

**Chapter  
1**

**GETTING  
STARTED**

*Get on the  
Fast Track!*



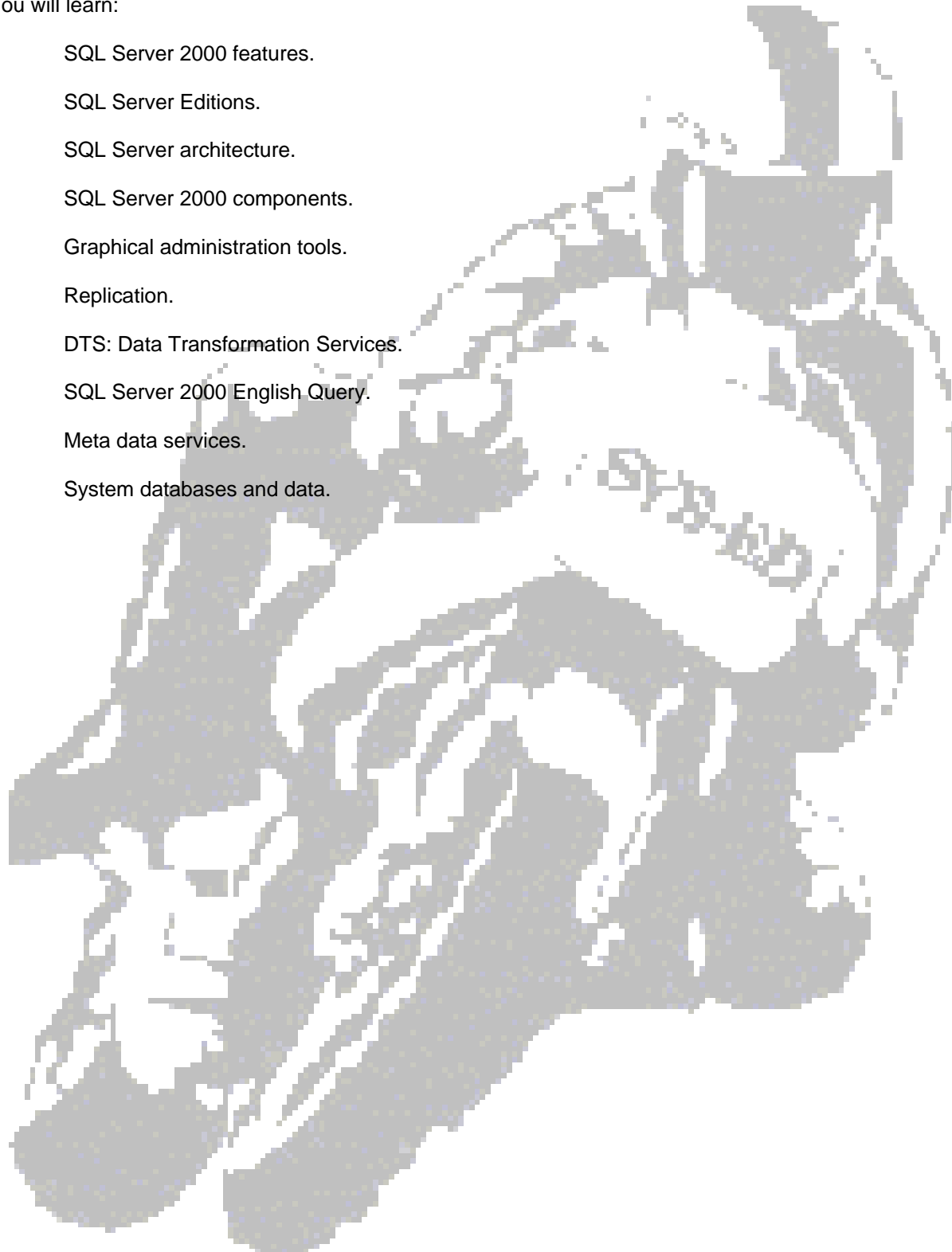
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**SYS-ED/  
COMPUTER  
EDUCATION  
TECHNIQUES, INC.**

**Objectives**

You will learn:

- C SQL Server 2000 features.
- C SQL Server Editions.
- C SQL Server architecture.
- C SQL Server 2000 components.
- C Graphical administration tools.
- C Replication.
- C DTS: Data Transformation Services.
- C SQL Server 2000 English Query.
- C Meta data services.
- C System databases and data.



