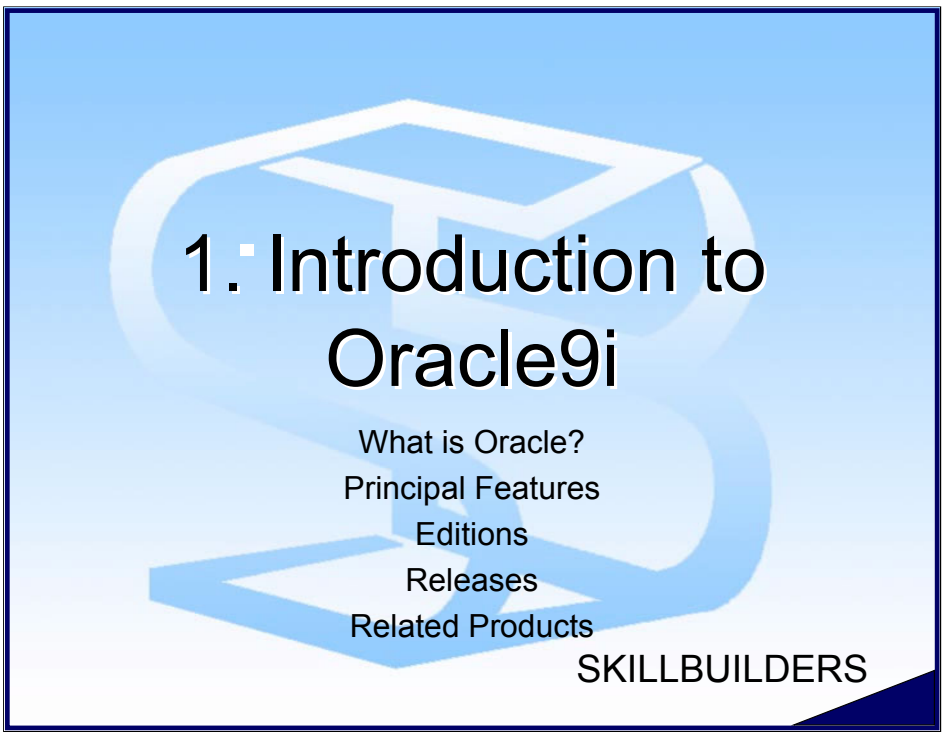
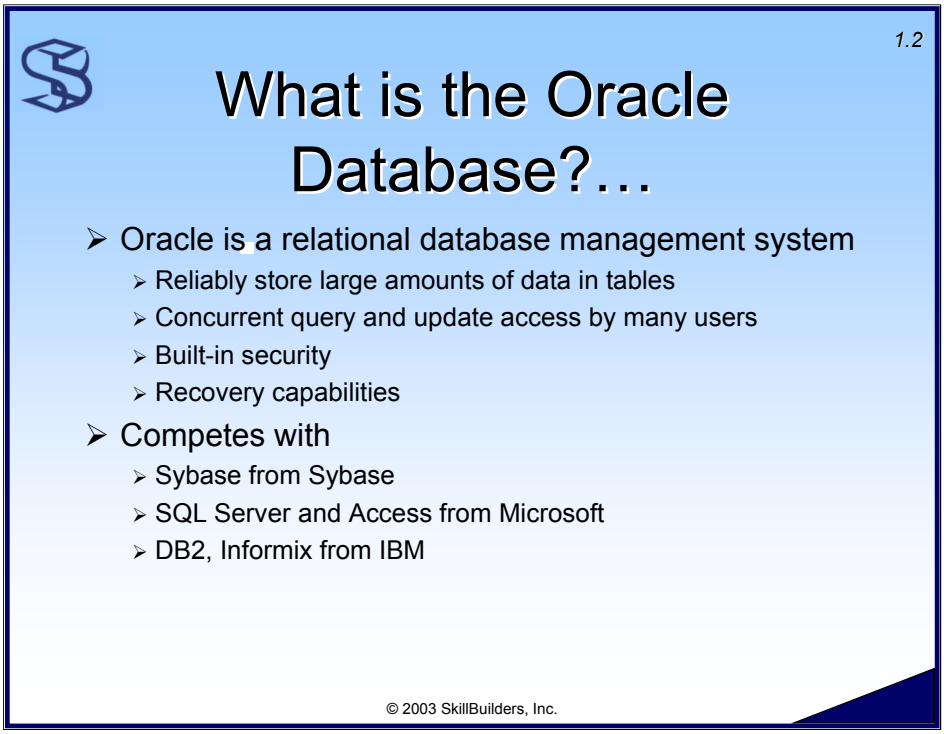

1. Introduction to Oracle9i
What is Oracle?
Principal Features
Editions
Releases
Related Products
SKILLBUILDERS

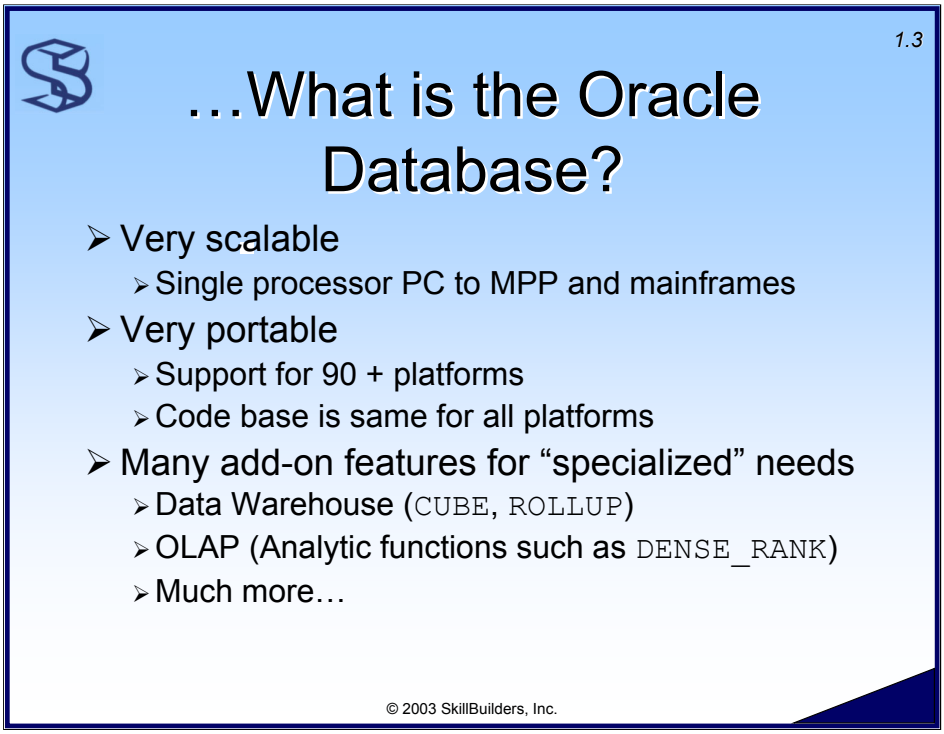


The Oracle Database is the flagship product of Oracle Corporation. First released in 1979, it is a multi-user relational database management system for small or large systems.

All multi-user database products generally provide the following functionality:

- Reliably store large amounts of data in tables
- Concurrent query and update access by many users
- Built-in security
- Recovery capabilities

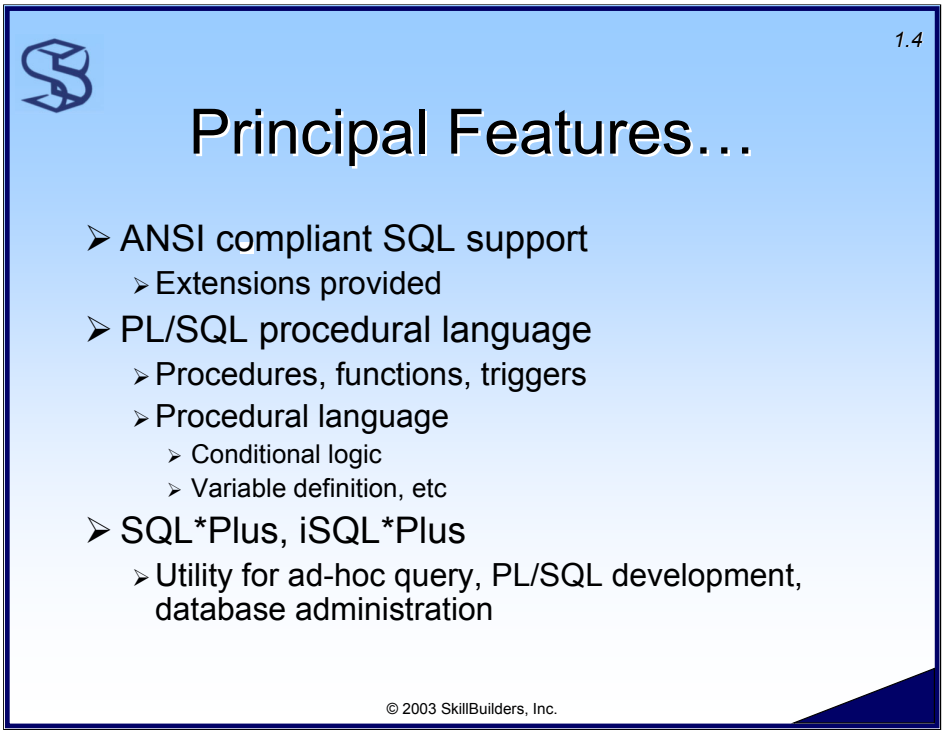
Oracle is in the same market space as DB2, Sybase, SQL Server and a few other products.



The Oracle database is very scalable. Oracle applications can scale from a mobile computing device to a massively parallel system running the new Oracle9i feature Real Application Clusters (formerly called Oracle Parallel Server).

Since the code base is the same across all platforms, applications written on one Oracle platform are easily ported to another platform. Oracle is provided on over 90 hardware/software platforms including Unix, Linux, Windows, and mainframe.

