Using Tivoli Data Protection for Microsoft SQL Server

- Strategic planning and implementation considerations for effective backup
- Backup over the LAN and Storage Area Network
- Successful recoveries

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Using Tivoli Data Protection for Microsoft SQL Server

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This edition applies to Version 2, Release Number 2 of TDP for Microsoft SQL Server, Program Number 5698-DPS for use with the Microsoft SQL Server 7.0 SP2 or later, Microsoft SQL Server 2000, Microsoft Windows NT4.0 SP4 or later, Microsoft Windows 2000.

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Preface

This IBM Redbook is an experience-based description of how to use Tivoli Data Protection (TDP) for Microsoft SQL Server v.2.2 to perform backups and restores in your SQL environment.

Tivoli Data Protection for Microsoft SQL Server performs online backups of Microsoft SQL Server databases to Tivoli Storage Manager (TSM) storage. We demonstrate how to back up and recover data on SQL 7.0 as well as SQL 2000 on a single server installation and a clustered environment. We decided to use Windows 2000 (Service Pack 1) as the operating system and cover SQL 7.0 as well as SQL 2000. However, we do not cover backing up the operation system itself.

Version 2.2 provides new functionality. Most significantly, the new version of Tivoli Data Protection for SQL supports one of the important features of Tivoli Storage Management: automatic expiration and version control by policy. We demonstrate how this frees users from having to explicitly delete backup objects in the Tivoli Storage Manager server.

TDP for SQL supports LAN-free environment. We show how to use TDP for SQL to perform backups across a traditional LAN as well as utilizing TSM LAN-free to support backups across Storage Area Networks (SANs).

This document is written for SQL server administrators as well as TSM administrators with a need to understand the issues and considerations pertinent to utilizing TSM and TDP to backup and restore Microsoft SQL server.

The team that wrote this redbook

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Chapter 1. SQL server overview for TSM administrators

SQL server is a client/server relational database management system (RDBMS) which uses Transact SQL to send request between the client and the SQL server. Transact SQL is a programming and query language which allows data to be accessed, queried, updated, and managed.

There can be no more than one instance of SQL Server 7.0 on one machine, while there can be more than one instance of SQL 2000 server on one machine. The maximum number of instances is 16. Any one instance may be clustered. The default instance may be SQL 7.0 (or SQL 6.5). A default instance is not required.

1.1 SQL applications

Software applications for SQL server can be divided into three logical layers, which can reside on one or more servers:

- Presentation — Usually, this layer is on the client computer, and it is responsible for presenting the data and application to the users.
- Business — Sometimes, the SQL server is involved in this layer, which is responsible for application logic and business rules.
- Data — Mainly, the SQL server is responsible for this layer.

Applications may have several designs, depending on where these layers take place:

- Intelligent server — Only the presentation layer is on the client, while the business logic and data are on the server; in this case the server may become a bottleneck.
- Intelligent client — Presentation and business are on the client and data is on the server; in this case, the network traffic is heavy.
- N-tier — Presentation is on the client side, business is on the application server, and data is on the database server; this approach allows adding more servers if needed.
- Internet — Clients use a browser, presentation and business are on the Web server, and data is served by SQL server.

1.2 SQL server services

There are four SQL services which run as Windows services.
• MSSQL Server Service — Its role includes allocating resources among users, preventing using the same data at the same time and providing data integrity and consistency.

• SQL Server Agent Service — Responsible for creating and managing jobs, alerts and operators.

• Microsoft Distributed Transaction Coordinator Service — Its role is to verify that in case of distributed transaction all updates on all servers are permanent or cancelled (if there are errors).

• Microsoft Search Service — A full text engine which uses indexes to alleviate queries.

1.3 SQL server database

SQL server databases can be divided into two types: system and user databases, both of which contain data. System databases store information about the system — about the SQL server itself, and about all user databases. User databases store user information.

Each database, including the master database, contains a database catalog — a collection of system tables containing metadata about the database. System tables store metadata, which is information about the data. The master database contains a collection of system tables that store information about the entire system and all other databases.

After installation of the SQL server, there are four system databases: master, model, tempdb, and msdb; and two sample user databases: pubs and northwind.

The master database manages the SQL server and user databases. The master database contains information about all databases residing on the SQL server. The master database is very important, and it must be backed up every time you perform certain statements or system stored procedures that modify it automatically. Without a current backup of the master database, in the case of failure, you must completely rebuild all of the system databases. The Master database can be backed up only by a full backup.

The model database is a template for new user databases. If the model database is modified, then back up the database. When rebuilding the master database, preceding changes to the model database will be lost, and must be restored from backup.
The **tempdb** database is used for temporary tables and other temporary working storage needs. You cannot back up this database — it is recreated each time the SQL server is started.

The **msdb** database is used as storage area for scheduling information and job history. If you do not have a backup of this database, you must rebuild all of the system databases and then recreate each job, alert, or operator.

The **pubs** and **northwind** databases are sample databases which can be used as learning tools.

**User databases** contain the user’s data. They must be backed up regularly, especially after an index has been created. That is so, because if you back up the transaction log, the actual data page modifications are not written to the log — only the fact that the index was created is backed up — and in case of restore, the index must be rebuilt. The amount of time that rebuilding the index takes may be longer than the restore from a full backup. Also, it is a good practice to back up user databases after operations which are not recorded to the transaction log. Refer to the Microsoft documentation about nonlogged operations.

An SQL server also includes **logs** which contained SQL server activity, and **logins** containing userids and permissions.

### 1.4 SQL server database structure

All SQL server databases have a primary database file (*.mdf) and one or more transaction log files (*.ldf). A database may also have a secondary data files (*.ndf). So a database has this physical structure:

<table>
<thead>
<tr>
<th>Database</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>File group</td>
</tr>
<tr>
<td></td>
<td>Data file</td>
</tr>
<tr>
<td></td>
<td>[Data file ...]</td>
</tr>
<tr>
<td></td>
<td>[File group ...]</td>
</tr>
<tr>
<td></td>
<td>Data file</td>
</tr>
<tr>
<td></td>
<td>[Data file ...]</td>
</tr>
<tr>
<td>Transaction log</td>
<td>Log file</td>
</tr>
<tr>
<td></td>
<td>[Log file ...]</td>
</tr>
</tbody>
</table>

|          | named PRIMARY |
|          | system/user tables, indexes |
|          | user tables, indexes |
|          | named by user |
|          | user tables, indexes |
|          | user tables, indexes |
A database has this logical structure:

Database
  Table
    Column
      Data stored with row
      Data stored separately
    Column
      Data stored with row
      Data stored separately
  Index
    Index ...
  Table ...

A data file has a logical name and a physical name.

When the data is modified, this modification is first written to the log and the disk, and on a regular basis, the transactions from the log are committed to the database and written to the disk. The transaction log records all database changes except bulk inserts. One transaction file per database is always present. Multiple log files are treated as if they were concatenated into a single file. In the case of a system failure, the system tries to replay any uncommitted transactions.

1.5 SQL important database options

- **SQL 7.0**
  - **Truncate log on checkpoint** — Cannot do log backups.
  - **Select into/bulk copy** — Must do a full or differential backup after bulk insert before log backups can be done.

- **SQL 2000**
  - Recovery model
    - **Simple** — Cannot do log backups.
    - **Bulk-logged** — Can do logs, but cannot do restores to a point in time.
    - **Full** — No restrictions.
1.6 SQL server security

SQL server uses two levels of security:

Login authentication — The user must have an account in order to be able to connect to the SQL server. There are two types of the login authentication mechanism: SQL server authentication and Windows authentication. SQL server authentication requires the user to have an SQL server login account and password. Windows authentication revalidates the Windows account and password from Windows. The SQL server administrator specifies which kind of authentication is used — whether users can only use Windows authentication, or whether both Windows and SQL authentication are allowed.

Permission validation — In order to gain access to the database, the user must have permissions to that database, which show what kind of activity the user can perform on that database.

1.7 SQL server administration

There are several management tools which administrators can use to minimize and automate daily tasks.

Service Manager — Can be used for starting and stopping the SQL server.

Enterprise Manager — Presents a graphical user interface for managing SQL server.

Query Analyzer — Presents a graphical user interface to issue Transact SQL commands.

Batch utilities — These include the osql utility, used to execute batch files, containing one or more Transact SQL statements; and the bcp utility, mainly used to import and export data to or from a data file.

Client Network Utility — Used to manage the client configuration for communications components.
Chapter 2. Planning considerations

This chapter outlines important considerations prior to changing from TDP version 1.1 to TDP version 2.2.

The various possibilities for a backup strategy are discussed, and how TDP can be applied to accomplish the decided strategy.

2.1 TDP for SQL Version 2 coexisting with Version 1

The extent to which TDP for SQL Version 2 changes the backup naming conventions, file space names and placement, and meta contents, means that it is completely incompatible with TDP for SQL Version 1.

You cannot query or restore backup objects created by one version with the other. Therefore, if you are storing backup objects created by Version 1, you must retain Version 1 for as long as you retain those backup objects.

Both versions can coexist with each other. The Version 2 installation program will not replace any installed Version 1. In addition, the TDP for SQL Version 2 interfaces are not compatible with the Version 1 interfaces, due to the great number of functional changes in Version 2.

No migration tool is provided to help convert Version 1 command line scripts to Version 2 syntax.

2.2 Backup strategies

When backing up your database(s) or any other data, keep in mind that this is done to be able to restore data, in case your SQL server fails, or databases are damaged.

SQL server has various backup and corresponding restore capabilities. Basically, the choice of backup type implies the restore possibilities.

These options, and restore requirements, are to be considered prior to deciding which method to use.

To do this, you need to determine:
• How critical your databases are to your business
• How long a time is available for doing a backup
• Your longest acceptable restore period (downtime)
• Necessity of doing a restore right up to a point-of-failure
Non-critical databases may have simple backups that can restore the database to the night before, or might not even be backed up, if they can be easily recreated from other sources.

Critical databases may have more complex backups in order to facilitate restore to a desired point in time, and minimize the restore period.

For very large data bases (VLDB) the need for complex backups is more outspoken, to meet the demand of acceptable backup periods, and often even more important acceptable restore periods.

2.2.1 Various backup approaches

In this section we consider some types of backup that may be used.

2.2.1.1 Full backup only

This approach is best for SQL databases that are relatively small, because it implies that the entire database is backed up each time. Each full backup takes longer to perform, but the restore process is most efficient, because only the most recent (or other appropriate) full backup needs be restored. This is the appropriate for system databases such as master, model, and msdb, due to their normally small size.

2.2.1.2 Full plus log backup

A full plus transaction log backup strategy is commonly used when the normal backup window or network capacity cannot support a full backup each time. In such cases, a periodic full backup followed by a series of log backups allows the backup window and network traffic to be minimized. For example, you can perform full backups on the weekend and log backups during the week. The full backups can be done during low usage times when a larger backup window and increased network traffic can be tolerated. The restore process becomes more complex, however, because a full backup, as well as subsequent log backups, must be restored. Note: It is possible to do a point in time restore to restore a transaction log to a specified date and time.

2.2.1.3 Differential backup

Perform this type of backup between full backups. A differential database backup can save both time and space — less space in that it consists of only the changed portions of a database since the last full backup (it is cumulative), and less time in that you can avoid applying all individual log backups within that time to the operation. This applies to restore operations as well; only the last differential backup (latest version) need be restored. If restore time is more critical than backup time, SQL Server 7.0 differential backups may be desirable. However, differential backups with SQL 7.0 may
take longer than log backups and longer than expected, even if the database has changed little since the last full backup. This is because SQL 7.0 processes every page of the database to determine if it should be included in the differential backup. SQL Server 2000, on the other hand, keeps track of which database pages have changed since the last full backup and does not have to process any pages that will not be included in the differential backup.

### 2.2.1.4 Full plus differential plus log backup

This strategy allows for a faster restore scenario by reducing the number of transaction logs that may need to be restored and applied. If, for example, a full backup is done weekly, a differential nightly, and a log backup every four hours, the restore would involve the full backup, a differential, and at most, five log backups. However, simply a full plus log backup scheme on the same cycle could require a full plus up to forty-one log backups to be restored (six days times six log backups per day, plus up to five backups on the day the full backup was done).

### 2.2.1.5 File or group backups

Use a file backup strategy when it is impractical to back up an entire database due to its size and accompanying time and performance issues. Note that when performing restore operations for a file or file group, it is necessary to provide a separate backup of the transaction log. File or group options can also save both backup and restore time in cases when certain tables or indexes have more updates than others and need to be backed up more often. It is time-effective to place such data in their own file group or files and then back up only those items.

### 2.2.2 Additional strategy considerations

The following list provides additional information you should consider when choosing a backup strategy for SQL Server 7.0 or 2000 with TDP for SQL Version 2.

#### Saving time

- If a SQL server volume fails, restoring only the files that are on that volume can save restore time.
- Using multiple data stripes can speed up both backup and restore time. If backing up directly to sequential storage media such as tape pool, use as many stripes as there are tape drives that can be allocated to the SQL backup; otherwise, the separate sessions will queue up waiting for a tape.
- For SQL Server 7.0, the restore must use the same number of data stripes as the backup.
• Using data compression will reduce network traffic and storage requirements. However, whether it increases or decreases total backup time depends on several factors including the speed of the processors doing the compression and available network bandwidth. For fast networks, compression can increase the backup and restore times.

Data striping
• If you use data striping, also use TSM server filespace collocation to try to keep each stripe on a different storage volume. Use the TSM command UPDATE STGPOOL to set this parameter. It is recommended that meta data (counted as a separate filespace) not be allowed to go to tape media.

• The maximum number of data stripes you can use must be smaller than the maximum supported by the SQL server and less than the value of the TSM server TXNGROUPMAX option in the dsmserv.opt file. SQL Server 7.0 allows a maximum of 32 data stripes, and SQL Server 2000 allows a maximum of 64.

Clustering
If you use Microsoft Cluster Server or Windows 2000 clustering for fail-over support, you must install TDP for SQL on each cluster node and configure it identically. Additional setup is required to complete the fail-over installation. You must identify a clustered SQL server by its virtual server name and use that name in TDP for SQL to access that SQL server.

Truncate log on checkpoint option
When you choose to perform only full backups in SQL, you can also indicate that you want to truncate the log after checkpoints. This will prevent the log from growing without bounds.

Truncate log option
When you choose to perform a transaction log backup, you can indicate that you do not want to truncate the log. In general, you do not want to truncate the log when rebuilding a corrupt database. This option enables the server to back up the transaction log but does not try to touch the data in any way. It writes all transaction log entries from the time of the last log backup to the point of database corruption. For SQL Server 7.0, the primary file group must be accessible.
Collocation

When using the full backup plus log backup strategy, you must decide whether to modify TSM storage management policies to ensure that all log backups are stored together on the TSM server (collocated). This helps improve restore performance by reducing the number of media mounts necessary for restoring a series of log backups. Consult your TSM Administrator Guide for details on collocation.

Multiple SQL servers

If multiple instances of the SQL server are running, the additional instances are identified by name. You must use that name in TDP for SQL to access that SQL server.

If you want to restore a backup to a different SQL server, in SQL Server 7.0, that server must have the same sort order, code page, and Unicode configuration as the original server; otherwise, SQL Server 7.0 will reject the restore and issue an error message.

Various recommendations

You must use the MAXNUMMP parameter on a TSM REGISTER NODE or UPDATE NODE command to allow a node to use multiple sessions to store data on removable media (which requires multiple mount points to be allocated to that node).

Set backups are intended for special circumstances. If you plan to back up a set of file groups and files regularly, back up each separately in order to exploit version limits within the management class.

Regardless of the frequency of database backups, it is highly recommended that you always run DBCC CHECKDB and DBCC CHECKCATALOG on a database just before backing it up to check the logical and physical consistency of the database. See your SQL Server documentation for more information on using the SQL Server database consistency checker.

2.2.3 TDP for SQL server backup options

The design of TDP is to utilize the backup types in SQL server, described in the previous section “Backup strategies” on page 7.
2.2.3.1 Full database backup
TDP for SQL backs up an entire SQL server database and the portion of the transaction log necessary to provide a consistent database state. With both full and differential backups, the copy includes enough information from any associated transaction logs to make a backup consistent with itself. The portion of the log included contains only the transactions that occur from the beginning of the backup until its completion.

Note
You do not have to do a full backup to constitute the equivalent of a full backup. Backing up all the groups or files in a database as well as its log are recognized as a full backup by SQL. A database backup may be a full, group, file, or set.

2.2.3.2 Differential backup
TDP for SQL backs up only the data pages in a SQL server database changed since the last full backup and a portion of the transaction log.

2.2.3.3 Log backup
TDP for SQL backs up only the contents of a SQL server database transaction log since the last successful log backup. To do the first log backup, you need to have done a full backup or its equivalent first. Log backups normally follow full backups. The portion of the log included in full and differential backups is not equivalent to a log backup. Also, in full and differential backups, the log is not truncated as it is during a log backup. However, a log backup following a full or differential backup will include the same transactions as a full or differential. Log backups are not cumulative (as are differential backups); they must be applied against a base backup and in the correct order.

Note
A log backup in SQL terms is not equivalent to an incremental backup in TSM terms.

2.2.3.4 File backup
TDP for SQL backs up only the contents of a specified SQL server logical file. This can ease the scheduling for backing up a VLDB or VLDBs by allowing you to back up different sets of files during different scheduled backups. File, group, and set backups must be followed by a log backup, but a full backup is not required.
2.2.3.5 Group backup
TDP for SQL backs up only the contents of a specified SQL server file group. This allows you to back up just the set of database tables and indexes within a specific group of files.

2.2.3.6 Set backup
TDP for SQL backs up the contents of specified SQL server file groups and files as a unit.

2.2.4 What does TDP not back up

Note: TDP for SQL provides backup and restore functions for SQL databases and associated transaction logs.

TDP does not back up full-text indexes; these must be recreated after restore.

TDP for SQL does not provide a complete disaster recovery solution for a SQL server by itself. There are many other files that are part of the SQL Server installation. These files would need to be recovered in a disaster recovery situation. Examples of these files are executable and configuration files. A comprehensive disaster recovery plan can be obtained by using the normal TSM backup-archive client for Windows NT, together with TDP for SQL. Consult your Microsoft SQL Server documentation for more details on SQL Server backup strategy and planning.

2.2.5 Which strategy to choose

Which strategy you choose really depends on what your environment is, plus what your demands are in regard to the restore process.

The more simple backup strategy you use, the more simple is your restore process. At the same time, the more simple backup strategy results in more limitations, considering both storage utilization and the restore operation.

The more complex backup strategy you use, the more work must be done when setting up the scheduled backups. At the same time, the more complex backup strategy gives you more options, considering both storage utilization and the restore operation.
2.2.5.1 Using full backup and restore
This is the simplest type of backup restore operation:

Steps to back up database:
  Full backup is performed periodically (for example, daily).

Steps to restore database:
  The database is restored in one step from the full backup.

TDP for SQL restores full database backup objects for specified SQL databases.

2.2.5.2 Using full and log backups and restores
If the demand is simply to be able to restore to a point in time, full and log backups are used.

Steps to back up database:
  Full backup is performed daily.
  Log backup is performed periodically (for example, every 1 hour).

Steps to restore database:
  Restore last full backup.
  Restore the transaction logs until the desired point in time.

TDP for SQL restores only the transaction logs for the specified SQL database until the desired point in time (or marked point for SQL 2000). Restore to just before failure is possible, but the restore requires a restore of a sequence of transaction logs (after its associated full backup is restored).

