate and IBM Certified Developer. IBM Certified Instructor certifies the professional instructor.

The Professional Certification Program from IBM provides you with a structured program leading to an internationally recognized qualification. The program is designed for flexibility by allowing you to select your role, prepare for and take tests at your own pace, and, in some cases, select from a choice of elective tests best suited to your abilities and needs. Some roles also offer a shortcut by giving credit for a certification obtained in other industry certification programs.

You might be a network administrator, systems integrator, network integrator, solution architect, solution developer, value-added reseller, technical coordinator, sales representative, or educational trainer. Regardless of your role, you can start charting your course through the Professional Certification Program from IBM today.

1.1.1 Benefits of certification

Certification is a tool to help objectively measure the performance of a professional on a given job at a defined skill level. Therefore, it is beneficial for individuals who want to validate their own skills and performance levels, their employees, or both. For optimum benefit, the certification tests must reflect the critical tasks required for a job, the skill levels of each task, and the frequency by which a task needs to be performed. IBM prides itself on designing comprehensive, documented processes to ensure that IBM certification tests remain relevant to the work environment of potential certification candidates.

In addition to assessing job skills and performance levels, professional certification can also provide such benefits as these:

- For employees:
  - Promotes recognition as an IBM certified professional
  - Helps to create advantages in interviews
  - Assists in salary increases, corporate advancement, or both
  - Increases self esteem
  - Provides continuing professional benefits
  - Helps to obtain new opportunities of professional development
- For employers:
  - Measures the effectiveness of training
  - Reduces course redundancy and unnecessary expenses
  - Provides objective benchmarks for validating skills
  - Makes long-range planning easier
  - Helps to manage professional development
  - Aids as a hiring tool
  - Contributes to competitive advantage
  - Increases productivity, morale, and loyalty
- For Business Partners and consultants:
  - Provides independent validation of technical skills
  - Creates competitive advantage and business opportunities
  - Enhances prestige of the team
  - Contributes to IBM requirements for various IBM Business Partner programs
  - Increases the sales of the products.

Specific benefits can vary by country (region) and role. In general, after you become certified, you should receive the following benefits:

- Industry recognition:

  Certification can accelerate your career potential by validating your professional competency and increasing your ability to provide solid, capable technical support.

- Program credentials:

  As a certified professional, you receive an e-mail with your certificate of completion and the certification mark associated with your role for use in advertisements and business literature. You can also request a hardcopy certificate, which includes a wallet-size certificate.

  The Professional Certification Program from IBM acknowledges the individual as a technical professional. The certification mark is for the exclusive use of the certified individual.

- Ongoing technical vitality:

  IBM Certified professionals are included in mailings from the Professional Certification Program from IBM.

1.1.2 Tivoli Software Professional Certification

Tivoli's professional certification program offers certification testing that sets the standard for qualified product consultants, administrators, architects, and partners.

The program also offers an internationally recognized qualification for technical professionals who are seeking to apply their expertise in today's complex business environment. The program is designed for those who implement, buy, sell, service, and support Tivoli solutions and want to deliver higher levels of service and technical expertise to IBM customers.

Whether you are a Tivoli customer, partner, or technical professional wanting to put your career on the fast track, you can start your journey to becoming a Tivoli Certified Professional today.

Other benefits of Tivoli Certification

Tivoli Certification has the following benefits:

- For the individual:
  - IBM Certified certificate and use of Tivoli logos on business cards.

    Note: Certificates are sent by e-mail; however, a paper copy of the certificate and a laminated wallet card can also be requested by sending an e-mail to certify@us.ibm.com.

  - Recognition of your technical skills by your peers and management
  - Possibility of giving back to the technical community by being a resource for other less experienced technicians
  - Enhanced career opportunities
  - Focus for your professional development
- For the Business Partner:
  - Confidence in the skills of your employees
  - Enhanced partnership benefits from Business Partner Program
  - Higher rates for billing out your employees
  - Stronger customer proposals
  - Demonstration of the depth of technical skills available to prospective customers
- For the client:
  - Confidence in the services of professionals handling your implementation
  - Ease of hiring competent employees to manage your Tivoli environment
  - Enhanced return on investment (ROI) through more thorough integration with Tivoli and third-party products
  - Ease of selecting a Tivoli Business Partner who meets your specific needs in the Tivoli Products for your implementation solution

Certification checklist

In preparing for certification, this general checklist can be helpful:

1. Select the certification you want to pursue.
2. Determine which tests are required by reading the certification role description.
3. Determine the study resources required to prepare for Tivoli Certification.

4. Prepare for the test using the following resources:
   - Test objectives for the Tivoli Certification
   - Recommended educational resources—for example, this book or Virtual Integration Center (VIC) Courses
   - Sample/assessment test
   - Other reference materials
   - Opportunities for experience

   Note: These resources are available from each certification description Web page, as well as from the Test information Web page.

5. Register to take a test by contacting one of our worldwide testing vendors:
   - Prometric
   - Pearson VUE (Virtual University Enterprises)

   Note: When providing your name and address to the testing vendor, be sure to specify your name exactly as you want it to appear on your certificate.

6. Take the test. Be sure to keep the Examination Score Report provided upon test completion, as your record of taking the test.

   Note: After you take the test, the results and demographic data (such as name, address, e-mail, and phone number) are sent from the testing vendor to IBM for processing (allow two to three days for transmittal and processing). After all the tests required for a certification are passed and received by IBM, your certificate will be issued.

7. Repeat Steps 3 through 5 until all required tests are successfully completed for the certification. If there are additional requirements (such as another vendor certification or exam), follow the instructions on the certification description page to submit these requirements to IBM.
8. After you meet the requirements, you will be sent an e-mail asking you to accept the terms of the IBM Certification Agreement.
9. Upon your acceptance, you receive an e-mail with the following deliverable:
   - A Certification Certificate in *.pdf format*, which can be printed in either color or black and white.
   - A set of graphic files containing the IBM Professional Certification mark associated with the certification achieved.
   - Guidelines for the use of the IBM Professional Certification mark.
10. To avoid unnecessary delay in receiving your certificate, ensure that your current e-mail is on file by keeping your profile up to date. If you do not have an e-mail address on file, your certificate will be sent by postal mail.

    After you receive a certificate by e-mail, you can also contact IBM at certify@us.ibm.com to request that a hardcopy certificate be sent by postal mail.

    Note: IBM reserves the right to change or delete any portion of the program, including the terms and conditions of the IBM Certification Agreement, at any time without notice. Some certification roles offered through the IBM Professional Certification Program require recertification.

1.2 IBM Certified Deployment Professional: Tivoli Storage Productivity Center V4.1

For the certification of Tivoli Storage Productivity Center V4.1, you will just have to take a single test. In this section you can find more specific information about:

- The target audience
- Recommended prerequisite skills
- Test components and characteristics

Important: IBM offers the following promotion code, which is good for a 15% discount on the IBM Tivoli Storage Productivity Center V4.1 exam if taken at any Prometric testing center.

- Code: 15T002
- Percent off: 15 percent.
- Valid for exam: 000-002
- Expires: Code is valid as long as the exam is available.

While the title of the certification specifies Tivoli Storage Productivity Center Version 4.1,the test and also the study guide relates to Tivoli Storage Productivity Center at the 4.1.0 level. It is not an incremental certification so having been certified at the Tivoli Storage Productivity Center V3.1 level is not a prerequisite. For the same reason it is important to understand that this certification does not only deal with the new functions, features and changes that were introduced with Tivoli Storage Productivity Center V4.1.0, instead, all functions and features that are available in Tivoli Storage Productivity Center Standard Edition are included in the certification.

1.2.1 Job role description and target audience

An IBM Certified Deployment Professional - Tivoli Storage Productivity Center V4.1 is a person who performs the requirements gathering and planning for the IBM Tivoli Storage Productivity Center deployment and integration into a computing environment. This person performs installation, configuration, administration, and problem determination of IBM Tivoli Storage Productivity Center V4.1, and demonstrates the features and functions of this product to the end user. It is expected that this person will be able to perform these tasks with limited assistance from peers, product documentation, and vendor support services.

1.2.2 Recommended prerequisite skills

Next we list the various prerequisites for taking the certification test.

Key areas of competency

Here are the key areas of competency expected:

- Determine the storage standards and best practices to be used in a customer environment.
- Assess customer requirements and create a solution design.
- Analyze the deployment environment.
- Develop and implement the project plan.
- Perform basic installation of the prerequisite applications.
- Demonstrate the use of IBM Tivoli Storage Productivity Center V4.1 Standard Edition features and functions to the end user.

- Provide a general understanding of storage infrastructure.
- Apply storage management concepts.
- Troubleshoot IBM Tivoli Storage Productivity Center V4.1 components.

Skill levels

To attain the IBM Certified Deployment Professional - IBM Tivoli Productivity Center V4.1 certification, candidates must pass one test.

The following prerequisites are recommended:

- Knowledge of supported IBM Tivoli Storage Productivity Center server and agent operating systems (AIX®, Windows®, and Linux®) -Skill level 2
- Knowledge of system administration for user account management-Skill level 2
- Knowledge of storage hardware technologies (NAS, DAS, SAN) -Skill level 2
- Knowledge of distributed server technologies -Skill level 2
- Knowledge of storage concepts -Skill level 2
- Knowledge of Tivoli Common Agent Services-Skill level 2
- Understanding of networking, TCP/IP and SNMP-Skill level 1
- Basic skills for DB2®-Skill level 2
- Basic skills for CIM/OM (Common Information Model / Object Manager) -Skill level 2
- Knowledge of operating system maintenance (fixes, patches, etc.) -Skill level 1
- Knowledge for upgrading DB2-Skill level 2
- Knowledge of WebSphere®-Skill level 1

Numeric skill levels

The numeric skill levels have the following meanings:

1. Basic Skill/Knowledge: Familiarity with basic functionality and concepts, might need to rely on assistance from documentation or other resources
2. Working Skill/Knowledge: Working knowledge of functionality and concepts, can use product or explain concepts with little or no assistance
3. Advanced Skill/Knowledge: Substantial experience with functionality or concepts, can teach others how to use functionality or explain concepts
4. Expert Skill/Knowledge: Extensive and comprehensive experience with functionality or concepts, can create or customize code, architecture, or processes

1.2.3 Test components and characteristics

IBM Certified Deployment Professional - Tivoli Storage Productivity Center V4.1

This test has the following components and characteristics:

- Test ID: 002
- Number of questions: 66
- Time allowed in minutes: 75
- Required passing score: 59%
- Test languages: English

1.3 Test objectives

Test 002 has five areas or sections of objectives, as we describe next.

1.3.1 Section 1: Planning

Here is a sequence overview for this section:

1. Given the customer's business objectives and storage environment, based on the pre-installation Technical and Delivery Assessment (TDA) document (formerly Solution Assurance Review), gather and analyze the customer's storage management requirements so that a solution that meets customer expectations can be implemented.

   With emphasis on performing the following tasks:

   – Gather and analyze the customer's storage management requirements.
   – Gather and analyze the customer's data reporting needs.
   – Gather and analyze the customer's storage area network (SAN) design and deployment.
   – Gather and analyze the customer's performance reporting needs and analysis.
   – Gather and analyze the customer's needs to data replication.
   – Review and validate the information with the customer.

2. Given the customer's IBM Tivoli Storage Productivity Center (Tivoli Storage Productivity Center) requirements, based on the TDA document, verify that software and hardware resources for the Tivoli Storage Productivity Center server, Agent Manager, and CIM/OM server are available so that Tivoli Storage Productivity Center server and Agent Manager (if needed in your environment) can be successfully installed.

   With emphasis on performing the following tasks:

   – Verify supported OS for the Tivoli Storage Productivity Center server.
   – Verify that Tivoli Storage Productivity Center server resources are sufficient.
   – Verify supported OS for the Agent Manager server.
   – Verify that Agent Manager server resources are sufficient.
   – Verify correct Tivoli Storage Productivity Center installation media.

3. Given the customer's SAN design which includes switches disk, tape, SAN, and any devices connected to the fabric, based on the TDA document, verify firmware levels of all hardware so as to ensure compliance with TPC.

   With emphasis on performing the following tasks:

   – Identify disk sub-systems.
   – Identify CIM/OMs already deployed.
   – Identify HBA and SAN switches.
   – Identify tape libraries.
   – Validate hardware firmware levels.

4. Given the customer's storage management requirements, identify agent candidates and types, and based on the TDA document, verify that they meet supported hardware and software prerequisites, so that Tivoli Storage Productivity Center agents (Data Agent, Fabric Agent, or Storage Resource Agent) can be successfully installed if needed.

   With emphasis on performing the following tasks:

   – Identify agent candidates.
   – Verify that agents meet hardware and software prerequisites.
   – Determine agent distribution methodology.

5. Given the customer requirements for managing file systems, databases, and devices, identify and verify the required databases and operating system user IDs so that the customer's environment can be properly discovered, probed, and scanned.

   With emphasis on performing the following tasks:

   – Identify and verify required databases.
   – Verify operating system user IDs.

6. Given management's commitment, document the customer requirements (environment, resources, components, and user base) so that an architectural document can be created.

   With emphasis on performing the following tasks:

   – Document customer requirements (environment, resources, components, user base).
   – Gather automated action requirements.
   – Identify integration points with other products.
   – Define user base.
   – Define exit criteria for a successful deployment.
   – Create an architectural document.

7. Given management's commitment during the kick-off meeting, create a task list that maps solutions to products so that a project plan can be developed.

   With emphasis on performing the following tasks:

   – Create a task list.
   – Map customer requirements to product functions.
   – Assemble resources to be used in projects.
   – Create a project plan.

1.3.2 Section 2: Installation

Here is a sequence overview for this section:

1. Given a customer environment where IBM Tivoli Storage Productivity Center (TPC) is deployed and running successfully, determine the current product release levels installed so that an upgrade to the latest release of Tivoli Storage Productivity Center can be performed.

   With emphasis on performing the following tasks:

   – Verify current Tivoli Storage Productivity Center release levels.
   – Check hardware prerequisites.
   – Verify current DB2 release levels.
   – Determine if current Tivoli Storage Productivity Center release is able to be upgraded per customer requirements.
   – Determine if current DB2 release is compatible with Tivoli Storage Productivity Center you are upgrading to.
   – Verify all SAN attached hardware firm levels and confirm that they are supported by Tivoli Storage Productivity Center.
   – Verify all SAN switches hardware / firm ware levels and confirm that they are supported by Tivoli Storage Productivity Center.
   – Obtain version information for any deployed CIMs and confirm that they are supported by Tivoli Storage Productivity Center.
   – Obtain current Tivoli Storage Productivity Center release.
   – Verify that the customer has the correct license.
   – If needed, obtain current DB2 release.
   – Understand which additional components will be installed with TPC 4.1 that were not installed with a previous level of TPC.
   – Perform upgrade.
   – Run any subsequent tasks (migrate DB script).
   – Verify upgrade.

2. Given that DB2 needs to be installed, determine system resources and logon authority, so that DB2 can be successfully installed.

   With emphasis on performing the following tasks:

   – Verify if system resources and access are available.
   – Verify RDBMS listening port.
   – Verify logon authority.
   – Install DB2.

3. Given the appropriate media, perform installation steps using an installer method so that Tivoli Agent Manager for Tivoli Storage Productivity Center is successfully installed and running, if required in your environment

   With emphasis on performing the following tasks:

   – Check hardware and software prerequisites.
   – Check for latest technical resource flashes on the Tivoli Storage Productivity Center support Web site.
   – Perform installation steps using the appropriate operating system installer.

4. Given Tivoli Storage Productivity Center media, perform installation steps using an installer method so that the Tivoli Storage Productivity Center server is successfully installed and running.

With emphasis on performing the following tasks:

   – Check hardware and software prerequisites.
   – Check for latest technical resource flashes on the Tivoli Storage Productivity Center support Web site.
   – Perform installation steps using the appropriate operating system installer.
   – Log in to Tivoli Storage Productivity Center GUI to verify installation.

5. Given a successful installation of the Tivoli Storage Productivity Center server, determine if errors exist in the installation logs, so that the installation for the Tivoli Storage Productivity Center Data Server, Device Server, Data Agent, and in-band Fabric Agent is verified.

   With emphasis on performing the following tasks:

   – Start the Tivoli Storage Productivity Center GUI.
   – Run a Discovery.
   – Go to the appropriate log directory in Windows or UNIX®.
   – Review log file for server and agent. If errors are found, take appropriate troubleshooting steps.
   – In Tivoli Storage Productivity Center GUI Navigation Tree, go to Administrative Services and verify that all services are up.
   – In Tivoli Storage Productivity Center GUI, go to administrative services/agents and verify that agent is active.

6. Given a successful installation for TPC, launch the Tivoli Integrated Portal (TIP) Console so that single sign-on (SSO) of the TPC GUI is verified.

   With emphasis on performing the following tasks:

   – Click the TPC link in the TIP console.
   – Click the TPC for Replication (TPC-R) link in the TIP console.
   – Verify that SSO works for TPC.
   – Verify that SSO works for TPC for Replication (TPC-R).

7. Given a large scale deployment for TPC and the customer's reporting requirements, deploy secondary Tivoli Productivity Center Servers and configure server rollup so that asset information can be probed and collected from secondary servers.

With emphasis on performing the following tasks:

- Deploy or identify secondary TPC Servers in the customer's environment.
- Identify correct listening ports for the secondary servers.
- Based on the customers reporting needs, determine a master TPC Server for data rollup and all data source TPC Server.
- Obtain user IDs needed to register secondary servers.
- Add secondary severs as data sources.
- Probe secondary TPC Servers.
- Verify that data can be collected from all TPC Servers.
- Display reporting categories based on available roll-up reports.

8. Given an installed TPC environment and the customer's reporting requirements, deploy the required types of TPC agents so that the appropriate agents are available and the customer's reporting requirements are met.

   With emphasis on performing the following tasks:

   - Determine if Agent Manager is required for the agents to be installed.
   - Determine if Storage Resource agents can be used instead of the TPC Data Agents.
   - Determine if TPC Fabric Agents are required at all.
   - Deploy the required agents:
     - From the TPC GUI
     - From the target machine
     - rxa
     - daemon

1.3.3 Section 3: Configuration

Here is a sequence overview for this section:

1. Given the customer operating system user account groups, map the IBM Tivoli Storage Productivity Center roles to local or domain user account groups so that role-based management can be created.

   With emphasis on performing the following tasks:

   - Create user account groups for mapping if not already created.
   - Map roles to user account groups.
   - Demonstrate user login and functionality.

2. Given an installed Tivoli Storage Productivity Center system, install CIMOM and validate that it is operational, and define it to the Tivoli Storage Productivity Center server so that storage area network (SAN) storage devices can be discovered and managed as needed.

   With emphasis on performing the following tasks:

   - Verify that the supported CIMOM for the operating system is available.
   - Install and verify CIM/OM operation.
   - Identify CIMOM login.
   - Configure CIMOM to Tivoli Storage Productivity Center server.
   - Run the Discovery.
   - Verify that the devices are visible.
   - Probe the devices.
   - Verify successful data collection.
   - Set up CIMOM for performance monitoring.

3. Given the IP Address or host name of the NAS, NetWare, or Virtual Center device or other Tivoli Storage Productivity Center server, create any definitions and scan or probe agent assignment so that Tivoli Storage Productivity Center can report on the data source.

With emphasis on performing the following tasks:

- Manually enter the server information and SNMP community name.
- Assign a scan/probe agent.
- Manually enter the host name or IP address of the NetWare Server and the login information.
- Create the Data Source definition for the Virtual Center.
- Perform Discovery or manual assignments of NAS, NetWare.
- For other NAS, verify that SNMP enterprise OID vendor number exists in NAS, configure file.
- Run Discovery job to discover NDS/edirectory trees and NAS.
- Configure NDS login for desired NDS tree.
- Assign agents to scan/probe each file system “scan probe agent admin.”
- Run a Discovery job.

4. Given a customer requirement for alert routing, configure the alerts to go to the appropriate SNMP manager or Tivoli Enterprise Console® or OMNIbus, so that alert notification is configured for Tivoli Storage Productivity Center.

   With emphasis on performing the following tasks:

   - Configure SNMP parameters.
   - Configure Tivoli Enterprise Console or OMNIbus parameters.

5. Given a successfully installed Tivoli Storage Productivity Center server, Data Agent, Fabric Agent, CIM agent, and properly configured SNMP community names, run a Discovery so that storage devices can be discovered.

   With emphasis on performing the following tasks:

   - Run CIM/OM Discovery.
   - Run out-of-band Fabric Discovery.
   - Run NetWare Filer Discovery.
   - Run Windows Domain, NAS, SAN FS, and VMware Discovery.

6. Given an installed Tivoli Storage Productivity Center system, configure and run a probe to collect a successful agent inventory and perform knowledge transfer to customer so that the customer understands the concepts.

   With emphasis on performing the following tasks:

   - Log in to TPC and demonstrate the product functionality.
   - Select the agents (computers) to be probed, when to probe, Triggered Condition/Alert Action.
   - Define groups.
   - Define profiles.
   - Run a probe.
   - Generate an asset report.
   - Perform knowledge transfer to customer.
   - Verify customer understanding of concepts.

7. Given a successful agent probe, run a scan against the inventory and gather file system level information and perform knowledge transfer to customer so that the customer understands the concepts.

   With emphasis on performing the following tasks:

   - Log in to Tivoli Storage Productivity Center and demonstrate the product functionality.
   - Select computers or file systems to be scanned.
   - Select the Profile(s).
   - Choose When to Scan.

- Choose Triggered Condition/Action.
- Run a scan.
- Perform knowledge transfer to customer.
- Verify customer understanding of concepts.

8. Given a computer configured as a TPC agent with a supported RDBMS installed, successfully configure and collect statistics on the given database so that RDBMS data can be collected and reported on.

   With emphasis on performing the following tasks:

   - Choose the host name and database type, entering the relevant database information.
   - Create and run a database probe job.
   - Create and run a database scan job.
   - Select the appropriate agent and enable Tivoli Storage Productivity Center for databases for that agent.
   - Define RDBMS login for appropriate database and agent.
   - Define database groups.
   - Define alerting.
   - Define and run probe.
   - Define profiles.
   - Define a quota.
   - Run a scan.
   - Generate reports.

1.3.4 Section 4: Customization and Administration

Here is a sequence overview for this section:

1. Given customer requirements for alerting, configure an alert so that IBM Tivoli Storage Productivity Center (Tivoli Storage Productivity Center) for Data can send alerts where needed.

   With emphasis on performing the following tasks:

   - Select computers or file systems to be scanned.
   - Define trigger condition.
   - Define trigger action (TEC, SNMP, Login Notification, Event Logs, E-mail, Scripts).
   - Configure parameters for selected trigger action. (for example, load Tivoli Enterprise Console TEC_ baroc file for event file; configure SNMP parameters, SNMP communicator, and compile MIB.)
   - Run a scan.
   - Verify customer understanding of concepts.

2. Given a functioning Tivoli Storage Productivity Center environment and a configured storage subsystem or storage area network (SAN) switch, create a performance monitor and alert so that performance monitoring and alerting functionality can be demonstrated.

   With emphasis on performing the following tasks:

   - Check the configuration utility and verify that the subsystem and switches are enabled for performance.
   - Create a performance monitor.
   - Create a performance alert and set thresholds.
   - Create a performance report.

3. Given a working Tivoli Storage Productivity Center environment and customer requirements, create profiles so that specific reports can be generated.

With emphasis on performing the following tasks:

- Create profiles.
- Assign the profile in a scan job.
- Select computers, file systems, or directories to be scanned.
- Select the Profile(s).
- Choose When to Scan.
- Choose Triggered Condition/Action.
- Run a scan.
- Create a report.

4. Given a working Tivoli Storage Productivity Center environment and customer requirements, set history retention so that the customer's requirements are met.

   With emphasis on performing the following tasks:

   - Understand which information can be found on the history retention panel.
   - Set history retention periods.

5. Given a working Tivoli Storage Productivity Center environment and group membership requirements, create monitoring groups so that jobs can be run.

   With emphasis on performing the following tasks:

   - Create computer groups.
   - Create file system groups.
   - Create directory groups.
   - Create user groups.
   - Create OS user groups.
   - Assign resources to groups.

6. Given a working Tivoli Storage Productivity Center environment and customer requirements, create custom policies so that customer's business requirements are met.

   With emphasis on performing the following tasks:

   - Set quotas.
   - Schedule data collection activities.
   - Configure alert constraints.

7. Given a working Tivoli Storage Productivity Center environment and customer requirements, perform backups so that customer backup requirements are met.

   With emphasis on performing the following tasks:

   - Identify the database name for Agent Manager and TPC for backup purposes.
   - Back up Agent Manager.
   - Back up Tivoli Storage Productivity Center repositories.
   - Back up configuration files.
   - Back up certification files.

8. Given a successful Tivoli Storage Productivity Center server installation, set up a batch report for violating constraints for file types and enable HTML output for Web site reporting so that the report is displayed on the Web server.

   With emphasis on performing the following tasks:

   - Define and run a probe.
   - Create a constraint for file types.
   - Create a profile.
   - Run scan with “file types” profile.
   - Create batch report (Select Computers, When to run, Triggered Condition/Alert).
   - Create HTML batch reports for Web sites.
   - Verify the TPC for Data Agent is installed on the Web server.
   - Verify that the Web server can display the output of the batch report.

9. Given a functioning Tivoli Storage Productivity Center environment and configured SAN fabric switches, create a zone and zone set, so that Tivoli Storage Productivity Center zone management functionality can be demonstrated.

   With emphasis on performing the following tasks:

   – Check the configuration utility and verify that the switch is enabled for zoning.
   – Create a zone set.
   – Create a zone.
   – Activate the zone set.

10. Given a functioning Tivoli Storage Productivity Center environment and configured SAN fabric switches, HBAs, and disk subsystems, use the Tivoli Storage Productivity Center analytics tools and problem determination assistance so that recommendations can be made on how to configure changes to the storage environment.

    With emphasis on performing the following tasks:

    – Set up a configuration analysis job to analyze SAN attached resources.
    – Specify the storage subsystems, computers, and the fabric to have the planner provide appropriate storage recommendation.

11. Given a functioning Tivoli Storage Productivity Center environment and configured SAN fabric switches, HBAs, and disk subsystems, use the topology display so that configuration planning and analysis can be performed.

    With emphasis on performing the following tasks:

    – Use Data Path Explorer to generate an end-to-end storage topology view.
    – Adjust the topology settings to display performance overlays.
    – Launch the planner to configure storage and zoning.
    – Determine alerts associated with a specific device.
    – Launch reports from the Topology Viewer for the Data and Disk Manager.
    – Launch the element manager to manage a specific device.
    – Use the pin function to highlight a specific device in applicable view.

1.3.5 Section 5: Troubleshooting

Here is a sequence overview for this section:

1. Given a malfunctioning IBM Tivoli Storage Productivity Center environment and a serviceability tool output request from IBM support, generate the serviceability report files so that they can be used for troubleshooting.

   With emphasis on performing the following tasks:

   – Check the services.
   – Locate log file directories and log files.
   – Look in the alert log of TPC.
   – Run the serviceability tool.
   – Collect the server logs.
   – Collect the common agent logs.

1.4 Recommended resources for study

Courses and publications are offered to help you prepare for the certification tests. The courses are recommended, but not required, before taking a certification test. When preparing for the certification test, keep in mind that real world experience is required to stand a reasonable chance of passing the certification test. Courseware does not replace the requirement for experience. If you want to purchase Web-based training courses or are unable to locate a Web-based course or classroom course at the time and location you desire, feel free to contact one of our delivery management teams at:

- Americas:

  tivamedu@us.ibm.com
- EMEA:

  tived@uk.ibm.com
- Asia-Pacific:

  tivtrainingap@au1.ibm.com

Note: Course offerings are continuously being added and updated. If you do not see the courses listed in your geography, contact the delivery management team.

1.4.1 Sample and assessment test

On the IBM Professional certification Web site, you can find a sample test and an assessment test to help you determine if you need further time for study or training in order to be prepared for the certification test.

http://www.ibm.com/certify/tests/sam002.shtml

The sample test is provided as a PDF document with 10 questions. You can use that as a starting point for your study because it also provides the correct answers.

The assessment test has the same number of questions as well as the time limit of the actual exam, so this test provides an even better checkpoint to see how well you are prepared for the certification.

1.4.2 Courses

On the following Web site, you can find a list of courses related to IBM Tivoli Storage Productivity Center when you click **Product Training** and go to the letter *T*.

http://www.ibm.com/software/tivoli/education

For information about pricing, scheduling, and course registration: Course names and course numbers vary depending on the education delivery arm used in each geography. Refer to the Tivoli software education Web site to find the appropriate course and education delivery vendor for each geography.

General training information can also be found at:

http://www.ibm.com/training

1.4.3 Publications

This section provides you a reference to the information that is available for IBM Tivoli Storage Productivity Center.

Product documentation

IBM Tivoli Storage Productivity Center product documentation:

- *IBM Tivoli Storage Productivity Center Installation and Configuration Guide Version 4.1*, SC27-2337
- *IBM Tivoli Storage Productivity Center User's Guide Version 4.1*, SC27-2338
- *IBM Tivoli Storage Productivity Center Problem Determination Guide Version 4.1*, SC27-2342

To order publications, access the IBM Publications Center on the Web (note publication order number) by visiting:

`http://www.elink.ibmlink.ibm.com/publications/servlet/pbi.wss`

You can also order publications by calling IBM Direct Publications: 1-800-879-2755 (US), 1-800-426-4968 (Canada), or by visiting any non-IBM bookstore.

To access the documentation online or download the PDF manuals. go to:

`http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp`

Support Web site

You can access the support Web site of IBM TotalStorage® Productivity Center/IBM Tivoli Storage Productivity Center in order to:

- Download the manuals or access the Information Center
- Look for flashes
- Read technical notes
- Find support metrics
- Access Redbooks publications

At the time of this writing, the support site is still using the older name TotalStorage in some places, but this will change soon. From a product perspective, there are three support sites:

- IBM Tivoli Storage Productivity Center Basic Edition Support:

  `http://www-01.ibm.com/software/sysmgmt/products/support/IBMTotalStorageProductivityCenterBasicEdition.html`

- IBM Tivoli Storage Productivity Center Standard Edition Support:

  `http://www-01.ibm.com/software/sysmgmt/products/support/IBMTotalStorageProductivityCenterStandardEdition.html`

- Support for System Storage™ Productivity Center (SSPC):

  `http://www-947.ibm.com/systems/support/supportsite.wss/supportresources?brandind=5000033&familyind=5356448&taskind=1`

  This site contains most information that is covered on the other two sites already, but for the installation of SSPC you might find some specific help on SSPC setup.

There are no special Web sites for other TPC licences such as TPC for Data or TPC for Disk, because both are already included in the TPC Standard Edition.

Redbooks publications

The following Redbooks publications can prove to be useful, in addition to the regular product documentation and support Web site, which are listed later in this section.

- *IBM Tivoli Storage Productivity Center V4.1: Release Guide*, SG24-7725

  Abstract: IBM Tivoli Storage Productivity Center is a storage infrastructure management software product that can centralize, automate, and simplify the management of complex and heterogeneous storage environments.

  This publication is intended for administrators or users who are installing and using IBM Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication. It describes the hardware and software requirements for installing the products and provides an overview of the installation procedures. The new features and functions introduced in this version are described. Working Scenarios showing how to take advantage of the product are included.

- *TotalStorage Productivity Center V3.3 Update Guide*, SG24-7490

  Abstract: IBM TotalStorage Productivity Center provides an integrated storage infrastructure management solution that is designed to allow you to manage every point of your storage infrastructure, between the hosts through the network and fabric, through to the physical disks. It can help simplify and automate the management of devices, data, and storage networks.

  IBM TotalStorage Productivity Center V3.3 continues to build on the function provided in prior releases. This book takes you through what is new in TotalStorage Productivity Center and explains how to implement and use the new function.

- *IBM TotalStorage Productivity Center Advanced Topics*, SG24-7348

  Abstract: You have installed and performed the basic customization of IBM TotalStorage Productivity Center. You have successfully completed performance data collection and have generated reports. But how do you best use the TotalStorage Productivity Center to manage your storage infrastructure?

  This IBM Redbooks publication shows how to best set up TotalStorage Productivity Center based on the storage environment infrastructure, and then manage that storage infrastructure with TotalStorage Productivity Center. It includes experiences from client accounts and our own internal experiences. This book includes the following topics:

  - TotalStorage Productivity Center installation considerations (number of servers, database placement, firewall considerations, and agent deployment)
  - CIMOM management (how many are required and how to customize them)
  - Performance monitoring (setting up thresholds and alerts, gathering data, and which reports to use)
  - Creating custom reports with TPCTOOL
  - Maintaining the TotalStorage Productivity Center implementation (data retention, database backup, and debugging tools)

  This Redbooks publication is intended for storage administrators, who are responsible for the performance and growth of the IT storage infrastructure.

- *Certification Study Guide: IBM TotalStorage Productivity Center for Data V3.1*, SG24-7390

  This IBM Redbooks publication covers the TPC for Data topic more in depth, so it might also help you to better understand those topics.

  Abstract: This IBM Redbooks publication is a study guide for IBM TotalStorage Productivity Center for Data Version 3.1, and it is targeted for professionals who want to get an IBM Certification in this specific product.

  This Certification, offered through the Professional Certification Program from IBM, is designed to validate the skills required of technical professionals who work in the implementation of the IBM TotalStorage Productivity Center for Data Version 3.1 product.

  This IBM Redbooks publication provides a combination of theory and practical experiences necessary for a general understanding of the subject matter. It also provides sample questions that will help in the evaluation of personal progress and provide familiarity with the types of questions that will be encountered in the exam.

- *SAN Storage Performance Management Using TotalStorage Productivity Center*, SG24-7364

  Abstract: TotalStorage Productivity Center is an ideal tool for performing storage management reporting, because it uses industry standards for cross vendor compliance, and it can provide reports based on views from all application servers, all Fibre Channel fabric devices, and storage subsystems from different vendors, both physical and virtual.

  This IBM Redbooks publication is intended for experienced storage managers who want to provide detailed performance reports to satisfy their business requirements. The focus of this book is to use the reports provided by TotalStorage Productivity Center for performance management.

  We do address basic storage architecture in order to set a level playing field for understanding of the terminology that we are using throughout this book.

  Although this book has been created to cover storage performance management, just as important in the larger picture of Enterprise-wide management are both Asset Management and Capacity Management. TPC is an excellent tool to provide all of these reporting and management requirements.

2

IBM Tivoli Storage Productivity Center: Architecture and functional overview

In this chapter, we provide a high-level technical introduction to IBM Tivoli Storage Productivity Center, including its architecture, functions, and base components.

We discuss these topics:

- Introduction to IBM Tivoli Storage Productivity Center
- Architecture
- What is new in Tivoli Storage Productivity Center since Version 3.1
- Functions no longer supported
- Product features

2.1 Introduction to IBM Tivoli Storage Productivity Center

IBM Tivoli Storage Productivity Center is designed to provide a comprehensive storage management solution for heterogeneous storage environments across the enterprise. It is the IBM primary operational management product within the Tivoli Service Management architecture.

Tivoli Storage Productivity Center includes:

- Storage resource management (SRM):
  - Reporting of volumes and file systems on a server level
  - Reporting on NAS and NetWare file systems
  - Reporting of databases capacity and usage
  - Constraint and quota reporting
- Storage subsystem management:
  - Volume allocation and assignment (provisioning)
  - Asset reporting
  - Performance reporting
  - DS8000® element management
- Fabric management:
  - Zoning
  - Asset reporting
  - Performance reporting
- Replication management
- Basic tape library reporting

In addition to those basic functions, Tivoli Storage Productivity Center includes more advanced functions that provide you with a set of analytics functions such as:

- Topology Viewer
- Data Path Explorer
- Configuration History
- Storage Optimizer
- SAN Planner
- Configuration Analytics

2.1.1 History of Tivoli Productivity Center

Tivoli Storage Productivity Center started as a suite of individual products that focus on different storage management tasks across the enterprise.

In Version 3.x, the individual products were combined into one and a new product (Tivoli Storage Productivity Center for Replication) was added to the Tivoli Storage Productivity Center suite of products.

With Tivoli Storage Productivity Center V4.x, the integration of TPC for Replication (TPC-R) starts with both Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication being installed together. In addition, the most obvious changes are a Navigation Tree item with launch points from TPC to TPC-R and mapping of the TPC superuser role to the TPC-R administrator role.

2.1.2 IBM Tivoli Productivity Center licenses

In this section we review the Licenses for Tivoli Storage Productivity Center.

IBM Tivoli Storage Productivity Center Basic Edition V4.1

IBM Tivoli Storage Productivity Center Basic Edition V4.1 provides basic storage management for SAN-attached storage devices and the networks to which they are connected. It provides device asset information, connectivity, capacity data, and health and status monitoring for the supported devices. If you have a license for Tivoli Storage Productivity Center Basic Edition installed, you can upgrade to advanced features by the simple procedure of installing a license file on the console where the software is running.

IBM Tivoli Storage Productivity Center for Data V4.1

IBM Tivoli Storage Productivity Center for Data V4.1 provides file-level capacity management for servers connected to a SAN infrastructure. It is designed to enable the administrator to create detailed reports on storage availability and utilization by server, operating system, user, and database application. Policy-based alerts can be configured to notify the administrator when the utilization of a selected volume exceeds a predefined threshold, and integration with Tivoli Storage Manager helps the administrator to reclaim space on the volume by deleting unneeded data or selecting it for archive.

IBM Tivoli Storage Productivity Center for Disk V4.1

Tivoli Storage Productivity Center for Disk V4.1 is designed to provide storage device configuration and management from a single console. It includes performance capabilities to help monitor and manage performance, and measure service levels by storing received performance statistics into database tables for later use. Policy-based automation enables event action based on customer policies. It sets performance thresholds for the devices based on selected performance metrics, generating alerts when those thresholds are exceeded. Tivoli Storage Productivity Center for Disk V4.1 helps simplify the complexity of managing multiple SAN-attached storage devices.

IBM Tivoli Storage Productivity Center for Replication V4.1

IBM Tivoli Storage Productivity Center for Replication V4.1 is designed to support hundreds of replication sessions across thousands of volumes, supporting both open and z/OS attached volumes. In addition, it helps monitor performance of all copy session types and reports on the amount of data exposed at the disaster recovery site (not in synchronization with the source site). The IBM Tivoli Storage Productivity Center for Replication Three-Site BC feature optionally provides three-site recovery management, supporting the IBM System Storage DS8000 Metro Global Mirror feature. The Three-Site feature is designed to support fast failover and failback, fast reestablishment of three-site mirroring, data currency at the remote site with minimal lag behind the local site, and quick resynchronization of mirrored sites using incremental changes only.

IBM Tivoli Storage Productivity Center Standard Edition V4.1

IBM Tivoli Storage Productivity Center Standard Edition V4.1 provides over 400 enterprise-wide reports, monitoring and alerts, policy-based action, and file-system capacity automation in a heterogeneous environment. You can address the challenges of an on demand environment with customizable storage-management policies that are designed to help manage key aspects of the storage infrastructure including capacity, assets, events, and availability. It provides a suite of tools to help enterprises identify, evaluate, control, and predict storage usage and growth. IBM Tivoli Storage Productivity Center Standard Edition V4.1 offers active, policy-based management for an automated, self-healing approach to storage resource management.

IBM System Storage Productivity Center

The IBM System Storage Productivity Center (SSPC) is an integrated offering designed to provide a consolidated focal point for managing IBM storage products as well as managing mixed-vendor storage environments. SSPC provides enhancements to daily storage administration by making available a broader set of configuration functions. SSPC provides the GUI and utilities to configure these devices and enhancements to provide a broader set of management functions. The SSPC combines the power of a customized IBM System x® server with preinstalled storage software that represents a significant point of centralized management. SSPC enhances several rudimentary device utilities for easier, more intuitive, context-based administration and on the whole lowers resource overhead.

The IBM System Storage Productivity Center comes pre-installed with IBM Tivoli Storage Productivity Center Basic Edition. However, the purchase of the SSPC does not include the software license or entitlement to this software.

2.1.3 Main focus of TPC: Reporting

One of the main focus of IBM Tivoli Storage Productivity Center is reporting. TPC provides a wide range of reports, alerts, and policy-based action. Starting with Version 4.1, in addition to the possibility to customize the provided reports (in terms of adding, removing, and changing columns), you can now also create your own reports by using SQL commands that use a special database schema called TPCREPORT. This feature enables enhanced customization as well as integration with other applications.

The standardized reports provide information about file systems, databases, and storage infrastructure. Depending on the type of manager or management function used, the following types of reports are available (see Table 2-1).

Table 2-1 Report types by manager

Type	Data	Databases	Disk	Fabric	Tape
Asset	x	x	Included in data manager	Included in TPC System reports	
Availability	x				
Capacity	x	x			
Usage	x	x			
Usage violation	x	x			
Backup	x				
Performance			x	x	
Special reports			Subsystem details		Tape library overview

From a high level perspective, TPC reporting consists of ways to import information into its database as well as ways to extract data from this repository. The diagram in Figure 2-1 provides a brief overview of the information gathering and extracting with TPC. We explain the functions and jobs later in this book.

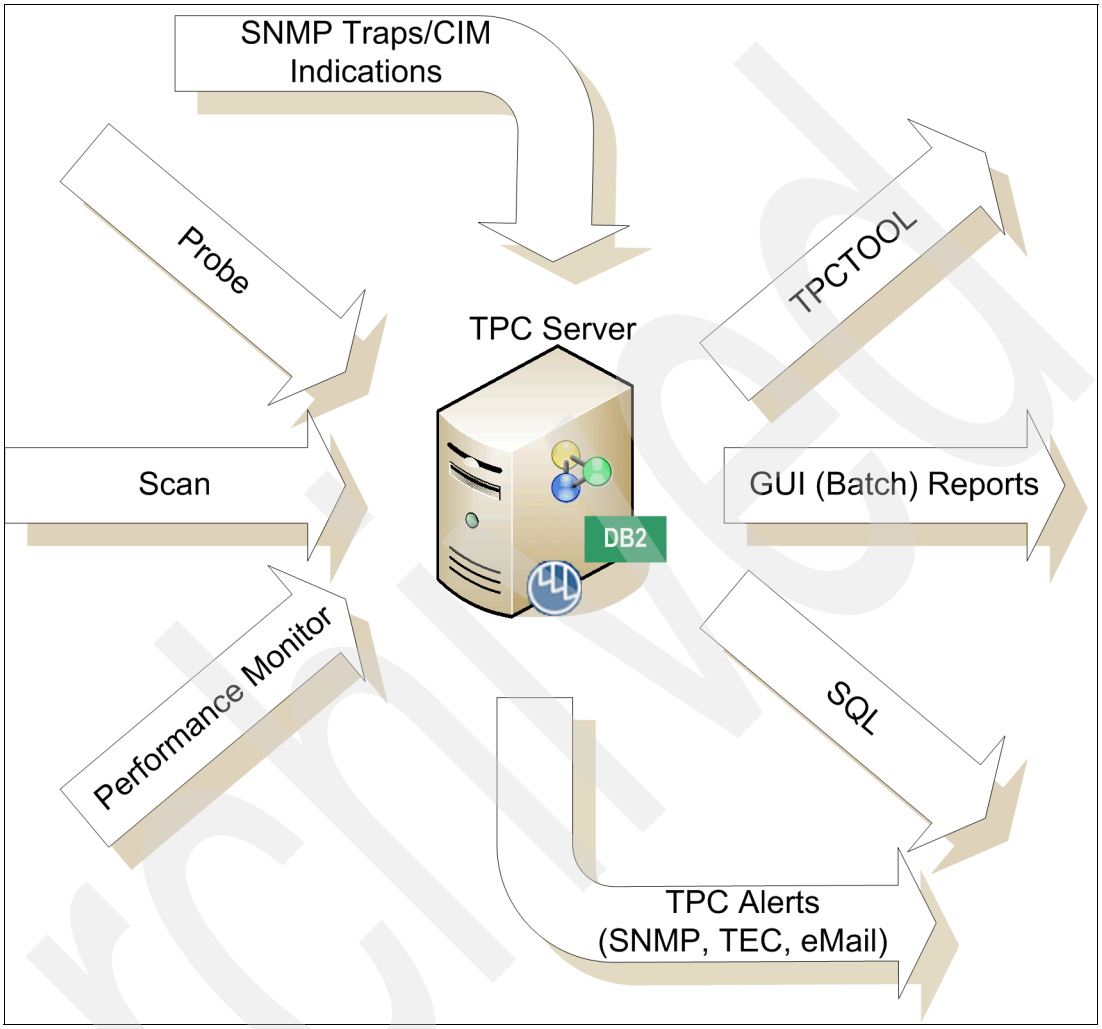


Figure 2-1 TPC repository report gathering and types

This diagram does not differentiate between the different sources of the data such as agents, CIMOMs, hypervisor, or other TPC servers. Instead, this diagram shows the information gathering and extracting form a functional point of view.

2.2 Architecture

The basic architecture of TPC has not changed dramatically since Version 3, but the infrastructure that TPC is using, and is integrated with, has changed in V4.

2.2.1 Data Server and Device Server

The main components of TPC are the Data Server and the Device Server, which work together and act as the TPC server. Both the Data Server and the Device Server run as a separate process and access the TPC database that is running inside a DB2 instance.

2.2.2 Tivoli Integrated Portal

Because Tivoli Storage Productivity Center V4 is integrated into the Tivoli Integrated Portal (TIP), the TIP provides the following optional services to TPC:

- Single Sign-On
- Tivoli Common Reporting

2.2.3 Tivoli Storage Productivity Center for Replication

With TPC Version 4.1 the IBM Tivoli Storage Productivity Center for Replication product is starting to get integrated into TPC, even though currently the integration limited to basic functions such as providing launch in context links in the TPC GUI as well as cross checks when a volume is deleted with TPC and mapping of user roles.

2.2.4 Information sources

Outside of the server, there are several interfaces that are used to gather information about the environment. The most important sources of information are the TPC agents (Data Agent, Fabric Agent, and the new storage resource agent) as well as SMI-S enabled storage devices that use a CIMOM agent (either embedded or as a proxy agent).

Agents

In addition to TIP, TPC uses the Tivoli Agent Manager for a certificate based authentication between the Common Agent based TPC agents (the Data and Fabric Agent) and the TPC server itself using the Secure Sockets Layer (SSL) protocol. The Storage Resource Agents does not use the Tivoli agent framework.

Figure 2-2 illustrates an architectural overview for IBM Tivoli Storage Productivity Center.

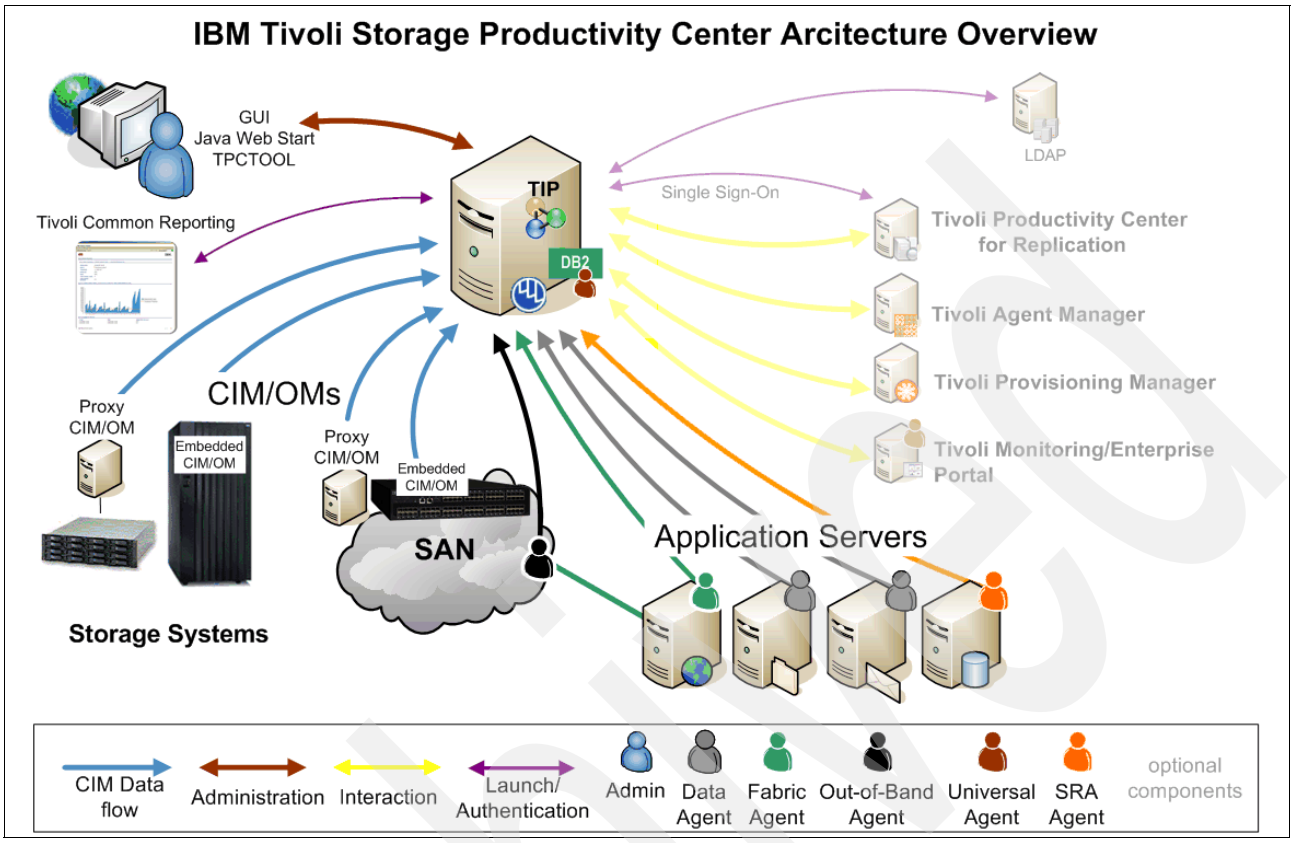


Figure 2-2 IBM Tivoli Storage Productivity Center Version 4.1 - Architecture Overview

The architectural diagram provides a logical overview of the main conceptual elements and relationships in the architecture, components, connections, users, and external systems. The diagram also shows the different methods used to collect information from multiple systems to give an administrator the necessary views on the environment, for example:

- Agent Manager with its registry repository
- Software clients (agents)
- Standard interfaces and protocols (for example, Simple Network Management Protocol)
- Common Information Model (CIMOM agent)
- Repository

2.2.5 Data Manager and Device Manager

The server is the center of TPC's architecture and directs all of the activities related to the monitoring performed on the monitored agent computers and the reporting performed on the client GUI computers. As mentioned earlier, the server consists of the two managers: the Data Manager and the Device Manager. The server interacts with the enterprise repository, job scheduler, agents, and agent manager (for authorization and authentication of agents).

Database repository: DB2

The managers receive information from the agents and saves that information in the repository. The repository is where all of your storage information and usage statistics are stored. All agent and user interface access to the central repository is done through a series of calls and requests made to the server.

All database access is done using the server component to maximize performance and to eliminate the need to install database connectivity software on your agent and UI machines.

2.2.6 User interfaces

As TPC gathers information from your storage (servers, subsystems and switches) across your enterprise, it accumulates a repository of knowledge about your storage assets and how they are used. You can use the reports provided in the user interface view and analyze that repository of information from different perspectives to gain insight into the use of storage across your enterprise.

The user interfaces (UIs) enable users to request information and then generate and display reports based on that information. Some user interfaces can also be used for configuration of TPC and storage provisioning for supported devices.

The following interfaces are available for TPC:

- TPC GUI:

  This is the central point of TPC administration. Here you have the choice of configuring TPC after installation, define jobs to gather information, initiate provisioning functions, view reports, and work with the advanced analytics functions.

- Java™ Web Start GUI:

  When you use Java Web Start, the regular TPC GUI will be downloaded to your workstation and started automatically, so you do not have to install the GUI separately. The main reason for using the Java Web Start is that it can be integrated into other products (for example, TIP). By using launch in context from those products, you are guided directly to the select panel. The launch in context URLs can also be assembled manually and be used as bookmarks.

- TPCTOOL:

  This command line (CLI) based program interacts with the TPC Device Server. Most frequently it is used is to extract performance data from the TPC repository database in order to create graphs and charts with multiple metrics, with different unit types and for multiple entities (for example, Subsystems, Volumes, Controller, Arrays) using charting software. Commands are entered as lines of text (that is, sequences of types of characters), and output can be received as text.

  Furthermore, the tool provides queries, management, and reporting capabilities, but you cannot initiate Discoveries, Probes, and performance collection from the tool.

- Database access (for example, JDBC):

  Starting with TPC V4.1, the TPC database provides views that provide access to the data stored in the repository which allows you to create customized reports. The views and the required functions are grouped together into a database schema called TPCREPORT. For this, the user needs to have sufficient knowledge about SQL. To access the views, DB2 supports different interfaces, for example, JDBC and ODBC.

2.2.7 Tivoli Integrated Portal

Tivoli Integrated Portal (TIP) is a standards-based architecture for Web administration. Tivoli Integrated Portal enables developers to build administrative interfaces for IBM and independent software products as individual plug-ins to a common console network. The installation of Tivoli Integrated Portal is required to enable single sign-on for Tivoli Storage Productivity Center.

Single Sign-On

Single Sign-On (SSO) is an authentication process that enables you to enter one user ID and password to access multiple applications. Single Sign-On integrates with the launch in context feature to enable you to move smoothly from one application to a specific location in a second application.

Tivoli Common Reporting

Tivoli Common Reporting (TCR) is a component provided by TIP. It is one possible option to implement customized reporting solutions using SQL database access, providing output in HTML, PDF or Microsoft® Excel.

Note that Tivoli Common Reporting is intended to provide a platform to reproduce custom reports in an easy way or for reports that are to be run repeatedly—typically on a daily, weekly, or monthly basis. It does not provide any online report creation or report customization features.

2.2.8 IBM Tivoli Storage Productivity Center for Replication

TPC for Replication (TPC-R) is designed to automate key replication management tasks to help you improve the efficiency of your storage replication. A simple graphical user interface is used to configure automation, manage ongoing activities, and monitor progress of all key tasks. Your IT experts can use a single integrated tool for advanced copy management of IBM storage subsystems, in order to save administrators time and effort.

The basic functions of TPC for Replication provide management of FlashCopy®, Metro Mirror, and Global Mirror capabilities for the IBM ESS Model 800, IBM DS6000™, and IBM DS8000. It also manages FlashCopy and MetroMirror for IBM System Storage SAN Volume Controller (SVC).

IBM Tivoli Storage Productivity Center for Replication for System z® provides all the functions of the two Tivoli Storage Productivity Center for Replication open systems products. It is packaged to run on System z, using a mixture of FICON® and TCP/IP communications, to provide replication management of DS8000, DS6000, and ESS 800, regardless of the type of data on them (ECKD™ or FBA).

2.2.9 Tivoli Storage Productivity Center Agents

Agents are used to collect statistics about your storage and send that information to the centralized Data Manager component. Depending on the information required and the target device, TPC uses different types of agents:

- Data Agent
- Fabric Agent
- Storage Resource Agent
- CIM Agents
- SNMP Agents
- Universal Agent

In general, agents receive jobs to run from a server's scheduling service and then contact the server for the job definition. After this activity has successfully completed, no further communication to the server is required until the job completes.

Data Agents

An agent is installed on each machine containing storage that should be monitored. Agents can perform different tasks, including probes, file system scans, and batch job processing. The most important functions of agents include:

- Keeping track of information, such as the uptime and downtime of the machine on which the agent is running
- Returning information to the server from Scans and Probes on file systems and databases

Fabric Agents

A special in-band Fabric Agent collects information about the SAN and sends that information to the IBM Tivoli Storage Productivity Center server. The in-band Fabric Agent is capable of gathering topology information for the entire fabric. To gather host-level and detailed Host Bus Adapter (HBA) information, the agent must be installed on each host where that information is desired.

Storage Resource Agent

Storage Resource Agents (SRAs) can collect information from computer systems (host systems) on which they are installed. Information is collected through Probe jobs. These agents are designed to be more lightweight and easier to install or deploy than the Data Agents.

In contrast to the Data Agents, an SRA cannot perform any more functions than a Probe. For example, Scans or Batch Reports are not possible with the SRAs delivered in TPC Tivoli Storage Productivity Center V4.1.

CIM Agent

TPC uses a Common Information Model - Object Manager (CIMOM) agent to gather information about storage subsystem controllers and switches. The communication is based on the Storage Management Interface specification (SMI-S), which standardizes the type of information and the communication between TPC and the CIM agent.

A CIM agent can run either as an embedded service in a storage device (disk, tape, or switch) or it can run as a proxy-agent on some kind of server, and establish the communication between the storage device and TPC. The CIM agents are referred to by a variety of names, including CIMOM agent, SMI-S Provider, and so on.

The CIM agents are provided by the vendor of the storage device, fabric switch, or tape library. For storage subsystems, the CIM agents are needed for storage asset information, provisioning, alerting, and performance monitoring. For tape libraries, the CIM agents are used for asset and inventory information. The CIM agents conform to the SNIA SMI-S specification to provide a communication transport between IBM Tivoli Storage Productivity Center and the managed devices.

For fabric switches (all switch vendors), the CIM agents are used for performance monitoring. For a subset of switch vendors, the CIM agents are also used to collect complete topology and zoning information, to receive and handle fabric events represented by “CIM Indications”, and for zone control.

Each of the CIM agents performs the following functions:

- Discovers the existence of fabrics and switches
- Gathers switch port information needed for performance monitoring
- Gathers statistics for performance monitoring
- Gathers information about SAN topology (for Brocade and McDATA only)

- Gathers information about the zoning and allows zone control (for Brocade and McDATA only)
- Gathers event information sent by CIM Indications from the CIM agent (for Brocade and McDATA only)

CIM agents are typically implemented by fabric vendors in these ways:

- One SMI-S CIM agent can manage the whole fabric. These are referred to as *fabric CIMOMs*.
- Each SMI-S CIM agent manages one switch in the fabric. These are referred to as *switch CIMOMs*". A switch CIMOM can be imbedded in the switch.

SNMP out-of-band agents

IBM Tivoli Storage Productivity Center uses SNMP queries to discover information about the SAN Management Information Base (MIB) information is collected from the switches and directors by the out-of-band Fabric Agent. Switches and directors are added as out-of-band Fabric Agents and contacted from the IBM Tivoli Storage Productivity Center Device Server by SNMP. The out-of-band Fabric Agent performs the following functions:

- Gathers information about the fabric by querying the switch or director for topology information
- Gathers information about the zoning and allows zone control (Brocade switch only) of the fabric
- Gathers virtual SAN information for Cisco switch

Universal Agent

IBM Tivoli Storage Productivity Center Universal Agent collects information about the Tivoli Storage Productivity Center Health, Data Server, and Data Server services information, Device information, alert information, and job information.

The collected data is used to reflect the information in IBM Tivoli Monitoring / Tivoli Enterprise Portal (ITM/TEP). One or more TPC Servers can be setup up in ITM/TEP to be monitored. For more information about ITM/TEP, go to:

http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/topic/com.ibm.itm.doc/itm610usersguide.htm

Import data in TEP

There are two ways to import data in TEP: by direct connection to the API of the programs or by data import from CSV files, where only the status information about the TPC Data Servers and Device Servers is transferred between TPC and ITM/TEP.

TPC Health, Data Server, and Data Server services information

The TPC Health, Data Server, and Data Server services information (API and CSV) include:

- Data Server status (API)
- Device Server status (API)
- Services status (API)
- CIMOM connection status (CSV)
- CIMOM information such as last Discovery, Managed devices (CSV)
- Agent connection status (CSV)
- Agent information such as last Discovery and Probe, Managed devices (CSV)
- Equivalent information about other TPC servers defined as data sources for Rollup Reporting (CSV)
- VMware (CSV)

Alert information

Alert information (CSV) includes:

- Amount of all alerts
- Alerts per component such as Computer, Data, Disk, Fabric etc.

Job information

Job information (CSV) includes:

- Amount of Jobs, such as Discovery, Probe, Scans, PM
- Job Status and Details, For example: Start Time, Finish Time, Status, Log File
- Name
- Scheduled Jobs and Details, For example: Intervals, Creator, Name

For more information, in the Tivoli Storage Productivity Center installation media, you can view the README.txt file located in the TPCUA.zip file (TPCUA.tar on UNIX platforms), in the Tool folder of Disk 1.

Other ways to gather information

For some environments (specially file servers), there are no supported agents available. Here we explain two alternative methods for data gathering:

- For NetWare servers, install and license an agent on a machine that:
  - Is running a supported Windows platform. To use Data Manager for retrieving storage information from the servers and volumes within NDS trees, you must install its agent on a Windows machines where a Novell NetWare client is already located. Data Manager gathers detailed storage information about NetWare servers and volumes using native NetWare calls from these Windows machines.
  - Has an installed NetWare Client.
  - Has access to the Novell NetWare servers and volumes within your environment.
- For NAS support, install and license an agent on Windows or UNIX machines from which the NAS filers you want to scan are visible. You do not install agents to the NAS filers themselves—rather, you install them to Windows, UNIX, and Linux machines that have access to those NAS filers (for example, install agents to Windows machines that can access your NAS filers, or install agents to UNIX or Linux machines that have imports for the file systems within the NAS filers).

  See the *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide Version 4.1*, GC32-1774 for more information.

2.2.10 Tivoli Common Agent Services

Tivoli Common Agent Services provide a way to deploy multiple agent code across multiple user machines or application servers throughout your enterprise. The deployed agent code collects data from and performs operations on managed resources on behalf of a management application.

The Tivoli Common Agent Services include an Agent Manager that provides authentication, authorization, and maintains a registry of configuration information about the agents and resource managers in your environment. The Resource Manager is a part of the Tivoli Common Agent Services and is the server component of products that manage subagents deployed on the common agent.

The Tivoli Common Agent Services also provides common agents that act as containers to host product subagents and common services. The common agent provides remote deployment capability, shared machine resources, secure connectivity, and a single-entry point on the client computers on which the agents reside.

Agent Manager

The Tivoli Agent Manager provides authentication and authorization using X.509 certificates and the Secure Sockets Layer (SSL) protocol. Agent Manager processes queries about its registry of configuration information about the agents and management applications.

Data Manager and agents must register with the Agent Manager before they can use its services to communicate with each other. Registration is password-protected, with separate passwords for agent registration and Resource Manager registration. The registry is a database that contains the current configurations of all known agents and resource managers. The registry is in a DB2 database (either remote or local).

The Agent Manager also provides an agent recovery service, which is a network service for error logging for agents that cannot communicate with other Agent Manager services. Agents use an unsecured HTTP connection to communicate with the agent recovery service on the port number. Because the connection is unsecured, an agent can always communicate with the agent recovery service, even if the agent is incorrectly configured or has expired or revoked certificates.

The agent recovery service is a WebSphere servlet container. Agents locate the agent recovery service using the unqualified host name TivoliAgentRecovery and port 80. The agent recovery service runs on the Agent Manager server. There must be an entry on your Domain Name System (DNS) server that maps the host name TivoliAgentRecovery to the computer system where you installed the Agent Manager.

Note: Agent Manager is optional, and is only required when you plan to deploy Data agents or Fabric agents. You can install Tivoli Storage Productivity Center with or without Agent Manager registration.

If you intend to install and use the Data agent or Fabric agent (or both), you must first install an Agent Manager and register your Tivoli Storage Productivity Center server with the Agent Manager before you install your Data agent or Fabric agent (or both). A check box is provided at installation for registering the Tivoli Storage Productivity Center server with Agent Manager.

2.2.11 Integration points with other applications

In this section, we describe IBM Tivoli Storage Productivity Center integration points with IBM Tivoli Storage Manager for backup or archival of files, IBM Tivoli Enterprise Console (TEC), or any other SNMP manager for alert notification

Integration with Tivoli Storage Manager

Integration between IBM Tivoli Storage Productivity Center for Data and IBM Tivoli Storage Manager can provide support for:

- The definition of a constraint violation is a means by which an administrator can enforce a request to have IBM Tivoli Storage Manager archive or back up the *n* largest violating files. Another kind of constraint violation is to define acceptable and unacceptable uses of storage systems. For example, a constraint can be defined to prohibit storing MP3 files on a file server. Productivity Center for Data currently reports on the *n* largest of the files, which violate the constraint (where *n* is configured by the administrator).
- Even the regularly run file reports can be modified to allow administrators to archive or back up selected files directly as an outcome of the reports. These file reports can identify, for example, a file system's largest files, orphaned files, and duplicate files. A storage administrator can use this feature to quickly free storage by archiving and deleting selected files.

The results of the IBM Tivoli Storage Manager backup-archive commands are viewable through the graphical user interface (GUI). In the case of constraints configured to archive-backup violating files, the results are included in the agent scan job logs (scans are responsible for enforcing constraints). In the case of file report driven archive-backup operations, a new type of job (archive-backup job) is created. The results of the backup operations in this case are found in archive-backup job logs.

Alert notification

The main purpose of Data Manager's alerting facility is to alert you to storage-related events that occur within your environment. After you have defined the events or conditions for which you want to be alerted, you can let Data Manager monitor your storage automatically.

SNMP

For users planning to make use of TPC's SNMP trap alert notification capabilities, SNMP Management Information Base (SNMP MIB) files are included on the installation media. The MIB is provided for use by your SNMP management console software (for example, IBM Tivoli NetView® or HP Openview). This will allow you to better view TPC-generated SNMP traps from within your management console software.

Integration with Tivoli Enterprise Console Netcool/OMNIbus

IBM Tivoli Storage Productivity Center can use the Event Integration Facility (EIF) to send messages to the IBM Tivoli Enterprise Console (TEC) or the follow-on product Netcool/OMNIbus. This can allow one of the two central monitoring applications to consider IBM Tivoli Storage Productivity Center alerts in causal analysis for problems.

TEC/OMNIbus is added as a destination for alerts, in addition to Simple Network Management Protocol (SNMP) Trap and Windows Event Log. The event definitions are specified in the tivoliSRM.baroc file, which is provided on the TPC installation media. It must be loaded to the active rule base running on the TEC/OMNIbus server. Based on that, the TEC/OMNIbus administrator can write its own correlation and automation rules for events sent by Data Manager. You have to provide the TEC/OMNIbus server name and the TEC/OMNIbus port to start sending events to the TEC/OMNIbus server.

Advanced provisioning

IBM Tivoli Storage Productivity Center supports Tivoli Provisioning Manager 5.1 for storage workflows. For information about how to use storage workflows, see *IBM Tivoli Storage Productivity Center Workflow User's Guide*, SC27-2341.

Additional IBM Tivoli applications

There are more applications in the IBM Tivoli portfolio that can be integrated with Tivoli Storage Productivity Center. Usually all these applications use Tivoli Storage Productivity Center as a tool to gather data about the storage environment. By using Tivoli Storage Productivity Center, they can abstract storage on a higher level and get the data in a kind of normalized relational database.

Only a few applications also use Tivoli Storage Productivity Center as an interface to execute commands against storage devices. However, Tivoli Storage Productivity Center's command line interface TPCTOOL can do this, so that again these applications interfacing with Tivoli Storage Productivity Center do not have to deal with a huge number of storage devices from different vendors.

Here are some examples of such software applications:

- IBM Tivoli Monitoring
- IBM Tivoli Enterprise Portal
- IBM Tivoli Configuration and Change Management Database (CCMDB)
- IBM Tivoli Usage and Accounting Manager

These applications can use different interfaces that TPC provides:

- Access to the TPCREPORT database schema
- Tivoli Discovery Library Adapter (DLA)
- TEP or Universal Agent

2.3 What is new in Tivoli Storage Productivity Center since Version 3.1

In this section we list all of the new functions and changes that have been introduced in the TotalStorage Productivity Center releases since V3. The purpose of this list is to provide a quick recap of the evolution that Tivoli Storage Productivity Center has gone through.

2.3.1 New functions and features in 3.3.1

This topic provides information about new features, functions, and enhancements in IBM TotalStorage Productivity Center release 3.3.1.

- IBM System Storage Productivity Center:

  TotalStorage Productivity Center now supports the IBM System Storage Productivity Center. The goal of IBM System Storage Productivity Center is to consolidate IBM storage administration and configuration utilities into a single console.

  IBM System Storage Productivity Center contains preinstalled software on a Windows System x machine.

  The IBM System Storage Productivity Center provides these preinstalled components:

  - IBM DB2 V9.1 with Fix Pack 2
  - IBM TotalStorage Productivity Center Basic Edition 3.3.1
  - IBM SAN Volume Controller Console

  You can also install all the components for IBM System Storage Productivity Center on your own server machine.

  You can optionally install Agent Manager and agents and TotalStorage Productivity Center for Replication 3.3.1.

- Installation changes:

  - DB2 Version 9.1:

    IBM TotalStorage Productivity Center supports DB2 Version 9.1 Fix Pack 2 as a database repository. If you have DB2 Version 8.1 with Fix Pack 14, you do not have to upgrade to DB2 Version 9.1. TotalStorage Productivity Center supports both versions of DB2.

  - Optional Agent Manager installation:

    With this release, you no longer need to install the Agent Manager before you install TotalStorage Productivity Center. If you decide to add Agent Manager and agents at a later time, you can do so. If you do not install the Agent Manager, you will not be able to deploy the agents.

- Launch in context:

  A script is provided that allows you to pass parameters to the TotalStorage Productivity Center GUI. Based on the parameters that you pass to the GUI, this will allow you to automatically log into the specified TotalStorage Productivity Center server and navigate to a specific panel.

- Improved TotalStorage Productivity Center server stability:

  To improve TotalStorage Productivity Center server stability, performance improvements have been made to the Topology Viewer and performance monitoring jobs. DB2 has also been tuned to improve performance and scalability.

- Storage subsystem support:
  - CIM Agent Version 5.3:

    TotalStorage Productivity Center supports CIM Agent Version 5.3 for ESS and DS storage subsystems. This updated version of the CIM Agent introduces a number of new features, most of which are designed to allow access to new features of the DS8000 R3, such as support for SMI-S 1.2, dynamic volume expansion and space-efficient FlashCopy. This release of TotalStorage Productivity Center "tolerates" this version of the DS CIM Agent, meaning that TotalStorage Productivity Center can operate with a 5.3 DS CIM Agent in the same way as previous versions of TotalStorage Productivity Center operated with previous versions of the agent. TotalStorage Productivity Center does not show configuration information or performance data for space efficient volumes.

  - DS8000 Element Manager perspective is integrated with TotalStorage Productivity Center GUI:

    The DS8000 Element Manager perspective is integrated with the TotalStorage Productivity Center GUI. This allows users to manage multiple DS8000 Element Managers within the TotalStorage Productivity Center GUI.

  - SAN Volume Controller CIM Agent 4.2.1:

    The CIM agent 4.2.1 for SAN Volume Controller is a major upgrade from Version 4.2.0. This CIM agent supports SMI-S 1.2, which includes the Storage Virtualizer profile instead of the In-Band Virtualization profile. Also, the LUN Masking and Mapping subprofile has been replaced by the Masking and Mapping subprofile in SMI-S 1.2. Do not manage the same SAN Volume Controller cluster with two or more SAN Volume Controller CIM Agents that are at different release versions. Mixing SAN Volume Controller CIM Agent releases causes failures in TotalStorage Productivity Center.

- Tivoli Enterprise Portal:

  A Universal Agent for TotalStorage Productivity Center is available to report TotalStorage Productivity Center asset information to IBM Tivoli Monitoring. This data is available for display in the Tivoli Enterprise Portal for reporting, charting, and establishing situations in Tivoli Monitoring. For more information about IBM Tivoli Monitoring and Tivoli Enterprise Portal, see:

  http://publib.boulder.ibm.com/infocenter/tivihelp/v3r1/index.jsp?toc==/com.ibm.itm.doc/toc.xml

2.3.2 New functions and features in 3.3.2

You can use this information to learn about the new features and enhancements provided in IBM TotalStorage Productivity Center release 3.3.2.

- Internet Protocol Version 6:

  IBM TotalStorage Productivity Center now supports Internet Protocol Version 6 (IPv6). This expands the IP address from 32 bits to 128 bits. There are special considerations for supporting IPv6 in TotalStorage Productivity Center.

  See the *TotalStorage Productivity Center Information Center and the Installation and Configuration Guide Version 3.3.2*, GC32-1774.

- Virtual I/O Server:

  TotalStorage Productivity Center supports the installation of Data Agents and Fabric Agents on the Virtual I/O Server for AIX. You must use the padmin user ID to install and configure the agents. For information about planning for installing the agents on the Virtual I/O Server, go to the Information Center at the following URL:

  `http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp`

  Click **TotalStorage Productivity Center** → **Planning** → **Planning for the Virtual I/O Server**.

- AIX 6.1:

  TotalStorage Productivity Center now supports AIX 6.1 for the TotalStorage Productivity Center server and agents. To run with AIX 6.1, you must have DB2 9.1 with fix pack 4 or DB2 8.1 with fix pack 16 installed.

- TotalStorage Productivity Center universal agent:

  The instructions for retrieving the TotalStorage Productivity Center universal agent included with 3.3.1 has been changed. You no longer retrieve the universal agent from Open Process Automation Library (OPAL).

  The universal agent package is located in the following TotalStorage Productivity Center directory:

  - For Microsoft Windows: <TPC_install_dir>\tool\TPCUA.zip
  - For UNIX and Linux: /<opt or usr>/tool/TPCUA.tar

  The zip file or tar file contains a readme file that describes how to configure the universal agent.

- Hitachi Data Systems TagmaStore:

  IBM TotalStorage Productivity Center now supports the Hitachi Data Systems TagmaStore Common Information Model (CIM) agent 5.8. This version of the CIM Agent supports only the Array Profile and not the Virtualizer Profile. However, IBM TotalStorage Productivity Center supports the TagmaStore as a Storage Virtualizer. IBM TotalStorage Productivity Center can display information for virtual disks and local disks.

- VMware Virtual Infrastructure:

  TotalStorage Productivity Center supports VMware ESX Server 3.5, VMware ESX Server 3.5 3i, and VMware VirtualCenter 2.5. reports now show the logical unit number (LUN) correlation. The ESX Server 3.5 3i is the hardware-integrated hypervisor. TotalStorage Productivity Center also supports ESX Server 3.0 and VirtualCenter 2.0 but does not support the LUN correlation for these releases.

- Launch in context feature:

  The launch in context feature can be used to download the latest version of the IBM TotalStorage Productivity Center graphical user interface (GUI) on the local workstation using Java Web Start. The IBM TotalStorage Productivity Center GUI must have been previously installed on the local workstation. The launch in context feature downloads the latest version of IBM TotalStorage Productivity Center GUI on the local workstation if an older version has been downloaded or if the IBM TotalStorage Productivity Center GUI

has not been previously downloaded. If the latest version exists on the local workstation at the Java Web Start download location, the IBM TotalStorage Productivity Center GUI is not downloaded.

The launch in context feature can be run in the following ways:

- From a URL with Java Web Start. You can remotely download and launch the TotalStorage Productivity Center GUI, using the launch in context feature, and perform a certain number of actions on a remote system.
- From the command line with Windows, Linux, or UNIX. (The IBM TotalStorage Productivity Center GUI must have been previously installed on the local workstation if it is to be launched through the command line.)
- From the Windows Start menu.
- From the Tivoli Enterprise Portal GUI.