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## 1 SQL Server 2000 Features

Microsoft SQL Server 2000 has the following features:

- C A relational database engine that can scale from running on an individual desktop to running the large web sites.
- C Integration in to the Microsoft data access environment: ADO, OLE DB, and ODBC.
- C Integration with Windows 2000 failover clusters and Windows 2000 authentication and encryption.
- C Integrated support for web-based application environment: ADO, OLE DC, and ODBC.
- C Integrated Analysis Services tools for performing data analysis and data mining of data warehouses.
- C Replication services, which allow sites to place copies of data on multiple computers and synchronize data.
- C Data Transformation Services (DTS) that make it easier to build OLAP data warehouses.
- C English Query, which applications can use for answering ad-hoc user questions.
- C Full-Text Search, which extends the pattern matching capabilities of SQL Server 2000.
- C Meta Data Services, which provide facilities for storing, viewing, and retrieving descriptions of the objects in your applications and system.

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## 2 SQL Server Editions

The different editions of MS SQL Server are designed to accommodate performance, runtime, and price requirements of organizations and individuals.

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### 2.1 SQL Server 2000 Enterprise Edition

SQL Server 2000 Enterprise Edition includes the complete set of SQL Server database and analysis features and is uniquely characterized by several features that make it the most scalable and available edition of SQL Server 2000. It scales to the performance levels required to support large web sites and enterprise online transaction processing (OLTP) and data warehousing systems. There also is support for failover clustering.

The additional features of SQL Server 2000 Enterprise Edition fall into four main areas:

- C Scalability
- C Availability/uptime
- C Performance
- C Advanced analysis

SQL Server Enterprise Edition supports up to 64 gigabytes and 32 processor.

Enterprise Edition features can:

- C support more than four CPUs in the database server.
- C use more than 2 GB of physical memory - RAM.
- C divide database workload across independent servers.
- C use System Area Networking (SAN) connection technologies between servers.
- C use failover clustering to ensure that applications stay up and running even when disaster strikes.
- C rely on log shipping to maintain a warm standby server.
- C take advantage of symmetric multiprocessor (SMP) computers.
- C provide improved performance of applications that frequently use queries that perform particular types of joins or aggregations.

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## 2.2 SQL Server 2000 Standard Edition

SQL Server 2000 is designed for small-sized and medium-sized organizations.

Standard Edition includes the core functionality needed for non-mission-critical e-commerce, data warehousing, and line-of-business solutions.

The following components are included in Standard Edition:

- C DTS: Data Transformation Services.
- C Replication: snapshot, transactional, and merge.
- C Full-Text Search.
- C English Query.
- C Stored procedure development and debugging tools.
- C SQL Profiling and performance analysis tools.

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## 2.3 SQL Server 2000 Personal Edition

SQL Server 2000 Personal Edition is designed for mobile users who spend time disconnected from the network but run applications that require SQL Server data storage, and for stand-alone applications that require local SQL Server data storage on a client computer.

This edition is functionally equivalent to the Standard Edition, with the following exceptions:

- C It includes a concurrent workload governor that limits its scalability; performance degrades when more than five Transact-SQL batches are executed concurrently.
- C It can use a maximum of two processors in an SMP computer (only one processor if running Windows 98 or Windows Millennium Edition).
- C It cannot act as a transactional replication publisher (subscriber only).

In addition to running on the server operating systems of the Microsoft Windows NT 4.0 and Windows 2000 operating system families, Personal Edition runs on non-server operating systems including Windows 2000 Professional, Windows NT Workstation 4.0, Windows Millennium Edition, and Windows 98. Full-Text Search and SQL Server 2000 Analysis Services, including OLAP, data mining, and data warehousing features, are included in Personal Edition but cannot be installed on Windows 98 or Windows Millennium Edition.

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## 2.4 SQL Server 2000 Developer Edition

SQL Server 2000 Developer Edition allows developers to build application on top of SQL Server. It includes all of the functionality of Enterprise Edition and a development and test end-user license agreement (EULA) that prohibits production deployment

SQL Server 2000 Developer Edition is the only edition of SQL Server 2000 that gives the licensee the right to download and install SQL Server 2000 Windows CE Edition (SQL Server CE) from <http://www.microsoft.com/sql>. The Developer Edition licensee also has the right to redistribute SQL Server CE-based applications to an unlimited number of devices at no additional cost beyond the purchase price of SQL Server 2000 Developer Edition. Devices running SQL Server CE that access or otherwise use the resources of a SQL Server must be properly licensed.