2.2.5.3 Using differential and log backups and restores
In a large database environment where a full backup window is not often available, you can use differential backups to cut down the length of log sequence needed for restore, to save time when restoring.

An example of using differential and log backups is described below.

Steps to back up database:
  Full backup is performed weekly.
  Log backup is performed periodically (for example every 1 hour).
  Differential backup is performed daily.
Steps to restore database:
   - Restore the last full backup
   - Restore the last differential backup (before desired restore point in time)
   - Restore the following transaction logs until the desired point in time.

TDP for SQL restores the differential database backup objects for specified SQL databases. Restore time is reduced, as only the latest differential backup is restored (after the preceding full backup).

### 2.2.5.4 Using group and file backups and restores

In large database environments, it can be necessary to divide the database into more file groups. Backup of file groups can be done separately, or the file groups or files can be restored separately.

TDP for SQL restores just the group backup objects needed from a full backup, file group backup, a file backup, or a set backup for specified SQL databases.

### 2.2.6 System databases

Always back up the system databases (master and msdb) on a regular basis and at times when alterations concerning system level information for SQL Server are performed. Also back up the model database if it is modified.

We recommend that you do backups of the system databases daily, since the model and msdb databases are unlikely to become large enough to do a full backup.

When this also applies to the distribution database (replicated SQL Servers), do a full backup.

**Note**

Tempdb is re-created every time the SQL server starts, since nothing in the database is saved from one session of the SQL server to the other. Therefore, it is not to be backed up and not shown in the TDP for SQL GUI.

### 2.2.7 Truncating the transaction log

SQL databases with the TRUNCATE LOG ON CHECKPOINT option (such as master or msdb) or that use the SQL server 2000 SIMPLE recovery model, do not have transaction logs that can be backed up.
2.3 Sizing

The chosen backup strategy and expiration settings (see “Policy management” on page 41) strongly influence the sizing demands.

Excessive use of full backups combined with high values of Versions Data Exists and Retain Extra Versions, may require increased storage.

If you want to send data directly to tape, using multiple mountpoints, your storage device must support the desired number of mountpoints. At the same time, make sure you do not interfere with other jobs utilizing the tape drives.

2.3.1 Differential estimates

When using TDP for the SQL differential database, the size of the differential backup must be estimated.

This estimate is needed because SQL Server does not provide a way to determine the size of a differential backup, and because the TSM server requires an accurate size estimate to efficiently allocate space and place objects.

By default, this value is set to 20% (percent of database pages changed since last full backup), as shown in Figure 5, “SQL Application Client Settings (tdpsql.cfg)” on page 32.

The TSM server uses this value to determine if there is enough space in the primary storage pool to contain the SQL database backup.

Because a separate backup object is created for each specified SQL database, this estimate applies to each specified SQL database individually.

---

Note

If the estimate is significantly smaller than the actual quantity of changes, the TSM server may be forced to abnormally end the backup, because the backup size is larger than the space the TSM server allocated for it.

If the estimate is significantly larger than the actual quantity of changes, the server may be forced to place the backup object higher in the storage pool hierarchy than otherwise necessary, possibly on removable media.
2.3.2 SQL 2000 log estimates

Unlike SQL Server 7.0, SQL Server 2000 allows transaction log backups even after non-logged operations such as SELECT INTO and BULK COPY.

SQL Server 2000 does this by appending the storage pages changed by the non-logged operations to the end of the transaction log backup.

For SQL Server 2000 log backups, `/logestimate` specifies the estimated fraction of an entire SQL database that has changed due to non-logged operations since its last log, differential, or full database backup.

Similar to the case of the differential backup, this estimate is needed because SQL Server does not provide a way to determine the size of non-logged changes, and because the TSM server requires an accurate size estimate to efficiently allocate space and place objects.

Because a separate backup object is created for each specified SQL database, this estimate applies to each specified SQL database individually. The numpercent variable can range from 0 to 99. Because a log backup with non-logged changes backs up database pages, this number is the percent of database pages changed since the last log, differential, or full database backup. The initial value is 0.

2.3.3 Growth

Databases have a tendency to grow in size when used over a period of time. Therefore, we advise you to evaluate your backup and restore strategy periodically (for example, every 3 months), and perform alterations if needed, to ensure that you can meet the demands for your strategy.
Chapter 3. Installation of TDP for SQL

In this chapter, we describe the procedures of installation of TDP for SQL in both cluster and non-cluster environments.

3.1 How to install the TDP agent for SQL

Tivoli Data Protection for Microsoft SQL (TDP) performs online backups of Microsoft SQL server databases to Tivoli Storage Manager (TSM) storage. TDP for SQL must be installed on the same machine as the Microsoft SQL server. TDP for SQL Version 2 supports Microsoft SQL Server 7.0 with SP2 or later and Microsoft SQL 2000 Server.

3.2 System requirements

Hardware requirements

TDP for SQL Version 2 has the following hardware requirements:

- Intel Pentium 166 or higher, or equivalent or later processor
- 48 MB of RAM (96 MB or more is highly recommended)
- 12 MB of free disk space

Note

If you are installing using the electronically downloaded selfextracting.exe file, you may need several additional MB of free space in your Windows system and temp directories. This self-starting, self-extracting file requires additional temporary working space. See the read1st.txt file that is shipped on the product installation media for current information.

Software requirements

TDP for SQL Version 2 has the following software requirements:

- Microsoft Windows NT Server (Server or Enterprise Edition) Version 4.0 or later with Service Pack 4 (SP4)
- Windows 2000 Server (Server, Advanced Server, Datacenter Server) or later


**Note**

- For Windows 2000, clustering capabilities are supported only by Advanced Server and Datacenter Server.
- Only Microsoft SQL Server 7.0 with SP2 or later, or Microsoft SQL Server 2000 or later is supported.
- If running SQL Server 7.0 and SQL Server 2000 on the same machine, see Microsoft Knowledge Base article Q280759 at: http://support.microsoft.com/support/kb/articles/q280/7/59.asp
- The TSM server must be Version 3.7.4 or later.
- TSM server can reside on a different machine than TDP for SQL.
- Install TSM Backup-Archive Client Version 3.7 or later to take advantage of TSM scheduling and a comprehensive disaster recovery plan.
- Use Microsoft Internet Explorer Version 4.01 to access TSM online information such as user’s guides, readmes, questions and answers, and links to Web sites.
- The current requirements for TDP for SQL can be obtained at: http://www.tivoli.com/products/solutions/storage
- TSM clients, requirements, and the latest PTFs can be obtained at: http://www.tivoli.com/support/storage_mgt/

**Supported communication protocols**

When communicating with a TSM server, TDP for SQL supports the following protocols:

- TCP/IP
- IPX/SPX
- NetBIOS
- Named Pipes (TDP for SQL to TSM connection)
- LU6.2 (CPIC)

Refer to the TSM server being used to see which protocols it supports.
3.3 How to install the TDP agent

This section gives you information on how to install TDP for SQL in a non-cluster environment, how to install the TDP agent in a cluster environment, how to perform a silent installation, and how to install the Backup/Archive Client in order to take advantage of the TSM Scheduler.

3.3.1 Installing TDP for SQL

In our Lab environment we set up two SQL servers — SQL 7.0 with SP2 and SQL 2000, both of them on Windows 2000 with SP1. Follow the Microsoft requirements and instructions for installing Microsoft SQL and be sure that you use the latest service packs available.

Before performing the installation, see the readme1st.txt file which includes useful information about installing and configuring TDP for SQL. Make sure you are logged on with an account having administrator privileges to the local system.

Follow these steps to install TDP for SQL:

1. Insert the TDP for SQL CD-ROM into the CD-ROM drive. If you have the autorun feature enabled, the setup will start as soon as you insert the CD into the drive. If autostart is not enabled:
   a. Select Run from the Start menu.
   b. Enter x:\setup where x is your CD-ROM drive letter.
   c. Click OK to start the installation program.
2. Follow the installation instructions contained in the prompt windows.
   If no previous version of TDP for SQL exists on the system, the default installation directory is ProgramFiles\Tivoli\TSM\TDPSQL. You may override it and specify a different installation directory.
   However, installing all TSM products into the same base directory is highly recommended. If the Tivoli Storage Manager product is detected, the path to that product becomes the default installation directory.
3. Click Finish to complete the setup.

---

Note

When using the NetBIOS communication protocol on a secondary LAN adapter, LANADAPTER n must be specified in the options file, where n represents the adapter number, for example, LANADAPTER 1.
If TDP for SQL Version 2 already exists on the system, you can **Repair** or **Remove** the previously installed TDP for SQL Version 2. By choosing **Repair** you will fix missing or corrupt files, but your configuration will remain intact. By choosing **Remove** you will afterwards be able to install TDP for SQL to a different installation directory.

---

**Note**

After uninstall of TDP for SQL, the use of another TDP or TSM product may produce the error message **tsmutill.dll not found**.

To solve this problem, install TSM Backup/Archive Client, TSM API runtime feature, 4.1.2 or later.

---

### 3.3.2 Registering TDP for SQL with a TSM server

Before you can perform backups and restores with TDP for SQL, your TSM administrator must register TDP for SQL as a client node with the server. The administrator will specify the node name for you, the initial password, the communication method to connect to the TSM server, the policy domain to which TDP for SQL belongs, TSM schedules, and whether you are allowed to use compression before sending files to the server. (Note that the TSM administrator can override your preferences about compression specified in your options file). For more information on this topic, see 4.1.2, “TSM setup” on page 30.

### 3.3.3 TDP for SQL options file

After registering the TDP for SQL node to the TSM server, you must configure several parameters in the options file. The default options file name is **dsm.opt** and it is stored in the TDP for SQL directory. You can edit this file using a text editor. You have to specify the following parameters:

- **NODename xxx** — The unique name which TSM administrator has registered.
- **TSM server name** — The name of the TSM server. (TCPserveraddress or IPXServeraddress or NETBIOSIservername).
- **Communication Options** — TDP supports the following communication protocols — TCP/IP, IPX/SPX, NetBIOS, Named Pipes.
You may specify the following additional options:

- **PASSWORD Access** — If this option is set to `generate`, the TSM API stores this password (encrypted) in the Windows registry and automatically generate the new password when the current one expires. Be aware that if this option is set to `prompt`, your backup may fail because of an expired password.

- **COMPRESSion** — You may use this option to compress data before sending it to the TSM server. However, this will lead to the higher CPU utilization on the machine where TDP for SQL is installed. On the other hand, this will cause less network traffic and less storage space on the TSM server. The TSM administrator settings on the TSM server takes precedence over your settings in options file, and the administrator can force you to always use compression, never use compression, or can leave this decision up to you.

- **Enablelanfree** — If this option is set to `yes`, you may run TDP for SQL in a LAN-free environment.

### 3.3.4 Installing TDP for SQL in a cluster environment

Installing TDP for SQL in a cluster environment is the same as installing it in a non-cluster environment. Install TDP for SQL on both nodes of the cluster. Make sure that option files on the both nodes of the cluster are identical. You must specify the `CLUSTERnode` parameter in the TDP for SQL options file to be `yes` for TDP for SQL to function on a MSCS. Also create a new shortcut so that the GUI is invoked by specifying the Virtual SQL Server Name with the `/sqlserver` parameter.

To do this, point to **Start -> Settings -> Taskbar** and **Start Menu Properties** and then click **Advanced tab** and then **Advanced command**. The TSM program group is located under the **Documents and settings\All users\Start Menu\Programs\Tivoli Storage Manager\TDP for MS SQL - V2**. Then by right clicking with the mouse create a new shortcut and specify the `/sqlserver` parameter. If you right-click on the shortcut and then click **Properties**, you should see a menu as shown in Figure 1.
Silent installation

The silent installation is extremely useful when you want to perform the installation of TDP for SQL on several identical machines, because administrators do not have to provide input to dialog boxes and specify the TDP for SQL parameters.

If you want to perform the silent installation, you have the following options:

- Use the command line setup program with \s (silent) and \v switches:
  - Use `setup /s /v/qn` from the command line to install in the default directory. Issue this command from the “main install” subdirectory.
  - Use `setup /s /v“INSTALLDIR="X:\Desired Install Path" /qn” to install to the specified directory. Make sure you use quotes if your installation path includes spaces and place a backslash (\) in front of each quote mark that is within an outer set of quotes. Also, there cannot be a space between the command-line option (/v) and the arguments that you are passing.
Create a batch file with desired parameters (Create this file with Notepad and save it as *.bat file). The following example shows the sample script:

```
@echo off
rem===================================================
rem silent install script
rem
setup /s /v"INSTALLDIR="x:\Desired Install Path" /qn"
rem
rem replace the option file
copy dsm.opt x:\Desired Install Path
rem===================================================
```

The silent installation package may reside on a file server, or you may choose to burn a special CD and distribute it for this purpose. This package contains the TDP for SQL code distribution files and usually a batch file for silent installation. If you use a silent install package on a CD and autostart is enabled the installation will begin after inserting the CD into the drive. If autostart is not enabled you may run the silent installation by activating the setup.bat file from the root of CD.

If the package is placed on the file server and you want to perform the silent installation from another machine you must execute the command: `net use x:\machine1\Silent_installation` whereas `machine1` is the file server and `Silent_installation` is the shared directory containing the silent installation package. No visual cues exist to inform you about the end of the installation. If the silent installation fails, you can create a detailed log file of installation by typing: `setup /v"/l*v setup.log"`.

### 3.3.5 Installing the Backup/Archive Client

If you want to take advantage of the TSM Scheduler, you must install the Backup/Archive Client on the same machine on which you have installed TDP for SQL. Make sure you are logged on using a Windows account with administrative privileges. To install the Backup/Archive Client, do the following:

1. Insert the CD-ROM containing the TSM Windows Client into your CD-ROM drive.
2. Select **Run** from the **Start** menu.
3. Type the name of the setup program in the Open field.
4. Click **OK**.
5. Follow the instructions displayed on the screen. You can choose between two setup types:
   - Complete — This setup gives you the Backup-Archive Client, the API, and the Web Client. Use the custom option if you want to install the Administrative Client.
   - Custom — This setup gives you the options to select the desired options. You must use this option if you want to install the Administrative Client. If you select to install the Backup/Archive client and the Administrative client, they must reside in a single directory. Both clients will share the same options file. Make sure there is enough disk space for the TSM Client files on the destination drive.

6. Click **Finish** once the installation process is complete.

For current installation and configuration information, refer to the README file that is shipped on the product installation media.

For current information concerning TSM, see:

http://www.tivoli.com/support/storage_mgr/tivolimain.html
Chapter 4. Configuration and setup

Setting up and configuring TDP involves both registration and configuration on the TSM server, as well as configuration of the TDP client on SQL server.

This is done by the DBA and the TSM administrator working together.

4.1 Getting started

In the following examples, setup and configuration will be done.

The examples refer to the setup shown in Figure 2.

Figure 2. Lab environment
The lab consists of an SQL server (Rainier), with both SQL Server 7 and SQL Server 2000.

The MS cluster, named Musala, is set up as an Active/Passive cluster at first, and later converted to an Active/Active cluster.

The TSM server is named Brazil, and the network protocol is TCP/IP.

The SAN environment is only used as described in Chapter 5, “SAN usage” on page 85.

4.1.1 TSM API

The Tivoli Storage Manager (TSM) Application Program Interface (API) enables an application client to use the TSM functions.

The client options file ‘dsm.opt’, on the SQL server, sets the conditions and boundaries for TDP sessions with the TSM server.

This includes setup of the connection to the TSM server and control of which objects are sent to the server, and their associated management classes.

Initial setup of the client options file

A nodename must be decided. We recommend that you use a naming convention which indicates that it is a TDP node.

We decided on "servername_sql2", to easily distinguish the node from both TDP version 1 nodes and Backup/Archive nodes on the TSM server.

Note

The TDP for SQL node name and password used to connect to the TSM server is comparable to the way Windows uses a user ID and password.
In Figure 3, the TDP for SQL node name RAINIER_SQL2 is specified for the SQL server Rainier, using TCP/IP to communicate with the TSM server Brazil. This is stored in the client options file dsm.opt.

![Image of dsm.opt file configuration]

Figure 3. Initial configuration of the dsm.opt file

The remaining options in the file are not required for initial configuration, a selection will be applied in the examples in this book.

If the node is a cluster node, the CLUSTERnode option must be set to yes.

See 4.1.4, “Clustered setup” on page 34
4.1.2 TSM setup

These steps must be done on the TSM server.

**Note:** It is expected that the following commands are familiar to the TSM administrator, otherwise please consult the TSM Administrators Guide.

4.1.2.1 Registering TDP for SQL with the TSM server

The TDP node must be registered on the TSM server before the node can start a session. Register TDP for SQL performing the steps listed below.

Register the TDP for SQL node name to an already defined policy domain:

```
register node rainier_sql2 pw domain=tdpsql2_domain
```

The initial password ‘pw’ will be prompted the first time TDP invokes a session to the TSM server -see “Setting password for SQL authentication” on page 33.

The TSM policy domain, tdpsql2_domain, is defined in “Detailed examples, rationales, TSM API and TSM settings” on page 45.

4.1.2.2 Configuring the TSM server

Before the TSM server can receive backups from the SQL server, the TSM server must be configured (do this for each node).

Set `BACKDELETE = YES`, for the node

This is needed so the TDP client can inactivate previous backups.

Set `MAXNUMPP` to at least the maximum number of stripes to be used for backup or restore, using removable media.

The value defines the maximum number of mount points a node can have at one time, default value is 1.
In Figure 4 BACKDELETE is set to YES and MAXNUMMP to 5 for the node rainier_sql2.

```
  tsm: BRAZIL> update node rainier_sql2 domain=tdpsql2_domain backdelete=yes maxnummp=5
  ANR2063I Node RAINIER_SQL2 updated.
  tsm: BRAZIL> q n rainier_sql2 f=d

   Node Name: RAINIER_SQL2
   Platform: TDP MSSQLV2 NT
   Client OS Level: 5.00
   Client Version: Version 4, Release 1, Level 2.0
   Policy Domain Name: TDPSQL2_DOMAIN
   Last Access Date/Time: 03/08/01 18:43:58
   Days Since Last Access: <1
   Password Set Date/Time: 03/08/01 18:43:25
   Days Since Password Set: <1
   Invalid Sign-on Count: 0
   Locked?: No
   Contact:
      Compression: Client
      Archive Delete Allowed?: Yes
      Backup Delete Allowed?: Yes
      Registration Date/Time: 03/08/01 18:26:29
      Registering Administrator: ADMIN
   Last Communication Method Used: Tcp/Ip
   Bytes Received Last Session: 516
   Bytes Sent Last Session: 2,153
   Duration of Last Session: 0.03
   Pct. Idle Wait Last Session: 58.06
   Pct. Comm. Wait Last Session: 0.00
   Pct. Media Wait Last Session: 0.00
   Optionset:
      URL:
   Node Type: Client
   Password Expiration Period:
      Keep Mount Point?: No
      Maximum Mount Points Allowed: 5
```

Figure 4. Configuring the TSM server

Other parameters that can be specified are:

- **COMPRESSION**: Parameter which defines if data is compressed before sending it to the TSM server. Default value is client, which means it depends on the setting in the clients options file. When set to YES or NO, this overwrite the setting in the clients option file.

- **COLLOCATE**: Parameter for DEFINE STGPOOL should be set to FILESPACE to ensure that individual data stripes stay on separate removable volumes. The default value is NO. Not doing so may require MOVE operations to make the data for each stripe of a restore simultaneously accessible.
- TXNGROUPMAX: Option in the TSM server options file (usually dsmserv.opt) must be at least one more than the maximum number of stripes to be used for backup or restore operations regardless of media. The default value is 40.