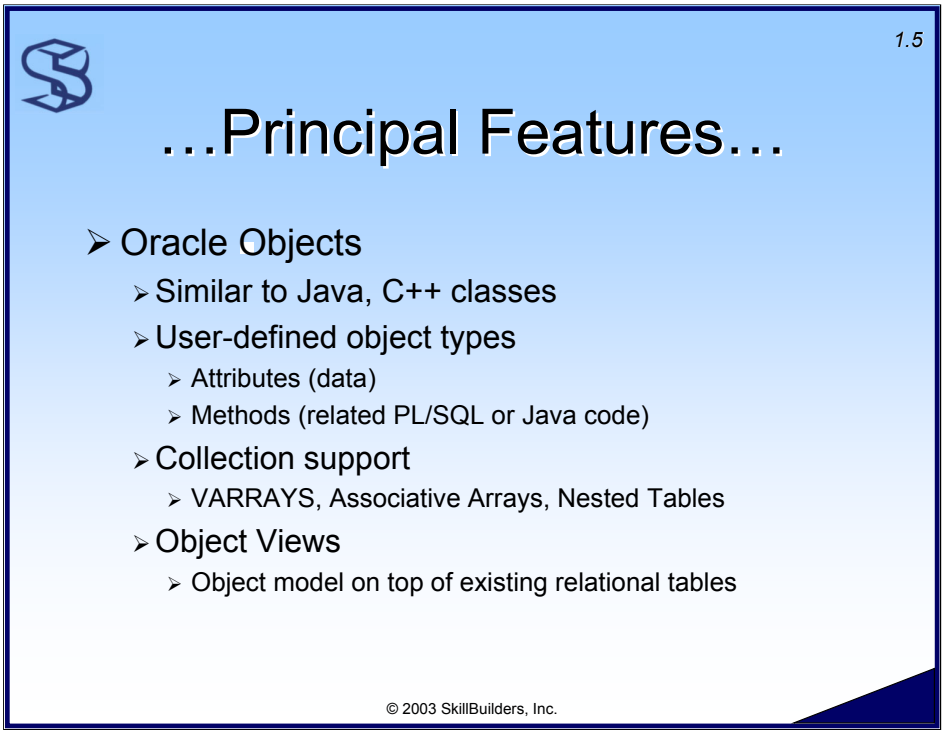
Oracle Corp has bundled many built-in and optional (extra cost) features that extend the usability of the database into specialized areas such as Data Warehousing and OLAP.



As with most relational database vendors, Oracle supports ANSI standard SQL, but adds its' own proprietary extensions. Even the standard SQL `SELECT` statement has its' extensions. For example, Oracle provides `CONNECT BY` for reporting-type queries against hierarchical data and the `NOWAIT` option to avoid waiting for exclusive lock access.

An important extension is PL/SQL, formally called Procedural Language Extensions to SQL. It is a 4th generation language that we use to write database procedures, functions and triggers. (Note that Oracle8i and up also supports Java for this purpose.) As a 4GL, it provides conditional logic (e.g. IF statement), variable definition and assignment, looping and branching constructs.

One of the standard tools that is provided with Oracle is SQL*Plus. It is used for ad-hoc query, database administration and PL/SQL development. SQL*Plus is often called the "query tool", though is supports all SQL statements. It is a ubiquitous "free" utility (shipped with all editions and releases of the Oracle database), and thus is required learning. Its use is covered in detail in the SkillBuilders Introduction to Oracle for Developers course. iSQL*Plus is a new browser-based version of SQL*Plus, introduced with Oracle9i.



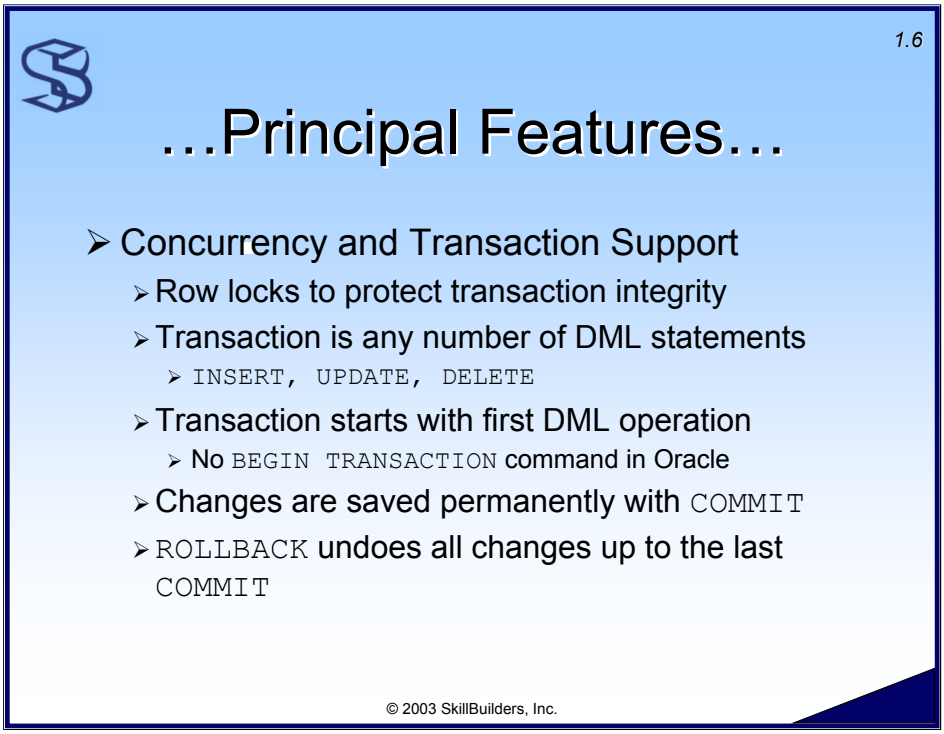
In the late 1990's, Oracle released Oracle8 (8.0). The highly visible and aggressively marketed feature in this release was support for objects. Oracle now had a Object-Relational Database (ORDBMS) to offer the marketplace.

Oracle objects are roughly similar to classes in Java and C++ languages. An Oracle object contains attributes (data) and methods (program code tied to the object that acts upon the object). An example of a method would be a constructor method that adds a new instance of the object.

Oracle also supports three types of collections: associative arrays, varrays and nested tables.

Using Oracle objects is not an all or nothing proposition. You can choose to build an object model on top of an existing relational model. Object views is designed for this purpose; I.e creating a view of an Object model on top of an existing relational table.

However, support for objects is limited, though better with the release of Oracle9i.



A single Oracle database can support hundreds or even thousands of users, all requesting updates to data. Oracle provides row-level locking to protect one transaction from another transaction.

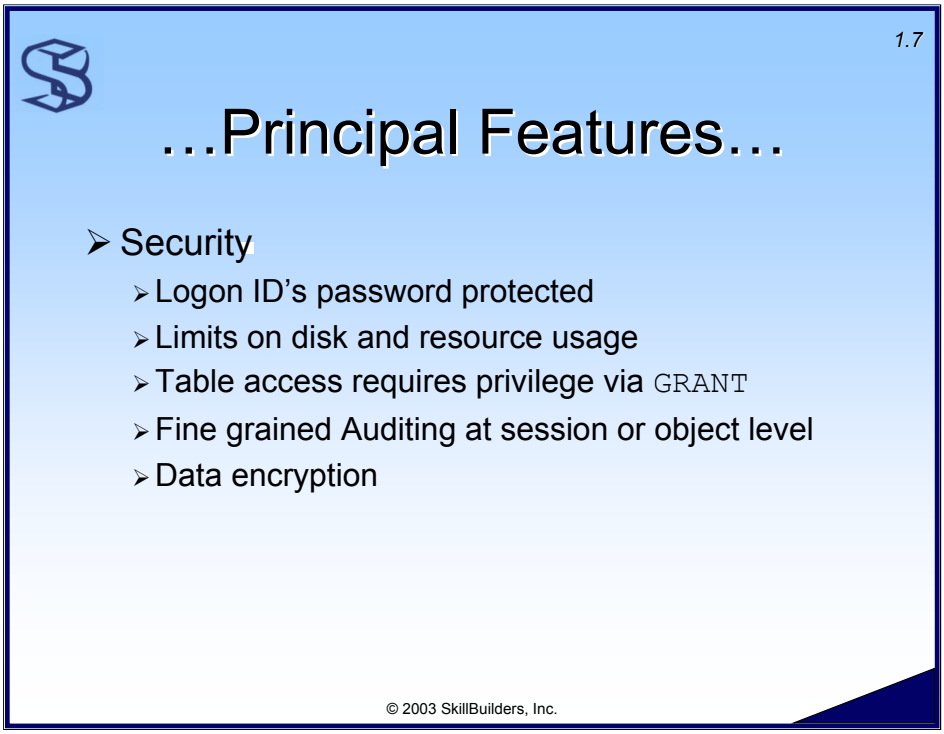
A transaction is a set of recoverable DML operations. For example, a transaction may include:

- `INSERT (start of transaction)`
- `UPDATE`
- `UPDATE`
- `DELETE`
- `INSERT`

To end the transaction, we issue:

- `COMMIT` to make the changes permanent, or
- `ROLLBACK` to undo all the changes since the start of the transaction.

Note that, in Oracle, a transaction begins with a DML statement; there is no `BEGIN TRANSACTION` command.