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## 2.5 SQL Server 2000 Evaluation Edition

SQL Server 2000 Evaluation Edition (also known as SQL Server 2000 Enterprise Evaluation Edition) is a time-limited version of SQL Server 2000 Enterprise Edition that is licensed for demonstration, testing, examination, and evaluation for a period of 120 days.

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## 2.6 SQL Server 2000 Windows CE Edition

Microsoft SQL Server 2000 Windows CE Edition (SQL Server CE) is the compact database for rapidly developing applications that extend enterprise data management capabilities to devices. SQL Server CE is the only edition of SQL Server 2000 that provides relational database management capabilities on Windows CE-based devices.

The SQL Server CE engine provides relational database features, including an optimizing query processor and support for transactions and assorted data types, while it maintains a compact footprint that preserves system resources.

SQL Server CE runs on devices that use Windows CE version 2.11 or later, including the Handheld PC Pro (H/PC Pro), Palm-size PC (P/PC), and Pocket PC. SQL Server CE can access SQL Server data in SQL Server version 6.5 or later, but can act as a merge replication subscriber only with SQL Server 2000 databases. SQL Server CE has a device footprint of approximately 1 megabyte (MB). Database size is currently limited to 2 GB.

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## 2.7 SQL Server 2000 Desktop Engine

SQL Server 2000 Desktop Engine is the successor to Microsoft Data Engine (MSDE) 1.0. The SQL Server 2000 Desktop Engine is not related to SQL Server 7.0 Desktop Edition.

Probably the most significant characteristic of the Desktop Engine is that it is a redistributable version of the SQL Server relational database engine. Third-party software developers can include it in their applications that use SQL Server to store data. The SQL Server 2000 Desktop Engine is made available as a set of Windows Installer merge modules that can be included in the application setup. The Desktop Engine is an ideal embedded or offline data store, because it is easy to install and has the smallest footprint of any edition of SQL Server 2000.

The SQL Server 2000 Desktop Engine does not include graphical management tools; the application distributing the engine is usually coded to perform any needed database administration. Instances of the Desktop Engine can be managed from the SQL Server 2000 graphical tools if installed with another edition of SQL Server. Other items not included in the Desktop Engine include analysis capabilities and SQL Server Books Online. The Desktop Engine limits database size to 2 GB.

### 3 Operating Systems Supported by the Editions of SQL Server 2000

The operating systems supported for running the server software from each Microsoft SQL Server 2000 edition is as follows.

Operating System	Enterprise Edition	Standard Edition	Personal Edition	Developer Edition	Desktop Engine	SQL Server CE	Enterprise Evaluation Edition
Microsoft Windows 2000 DataCenter	Supported	Supported	Supported	Supported	Supported	N/A	Supported
Windows 2000 Advanced Server	Supported	Supported	Supported	Supported	Supported	N/A	Supported
Windows 2000 Server	Supported	Supported	Supported	Supported	Supported	N/A	Supported
Windows 2000 Professional	N/A	N/A	Supported	Supported	Supported	N/A	Supported
Microsoft Windows NT 4.0 Server, Enterprise Edition	Supported	Supported	Supported	Supported	Supported	N/A	Supported
Windows NT 4.0 Server	Supported	Supported	Supported	Supported	Supported	N/A	Supported
Windows NT 4.0 Workstation	N/A	N/A	Supported	Supported	Supported	N/A	Supported
Microsoft Windows 98	N/A	N/A	Supported	N/A	Supported	N/A	N/A
Microsoft Windows CE	N/A	N/A	N/A	N/A	N/A	Supported	N/A

The client software from all SQL Server 2000 editions, except SQL Server CE, runs on any version of Microsoft Windows NT, Microsoft Windows 2000, and Microsoft Windows 98.

Only the server components, such as the database engine and the Analysis server, are limited to specific versions of the operating systems.

All of the software from SQL Server CE runs exclusively on the Windows CE operating system.

## 4 SQL Server Architecture

SQL Server 2000 is a family of products that decides how to meet the data storage requirements of the largest data processing systems and commercial web sites and provide data storage services to an individual or small business.