The additional functions that can be launched on the remote system are as follows (this is in addition to the functions supported in the previous release):

- Create Volume
- Create VDisk
- Launch SAN Planner
- Launch Wasted Space report

- High-Availability Cluster Multi-Processing support on AIX:

  IBM TotalStorage Productivity Center supports Data Agents and Fabric Agents installed on High-Availability Cluster Multi-Processing (HACMP™) nodes. You will be able to monitor the cluster resource groups. You can probe the HACMP cluster to get cluster reports and produce alerts when changes occur in the HACMP cluster.

  The HACMP software supports both the non-concurrent and concurrent cluster resource groups. TotalStorage Productivity Center does not support concurrent cluster resource groups.

- DS8000 space-efficient volumes:

  IBM TotalStorage Productivity Center supports the DS8000 space-efficient volumes. Using space-efficient volumes, you can copy only those blocks (which have been written to) to a target. Information about space-efficient volumes and their relationship to extent pools is collected. Information about virtual pools is collected but does not persist in the database. You can identify space-efficient volumes in the Topology Viewer and in reports. You cannot use Disk Manager to create or delete space-efficient volumes.

  When you use space-efficient volumes, you cannot see the real allocated space but you can see the consumable space, so you cannot create a report using summarized volume capacity.

- SMI-S support as the single standard interface for managing Brocade and McDATA:

  TotalStorage Productivity Center now supports Storage Management Initiative Specification (SMI-S) as the single standard interface for managing Brocade and McDATA storage area networks (SANs). For these switch vendors, you no longer need the in-band agents for zone discovery and zone control operations. TotalStorage Productivity Center uses the SMI-S fabric profile and related subprofiles for inventory collection of SAN topology and zoning, for active configuration of zoning, and for fabric and switch alerts for Brocade and McDATA switches.

  The use of the software interfaces for discovery of topology information (SNMP and GS-3), for zone inquiry (Brocade API and GS-3), and for zone control (Brocade API and GS-3) are still supported for these vendors to provide a choice. However, the SMI-S interface is the preferred mechanism for these vendors.

The interfaces (SNMP and GS-3) are still necessary for QLogic and Cisco switches and SANs.

- Automount maps in Sun Solaris:

  You can skip automount maps (automaps) for a discovery job on Sun Solaris. To skip automount maps, specify the skipAutoFS=1 parameter in the server section of the TPCD.config file

2.3.3 New functions and features in V4.1

You can use this information to learn about new features and enhancements in IBM Tivoli Storage Productivity Center Version 4.1. This section highlights the changes since IBM TotalStorage Productivity Center 3.3.2.

For more information about each of the features, go to the Tivoli Storage Productivity Center Information Center and search for Planning for the IBM Tivoli Storage Productivity Center family. For information about how to use the features, see the *IBM Tivoli Storage Productivity Center User's Guide Version 4.1,* SC27-2338.

Tivoli Storage Productivity Center V4.1 adds the following new features, functions, and enhancements:

- Name change:

  TPC has been renamed from IBM TotalStorage Productivity Center to IBM Tivoli Storage Productivity Center. All user interfaces, documentation, online help, and messages have also been changed to reflect the name change.

  Note: Although great effort has been invested to change the name of the product on all Web pages, in the product manuals and GUI, you might still find the old name. In most instances, the old name is still used to point out a release prior to Version 4. In some rare cases, the name changes have not been applied yet.

- Licensing changes:

  These are the licenses available for IBM Tivoli Storage Productivity Center:

  - IBM Tivoli Storage Productivity Center Basic Edition
  - IBM Tivoli Storage Productivity Center Standard Edition
  - IBM Tivoli Storage Productivity Center for Disk
  - IBM Tivoli Storage Productivity Center for Data

  Note: There is no TPC for Fabric licence orderable anymore. Because the functionality of TPC for Fabric is now included in TPC Standard Edition, we typically refer to this part of the product simply as fabric management or as Fabric Manager.

  The TPC Standard Edition includes TPC for Data and TPC for Disk as well as Fabric Manager functions of TPC (which can no longer be ordered separately).

  If you have an IBM TotalStorage Productivity Center for Fabric license only, you can upgrade to IBM Tivoli Storage Productivity Center Standard Edition.

  If you have an IBM TotalStorage Productivity Center for Basic Edition license only, you can upgrade to IBM Tivoli Storage Productivity Center for Disk, IBM Tivoli Storage Productivity Center for Data, or IBM Tivoli Storage Productivity Center Standard Edition.

If you have an IBM TotalStorage Productivity Center for Data license only, you can upgrade to IBM Tivoli Storage Productivity Center for Data or IBM Tivoli Storage Productivity Center Standard Edition.

If you have an IBM TotalStorage Productivity Center for Disk license only, you can upgrade to IBM Tivoli Storage Productivity Center for Disk, IBM Tivoli Storage Productivity Center for Data (Disk plus Data), or IBM Tivoli Storage Productivity Center Standard Edition.

If you have an IBM TotalStorage Productivity Center Standard Edition license, you can upgrade to IBM Tivoli Storage Productivity Center Standard Edition.

For more information about which features are available for each license, see “Feature to license mapping” on page 54.

- Integration features:

  Tivoli Storage Productivity Center provides these integration features:

  - Integration of Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication

    Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication, previously separated products, are now integrated. You can start the IBM Tivoli Storage Productivity Center for Replication user interface from within the Tivoli Storage Productivity Center user interface.

    The *IBM Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication Installation and Configuration Guide* Version 4.1, SC27-2337 also includes the installation, upgrade, and uninstallation information for IBM Tivoli Storage Productivity Center for Replication.

    This integration enables you to:

    - Start the IBM Tivoli Storage Productivity Center for Replication user interface from within the Tivoli Storage Productivity Center user interface.
    - Use the Tivoli Storage Productivity Center GUI to set up IBM Tivoli Storage Productivity Center for Replication SNMP alerts and IBM Tivoli Enterprise Console events.
    - Provide a Tivoli Storage Productivity Center superuser role that has authority over all Tivoli Storage Productivity Center commands. IBM Tivoli Storage Productivity Center for Replication includes a replication administrator role that has authority to all IBM Tivoli Storage Productivity Center for Replication commands. IBM Tivoli Storage Productivity Center for Replication will honor the Tivoli Storage Productivity Center superuser role, giving the superuser role authority over all Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication commands.

  - Integration of Tivoli Storage Productivity Center and IBM Tivoli Integrated Portal:

    Tivoli Integrated Portal is a standards-based architecture for Web administration. Tivoli Integrated Portal (TIP) enables developers to build administrative interfaces for IBM and independent software products as individual plug-ins to a common console network. The installation of Tivoli Integrated Portal is required to enable single sign-on for Tivoli Storage Productivity Center.

    Single Sign-On is an authentication process that enables you to enter one user ID and password to access multiple applications. Single Sign-On integrates with the launch in context feature to enable you to move smoothly from one application to a specific location in a second application.

Tivoli Common Reporting is a runtime environment for reports developed with the Business Intelligence Reporting Tool (BIRT) report designer (not included). Reports can be created and integrated into TIP for repeated use. The user role management of TIP provides a way to limit access to information gathered by TPC on an individual report basis.

– Launch in context feature:

The launch in context feature enables you to access external applications from the Tivoli Storage Productivity Center GUI. Element managers are the most prevalent external applications that use the launch in context feature. An element manager is usually the vendor-specific software that is used to administer a particular storage device. The launch in context feature provides starting points in the Tivoli Storage Productivity Center GUI so you can click a button or select a menu item to start an element manager.

When you install Tivoli Storage Productivity Center, Tivoli Integrated Portal, and Tivoli Storage Productivity Center for Replication, the components are automatically configured to use launch in context. You can access Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication from the Tivoli Integrated Portal GUI and you can access Tivoli Storage Productivity Center for Replication from the Tivoli Storage Productivity Center GUI.

There are three levels of launch in context ability:

- Simple launch:

  This level exists in TotalStorage Productivity Center 3.3.2. Tivoli Storage Productivity Center discovers basic information about the device and the management of the device.

- Launch with parameters:

  You can specify additional parameters in the URL or command-line interface when starting an application. The parameters that are passed enable you to navigate to a particular panel or state of the application that was started. You can also identify objects to operate on and possibly provide values to use in the operation.

- Launch with single sign-on:

  You can enhance the launch in context feature to include single sign-on. Single Sign-On can be used when an external application can perform authentication against the same user repository as Tivoli Storage Productivity Center. A directory that is Lightweight Directory Access Protocol (LDAP) compliant is a common example of such a user repository.

  External applications that do not include the WebSphere Application Server (WAS), require the authentication service that is provided by Tivoli Integrated Portal. For example, the element manager for IBM System Storage DS8000, DS8000 Storage Manager, uses the authentication service to handle launch in context with single sign-on from the Tivoli Storage Productivity Center GUI.

– Single Sign-On:

Single Sign-On is an authentication process that enables you to enter one user ID and password to access multiple applications. Single Sign-On enables you to access:

- Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication from the Tivoli Integrated Portal GUI.
- Tivoli Storage Productivity Center for Replication from the Tivoli Storage Productivity Center GUI.
- External applications such as element managers from the Tivoli Storage Productivity Center GUI.

The single sign-on feature requires a centralized user and group repository, such as an LDAP-compliant directory, which all participating applications can access.

Tivoli Storage Productivity Center uses Lightweight Third Party Authentication (LTPA) tokens to pass the user information between applications. To use LTPA tokens for single sign-on, each participating application must possess the same set of keys to encode and decode the user information contained in the token. As an additional security feature, the LTPA tokens expire after a determined amount of time. When the tokens expire, you must re-enter your user ID and password information.

If you select operating system authentication, then the use of the single sign-on feature is limited. Operating system authentication does not support single sign-on for element managers, even when the element manager is installed on the same machine as Tivoli Storage Productivity Center.

- Storage Resource agents:

  Tivoli Storage Productivity Center now supports Storage Resource agents on Microsoft Windows, AIX, and Linux. The Storage Resource agent probe is equivalent to the information that is collected by probes using the Data Agent.

  The Storage Resource agents do not require the Agent Manager and can be deployed to other systems using the Tivoli Storage Productivity Center GUI on the server system.

  You can use the following functions:

  – Asset reports (including HBA)
  – Capacity reports
  – Subsystem to host storage correlation including multipathing information
  – Topology and Data Path Explorer functions

  This support does not include file system scans, NAS discovery or topology, zoning and zone control functions, or subsystem device driver configuration. You can still use the Data Agent and Fabric Agent for this information.

- SQL access to Tivoli Storage Productivity Center database:

  Tivoli Storage Productivity Center will provide a set of DB2 views within a separate schema that represent key information that has been collected by monitoring jobs and stored in the database repository. A view is a way of describing data that exists in one or more tables within the database repository. It does not contain data but, instead, is a stored set of SQL commands that define a subset of rows and columns in the base tables.

  You can use the Structured Query Language (SQL) to retrieve the information from the views and create reports using your own tools, such as Business Intelligence and Reporting Tools (BIRT) or Microsoft Excel. Other applications can also use these views to gather and import information that is collected by Tivoli Storage Productivity Center.

  The following categories of views in the report schema will contain information collected by Tivoli Storage Productivity Center:

  – Storage entity views:

    These views include information about the properties of the entity. For example, the name, capacity, and freespace.

  – Entities defined by Tivoli Storage Productivity Center:

    These entities include Data Agents, Fabric Agents, alert log, Tivoli Storage Productivity Center server, computer groups, storage subsystem groups, file system groups, storage resource groups, and so forth.

  – Aggregated views:

    These views provide summary information for the database history, data in a database instance, and the Data Agent file system.

- Reporting views:

  These views combine several different entities in one view for a report.

- Rollup views:

  These views include rollup report information from the master and subordinate Tivoli Storage Productivity Center servers, Data Agents and Fabric Agents, host cluster data, computer group, host, database computer groups, fabric SAN assets, switch assets, storage subsystem group, storage subsystems, and Tivoli Storage Productivity Center for Databases.

- Storage Optimizer:

  The Storage Optimizer tool helps you analyze your storage networks to identify hot spots or bottlenecks, plan for storage growth, improve performance, and help develop storage migration or storage consolidation plans. Using the data in the Tivoli Storage Productivity Center database, the Storage Optimizer enables you to create an analysis report and an optimization report. The analysis report analyzes your data storage environment and recommends changes to improve your environment. Based on the analysis report, the optimization report includes storage migration or storage consolidation recommendations.

  This feature requires a Tivoli Storage Productivity Center Standard Edition license.

- Storage resource groups:

  Storage resource groups are new objects provided to help storage administrators plan, monitor, and report on the managed environment.

  A storage resource group is a set of entities managed by Tivoli Storage Productivity Center. These entities can be servers, switches, storage subsystems, fabrics, storage pools, and storage volumes. Storage resource groups can be a group of heterogeneous objects and can also contain other storage resource groups without any connectivity.

  Policies for provisioning (volume creation and selection, profiles, zoning and multipathing configuration) can be specified and associated with storage resource groups. These policies are used by the SAN Planner to populate default settings.

  Storage resource groups are used primarily for planning functions but are also available with the Tivoli Storage Productivity Center Basic Edition license. With the basic license, you can create and view storage resource groups in the Topology Viewer. When you have TPC for Disk, you can define and change the profiles. With the Standard Edition license, the planner function is enabled and you can use storage resource groups as input.

  Storage resource groups also work with these Profiles:

  - Provisioning Profiles:

    Describes the requirements such as total capacity, number of volumes, Redundant Array of Independent Disks (RAID) level, the Workload Profile, volume name prefix, multipathing options, zoning options, and so forth.

  - Workload Profiles:

    Describes the requirements that define the performance characteristics of newly provisioned capacity.

- IBM General Parallel File System:

  Tivoli Storage Productivity Center supports the monitoring of the IBM General Parallel File System (GPFS™) 3.2 on AIX. GPFS provides access to critical file data. GPFS also provides concurrent high-speed file access to applications that are running on multiple nodes of an AIX cluster, a Linux cluster, or a heterogeneous cluster of AIX and Linux nodes. In addition to providing file storage capabilities, GPFS provides storage management, information life cycle tools, and centralized administration, and it allows for shared access to file systems from remote GPFS clusters.

- Installation changes:
  - Installation of IBM Tivoli Integrated Portal:

    Tivoli Storage Productivity Center now installs IBM Tivoli Integrated Portal along with Tivoli Storage Productivity Center.
  - IBM Tivoli Storage Productivity Center for Replication:

    The *IBM Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication Installation and Configuration Guide*, SC27-2337 also includes the installation, upgrade, and uninstallation information for IBM Tivoli Storage Productivity Center for Replication. IBM Tivoli Storage Productivity Center for Replication is now installed with IBM Tivoli Storage Productivity Center.
  - IBM DB2 Database for Linux, UNIX, and Windows:

    Tivoli Storage Productivity Center now supports DB2 9.5. You will be able to migrate your Tivoli Storage Productivity Center databases from DB2 9.1 or DB2 8.2 to DB2 9.5. DB2 9.5 is optional. Tivoli Storage Productivity Center still supports DB2 9.1.
  - Embedded WebSphere 6.1 and JRE 1.5:

    The Device Server is upgraded to run under Embedded WebSphere 6.1 (from Embedded WebSphere 6.0.2). The Data Server, GUI, and CLI is upgraded to use JRE Version 1.5. InstallShield uses JRE 1.5 during the installation and uninstallation process when Tivoli Storage Productivity Center is installed using the disk1 image. The image to perform local agent installations uses JRE Version 1.4.2.
  - Silent installation:

    Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication do not support silent installation except for the Data Agents and Fabric Agents.
- New device and application support:
  - IBM System Storage DS8000 4.2
  - IBM System Storage SAN Volume Controller 4.3.1
  - Microsoft SQL Server 2005 and Microsoft SQL Server 2008 databases:

    Tivoli Storage Productivity Center can now monitor the Microsoft SQL Server 2005 and Microsoft SQL Server 2008 databases. You must configure Microsoft SQL Server before you can monitor the database. For information about configuration, see the Information Center. Search for Configuring Microsoft SQL Server 2005 or 2008.
  - EMC PowerPath:

    With Tivoli Storage Productivity Center, you can now use EMC PowerPath storage systems such as CLARiiON and Symmetrix. Using these storage systems, you can discover host volume information and display detailed information for the volume for capacity planning purposes. Connection reports can show the connectivity from the host to the storage subsystems.

    EMC PowerPath Version 4.0 or later is supported.
  - Network Appliance™ (NetApp®):

    With Tivoli Storage Productivity Center, you can use the Network Appliance SMI-S agent to support block storage devices (see “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109). The SMI-S agent supports the SMI-S 1.2 array profile.

– IBM XIV® Storage System:

Important: The XIV Storage System information provided in the Tivoli Storage Productivity Center 4.1 documentation is only for planning purposes until the supported XIV Storage System software (CIMOM) is available. Tivoli Storage Productivity Center support is targeted for a future XIV Storage System software release. A flash will be issued when Tivoli Storage Productivity Center support for XIV Storage System is available.

The XIV Storage System will have an embedded CIM agent that Tivoli Storage Productivity Center will use to run discovery and probe jobs.

You will be able to start the XIV Storage System GUI from within Tivoli Storage Productivity Center if the GUI is installed on the same system as the Tivoli Storage Productivity Center GUI. The XIV Storage System GUI will be supported on Windows and Linux.

Both the Data Agent and Storage Resource agent will support XIV Storage System.

For more information about XIV Storage System planning, see the *Installation and Configuration Guide, Version 4.1*, SC27-2337.

– Multipath subsystem device drivers:

Tivoli Storage Productivity Center supports these subsystem device drivers (SDD):

- AIX SDD
- Windows SDD
- Windows SDD DSM
- Linux SDD
- HP SDD
- Solaris SDD
- Novell SDD (reporting only)
- AIX SDD PCM
- Linux DM_Multipath

– IBM System Storage N Series Gateway servers:

IBM Tivoli Storage Productivity Center supports IBM System Storage N Series Gateway servers as Other NAS. This support allows you to monitor and report on file systems through the Windows CIFS or UNIX NFS shares that are accessible to the scan or probe jobs for the Data Agent. No back-end storage information such as controllers, disks, and logical volumes is collected or reported.

- High-Availability Cluster Multi-Processing:

  This release provides additional support for High-Availability Cluster Multi-Processing Version 5.5.

- Tivoli Enterprise Portal:

  A Universal Agent for Tivoli Storage Productivity Center that utilizes a set of Tivoli Storage Productivity Center Web services calls to gather information and provide results files that will display enhanced information such as job status and Tivoli Storage Productivity Center status in the IBM Tivoli Integrated Portal.

- Terminology changes:

  The Tivoli Storage Productivity Center documentation uses the term “storage subsystem” and the Tivoli Storage Productivity Center for Replication documentation uses the term “storage system”. Both terms refer to the devices used for storage management.

You can access the frequently-asked questions under the Reference section in the Information Center or in Appendix B of the *IBM Tivoli Storage Productivity Center User's Guide Version 4.1*, SC27-2338.

2.4 Functions no longer supported

The following functions are no longer supported:

- Starting GUI as Java applet not supported:

  Starting the TotalStorage Productivity Center GUI as a Java applet is no longer supported. To start the TotalStorage Productivity Center GUI remotely, use the Java Web Start support, as documented in the *Installation and Configuration Guide Version 4.1*.

  This support for starting the GUI as a Java applet was removed in TPC Version 3.3.1

- TotalStorage Productivity Center Assistant is no longer supported:

  TotalStorage Productivity Center Assistant is no longer available as a separate tool. The links that were previously provided by this tool have been merged into the user interface under the Help menu. This includes links to the Tivoli Storage Productivity Center Information Center, supported products matrixes, and product demonstration Web pages.

  The TPC Assistant was removed in Version 3.3.2.

- Servers with less than 4 GB of RAM:

  TPC will no longer install on systems with less than 4 GB of RAM. If the system has between 4 GB and 8 GB, the installer will issue a warning message. This raised prerequisite is due to the fact that with the installation of TIP and TPC-R, more resources will be needed.

  The memory requirements have been changed with TPC Version 4.1.

- Support dropped for DB2 Version 8:

  DB2 Version 8 is no longer supported as the database for TPC. Form TPC Version 4.1 on only DB2 Version 9.1 and 9.5 is supported.

- SSPC changes:

  Starting with the new model MC3 of the SSPC (type 2805), there is no performance upgrade kit available anymore. The system is already equipped with 8 GB of RAM and two CPUs.

2.5 Product features

This section describes significant features of Tivoli Storage Productivity Center.

2.5.1 Topology Viewer

The Topology Viewer is designed to provide an extended graphical topology view; that is, a graphical representation of the physical and logical resources (such as computers, fabrics, and storage subsystems) that have been discovered in your storage environment (see Figure 2-3). In addition, the Topology Viewer depicts the relationships among resources, for example, the disks comprising a particular storage subsystem, as well as connections between entities with the Data Path Explorer. Detailed, tabular information, such as the attributes of a disk, is also provided.

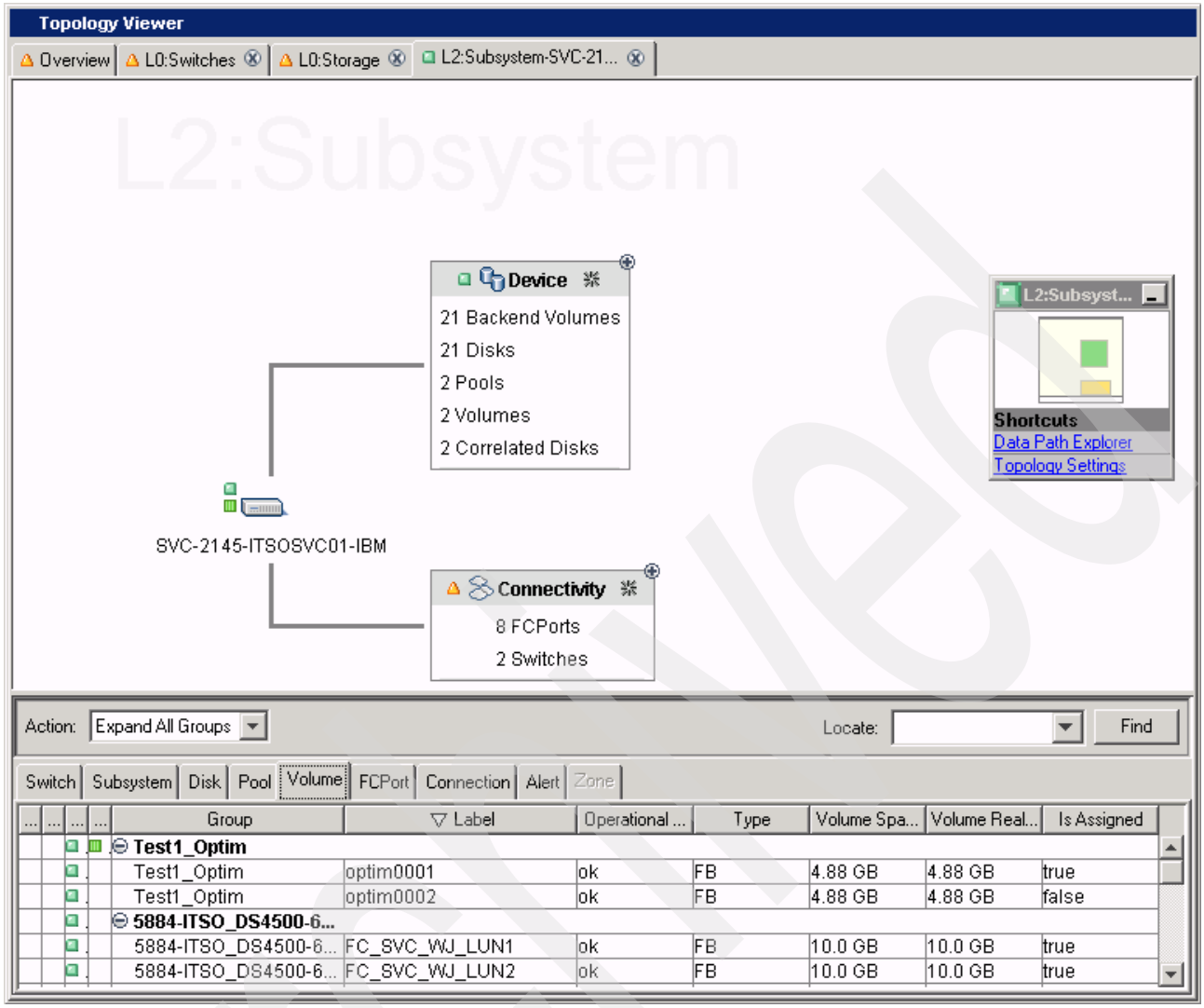


Figure 2-3 Topology Viewer

The overall goal of the Topology Viewer is to provide a central location to view a storage environment, quickly monitor and troubleshoot problems, and gain access to additional tasks and functions within the TPC User Interface as well as start external element managers without users loosing their orientation to the environment. This kind of flexibility through the Topology Viewer User Interface displays better cognitive mapping between the entities within the environment, and provides data about entities and access to additional tasks and functionality associated with the current environmental view and the user's role.

When you use the User Defined Property (UDP) fields for computers, devices, and Storage Resource Groups, the Topology Viewer can use the related information to group the objects in multiple ways. For example, use UDP1 for describing the location (datacenter) of the entity and have the Topology Viewer group the entities by UPD1 so that all entities are grouped by data center (you might want to turn off the grouping by health status for this).

2.5.2 Policy-based management for file systems and databases

Tivoli Storage Productivity Center can enable you to define and enforce storage policies through user-defined alerts, quotas, and constraints, notifying the user by e-mail, pager, or the event log, or a systems management console for events such as when a quota has been exceeded or a constraint violated. This function is available with TPC for Data or TPC Standard Edition.

The aim should not be just to find a problem; you need a way to fix problems. Tivoli Storage Productivity Center for Data can provide automated solutions through event management. For example, if Tivoli Storage Productivity Center for Data discovers data that has not been accessed in more than a year, it can trigger Tivoli Storage Manager to archive this data.

This feature allows you to effectively manage your storage. Benefits include the consistent implementation of storage resource management policies across platforms, automated scheduled reporting, and automated file system extension.

2.5.3 Storage provisioning and zoning (SAN Planner and wizard)

Tivoli Storage Productivity Center allows you to create volumes on attached storage subsystems, and by that it provides a single interface for many different storage subsystems. The prerequisite is that the subsystem has already been setup and formatted, so that storage volumes can be allocated from the pools and assigned to servers.

If Fabric management is configured, the volume creation wizard will also perform any necessary zone changes for you. This function is great for heterogeneous environment. An operator or administrator cannot be an expert in using all the different switch and storage vendors element management tools.

With the SAN Planner tool, you can do more advance planning for creating new volumes, because it allows you to specify workload profiles, multipath driver options, and also zoning details.

2.5.4 Subsystem reporting

Tivoli Storage Productivity Center gathers and reports on disk subsystems. Information includes physical characteristics, such as the drive's manufacturer, model, serial number, capacity, and rotational speed. Also included is how that drive's storage is allocated to logical volumes, snapshot copy volumes, and free space. This feature provides asset and capacity reporting. Information available includes:

- Displaying the physical disks behind what the host sees as a disk drive
- Showing the allocated and free capacity of subsystems in the network
- Showing which hosts have access to a given subsystem volume
- Showing which hosts have access to a given disk drive (within the subsystem)
- Showing which subsystem volumes (and disks) a host has access to
- Showing detailed characteristics of storage subsystems, such as disks, volumes. storage pools, and more
- Obtaining SAN Volume Controller specific reporting, such as volume to back-end volume

The extent of the information available is subject to the vendor's implementation of Storage Management Initiative Specification (SMI-S.

2.5.5 Performance reporting of storage subsystems and switches

Tivoli Storage Productivity Center provides the ability to collect performance data for storage subsystems and switches. The data is stored and aggregated within the TPC databases as well as expired over time. The intervals of performance data collection and inserting data into the database are specified in the performance data collection job's individual configuration panel.

After the data is recorded in its database, you can bring up predefined performance reports or create individual reports. The reporting function provides filtering, sorting, and basic charting capability. In addition, the tabular report allows you to drill-up and down from entity to entity.

The three main TPC performance management functions (performance monitoring, performance threshold/alerts, and performance reports) together give you a comprehensive Performance Management environment on the entire SAN infrastructure, from the HBA, through the Fibre Channel switches as well as storage subsystems and volumes.

2.5.6 Monitoring and alerts

In IBM Tivoli Storage Productivity Center you can define alerts that monitor storage assets, discover newly added storage resources on your network, set up thresholds and more. Alerts triggered based on your specification can then send notifications by e-mail, an SNMP trap, Tivoli TEC/OMNIBUS, or a UNIX or Microsoft Windows Event log. application. TPC generates these types of alerts based on its regular discoveries, probes, and scans, and provides input to an enterprise monitoring solution.

2.5.7 Additional functions

In this section we discuss function provided in Tivoli Storage Productivity Center for Data.

Automatic file system extension: TPC for Data

Through monitoring, Tivoli Storage Productivity Center for Data detects when a file system has exceeded a user-defined threshold and automatically extends the file system to prevent an out of space condition. When used in conjunction with certain IBM storage devices, a LUN is created and provisioned to the file system automatically.

A probe runs on agents and sends file system statistics to the server. The server compares the current file system state against the policy and invokes provisioning and extension as necessary.

Chargeback support: TPC for Data

Tivoli Storage Productivity Center for Data offers an end-to-end system for invoicing your cost centers based on their storage usage. Tivoli Storage Productivity Center for Data makes your data owners aware of and accountable for their data usage, helping to keep storage costs distributed accurately across an organization.

NAS support: TPC for Data

Tivoli Storage Productivity Center for Data can enable storage administrators to monitor, report on, and manage NAS resources. Tivoli Storage Productivity Center for Data is designed to provide a universal view of direct-attached and network-attached storage, from a file system or application perspective. For Network Appliance files, Tivoli Storage Productivity Center for Data monitors, reports on, and manages physical disk information, such as total disk capacity and disk usage information.

By providing this information as part of a universal view of enterprise storage, storage administrators can manage storage from a logical (file system) perspective as well as a physical (disk) perspective. Administrators can also view information for a single filer, a group of filers, a user or a group of users, or all filers enterprise-wide, enabling them to manage all enterprise storage resources from a single Web-based interface, to help them reduce costs and increase availability by pinpointing and solving problems more effectively.

3

Solution planning and assessment

In this chapter, we describe the solution planning part of an IBM Tivoli Storage Productivity Center 4.1 implementation project. We discuss requirements and considerations for the use of TPC. However, we do not include those tasks that are common to any IT projects solution design phase, such as what is the best way to gather customer requirements.

Besides some general solution design considerations, the special focus of this chapter is targeted at the new and complex functions of the TPC V4.1 features. Other items are related to functions that typically have been too complex to understand.

First we introduce these overall considerations:

- Gathering requirements
- General solution design
- Solution design for new functions and features

Then we describe the following features and functions:

- Planning for the Storage Optimizer
- Tivoli Integrated Portal
- LDAP with Single Sign-On
- Storage Resource Agents versus Data Agent
- Replication Manager integration
- SAN Fabric Management
- Storage Resource Groups
- CIMOM Data Sources
- Agent Manager
- Planning for Policy Management
- TPC server sizing guidelines

3.1 Gathering requirements

Before you start to install TPC or even to plan the installation, you should spend some time talking to your client and gathering information to define what the customer is trying to achieve by installing and using TPC. This is especially important because:

- There might be more than one way of implementing TPC.
- A requirement might not be able to be fulfilled because of reasons such as these:
  - There is a mismatch of supported devices or code levels.
  - Feature requirements are currently not implemented in TPC.
  - The amount of data gathered, agents deployed, and multiple data centers might make it necessary to use multiple TPC servers.

It is especially important that the customer understands what is the level of monitoring versus the level of reporting that TPC can provide. But at the same time it is important to plan the operational monitoring of the TPC server after it is installed and running.

In addition to this, you should make sure that for the planned use of TPC, the correct licenses have been ordered and the managed capacity has been properly calculated.

Last but not least, you need to be able to understand from the requirements what external components are required for a complete and successful installation, for example, CIMOM agents and LDAP server access.

3.1.1 Technical Delivery Assessment

The Technical Delivery Assessment is a technical quality assurance process, which helps you maximize your success when you plan and implement IBM solutions and offerings.

Business partners and IBM employees need to check if it is mandatory to perform a Technical Delivery Assessment (formerly called a Solution Assurance Review). The TDA is not always mandatory, it can vary from country to country, but it also depends on other factors.

Business partners can get more information, including a TDA checklist, at:

https://www-304.ibm.com/jct09002c/partnerworld/wps/servlet/ContentHandler/LLIE-6M7NYY/lc=en_US

SA number: SA06
Document ID: SA757
Document name: SA06-004-10

Even if you discover that a TDA is not mandatory for you, it is still a good idea to read the SAR guide, especially the checklists, to do a quick self-review of your planned solution. It will also be helpful to read the document as a preparation for the assessment of the target environment before you meet with a customer.

3.1.2 Customer environment assessment

For a successful project, it is always important to understand the customer requirements. In addition to the requirements, you need to understand the environment that should be managed. TPC might be able to fulfill the requirements in general, but some of the features and functions are not available for certain environments because not all storage resources provide the same level of management functions.

The most important task in this phase is to gather the details about the servers and the devices that are planned to be integrated into the TPC environment.

In addition to the items listed in the following section, it is really helpful to create a small network diagram that helps to understand if SLP can or should be used, if firewalls are restricting communication between the TPC server and any agent or device, and where the LDAP, NTP, Mail Server, and other infrastructure systems are located.

Devices to be managed by TPC

For the assessment of the disk subsystems used in the target environment, a planning worksheet is included in Appendix B, “Worksheets”, in the book *TotalStorage Productivity Center V3.3 Update Guide*, SG24-7490. These worksheets are specific for some IBM storage resources, so the following more generic list of information should help you and your customer collect the most important information:

- Brand and type of storage device, including disk, switch, and tape library devices
- Firmware version, sometimes also called Licensed Internal Code (LIC) or microcode
- Type of interface that can be used:
  - CIMOM: Embedded or proxy
  - SNMP: SNMP version
- Connection information:
  - IP address
  - IP port
  - User ID/password

If proxy CIM Agents are required but not yet installed, make sure to review the installation manuals of the software package to understand its hardware and software requirements. Although on the System Storage Productivity Center (SSPC) the SVC CIM Agent is pre-installed, it is generally not recommended to install a CIM Agent on a stand-alone TPC server. This recommendation is simply because careful planning is required and IBM cannot provide support for all the possible configurations.

TPC agents

If the requirements demand that TPC agents have to be deployed, you need to gather information about the target servers. Ask your customer about the following important facts regarding their servers:

- Platform and operating system level
- Connection information:
  - IP address
  - IP port
- Security considerations
- Whether the server is part of a cluster
- Applications that are running on the server

You will use this information to determine if there is a need for configuring a database login or to define Storage Resource Groups (SRG).

System Storage Productivity Center

IBM System Storage Productivity Center is a hardware and software solution that includes a suite of storage infrastructure management software that can centralize, automate, and simplify the management of complex and heterogeneous storage environments.

The following software is pre-installed:

- Tivoli Storage Productivity Center
- SVC CIM Agent
- SVC GUI
- DS3000/DS4000/DS5000 Storage Manager

For the purpose of this certification, it is not required to have SSPC experience. Having configured and customized TPC on SSPC is actually the same as configuring and customizing TPC on any other server.

3.2 General solution design

In this part of *Solution Planning and assessment*, we cover those objectives that are not closely related to any of the new functions or features of TPC V4.1

3.2.1 Feature to license mapping

The purpose of this section is to map features to TPC licenses, not to provide details about how the features work. For example, you should already know the definition of a TPC Alert, and that alerts can use different ways to act on events, such as sending SNMP traps, e-mails, or starting a script for automatic event handling.

Before you start looking at the mapping, we want to remind you of these considerations:

- When we talk about a feature, we usually refer to the given name of a function that is part of the product *("what it is")*. Perhaps you think that some of the items in Table 3-1 are not really features and say that they are more like procedures *("how this is achieved")*, but for the purpose of mapping to the licenses, we choose to ignore this possibility. In the column labeled Function, we describe what a certain feature does *("what it does")*.
- The column labeled "Feature/Capability" sometimes contains the well known name of a TPC feature and sometimes a high level description of a capability of a feature.
- The use of agents is not bound to any license, but the functions and features do depend on the license. For example, you can deploy a Data Agent with any license, but you cannot use the Scan function unless you have TPC for Data or Standard Edition.

  The objects in the column "Available for" does not map one-to-one to the software components, because we do not talk about the different agent types. You can use Figure 3-1 on page 60 to understand which feature or procedure is available by a certain agent.
- The extent of information stored in the TPC repository sometimes depends on the way that the information was collected. This means that some reports will not always display every possible detail. This also applies to reports created by using the TPC reporting schema.
- This table is not a replacement for a device support matrix.
- All devices that can be attached by SMI-S and provide LUNs to a server are grouped into the "Disk Storage" category. This includes IBM N series and Network Appliances Devices.

Table 3-1 TPC feature matrix based on TPC Version 4.1

Feature/capability **(what it is):**	**Function/source** **(what it does / how it is obtained):**	**Basic Edition**	**TPC for Disk**	**TPC for Data**	**Standard Edition**	**Available for:** C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
General TPC features:						
Device Discovery	Discovery of new devices available by CIMOM, SLP, Out-of-band agents, NetWare, NAS and VMware VI Data Source.	X	X	X	X	D, F, N, T, V
Probes	Collect basic information about devices (asset and also capacity).	X	X	X	X	C, D, F, N, S, T, TPC, V
Scans	Collect more details about files, table space, and tables than Probes provide.			X	X	C
Batch Reporting	Schedule the creation of reports that will be saved in different file formats, including CSV, HTML, PDF, and text files.			X	X	C, D, F, N, TPC
Script Execution	Execute a script when an event occurs, such as a failed job. This is currently not possible with the Storage Resource Agent.	X	X	X	X	C
Topology Viewer	Visualize information both in diagrams and tabular form. Includes functions for grouping, health and performance overlays.	X	X	X	X	C, D, F, S, T, V
LDAP integration	Uses LDAP as the user ID repository. Currently only available for TPC interfaces and some devices.	X	X	X	X	D, TPC
Single-Sign-On (SSO)	SSO is an authentication process that enables you to enter one user ID and password to access multiple applications, currently TPC, TPC-R and DS8000 Storage Manager.	X	X	X	X	D, TPC
Element Manager	Launch external Element Managers that are either locally installed or Web based.	X	X	X	X	D, F, T
Basic asset and capacity reporting capabilities:						
Report customization and export	Report customization includes selection and order of the columns to include time frames and filters. Export is available in different formats including CSV, HTML, PDF and text file.	X	X	X	X	C, D, F, N, S, T, TPC, V
Host asset information	Provided by Probes with the Data Agent or Storage Resource Agent. Data Manager → Reporting → Asset	X	X	X	X	C, S

Feature/capability **(what it is):**	**Function/source** **(what it does / how it is obtained):**	**Basic Edition**	**TPC for Disk**	**TPC for Data**	**Standard Edition**	**Available for:** C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
Host capacity utilization	Provided by Probes with the Data Agent or Storage Resource Agent: Data Manager → Reporting → TPC-wide Storage Space and Data Manager → Reporting → Monitored Computer Storage Space.	X	X	X	X	C, S
HBA reporting	Provides detailed information about server HBAs, requires Storage Resource or Fabric Agent. *Administration → Data Sources → Data and Storage Resource Agents*	X	X	X	X	C, S
Device asset reports	Includes disk storage subsystems, switches, and tape libraries.	X	X	X	X	D, F, T
Historic capacity reporting?	Measure and forecast storage growth.	X	X	X	X	C, D
Basic database reporting	Information provided by Probes.			X	X	C
Advanced reporting capabilities:						
Performance reporting for storage subsystems	Performance table and graphical reports for storage subsystems and virtualized storage (SVC), Network Appliance LUNs. Reports are available on the component level (subsystem, storage pools, ports, volumes, and so on) as well as Top n reports.		X		X	D
Performance reporting for SAN switches	Performance table and graphical reports for switches, for example: Top 25 Switch Ports Ops Rate Report, Top 25 Switch ports data rate reports, Historical Switch Performance Trending.				X	F
SAN Switch Port Error Reports	Error statistics are collected during performance data collection jobs.				X	F
Detailed capacity reports on storage used by file systems, users, user groups, directories….	Data gathered during Scans is used for enhanced reporting, alerting and automation functions.			X	X	C
Detailed capacity reports on databases - DB2, Oracle, SQL Server, and Sybase	Data gathered during Scans is used for enhanced reporting, alerting and automation functions.			X	X	C

Feature/capability **(what it is):**	**Function/source** **(what it does / how it is obtained):**	**Basic Edition**	**TPC for Disk**	**TPC for Data**	**Standard Edition**	**Available for:** C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
Chargeback	This is a usage and accounting function: Costs can be allocated by storage usage by user; disk capacity by computer; table space; or file system/physical device.			X	X	C
Network Attached Storage (NAS)	Reports on capacity and shares of an NAS server. Requires a proxy Data Agent to be installed and configured.			X	X	C
VMware Virtual Infrastructure	Report on storage for virtualized machines. Both the ESX Server and the Agent in the virtual machines should be probed for most accurate reports for disk and file system capacity.			X	X	C
AIX Virtual I/O Servers	TPC Agents can be installed on a VIO server to gather limited information about the storage dedicated to the VIO server.	X	X	X	X	C
Roll-up Reporting	Consolidates multiple reports from multiple TPC servers.				X	C, D, F, S, TPC, V
Custom reporting	Create custom reports based on TPC reporting schema (SQL access to TPC database).	X	X	X	X	C, D, F, N, S, T, V
Storage Reource Groups (SRG)	SRGs allows you to create groups of entities including servers and devices to be used in planning and reporting.			X	X	C, D, F, S, T, V
Alerting and monitoring features:						
Availability monitoring	Using Pings and recording reboots of computers that have an agent installed, TPC can provide availability reports (based on regular pings and reboot processes),			X	X	C, S
Basic computer alerts	Create alerts for computer and file system.	X	X	X	X	C, S
Enhanced computer alerts	Create alerts on users and VMware hypervisors.			X	X	C, V
File and quota alerts	Based on defined constraints and quotas TPC can create alerts.			X	X	C, N
Database alerts	Create instance, table space, and table alerts.			X	X	C

Feature/capability **(what it is):**	**Function/source** **(what it does / how it is obtained):**	**Basic Edition**	**TPC for Disk**	**TPC for Data**	**Standard Edition**	**Available for:** C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
Basic subsystem alerts	Create alerts on storage subsystem events (capacity change, volume change, come online/offline, and so on.)	X	X	X	X	D
Subsystem performance alerts	Create threshold based alerts on data rate, I/O rate, cache, and utilization values.		X		X	D
Basic SAN alerts	Create fabric, switch and endpoint alerts.	X	X	X	X	F
SAN performance and error alerts	Create threshold based alerts on data rate and packet rate, link failure, and error frames.				X	F
Replication alerts	Create and store alerts form Replication Manager.	X	X	X	X	TPC-R
Automation with Policy and Profile Management capabilities:						
Data classification	Data classification and migration using TSM to enable storage space optimization and ILM practices based on aged files, orphan files, files by file type, and so on.			X	X	C, N
File system analysis	Scans that collect information about filenames, file types, file sizes, date attributes, who owns, last accessed, last modified according to the associated profiles. Constraints can be created based on the collected information.			X	X	C, N
File system extension	TPC can provision new LUNs and extent file systems automatically when thresholds are exceeded.			X	X	C, D
Quota management	Available for file systems of computers running the Data Agent and Network Applicance Filers.			X	X	C, N
Storage Classes/Tiers	You can define Provisioning and Workload profiles in TPC that are later used as an input for the TPC planner functions.				X	D
Management features:						
Provisioning	Provisioning of storage volumes (LUNs) of storage subsystems (both IBM and heterogeneous). This includes N series and NetApp devices that are attached by SMI-S.	X	X	X	X	D

Feature/capability **(what it is):**	**Function/source** **(what it does / how it is obtained):**	**Basic Edition**	**TPC for Disk**	**TPC for Data**	**Standard Edition**	**Available for:** C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
Provisioning automation	Integration into Tivoli Provisioning Manager (TPM) workflows.	X	X	X	X	D, F
Fabric Management	Fabric switch zoning and alias management.	X	X	X	X	F
Low level device management	Integrated DS8000 storage manager interface. For other subsystems, the element managers can be launched from TPC.	X	X	X	X	D
Analytics:						
Configuration Change Management	Analytics → Configuration History. Review changes in the environment based on previously saved snapshots.				X	C, D, F, S, T, V
Storage Performance Optimization	Analytics → Storage Optimizer. Analyze and recommend changes to achieve well balanced load on storage subsystems.				X	D
SAN Storage Planners	Analytics → SAN Planner. Best practice configuration guidance & analysis on LUN placement, multipathing configuration and zoning.				X	C, D, F
Analyze setup/configuration	Analytics → Configuration Analysis. Review configuration based on selected policies.				X	C, D, F
End-to-end connectivity visualization	Data Path Explorer, requires SRA or Fabric Agent.				X	C, D, F, S
Integration with other products:						
Tivoli Storage productivity Center for Replication (TPC-R)	Launch TPC for Replication GUI, perform cross checks,	X	X	X	X	TPC-R
IBM Tivoli Change and Configuration Management Database (CCMDB)	Using a Discovery Library Adapter (DLA), TPC can provide information including: CIMOM, ComputerSystem, Fabric, FiberChannelPort, FiberChannelSwitch, OperatingSystem, SoftwareComponent (contains Data Agent & Fabric Agent), StoragePool, StorageSubsystem, StorageVolume, TapeDrive, TapeLibrary, TapeMediaChanger, Zone, ZoneSet.	X	X	X	X	C, D, T, F

Feature/capability (what it is):	Function/source (what it does / how it is obtained):	Basic Edition	TPC for Disk	TPC for Data	Standard Edition	Available for: C=Computers & DBs (Data Agent) D=Disk Storage F=Fabrics & Switches N=NAS/File servers S=Storage Resource Agent T=Tape Libraries TPC=TPC servers TPC-R= Replication Manager V=VMware VI
Tivoli Enterprise Portal (TEP) - Universal Agent	A solution for monitoring TPC SAN storage assets by IBM Tivoli Monitoring Universal Agent. It enables you to monitor and gather information from TPC.	X	X	X	X	C, D, F, T, TPC
Tivoli Provisioning Manager (TPM)	Using the storage workflows, you can automate the steps of the manual process of storage provisioning.				X	D, F
Tivoli Storage Manager (TSM)	TSM backup or archive commands can be executed.			X	X	C

Note: NAS functions require a Data Agent to be installed as a proxy to access the shares of the file server, because a Data Agent cannot be installed on the file server directly.

Agent functions by TPC license

The diagram in Figure 3-1 illustrates the functions of the different agents.

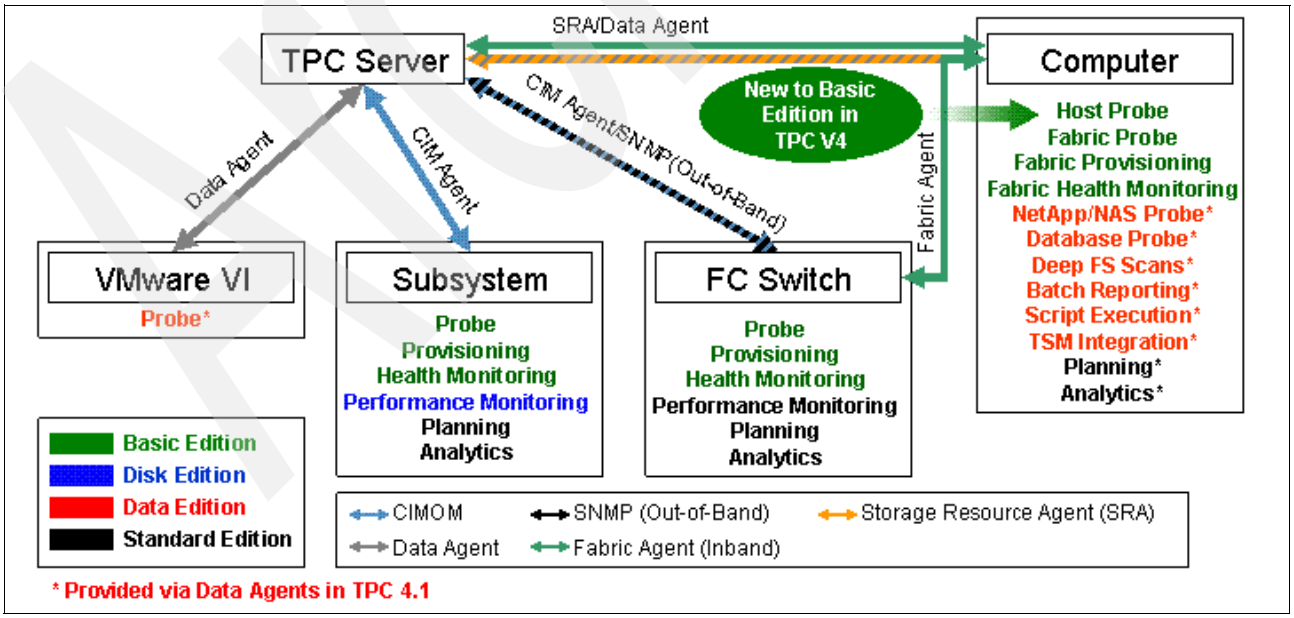


Figure 3-1 Agent functions by TPC license

3.2.2 General planning items

- User and group planning:
  - In 3.3.3, “LDAP with Single Sign-On” on page 68, we explain why user management is important.
  - Replication Manager groups:

    If you plan to use Replication Manager then you need to set up user and group roles in this part of the product as well. The TPC Role-to-Group mapping was not modified for this purpose.
  - Different organizational groups:

    Although there are groups and roles available in TPC, and Single Sign-On can be used for some subsystems, you cannot restrict the access to groups of devices. Users will always be able to perform all the tasks that are available for their roles on all devices. For this reason, TPC will not initiate functions on behalf of a user (using this user ID), but with the ID that is configured for the CIMOM (for example, the current version of DS open API) or the ID that is configured within the CIMOM (for example older version of the DS open API).

    If you need to limit the access on groups of storage devices, you will need to set up different TPC server environments. It is probably more likely to have such a requirement when there is a test and a production environment.
- TPC environment resources in terms of how many TPC servers, CIMOM servers, and more:

  Even though you sometimes read that you can turn off a component of TPC (and you might be tempted to even uninstall it), this can lead to future complications, for example when you install updates.

  Usually it is better to leave the component turned on, and just not use it if you do not need it. Examples of such components are TIP and Replication Manager.
- TPC installation documentation and the TPC support site:

  Not all functions of TPC are working with all storage resources, so you need always to consult the TPC installation documentation and look for flashes on the TPC support site.

  One example for such a function is the SAN Planner. This function is only supported for IBM D8000, IBM DS6000, and IBM ESS. It does not work with DS4000, DS5000, or IBM SAN Volume Controller.
- Ports used by the TPC components:

  After you have created a simple network diagram, you can easily discuss with your customer if there are firewalls located between any of the components. If so, consult the list of used ports provided in Chapter 4, “Installation and upgrade” on page 93 to discover what firewall changes are required for TPC to work properly.

3.3 Solution design for new functions and features

In the last section of “Solution Planning and assessment” we cover those objectives that are closely related to any of the new functions or features of TPC V4.1, including:

- Storage Optimizer
- Tivoli Integrated Portal
- LDAP and Single Sign-On
- Storage Resource Agent (versus Data Agent)

- Replication Manager Integration
- SAN Fabric Management
- CIMOMs
- Agent Manager
- Policy Management

3.3.1 Planning for the Storage Optimizer

In this section we present the Storage Optimizer, a TPC Analytics function for data center storage provisioning, which takes the approach of maintaining storage services for applications in TPC a step further by ensuring well-balanced utilizations in all internal components of the storage subsystems (see Chapter 6, “Customization and administration” on page 193 for more information).

The Storage Optimizer is a tool to help you analyze your storage subsystems to identify hot spots or bottlenecks, plan for storage growth, improve performance, and help develop storage migration or storage consolidation plans. The optimizer provides recommendations to ensure well-balanced utilizations in all internal components of the storage subsystem.

Using the data in the Tivoli Storage Productivity Center database, the Storage Optimizer enables you to create two different type of reports—one for each of the two processes that are executed in sequence:

- Result of the first process: Analysis report

  The analysis report in an interactive panel in the TPC GUI that presents you key figures of your data storage environment and lets you select the components to examine further.

- Result of the second process: Optimization report

  Based on the analysis report, the optimization run creates a second report that provides actual recommendations for changes to your storage to achieve the thresholds you had defined.

The optimizer will not actually perform any migrations or make modifications to subsystem configurations, but for IBM SAN Volume Controller (SVC), it will create a list of commands that later can be executed by the SVC administrator using the SVC command line.

When to use Storage Optimizer

The analysis of the Storage Optimizer can be used to achieve two different goals:

- Migration:

  This means looking for hot storage pools and giving recommendations about which volumes to migrate to a different storage pool.

- Consolidation:

  In this case a subsystem will be retired and you are looking for recommendations about which subsystem you should move the volumes to.

Considerations for Storage Optimizer

In this section we list various considerations regarding the use of the Storage Optimizer:

- The input for the analysis process of Storage Optimizer are subsystems. Even though you can select single storage pools, all storage pools of the selected subsystems will be included. So you cannot use this feature to reduce the amount of data to be analyzed. Even though the Storage Optimizer uses subsystems as the input, the analysis will be performed on a single storage pool level.

- The optimization process goes a step further and looks at the volumes in the pools, so the recommended changes will be given at a volume level in order to reach the defined storage pool threshold again.
- The time frame that you can select is limited to days only, so you cannot run an analysis just for some hours with peak workload.
- There has to be at least one day of performance data available for the selected subsystems, otherwise the optimizer will not work, and you will receive `Error HWNOP0034E No daily performance data is available`. Even if the data was not collected during the whole day, it is sufficient if there is aggregated data for that day available.
- After the analysis phase, when you select a threshold for the optimization, this value is used as a maximum value for utilization values. Four of the six utilization values are used. Host Adapter, Hard Disk, Controller, Device Adapter. Space, and the overall "utilization" (which is simply the maximum of the other four utilization values) are not considered during an optimization process.
- Unlike other reports that a user can define and save under My Reports, the results of Storage Optimizer runs and reports are visible to other users as well (given the appropriate access level).
- It is important to understand that the Storage Optimizer in TPC V4.1 does not take into account if replication sessions are established when providing change recommendations.
- If you use a naming convention for storage pools, it can make the use of the optimizer easier, especially if your storage pool names include information about attributes such as RAID Level, format (for example, FB or CKD, for some subsystems only). Storage Optimizer does not provide you this level of detail but requires that source and target pool do share the same attributes.
- The details optimization report can only be printed, and cannot be saved in any other format, so the TPC server should have a printer defined. As an alternative, you can also install a virtual printer that creates PDF files.
- The Storage Optimizer will only optimize storage subsystem utilization. SAN fabrics or switches are not analyzed for performance bottlenecks.
- If you include the same subsystem in two different jobs, TPC will have to do the analysis twice, so careful job grouping and scheduling is recommended.
- Retention of the optimization reports is not related to the retention setting of resources, you have to manually delete old reports if you do not need them anymore.

Requirements for Storage Optimizer

The following requirements apply to using the Storage Optimizer:

- License:

  This feature requires an IBM Tivoli Storage Productivity Center Standard Edition (5608-WC0) license.

- Supported devices:

  DS8000, DS6000, DS4000 (some models only), TotalStorage Enterprise Storage Server, and SAN Volume Controller are supported.

- Implementation/Configuration/Operation:
  - Subsystem Performance Monitors must have collected data for systems that you want to analyze.

- You should also have a baseline of the storage utilization so that you can understand if there really is a situation that you need to look at further. For information about how to create a baseline, see *SAN Storage Performance Management Using TotalStorage Productivity Center,* SG24-7364.
- There needs to be at least one daily summation level of performance data.

3.3.2 Tivoli Integrated Portal

Tivoli Integrated Portal (TIP) is a standards-based architecture for Web administration. Tivoli Integrated Portal enables IBM to build administrative interfaces for IBM and independent software products as individual plug-ins to a common console network, by leveraging the underlying WebSphere Application Server (WAS).

Additionally, TIP provides a runtime environment called Tivoli Common Reporting (TCR), which can be used to host custom reports that have been created with the open source Business Intelligence Reporting Tool (BIRT).

When to use TIP

The installation of Tivoli Integrated Portal is required to enable Single Sign-On for Tivoli Storage Productivity Center. Integrated in TIP/WAS is a service called Embedded Security Service (ESS), which is used for providing the Single Sign-On capability of TIP. This service is a prerequisite when you plan to use Single Sign-On for IBM storage devices (currently IBM DS8000 only).

In general, TPC does work without TIP. Even if you cannot install TPC without TIP, it is not mandatory for using TPC. However, TIP provides a set of functions that are otherwise not available to TPC:

- To access the TPC GUI, you do not have to go through TIP. Instead, you can either use the desktop icon (on Windows), use Java Web Start (which is served by the Device Server), or install the GUI locally on your computer.
- If you need to provide a single Web launch point for both TPC and TPC-R, then you should use TIP because both TPC products can be launched from there.
- Requirements in relation to user ID management:
  - If you need the user management to be outside of the TPC server (not using local OS users and groups) using LDAP, TIP is required because of the Embedded Security Service running in TIP. LDAP configuration is only available through TIP.
  - If there is a requirement for reports that are not available in the TPC GUI, you can use SQL access to Tivoli Storage Productivity Center database to create custom reports based on the views in the TPCREPORT schema.

    This alone is not a requirement for TIP, but if:

    - You want to run the reports repeatedly.
    - The reports need to be available by a Web browser.
    - You need to provide different authorization levels for the reports.
    - You need to schedule the reports to run at certain time.

    Then the Tivoli Common Reporting (TCR) included in TIP will help you satisfy these requirements, even though there are also other software products that can provide the same functions. Designing the report with BIRT then becomes a prerequisite.

Table 3-2 provides a quick reference to TIP and the reasons why you would want to use it.

Table 3-2 Quick reference to understand when TIP is used

Components you have	Functions you want	Requirements
TPC	GUI	TPC
TPC	Remote Web GUI	TPC, TIP optionally
TPC	LDAP user repository	TIP and TPC
TPC	SQL Reporting	TIP/TCR recommended
DS8000	Graphical Element Manager	TPC but not TIP
DS8000	LDAP user repository	TIP but not TPC
SVC	Graphical Element Manager	Both TPC and TIP are not required
SVC	LDAP user repository	TIP but not TPC

Considerations for using TIP

Here are some things to consider when using TIP:

- Within the TIP navigation tree, there is only a single top-level entry labeled “IBM Tivoli Storage Productivity Center”. When you click that link, you can either launch TPC, TPC-R, or access TPC documentation and demonstrations on the Internet.

  If the TPC or TPC-R entry is written in red, this means that the service is not running.
- A user can only log into TIP once with the same user ID. If you try to log in a second time, you will see the message in Figure 3-2.

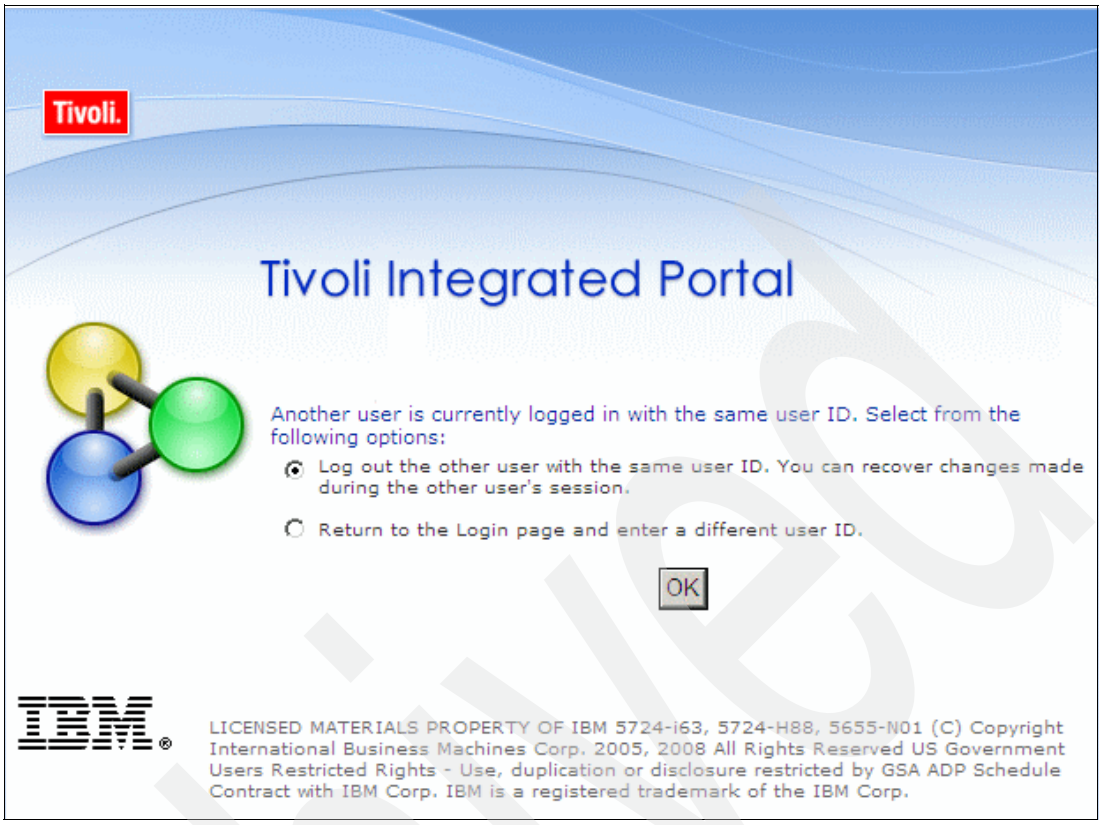


Figure 3-2 TIP duplicate user ID login message

As a result, you need to carefully plan the user ID management:

- The TIP instance installed with TPC or an existing TIP instance already on the same server as the TPC instance have to be exclusively used for TPC and TPC-R. Although theoretically possible for this version of TPC, it is not supported to share the TIP instance with other applications, or use a TIP that is not locally installed.
- TIP provides three methods for user authentication: local OS, file based, and LDAP. Note that TPC does not support the file base user repository.
- Typically users that are granted a role in TPC can log on to TIP because the user's group has been mapped to roles on the Role-to-Group Mapping panel in TPC; this is synchronized with the TIP groups.

  The synchronization of the groups works only when adding a group through TPC. When a group is removed from the Role-to-Group mappings in the TPC GUI, the same group is not automatically removed from the Administrative Group Roles in TIP. If you want to remove it, you need to do it manually.
- User groups that have been synchronized from TPC to TIP do not have any roles granted for using the Tivoli Common Reporting function. This role has to be added manually.
- If users without a role in TPC are granted access to TIP (for example, if these users should be able to use TCR reports, but not TPC) they still can see the Tivoli Storage Productivity Center Navigation Tree entry.

  However, if these users try to launch TPC, they will see the error message in Figure 3-3.

Figure 3-3 Failed TPC login for a user not mapped to a TPC role

- For the Reporting Navigation Tree entry, this is different: only users with a TCR role assigned are able to see the entry. Compare the screen captures in Figure 3-4.

  The left screen capture shows that users with any role logged in to TIP can see the Tivoli Storage Productivity Center navigation tree entry. The right screen capture shows that users with a TCR role granted can also see the Reporting navigation tree entry.

Figure 3-4 Comparison of navigation tree entries based on user roles

- For detailed TPC user and group considerations, see Chapter 5, “Configuration” on page 145.

Requirements for using TIP

The following requirements apply to using TIP:

- License:

  TIP is part of every TPC installation. You do not need a special license to use TIP or any of its functions, TPC Basic Edition is all that is needed also if you just want to use LDAP with DS8000.

- Port requirements:

  Port 16310 is the default base port and TIP will use 10 additional ports (not sequentially): base port +1, base port +2, base port +3, base port +5, base port +6, base port +8, base port +10, base port +12, and base port +13.

  During the installation you can specify a different base port, but you should make sure that the additional ports are also free.

- The server should have access to the Internet to be able to launch the TPC documentation and product demonstration Web pages.

Additional information about TIP

For more information about TIP, see the following sources:

- Walkthrough of TIP:

  http://www14.software.ibm.com/webapp/download/demo.jsp?id=Tivoli+Integrated+Portal+Walkthrough+Aug08&locale=en

- TIP manuals in the Information Center (but not in PDF format):

  http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/index.jsp?topic=/com.ibm.tip.doc/ctip_install_overview.html

3.3.3 LDAP with Single Sign-On

Single Sign-On (SSO) is an authentication process that enables you to enter one user ID and password to access multiple applications. Single Sign-On integrates with the launch in context feature to enable you to navigate smoothly from one application to a specific panel in a second application.

The SSO strategy implemented in TIP/TPC is based on the exchange of Lightweight Third-Party Authentication (LTPA) tokens between the different applications, based on the underlying Embedded Security System (ESS) within WebSphere Application Server capabilities.

LDAP and also Microsoft Active Directory provide a centralized repository for use in a system wide authentication. The benefit that this provides is a single place to manage all user accounts. This means that all authentication requests within an environment can be sent to a remote LDAP/Active Directory server as opposed to the local OS repository.

When to use LDAP and Single Sign-On

For administrators, it is always a major effort to use different user IDs and password across all the servers and devices that they need to access. In order to make the work easier, many administrative users use the same user ID/password combinations on multiple devices by creating the same user on all the devices manually. Because this is a cumbersome task, user IDs are often shared with the others.

In a running TIP environment, you do not need to enter passwords if you switch between TPC and TPC-R even if local authentication is used, but this level of comfort ends as soon as you try to launch an element manager (perhaps with the exception of the DS8000 element manager started from TPC—here you could store the user ID and password because it was integrated into TPC).

Sharing the same user ID with teams is not a secure method and not welcomed in many organizations. When you need to restrict the access to systems for smaller groups, you will again face the cumbersome task to set up the group's ID on all the devices manually.

The idea of Single Sign-On overcomes these issues, because:

1. A user does not need to enter passwords again and again, because the systems essentially share a common user ID database.
2. Because the systems share a database, the effort to set up individual user IDs for each person, as well as using user groups to manage user access, is dramatically reduced.

This central user ID database has to be LDAP/Active Directory in order to be shared with applications and systems not running on the TPC server.

Considerations for Single Sign-On and LDAP

Here we list some considerations regarding Single Sign-On and LDAP:

- LDAP is not a prerequisite for Single Sign-On to work, but without LDAP, SSO is limited to applications that can access the same user ID repository. So at the end, only SSO between TIP, TPC, and TPC-R will work without LDAP.
- If there are a limited number of TPC users in your organization and you do not have LDAP enabled storage devices, you probably do not need to set up LDAP.
- It is much easier to set up LDAP during the installation than to switch later on. So talk to your customer first, instead of starting with the installation right away and discovering later that the customer wants to use LDAP.
- All configuration and setup is performed within TIP. If you need to switch Single Sign-On on or off, understand that this function is located within TIP.
- If you switch between LDAP/Active Directory and local authentication, all role to group mappings are lost.
- Due to the WebSphere Application Server APAR PK77578, the LDAP TPC Administrator username value must not contain a space in it.
- If no LDAP/Active Directory is used, Single Sign-On can still work with local authentication (on Windows).
- The TPC CLI supports OS, LDAP or Active Directory authentication. TPC CLI leverages the security of the Device Server. It will automatically pick up the authentication mechanism that the Device Server is configured for.

  While LDAP/Active Directory will be added as an authentication mechanism, the use of LTPA tokens will not be supported within the TPC CLI. This means that Single Sign-On capability is not supported with the TPC CLI and the user credentials must be provided every time the TPC CLI is invoked.
- In order for Single Sign-On to be most effective, the storage devices have to be set up to use LDAP as well. During this setup, you will point the device (such as DS8000) to the same TIP that TPC is using.

  For a detailed example of the DS8000 LDAP setup, see the section 2.5 “Configuring the DS8000 for LDAP authentication”, in *IBM System Storage DS8000: LDAP Authentication*, REDP-4505.

  Because the devices that use LDAP are using TIP and LDAP, you need to make sure that these two services are highly available. It is possible and recommended that you use two TPC/TIP installations and in an active/standby manner. Information about how to configure this kind of setup are explained in *IBM System Storage DS8000: LDAP Authentication*, REDP-4505.
- If the clocks in the servers are off by too much (approximately 10-15 minutes), you can encounter unrecoverable validation failures that can be avoided by having them in sync. Ensure that the clock time, date, and time zones are all the same between systems. It is acceptable for nodes to be across time zones, provided that the times are correct within the time zones (for example, 5 PM CST = 6 PM EST, and so on).
- Last, but not least, all computers of a Single-Sign-On domain have to be in the same DNS domain if the LTPA token is transferred in a cookie, because browsers do not pass cookies to servers in a different domain than the server, which sent them the LTPA cookie initially.

Requirements for Single Sign-On and LDAP

The following requirements apply to using LDAP Single-Sign-On:

- License: To use LDAP and Single Sign-On, at minimum, the TPC Basic Edition License (5608-WB1) is required.
- TIP needs to be running, because Single Sign-On relies on the Embedded Security Service (ESS) that is provided by TIP/WAS.
- Subsystems need to support LDAP authentication with Single Sign-On capability (LTPA token). Currently only DS8000 R4.2 supports LDAP authentication.
- For the configuration of LDAP, Table 3-3 lists the minimum information that you will need.

Table 3-3 Minimal LDAP information set

Information	Description
Directory type	The type of LDAP server to which you want to connect.
Primary Host Name	The host name of the primary LDAP server.
LDAP Server Port	The LDAP server port.
Bind Distinguished name and password	The distinguished name (DN) and password to use when binding to the LDAP repository if anonymous binding is not allowed (for example Windows Active Directory).
Search bases for Group, OrgContainer and PersonalAccount object types	The search bases that are used to search these entity types. The search bases specified must be subtrees of the base entry in the repository.
Relative DN for Group, OrgContainer and PersonalAccount object types	The LDAP attribute name to use when searching for these entity types.
Administrative User ID and password	The user in the repository that will be granted administrative privileges in the TIP.
LDAP TPC Administrator Group	The name of the user group that will be assigned the super user role in TPC.

- Because TIP is not directly interfacing with LDAP (it is using the underlying WebSphere Application Server), the support of LDAP server types matches whatever WebSphere supports. The following Web site lists the different types of LDAP WebSphere Application Server supports:

  http://www-1.ibm.com/support/docview.wss?rs=180&uid=swg27007642

- The default LTPA token expiration time is 1440 minutes (24 hours). However, some environments might not allow such a long duration or might agree to longer expiration times. Discuss with your customer the appropriate setting for this installation.

  To change the expiration in TIP, see “Changing the LTPA token expiration for single-sign on” in Chapter 6, “Administering IBM Tivoli Storage Productivity Center” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337.

Further information about LTPA tokens

Lightweight Third-Party Authentication (LTPA), is an authentication technology used in IBM WebSphere and Lotus Domino products. When accessing Web servers that use the LTPA technology, it is possible for a Web user to re-use their login across physical servers.

During authentication processing, the Single Sign-On service returns an LTPA token and additional credentials such as groups to the initiating application. The LTPA token is cached.

To allow the applications Single Sign-On to work with the LTPA token and actually perform the authentication of the user, they need to “understand” the LTPA token and use the same common user directory, which in this case has to be a directory using the Lightweight Directory Access Protocol (LDAP) or Microsoft Active Directory.

A Single Sign-On domain includes all servers/applications, which are set up to allow a user to switch from one to the other without having to re-enter a user ID or password, but use one application’s knowledge about the logged on user to authenticate the same user in other members of the domain.

Additional information can be found at the following Web site:

http://en.wikipedia.org/wiki/IBM_Lightweight_Third-Party_Authentication

3.3.4 Storage Resource Agents versus Data Agent

Storage Resource Agents are a type of agent that can collect information from computer systems (host systems) on which they are installed. Information is collected through Probe jobs. These agents are designed to be more lightweight and easier to install or deploy than the Date Agents.

The Storage Resource Agent is usually invoked by using remote execution mechanisms such as SSH, RSH, or REXEC, so that it does not need to be running even if there is nothing to do. This reduces the requirements for memory and CPU on the target system.

Besides allowing a different communication approach, the daemon process also eliminates the need to manage the remote access passwords for the monitored computers in the TPC repository database, because the communication can use certificate-based authentication.

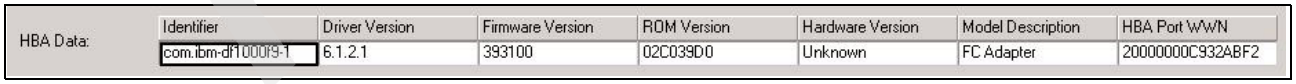
Using Storage Resource Agents

The Storage Resource Agents (SRAs) are new in TPC V4.1 and will eventually replace the common agent based Data and Fabric Agents. So looking from a strategic standpoint, you should install and use the SRA whenever possible (see the following considerations for reasons why you might need to use the older Data Agent).

If you are familiar with the functions that the Data Agent provides, then generally you can decide which agent to use by asking yourself if you need any more information that is collected during a Probe job. If the answer is no, then a Storage Resource Agent is all you pobably need.

If you are not sure about the functions and information that an SRA provides, or if you need any type of agent at all, refer to the following list to help with your decision:

- When you need to gather information about servers, including:
  - Asset information, such as host name, IP address, MAC address, cluster information
  - HBA details of a computer with an agent, as in Figure 3-5.


HBA Data:

Identifier	Driver Version	Firmware Version	ROM Version	Hardware Version	Model Description	HBA Port WWN
com.ibm-df1000f9-1	6.1.2.1	393100	02C039D0	Unknown	FC Adapter	20000000C932ABF2

Figure 3-5 Details of an SRA as shown in Administration → Data Sources - → Data and Storage Resource Agents

- If you need a report form of a table listing the details of all HBAs instead of only one, you can create an SQL query using the SQL access to the TPC database:
  - Storage information, such as disks, logical volumes, file systems, or mountpoint/share

- Availability reports that show the computer uptime:

  This does not really require any action of the agent, but TPC needs to know the computer, and TPC only knows about a computer if a Data Agent or SRA is installed.

- If you do not need to do file system Scans, use the SRA instead of the Data Agent:
  - When you want to correlate subsystems to host storage
  - When you want to use the Data Path Explorer

  The Data Agents need too much resource in terms of disk capacity as well as CPU cycles (especially because the Data Agent is running all the time, even if tasks such as Probes, Scans or Batch Reports are not executed). This is called on-demand service (non-daemon service) mode.

Reasons to use the Data Agent

Next we list some reasons that you might need to use the Data Agent, although it is the more complex situation to manage (for example, because you need Agent Manager):

- You might need detailed information about files within the file systems monitored by the agent. This information can currently only be provided by running Scans.
- You might need to report on databases.
- The reporting is planned/required to be scheduled and automated (Batch Reporting).
- File system extention only works if you have a Data Agent installed, because at this time there is no SRA available for Sun Solaris.
- You might want to perform tasks based on files identified on managed computers.
- You cannot use an SRA to collect information about NAS or NetWare devices, because the Scan function is not available.