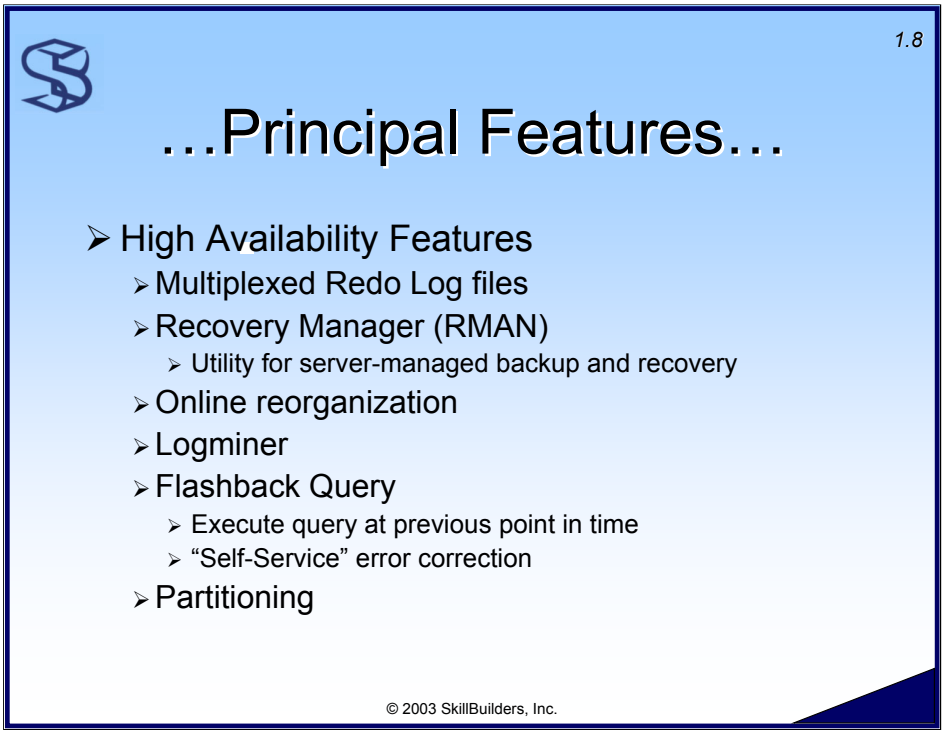


As we would expect in a multi-user database environment, Oracle provides many standard security features.

All logon userids are protected against unauthorized access either by an Oracle password or by the operating system.

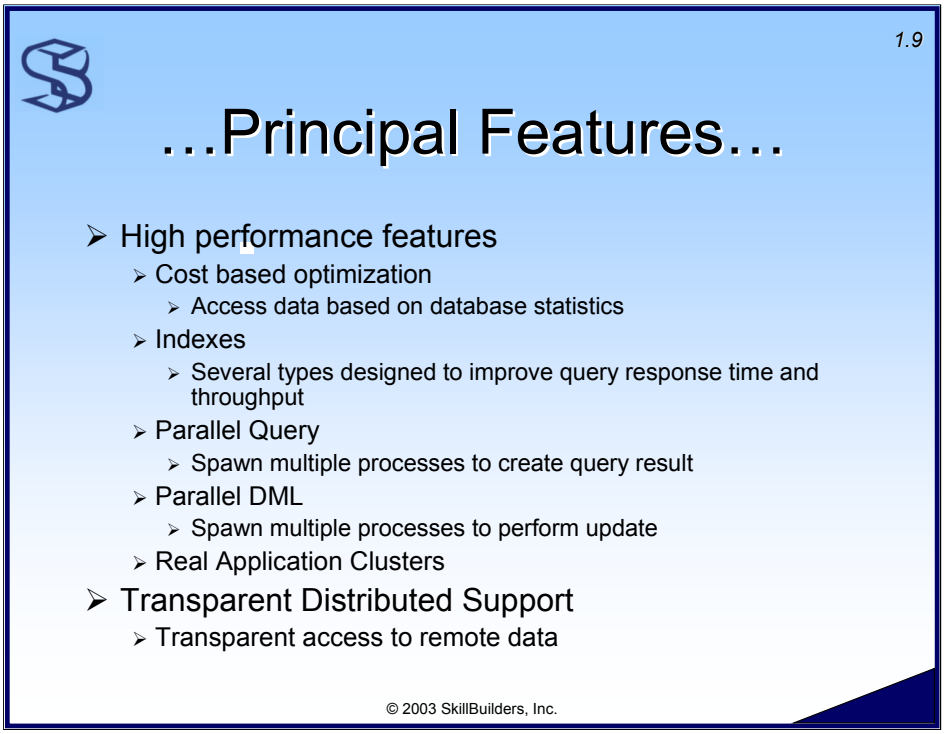
Disk and system resources such as CPU time are protected. Disk usage is governed by assigning `QUOTA` on a tablespace; CPU resources are governed with profiles or with the Database Resource Manager.

Once logged into the database, privileges are needed to do anything. For example, to query a table created by another user, you will require `SELECT` privilege on that object. That can be granted by the object owner with a `GRANT` statement. Conversely, it can be taken away with the `REVOKE` statement.



Oracle provides many standard high availability features. These include:

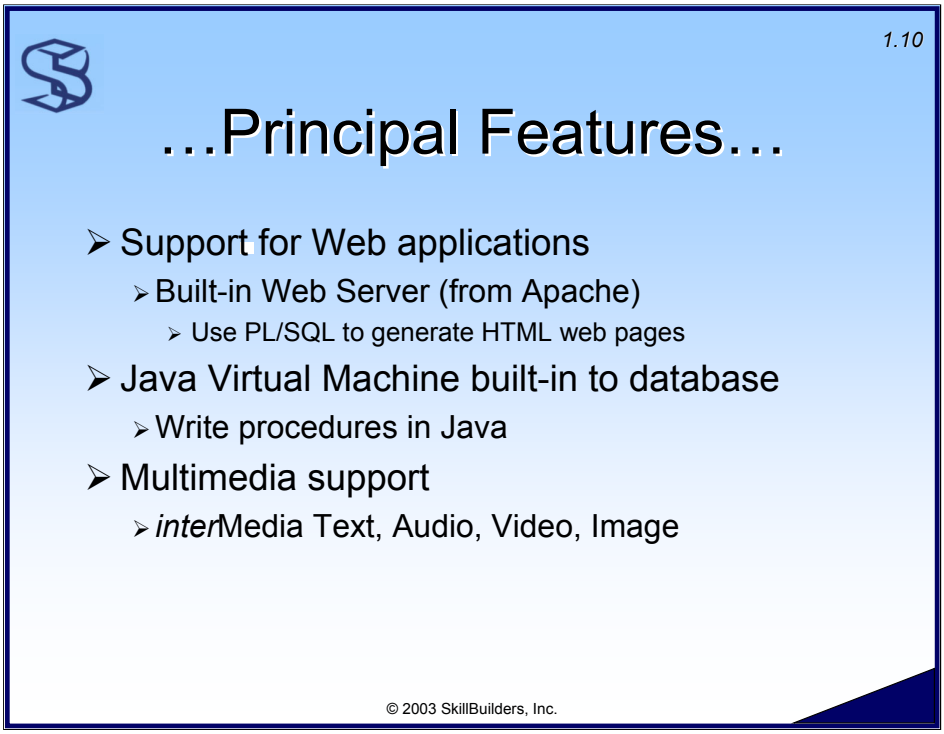
- Multiplexed Redo Log files – All committed transactions are secure in the redo log file. Database (instance) failure is recoverable by applying committed transactions from the redo log files.
- Recovery Manager – RMAN is a built-in utility for server-managed backup and recovery.
- Online reorganization – Oracle has been providing limited online operations since release 8.0. 9i provides an advance in this area with the introduction of `DBMS_REDEFINITION` for complete online table redefinition.
- Logminer – Logminer is another built-in utility that provides the ability to "look inside" the redo logs, to see activity that has transpired in the database. Both `REDO` and `UNDO` SQL can be mined from the logs using Logminer.
- Flashback Query – This feature allows you to execute a query at previous point in time. By loading a table from a query run while in flashback query mode, we are provided "self-service" error correction capability.
- Partitioning – By dividing up large logical tables into smaller physical partitions (transparent to applications), we gain the ability to maintain pieces of the object , while leaving other partitions available for general use.



Oracle will support query and update activity on very large databases. In order to accomplish this, many high performance features are built-in. These include:

- Cost Based Optimization – Oracle comes with a query optimizer that automatically and transparently optimizes the query access path based on database statistics such as object size.
- Indexes – Much like the index in a text book helps you find a specific item in the book, a database index is an object that helps find a row in a table. Oracle provides several index types, each designed for a different type of access or type of data. These include B-Tree, bitmap and function-based indexes.
- Parallel Query and Parallel DML – Parallel Query allows a single SQL statement to be processed by several server processes, thus reducing overall response time. This is excellent for I/O intensive operations.
- Real Application Clusters – This feature, formerly called Oracle Parallel Server, allows many servers (instances) to access the same set of database files, allowing the processing load to be distributed across many machines.

Oracle supports distributed database, meaning that one can access a table (query or update) on a remote server. Transparency is achieved via database objects called `SYNONYMS` and `DATABASE LINKS`.



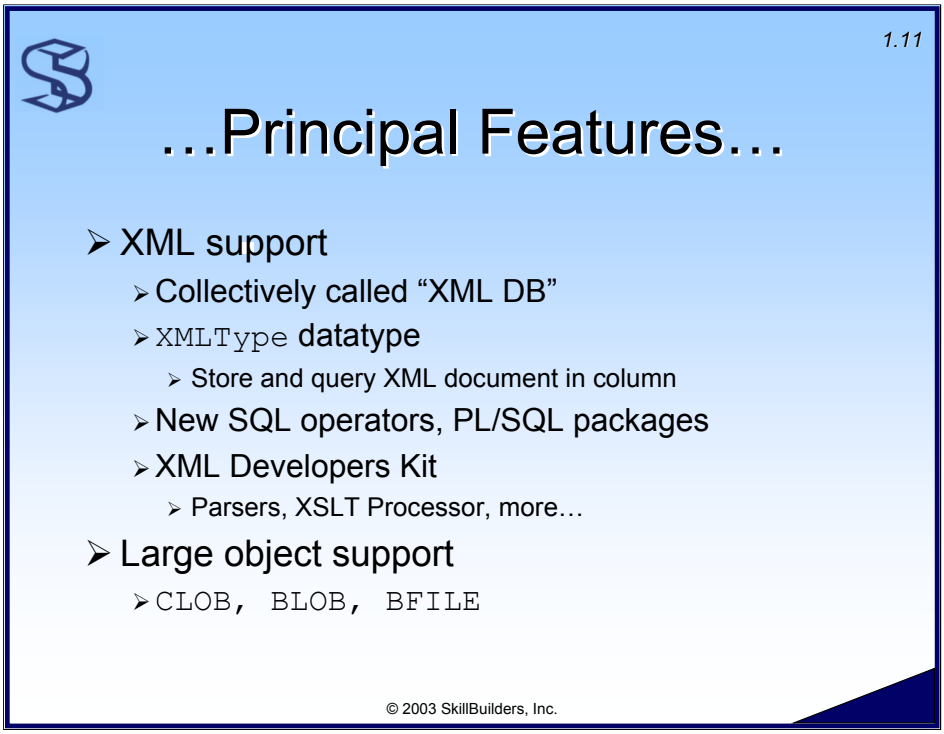
After releasing Oracle8 (8.0), Oracle Corp indicated that the Internet was the key to its' future success. Since then the company has added new features and products designed for Internet and Web application support.