### 4.1 SQL Server 2000 Components

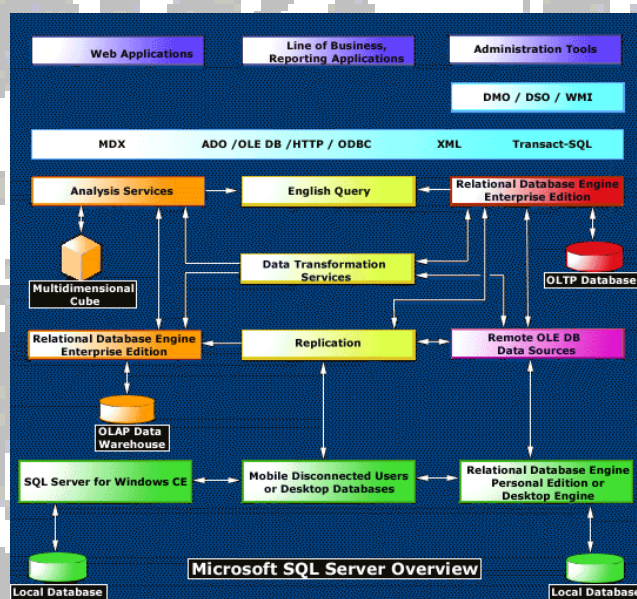
The SQL Server 2000 relational database engine is a scalable, reliable engine for storing data. The database engine stores data in tables. Each table represents some object of interest to the organization, such as vehicles, employees, or customers.

Each table has:

Columns	Represent an attribute of the object modeled by the table, such as weight, name, or cost.
Rows	Represent a single occurrence of the type of object modeled by the table.

Applications can submit Structured Query Language (SQL) statements to the database engine, which returns the results to the application in the form of a tabular result set. The specific dialect of SQL supported by SQL Server is called Transact-SQL.

Applications can also submit either SQL statements or XPath queries and request that the database engine return the results in the form of an XML document.



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## 4.2 Application Support

Both the relational database engine and Analysis Services provide native support for the common Windows DNA or Win32 data access interfaces, such as ActiveX Data Objects (ADO), OLE DB, and Open Database Connectivity (ODBC).

Applications can use any of these application programming interfaces (APIs) to send SQL or XML statements to the relational database engine using a native OLE DB provider or ODBC driver.

SQL Server 2000 provides the ability to use HTTP to send SQL or XML statements to the relational database engine. Applications can use the multidimensional extensions of either ADO or OLE DB to send Multidimensional Expressions - MDX queries to Analysis Services. Interactive query tools, such as Query Analyzer, provide templates, interactive debuggers, and interactive test environments that speed the ability of your programmers to deliver SQL Server applications.

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## 4.3 Graphical Administration Tools

SQL Server 2000 provides a full set of easy to use, graphical administration tools and wizards for creating, configuring, and maintaining databases, data warehouses, and data marts. The administration APIs used by the SQL Server tools, provides the capability for incorporating SQL Server administration functionality directly into the applications.

The SQL Server administration APIs include:

SQL-DMO	SQL Distributed Management Objects	A set of COM objects that encapsulates the administration functions for all of the entities in the relational database engine and databases.
DSO	Decision Support Objects	A set of COM objects that encapsulates the administration functions for all of the entities in Analysis Services engine and multidimensional cubes.
WMI	Windows Management Instrumentation	SQL Server 2000 provides a SQL Server WMI provider that lets WMI applications get information on SQL Server databases and instances.

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## 4.4 Replication

SQL Server 2000 replication allows sites to maintain multiple copies of data on different computers in order to improve overall system performance while at the same time making sure the different copies of data are kept synchronized.

Several mobile disconnected users can disconnect from the network, work throughout the day, and at the end of the day use merge replication to merge their work records back into the main database. These workers can be using SQL Server Personal Edition on notebook or laptop computers, or using SQL Server for Windows CE on Windows CE devices. All are supported by SQL Server replication. SQL Server replication also supports replicating data to data warehouses, and can replicate data to or from any data source that supports OLE DB access.

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## 4.5 DTS: Data Transformation Services

SQL Server 2000 Data Transformation Services greatly improves the process of building OLAP data warehouses. Large OLTP databases are finely tuned to support the entry of thousands of business transactions at the same time. OLTP databases are also structured to record the details of every transaction.