Considerations for Storage Resource Agents

Keep in mind the following considerations when you use Storage Resource Agents:

- As of TPC V4.1, the platform coverage of the Data Agent is larger than the coverage of the SRA, so check your platforms to verify if there is an SRA available.
- To address situations where remote access is not possible (or only on a very limited basis), the SRA will also provide a functionality to run as a daemon process, which can then act as a communication endpoint for the TPC server instead of the enabled OS remote access method.
- Probes can be performed by either one of the agents, but only the Data Agent can provide the file system Scan function—this function is currently not available for the SRA.
- Agent Manager installation is not required for using SRAs.
- The SRAs will be deployed from TPC GUI, unlike Data/Fabric Agents, which can be installed using a separate installer image (in TPC V4 this is disk2), but there is the possibility to perform a CLI based installation of the SRA. To uninstall an SRA using the TPC GUI, simply click the **Delete** button.
- To access “Storage Resource Agent Deployments” in the Navigation Tree in order to schedule a job for deployment, the user needs to belong at minimum to the “Productivity Center Administrators” group.
- In order to run SRAs on any target system, the process should be run under privileges of either administrator or root in Windows or UNIX respectively.
- User IDs and passwords that the SRA is using can be easily changed later on.

- The SRA is not a replacement for the Fabric Agent, simply because it does not perform any inband FC-GS3 fabric management.
- Computer uptime statistics are only available when the SRA runs in daemon mode.
- You cannot include computers and file systems that are monitored by Storage Resource Agents only into the Computer and file system monitoring groups.
- A computer with an SRA installed cannot be used as a “Selected Element” in the SAN Planner. A Data Agent is currently required for using the SAN Planner function. We verified this in our lab.
- Storage Resource agents that are invoked using the non-daemon protocol do not support data collection for Computer Uptime reports. These reports will not contain data for computers on which non-daemon based Storage Resource agents are deployed. To collect computer uptime information using a Storage Resource agent, that agent must use a daemon service for runtime operation.
- Co-existence of Agents on a system:
  - SRA and Fabric Agent pointing to the same server: This is allowed.
  - SRA and Data Agent pointing to same server: This *is not* allowed.

    When you try to install the Data Agent, the SRA will be uninstalled automatically.
  - SRA and Data Agent pointing to a different server: This is allowed.

    You need to install the Data Agent first, because otherwise the SRA would get uninstalled automatically.
  - More than one SRA pointing to same server: This *is not* allowed.
  - Multiple SRAs pointing to different servers: This is allowed.

    The agents need to be in two separate directories because the certificates of the TPC servers could be different and you might plan to upgrade the agents at different times.
- Security considerations and run modes:

  The SRA can be run using different communication types that can be set for each installed agent individually:
  - Daemon mode (like the Data Agent)
  - Remote execution (TPC uses remote execution of the agent, for example, by using SSH to connect to the computer and run the **`agent.sh`** / **`agent.exe`**)

  With the different communication types, there are certain security considerations that you should be aware of:

  a. When the agent runs in daemon mode, then you only need the administrator credentials during the installation. After installation, the security is based on certificates that are shipped with TPC. In the manuals, you can find instructions showing how this can be changed.

  b. When running in remote execution mode, TPC needs to store the credentials (user ID and password) of the administrator. When the password expires or changes, TPC will no longer be able to talk to the agent until you change the stored password for the agent. Because this could happen for more than one agent at a time, there is a procedure to change the credentials of multiple agents at the same time.

     SSH offers the possibility to use an optional alternative to the authorization method using a user ID and password. TPC can use a user ID, a certificate, and a passphrase to log into the computer and start the agent. The advantage of this method is that there is no password that expires and needs to be changed.

Table 3-4 shows a comparison of the three connection methods of the SRA.

Table 3-4 SRA connection types

Communication Type (COMMTYPE)		Considerations
Daemon		► TPC admin does not need to have access to the computer running the agent ► TPC does not need to refresh passwords ► Authentication is provided using default certificates, no clear text password is transferred ► Can provide computer uptime staticstics ► Requires one open firewall port (default 9510)
Remote execution	User ID and password (REXEC, RSH, SSH, SMB)	► Password might expire and/or need to be refreshed periodically ► TPC administrator knows the root passwords ► There is no constantly running agent ► Only well known ports are used on the computer
	User ID, certificate, and passphrase (SSH only)	► Password changes are transparent to TPC ► TPC administrator has the information required to access the computer running the agent ► SSH daemon needs to be enabled for login with certificates ► There is no constantly running agent ► Only well known ports are used on the computer

In both cases where remote execution is used, somebody else could enter the credentials (password or passphrase) so that the TPC administrator does not know the password or passphrase. When certificates and passphrases are used, this is a one time task. When user IDs and passwords are used and differ from computer to computer, this is not a practicable solution.

- There is no native Microsoft SSH implementation, so using the SSH communication for computers running the Windows operating system does require you to install an SSH service. In the *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337, you will find an example that uses the Cygwin software to provide an SSH service on Windows.
- TPC uses the Tivoli Global Unique ID (GUID) software in order to distinguish between the individual agents. This component is installed during the agent deployment if not already installed on the target system. In situations where the Tivoli GUID component was part of an OS deployment image, it is important to ensure that the IDs are really globally unique. If they are not multiple different computers with agents installed, they might be displayed as a single system in the TPC GUI, or the deployment might fail with SRA return code 45, `Agent Registration to Server failed`. In the TPC documentation, you can find information about how to change a GUID at the following URL:
  `http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp?topic=/com.ibm.tpc_V41.doc/fqz0_t_set_up_master_image.html`
- The SRA return codes are not documented in the Tivoli Storage Productivity Center PDF documents, but can be found in the Information Center at the following URL:
  `http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/topic/com.ibm.tpc_V411.doc/fqz0_r_return_codes_used_by_strg_resource_agent.html`
- The capacity required for the SRA is far less than the capacity for Data Agent. Depending on the amount of logging that you are doing, it is about 5 MB RAM and 10 MB disk space for the SRA.
- Batch reporting is currently not possible with the Storage Resource Agent.

Requirements for Storage Resource Agents

The following requirements apply to the Storage Resource Agent:

- License:

  The Storage Resource Agent function can be used with IBM Tivoli Storage Productivity Center Basic Edition (5608-WB1).

- For platform support, see Chapter 4, “Installation and upgrade” on page 93.

- Protocols and ports:
  - SSH protocol
  - Windows SMB protocol
  - REXEC protocol
  - RSH protocol

Quick comparison of the Data Agent and the Storage Resource Agents

Table 3-5 provides a comparison of the Data Agent and Storage Resource Agent.

Table 3-5 Quick comparison of the Data Agent and the Storage Resource Agents

TPC functions	Data Agent	Storage Resource Agent
Probes	Yes	Yes
Scans	Yes	No
Batch Reports	Yes	No
File system Extention	Yes	No
Run scripts on alerts	Yes	Yes
Deploy and run scheduled actions (scripts)	Yes	No
Scans of supported databases	Yes	No
Provide input to chargeback reports	Yes	Yes (but limited)
Deployment	Installer GUI	TPC GUI, CLI
Agent Manager required	Yes	No
Update	From TPC	From TPC
Provide Information for Data Path Explorer	Yes	Yes
User ID requirements	Root/Administrator	Root/Administrator
Protocols	Common Agent proprietary	REXEC, RSH, SSH, SMB
Service mode: daemon / on-demand	Yes / No	Yes / Yes

Communication between TPC and SRAs

The diagram in Figure 3-6 illustrates how the deployment and installation of the new Storage Resource agent are performed.

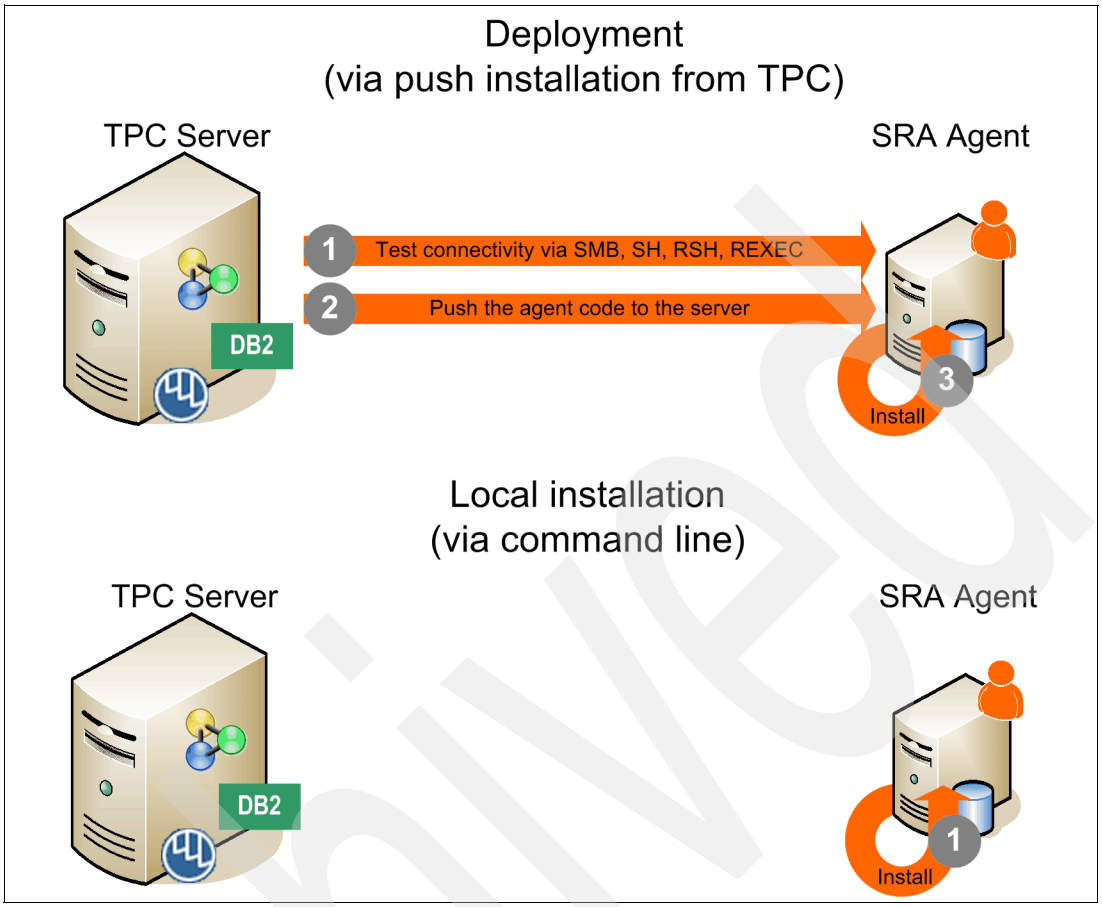


Figure 3-6 Deployment and local installation

The diagram in Figure 3-7 shows the execution of a probe with the new Storage Resource Agent. At this point there is no huge difference if the agent is running in daemon mode or in on demand mode. The TPC server will initiate the task in both cases. What is different though is the protocol used for the communication:

- When running in daemon mode, the server will connect to the **`agent.exe`** application.
- When running in on demand mode, the server will connect using one of the supported protocols and start the application directly.

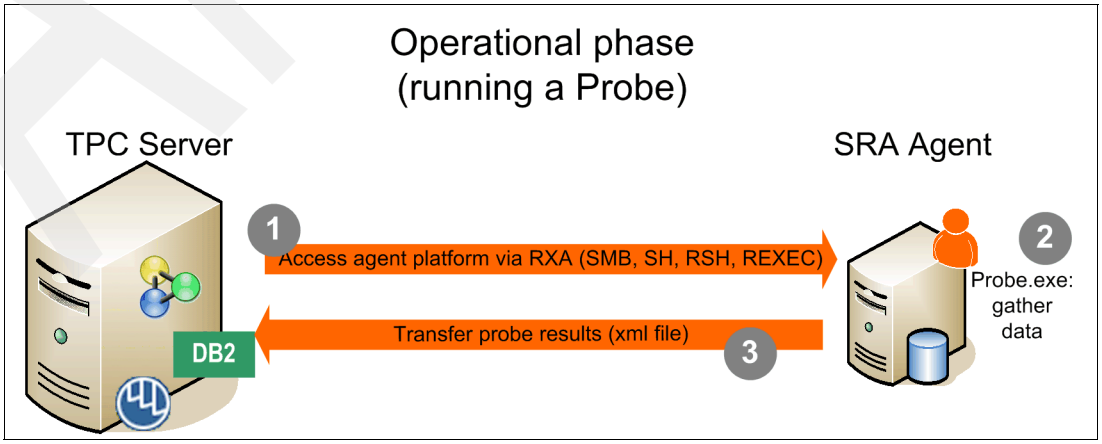


Figure 3-7 Running a Probe

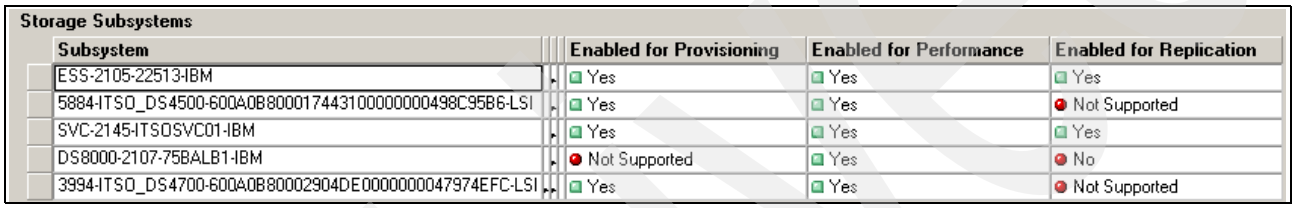
3.3.5 Replication Manager integration

TPC for Replication (TPC-R) or Replication Manager (RM) is a product to manage and configure FlashCopy and MetroMirror relationships of supported IBM storage subsystems. Starting with Version 4.1, TPC and TPC-R are no longer completely separate applications within the same family of products any more. In TPC V4.1, both products are loosely coupled with some basic functions, but over time, we expect to see more of the integration initiative.

What is new

The integration of TPC-R into TPC provides the following functions:

- In **Administrative Services** → **Services** node, there is a new entry for Replication Manager, which allows you to check the connectivity to RM server.
- In **IBM TotalStorage Productivity Center** → **Configuration Utility** node, on the Disk Manager tab, there is a new column in Storage Subsystems section, called *Enabled for Replication* (see Figure 3-8), which indicates whether a subsystem is enabled for replication or not.


Storage Subsystems

Subsystem	Enabled for Provisioning	Enabled for Performance	Enabled for Replication
ESS-2105-22513-IBM	Yes	Yes	Yes
5884-ITSO_DS4500-600A0B80001744310000000498C95B6-LSI	Yes	Yes	Not Supported
SVC-2145-ITSOSVC01-IBM	Yes	Yes	Yes
DS8000-2107-75BALB1-IBM	Not Supported	Yes	No
3994-ITSO_DS4700-600A0B80002904DE0000000047974EFC-LSI	Yes	Yes	Not Supported

Figure 3-8 Storage Subsystem panel that shows if devices are enabled for replication

- The Storage Subsystem details panel now shows the RM configuration information, if the subsystem is configured for replication.
- When a Storage Subsystem, Volume, or VDisk is deleted from TPC, it checks if it is used in the replication session or not, and deletion is not allowed if it is used in the RM session.
- TPC-R alerts are now shown in the TPC alert log, under a new node in **Alerting** → **Alert Log** → **Replication**. All possible alerts are enabled by default, and you can only change the notification settings. Following is a list of the alerts:
  - Replication Communication Failure
  - Replication Configuration Change
  - Replication Management Server State Change
  - Replication Session Change
  - Replication Suspending Event Notification
- There is a new node in TPC Navigation Tree, called Replication Manager which allows configuration of replication alerts, based on triggering conditions. A sub node there, called Replication Management brings up launch buttons for launching to TPC-R GUI.
- RM will use the authorization method configured in TIP, so LDAP/Active Directory and local system user ID can be used.

Figure 3-9 shows the most important changes that have been made to the TPC V4.1 in relation to the Replication manager integration.

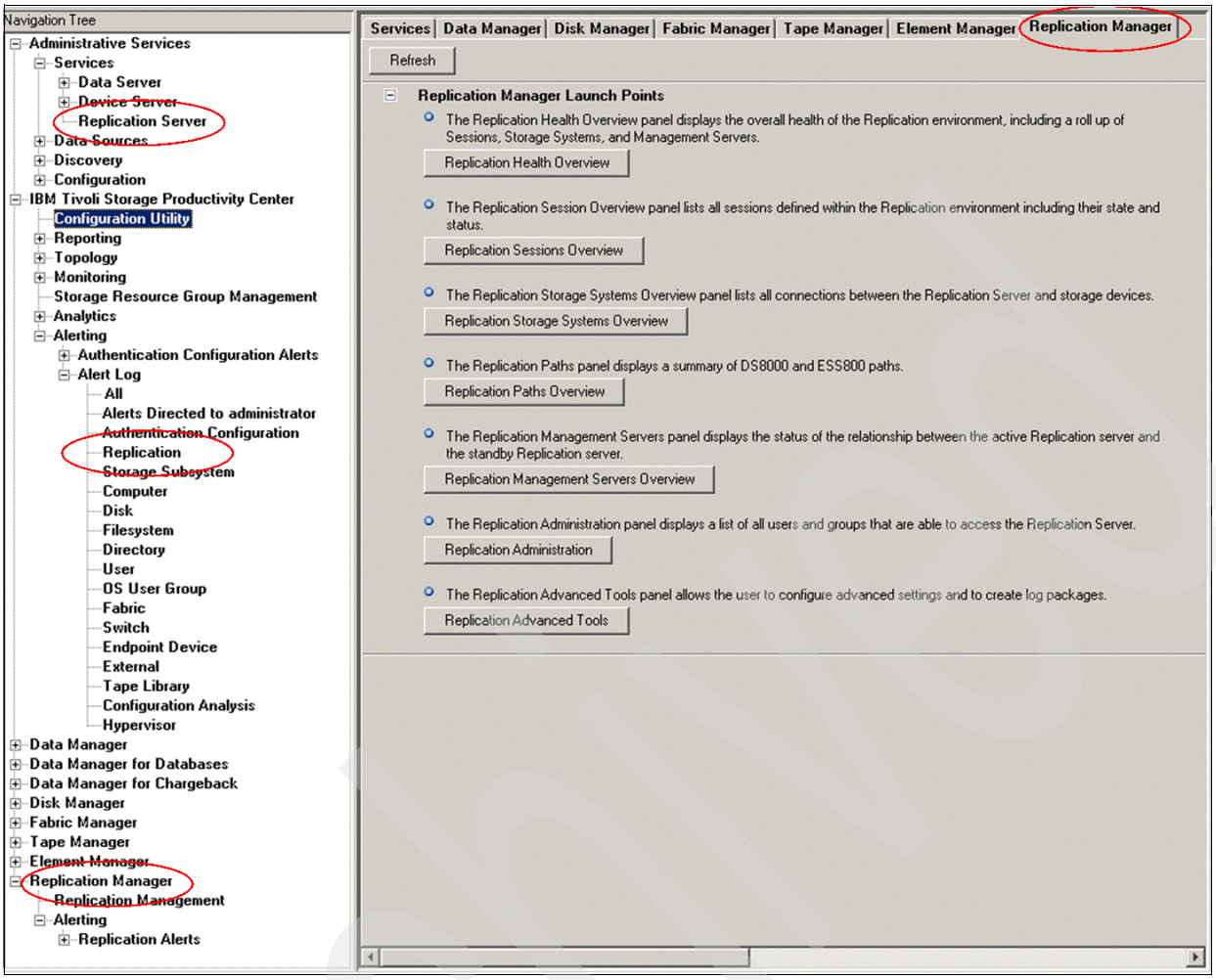


Figure 3-9 TPC GUI changes for the Replication Manager integration

- These are not the only changes, but the major and most visible changes. For example, the Topology Viewer' s context menus also include an entry to launch the Replication manager GUI.

When to use TPC-R

The decision to use TPC-R or not depends very much on the following circumstances:

- Is the customer using any copy functions in their storage environment?
- Are the subsystems that are using copy functions supported by TPC-R?

Considerations for TPC-R

Using TPC-R is not part of this certification test, but you should understand the following considerations in order to plan, install, and run a TPC environment:

- TPC will always install TPC-R, even if you do not plan to use it. If you cancel the TPC-R installer during the TPC installation, the complete TPC installation will be rolled back.
- Only for z/OS, there is still a “stand-alone” Version of TPC-R available; all other TPC-R versions need to be installed together with TPC.
- The possibility of launching TPC-R from TIP or from the TPC GUI will only work for a locally installed TPC-R.

- Some TPC reports show information about FlashCopy volumes (see the example in Figure 3-10), but this information is gathered through the storage subsystem CIMOMs, so no configuration of TPC-R is needed. Because Replication Manager does not use any CIM for communication with the devices, no conflict between TPC and TPC-R can occur.

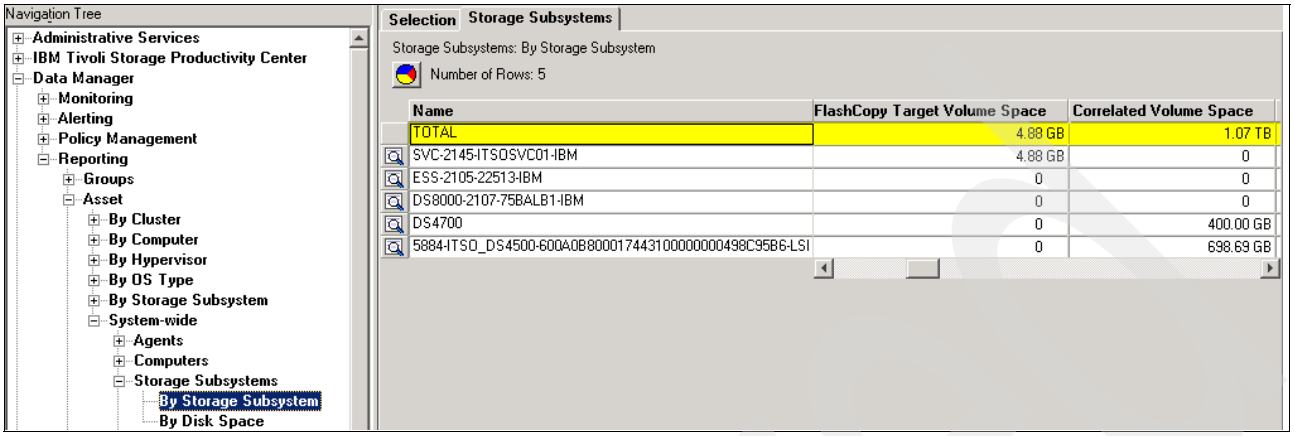


Figure 3-10 Example of FlashCopy information available in TPC

- TPC-R can be safely turned off if you have less than 8 GB of RAM, but you should be aware that:
  - When you try to delete a volume/LUN/vdisk, TPC will do a check with TPC-R if any copy or mirror relationship is defined for this volume.
  - When you try to delete a subsystem, TPC will also perform a check with TPC-R.

  If TPC cannot talk to TPC-R because TPC-R is stopped, the command will stop with the error message shown in Figure 3-11.

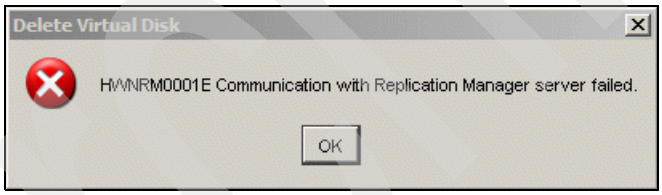


Figure 3-11 Error message when TPC-R is not running

- TPC-R has been changed to support Single Sign-On, but this can only work if you assign the users to the correct groups.

Considerations for later use of Replication Manager

Here are some considerations if you might want to use Replication Manager at a later time:

- If you change or add users or groups in TPC-R, these changes are not synchronized back into TIP.
- User Roles are not automatically synchronized in TPC-R, but you should set up the Superuser group to the same value as the TPC-R Administrator (other TPC-R roles are Session Operator and Monitor). TPC-R is unlike TPC where changes are synchronized back to TIP.
- TPC-R will not use DB2. It uses a separate database, so you need to update your backup procedures.

- With TPC V4.1, the TPC server is supported to run as a VMware guest system (given the right amount of resources), however TPC-R is not. So if you need to use TPC-R later on, you have to switch to a dedicated, not virtualized server.
- The TPC server integration currently does not support the active/stand-by setup of TPC-R. Functions such as launching TPC-R from TPC will only work with a local running Replication Manager.

Requirements for Replication Manager integration

The following requirements apply to the TPC Replication Manager integration with TPC:

- License:

  Although TPC for Replication is installed with TPC, it requires a separate license in order to use it. There are currently two licenses available:

  – IBM Tivoli Storage Productivity Center for Replication (5608-WB2)
  – IBM Tivoli Storage Productivity Center for Replication Three Site BC (5608-WB3)

  Notes:

  – IBM Tivoli Storage Productivity Center for Replication is licensed based on the amount of storage to be replicated at the source location.
  – IBM Tivoli Storage Productivity Center for Replication V4.1 is a prerequisite for IBM Tivoli Storage Productivity Center for Replication Three Site BC V4.1.
  – It is not possible to order a number of TB for TPC-R Three Site BC that exceeds the number of TB ordered for IBM Tivoli Storage Productivity Center for Replication.
- Because TPC-R is installed together with TPC, the same server requirements apply.
- Currently only IBM DS8000, IBM DS6000, IBM ESS, and IBM SAN Volume Controller are supported by TPC-R. Review also the “4.1 - Supported Storage Products List” on the TPC support Web site to determine the required microcode levels:

  a. Go to:

     https://www-01.ibm.com/software/sysmgmt/products/support/IBMTotalStorageProductivityCenterStandardEdition.html

  b. Click **Plan**.

  c. Click **[View all Install documents]** located under “**Latest Plan information**”

3.3.6 SAN Fabric Management

When we use the term SAN Fabric Management, we are referring to those tasks that are needed on a regular or daily basis in a Storage Area Network. In order to avoid confusion, we are not using the term TPC for Fabric, because this product has been integrated into TPC Standard Edition with TPC V4.1.

In this solution design section about the TPC Fabric Manager, we cannot provide all the detailed information that is required to fully understand every aspect of the pre-installation planning for Fabric Manager. This is covered in “Planning for the Fabric Manager” in the chapter, “Planning for the IBM Tivoli Storage Productivity Center family”, in the *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337.

To help you understand that chapter, we provide a short outline of what you can find there:

- More and more TPC functions can be used through CIMOMs, therefore the section about “Planning for SMI-S” is included in the installation guide.

- A more general overview of collecting data with TPC is provided rather than only using SMI-S as a source for fabric information.
- Information about each of the different ways to collect data (CIM Agent, In-Band Fabric Agent, Out-of Band Agent (SNMP) is provided.
- Planning information for Performance Monitor Jobs is provided. Additional information can be found in this book in Chapter 5, “Configuration” on page 145.
- Planning information about switches and directors is given.
- Configuration information for switches is included.

In the *IBM Tivoli Storage Productivity Center User’s Guide Version 4.1*, SC27-2338, the following chapters can help you to better understand the functions, which makes it easier to decide if you need those functions:

- Chapter 2, “Fabric and zones”
- Chapter 3, “Administering data sources”

At this point we will help you to understand if you need to use Fabric Manager’s features at all, which components you need to deploy, and what the prerequisites are—strictly from a solution design point of view.

Using SAN Fabric Management

For easier reference, in Table 3-6 on page 83 we have summarized the situations when you should use Fabric Manager.

Fabric Manager provides two main functions: performing zoning activities and reporting. Here are some reasons for using Fabric Manager:

1. Creating, modifying, or deleting SAN zones from a central point of administration. You can do so with the TPC Fabric Manager, especially if:
   - The SAN switches are from different vendors in different SANs, Fabric Manager allows them to use always the same interface.
   - You have an organizational structure with different groups for the daily administration tasks (first level) and more complicated setup tasks (second level). TPC can be used for the first-level staff because of the limited functionality.
2. Provisioning new LUNs/volumes/vdisks from storage subsystems and at the same time adjusting the zoning with just one wizard, so that a server can access the new storage quickly.

Even if you do not plan to use the Fabric Manager for performing any of these tasks, the reporting functions provided by the Fabric Manager or those that are enabled by the Fabric Manager and the agents might still be important to you.

The following reporting functions are only available if you are collecting information about the SAN devices:

1. Create a visual diagram of your SAN infrastructure using the Topology Viewer.
2. Produce reports on performance and switch port errors (only available through CIMOMs).
3. Find information about the HBAs in the servers.
4. Based on regular data collections such as Probes, Scans, or Performance Monitors, TPC can create Alerts that are then stored in the TPC Alert Log and sent to the specified event management applications.

5. Produce SAN Asset reports (located in the Navigation Tree under **IBM Tivoli Storage Productivity Center → Reports → System Reports → Fabric**) or create your own reports by using SQL queries.
6. The Data Path Explorer can only work if information about the fabric setup (switches, ports, and ISLs, for example) has been collected.
7. Check the fabric configuration regularly or manually for configuration errors based on best practices rules. For that, you need to use the Configuration Analysis function from the TPC Analytics functions.

Considerations for SAN Fabric Management

The following considerations apply to using SAN Fabric Management:

- Fabric Managers element management capabilities are limited. Customers who only have one vendor for SAN switches are likely to use the tools provided by that vendor instead of using Fabric Manager.
- HBA information is only provided when you deploy Fabric Agents or Storage Resource Agents.
- The actual interfaces/Data Sources used by TPC to perform data collections depend on the switch vendor, see Table 3-7 on page 84, There are two types of data collection jobs:
  - Probes, which can be done Inband by using Fabric Agents, or Out-of-Band using SNMP or by CIMOMs
  - Performance Monitors, which only work with CIMOMs

  There is no Scan job function for Fabric Management
- SMI-S is the preferred way to interact with switches, but the proprietary interfaces (SNMP and FC GS-3) are still supported and required for certain types of switches. If both the proprietary and the CIM interfaces are configured in TPC, SMI-S is automatically the preferred mechanism.

  The advantage of using CIM Agents instead of in-band Fabric Agents is that no TPC activities occur within the data path of a server. In addition, Zone Alias control is only available when using CIM Agents.

  Even though SMI-S is the preferred way to work with switches and fabrics, you should consider what happens if your fabric gets segmented in case of ISL errors (especially when ISL are not redundant and the fabric is not set up in a meshed design, so that a segmentation can happen more easily). In such a situation, a new fabric gets created but is not set up within TPC. To be able to get at least some information, out-of-band Fabric Agents could still be used by TPC, so using this proprietary interface for redundancy is a good idea.
- You need to be aware that there are two types of Brocade CIM Agents: one to be used with Brocade switches and another one for switches that came from the McData acquisition.

Requirements for Fabric Management

The following requirements apply to using Tivoli Storage Management Fabric Management:

- License:

  In TPC V4.1, the IBM Tivoli Storage Productivity Center for Fabric licence was merged into the IBM Tivoli Storage Productivity Center Standard Edition (5608-WC0) license, so the Standard Edition is required.

- Previously, you have learned the reasons why you should use the Fabric Manager of TPC. Next, you determine if all these functions are available in your environment, because there are some restrictions specified by the switch vendors in terms of the support of different standards and management interfaces. In addition, you need to discover what components, jobs, and configuration activities are required to satisfy the requirements.

  For this part of the planning, the best starting point is "Table 20. Supported agent type for Switch and Fabric Functions" in the chapter "Planning for the IBM Tivoli Storage Productivity Center family", in the *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337. We have included a copy of that table as Table 3-7.

  At this point we provide you with a mapping from the high level functions to the details in Table 3-6 so that you can better understand what to look at in Table 3-7.

Table 3-6 How to understand what features and functions are needed

#	If you want to:	Look for the following function in Table 3-7:	Corresponding Job
1	Create, modify, or delete SAN zones	► Zone Control ► Zone information collection (sometimes also called zone discovery) ► Optinoally: Zone Control with Zone Alias (not available for all switch vendors)	Fabric Manager → Fabrics → Zone Configuration
2	Use one wizard for storage provisioning	► Zone Control ► Zone information collection (sometimes also called zone discovery) ► Optinoally: Zone Control with Zone Alias (not available for all switch vendors)	Disk Manager → Storage Subsystems then select Volumes, Create Volume, Virtual Disks or Create Virtual Disk
3	Get a diagram of your SAN infrastructure	► Switch and switch port information collected ► Topology connectivity information collected	IBM Tivoli Storage Productivity Center → Monitoring → Probes
4	Get reports on performance and SAN errors	► Switch Performance Monitoring	Fabric Manager → Monitoring → Switch Performance Monitors
5	Find information about the HBAs in the servers	► You need to have a Fabric or Storage Resouce Agent	IBM Tivoli Storage Productivity Center → Monitoring → Probes
6	Define TPC Alerts	► Tivoli Storage Productivity Center Alerts	Fabric Manager → Alerting
7	Get SAN Asset reports	► Switch and switch port information collected	IBM Tivoli Storage Productivity Center → Reporting → System Reports → Fabric
8	Use Data Path Explorer	► Topology connectivity information collected	IBM Tivoli Storage Productivity Center → Topology Viewer → from the little overview (or mini map) select Data Path Explorer
9	Check the fabric for configuration errors based on best practices rules	Topology connectivity information collected	IBM Tivoli Storage Productivity Center → Analytics

- If the requirements make it necessary that you use the Fabric Agent, then you will also need to use Agent Manager. If you just plan to use the Storage Resource Agent, you do not have to use Agent Manager.

Copy of table "Supported agent types for Switch and Fabric Functions"

For future reference, we explain where you can find the following table in the official TPC documentation:

- See the section "Collecting data with the Fabric Manager" within Chapter 1, "Planning to install the IBM Tivoli Storage Productivity Center family" in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337.
- See Appendix A in *IBM Tivoli Storage Productivity Center User's Guide 4.1*, SC27-2338.

Table 3-7 shows the supported agent types for Switch and Fabric functions. Use Table 3-6 to understand which functions you really need to look at, and then use Table 3-7 to discover how you can accomplish this.

Table 3-7 Supported agent types for Switch and Fabric functions

Function > Switch	**Brocade**	**McDATA**	**Cisco**	**QLogic**
Switch Performance Monitoring	CIMOM agent	CIMOM agent	CIMOM agent	Not supported
Zone Control	Recommended: CIMOM agent Also supported: Out-of-band fabric agent	Recommended: CIMOM agent Also supported: In-band fabric agent	In-band fabric agent required in each VSAN	In-band fabric agent
Zone Control with Zone Aliases	CIMOM agent	Not supported	Not supported	Not supported
Switch and switch port information collected	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Out-of-band fabric agent, In-band fabric agent
Topology connectivity information collected	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Out-of-band fabric agent, In-band fabric agent	Out-of-band fabric agent, In-band fabric agent
Zoning information collected	Recommended: CIMOM agent Also supported: Out-of-band fabric agent	Recommended: CIMOM agent Also supported: In-band fabric agent	In-band fabric agent required in each VSAN	In-band fabric agent

Function > Switch	Brocade	McDATA	Cisco	QLogic
Tivoli Storage Productivity CenterAlerts	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Recommended: CIMOM agent Also supported: Out-of-band fabric agent, In-band fabric agent	Out-of-band fabric agent, In-band fabric agent	Out-of-band fabric agent, In-band fabric agent
Hosts, endpoint devices, device-centric and host-centric information collected	In-band fabric agent	In-band fabric agent	In-band fabric agent	In-band fabric agent
Switch “Sensors and Events”	Out-of-band fabric agent	Out-of-band fabric agent	Out-of-band fabric agent	Out-of-band fabric agent

3.3.7 Storage Resource Groups

Administrators can logically group entities that are related to each other, not just connected to each other into a Storage Resource Group (SRG). The grouped elements can be tagged with User Defined Properties (UDP), and you can configure a Provisioning Profile.

Provisioning Profiles define the capacity (and security – zoning) characteristics and serve as templates of the capacity provisioning in the SAN Planner.

Using Storage Resource Groups

Storage Resource Groups (SRGs) can used in custom reports using the SQL schema, including the UDPs. This provides a powerful custom reporting function that allows a great extent of customization, for example, you can build SRGs for projects, departments, and data centers.

When an SRG is used as input to the SAN planner, the configured Provisioning Profiles are used as an easier and more consistent means for the administrator to add capacity to the application while providing minimal input.

Considerations for Storage Resource Groups

The following considerations apply to using Storage Resource Groups:

- You can assign profiles to storage resource groups with any license of TPC, but only with TPC Standard Edition you can actually exploit this feature, because you need the SAN Planner.
- Every Provisioning Profile includes a Workload Profile. Both types of profiles are defined in the Disk Manager.
- A single resource can be included in multiple SRGs.
- There is no limit to the depth of nesting. However, an existing SRG cannot contain itself, nor can any descendant SRG contain one of its ancestors (no circular relationships).
- The health status of all elements in a SRG is aggregated into a single health status of the SRG.

- The groups can contain volumes. When a storage volume is provided as input to the SAN Planner, the planner usually considers the volume to be “available” capacity. By default, any SRG’s **assigned** volumes will not be included as plan input.
- One user can see the SRG defined by a different user, and many user roles can modify SRG definitions, but only a TPC Superuser can create new SRGs.

Requirements for Storage Resource Groups

The following requirement applies to a Storage Resource Group:

- License: As a minimum, TPC Basic Edition (5608-WB1) is required.

3.3.8 CIMOM Data Sources

CIMOMs (also call CIM Agents or SMI-S Agents) are used in different part of TPC in order to collect information or to provide management of storage devices. There are three types of devices that TPC can work with:

- SAN Switches
- Disk Storage Subsystems
- Tape Libraries

The extent of the support for a certain device depends on the vendor’s implementation of SMI-S functions (in SMI-S this is called profiles and subprofiles).

A CIMOM is basically just a simple software with two modules, which is able to communicate with any SMI-S enabled application on the one side, and translate the SMI-S instructions into the device specific commands.

In order to be able to fully work with devices, the administrator has to add the CIMOM as a Data Source, run a Discovery, and set up a Probe for regular inventory updates.

Using CIMOM Data Source

In the following discussion, we explain when to use a CIMOM as a Data Source.

- Asset reports in Data Manager:

  All subsystem related information included in the Asset reports is only available when you have CIMOM Data Sources configured and discovered, and you have probed the devices.

- Performance Reports:

  If you need TPC to collect performance data from Storage Subsystems or Switches, you need to do that through the corresponding CIMOMs.

- Storage Provisioning in Disk Manager:

  If you want to be able to create, change, or delete volumes/LUNs/vdisks, you need to have CIMOMs for those subsystems in place.

- Defining Zone and WWN Alias:

  TPC calls this function Zone Control with Zone Alias. This function is only available when you use the CIMOM for your SAN switches. Even in that case, this is only supported for some switches at this time.

Considerations for CIMOMs

The following considerations apply when using CIMOMs as data sources:

- From an architecture standpoint, there are two implementations of CIMOMs:

- Embedded in the storage device
- Running as a so-called proxy-agent on a regular server

You need to check the device vendors documentation to understand if your device does include an embedded agent, or if you have to install the CIMOM Agent software on a server.

- You should be careful if you plan to install multiple CIMOMs on one server. In most cases this is not supported because most of the CIMOMs use the same IP ports. Even if you can change the external ports for the access of storage management applications, there still might be conflicts because usually the CIMOMs use more IP connections for internal communications.

  Depending on the CIMOM vendors installer, SLP is another reason why the installation of a second CIMOM might fail, because SLP might already be running if you try to install the second CIMOM.

- If you install a CIMOM on a server, then in general you can use that CIMOM for multiple devices of the same type, but there might be limitations in terms of number of devices or number of configured objects (for example volumes) that can be managed through this CIMOM.

- Some CIMOMs have internal user security, others might use operating system user security, and a third group might not have any security setup by default. Refer to the vendor documentation (manuals or readme files) to understand what kind of security mechanisms are available.

- Even with embedded CIMOMs, it might be necessary to perform some configuration steps before the TPC Discovery job will be able to find any devices (for example, with older versions of the DS open API CIMOM, you need to add a device to the CIMOM by using the **`dscimcli mkdev`** command).

Requirements for CIMOMs

The following considerations apply to CIMOMs:

- Licence:

  In regard to licenses, there are no special requirements of TPC. TPC Basic Edition (5608-WB1) already provides you the possibility to use CIMOMs for simple reporting tasks and storage provisioning.

  For storage subsystem performance reporting, you need TPC for Disk (5608-WC4) or TPC Standard Edition (5608-WC0) for switch performance reporting.

- Consult the CIMOM vendors documentation to understand the required setup steps (installation, configuration, and security, for example.)

3.3.9 Agent Manager

In 2.2.10, “Tivoli Common Agent Services” on page 32, we gave you an overview of the Tivoli Common Agent infrastructure, where the Agent Manager plays the central role.

Using Agent Manager

You really only need an Agent Manager when you either need to use Data Agents or Fabric Agents, so at this point we list the functions that are available with these agents. If any one of the following items apply to the requirements in your installation, Agent Manager is required:

- Alerting for directories, database instances, table spaces, or tables.
- Backup/archive policies, because these policies depend on file based reports that are only available when Scans have been performed.

- Batch Reporting, schedule to run reports repeatedly.
- Chargeback on User, Database User, or Database Table Space level.
- Constraint Reports, because they are based on the findings of Scans and the profiles associated to the Scans.
- File System Extention (limited to certain platforms only).
- Monitoring Groups for Directories, Users, and OS User Groups.
- Quotas: for users, databases, or Network Appliance filers.
- Reporting on file and directory level.
- Usage and Usage Violation reports. These reports provide usage information based on Access Load, Files, Directories Users, OS User Groups, and therefore Scans are required to collect that level of information.

  If you are interested only in usage reports based on the file system level (overall, used, or empty space) then you do not need the Data Agent.
- Proxy Agent for NetWare or other NAS file servers. In this case you usually want to use the Scan function to look for certain files on those file servers, which is only possible with the Data Agent.

Considerations for Agent Manager

The following considerations apply to Agent Manager:

- In contrast to TIP and TPC-R, Agent Manager is supported to be installed on a separate server from the TPC instance.
- Although it is common to install Agent Manager before installing TPC, you can also decide to start using TPC without Agent Manager. If the requirements later change, you can still choose to configure TPC later on to use Agent Manager.
- A TPC instance can only communicate with one Agent Manager.
- The agent recovery service is a network service for error logging for agents that cannot communicate with other Agent Manager services.

  If you plan to use this service, your Domain Name System (DNS) server must map the host name TivoliAgentRecovery to the computer system where you installed the Agent Manager.

Requirements for Agent Manager

The following system requirements are for Agent Manager:

- License: Agent Manager does not require any special TPC license.
- DB2 is required as the database.
- TPC requires Agent Manager 1.3.2 or higher (for a fresh Agent Manager install with DB2 Version 9.5, you should use the version that was shipped with TPC). For existing TPC environments, Agent Manager 1.2.3 also works.
- Server requirements: See the Agent Manager documentation.
- Ports used by Agent Manager: 9511, 9512, 9513, optionally port 80 (enabled by default).

3.3.10 Planning for Policy Management

Policy Management is a function of TPC for Data. The basic concept behind the Policy Management feature is that you define different kinds of policies (rules), which TPC will observe during operations, and alert you (or a user) when a defined rule has been breached.

Policies are easily confused with Profiles. In fact, Policies rely on Profiles, and both are used with data collected by Scans:

- A Profile defines which data is to be saved in the TPC database during a Scan, and how long the data should be retained.
- A Policy defines the rules that TPC will observe and which action to take. There are six types of policies:
  - Quotas, which include:
    - (normal) Quotas
    - Network Appliance Quotas
  - Rules, which are called Constraints
  - Automated Tasks, which include:
    - Scheduled Actions
    - file system Extensions
    - Archive/Backup

Without setting up policies, you still can report on the different topics such as usage by user of largest files and so on, but defining policies enables you to be informed and trigger an action when a defined policy is met.

There are exceptions to this situation: Scheduled Actions and Archive/Backup activities are not really bound to a policy. Rather, they are simple jobs to automate certain tasks.

Using policies

The following considerations determine when to use policies:

1. When you want to define limits on the amount of storage that a user or a group of users can consume. Quotas allow you to specify limits at three different levels for a user or group of users: at the table space level, at the Instance level, and at the level of the whole network.
2. When you want to be notified about the acceptable and unacceptable file types, file sizes, and file owners for a computer or a set of computers in your environment. Constraints enable you to do such tasks as restricting users from putting certain files (for example, MP3 files) on monitored servers.
3. Initiate an ad-hoc backup or archive task using IBM Tivoli Storage Manager (TSM) of files identified listed in the reports as shown in Figure 3-12.

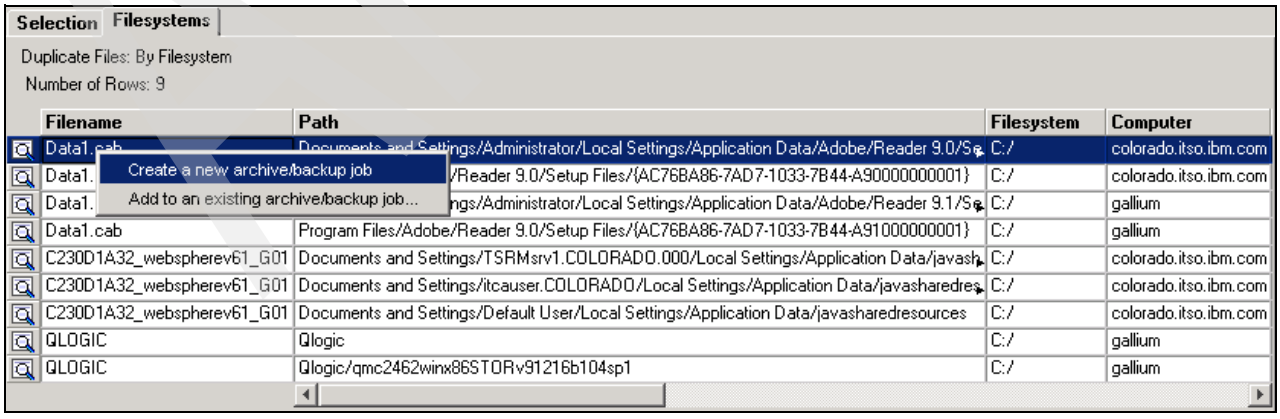


Figure 3-12 Initiating an ad-hoc backup job

TSM is a backup application that protects your organization's data from hardware failures and other errors by storing backup and archive copies of data on offline storage.

4. When you want to schedule actions to execute scripts against your storage-related resources. There is also a script deployment function included: If the script is not yet available on the agent computer, TPC will transfer the script before execution.
5. When file systems should be automatically extended if utilization reaches a specified threshold. For hosts with access to an ESS subsystem, additional LUNs can be automatically allocated as required.

Considerations for Policy Management

The following considerations are useful for implementing Policy Management:

- You need to have agents deployed because all policies rely on data collected by the agents in some form.
- Especially, file system extention is only available when you use Data Agents, because at this time there is no SRA for Sun Solaris.
- Before you can really use most of the Policy Management functions, you need to have Scans running and the correct Profiles associated with the Scans. Table 3-8 shows a summary of the steps to implement Policy Management.

Table 3-8 Sequence of steps for using Policy Management

#	Action	Equivalent in TPC	Navigation Tree: Data Manager
1	What to look for	Define or modify one or more Profiles	Monitoring → Profiles
2	When to look	Set up a Scan, and associate the profiles	Monitoring → Scans
3	What to do	Define a policy	Policy Management

- For the Quota policies, you need to define a schedule, when TPC should “check” if the policy has been breached. You have to make sure that the data is still available in the TPC database and has not yet been expired.
- Constraints are evaluated automatically; they do not require a schedule on their own.
- Backup/Archive policies still need a Data Agent, because the policies act on individual files, and that level of information is only available with Scans, which an SRA cannot do.
- You can create reports about the files, even without configuring profiles. In fact, a new Archive/Backup policy can only be created while looking at a report (see Figure 3-12 on page 89).
- Storage Resource Agents cannot be provide the Policy Management functions at this time, so you need to deploy Data Agents.

Requirements for Policy Management

The following requirements are for implementing Policy Management:

- License:

  IBM Tivoli Storage Productivity Center for Data (5608-WC3) is required for the Policy Management.
- Agent Manager is required because Scans are only available with the Data Agent, and the Data Agent is based on the Common Agent/Agent Manager framework.

Line item 4 under “Using policies” on page 89 is an exception to this requirement: Scheduled Actions are also possible on computers with a Storage Resource Agent installed.

- For the Network Appliance Quotas, the filer needs to be set up with TPC, but this is already a requirement for running Scans and Probes.

3.3.11 TPC server sizing guidelines

Several resources are available that provide details about the sizing for a TPC server. There are different things to keep in mind when working on the sizing of a TPC server. Obviously you need to meet the minimum hardware requirement, but there is more to consider.

Using sizing guidelines

For every installation, you should quickly check if you need to perform a detailed plan, or if the minimum hardware and software requirements will be sufficient for your environment.

From a solution design point of view, it is most important that you do not exceed the following maximum recommended data sources:

- Storage systems: 100
- Data Agents and Storage Resource Agents: 1500
- Volumes (including SVC vdisks + mdisks): 15000

Although these values are taken from the sizing for TPC Version 3.x, you can use these numbers as an indication if you should look more deeply into the sizing of the TPC server.

Considerations for server sizing

The following considerations apply to server sizing:

- Not only the number of data sources, but also the retention values, play a major role for the sizing of the TPC server, especially for the sizing of the database capacity.
- Scheduling of activities such as Discovery, Probes, and Scans can improve the performance and scalability of your TPC server.
- You need to think about the sizing of CIMOM agents, especially when they run as proxy agents, because then you will likely use a CIM Agent for multiple devices. The CIMOM vendors provide documentation about the maximum configurations that are supported.
- The number of parallel jobs per CIMOM can severely affect the stability of TPC, because the common impression is that TPC is not stable or working correctly. The reason is often that CIMOMs fail because they are overloaded.
- TPC can be tuned in a number of ways:
  - Striping the TPC database across disks (within a subsystem to provide redundancy)
  - Adjusting time outs
  - Adjusting maximum memory settings
  - Database type DMS or SMS

Further reading

For details about sizing the TPC database capacity, you should read the following Redbooks publications:

- *IBM TotalStorage Productivity Center Advanced Topics*, SG24-7348
- *SAN Storage Performance Management Using TotalStorage Productivity Center*, SG24-7364

4

Installation and upgrade

In this chapter, we describe the installation of IBM Tivoli Storage Productivity Center V4.1. We discuss tasks that are necessary to determine whether the client's environment fulfills IBM Tivoli Storage Productivity Center V4.1 requirements and are necessary to successfully install the product, or upgrade it from a previous version. This chapter covers the installation part of the certification exam.

4.1 Checking prerequisites for the installation

Before deploying Tivoli Storage Productivity Center, you need to analyze the environment, using Tivoli Storage Productivity Center system requirements. In this section we provide information about Tivoli Storage Productivity Center V4.1 system requirements and prerequisites, for example, Data Manager Repository considerations and storage subsystem support.

4.1.1 General considerations

This section provides environmental information that you must take into consideration for the implementation of IBM Tivoli Storage Productivity Center V4.1.

Considerations for 64-bit environments

If you are running Tivoli Storage Productivity Center in a 64-bit environment, note these considerations:

- All Tivoli Storage Productivity Center programs running in a 64-bit environment will be run in 32-bit compatibility mode.
- The database that Tivoli Storage Productivity Center uses can be running in a 64-bit instance if DB2 9 is used.
- The IBM Tivoli Storage Productivity Center agents must be running in a 32-bit native mode or compatibility mode environment.
- The databases to be monitored by Tivoli Storage Productivity Center must be in a 32-bit native mode or compatibility mode environment.
- Tivoli Storage Productivity Center can monitor DB2 in 64-bit native mode on Windows and AIX as long as the DB instance is created in 32-bit mode.
- When installing Tivoli Storage Productivity Center on a 64-bit Windows machine, the default directory will appear as:

  ```
  C:\Program Files (x86)\IBM\TPC
  ```

  This default location must be changed for the installation to be successful. The suggested installation folder name can be either of the following possibilities:

  ```
  C:\IBM\TPC
  C:\Program files\IBM\TPC
  ```

  When installing DB2 on a 64-bit Windows machine, change the default installation path so that it is *not* either of the following possibilities:

  ```
  C:\Program Files (x86)\IBM\SQLLIB
  C:\Program Files\IBM\SQLLIB
  ```

  The Windows installer puts back the (x86) into the directory path and this prevents the TPC Device Server from starting.

  After it has been installed, the Tivoli Storage Productivity Center program will run in Windows 32-bit compatibility mode.

Network considerations

It is strongly recommended to use fully qualified host names wherever possible during the installation and configuration of TPC. Be sure that name resolution is properly set up before installing IBM Tivoli Storage Productivity Center.

Especially check the following considerations:

- The Tivoli Storage Productivity Center server needs a static IP address - do not use DHCP
- The Tivoli Storage Productivity Center server's IP address needs to be mapped to its fully qualified host name. This can be done in either of the following ways:
  - By an appropriate DNS entry
  - By an appropriate entry in the following file:
    - On Windows: `C:\WINDOWS\system32\drivers\etc`
    - On Linux / UNIX: `/etc/hosts`

  An appropriate entry would have the following format:

  `<IP-Address> <fully qualified hostname> <short hostname>`

  Where `<IP-Address>` is the server's static IP address, `<fully qualified hostname>` is the server's "long" host name, including its suffix, and `<short hostname>` is the host name without its suffix.
- The Tivoli Storage Productivity Center server's host name as returned by the host name command must be the same as the host name that is mapped to its IP address (use the **`nslookup`** command to verify).
- Refer to your operating system documentation for additional information.

Multiple NIC cards are not supported on the Tivoli Storage Productivity Center server. If you do have multiple NIC cards, you must make sure that the first NIC card in the list is the one that all the agents can communicate with.

Firewall considerations

The TCP/IP ports in Table 4-1 are used by the Tivoli Storage Productivity Center server. Be sure to grant appropriate access when using firewalls and ensure that the ports are available.

Table 4-1 Required TCP/IP ports

Component	Default port	Inbound / outbound (server perspective)
Data Server	9549, 9559	Both
Device Server	9550	Both
Common Agent	9510, 9514, 9515	Outbound
SRA (in daemon mode)	9510	Inbound
Agent Manager	80, 9511, 9513	Inbound
Agent Manager	9512	Both
Remote installation of UNIX all agents	22, 512, 514	Outbound
Remote installation of UNIX all agents	601	Inbound
Remote installation of Windows all agents	139	Outbound
Device Server to CIM Agent	5988, 5989, 6989, 6989	Outbound
VMware VI Data Source to Virtual Center or ESX server	80, 443	Outbound

Component	Default port	Inbound / outbound (server perspective)
Tivoli Integrated Portal to LDAP Authentication	389	Outbound
DB2	50000	Inbound
Tivoli Storage Productivity Center with DS8000 GUI	8451, 8452	Outbound
Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication	162	Inbound
Tivoli Storage Productivity Center for Replication	3080, 3443, 5110, 5120	Inbound
Tivoli Storage Productivity Center for Replication	2433, 1750, 22	Outbound
Tivoli Integrated Portal	16310, 16311, 16312, 16313, 16315, 16316, 16318, 16320, 16322, 16323	Inbound

Other TCP/IP ports used by Tivoli Storage Productivity Center

Table 4-2 lists other TCP/IP ports used by Tivoli Storage Productivity Center.

Table 4-2 Other TCP/IP ports used by Tivoli Storage Productivity Center

Port	Default
DB2	50000
CIM Agent for SAN Volume Controller	For proxy CIM Agent: 5988 (http) 5989 (https)
CIM Agent for IBM TotalStorage Enterprise Storage Server (ESS)	5989
CIM Agent for DS8000	6989 (for embedded CIM Agent, cannot be changed) 5989 or 5988 (for proxy CIM Agent, can be changed)
IBM Tivoli Storage Productivity Center with DS8000 GUI	8451 8452
IBM Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication	162 (default SNMP listening port)

Tivoli Integrated Portal

The Tivoli Integrated Portal (TIP) component requires additional network ports available on the system in order to work correctly. TIP will use 10 port numbers starting from one port, called Base Port (the default value is 16310). The 10 ports will be:

- base port
- base port+1
- base port+2
- base port+3
- base port+5
- base port+6
- base port+8

- base port+10
- base port+12
- base port+13

Before selecting a base port, ensure that all the required ports are available on the system.

Furthermore, the user ID currently administering the WebSphere instance of the Tivoli Storage Productivity Center Device Server will be given also administrative rights to TIP.

Note: To list ports in use, execute the following commands:

- For Windows:
  - `netstat -an`
- For UNIX and Linux:
  - `netstat -an | grep LISTEN`

Internet Information Services

On systems running Internet Information Services (IIS) port 80 can already be in use. Port 80 is also used by the Agent Manager for the recovery of agents that can no longer communicate with the manager, because of lost passwords or certificates. If any service is using port 80, then Agent Recovery Service installs, but it does not start.

Before beginning the installation of Tivoli Storage Productivity Center, you must do one of the following actions:

- Uninstall or disable IIS.

  To uninstall or disable IIS, refer to “3.2.4 Internet Information services”, in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725.
- Change the IIS port to something other than 80, for example, 8080.

  To change IIS default port, refer to the ISS documentation.

Considerations for Internet Protocol Version 6

IBM Tivoli Storage Productivity Center supports Internet Protocol Version 6 (IPv6) for communication between its components. The key IPv6 enhancement is the expansion of IP address spaces from 32 bits (up to 15 characters in length) to 128 bits (up to 45 characters in length).

You can install and run IBM Tivoli Storage Productivity Center on computers that are enabled for IPv4, IPv6, or dual stack. Dual stack indicates that a machine has both the IPv4 and IPv6 stacks enabled and both addresses configured.

For installation considerations about IPv6, refer to ¨Planning for Internet Protocol Version 6” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1,* SC27-2337.

Note that not all components and their related functions of IBM Tivoli Storage Productivity Center are enabled for IPv6. Any functions that are not enabled for IPv6 will be unavailable through the user interface when you install IBM Tivoli Storage Productivity Center on an IPv6-only system.

Security considerations

This section provides information about the user IDs and user rights required to install IBM Tivoli Storage Productivity Center.

Before installation, identify or create one unique Windows administrator user ID or UNIX user ID with root authority to be used for installing all Tivoli Storage Productivity Center products.

To create the database schema, the user ID also needs database administrator authority. This user ID is required only to install the product and is not required to run the product.

To install Tivoli Storage Productivity Center on Windows, the user ID must belong to the administrators and DB2ADMNS group and have the user rights listed next.

This user ID can be for a local account or domain account.

On UNIX or Linux, the user must have root authority.

The following user rights are required on Windows 2003 and 2008 for installation:

- For Device Server or Data Server:
  - Log on as a service
  - Act as part of the operating system
  - Adjust memory quotas for a process
  - Create a token object
  - Debug programs
  - Replace a process-level token

  Note that this user ID is automatically given the appropriate user rights when you install DB2.
- For Data agent or Fabric agent:
  - Act as part of the operating system
  - Log on as a service
- For GUI or CLI:
  - None
- For Database schema:
  - Needs to be in DB2ADMNS group and Administrators group.

Lightweight Directory Access Protocol

Remember that if you plan to select LDAP authentication during your Tivoli Storage Productivity Center installation, then the group you intend to map to the Tivoli Storage Productivity Center Superuser role must exist in the LDAP-compliant directory before you start your Tivoli Storage Productivity Center installation. see “LDAP with Single Sign-On” on page 68 for details on TPC integration with LDAP.

For information about the usage and setup steps to leverage a Lightweight Directory Access Protocol (LDAP) server for authentication in TPC and how it can enable the Single Sign-On functionality refer to “7.1 LDAP Authentication” in Chapter 7 “LDAP authentication support and Single Sign-On” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide, SG24-7725.*

4.1.2 Infrastructure requirements and considerations

This section provides information about the components DB2, LDAP and Agent Manager, elements of the TPC infrastructure.

DB2 considerations

Before you install DB2, it is important to understand the default user IDs and groups created. The DB2 administrator user ID and password created will be the user ID and password that you use to install Agent Manager and IBM Tivoli Storage Productivity Center. You can use the default user ID and password or provide your own user ID and password.

If you are using IPv6–only machines, you must install DB2 Database V9.1 or V9.5 for Linux and UNIX. This is required for the database repository on IPv6-only machines. Note that Windows platforms do not support machines configured for IPv6-only (Windows is enabled for both IPv6 and IPv4).

Users and groups: Windows

If you have an administrator user ID that you want to use for installing DB2 and Tivoli Storage Productivity Center, make sure this user ID is a member of DB2ADMNS group and the Administrators' group.

When you install DB2, two groups will be created:

- DB2ADMNS: This group will have all the required user rights assigned for administrative authority.
- DB2USERS: This group will have user rights assigned for DB2 users.

Assign users that need administrative authority to the DB2ADMNS group and DB2 users to the DB2USERS group. When you assign a user ID to either group, that user ID will have all the user rights required for that group; you do not have to assign individual user rights to each user ID.

Important: DB2 can automatically create a DB2 user ID with administrative authority. The default user ID is db2admin. If you do not want to use this user ID to install Tivoli Storage Productivity Center, you can create a new administrative user ID, for example tpcadmin. If DB2 creates this user ID, this user ID will be added to the DB2ADMNS group and the Windows Administrators group.

Users and groups: UNIX or Linux

Three users and groups are required to operate DB2 UDB on UNIX or Linux: the instance owner, the fenced user, and the DB2 administration server user. These users and groups are automatically created during the installation of DB2. Figure 4-3 shows descriptions of the users and groups.

Table 4-3 DB2 Setup Wizard default user and group names

Required user	Default user name	Default group name	Description
Instance owner	db2inst1	db2iadm1	Created in the instance owner home directory. This user ID controls all DB2 processes and owns all file systems and devices used by the databases contained within the instance.
Fenced user	db2fenc1	db2fadm1	Used to run user-defined functions (UDFs) and stored procedures outside of the address space used by the DB2 database.

Required user	Default user name	Default group name	Description
DB2 administration server user	dasusr1	dasadm1	Used to run the DB2 administration server on your system. Used by the DB2 GUI tools to perform administration tasks. This user does not contain any databases and there is only one administration server per machine.

Agent Manager requirements and considerations

This section provides planning information for the Agent Manager.

Notes:

- The Agent Manager is disabled for IPv6 communication. Agent Manager and agent communication use IPv4 only.
- You need the Data agent and Agent Manager installed to run IBM Tivoli Storage Productivity Center batch reports.

Hardware requirements

The Agent Manager with embedded WebSphere uses approximately 150 MB of disk space. An additional 100 MB of temporary disk space is used during the installation. On Windows systems, the temporary space must be on the `C:` drive, even if you are installing to a different drive. This space estimate does not include space required for the RDBMS server software or the registry database. Although you do not explicitly configure the size of the database, you must make sure that sufficient space is available. For local DB2, the database is on the Agent Manager server in an operating system-specific location. Refer to "Estimating the size of the registry database", in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1,* SC27-2337 to determine how much hard drive space the database will require.

Software requirements

The Agent Manager can be installed on the following operating systems:

- AIX 5.3 (32 and 64-bit kernel)
- Windows Server 2003 Standard Edition (32-bit kernel)
- Windows Server 2003 Enterprise Edition (32-bit kernel)
- Windows 2003 Datacenter Edition (32-bit kernel)
- Red Hat Enterprise Linux AS Version 3.0 for xSeries®

Notes:

- DB2 is installed on the same computer as Agent Manager.
- Do not use the Cloudscape database when installing the Agent Manager.
- The Agent Manager can be installed on a separate computer from Tivoli Storage Productivity Center.

Security considerations for the Agent Manager

The following security considerations apply when installing Agent Manager.

- Authority needed to access the registry database:

  For a DB2 registry, you must configure the Agent Manager server so that it uses the instance owner to access the registry database. The Agent Manager applications do not run correctly if you use a different DB2 user, even if that user has the same authorization privileges as the instance owner.

- Authority needed to install the Agent Manager:

  To install the Agent Manager, you must log in as a user with the following authority:

  - On Windows systems, you must have administrator authority.
  - On AIX, Linux, and Solaris systems, you must have root authority. After installing the Agent Manager, you can configure it to run as a user other than root.

  Only the user who installs the Agent Manager has access to the directory that contains the certificates.

- Controlling access to the Agent Manager:

  Only registered agents and resource managers can access Agent Manager services (other than the agent recovery service). Registration requires a password, and separate passwords are used to control registration by agents and resource managers. After an agent or resource manager registers, it can access only the Agent Manager functions that are appropriate to its type (agent or resource manager).

- Controlling access by resource managers:

  A resource manager has access to sensitive information about your environment and has the authority to install and run programs on agent systems. Therefore, it is important to make sure that only authorized resource managers can register with the Agent Manager. The person installing a resource manager must provide a user ID and password of a user that is authorized to register the type of resource manager being installed.

  The resource manager access is controlled using the `Authorization.xml` file in the `<Agent_Manager_install_dir>\config` directory. This file contains a list of users that are authorized to register a resource manager, an encrypted version of the user's password, and the type of resource manager each user is authorized to register.

  When the Agent Manager is installed, a single user is defined. This default user, named manager, has the authority to register all resource managers. The default password for the user manager is `password`. You can change the password after installing the Agent Manager. You can optionally configure more granular control, down to a separate user ID and password for each type of resource manager. See *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337 for more information about user configuration.

  The registration password for a resource manager can be changed at any time. The new password takes effect as soon as the Agent Manager server is restarted. For more information about changing resource manager registration passwords, see *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

  The Agent Manager protects resource manager registration against attacks that attempt to find a valid password through exhaustive search, by limiting the number of unsuccessful login attempts that can be made by a user in a fixed time period. This makes it impractical for an attacker to try a large number of user ID and password combinations. You set the threshold for unsuccessful attempts to register. After a configurable number of unsuccessful attempts, the user is locked out for a configurable time period.

- Controlling access by agents:

  A person who installs the agent must provide the agent registration password, which is used to determine whether the agent is allowed to register. You set the agent registration password when you install the Agent Manager. After installation, you can change the password using the **`EncryptAMProps`** command. See *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337 for the description of the command.

- Deploying the certificate authority truststore file:

  You want to be sure that the Agent Manager that accepts the registration of an agent or resource manager is authorized to do so. The agent or resource manager checks for you by comparing the certificate presented to it by the Agent Manager with a certificate from a trusted source, which is the signer certificate of the certificate authority provided by the Agent Manager. This certificate is in the agentTrust.jks truststore file in the `<Agent_Manager_install_dir>\certs` directory on the Agent Manager server. Your role is to decide on the level of security that is required in your environment, and to choose the appropriate method for providing the agent or resource manager installation program with a copy of the truststore file.

  To access the truststore file on the Agent Manager server, you must be logged in as the user who installed the Agent Manager. Be sure that only authorized users can access the copy of the truststore file.

  The truststore file is automatically copied to the agent and resource manager directories when you install or upgrade the agent or resource manager.

  The Agent Manager provides a demonstration certificate to facilitate the rapid deployment of a test environment or demonstration environment. The demonstration certificate and its password are publicly available.

  Anyone who has a demonstration certificate can participate in your deployment. Using the demonstration certificate does not provide the level of security required by a typical production environment. In a production environment, let the Agent Manager installation program generate a certificate that is unique to your Agent Manager installation.

  If you choose to use the demonstration certificate, you must specify that as an option during the installation of the Agent Manager. Then, when you install each agent or resource manager, specify the demonstration certificate, which is the agentTrust.jks file in the \certs directory on the installation media.

LDAP servers requirements

For information about the LDAP servers supported, see:

`http://www-01.ibm.com/support/docview.wss?rs=180&uid=swg27007642`

Click the relevant operating system and then navigate to the row labeled “LDAP Servers using Federated Repository Configuration.”

4.1.3 TPC Server and GUI requirements

In this section we describe the hardware and software requirements for the TPC server and the GUI.

Hardware prerequisites

The Tivoli Storage Productivity Center server can require a large amount of memory, network bandwidth, and processor resources. In many cases, the server performs best when other applications are not installed on the same system.

See Table 4-4 for information about the minimum hardware requirements needed for the Tivoli Storage Productivity Center server and Tivoli Storage Productivity Center for Replication.

Table 4-4 Hardware requirements for TPC and TPC-R

Item	Hardware requirements
Processor	For Tivoli Storage Productivity Center: ► Intel® - Dual processor 3.2 GHz ► pSeries® - Dual POWER5™ For Tivoli Storage Productivity Center for Replication: ► Intel: 1 x Intel Quad-Core Xeon or greater ► pSeries: IBM POWER4™ or IBM POWER5 processor, 1 GHz
Memory	8 GB of RAM. If you have at least 4 GB but less than 8 GB of RAM, you can still install Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication. However, you will get a warning message. If you have less than 8 GB of RAM, you should run only Tivoli Storage Productivity Center or Tivoli Storage Productivity Center for Replication because of system load. For detailed information about how to disable Tivoli Storage Productivity Center or Tivoli Storage Productivity Center for Replication after installation, refer to the *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337. **Note:** To run Tivoli Storage Productivity Center on AIX requires at least 6 GB of RAM. If you cannot run with 6 GB of RAM, increase your paging swap space. For information about paging swap space, see the man pages mkps or chps.
Disk Space	► For installations on Windows, you need 6 GB of available disk space and 500 MB in the Windows temporary directory. ► For installations on AIX or Linux, you need a total of 6 GB of free disk space: - 2.25 GB for the **/tmp** directory - 3 GB in the **/opt** directory - 250 MB in the **/home** directory - 10 KB of free space in **/etc** directory - 200 MB in the **/usr** directory - 50 MB in the **/var** directory **Note:** After you have installed Tivoli Storage Productivity Center and start collecting data, you will need a large amount of disk space. The amount of data collected depends on many factors, including how many devices you have, how long you keep the data, and how frequently you collect data. Some users have experienced disk space usage of about 40 - 80 GB.
Network interface card (NIC)	Multiple NIC cards are not supported on the Tivoli Storage Productivity Center server. If you do have multiple NIC cards, you must make sure that the first NIC card in the list is the one that all the agents can communicate with.
Console	A console or remote-connectivity application such as KDE, Remote Desktop, or VNC is required during installation of Tivoli Storage Productivity Center. The installation program is interactive (as opposed to silent).

See Table 4-5 for information about the minimum hardware requirements needed for the IBM Tivoli Storage Productivity Center GUI.

Table 4-5 Hardware requirements for the Tivoli Storage Productivity Center GUI

Operating system	Item	Hardware requirements
Windows	Processor	Minimum is PII 500 MHz processor, suggest PII 1 GHz processor or above
	Disk space	► 256 MB of RAM ► Approximately 100 MB of hard disk space
	Console	1024 x 768 console or above
UNIX	Disk space	► 256 MB of RAM ► Approximately 100 MB of hard disk space
	Console	1024 x 768 console or above

Software prerequisites

Table 4-6 gives you a summary of the operating systems supported by the Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication.

Table 4-6 Operating systems support for TPC and TPC-R

Item	Operating system
Tivoli Storage Productivity Center server	► AIX 5.3 (32 bt), AIX 6.1(32 bit) ► AIX 5.3 (64 bit), AIX 6.1(64 bit) - ONLY in 32-bit compatibility mode ► Windows 2003 SE or SE R2, EE or EE R2 (32 bit), Windows 2008 SE or SE R2, EE or EE R2 (32 bit) ► Windows 2003 SE or SE R2, EE or EE R2 (64 bit), Windows 2008 SE or SE R2, EE or EE R2 (64 bit) - ONLY in 32-bit compatibility mode ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on x86 ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on iSeries® ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on zSeries® ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (64 bit) on x86 - ONLY in 32-bit compatibility mode ► VMware V2.5x, 3.0.x, 3.5.x - ONLY on Windows 2003 and Red Hat

Item	Operating system
Tivoli Storage Productivity Center GUI and CLI	► AIX 5.3 (32 bt), AIX 6.1(32 bit) ► AIX 5.3 (64 bit), AIX 6.1(64 bit) - ONLY in 32-bit compatibility mode ► Windows 2003 SE or SE R2, EE or EE R2 (32 bit), Windows 2008 SE or SE R2, EE or EE R2 (32 bit) ► Windows 2003 SE or SE R2, EE or EE R2 (64 bit), Windows 2008 SE or SE R2, EE or EE R2 (64 bit) - ONLY in 32-bit compatibility mode ► Windows XP (32 bit) ► Windows Vista (32 bit) ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on x86 ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on iSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on zSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (64 bit) on x86 - ONLY in 32-bit compatibility mode ► VMware V2.5x, 3.0.x, 3.5.x - ONLY on windows 2003 and Red Hat
Tivoli Storage Productivity Center for Replication	► AIX 5.3 (32 bt), AIX 6.1(32 bit) ► AIX 5.3 (64 bit), AIX 6.1(64 bit) - ONLY in 32-bit compatibility mode ► Windows 2003 SE or SE R2 (32 bit), Windows 2003 EE or EE R2 (32 bit), Windows 2008 SE or SE R2 (32 bit), Windows 2008 EE or EE R2 (32 bit) ► Windows 2003 SE or SE R2 (64 bit), Windows 2003 EE or EE R2 (64 bit), Windows 2008 SE or SE R2 (64 bit), Windows 2008 EE or EE R2 (64 bit) - ONLY in 32-bit compatibility mode ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on x86 ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on iSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on zSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (64 bit) on x86 - ONLY in 32-bit compatibility mode.

For detailed and up-to-date information regarding the software prerequisites, refer to the official product Web sites. Before installing Tivoli Storage Productivity Center, check the IBM Tivoli Storage Productivity Center support site for the latest platform support. Go to:

http://www.ibm.com/systems/support/storage/software//tpc

Then search for Compatibility Matrix in the *Plan* or *Install* sections of the documentation.

4.1.4 Requirements for TCP Agents: Data, Fabric, Storage Resource

In this section we describe the hardware and software requirements for the TPC Agents.

Hardware prerequisites

See Table 4-7 for information about the minimum hardware requirements needed for the IBM Tivoli Storage Productivity Center agents.

Table 4-7 Hardware requirements for the IBM Tivoli Storage Productivity Center agents

Operating system	Item	Hardware requirements
► Windows and Linux on Intel ► UNIX ► AIX on IBM eServer™ iSeries, and IBM eServer pSeries	Processor	Pentium® 400 MHz processor, or above
	Memory and disk space	Minimum memory and space requirements to run: ► 256 MB of RAM. ► For a locally installed Data agent, the temporary space required is 100 MB. For a remotely installed Data agent, the temporary space required is 250 MB. If you also have the Fabric agent installed on the same machine, that will require an additional 100 MB.
All	Network interface card (NIC)	Tivoli Storage Productivity Center supports multiple NIC cards. When you install an agent on a machine locally or remotely and the machine has more than one NIC card, the Tivoli Storage Productivity Center agent installer will determine the NIC card to use for two-way communication between the server and agent. If there are no NIC cards that can be used for two-way communication, the installer will return an error message.

Software prerequisites

Figure 4-8 gives you an overview of the operating systems supported by the IBM Tivoli Storage Productivity Center agents.