### 4.1.3 TDP setup

It is assumed that TDP for SQL is installed according to Chapter 3, “Installation of TDP for SQL” on page 19.

Start the SQL Client GUI and choose **Configuration** under **Edit** in the menu (Figure 5).

![Figure 5. SQL Application Client Settings (tdpsql.cfg)](image)

The servername is registered automatically and SQL authentication set to integrated (if cluster see 4.1.4, “Clustered setup” on page 34).

If a different date/time/number format is desired this can be set here, on the **Regional** tab.

We advise that you leave the SQL Application Client Settings to default, unless experience shows a need for changing the values.

The settings are stored in the configuration file tdpsql.cfg.
Chapter 4. Configuration and setup

When you invoke an action the first time, you will be prompted for the password to the TSM server, defined in 4.1.2.1, “Registering TDP for SQL with the TSM server” on page 30. (See Figure 7.)
Enter the password, in this case ‘pw’, and the password is stored encrypted in the registry, since password access is set to generate in the options file shown in Figure 3 on page 29.

We recommend to leave the password access setting to default, since a new password is automatically generated from the TSM server, when the current expires, thus minimizing administration.

TDP for SQL is now ready and backups can be performed.

4.1.4 Clustered setup

When using TDP on an MS cluster, install TDP on both nodes (identical file path). Configure dsm.opt and tdpsql.cfg as follows, on one node, and copy it to the other node.
In the dsm.opt file, the cluster node option must be set to yes (see Figure 8).

![dsm.opt Notepad](image)

Figure 8. dsm.opt configured for cluster node
TDP does not automatically register the SQL server name (Virtual Server name), so this must be done manually.

To do this, open **configuration** under **Edit** in the GUI, and enter the name. See Figure 9. This is saved to the file tdpsql.cfg.

![Figure 9. Configuring the Virtual SQL server name and cluster name](image)

Then restart the GUI.

**Note**

When running TDP for SQL on an Active/Active cluster, you must do the configuration differently (see “Active/Active” on page 66).
In Figure 10, configuration has been done, and the TDP for SQL GUI for the Virtual SQL server is ready for use.

![Figure 10. TDP for SQL, Virtual Server MUSALA_SQL_A is registered](image)

Remember, if you want to utilize SQL authentication instead of Windows integrated authentication, the credentials are set via SQL server login settings under Utilities.

For a detailed description of clustered setup and use of TDP for SQL on an Active/Active cluster, see “Clustering” on page 65.

### 4.1.5 Multiple SQL server instances

When performing operations from multiple SQL server instances on the same network node as the application client (for SQL Server 2000), you can access only one SQL server per execution of TDP for SQ. Multiple server names may appear in restore trees if backup objects from different SQL server instances exist on the same node, but you cannot switch server instances from the GUI for backup operations.
To use the GUI for operations of another SQL server instance, create a shortcut to `tdpsql.exe` and specify another instance:

```
/sqlserver=server_instance_name
```

In Figure 11, the shortcut ‘SQL 2000 instance’ is defined to start the GUI with the server instance Rainier\Rainier2000.

When both SQL Server 7 and SQL Server 2000 are installed on the same server, consult the MS Knowledge Base Article Q280759:

http://support.microsoft.com/support/kb/articles/q280/7/59.asp
4.1.6 Authorities and permissions

The SQL logon user name or Windows user name must be added to the SYSADMIN fixed server role, before it can be used by TDP for SQL.

The Windows user name must have administrative rights on the server.

4.1.7 Meta data

When a backup is performed, TDP for SQL retains information about the SQL server and database. This information is available for query and restore operations after the backup is completed. The information about the names and sizes of the database filegroups and files is stored along with the database data, as a sub-object. This sub-object is referred to as meta data. You will need this meta sub-object only when you need information about individual database filegroups and files.

If any TDP for SQL meta data is on removable media, queries may require media mounts, and backups or restores may require additional media mounts.

When invoking a restore, you will experience the error message shown in Figure 12, if the meta data is on removable media.

![Figure 12. Meta data not available on disk](image)

In this situation, check the **Wait for Tape mounts for File Information** checkbooks, as instructed, shown in Figure 13.
To avoid this situation, you should define a management class for meta data that is identical to the corresponding management classes for database data, except that the meta data management classes should not allow migration to removable media. This is done by creating a storage pool for the meta data which does not migrate to tape:

```
define stgpool META_DISK_30days disk description='Disk for Meta data' (remember to activate the policy set after making alterations).
```

Then specify in the dsm.opt file that meta data should go to this storage pool. For example:

```
INCLUDE "\...\meta\...\Stock_VLDB\...\*" meta_disk_30days,
```

This will send all meta data for database Stock_VLDB to the management class meta_disk_30days. The policy of the management class used for the meta data must be equal to the management class for the other database objects. These concepts are discussed in the following sections.
4.1.8 Policy management

Tivoli Storage Manager policies are used to specify how objects (files) are backed up and migrated.

The way in which TDP for SQL Version 2 names the backup objects it stores on the TSM server differs significantly from that used by Version 1.

These changes are made in order to allow exploitation of the automatic policy-based expiration capabilities provided by the TSM server. As a result, you do not use the same management class parameters recommended for TDP for SQL Version 1.

In the next section, the life cycle of backup data objects is explained.

4.1.8.1 Life cycle of backup data objects

A backup object exists in three states: active, inactive, and expired, before being purged from the TSM server. Figure 14 shows the four steps involved in the life cycle of an backup data object:

Step 1: A copy of the client data is sent to the TSM server as a backup object. When a backup object is sent to the TSM server, it becomes the active version.

Step 2: The backup object remains in an active state until the TSM client program deletes it manually, or a newer version of the backup object is sent. At this point the backup object changes state from active to inactive.

Step 3: The backup object remains inactive until it exceeds its retention settings. A backup object can exceed retention settings by either time or number of versions. At this point the backup object changes state from inactive to expired.

Step 4: The backup object remains in the expired state until expiration processing runs on the TSM server. This process is invoked by a TSM administrator with the expire inventory command. When expiration processing encounters a backup object in the expired state, it purges that object from the TSM database and frees up the storage space where the backup object resided.
A backup object that is the active version or in the active state will never be purged from TSM storage. It must first be inactivated by the TSM client program. The TSM client program can do this by manually deleting the backup object or sending a new version of the backup object.

When a backup object becomes inactive or moves into the inactive state, it is still accessible by the TSM client. A main difference between active and inactive is that an active object becomes inactive due to a client operation. An inactive object becomes expired automatically by the TSM server as soon as it exceeds its retention criteria. Changing from inactive to expired does not require a client operation. There is no way for a backup object to change back to the active state once it has become inactive.

When a backup object moves into the expired state, it is no longer accessible by the TSM client. Additionally, there is no way for the backup object to change back to the inactive state once it has become expired.
What is considered a unique backup object by TSM

Backup objects can be deactivated by the client program that initially backed them up, in our case TDP for SQL. A backup object changes state when a newer version of the backup object is sent to the TSM server. This brings up the question of how the TSM determines what a unique version is.

A backup object is considered ‘unique’ based on NODE_NAME, FILESPACE_NAME, HL_NAME, LL_NAME. When a backup data object is sent to the TSM server, if it has the same NODE_NAME, FILESPACE_NAME, HL_NAME, LL_NAME as an existing backup data object. The new data object becomes the ACTIVE_VERSION, and the older version changes state and becomes an INACTIVE_VERSION.

Many API products use a unique value for the LL_NAME based on a timestamp or a random non-reoccuring value, which is the case with log and set backups by TDP for SQL. Because of this unique value for the LL_NAME, the backup object will only change states from active to inactive when the API product manually inactivates the backup object. An active object is not subject to retention settings until it is inactivated. If the API (in our case TDP for SQL) does not inactivate backup objects, they will remain forever on the TSM server. TDP for SQL Version 2 inactivates all backup objects for a SQL database not otherwise inactivated whenever a new full database backup of that SQL database is performed.

In the following section, the recommended policy settings for the backup copy group are explained.

---

**Note**

If the retention for the backup object is set to retain zero inactive objects (verexist=1, verdelete=0) or to retain inactive copies for zero days (reextra=0, retonly=0), the active backup object will change to the expired state as soon as the active backup is inactivated.

In TDP for SQL Version 1, these were the settings for the backup copy group. Since all backup objects were unique, Version 1 could not utilize TSM automatic expiration, and all backup objects were inactivated (deleted) manually from TDP for SQL Version 1.

If the same settings are used with SQL for TDP Version 2, this will result in every previous backup, for a database, being purged whenever a full backup of the database is performed, thus leaving you with only the last full backup.
4.1.9 Why, what, how

TDP for SQL stores all objects as backup objects on TSM in backup storage pools, so an Archive Copy Group is not required, although it can exist. For convenience, we created one to suppress warning messages, about a missing Archive Copy Group for the management class, from the TSM server in various situations (for example, when activating the policy).

Set the Version Control Copy Group parameters as desired to define the version limit and retention periods for SQL database backup objects:

- VERSIONS DATA EXISTS
- VERSIONS DATA DELETED
- RETAIN EXTRA VERSIONS
- RETAIN ONLY VERSION

Here are our recommendations:

- Set VERSIONS DATA EXISTS and VERSIONS DATA DELETED to NO LIMIT.
- Set RETAIN EXTRA VERSIONS and RETAIN ONLY VERSION to the desired amount of days you want you want to be able to go back and restore from.
- Accept the default values for the backupcopy group parameters COPY MODE, COPY_SERIALIZATION, COPY FREQUENCY because they are not applicable to TDP for SQL.

4.1.9.1 Log and set expiration values

Because log and set objects are always uniquely named, they do not participate in expirations due to version limit. However, TDP for SQL Version 2 inactivates all backup objects for a SQL database not otherwise inactivated, whenever a new full database backup of that SQL database is performed. Therefore, the retention period defined through the RETAIN ONLY VERSION parameter controls the expiration of log and set backups.

--- Note ---

There will never be more than one version of a log or set object, since they are always uniquely named.

4.1.9.2 Considerations

When selecting the RETAIN ONLY value for log backups, ensure that it is at least as long as the value for the backup objects the logs are associated with. You may use the same management class for log backups and the backup objects that are retained the longest to be sure you use an adequate value.
We recommend that you use the same value for RETAIN EXTRA as for RETAIN ONLY. In this case, the log backup (or sequence hereof) will exist as long as the corresponding full or differential backup and vice versa.

For more information on automatic expiration, consult your TSM Administrators Guide.

4.1.10 Detailed examples, rationales, TSM API and TSM settings

The following example shows how we decided to set up the TSM server for backup of SQL server with TDP.

Commands for the following tasks are shown below:

- Policy Domain is defined, as tdpsql2_domain.
- Policy Set is defined, as standard.
- Management class defined, as API_DISK_30days.
- Backup Copy Group defined, with API_DISK as destination.
- Archive Copy Group defined, with API_DISK as destination.

```plaintext
<table>
<thead>
<tr>
<th>Command</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>tsm: BRAZIL&gt;def domain tdpsql2_domain</td>
<td>ANR1500I Policy domain tdpsql2_DOMAIN defined.</td>
</tr>
<tr>
<td>tsm: BRAZIL&gt;def policy tdpsql2_domain standard</td>
<td>ANR1510I Policy set STANDARD defined in policy domain tdpsql2_DOMAIN.</td>
</tr>
<tr>
<td>tsm: BRAZIL&gt;def mgmtclass tdpsql2_domain standard api_disk_30days</td>
<td>ANR1520I Management class API_DISK_30DAYS defined in policy domain tdpsql2_DOMAIN, set STANDARD.</td>
</tr>
<tr>
<td>tsm: BRAZIL&gt;def copygroup tdpsql2_domain standard api_disk_30days</td>
<td>ANR1530I Backup copy group STANDARD defined in policy domain tdpsql2_DOMAIN, set STANDARD, management class API_DISK_30DAYS.</td>
</tr>
<tr>
<td>tsm: BRAZIL&gt;def copygroup tdpsql2_domain standard api_disk_30days</td>
<td>ANR1535I Archive copy group STANDARD defined in policy domain tdpsql2_DOMAIN, type=archive dest=api_disk.</td>
</tr>
</tbody>
</table>
```

Then the management class is assigned as default, settings for the Copy group are defined, and the Policy Set is activated.

- Default management class is assigned to API_DISK_30DAYS.
- Copy group is updated with the desired settings:
  - Versions Data Exist: This is set to NO LIMIT.
  - Versions Data Deleted Exist: This is set to NO LIMIT.
  - Retain Extra Versions: This is set to 30 (days).
  - Retain Only Version: This is set to 30 (days).
The Policy Set standard is activated for tdpsql2_domain:

```
tsm: BRAZIL> assign defmgmtclass tdpsql2_domain standard api_disk_30days
ANR1538I Default management class set to API_DISK_30DAYS for policy domain tdpsql2_DOMAIN STANDARD.

AnR1532I Backup copy group STANDARD updated in policy domain tdpsql2_DOMAIN, set STANDARD, management class API_DISK_30DAYS.
```

4.1.11 Active, inactive, expired

The defined settings for the Backup Copy Group affect the backup objects in the following ways:

**Versions Data Exists**
- Apply when you have 1 active object and 0 or more inactive versions.

**Versions Data Deleted**
- Apply when you have 0 active and 1 or more inactive versions.

**Retain Extra Versions**
- Apply to the inactive versions when you have more than 1 inactive version.

**Retain only version**
- Apply when you have 0 active and only 1 inactive version.

**We decided to set the policy to:**
- Versions Data Exist: This is set to NO LIMIT
- Versions Data Deleted Exsit: This is set to NO LIMIT
- Retain Extra Versions: This is set to 30 (days)
- Retain Only Version: This is set to 30 (days)

**This means:**

The active version will be kept indefinitely, until it is inactivated. Active versions are automatically inactivated when a full database backup is performed (creating a new active version).
There is no limit on how many inactive versions will be kept. Inactive versions (both Extra and Only versions) will expire in 30 days and be deleted.

**Note**

You can also manually inactivate backups. From the GUI, select **Inactivate** under **View** in the Menu to display the **Inactivate** tab.

Now select the backup you want to inactivate, see Figure 15 and click the **Inactivate** button.

![Figure 15. Manually inactivating backup from the GUI](image)

With the defined expiration settings, we will be able to retrieve backups performed within the last 30 days.
4.1.12 When to use set backups

Set backups are intended to be used in unusual one-of-a-kind situations.

Because set backups are always uniquely named (like log backups), they do not participate in expiration due to version limit.

This means that whenever a set backup is performed, it does not inactivate any of the previous backups.

The reason for using a set backup is if you do not want the backup to be part of your normal expiration process. Thus, set backups are uniquely named. The TSM automatic expiration that applies is the Retain Only Version parameter, when the backup is inactivated. See “Active, inactive, expired” on page 46.

Otherwise, you should use File/Group backups to be part of the normal expiration process.

---

**Note**

Remember to do a log backup after the set backup in order to be able to restore the set backup. Afterwards, you must apply the transaction log.

4.2 Triggering backups

Triggering backups can be done manually, but is more likely to be done on a periodic basis by a scheduler.

4.2.1 Manual backups

From the TDP for SQL GUI, you can perform backups and restores, and inactivate your performed backups.

To perform a backup, check-mark the desired database(s) and what kind of backup to perform.
In the example shown in Figure 16, a full backup of Stock_VLDB is done.

![Figure 16. Full backup of Stock_VLDB](image1)

Stock_VLDB is selected and backed up (Figure 17).

![Figure 17. Backup completed](image2)

Notice that all previous backup objects are inactivated by a full backup.
To manually make a differential or log backup from the TDP for SQL GUI, in the same way, simply mark the type of backup desired and click **Backup**.

From the Backup Groups/Files tab, you can perform Group, File, or Set backups. To perform the backup, select the **Group**, **Files**, or **Set** that you want to back up.

For group backups, selections propagate up the hierarchy to the group level. For example, if you expand a database and select a file in the tree, the container group and all of its other files are also selected, as shown in Figure 18, where the file Stock_VLDB_Data1 is selected.

For file and set backups, selections are never propagated up the hierarchy, and for set backups, a selection at the database level means that all groups will be backed up in the set.

![TDP for MS SQL Server](image)

**Figure 18.** The file Stock_VLDB_Data1 is selected, doing group backup

For group backups, selections propagate up the hierarchy to the group level. For example, if you expand a database and select a file in the tree, the container group and all of its other files are also selected, as shown in Figure 18, where the file Stock_VLDB_Data1 is selected.

For file and set backups, selections are never propagated up the hierarchy, and for set backups, a selection at the database level means that all groups will be backed up in the set.

**Note**

When doing Group, File or Set backups you need to back up the tail of the log to prior to restoring the backup objects. See “Need to back up tail of log before restore” on page 125.

Manual backups can also be done from the TDP for SQL CLI. In Appendix B, “TDP for SQL CLI” on page 129, it is shown how to use the TDP for SQL CLI.
4.2.2 Scheduled backups

To use scheduled backups, you must first create cmd files (corresponding to creating a step for a job in SQL server), which are invoked by a scheduler service.

Use the sample file sqlfull.smp (in C:\Program Files\Tivoli\TSM\TDPSql\) to create the cmd files from. Create a cmd file for each different backup task you want to schedule.

In the cmd file, which uses the TDP CLI (Command Line Interface), you must specify the option file to be used (boundaries for communication with the TSM server), the object you want to back up, and type of backup (see Figure 19, Figure 20, and Figure 21).

Below, cmd files are created for the database Stock_VLDB, to perform Full, Log and Differential backup.

Then you need to store the cmd files on the SQL server. We decided to place the cmd files in C:\TSM_Jobs\.

![Figure 19. Full backup of Stock_VLDB](image_url)

![Figure 20. Log backup of Stock_VLDB](image_url)
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Figure 21. Differential backup of Stock_VLDB

All three backup types are set to use the option file dsm.opt and write to the same log files; however, this is not mandatory.

It can be useful to use a different option file, in order to achieve usage of another management class or node name than the defined in dsm.opt. See also 4.4.3, “Recommendations: Include/Exclude statements, nodenames” on page 80 for more information on how to use the Include/Exclude statement.

4.2.3 Scheduler

When the cmd files are created as described in 4.2, “Triggering backups” on page 48 you must decide on which scheduler to use. We recommend that you use the TSM Scheduler service to benefit from centralized management of all the servers in the enterprise, apart from setting up schedules on each server using for example SQL Scheduler.

To use TSM Scheduler you must install the Backup/Archive Client on the same machine on which you have installed TDP for SQL. Make sure you are logged on using a Windows account with Administrative privileges.

In the following examples, the TSM Scheduler Service is installed on a standalone SQL server, and on an MS cluster.

4.2.3.1 Installing the Backup/Archive Client

Installing the TSM Backup/Archive Client:

- Insert the CD-ROM containing the TSM Windows Client into your CD-ROM drive.
- Select Run from the Start menu.
- Type the name of the setup program in the Open field.
- Click OK.
• Follow the instructions displayed on the screen. You can choose between two setup types:
  - **Complete**: This setup gives you the Backup-Archive Client, the API, and the Web Client.
  - **Custom**: This setup gives you the options to select the desired components. You must choose this option to install the Administrative command line client.

• If you select to install the backup-archive client and the administrative client, they must reside in a single directory. Both clients will share an options file. Make sure there is enough disk space for the TSM Client files on the destination drive.

• Click **Finish** once the installation process completes.

• For current installation and configuration information, refer to the README file that is shipped on the product installation media.

