Oracle 11g DBA Fundamentals Overview

Lesson 06: Managing Tablespaces

Lesson Objectives

- Creating Tablespaces
- Altering Tablespace Availability
- Using Read-Only Tablespaces
- Renaming Tablespaces
- Managing the SYSAUX Tablespace

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Table spaces

- A tablespace is a logical storage unit within an Oracle database.
- It is logical because a table space is not visible in the file system of the machine on which the database resides.
- A table space, in turn, consists of at least one data file which, in turn, are physically located in the file system of the server.
- A datafile belongs to exactly one tablespace.
- Each table, index and so on that is stored in an Oracle database belongs to a table space.
- The table space builds the bridge between the Oracle database and the file system in which the table's or index' data is stored.
- There are three types of table spaces in Oracle:
  - Permanent table spaces
  - Undo table spaces
  - temporary table spaces

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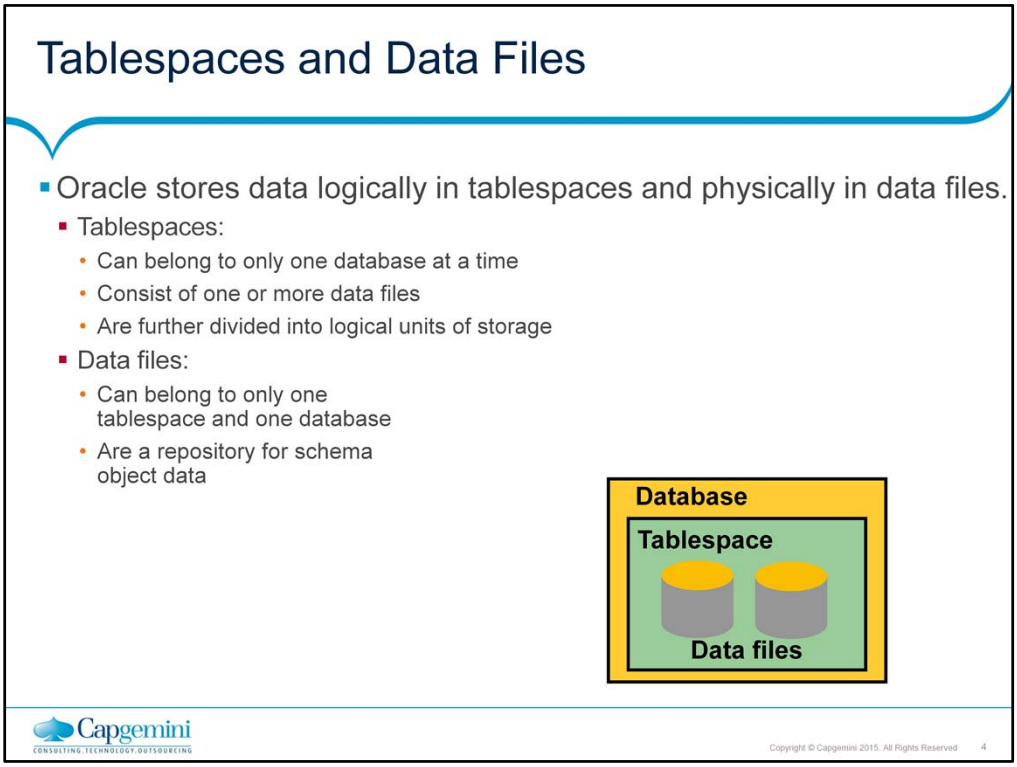