Oracle9i provides a built-in Web server from Apache. This means that PL/SQL can be used to generate dynamic Web pages that access data in the database.

Oracle also added support for Java in the database (via a Java Virtual Machine, JVM, installed in the database) and created an application server that also contained a Java virtual machine. (Large applications typically require a middle tier application server to support the business logic. Oracle provides this in the form of iAS. Note that Oracle Corp's first application server - OAS - was not very popular and has been rewritten and re-released as iAS.)

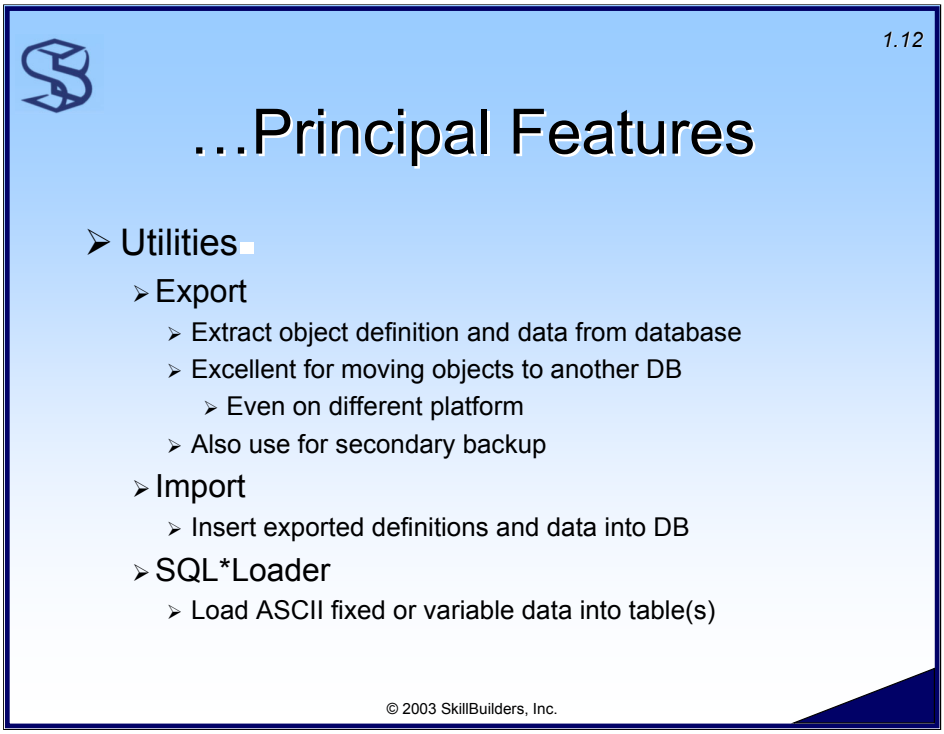
Developers can now write enterprise-strength Java applications using the Oracle product suite – Oracle9i database and iAS. These two products together will support Servlets and JSP (version 1.1 compliant - includes custom tag libraries) for the web-based front end, CORBA and EJB support in iAS, and JDBC, SQLJ and stored procedures (Java or PL/SQL) for database access (data management).

The interMedia product provides indexing and searching of text data. The interMedia Audio Image and Video product provides the storage, retrieval, management, and manipulation of multimedia data.



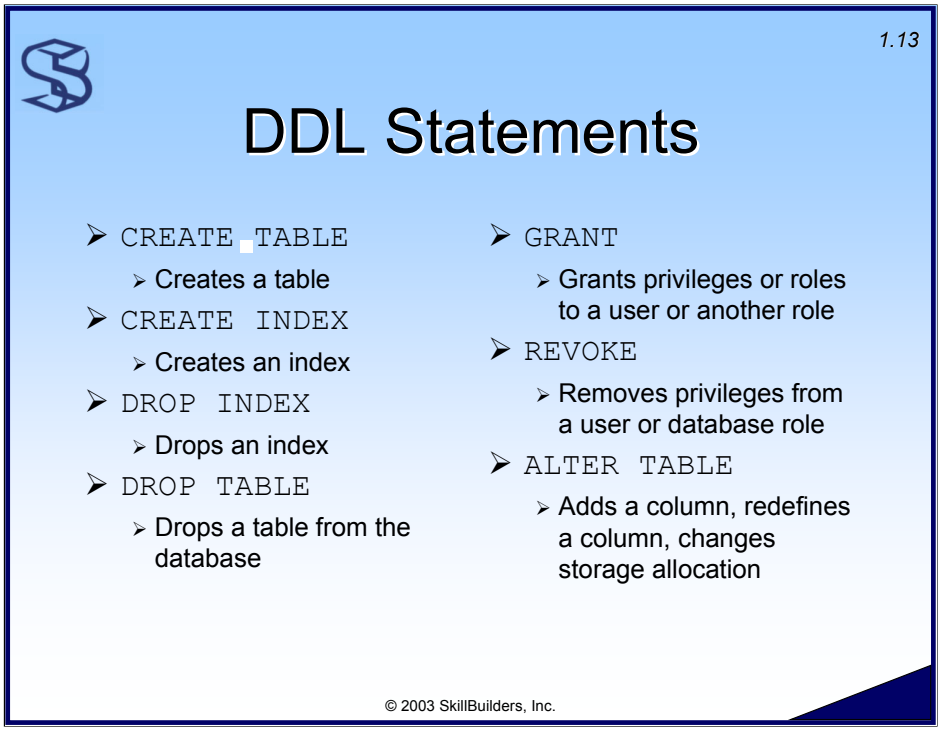
XML support is also provided in a set of features collectively called “XML DB”. XML can be stored natively in a table column defined with the datatype `XMLType`. SQL extensions and new PL/SQL packages have been added. An XML SQL Utility is provided for generating XML output from SQL or JDBC calls; an XML developers kit for Java, C++ and other languages is available. The XDK contains parsers, XSLT processors and much more.

Since Internet applications often involve multimedia datatypes, Oracle created new, more efficient built-in datatype support for character-based large objects (**`CLOBs`**) and binary large objects (**`BLOBS`**).



All editions of the Oracle database come with three utilities. They are:

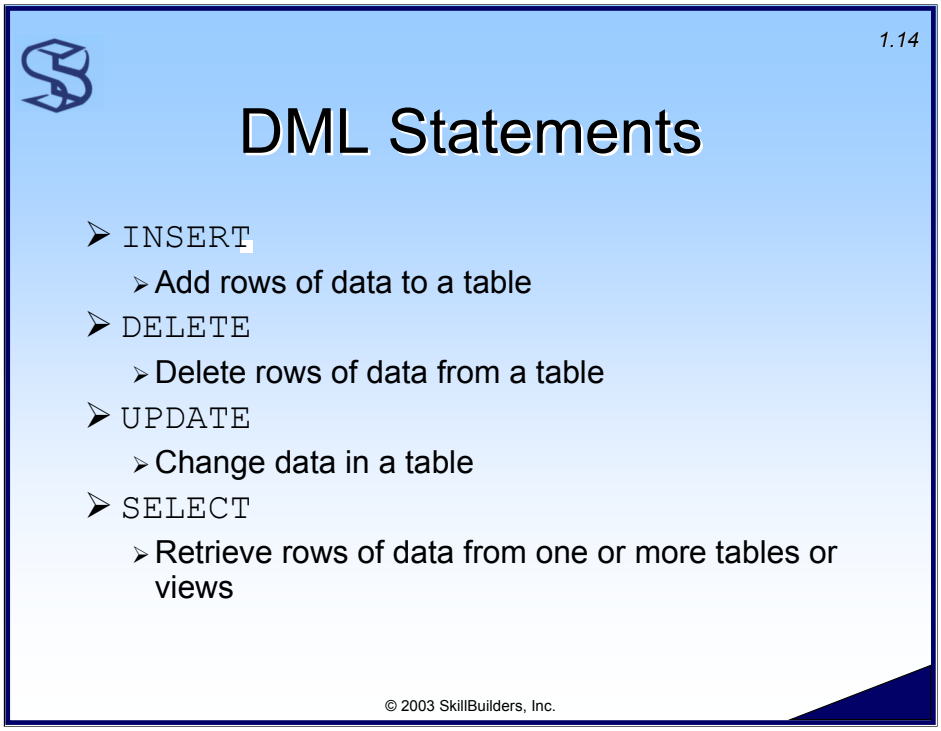
- Export – The export utility is used to extract object definitions (metadata) and data from a database. This is useful when you need to move or copy an object to another database (even on an entirely different platform) or as a secondary means of backup (consider RMAN as a primary backup utility).
- Import – The import utility can read the files created by the export utility and is used to insert objects (e.g. tables) and object data into a database.
- SQL*Loader – The SQL*Loader utility can read ASCII files containing fixed field or delimited records and load them into database tables.