For current information concerning TSM, see this Web site:
http://www.tivoli.com/support/storage_mgr/tivolimain.html

4.2.3.2 **Installing the TSM Scheduler service**

Even if the TSM scheduler is already installed on the server, for use with the Backup/Archive Client, you need to install one with a unique name for TDP for SQL. (The scheduler should have a different nodename from the regular Backup/Archive Client.)

When TSM Backup/Archive Client is installed, the TSM Scheduler Service is installed using the `dsmcutil.exe` with these settings:

```
/name:"TSM TDPSQL Scheduler"
/node:rainier_sql2
/password:pw
/autostart:yes
/clientdir:"c:\progra~1\tivoli\tsm\baclient"
/optfile:"c:\progra~1\tivoli\tsm\tdpsql\dsm.opt"
/startnow:no
```
The Scheduling service can now be started issuing the command `net start "TSM TDPSQL Scheduler"`, and is ready for use.

### 4.2.3.3 Setup of TSM Scheduler Service on a cluster

In this section we describe how to install the Scheduler service on a cluster.

Even if the TSM scheduler is already installed on a cluster, for use with the Backup/Archive Client, you need to install one with a unique name for TDP for SQL.

**Note:** The scheduler should have a different nodename from the regular Backup/Archive Client.
Below the scheduler service, the TSM TDPSQL Scheduler is installed using the dsmcutil.

**Note**

This must be done on both nodes!

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil inst /name:"TSM TDPSQL Scheduler" /node:musala_sql2_a /password:pw /autostart:no /clientdir:"c:\progra~1\tivoli\tsm\baclient" /optfile:"c:\progra~1\tivoli\tsm\tdpsql\dsm.opt" /startnow:no
TSM Windows NT Client Service Configuration Utility
Command Line Interface Version 4.00.a
Last Updated Feb 17 2001 (Non-Unicode Build)
TSM ApI Version 4.1.2

Command: Install TSM Client Service
Machine: CLYDE(Local Machine)

Installing TSM Client Service:

  Machine : CLYDE
  Service Name : TSM TDPSQL Scheduler
  Client Directory : C:\Program Files\Tivoli\TSM\baclient
  Automatic Start : no
  Logon Account : LocalSystem

The service was successfully installed.

Creating Registry Keys ...

Updated registry value 'ImagePath' .
Updated registry value 'EventMessageFile' .
Updated registry value 'TypesSupported' .
Updated registry value 'OptionsFile' .
Updated registry value 'EventLogging' .
Updated registry value 'ClientNodeName' .
Updated registry value 'ADSMClientKey' .
Updated registry value 'TSM TDPSQL Scheduler' .

Generating registry password ...
Authenticating TSM password for node MUSALA_SQL2_A ...

Connecting to TSM Server via client options file 'c:\progra~1\tivoli\tsm\tdpsql\dsm.opt' ...

Password authentication successful.

The registry password for TSM node MUSALA_SQL2_A has been updated.
```
Now start the Cluster Administrator.

Select the **SQL Server Cluster Group** and create a new resource to represent the TDP for SQL scheduler service.

Specify Name, Description, Resource type, and Group as shown in Figure 22. and click **Next**.

![Figure 22. Configuring Name, Description, Resource type and group](image)

Both servers are set to possible owners, as shown in Figure 23. Click **Next**.
Make the TSM Scheduler service dependent on the SQL server, shown in Figure 24, and click **Next**.
Enter the name of the TSM Scheduler service, shown in Figure 25.

This must match the name defined when the service was created with the dsmcutil, in this case **TSM TDPSQL Scheduler**. Then click **Next**.

![Generic Service Parameters](image)

**Figure 25. Entering the name of the service**

---

**Note**

Do not set up Registry Replication at this time. This action is performed in a later step (Figure 26).
Click **Finish**. The cluster resource is now created (Figure 27).

Check if the TSM password is set correctly.

An easy way to do this is to make a backup, using the command line interface, while specifying the password:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc back model full /tsmp=pw /sqlserver=musala_sql_a
```

Now bring the new resource online.
When the resource is online, select properties of the resource to add the registry entry `SOFTWARE\IBM\TSM\CurrentVersion\BackupClient\NODES\<nodename>` for the TDP for SQL nodename password.

![Figure 28. Configuring registry replication](image)

Then take the resource offline (this stores the password registry key to the quorum disk)

Bring the resource online, and the TSM Scheduler service is ready.

Test if the TSM Scheduler service can failover by moving the SQL Server Cluster Group to the other node.
4.2.4 Automating backups with TSM central scheduler

To utilize TSM Central Scheduler, the scheduling must be done on the TSM server.

This is done in a two-step process:

- Define a schedule.
- Associate a node with the schedule defined.

To define a schedule, numerous parameters can be set (consult TSM Administrators guide for details). In this example we define three different schedules (hourly, daily and weekly), with the parameters shown below.

### Defining hourly backup for default scheduling

```
DEFINE SCHeDule tdpSQL2_domain def_hourly_backup
DESCRIPTION="Hourly Backup for default scheduling"
ACTION=command
OBJECTS="C:\TSM_jobs\BackupJobHourly.cmd"
STARTDate=TODAY
STARTTime=NOW
DURATION=15
DURUnits=minutes
PERIods=1
PERUnits=Hours
DAYofweek=any
EXPIration=never
```
Defining daily backup for default scheduling

DEFine SCHedule tdpsql2_domain def_Daily_backup
DESCRIPTION="Daily Backup for default scheduling"
ACTION=command
OBJECTs="C:\TSM_jobs\BackupJobDaily.cmd"
STARTDate=TODAY
STARTTime=NOW
DURATION=15
DURUnits=minutes
PERIods=1
PERUnits=Days
DAYofweek=any
EXPIration=never

Defining weekly backup for default scheduling

DEFine SCHedule tdpsql2_domain def_weekly_backup
DESCRIPTION="Daily Backup for default scheduling"
ACTION=command
OBJECTs="C:\TSM_jobs\BackupJobWeekly.cmd"
STARTDate=TODAY
STARTTime=18:00
DURATION=15
DURUnits=minutes
PERIods=1
PERUnits=Weeks
DAYofweek=Sunday
EXPIration=never

The defined schedules can now be associated with the nodes. The example below associate the def_Daily_backup schedule with the nodes rainier_sql2 and all nodes where the name starts with Musala.

DEFine ASSOCIation tdpsql2_domain def_Daily_backup Rainier_sql2, musala*

For details on parameters, consult the TSM Administrators Guide at the URL:
4.2.5 Automating backups using SQL server scheduler

The built-in scheduler in SQL server can be used to invoke the TSM backup (as well as any other scheduler). To do so, create a job in SQL server Enterprise Manager. The SQL server agent must be running to invoke the scheduled jobs.

Name the backup job, as shown in Figure 29.

Figure 29. Naming the job

Define the first step to call the cmd file, as shown in Figure 30.

Note

The cmd file must be present on each client node, in the defined file path.

The examples above show that you can define general backup schedules and apply them to numerous nodes. However, if your environment is diverse, the option to tailor both backup jobs (cmd files) and schedules is available, to meet specific demands.

In the examples above, the schedules and associations are done from the command line. These can also be done using the TSM Web interface, or if the TSM server is a Windows server, the TSM server Utilities GUI.
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Then set the schedule for the job, shown in Figure 31.

Notification and additional output files can also be specified. For further information, consult SQL Server Books Online.

When the job is created, test to see if it runs as intended.
4.3 Clustering

This section describes what you should be aware of when TDP for SQL is installed on an MS cluster.

If TSM Scheduler is not installed (involving setup configuration of registry replication of the TSM node password key, as described in “Setup of TSM Scheduler Service on a cluster” on page 54), it must be configured when using the PasswordGenerate option.

To do this, select properties for the Virtual SQL Server Resource in the Cluster Administrator, and choose the **Registry Replication** tab. Then click **Add** to add the registry key to be replicated, as shown in Figure 32.

![Figure 32. Configuring registry replication of the TSM node password key](image)

The password for TSM nodes is registered under:

`HKEY_LOCAL_MACHINE\SOFTWARE\IBM\ADSM\CurrentVersion\BackupClient\Nodes\`
When it is an Active/Active cluster, using two TSM node names, this must be done for the other as well. (with the corresponding Virtual SQL server resource).

### 4.3.1 Active/Passive

The most simple MS cluster setup is the Active/Passive SQL server.

Once TDP for SQL is set up, as described in “Clustered setup” on page 34, it is very similar to a standalone SQL server. Only one TSM node name is necessary to communicate with the TSM server, though the files must be present on both cluster nodes.

**Note**

You should be aware that you can only use TDP for SQL on the cluster node which owns the SQL server resource at the time. If you invoke an action using TDP for SQL on the cluster node not possessing the SQL server resource, it will fail.

### 4.3.2 Active/Active

The Active/Active cluster is a little more complicated, since basically, it has two SQL servers on the same MS cluster.

Due to the fact that it has two different SQL servers, we advise you to use two TSM node names; this implies two dsm.opt and two tqpsql.cfg files. You can use the same node name (dsm.opt) and two different tdpsql.cfg files, but this is not recommended.

**Note**

It is possible to only use one TSM node name and create shortcuts to the TDP for SQL GUI, using the `/sqlserver` parameter, but it is much easier to manage (and avoid mistakes) if two different TSM node names are used.

Also, there must be installed two TSM Scheduler services bound to their corresponding SQL server (Virtual Server Resource). Both services cannot have the same name — thus, simply give each Scheduler service a number suffix.
We recommend configuring TDP for SQL on an Active/Active cluster in the following way:

Install TDP for SQL on both nodes (same file path).

**Creating client options files for each Virtual SQL server:**

Create a dsm.opt file for each Virtual SQL server. This is done by editing dsm.opt, as described in “TSM API” on page 28, entering the TSM node name for the first Virtual SQL server and for the other Virtual SQL server, and renaming the files when saving. In our example, we decided to use the tsm node names Musala_sql2_A and Musala_sql2_b. This results in two client options files, SQL_A_dsm.opt and SQL_B_dsm.opt. The two files are shown in Figure 33 and Figure 34.

![Figure 33. Configuring SQL_A_dsm.opt for Virtual SQL Server Musala_SQL_A](image-url)
Figure 34. Configuring SQL_B_dsm.opt for Virtual SQL server Musala_SQL_B
Creating tdpsql.cfg files for each Virtual SQL server:

The tdpsql.cfg files can be done manually, but the easiest way is to simply specify a name for the tdpsql.cfg file when creating TDP for SQL GUI shortcuts for each server.

To create the TDP for SQL shortcut for each Virtual SQL server, right-click on tdpsql.exe in the directory where TDP for SQL is installed, as shown in Figure 35:

![Figure 35. Creating shortcut to tdpsql.exe](image)

Then rename the shortcut, for example “Musala_SQL_A tdpsql.exe”, and select properties to modify the shortcut.
In the Target box, we specify the parameters /Configfile=A_tdpsql.cfg /Tsmoptfile=SQL_A_dsm.opt. This is shown in Figure 36.

Figure 36. Setting the parameters for the shortcut “Musala_SQL_A tdpsql.exe”
Now start the TDP for SQL GUI using the shortcut. Then we configure the Virtual SQL server name and Servername (cluster Server name) in the configuration window. This is shown in Figure 37.

![Figure 37. Configuring A_tdpsql.cfg](image)

When we click **Apply**, the configuration file A_tdpsql.cfg is created. Refresh the tree view and TDP for SQL for Virtual Server Musala_SQL_A is ready for use.

The same procedure must be done for Musala_SQL_B.
For completion, the screen displays are shown in Figure 38.

Figure 38. Creating shortcut to tdpsql.exe

The shortcut is renamed to “Musala_SQL_B tdpsql.exe”, and properties are selected to modify the shortcut.
In the Target box, we specify the parameters `/Configfile=B_tdpsql.cfg` 
`/Tsmoptfile=SQL_B_dsm.opt` This is shown in Figure 39.

![Figure 39. Setting the parameters for the shortcut “Musala_SQL_B tdpsql.exe”](image)
Now TDP for SQL GUI is started using the shortcut “Musala_SQL_B tdpsql.exe”. Then we configure the SQL server name and Servername (cluster Server name), for Musala_SQL_B in the configuration window, as shown in Figure 40.

![Figure 40. Configuring B_tdpsql.cfg](image)

When we click **Apply**, the file B_tdpsqlcfg is created. Refresh the tree view, and TDP for SQL for Virtual Server Musala_SQL_A is ready for use.

**Copy the files created to the other cluster node:**

Now we copy the six files we have created to the other server in the cluster. The configuration files must be in the file path where TDP for SQL is installed, while the shortcuts can be placed wherever most convenient, for example, on the Desktop.

**The files to copy are:**

- SQL_A_dsm.opt
- SQL_B_dsm.opt
- Musala_SQL_A tdpsql.exe.lnk
- Musala_SQL_B tdpsql.exe.lnk
- A_tdpsql.cfg
- B_tdpsql.cfg
Now TDP for SQL is ready to be used on the Active/Active cluster, assuming you have already registered the TSM node names (Musal_SQL2_A and Musal_SQL_B) on the TSM server.

---

**Note**

The Virtual SQL server resources must be on the node, when starting TDP for SQL the first time. Otherwise, the tdpsql.cfg file is overwritten if TDP for SQL cannot establish a connection to the Virtual SQL server.

Also, you need to invoke a query to the TSM server so the password can be entered and stored to the registry. See “Setting password for SQL authentication” on page 33.

---

### 4.3.3 Failing over

While the SQL server (or any other clustered instance) is failing over, it is offline and cannot be accessed. This means that backups or restores which are running when failover takes place will fail.

This also applies to your scheduled jobs; if any are running while failover takes place, they will fail. Therefore, always check on your scheduled jobs, if you are experiencing a failover.

---

### 4.3.4 Backups and restores with Virtual SQL server on other node

When doing a backup or restore you most invoke it from the server who owns the SQL server resource at that time, this applies regardless of using the GUI or the CLI.

---

### 4.3.5 3-node and 4-node clusters

TDP for SQL version 2 has not been tested on 3-node or 4-node clusters.

---

**Note**

Currently only Windows 2000 Datacenter supports more than 2-node clustering.
4.4 Standby servers

Using a standby server, also known as a warm backup, is a way to ensure availability of your databases. A standby server is a second server, containing a copy of the databases on the primary server. When the primary server becomes unavailable, the users will instead use the standby server.

To be able to utilize this setup, the applications data source can be coded to use a connection broker (file or table with data source connection settings); otherwise the DBA must manually change the standby servers IP address or Netbiosname, when the primary server fails.

This setup demands ongoing log backup on the primary server and restore on the standby server, also known as log shipping. This maintenance of the standby server must be done to keep it consistent with the primary server.

4.4.1 Log shipping

Log shipping was introduced with Microsoft BackOffice 4.5 Resource Kit (BORK), and in SQL server 2000 Enterprise Edition it fully supports log shipping and provides a Wizard for configuring log shipping.

Though TDP for SQL does not provide an interface for use with the SQL 2000 Log Shipping Wizard, log shipping can simply be done utilizing TSM Scheduler, regardless of whether the server is SQL 7.0 or SQL 2000.

4.4.2 Setting up a standby server

In the following example, log shipping is set up, step-by-step, from Rainier to Recover, using TSM Scheduler. The setup is illustrated in Figure 41.
The node name Rainier_logship is registered on the TSM server, and a client options file logship.dsm, containing the boundaries for this node name’s communication with the TSM server, is created.

A full backup of the database InvoiceReg is performed on Rainier, specifying the /tsmoptfile=logship.dsm. In this case, Truncate Log on Checkpoint and Select into/bulk copy are disabled to ensure that all SQL servers will log all data changes.

The full backup of InvoiceReg is restored on Recover with NORECOVERY. You can also restore with STANDBY, thus leaving the database in a read-only condition. Be aware that users logged on to the standby server can conflict with the following shipped log restores.

Backup for the transaction logs for the database InvoiceReg is performed regularly on Rainier. On the TSM server, the cmd file shown below is scheduled to run with the desired cycle. It is not recommended to back up transaction logs more often than every 5 minutes, to avoid the risk of excessive overhead on a large database. Below is a sample script for backup of the transactions log for the database InvoiceReg on the SQL server Rainier\Rainier2000 (the SQL 2000 instance on the server).
Using Tivoli Data Protection for Microsoft SQL Server

With the TSM Scheduler, the cmd file shown below is scheduled to run every 10 minutes, therefore the transaction logs are restored on the standby server Recover with **NORECOVERY**. The cmd file first restores all active log backups for the database InvoiceReg from SQL server Rainier\Rainier2000. Then all log backups are inactivated. This must be done, otherwise every log from the start (since the full backup) will be restored every time the restore job runs.

```
REM This cmd file is placed on the primary Server
REM C:\TSM_jobs\BackupLogShip.cmd
REM-----------------------------------------------------
set sql_dir=C:\Program Files\Tivoli\TSM\TDPSql
C:
  cd %sql_dir%
  date < NUL > %sql_dir%sqlsched.log
  time < NUL > %sql_dir%sqlsched.log
  %sql_dir%tdpsqlc backup InvoiceReg log /sqlserver=rainier\rainier2000
     /tsmoptfile=logshipdsm.opt
REM This command file is placed on the standby server
REM C:\TSM_jobs\RestoreLogShip.cmd
REM------------------------------------------------------
set sql_dir=C:\Program Files\Tivoli\TSM\TDPSql
C:
  cd %sql_dir%
  date < NUL > %sql_dir%sqlsched.log
  time < NUL > %sql_dir%sqlsched.log
  %sql_dir%tdpsqlc restore InvoiceReg log=* /standby="e:\temp\file2"
     /fromsqlserver=rainier\rainier2000 /tsmoptfile=logshipdsm.opt
  %sql_dir%tdpsqlc inactivate InvoiceReg log=* /fromsqlserver=rainier\rainier2000
```

- If the file path for the database files on the standby server, use the `/relocate=logicalfilename /to=physicalfilename`. See “TDP for SQL CLI” on page 129 for more information on the relocate parameter.
Chapter 4. Configuration and setup

The management class for the log objects should be defined so they are always available on disk. This is done with the command:
```
define stgpool LOG_SHIP_DISK disk description='Disk for Log Shipping'
```

The schedules for the two jobs are defined on the TSM server, and are assigned to the node name:

**Scheduling backup of log**
```
define schedule tdpsql2_domain log_ship_backup
  description="Log Ship every 10 minutes"
  action=command
  objects="C:\TSM_jobs\BackupLogShip.cmd"
  startdate=today
  starttime=18:00
  duration=5
  duration=minutes
  periods=600
  period=seconds (seconds is not documented but it works)
  dayofweek=any
```

**Scheduling restore of log**
```
define schedule tdpsql2_domain log_ship_restore
  description="Log Ship every 10 minutes"
  action=command
  objects="C:\TSM_jobs\RestoreLogShip.cmd"
  startdate=today
  starttime=18:05
  duration=5
  duration=minutes
  periods=600
  period=seconds (seconds is not documented but it works)
  dayofweek=any
```

---

**Note**

In both cmd files the `/tsmoptfile=logshipdsm.opt` is specified. The client options file, `logshipdsm.opt`, defines a different node name than the one defined in `dsm.opt`. This is done so that the periodic full backup on the primary server does not interfere with the log shipping. If the full backup is done with the same nodename as the log backups for shipping, the log backups which are active at the time the full backup is completed will be inactivated. This implies more complicated scripting, since you will then have to check that the latest log backup is already restored on the standby server prior to performing the full backup, which inactivates all the prior backups.
The schedules are then associated with the nodename used for log shipping:

```
DEFINE ASSOCIATION tdpsql2_domain log_ship_backup Rainier_logship
DEFINE ASSOCIATION tdpsql2_domain log_ship_restore Rainier_logship
```

Install TSM Scheduler Service on both nodes by specifying:

```
/tsmoptfile=logship.dsm
```

Now check that your scheduled jobs are running on both servers, and that they complete successfully, by checking the tdpsql.log files on both servers.