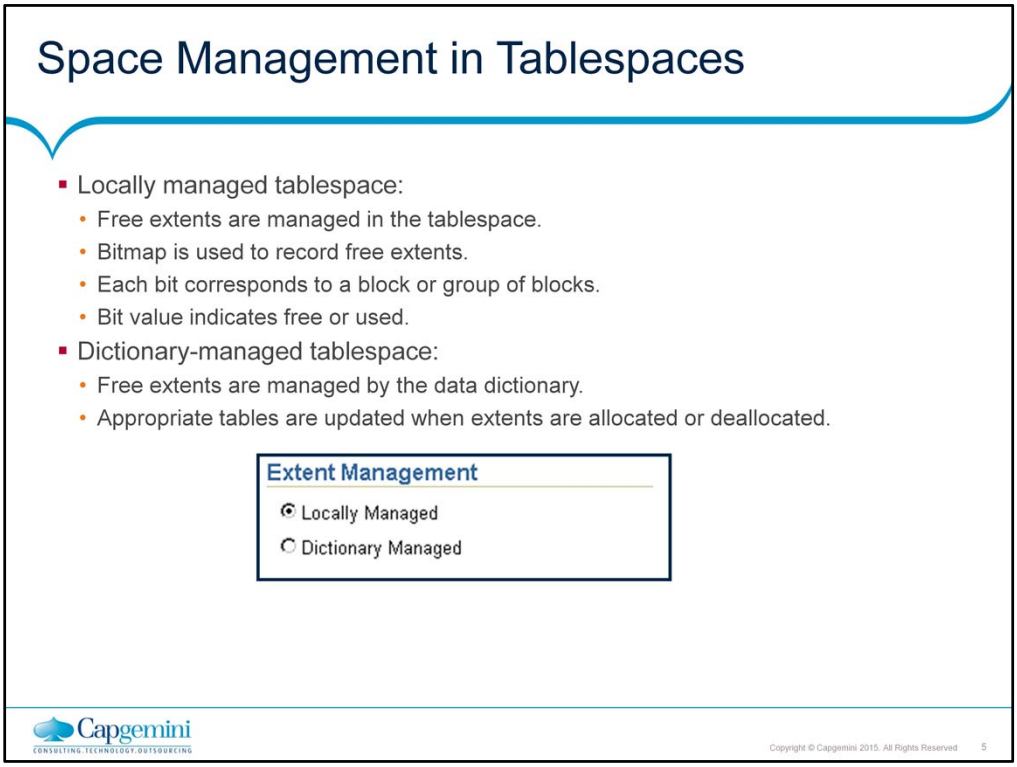
Tablespaces and Data Files

Databases, tablespaces, and data files are closely related, but they have important differences:

An Oracle database consists of one or more logical storage units called tablespaces, which collectively store all of the database's data.

Each tablespace in an Oracle database consists of one or more files called data files, which are physical structures that conform with the operating system on which Oracle is running.

A database's data is collectively stored in the data files that constitute each tablespace of the database. For example, the simplest Oracle database would have one tablespace and one data file. Another database can have three tablespaces, each consisting of two data files (for a total of six data files). A single database could potentially have as many as 65,535 data files.

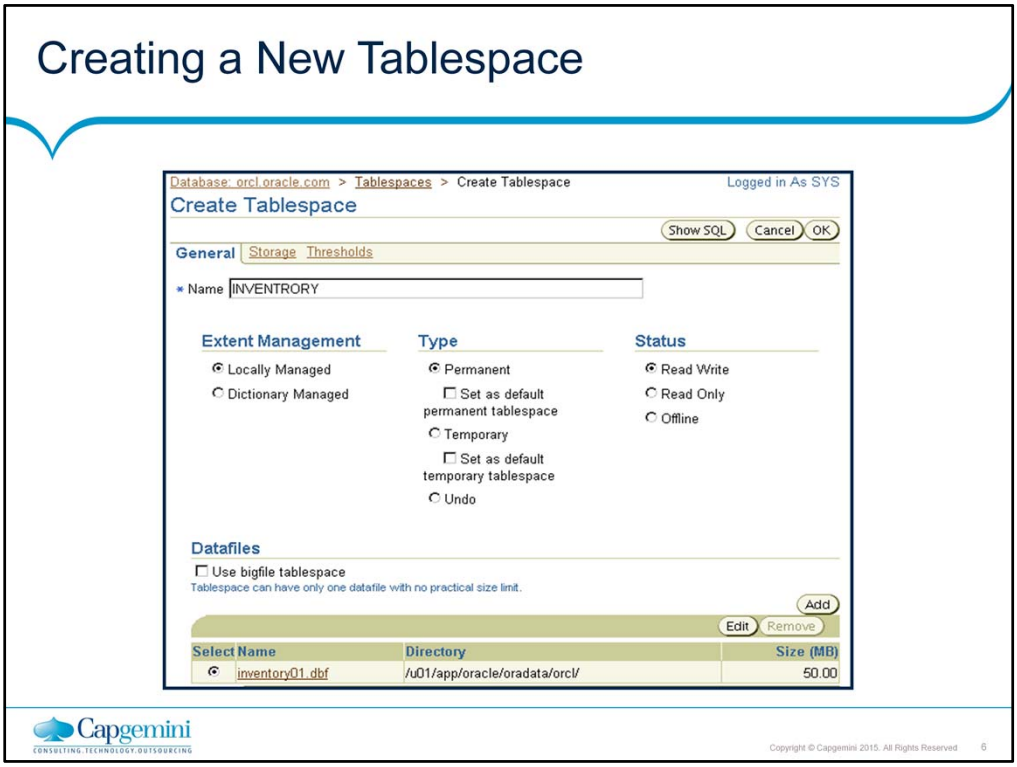


Space Management in Tablespaces

Tablespaces allocate space in extents. Tablespaces can be created to use one of the following two different methods of keeping track of free and used space:

Locally managed tablespaces: The extents are managed within the tablespace via bitmaps. Each bit in the bitmap corresponds to a block or a group of blocks. When an extent is allocated or freed for reuse, the Oracle server changes the bitmap values to show the new status of the blocks.