Partial List of DDL Statements

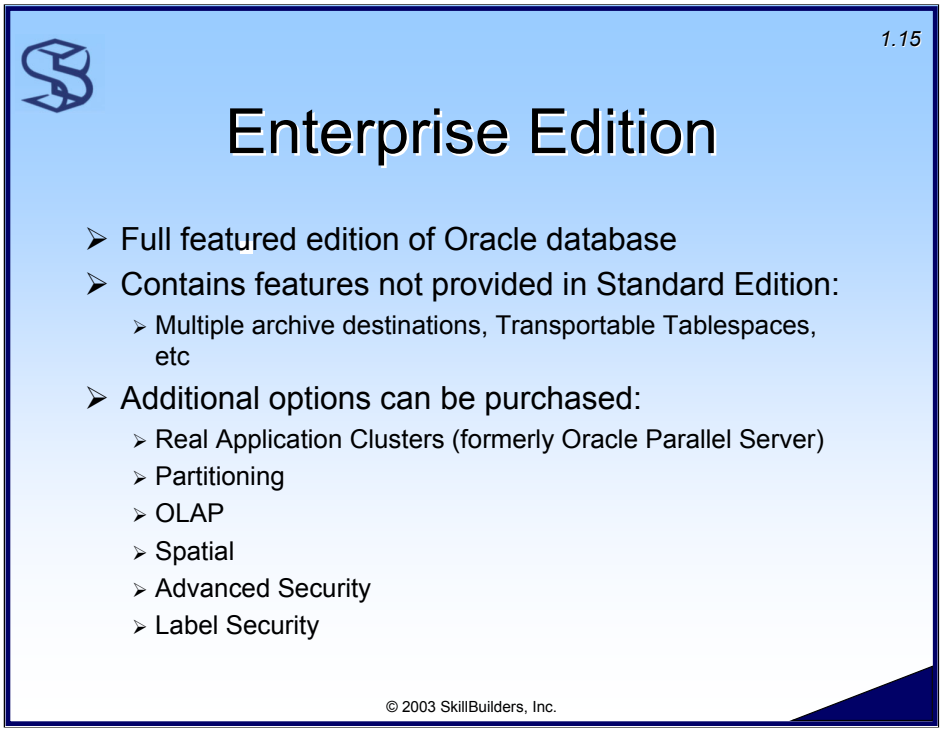
There are numerous DDL (data definition language) statements. Each DDL statement effects the definition of some object in the database.

It is important to note that DDL statements cannot be rolled back!



DML statements manipulate the data within the database. All changes are made as part of a transaction and are tentative until a COMMIT is executed.

Numerous examples of all these SQL commands can be found throughout the course.



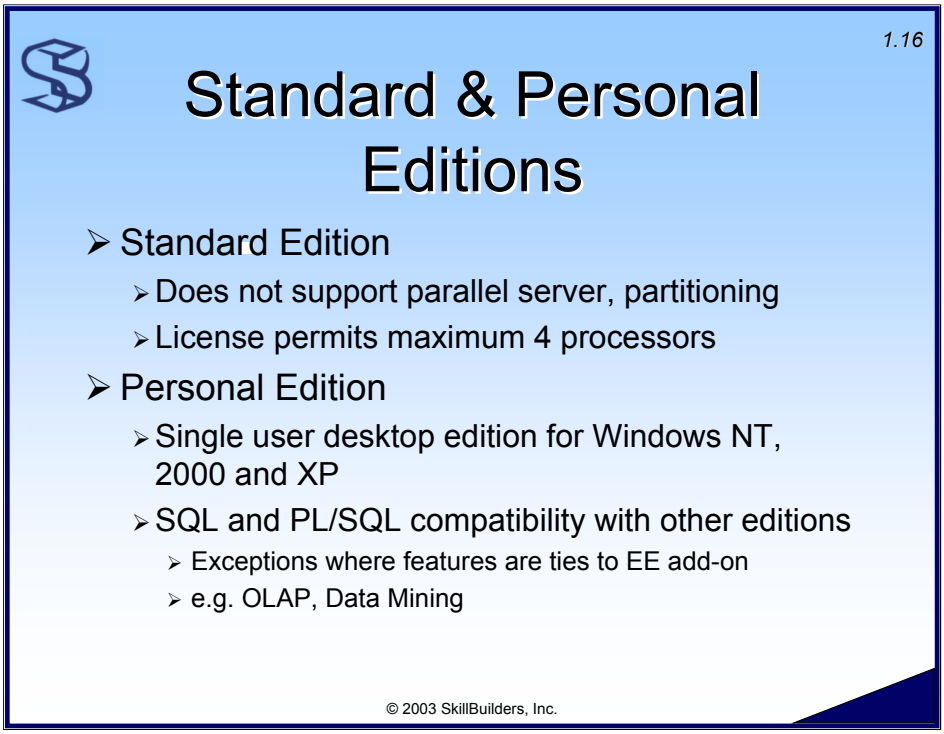
There are several different editions of the Oracle database. The are all compatible in the sense that they all support the same SQL, PL/SQL, Java and XML, but they support different scalability features and options.

The Enterprise Edition is the grand-daddy. It supports all scalability, security and performance options such as Parallel Server, Partitioning and the Advanced Security Option (for network encryption and authentication). These options will be discussed in greater detail later in this unit.

Real Application Clusters - This allows multiple instances (server processes and associated memory; see definition in next chapter) to access a single set of database files. This is useful for load balancing and failover.

Partitioning - Tables and indexes can be partitioned, meaning that a single logical table consists of more than one physical underlying object. Useful for large objects that require too much resource to query, manipulate and/or manage. Divide and conquer! This feature was introduced in Oracle 8.0.

Source: `www.oracle.com/ip/deploy/database/8i/index.html`

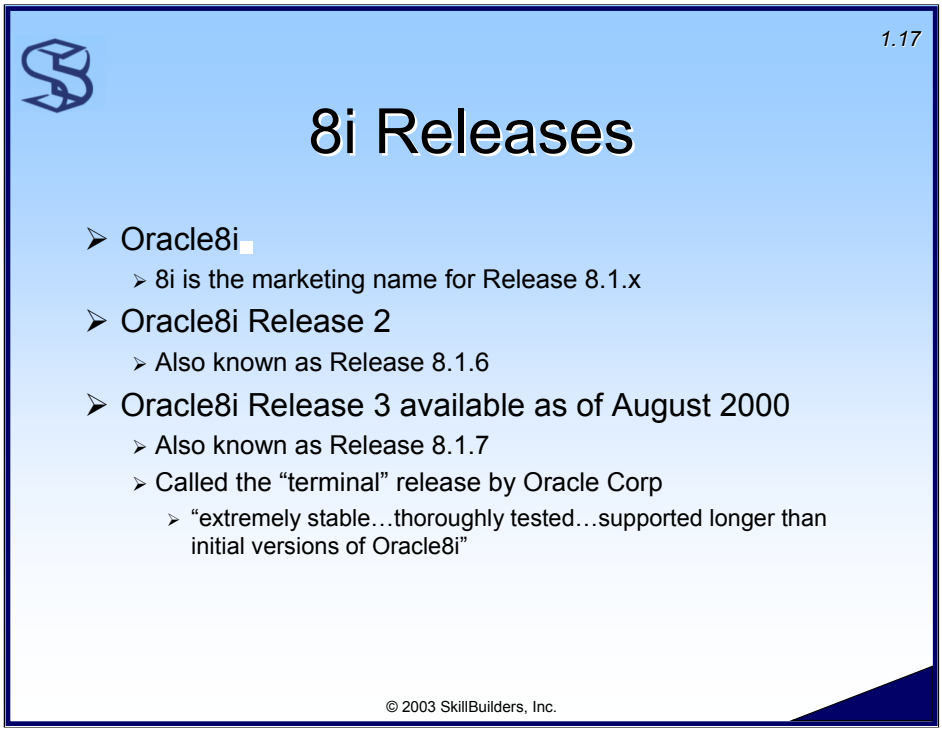


Standard Edition will not scale up as much as Enterprise Edition because it will not support Parallel Server and Partitioning. An abbreviated list of other features that Standard Edition does not support:

- Online table redefinition
- Online index coalesce
- Parallel Query
- Parallel DML
- Parallel index build
- Parallel index scans

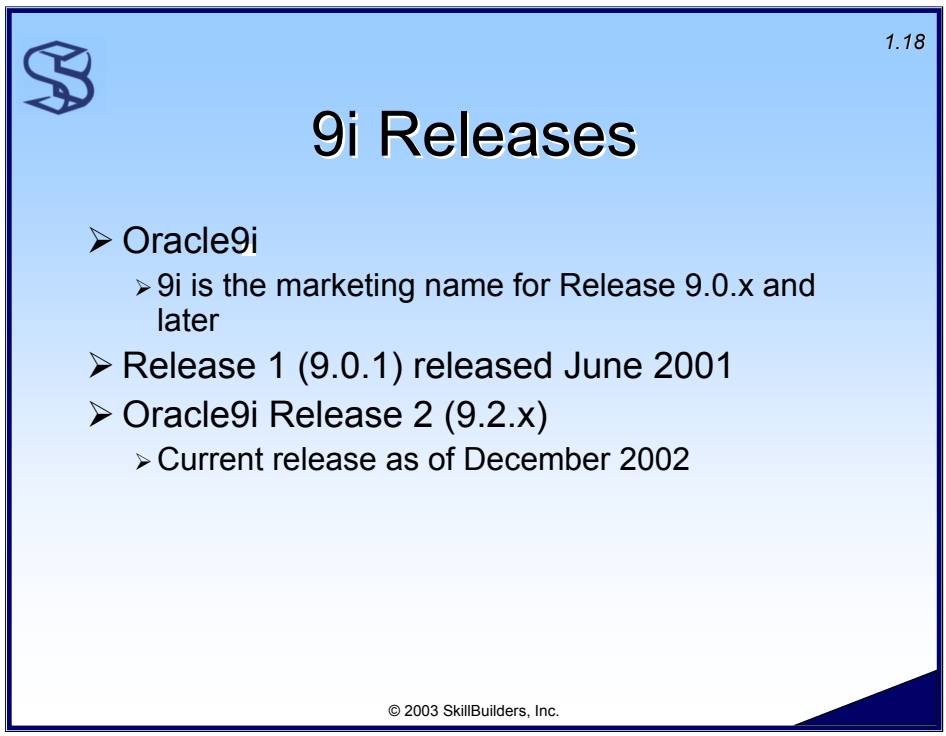
Personal Edition is a *single-user* license for desktops – Windows NT, XP and 2000. Excellent for application development and learning Oracle. Applications built with this platform can be migrated to Standard or Enterprise Edition without code changes.