For more information on how to implement Log Shipping, consult MS SQL Books Online.

### 4.4.3 Recommendations: Include/Exclude statements, nodenames

In this section we offer some general recommendations regarding the use of Include/Exclude statements and nodenames.

#### 4.4.3.1 Include/exclude statements

The Include/Exclude statement is used to control which management class each database or backup type is managed by. This means you can use the Include/Exclude statement to send specific databases or types of backups to the desired management classes.

When specifying different management classes using the Include statement, make sure the meta data is managed by a management class with corresponding settings for automatic expiration of backup objects.

We recommend that you make an Include statement for the meta object to be sent to a separate management class assigned for meta data purposes only, as described in 4.1.7, “Meta data” on page 39.

When using Include/Exclude statements, they are processed from bottom and up in the dsm.opt file, and processing of the object stops after the first match (regardless of whether the statement is exclude or include). To ensure that more specific specifications are processed at all, you should list the more general specifications before the more specific ones, so that these objects will be processed after the specific. Otherwise, the more general ones will match the target before the more specific ones are seen.

#### 4.4.3.2 Nodenames

We recommend using a nodename which identifies the node and the type of TSM client, for example ‘Servername_sql2’; see also 4.1.1, “TSM API” on page 28.
4.5 Performance recommendations

Many factors can affect the backup and restore performance of TDP for SQL, such as hardware configuration, network type, and capacity. These factors are not within the scope of this document. However, some parameters that are related to TDP for SQL can be tuned for optimum performance.

To be able to increase performance, you must first identify your bottlenecks. Hardware configuration and network capacity are the most likely to affect the performance of TDP for SQL. When this is done, you can either remove or change the component (hardware, software, and so on) that causes the bottleneck, or more likely, create a workaround.

Considering performance issues when backing up your SQL server databases, you should first plan the more workload intensive backup jobs (full and differential) to run when both the server and the network are less utilized. Using group/file backup gives you extra opportunities when planning your backups, to avoid backup jobs having an impact on the performance of your SQL server as well as your network.

4.5.1 LAN-free versus LAN operations

When running TDP for SQL in a LAN-free environment, you avoid network constraints, since only meta data is send over the LAN, when LAN-free backup is performed. To enable LAN-free operations, you must specify this in the dsm.optfile:

```
ENABLELANFREE=YES
```

Also, see Chapter 5, “SAN usage” on page 85

4.5.2 Stripes, buffers, buffer sizes

To improve performance, stripes and buffers can be utilized. The following sections describe what those parameters mean.

4.5.2.1 Buffering

TDP for SQL is a multi-threaded application that uses asynchronous execution threads to transfer data between the SQL and TSM servers. To accomplish this, multiple data buffers are used to allow one thread to receive data from one side, while another thread sends data to the other side. For example, one thread can be reading data from a SQL server while another is sending data to the TSM server.
The number of buffers that TDP for SQL allocates to these threads can be specified in the /buffers and /sql buffers parameters of the command line interface. The size of these buffers can be specified in the /buffersize and /sqlbuffersize parameters.

### 4.5.2.2 Data striping

In addition to using multi-threading to maximize throughput on a single session, TDP for SQL uses separate threads to support SQL data striping, which allows use of multiple parallel sessions to back up and restore a single database. This is another method to maximize data throughput. If a single session cannot fully exploit available bandwidth, multiple parallel sessions can yield improved data throughput, especially if the database is spread across multiple physical volumes.

If you use one data stripe per physical volume for both the SQL server and the TSM server, the performance (measured as the amount of time necessary to backup or restore a particular SQL database) should show an improvement over the unstriped case (approximately proportional to the number of data stripes used, given the constraints of the devices and the network used, and striping independent overhead in SQL server, TSM, and TDP for SQL).

---

**Note**

Additional striping does not necessarily improve performance and may even decrease performance if system constraints involving real and paged memory, CPUs, network interface cards, networks, device reads and writes, and RAID become saturated or exceed capacity.

If you use striping in conjunction with SQL buffers, be certain that the number of stripes specified is equal to or less than the number of SQL buffers.

The default values that TDP for SQL assigns to buffers, buffersize, and stripes can be edited in the TDP for SQL configuration file. To edit the configuration file, use the Edit menu of the GUI.
4.5.3 TSM API, TSM settings, collocation

We recommend that you use collocation, which means that the TSM server will attempt to keep all data belonging to a single client node (or a single client filespace) on a minimal number of sequential access media volumes within a storage pool. In other words, collocation can reduce the number of volumes that must be accessed when a large amount of data must be restored, and also avoids transaction logs being scattered over multiple tapes (only relevant when the storage pool is not on disk).

This is done with the command: `update stgpool api_3580 collo=yes`

If you use data striping, use collocation by filespace on sequential storage pools to maintain the stripes on separate storage volumes. This is necessary to allow concurrent parallel access to each stripe.

This is done with the command: `update stgpool api_3580 collo=filespace`

4.5.4 Multiple TDP instances

You can define multiple TDP instances on each node to use for complex scheduling or handling multiple jobs independently.

Basically, each TDP instance is a separate TSM node name which sends backups to the TSM server. Running multiple TDP instances does not necessarily decrease your backup time. The more instances that are running simultaneously, the higher is the demand on your CPU and disk system.

Therefore, doing backup using multiple TDP instances does not necessarily decrease the backup time.
Chapter 5.  SAN usage

Storage Area Networks (SANs) have become increasingly popular. There are many reasons for this, which are beyond the scope of this book. Neither will we provide a thorough description on how to set up and run a SAN.

Neither will we provide a thorough description on how to setup and run a SAN. We will introduce the concepts of integrating a SAN with the TSM environment utilizing TDP for SQL. We describe how to move from an existing TDP/TSM installation using the LAN to transfer data to an environment utilizing TSM LAN-free to transfer data on the SAN.

We advise you to consult the following books to get a deeper insight into setting up a SAN and TSM in a SAN environment:

- *Using Tivoli Storage Manager in a SAN environment*, SG24-6132
- *Introduction to Storage Area Network, SAN*, SG24-5470

5.1 Overview of LAN-free SAN and TDP for SQL

As SQL databases grow and the amount of data that requires backup is increasing, it may become troublesome to perform TDP backups across the LAN connection to the TSM server. One solution to overcome the problem could be to install a TSM server locally on the SQL server itself along with a TSM storage device. This will prevent the backup data from travelling across the LAN and decrease the backup and restore times if the LAN is the bottleneck. However, this solution not only adds additional hardware cost to the TSM environment, but it also makes managing the system more cumbersome and complicated. Also, it is not wise to store backups and backup equipment at the same location as the production system itself.

A better solution to problems due to the LAN being a bottleneck for the data transfer is to set up a SAN. SANs, using *Fiber Channel Protocol (FCP)*, are designed for large data transfers, and will outperform even high-speed LANs.

TDP for SQL supports LAN-free backup for TSM. In order to shift the data movement from the LAN to the SAN, TDP is utilizing the *TSM Managed System for SAN Storage Agent*, which must be installed on the client machine along with TDP for SQL.
The implementation is depicted in Figure 42. As seen, the main purpose is to move data from the client across the SAN instead of from the LAN to the TSM storage connected to the SAN. The placement of the data is controlled by the Tivoli Storage Manager server, and only metadata, which is just a fraction of the raw backup data, is communicated across the LAN between the TSM server and the TDP for SQL client.

The Storage Agent functions as an interface to the SAN for TDP for SQL.

5.1.1 The TSM Storage Agent

To support LAN-free data transfer, the Managed System for SAN Storage Agent has been introduced. The Storage Agent is running on the client machine in order to enable data transfers to the SAN. To the TDP for SQL client it looks pretty much like any other TSM server.
From a high level standpoint, the Storage agent works in the following way:

1. TDP for SQL invokes a backup. The client contacts the TSM server and exchanges policy information over the LAN to determine the destination of the backup data. If the client is configured to use LAN-free data movement, the destination will be a storage pool that is set up to use a device on the SAN. The device must also be mapped on the client.

2. Because the backup destination is on the SAN, the client contacts the Storage Agent by opening a named pipe session. The name of the named pipe is hardcoded in TDP code and the only communication protocol supported is named pipes.

3. The Storage Agent opens a server-to-server connection to Tivoli Storage Manager server via the LAN; the only supported communication protocol at this time is TCP/IP.

4. TDP sends a begin-transaction verb to Storage Agent. When the transaction is successfully committed, the Storage Agent opens a SAN data transfer to a tape storage device. Otherwise, if the first transaction fails, the communication will be switched over to the LAN, and the SAN data transfer will not be used.

5. The LAN server-to-server communication between the Storage Agent and Tivoli Storage Manager server is used by the Storage Agent for accessing Tivoli Storage Manager server database. That is because the Storage Agent does not have its own database, nor a recovery log. You can imagine the Storage Agent as a “truncated” Tivoli Storage Manager Server.

6. When the Storage Agent finishes the backup, it sends file attribute data to the TSM server, and the server stores the data in the database.

When restoring data, the restore session is always opened through a Storage Agent. If any data was backed up through the SAN, the restore will also go through the SAN. If any data was backed up through a LAN, then the LAN connection will be used during restore. If you have backed up some data using the SAN, you can still access this data through the LAN, if needed.

Some limitations and requirements apply to running TDP for SQL across the SAN:

- Only TSM server versions 4.1 or higher are supported.
- Windows NT 4.0 service pack 6, Windows 2000 build 2195 or later
- TCP/IP is required for the LAN communication.
- Currently only tape storage pools are valid backup destinations.
5.2 Setting up LAN-free SAN support

In the following sections we will describe the steps performed to enable TDP for SQL to successfully move backup data across the SAN. We assume that the SAN itself is already up and running. Our approach is, based on that assumption, to describe how to get a running TDP LAN implementation to work on the SAN. Consult Chapter 3 and Chapter 4 regarding general installation and configuration of TDP for SQL.

Before setting up LAN-free data transfer, you must ensure that you have Tivoli Storage Manager 4.1 server configured and running, since it must be able to communicate with any tape device via the SAN. You can have any server platform running; the only requirement is that it must be TSM Release 4.1 or later. In our environment we used Tivoli Storage Manager Server 4.1.2.0 running on AIX 4.3.3 maintenance level 6.

5.2.1 Preparing the TSM server for LAN-free configuration

We assume that the server already has the connectivity to the SAN tape devices configured on the OS. In our test environment we had a Magstar 3570 with two drives connected to the SAN through a 2108 SAN Data Gateway, which was used to bridge SCSI to FCP.

Use `lsdev -C -c tape` to see tape devices available on AIX:

```
# lsdev -C -c tape
rmt0 Available 30-58-00-0,0 IBM 3580 Ultrim Tape Drive
rmt1 Available 30-58-00-1,0 IBM 3580 Ultrim Tape Drive
smc0 Available 30-58-00-6,0 IBM 3583 Library Medium Changer
rmt2 Available 20-58-01-2,0 IBM Magstar MP Tape Subsystem (FCP)
rmt4 Available 20-58-01-3,0 IBM Magstar MP Tape Subsystem (FCP)
```

To prepare your Tivoli Storage Manager server for LAN-free configuration, we did the following:

- Defined library and drives. The library must be defined as a SHARED library, otherwise the Storage Agent will not be able to communicate with it. To define the library and drives, we entered the following TSM commands:

```
DEFINE LIBRARY 3570LIB LIBT=SCSI DEVICE=/dev/rmt2.smc SHARED=YES
DEFINE DRIVE 3570LIB DRIVE0 DEVICE=/dev/rmt2
DEFINE DRIVE 3570LIB DRIVE1 DEVICE=/dev/rmt4
```
If you already have a library defined on your server, make sure that the parameter SHARED is set to YES. Note that you cannot use the update library command to update this parameter. You must remove the drives definition, delete the library, and then define it again with the SHARED parameter set to YES.

- Defined a device class. We defined the device class 3570CLASS for the library:

```
DEFINE DEVCLASS 3570CLASS DEVTYPE=3570 MOUNTRET=2 MOUNTL=2
LIBRARY=3570LIB
```

We specified the MOUNTLIMIT to equal the number of physical drives in the tape library (two drives). Since the library is shared, we set the MOUNTRE Styension as low as 2 minutes. The default is 60 minutes.

- Defined a storage pool in the device class.

```
DEF STG 3570SAN 3570CLASS
```

We already performed backups across the LAN, and hence our TDP client node was already configured on the server. However, we needed to create copy groups for the new storage group. We decided to simply use the existing policy set and domain and then create a new management class API_SAN_30DAYS:

```
ANR1520I Management class API_SAN_30DAYS defined in policy domain
TDPSSL_DOMAIN, set STANDARD.
```

And again, we defined both a backup and an archive copy group:

```
ANR1530I Backup copy group STANDARD defined in policy domain TDPSQL2_DOMAIN, set STANDARD, management class API_SAN_30DAYS.
ANR1535I Archive copy group STANDARD defined in policy domain TDPSQL2_DOMAIN, set STANDARD, management class API_SAN_30DAYS.
```
Just as TDP nodes must be defined on the TSM server, so must the Storage Agents. Storage Agents are defined as servers. We decided to name our Storage Agents by the template Servername_STA. Hence we defined the TSM server RAINIER_STA with the password **pw**.

```plaintext
tsm: BRAZIL>define server RAINIER_STA serverpassword=pw hladdress=193.1.1.142 lladdress=1500
ANR1660I Server RAINIER_STA defined successfully.
```

In these statements, **hladdress** and **lladdress** are the IP-address and port number for the Storage Agent installation.

### 5.2.2 Setting up the client node to support LAN-free

On the TDP client, the following must be accomplished:

- The Host Bus Adapter (HBA) must be installed to physically connect the client to the SAN.
- Installation of the Storage Agent software.
- Configuration of the Storage Agent (dsmsta.opt).
- Set up server-to-server communication between Storage Agent and TSM server.
- Obtain device information on the client and define drive mapping on the TSM server.
- Install and configure the Storage Agent as a service.
- Reconfigure TDP for SQL.

#### 5.2.2.1 Installing the Host Bus Adapters (HBA)

The first step on the client to enable LAN-free is to get access to the SAN. For the purpose of getting access, a Host Bus Adapter (HBA) has to be installed.

In our setup we used a Qlogic 2100 series HBA. Firmware and device driver updates are found at:


Installation is straightforward — just plug in the card and start up the system. Assuming the SAN administrator has added your system to the correct SAN zone, the tape drives and media changer should appear as new devices on the Windows 2000 server.

![Computer Management](image)

Figure 43. SAN devices as seen by Windows 2000 after installing HBA

The changer and drives may appear without any drivers installed, as shown in Figure 43. There is no need to worry too much about that. However, in our experience, the Storage Agent worked just fine anyway.

**5.2.2.2 Installation of the Storage Agent software**

It is recommended to install the latest version of TDP for SQL and the TSM API before installing the Storage Agent software. There may be a newer version of the API-DLL available than the one included with TDP. You can check the version of the API-DLL by looking at its file properties (see Figure 44). The DLL is found in the Windows 2000 system directory `<SystemRoot>\System32`, typically `C:\WinNT\System32`. The name of the DLL is `tsmapi.dll`. 
Update the DLL-version by installing or reinstalling the latest version of the TSM Backup/Archive client. The latest version is downloadable from:


or

http://www.tivoli.com/support/storage_mgr/tivolimain.html

If you do not need the Backup Archive client itself, you can select the custom installation option and select the API for installation only. It may seem natural to install the API and possibly the Backup/Archive client before installing TDP for SQL, and we did not experience the TDP installation overwriting an existing version of the API-dll with an older one.

By installing the Backup/Archive client (PTF IP22151_12) on our test machines, we upgraded the API-dll from version 4.1.2.0 to 4.1.2.12.

The Storage Agent software itself is installed like any other Windows based application through a guided installation wizard. Initiate installation by starting up the setup.exe from the CD-ROM or invoking the downloaded .exe file.
For our test lab we used Storage Agent version 4.1.3.0. Software updates are found at:


There are only a few options available for the software installation, such as the possibility to install in another directory than the default directory, and whether to include online information or not. A minimum of 12 MB free disk space is needed for the installation, and an additional 20 MB is needed for temporary files if installing from the downloadable package. Note that the installation requires a reboot.

5.2.2.3 Configuration of the Storage Agent (dsmsta.opt)

Configure the Storage Agent options file, dsmsta.opt, which is found in the directory where the Storage Agent is installed (default: \Program Files\Tivoli\TSM\storageagent). The Storage Agent must be configured for TCP/IP and named pipes. These are default settings. A device configuration file (see 5.2.2.4) must also be specified in the Storage Agent options file. If there is a need for other clients to use the same Storage Agent, for instance TDP for Microsoft Exchange, the ENABLEALLCLIENTS parameter must be set to YES. Verify that the following is included in the dsmsta.opt file:

```
COMMmethod TCPIP
COMMmethod NAMEDPIPE
DEVCONFIG devconfig.txt
ENABLEALLCLIENTS yes
```

After configuring the Storage Agent make sure that the AdsmScsi device driver is running. In the Storage Agent directory, issue the command:

```
net start AdsmScsi
```

If experiencing problems getting the service running, there is probably a problem pertaining the installation of the HBA. The device driver is also found in the Window 2000 Computer Management MMC (Start -> Programs -> Administrative Tools -> Computer Management) from where it can be managed too. See Figure 45.

**Note:** You will need to enable viewing hidden devices by right-clicking on Device Manager and selecting Show hidden devices.
5.2.2.4 Setting up server-to-server communication

In the Storage Agent directory issue the following command:

```
E:\Program Files\Tivoli\TSM\storageagent>dsmsra setstorageserver myname=RAINIER_STA
mypassword=pw servername=brazil serverpassword=brazil hladdress=193.1.1.11
lladdress=1500
```

The parameters myname and mypassword correspond to the ones specified when configuring the Storage Agent as a server (see Chapter 5.2.1). The parameter servername specifies the TSM server, and serverpassword specifies the corresponding password. The parameters hladdress and lladdress specify the IP-address and port number for the TSM server.

The command updates the Storage Agent device configuration file (device.txt) with the following entries:

```
SET STANAME RAINIER_STA
SET STAPASSWORD 18686e
DEFINE SERVER BRAZIL HLADDRESS=193.1.1.11 LLADDRESS=1500 SERVERPA=185b801eb97c22
```

As seen, the passwords are encrypted before they are stored. It is also possible, though not recommended, to manually enter the passwords into the files without encrypting them. The Storage Agent will still work.

The command also updates the Storage Agent options file (dsmsta.opt) with the following entry:

```
SERVERNAME=brazil
```

Figure 45. AdsmScsi device management
Running the command more than once will not clean up old entries.

5.2.2.5 Define drive mapping on the TSM server
As part of the Storage Agent installation, the TSM device driver is installed on
the client machine but it is not enabled or started. Enable the device driver by
issuing the following command in the Storage Agent directory:

tsmcsi /enable

The output from the command will inform that support is enabled:

| TSM Windows 2000 / Optical support is enabled on RAINIER. |

On NT, the message will be something like this:

| TSM Optical Support enabled on RAINIER. |

---

**Note**
The message tells you that optical support is enabled. However, that is a
misleading message. The Managed System for SAN feature does not
support optical devices on the SAN.