Dictionary-managed tablespaces: The extents are managed by the data dictionary. The Oracle server updates the appropriate tables in the data dictionary whenever an extent is allocated or deallocated. This is for backward compatibly; you should use locally managed for all tablespaces.



Creating a New Tablespace

To create a tablespace, perform the following steps:

1. Navigate to the Tablespaces page. Go to the Administration tab, then click Tablespaces under the Storage heading.
2. Click the Create button.

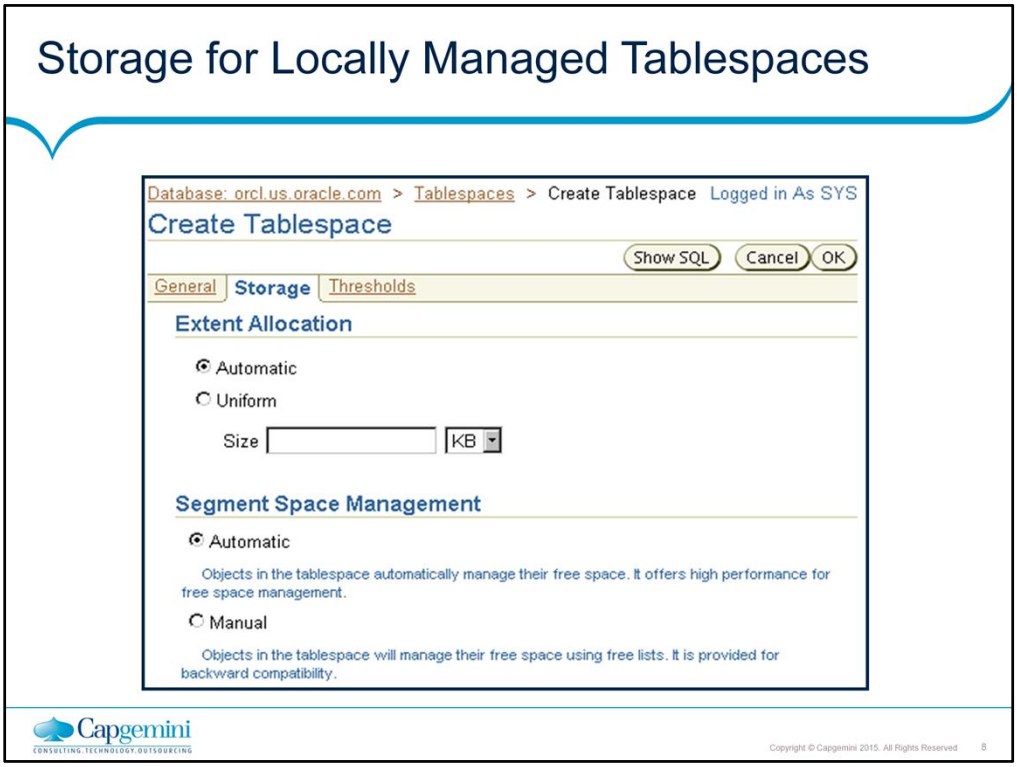
   Note: If you want to create a tablespace that is like an existing tablespace, select an existing tablespace and select Create Like from the Actions menu. Click Go.

   The Create Tablespace General page appears.
3. Enter a name for the tablespace.
4. Under the Extent Management heading, select Locally Managed. The extents of a locally managed tablespace are managed efficiently within the tablespace by the Oracle database server. For a dictionary managed tablespace you must more actively manage extents and data dictionary access is required for tracking them. Dictionary managed tablespaces are being deprecated. Oracle does not suggest their use.
5. Under the Type heading, select Permanent. Permanent tablespaces store permanent database objects created by the system or users.
6. Under the Status heading, select Read Write. Read/write status means users can read and write to the tablespace after it is created. This is the default.