Table 4-8 Operating system support for Agents

Agent supported	Operating system
Data Agent and Fabric Agent	► AIX 5.3 (32 bt), AIX 6.1(32 bit) ► AIX 5.3 (64 bit), AIX 6.1(64 bit) - ONLY in 32-bit compatibility mode ► Sun Solaris 9 and 10 (32 bit) ► Sun Solaris 9 and 10 (64 bit) - ONLY in 32-bit compatibility mode ► HP-UX 11,11i.1, 11i.2 (32 bit) ► HP-UX 11,11i.1, 11i.2 (64 bit) - ONLY in 32-bit compatibility mode ► Windows 2003 SE or SE R2, EE or EE R2 (32 bit), Windows 2008 SE or SE R2, EE or EE R2 (32 bit) ► Windows 2003 SE or SE R2, EE or EE R2 (64 bit), Windows 2008 SE or SE R2, EE or EE R2 (64 bit) - ONLY in 32-bit compatibility mode ► Red Hat Enterprise Linux AS Version 4.0 (32 bit) on x86 ► Red Hat Enterprise Linux AS Version 4.0 (64 bit) on x86 - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 (32 bit) on x86 ► SuSE Linux Enterprise Server 9 (64 bit) on x86 - ONLY in 32-bit compatibility mode ► AIX Virtual I/O Server 1.5.2 or later - ONLY for agents installed on the same partition of ths Virtual I/O Server ► HACMP on AIX v5.3.0.4 or later v5.4.0.1 or later v5.5 or later
Data Agent only	► SuSE Linux Enterprise Server 9 (32 bit) on iSeries ► SuSE Linux Enterprise Server 9 (32 bit) on pSeries ► SuSE Linux Enterprise Server 9 (32 bit) on zSeries ► SuSE Linux Enterprise Server 9 (64 bit) on iSeries - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 (64 bit) on pSeries - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 (64 bit) on zSeries - ONLY in 32-bit compatibility mode ► VMware V2.5x, 3.0.x, 3.5.x

Agent supported	Operating system
Storage Resource Agent	► AIX 5.3 (32 bt), AIX 6.1(32 bit) ► AIX 5.3 (64 bit), AIX 6.1(64 bit) - ONLY in 32-bit compatibility mode ► Windows 2003 SE or SE R2, EE or EE R2 (32 bit), Windows 2008 SE or SE R2, EE or EE R2 (32 bit) ► Windows 2003 SE or SE R2, EE or EE R2 (64 bit), Windows 2008 SE or SE R2, EE or EE R2 (64 bit) - ONLY in 32-bit compatibility mode ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on x86 ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on pSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on iSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x (32 bit) on zSeries ► Red Hat Enterprise Linux AS Version 4.0 and 5.x(64 bit) on x86 - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 and 10 (32 bit) on x86 ► SuSE Linux Enterprise Server 9 and 10 (32 bit) on iSeries ► SuSE Linux Enterprise Server 9 and 10 (32 bit) on zSeries ► SuSE Linux Enterprise Server 9 and 10 (64 bit) on x86 - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 and 10 (64 bit) on iSeries - ONLY in 32-bit compatibility mode ► SuSE Linux Enterprise Server 9 and 10 (64 bit) on zSeries - ONLY in 32-bit compatibility mode ► VMware V2.5x, 3.0.x, 3.5.x ► AIX Virtual I/O Server 1.5.2 or later - ONLY for agents installed on the same partition of ths Virtual I/O Server ► HACMP on AIX - v5.3.0.4 or later - v5.4.0.1 or later - v5.5 or later

For detailed and up-to-date information regarding the software prerequisites, refer to the official product Web sites. Before installing IBM Tivoli Storage Productivity Center, check the IBM Tivoli Storage Productivity Center support site for the latest platform support. Go to:

http://www.ibm.com/systems/support/storage/software//tpc

Click **Plan** and search for the *4.1 - Platform Support: Agents, Servers and GUI* document.

Considerations for Tivoli Common Agent services

Tivoli Common Agent Services is required only if you are installing the Data agents and Fabric agents. Tivoli Common Agent Services uses DB2 as the database repository.

When you install a new version of Agent Manager or Common agent on your system, you will be installing Version 1.3.

Notes:

- If you are at level Agent Manager 1.2.x, consider upgrading to Agent Manager 1.3, but this is not mandatory. Agent Manager runs inside a WebSphere version that is not supported anymore but still works with Tivoli Storage Productivity Center.
- If any problems should arise, IBM support will ask you for Agent Manager upgrade.

For information about upgrading the Agent Manager, refer to “Upgrading Agent Manager” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

If you install an agent locally through the IBM Tivoli Storage Productivity Center installation program, and a Common agent already exists on the system, the Common Agent will be upgraded from Version 1.2.2 to Version 1.2.3. The Common Agents are not upgraded to 1.3; they remain at level 1.2. The Common Agents 1.2 will work with Agent Manager 1.3.

When the Common agent starts for the first time, it connects to the Agent Manager to register itself. The date and time on the managed system must be within 24 hours of the date and time on the Agent Manager server for successful registration. The values are compared in coordinated universal time (UTC), so the systems can be in different time zones.

4.1.5 Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware

This section provides an overview of the subsystems, tape libraries, file system formats, and databases that IBM Tivoli Storage Productivity Center supports.

Storage subsystems

Tivoli Storage Productivity Center supports IBM and independent software vendors storage systems that are Storage Management Interface Specification (SMI-S) compatible. This support includes storage provisioning, as well as asset and capacity reporting. Tivoli Storage Productivity Center implements many of its disk, tape, and fabric management functions through exploitation of the SMI-S standards.

The IBM storage subsystems supported are as follows:

- IBM System Storage SAN Volume Controller
- IBM Tivoli Storage Enterprise Storage Server (Tivoli Storage Enterprise Storage Server)
- IBM Tivoli Storage Productivity Center Disk Subsystems (DS4000, DS5000, DS6000, and DS8000 series)
- FAStT
- IBM XIV Storage System

Important:

- The XIV Storage System information provided in the Tivoli Storage Productivity Center 4.1 documentation is only for planning purposes until the supported XIV Storage System software is available. Tivoli Storage Productivity Center support is targeted for a future XIV Storage System software release. A flash will be issued when Tivoli Storage Productivity Center support for XIV Storage System is available.
- XIV Storage System will have an embedded CIM Agent that Tivoli Storage Productivity Center will use to run Discovery and Probe jobs.
- You will be able to start the XIV Storage System GUI from within Tivoli Storage Productivity Center if the GUI is installed on the same system as the Tivoli Storage Productivity Center GUI. The XIV Storage System GUI will be supported on Windows and Linux.
- Both the Data agent and Storage Resource agent will support XIV Storage System.
- For more information about XIV Storage System, see the XIV Storage System Information Center at: http://publib.boulder.ibm.com/infocenter/ibmxiv/r2/index.jsp

- SMI-S certified subsystems.

For detailed and up-to-date information about the supported storage systems, go to:

http://www.ibm.com/systems/support/storage/software//tpc

Click **Plan** and search for the *4.1 - Supported Storage Product List* link.

Switches

IBM Tivoli Storage Productivity Center supports IBM and independent software vendor switches that are Storage Management Interface Specification (SMI-S) compatible.

IBM Tivoli Storage Productivity Center supports the following switches:

- Brocade
- Cisco
- NT
- IBM 2005, 2026, 2027, 2031, 2032, 2061, 3534
- McDATA Intrepid 10000
- McDATA Sphereon
- QLogic

For information about the specific models supported, go to:

http://www.ibm.com/systems/support/storage/software//tpc

Click **Plan** and search for the *4.1 - Switch & Director - Supported Products Matrix* link.

Tape libraries

Tivoli Storage Productivity Center supports the following tape libraries:

- IBM TotalStorage 3584 Tape Library
- IBM TotalStorage 3310 Tape Library, ADIC i500/i2000
- IBM 3584/TS3500 UltraScalable Tape Library

For detailed and up-to-date information about the supported storage systems, go to:

http://www.ibm.com/systems/support/storage/software//tpc

Click **Plan** and search for the *4.1 - Supported Storage Product List* link.

Notes:

- The media changers displayed by Tivoli Storage Productivity Center for the TS3500 tape libraries are really logical partitions of the given library, and not physical accessors.
- Depending on the size of the tape library and network latency between the SMI-S agent host and the tape library, probes of the tape library might take a long time and might fail because of time-outs.
- The SMI-S agent does not display an exception to the SMI-S client such as Tivoli Storage Productivity Center when communication between the SMI-S agent and the tape library fails. Instead, empty result sets are returned. This limits Tivoli Storage Productivity Center's capabilities in detecting connection failures relating to tape libraries.
- In this release, support for the IBM 3494 Tape Libraries is limited to discovery and in-place launching of the ETL Specialist. This assumes that the SMI-S agent has been configured accordingly.
- When probing tape libraries that are registered with the same IBM SMI-S Agent for tape, do not probe more than two or three tape libraries within the same probe job because the increased load on the Agent would increase the likelihood of time outs. Instead, spread the libraries across multiple probe jobs with different start times.
- After the tape libraries are registered, and then a change is made to the IBM SMI-S Agent for Tape, a condition can occur where not all of the tape cartridges are returned to the CIM client, in this case, Tivoli Storage Productivity Center. To resolve this situation, restart the IBM SMI-S Agent for Tape; refer to the documentation for the SMI-S Agent for instructions on how to do this.

  The same issue can occur if one out of a set of libraries registered with the same agent is unavailable, for example, because of a network problem. To work around this problem, unregister the affected library from the agent (or fix the communication problem).

CIM Agent considerations

The CIM Agents are provided by the vendor of the storage device, fabric switch, or tape library.

For storage subsystems, the CIM Agents are needed for storage asset information, provisioning, alerting, and performance monitoring. For tape libraries, the CIM Agents are used for asset and inventory information. The CIM Agents conform to the SNIA SMI-S specification to provide a communication transport between IBM Tivoli Storage Productivity Center and the managed devices.

The CIM Agents can be referred to by a variety of names, such as CIMOM (CIM Object Manager) or SMIS agent. A CIM Agent consists of a CIMOM and an SMIS provider for the managed device. The CIM Agent can be a separate agent installation or can be imbedded in the device itself, as is the case with Cisco fabric switches. In this case, there is no proxy agent to install and Tivoli Storage Productivity Center is configured to point to the managed device itself.

After the CIM Agent is installed and configured, IBM Tivoli Storage Productivity Center can be configured to communicate with it.

The CIMOM for XIV Storage System will be embedded in the firmware and therefore will be started and ready for SLP discovery. IBM Tivoli Storage Productivity Center support for this CIMOM is targeted for a future XIV Storage System software release. The XIV Storage System information provided in the Tivoli Storage Productivity Center 4.1 documentation is only for planning purposes until the supported XIV Storage System firmware is available. A flash will be issued when Tivoli Storage Productivity Center support for XIV Storage System is available.

Notes:

- Do not use different DS CIM Agent releases (for example 5.1, 5.2.1, 5.3, and 5.4) to manage the same DS8000, DS6000, or Tivoli Storage Enterprise Storage Server with IBM Tivoli Storage Productivity Center. Each DS CIM Agent release reports some information in a different way, so this can cause a reporting failure. Use the same release of DS CIM Agent for all CIMOMs managing the same device.
- If an Engenio Provider is being used by the Tivoli Storage Productivity Center server, then no other SMIS-enabled application should be using that Engenio Provider. This controlled environment is required to ensure that the Engenio Provider receives synchronized CIM Client requests.
- For the Tivoli Storage Enterprise Storage Server 2105, disk drive information could be displayed twice after an upgrade. The first half of the information is new and is displayed online. The second half of information is no longer detectable. The second half of information is impossible to correlate.

For detailed and up-to-date information about the supported storage systems, go to:

`http://www.ibm.com/systems/support/storage/software//tpc`

Click **Plan** and search for the following links:

4.1 - Supported Storage Product List: Storage Subsystems and Tape libraries CIM support

4.1 - Switch & Director - Supported Products Matrix: Switches CIM support

Interoperability namespace summary table

The interoperability namespace for a CIMOM is discoverable through SLP and is automatically populated in the IBM Tivoli Storage Productivity Center GUI for CIMOMs discovered through SLP. For CIMOMs that are manually entered rather than discovered through SLP, you should check their provider's documentation for the correct interop namespace. Table 4-9 reflects the namespaces at the time this book was written.

Important: When providers release new versions of their products, these values could change. Check the provider's documentation for that provider's interop namespace.

Table 4-9 Interoperability namespaces

Vendor	Interoperability namespace
Cisco	**`/root/cimv2`**
Brocade	**`/root/interop`** or **`/root/brocade1`** **Note**: Contact your switch vendor for the correct namespace to use.
McData	**`/interop`**
ESS, DS6000, DS8000, and SVC	**`/root/ibm`**

Vendor	Interoperability namespace
Engenio	**/interop**
EMC	**/root/emc**
Hitachi	**/root/hitachi/dm35** for HiCommand 3.5 **/root/hitachi/dm42** for HiCommand 4.0 **/root/hitachi/dm42** for HiCommand 4.2 **/root/hitachi/dm43** for HiCommand 4.3
HP	**/root**
SUN StorEdge	**/root/sun3510** or **/interop** **Note**: This is for a subsystem and not a switch.
IBM Tape	**/root/ibm**
ADIC Tape	**root/cimv2**

Databases for monitoring

The Data Manager can monitor these databases:

- DB2 8.1 with fix pack 14
- DB2 8.2 with fix pack 7a
- DB2 9.1
- DB2 9.5
- Microsoft SQL Server 7.0
- Microsoft SQL Server 2000
- Microsoft SQL Server 2005
- Microsoft SQL Server 2008
- Oracle 8i
- Oracle 9i
- Oracle 10g
- Sybase

Note: There are some configuration steps required before you can monitor the Microsoft SQL Server 2005 and 2008 databases. For information about configuration, refer to *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1,* SC27-2337.

File systems

The Data Server supports monitoring and reporting of the following file systems:

- EXT2, EXT3
- FAT, FAT32
- GPFS file system
- HP-UX's HFS file system
- JFS, JFS2
- Network File System
- NTFS4, NTFS5
- NetWare_FAT, NetWare_NSS
- REISERFS
- IBM Tivoli Storage Productivity Center SAN File System
- Network Applicance's Data ONTAP® V7, including flexible volumes (FlexVol™).
- TMPFS
- UFS
- VXFS
- WAFL®

Networked file systems

When using the Data Server, you can use the monitoring and reporting of the following networked file systems:

- IBM Tivoli Storage Productivity Center SAN File System 2.1, 2.2 from Windows 2000 Server and Advanced Server, Red Hat Enterprise Linux 3.0 Advanced Server, and Sun Solaris 9 clients.
- IBM General Parallel File System (GPFS) Version 2.3, 3.1, and 3.2 on AIX.

  The IBM Tivoli Storage Productivity Center Data agent must be installed on one node within a GPFS nodeset. A nodeset is a collection of computers that see the same file system. If multiple agents are installed per GPFS nodeset, the first agent that sees the file system owns the file system. You cannot change the owning (or scanning) agent. If the agent is deleted, another agent takes ownership.

  Because only one agent owns the file system and a file system cannot be scanned by more than one agent, there is no benefit to having more than one agent.

  If more than one agent is installed, the last agent that runs a probe job takes ownership of the volume group. If a GPFS file system exists in that volume group and the agent that owns the volume group is not the agent that owns the file system, the file system information is not displayed in the volume group that is part of the asset tree. However, when the agent that owns the file system probes again, the data is corrected.

  There must be physical access to the GPFS disk for IBM Tivoli Storage Productivity Center to gather hardware disk information. File system information is gathered.

  If the cluster manager for AIX HACMP is installed, the levels supported are shown in Table 4-10.

Table 4-10 Supported software levels for an HACMP cluster type

Operating system	HACMP
AIX 6.1 AIX 5.3	HACMP 5.5 HACMP 5.4 (with IY89869) HACMP 5.3 (with IY80002)
AIX 5.3	HACMP 5.3

Volume managers

The Data Server supports the monitoring of the following volume managers:

- Veritas Volume Manager on Sun Solaris
- Veritas Volume Manager on HP-UX
- AIX Logical Volume Manager (LVM)
- HP-UX Logical Volume Manager

Using these volume managers, you can create groups of logical volumes and disks. You can generate a variety of reports for these disk and volume groups.

Multipathing software

With IBM Tivoli Storage Productivity Center, you can use the following multipathing software:

- Subsystem Device Driver (SDD):
  - AIX SDD
  - Windows SDD
  - Windows subsystem device driver device specific module (SDDDSM)
  - Linux SDD
  - HP SDD

- Solaris SDD
- Novell SDD (reporting only)
- AIX subsystem device driver path control module (SDDPCM)
- Linux DM_Multipath

- EMC PowerPath Multipathing:

  IBM Tivoli Storage Productivity Center supports basic EMC PowerPath Multipathing Version 4.0 or later. Disks provided by the EMC PowerPath driver are detected by IBM Tivoli Storage Productivity Center's Data agents and Storage Resource agents. The disks will be visible in the Topology Viewer and in Data Manager asset reports. The correlation of EMC PowerPath provided hdisks to EMC storage systems is supported and the relation is visible in the Topology Viewer.

  - Multipathing information is not available for those disks.
  - The data reports are accurate because they do not double-count capacities.
  - The Data Path Explorer does not show multipathing.
  - The SAN Planner does not support configuring multipathing on hosts using EMC PowerPath Multipathing.

Network Attached Storage

This section provides information about the requirements for installing and running the Data Manager within a Network Attached Storage (NAS) environment.

To be supported, NAS devices other than Network Appliance Filers must meet the following criteria:

- If scanned from a UNIX agent, an NAS device must support Network File System (NFS) queries.
- If scanned from a Windows agent, an NAS device must support Common Internet File System (CIFS) queries.
- An NAS device must support SNMP queries (sysName and sysOID).
- An NAS device must supply a unique sysName.
- If an NAS device hosts both Windows and UNIX file systems, you will need at least two proxy Data agents to monitor the device. At least one Windows proxy Data agent will be required to probe and scan the Windows CIFS shares, and at least one UNIX proxy Data agent will be required to probe and scan those UNIX NFS shares.

You must install the agent on a machine that has access to the NAS filers within your environment that you want to monitor.

If you want to monitor NAS filers from Windows, you must configure those NAS filers to be members of a Windows domain.

- For Windows: The agent that is logging into and scanning the NAS filer is not required to be in the same domain as the user or the NAS filer. If you install the agent on a different domain from the NAS filer, the agent will scan the NAS filer if the domain of the agent computer is a "trusted domain" by the domain of the NAS filer.
- For UNIX and Linux: The agent computer must import the NAS filer's exports as NFS mounts (or automounts on Solaris).

Notes:

- You do not install agents to the NAS filers themselves.
- For Tivoli Storage Productivity Center 5196 network attached storage 300 G machines only, install the agent directly on those machines. If the 300 G is clustered, you will need to install an agent on each local node.

Novell NetWare system requirements

IBM Tivoli Storage Productivity Center supports Novell NetWare 5.1 or later.

You must install the agent on a machine that meets these requirements:

- A supported Windows platform. To use the Data Server for retrieving storage information from the servers and volumes within the Novell Directory Services (NDS) trees, you must install the agent on a Windows computer or computers where a Novell NetWare client is already located. The Data Server gathers detailed storage information about the NetWare servers and volumes using native NetWare calls from the Windows computers.
- NetWare Client.
- Access to the Novell NetWare servers and volumes within your environment.

NetApp device

IBM Tivoli Storage Productivity Center provides the same file and block-level support for NetApp devices as is provided for other filers and storage subsystem devices.

Tivoli Storage Productivity Center provides the following support for NetApp devices:

- Supports NetApp Data ONTAP SMI-S Agent 3.0
- Supports the SMI-S 1.2 Array profile implemented by the NetApp SMI-S agent
- Supports all filer models running NetApp Data ONTAP Version 7.2 and 7.3

The following licenses are required:

- For performance monitoring, a Tivoli Storage Productivity Center for Disk license is required.
- For SNMP discovery, a Tivoli Storage Productivity Center Standard Edition license is required.

The way you use Tivoli Storage Productivity Center to interact with NetApp devices, and the data you can collect for NetApp devices, depends on how you configure your NetApp devices. For example:

- If you configure a Data Manager agent to be a Scan/Proxy agent, you use Data Manager to work with NetApp devices. The Data Manager user interface displays a NetApp filer as a “computer”. For NetApp devices configured this way, Tivoli Storage Productivity Center collects file storage information.
- If you configure a NetApp SMI-S agent (CIMOM), you use Disk Manager to work with NetApp devices. The Disk Manager user interface displays a NetApp device as a “subsystem”. For NetApp devices configured this way, Tivoli Storage Productivity Center collects block storage information.
- If you configure a NetApp device as both a filer and a subsystem, Tivoli Storage Productivity Center collects both file and block storage information. You can use Disk Manager and Data Manager to work with the NetApp device. Keep in mind that the Data Manager user interface displays a NetApp filer as a “computer”, and the Disk Manager user interface displays a NetApp device as a “subsystem”.

- If you initially configure a NetApp device using a Data agent, you will not lose any functionality if you later decide to also configure the NetApp device using a CIM Agent.

Limitations of NetApp support

Keep in mind the following limitations for NetApp support:

- The NetApp Data ONTAP SMI-S Agent 3.0 implements the Block Server Performance subprofile. It provides volume performance data but, for now, does not provide performance data at the storage subsystem level.
- Tivoli Storage Productivity Center supports only the SMI-S Array profile of the NetApp Data ONTAP SMI-S Agent. Other SMI-S profiles, including the self-contained NAS profile and the NAS Head profile, are not supported.
- For the Data ONTAP SMI-S 3.0 agent, if a volume is offline, the performance monitor might fail with the message:

  ```
  PM HWNPM2132W Performance data could not be collected for device <device>.
  ```

- To work with Network Appliance quotas (using **Data Manager** → **Policy Management** → **Network Appliance Quotas**), the NetApp device must be configured as a filer. This functionality is not available if the NetApp device is configured only as a CIMOM.

For the detailed implementation and configuration steps, refer to *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1,* SC27-2337.

VMware

IBM Tivoli Storage Productivity Center supports the VMware Virtual Infrastructure, which consists of the ESX Server and VMware VirtualCenter.

The storage subsystems supported through VMware are:

- IBM DS4000
- IBM DS6000
- IBM DS8000
- SAN Volume Controller
- Enterprise Storage Server (Tivoli Storage Enterprise Storage Server)
- IBM XIV Storage System
- Hewlett Packard Enterprise Virtual Arrays (EVA)
- Hitachi Data Systems 9xxxx
- EMC Symmetrix
- EMC CLARiiON
- 3PAR

For full functionality, both the Data agent and Virtual Infrastructure must be up and running. If one of the items is not present in a given environment, only a limited picture is presented to the user (some virtual machines might not be recognized).

The hierarchical mapping of storage allocated to the virtual machine will be available for the virtual machines on the ESX Server.

Note: IBM Tivoli Storage Productivity Center now supports the mapping of storage from the ESX Server to the disk drives for the ESX Server 3.5.

Note the following limitations:

- No HBA virtualization is available for the VMware virtual machines. Therefore, if you install a Fabric agent on a VMware virtual machine, the Fabric agent will not be useful.
- No events directly generated by the Virtual Infrastructure will be supported.

- No VMware clusters will be supported.
- Data Path Explorer is not supported for VMware ESX Server and virtual machines.

Software requirements

Tivoli Storage Productivity Center supports the following ESX Servers and VirtualCenter:

- ESX Server 3.0.1 or later (LUN correlation is not supported)
- VMware VirtualCenter 2.0.1 or later (LUN correlation is not supported)
- ESX Server 3.5 or later (LUN correlation is supported)
- ESX Server 3.5 3i or later (LUN correlation is supported)
- VMware VirtualCenter 2.5 or later (LUN correlation is supported)

4.2 Preparation for Tivoli Storage Productivity Center install

This section provides information about the preparation work required before installing the IBM Tivoli Storage Productivity Center family.

4.2.1 Considerations for upgrading from a previous release

You can upgrade TotalStorage Productivity Center V3.1.3 or later releases to IBM Tivoli Storage Productivity Center V 4.1. You can also migrate previous TotalStorage Productivity Center for Replication V3.x to IBM Tivoli Storage Productivity Center V4.1. This section provides information about what you must consider before upgrading and migrating.

For the latest information about PTFs, patches, and flashes, check the information available at the Tivoli Storage Productivity Center support page:

`http://www.ibm.com/systems/support/storage/software//tpc`

General considerations

Before starting the upgrade, ensure that your system meets the hardware and software requirements of TPC V4.1. See 4.1, “Checking prerequisites for the installation” on page 94.

TPC for Replication

TPC for Replication is no longer a stand-alone application (except for TPC- R z/OS, which is stand-alone). TPC V4.1 now installs Tivoli Integrated Portal and TPC for Replication V4.1 when going through an upgrade process as well.

If TPC exists, but TPC for Replication does not, then the upgrade process will consist of a fresh installation of TPC for Replication and an upgrade of TPC.

If TPC for Replication exists on the server and TPC does not, then this upgrade will be a fresh installation of TPC and an upgrade of TPC for Replication.

Interrupted upgrade

If you do not plan to use TPC for Replication, *do not* interrupt the installation by clicking the **Cancel** button. Complete the upgrade and then disable TPC for Replication.

Note: All PTFs and patches use the upgrade procedure to install. This implies that if you cancel the TPC for Replication install during the upgrade procedure, every time you apply a new patch the installation program will prompt you to install it again.

Failed upgrade

When you upgrade Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication, if a component fails to upgrade, then just the component will not be upgraded. If a failure occurs, an error message will be displayed, but there will be no complete rollback. As an example, if there is a failure in the TPC installation, a rollback will occur of Tivoli Storage Productivity Center but Tivoli Storage Productivity Center for Replication will still remain. This differs from the installation process where if a component installation fails the entire installation is rolled back.

License

You must have a valid TPC license to use the upgrade procedure. If you are upgrading from one license to a higher-level license, for example, you have Tivoli Storage Productivity Center Basic Edition installed and want to upgrade to Tivoli Storage Productivity Center Standard Edition, you must first install the TPC Standard Edition license, then you can upgrade the product.

IPv6

You can upgrade an existing version of TPC on an IPv4-only computer for use on a computer that is configured for both IPv4 and IPv6 (dual stack). You cannot upgrade TPC on an IPv4-only computer for use on a computer that is configured for IPv6 only. If you want to use TPC on an IPv6-only computer, you must perform a new install of the product on that computer.

Typical installation versus custom installation

The Typical installation allows you to install all the components of the Tivoli Storage Productivity Center on the local server in one step. Note these considerations:

- The typical installation will install the following components:
  - TPC Server
  - TPC Agents (Data Agent and Fabric Agent, NOT Storage Resource Agent)
  - GUI
  - CLI
- If you install the IBM Tivoli Storage Productivity Center servers using typical installation, the user ID and password you use for installation will be used for:
  - Database administrator user ID and password (for Data Server and the Device Server to connect to the database)
  - Database user ID and password to create the database schema
  - Host authentication password (for the Fabric agents to communicate with the Device Server)
  - Common agent service logon user ID and password (for Windows only, if the user ID does not exist)
  - WebSphere administration user ID and password (for the Device Server to communicate with embedded WebSphere if the user ID does not exist) only when you select “OS” as the authentication mechanism; if you select “LDAP”
  - As the authentication mechanism, then the LDAP TPC Administrator
  - Username and password values you enter during installation are used for the WebSphere administrator user ID and password

- If you subsequently install the Data agent or Fabric agent on a different machine using typical installation, you must use the same installation logon user ID and password that you used when installing the Tivoli Storage Productivity Center servers. If the server installation password is different or has changed, you should use custom installation to install the agents so that you can specify the passwords for the agents to match the password for the server.

Note: Our recommendation is not to use the Typical installation, because the control of the installation process is much better when you use the Custom installation method.

4.2.2 Upgrading and migrating Tivoli Storage Productivity Center from 3.x

To upgrade from Tivoli Storage Productivity Center Version 3.x, these are the general steps to follow with the related considerations:

1. If you are using DB2 Version 8, you must migrate to DB2 Version 9.5.

   TPC V4.1 requires one of the following DB2 versions:

   – IBM DB2 UDB Enterprise Server Edition v9.1 Fix Pack 2 or later
   – IBM DB2 UDB Enterprise Server Edition v9.5 Fix Pack 3a or later

   Depending on the version of DB2 currently available in your environment, you might need to upgrade it or install the required fix pack level. Table 4-11 reports the suggested action for each current DB2 version installed and an alternate action if available.

Table 4-11 DB2 Upgrade paths

Current DB2 version	Suggested action	Alternate action
DB2 v8.1	Upgrade to DB2 v9.5 Fix Pack 3	
DB2 v9.1 Fix Pack 2 or lower	Apply DB2 v9.1 Fix Pack 5	Upgrade to DB2 v9.5 Fix Pack 3
DB2 v9.5	Apply DB2 v9.5 Fix Pack 3	

Note: On Windows 2003 there is a known issue with the maximum size of environment variables like the PATH variable You need to install a hot fix from Microsoft. For information about the hot fix, go to:

`http://support.microsoft.com/kb/906469`

If you are running a 32-bit instance of DB2 8.1 on a Windows 64-bit and you want to use a 64-bit instance of DB2 9.5, the direct migration of DB2 is not supported. The migration must be performed in two different steps and there are two possible paths that can be followed:

– From DB2 v8.1 32-bits → Upgrade to DB2 v8.1 64-bits → Migrate to DB2 v9.5 64-bit
– From DB2 v8.1 32-bits → Migrate to DB2 v9.5 32-bits → Upgrade to DB2 v9.5 64-bit

2. Upgrade the Agent Manager.

   Agent Manager Version 1.3.2 is available for use with TPC V4.1. If you have Agent Manager 1.2 installed, it is optional to upgrade to V1.3.2. Note that the common agents remain at release 1.2 and are compatible with Agent Manager 1.3.2. If this is a new installation of TPC (for example, you are upgrading a TPC for Replication instance), then you can optionally install Agent Manager Version 1.3.2 as part of the new TPC environment.

Note: If your Agent Manager 1.2 is running fine, you do not need to upgrade. Nevertheless this version of Agent Manager runs within an unsupported version of WebSphere Application Server. For this reason if you experience any problem with the Agent Manager, you will be requested to upgrade to V1.3.2 and verify if the problem persists.

3. Upgrade TPC or TPC for Replication components to V4.1.

   During the upgrade process you might see several windows prompting you with the text `Replace Existing File.` Reply **`Yes`** to all to these prompts.

   As already mentioned, additional components will be installed during the upgrade and additional options are made available.

General considerations

Next we discuss several considerations for the upgrade.

TIP considerations

If not already present on the system, during the upgrade process the TIP will be installed, which uses 10 additional ports. See “Tivoli Integrated Portal” on page 96 for a list of the ports used by TIP.

TPC for Replication

If TPC for Replication is going to be installed on the system, you will be prompted for two additional network ports: a Default Port and a Default SSL port. Ensure that the ports you are providing to the installation programs are available on the system.

If you are installing TPC for Replication for the first time, you will be also prompted for the user ID and the password of the user with administrative authority on the TPC for Replication server. Ensure that the user exists on the system (or on the LDAP server) before starting the upgrade program.

If you are upgrading from a previous version of TPC for Replication that makes use of DB2 as database repository, you will be asked to provide the DB2 user ID and password. If you are upgrading from a previous version of TPC for Replication using its internal database repository, the previous version will be upgraded to the latest version.

LDAP

During the upgrade process you are given the chance to change the authentication method used by TPC. The program allows you to set up your environment to use the new LDAP support functionality. You can change the authentication method also after having completed the upgrade process; nevertheless we strongly suggest you decide the authentication method that TPC must use before starting the upgrade procedure. For additional details about what must be considered when planning for LDAP server usage for authentication, see Chapter 7, “LDAP authentication support and Single Sign-On” in the *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725.

4. Migrate the TPC database.

   After you perform the upgrade operation, you must migrate the TPC database using the database migration tool (**`partitiontables.bat`** or **`partitiontables.sh`**). The TPC V4.1 database has been changed to improve performance of some queries by either partitioning some databases or including multidimensional clustering. These changes are automatically included when you install TPC (but the TPC V3.x database is not migrated at this time).

Because the database migration tool can take a long time to run (depending on the size of the database to be migrated), you can run the migration tool at a time that is convenient for you. You only have to run the database migration tool one time. You must run the database migration tool before you apply any patches or PTFs for TPC. The database migration tool can be run more than once if an error occurred during execution. Tables that were migrated during previous attempts will not be migrated in subsequent runs.

When you run the database migration tool, you can check the progress of the database migration in the migrateTable.log file in the **<TPC_install_directory>\data\server\tools** directory. You will see warning messages if the migration cannot be performed on the database or if the migration has been previously completed. The database migration tool prints out messages indicating which table is currently being migrated and which subsystem ID is currently being migrated.

The database migration tool can be run more than once if an error occurred during execution. Tables that were migrated during previous attempts will not be migrated in subsequent runs.

5. Upgrade TPC Agents.

   You do not need to upgrade the agents at the same time you upgrade the other TPC components. You can plan to upgrade them at a time that is convenient for you and with the methodology that best suites your needs (local/remote, scheduled/assisted).

   If you plan to use the new Storage Resource Agents and you have Data/Fabric agent installed on you systems, it is suggested to uninstall the old Common Agent based agents before installing the new Storage Resource Agents.

4.3 Executing and verifying the installation

This section gives guidelines and considerations regarding DB2, Agent Manager, IBM Tivoli Storage Productivity Center, and IBM Tivoli Storage Productivity Center for Replication installation steps. For detailed information about the required steps for each platform see *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

4.3.1 Installation steps overview

You can install all the IBM Tivoli Storage Productivity Center family using typical installation or custom installation. Custom installation allows you to see what components are being installed and where the components are being installed as well as set different passwords for user IDs.

Keep in mind that Tivoli Storage Productivity Center for Replication is no longer a stand-alone application. Also, Tivoli Storage Productivity Center Version 4.1 now installs Tivoli Integrated Portal and Tivoli Storage Productivity Center for Replication Version 4.1.

When you install IBM Tivoli Storage Productivity Center, you have these installable components:

- Database schema
- Data Server and Device Server
- Graphical User Interface (GUI)
- Command Line Interface (CLI)
- Data agent
- Fabric agent

You will need to install most of these components in order to get Tivoli Storage Productivity Center to work. The CLI is considered optional. The Data agents and Fabric agents will most likely be installed in multiple locations. The GUI is installed wherever a user might want to control IBM Tivoli Storage Productivity Center.

If you are using a remote database for Tivoli Storage Productivity Center, you must install the database schema on that remote database after you have installed DB2 on that remote machine.

After Tivoli Storage Productivity Center is installed, the installation program will start the Tivoli Storage Productivity Center for Replication installation wizard.

Tivoli Storage Productivity Center also supports a Java Web based GUI which gives you the option of installing the GUI wherever you want to use IBM Tivoli Storage Productivity Center. For information about the Java Web based GUI, see “Configuring Java Web Start to start the IBM Tivoli Storage Productivity Center GUI” in the publication *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1,* SC27-2337.

If you are using IPv6, see “Considerations for Internet Protocol Version 6” on page 97.

DB2 and Agent Manager are separate installation programs from the Tivoli Storage Productivity Center. The DB schema, Data Server, Device Server, agents, GUI, and CLI are all components of Tivoli Storage Productivity Center. They can be installed all at once or at different times.

You can install Tivoli Storage Productivity Center with or without Agent Manager and agents. If you install Tivoli Storage Productivity Center without Agent Manager and agents, you can install Agent Manager and agents at a later time and register the Agent Manager with IBM Tivoli Storage Productivity Center.

Component install order

If you install the Tivoli Storage Productivity Center components at different times, you must install the components in this order:

1. DB2 (DB2 is required for Agent Manager and IBM Tivoli Storage Productivity Center).
2. Agent Manager (including the embedded version of IBM WebSphere Application Server - Express).
3. DB schema (this is installed using the IBM Tivoli Storage Productivity Center installation program).
4. Data Server and Device Server (this is installed using the IBM Tivoli Storage Productivity Center installation program).
5. Agents, GUI, or CLI:
   a. You can install Data agents, Fabric Agents, GUI or CLI using the IBM Tivoli Storage Productivity Center installation program).
   b. You can both deploy Storage Resource Agents using the IBM Tivoli Storage Productivity Center user interface, or install them locally using the installation image contained in the **`disk1`** or **`disk2`** IBM Tivoli Storage Productivity Center installation image.

Ports used by Tivoli Storage Productivity Center

The IBM Tivoli Storage Productivity Center components use several TCP/IP ports for communication. These ports should be opened through the firewall when you install the IBM Tivoli Storage Productivity Center and IBM Tivoli Storage Productivity Center for Replication

servers. You must disable the firewall program or open the ports to allow incoming requests to the Tivoli Storage Productivity Center ports. Review these ports before installing the Tivoli Storage Productivity Center and Tivoli Storage Productivity Center for Replication.

For a detailed list of default TCP/IP ports, see “Firewall considerations” on page 95.

Fully qualified host names

Tivoli Storage Productivity Center requires fully-qualified host names. Some systems might be configured to return a short host name, such as ddunham instead of a fully-qualified host name, such as `ddunham.myorg.mycompany.com`. Tivoli Storage Productivity Center should only be installed on a computer that has a fully-qualified host name. If you install Tivoli Storage Productivity Center on a system without a fully-qualified host name, the installation might appear to be successful but the Single Sign-On feature for Tivoli Integrated Portal, Tivoli Storage Productivity Center, and Tivoli Storage Productivity Center for Replication might fail to operate.

For detailed information about how to verify a fully qualified host name on each platform, see *“Checking for a fully qualified host name” in IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

InstallShield limitations

These are some limitations that you might encounter when installing IBM Tivoli Storage Productivity Center:

- When running the Tivoli Storage Productivity Center installation program on Solaris systems, some of the graphical elements in the installation panels might not display correctly. For example, in the panel, Select the type of installation you want to run, the TPC Installation Location button might appear truncated. This is due to an InstallShield limitation on Solaris systems.
- When using the IBM Tivoli Storage Productivity Center installation program to install Tivoli Integrated Portal on AIX systems, the progress bar incorrectly indicates that Tivoli Integrated Portal installation is 100% complete even though it is not yet complete. You must continue to wait until installation is complete. This is due to an InstallShield limitation on AIX systems that prevents the progress bar from correctly reflecting the installation progress.
- When you install IBM Tivoli Storage Productivity Center on AIX, the progress bar can incorrectly display 100% for any component that is installed even though the installation is not complete. This does not affect the installation.
- When you are upgrading the system, you might see several windows prompting you with the text `Replace Existing File`. Reply **`Yes`** to all to these prompts.

4.3.2 Installation and verification steps

This section summarizes the execution and verification steps per the IBM Tivoli Storage Productivity Center components installation or upgrade, with references to the documentation containing the detailed steps.

DB2

The following considerations apply to DB2:

- DB2 is required for Agent Manager and Tivoli Storage Productivity Center.
- Before installation, review user ID and Groups considerations in “DB2 considerations” on page 99

- If you are using a remote database for Tivoli Storage Productivity Center, you must install the database schema on that remote database after you have installed DB2 on that remote machine.

For detailed installation steps on DB2 installation, see the following references:

- For Windows platform: “3.3.1 DB2 installation” in Chapter 3 “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For AIX platform: “4.3.1 DB2 installation - Command line” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For Linux platform: “5.3.1 DB2 installation - GUI install” in Chapter 5, “Tivoli Storage Productivity Center install on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

DB2 upgrade and Tivoli Storage Productivity Center database migration

If you are using DB2 Version 8, you must migrate to DB2 Version 9.5:

- Tivoli Storage Productivity Center V4.1 requires one of the following DB2 versions:
  - IBM DB2 UDB Enterprise Server Edition v9.1 Fix Pack 2 or later
  - IBM DB2 UDB Enterprise Server Edition v9.5 Fix Pack 3a or later

  Depending on the version of DB2 currently available in your environment, you might need to upgrade it or install the required fix pack level. See Table 4-11 on page 120 for DB2 Upgrade paths.

For detailed DB2 upgrade and TPC database migration steps, see the following references:

- For Windows platform: “3.6 Upgrade DB2 and migrate the TPC database” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For AIX platform: “4.6 Upgrade DB2 and migrate the TPC database” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

Verifying the DB2 installation

You can verify that DB2 has been installed properly using the command line processor (CLP) or the First Steps GUI.

The general steps to verify that DB2 has been installed properly are as follows:

1. Create the SAMPLE database.
2. Connect to the SAMPLE database.
3. Run a query against the SAMPLE database.
4. Drop the SAMPLE database.

For the detailed steps to verify the DB2 installation using the command-line processor (CLP) or the First Steps GUI, see: “Verifying that DB2 is installed correctly” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1*, SC27-2337.

Agent Manager

The following considerations apply to the Agent Manager:

- The Agent Manager is disabled for IPv6 communication. Agent Manager and agent communication use IPv4 only.
- Installation of Agent Manager is not mandatory with IBM Tivoli Storage Productivity Center 4.1; it is only required when you plan to deploy Data agents or Fabric agents.
- You need the Data agent and Agent Manager installed to run IBM Tivoli Storage Productivity Center batch reports.
- When you install the Agent Manager, you will also be installing the Embedded version of IBM WebSphere Application Server (WebSphere Express).
- Before installing the Agent Manager, review and verify the security considerations discussed in “Security considerations for the Agent Manager” on page 100.
- Before you install the Agent Manager, make sure that the computer system that hosts the registry has sufficient file system space. See “Estimating the size of the registry database” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1* for guidelines for the calculation of the amount of space you will need for the registry.

For detailed installation steps of the Agent Manager, see the following references:

- For Windows platform: “3.3.2 Agent Manager installation for Windows” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1, SC27-2337.*
- For AIX platform: “4.3.2 Agent Manager installation using 64-bit DB2 instance - Console install” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1, SC27-2337.*
- For Linux platform: “5.3.2 Agent manager installation using 64-bit DB2 instance - GUI install” in Chapter 5, “Tivoli Storage Productivity Center install on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1, SC27-2337.*

Agent Manager upgrade

If you are running an Agent Manager v1.2.x, is not mandatory to upgrade to v1.3.2 because v1.2.3 runs inside a WebSphere version that is not supported anymore but still works with TPC.

If you are upgrading Agent Manager and have also upgraded DB2 8.1 to DB2 9.5, you must also migrate the DB2 database after upgrading the Agent Manager.

For information about migrating the database, see the following references:

- For Windows platform: “3.7 Upgrading the Agent Manager” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1, SC27-2337.*
- For AIX platform: “4.7 Upgrading the Agent Manager” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1, SC27-2337.*

Verifying the Agent Manager installation

You can verify the installation by running the **HealthCheck** utility from a command-prompt. The utility is located in one of the following directories, depending on the platform:

- For Windows: `<InstallDir>\toolkit\bin`
  (where `<InstallDir>` is where the Agent Manager is installed)
- For AIX or Linux: `<InstallDir>/toolkit/bin`
  (where `<InstallDir>` is where the Agent Manager is installed)

For details about **HealthCheck** toolkit, see the following references:

- For Windows platform: “3.3.2 Agent Manager installation for Windows” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For AIX platform: “4.3.2 Agent Manager installation using 64-bit DB2 instance - Console install” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For Linux platform: “5.3.2 Agent manager installation using 64-bit DB2 instance - GUI install” in Chapter 5, “Tivoli Storage Productivity Center install on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

IBM Tivoli Storage Productivity Center components

After that all the prerequisites have been installed, it is possible to install the TPC components:

- Database schema
- Data Server
- Device Server
- GUI
- CLI
- Data Agent and Fabric Agent

  During this process, two additional components will be also installed: the Tivoli Integrated Portal and IBM Tivoli Storage Productivity Center for Replication.

Before you begin the installation, complete the following steps:

1. Make sure you have the correct version of DB2 and Agent Manager installed on your system. (The Agent Manager could be on a remote computer.) Also make sure that DB2 is running.
2. Ensure that you do not have any port conflicts. See “TCP/IP ports used by the IBM Tivoli Storage Productivity Center family” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337.
3. Make sure that your computers are using fully qualified host names. Make sure you change the HOSTS file.
4. Check the readme file on the product CD for additional information about using the product. The readme files are in the readme directory. The files are:
   `readme_tpc_<language>.txt`
5. Check for any Flashes on the following Web site. The Flash contains last minute information that could not be included in the documentation. Go to:

   `http://www.ibm.com/systems/support/storage/software/tpc/`

   Then click a product. Then click **Flashes**.

6. It is a good practice to subscribe to the Tivoli Storage Productivity Center technical support Web site to receive information about important technical notes, flashes, and APAR information.
7. If you are installing the server on a UNIX platform, you must set up your shell environment to point to the instance where the repository will be installed. To do this, source the **db2profile** script for the desired instance. For example, if the DB2 instance is **db2inst1**, perform the following steps:
   a. Source the file by typing **. /home/db2inst1/sqllib/db2profile**
   b. Start the installation program.
8. Plan for the user IDs and passwords you expect to use.
9. If you install Tivoli Storage Productivity Center and select to authenticate users against an LDAP-compliant directory, then make sure you have all the necessary LDAP information:
   – The fully-qualified host name of the server running the LDAP-compliant directory
   – The port on which the LDAP-compliant directory is listening
   – The Bind Distinguished Name and password for connecting to the LDAP-compliant directory
   – The Relative Distinguished Names for the Tivoli Storage Productivity Center users and groups in the LDAP-compliant directory
   – The attributes used to “name” the Tivoli Storage Productivity Center users and groups in the LDAP-compliant directory
   – The LDAP TPC Administrator username and password; this must be an existing entry in the LDAP-compliant directory in the “branch” specified by the “Relative Distinguished Name for usernames” value
   – The LDAP TPC Administrator group; this must an existing entry in the LDAP-compliant directory in the “branch” specified by the “Relative Distinguished Name for groups” value; the LDAP TPC Administrator user must be a member of this group.

Note:

- On Windows, you cannot run the Tivoli Storage Productivity Center installation program from a network share (for example, Universal Naming Convention format). You must map your network share to your local drive and run the installation program from that drive.
- For custom installation: in UNIX, the IBM Tivoli Storage Productivity Center installation program validates the WebSphere user ID and then gives an error if that user ID does not exist. In Windows, the Tivoli Storage Productivity Center installation program will create the WebSphere user ID if that user ID does not exist.
- For information about installing the Data agent and Fabric agent in silent mode, see “Installing IBM Tivoli Storage Productivity Center in silent mode” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*.
- If you are using an IPv6 machine, see “Planning for Internet Protocol Version 6” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1.*

For detailed installation steps in Tivoli Storage Productivity Center components installation, see the following references:

- For Windows platform: “3.4 Installing Tivoli Storage Productivity Center components” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For AIX platform: “4.4 Installing Tivoli Storage Productivity Center components” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For Linux platform: “5.4 Installing Tivoli Storage Productivity Center components” in Chapter 5, “Tivoli Storage Productivity Center install on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

Tivoli Storage Productivity Center components backup

Before proceeding with the upgrade, is a good practice is to back up the following components:

- All the TPC local databases
- The TPC installation directory:
  - `<usr or opt>/IBM/TPC` for AIX or Linux
  - `C:\Program Files\IBM\TPC` for Windows
- The Common Agent installation directory:
  - `C:\Program Files\IBM\TPC\ca` for Windows
  - `<usr or opt>/IBM/TPC/ca` for AIX or Linux
- The InstallShield registry:
  - `C\Program Files\Common Files\InstallShield\Universal` for Windows
  - `<usr or opt>/lib/objrepos/InstallShield/Universal/IBM-TPC` for AICX or Linux
- The Windows registry. For Windows 2003 Server platforms, you can refer to the following document:

  `http://technet.microsoft.com/en-us/library/cc758453(WS.10).aspx`

For detailed steps in backing up the Tivoli Storage Productivity Center components and upgrade procedure, see the following references:

- For Windows platform: “3.8 Upgrading TPC components” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
- For AIX platform: “4.7.1 Upgrading TPC components” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.

Verifying the Tivoli Storage Productivity Center components installation

At the end of the installation, it is a good idea to make sure that all the components have been installed successfully and that Tivoli Storage Productivity Center is in working order. To do so, launch the Tivoli Storage Productivity Center GUI. From the Navigation Tree, expand **Administrative Services** → **Services** and verify that all services are started and running, as shown in Figure 4-1.

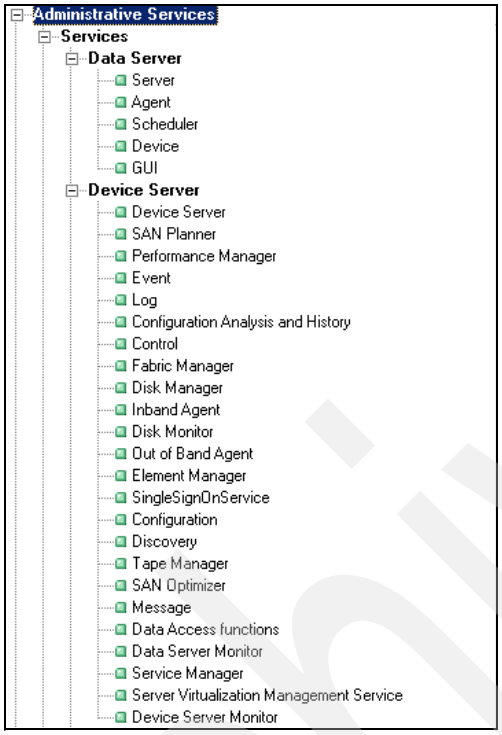


Figure 4-1 Data and Device Server services

Moreover, if Tivoli Storage Productivity Center for Replication is active on the Server, you should test the Replication Server status and connection with the Tivoli Storage Productivity Center Server.

To do so, click **Administrative Services Replication Server**, click the **Test RM Connection** button, and verify that the Connection Status is **Active**, as shown in Figure 4-2.

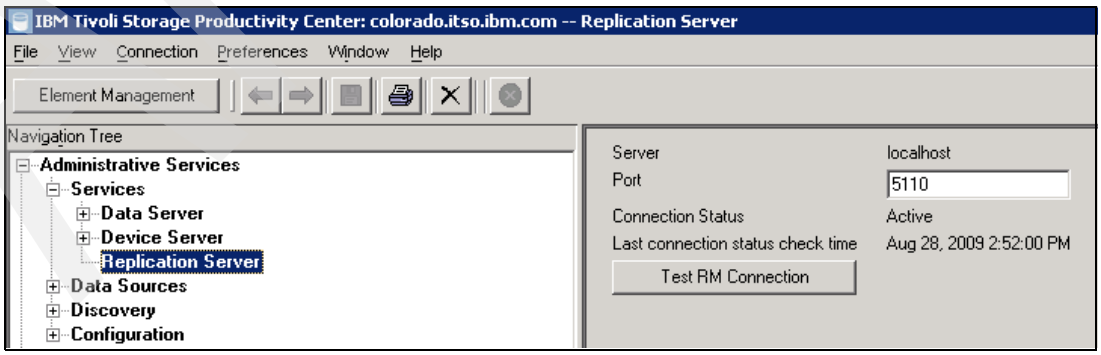


Figure 4-2 Test Replication Manager connection

Data agents and Fabric agents

The following considerations apply to Data agents and Fabric agents:

- The agents are composed of the Common agent and one or more Data agents and Fabric agents. When you uninstall the Data agent and Fabric agent, the last agent to be uninstalled will also uninstall the Common agent.
- If you are installing the Data agent and Fabric agent, you must have previously installed the Agent Manager and have registered the Device Server and Data Server with the Agent Manager.
- If on the system there is a Storage Resource agent already installed, it will be migrated to a Data agent.
- You can install a Storage Resource agent and a Data agent on the same computer if those agents communicate with different Data Servers.
- If the default port is not used for the agent port, then the Tivoli Storage Productivity Center agents need to be installed using custom installation.
- Do not install Fabric agents on VMware systems.

  No HBA virtualization is available for the VMware virtual machines. Therefore, if you install a Fabric agent on a VMware virtual machine, the Fabric agent will not be useful.
- For HACMP: A Data agent must be installed on each node of the cluster and all agents in a cluster must be configured to use the same listening port. To perform a scan on a cluster resource group, you must configure the cluster resource group to have at least one IP address that is accessible from the Tivoli Storage Productivity Center server.

  The Fabric agent can be installed on any number of nodes in a cluster.
- To install the Data agents and Fabric agents, you must log in as a user with the following authority:
  - On Windows systems, you must have Administrator authority and the following rights:
    - Act as part of the operating system
    - Log on as a service
  - On UNIX or Linux systems, you must be logged in as the **root** user.
- Depending on the decision of running the agent as a daemon or non-daemon service (on-demand service) and on the communication protocol that must be used, different parameters can be required. Refer to “Storage Resource agent and Data agent protocol support” in IBM Tivoli Storage Productivity Center: *Installation and Configuration Guide V 4.1*, SC27-2337 for details.

Tivoli Storage Productivity Center agents installation methods

Tivoli Storage Productivity Center agents can be installed in two ways:

- Local installation on the server:

  The TPC Agent installation program is located in the root directory of TPC installation **disk2**. For detailed steps for the locally agent installation, see the following references:
  - For Windows platform: “3.4. Installing Tivoli Storage Productivity Center components” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows”, in IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1, SC27-2337.
  - For AIX platform: “4.4 Installing Tivoli Storage Productivity Center components” in Chapter 4, “Tivoli Storage Productivity Center install and upgrade on AIX”, in IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1, SC27-2337.

- For Linux platform: “5.4 Installing Tivoli Storage Productivity Center components” in Chapter 5, “Tivoli Storage Productivity Center install on Windows”, in IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1, SC27-2337.

- Remote deployment from the Tivoli Storage Productivity Center V4.1 server:

  Before deploying the agents, observe these considerations:

  - You must run the installation from the server where the Data and Device Server resides.
  - You will need to have access to the media required to install the agents, this software is found on both installation disks or images.
  - You must know the name or IP address of the computers on which you will be installing the agents.
  - Ensure that you have at least one of the following protocols set up between the server and computers (agents):
    - Secure shell protocol (SSH)
    - Windows server message block protocol (SMB)
    - Remote execution protocol (REXEC)
    - Remote shell protocol (RSH)
  - Seeing that the Common agent is installed with the Data agent, you will need to install the Data agent prior to the Fabric agent, because the Fabric agent requires that the Common agent be installed and running on the target server.
  - You must supply a user ID and password that has administrative privileges on the target computer. The user ID must be a local administrative account on the target computer (not a domain administrative account).
  - If you are installing the Data agent remotely on a Linux system, you must set the */etc/ssh/sshd_config* file parameter `PasswordAuthentication` to **`yes`**. Then stop and start the ssh daemon for the change to take effect.
  - If you are installing the Data agent remotely on a Solaris 10 system, you must set the following parameters in file */etc/ssh/sshd_config:*

    - `PasswordAuthentication` **`yes`**
    - `PermitRootLogin` **`yes`**

    Stop and start the ssh daemon.

For detailed steps for the agents deployment, see “6.1.3 Deploying Agents” in Chapter 6, “TPC Basic configuration and use” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide,* SG24-7725.

Agents upgrade

You have two options for upgrading an existing or older version of Tivoli Storage Productivity Center Data or Fabric agents to the current release:

- Upgrading the agents through the GUI. This is also called a scheduled upgrade because you can specify to upgrade the agents at a time when network activity will not be impacted by the upgrades.
- Performing a local install of the agent, where the upgrade is actually done through the installation program.

Note: If you plan to use the Storage Resource Agents and you have a TPC for Data or Fabric agent installed, we strongly recommend to uninstall them, because you can have only one type of agent per host that points to the same server.

For detailed steps on agent upgrade, see “3.9 Upgrading the agents” in Chapter 3, “Tivoli Storage Productivity Center install and upgrade on Windows” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide*, SG24-7725.

Verifying agent installation

To verify that the installation completed correctly, log in to the Tivoli Storage Productivity Center GUI and go to:

- **Administrative Services** → **Data Sources** → **Data/Storage Resource Agents** for the Data Agents.
- **Administrative Services** → **Data Sources** → **Inband Fabric Agents** for the Fabric Agents.

The installed agents are present in the list and should be in *green* state, as shown in Figure 4-3 and Figure 4-4.

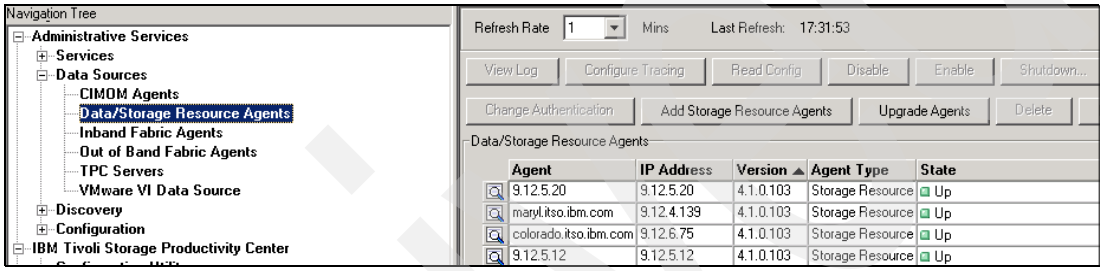


Figure 4-3 Data/Storage Resource Agents status

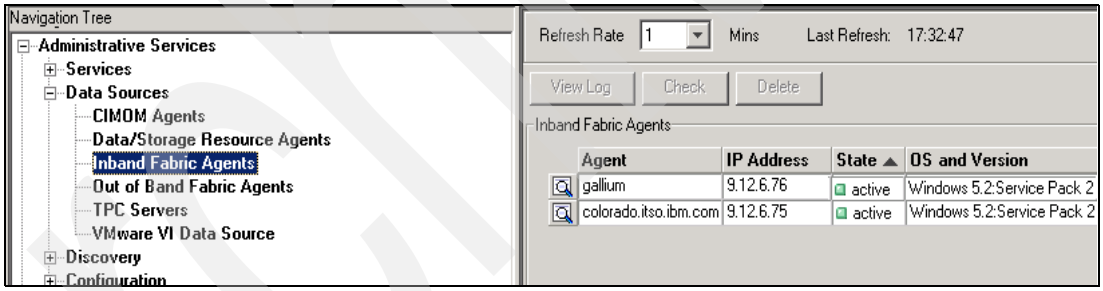


Figure 4-4 Fabric Agent status

The agent installation process creates a number of logs that can be checked to retrace the installation process and also to monitor the activity during normal operation. These logs provide ample detailed information and are especially useful in the case of a failed installation in order to determine the reason for the failure and to troubleshoot the installation. They are spread over several locations.

- Data agent logs:

  The following installation logs are for the Data agent when installed locally:

  - `<InstallLocation>\log\subagents\TPC\Data\install\` for Windows
  - `<InstallLocation>/log/subagents/TPC/Data/install/` for UNIX AND Linux

  The following installation logs are for the Data agent when installed remotely for Windows.

  - `<InstallLocation>\logs\`
  - `<InstallLocation>\logs\install\`
  - `<InstallLocation>\subagents\TPC\Data\log\`

The following installation logs are for the Data agent when installed remotely for UNIX and Linux:

- <InstallLocation>/logs/
- <InstallLocation>/subagents/TPC/Data/log/
- <InstallLocation>/logs/

The following operational log is for the Data agent when installed locally for Windows:

- <InstallLocation>\ca\subagents\TPC\Data\log\<host name>\

The following operational log is for the Data agent when installed locally for UNIX and Linux:

- <InstallLocation>/ca/subagents/TPC/Data/log/<host name>/

The following operational logs are for the Data agent when installed remotely for Windows:

- <InstallLocation>\logs\
- <InstallLocation>\subagents\TPC\Data\log\<host name>

The following operational logs are for the Data agent when installed remotely for UNIX and Linux:

- <InstallLocation>/logs/
- <InstallLocation>/subagents/TPC/Data/log/<host name>

- Common agent logs:

  The following installation and operational logs are for the Common agent when installed locally for Windows:

  - <InstallLocation>\ca\logs\
  - <InstallLocation>\ca\logs\install\

  The following installation and operational logs are for the Common agent when installed locally for UNIX and Linux:

  - <InstallLocation>/ca/logs/
  - <InstallLocation>/ca/logs/install/

  The following installation and operational logs are for the Common agent when installed remotely for Windows:

  - <InstallLocation>\logs\
  - <InstallLocation>\logs\install\

  The following installation and operational logs are for the Common agent when installed remotely for UNIX and Linux:

  - <InstallLocation>/logs/
  - <InstallLocation>/logs/install/

Storage Resource Agents

The following considerations apply to Storage Resource Agents:

- If you plan to use the new Storage Resource Agents and you have Data and Fabric agents installed on your systems, we suggest that you uninstall the old Common Agent based agents before installing the new Storage Resource Agents.
- Storage Resource agents are not part of the Tivoli Common Agent Services framework and do not require the Agent Manager to be installed. They do not require a JRE to be installed on the same system.

- If you are planning to install Storage Resource agents remotely on a Windows 2008 or Windows Vista system, you must disable the User Account Control (UAC) remote restrictions on the Windows system. User Account Control is a security component on Windows. For details on disabling the UAC remote restrictions, see “Preparing to install Storage Resource agents remotely on Windows 2008 and Windows Vista” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V4.1*, SC27-2337.
- You can install a Storage Resource agent and a Data agent on the same computer if those agents communicate with different Data Servers.
- Depending on the decision of running the agent as a daemon or non-daemon service (on-demand service) and on the communication protocol that must be used, different parameters can be required. Refer to “Storage Resource agent and Data agent protocol support” in IBM Tivoli Storage Productivity Center: *Installation and Configuration Guide V4.1,* SC27-2337 for details.

Storage Resource Agents installation methods

Storage Resource Agents can be installed in two ways:

- Local installation on the server:
  - The images of the Storage Resource agent are located on both TPC images disks under `<DiskImage>/data/sra/<operating_system_name>`.

  For Storage Resource Agent installation detailed steps, see “3.4.3 Agent installation” in Chapter 3 “Tivoli Storage Productivity Center install and upgrade on Windows” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide*, SG24-7725.
- Remote deployment from the TPC 4.1 Server:
  - You can enter host names from a Microsoft directory, enter host names manually, or import a host list file.
  - You can schedule a job to add the Storage Resource agents at a time that is convenient for you. You can also specify the type of alerts to generate if a job fails.
  - After you enter information for the Storage Resource agent, you can optionally validate the connection to the Data Server. This step helps to eliminate most of the possible failure cases after you have submitted the job for Storage Resource agent deployment.
  - You can define a deployment job to include multiple computers on which to install Storage Resource agents. The computers that you include in a deployment job must share the same administrative user ID and password. Tivoli Storage Productivity Center uses these user credentials to log into the computers when installing Storage Resource agents. If the computers in a deployment job do not share the same administrative user credentials, you must create separate deployment jobs for them.

  For Storage Resource Agent deployment detailed steps, see “6.1.3 Deploying Agents” in Chapter 6 “TPC Basic configuration and use” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide*, SG24-7725.

Verifying Storage Resource Agent installation

To verify that the installation completed correctly, follow the same steps described for the Data Agent in “Verifying agent installation” on page 133.

4.4 Launching the Tivoli Storage Productivity Center GUI

The Tivoli Storage Productivity Center GUI can be launched in several ways. We discuss all possibilities and describe what you can expect to see when launching the GUI using the different methods illustrated.

Note: IBM Java Runtime Environment (JRE) 1.5 is required as a prerequisite when launching the TPC GUI using a Web browser. Included in Java 1.5 is Java Web Start.

Java Web Start enables you to run the Java based TPC GUI on a system even if you do not have the TPC GUI installed locally. It enables a system to communicate with the Tivoli Storage Productivity Center Server that is running on AIX, Linux, UNIX, and Windows systems.

Java Web Start on the server automatically checks the remote system and provides links to the appropriate levels of the JRE and Java Web Start if it does not detect them.

4.4.1 Through Tivoli Integrated Portal

This section describes how to start the Tivoli Storage Productivity Center graphical user interface (GUI) through Tivoli Integrated Portal (TIP) local to the Tivoli Storage Productivity Center server or from a remote computer.

The only difference that you need to be aware of when launching the TPC GUI remotely is the fact that you are required to have Java 1.5 installed as mentioned before.

When launching the Tivoli Storage Productivity Center GUI through TIP Single Sign-On is enabled by default allowing you to log on to the Tivoli Storage Productivity Center GUI without having to explicitly enter your username and password.

Before logging into Tivoli Integrated Portal, ensure that you are using one of the following Web browsers:

- AIX: Firefox 2.0
- Linux and UNIX: Firefox 2.0
- Internet Explorer 7, Firefox 2.0, Firefox 3.0

To start IBM Tivoli Storage Productivity Center from Tivoli Integrated Portal, complete the following steps:

1. Start a Web browser, and type the following information in the address bar as shown in Figure 4-5:

   `http://hostname:port`

   Where `hostname` defines the server that is running Tivoli Integrated Portal such as the server name or IP address and port defines the port number for Tivoli Integrated Portal.

   If the default port was accepted during the installation of Tivoli Integrated Portal, the port number is **16310**.

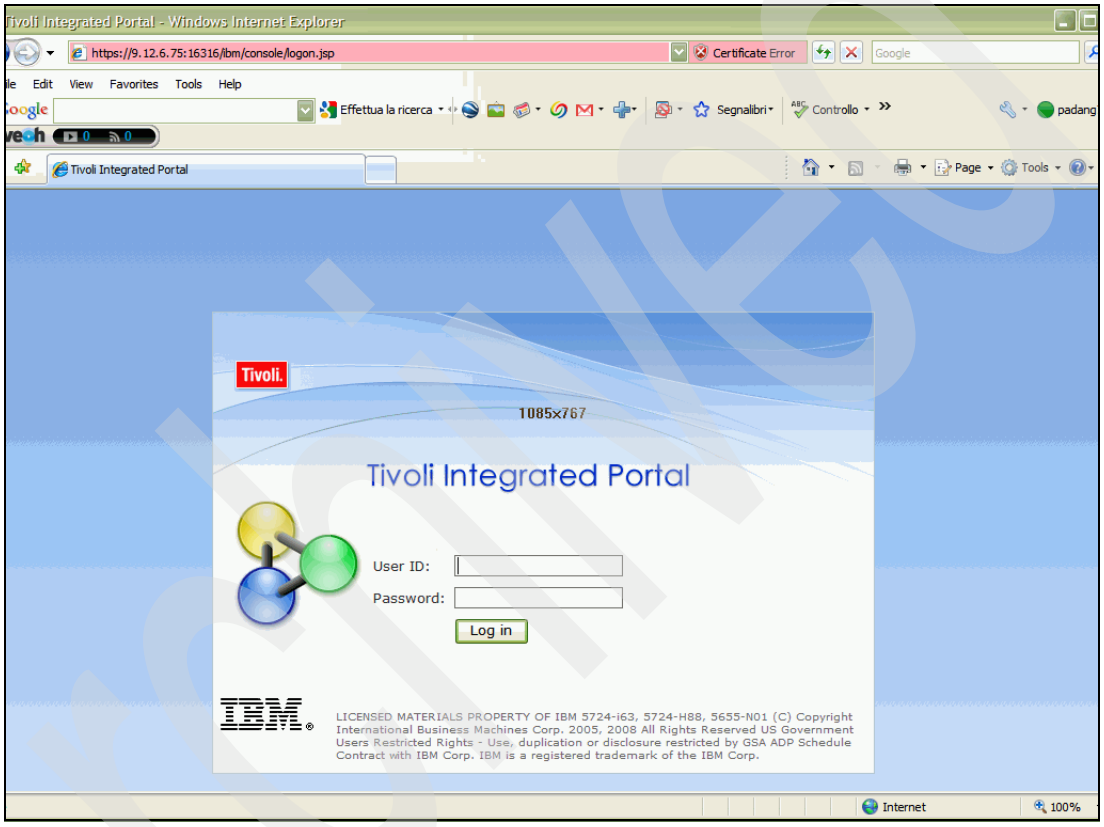


Figure 4-5 Tivoli Integrated Portal

2. Log on to TIP using the appropriate user ID and password. This depends on the type of authentication that has been set up, OS authentication or LDAP.
   - When using OS Authentication, you are required to enter the user ID and password as defined during the installation.
   - When using LDAP, you are required to enter the user ID and password defined in the LDAP server and provided during the installation.

   The Tivoli Integrated Portal opens, as shown in Figure 4-6.

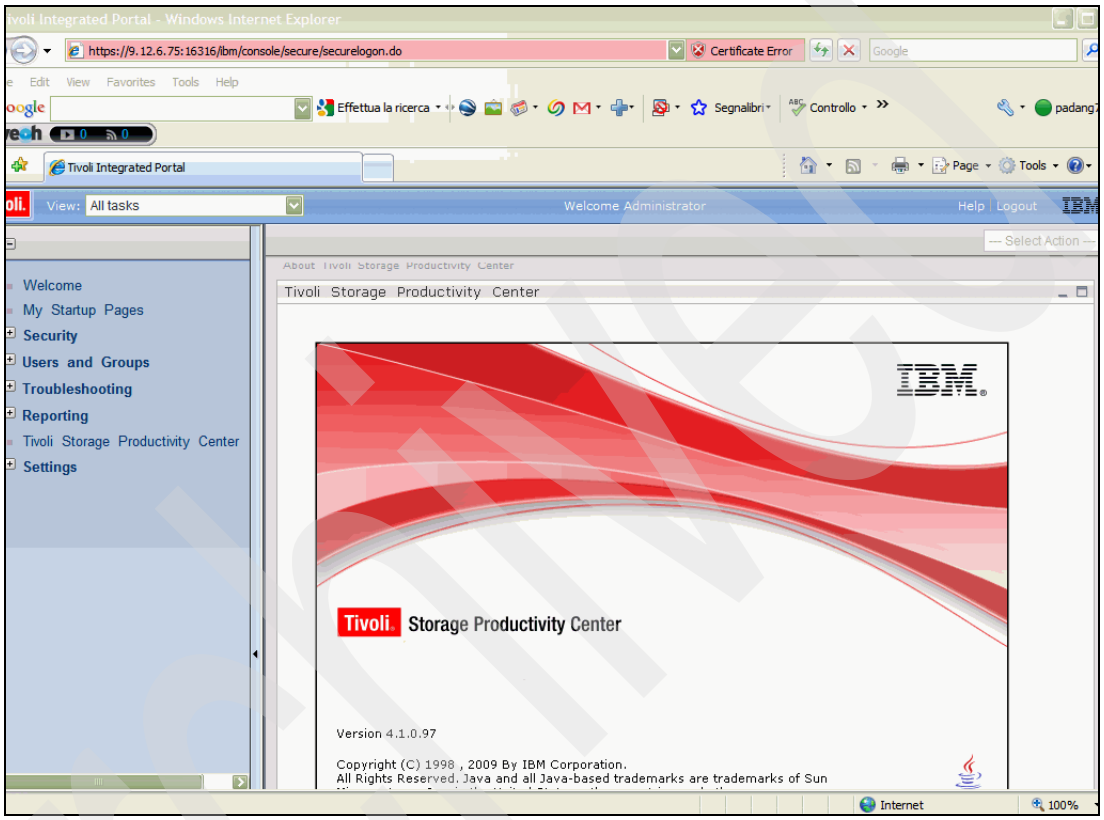


Figure 4-6 Launch TPC Portlet

3. In the TIP navigation tree, click the **Tivoli Storage Productivity Center**.

   An error message is displayed within the Tivoli Storage Productivity Center portlet because Tivoli Storage Productivity Center for Replication server is not accessible (we disabled Tivoli Storage Productivity Center for Replication), as shown in Figure 4-7, so you will not be able to launch it.

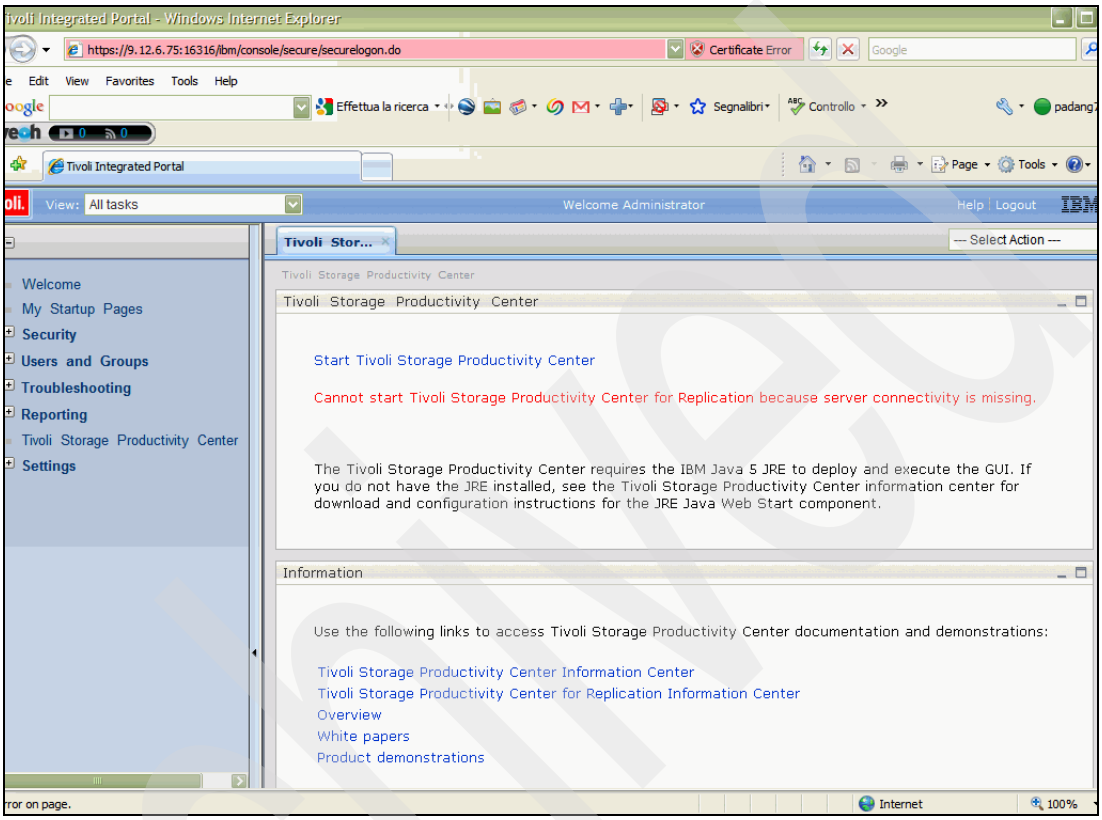


Figure 4-7 TPC-R Not Accessible

4. On the Tivoli Storage Productivity Center portlet page, click **Start Tivoli Storage Productivity Center**. One of the following actions occurs:
   - If Single Sign-On is successful, Tivoli Storage Productivity Center starts without displaying a logon window.
   - If Single Sign-On is not successful, an error message is displayed, a Tivoli Storage Productivity Center logon window will appear and you are required to enter a user ID and password.
   - If you are using a Lightweight Directory Access Protocol (LDAP) server for TPC user authentication and the directory is not available, an error message is displayed.

Lightweight Third-Party Authentication (LTPA)

After you have logged on to Tivoli Integrated Portal, a Lightweight Third-Party Authentication (LTPA) token is created. This token is passed to other applications that you start from Tivoli Integrated Portal for Single Sign-On authentication purpose.