Read the Oracle White Paper “Oracle9*i* Database: A Family of Database Products” found at http://otn.oracle.com/products/oracle9i/pdf/9idb_rel2_prod_fam.pdf for a complete list of features that can be found with each edition of the database.

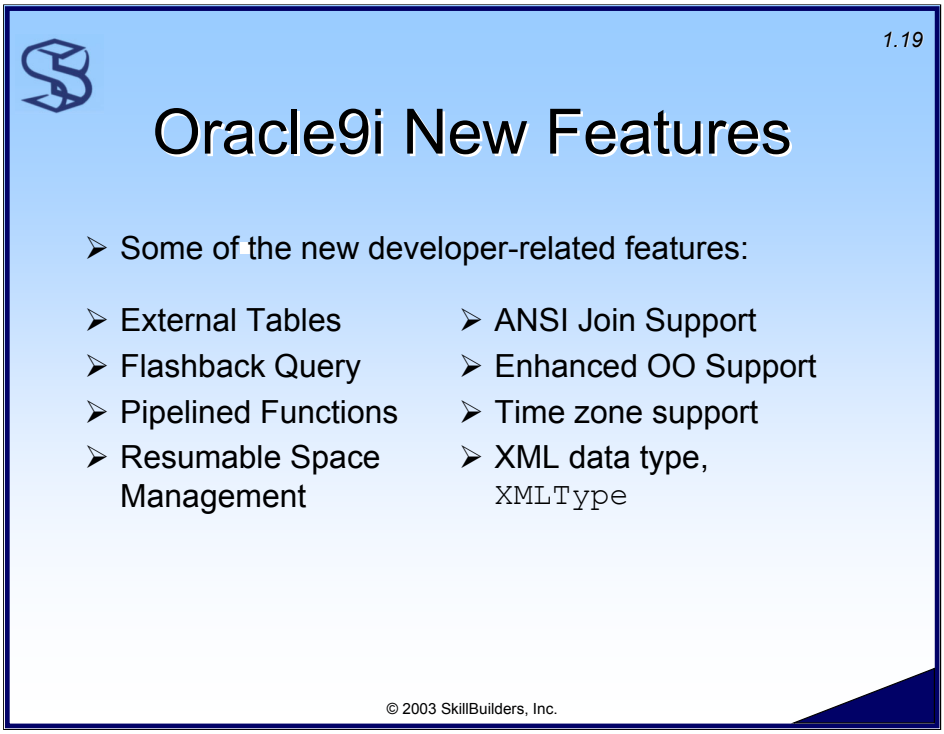


“Oracle8i” is really just Oracle Release 8.1. The “i” stands for “internet” and was added for marketing purposes; “Oracle8i is an Internet ready database!”

Release 8.1.6 is also called Release 2 - certainly only to confuse us! 8.1.7 is also called Release 3, and is said be Oracle Corp to be very stable. It is the last release in the 8 series, hence the "terminal release". Oracle will drop support for earlier versions shortly.



Oracle9i, like Oracle8i, focuses on the internet with continued support for XML and Java.



External Tables provides for read only access of flat files as if they were an Oracle table. An access driver called `ORACLE_LOADER` makes this possible.

Flashback Query lets you run a query as if it were being run in the past. You can get results as if the data were in a state at a given point in time – in the past. The `UNDO_RETENTION` parameter to make this possible.

Pipelined Functions provides the means to start returning rows (piping rows) back to the caller before the function even completes.

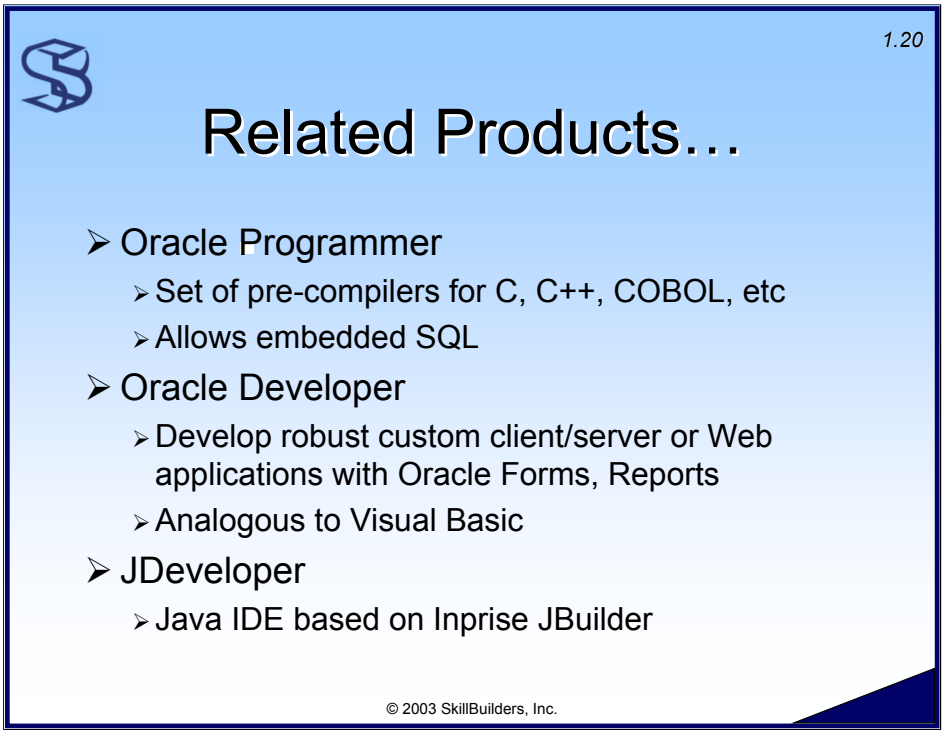
With **Resumable Space Management,** a transaction that has encountered a space allocation error is suspended for a period of time - allowing you to fix the suspend condition and eventually allowing the transaction to resume.

ANSI JOIN Support allows one to write joins conformant to SQL92 syntax. They also allow one to write 'full outer joins' something that was not easily done up to now using the old syntax.

Enhanced OO Support provides more OO support including support for type evolution and inheritance.

Time zone support is available in timestamp datatypes and functions. Oracle maintains a db and session timezone for each session.

XML datatype support provides the means to hold native XML in a column of a table.

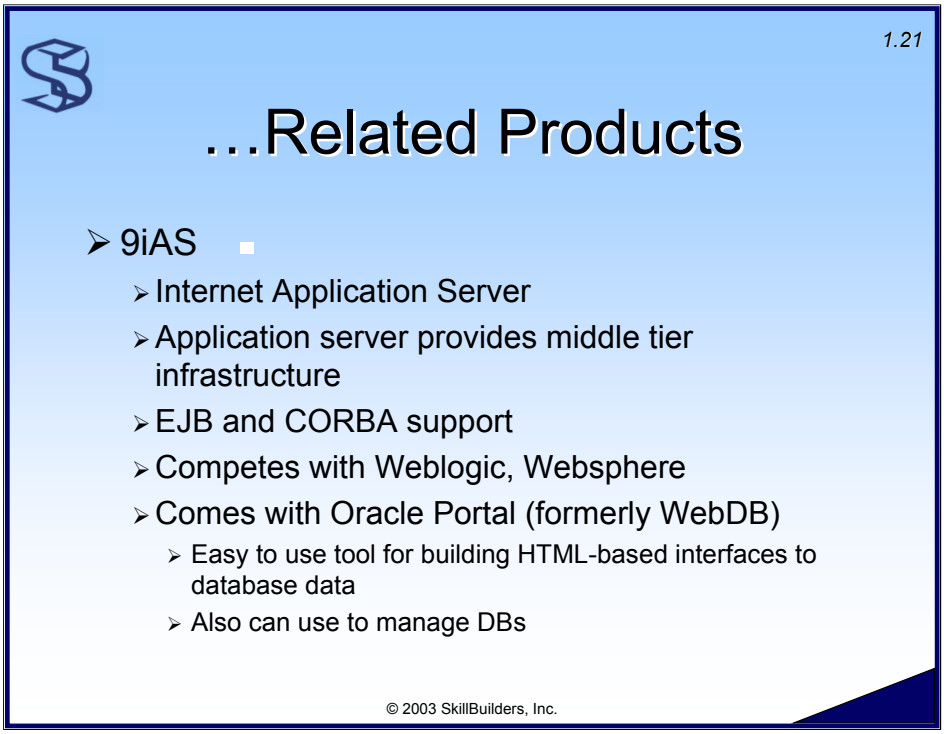


Oracle Corp provides several tools for developers (and end-users) that assist with the creation of applications.

Oracle Programmers is a set of precompilers that allow SQL statements to be directly embedded within 3rd generation languages such as C, C++ COBOL and more.

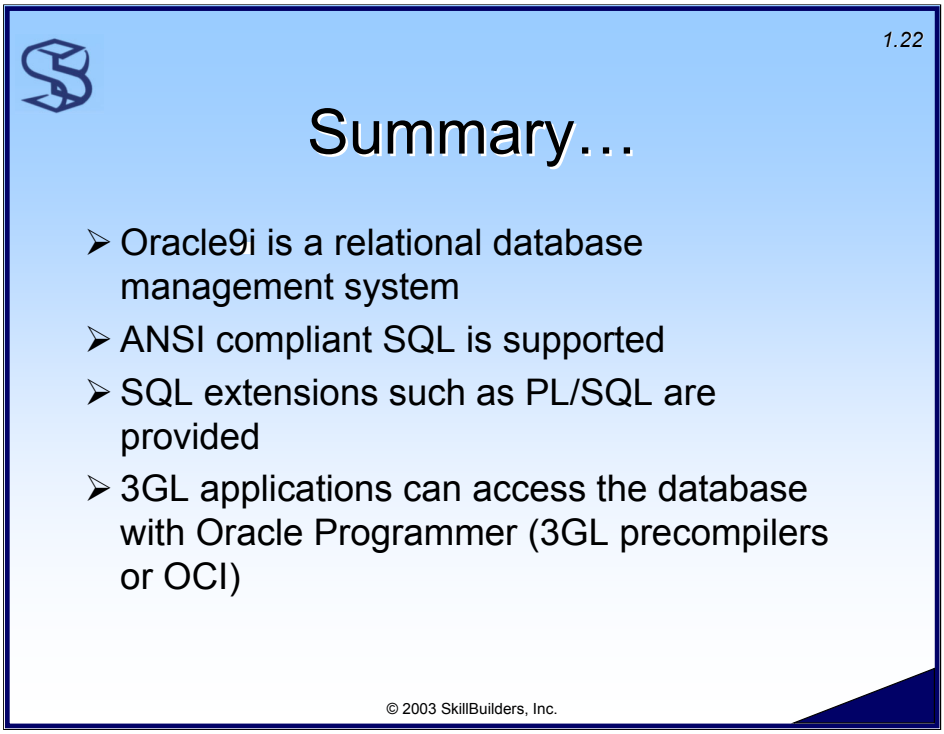
Oracle Developer (formerly called Developer 2000) is a development tool set designed for programmers. The tool set includes Form Builder (formerly Oracle Forms) and Report Builder (formerly Oracle Reports).