Creating a New Tablespace (continued)

7. In the Datafiles region of the page click Add to add datafiles to the tablespace, a tablespace must have at least one file. Bigfile tablespaces are used with ultra large databases where Oracle's Automatic Storage Management or other logical volume managers support striping or RAID, and dynamically extensible logical volumes.
8. In the Add Datafiles page, enter a file name. Accept the defaults for the File Directory and File Size.
9. Under the Storage region, select "Automatically extend datafile when full (AUTOEXTEND)" and specify an amount in the Increment field by which you want to extend the data file each time it fills. Leave the Maximum File Size set to Unlimited. Click OK. You are returned to the Create Tablespace General page.
10. Click the Storage tab. The Create Tablespace Storage page appears.
11. Accept all of the defaults on the Storage page.
12. Click the Thresholds tab to open the Thresholds page. This page enables you to set monitored thresholds for space usage. You receive advice and an option for action when the threshold is reached.
13. After specifying thresholds click OK to add the tablespace. You are returned to the Tablespaces page where you receive a confirmation of the creation of the tablespace. You can view your new tablespace in the Results section.

Note: These steps are intended to show you how to quickly create a tablespace for most situations. You may need to change some options depend on your particular system requirements.



Storage for Locally Managed Tablespaces

Extents within a locally managed tablespace can be allocated in one of two ways:

Automatic: Also called autoallocate, specifies that the size of the extents within the tablespace are system managed. You cannot specify an extent size. You cannot specify automatic for a temporary tablespace.

Uniform: Specifies that the tablespace is managed with uniform extents of a size you specify. The default size is 1 megabyte. All extents of temporary tablespaces are of uniform size, so this is optional for a temporary tablespace. You cannot specify uniform for an undo tablespace.

Segment space management within a locally managed tablespace:

Automatic: Oracle uses bitmaps to manage the free space within segments. A bitmap, in this case, is a map that describes the status of each data block within a segment with respect to the amount of space in the block available for inserting rows. As more or less space becomes available in a data block, its new state is reflected in the bitmap. Bitmaps allow Oracle to manage free space more automatically, and thus, this form of space management is called automatic segment-space management.

Storage for Locally Managed Tablespaces (continued)

Manual: This tells Oracle that you want to use free lists for managing free space within segments. Free lists are lists of data blocks that have space available for inserting rows. This form of managing space within segments is called manual segment-space management because of the need to specify and tune the PCTUSED, FREELISTS, and FREELIST GROUPS storage parameters for schema objects created in the tablespace. This is supported for backward compatibility.

Advantages of Locally Managed Tablespaces

Locally managed tablespaces have the following advantages over dictionary-managed tablespaces:

- Local management avoids recursive space management operations. This can occur in dictionary-managed tablespaces if consuming or releasing space in an extent results in another operation that consumes or releases space in an undo segment or data dictionary table.
- Because locally managed tablespaces do not record free space in data dictionary tables, they reduce contention on these tables.
- Local management of extents automatically tracks adjacent free space, eliminating the need to coalesce free extents.
- The sizes of extents that are managed locally can be determined automatically by the system.
- Changes to the extent bitmaps do not generate undo information because they do not update tables in the data dictionary (except for special cases such as tablespace quota information).

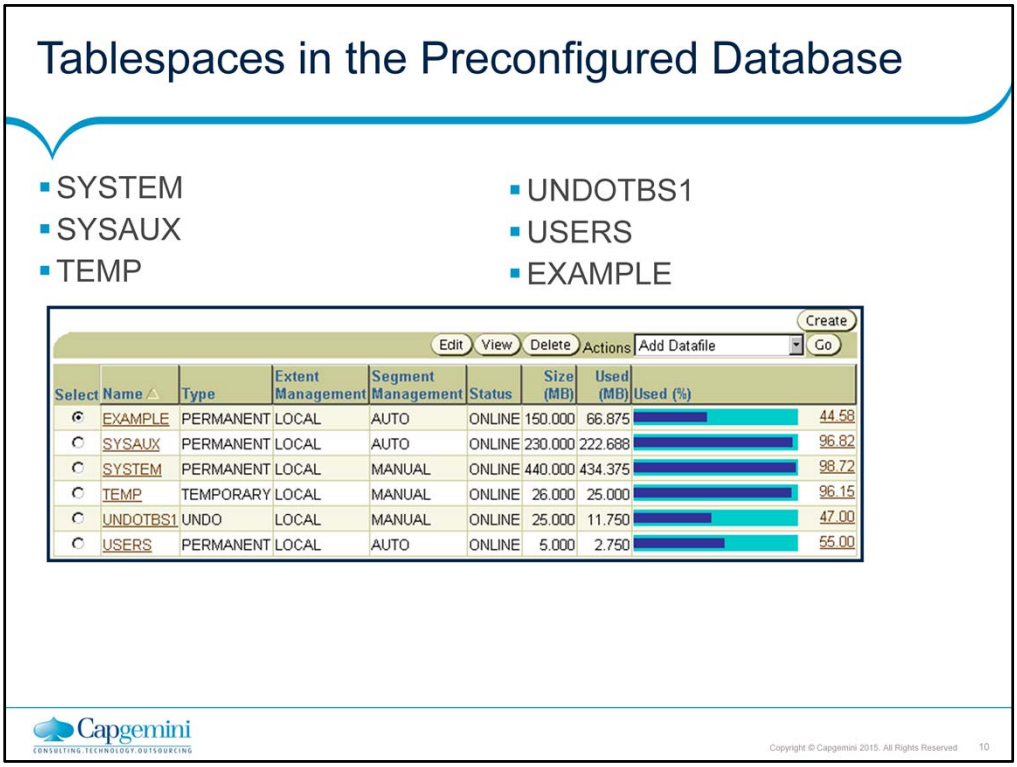
Note: If you are managing a database that has dictionary managed tablespaces and you want to convert them to locally managed, use the DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_TO_LOCAL procedure to do this. For details on the use of this procedure see the *PL/SQL Packages and Types Reference* and the *Database Administrator's Guide*.