We show an example of this in Figure 4-8 when launching Tivoli Storage Productivity Center from TIP.

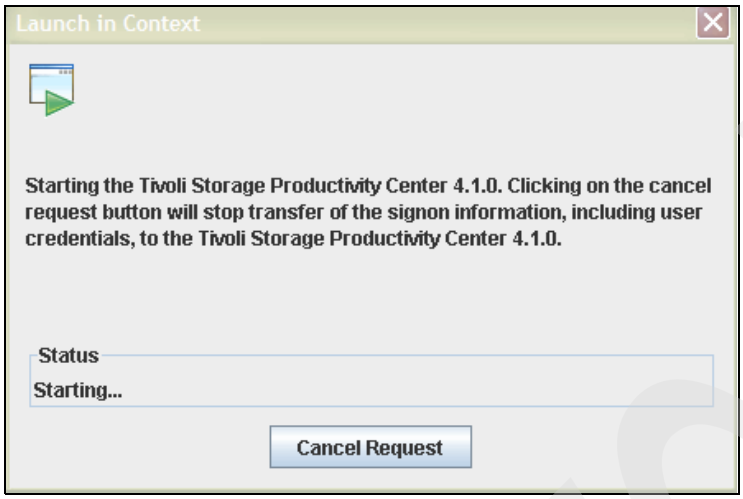


Figure 4-8 LTPA

During the period between logging on to Tivoli Integrated Portal and when you start another application such as Tivoli Storage Productivity Center from Tivoli Integrated Portal, the following conditions might occur:

- The user password that was used to log on to Tivoli Integrated Portal is changed in the user repository.
- The user ID that was used to access Tivoli Integrated Portal is changed in the repository or removed from the user repository.
- The user repository is not accessible.

Under the first condition, the original user credentials that were used to access Tivoli Integrated Portal are used to access other applications until the time-out period for the LTPA token that is used for Single Sign-On expires. When the LTPA token expires, you are prompted to re-enter your user ID and password when you attempt to start another application using Single Sign-On.

Under the second and third conditions, the Single Sign-On feature does not work.You are always prompted to re-enter your user ID and password when you attempt to start another application.

4.4.2 Without Tivoli Integrated Portal

This section describes how to start the Tivoli Storage Productivity Center graphical user interface (GUI) without using Tivoli Integrated Portal.

We describe how to start the TPC GUI locally from the Microsoft Windows Start menu, Productivity Center icon on your desktop or from command line (AIX, Linux, or UNIX) as well as using a Web browser for local or remote access.

Starting the GUI locally

You can start the GUI as follows:

- On Windows:
  - Click **Start** → **All Programs** → **IBM Tivoli Storage Productivity Center** → **Productivity Center**
  - You can also double-click the Tivoli Storage Productivity Center icon if it is installed on your desktop.
- On UNIX, Linux or AIX:
  - Type the following path and command on the command line:

    </usr or /opt>/IBM/TPC/gui/TPCD.sh

In all cases above you will see the Tivoli Storage Productivity Center GUI launched and requesting a user ID and password as seen in Figure 4-9.

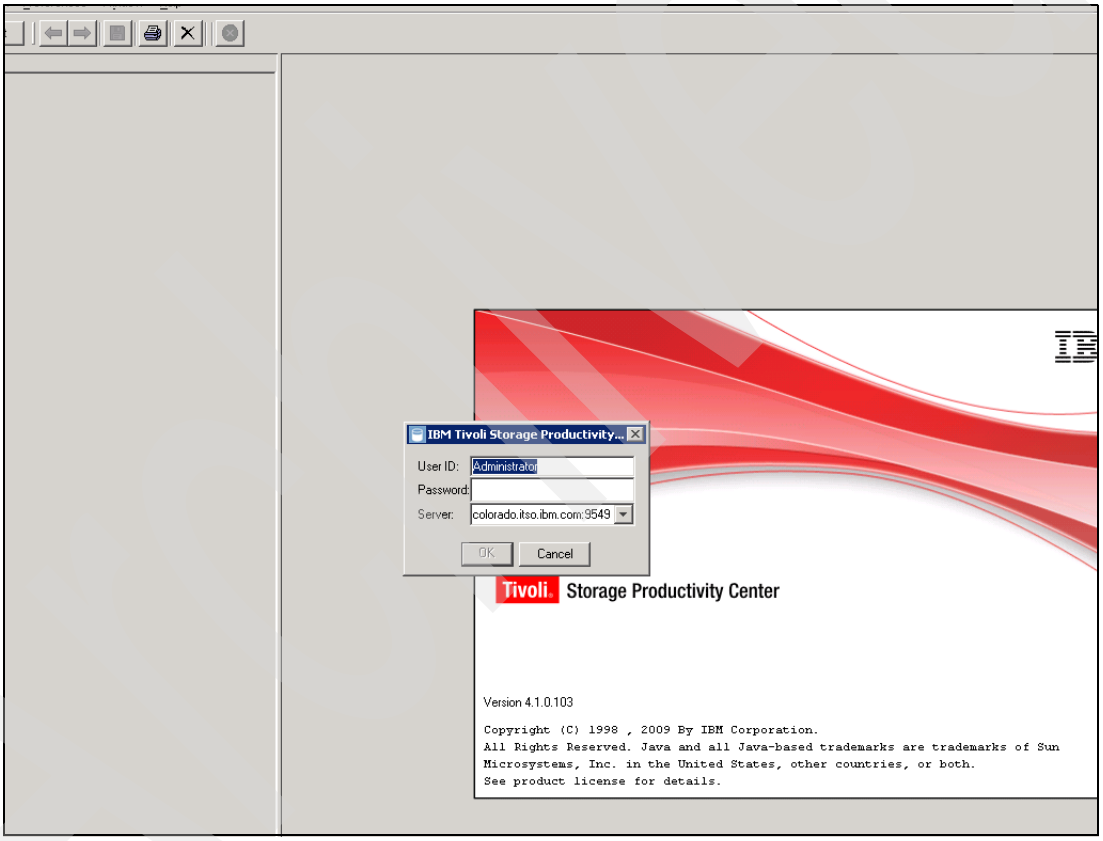


Figure 4-9 TPC GUI Interface Login panel

Starting Tivoli Storage Productivity Center GUI using a Web browser

You can start the Tivoli Storage Productivity Center GUI locally or from a remote location, for example, using a mobile computer or desktop, using a Web browser interface.

Make sure that you have Java 1.5 or later installed on the remote system prior to attempting to launch the GUI by a Web browser.

Ensure that you are using one of the following Web browsers:

- AIX: Firefox 2.0
- Linux and UNIX: Firefox 2.0
- Internet Explorer 7, Firefox 2.0, Firefox 3.0

To launch the Tivoli Storage Productivity Center GUI from a Web browser, follow these steps:

- Open a Web browser window and enter the Web address of the target server (TPC server). This could be done locally or from a remote computer, see Figure 4-10. The URL is in the format:

  http://<device_server_location>:<device_server_port>/ITSRM/app/welcome.html

  Note: The default Device Server port is 9550; however, this number could have been changed during installation.You should check with your system administrator to see if this port has changed.

- As mentioned previously, Tivoli Storage Productivity Center requires that IBM JRE 1.5 (Java) be installed on your system. You will see a message displaying a link to download the required JRE if needed, as shown in Figure 4-10. If required, click the appropriate package to download and install the JRE.

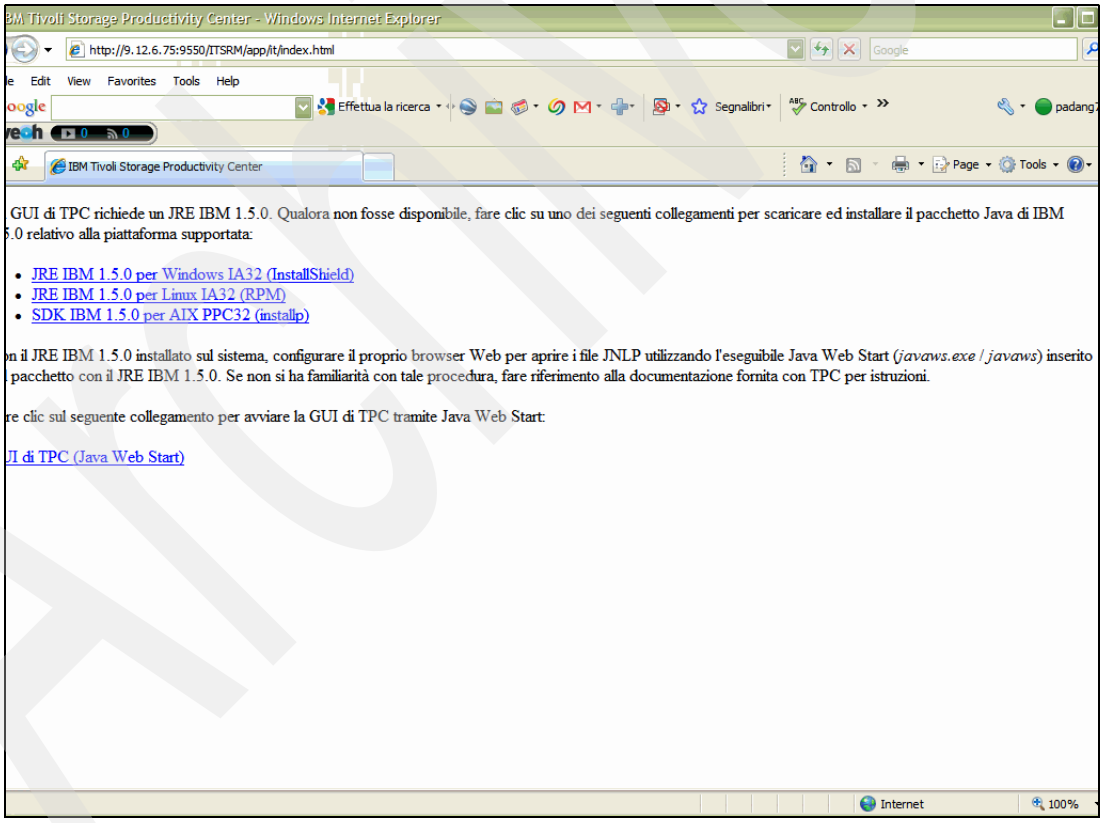


Figure 4-10 TPC GUI Pre-reqs

If you have already installed the required JRE on your system, click the TPC GUI (Java Web Start) link as shown in Figure 4-10.

This will start the TPC GUI where you will be required to login; you should see the Java Web Start icon. Subsequent to this, you will be presented with the Tivoli Storage Productivity Center GUI login as shown in Figure 4-11.

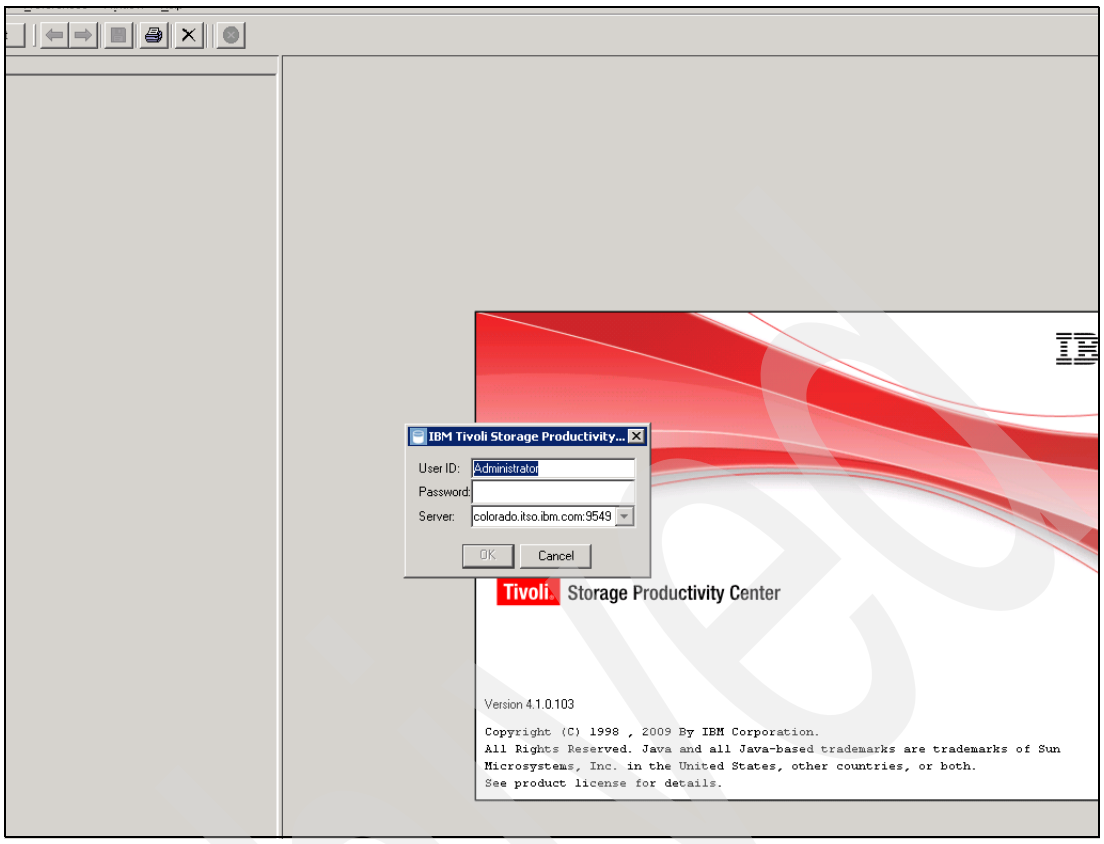


Figure 4-11 TPC GUI Login

Note: For additional information regarding specific Web browser settings or limitations pertaining to JRE and Java Web Start, refer to the TPC V4.1 specific online documentation, which can be found at:

`http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp`

Logging on to Tivoli Storage Productivity Center

Use the logon window to specify the following information when logging into the Tivoli Storage Productivity Center server as shown in Figure 4-11:

- User ID:

  Enter the user ID. The roles that are assigned to that user ID determine what nodes in the navigation tree you can see and act upon; in other words, it will determine your level of authorization.

- Password:

  Enter the password that is associated with the User ID.

- Server:

  Enter the IP address or Domain Name System (DNS) name of the computer on which the TPC server is installed.

  Note: Entering the information above is dependent on which type of authentication was specified during the install, OS or LDAP.

The first panel that you see when logging into the Tivoli Storage Productivity Center GUI is a “Welcome to the IBM Tivoli Storage Productivity Center” window, as shown in Figure 4-12.

Click one of the displayed buttons to select an option from the list:

- **Configuration**:

  Opens the Services Tab of the Configuration Utility.

- **Element Management**:

  Opens the Element Manager of the Configuration Utility.

- **Dashboard**:

  Opens the main dashboard. Select this option if you do not want to work with the Configuration Utility immediately.

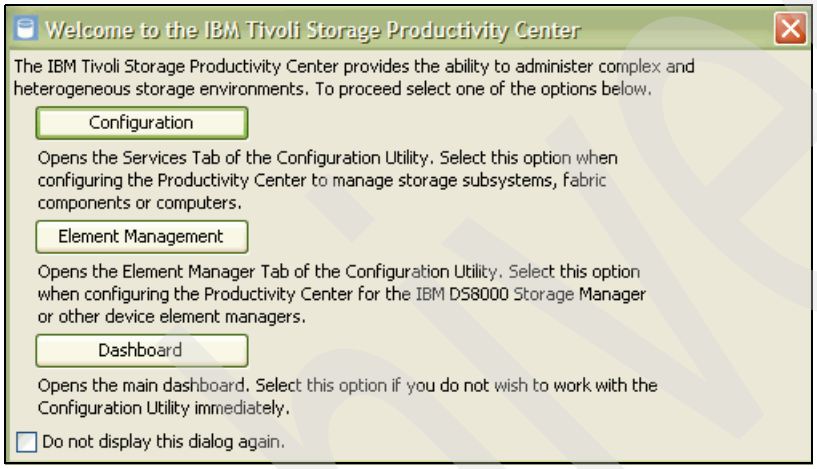


Figure 4-12 Welcome to the IBM Tivoli Storage Productivity Center window

5

Configuration

In this chapter, we cover configuration concepts for deploying Tivoli Storage Productivity Center V4.1. Tivoli Storage Productivity Center is a powerful console for the storage environment that provides a set of policy-driven automated tools for managing storage capacity, availability, events, performance, and assets in your enterprise environment.

This chapter provides a guideline for you to configure the Tivoli Storage Productivity Center for your environment and obtain several different reports for your environment.

We cover the following topics:

- CIMOM configuration and usage within TPC
- Out-of-band Fabric agents configuration
- Setting up additional data sources
- Jobs types
- Reporting through Tivoli Storage Productivity Center
- Working with scripts
- Tivoli Storage Productivity Center alert disposition
- Database management

5.1 Roles and authorization

Tivoli Storage Productivity Center provides user roles that can be mapped to user groups contained in the authentication repository, which is either the local operating system or an LDAP-compliant directory, depending on the choice of authentication mechanism made during the Tivoli Storage Productivity Center installation. The roles determine the user's ability to see and act upon specific nodes in the Navigation Tree of the GUI. Other factors that affect the user's capability are the components that are licensed, installed, and running.

One of the first tasks you should perform after installing Tivoli Storage Productivity Center is to assign roles to individuals who will use the product. From the *Role-to-Group Mapping* node, you can map Tivoli Storage Productivity Center roles, such as *Tape Operator or Fabric Administrator*, to user groups that you create in your operating system or in your LDAP-compliant repository.

For example, on a Windows computer you can create user groups using the Administrative Tools control panel. When a user name is used to authenticate with Tivoli Storage Productivity Center, the user's group membership determines the authorization level.

Operating system groups or LDAP groups (for example, groups contained in your LDAP-compliant repository) are associated with predefined roles. When a user ID is authenticated to Tivoli Storage Productivity Center through the GUI, CLI, or APIs, membership in an operating system or LDAP group determines the user's authorization level.

The superuser is the highest level role and can be used to install Tivoli Storage Productivity Center and to initially set up the product. The superuser has authority over all the other roles in Tivoli Storage Productivity Center. Figure 5-1 shows the roles hierarchy:

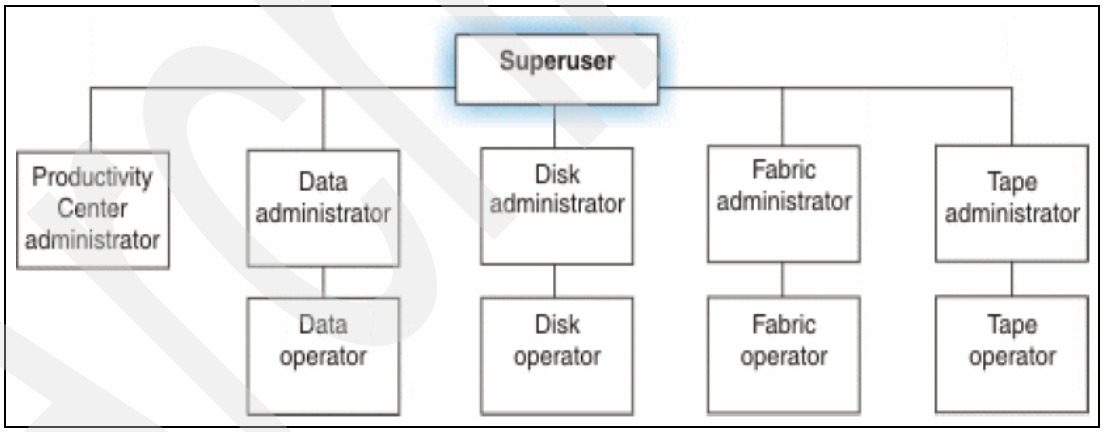


Figure 5-1 User roles in Tivoli Storage Productivity Center

Table 5-1 shows the association between roles and authorization level.

Table 5-1 Roles and authorization levels

Role	Authorization level
Superuser	Has full access to all IBM Tivoli Storage Productivity Center functions.
Productivity Center administrator	Has full access to operations in the Administration section of the GUI.
Disk administrator	Has full access to IBM Tivoli Storage Productivity Center disk functions.

Role	Authorization level
Disk operator	Has access to reports only for IBM Tivoli Storage Productivity Center disk functions. This includes reports on tape devices.
Fabric administrator	Has full access to IBM Tivoli Storage Productivity Center for Fabric functions.
Fabric operator	Has access to reports only for IBM Tivoli Storage Productivity Center for Fabric functions.
Data administrator	Has full access to IBM Tivoli Storage Productivity Center for Data functions.
Data operator	Has access to reports only Tivoli Storage Productivity Center for Data functions.
Tape administrator	Has full access to Tivoli Storage Productivity Center tape functions.
Tape operator	Has access to reports only for tape functions.

Notes:

1. If a user has multiple roles, the authorization level is a combination of the levels for each of the roles.
2. If a user is not a member of any of the roles listed, no access is granted to that user.
3. For enterprise-rollup reports, you need superuser or IBM Tivoli Storage Productivity Center administrator authority to do the following:
   - Add, remove, or modify the IBM Tivoli Storage Productivity Center subordinate server that the master server is monitoring.
   - Create or run probe jobs that include IBM Tivoli Storage Productivity Center subordinate servers.

   Any Tivoli Storage Productivity Center user can generate enterprise-rollup reports.
4. When you create and save role-to-group mappings in Tivoli Storage Productivity Center, these mappings get propagated into Tivoli Integrated Portal, where the groups are given the operator authorization. Occasionally, you might find that after creating and saving the role-to-group mappings in IBM Tivoli Storage Productivity Center, you are unable to access Tivoli Integrated Portal as a valid user (in a valid group that is mapped to the operator authorization in Tivoli Integrated Portal). If this occurs, stop and restart the Tivoli Integrated Portal server.

Table 5-2 shows the GUI nodes that require special roles to view, edit, and act upon the services. The Tivoli Storage Productivity Center administrator or superuser is required for viewing configurations.

Table 5-2 GUI nodes that require special roles or licenses

GUI node	Special roles
Administrative Services	All roles can see this node but the user must be a Tivoli Storage Productivity Center administrator or superuser to edit and act upon the services (for example enable or disable tracing, shut down services, delete services, and so forth).

GUI node	Special roles
Administrative Services ► Configuration - Role-to-Group Mappings	Only the IBM Tivoli Storage Productivity Center administrator or superuser can see this node.
Administrative Services ► Configuration - License Keys	Only the IBM Tivoli Storage Productivity Center administrator or superuser can see this node.
Tivoli Storage Productivity Center ► My Reports - System Reports - Data	Requires the data administrator role to create or edit objects, or to run jobs, (for example, pings and scans). Requires the data operator role to view reports.
Tivoli Storage Productivity Center ► My Reports - System Reports - Disk	Requires that the disk performance function be installed and the disk operator role.
Tivoli Storage Productivity Center ► My Reports - System Reports - Fabric	Requires the fabric administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the fabric operator role to view reports. This includes being able to view the fabric assets, port connections, SAN switch report, switch port errors, and switch ports (packet rate and data rate).
Tivoli Storage Productivity Center - My Reports - Batch Reports	Requires any administrator role to create the Batch Reports.
Tivoli Storage Productivity Center ► Monitoring - Probes	Requires any administrator role to create or edit probes.
Tivoli Storage Productivity Center ► Alerting - Alert log	Requires any administrator role to delete or clear alerts. The Storage subsystems node appears if any disk array is installed.
Data Manager	Requires the data administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the data operator role to view reports.
Data Manager for Databases	Requires the data administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the data operator role to view reports.
Data Manager for Chargeback	Requires the data administrator or data operator role.
Disk Manager	Requires the disk administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the disk operator role to view reports. The Storage Subsystem Performance Monitors node requires that the Disk performance function is available.
Disk Manager ► Monitoring - Subsystem Performance Monitors ► Profile Management ► Reporting - Storage Subsystem Performance	Disk performance function must be available.

GUI node	Special roles
Fabric Manager	Requires the fabric administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the fabric operator role to view reports.
Fabric Manager ► Monitoring - Switch Performance Monitors ► Reporting - Switch Performance - Constraint Violations	Fabric performance function must be available.
Tape Manager	Requires the tape administrator role to create or edit objects, or to run jobs (for example, pings and scans). Requires the tape operator role to view reports.
Element Manager	All roles can view and edit objects and run jobs.

5.2 CIMOM configuration and usage within TPC

SMI-S Providers (CIM Agents) are needed by TPC to discover the devices that will be managed by TPC, and collect information from them.

SMI-S uses an architecture called Common Information Model (CIM). You can think of CIM in three layers, from the bottom up:

- The Provider is the device instrumentation. These providers use an imbedded or proxy model when implementing the Provider. We refer to them as SMI-S Providers. They are also referred to as CIM Agents.
- The CIMOM is a middle layer capable of connecting to multiple Providers and responding to CIM client requests. This layer is a combination of SMI-S Provider, data transport, and parts of the TPC server. It encompasses the means of requesting data from a device, getting the data back into TPC, and processing that data.
- The CIM Client is the application leveraging CIM by the CIMOM. This is the TPC server. It is the requester of information from managed devices.

You will need a SMI-S Provider for the following types of devices:

- Storage Subsystems
- Fabric Switches
- Tape Libraries

Refer to “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109 for devices supported by TPC and for CIM Agent considerations.

Here are the common steps that need to be completed to make these devices usable in TPC:

1. Install or configure the device vendor’s SMI-S Provider.
2. Manually add any SMI-S Provider agents (CIMOMs) to TPC.
3. Run a CIMOM Discovery. After each SMI-S Provider is authenticated, TPC will use that agent to discover devices, and record those devices in the TPC repository.
4. Create a device probe for each device or device group. These probes will collect asset information associated with the device, much like a data probe does for computers.

Detailed steps for add a CIMOM to the TPC Server and run a CIMOM Discovery are described in 6.1.7 “Adding a CIMOM” in Chapter 6 “Basic Use and Configuration Steps” in *IBM Tivoli Storage Productivity Center V4.1 Release Guide*, SG24-7725.

5. You can also create performance monitors for storage subsystems and fabric switches.

In the following sections we describe these tasks in detail.

5.2.1 CIMOM installation and configuration

CIM Agents are provided by the vendor of the storage subsystem, fabric switch, or tape library. Each vendor provides unique agent code for their family of storage devices. This code implements a Common Information Model Object Manager (CIMOM) that conforms to the Storage Management Initiative Specification (SMI-S) of the Storage Networking Industry Association (SNIA).

The CIM Agent usually must be installed and configured, so that it can identify the storage devices with which it communicates. Some storage devices, such as Cisco fabric switches, contain embedded CIM Agents and so do not require that CIM Agents be installed, although Tivoli Storage Productivity Center must be configured to point directly to the storage devices that contain the embedded CIM Agents.

Note: From DS8000 Release 4.2 on, is no longer needed to configure the CIM Agent through the DS CIM CLI. The CIM Agent uses the DSCLI (ESSNI) user to connect to the disk system.

Install or configure, depending on the type of the CIM Agent (if embedded or proxy-based), the device vendor’s SMI-S Provider according to the vendor’s instructions, and configure it to communicate with the device(s) to be managed by TPC.

Notes:

- Do not install multiple CIM Agents on a single computer because of port conflicts.
- Do not install a CIM Agent on the system where a Tivoli Storage Productivity Center server component is installed.

5.2.2 Adding the CIMOM to Tivoli Storage Productivity Center

Next, we enter the CIMOMs manually:

1. To do this, select **Administrative Services** → **Data Sources** → **CIMOM Agents**. Select the button **Add CIMOM** from the right panel.

   Tivoli Storage Productivity Center shows us a dialog where the basic information about the CIMOM has to be entered, as shown in Figure 5-2.

   – IP address, port, and protocol (http or https) for the CIMOM (the default ports are **5988** for http and **5989** for https).

   – Interoperability namespace (refer to “Interoperability namespace summary table” on page 112 and the manufacturer of the CIMOM for the correct namespace). It is usually */root/ibm* for IBM storage and tape systems).

   – User ID and password for the CIMOM (if required)

   – Display name (optional)

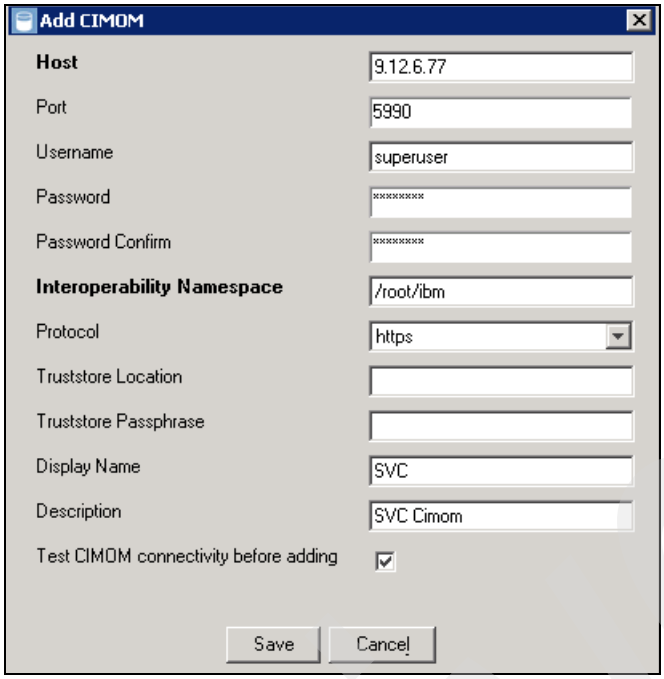


Figure 5-2 Configuring CIMOMs: add CIMOM dialog

2. After entering the CIMOM, we see the CIMOM entry under **Administrative Services** → **Data Sources** → **CIMOM Agents** (see Figure 5-3):

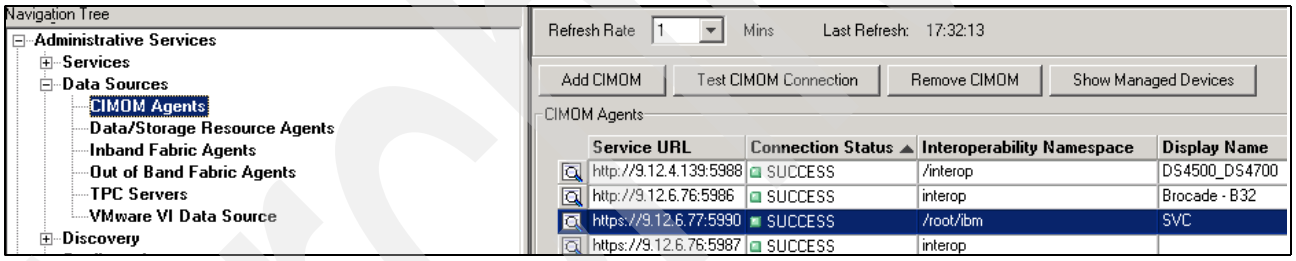


Figure 5-3 Configuring CIMOMs: CIMOM configuration complete

We have now completed the configuration of our CIMOMs in the Tivoli Storage Productivity Center. However, the retrieval of the information about the managed elements (storage subsystems, tape library, and switch) has not yet occurred for those CIMOMs, which require authentication. So we have to run a further CIMOM Discovery job. This CIMOM Discovery job does not discover any new CIMOMs (as long as we did not add any new ones to our infrastructure in the mean time). However, the CIMOM Discovery job is now able to log in into each of the configured CIMOMs and retrieve all information about the managed storage subsystems, tape libraries, and switches.

To initiate an automatic CIMOM discovery, we select **Administrative Services** → **Discovery** and click **CIMOM**; simply select the button **Run Now** and save the page (see Figure 5-4).

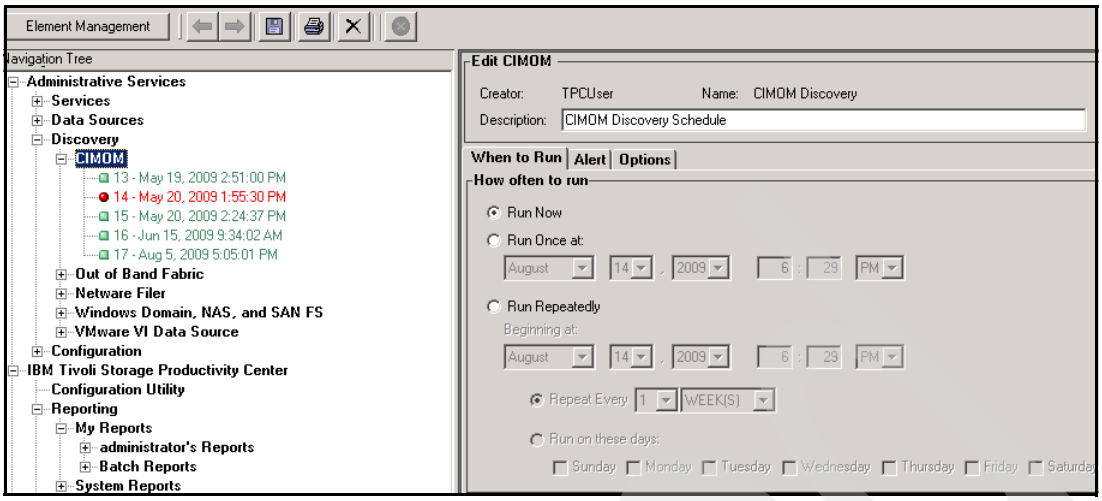


Figure 5-4 Configuring CIMOMs: initiate CIMOM discovery

Monitoring CIMOM Discovery job

We can view this entry by selecting **Administrative Services** → **Discovery** → **CIMOM**, right-clicking **CIMOM**, and selecting **Refresh Job List** from the drop-down menu. Then, expand the **CIMOM** node of the Navigation Tree.

The entry for our job is named with the time stamp of its starting time. We see a small icon next to the entry. A blue circle indicates that the job is currently running. A red circle indicates that the job has competed with errors, and a green square indicates that the job has completed without errors.

Tivoli Storage Productivity Center uses also a yellow triangle to indicate that a job has completed with warnings.

Figure 5-5 shows the entry that belong to the job we just submitted. The blue circle beside this entry indicates that the job is running.

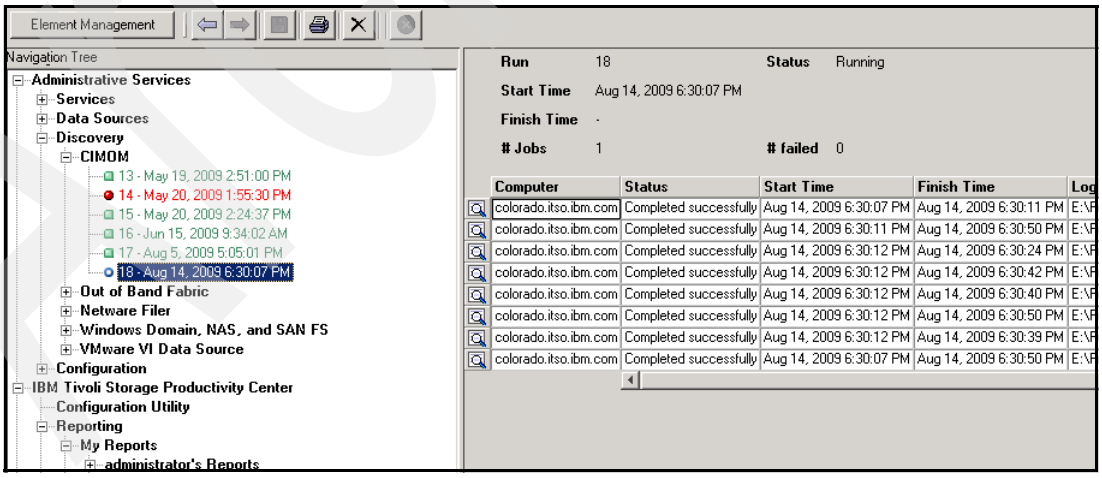


Figure 5-5 Configuring CIMOMs: CIMOM discovery running

We can update the status of the job by right-clicking **Administrative Services** → **Discovery** → **CIMOM** and select **Update Job Status**. Note that the status does not update unless we refresh it this way. We finally see the information in Figure 5-6 which indicates that our Discovery job has successfully completed.

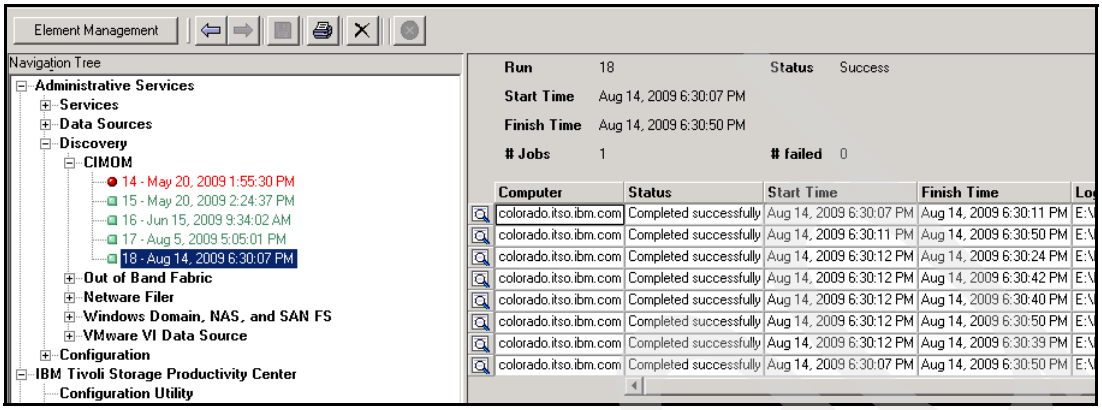


Figure 5-6 Configuring CIMOMs: CIMOM discovery job completed successfully

This CIMOM Discovery job does not discover any new CIMOMs (as long as we did not add any new ones to our infrastructure in the meantime). However, the CIMOM Discovery job is now able to log in into each of the configured CIMOMs and retrieve all information about the managed storage subsystems, tape libraries, and switches.

Log files

We should now inspect the logs to verify that all of our storage subsystems, tape libraries, and switches have been discovered successfully.

We can also verify the discovery of a storage subsystem by inspecting the alert log. IBM Tivoli Storage Productivity Center comes with a default alert configured that raises an entry in the storage subsystem alert log each time a new storage subsystem is discovered.

We can view this Alert Log by selecting **IBM Tivoli Storage Productivity Center** → **Alerting** → **Alert Log** → **Storage Subsystem**. Note that a SAN Volume Controller is not considered a storage subsystem in this context, so an alert for the discovery of an SVC is not generated by default.

IBM Tivoli Storage Productivity Center also provides default alerts for the discovery of switches, fabrics, and endpoints.

Now, that we have successfully discovered all our storage subsystems, tape libraries, and switches behind our CIMOMs, we take a look at the CIMOMs and check the connection with the managed devices.

5.2.3 CIMOM managed devices

Note: After adding the CIMOM on Tivoli Storage Productivity Center, you are required to run a Discovery job. This allows Tivoli Storage Productivity Center to communicate with the CIMOM and discover any devices managed by the CIM Agent.

To see which devices are managed by the CIMOM added, navigate to **Administrative Services** → **Data Sources** → **CIMOM Agents**, select the **CIMOM** and click **Show Managed Devices** as shown in Figure 5-7.

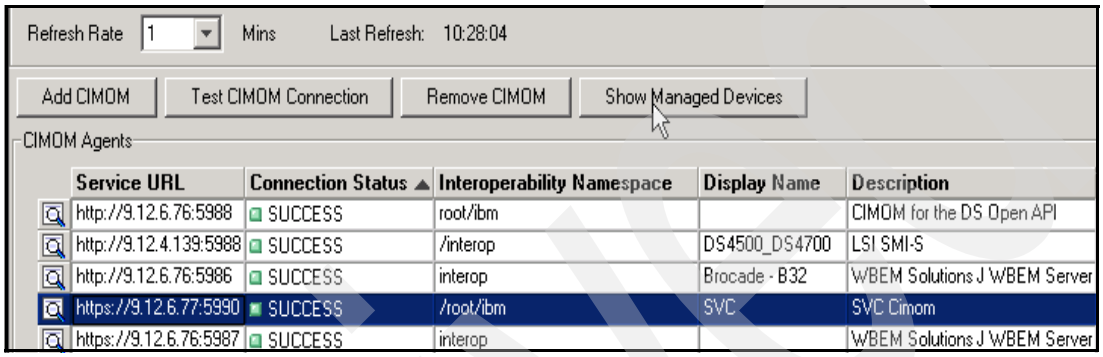


Figure 5-7 Show Managed Devices

We see the managed devices within the CIMOM Managed Devices window as shown in Figure 5-8.

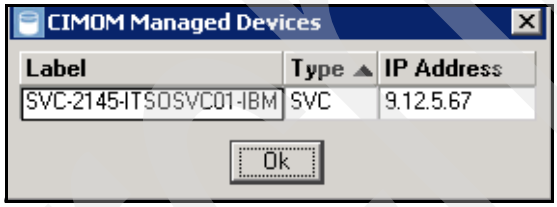


Figure 5-8 CIMOM Managed Devices panel

You can now execute Probe jobs and Performance Monitor jobs against the managed devices.

See 5.5.2, “Probes: Collecting storage statistics” on page 167 for detailed steps on defining a Probe job.

See 5.5.5, “Performance Monitor job: Collecting Performance Data” on page 178 for detailed steps on defining a Performance Monitor job.

CIMOM agents reports

You can gather detailed information about the CIMOM agents defined in your environment by running a Report against the CIMOM agents. To do so expand on **IBM Tivoli Storage Productivity Center → Reporting → Data Source Reports → CIMOM Agents**. From here you can choose if order the view **by CIMOM Agents** or **By Managed Devices** selecting one of the corresponding node. The report pane opens as shown in Figure 5-9.

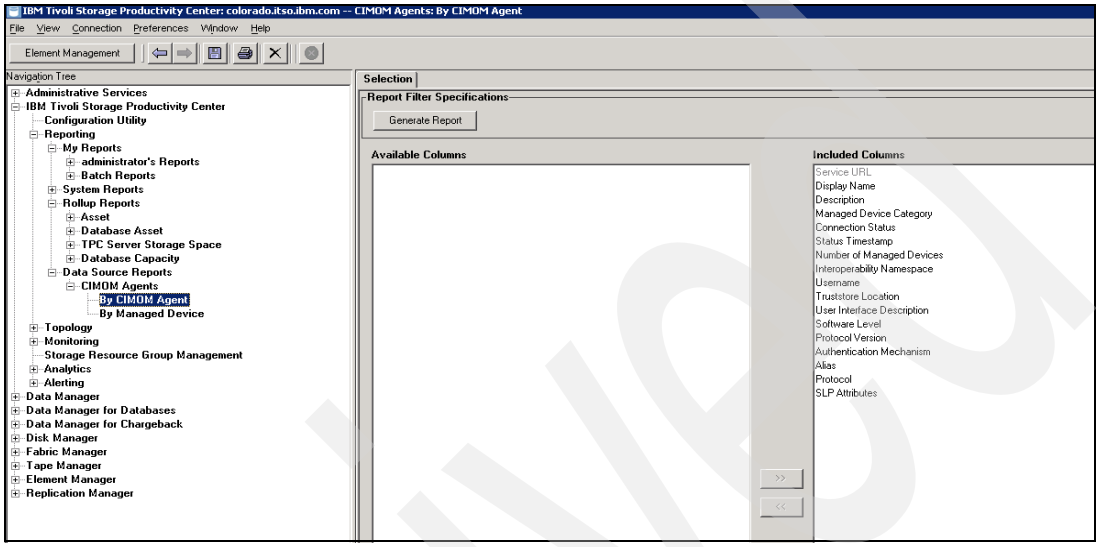


Figure 5-9 CIMOM Report pane

To view the Report, click **Generate report** (see Figure 5-10).

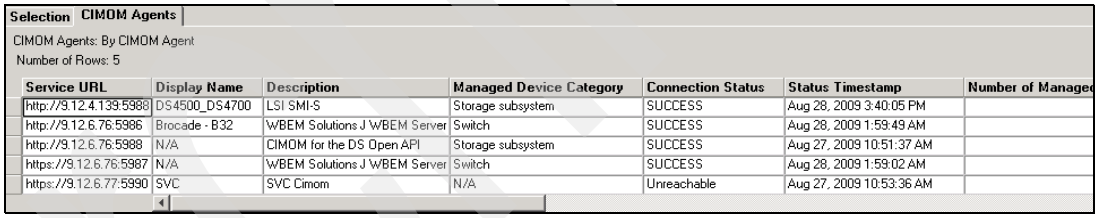


Figure 5-10 CIMOM Agents report

5.3 Out-of-band Fabric agents configuration

Tivoli Storage Productivity Center uses SNMP queries to discover information about the SAN. Management Information Base (MIB) information is collected from the switches and directors by the out-of-band Fabric agent. Switches and directors are added as out-of-band Fabric agents and contacted from the Tivoli Storage Productivity Center Device Server by SNMP.

5.3.1 Functions and limitations

The out-of-band Fabric agent performs the following functions:

- Gathers information about the fabric by querying the switch or director for topology information.
- Gathers information about the zoning and allows zone control (Brocade switch only) of the fabric.
- Gathers virtual SAN information for Cisco switches.

These are some limitations to note:

- Topology information is only gathered for the switch added as an out-of-band Fabric agent. The agent will not be able to gather the topology information for any connected switches unless they are also defined as out-of-band Fabric agents. If you are performing out-of-band discovery only on a fabric with several switches, you must configure an out-of-band Fabric agent for each switch in the fabric to discover the whole fabric.
- Device information is limited; most devices will be unknown with a type equal to “Other” and identified by their WWN.
- For Brocade switches, zoning information is gathered by configuring the out-of-band Fabric agent to also include the admin ID and password for the switch. If a Brocade CIM Agent is present, zoning information is gathered through the CIM Agent rather than the Out-of-band Fabric agent for Brocade.
- There must be a TCP/IP connection between the switch and the Tivoli Storage Productivity Center Device Server.
- To enable events from the switch to the Device Server, the switch must be configured to send SNMP traps to the Device Server. The SNMP traps are synonymous to the events that are received by the in-band Fabric agent.

For information about the supported agent types for switch performance management and fabric zone configuration, see “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109.

5.3.2 Adding an Out-of-Band Agent

To add an Out-of-Band Agent to Tivoli Storage Productivity Center, select **Administrative Services** → **Data Sources** → **Out of Band Fabric Agents** and click the **Add** button on the right panel.

Tivoli Storage Productivity Center shows us a dialog where the IP Address of the has to be entered, as shown in Figure 5-11 for a Brocade switch.

Note: Not all Brocade switches in a fabric should have the admin user ID and password added to gather zoning information. One switch is capable of gathering the information for the entire fabric, but enabling two might be desirable for redundancy. Enabling all of the Brocade switches in a fabric will cause unnecessary activity on the switches. When choosing which switches to enable, thought should be given to the models and firmware levels that make up the fabric. It is best to choose the most powerful switches, particularly those running the highest levels of firmware, as the ones to enable.

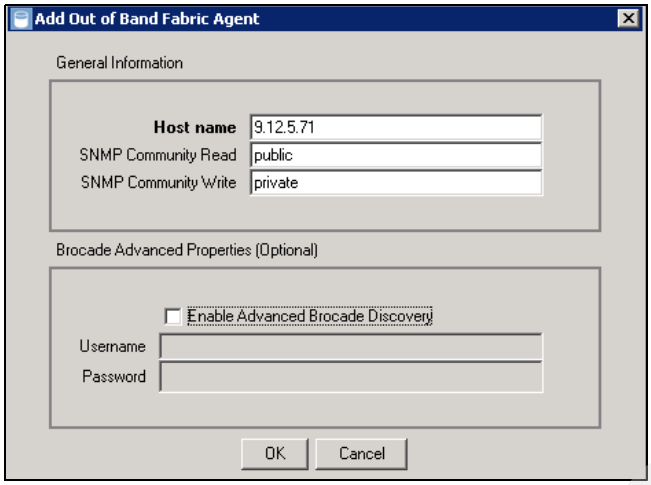


Figure 5-11 Adding an Out of Band Agent

Important: If a CIM Agent for the Brocade switches is already defined and configured in your Tivoli Storage Productivity Center environment, do not check the "Enable Advance Brocade Discovery" check box, because this can interfere with Probes on the devices. If you check the box, you will get a warning message, as shown in Figure 5-12.

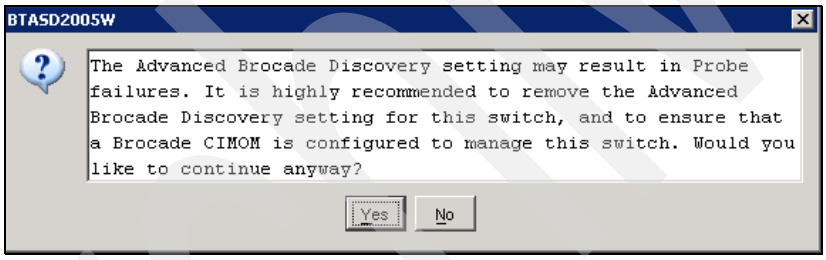


Figure 5-12 Warning message for Probe of Brocade switches

After entering the Out of Band Fabric Agent, we see the Agent entry under **Administrative Services** → **Data Sources** → **Out of Band Fabric Agents** (see Figure 5-13).

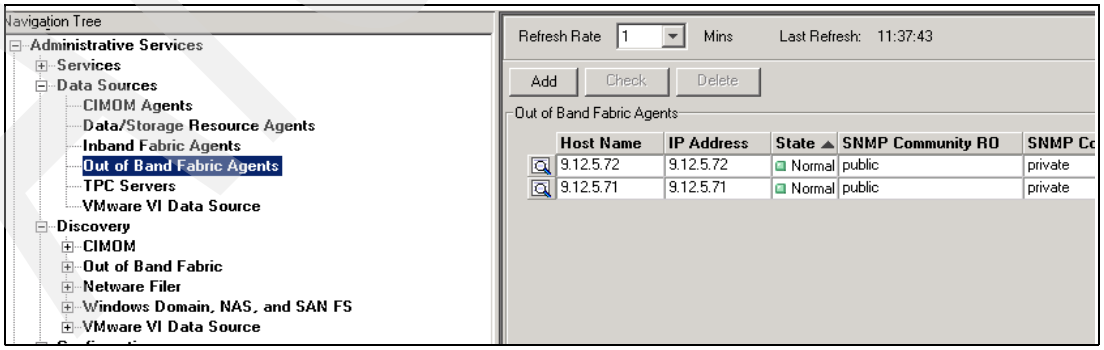


Figure 5-13 Out of Band Fabric Agent configuration complete

If you have many switches, and do not want to enter the information manually, you can edit a Discovery job to search for switches in specific subnets. See "Out-of-Band Agents discovery" on page 164 for detailed steps to set up an Out-of-Band Discovery job.

5.4 Setting up additional data sources

In this section we discuss the configuration of additional data sources for Tivoli Storage Productivity Center.

5.4.1 NAS NetWare

IBM Tivoli Storage Productivity Center for Data can enable storage administrators to monitor, report on, and manage NAS resources.

Refer to “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109 for details on NAS support.

NAS environment considerations

This section contains the requirements for installing and running the Tivoli Storage Productivity Center Data Manager within an NAS environment.

Agent requirements

When installing the Data Agent in an NAS environment, the agent must be installed on a machine that has access to the NAS filers within your environment that you want to monitor:

- Windows:

  The agent that is logging into and scanning the NAS filer is not required to be in the same domain as the user or the NAS filer. If you install the agent on a different domain from the NAS filer, the agent scans the NAS filer if the domain of the agent computer is a “trusted domain” by the domain of the NAS filer.

- UNIX and Linux

  The agent computer must import the NAS filer's exports as NFS mounts (or automounts on Solaris).

Adding an NAS or NetWare server entry

You can manually enter information about NetWare and NAS servers that you want to monitor. After adding it, you can assign an agent for the selected servers by using the procedure in the previous section.

1. Select **Administrative Services** → **Configuration** → **Manual NAS/NetWare Server Entry**
2. To add an NAS server, click **Add NAS server**.
   a. A pop-up window appears (see Figure 5-14). Fill in the parameters and press **OK**:
      - Enter the network name of the NAS server.
      - Select the operating system of the agent that gathers the information for the NAS server.
      - Select the agent from the drop-down list.
      - Specify the SNMP community. IBM Tivoli Storage Productivity Center uses SNMP protocol to contact and identify an NAS filer.
      - Specify the login ID and password to log on to the NAS filer.

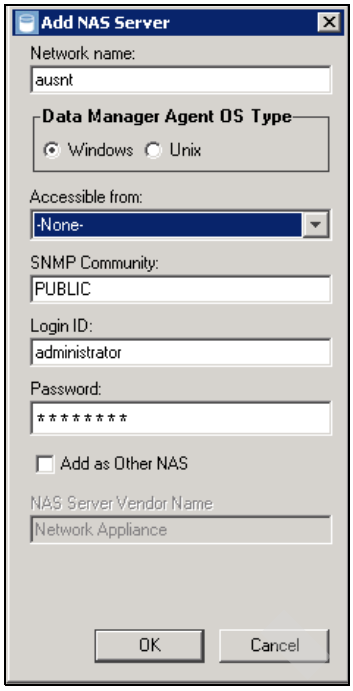


Figure 5-14 Adding NAS server to Tivoli Storage Productivity Center

b. IBM Tivoli Storage Productivity Center contacts the NAS filer and collects information from the NAS filer.

c. Now, you can access the Scan/Probe Agent Administration window and assign agents for the file system.

d. To add NetWare server, click **add NetWare server**.

e. A pop-up window appears. Fill in the parameters and press **OK**.

- Select the NDS tree. The NDS tree information is discovered by probe jobs that are run during agent installation.
- Enter the network name.

f. Tivoli Storage Productivity Center contacts the NetWare Server and collects the volume or file system information of the NetWare server.

g. Now, you can access the Scan/Probe Agent Administration window, and assign agents for the file system.

h. To delete the information that you manually added, highlight the row and click **Delete**.

Data Manager NetWare tree login

The probe job discovers the NetWare servers in your environment during Agent installation. In this window, you can edit NetWare server login information.

Tivoli Storage Productivity Center uses this login data to contact the NetWare server and collect necessary information about NetWare server.

1. Select **Administrative Services** → **Configuration** → **NetWare Tree Logins**.
2. Highlight the row and click **Edit**.
3. You can edit the following information:
   – Discovering agent, select the agent from the drop-down list.

- Logon ID: Specify the fully qualified ID. This ID must have permission to enumerate the volumes in the NetWare server and to scan any selected file system.
- Password

4. Save to make the changes permanent.

5.4.2 Configuring VMware environments

Tivoli Storage Productivity Center supports the VMware Virtual Infrastructure which consists of the ESX Server and VMware VirtualCenter. See “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109 for details on the Tivoli Storage Productivity Center VMware support.

Before you can display reports or see the topology for VMware Virtual Infrastructure, you must configure the VMware environment.

You must complete the following general steps:

1. If the VMware Virtual Infrastructure uses SSL certificates for communication, you will have to use keytool to manually import the SSL certificates into a truststore. Each Virtual Infrastructure data source provides an individual certificate. There will be a default truststore registered in the Device Server’s system properties file. Keytool is a tool shipped with the Java run-time environment. For information about how to import the SSL certificates, see “Importing SSL certificates for VMware” in *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide V 4.1*, SC27-2337.
2. Add the VMware VI data source. The data source can be a hypervisor (ESX Server or VirtualCenter). This is the first step in getting information from VMware Virtual Infrastructure. Adding a VMware Data Source is similar to adding a CIM Agent or Data agent. To do this, select **Administrative Services** → **Data Sources** → **VMware data Source**. Select the button **Add VMware VI Data Source** from the right panel.

   Tivoli Storage Productivity Center presents a dialog where the basic information about the VMware has to be entered, as shown in Figure 5-15:

   - Host Name (or IP address), protocol (http or https), and port for the VMware.
   - User ID and password
   - Display name (optional)
   - Description (optional)

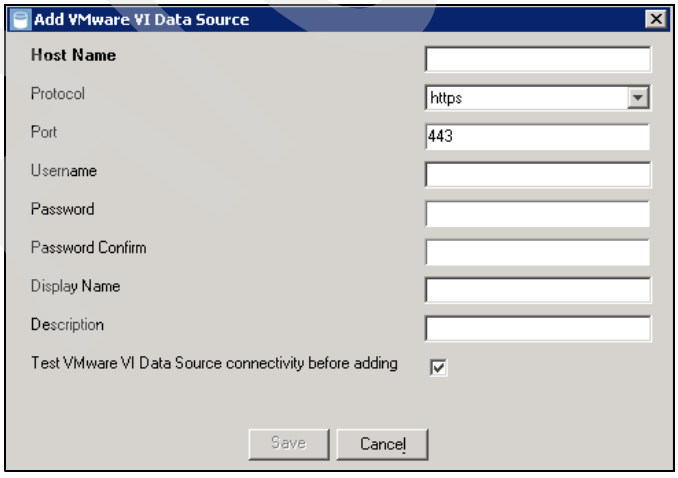


Figure 5-15 Adding a VMware Data Source

5.4.3 Other Tivoli Storage Productivity Center servers

You can consolidate multiple reports from multiple TPC servers, by associating subordinate TPC servers with the master server. Select **Administrative Services** → **Data Sources** → **Tivoli Storage Productivity Center Servers** and click the **Add TPC Server** button in the right panel, as shown in Figure 5-16:

- Host Name
- Host Device Server port (default is 9550)
- Host Authentication password
- Display Name and Description (optional)

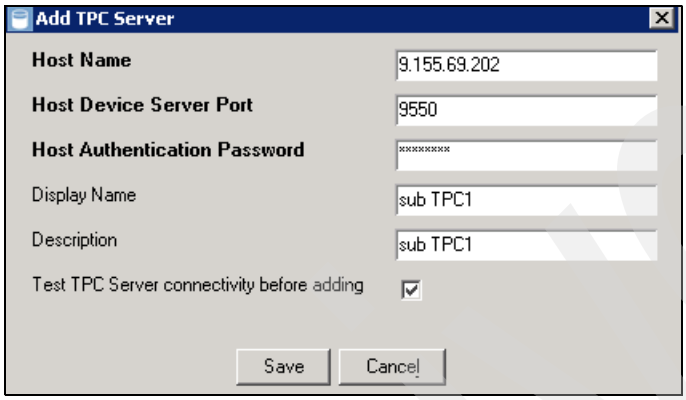


Figure 5-16 Adding a subordinate TPC Server

Rollup reports

Use rollup reports to view the storage information collected by the master Tivoli Storage Productivity Center server from its associated subordinate servers.

After you have defined one or more Tivoli Storage Productivity Center subordinate servers, to generate rollup reports you have to:

- Run Discoveries, Probes, and Scans from the subordinate servers to gather information about their locally-monitored storage entities.
- Run Discoveries, Probes, and Scans from the master server to gather information about its locally-monitored storage entities. Note that information about the storage entities monitored by a master server are automatically shown in rollup reports.
- Run Tivoli Storage Productivity Center Server probes from the master against the subordinate servers to collect their storage information for the rollup reports. See “Probing Tivoli Storage Productivity Center Servers” on page 170 for detailed steps to define a Tivoli Storage Productivity Center Server Probe job.

Note:

- If the same storage entity is managed by multiple subordinate servers, rollup reports reflect the storage information from the subordinate server that most recently probed that entity.
- After upgrading to Tivoli Storage Productivity Center V4.1 or later from a previous version of the application, you must run probes against a master server’s monitored storage assets to have information about those assets appear in **Tivoli Storage Productivity Center** → **Reporting** → **Rollup Reports**.

5.5 Jobs types

Create data collection jobs to gather information about the storage resources in your environment. There are different data collection jobs within Tivoli Storage Productivity Center depending on the type of information is collected and from which types of resources the information is retrieved: discovery, probes, Tivoli Storage Productivity Center Server Probes, Scans, and Pings.

5.5.1 Discovery: Discovering storage resources

The process of finding resources within an enterprise, including detection of network topology, is called discovery. Use discovery jobs to collect basic information about the storage resources in your environment, including computers, CIMOMs, storage subsystems managed by CIMOMs, fabrics and switches managed by CIMOMs, NetWare trees, filers, clusters, and tape libraries. You must run discovery jobs before you can collect more detailed information about storage resources using probes, scans, and pings.

Tivoli Storage Productivity Center supports a variety of discovery types. Use discovery jobs to find new CIMOMs, Out of Band Fabrics, NetWare Filers, Windows Domains, NAS filers, and SAN File System that have been introduced into your environment.

The discovery types in Tivoli Storage Productivity Center are summarized in Table 5-3. Additionally the table summarizes the types of information that each discovery provides.

Table 5-3 Discovery types, their data sources, and top-level entities that are discovered

Type of discovery	Data source	Top-level entities
CIMOM	CIM Agent	► Fabric (switches) ► Storage subsystems ► Tape subsystems
Out-of-band	SNMP agents on the switches	Fabric (switches). A fabric discovery gets all the fabric information switches that have been added as out-of-band agents. All information is collected by using the SNMP protocol to send queries across the IP network to the management information bases (MIBs) supported on the switch.
NetWare Filer	NetWare agent	NetWare trees
Windows domain, NAS	Data agent	► Computers ► Filers ► Clusters ► Names or agents
VMWare VI	VMWare VI data source	The data source can be a hypervisor (ESX Server or VirtualCenter).

As a general rule, discovery only provides information about the existence of a resource. Use probes and scans to obtain detailed information about a specific resource after it has been discovered.

CIMOM discovery

This topic describes how the Tivoli Storage Productivity Center manages and monitors disk, switch, and tape devices through Common Information Model Object Managers (CIMOMs).

Note: CIMOM can be referred to by a variety of names, such as CIM Agents or SMIS agents. A CIM Agent consists of a CIMOM and an SMIS provider for the managed device.

CIM Agents on the same subnet as the Tivoli Storage Productivity Center Device Server are automatically discovered with CIMOM discovery. If CIM Agents are not in the same subnet, they can be discovered using a Service Location Protocol (SLP) Directory Agent (DA) or they can be added manually. If you do not want Tivoli Storage Productivity Center to discover CIM Agents in the local subnet, clear the Scan local subnet box in the CIMOM discovery Options panel. To include SLP Directory Agents in the discovery, add the IP address of the DA in the CIMOM discovery Options panel and click **Add**.

CIMOM discovery has several purposes. It can scan the local subnet to find CIM Agents and contact CIM Agents that have been added through the dialog. After it has found a CIM Agent, it attempts to log in and discover the storage entities being managed by the CIM Agent. If a CIM Agent is discovered but requires login information, you need to enter it in the View and Edit CIMOM panel and then rerun the discovery to collect the information for the storage entities. The amount of time CIMOM discovery takes depends on the number of CIM Agents, the number of storage entities, and whether you are scanning the local subnet.

CIMOM discovery can be run on a schedule. How often you run it depends on how dynamic your environment is. It must be run to detect a new subsystem. CIMOM discovery also performs basic health checks of the CIM Agent and subsystem.

For Tivoli Storage Productivity Center to successfully communicate with the CIM Agents, the CIMOM service must be accessible through the IP network. The TCP/IP network configuration on the host where Tivoli Storage Productivity Center is installed must include in its list of domain names, all the domains that contain storage devices that are discoverable by Tivoli Storage Productivity Center.

See 5.2.2, “Adding the CIMOM to Tivoli Storage Productivity Center” on page 150 for detailed steps on defining a CIMOM discovery job.

Limitation when running a CIMOM Discovery against a McDATA CIM Agent

When you run a CIMOM discovery against a McDATA CIM Agent, the following switch information is collected:

- Manageable McDATA switches that exist in the fabric.
- Unmanageable switches that connect to the manageable McDATA switches. In a homogenous fabric, a McDATA switch is considered unmanageable when it is managed by an Enterprise Fabric Connectivity Manager (Proxy Mode) or a McDATA CIM Agent (Direct Mode) other than the McDATA CIM Agent against which you ran a CIMOM discovery. In a heterogeneous fabric, unmanageable switch is either a non-McDATA switch or a McDATA switch which is managed by different Enterprise Fabric Connectivity Manager in proxy mode or different McDATA CIM Agent in direct mode.

You can use Tivoli Storage Productivity Center to view detailed information about the manageable McDATA switches and collect performance data about them. For unmanageable switches, you can use Tivoli Storage Productivity Center to view their WWN and port numbers which connect to manageable McDATA switches only, and you cannot collect performance data about them.

Out-of-Band Agents discovery

The Fabric Manager uses SNMP queries to discover information about selected fabric switches. Management Information Base (MIB) information is collected from those switches.

Out-of-band agents are configured for the Device Server and contacted from the server through SNMP.

To create an Out-of-Band Discovery job, complete the following steps:

1. Select **Administrative Services** → **Discovery** → **Out of Band Fabric**. The **Edit Out of Band Fabric** pane opens.
2. From the **When to Run** tab select job schedule characteristics (see Figure 5-17):
   - Run now
   - Run once at a certain time
   - Run repeatedly

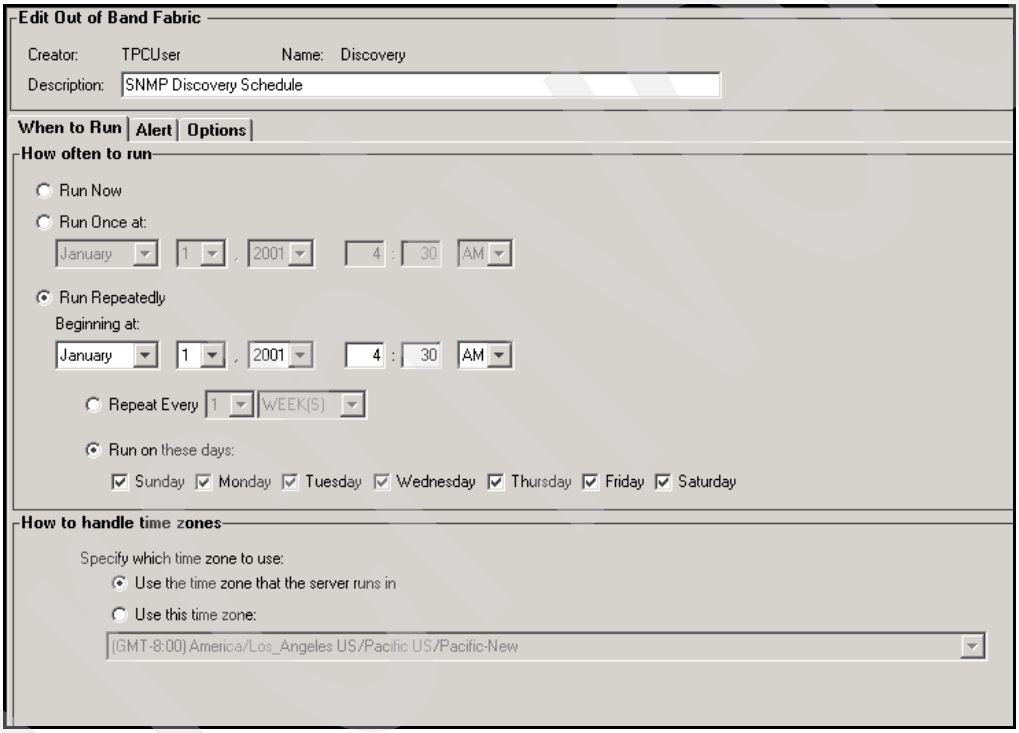


Figure 5-17 Discovery Job - When to Run tab

3. In the **Alert** tab specify the action to be taken if the monitor fails (see Figure 5-18).

   In the **Triggered Actions** area, select actions to trigger when the data collection task fails.

   You can choose from the following check boxes:

   - SNMP Trap. See
   - TEC Event.
   - Login Notification
   - Windows Event Log
   - Run Script
   - Email

Depending on what action you select, you might have other choices to make. Suppose that you select the **Windows Event Log** check box, for example. The **Event Type** field becomes activate to specify a severity for the event in the Windows event log.

See 5.8, “Tivoli Storage Productivity Center alert disposition” on page 187 for detailed description of how configure TPC to send SNMP Trap and IBM Tivoli Enterprise Console events.

See 5.7, “Working with scripts” on page 185 for description of how configure TPC to run scripts.

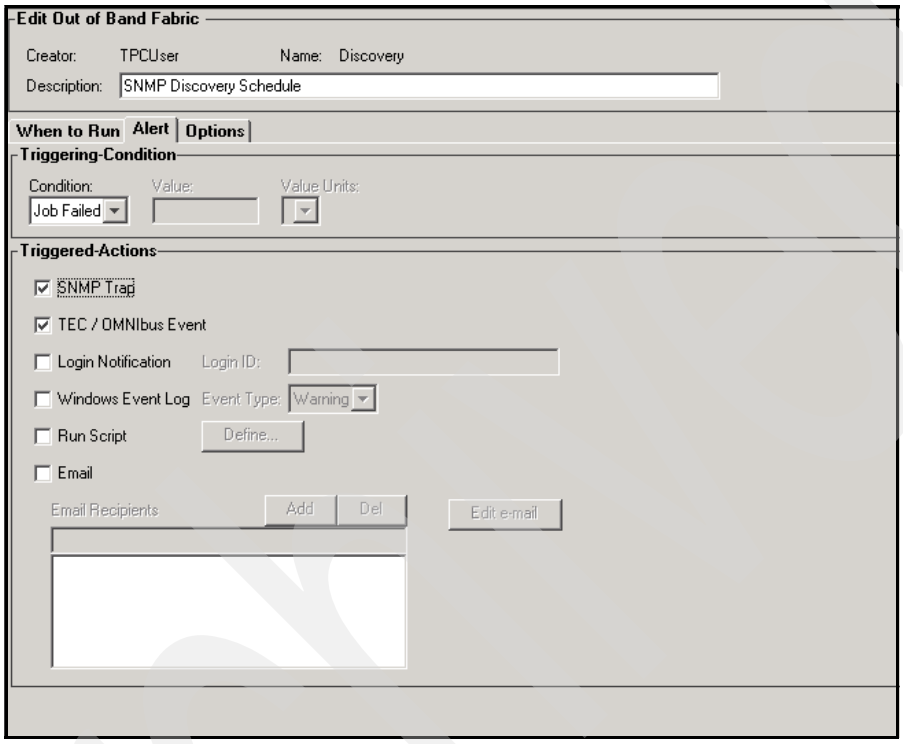


Figure 5-18 Discovery job - Alert tab

4. In the **Option** tab you can configure additional settings for the job (see Figure 5-19):
   - Default SNMP community
   - SNMP Scans time-out
   - Range of the IP Addresses to scan

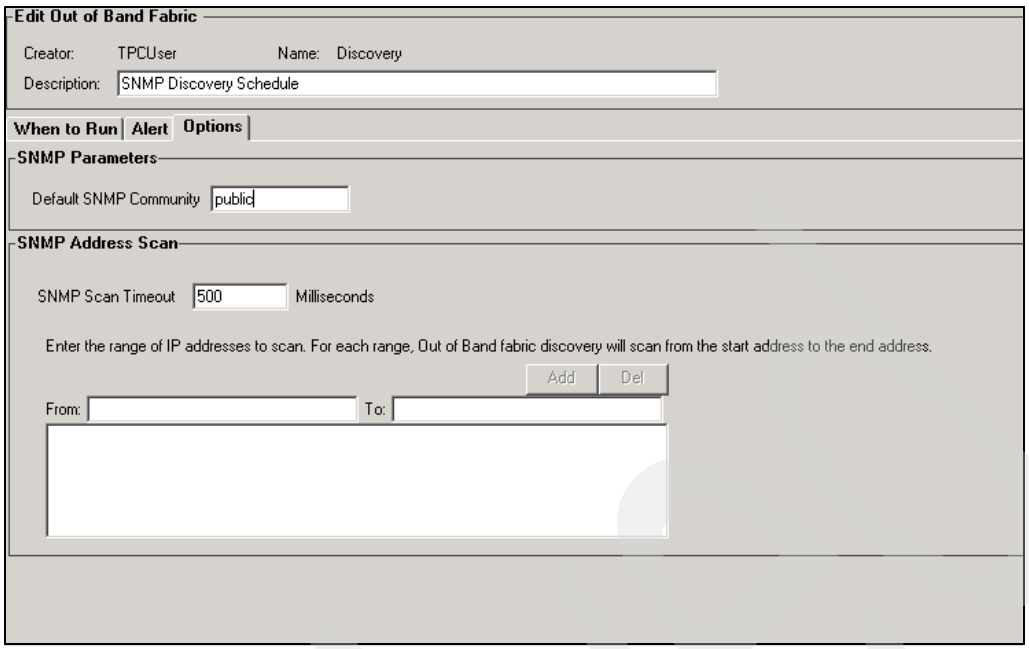


Figure 5-19 Discovery job - Options tab

5. Save to create the Discovery job
6. You can follow the status of the probe job by selecting **Administrative Services** → **Discovery** → **Out of Band Fabric** → **date-time-of-run** (see Figure 5-20).

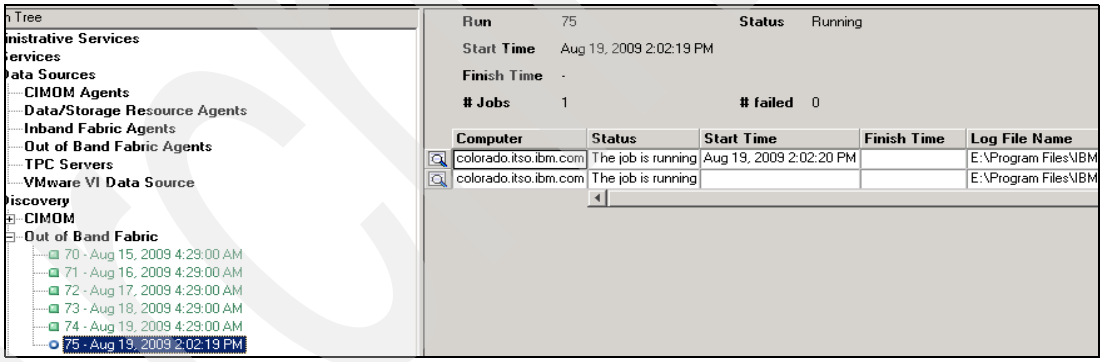


Figure 5-20 Discovery Job - Job status

Discovering NetWare Filer systems

The Data Agent cannot be deployed on a NetWare Filer system.

To discover NetWare Filer systems, complete the following steps:

1. In the Navigation Tree pane, expand **Administrative Services** → **Discovery**.
2. Right-click NetWare Filers and click **Run Now**
3. Save to create the Discovery Job.
4. You can follow the status of the probe job by selecting **Administrative Services** → **Discovery** → **Netware Filer** → **date-time-of-run.**

Discovering computers in the Windows domain, NAS

To discover Windows computers that do not have Data agents in your Windows domain, or to discover NAS Filers, complete the following steps:

1. In the Navigation Tree pane, expand **Administrative Services** → **Discovery**.
2. Click **Windows Domain, NAS, and SAN FS** and configure the "**When to Run**", "**Alert**" and "**Options**" tabs (see "Out-of-Band Agents discovery" on page 164 for detailed steps).
3. Save to create the Discovery job
4. You can follow the status of the probe job by selecting **Administrative Services** → **Discovery** → **Windows Domain, NAS, and SAN FS** → **date-time-of-run**

Discovering VMware VI Data Sources

1. In the Navigation Tree pane, expand **Administrative Services** → **Discovery** → **VMware VI Data Source**.
2. Click **VMware VI Data Source** and configure the "**When to Run**" and "**Alert**" tabs (see "Out-of-Band Agents discovery" on page 164 for detailed steps).
3. Save to create the Discovery job
4. You can follow the status of the probe job by selecting **Administrative Services** → **Discovery** → **VMware VI Data Source** → **date-time-of-run**

5.5.2 Probes: Collecting storage statistics

Probe jobs collect detailed statistics about all the assets of the managed infrastructure, such as computers, disk controllers, hard disks, clusters, fabrics, storage subsystems, LUNs, tape libraries, and file systems. Probe jobs can also discover information about new or removed disks and file systems. Probe jobs can be directed against any elements in the managed infrastructure. In our examples, we run the Probe job against storage subsystems.