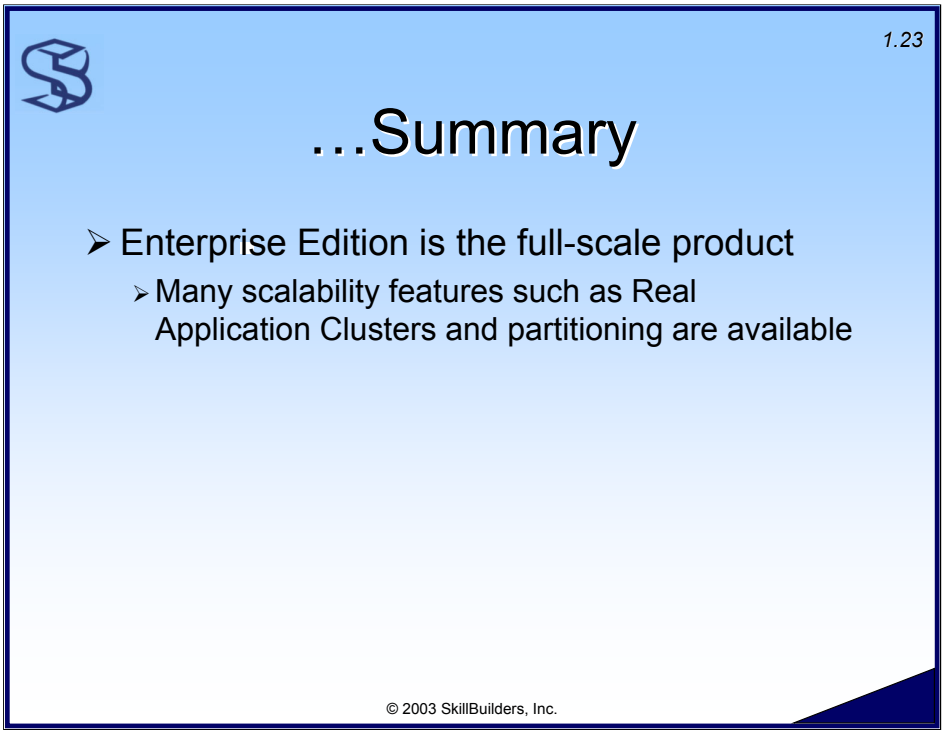
JDeveloper is a Java IDE based on Inprise's JBuilder.

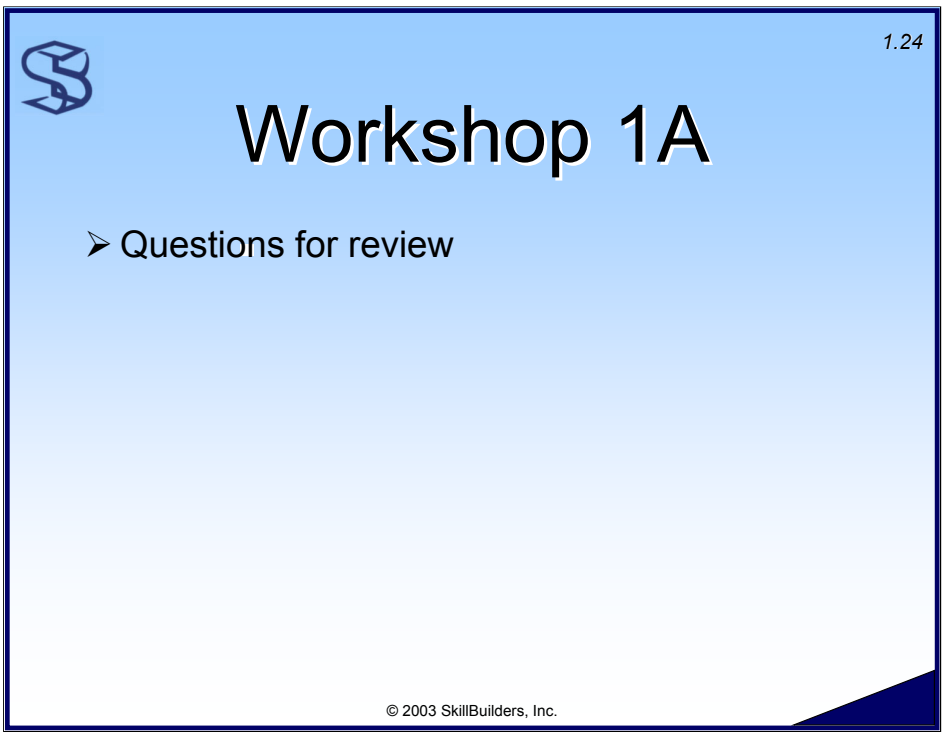


To support large Internet applications, Oracle also created a middleware component. (The middle tier supports business logic, removing that overhead from the database server and/or the display tier.) Oracle's first attempt was a product called Oracle Application Server (OAS). This product was overshadowed by competitors BEA Systems Weblogic and IBM's Websphere. Oracle has since rewritten the product; its' new name is Internet Application Server, or iAS.

Oracle Portal (formerly called WebDB) provides an HTML interface that end-users, programmers and database administrators can use to build Web-based database applications. End-users can build simple interfaces to their data. Programmers can create more robust interfaces while administrators can use Portal to view and manage database objects.


1.22
Summary…
Oracle9i is a relational database management system
ANSI compliant SQL is supported
SQL extensions such as PL/SQL are provided
3GL applications can access the database with Oracle Programmer (3GL precompilers or OCI)
© 2003 SkillBuilders, Inc.


1.23
…Summary
Enterprise Edition is the full-scale product
Many scalability features such as Real Application Clusters and partitioning are available
© 2003 SkillBuilders, Inc.



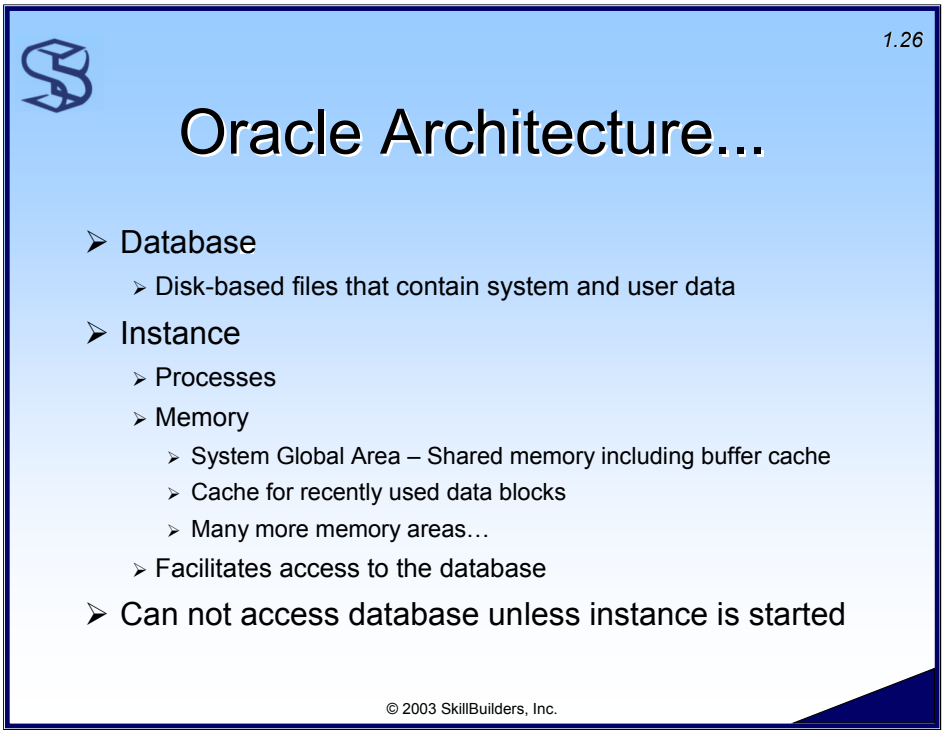
Workshop 1A

1. Oracle is a relational database management system, with an optional object support layer on top.
   TRUE or FALSE
2. SQL*Plus is a Java IDE.
   TRUE or FALSE
3. Oracle userids are password protected.
   TRUE or FALSE
4. What command is used to give a user privileges?
5. The Flashback Query feature can allow me to see a table as it existed 15 minutes ago.
   TRUE or FALSE
6. I can use PL/SQL to generate dynamic Web pages directly from the database.
   TRUE or FALSE
7. Enterprise Edition provides the most scalability of all available editions of Oracle.
   TRUE or FALSE

8. DDL statements can be rolled back.
   TRUE or FALSE

9. `INSERT, UPDATE, DELETE` and `SELECT` statements are considered data manipulation language statements.
   TRUE or FALSE

10. I have a comma-delimited ASCII text file that I need to load into a table. What utility should I use?
    A. IMPORT
    B. EXPORT
    C. SQL*Loader
    D. It cannot be done.