Logging

When changes are made to objects in the tablespace, the change is logged in to what is called the redo stream. This redo stream starts in memory, the is written to the online redo log files and may be written to archive log files. You can turn this processes off. If you do turn off logging, the objects in this tablespace will be unrecoverable in the event of any kind of failure.

Thresholds

Use the Tablespace Thresholds tab to set the space used thresholds for the current database tablespace. You can choose to use the default usage thresholds for tablespaces for the database or you can specify the threshold for the percentage of space used for the current tablespace by entering the values for the Warning and Critical fields. You can also disable space used thresholds entirely for this tablespace. Thresholds are covered in more detail in lesson 15.



Tablespaces in the Preconfigured Database

The following tablespaces are created for you in the preconfigured database:

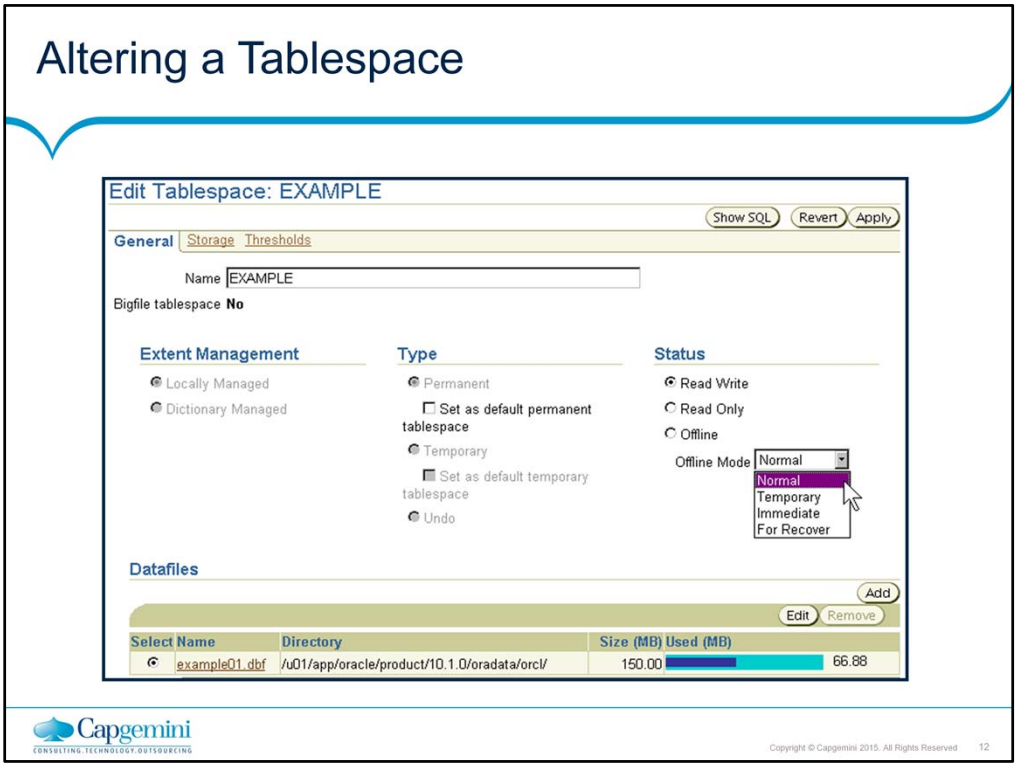
SYSTEM: The SYSTEM tablespace is used by the Oracle database server to manage the database. It contains the data dictionary and tables that contain administrative information about the database. These are all contained in the SYS schema, and can be accessed only by the user SYS, or other administrative users with the required privilege.