You can define any number of probes to collect statistics for different storage resources at different times.

- From the **IBM Tivoli Storage Productivity Center** node you can collect statistics on computers, disk controllers, hard disks, clusters, fabrics, storage subsystems, volumes, tape libraries, and file systems.
- From the **Data Manager for Databases** node you can itemize and create an inventory of the files, instance, logs, and objects that make up your enterprise's monitored RDBMSs.

> **Note:** The login ID that Data Manager for Databases uses to log into Microsoft SQL Server instances that you want to probe must have "Permit" access. For information about how to set the logins for Microsoft SQL Server instances, see *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337.

To ensure the accuracy and consistency of the data that appears in the reports, run regularly scheduled probes against the hosts that use or import volumes and the storage subsystems upon which you want to report. You should run probes against storage subsystems after running them against any hosts.

Creating Probe jobs

In this section we describe the required steps to configure Probe jobs with Tivoli Storage Productivity Center.

IBM Tivoli Storage Productivity Center Probe

To create the Probe job, complete the following steps:

1. Select **IBM Tivoli Storage Productivity Center** → **Monitoring** → **Probes**. Right-click and select **Create Probe**.
2. You can add computer, computer groups, clusters, storage subsystem groups, or storage subsystems for the probe job to run from the tab **What to Probe** (see Figure 5-21). You can create separate probe jobs for different groups.

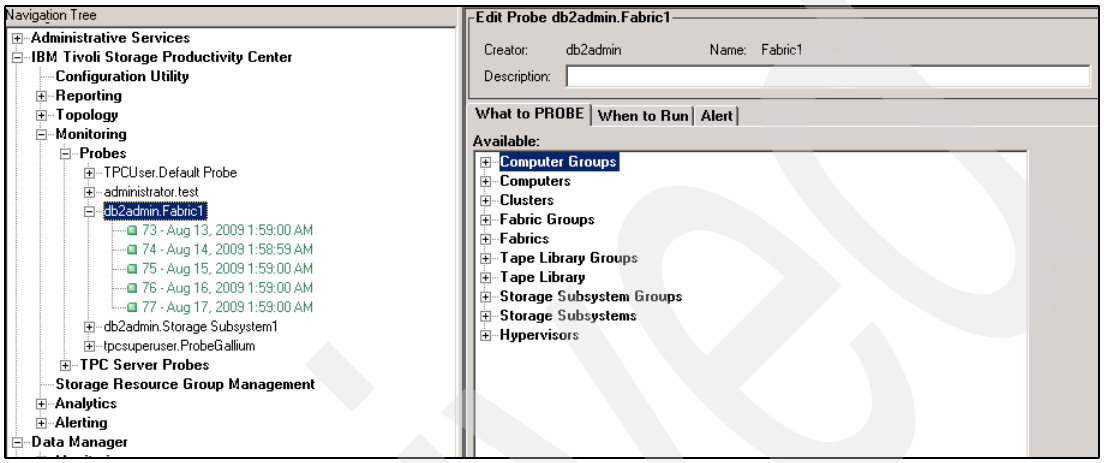


Figure 5-21 creating a probe job

3. In our example, we select the Storage Subsystem DS8000 to probe, selecting the device in the left side of the "**What to PROBE**" pane (**Available**) and improving to the right side (**Current Selection**) by clicking on "**>>**" (see Figure 5-22).

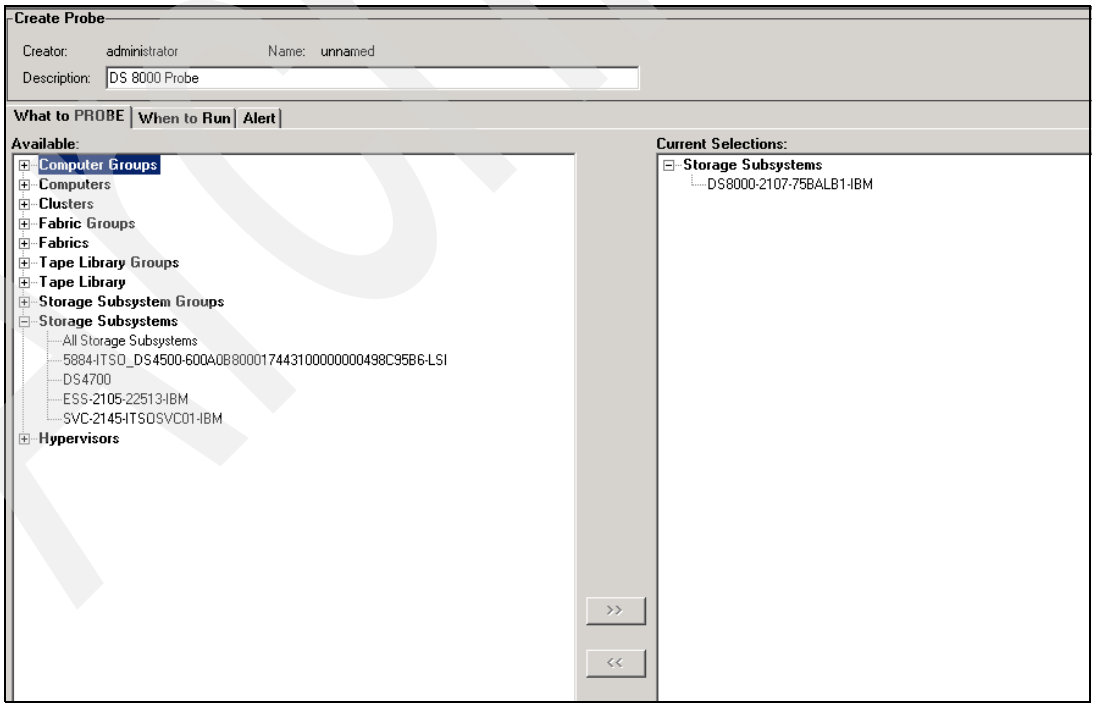


Figure 5-22 creating a Probe Job- adding resources

4. Configure the “**When to Run**” and “**Alert**” tabs (see “Out-of-Band Agents discovery” on page 164 for detailed steps)
5. Save to create the Probe Job.
6. You can follow the status of the probe job by selecting **IBM Tivoli Storage Productivity Center** → **Monitoring** → **Probes** → **Probe-job-name** → **date-time-of-run**.

Note: You can only run probes to collect information for the Fabric(s), not for the switches.

Probing Databases

Note: Before a Database is available for probing, all agents, which run for database reports, must be registered using the Databases portion of the License Key Editor. See 5.9, “Database management” on page 189 for detailed steps to register a Database.

To create a Probe job for Databases, complete the following steps:

1. Expand **Data Manager for Databases** → **Monitoring** → **Probes**. Right-click **Probes** and select **Create Probe**.
2. In the **Instances** tab, highlight the resource you want to probe and move it from the **Available** list box to the **Current Selection** list box, by clicking on the “>>” button (see Figure 5-23).

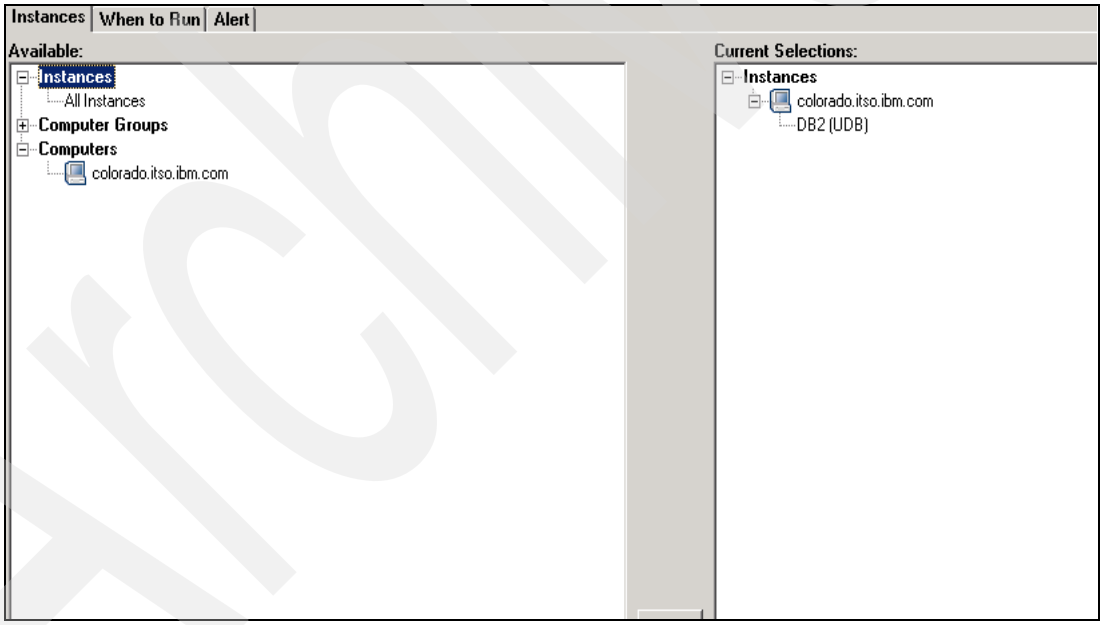


Figure 5-23 Creating a Database Probe Job - adding resources

3. Configure the “**When to Run**” and “**Alert**” tabs (see “Out-of-Band Agents discovery” on page 164 for detailed steps).
4. Save to create the Probe job.

You can follow the status of the probe job by selecting **Data Manager for Databases** → **Monitoring** → **Probes** → **Probe-job-name** → **date-time-of-run**.

Probing Tivoli Storage Productivity Center Servers

If you are using roll-up reports, run Tivoli Storage Productivity Center server probes from the master server to collect storage information that has been gathered by subordinate servers.

Before you run Tivoli Storage Productivity Center server probes, make sure to perform the following:

1. Associate subordinate servers with the master server on the Administrative Services → Data Sources → TPC Servers window. See 5.4.3, “Other Tivoli Storage Productivity Center servers” on page 161 for steps information about how to associate subordinate servers with a master server.
2. Run discoveries, probes, and scans on the subordinate servers to gather information about their locally-managed entities.

To create a Tivoli Storage Productivity Center server probe, complete the following steps:

1. Expand **IBM Tivoli Storage Productivity Center → Monitoring → TPC Server Probes**. Right-click **TPC Server Probes** and select **Create TPC Server Probes**
2. In the **What to Probe** page select the subordinate TPC Servers you want to Probe.

   You can expand the node for a subordinate server and select the specific entities for which you want to collect data: All Resources, Clusters, Computer Groups, Computers (including Hypervisors), Database Instances, Fabrics, RDBMS Computer Groups, Storage Subsystem Groups, and Storage Subsystems.
3. Configure the “**When to Run**” and “**Alert**” tabs (see “Out-of-Band Agents discovery” on page 164 for detailed steps)
4. Save to create the Probe Job.

Note: If the same storage entity is managed by multiple subordinate servers, rollup reports reflect the storage information from the subordinate server that most recently probed that entity.

Asset reports

After a Probe Job has run, you are able to generate an asset report for the probed resource.

Several reporting types are reports are available with Tivoli Storage Productivity Center and located in different nodes of the Tivoli Storage Productivity Center tree, depending on the probed resource:

- **IBM Tivoli Storage Productivity Center → Reporting → System Reports**
- **Data Manager → Reporting**
- **Data Manager for Databases → Reporting**
- **Disk Manager → Reporting**
- **Fabric Manager → Reporting**
- **Tape Manager → Reporting**

Moreover, you will find additional reports in:

- **IBM Tivoli Storage Productivity Center → Reporting → My Reports → Administrator’s Reports** and **Data Manager for Databases → My Reports → Administrator’s Reports**

  If any customized report has been saved from a Tivoli Storage Productivity Center administrator.

- **IBM Tivoli Storage Productivity Center → Reporting → My Reports → Batch Reports** if any Batch Report has been defined (see for details on Batch Reports)

For more detailed information about the various reporting categories available after a Job, refer to *IBM Tivoli Storage Productivity Center User's Guide*, SC27-2338, Chapter 5. Reporting ¨ Choosing a reporting type.

5.5.3 Pings: Determining the availability of storage resources

Use pings to collect information about the availability of the storage resources in your environment. You can view the information collected by pings in Availability and System reports.

Pings enable you to monitor and report on the availability of your storage from a network point of view or from a computer uptime perspective. See the percentage of off-network time due to network problems or system downtime. Define any number of pings that each check the availability of a unique storage resource.

Creating a Ping job

To create a Ping job, complete the following steps:

1. Select **Data Manager → Monitoring → Pings**.
2. Right-click and select **Create Ping**.
3. You can add a computer, computer groups, or clusters for the Ping job to run against (see Figure 5-24).

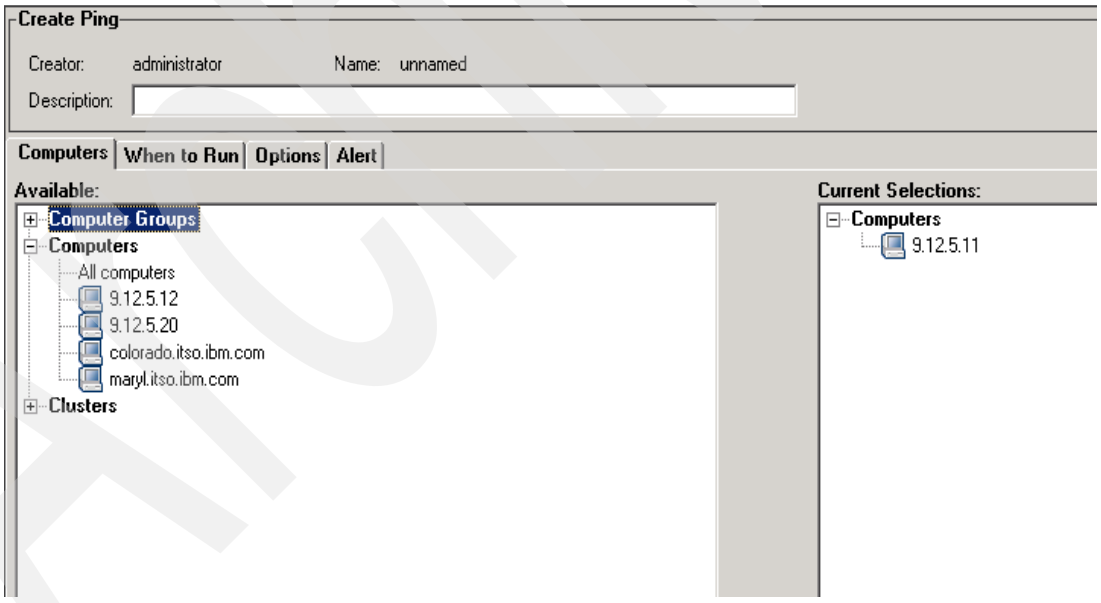


Figure 5-24 Create a Ping job

4. You can create separate Ping jobs for different groups, if you want, for example, one Ping job for computers that have DB2 and one Ping job for Linux computers.
5. Configure the "**When to Run**" and "**Alert**" tabs (see "Out-of-Band Agents discovery" on page 164 for detailed steps).
6. In the "**Options**" tab you can configure the frequency for saving the ping statistics (see Figure 5-25).

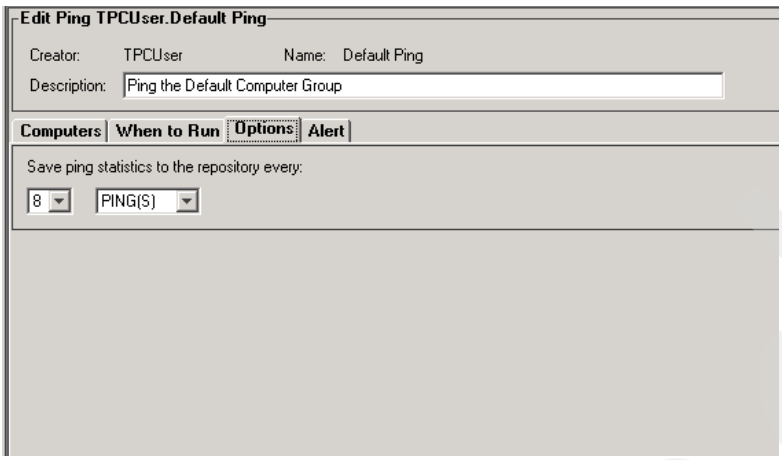


Figure 5-25 Ping job - Option tab

7. Press Ctrl-S to create and save the Ping job.
8. You can follow the status of the Ping job by selecting **Data Manager** → **Monitoring** → **Pings** → **Ping-job-name** → **date-time-of-run**. See Figure 5-26.

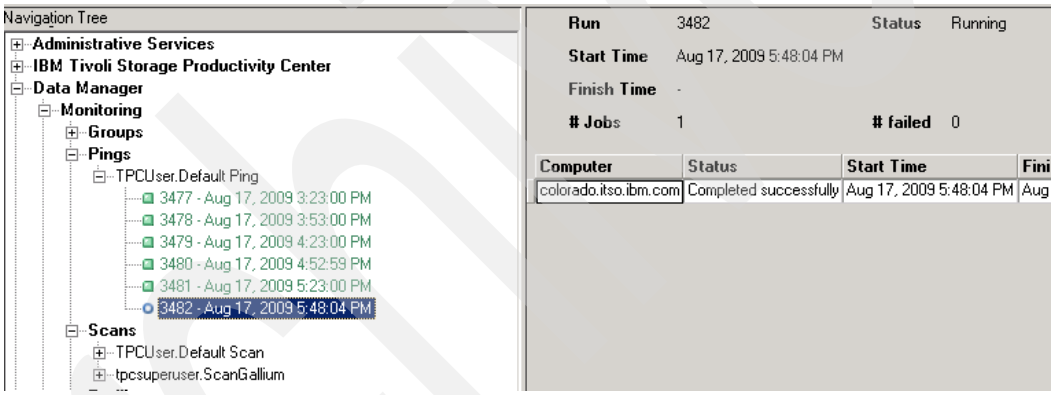


Figure 5-26 Ping - Job status

Availability report

After a Ping Job has run, you are able to generate an availability report for the pinged computers.

The Ping report is available in the following TPC node:

- **Data Manager** → **Reporting** → **Availability** → **Ping**

For more detailed information about the various reporting categories available after a Job, refer to ¨Choosing a reporting type" in Chapter 5. Reporting in *IBM Tivoli Storage Productivity Center User's Guide*, SC27-2338.

5.5.4 Scans: Collecting storage usage and trending information

Use scans to collect statistics about the usage and trending of storage consumption within your environment. You can view the information collected by scans in Capacity, Usage, Usage Violations, Backup, and System reports, as well as use that information as part of quota analysis. Refer to "Planning for Policy Management" on page 88 for a description of the planning for Policy Management.

Scans are always directed against a Data agent and deliver very detailed information about the file systems, files, and RDBMS objects (instances, databases, devices, table spaces, tables, indexes, datafiles, containers) of computers. Use the statistics gathered by scans to:

- View information about when storage resources are created, accessed, and modified and by what group or user.
- Map the actual storage resource to the consumers of that resource.
- Generate a historical view of storage consumption to help determine usage trends over time.

You can define any number of scans to gather information about different storage resources at different times.

Creating Scan jobs

In this section we describe the required steps to configure Scan Jobs with IBM Tivoli Storage Productivity Center.

Data Manager Scan job

To create the Scan job, perform the following steps:

1. Select **Data Manager** → **Monitoring** → **Scans**. Right-click and select **Create Scan**.
2. You can add file systems, a computer, computer groups, or clusters to the scan job, which runs as shown in Figure 5-27.

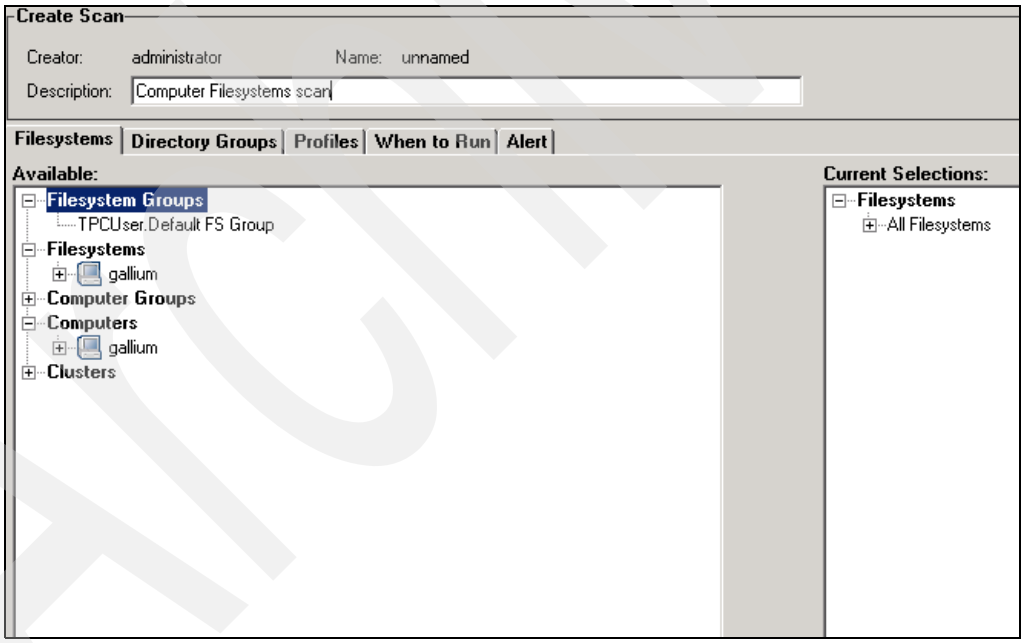


Figure 5-27 Creating a scan

3. You can add specific directories to the scan job from the "**Directory Groups**" tab:
   a. Click the **Directory Groups** tabs.
   b. Select the **Available Directory Groups** or create one by clicking **New Directory Group**.
   c. Click **New Computer**.
   d. A pop-up window appears. Select the computer name from the list and add the directory for the selected computer. Press **Add**.

e. Click **OK** and save the directory group by pressing Ctrl-S.

4. Select the **Profile** tab to customize the Scan job, as shown in Figure 5-28.

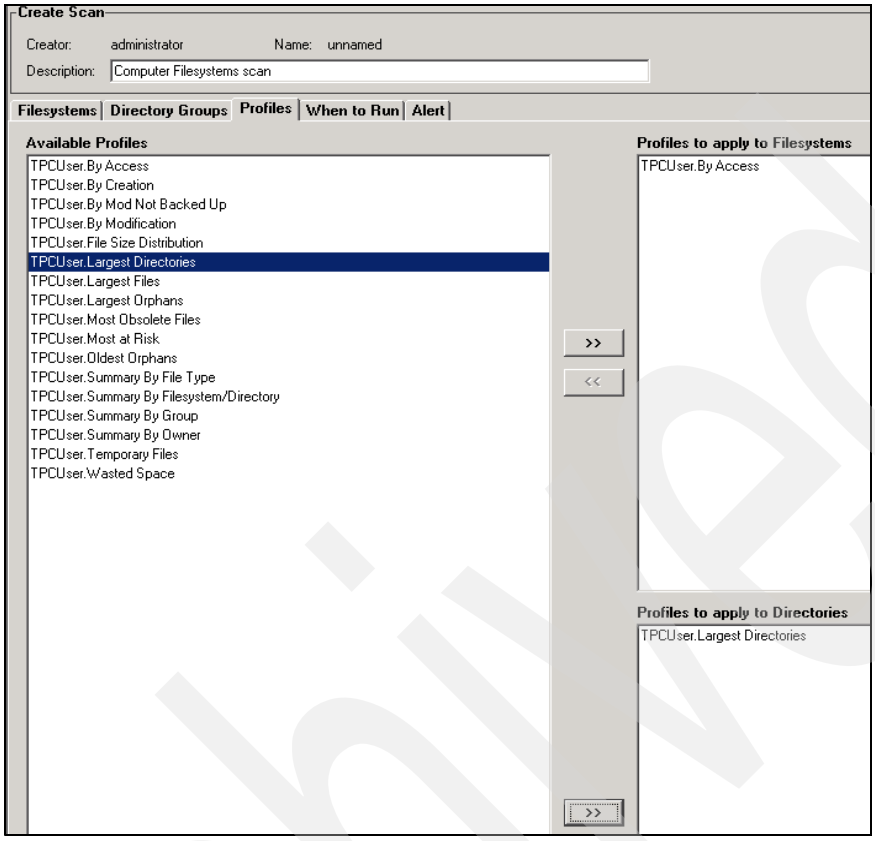


Figure 5-28 Scan job Profile selection

5. Configure the "**When to Run**" and "**Alert**" tabs (see "Out-of-Band Agents discovery" on page 164 for detailed steps).

6. Save to create the Scan job.

7. You can follow the status of the Scan job by selecting **Data Manager** → **Monitoring** → **Scans** → **scan-job-name** → **date-time-of-run** as shown in Figure 5-29.

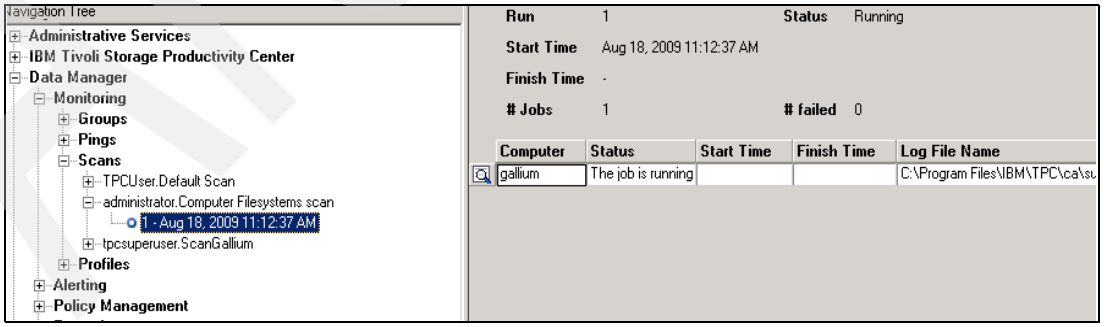


Figure 5-29 Scan job status

Profiles

A Profile enables you to define which statistical information you plan to gather during the Scan. IBM Tivoli Storage Productivity Center comes with a predefined set of profiles. You can find the information about default profiles in Table 5-4.

Table 5-4 List of Profiles

Profile name	Description
Most At Risk	Statistic about the number of files that are modified (longest) but not backed up since modified (20 files are the default) (Windows only).
By Access	Statistics about the file based on their access time.
By Creation	Statistics about the file based on their creation time (Windows only).
By Mod Not Backed Up	Statistic about files that are modified but not backed up since the modification (Windows only).
By Modification	Statistics about files by length of time since last modification.
File Size Distribution	Information about the size of the files.
Largest Directories	Statistics for the number of largest directories (20 directories are the default).
Largest Files	Statistics for the number of largest files (20 files are the default).
Largest Orphans	Statistics for the number of largest orphans. Orphans are the files that have no owner since they were created (20 files are the default).
Most Obsolete Files	Statistics for the number of most obsolete files. Obsolete files are the files that have not been modified or accessed for a long time (20 files are the default).
Oldest Orphans	Statistics for the number of oldest orphans (20 file is the default).
Summary By File Type	Summary based on file type.
Summary By File System/Directory	Summary based on file system/directory.
Summary By Group	Summary based on groups.
Summary By Owner	Summary based on owner.
Temporary Files	Statistics for files that are not owned by the operating system and have not been not accessed in one year.
Wasted Space	Statistics for space usage for space that is not owned by the operating system and has not been accessed in one year.

To create a user defined profile, perform the following steps:

1. Select **Data Manager** → **Monitoring** → **Profiles**.
2. Right-click and select **Create Profile**.
3. In the Statistics tab, you can define several options for the files to be included in the Profile (see Figure 5-30):
   a. **Summary space usage by**:
      - File system
      - Owner
      - Group
      - File types

b. **Gather statistics by length of time since**:

- Last access
- Creation
- Last modification
- Last modification (not backed up)

c. **Accumulate history**. From here you can define how long to retain the data gathered in the TPC database, and if or not maintain weekly and monthly averages (and for how long).

d. **Gather information about the**:

- Size of the distribution
- Largest file
- Largest directories
- Most obsolete files
- Most at risk files
- Largest orphaned files
- Oldest orphaned files

4. Optionally, define the number of files to gather information about as shown in Figure 5-30.

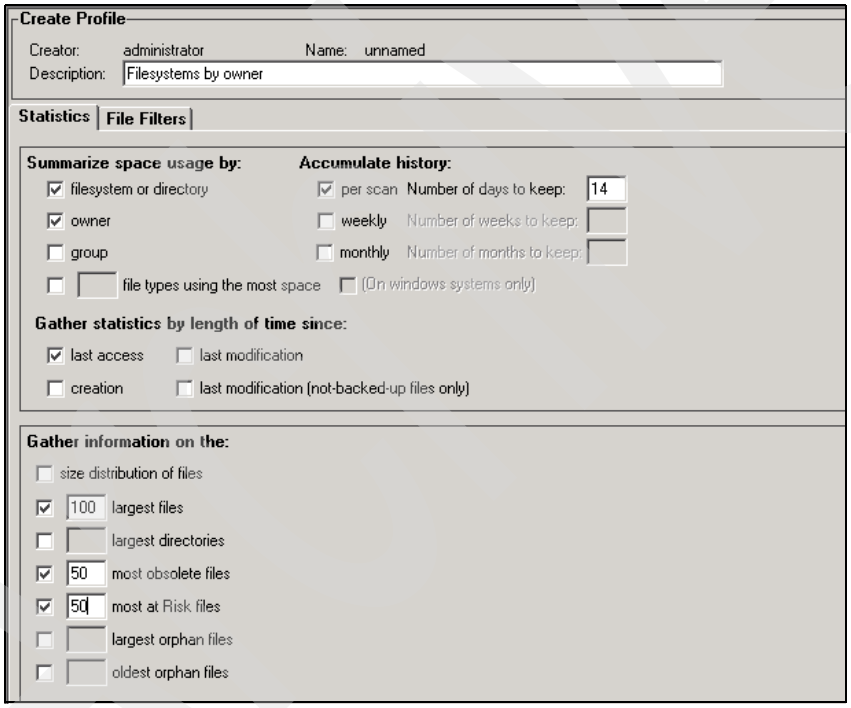


Figure 5-30 Creating profiles based on file attributes

5. Press Ctrl-S to save and create the Profile. Continue to use these windows if you want to create more profiles with your own definitions.

Data Manager for Databases Scan job

To create the Scan job, perform the following steps:

1. Select **Data Manager for databases** → **Monitoring** → **Scans**. Right-click and select **Create Scan.**
2. In the **Instances** tab, highlight the resource that you want to probe and move it from the **Available** list box to the **Current Selection** list box, by clicking the "**>>**" button (see Figure 5-31).

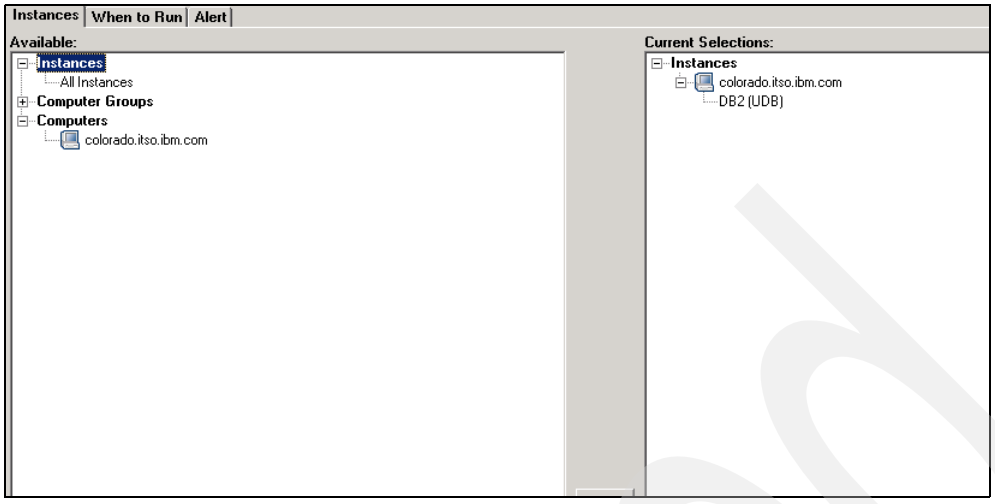


Figure 5-31 creating a Data Manager for databases Probe - adding resources

3. Configure the "**When to Run**" and "**Alert**" tabs (see "Out-of-Band Agents discovery" on page 164 for detailed steps).
4. Save to create the Scan job.
5. You can follow the status of the scan job by selecting **Data Manager for Databases** → **Monitoring** → **Probes** → **Probe-job-name** → **date-time-of-run**.

Usage and Trending reports

After a Scan Job has run, you are able to generate Usage and Trending reports for the probed resource.

Several reporting types are reports are available with TPC and located in different nodes of the TPC tree, depending on the probed resource:

- **IBM Tivoli Storage Productivity Center** → **Reporting** → **System Reports**
- **Data manager** → **Reporting**
- **Data Manager for Databases** → **Reporting**
- **Disk Manager** → **Reporting**
- **Fabric Manager** → **Reporting**
- **Tape Manager** → **Reporting**

Moreover, you will find additional reports in:

- **IBM Tivoli Storage Productivity Center** → **Reporting** → **My Reports** → **administrator's Reports** and **Data Manager for Databases** → **My Reports** → **administrator's Reports**
  if any customized report has been saved from a TPC administrator.
- **IBM Tivoli Storage Productivity Center** → **Reporting** → **My Reports** → **Batch Reports**
  if any Batch Report has been defined (see this for details on Batch Reports).

For more detailed information about the various reporting categories available after a Job, refer to Chapter 5. Reporting ¨Choosing a reporting type" in *IBM Tivoli Storage Productivity Center User's Guide*, SC27-2338.

5.5.5 Performance Monitor job: Collecting Performance Data

Use the tasks in this section to collect performance data about your storage subsystems and fabric switches.

Monitoring switch performance

You can monitor the performance of those switches in your fabrics from which you can collect performance data.

You can monitor the performance of selected fabric switches. Fabric Manager can collect performance data for the switches and generate reports from the results of those monitors.

Report data is collected on data rates, operations rates, switch port errors, and other performance statistics. For information about generating those reports, refer to Chapter 5 “Reporting” in *IBM Tivoli Storage Productivity Center User’s Guide*, SC27-2338.

Note: A fabric probe is required after a CIMOM discovery before a switch performance monitor job can be run.

Creating a switch performance monitor

To create a switch performance monitor, complete the following steps:

1. Expand **Fabric Manager** → **Monitoring**, right-click **Switch Performance Monitors**, and select **Create Switch Performance Monitors**.
2. In the Switches tab enter a description for the performance monitor, and from the **Available Switches** column, select the switches to be added to the monitor definition and move them to the **Selected Switches** column by clicking on the “>>” button (see Figure 5-32).

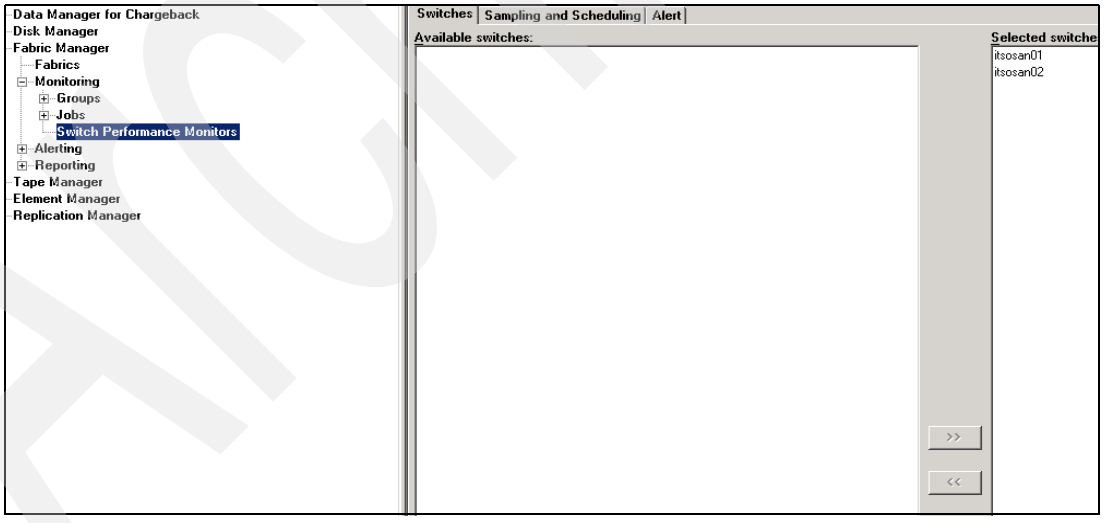


Figure 5-32 Switch Performance job - adding switches

Note: Only those switches from which Fabric Manager can collect performance data are listed in the Available column. If a switch is added to a performance monitor, it is no longer listed as an available switch.

3. In the **Sampling and Scheduling** tab specify an interval for the performance averages, the duration of the data collections, and a schedule for the monitor. You can begin the monitor immediately, schedule it to begin at a later time, and specify if it should be run repeatedly (see Figure 5-33).

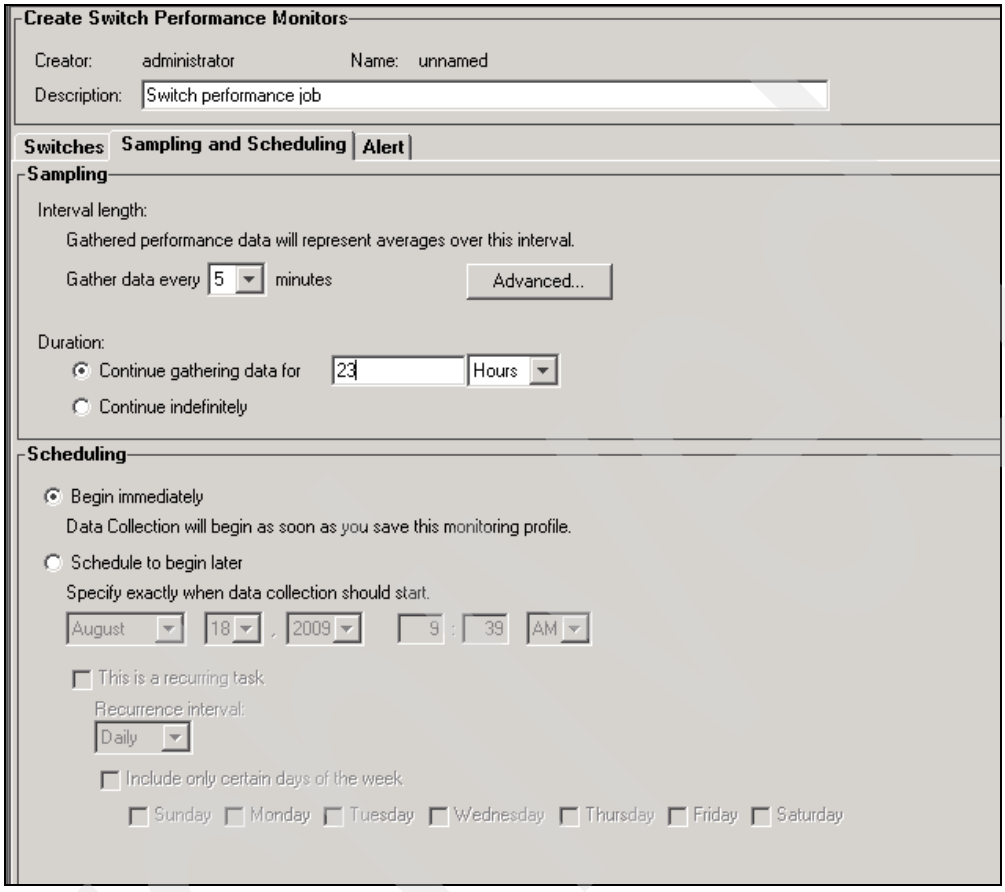


Figure 5-33 Switch Performance job - Sampling and scheduling

- In the **Sampling** area, specify the length of the sampling window and how frequently the performance data is gathered.

  a. In the **Interval length** field, select the length of the sampling window.

  The interval length is the number of minutes over which performance data is averaged. For example, if you select 15 minutes, all performance-data samples gathered from the storage subsystem represent an average of the performance of the subsystem over the previous 15 minute interval.

  a. In the **Duration** field, specify how long the monitoring task will run.

  You can specify that the task runs indefinitely or specify the length of time that the performance data is gathered.

Click the **Advanced** button to access to the skipping function of the Job, to choose a frequency larger than the interval length, in order to save not all the sample gathered and save disk space (see Figure 5-34).

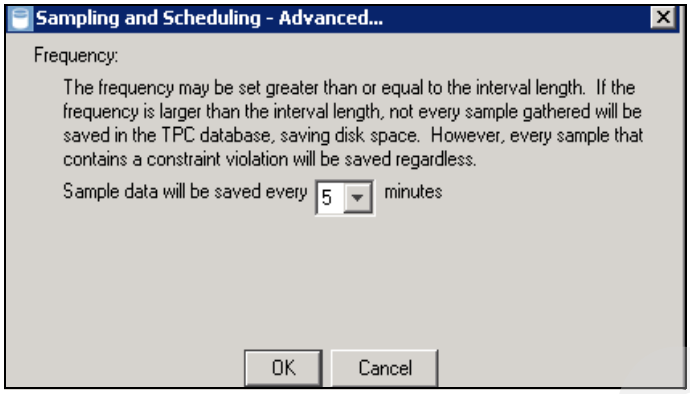


Figure 5-34 Sampling and Scheduling - Advanced Pane

This skipping function is useful when you need to do SLA reporting and longer term capacity planning at the same time.

Important: It is important to understand that every time that a defined alerting threshold is reached, the sample is stored in the database anyway

- In the **Scheduling** area, click either **Begin immediately** or **Schedule to begin later**.

  If you click **Schedule to begin later**, specify the data and time that you want to the data collection to start. You also can specify that the data collection will recur, how frequently it recurs, and whether certain days of the week are excluded.

4. Configure the "**Alert**" tab (see "Out-of-Band Agents discovery" on page 164 for detailed steps)
5. To save the performance monitor, click **Save**.
6. In the **Save As** window enter the performance monitor name and click **OK**.
7. To display the name of the new monitor, right-click **Switch Performance Monitors** and select **Refresh**. The new name is listed under the node (see Figure 5-35).
8. After the monitoring job has completed, expand the name of the storage-subsystem performance monitor.

   The following information is displayed:

   – A status icon that indicates whether the task completed successfully
   – Number of times that the task ran
   – Date that the task ran
   – Time that the task began

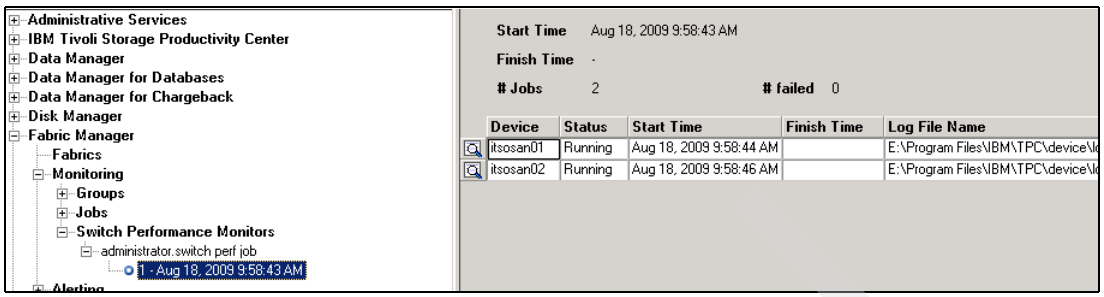


Figure 5-35 Switch Performance job - job running

Monitoring storage-subsystem performance

A storage-subsystem performance is used to monitor to gather performance data and view the results in the log file.

Creating a subsystem Performance Monitors

Note: A storage subsystem probe is required after a CIMOM discovery before a performance monitor job can be run on the device.

Note: If you schedule a performance monitor to collect data about a storage subsystem at the same time you plan to create a large number of volumes on that subsystem, the performance of the volume creation job and the general performance of the associated CIMOM might decrease. We recommend scheduling a performance monitoring job at a different time than when you plan to create a large number of volumes on a subsystem.

To create a switch performance monitor, expand **Disk Manager** → **Monitoring**, right-click and select **Create Subsystems Performance Monitors** and follow the steps described in “Creating a switch performance monitor” on page 178.

5.5.6 History Aggregator

The History Aggregator in Tivoli Storage Productivity Center defines and runs jobs to sum data in the enterprise repository for historical reporting purposes. For example, you can view the sum of usage across multiple storage resources, by file system. rending enables you to see patterns of your historical data across your entire network.

Note: History Aggregator is only used to aggregate capacity information. It is not used to aggregate Performance Monitoring data.

You can configure the time that you want it to run.

1. Select **Administrative Services** → **Configuration** → **History Aggregator**, as shown in Figure 5-36.

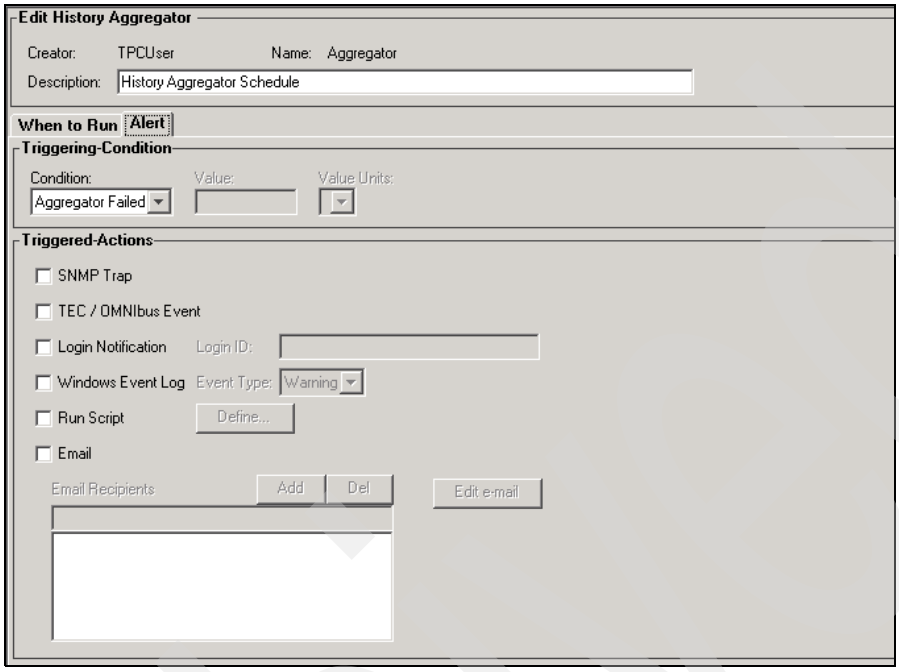


Figure 5-36 Defining the time to run

2. Configure the "**Alert**" tab (see "Out-of-Band Agents discovery" on page 164 for detailed steps).
3. Check the **Enabled** box shown in Figure 5-36 in the upper right corner of the window to make the aggregate job active.
4. Save to make the changes permanent.

Note: We recommend that you run a history aggregator job regularly to ensure that the latest information is displayed in the dashboard. See the Tivoli Storage Productivity Center for information about how to create and schedule history aggregator jobs.

5.6 Reporting through Tivoli Storage Productivity Center

Tivoli Storage Productivity Center collects a wide range of information from the storage environment it is monitoring. All collected data, including configuration, utilization and performance data is stored in a relational DB2 database schema. This chapter gives an overview illustrating the various reports TPC can generate from this collected data.

In addition to information collected from the storage environment, TPC provides reports on its internal definitions such as Data Sources and Groups, including newly introduced Storage Resource Groups.

5.6.1 Options for data extraction

There are multiple options available to extract data from Tivoli Storage Productivity Center:

- Tivoli Storage Productivity Center GUI:

  Tivoli Storage Productivity Center's Graphical User Interface (GUI) provides access to a large number of predefined reports, provides charting and graphing functions, allows customizing reports (up to a certain extend) as well as scheduling them to run on a repeated basis (known as "Batch Reports"). In addition, a graphical Topology Viewer is provided to interactively browse the current, as well as historic states of the monitored storage environment (Configuration History).

  We described the TPC GUI capabilities for the different Job types in 5.5, "Jobs types" on page 162.

  For more detailed information about the various reporting categories available after a Job, refer to Chapter 5. "Reporting" in *IBM Tivoli Storage Productivity Center User's Guide*, SC27-2338.

- Batch Reports:

  The Tivoli Storage Productivity Center GUI allows also definition of Batch Reports that are typically scheduled to run repeatedly, producing output in either CSV (comma separated values), plain text, PDF, or HTML format. A subset of the reports available through the GUI can be exported that way in order to allow for automatic publishing or post-processing of Tivoli Storage Productivity Center data, without having to invoke either GUI or CLI.

  Note: Batch Reports require installation of a TPC Data Agent in order to run - thus, they are only available with the TPC for Data or TPC Standard Edition licenses.

  For more detailed information about creating Batch Reports, refer to *IBM Tivoli Storage Productivity Center User's Guide*, SC27-2338, Chapter 5. Reporting ¨ Batch Reports".

- TPC CLI (TPCTOOL):

  Tivoli Storage Productivity Center Command Line Interface (CLI or TPCTOOL) provides programmatic access to a subset of the reports that are available through the GUI - primarily performance reports, as well as a limited amount of configuration reports.

  For additional information about reporting by TPC CLI, refer to 7.1 CLI - TPCTOOL as a reporting tool, in *SAN Storage Performance Management Using TPC*, SG24-7364. In addition, refer to *Reporting with TPCTOOL*, REDP-4230 for detailed information about how to use TPC's Command Line Interface to generate reports.

- TPC Reporter:

  IBM TPC Reporter is a Java application developed to allow export of historic performance, as well as limited amounts of configuration data for certain subsystems. It produces a white-paper style PDF document with all relevant information, which makes sending the information (by e-mail, for example) very easy.

  For additional information about using TPC Reporter to generate reports, refer to section 7.2, "TPC Reporter" in *SAN Storage Performance Management Using TPC*, SG24-7364.

- Reporting Database Views:

  Introduced in TPC V4.1, a set of database views is available to access data from DB2 directly using Structured Query Language (SQL). The views represent the raw data "behind" the reports that can be produced through GUI and CLI, thus allowing very flexible customizations.

Note that the database views do not allow exporting the reports readily available through GUI and CLI directly, but instead provide access to the actual data within the database repository. When generating reports through, for example, the Tivoli Storage Productivity Center GUI, additional calculations are performed on the data in the repository.

Note: All of the reporting functions just mentioned only allow extracting data that has previously been collected to the database repository. The configured data sources and collection jobs, collection periods and frequencies, as well as history retention settings, will affect the amount of information that appears in any kind of report.

5.6.2 Reporting types and categories

Reports in the Tivoli Storage Productivity Center GUI are organized into reporting types and reporting categories. While reporting types define how the report is handled by the system (run online or offline, user or system-defined), reporting categories are intended to organize the sheer amount of available reports and help users find the information they are particularly interested in.

The available reporting types are:

- User-defined online reports (in the *My reports* node)
- (Pre-defined) system reports
- User ID (saved) reports
- Batch Reports

For more detailed information about the various reporting types, refer to Chapter 5. “Choosing a reporting type,” in *IBM Tivoli Storage Productivity Center Users Guide*, SC27-2338.

Table 5-5 shows the available reporting categories with the associated Collection Jobs needed.

Table 5-5 Reporting categories and jobs

Report category	Collection job needed
Asset reports	► Probes ► Discovery Data for System-wide Users and Monitored Directory reports are gathered by Scans.
Availability reports	► Ping Data: Pings ► Computer Uptime: Probes
TPC-wide Storage Space (new in TPC 4.1, previously Capacity reports)	► Probes
Usage reports	► Scans
Usage violation reports	► Scans ► The following Policy Management items have to been defined: - Quota - Constrains
Backup reports	► Scans
Monitored Computer Storage Space (new in TPC 4.1)	► Probes
Storage Subsystem reports	► Probes

Report category	Collection job needed
Storage Subsystem Performance reports	► Subsystem Performance Monitors
Switch Performance reports	► Switch Performance Monitors
Rollup reports: ► Asset ► Capacity ► Database Asset ► Database Capacity	► IBM Tivoli Storage Productivity Center Probes
Data Source reports (new in TPC 4.1)	These reports are available for data sources that have been associated with IBM Tivoli Storage Productivity Center.

5.7 Working with scripts

Use the triggered action facility to run scripts based upon conditions/alerts that are detected within your storage environment. Use the scheduled action facility to run scripts according to the schedule that you define, without having to associate the script with an alert.

Both the triggered action and scheduled action facilities are script-based, allowing you to use any third-party tools for actions, such as recovery and provisioning.

5.7.1 Running scripts with alerts

Monitoring, alerting, and policy management jobs enable you to use the triggered action facility to run scripts based on storage events that you define.

The triggered action facility allows you to define thresholds and constraints that result in notification or action. A script can be run when a job fails, an alert condition is detected in a storage resource, a constraint is violated (Data Manager only), or a quota is exceeded (Data Manager only). The triggered action facility is script-based, allowing you to use any third-party tools for actions such as recovery or provisioning.

1. Create or edit a monitoring, alerting, or policy management job. The following jobs enable you to define a condition that triggers a script:
   - Data Manager:
     - **Monitoring → <all_monitoring_jobs>**
     - **Alerting → <all_alert_jobs>**
     - **Policy Management → Constraints**
     - **Policy Management → Quotas**
     - **Policy Management → Scheduled Actions**
   - Data Manager for Databases:
     - **Monitoring → <all_monitoring_jobs>**
     - **Alerting → <all_alert_jobs>**
     - **Policy Management → Quotas**
     - **Policy Management → Scheduled Actions**

- Disk Manager:
  - **Monitoring → Subsystem Performance Monitors**
  - **Alerting → Storage Subsystem Alerts**
- Fabric Manager:
  - **Monitoring → Switch Performance Monitors**
  - **Alerting → <all_alert_jobs>**

2. Check **Run Script** on the **Alert** page for the job.
3. Click **Define**. The **Specify Script** dialog box displays.
4. Enter the name of the script in the **Script Name** field. This script name is used to tell the server what script to send to the agent. If the script sent by the server is run by the agent, the name of the script will not be the name you specify in the **Script Name** field. Instead, the agent names the script as temporary file, runs it, then deletes it after the script has run. Because of this, you should not have code in your script that depends on this script name.
5. Specify where you want the script to run in the **Where to Run** field. You can select a specific agent, or the triggering computer. For example, if a file system alert is triggered on a on a specific computer, you would typically want the script to run on the computer that triggered the alert. (For some types of alerts such as Job Failed, you will not have the option to run the script on the triggering computer. Here you can run the script on any agent you choose).
6. The **Script Parameters** section displays what parameters will be passed to the script when it is run. Each triggering condition passes different parameters. The parameters will be passed in the order specified on the dialog box.
7. Click **OK**.

5.7.2 Running scripts using scheduled actions

Use the scheduled action facility to run a script according to a schedule that you define. The scheduled action facility is available in Data Manager and Data Manager for Databases.

Use scheduled actions to run scripts against selected computers and computer groups. The scheduled actions facility is script-based, allowing you to use any third-party tools for actions, such as recovery, or provisioning. You can schedule scripts to run:

- Immediately
- Once at a specified time and date
- Repeatedly according to a schedule you specify

Scheduled actions should not be confused with triggered actions. Triggered actions enable you to run scripts based upon conditions and alerts that are detected within your storage environment. Scheduled actions enable you to run scripts according to the schedule that you define, without having to associate the script with an alert.

To create a scheduled action, complete the following steps:

1. In the **Navigation tree** pane, expand **Data Manager** → **Policy Management** → **Scheduled Actions or Data Manager for Databases** → **Policy Management** → **Scheduled Actions**. Right-click **Scripts**, and click **Create Script**. The **Create Script** window opens.
2. Select computers and computer groups against which to run the action:
   a. In the **Available** field, click the computers and computer groups against which you want to run the action. You can select individual computers as well as computer groups that you have previously defined using the group facility. Note that cluster resource groups in an HACMP or MSCS clustered environment are listed as computers.
   b. Click ">>". The computers and computer groups are moved to the **Current Selections** field.
3. Click the **Script Options** tab; the **Script Options** page opens. Use this page to select the script you want to run against the selected computers and computer groups.
4. Select a script from Script Name. The scripts that appear in Script Name are stored in the *\<TPC_installation_directory\>\scripts* directory on the Data Server. The default installation directory where scripts are located is:
   – Windows: *\program files\IBM\TPC\data\scripts*
   – UNIX, Linux: */opt/IBM/TPC/Data/scripts* or */usrs/IBM/TPC/Data/scripts*

   Note: The scripts that appear in the **Script Name** list are stored on the computer where the Data Server component is located. If you want to run a script that is stored on a Data agent, you must type the name of that script in the **Script Name** field.

5. Click the **When to Run** tab; the **When to Run** page opens. Use the this page to specify when the scheduled action will run.
6. Click the **Alert** tab; the **Alert** page opens. Use the **Alert** tab to define the alerting criteria for a scheduled action.

   In the Triggering Condition area, the only condition is Script Failed. This indicates that an alert will automatically be triggered if the scheduled action fails to run.
7. Click **File** → **Save**, specify a job name and click **OK**.

5.8 Tivoli Storage Productivity Center alert disposition

You can configure Tivoli Storage Productivity Center so that SNMP traps and Tivoli Enterprise Console (TEC) events can be sent to other consoles.

This topic provides information about how to configure IBM Tivoli Storage Productivity Center to send SNMP traps, Tivoli Enterprise Console events, or e-mail notifications that are generated when an event specified in an alert is detected. From this node, you can also specify the number of days after which records in the alert log are deleted.

5.8.1 Planning considerations

To enable SNMP traps and Tivoli Enterprise Console event alert notifications, consider the following:

- **SNMP traps**

  System administrators must set up their SNMP trap ringer with the provided MIB files in order to receive SNMP traps from Tivoli Storage Productivity Center. These files are located in the following directories on the product installation CD:

  - Fabric: **device\snmp\fabric.mib**
  - Data: **data\snmp\tivoliSRM.mib**

- **TEC events**

  Send an alert to the Tivoli Enterprise Console. The Tivoli Enterprise Console administrator can write correlation and automation rules to analyze Tivoli Storage Productivity Center events according to the event definitions specified in the **tivoliSRM.baroc** and **fabric.baroc** files. It also performs responses such as sending further notification, creating or updating trouble tickets, running programs, and so forth.

  The **tivoliSRM.baroc** and fabric.baroc files must be loaded into the current active rule base of the Tivoli Enterprise Console server. This allows Tivoli Enterprise Console events sent by Tivoli Storage Productivity Center to display on the console. These files are located in the following directories on the product installation CD:

  - Device Server: **device\conf\manager\fabric.baroc**
  - Data Server (for Data and Disks): **data\tec\tivoliSRM.baroc**

- **Port 162**

  Tivoli Storage Productivity Center uses port 162 to listen for SNMP traps.

  This is the default port. For switches, you must configure the switch to send SNMP traps to the Device Server IP address. If you need to change the default port number, use the **setdscfg** command. The attribute to set is **SNMPTrapPort**.

5.8.2 Alert disposition implementation

To configure Tivoli Storage Productivity Center to send traps and Tivoli Enterprise Console events, follow these steps:

1. Go to **Administrative Services** → **Configuration** → **Alert Disposition**.
2. On the right pane, you can enter information for two SNMP destinations and one Tivoli Enterprise Console event destination. For the SNMP destination, enter the community name, host, and port information. For the Tivoli Enterprise Console event destination, enter the server and port information. You can also enter information for e-mail information (see Figure 5-37).

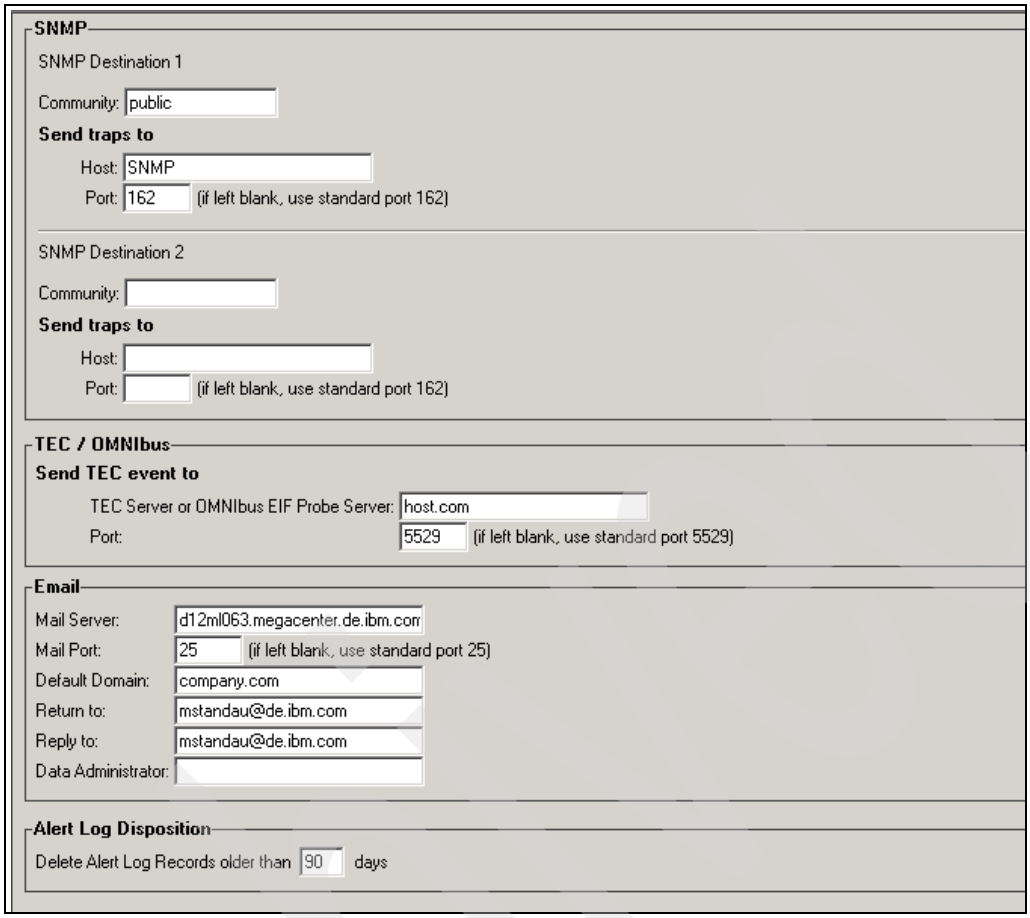


Figure 5-37 Alert disposition configuration

3. Click **File** → **Save**.

5.9 Database management

In general, when an agent is registered to IBM Tivoli Storage Productivity Center, by default, it only reports its file system storage assets.

To use the database reporting of BM Tivoli Storage Productivity Center as well, all agents, which run for database reports, must be registered using the Databases portion of the License Key Editor. See “Supported subsystems, devices, file systems, databases, volume managers, NAS, VMware” on page 109 for supported databases for monitoring.

If there are databases running that you want to monitor, you need to manually register your databases and then you can run jobs against your agents to report the databases. To do that:

1. Select **Administrative Services** → **Configuration** → **License Keys** and click the magnifying glass icon to the left of the line for **IBM TPC for Data-Databases** (see Figure 5-38 on page 190).

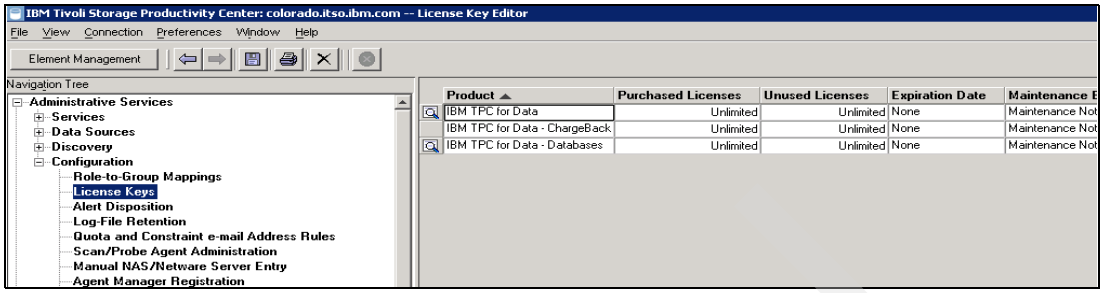


Figure 5-38 License Keys IBM TPC for Data: Databases

2. Click the magnifying glass icon to the left of the line for **IBM TPC for Data-Databases**
3. In Licensing tab, agents are displayed (see Figure 5-39).

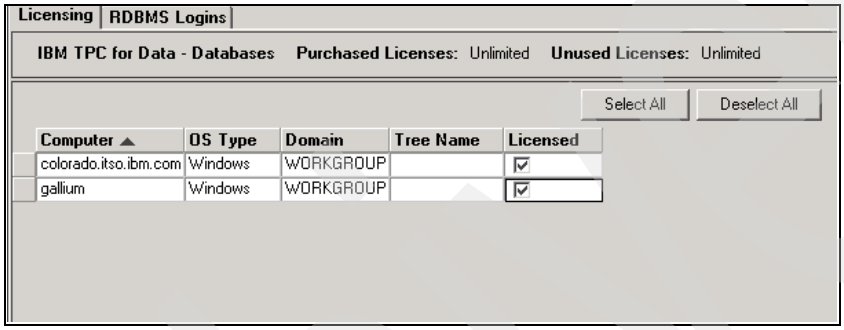


Figure 5-39 TPC for Data - Databases - agents list

4. Click the **RDBMS logins** tab. Initially, there should not be any entries for a computer. Click **Add new**. The RDBMS Login Editor pop-up window appears (see Figure 5-40 on page 191). Type the values accordingly:
   - For Oracle:
     - Select the agent where Oracle runs.
     - Enter the Oracle SID ID.
     - Type the Oracle Host name.
     - Specify the user name and password for IBM Tivoli Storage Productivity Center to log on to the Oracle database.
     - The default port is 1521. If you installed Oracle by using a different port number, contact your Oracle specialist to obtain the correct port number and type in the correct port number.
     - JDBC driver
   - For Microsoft SQL Server:
     - Select the agent where the Microsoft SQL server runs. Tivoli Storage Productivity Center for Data only shows you agents that are on the Windows machine.
     - Instance of SQL server. If it is left blank, Tivoli Storage Productivity Center uses the default instance.
     - User name and password of SQL server instance.
     - The default port is 1433.
     - JDBC driver.

– For Sybase and IBM UDB DB2:
  - Select the agent where Sybase or DB2 runs.
  - Instance or server name of Sybase and DB2.
  - User name and password of Sybase or DB2 instance.
  - The default port for Sybase is 5000 and for DB2 is 50000.

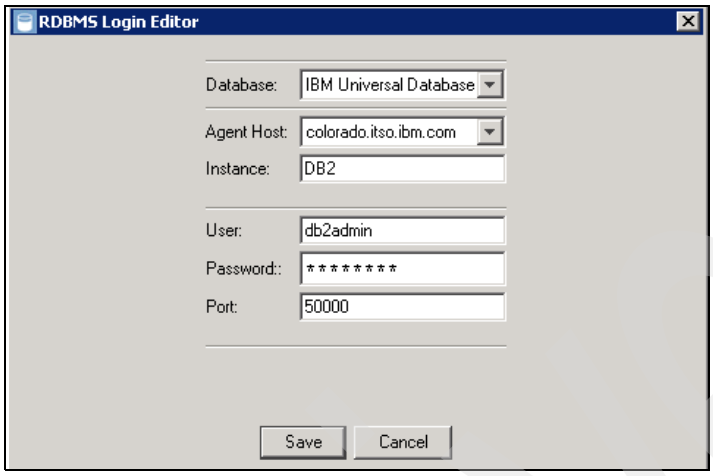


Figure 5-40 RDBMS Login Editor window

5. Click **Save** to continue.

   Tivoli Storage Productivity Center contacts the database immediately and registers the database to IBM Tivoli Storage Productivity Center repository and also runs a probe job for the selected agent. The message shown in Figure 5-41 is displayed.

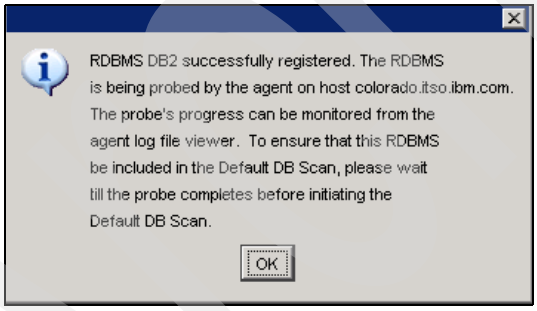


Figure 5-41 DB2 successfully registered

6. You can now edit or delete the database entry by highlighting the line and clicking **Edit** or **Delete**.

   If you choose **Edit**, then you can only change user name, password, and port number.

After the database has been registered, you can run jobs as Probe and Scans against your agents to report the databases.

Refer to “Probing Databases” on page 169 for detailed steps to create a Probe Job for Databases.

Refer to “Data Manager for Databases Scan job” on page 176 for detailed steps to create a Scan Job for Databases.

6

Customization and administration

In this chapter, we provide information about all further customization tasks and administration tasks that are necessary to keep Tivoli Storage Productivity Center running. We describe how to work with the user interface.

6.1 Policy management

Tivoli Storage Productivity Center can enable you to define and enforce storage policies through user-defined alerts, quotas, and constraints, notifying the user by e-mail, pager, or the event log, or a systems management console for events such as when a quota has been exceeded or a constraint violated.

The aim should not be just to find a problem; you need a way to fix problems. Tivoli Storage Productivity Center can provide automated solutions through event management. For example, if Tivoli Storage Productivity Center discovers data that has not been accessed in more than a year, it can trigger Tivoli Storage Manager to archive this data.

This feature allows you to effectively manage your storage. Benefits include the consistent implementation of storage resource management policies across platforms, automated scheduled reporting, and automated file system extension.

6.1.1 Policy Management capabilities with Tivoli Storage Productivity Center

Figure 6-1 shows the available Policy Management areas in the Tivoli Storage Productivity Center Navigation Tree.

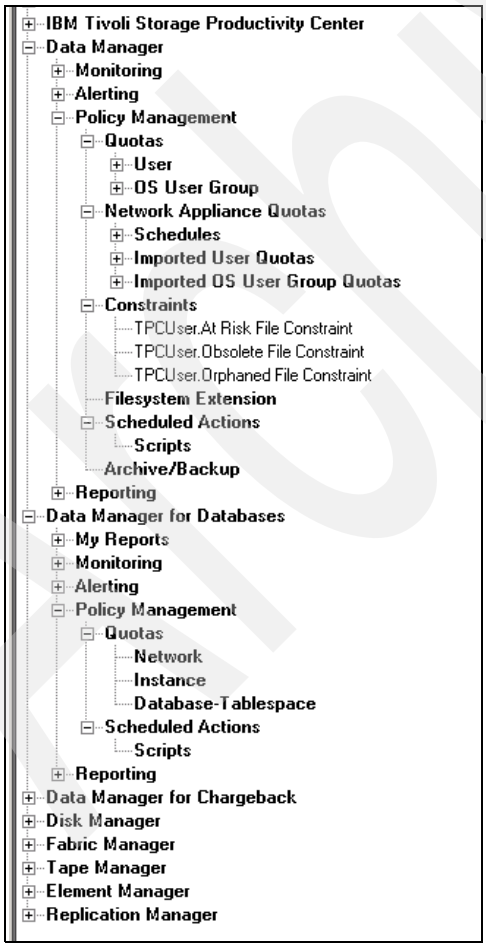


Figure 6-1 Policy Management node

There are six areas available for Data manager and two for Data Manager for Databases:

- Data Manager:
  - Quotas
  - Network s
  - Constraints
  - File System Extension
  - Scheduled Actions
  - Archive/Backup
- Data manager for Databases:
  - Quotas
  - Scheduled Actions

6.1.2 Policy Management capabilities and their Monitoring Jobs

In the next sections we report a description of each Policy Management capability, together with the Monitoring Job that detects the conditions.

For the detailed steps needed to implement Policy Management tasks with Tivoli Storage Productivity Center, refer to 6.3.6 “Policy Management” in *IBM Tivoli Storage Productivity Center: User’s Guide V 4.1*, SC27-2338.

Quotas

Use quotas to define limits on and monitor the amount of storage that a user or a group of users can consume. You can set quotas to specify limits for storage usage at different levels, which enables you to control precisely how much storage a user can consume on specific storage entities:

- Define quotas in Data Manager to set limits on the amount of storage that a user or a group of users can consume at a network, file system, or computer level.
- Define quotas in Data Manager for Databases to set limits on the amount of storage that a user or a group of users can consume at a network, instance, database, or table space level.

Note: Quotas allow users to exceed the limits. Quotas just alert the system administrator or storage administrator about the quotas violations. You can limit a user to use a certain amount of storage by using operating system utilities.

Important: Only after the next scan runs successfully is the information, according to the current situation in the file system, gathered and written into the Data Manager repository. To have an up-to-date file system as opposed to quota information, plan to run the Quota job after the Scan job. The Data Manager then compares the file system information against the defined quotas.

Related Monitoring Job

The Monitoring Job that detects conditions in Quotas is the **Scan** job.

NAS support

You can use the NAS support within Data Manager to work with Quotas defined using the software provided with Network Appliance Filers.

Using the Network Appliance node under Policy Management, you can:

- Import certain Quotas from NetApp filers when you schedule and run a Quota checking job.
- View the definition for each imported Quota.
- Determine when and how you are alerted when the hard limit defined with a NetApp Quota is close to being violated.

For example, you can define a policy to be alerted when:

- A user or user group is close to reaching the hard limit defined within the corresponding NetApp Quota.
- The space consumed on a QTree is approaching the hard limit defined within the corresponding NetApp Quota.

Specifically, the Data Manager NAS component enables you to work with the following types of Networks:

- Quotas that limit the space that QTree directories can consume on a volume
- Quotas that limit the space consumed by specific users on a volume
- Quotas that limit the space consumed by specific user groups on a volume

Related Monitoring Job

The Monitoring Job that detects conditions in Network s is the **Scan** Job.

Constraints

You can use constraints to:

- Define the acceptable and unacceptable file types, file sizes, and file owners for computers in your environment. For example, you can use constraints to alert you when users store certain files (such as MP3 or .avi files) on a monitored computer.
- Request an Tivoli Storage Productivity Center archive and backup of the largest violating files identified by a constraint. IBM Tivoli Storage Manager protects your organization's data from hardware failures and other errors by storing backup and archive copies of data on offline storage.