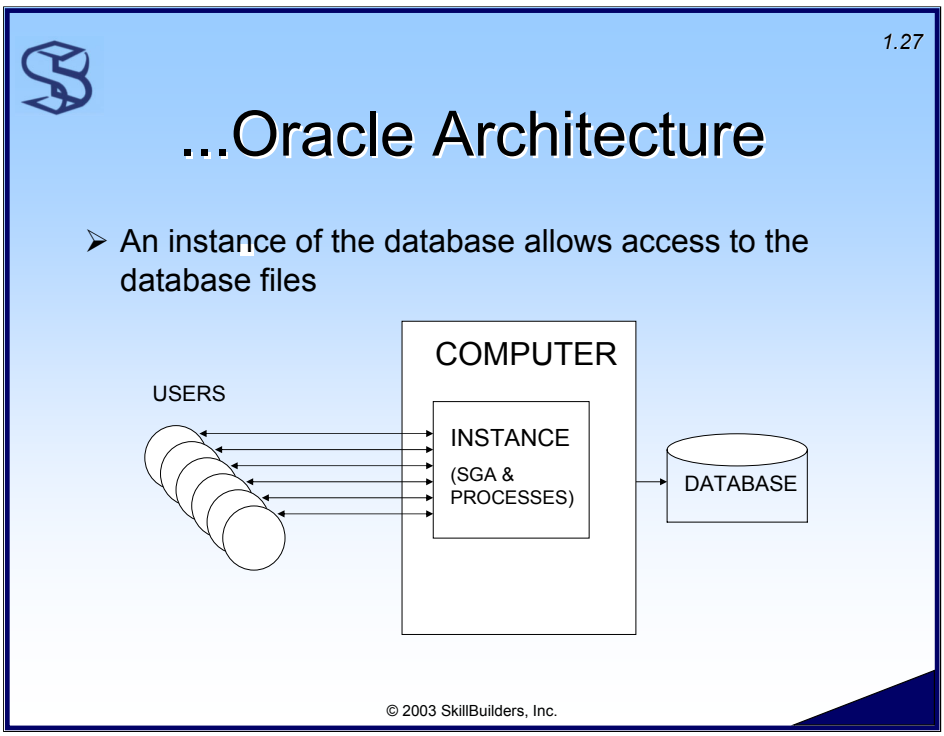


Oracle makes a distinction between database files that contain database data and the memory and process required to access those files. A **database** is the disk-based files that contain the system and user data. An **instance** is the active processes and memory areas that facilitate access the the database.

Instance and database each are assigned a name. They often have the same name (but not always true; in a Real Application Cluster environment, mulitple instances can access the same database - the instances will not have the exact same name.)

The instance name is called the System Identifier (SID). It is stored in the environment variable `$ORACLE_SID`. It can also been seen by querying the dynamic performance table `v$instance`. When you connect to the database with the `CONNECT` command, the current `$ORACLE_SID` (or the database alias explicitly specified in the `CONNECT` command) determines which instance you connect to and thus what database you are connected to. You cannot be connected to more than one database at a time.

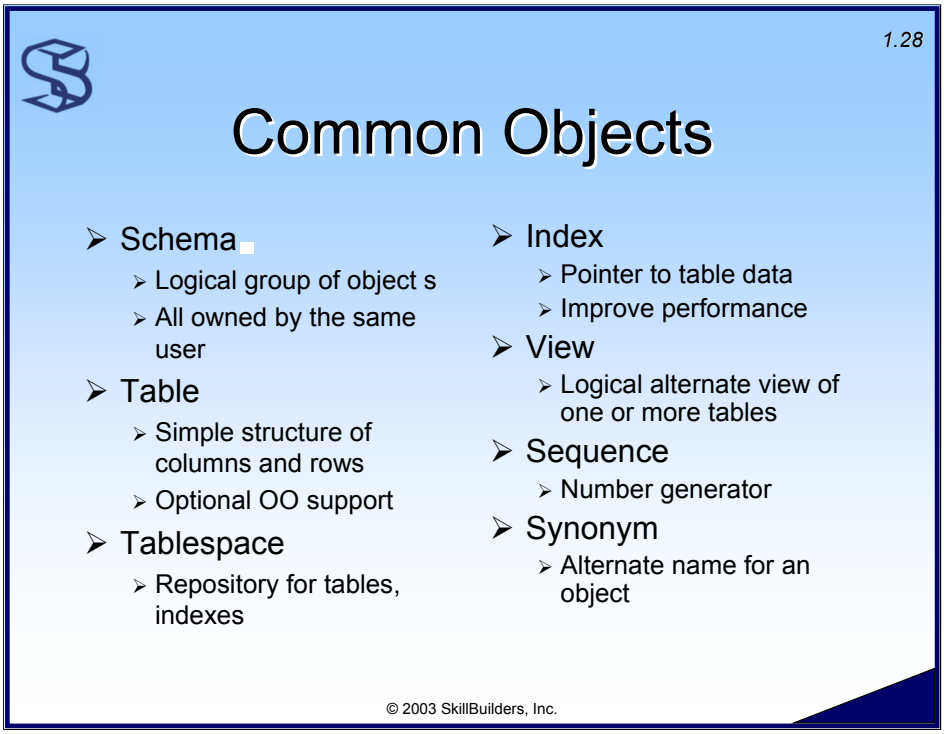
The database name is assigned with the `CREATE DATABASE` command and is stored in a control file. Query `v$database` to see the database name.



A picture is worth a thousand words. Here we see that in order to access the database, we must have an **instance** started.

Note that an `instance` provides access to one database (plus other databases via Distributed Database). However, a single database can be accessed by more than one `instance`; this is accomplished by using the Oracle Parallel Server (OPS) architecture in Oracle releases prior to Oracle9i and is accomplished by using Real Application Clusters (RAC) in Oracle9i and later.

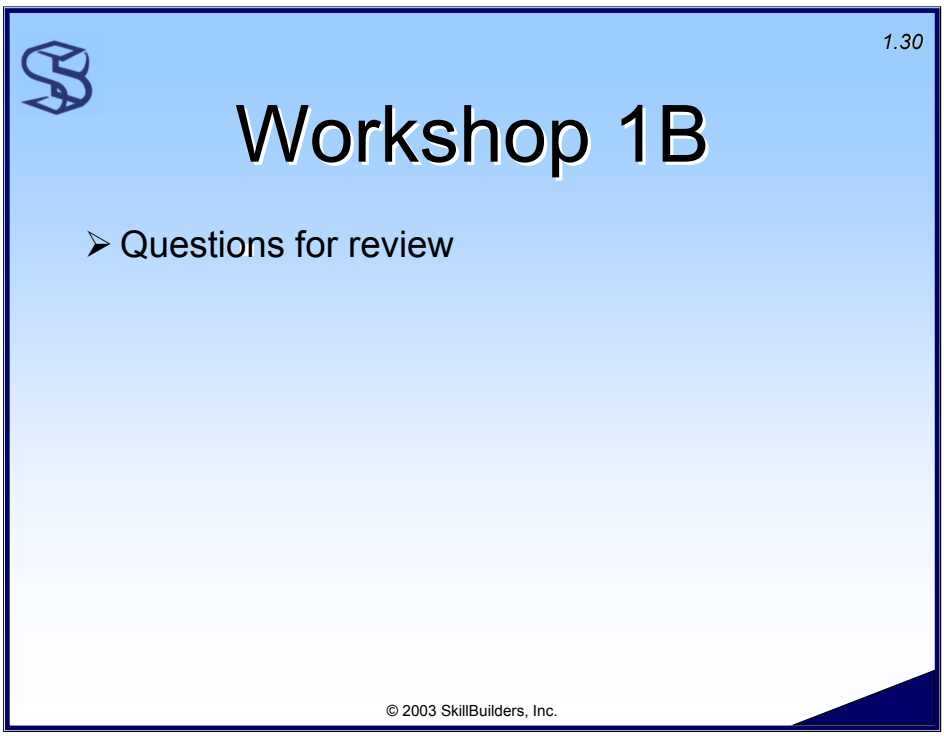
Note also that a single computer can run more than one `instance`, or more than one **`database/instance.`** (A single machine running more than one instance is typically a unit testing computer in the development environment. A production database/instance normally runs on a dedicated machine.)



As an application developer, you will need to know about several objects that can be created. These include:

- Schema – A schema is a logical group of objects all owned by the same user. So, when user `DAVE` is first created, the schema is empty. If `DAVE` executes a `CREATE TABLE` command, the schema has one object.
- Table – A table is the basic unit of storage in Oracle. Most tables are simple structures of columns and rows. However, with the advent of object support, a table can contain objects (complex user-defined datatypes that model real-world objects) or even be an object table (contains objects rather than columns and rows). A table is identified by a schema name and a table name, for example `DAVE.CUSTOMER`.
- Tablespace – A tablespace is a logical repository of other objects such as tables and indexes. A tablespace points to one or more datafiles – actual disk files that contain the blocks that make up our database. We often group related tables and indexes in the same tablespace for administrative reasons. For example, you can take an entire tablespace offline with one simple command.
- Index – An index is an object that contains pointers to table data and is created to improve the performance of access to a table. Once created, an index is automatically and transparently maintained by Oracle as inserts, updates and deletes occur against the related table.

- View – A view is a logical and alternate representation of one or more underlying tables (or views).
- Sequence – An Oracle sequence is an object that produces numbers. It is often used as a primary key generator.
- Synonym – A synonym is an alternate name for an object. Often used to eliminate the need for a schema name. For example, rather than user `GEOFF` querying "`DAVE.CUSTOMER`", user `GEOFF` can, after creating a synonym, query "`CUSTOMER`".



Workshop 1B

1. What is an *instance*?

2. The SGA is a shared memory area that contains the buffer cache.
   TRUE or FALSE

3. The buffer cache increase database performance be keeping recently used data blocks in memory, lowering physical I/O counts.
   TRUE or FALSE

4. The database can be accessed even if the instance is not started.
   TRUE or FALSE

5. What object can be created to eliminate the need to include the schema name in a reference to another users object?

6. What object can be created to improve the performance of a query?

Workshop continues on the next page…

7. What object generates numbers?

8. When a table is created, it is created in a _____?
   View
   Tablespace
   Index
   Synonym