SYSAUX: This is an auxiliary tablespace to the SYSTEM tablespace. Some components and products that used the SYSTEM tablespace or their own tablespaces in prior releases of Oracle, now use the SYSAUX tablespace. Every Oracle Database11g or higher-level database must have a SYSAUX tablespace.

TEMP: This tablespace is used to store temporary tables and indexes when processing SQL statements. It would, for example, be used for sort work space. Every database should have a temporary tablespace that is assigned to users as their temporary tablespace. In the preconfigured database, the TEMP tablespace is specified as the default temporary tablespace. This means that if no temporary tablespace is specified when the user account is created, then Oracle assigns this tablespace to the user.

Tablespaces in the Preconfigured Database (continued)

- UNDOTBS1: This is the undo tablespace used by the database server to store undo information. Every database must have an undo tablespace that is created during database creation.
- USERS: This tablespace is used to store permanent user objects and data. In the preconfigured database, the USERS tablespace is the default tablespace for all objects created by nonsystem users. For the SYS and SYSTEM users (the system users), the default permanent tablespace remains SYSTEM.
- EXAMPLE: This tablespace contains the sample schemas that can be installed when you create the database. The sample schemas provide a common platform for examples. Oracle documentation and courseware contain examples based upon the sample schemas.



Altering a Tablespace

After you create a tablespace, you can later alter it in several ways as the needs of your system change.

Renaming: Simply enter a new name for the tablespace and click Apply.

Changing the Status: A tablespace can be in one of three different statuses or states. Depending on the type of tablespace, not all states may be available:

Read Write: The tablespace is online and can be read from and written to.

Read Only: Specify read-only to place the tablespace in transition read-only mode. In this state, existing transactions can complete (commit or roll back), but no further DML operations are allowed to the tablespace except for rollback of existing transactions that previously modified blocks in the tablespace. The tablespace is online while in the read-only state.You cannot make the SYSTEM or SYSAUX tablespace read-only.

Altering a Tablespace (continued)

Offline: You can take an online tablespace offline so that this portion of the database is temporarily unavailable for general use. The rest of the database is open and available for users to access data. When you take it offline you have choices of how to do this:Normal: A tablespace can be taken offline normally if no error conditions exist for any of the data files of the tablespace. Oracle takes a checkpoint for all data files of the tablespace as it takes them offline.Temporary: A tablespace can be taken offline temporarily, even if there are error conditions for one or more files of the tablespace. Oracle takes offline the data files that are not already offline, checkpointing them as it does so. If no files are offline, but you use the temporary clause, media recovery is not required to bring the tablespace back online. However, if one or more files of the tablespace is offline because of write errors, and you take the tablespace offline temporarily, the tablespace requires recovery before you can bring it back online.Immediate: A tablespace can be taken offline immediately, without Oracle taking a checkpoint on any of the data files. When you specify Immediate, media recovery for the tablespace is required before the tablespace can be brought online. You cannot take a tablespace offline immediately if the database is running in NOARCHIVELOG mode.For Recover: The FOR RECOVER setting has been deprecated. The syntax is supported for backward compatibility.

Change the Size: You can add space to an existing tablespace by adding data files to the tablespace or you can change the size of an existing data file.

To add a new data file to the tablespace click Add, and fill in the information about the data file on the Add Data File page. Note that the tablespace name is fixed.

To change the size of an existing data file, select the data file in the Datafiles region of the Edit Tablespace page by clicking the name of the data file, or select the data file and click Edit. Then on the Edit Datafile page you can change the size of the data file. You can make the tablespace either larger or smaller. However you cannot make a data file smaller than the used space in the file; if you try you get the following error:

ORA-03297: file contains used data beyond requested RESIZE value

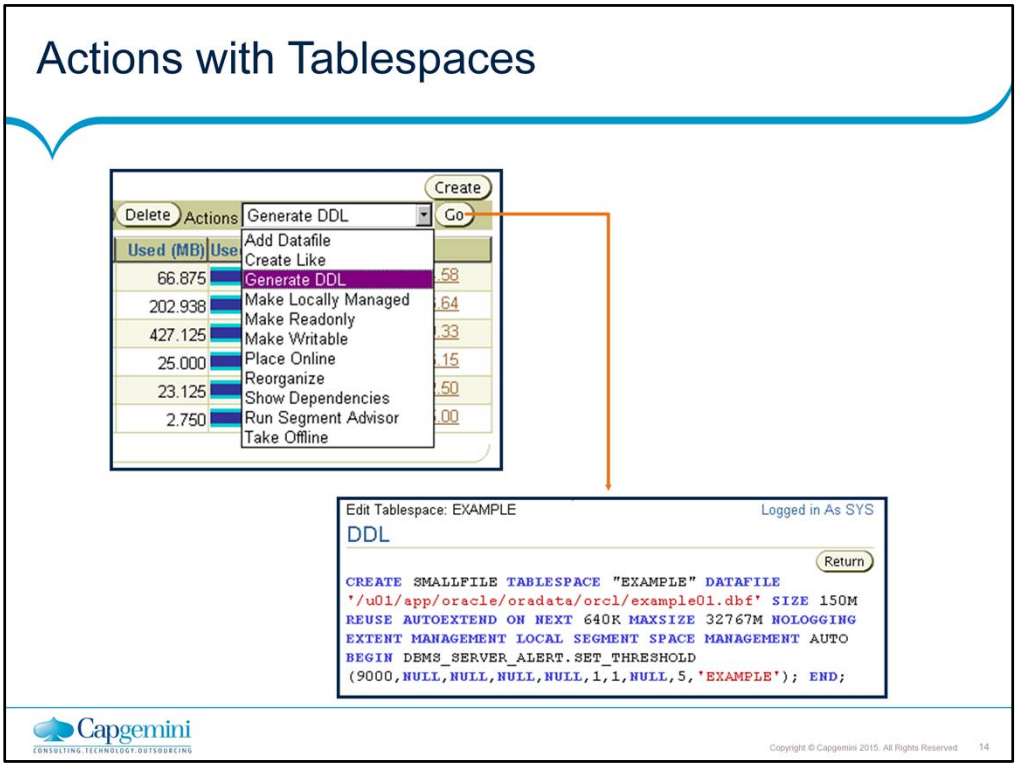
Storage Options: Click Storage to change change the logging behavior of the tablespace.

Thresholds: Click Thresholds to can change the warning and critical used space alters for the tablespace. You have three options:

Use Default Thresholds: This uses preset defaults, and you have the option of setting these defaults.

Specify Thresholds: This allows you to set thresholds for this particular tablespace.

Disable Thresholds: This turns off space usage alerts for this tablespace.



Actions with Tablespaces

With the Actions Menu you can perform a verity of tasks with your tablespaces. Select a tablespace and then the action you want to perform:

Add Datafile: Adds a data file to the tablespace, which makes the tablespace larger.

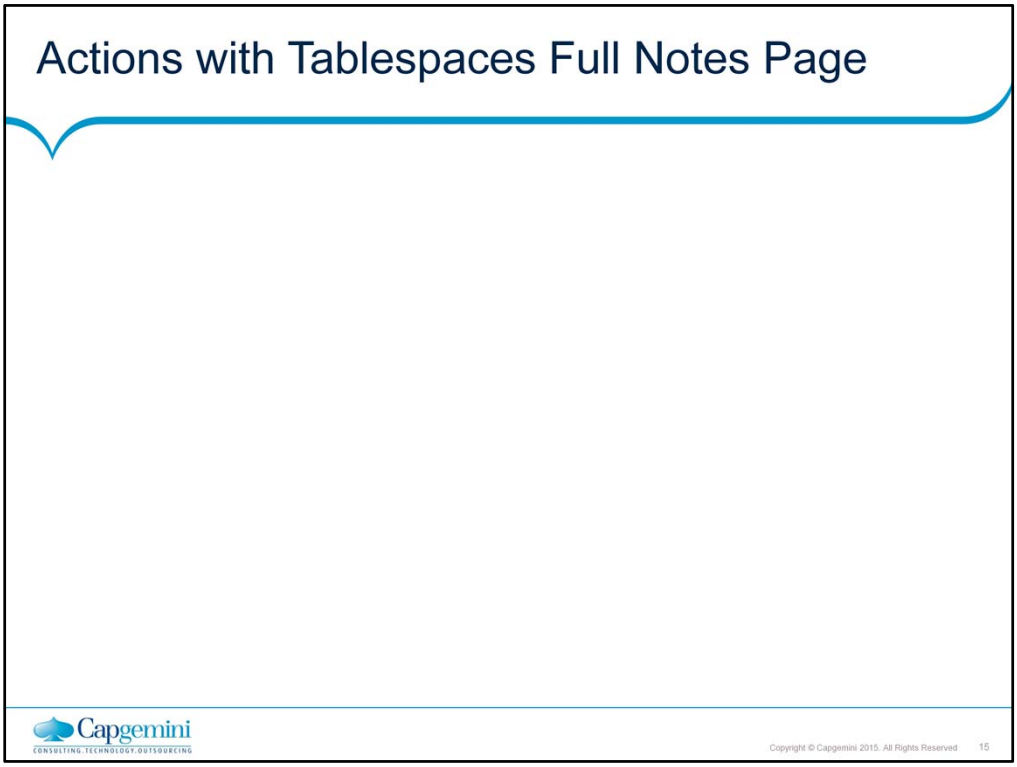
Create Like: Create another tablespace using the tablespace as a template.