Data warehouses and data marts are built from the data in one or more OLTP systems that is extracted and transformed into something more useful for OLAP processing. OLTP detail rows are periodically pulled into a staging database, where they are summarized and the summary data is stored in a data warehouse or data mart.

Data Transformation Services supports extracting data from one source of data, performing sometimes complex transformations of the data, and then storing the summarized, transformed data in another data source. The component simplifies the process of extracting data from multiple OLTP systems and building it into an OLAP data warehouse or data mart.

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## 4.6 SQL Server 2000 English Query

SQL Server 2000 English Query makes it possible to build applications that can customize themselves to ad hoc user questions. An English Query administrator defines for the English Query engine all of the logical relationships between the tables and columns of a database or the cubes in a data warehouse or data mart. An application can then present the user with a box where a character string can be entered with a question written in English about the data in the database or data warehouse.

The application passes the string to the English Query engine, which analyzes the string against the relationships defined between the tables or cubes. English Query then returns to the application a SQL statement or MDX query that will return the answer to the user's question.

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## 5 New in Microsoft SQL Server 2000

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### 5.1 OLAP to Analysis Services

Microsoft SQL Server 2000 extends and renames the former OLAP Services component, now called Analysis Services. Analysis Services introduces data mining, which can be used to discover information in OLAP cubes and relational databases.

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### 5.2 Meta Data Services

Microsoft SQL Server 2000 Meta Data Services extends and renames the former repository component known as Microsoft Repository.

Meta Data Services extends repository technology by introducing a:

- C Browser for viewing data in a repository database.
- C XML - Extensible Markup Language interchange support.
- C New repository engine features.

Meta Data Services provides facilities for storing, viewing, and retrieving descriptions of the objects in the applications and system. Meta Data Services supports the MDC Open Information Model (OIM) specification defining a common format for storing descriptions of entities such as tables, views, cubes, or transformations, as well as the relationships between these entities.

Application development tools that support OIM can use these descriptions to facilitate rapid development and interchange with other tools and applications. SQL Server components, such as Data Transformation Services packages and Analysis Services databases, can also be stored in the Meta Data Services repository.

### 5.3 Relational Database Enhancements

Microsoft SQL Server 2000 introduces several server improvements and new features:

Enhancement	Description
XML Support	The relational database engine can return data as Extensible Markup Language (XML) documents. XML can also be used to insert, update, and delete values in the database.
Federated Database Servers	SQL Server 2000 supports enhancements to distributed partitioned views that allows tables to be partitioned horizontally across multiple servers.
User-Defined Functions	The programmability of Transact-SQL can be extended by creating own Transact-SQL functions. A user-defined function can return either a scalar value or a table.
Indexed Views	Indexed views can improve the performance of an application where queries frequently perform certain joins or aggregations. An indexed view allows indexes to be created on views, where the result set of the view is stored and indexed in the database.
New Data Types	There are three new data types. <ul style="list-style-type: none"> <li>C     bigint is an 8-byte integer type.</li> <li>C     sql_variant is a type that allows the storage of data values of different data types.</li> <li>C     table is a type that allows applications to store results temporarily for later use. It is supported for variables, and as the return type for user-defined functions.</li> </ul>
INSTEAD OF and AFTER Triggers	INSTEAD OF triggers are executed instead of the triggering action. They can also be defined on views, in which case they greatly extend the types of updates a view can support.  AFTER triggers fire after the triggering action. SQL Server 2000 has the ability to specify which AFTER triggers fire first and last.
Cascading Referential Integrity Constraints	The actions SQL Server 2000 takes when attempting to update or delete a key to which existing foreign keys point can be controlled. It is controlled by the new ON DELETE and ON UPDATE clauses in the REFERENCES clause of the CREATE TABLE and ALTER TABLE statements.
Collation Enhancements	SQL Server 2000 replaces code pages and sort orders with collations. Collations can be specified at the database level or at the column level.
Full-Text Search Enhancements	Full-text search includes change tracking and image filtering.