The TSM server needs to know how the client sees the tape devices on the
SAN. The information is used to configure drive mapping on the TSM server.
Issue the following command in the Storage Agent directory in order to obtain
the information:

tsmdev

The following device information was found on our specific installation:

<table>
<thead>
<tr>
<th>Computer Name: RAINIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSM Device Driver: Running</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TSM Device Name</th>
<th>ID</th>
<th>LUN</th>
<th>Bus</th>
<th>Port</th>
<th>TSM Device Type</th>
<th>Device Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>mt0.2.0.2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3570</td>
<td>IBM 03570C125424</td>
</tr>
<tr>
<td>lb0.3.0.2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>LIBRARY</td>
<td>IBM 03570C125424</td>
</tr>
<tr>
<td>mt0.4.0.2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>3570</td>
<td>IBM 03570C125424</td>
</tr>
</tbody>
</table>
Use the information obtained in the TSM Device Name column to specify the drive mapping on the TSM server:

```bash
tsm: BRAZIL>define drivemapping RAINIER_STA 3570LIB DRIVE1 DEVICE=mt0.2.0.2
ANR8916I Drivemapping for drive DRIVE1 in library 3570LIB on storage agent RAINIER_STA defined.

tsm: BRAZIL>define drivemapping RAINIER_STA 3570LIB DRIVE2 DEVICE=mt0.4.0.2
ANR8916I Drivemapping for drive DRIVE2 in library 3570LIB on storage agent RAINIER_STA defined.
```

5.2.2.6 Install and configure the Storage Agent as a service

Install the Storage Agent as a service by using the `install.exe` found in the Storage Agent directory:

```
E:\Program Files\Tivoli\TSM\storageagent>install "TSM Storage Agent" "E:\Program Files\Tivoli\TSM\storageagent\dstasvc.exe"
```

The service is installed to be started manually. Change the setting to automatic from the Windows 2000 services MMC console and start the service.

The command `install.exe` accepts a user ID and password. Use these options if installing the service to run under a specific account. We simply let the service run under the local system account. The `remove.exe` utility in the same directory can be used if there for some reason is a need to remove the service.

5.2.2.7 Verification of Storage Agent operation

As soon as the Storage Agent service has been started, you can query sessions on the TSM server to verify that the Storage Agent is able to connect appropriately to the server.
Another option is to try to connect to the Storage Agent itself using an administrative client (remember that the Storage Agent acts as a server in the TSM environment). Use the same user ID and password as on the TSM server. Interesting commands are, for instance, QUERY SESSION, QUERY PROCES, and QUERY ACTLOG, but tasks like querying the backups table, of course, do not reveal anything.

### 5.2.2.8 Reconfiguring TDP for SQL

If TDP for SQL was already set up to run on the LAN, update the options file (`dsm.opt`) to enable LAN-free operation:

```
ENABLELANFREE YES
```

This is the only change needed to be configured for TDP if the default management class for your node is using the SAN for storage. In this case, however, we created a new management class `API_SAN_30DAYS` without making it the default management class. Thus we need to specify whenever we want to use the SAN destination management class. This is done using the INCLUDE/EXCLUDE statements in the `dsm.opt` file, for instance:

```
INCLUDE "RAINIER\...\*" API_SAN_30DAYS
```

It is a good idea to keep meta data on disk instead of removeable media. Utilize a separate management class and the include/exclude specifications to do this.

Consult Chapter 3 and Chapter 4 if you do not already have a running TDP for SQL installation.
5.2.2.9 Backing up across the SAN
To the end user, there is no difference in using TDP for SQL, whether it is set up for LAN-free or LAN operation. The only difference experienced will be the higher data transfer rate.

In order to verify that the backup data actually was sent across the SAN, we used the `query session` command on both the TSM server and the Storage Agent.

The following output is from the TSM server:

```text
<table>
<thead>
<tr>
<th>Session Number</th>
<th>Session Method</th>
<th>Session State</th>
<th>Wait Time</th>
<th>Sent Bytes</th>
<th>Received Bytes</th>
<th>Platform</th>
<th>Client Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,210</td>
<td>Tcp/Ip</td>
<td>Run</td>
<td>0 S</td>
<td>3.3 M</td>
<td>99</td>
<td>Admin</td>
<td>AIX ADMIN</td>
</tr>
</tbody>
</table>
| 14,862         | Tcp/Ip         | IdleW         | 1 S       | 12.7 K     | 8.2 K         | Server   | Windows RAINIER_STA
| 14,864         | Tcp/Ip         | IdleW         | 1 S       | 34.2 K     | 19.9 K        | Server   | Windows RAINIER_STA
| 14,865         | Tcp/Ip         | IdleW         | 2 S       | 166        | 758           | Server   | Windows RAINIER_STA
| 14,866         | Tcp/Ip         | IdleW         | 2 S       | 19.5 K     | 2.1 K         | Node     | TDP MSS- RAINIER_SQL2
| 14,867         | Tcp/Ip         | IdleW         | 1 S       | 537        | 603           | Server   | Windows RAINIER_STA
| 14,868         | Tcp/Ip         | Run           | 0 S       | 171        | 318           | Server   | Windows RAINIER_STA |
```

The query has been done just as a full backup of the RAINIER_SQL2 node finished. There are, as seen, six sessions, including the storage agent session running due to this particular node, but only a little data has been transferred on the TCP/IP connections.
We did the same query on the Storage Agent itself:

```
<table>
<thead>
<tr>
<th>Sess</th>
<th>Comm</th>
<th>Method</th>
<th>State</th>
<th>Time</th>
<th>Bytes Sent</th>
<th>Bytes Recvd</th>
<th>Platform</th>
<th>Client Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tcp/Ip</td>
<td>Start</td>
<td>0 S</td>
<td>8.7 K</td>
<td>13.3 K</td>
<td>Serv-</td>
<td>RAINIER_STA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Tcp/Ip</td>
<td>Start</td>
<td>0 S</td>
<td>24.4 K</td>
<td>38.6 K</td>
<td>Serv-</td>
<td>RAINIER_STA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tcp/Ip</td>
<td>IdleW</td>
<td>0 S</td>
<td>2.5 K</td>
<td>166</td>
<td>Serv-</td>
<td>RAINIER_STA</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Named</td>
<td>Run</td>
<td>0 S</td>
<td>448</td>
<td>7.0 M Mode</td>
<td>TDP MSS-QLV2</td>
<td>RAINIER_SQL2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Tcp/Ip</td>
<td>Start</td>
<td>0 S</td>
<td>120.4 K</td>
<td>171.8 K</td>
<td>Serv-</td>
<td>RAINIER_STA</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Tcp/Ip</td>
<td>Run</td>
<td>0 S</td>
<td>9.5 K</td>
<td>374</td>
<td>Admin</td>
<td>ADMIN</td>
<td></td>
</tr>
</tbody>
</table>
```

On the Storage Agent, we notice the named pipe (session 6), which has received 7.0 MB at this time. That is the actual backup data sent from TDP for SQL and forwarded on the SAN. Note that as the backup is ended, the named pipe is closed, and it will no longer be possible to see the pipe when querying the sessions on the Storage Agent.
Chapter 6.  Day-to-day monitoring

When you have implemented TDP for SQL and configured the scheduling to fulfill your backup strategy, it is vital to monitor to ensure that your backup jobs are running, and if they fail, to be notified. In the following sections, we explain where to look when setting up monitoring.

6.1  Day-to-day verifications

The simplest way to verify your backup and restore jobs is to manually look through the log files on your servers. In a large enterprise, however, this is very time-consuming, and automated monitoring should be implemented.

Enabling event forwarding can give you valuable information on your ongoing jobs, briefly described in 6.2, “Integration with Tivoli Enterprise Console” on page 102.

In the following sections, the log files which you should monitor are described. Which tool to use, or how to script monitoring of the log files, is beyond the scope of this book and will not be discussed.

6.1.1  TDP for SQL log files

The activity log records significant events such as completed commands and error messages. You can specify the name of the activity log with the command /logfile=logfilename. If the file does not already exist, it will be created. If no file path is defined, the file will be placed in the directory where TDP for SQL is installed.

Specifying an invalid management class name does not generate an error in the activity log, but will generate an error message in the dsierror.log.

The file named dsmsched.log contains status information for the TSM central scheduler service. (By default, it is placed in the directory where the Backup/Archive Client is installed.)

Output from scheduled commands are sent to the scheduler log file (sqlsched.log). After scheduled work is performed, check the log to ensure that the work completed successfully.

These log files or others specified in your scheduled scripts should be checked on a day-to-day basis, either manually or automatically.
6.2 Integration with Tivoli Enterprise Console

The TSM server has a built-in adapter which can be used to forward all event messages to a receiver. The receiver, for example, can be: Tivoli Enterprise Console, SNMP traps, to a file, and so on.

You can utilize this feature to automate monitoring of your scheduled backups.

Assuming that you already have a TEC Server in your environment, you can forward all TDP for SQL events to the Tivoli Enterprise Console. On the TSM server, specify enable events TIVOLI <eventid> NODEname=<node> where the TDP event id prefix is ACO and range is 3000-3999.

**Note**

The application client must have enhanced TEC support enabled in order to route these event messages to the Tivoli Event Console.

For more information, consult the TSM Administrators Guide at the URL:


6.2.1 Test restores

The only one way to validate if your backups in fact are restorable, is by doing a test restore.

Therefore, we recommend that you do test restores whenever you change your backup strategy and setup. Also, regular test restores can be very valuable. This can be done manually, or as an example, you can script quarterly restores of your databases in a test environment using TSM Scheduler in conjunction with TDP for SQL.

This can seem a minor or even negligible task, but the worst time to discover that your backup is corrupt, is when you need it the most. Unfortunately, this might just be the case if test restores are not performed.
6.3 Auto deletion of old backups

TDP for SQL Version 2 utilizes the automatic policy-based expiration capabilities on the TSM server. This is different from TDP for SQL Version 1, which did not offer this functionality.

This means that the settings for the Backup Copy Group, which apply to the management class managing a backup, are able to control when a backup is expired, and can automatically delete it. Also see 4.1.8, “Policy management” on page 41.

---

**Note**

Only inactive objects (backups) are candidates for deletion.

---

You can manually inactivate backup objects, from the TDP for SQL GUI, or from the TDP for SQL CLI.

To inactivate backups from the TDP for SQL GUI, see “Active, inactive, expired” on page 46.

To inactivate backups from the TDP for SQL CLI, use the command

/olderthan=numberofdays.

The /OLDERthan parameter specifies how old a backup object must be before the command can inactivate it. If you specify 0, you inactivate all selected backup objects. If you specify 1, you inactivate all selected backup objects created prior to the current date. Any part of a day counts as a whole day.
Chapter 7. Restore

Restores done on your SQL server can cover a wide range of complexity, from simply restoring databases on a running server, to accomplishing a complete disaster recovery.

This chapter shows a complete example of how a disaster recovery is performed, plus how to restore from different backup types, in various situations.

7.1 Examples

In the following sections, we describe the steps for a disaster recovery of the databases from SQL server Rainier. Restore of the actual server, operating system, and scheduled jobs are not covered in the following example, since these functions are beyond the scope of this book. To do a complete restore of the operating system and files, you must use the Backup/Archive Client.

7.1.1 Disaster recovery

In a disaster recovery situation, the most likely scenario may involve a reinstalled SQL server, or you may have to rebuild the master database on your existing SQL server. Remember to use the same sort order and code page as the SQL server you recover.

Note

To rebuild the master database use the Rebuildm.exe utility in \\mssql7\binn\ or \\Microsoft SQL server\80\Tools\Binn\ for SQL 2000.

We reinstalled the SQL server from scratch on new hardware and apply Service Pack 3 for SQL.

Install TDP for SQL according to the description in Chapter 3, “Installation of TDP for SQL” on page 19, and restore the dsm.opt and tdpsql.cfg files with the TSM Backup/Archive Client. You can also recreate the dsm.opt and tdpsql.cfg files yourself, as described in 4.1.1, “TSM API” on page 28 and “TDP setup” on page 32.

Then the SQL server is started in single user mode:

sqlservr.exe -m
Now start the TDP for SQL GUI, and select the master database for restore, as shown in Figure 46.

Regardless of the previous file path of the master database files, which is stored with the backup object of the database, it will be restored where the reinstalled/rebuild master database is present.

When the restore is complete, TDP for SQL reports an error message, since the SQL server is shutdown after restoring the master database. This is expected; the error message is shown in Figure 47.
Now the SQL server is started in normal mode `sqlservr.exe` as a service.

**Note**

When the file path settings (in the restored master database) are different from the current file path of the model database (obtained by rebuild of the master database or from reinstalling SQL server) the SQL server fails to start.

Workaround: Move the model database files `model.mdf` and `modellog.ldf`, to the file path defined in the restored master database.
Now restore the msdb database using TDP for SQL. If needed, you can relocate the file space destination for the database, as shown in Figure 48 and Figure 49.

![Figure 48. Relocating msdb when restoring](image)

In the relocate window, the file space destination is chosen.

![Figure 49. Entering the file path for relocation of the database msdb](image)
The database msdb is restored, as shown in Figure 50.

![Database msdb is restored](image)

*Figure 50. Database msdb is restored*

Restore the model database, and relocate if needed/desired according to the description above for msdb.

Now the system databases are intact, we restore the other databases.

You can choose to restore multiple databases at the same time. If you want to relocate, you must specify this for each database to be restored.
In this example, all databases are restored to the latest full backup, as shown in Figure 51.

7.1.2 Point in time

When performing log backups, described in “Full plus log backup” on page 8, it is possible to restore a database to a specified point in time.

To restore a database to a specific point in time using TDP for SQL you must first restore the latest full backup prior to the desired point in time. To select backups which are inactive check the Show Active and Inactive check-box.
In this example we restore the database InvoiceReg to 03/12/2001 23:00. The latest full backup prior to the desired time is 03/12/2001 17:02 is marked, as shown in Figure 52.

Figure 52. Choosing the latest full backup prior to the desired point in time
Then the first log backup after the desired point is chosen, as shown in Figure 53.

Figure 53. Choosing the log files until after the desired point in time

Notice that all log files in the period from the last backup to the chosen log file are marked, since they must be restored in sequence after the full backup.
Then the desired point in time 03/12/2001 23:00 is entered by clicking the **Point in Time** button, as shown in Figure 54.

![Figure 54. Specifying point in time to restore](image)

Then click **OK** and click **Restore** and the database is restored to the time 03/12/2001 23:00, as shown in Figure 55.

![Figure 55. Restoring to the point in time, 03/12/2001 23:00](image)
7.1.3 Named point

When the need to keep two or more databases consistent, you may implement named mark transactions. SQL server 2000 supports named mark transactions, which means you can mark transactions across related databases and use these marked transactions to recover related databases to the same transaction consistent point. Therefore it is not needed to do synchronized backups.

TDP for SQL server supports restore to a named mark. To restore to a named mark, you must specify the mark name, and restore to before or after the mark. Since the mark is bound to the transaction, it is most likely repeated in the log, therefore you must specify a time prior to the desired mark in time.

In Figure 56, Stop at Mark is selected, the mark is mark2, and the desired point in time is after 03/12/2001 23:00.

![Figure 56. Restore to named mark in time](image)

For more information on using named mark transactions, consult the Microsoft SQL server 2000 Online Documentation.
7.1.4 Relocating files

The backup object of a database file contain the file's name and file path location from where it was backed up. Therefore, when restoring to another file path or physical filename, relocation must be specified.

To relocate the database files, when restoring using TDP for SQL GUI, right-click on the database object and select Relocate, shown below in Figure 57.

![Figure 57. How to chose relocate from TDP for SQL GUI](image)

Then the relocate box pops up; and the new location and physical filename can be entered, as shown in Figure 58.
Using Tivoli Data Protection for Microsoft SQL Server

Figure 58. Specifying the new location of the database files

Note

If the relocate popup window is blank, you must check the Wait for Tape Mounts for File Information box, and refresh the tree view.

This happens because your meta data is migrated to removable media, to avoid this see “Meta data” on page 39.

TDP for SQL CLI

To specify relocation using the TDP for SQL CLI, use the command:

```
/RELocate=logicalfilename,... /TO=physicalfilename,...
```

In the example from Figure 58 the syntax is:

```
/RELocate=InvoiceReg_Data,InvoiceReg_Log /TO=E:\Program Files\MSSQL\data\InvoiceReg_Data.MDF,E:\Program Files\MSSQL\data\InvoiceReg_Log.LDF
```

Also see Appendix B, “TDP for SQL CLI” on page 129.
7.1.5 Inactive objects

To select inactive objects from the TDP for SQL GUI, you must check the Show Active and Inactive check box, and the tree view is automatically refreshed, now displaying all available backup objects, as shown in Figure 59.

![Figure 59. View Active and inactive backup objects](image)

7.1.6 Differential restore

Restore of differential backups is similar to restore of transaction logs. You must first restore the latest full backup prior to the differential backup. To select backups which are inactive, check the **Show Active and Inactive** check-box.
In this example, we will restore the database to the differential backup on 03/12/2001 17:31:39. In Figure 60, the differential backup of the database Stock_VLDB is selected, and the preceding full backup is therefore also marked.

![Figure 60. The differential backup is selected](image)

Now the database is restored by clicking `restore`, which restores first the full backup and then the differential backup.

When differential or logs backups are selected, the Recovery check box applies only to the final restore for a database. The prior restores are made with norecovery to allow the later restores.

**Note**

When the check box **Recovery** is checked (default), the database is ready for use as soon as the restore is completed, and no following logs can be applied. When **Recovery** is unchecked, the database is restored with norecovery, leaving it in a unusable intermediate state, and further transaction logs can be applied. The last backup to restore must be with recovery in order to make the database ready for use.

For further information, consult SQL Server Books Online.
7.1.7 Restore into another database

When restoring a database into another database, you must specify the name of the database to restore into, and if the database already exists on the SQL server, the Replace check box must be checked. Also, if the file path is different than specified in the backup object, it must be relocated, and if the files already exist but are in use by another database, the physical file names must be changed.

This is illustrated in the example in Figure 61. We restore the database AddressCat into AddressCatNew on Rainier. From the TDP for SQL GUI, the latest full backup of AddressCat is selected, and the Restore into parameter is specified as AddressCatNew. Notice that the Replace check box is checked.

![Figure 61. Restore into AddressCat](image)

Figure 61. Restore into AddressCat
Then we specify the **Relocate** parameter (Figure 62).

![Figure 62. Relocating and renaming the physical database files](image)

Now click **Restore** to restore the database.

The database does not need to exist prior to restoring. If the database does not already exist, it will be created.

### 7.1.8 Restore to another server

When restoring a database to another server, you must logon to the TSM server with the correct nodename to be able to retrieve the backup.

The TSM nodename of the server, from which you backed up the database, must be specified in the dsm.opt file to provide the correct logon to the TSM server, and the tdpsql.cfg must specify the server you want to restore to.

In the example in Figure 63, the database InvoiceReg from the SQL server Rainier\Rainier2000 is restored on server Recover.

On the server Recover, the client configuration file dsm.opt is modified so that the node name to log on to the TSM server matches the node name which backed up the database. This is done because the node name with which the backup is stored on the TSM server is Rainier_sql2.
Figure 63. Client configuration file defines node name used to back up database

From the TDP for SQL GUI, on Recover, the database is selected. Here we must specify the **Relocate**, since the file path differs from the original, as shown in Figure 64.
7.1.9 System databases

When restoring system databases, basically you can follow the procedure described in the example in “Disaster recovery” on page 105.