The following three default constraints are available:

- **TPCUser.AtRiskFile Constraint**
- **TPCUser.ObsoleteFile Constraint**
- **TPCUser.Orphaned File Constraint**

Related Monitoring Job

The Monitoring Job that detects conditions in Constraints is the **Scan** job.

File System extension

Use File System extension to create additional space in the local file systems of managed hosts.

You can extend file systems manually, or set up policy to do it automatically. You can extend file systems at a specified time, or when utilization reaches a specified threshold.

Note: File system extension is supported for JFS file systems running on AIX 5L™ V5.1 and VxFS file systems running on Sun Solaris 2.8. The AIX JFS2 file system is not supported.

Related Monitoring Job

The Monitoring Job that detects conditions in File System extension is the **Scan** job.

Scheduled actions

Use scheduled actions to schedule scripts to run against computers and computer groups.

Scheduled actions are script-based, enabling you to use any third-party tools for actions, such as recovery or provisioning.

Tip: The Triggered action facility is used to run the scripts when certain alerts are set. But Scheduled actions can be run whenever you want without waiting for an alert condition.

Important: If the script that you prepare on the server does not run, then check the following requirements:

- Make sure that no script with the same name is on the agent script directory.
- Make sure that the agent is installed by enabling the Agent can run a script sent by the server option.

Related Monitoring Job

There is no Monitoring Job that detects conditions in Scheduled Actions.

Archive and backup

View and edit archive and backup jobs that were created based on files selected from reports in the Reporting facility.

You can use Tivoli Storage Manager to archive or back up files. From this window, shown in Figure 6-2, you can only update, delete, or run the jobs that have already been created using a slightly different method. The window shown displays if you try to create a backup by right-clicking **Archive/Backup**.

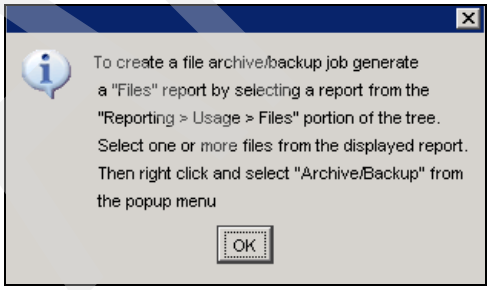


Figure 6-2 Pop-up window when right-clicking Archive/Backup

6.2 Setup alerting

Alerting is used to inform the Tivoli Storage Productivity Center administrator when certain conditions occur on the monitored resources. Tivoli Storage Productivity Center collects statistics for the computer, storage subsystems, SAN switches, file systems, and directories. You can set certain thresholds to detect the problem or events that might create problems later, so that storage administrators can be proactive in correcting potential problems.

Alerts are triggered based on the data collected by Monitoring Jobs (pings, scans, and probes), so the alerts must be defined before the Monitoring Jobs are run. For each alert, you select a condition that triggers the alert and (optionally) an action to be performed when that condition occurs.

You can define an alert in the following ways:

- As part of a data collection job
- As a separate, alerting job, triggered by an event.

The following types of alerts are set for your system by default:

- New entity found
- Job failed

You can change the triggered actions and enable or disable these alerts, but you cannot delete them.

In general, the following types of conditions can trigger alerts:

- A data collection job failed to complete.
- A change occurred in the storage infrastructure.
- A performance threshold was violated.

All the alerts are always stored in the Alert Log, even if you have not set up notification. The log can be found in the Navigation Tree at **IBM Tivoli Storage Productivity Center** → **Alerting** → **Alert Log**.

Note: Alerts are not generated in a Tivoli Storage Productivity Center instance for actions that you perform from that instance. For example, if you start Tivoli Storage Productivity Center and use Disk Manager to assign or unassign volumes for a subsystem, you will not receive alerts for those volume changes in that instance. However, if you assign and unassign volumes outside of that Tivoli Storage Productivity Center instance, an alert is generated.

We described the alert definition associated to a failure in a Data Collection job in “Jobs types” on page 162. In this section we describe the Alert definition as a separate Alerting Job (triggered by a change in the Storage infrastructure or a performance threshold violated).

6.2.1 Alerts defined as Alerting jobs

These types of alerts are either condition-based or threshold-based. When we discuss setting up a threshold, we really mean setting up an alert that defines a threshold. The same is true if someone says they set up a constraint. They really set up an alert to define a constraint.

Note: The following conditions must be met in order to successfully use alerts:

- Data collection jobs are configured and scheduled to run on a regular basis.
- If you want to be notified about an alert in some way other than an entry in the log file, such as using SNMP traps, Tivoli Enterprise Console events, or e-mail, alert notification instructions must be configured prior to using the alert. See “Tivoli Storage Productivity Center alert disposition” on page 187.

Thresholds

Thresholds are a type of triggering condition with which you can monitor a component with user-defined values.

You can monitor the performance of your enterprise by creating alerts on performance thresholds for switches and storage subsystems. By creating alerts that are triggered by performance thresholds, you can be informed about performance issues in your enterprise. Threshold events tell you when a component has fallen outside of the user-defined values. For example, when a threshold value has reached critical stress.

Threshold boundaries

You can establish your boundaries for the normal expected subsystem performance when defining storage subsystem alerts for performance threshold events. When the collected performance data samples fall outside out of the range you have set, you are notified of this threshold violation so you are aware of the potential problem. The upper boundaries are Critical Stress and Warning Stress. The lower boundaries are Warning Idle and Critical Idle. Usually you will want the stress boundaries to be high numbers and the idle to be low numbers. The exception to this rule is Cache Holding Time Threshold, where you want the stress numbers to be low and the idle numbers to be high.

If you do not want to be notified of threshold violations for any boundaries, you can leave the boundary field blank and the performance data will not be checked against any value. For example, if the Critical Idle and Warning Idle fields are left blank, no alerts will be sent for any idle conditions.

Note: The Suppress alerts when sequential I/O exceeds check button is active only for the triggering condition Disk Utilization Percentage Threshold. It is a filter condition. The default is 80%.

Setting the thresholds

Only a few thresholds have defaults and on the other thresholds you will have to determine the best values for stress, idle, critical, and warning values so you can derive the maximum benefit without generating too many false alerts. Because suitable stress thresholds are highly dependent on the type of workload you are running, your exact hardware configuration, the number of physical disks, exact model numbers, and so forth, there are no easy or standard default rules.

One of the best approaches is to monitor your performance for a number of weeks and, using this historical data, determine reasonable values for each threshold setting. After that is done, you can fine-tune these settings to minimize number of false alerts.

6.2.2 Alert definition in Tivoli Storage Productivity Center tree

Table 6-1 lists the threshold categories and the node in the Tivoli Storage Productivity Center GUI tree from where thresholds can be set.

Table 6-1 Thresholds categories

Thresholds	TPC GUI node
Controller thresholds	► **Disk Manager → Alerting → Storage Subsystem Alerts**
Port thresholds	► **Disk Manager → Alerting → Storage Subsystem Alerts** ► **Fabric Manager → Alerting → Storage Subsystem Alerts**
Array thresholds	► **Disk Manager → Storage Subsystem Alerts**

Table 6-2 lists the triggering conditions and the node in the TPC GUI tree from where Alerts can be set:

Table 6-2 Triggering Conditions

Triggering Condition	TPC GUI node
Triggering condition for Computer alerts	► **Data Manager → Alerting → Computer Alerts**
Triggering condition for File System alerts	► **Data Manager → Alerting → File System Alerts**
Triggering condition for Directory alerts	► **Data Manager → Alerting → Directory Alerts**
Triggering condition for Instance alerts	► **Data Manager for Databases → Alerting → Instance Alerts**
Triggering condition for Database-Table Space alerts	► **Data Manager for Databases → Alerting → Database-Tablespace Alerts**
Triggering condition for Sable alerts	► **Data Manager for Databases → Alerting → Database-Tablespace Alerts**
Triggering condition for Storage Subsystem alerts	► **Disk Manager → Alerting → Storage Subsystem Alerts**
Triggering condition for Fabric alerts	► **Fabric Manager → Alerting → Fabric Alerts**
Triggering condition for Switch alerts	► **Fabric Manager → Alerting → Switch Alerts**

See Appendix E, “Triggering conditions for alerts” in *IBM Tivoli Storage Productivity Center: User’s Guide V 4.1*, SC27-2338 for exhaustive lists of triggering conditions and thresholds.

6.3 Batch Reports

A Batch Report represents any Tivoli Storage Productivity Center report that you want to run on a regular basis and save its data to a file. You can view the information in a generated Batch Report file directly or import it into an application of your choice.

Note: You need the Data agent and Agent Manager installed to run Tivoli Storage Productivity Center Batch Reports.

To create the Batch Report, perform the following steps:

1. Select I**BM Tivoli Storage Productivity Center** → **Reporting** → **My Reports** → **Batch Reports**. Right-click and select **Create Batch Report**.
2. In the **Report** tab, select the report type, as shown in Figure 6-3 on page 201. You can select the following reports:
   - Roll-up reports
   - Data source reports
   - Asset System-wide
   - Availability
   - TPC-wide Storage Space
   - Usage
   - Usage Violations
   - Backup
   - Monitored Computer Storage Space (new in TPC 4.1)
   - Storage Subsystems
   - Storage Subsystems Performance
   - Switch Performance

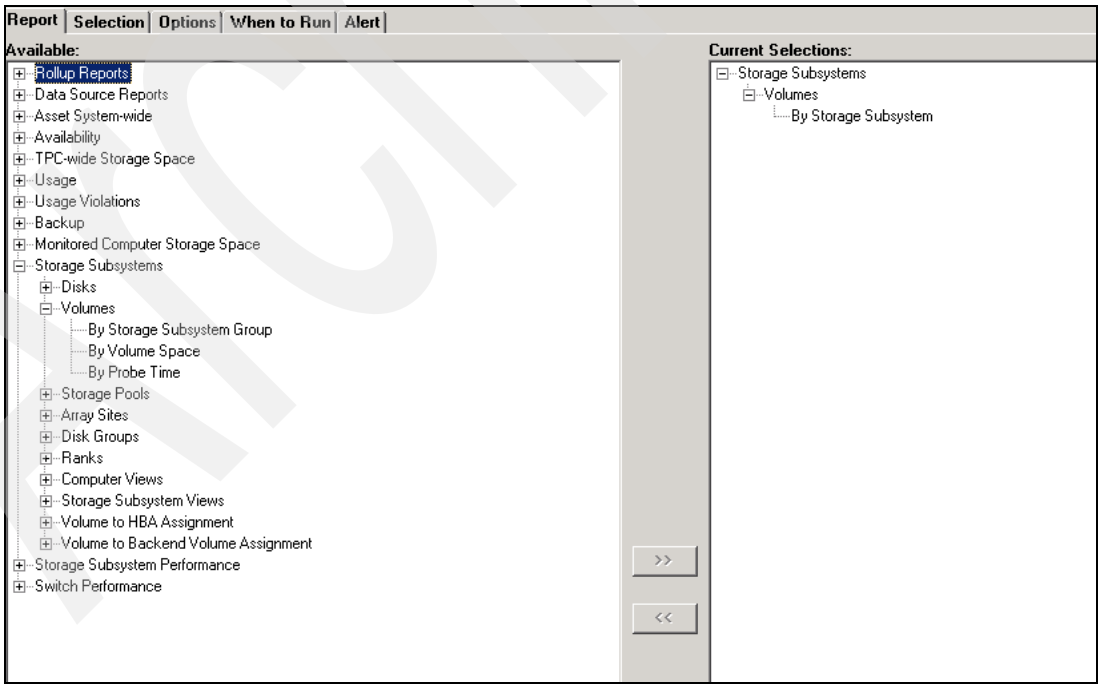


Figure 6-3 Batch Reports types

3. In the Options tab, define the Batch output (see Figure 6-4). This option includes:
   - Select Agent computer to run the Batch Report job.
   - Select output format:
     - CSV
     - Formatted File
     - HTML File
   - Select the format for the output file name

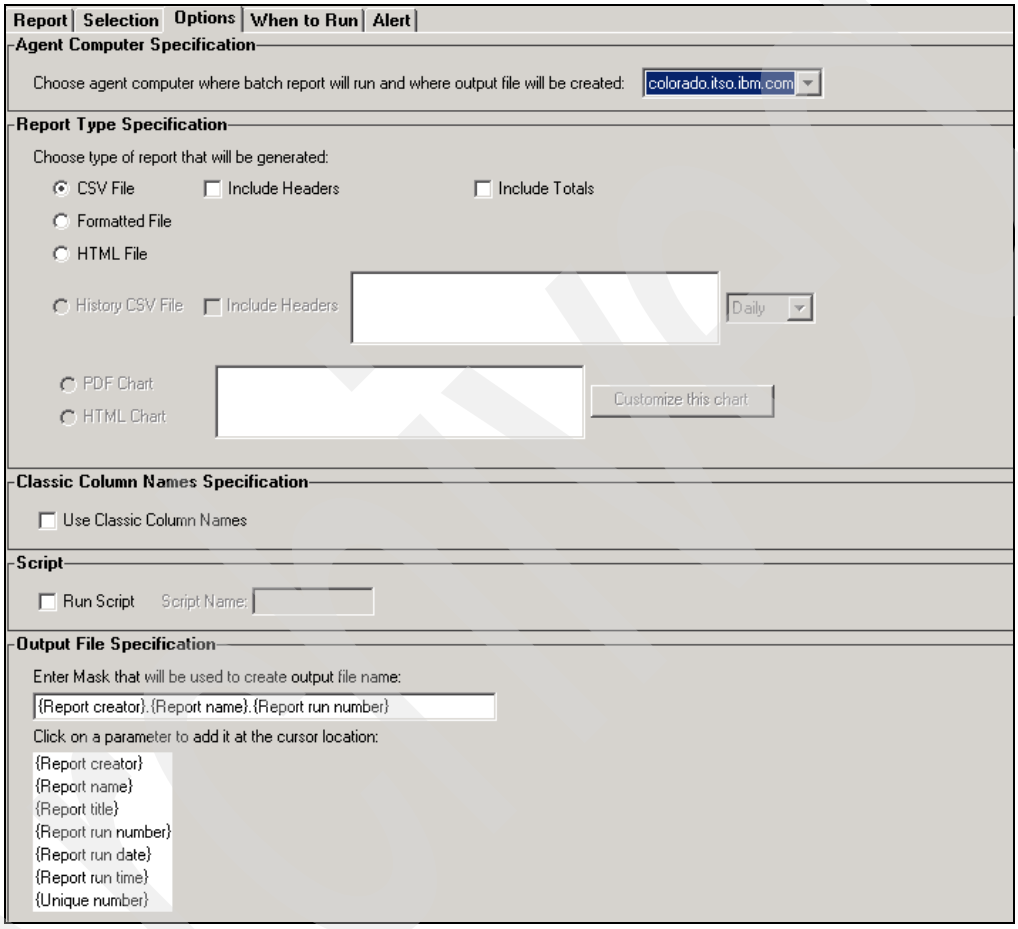


Figure 6-4 Batch report options

4. Configure the "**When to Run**" and "**Alert**" tabs (see "CIMOM managed devices" on page 154 for detailed steps).
5. Press Ctrl-S to save the Batch Report. The job will be submitted at the specified time and day. You can follow the status by selecting **IBM Tivoli Productivity Center** → **Reporting** → **My Reports** → **Batch Reports**.
6. The Batch Report output is saved to the specific directory of the agent machine with the name that you specified in the Options tab.
   - For Windows, the output is saved in:

     \Program Files\IBM\TPC\ca\subagents\TPC\Data\log\computername\reports
   - For UNIX, the output is saved in:

     /opt/IBM/TPC/ca/subagents/TPC/Data/log/computername/reports/

6.4 Storage Optimizer

The Storage Optimizer uses data in the Tivoli Storage Productivity Center database to analyze your storage subsystems to identify performance bottlenecks, and recommend changes to improve performance. This topic lists the supported subsystems and describes the general steps for using Storage Optimizer, as well as a look into how the Storage Optimizer functions.

The Storage Optimizer also helps you develop storage migration or storage consolidation plans, and helps you plan for the growth of your storage infrastructure, based on the different performance behaviors.

Note: To use the Storage Optimizer you must have a Tivoli Storage Productivity Center Standard Edition License.

6.4.1 How the Storage Optimizer works

The main aspects of the Storage Optimizer are:

- Analysis: This aspect regards collecting, aggregating and predicting the utilizations of the storage subsystem infrastructure.
- Optimization: Utilizes the results of the Analysis to help put together a plan for potential migrations and consolidations, to improve overall utilization of the infrastructure.

The Analysis is responsible for using the Disk Magic tool to produce some predicted utilizations based on actual measured performance metrics collected for that device by Tivoli SToRage Productivity Center (for a description of the Disk Magic tool refer to “A word on Disk Magic” in Chapter 8 “Optimizing storage configurations through Tivoli Storage Productivity Center” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725).

These predicated utilizations are provided on a per storage pool basis. The Storage Optimizer produces the following output:

1. An analysis report that displays performance heat maps and tables that graphically illustrate the performance utilization of the storage subsystems that you specified as input.

   The Analysis reports on four unique aspects of the internals of a storage subsystem and how these are specific to a particular pool. It then produces a percentage number that represents how much of that component’s total capacity is being used by the measured workload and configuration.

   These are the four utilizations predicated by the Analysis:

   - **HDD (Hard Disk)**. This is the estimated overall “saturation” of the physical disks in a given subsystem. This number is very much impacted by the RPM speed, capacity and workload being measured.
   - **HA (Host Adapter)**. This is the estimated “saturation” of the ports on the subsystem. This number is very much impacted by the number of ports, maximum hardware bandwidth and workload being measured.
   - **DA (Device Adapter)**. This is the estimated “saturation” of the RAID controllers of the subsystem. This number is very much impacted by the model of subsystem and the workload being measured.
   - **SMP (Controller)**. This is the estimated “saturation” of the CPU complex of the subsystem. This number is very much impacted by the model of subsystem and workload being measured.

2. An optimization report that provides recommendations for improving performance on the following actions:
   - *Migration*, to alleviate hot spots by relocating “hot” volumes in the “hot” pools to “colder” pools and subsystems.

     When selecting particular pool(s) as the **`source`** of the migration, you are effectively telling the Optimizer to consider migrating any volumes in the pool that cause the pool to exceed the set threshold level (cause the pool to appear as red in the Heat Map).

     The pools and subsystems listed as the **`target`** of the migration are the potential destinations for the volumes being considered.

     Note: The following criteria must be met on the **`target`** volume before the Optimizer can suggest moving a volume:
     - have the same format as the source pool (CKD versus FB format).
     - have the same RAID level as the source pool (Not the case for an SVC).
     - have adequate capacity for the potential new volume.
     - not exceed the utilization threshold when the Optimizer simulates the source volumes.
     - workload characteristics being added to the target pool.

   - *Consolidation*, to identify possibilities for reclaiming space.

     Retiring individual pools or entire subsystems can be a useful endeavor to essentially “defrag” your storage environment. This will help to increase the density of your storage utilization to help you get the most out of your hardware investment.

     Instructing the Storage Optimizer to make retirement recommendations for the source entities is the same as telling the Optimizer to continue producing recommendations when the source pool(s) is below the established threshold, but rather to continue until the source pool(s) no longer contain any volumes.

     Otherwise, all the same rules and restrictions from the Migration scenario still apply. The target pools provided must adhere to the same restrictions, and most importantly to note, the threshold setting still applies even in the Consolidation scenario. Space is often the most restricting requirement when trying to consolidate a given set of pools.

Note: It is the Storage Optimizers primary purpose to provide you with a performance analysis and optimization recommendations report, that you can choose to implement at your own discretion.

- The Storage Optimizer does not actually perform any migrations or make any modifications to subsystem configurations.
- Storage Optimizer does not take into account any established replication relationships or sessions. Migration recommendations should be followed with care to ensure continuity of all replication relationships.
- When the Optimizer runs the Analysis it looks at the period specified and during this time takes an average workload over this period. So in the case where you might have a storage pool running at 40% utilization and once a week it spikes to 90%, the Optimizer will average this out over the period chosen and not take the peaks or spikes into consideration.

6.4.2 Supported storage devices

The following IBM storage devices are supported:

- DS4000
- DS6000
- DS8000
- SAN Volume Controller
- ESS

Table 6-3 shows the detailed support for the storage subsystems configurations:

Table 6-3 Support matrix *for Tivoli Storage Productivity Center V4.1*

Storage device	FC Drives	SATA Drives	SAS Drives	Solid® State drives
DS4000	Yes	No	No	No
DS6000	Yes	No	No	No
DS8000	Yes	No	No	No
ESS	Yes	No	No	No
SVC	Yes	No	No	No

No special firmware or CIMOM level requirements introduced by this feature. The supported Tivoli Storage Productivity Center levels will be sufficient.

Note: Non-IBM subsystems are not supported by the Storage Optimizer.

You can analyze the front-end of an SVC that has non-IBM back-end storage, however no recommendations will be made for these non-IBM back-end subsystems as there are no Disk Magic models for those devices. The analysis will be useful when looking at the “Hot Spots” and determining where the bottlenecks lie on the SVC.

6.4.3 Prerequisite steps for Storage Optimizer

- Before running Storage Optimizer, you must set up performance monitors and collect performance monitoring data for all the storage subsystems that you want Storage Optimizer to analyze.
- You must also collect performance monitoring data for a SAN Volume Controller’s back-end subsystems in order to produce the most accurate Storage Optimizer analysis.

Note: You must have daily summation level performance monitor data.

6.4.4 General steps for using Storage Optimizer

In this section we list the basic steps required to use the Storage Optimizer. For the detailed steps, refer to Chapter 8, “Optimizing storage configuration through Tivoli Storage Productivity Center” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725.

1. Create the analysis report. The Tivoli Storage Productivity Center nodes from where you can execute the Analysis Report are:
   - **IBM Tivoli Storage Productivity Center → Analytics → Storage Optimizer**
   - **Disk Manager → Storage Optimizer**

   See 8.2.2, “Viewing an analysis report” in *BM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725 for detailed steps.
2. Review the Storage Optimizer analysis report, by clicking on the completed (green) job submitted in Step 1.

   See 8.2.2, “Viewing an analysis report” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725 for detailed explanation of the panel.
3. Create optimization report based on this analysis, see 8.2.3, “Creating an optimization report” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725 for detailed steps).
4. Review the optimization report (see 8.2.4, “Viewing an optimization report” in *IBM Tivoli Storage Productivity Center V 4.1 Release Guide*, SG24-7725 for detailed steps).

   After the report job begins, you can view the report and job status under the *View Previously Run Optimization Reports* pane located at the bottom of the Create Optimization report pane. When the job is complete. To view a completed optimization report, click the magnifying glass icon.
5. At your discretion, implement the recommendations suggested in the optimization report, or re-run the analysis using different inputs.

6.5 Storage resource groups

Storage resource groups are new objects provided to help storage administrators plan, monitor, and report on the managed environment. A storage resource group is a set of entities managed by Tivoli Storage Productivity Center. These entities can be servers, switches, storage subsystems, fabrics, storage pools, and storage volumes. Storage resource groups can be a group of heterogeneous objects, and they can also contain other storage resource groups without any connectivity.

6.5.1 Capabilities of storage resource groups

Policies for provisioning (volume creation and selection, workload profiles, zoning and multipathing configuration) can be specified and associated with storage resource groups. These policies are used by the SAN Planner to populate default settings.

Storage resource groups are used primarily for planning functions but are also available with the Tivoli Storage Productivity Center Basic Edition license:

- With the Basic license, you can create and view storage resource groups in the topology.
- With the Standard Edition license, the planner function is enabled and you can use storage resource groups as input.

Storage resource groups also work with these profiles:

- Workload profiles. Describes the requirements that define the performance characteristics of newly provisioned capacity.
- Provisioning profiles. Describes the requirements such as total capacity, number of volumes, Redundant Array of Independent Disks (RAID) level, volume name prefix, multipathing options, zoning options, and so forth.

6.5.2 Creating storage resource groups

In this section we describe the steps needed to define a Storage Resource Group.

1. A Storage Resource Group can be created using one of the following methods:

   a. In the navigation tree, expand I**BM Tivoli Storage Productivity Center** → **Storage Resource Group Management**, then click **Create** (see Figure 6-5).

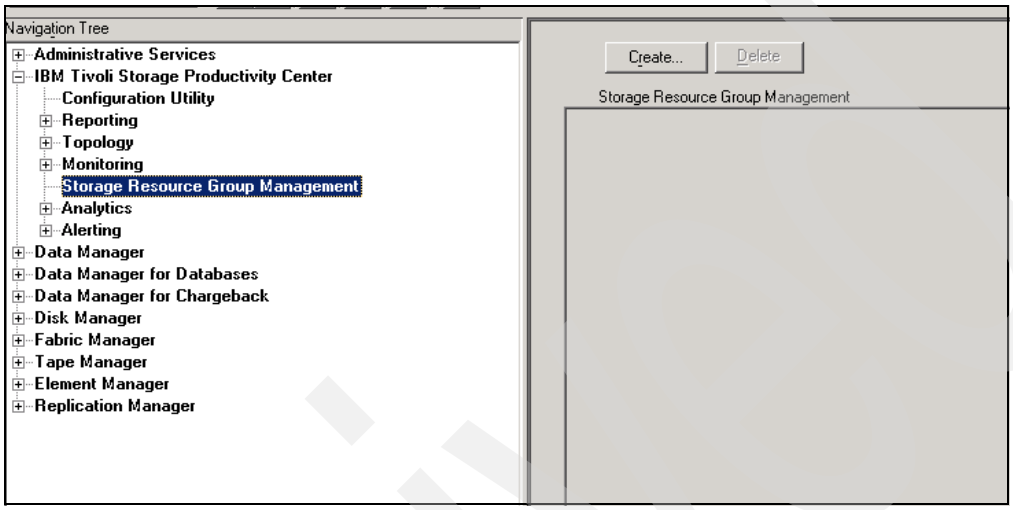


Figure 6-5 Create Storage Resource Group

   b. From the Topology Viewer, click a node that represents a storage entity, right-click an entity that appears in the content pane, and select **Add to new Storage Resource Group** (see Figure 6-6).

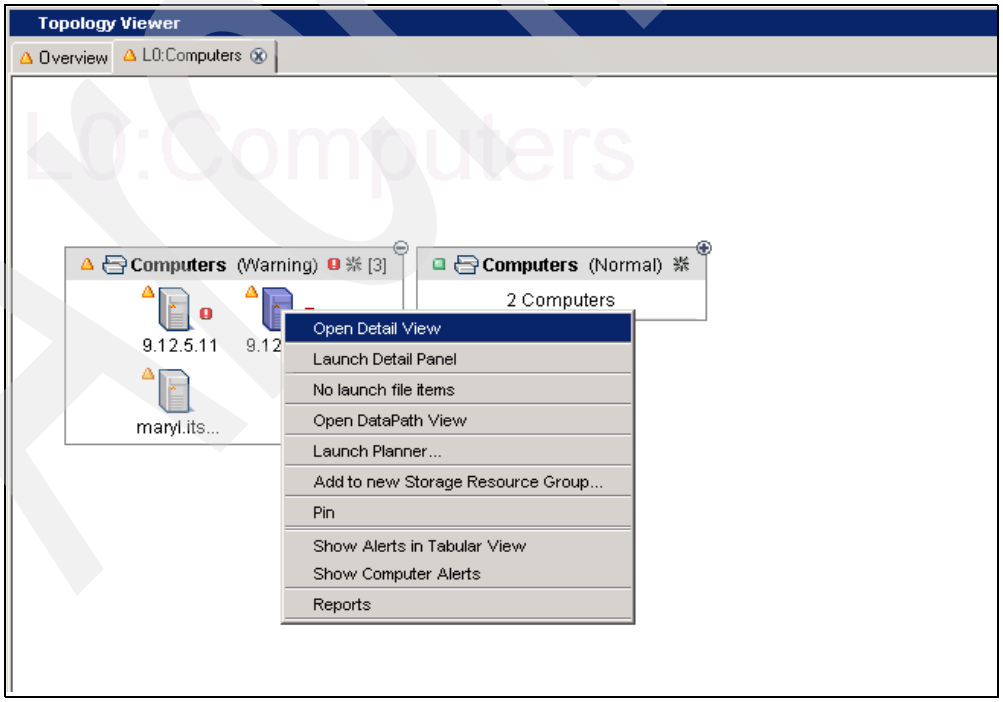


Figure 6-6 Adding a resource to a Storage Resource Group

2. In both cases, the **Create Storage Resource Group** panel opens (see Figure 6-7). The following fields are displayed within the panel:
   - **Creator** - Displays the user name of the creator.
   - Name. Displays the name of the storage resource group or unnamed, if it is not yet named.
   - **Description (Optional)** - Displays the user defined description for the storage resource group.
   - **Selected Elements** - Lists the elements selected to be members of this storage resource group.
   - **Add** - Adds one or more selected elements to the list. The Storage resource group element selection panel is displayed.
   - **Remove** - Removes one or more selected elements from the list.
   - **Default Provisioning Profile** - Lists the available provisioning profiles which can be associated with storage resource groups. The list also includes None. If this storage resource group is used as input to the SAN Planner, the settings defined in this profile will be used to pre-populate the planner inputs.
   - **Create a New Profile** - Launches the Provisioning Profile creation wizard. When you complete the wizard, the Provisioning Profile list is updated.
   - **User defined property 1 (UDP1)** - Specifies any user-defined properties that will be used by the Topology Viewer to provide custom groupings.
   - **User defined property 2 (UDP2)** - Specifies any user-defined properties that will be used by the Topology Viewer to provide custom groupings.
   - **User defined property 3 (UDP3)** - Specifies any user-defined properties that will be used by the Topology Viewer to provide custom groupings.

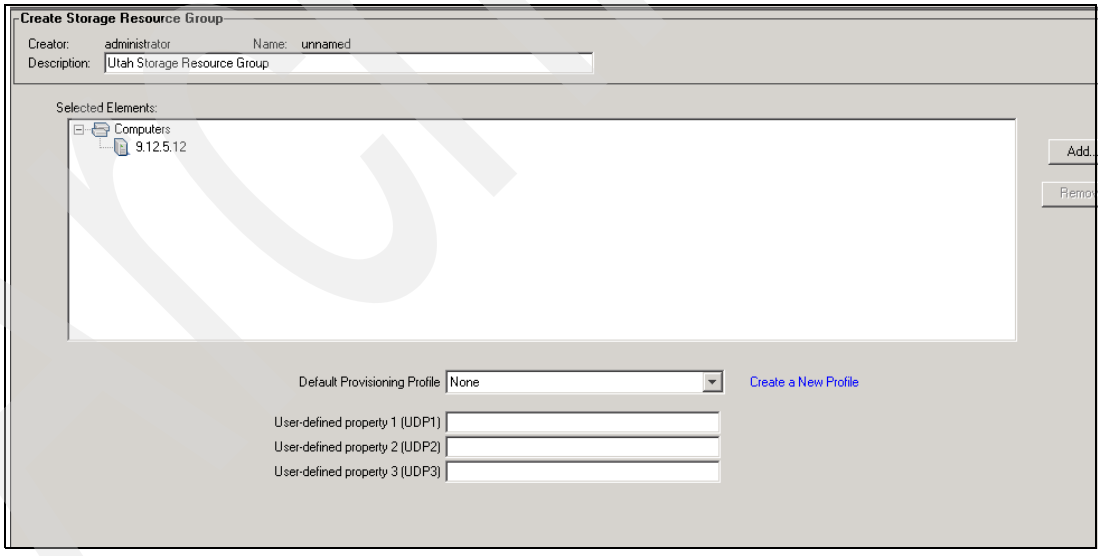


Figure 6-7 Create Storage Resource Group

3. To add element to the Storage Resource Group, click the **Add** button. The **Storage Resource Group Element Selection** panel is displayed (see Figure 6-8). Use this panel to select the storage entities that you want to include in a storage resource group.
   - The **Available elements** window displays the storage entities that you can include in a storage group.
   - The **Selected elements** window displays the storage entities selected to be included in a storage group.

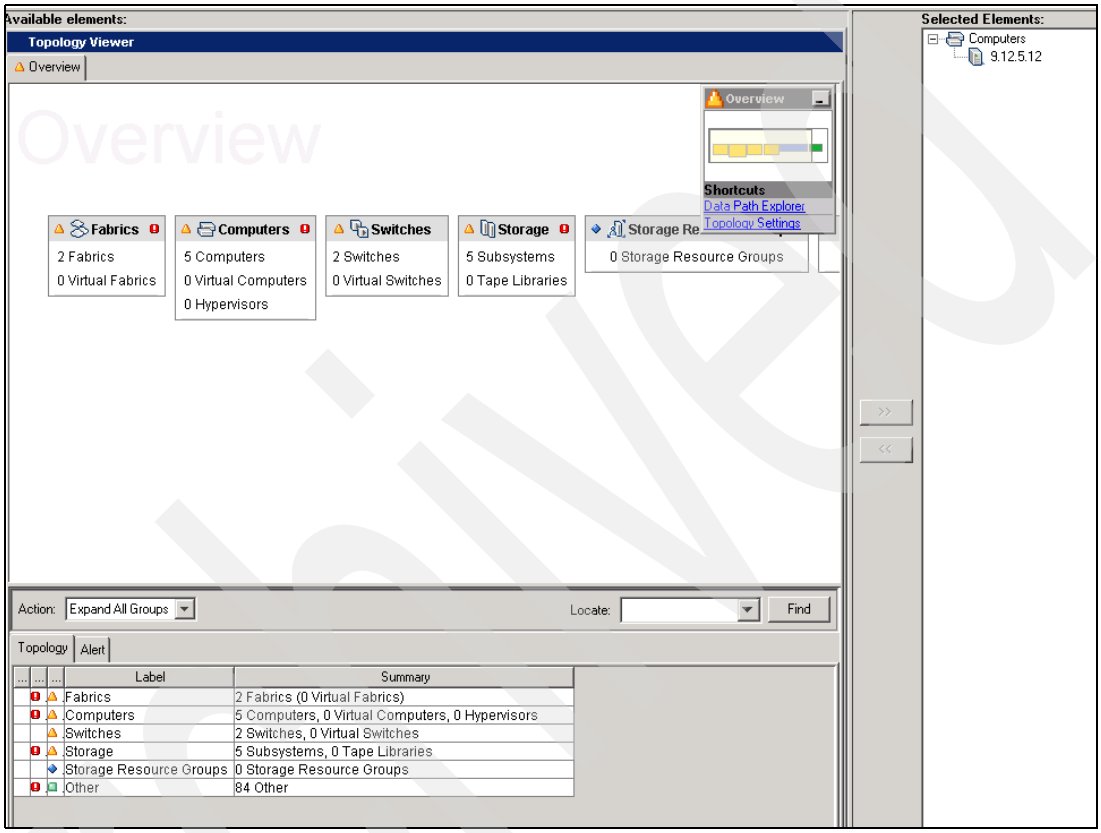


Figure 6-8 Storage Resource Group Element Selection panel

4. Select storage entities to add to the storage resource group, to do this perform the following steps:
   a. Open a detailed view of a storage entity type on the Topology Viewer's Overview page.
   a. Expand the storage entity type to view the storage entities that are part of that type.
   a. Select the storage entities you want to include in the storage resource group.
   b. Click "**>>**".

   Click **OK** when you are satisfied with all your selections to add them to the storage resource group.

   Figure 6-9 shows an example of Storage Resource Groups, where we selected one computer, two switches and the four volumes allocated for the Computer from the DS 4700 Storage Subsystem (we discovered these volumes using the Data Path Explorer, refer to 6.10.2, "Data Path Explorer" on page 231).

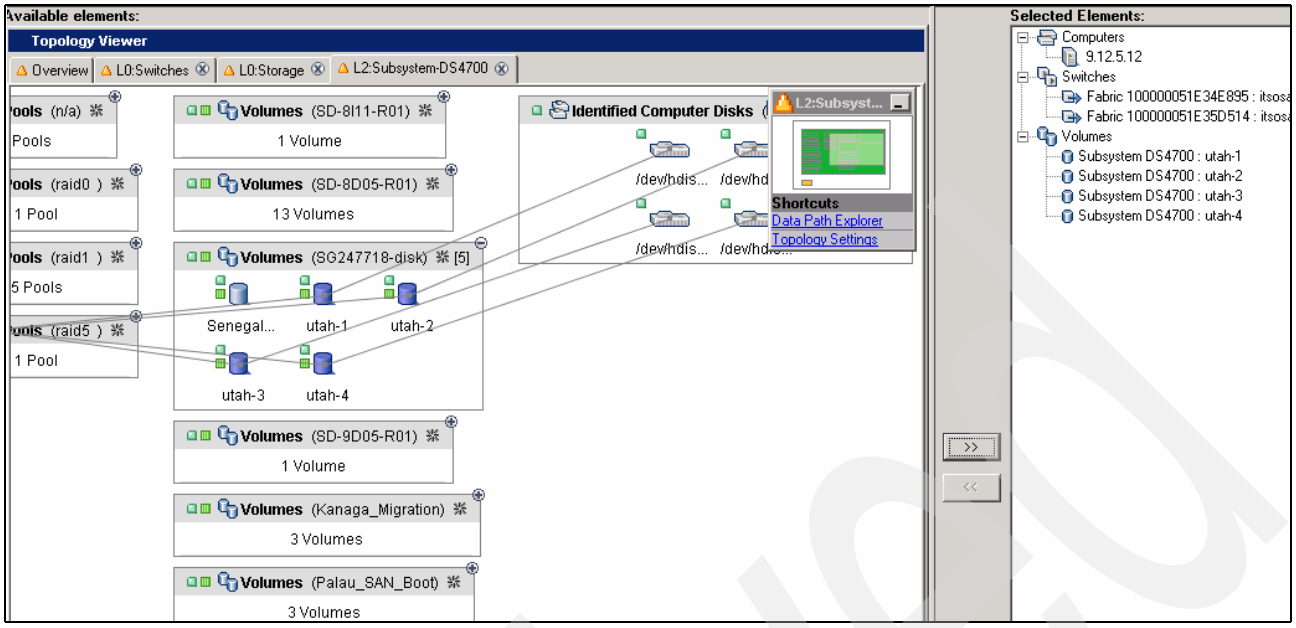


Figure 6-9 Select storage entities

5. The **Create Storage Resource Group** panel is displayed reflecting the selections made under the Selected Elements window as shown in Figure 6-10.

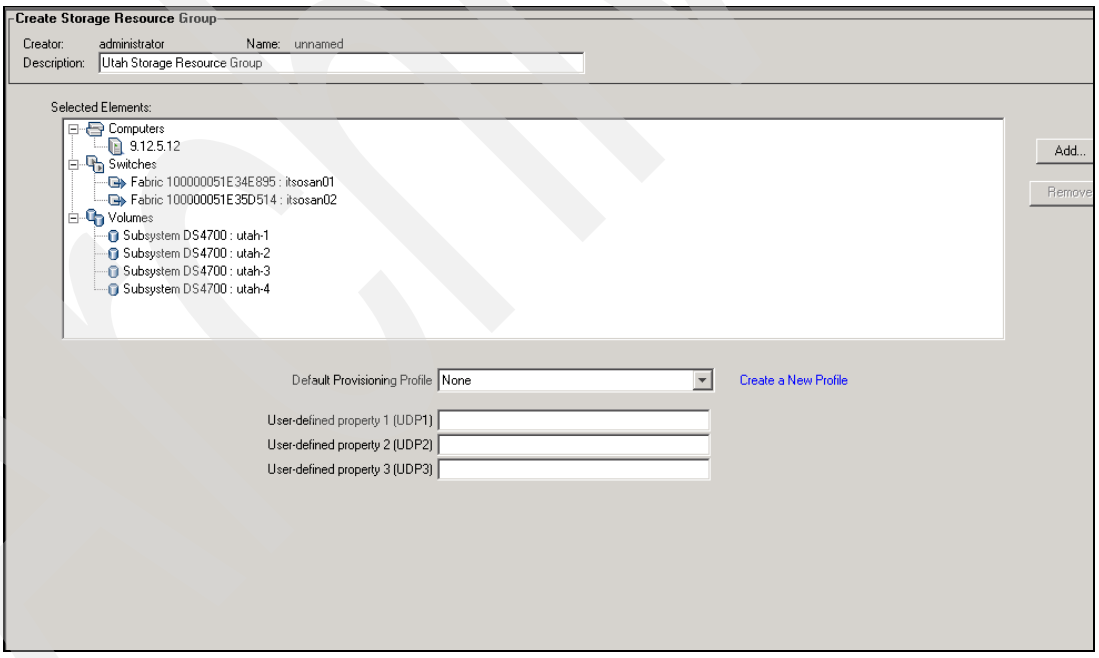


Figure 6-10 Create Storage Resource Group: Selected Elements

6. Save the Storage Resource Group by clicking the **Save** button. You are prompted to specify a name for the new Storage Resource Group.

6.6 SAN Planner

The SAN Planner assists the user in end-to-end planning involving fabrics, hosts, storage controllers, storage pools, volumes, paths, ports, zones, and zone sets.

After a plan is made, the user can select to have the plan implemented by the SAN Planner.

Note: A **Standard Edition** license is required to run the SAN Planner.

6.6.1 Supported devices

The planners support the following IBM storage subsystems:

- DS6000
- DS8000
- ESS

Unsupported subsystems cannot be selected by the user.

6.6.2 Requirements for SAN Planner

Keep the following requirements in mind when using the SAN Planner:

- Before running SAN Planner, you must set up performance monitors and collect performance monitoring data for all the storage subsystems that you want Storage Optimizer to analyze.
- For planning, Tivoli Storage Productivity Center must be managing the host system, subsystem and the fabric interconnecting them. If the host, subsystem, or fabric information is not collected by performing subsystem probes and fabric discovery then the planner will not be able generate the plan or execute portions of the plan and issues an error message.
- For volume creation, Tivoli Storage Productivity Center must be managing the subsystem. You need an active CIMOM to do a CIMOM discovery and a subsystem probe.
- For volume assignment, Tivoli Storage Productivity Center must be managing the host, fabric, and subsystem. The host and subsystem must be in the same fabric. If zoning changes are required, the zoning planner can be used to configure the zoning.
- For a zoning configuration, Tivoli Storage Productivity Center must manage the fabric. For Brocade fabrics, use the Storage Management Initiative Specification (SMI-S) agent to obtain zone information from Brocade SAN. For an out-of-band fabric agent, if you select the **Advanced Brocade Discovery** check box, a message informs you that by selecting this option probe failures might occur. The system prompts you to respond Yes or No. If your response is No, the message dialog is closed and the Advanced Brocade Discovery check box is cleared. If your response is Yes, the Advanced Brocade Discovery check box remains selected and can enter a user ID and password. For other fabrics, you must connect an in-band fabric agent to the fabric for zone control operations.
- A storage controller performance monitor must be run in order to select the Workload Profile options. If a performance monitor has not been run, the Space Only workload profile option is allowed for planning on capacity only.
- The IBM Subsystem Device Driver (SDD) installed on a host is required for multipath planning.

Note: The Linux SDD driver is no longer available. Starting with Red Hat Enterprise Linux Version 5 and SUSE Linux Enterprise Server Version 10,only the DM_Multipath is available.

6.6.3 SAN Planner components and general steps for implementation

The SAN Planner is accessible from the following TPC tree nodes:

- **IBM Tivoli Storage Productivity Center → Analytics → SAN Planner**
- **Disk Manager → SAN Planner**

The SAN Planner can be executed also through the **Launch Planner** selection from the Tivoli Storage Productivity Center **Topology Viewer**. In the graphical view of the Topology Viewer, highlight a supported element (or several), right click, and select Launch Planner from the context menu. See Figure 6-11.

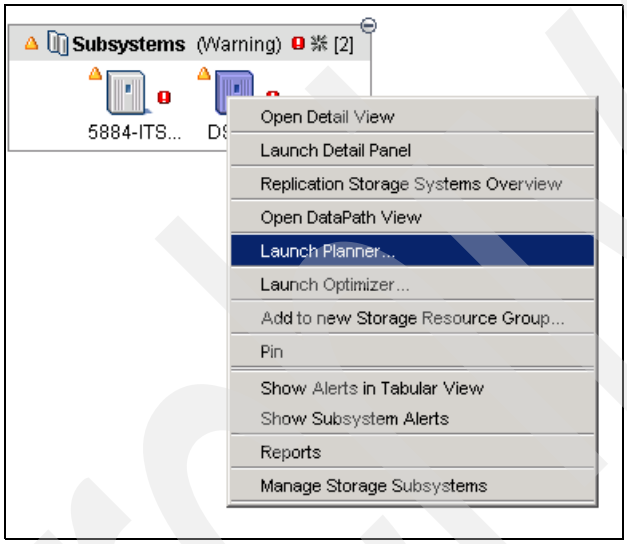


Figure 6-11 Launching SAN Planner from the Topology Viewer

Figure 6-12 shows the SAN Planner pane.

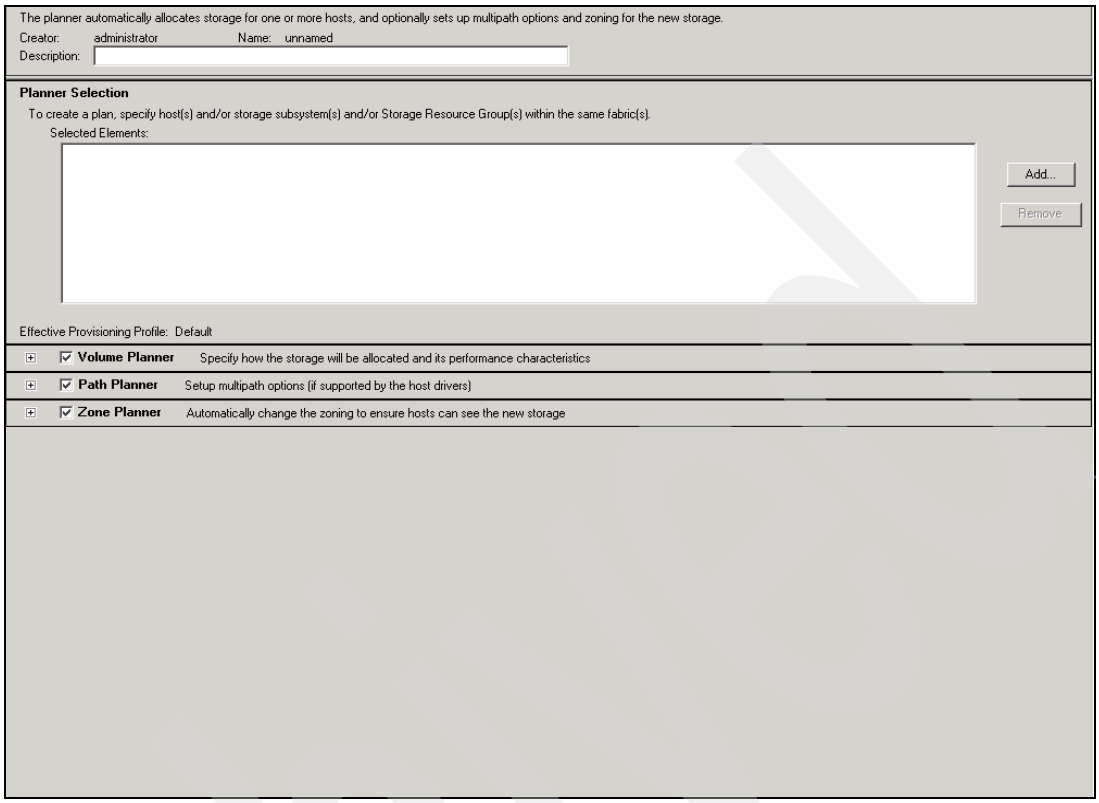


Figure 6-12 SAN Planner panel

Planner selection

Clicking the **Add** button on the **Planner Selection** pane brings the user into the **Planner Selection Topology Viewer** panel.

This provides a topology view of the current system configuration. Select the elements to be used for consideration in the SAN planning. The elements that can be selected are:

- Storage resource groups
- Storage controllers
- Hosts
- Fabrics
- Storage pools

Note:

- A Data agent is required to obtain host information used in volume assignments.
- An inband Fabric agent is optional if the fabric information is available through another inband agent in the same fabric, an outbound agent, or through a CIMOM managed switch.

If you try to add a Computer where a Data agent is not installed, you receive an error message (see Figure 6-13).

Figure 6-13 SAN Planner - error message

Note:

- The **Select Elements** pane lists the storage resource groups, fabrics, computers, subsystems, pools, and volumes if selected. All selections must be located within the same fabric for SAN Planner to work.
- The Fabrics section lists the fabrics (by WWN) and the corresponding selected subsystems and selected hosts within each fabric.
- A subsystem is listed multiple times if it has been configured in different fabrics. The Subsystems section contains the selected storage subsystems. The number of fabrics the subsystem belongs to is shown next to each subsystem.
- Selected pools are listed under their storage subsystems. Selected volumes are listed under their pools.
- The Computers section lists the selected hosts and the number of fabrics the host belongs to. The hosts is used in path planning and zone planning if Path Planner and Zone Planner are selected in the configuration panel.

Figure 6-14 shows an example of resource selection from the **Planner Selection** pane, where we added one Fabric, a Computer and the ESS storage subsystem, selecting from the Topology Viewer and clicking on the "**>>**" button.

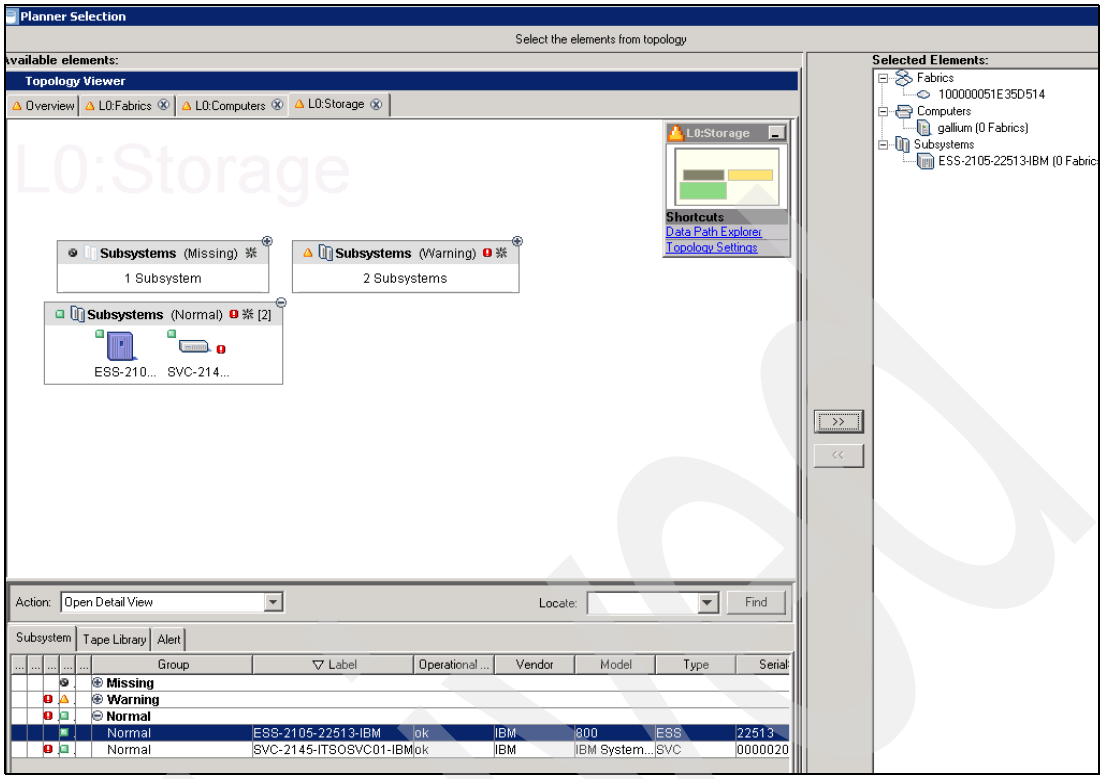


Figure 6-14 SAN Planner - selecting the resources

Now the selected resources are available in the **Planner Selection** section of the **Planner Selection** pane (see Figure 6-15).

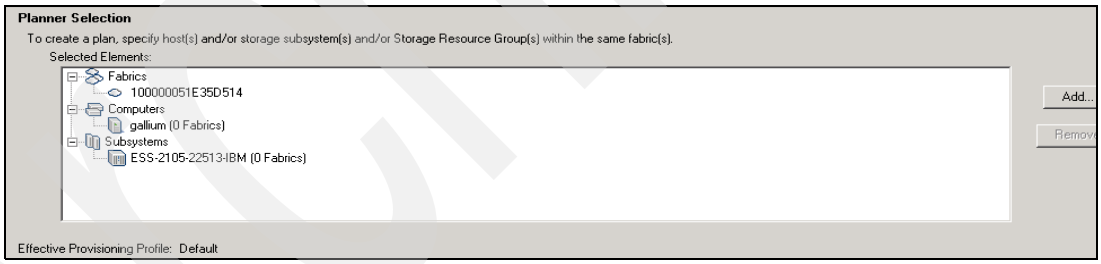


Figure 6-15 SAN Planner - selected resources

Volume Planner

Use the Volume Planner to plan and select appropriate storage controllers, storage pools, and storage volumes (when using unassigned volumes) that satisfy your inputs. It allows you to select controller type preference, whether storage request can be satisfied by multiple controller types, and select RAID level. Volume Planner uses the current performance utilization of storage resources to determine whether a new volume should be allocated on particular pool in a particular storage controller. If multiple storage pools from different controllers can potentially satisfy your provisioning request, then the Volume Planner will use the rated utilization of the pools (the sum of the previous provisioning performance requirements, which might be greater than the current utilization) to break the ties and select a candidate storage pool.

Select workload profiles an inputs to the Volume Planner's analysis.

To start the Volume Planning, click **+** to expand the **Volume Planner** options (see Figure 6-16).

If you do not want to do volume planning, clear the **Volume Planner** check box to disable the fields within the pane.

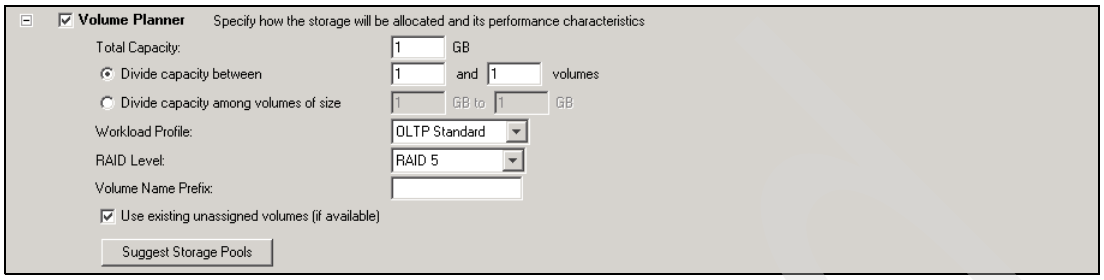


Figure 6-16 SAN Planner - Volume Planner

For a detailed descriptions of the **Volume Planner** fields and for the configuration steps, refer to “Planning and modifying storage configuration” in *IBM Tivoli Storage Productivity Center V4.1: User’s Guide*, SC27-2338.

Note:

- The *Volume Planner* uses your inputs to select appropriate storage controllers, storage pools, and storage volumes when using unassigned volumes.
- If you specified storage controllers in the Planner Selection pane, the SAN Planner lists the storage pools from those storage controllers that have the storage capacity you requested.
- If you specified storage controllers and pools in the Planner Selection pane, the SAN Planner lists additional pools from storage controllers that have the storage capacity you requested.

By clicking on the **Suggest Storage Pools** button you get a set of storage pools to create the volumes from.

Note:

- *Suggest Storage Pools* cannot be used if volumes were selected during the selection process and are visible in the Planner Selection pane.
- Storage pools are used if they are not full or are not visible from all hosts.
- Only fixed block storage pools can be used by the SAN Planners.

Path Planner

The Path Planner allows setup of multipath options.

The supported multipath driver on a host is:

- IBM Subsystem Device Driver (SDD).

Note: The Linux SDD driver is no longer available. Starting with Red Hat Enterprise Linux Version 5 and SUSE Linux Enterprise Server Version 10, only the DM_Multipath is available.

The Path Planner enables system administrators and SAN administrators to plan and implement storage provisioning for hosts and storage subsystems with multipath support in fabrics managed by Tivoli Storage Productivity Center. Planning the provisioning of storage to hosts with multipath drivers requires knowing which storage subsystems are supported by the host multipath driver and the multipath modes which are supported by the driver and storage subsystem. Planning the paths between the host(s) and storage controller requires designing paths between hosts and storage subsystems which will be implemented through zones in the fabric.

The Path Planner is used for specifying multiple paths options between selected hosts and storage subsystems. This setting requires each host to have at least two Fibre Channel ports connected to the SAN.

To start the Path Planning, click **+** to expand the **Path Planner** options (see Figure 6-17).

If you do not want to do Path planning, clear the **Path Planner** check box to disable the fields within the pane.

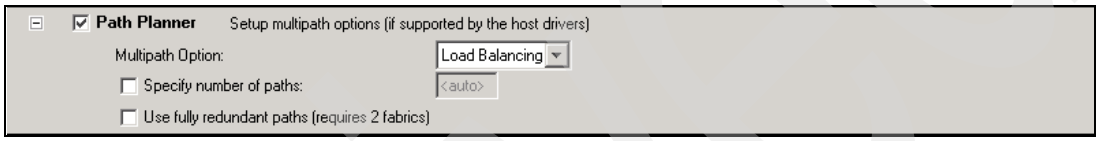


Figure 6-17 SAN Planner - Path Planner

For a detailed descriptions of the **Path Planner** fields and for the configuration steps, refer to “Planning and modifying storage configuration” in *IBM Tivoli Storage Productivity Center V 4.1: User’s Guide*, SC27-2338.

Zone Planner

Zone Planner specifies automatic zoning between ports on the selected hosts and subsystems in a fabric. It plans zoning configuration for new storage that is provisioned for use by a host. For example, it can be used when a new storage volume is created and assigned to a host. It can also be used with a volume that has already been created and is assigned to a host needing more storage. In these cases, the Path and Volume Planner determines which host and storage need to be zoned together, providing the Zone planner the exact set of ports which need to be zoned together. The Zone planner then uses the zoning inputs for the planning. In the case where Volume and Path planners are not used, manually select the host and storage ports and then invoke the Zone planner.

Note: All zoning is done with WWPN based zoning.

The Zone planner expects a list of host port and storage port pairs as input. If the Path Planner has been invoked prior to the Zone Planner, its output is used as input to the Zone Planner. If the subsystem/host are within the same fabric and Zone Planner is not checked, then existing zones or zone sets are used. If Zone Planner is checked, this creates a new zone or zone set.

In order to do any zoning, the host and subsystem being zoned by the Zone Planner must be within the same fabric. For the case where the host and subsystem reside in more than one of the same fabrics, you are given two options. The first option is to create identical zones in all of the fabrics. The second option is to select specific fabrics to create identical zones in.

To start the Zone Planning, click **+** to expand the **Zone Planner** options (see Figure 6-18).

If you do not want to do Zone Planning, clear the **Path Planner** check box to disable the fields within the pane.

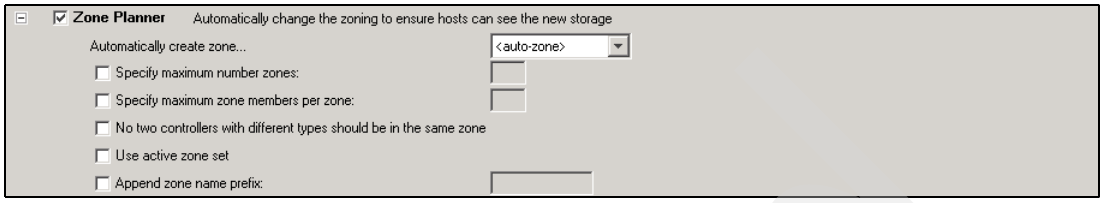


Figure 6-18 SAN Planner - Zone Planner

For a detailed descriptions of the **Zone Planner** fields and for the configuration steps, refer to “Planning and modifying storage configuration” in *IBM Tivoli Storage Productivity Center V4.1: User’s Guide*, SC27-2338.

After you select the **Zone Planner** options, click the **Get Recommendation** button. The **Get Recommendation** button causes the SAN Planner to analyze the current configuration, performance values, and storage space to recommend a potential configuration change. You can accept the plan or change the inputs and get another plan recommendation.

6.7 Configuration Analysis

The Configuration Analysis feature allows a system administrator to select up to 13 policies and to specify the name of a target SAN (or zone set) for the analysis. The analysis tool reads the specified SAN data and the policy information for the specified policies from the Tivoli Storage Productivity Center database. It outputs the policy violations as Tivoli Storage Productivity Center alerts.

System administrators can use configuration analysis to learn of any best-practices violations their actions might have caused. For example, in provisioning a new storage subsystem, an administrator might inadvertently violate a zoning-related policy. If the zoning-related configuration changes persist in the database, configuration analysis can detect this policy violation.

Note: A **Standard Edition** license is required to run the Configuration Analysis.

6.7.1 Requirements for Configuration Analysis

Before Configuration Analysis job can be executed, ensure that:

- You have previously run discovery and probe jobs for the computers, fabrics, switches, storage, and other objects of interest.
- The following Tivoli Storage Productivity Center agents are installed and configured:
  - A mix of in-band, out-of-band, and CIMOM fabric agents to collect all fabric topology information (switches, interconnections, and zoning). This information is needed for the evaluation of all configuration analysis policies.
  - CIMOM agents for storage subsystems to collect the storage subsystem information (subsystem details, storage volumes, storage ports and storage volumes to hosts’ mappings). This information is needed for the evaluation of configuration analysis policies 2, 3, 5, 7 and 11.

– Data agents to collect the host information (operating system type and version). This information is needed for the evaluation of configuration analysis policies 3 and 9.
– In-band fabric agents to collect the attribute information from the host information (HBA and host port details). This information is needed for the evaluation of configuration analysis policies 2, 3, 4, 8 and 9.
– CIMOM agents for Tape to collect the tape information. This is needed for the evaluation of configuration analysis policy 2.

Important: Policy violations are not raised if the agent information needed to evaluate a policy is not collected and stored in the Tivoli Storage Productivity Center database.

6.7.2 General steps for using Configuration Analysis

In this section we explain how to use Configuration Analysis.

Defining a Configuration Analysis job

To perform Configuration Analysis, complete the following steps:

1. In the Navigation Tree, expand **IBM Tivoli Storage Productivity Center** → **Analytics** → **Configuration Analysis,** right click and select **Create Analyzer** (see Figure 6-19).

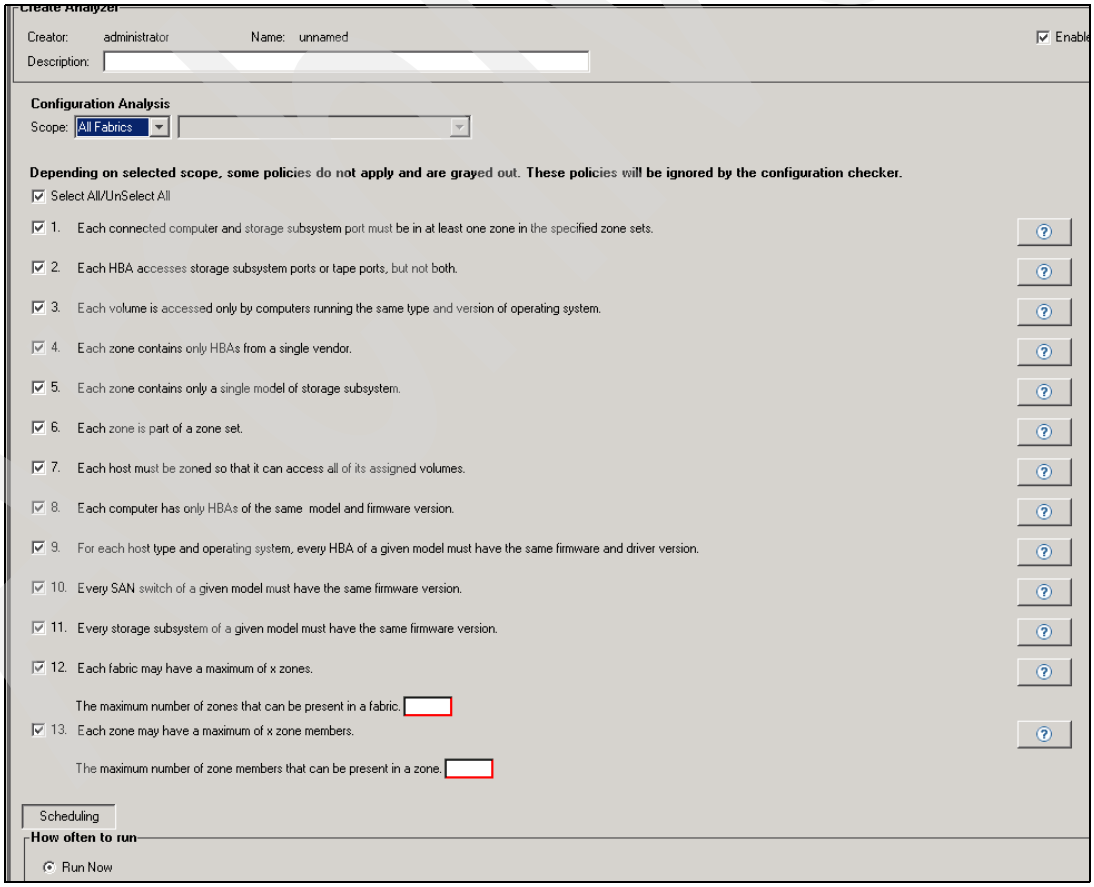


Figure 6-19 Configuration Analysis window

a. In the **Configuration Analysis** area, you can:

– Select the scope of the SAN data to be checked:

- All Fabrics
- One fabric
- One Zoneset

– Check the SAN data against up to 13 policies. You can access to the explanation for each policy by clicking on the related "**?**" button.

b. In the **Scheduling** area schedule how often you want the job to run.

c. In the **How to handle time zones area**, indicate the time zone to be used when scheduling and running the policy.

2. Save the job. In the Navigation Tree pane, the newly named analyzer job displays under **IBM Tivoli Storage Productivity Center** → **Analytics** → **Configuration Analysis**.

Analyzing the job results

- To view whether a policy violation occurred, click the magnified of the related Job. The Job log file page displays the following information:
  – Scope of the run (all fabrics, one fabric, or one zone set)
  – Policies that were checked
  – Total violations
  – Breakdown of violations per policy
  – Whether the run completed successfully or the errors it encountered

Note: To avoid overloading the Topology Viewer, the analysis job stores and displays only the first 50 policy violations. You must resolve these violations and run the job again to view any remaining violations, or you can change this policy violation limit by using the **`setdscfg`** command. The attribute to set is MaxPolicyViolationsStored.

- To view one or more alerts generated by policy violations, in the Navigation tree expand **IBM Tivoli Storage Productivity Center** → **Alerting** → **Alert Log** → **Configuration Analysis**. The Alert History - All Policy Violations page displays a log of job runs that generated alerts for policy violations. A policy violation alert is generated for each policy that was violated during a run. A policy can be violated several times, but only one alert is generated; the text in the alert indicates the number of times the policy was violated.

For detailed explanation of the policies and for suggestion on how verify and fix the Policy Violations, refer to "Using configuration analysis" in *IBM Tivoli Storage Productivity Center V 4.1: User's Guide*, SC27-2338.

6.8 Fabric Management with Tivoli Storage Productivity Center

From the Topology Viewer you can view the defined Fabrics and their components. Figure 6-20 shows an example of Level 2 Fabric visualization, with the components of the Fabric and the relationships between the components.

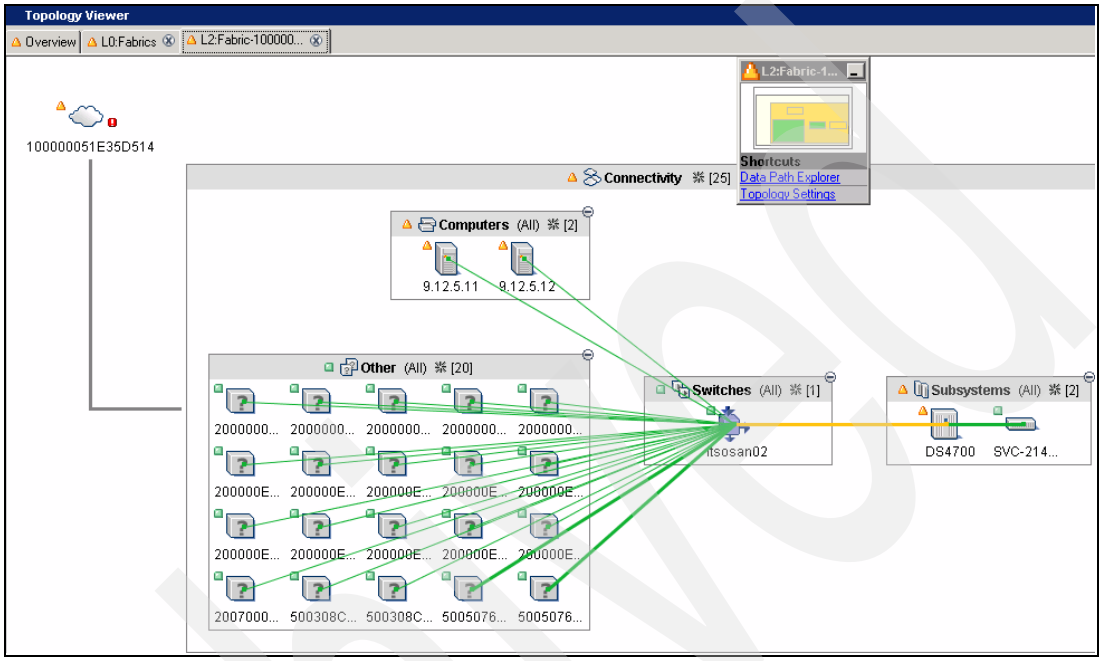


Figure 6-20 Topology Viewer - L2 Fabric View

6.8.1 Guidelines for managing zones with Tivoli Storage Productivity Center

Fabric Manager lets you create, update, and delete zones, zone aliases, and zone sets in a SAN. In addition, you can do the following:

The advantages to using Fabric Manager to create zones rather than the management applications of the devices are that Fabric Manager lets you perform zoning from a single interface, and you can use consistent, familiar methods to work with devices from multiple vendors.

Consider the following guidelines if you use Fabric Manager with zones:

- For Brocade and McDATA fabrics, topology information is collected through CIM Agents. If no CIM Agents are configured, or if the fabric is a QLogic or Cisco fabric, have at least one managed host per zone for the complete topology display. In this way, you can manage your switches and a string is returned, provided by the vendor, that can be the worldwide name (WWN) or a vendor, model, and level type designation.
- If CIM Agents cannot be used to collect zoning, the Fabric Manager can retrieve the zone information from IBM 2005 and 2109 switches and from Brocade Silkworm Fibre Channel Switches. SNMP agents must log into the switch with administrative rights. To see zone information, specify the login ID for the agents you define.

For zone discovery and zone control for any fabrics with Brocade switches or vendor Brocade switches, you must have a SMI-S agent configured for the fabric. If a SMI-S agent is not configured, you must enable Advanced Brocade Discovery. To do this, enter the administrator user ID and password for at least one switch in a fabric. However, you should not enable advanced discovery for all Brocade switches that have been configured as SNMP agents. The enabled switch acts as a proxy and gathers zone information for the entire fabric. You can enable a second switch for redundancy. Enabling all Brocade switches puts an unnecessary load on the switches and fabric. You should enable newer, more powerful switches (such as director class) and those running the highest level of firmware.

- A zone set can be deleted while it contains zones. With QLogic switches, those zones are put into an orphan zone set (that is, zones that do not belong to any zone set). The zones can later be moved from an orphan set into other zone sets. The Fabric Manager zone configuration panels cannot display zones in an orphan zone set. However, the zones exist on the switch, and they can be configured using the switch vendor's tool.
- For McData switches, you can add empty zones to inactive zone sets. You cannot add empty zones to inactive zone sets for other vendors' switches.

Note: Activating an inactive zone set that contains empty zones will fail if a switch does not support empty zones in active zone definitions.

Note: In-band discovery does not detect orphan zones. These zones are not listed in the Zone Configuration window. However, the zones exist on the switch, and they can be configured using the switch vendor's tool. However, Brocade orphan zones, which are discovered through SMI-S agents and out-of-band discovery, are listed in the Zone Configuration window and can be configured by the Fabric Manager. Brocade orphan zone aliases, which are discovered through SMI-S agents, are listed in the Zone Configuration window and can be configured by the Fabric Manager.

Similarly, for McDATA fabrics managed where a CIM Agent is configured, orphan zones are listed in the Zone Configuration window and can be configured by the Fabric Manager.

Refer toTable 3-7 on page 84 for the Tivoli Storage Productivity Center supported agent types for Zoning.

6.8.2 Fabric Management capabilities with Tivoli Storage Productivity Center

To access to the **Zone Configuration** window, in the Navigation Tree click **Fabric Manager** → **Fabrics.** The **Zone Configuration** window opens (see Figure 6-21).

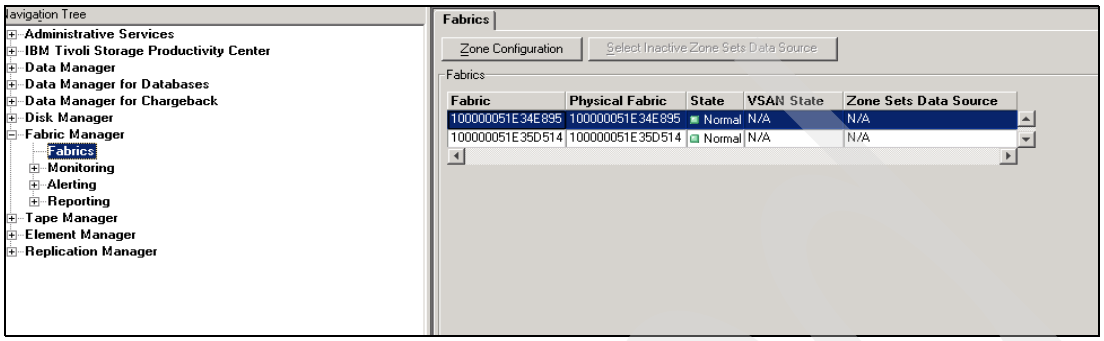


Figure 6-21 Fabric Manager window showing Fabrics

To view the Zone Configuration for a specific Fabric, from the **Zone Configuration** Pane, select a Fabric and click the **Zone Configuration** button. The **Zone Configuration** window opens (see Figure 6-22).