Enhancement	Description
Multiple Instances of SQL Server	SQL Server 2000 supports running multiple instances of the relational database engine on the same computer. Each computer can run one instance of the relational database engine from SQL Server version 6.5 or 7.0, along with one or more instances of the database engine from SQL Server 2000.
Index Enhancements	Indexes can be created on computed columns. Indexes can be specified as built in ascending or descending order, and whether the database engine should use parallel scanning and sorting during index creation.
Failover Clustering Enhancements	<p>The administration of failover clusters has been improved to make it easier to install, configure, and maintain a Microsoft SQL Server 2000 failover cluster.</p> <p>Additional enhancements include the ability to failover and failback to or from any node in a SQL Server 2000 cluster, the ability to add or remove a node from the cluster through SQL Server 2000 Setup, and the ability to reinstall or rebuild a cluster instance on any node in the cluster without affecting the other cluster node instances.</p>
Net-Library Enhancements	<p>The SQL Server 2000 Net-Libraries have been rewritten thereby greatly reducing the need to administer Net-Library configurations on client computers when connecting SQL Server 2000 clients to instances of SQL Server 2000.</p> <p>The new Net-Libraries also support connections to multiple instances of SQL Server on the same computer, and support Secure Sockets Layer encryption over all Net-Libraries.</p>
64-GB Memory Support	Microsoft SQL Server 2000 Enterprise Edition can use the Microsoft Windows 2000 Advanced Windows Extension (AWE) API to support up to 64 GB of physical memory (RAM) on a computer.
Distributed Query Enhancements	SQL Server 2000 introduces a OPENDATASOURCE function, which can be used to specify ad hoc connection information in a distributed query. SQL Server 2000 also specifies methods that OLE DB providers can use to report the level of SQL syntax supported by the provider and statistics on the distribution of key values in the data source.
Updatable Distributed Partitioned Views	Enhancements have been made to distributed partitioned views. Tables can be partitioned horizontally across several servers, and define a distributed partitioned view on each member server that makes it appear as if a full copy of the original table is stored on each server.
Kerberos and Security Delegation	SQL Server 2000 uses Kerberos to support mutual authentication between the client and the server, as well as the ability to pass the security credentials of a client between computers.
Backup and Restore Enhancements	There is a new model for specifying backup and restore options. Support is included for recovery to specific points of work using named log marks in the transaction log, and the ability to do partial database restores.

Enhancement	Description
Scalability Enhancements for Utility Operations	SQL Server 2000 enhancements for utility operations include faster differential backups, parallel Database Console Command (DBCC) checking, and parallel scanning.
Text in Row Data	SQL Server 2000 supports a text in row table option that specifies that small text, ntext, and image values be placed directly in the data row instead of in a separate page.

## 5.4 Graphical Administration Enhancements

Microsoft SQL Server 2000 introduces these graphical administration improvements and new features:

Log Shipping	Log shipping allows the transaction logs from a source database to be continually backed up and loaded into a target database on another server.
SQL Profiler Enhancements	<p>SQL Profiler supports size-based and time-based traces, and includes events for Data File Auto Grow, Data File Auto Shrink, Log File Auto Grow, Log File Auto Shrink, Show Plan All, Show Plan Statistics, and Show Plan Text.</p> <p>Auditing of SQL Server activities has been enhanced up to the auditing levels required by the C2 level of security defined by the United States government.</p>
SQL Query Analyzer Enhancements	SQL Query Analyzer now includes Object Browser, which affords the capability to navigate and obtain information about database objects, including user and system tables, views, stored procedures, extended stored procedures, and functions. The Object Browser also supports generating scripts to either execute or create objects.
Copy Database Wizard	Users can run the Copy Database Wizard to upgrade SQL Server version 7.0 databases to SQL Server 2000 databases. It can also be used to copy complete databases between instances of SQL Server 2000.

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## 5.5 English Query Enhancements

English Query introduces new features such as:

- C Greater integration with Microsoft Visual Studio, Analysis Services, and Full-Text Search.
- C A graphical user interface for English Query authoring.
- C The SQL Project Wizard.
- C An XML-based language for persisting English Query model information.

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## 6 Microsoft Environment

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### 6.1 Clients

Microsoft SQL Server 2000 supports the following clients:

C	Windows NT Workstation	C	Windows 2000 Professional	C	Windows 98
C	Windows 95	C	Apple Macintosh	C	OS/2
C	UNIX				

Macintosh, OS/2, and UNIX do not support the SQL Server graphical tools and require ODBC client software from a third-party vendor.