7.1.10 Partial restores

Partial restores are only available in SQL server 2000. It is only possible to do partial restores on full database backup objects.

When performing a partial restore, the primary file group must always be restored, together with the other files you specify.

When doing a partial restore on a new server, you must do this from the TDP for SQL CLI, because the relocation option is not valid with partial restore using TDP for SQL GUI.

From the SQL for TDP CLI, it is possible to restore with the parameters /partial /groups /relocate /to — the database does not need to be present.

Also see B.1, “Using TDP for SQL CLI” on page 129, for a complete example.
7.1.11 Group, file

File group backups should be followed by a transaction log backup. It is not possible to restore a file group (or multiple groups) without having a current transaction log backup, or sequence thereof, following the group backup.

When restoring a file group only, it is not possible to restore with recovery. Even though it is possible to check the Recovery check box from the TDP for SQL GUI, the database will be in a loading state after the restore; see Figure 65.

---

**Note**

The use the /relocate option with TDP for SQL CLI, first apply: **Fix patch 2.2.0.01, APAR: IC30018.**

---

**Note**

When having both SQL Server 7.0 and SQL Server 2000, instances on same node the Partial restore, may be grayed out (since this option does not apply to the SQL Server 7 instance). To resolve this situation, refresh the tree view and then select the SQL Server 2000 instance.

---

*Figure 65. Group is selected for restore*
To restore with recovery, the transaction log file(s) must be applied either at the same time or afterwards, as shown in Figure 66.

Figure 66. The following transaction logs are restored, with recovery
7.1.12 Need to back up tail of log before restore

When restoring Group, Files, and Set backups, you can experience the error message shown in Figure 67, that the database has not been backed up, and you must back up the tail of the log. Simply back up the transaction log restore of the Group/File and then roll forward the transaction log backup.

![Figure 67. Tail log must be backed up](image)

7.1.13 Case, other sensitivities, sort order, code pages

All restore operations in SQL server 7.0, demand that the server has the same Sort order, Code page and Unicode collation as the database object you want to restore.

On SQL Server 2000, different collations are accepted on the same server, thus making it possible to restore a database object with different collation.

7.1.13.1 TDP for SQL commands

When using TDP for SQL commands, keep in mind that all SQL names of databases or parts of databases are case-sensitive, when addressing commands:

- SQL database names are case-sensitive.
- The logicalfilename variable is case-sensitive.
- The groupname variable is case-sensitive.
A TSM password is not case sensitive and may be composed of 1 to 63 of the following characters:

- The letters A through Z
- The digits 0 through 9
- The special characters plus (+), period (.), underscore (_), hyphen (—), and ampersand (&).
Appendix A. Troubleshooting backup and restore

This appendix is intended to give you an idea of what to look for, when you need to troubleshoot failed backup and restore jobs.

A.1 When a backup job fails

When troubleshooting failed backup jobs, here is what should be checked:

- When backup fails, it is either communication with the SQL server, or with the TSM server which fails, or the command cannot be completed. Usually you can see from the error message, in which tier the communication fails.
- Check that the TSM node name used can connect with the TSM server.
- Check that the number of mount points specified for the node is equal to or higher than the number of stripes, when backing up to removable media.
- Check that there is storage allocated to the storage pool for your management class.
- If the options for your database are set to Truncate Log on Checkpoint (SQL 7.0) or Simple (SQL 2000), you cannot back up the transaction log.
- If the database is not recovered, it cannot be backed up (Read-Only or Loading).

For further troubleshooting, check the Windows Eventlog, and the appropriate TDP for SQL log files, mentioned in 6.1.1, “TDP for SQL log files” on page 101.

A.2 When a restore job fails

When troubleshooting failed restore jobs, here is what you should check:

- If your meta data migrated to tape, then **Wait for Tape Mount** must be selected. To avoid this problem, specify that meta data is sent to a storage pool which is not migrated to disk.
- If your backup was done using multiple stripes, the same number of stripes must be available when restoring to a SQL 7.0 server.

Check that the actual file path exists and there are no other files present (used by other databases) with the same name.
Select the Replace option in the following cases:

- When doing a full restore (or File, Group, Set) specifying /INTO a database which already exist.
- When the number of files in the backup object differs from the existing database, when wanting to overwrite an existing database.
- When the names of the files in the existing database differs from the file names in the backup object.

If there are no available backup objects, check that you are using the correct TSM nodename, specified the /tsmoptfile or /fromsqlserver correctly. Also, when specifying the backup object from the CLI, it is case sensitive.

For further troubleshooting, check the Windows Eventlog, and the appropriate TDP for SQL log files, mentioned in “TDP for SQL log files” on page 101.

### A.2.1 Tempdb

Tempdb is a temporary database which cannot be backed up, since it is recreated (physical files in the same directory as for the master) every time the SQL server is started. Therefore, it is not shown in TDP for SQL GUI.
Appendix B. TDP for SQL CLI

This appendix provides an introduction to the TDP for SQL CLI. In the following examples, we explain how to do backup and restore from the TDP for SQL CLI.

B.1 Using TDP for SQL CLI

The Command Line Interface is where you will type your scheduled commands. To ease the task of writing scheduled jobs (cmd files), we recommend becoming familiar with the CLI.

The TDP for SQL Command Line Interface is started by executing the shortcut SQL Client CMD Line, as shown in Figure 68. Basically, it is a command line started in the directory where TDP for SQL is installed.

Figure 68. Starting the Command Line Interface
For example, all commands start with `tdpsqlc` followed by the command `backup`, then the positional parameter `dbname`, and the type for the command `full`, followed by optional parameters. In the following samples, some different types of backup and restores are listed. For a full list of commands, type `tdpsqlc` and press Enter, or use the TDP for SQL online documentation.

**Full, log, and differential backup**

To make a full backup of all databases on the SQL server (default instance):

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc backup * full
```

To specify a specific database replace `*` with `dbname` (case sensitive).

To use a different option file specify `/tsmoptfile=Otherdsom.apt`, if for example other node name include\exclude statements is wanted.

To make log or differential backup replace `full` with `log` or `diff`

```
Backing up the log file from database InvoiceReg
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc backup InvoiceReg log
```

**Group, file, and set backups**

When doing group or file backup, you should specify which groups or files to backup. Also the use of `*` (wildcard) is possible to backup all (files or groups).

To back up the database file `Stock_VLDB_Data` from database `Stock_VLDB`:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc backup Stock_VLDB file=Stock_VLDB_Data
```

To back up the PRIMARY group from database `Stock_VLDB`:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc backup Stock_VLDB group=primary
```

When doing a Set backup, you must specify `/files=file1,file2...` or `/groups=group1,group2...`. Here you can also use `*` (wildcard).

In this example, a set backup of the group secondary is backed up from the database `Stock_VLDB`:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc backup Stock_VLDB set /groups=secondary
```
Appendix B. TDP for SQL CLI

Restore from the command line interface

It is seldom necessary to schedule restore jobs, unless log shipping or automated restore tests are done, and you will probably find it easier to use the TDP for SQL GUI. Therefore, the following restore example shows how to do partial restores while relocating the files (this cannot be done from the TDP for SQL GUI).

Relocating files while doing partial restore

![Note](https://via.placeholder.com/150)

To use the `/relocate` option with TDP for SQL CLI, first apply: 
Fix patch 2.2.0.01, APAR: IC30018.

Below, the filegroup PRIMARY from the full database backup of the database DB_Name on Rainier is restored on another server, into the new database DB_Part (which is created in the restore process), relocating the files to a location, and different physical file names than contained in the backup object.

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc rest DB_Name full
/fromsqlserver=rainier /partial /groups=PRIMARY /into=DB_Part
/relocate=DB_Name_Data,DB_Name /to=c:\temp\File1.mdf,c:\temp\Log.ldf
```

The corresponding restore while restoring the file group TERTIARY, is shown below, notice that the PRIMARY filegroup must always be restored when doing partial restores.

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc rest DB_Name full
/fromsqlserver=rainier /partial /groups=TERTIARY /into=DB_Part3
/relocate=DB_Name_Data,DB_Name,DB_Name_Data3
/to=c:\temp3\File1.mdf,c:\temp3\Log.ldf,c:\temp3\File3.ndf
```
Queries from the CLI

Queries from the CLI can be very helpful to get a good overview of your backup objects. The following examples show how to do queries.

When performing queries from the CLI, you can query the TSM server, SQL server or TDP.

When querying TDP, the TDP for SQL settings are listed shown below.

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc query tdp
Tivoli Storage Manager
Tivoli Data Protection for Microsoft SQL Server
Version 2, Release 2, Level 0.01
(C) Copyright IBM Corporation 1997, 2001. All rights reserved.

TDP for Microsoft SQL Server configuration settings
---------------------------------------------------
BUFFers................................... 3
BUFFERSize............................... 1024
DIFFESTime.............................. 20
FROMSQLserver........................... RECOVER
Logoff................................... tdpsql.log
LOGPrune................................ 60
MONTHWaitfordata........................ Yes
NUMBERformat............................ 1
SQLAUTHentication....................... INTegrated
SQLBUFFers................................ 0
SQLBUFFERSize........................... 1024
SQLSERVer............................... RECOVER
STRIPes................................... 1
TIMEformat................................ 1
```

When querying the SQL server information about the databases are listed.

You can specify to query a specific database or use * (wildcard), to get information about all databases on the server. A subset is shown:
C:\Program Files\Tivoli\TSM\TDSql\tdpsqlc query SQL *

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SQL Server Information
-------------------------------

SQL Server Name........................ RECOVER

SQL Database Information
-------------------------------

<table>
<thead>
<tr>
<th>SQL Database Name</th>
<th>SQL Database Data Space Allocated</th>
<th>SQL Database Data Space Used</th>
<th>SQL Database Log Space Allocated</th>
<th>SQL Database Log Space Used</th>
<th>SQL Database Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>master</td>
<td>11,993,088</td>
<td>11,993,088</td>
<td>786,432</td>
<td>351,232</td>
<td>System database</td>
</tr>
<tr>
<td>model</td>
<td>655,360</td>
<td>655,360</td>
<td>524,288</td>
<td>263,168</td>
<td>System database</td>
</tr>
<tr>
<td>msdb</td>
<td>11,796,480</td>
<td>11,796,480</td>
<td>2,359,296</td>
<td>1,038,336</td>
<td>System database</td>
</tr>
<tr>
<td>NewDB</td>
<td>46,137,344</td>
<td>2,097,152</td>
<td>12,582,912</td>
<td>1,224,704</td>
<td>Torn page detection</td>
</tr>
<tr>
<td>Northwind</td>
<td>2,752,512</td>
<td>2,752,512</td>
<td>1,048,576</td>
<td>513,024</td>
<td>Torn page detection</td>
</tr>
</tbody>
</table>

Appendix B. TDP for SQL CLI   133
When querying the TSM server, you can get information about which node name is used and how the node name is defined on the TSM Server, as shown:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc query tsm

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Tivoli Data Protection for Microsoft SQL Server
Version 2, Release 2, Level 0.01
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Tivoli Storage Manager Server Connection Information
----------------------------------------------------
Nodename............................... RAINIER_SQL2
NetWork Host Name of Server............ 9.1.150.57
TSM API Version......................... Version 4, Release 1, Level 2
TSM Server Name........................ BRAZIL
TSM Server Type......................... AIX-RS/6000
TSM Server Version..................... Version 4, Release 1, Level 2.0
Compression Mode....................... ON
Domain Name............................. TDPSQL2_DOMAIN
Active Policy Set...................... STANDARD
Default Management Class.............. API_DISK_30DAYS
```
To get information about available backup objects, specify the `type` parameter and `/fromsqlserver=servername` if it is not the default SQL server, as follows:

```
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc query tsm * type /fromsqlserver=rainier
```

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Backup Object Information
-------------------------

<table>
<thead>
<tr>
<th>SQL Database Name</th>
<th>AddressCat</th>
<th>SQL Server Name</th>
<th>RAINIER</th>
<th>Number of Full Active Backup Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>InvoiceReg</td>
<td></td>
<td>RAINIER</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>master</td>
<td></td>
<td>RAINIER</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>model</td>
<td></td>
<td>RAINIER</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
For detailed options about each object you must specify the object in the query. Below the Log backups for Stock_VLDB are queried:

```sql
C:\Program Files\Tivoli\TSM\TDPSql>tdpsqlc query tsm Stock_VLDB log=* /fromsqlserver=rainier
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Tivoli Data Protection for Microsoft SQL Server
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Backup Object Information
-----------------------------------
SQL Server Name..................... RAINIER
SQL Database Name.................... Stock_VLDB
Backup Object Type................... Log
Backup Object State.................. Active
Backup Creation Date / Time........... 04/05/2001 18:31:03
Backup Size.......................... 82,432
Database Object Name.................. 20010405183103\00000988
Number of stripes in backup object... 1

SQL Server Name..................... RAINIER
SQL Database Name.................... Stock_VLDB
Backup Object Type................... Log
Backup Object State.................. Active
Backup Creation Date / Time........... 04/05/2001 19:30:24
Backup Size.......................... 82,432
Database Object Name.................. 20010405193024\0000078C
Number of stripes in backup object... 1

SQL Server Name..................... RAINIER
SQL Database Name.................... Stock_VLDB
Backup Object Type................... Log
Backup Object State.................. Active
Backup Creation Date / Time........... 04/05/2001 20:30:25
Backup Size.......................... 15,872
Database Object Name.................. 20010405203025\000008D8
Number of stripes in backup object... 1
```

For further information on using the CLI, consult TDP for SQL Books Online.
Appendix C. Quick start / checklist Win2000

This appendix is intended to show you the easiest way to install, configure, and perform backups and restores using TDP for Microsoft SQL.

C.1 Checklist

Before performing installation of TDP for SQL, check whether you meet the following requirements:

1. You have the appropriate hardware: Intel Pentium Processor, at least 166 MHz or equivalent, 8 MB of free disk space, and at least 48 MB of RAM (96 MB or more is highly recommended). If you plan on installing TDP in a cluster environment, consult the Microsoft documentation about hardware requirements.

2. You have the Microsoft Windows 2000 Server, Advanced Server, or Datacenter Server installed with Service Pack 1 (SP1) or later.

3. SQL Server 2000 or 7.0 is installed. If you plan on using SQL in a cluster environment, follow the Microsoft instructions about cluster installation.

4. TSM server is installed. Your TSM administrator has registered the node for you and supplied you with a password and communication method to access the server. Your TSM administrator has adjusted the following parameters:
   - The BACKDELETE parameter for REGISTER or UPDATE NODE must be YES.
   - The MAXNUM parameter for REGISTER or UPDATE must be at least the maximum number of stripes to be used, when removable media such as types are used.
   - The COLLOCATE parameter for DEFINE STGPOOL should be set to FILESPACE to ensure that individual data stripes stay on separate removable volumes.
   - The TXNGROUPMAX option must be at least one more than the maximum number of stripes to be used for backup and restore, regardless of the type of media.
   - The management class for TDP for SQL meta data should be identical to the corresponding management classes for database data, except that the meta data management class should not allow migration to removable media.
C.2 Installation

The installation of TDP for SQL must be performed with an account having administrator privileges to the local system. TDP for SQL must be installed on the same machine on which SQL server is installed. Follow these steps:

1. Start the setup program. Choose the installation path and follow the installation instructions contained in the prompt windows. If you are setting up TDP in a clustered environment, repeat the same on the second node.

2. Specify the node name, password method, and the TSM server in your TDP for SQL options file — the dsm.opt file, which is located in the directory in which TDP for SQL is installed. You can edit this file by using a text editor. For clustering, the options file on both nodes must be identical, and the TDP for SQL GUI must be invoked by specifying the name of the Virtual SQL server.

C.3 Performing backups

After installation of TDP for SQL and connecting to the TSM server you are ready to perform backups. You can use the Graphical User Interface or Command Line Interface. If you are using the Command Line Interface, you can obtain help about the command syntax and options by typing:

```
tdpsqlc help
```

If you use the Graphical User Interface, choose the server and databases you want to back up. There are six different types of backups:

**Full database backup** — TDP for SQL backs up the entire SQL server database, any activity that took place during the backup process, and uncommitted transactions in the transaction log. Perform this type of backup when the database is small and relatively permanent and you are able to accept a minor loss of data if the database fails between backups.

**Log backup** — TDP for SQL backs up only the content of the transaction log since the last executed BACKUP LOG statement to the end of the current transaction log. This kind of the backup gives you the possibility to truncate the log, which means that the inactive part of the log is deleted. This in turn prevents the log from growing. The first log backup must be performed after a full backup.
**Differential backup** — TDP for SQL backs up only the parts of the databases that have changed since the last full backup, any activity that took place during the differential backup, and any uncommitted transactions in the transaction log. This kind of backup is different from transaction log backup, and it does not contain the history of the changes.

**File backup** — TDP for SQL backs up only the contents of a specified SQL server logical file. This can be used for backing up very large databases: Instead of backing up the entire database, you can back up each file individually.

**Group backup** — TDP for SQL backs up only the contents of the specified server group. For instance, if an index and a base table are created in one filegroup, you must back up the entire filegroup as a unit.

**Set backup** — TDP for SQL backs up the contents of specified SQL servers filegroups and files as a unit. This can be used, for example, when indexes are created on multiple filegroups and the base table is created on another filegroup. In this case, you must back up all filegroups as a single unit.

**C.4 Performing restores**

When you restore a database, the data which exists in the database is overwritten and is no longer available. If you are using the Command Line Interface, you may obtain help for the CLI syntax by typing:

```
tdpsqlc help
```

If you are using the Graphical User Interface, there are two windows which support SQL restore operations:

- **Restore databases** — For restoring databases or part of databases from full, differential and log backups.
- **Restore Groups/Files** — For restoring databases or part of databases from group, file, set and log backups.

**Restore from a full backup** — If, for the database which you are going to restore, the `trunc.log on checkpoint` is set to true, all modifications that were made since the last full backup are lost. If this parameter is set to false, and you back up the transaction log without truncating before restoring from the full backup and then apply the transaction log, you will be able to recover to the current state (if the transaction log is not corrupt).
Restore from a log backup — If you use the full and log backup strategy, you can restore a database from the full backup and then apply all of the transaction log backups, created since the last full database backup. Before restoring from the full backup, try to backup the transaction log if possible using NO_TRUNCATE option; then after restore of full and log backups, try to apply the transaction log backup which you created before restore operations. Thus you will have the database restored to the current state.

Restore from differential backup — You must first restore the full database backup and then the latest differential backup, which contains only the changed portions of the database since last full backup, without capturing the changes in transaction logs. By using this approach, you will reduce the necessary time for restore, because you do not have to apply large transactions log. However, this will give you the state of the database to the moment to which the differential backup was performed. If you want to bring the database to the current state combine this backup strategy with log backups. The best practice is to include log backups between differential backups. In case of failure try to back up the log with NO_TRUNCATE option, then restore the full backup, differential backup and any log backups.

Restore from a file backup — TDP for SQL restores only the file backup objects needed from a full backup, a filegroup backup, a file backup, or a set backup for specified SQL databases.

Restore from a group backup — TDP for SQL restores only the group backup objects needed from a full backup, a filegroup backup, or a set backup for the specified SQL databases.

Restore from a set backup — TDP for SQL restores only the set backup objects for the specified SQL databases.

From both of the windows, Restore databases and Restore Groups/Files, you have the following options:

- Show active and inactive — Check this box if you want to see inactive objects. By default, only active objects are shown.
- Stripes — You can specify the number of stripes which you use in the restore operation. Keep in mind that this number must be equal or less than the number of SQL buffers; for SQL server 7.0 this number is a maximum of 32; for SQL 2000, the maximum number is 64.
- Replace — By selecting this box, you will replace the existing database.
Appendix C. Quick start / checklist Win2000

• Recovery — Specify this option as no if you are making the a sequence of restores and the current restore is not the final restore. Specify as yes if the current restore is the final restore.