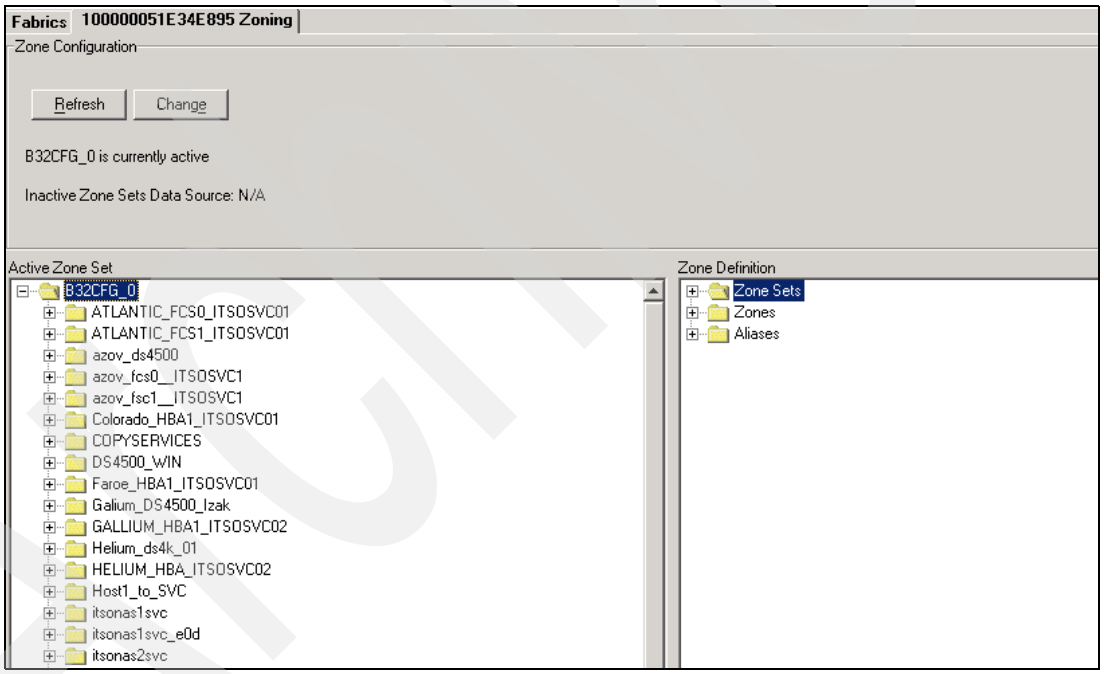


Figure 6-22 Zone Configuration pane

To change a Zone configuration, click the **Change** button. The Fabric definitions pane opens (see Figure 6-23).

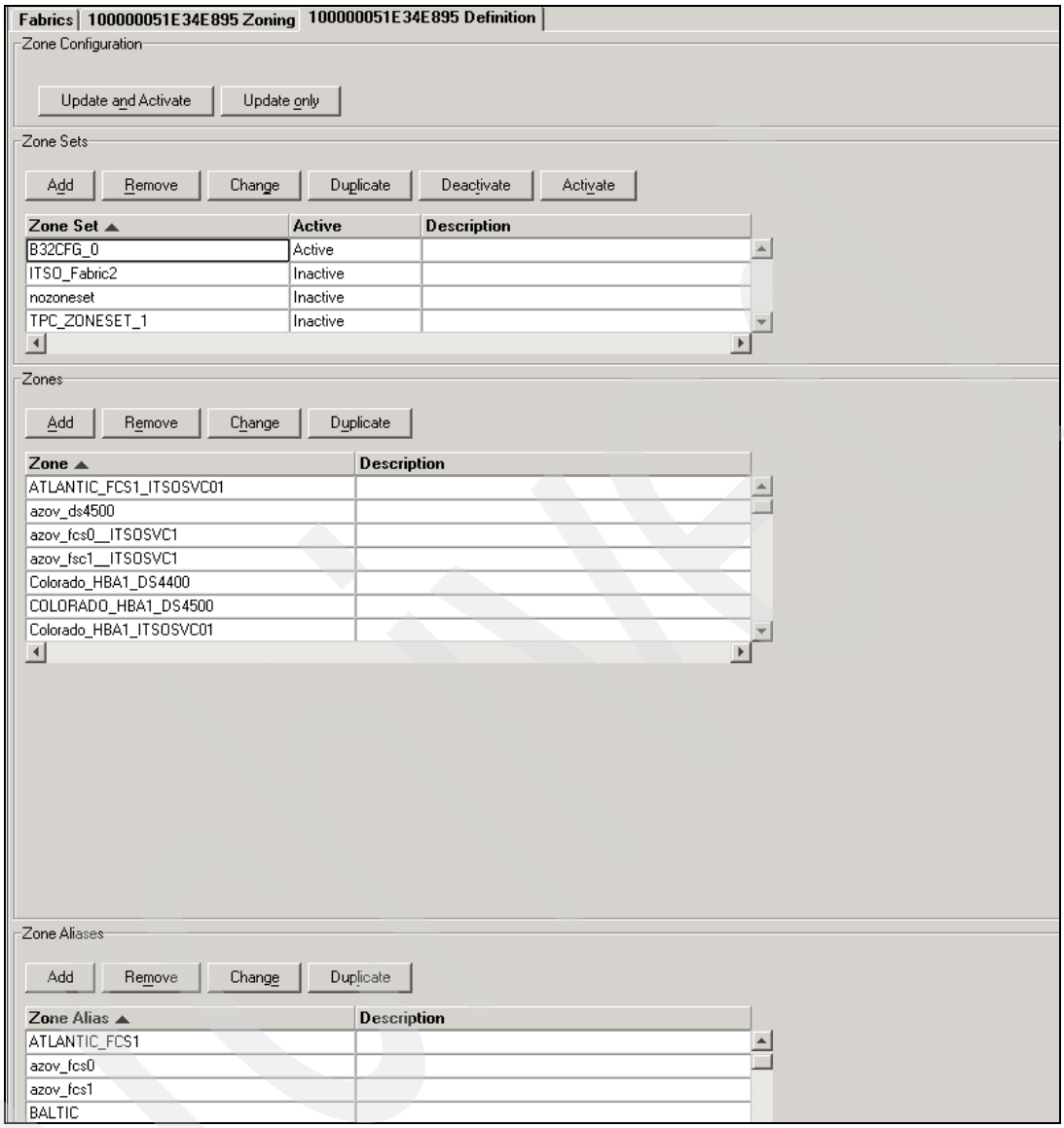


Figure 6-23 Fabric definition pane

Attention: After you click **Change** to begin your zone configuration changes and before you click **Update and Activate** or **Update Only** to conclude your changes, it is possible that other users might have made zoning changes to the same fabric. This might have happened through a switch element manager or switch CLI, as some switch vendors and models lack zone control session locking across the fabric. This could allow overwrite conditions of the changes to the active zoneset for the fabric and to the set of inactive zonesets.

Following are listed all the Fabric Management capabilities with Fabric Manager. Refer to “Managing fabrics” in *IBM Tivoli Storage Productivity Center V 4.1: User’s Guide*, SC27-2338 for detailed implementation steps for each capability.

- **Working with zones**
  - Creating zones
  - Adding storage to a server and setting up a zone
  - Changing zone properties
  - Duplicating zones
  - Removing zones
- **Working with zone sets**
  - Creating zone sets
  - Changing zone set properties
  - Activating and deactivating a zone set
  - Selecting the inactive zone sets data source
  - Duplicating zone sets
- **Working with zone aliases**
  - Creating zone aliases
  - Changing zone alias properties
  - Duplicating zone aliases
  - Removing zone aliases

6.9 Volumes and Virtual Disks Management

From the Topology Viewer you can view the Storage Subsystems and their configurations. Figure 6-20 shows an example of Level 2 Storage visualization, with both physical and logical components (disks, pools, volumes) and their relationships.

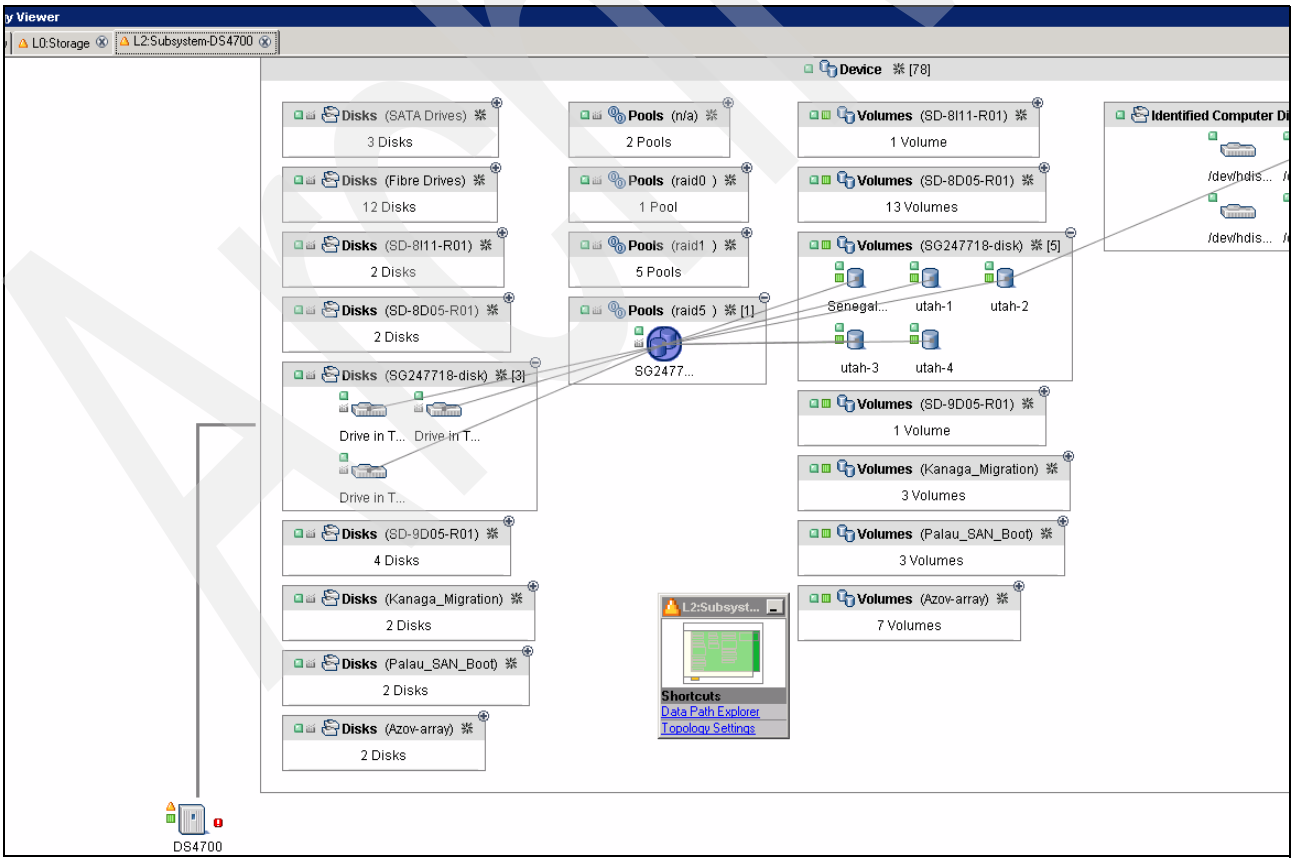


Figure 6-24 Topology Viewer - L2 Storage View

6.9.1 Accessing the Storage Subsystems

To access to the **Storage Subsystems** window, in the Navigation Tree click **Disk Manager** → **Storage Subsystems** (see Figure 6-25).

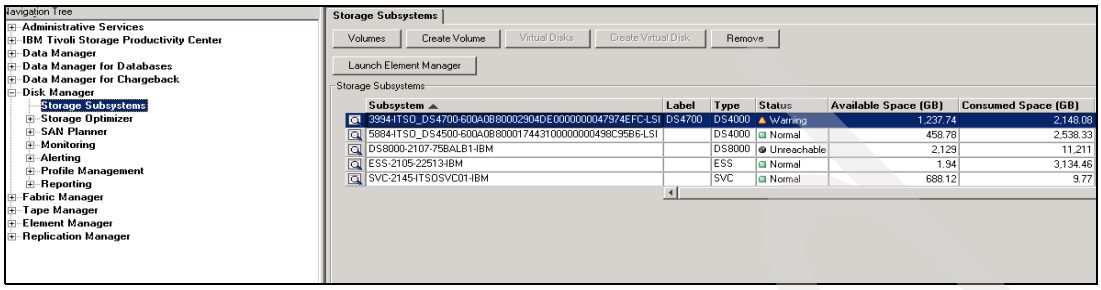


Figure 6-25 Storage Subsystems windows

To view the configuration for a specific device, from the **Storage Subsystem** pane, select a device and click one of the available buttons, depending on the type of storage device:

- **Volumes** - for Storage Subsystems. It Opens the **Volumes** pane, from where you can get the list of the defined volumes, filtering it by **Extent Pool** or by **Hot Port** (see Figure 6-26 on page 226).

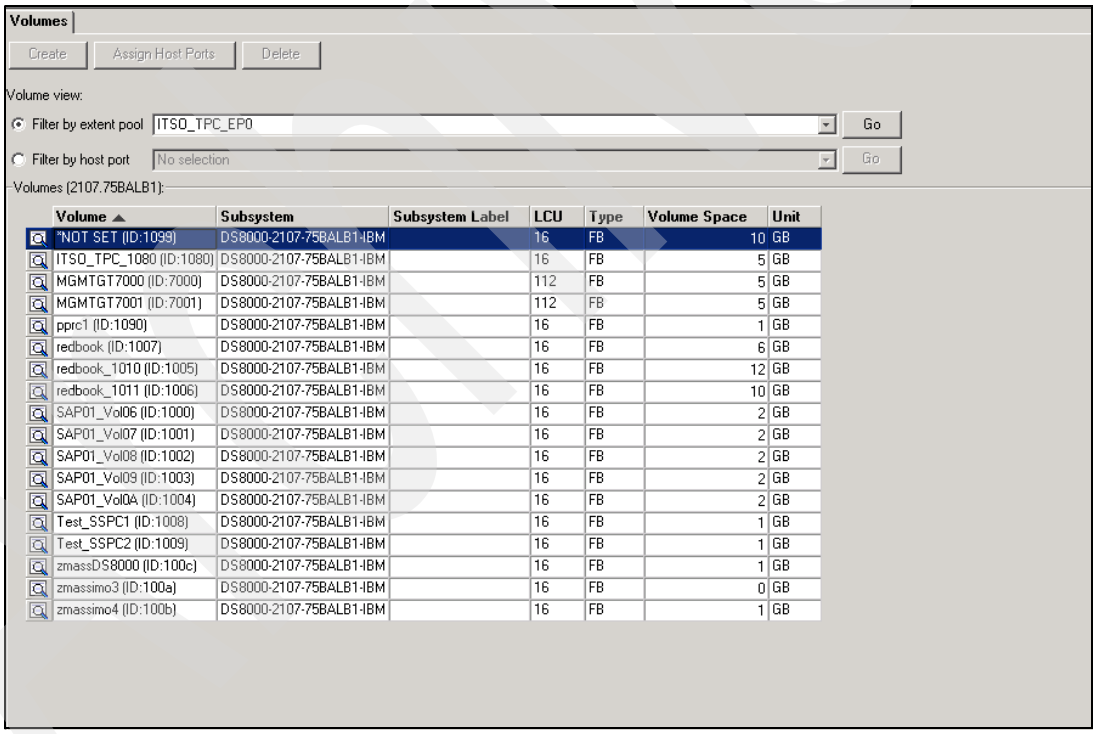


Figure 6-26 Volumes list filtered by Extent Pool

- **Virtual Disks** - for SAN Volume Controller. It Opens the **Virtual Disks** pane, from where you can get the list of the defined Virtual Disks, filtering it by **MDisk Group** or by **Hot Port** (see Figure 6-27).

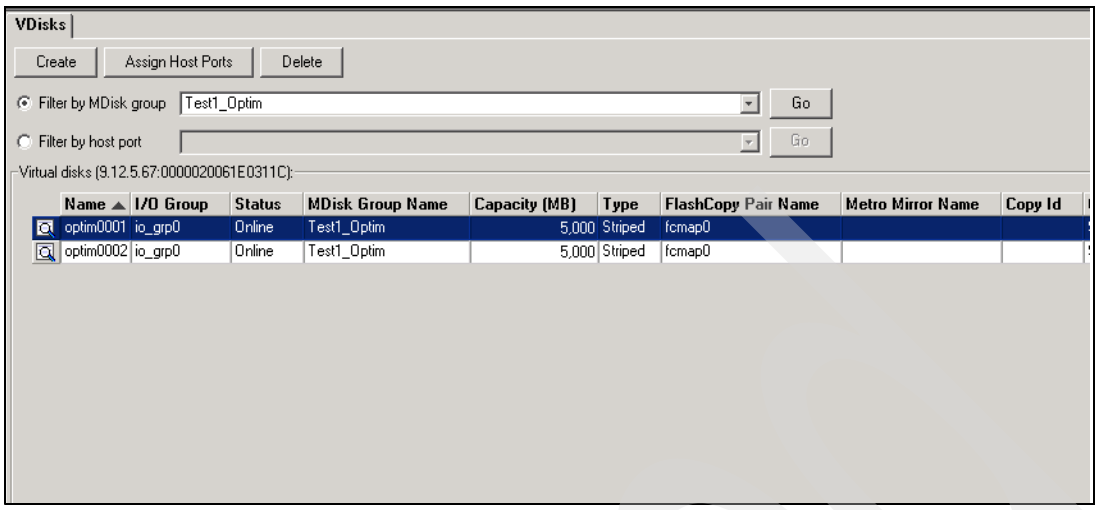


Figure 6-27 Virtual Disks list filtered by MDisk Group

6.9.2 Volumes and Virtual Disks capabilities

Following are listed all the Volumes and Virtual Disks capabilities with Fabric Manager. Refer to “Managing fabrics” in *IBM Tivoli Storage Productivity Center V4.1: User’s Guide*, SC27-2338 for detailed implementation steps for each capability.

- Managing volumes:
  - Assigning host ports
  - Creating volumes
  - Creating volumes and assigning them to a host
  - Deleting volumes
  - Viewing volume information
- Managing virtual disks:
  - Adding a managed disk to a managed-disk group
  - Assigning host ports
  - Creating virtual disks
  - Deleting a virtual disk
  - Viewing virtual-disk information

6.10 Functions and use of Topology Viewer

The Topology Viewer provides a graphical representation of the physical and logical resources that have been discovered in your storage environment by Tivoli Storage Productivity Center.

You can view health status, performance, and other details about switches, computers, storage subsystem servers, fabrics, and other entities. To launch the Topology Viewer, expand **IBM Tivoli Storage Productivity Center** → **Topology** in the **Navigation Tree** pane.

The information displayed by the Topology Viewer is collected by discovery, probing, performance data collection, and alerting. The Topology Viewer consists of two views, a **graphical** view (see Figure 6-28) and a **table** view (see Figure 6-29), organized vertically with the graphical view on top of the table view. The table view shows the same information as the graphical view, but in a tabular format.

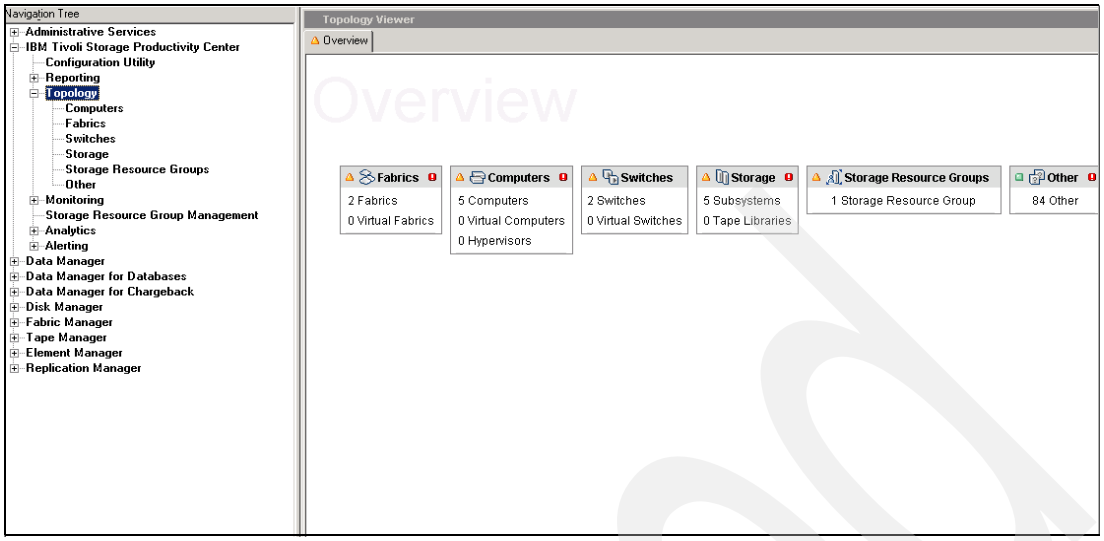


Figure 6-28 Topology Viewer - graphical view

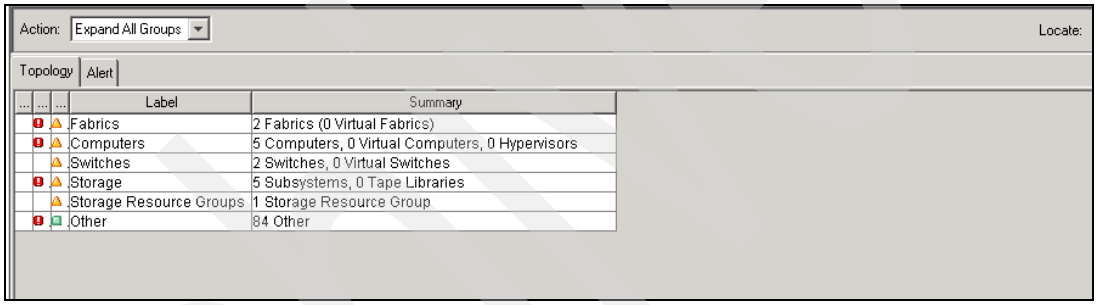


Figure 6-29 Topology Viewer - table view

Notes:

- The availability of certain action items depends on the entity class and view level.
- When you right-click an object in the graphical view, a context menu is displayed. The action items in this menu are identical to the action items displayed when you right-click the corresponding object in the table view and click the arrow in the Action field.
- If the discovery process is not completed and there are entities in the environment that have not been rendered into the current view, the view will build dynamically as entities are discovered.
- Some columns and fields displayed within the Topology Viewer might not be populated with data for the storage resources that you are monitoring. Columns and fields appear empty if you have not configured IBM Tivoli Storage Productivity Center to discover or collect the information intended for those columns and fields. Use discovery, probe, ping, or scan jobs to ensure that you collect information for all the columns and fields that appear in the Topology Viewer.
- In environments where you are monitoring a large number of storage entities, Tivoli Storage Productivity Center might not be able to display all of those entities within the Topology Viewer. See “Viewing large environments in the Topology Viewer” on page 379 for more information about how to ensure that all your monitored entities are displayed. It is recommended that you perform this task in larger environments.

6.10.1 Topology Viewer: Four levels of detail

The Topology Viewer supports four levels of detail, from a high-level overview of the entire storage environment to detailed information about individual entities. This allows you to view as much or as little detail as you need:

- **Overview** - A global, highly aggregated view of the entire storage environment (see Figure 6-28 on page 228).
- **Groups level (L0)** - This level focuses on groups of a particular type (see Figure 6-30 for an example of Level 0 view for the switches). The default groups are:
  - **Computers** - All discovered computer groups in your storage environment
  - **Fabrics** - All fabric groups in your storage environment. A fabric is a network of entities that are attached through one or more switches. The topology viewer also displays Virtual SANs (VSANs) and Logical SANs (LSANs).
  - **Switches** - All switches in your environment.
  - **Storage** - All storage subsystems and tape libraries in your environment.
  - **Other** - All entities that are discovered in your environment but that do not fit in either the computer, fabric or storage classes.

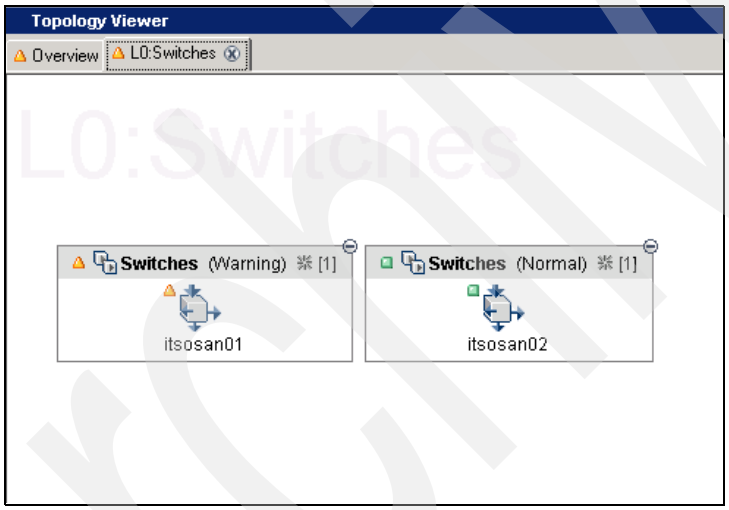


Figure 6-30 Topology Viewer - L0 Switches

- **Group level (L1)** - This level focuses on one selected group and its related entities (for example, a group of computers. See Figure 6-31). At L1, individual entities can be shown by expanding the group box. You can also display lines representing connections between entities or between entities and groups.

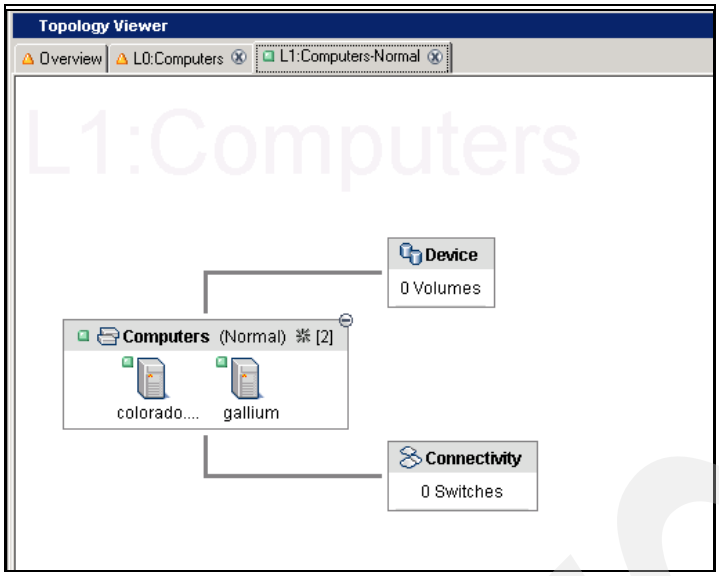


Figure 6-31 Topology Viewer - L1 Computers

- **Detail level (L2)** - This level focuses on individual entities (for example, a single computer, switch, subsystem, or tape library. See Figure 6-32) and the paths to associated logical and physical entities. This level shows details all the way to the port level.

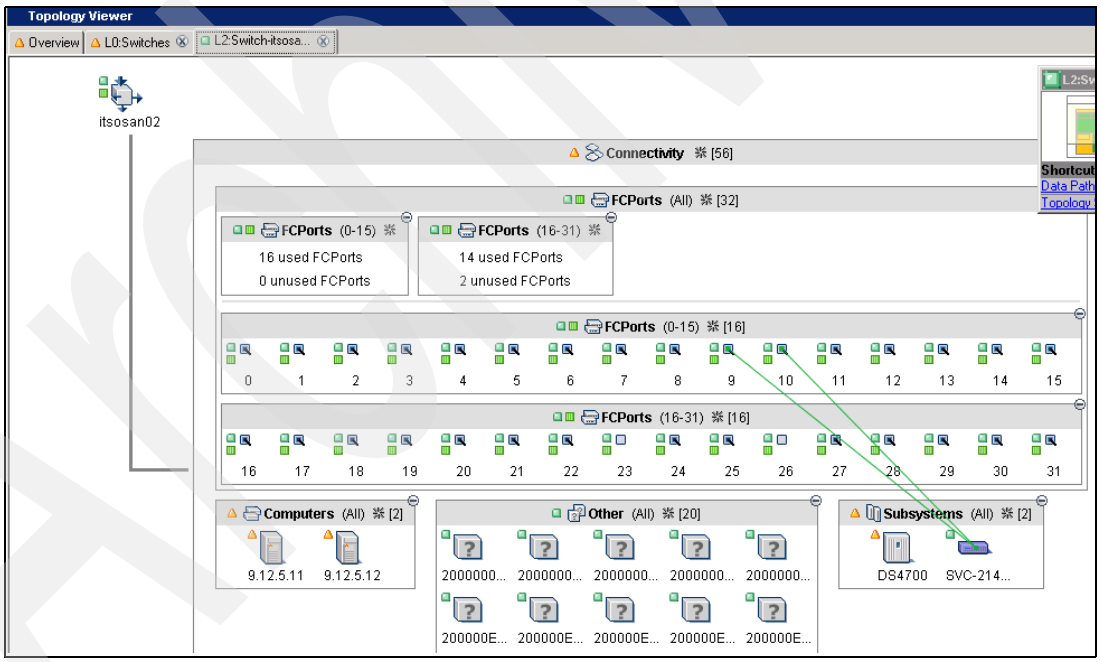


Figure 6-32 Topology Viewer - L2 Switch

In addition, the Topology Viewer depicts the relationships among resources (for example, the disks comprising a particular storage subsystem. See Figure 6-32). Detailed, tabular information (for example, attributes of a disk) is also provided. With all the information that the topology viewer provides, you can more quickly and easily monitor and troubleshoot your storage environment and perform critical storage-management tasks.

For further details on the Topology View (icon, status, tabular view) refer to “Using the Topology Viewer” in *IBM Tivoli Storage Productivity Center V 4.1: User’s Guide*, SC27-2338.

6.10.2 Data Path Explorer

The Data Path Explorer is a new type of view in the Topology Viewer. Data Path Explorer combines several of the usual Topology Views into a visualization that allows users to follow connectivity from one endpoint in the topology view to another. Storage administrators can use this view to debug connectivity and performance problems in the storage environment. Data Path Explorer will display the different data paths (SAN access paths or I/O paths) for each host disk. This allows you to use the Data Path Explorer to check the health and performance statistics of the storage components along the I/O path.

Different agents play different roles when discovering information and what can be shown in the topology viewer. The Data Path Explorer view is also subject to those limitations as well. Different amounts of information can be shown by the Data Path Explorer view depending on the agents deployed throughout the fabric.

Viewing a single data path allows you to monitor performance status and pinpoint weaknesses without navigating the many entities typically seen in Topology Viewer.

Data Path Explorer shows only those entities that are part of the selected data path, and only certain types of entities, such as host, switch, host bus adapter (HBA), port, storage subsystem, and storage volume.

Prerequisites for Data Path Explorer

To display data paths from a host to a subsystem in this view, it is necessary to have the following agents installed and configured:

- CIM Agent to monitor the storage subsystem
- Data agent to monitor the host
- In-band Fabric agent to monitor the fabric. Also a CIM Agent for the fabric to collect fabric performance information.

The Data Path Explorer view will not be able to display the data path from a host to a subsystem if any one of these agents is not installed and configured.

To show the host disk assignment from a given storage subsystem, it is necessary for IBM Tivoli Storage Productivity Center Data Server to have access to the subsystem's CIM Agent (SMI-S agent). In the case of the subsystem, the data path is defined by the host masking or mapping information maintained by the CIM Agent.

Analysis on data paths involving SAN Volume Controllers would require one or more CIM Agents pointing to the SAN Volume Controller as well as the disk drives for the storage system.

To show accurate information, it is important to have the most current information from the CIM Agents, Fabric agents, and Data agents. You must probe all the components within the data path (or a set of agents strategically placed throughout the fabric).

To show physical fabric connectivity, you must have an in-band Fabric agent, out-of-band Fabric agent, or a CIM Agent for the fabric.

To show performance overlay in the Data Path Explorer view, you must first create and run performance monitors on the switches and storage subsystems of interest.

To see the overlays you must also go to the topology viewer. Right-click the topology viewer. Click Global Settings. On the Settings window under Active Overlays, click the Performance check box.

To show the zone overlay, you need an in-band Fabric agent connected to the fabric along the data paths defined or a CIM Agent for the fabric. To see the overlays you must also go to the Topology Viewer. Right-click the Topology Viewer. Click Global Settings and check the Show zone tab check box. Click **OK**.

Graphical View

When you open a data path view, three tiles display in the graphical view: Initiator Entities, Fabrics, and Target Entities. These contain all the entities in all the data paths related to the selected host or storage entity (see Figure 6-33).

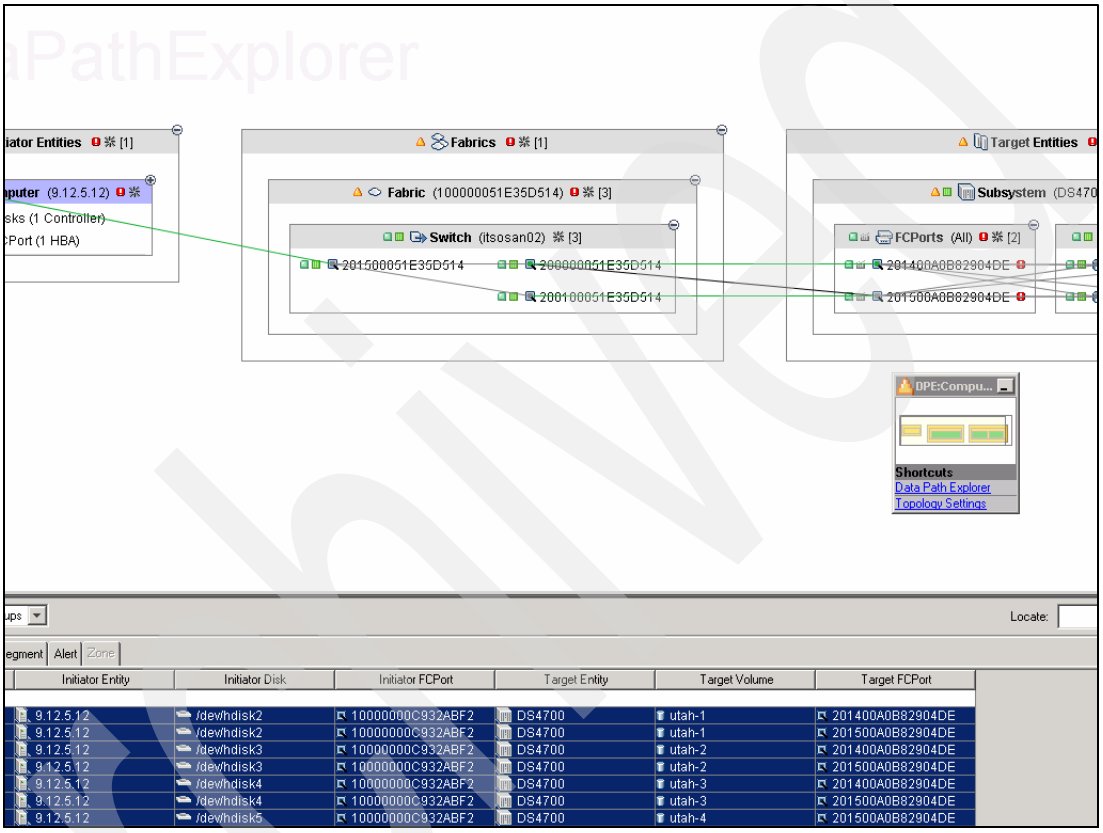


Figure 6-33 Topology Viewer - Data Path Explorer

Selecting an entity in any of the tile groups at any level displays connector lines showing the data paths the entity is involved in. the entities are:

- **Initiator Entities**: The Initiator Entities tile contains the computers and related volumes, disks, and HBA ports that have valid data paths to the storage system. Expanded computer tiles display each computer, its health status icons, and a count of the entities within the computer that are part of the valid data paths. Expanded computer tiles show the controllers and disks, HBA ports, and volumes on the computer that are part of valid data paths. The initiator entities tile can also contain SAN Volume Controllers. An SAN Volume Controller is a storage virtualization device and can act as an initiator entity. Expanded SAN Volume Controller tiles show the SAN Volume Controller managed disks and ports that are part of valid data paths.
- **Fabrics**: The Fabrics tile contains the fabrics entities, mainly switches and ports, through which valid data paths for the selected endpoint traverse. A count of the switches and switch ports with health status icons and labels are shown in the group title. Expanded Fabric tiles display a view of the switches to the port level. Only switches and ports with valid data paths traversing through them are displayed.

- **Target Entities**: The Target Entities tile contains the endpoint storage systems in data paths for the selected endpoint. Expanded Target tiles display each storage subsystem, its status icons, a count of entities, and the number of subsystem front-end ports and volumes involved. When these are expanded, the associated port and volume tiles display. These can also be expanded to show individual entities.

Each tile behaves like an active Topology Viewer tab, allows grouping and regrouping, expanding and collapsing of groups and so forth. Each tile can be expanded to view the lower level details such as the disks, ports and volumes involved in a data path.

Table View

The data path table displays below the graphical view (see Figure 6-33 on page 232). Each row in the table view shows a valid data path for the selected endpoint.

Display a single data path in the graphical view by selecting a row in the data path table.

The data path table has two tabs:

- **Data Path tab**: This is the default view. This tab shows each data path associated with the entity for which the data path was opened.
- **Data Path Segment tab**: This tab displays the segments in a data path. One segment is listed per row.

For further details on the Data Path Explorer refer to “Displaying data paths from one endpoint in the topology to another” in *IBM Tivoli Storage Productivity Center V 4.1: User’s Guide*, SC27-2338.

6.11 Configuration history

The configuration history feature takes and displays snapshots of changes that occurred in your SAN configuration over a period of time that you specify. After you set the time period (how often to take snapshots and how long to store them), in a page similar to the Topology Viewer you can manipulate a snapshot selection panel to show changes that occurred between two or more points in the time period. System administrators can use the configuration history feature to:

- Correlate performance statistics with configuration changes:

  For example, during collection of performance statistics (including volume performance statistics) on an Tivoli Storage Enterprise Storage Server system you might delete a volume. While no new statistics are reported on that volume, the Tivoli Storage Productivity Center Performance Manager would have already collected partial statistical information prior to the deletion. At the end of the data collection task, reporting of the partially collected statistics on the (now) deleted volume would require access to its properties which would not be available. The configuration history feature, with its ability to take and store snapshots of a system’s configuration, could provide access to the volume’s properties.

- Analyze end-to-end performance:

  You want to know why performance changed on volume A during the last 24 hours. To learn why, it is useful to know what changes were made to the storage subsystem’s configuration that might affect the volume’s performance, even if performance statistics were not recorded on some of those elements. For example, even if performance statistics on a per-rank basis are not collected, but the number of volumes allocated on a rank is

increased from 1 to 100 over time, access to that configuration history information helps with analyzing the volume's degraded performance over time.

- Aid in planning and provisioning:

  The availability of configuration history can enhance the quality of both provisioning and planning.

To use the configuration history feature, complete the following steps:

1. In the Navigation Tree pane, expand **Administrative Services** → **Configuration** → **Configuration History Settings**. The Configuration History Settings page displays for you to indicate how often to capture SAN configuration data and how long to retain it.
2. Perform the following to collect historical data:
   a. In the **Create snapshot every** field, click the check box to enable this option and type how often (in hours) you want the system to take snapshot views of the configuration.
   b. In the **Delete snapshots older than** field, click the check box to enable this option and type how long (in days) you want the snapshots to be stored.
   c. The page displays the total number of snapshots in the database and the date and time of when the latest snapshot was taken. To refresh this information, click **Update**.
   d. To optionally create and title a snapshot on demand, in the **Title this snapshot** field type a name for the on demand snapshot and click **Create Snapshot™ Now**. If you do not want to title the on demand snapshot, simply click **Create Snapshot Now**.

In Figure 6-34 we show the panel with the recommended values (12 hours for "create snapshot" frequency and 30 days for the snapshots retention).

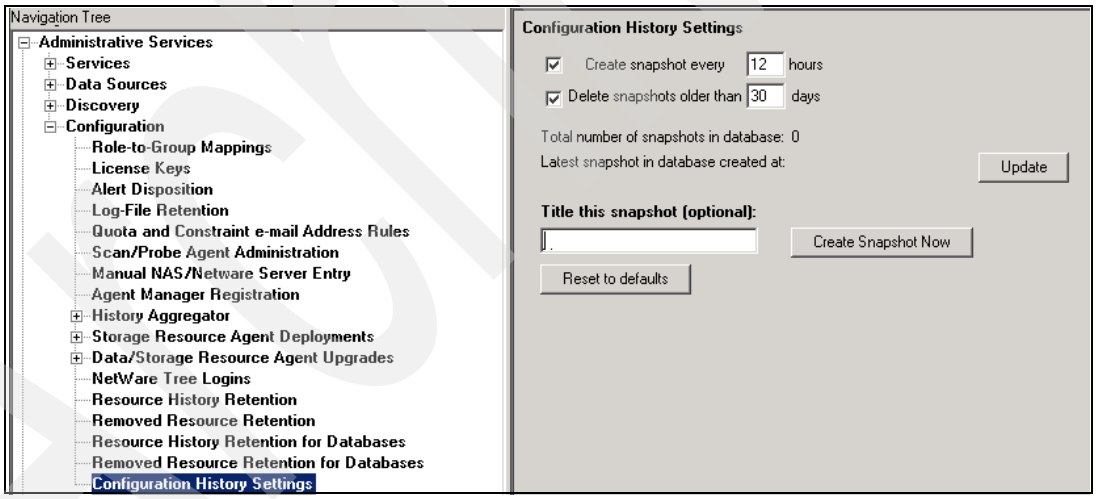


Figure 6-34 Configuration History settings

In the Navigation Tree pane, expand **IBM Tivoli Storage Productivity Center** → **Analytics** → **Configuration History**, and click **Configuration History**. The software loads the snapshot data for the length of time that you specified. The Configuration History page (a variation of the topology viewer) displays the configuration entities and a floating snapshot selection panel. The panel allows you to define the time periods against which the configuration is compared to determine whether changes have occurred (see Figure 6-35).

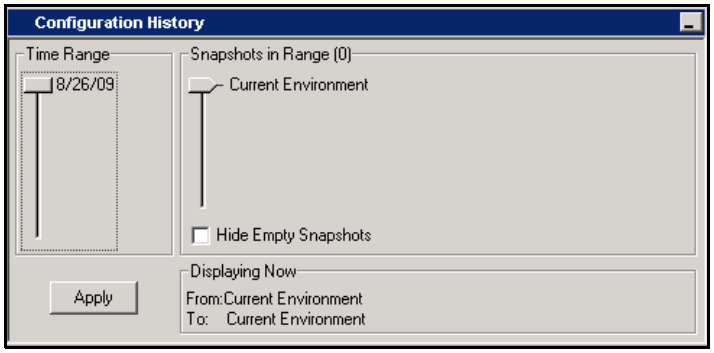


Figure 6-35 Snapshot selection panel

To define the time periods that you want to compare, perform the following steps:

1. Using the mouse, drag the two “thumbs” in the left **Time Range** slider to establish the desired time interval. The Time Range slider covers the range of time from the oldest snapshot in the system to the current time. It indicates the date as mm/dd/yyyy, where mm equals the month, dd equals the day, and yyyy equals the year.
2. Drag the two thumbs in the right **Snapshots in Range** slider to indicate the two snapshots to compare. The Snapshots in Range slider allows you to select any two snapshots from the time interval specified by the Time Range slider. The value in parentheses beside the Snapshots in Range slider indicates the total snapshots in the currently selected time range. The Snapshots in Range slider has one tick mark for each snapshot from the time interval that you specified in the Time Range slider.

   Each snapshot in the Snapshots in Range slider is represented as time stamp mm/dd/yyyy hh:mm, where the first mm equals the month, dd equals the day, yyyy equals the year, hh equals the hour, and the second mm equals the minute. The value in parentheses beside each snapshot indicates the number of changes that have occurred between this and the previous snapshot.

   Snapshots with zero changes are referred to as empty snapshots. If you provided a title while creating an on demand snapshot, the title displays after the time stamp. If you want to remove empty snapshots, click the check box to display a check mark in Hide Empty Snapshots. The Displaying Now box indicates the two snapshots that are currently active.
3. Click **Apply**.
4. Determine the changes that have occurred to the entities by examining the icons and colors associated with them in the graphical and table views.

Important: If you manually deleted a missing entity from the Tivoli Storage Productivity Center, the configuration history feature rediscovers and displays the entity in the configuration history viewer as both Missing and in a Normal state.

For detailed information about how to determine the changes that have occurred to a configuration over time by examining the icons and colors of the change overlay in the graphical view of the Configuration History page, see “Viewing configuration changes in the graphical view” in *IBM Tivoli Storage Productivity Center V4.1: User’s Guide*, SC27-2338.

6.12 Information retention

The Tivoli Storage Productivity Center information retention has impact on the size of the Tivoli Storage Productivity Center database. In this section we illustrate how to set the information retention for the Tivoli Storage Productivity Center components.

6.12.1 Log file retention

You can define how many runs or how long you retain logs in the repository.

1. Select **Administrative Services** → **Configuration** → **Log-file retention** (see Figure 6-36 on page 236).
2. Define the following two parameters:
   - **Maximum number of runs to keep of each schedule**: Enter the number of runs you want to keep for every scheduled job. The default is 5 runs.
   - **Maximum number of days worth of log-files to keep (regardless of schedule)**: Enter the number of days you want to keep log files regardless of schedules. The default is 90 days.

Tip: This defines parameters accordingly. If you define five days to retain and you are running scheduled jobs every day, even if you choose 10 runs, five of them are deleted.

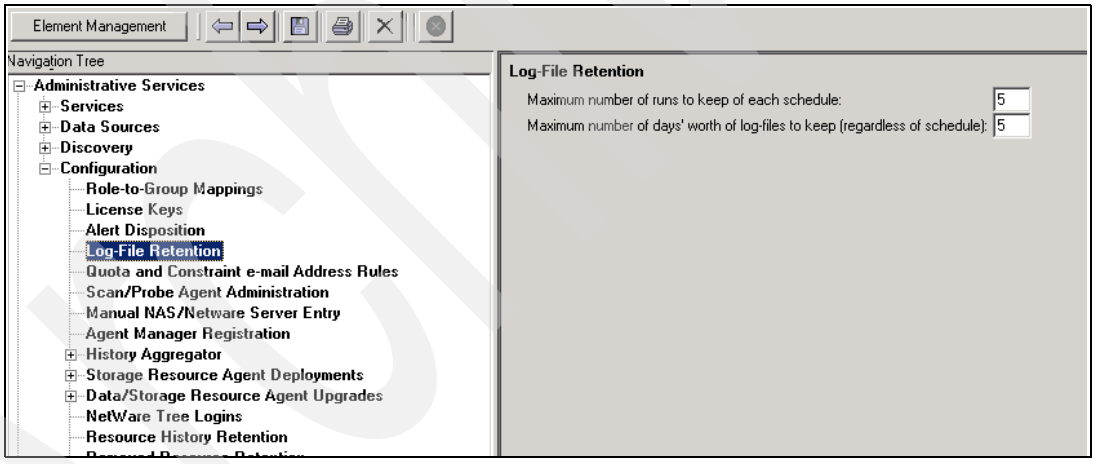


Figure 6-36 Log-File retention

6.12.2 Resource history retention

You can specify how long you want to keep the history of data in Data Manager repository. The longer you keep the data, the more information for the analysis is available, but on the other hand, the more space you need for the repository.

1. Select **Administrative Services** → **Configuration** → **Resource History Retention** (see Figure 6-37).
2. Clicking the check box activates the value of the related line.
3. You can select to not keep the history by clicking No History or by unchecking all boxes.
4. To get the default values, click Use Defaults.
5. Save to make changes permanent.

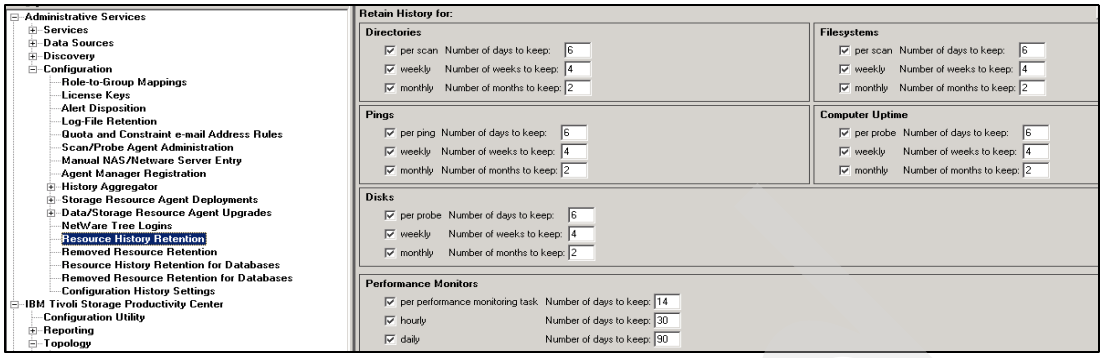


Figure 6-37 Retain History Panel

The data retention setting is important, because here you have a second chance to control the amount of stored performance data. But first, you need to understand the structure of the data that Tivoli Storage Productivity Center collects.

For the Performance Data retention considerations refer to “Data collection considerations” and “How long do you retain the data” in *SAN Storage Performance Management Using TotalStorage Productivity Center*, SG24-7364.

For the analysis of the impact of the collected data on the database sizing refer to 2.1.5 “TotalStorage Productivity Center database repository sizing formulas” in *SAN Storage Performance Management Using TotalStorage Productivity Center*, SG24-7364.

6.12.3 Removed resource retention

This window allows you to specify how long to keep information in the repository for the values that are not in the system any longer. In other words, you can already remove some files from your system after the scan. In the next scan, Tivoli Storage Productivity Center identifies those files as removed. By using a parameter in this window, IBM Tivoli Storage Productivity Center keeps them as long as you specified.

1. Select **Administrative Services** → **Configuration** → **Removed Resource Retention** (see Figure 6-38).
2. Select the appropriate check boxes to activate and adjust the value if needed.
3. Save to make the changes permanent.

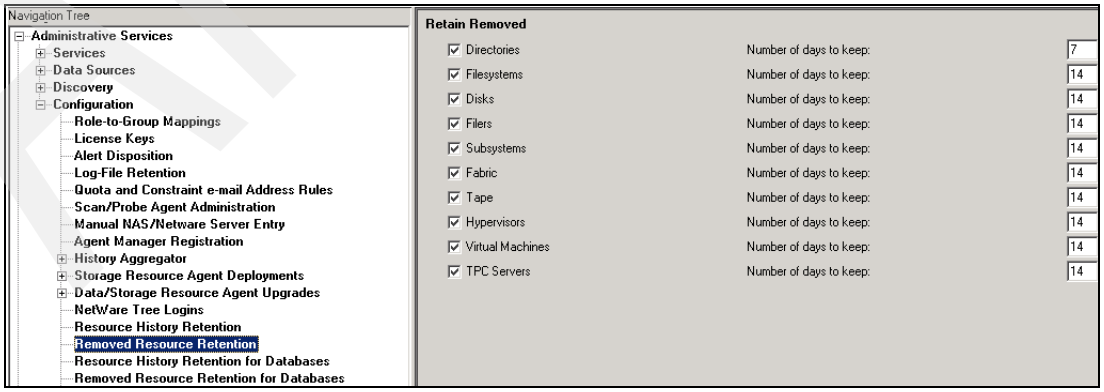


Figure 6-38 Removed Resource Retention window

6.12.4 Resource history retention for databases

You can specify how long you want to keep the history of data in the repository for database table space, and tables. The longer you keep the data, the more information for the analysis and also the more space you need for the repository.

1. Select **Administrative Services** → **Configuration** → **Resource History Retention for Databases** (see Figure 6-39).
2. Clicking the check box activates the value of the related line.
3. You can select to not keep the history by clicking **No History** or by unchecking all boxes.
4. To get the default values, click **Use Defaults**.
5. Save to make the changes permanent.

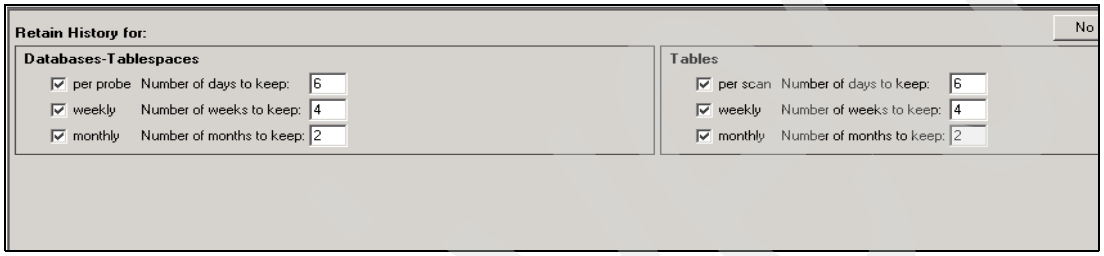


Figure 6-39 Retain History for Databases options window

6.12.5 Removed resource retention for databases

You can specify how long to keep information in the repository for the values that are not in the system anymore. In other words, you can remove some tables from your database after the scan. In the next scan, IBM Tivoli Storage Productivity Center identifies those files as being removed. By using the parameter in this window, Tivoli Storage Productivity Center keeps them as long as you specified.

1. Select **Administrative Services** → **Configuration** → **Removed Resource Retention for Databases** (see Figure 6-40).
2. Click the check boxes to activate the value and insert desired values
3. Save to make changes permanent.

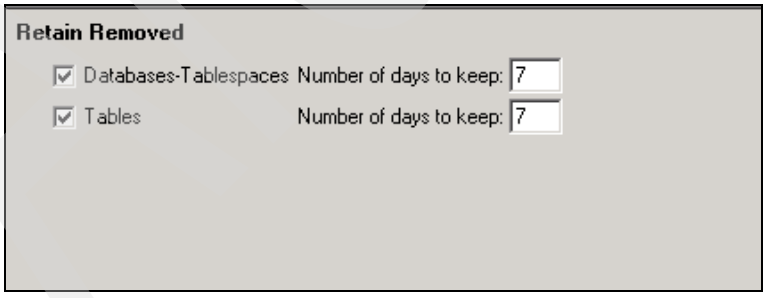


Figure 6-40 Retain removed databases

7

Problem determination

When a problem occurs with IBM Tivoli Storage Productivity Center, you need to collect information to help diagnose the problem.

In this chapter, we provide information about collecting information and some basic troubleshooting. We briefly discuss following topics:

- High level problem diagnosis
- Basic Troubleshooting
- File location references

7.1 High level problem diagnosis

Collecting the following information can be helpful when diagnosing a problem that occurs with Tivoli Storage Productivity Center:

- An exact description of the problem.
- The function being used.
- The sequence of steps that resulted in the problem.
- The expected results from the failing step.
- Any error messages that you see.
- The date and time when the problem occurred.
- The log files collected with the service utility.
- Disk storage devices microcode level, if known. The microcode level can be obtained by looking at the properties of the discovered device.
- Disk storage devices CIM Agent version, if known.
- The last time that inventory collection was performed (this indicates that the repository is in synchronization with the real configuration).
- Whether the error is repeatable or it occurs intermittently.
- The answers to the following connectivity questions can help you determine whether there is a communication issue between Tivoli Storage Productivity Center and the CIM Agent server:
  - Is there any firewall enabled interfering with the communication between the IBM Tivoli Storage Productivity Center components and the CIM Agents?
  - Is it possible to ping the CIM Agents?
  - Is it possible to telnet to the CIM Agents?
  - Is it possible to contact the CIM Agents with a CIM browser?
  - Are the CIM Agents locate in the local subnet with IBM Tivoli Storage Productivity Center or is a DA in another subnet used for discovery?
  - Is the DA on the remote subnet registered with IBM Tivoli Storage Productivity Center?

  Was the CIM Agents SLP registration successful? Use the **`slptool findsrvs`** command.

7.2 Troubleshooting Tivoli Storage Productivity Center

To troubleshoot Tivoli Storage Productivity Center problems, you can often follow these steps, if you can recreate the issue.

- Turn logging and tracing on through the GUI. Remember to turn tracing off when you are finished.
- Recreate the issue.
- Use the service tool to get the Device Server and Data Server logs and the common agent.
- Run **`repocopy`** to get a copy of the database.
- Get the DB2 logs:
  - Db2diag.log

- Get output from the **db2 list applications** command:
  - **db2 connect to tpcdb**
  - **db2 list applications**
- Review the collected data
- open a PMR

7.2.1 Hints and tips for solving frequently seen problems

Here are some hints and tips:

- If you run out of memory for the Data Server, Device Server, or agent, you might want to increase the memory allocated for these components. Refer to *IBM Tivoli Storage Productivity Center Installation and Configuration GUide - SC27-2337* for detailed steps on how to increase the memory allocation for each components.
- On UNIX, the swap space should be more than physical memory on the machine. It would be good if the swap space is twice the amount of physical memory.
- It is better to run the GUI on a different machine.
- After you import **repocopy** data from a customer, you will have to change the Device Server host authentication password in t_res_server table. There will be at least two entries in that table. The entry with server_id 1 is the Device Server entry. You need to copy the host authentication password from the following file:

  <TPC_install_directory>\device\conf\setup.properties

If you are importing data from UNIX to Windows or from Windows to UNIX, you will need to change the t_res_auth_roles table. Change the value of the group_name column to the group name that your logon user ID belongs to.

- To change the database logon password, follow these steps:
  a. Go to a command prompt window and go to the following folder:

     <TPC_install_directory>\data\config\

  b. Run the following command:

```
<TPC_install_directory>\jre\bin\java -classpath
<TPC_install_directory>\data\server\lib\TSRMsrv.zip
com.tivoli.itsrm.repository.Transform -p <new_db2admin_password>
repository.config
```

  c. Stop and restart the Data Server.
- Logging and tracing can be turned on through the GUI. It will be turned on until you turn it off through the GUI.

7.2.2 Troubleshooting CIM Agents and discovery

This section provides the first steps in analyzing CIM Agent and discovery problems.

Common user errors

A discovery or probe operation does not complete. When you look into the standard log files for discovery in the TPC GUI you might find indications for the following situations:

- There is a lock contention when Tivoli Storage Productivity Center accesses the database tables.

- DB2 does not return information from a query.
- The CIM Agent starts returning information and then stops.

To work around this problem, stop and then restart the Data Server and Device Server. Also, collect log information using the service tool.

Deeper analysis

If you are having problems with adding or editing the CIM Agent, check the following:

- For discovery problems, there are several service level logs to check. Those log files can be found in <TPC_install_directory>\device\log:
  - dmSvcTrace.log
  - msgTPCDeviceServer.log
  - traceTPCDeviceServer.log (if tracing is enabled)
  - tracePerfMgr.log (if tracing is enabled)
  - TPCZoneControl.log

  Look for HWN09999 error codes.
- The database only knows about the last status as updated by the Device Server (through a discovery or probe). If the Device Server is down, the status will not change. The add, edit, or test function only works if the Device Server is up. If you test the CIM Agent, this will update the status.
- To discover the job activity, issue the following command:

```
srmcp -u <user_ID> -p <password> DiscoverService list jobs
```

Further information about troubleshooting discovery problems can be found in Chapter 4, “Troubleshooting IBM Tivoli Storage Productivity Center problems” in *IBM Tivoli Storage Productivity Center: Problem Determination Guide*, SC27-2342.

7.2.3 Problems when troubleshooting the tpctool

This section provides information about common problems when using the tpctool.

The tpctool is a stand-alone Java client and connects to the Device Server only. The tpctool connects through TCP, HTTP, and SOAP to the Web service APIs. The commands provide query, control, and reporting capabilities only. The commands do not initiate discovery, probes, or configuration and control of agents.

The tpctool is installed in the following default directories:

- C:\Program Files\IBM\TPC\cli (for Windows)
- /<usr or opt>/IBM/TPC/cli (for UNIX or Linux)

The Windows command to run the tool is **`tpctool`**. The UNIX or Linux command to run the tool is **`tpctool.sh`**.

Authentication

There are two distinct kinds of authentication:

- User authentication
- Super user or host-based authentication

The user authentication requires a user ID and password authenticated in the Device Server's authentication domain. Role-based authorization is enforced on a per command basis.

The super user or host authentication is for the user ID tpc_superuser. The password for this user ID bypasses role-based authorization. This is the required authentication method for AIX-based Device Servers.

For fabric reports, the commands pass through the Fabric service for authorization. For subsystem reports, the commands pass through the Disk service for authorization.

Log files

Some of the control commands run a long time. An example is the **mkvol** command. There is no way to determine the intermediate status of the command. If the tpctool client stops (for example, the user presses Ctrl-C or the node crashes), all connections with the job is lost. There is no way to reconnect to the host to check on the status.

The Device Server logs and trace files (assuming that tracing is on) are shown below. For the Disk commands, see this log:

DiskManagerService:

- dmSVCTrace.log

For the Fabric commands, see these logs for the Fabric Manager Service:

- TPCZoneControl.log
- msgTPCDeviceServer.log
- traceTPCDeviceServer.log

For the reporting commands, see this log:

- PerformanceService:
  - tracePerfMgr.log

For configuration commands, see this log:

- ConfigService: traceTPCDeviceServer.log

For all other commands, see this log:

- msgTPCDeviceServer.log

Common tpctool user errors

Some of the common user problems are:

- Do not know where the installation directory is. Is the installation directory in a nonstandard location?
- Did not set the PATH or **chdir** to the <TPC_install_dir>/cli directory.
- Using tpctool on UNIX or Linux instead of tpctool.sh.
- Did not provide the following parameters in the command:
  - -url
  - -user
  - -pwd

- This is a common error message for tpctool:

  ```
  AAJ0000009E Error communicating to the App server.
  ```

  This same error message indicates an invalid port, invalid host, or the Device Server is unreachable. To distinguish what the problem is, you can set a debug flag that prints the Java stack if an exception occurs. Most errors are propagated to tpctool as exceptions. To set this flag:

  - For Windows: **`set TPCCLIDBG=1`**
  - For UNIX or Linux: **`export TPCCLIDBG=1`**

  Here are some possible reasons for this kind of error:

  - For an invalid host, the host name is embedded in the message. For example:

    ```
    [SOAPException: faultCode=SOAP-ENV:Client: msg=Error opening socket:
    java.net.UnknownHostException:badhost:...]
    ```

  - For a valid host, but an invalid port or when the Device Server is down, an example of a message is as follows:

    ```
    [SOAPException: faultCode=SOAP-ENV:Client: msg=Error opening socket:
    java.net.ConnectException: Connection refused:...]
    ```

    An invalid port is the most common problem.

  - If the Device Server node is unreachable, an example of the message is as follows:

    ```
    [SOAPException: faultCode=SOAP-ENV:Client: msg=Error opening socket:
    java.net.SocketException: Operation timed out:
    connect:could be due to invalid address:...]
    ```

7.2.4 Troubleshooting with the srmcp tool

The srmcp tool is a command line tool that is used to set and query tracing options, get the status of components and configure settings.

This tool should only be used with great care. In *IBM Tivoli Storage Productivity Center: Problem Determination Guide*, SC27-2342 you can find many different scenarios where the srcmp tool is used. Because it is not a general purpose tool, we will not explain it in this book, other than the general use and the indication where to find more information about it. Usually the IBM support will provide you with detailed instruction when and how to use the tool in necessary.

Running srmcp

To run the **`srmcp`** tracing command, follow these steps:

1. Open a command prompt.
2. Go to the following default directory:
   - For Windows: C:\Program Files\IBM\TPC\device\bin\w32-ix86
   - For AIX: /<usr or opt>/IBM/TPC/device/bin/aix
   - For Linux: /<usr or opt>/IBM/TPC/device/bin/linux
3. Run the following command to initialize the environment:
   - For Windows: setenv.bat
   - For AIX or Linux: ./setenv.sh

   Without this initialization, the **`srmcp`** tool will not work at all.

4. Start the **srmcp** tool in interactive mode:
   - For Windows: srmcp -u <user_id> -p <password>
   - For AIX or Linux: ./srmcp.sh -u <user_id> -p <password>

   To quit the tool, enter **exit**.

You can also start the **srmcp** tool in batch mode. In this case you simply add the commands and parameters after the password.

7.3 Configuration file reference

The default file locations for the configuration files are shown in Table 7-1.

Table 7-1 Default file locations for Tivoli Storage Productivity Center configuration files

Component	Default file location
IBM Tivoli Storage Productivity Center	For Windows: C:\Program Files\IBM\TPC\config For UNIX or Linux: /<usr or opt>/IBM/TPC/config
Data Server	For Windows: C:\Program Files\IBM\TPC\data\config For UNIX or Linux: /<usr or opt>/IBM/TPC/data/config
Device Server	For Windows: C:\Program Files\IBM\TPC\device\conf For UNIX or Linux: /<usr or opt>/IBM/TPC/device/conf
Common Agent	For Windows: C:\Program Files\IBM\TPC\ca\config For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/config
Data Agent	For Windows: C:\Program Files\IBM\TPC\ca\subagents\TPC\Data\config For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/subagents/TPC/Data/config
Fabric Agent	For Windows: C:\Program Files\IBM\TPC\ca\subagents\TPC\Fabric\conf For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/subagents/TPC/Fabric/conf
Storage Resource Agent	For Windows: C:\tpcsra\agent\config For UNIX or Linux: /<usr or opt>/IBM/TPC/agent/config

7.4 Tivoli Storage Productivity Center log file reference

Depending on the type of problem that you are facing, you need to select the log files to be checked. For example, the database schema log file is usually only important when you are having problems installing or upgrading Tivoli Storage Productivity Center.

7.4.1 Product log files to check

There are several product log files to check when you have a problem. See Table 7-2.

Table 7-2 Default log file locations for IBM Tivoli Storage Productivity Center components

Components	Log file location
Data Server	For Windows: c:\Program Files\IBM\TPC\data\log For UNIX or Linux: /<usr or opt>/IBM/TPC/data/log For the Data Server, check the following log files: server_<xxxxx>.log
Device Server	For Windows: c:\Program Files\IBM\TPC\device\log For UNIX or Linux: /<usr or opt>/IBM/TPC/device/log For the Device Server, check the following log files: "msgTPCDeviceServer.log - the main log file "traceTPCDeviceServer.log - the main trace file "msg.discovery.<individual_log_files> - individual log files from various discovery jogs "msg.control.* - control job log files "dmSvcTrace.log - Disk Manager trace file "tracePerfMgr<xx>.log - Performance Manager trace file Also look in the WebSphere logs for the Device Server. Look in this directory: <TPC_install_dir>\device\apps\was\logs\server1
Common Agent	For Windows: c:\Program Files\IBM\TPC\ca\logs For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/logs
Data Agent	For Windows: C:\Program Files\IBM\TPC\ca\subagents\TPC\Data\log For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/subagents/TPC/Data/log
Fabric Agent	For Windows: C:\Program Files\IBM\TPC\ca\subagents\TPC\Fabric\log For UNIX or Linux: /<usr or opt>/IBM/TPC/ca/subagents/TPC/Fabric/log
Storage Resource Agent	For Windows: C:\tpcsra\agent\log For UNIX or Linux: /<usr or opt>/IBM/TPC/agent/log
GUI	For Windows: C:\Program Files\IBM\TPC\gui\log For UNIX or Linux: /<usr or opt>/IBM/TPC/gui/log
Database schema	For Windows: C:\Program Files\IBM\TPC\dbschema\log For UNIX or Linux: /<usr or opt>/IBM/TPC/dbschema/log

7.4.2 Tools used to collect information

If you encounter a problem in Tivoli Storage Productivity Center and are going to open a PMR or you have already opened a PMR, it is very likely that you need to collect data to send to the IBM support teams

Service Tool

This topic describes the service tool and how to run the Service tool for the Data Server and the Device Server.

The service tool is use to collect the logfiles that the various components of Tivoli Storage Productivity Center will create. This is useful, if you need to send data to IBM support, or if you just want to capture the log files so that they are not overwritten.

To run the tool for the servers, complete the following steps:

1. Log onto the system. You must have administrator authority on Windows or root authority on UNIX or Linux.
2. If you used the default directory, go to the following directory:
   - For Windows: C:\Program Files\IBM\TPC\service\.
   - For Linux or UNIX: /<usr or opt>/IBM/TPC/service/.
3. Run the following program:
   - For Windows: service.bat.
   - For Linux or UNIX: service.sh.
4. One or more zip files are created in the directory where you ran the Service tool. If you have a Data agent or Fabric agent installed on the same computer as the Data Server or the Device Server, that information is collected when you run the tool for the Data Server or the Device Server. The following zip files are created:
   - TPCDATAservice.zip (for the Data Server)
   - TPCDEVservice.zip (for the Device Server)
   - TPCDATACAservice.zip (for the Data agent)
   - TPCDEVCAservice.zip (for the Fabric agent)

Repository Copy tool

The Repository Copy tool (or short repocopy) enables you to export all the tables in the IBM Tivoli Storage Productivity Center repository (Data Manager data) for purposes of debugging problems.

You can send the output to the IBM Support Center to help debug problems.

Use the Repository Copy tool to export data from an existing repository into a comma delimited file.

To export repository data, follow these steps:

1. Stop the Device Server and Data Server.
2. Go to the following default directory:
   - If on Windows: c:\Program Files\IBM\TPC\data\server\tools
   - If on Linux or UNIX: /opt/IBM/TPC/data/server/tools

3. Run the repocopy.bat or repocopy.sh command. A window is displayed prompting you for what you would like to do.
4. Select Export data from repository tables, and then click Next. The Options for Import/Export window is displayed.
5. In the Options for Import/Export window, enter information in the following fields:
   - Directory for Export

     Enter the directory where the comma delimited file will be saved.
   - Delimiter

     Enter a delimiter for the delimited file format (comma is the default).
   - Quote

     Enter the symbol that will contain string data (double quotes is the default).

   IBM Tivoli Storage Productivity Center will export the data into the comma delimited file you specify, and place it in a file named <tablename>.txt. Click **Next**.
6. The Choices for DB2 Export window is displayed. You have the following choices:
   - Export Using DB2 native format
   - Export Using text files

   Make a choice and click Next.
7. The Table Export Choices windows is displayed. You have the following choices:
   - Export base tables (always)
   - Export Performance Manager tables
   - Export history tables used for IBM Tivoli Storage Productivity Center for Data history reports

   Make a choice and click Next.
8. The Connection Properties window is displayed. In this step, Tivoli Storage Productivity Center reads the server.config file and determines your current repository and the information for accessing the database.

   The information detected in the server.config file is displayed in the Connection Properties window within the following fields: Database Types, User name, Password, Driver Class, Driver URL, Database, DB Creator, Classpath.

   Note: If you want to export data from a different database from the one listed in the server.config file, you can select the database from the Database Types list box and manually enter the database information. Click Finish.
9. Tivoli Storage Productivity Center will then connect to the database and display the database and connection information. Click Run to begin the export process.
10. A window is displayed containing the export progress log. As you progress through the export, messages are written to this progress log, allowing you to keep track of the steps as they happen.

    Note: When you run the repocopy tool on a server that has a remote database, the repocopy tool displays a message. When the repocopy tool is used with a remote database, the DB2 shared library is not available for loading libTSRMinsudb.so. You can ignore this message. Just click OK and continue.

Device Server Core Dumps

Furthermore, you can get a core dump file in this directory:

```
<TPC_install_directory>\device\apps\was
```

To initiate the core dump file creation on Windows, follow these steps:

1. Go to this directory:

   ```
   C:\Program Files\IBM\TPC\device\apps\was\bin
   ```

2. Enter the following statements:

   ```
   wsadmin
   set jvm [$AdminControl completeObjectName
   type=JVM,process=server1,*]
   $AdminControl invoke $jvm dumpThreads
   ```

For AIX or Linux, follow these steps:

1. Enter this command:

   ```
   ps -ef | grep "IBM/TPC" | grep "apps/was" |
   awk '{print $2}' | xargs kill -3
   ```

7.5 IBM CIM Agent log file reference

This section provides information about how to collect the log files of the most commonly used IBM CIM Agents.

7.5.1 DS Open API CIM Agent

When your CIM Agent for IBM DS8000, DS6000 or ESS is running on a server, and you are having problems with it, you can run a script to collect log information.

Windows

Steps to collect log on Windows:

1. Go to this directory:

   ```
   C:\Program Files\IBM\cimagent\cimom
   ```

2. Run the following command:

   ```
   collectLogs.bat
   ```

UNIX/Linux

Steps to collect log on Windows:

1. Go to this directory:

   ```
   /opt/IBM/cimagent/cimom
   ```

2. Run the following command:

   ```
   ./collectLogs.sh
   ```

The script generates a collectedLogs.zip file. Keep in mind that this file will be overwritten if the script is run again.

7.5.2 DS Open API CIM Agent running on a HMC

If you are using the CIM Agent that is embedded in the DS8000 HMC, you need to run the **collectlog** command to remotely collect the CIM Agent log files:

1. Go to the directory where the **dscimcli** program is installed.
2. Run the following **dscimcli** command:

   collectlog -d <directory_path>

If you do not use user variables for the server location and user authentication, you will need to specify that information as well, by using the -s and -u parameters.

A zip file with date and time in the name will be created in the specified directory or (if you omit the **-d <directory_path>**) in the home directory of the **dscimcli** software.

7.5.3 SVC CIM Agent

If you are having problems with the SVC CIM Agent, you can run a script to collect log information. Go to this directory:

Windows:

```
C:\Program Files\IBM\svcconsole\support
```

For Windows, run the following command:

```
run collectLogs.bat
```

The script generates a collectedLogs.zip file. Keep in mind that this file will be overwritten if the script is run again.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks publications

For information about ordering these publications, see “How to get Redbooks publications” on page 252. Note that some of the documents referenced here might be available in softcopy only.

- *TotalStorage Productivity Center V3.3 Update Guide*, SG24-7490
- *SAN Storage Performance Management Using TotalStorage Productivity Center,* SG24-7364
- *IBM System Storage DS8000: LDAP Authentication*, REDP-4505

Other publications

These publications are also relevant as further information sources:

- *IBM Tivoli Storage Productivity Center: Installation and Configuration Guide*, SC27-2337
- *IBM Tivoli Storage Productivity Center User’s Guide Version 4.1*, SC27-2338

Online resources

These Web sites are also relevant as further information sources:

- Tivoli Storage Productivity Center support site:

  https://www-01.ibm.com/software/sysmgmt/products/support/IBMTotalStorageProductivityCenterStandardEdition.html

- Partner World Technical Delivery Assessment:

  https://www-304.ibm.com/jct09002c/partnerworld/wps/servlet/ContentHandler/LLIE-6M7NYY/lc=en_US

- Tivoli Integrated Portal demonstration:

  http://www14.software.ibm.com/webapp/download/demo.jsp?id=Tivoli+Integrated+Portal+Walkthrough+Aug08&locale=en

- Tivoli Integrated Portal documentation:

  http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/index.jsp?topic=/com.ibm.tip.doc/ctip_install_overview.html

- LDAP information:

  http://en.wikipedia.org/wiki/IBM_Lightweight_Third-Party_Authentication

- Tivoli Storage Productivity Center Standard Edition Web site:

  http://www.ibm.com/systems/support/storage/software//tpc

- Tivoli Enterprise Portal site:

  http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/topic/com.ibm.itm.doc/itm610usersguide.htm

- IBM Certification Web site:

  certify@us.ibm.com

- IBM training site:

  http://www.ibm.com/training

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This book provides a combination of theory and practical experience necessary for a general understanding of the subject matter. It also provides links to questions that can help in the evaluation of personal progress and provide familiarity with the types of questions that will be encountered in the exam.

This book does not replace practical experience, nor is it designed to be a stand-alone guide for any subject. Instead, it is an effective tool that, when combined with educational activities and experience, can be a useful preparation guide for the exam.

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