Some Microsoft products require Service Release or Service Packs to operate correctly with SQL Server 2000.

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### 6.2 Access 2000

Microsoft Access 2000 requires the installation of either Microsoft Office 2000 Service Release 1 (SR1) or Access 2000 SR1 to operate correctly with SQL Server 2000.

SR1 allows Access 2000 to:

- C Test automatic data processing (ADP) applications against SQL Server 2000.
- C Alter database diagrams, stored procedures, table designs, or view designs, but you the changes cannot be saved. A future Access Service Release will allow limited ability to save changes.

The Access 2000 Create Database Wizard cannot successfully create a SQL Server 2000 database. A work around this is creating the database using SQL Server Enterprise Manager, and then create an ADP for the database using the Project (Existing Database) option on the New dialog box in Access 2000.

The Access 2000 Upsizing Wizard does not support upsizing to SQL Server 2000. A work around this limitation is to use Data Transformation Services in the Enterprise Manager to import the MDB database file into SQL Server. The MDB tables then have to be renamed and linked tables have to be created to the resulting SQL Server database with the same names as the original MDB table names.

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### 6.3 Visual Studio 6.0

Microsoft Visual Studio 6.0 cannot be used to access database diagrams, stored procedures, table designs, or view designs in SQL Server 2000.

Visual Studio 6.0 Service Pack 4 allows the following to be altered:

- database diagrams
- stored procedures
- table designs
- view designs

However they can not be saved; A future Service Pack will allow a limited ability to save changes.

The SQL Server 2000 tools cannot access database diagrams saved using the design tools in Visual Studio 6.0 until the dtproperties table in the database is modified.

## 7 System Databases and Data

Microsoft SQL Server 2000 systems have four system databases:

master	<p>The master database records all of the system level information for a SQL Server system. It records all login accounts and all system configuration settings.</p> <p>master is the database that records the existence of all other databases, including the location of the database files. master records the initialization information for SQL Server; always have a recent backup of master available.</p>
tempdb	<p>tempdb holds all temporary tables and temporary stored procedures. It also fills any other temporary storage needs such as work tables generated by SQL Server.</p> <p>tempdb is a global resource; the temporary tables and stored procedures for all users connected to the system are stored there.</p> <p>tempdb is re-created every time SQL Server is started so the system starts with a clean copy of the database. Since temporary tables and stored procedures are dropped automatically on disconnect, and no connections are active when the system is shut down, there is never anything in tempdb to be saved from one session of SQL Server to another.</p>
model	<p>The model database is used as the template for all databases created on a system. When a CREATE DATABASE statement is issued, the first part of the database is created by copying in the contents of the model database, then the remainder of the new database is filled with empty pages.</p> <p>Since tempdb is created every time SQL Server is started, the model database must always exist on a SQL Server system.</p>
msdb	<p>The msdb database is used by SQL Server Agent for scheduling alerts and jobs, and recording operators.</p>

In SQL Server 2000 and SQL Server version 7.0, every database, including the system databases, has its own set of files and does not share those files with other databases.

Database file	Physical file name	Default size, typical setup
master primary data	Master.mdf	11.0 MB
master log	Mastlog.ldf	1.25 MB
tempdb primary data	Tempdb.mdf	8.0 MB
tempdb	log Templog.ldf	0.5 MB
model primary data	Model.mdf	0.75 MB
model log	Modellog.ldf	0.75 MB
msdb primary data	Msdbdata.mdf	12.0 MB
msdb log	Msdblog.ldf	2.25 MB

The sizes of the files may vary slightly for different editions of SQL Server 2000.

Each database in SQL Server 2000 contains system tables recording the data needed by the SQL Server components. The successful operation of SQL Server depends on the integrity of information in the system tables; therefore, Microsoft does not support users directly updating the information in the system tables.

Microsoft provides administrative tools that allow users to administer their system and manage all users and objects in a database.

- C Users can use the administration utilities, such as SQL Server Enterprise Manager, to directly manage the system.
- C Programmers can use the SQL-DMO API to include complete functionality for administering SQL Server in their applications. Programmers building Transact-SQL scripts and stored procedures can use the system stored procedures and Transact-SQL DDL statements to support all administrative functions in their systems.

Microsoft does not support triggers defined on the system tables; they may alter the operation of the system.