• Database owner only — If desired, you may restrict the database to be used by the owner only.

• Wait for Tape Mounts for Restore — Defines whether the TDP for SQL restore operation will wait for the TSM server to mount removable media such as tapes or CD-ROMs.

• Wait for Tape Mounts for File Information — Defines whether TDP for SQL waits for the TSM server to perform media mounts if you are querying TSM server for file information.

The following two options are only available from the Restore Database tab:

• Partial restore — Applies for full backups; creates a subset of the database to which differential and log backups can be applied. This option is valid for SQL server 2000.

• Point in Time — Available only when you select for restore a full backup object and at least one log backup.

C.5 Solving problems

There are several sources of information which you can view in case of problems:

• You can monitor the TSM server activity log, or if you do not have rights, the TSM administrator can do it.

• TDP for SQL writes log information to the Windows Event Log and to the tdpsql.log file, which is by default in the directory where TDP for SQL is installed.

• The TSM API logs information to the dsierror.log — this information concerns API errors, not backup statistics. The dsierror.log is, by default, in the directory where TDP for SQL is installed.

• The SQL server logs information to the SQL Server error log. You can view this information by using Enterprise Manager by selecting Server->Management->SQL server Logs->Current or Archive #n.
Appendix D. Special notices

This publication is intended to help MS SQL administrators use Tivoli Data Protection for MS SQL, and to help TSM administrators understand how to back up and recover MS SQL server databases. The information in this publication is not intended as the specification of any programming interfaces that are provided by Tivoli Data Protection for Microsoft SQL. See the PUBLICATIONS section of the IBM Programming Announcement for Tivoli Data Protection for Microsoft SQL for more information about what publications are considered to be product documentation.

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# Appendix E. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

## E.1 IBM Redbooks

For information on ordering these publications see “How to get IBM Redbooks” on page 153.

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<tr>
<td>Tivoli Storage Manager Version 3.7: Technical Guide</td>
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<td>A Project Guide for Deploying Tivoli Solutions</td>
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<tr>
<td>TME 10 Cookbook for AIX: Systems Management and Networking Applications</td>
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<tr>
<td>TME 10 Deployment Cookbook: Courier and Friends</td>
<td>SG24-4976</td>
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E.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at ibm.com/redbooks for information about all the CD-ROMs offered, updates and formats.

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<thead>
<tr>
<th>CD-ROM Title</th>
<th>Collection Kit Number</th>
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<tbody>
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<td>IBM Networking Redbooks Collection</td>
<td>SK2T-6022</td>
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E.3 Tivoli publications

These publications are also relevant as further information sources:

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<thead>
<tr>
<th>Book Title</th>
<th>Publication Number</th>
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<tbody>
<tr>
<td>Tivoli Asset Management Inventory Integration System Administration</td>
<td>GC31-5204</td>
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<tr>
<td>Tivoli Asset Management Inventory Integration User's Guide</td>
<td>GC32-0288</td>
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E.4 Other resources

Microsoft Knowledge Base Articles
Q266367 - XADM: Extensible Storage Engine 98 Error Codes -1051 to -999999
Q266361 - XADM: Extensible Storage Engine 98 Error Codes 0 to -1048
Q267273 - XADM: How to Install the Key Management Server

E.5 Referenced Web sites and newsgroups

E.5.1 Newsgroups

For information about TSM check
http://msgs.adsm.org/cgi-bin/get/adsm-current.html
How to get IBM Redbooks

This section explains how both customers and IBM employees can find out about IBM Redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

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First name | Last name

Company

Address

City | Postal code | Country

Telephone number | Telefax number | VAT number

☐ Invoice to customer number

☐ Credit card number

Credit card expiration date | Card issued to | Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.
Glossary

A

Access control. A security mechanism used by Windows 2000 to control access to information.

Active directory. The Windows 2000 directory service, which allows users to use a single user account for accessing resources on the network. Active directory alleviates administrators work by providing a single point of administration for all network objects.

Active Directory Users and Computers. A Microsoft Management Console used for administering objects in active Directory.

Active policy set. The policy set within a policy domain that contains the most recently activated policy. This policy set is used by all client nodes assigned to the current policy domain. See policy set.

Active version. The most recent backup copy of a file stored in TSM storage for a file that currently exists on a file server or workstation. An active version remains active and exempt from deletion until:

- Replaced by a new backup version.
- TSM detects, during an incremental backup, that the user has deleted the original file from a file server or workstation.

Administrative client. A program that runs on a file server, workstation, or mainframe. This program lets administrators monitor and control TSM servers using TSM administrator commands. Contrast with backup-archive client.

Administrative group. A collection of Active Directory objects for the sake of easy permission administration.

Application program interface (API). A set of functions that applications running on a client platform can call to store, query, and retrieve objects from TSM storage.

Archive. A function permitting users to copy one or more files to a long-term storage device. Archive copies can:

- Accompany descriptive information
- Imply data compression software usage
- Be retrieved by archive date, file name, or description

Contrast with retrieve.

Archive copy. A file or group of files residing in an archive storage pool in TSM storage.

Archive copy group. A policy object containing attributes that control the generation, destination, and expiration of archived files. The archive copy group belongs to a management class.

Archive retention grace period. The number of days TSM retains an archived copy when the server is unable to rebind the file to an appropriate management class.

Audit. The process of tracking the user actions recorded in an event log on a server or workstation.

Authentication. The process of checking and authorizing a user's password before permitting user access to the server.

Authorization rule. A specification permitting another user to either restore or retrieve a user's files from TSM storage.

Automatic recovery. Recovery that occurs every time SQL Server is restarted. Automatic recovery can protect databases in case of a system failure. In each database, the automatic recovery mechanism checks the transaction log. If the log has committed transactions that have not been written to the database, it replay those transactions again.

B

Backup. A function permitting users to copy one or more files to a storage pool to protect against data loss. Contrast with restore.
Backup-archive client. A program that runs on a file server, PC, or workstation and provides a means for TSM users to back up, archive, restore, and retrieve files. Contrast with administrative client.

Backup copy group. A policy object containing attributes that control the generation, destination, and expiration of backup files. A backup copy group belongs to a management class.

Backup version. A backed up file, directory, or file space that resides in a backup storage pool in TSM storage. The active version is the most recent backup version. See active version and inactive version.

Batch. A set of SQL statements submitted together and executed as a group.

Character set. A character set determines the types of characters that SQL Server recognizes. A character set is a set of 256 letters, digits, and symbols specific to a country/region or language. The printable characters of the first 128 values are the same for all character sets. The last 128 characters, are unique to each character set. A character set is related to, but separate from, Unicode characters.

Checkpoint file. A file used to show which transactions have been successfully committed to the database file. Separate checkpoint files are maintained for each storage group.

Client. A program running on a file server, PC, workstation, or terminal that requests services of another program called the server. There are two types of TSM clients: administrative and backup-archive. See administrative client and backup-archive client.

Client node. A file server or workstation registered with the server on which the backup-archive client program is installed.

Client options file. A file that a client can edit, containing a default set of processing options that identify the server, communication method, backup and archive options, space management options, and scheduling options.

Client/server. A communications network architecture in which one or more programs (clients) request computing or data services from another program (the server).

Closed registration. A registration process in which an TSM administrator must register workstations as client nodes with the server. Contrast with open registration.

Code page. See character set.

Command line interface. A type of user interface where commands are specified on the command line. Contrast with graphical user interface.

Commit. To make changes permanent in the databases files. Changes made to the database files are not permanent until they are committed.

Communication method. The method by which a client and server exchange information.

Communication protocol. A set of defined interfaces that permits computers to communicate with each other.

Compression. The process of saving storage space by eliminating empty fields or unnecessary data to shorten the length of the file. In TSM, compression can occur at a workstation before files are backed up or archived to server storage. On some types of tape drives, hardware compression can be used.

Copy group. An TSM policy object that determines how TSM backs up or archives files. Copy groups belong to management classes. There are two copy groups:

Backup copy group--determines how TSM backs up or archives files.

Archive copy group--determines how TSM archives files.

Data file. A file that contains data. Databases can span multiple data files.

Data integrity. Accuracy and reliability of data. Data integrity is important because the cost of data corruption is high.
Data modification. Adding, deleting, or changing information in a database by using the INSERT, DELETE, and UPDATE Transact-SQL statements.

Data transfer. The process of copying data to or from a computer running SQL Server.

Data Transformation Services (DTS). A SQL Server component used to import, export, and transform data from different data sources.

Database. A collection of information, tables, and other objects. Databases are stored in files.

Database catalog. The system tables of a database.

Database consistency checker (DBCC). A statement used to check the logical and physical consistency of a database, check memory usage, decrease the size of a database, check performance statistics, and so on.

Database file. A file in which databases are stored. One database can be stored in several files.

Database object. One of the components of a database: a table, index, trigger, view, key, constraint, default, rule, user-defined data type, or stored procedure.

DBCC. See database consistency checker.

Default management class. A management class assigned to a policy set. This class is used to govern backed up or archived files when a user does not explicitly associate a file with a specific management class through the include-exclude list.

Domain. See policy domain or client domain for the meaning of this term in regards of TSM server.

In Windows 2000 this term means group of computers which are part of a network and which share a common directory database.

Domain controller. A computer running Windows 2000 Server that administer user access to a network.

dsm.opt file. See options file. Also called client options file.

E

Error log. A text file written on disk that contains TSM processing error messages. These errors are detected and saved by the TSM server.

Event. The occurrence of a particular action or change of state.

Exclude. The process of identifying files in an include-exclude list. This process prevents the files from being backed up or migrated whenever a user or schedule enters an incremental or selective backup operation.

Expiration. The process in which files are identified for deletion because their expiration date or retention period has passed. Backed up or archived files are marked for deletion based on the criteria defined in the backup or archive copy group.

Extent. The space allocated upon creation of a SQL Server object, such as a table or index. In SQL Server, an extent is eight contiguous pages.

F

Failover. The process of taking resources offline on one node of the cluster and bringing them online on the other node.

File server. A dedicated computer and its peripheral storage devices connected to a local area network that stores both programs and files shared by users on the network.

File space. A logical space on the TSM server that contains a group of files. In TSM, users can restore, retrieve, or delete file spaces from TSM storage.

Fixed database role. Predefined roles defined at the database level existing in each database.

Fixed server role. Predefined roles defined at the server level existing outside individual databases.

Full backup. A TSM function that copies the entire database. A full backup begins a new database series.
**G**

**Generate password.** Processing that stores a new password in an encrypted password file when the old password expires. Automatic generation of a password prevents password prompting. Password generation can be set in the options file (passwordaccess option). See options file.

**Graphical user interface (GUI).** A type of user interface that takes advantage of a high-resolution monitor, includes a combination of graphics, the object-action paradigm, and the use of pointing devices, menu bars, overlapping windows, and icons. Contrast with command line interface.

**GUI.** Graphical user interface.

**I**

**Inactive version.** A copy of a backup file in TSM storage that either is not the most recent version, or the corresponding original file was deleted from the client file system. Inactive backup versions are eligible for expiration according to the management class assigned to the file.

**Include-exclude file.** A file containing statements to determine the files to back up and the associated management classes to use for backup or archive. See include-exclude list.

**Include-exclude list.** A list of include and exclude options that include or exclude selected files for backup. An exclude option identifies files that should not be backed up. An include option identifies files that are exempt from the exclusion rules or assigns a management class to a file or a group of files for backup or archive services. The include-exclude list is defined in one or more include-exclude files or in the client options file. The include-exclude list may contain entries from any or all of the following sources: the client options file, separate include-exclude files, or the TSM server. See options file.

**Incremental backup.** (1) A function that allows users to backup files or directories that are new or have changed since the last incremental backup. With this function, users can back up files or directories from a client domain that are not excluded in the include-exclude list and that meet the requirements for frequency, mode and serialization as defined in the backup copy group of the management class assigned to the files.

(2) A TSM function that copies only the transaction logs for the database and that are new or changed since the last full or incremental backup. Contrast with full backup.

**Index.** A database object in a relational database, that provides fast access to data in the rows of a table, based on key values.

**L**

**LAN.** Local area network.

**Local Area Network (LAN).** A variable-sized communications network placed in one location. LAN connects servers, PCs, workstations, a network operating system, access methods, and communications software and links.

**Locale.** Information that corresponds to a specific language and country/region, such as decimal separators, date and time formats, and character-sorting order.

**Log file.** A file or set of files containing a record of a database's transactions.

**Login security mode.** Determines the manner in which a SQL Server validates a login request. There are two types of login security: Windows Authentication and Mixed Mode.

**M**

**Management class.** A TSM policy object that associates specific policies for backups, archives, and space management with client files. A management class can contain both a backup and archive copy group, or only an archive copy group. Management classes can also include space management policy for Hierarchical Storage Management (HSM) clients.

**Master database.** The database that manages user databases and the operation of SQL Server as a whole.

**Metadata.** Information about the structure of data.
Mixed Mode. Combines Windows Authentication and SQL Server Authentication. Allows users to connect to SQL Server, through either a Windows user account or a SQL Server login.

Model database. A database installed with SQL Server that provides the template for new user databases. A new database cannot be smaller than model database. The model database can be modified to meet your requirements.

N

Node. See client node.

Node name. A unique name used to identify a workstation, file server, or PC to the server.

O

Object. A component of a database. It can be a table, index, trigger, view, key, constraint, default, rule, user-defined data type, or stored procedure.

Open registration. A registration process in which users can register their own workstations or PCs as client nodes with the server. Contrast with closed registration.

Options file. A file that contains processing options. Identifies TSM servers, specifies communication methods, defines scheduling options, selects backup, archive, restore, and retrieve options. Also called the client options file.

P

Permissions. Specified the Transact-SQL statements, views, and stored procedures each user is authorized to use.

Policy domain. A TSM policy object that lets TSM group client nodes by the policies that govern their files and by the administrator who manages the policies. The policy domain contains one or more policy sets.

Policy set. A TSM policy object that specifies the management classes that are available to groups of users. More than one policy set can exist. However, only one policy set at a time can be active.

R

Recovery log. A log of updates that are about to be written to the database. The log can be used to recover from system and media failures.

Registration. The process of identifying a client node or administrator to the server by specifying a user ID, password, and contact information. For client nodes, a policy domain, compression status, and deletion privileges are also specified.

Registry. A central database in Windows that contains information about hardware, applications, and operating system settings for each machine on the network. Provides security and control over system, security, and account settings.

Relational database management system (RDBMS). A system that organizes data into related rows and columns. SQL Server is a relational database management system (RDBMS).

Restore. A function that permits users to copy a version of a backup file from the storage pool to a workstation or file server. The backup copy in the storage pool is not affected. Contrast with backup.

Retention. The amount of time, in days, that inactive backed up or archived files are retained in the storage pool before they are deleted. The following copy group attributes define retention: retain extra versions, retain only version, retain version.

Retrieve. A function permitting users to copy an archived file from the storage pool to the workstation or file server. The archive copy in the storage pool is not affected. Contrast with archive.

S

SAN Storage Area Network

Scheduling. A function permitting an administrator to schedule backup and archive operations from a central location. Operations can be scheduled on a periodic basis or on an explicit date.
Scheduling mode. The type of scheduling operation for the client-server node. TSM supports two scheduling modes: client-polling and server-prompted.

Server. A program running on a mainframe, workstation, or file server that provides shared services such as backup and archive to other various (often remote) programs (called clients).

Server cluster. A group of physically and software connected computers which work together and appear to the user as a single system.

Server-prompted scheduling. A client-server communication technique where the server contacts the client node when tasks need to be done.

Session. A period of time in which a user can communicate with a server to perform backup, archive, restore, or retrieve requests.

Sort order. Rules which determine how character data is compared, collated, and presented in response to database queries.

Space management. The process of keeping sufficient free storage space available on a local file system for new data and making the most efficient and economical use of distributed storage resources. SQL Server Agent. SQL Server Agent creates and manages local or multiserver jobs, alerts, and operators. SQL Server Agent communicates with SQL Server to execute the job according to the job’s schedule, which is defined in the Job Properties dialog box.

SQL Server Authentication. Allows users to connect to SQL Server by using authentication from a SQL Server.

SQL Server Enterprise Manager. A graphical application that allows easy configuration and management of SQL Server and SQL Server objects.

SQL Server login. An account stored in SQL Server that users use to connect to SQL Server.

SQL Server Service Manager. A SQL Server utility that provides a graphical way to start, pause, and stop SQL Services.

Storage pool. A named set of storage volumes used as the destination of backup, archive, or migrated copies.

System catalog. A collection of system tables found only in the master database.

System tables. System tables store SQL Server configuration information and definitions of all the objects, users, and permissions in every SQL Server databases. Server-level configuration information is stored in system tables in the master database.

T

Table. An object in a database that stores data as a collection of rows and columns.

Tabular data stream (TDS). The SQL Server internal client/server data transfer protocol which allows client and server products to communicate regardless of operating-system platform, server release, or network transport.

TDS. See tabular data stream.

Transact-SQL. The standard language for communicating between applications and SQL Server.

Tivoli Storage Manager (TSM). A client/server program that provides storage management to customers in a multivendor computer environment.

Transaction log file. A file that contain all transactions that take place and which can be used in event of system failure for replying the uncommitted transactions to the database.

U

Unicode. Unicode defines a set of letters, numbers, and symbols that SQL Server recognizes. Unicode has more than 65,000 possible values compared to a character set’s 256, and takes twice as much space to store. Unicode includes characters for most languages.

Update. An addition, deletion, or change to data.

Utility. A SQL Server application run from a command prompt to perform common tasks.
Version. Storage management policy may allow back-level copies of backed up objects to be kept at the server whenever an object is newly backed up. The most recent backed up copy is called the "active" version. Earlier copies are "inactive" versions. The following backup copy group attributes define version criteria: versions data exists, and versions data deleted.

Wildcard character. An asterisk (*) or question mark (?) character used to represent multiple (*) or single (?) characters when searching for various combinations of characters in alphanumeric and symbolic names.

Workstation. A programmable high-level workstation (usually on a network) with its own processing hardware such as a high-performance personal computer. In a local area network, a personal computer that acts as a single user or client. A workstation can also be used as a server.
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166   Using Tivoli Data Protection for Microsoft SQL Server
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This IBM Redbook explains how to use Tivoli Data Protection (TDP) for Microsoft SQL Server v.2.2 to perform backups and restores in your SQL environment. Tivoli Data Protection for Microsoft SQL Server performs online backups of Microsoft SQL Server databases to Tivoli Storage Manager (TSM) storage. We demonstrate how to back up and recover data on SQL 7.0 as well as SQL 2000 on a single server installation and a clustered environment. Windows 2000 (Service Pack 1) is used as the operating system and SQL 7.0 as well as SQL 2000. However, we do not cover backing up the operating system itself.

Version 2.2 provides new functionality as well as support for one of the important features of Tivoli Storage Management: automatic expiration and version control by policy. We demonstrate how this frees users from having to explicitly delete backup objects in the Tivoli Storage Manager server. TDP for SQL also supports LAN-free environments. We demonstrate how to use TDP for SQL to perform backups across a traditional LAN as well as utilizing TSM LAN-free to support backups across Storage Area Networks (SANs).

This book is written for SQL server administrators as well as TSM administrators with a need to understand the issues and considerations pertinent to utilizing TSM and TDP to back up and restore Microsoft SQL server.