Generate DDL: Generate the DDL statement that creates the tablespace. This can then be copied and pasted into a text file for use as a script or for documentation purposes.

Make Locally Managed: If the tablespace is currently dictionary managed, this will convert the tablespace to locally managed.

Make Readonly: Stops all writes to the tablespace. Current transactions are allowed to compete but no new DML or other write activities are allowed to start on the tablespace.

Make Writable: Allows DML and other write activities to be initiated on objects in the tablespace.



Actions with Tablespaces (continued)

Place Online: If the tablespace is currently offline, this brings it back online.

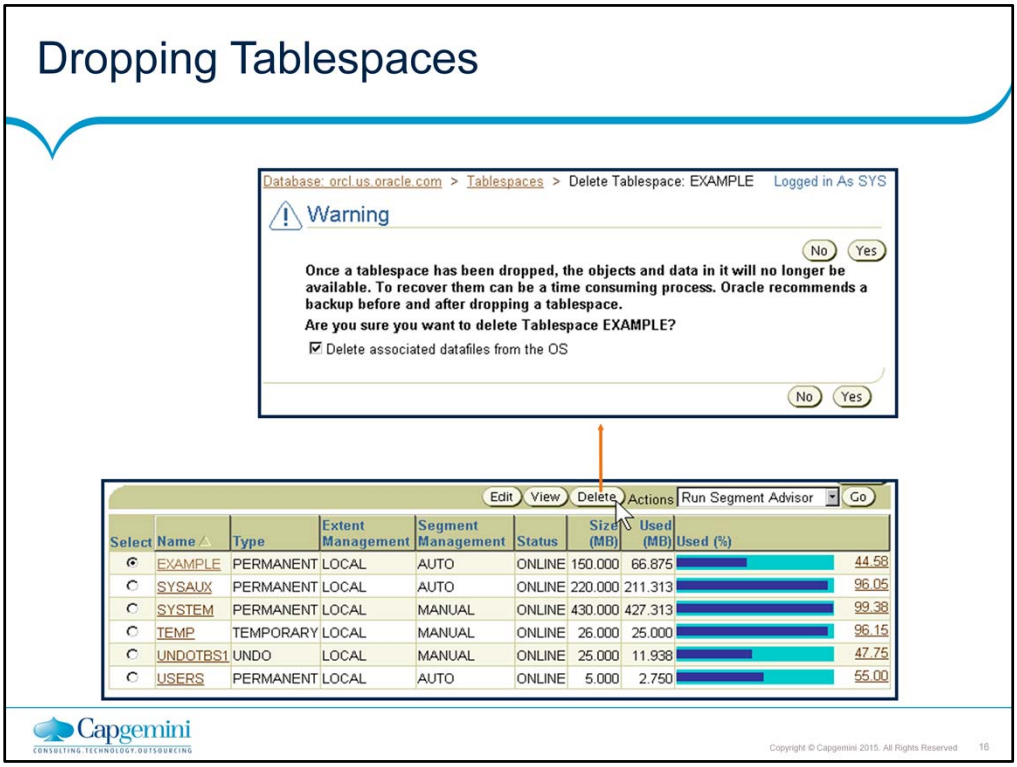
Reorganize: This starts the Reorganization Wizard, which you can use to move objects around within the tablespace to reclaim space that otherwise might not be used. This is a task that should be done during nonpeak usage of the objects in the tablespace.

Show Dependencies: This shows objects that this tablespace depends on or objects that depend on this tablespace.

Run Segment Advisor: The Segment Advisor helps you determine whether an object has space available for reclamation based on the level of space fragmentation within the object. At the tablespace level, advice is generated for every segment in the tablespace.

Take Offline: If the tablespace is currently online this will make the tablespace unavailable. The tablespace is not deleted or drop, just unavailable.

Note: Not all actions are available for each tablespace. Depending on the type of tablespace selected, some actions cannot be performed. For example, you cannot take the SYSTEM tablespace offline, nor can you make an undo tablespace read-only.

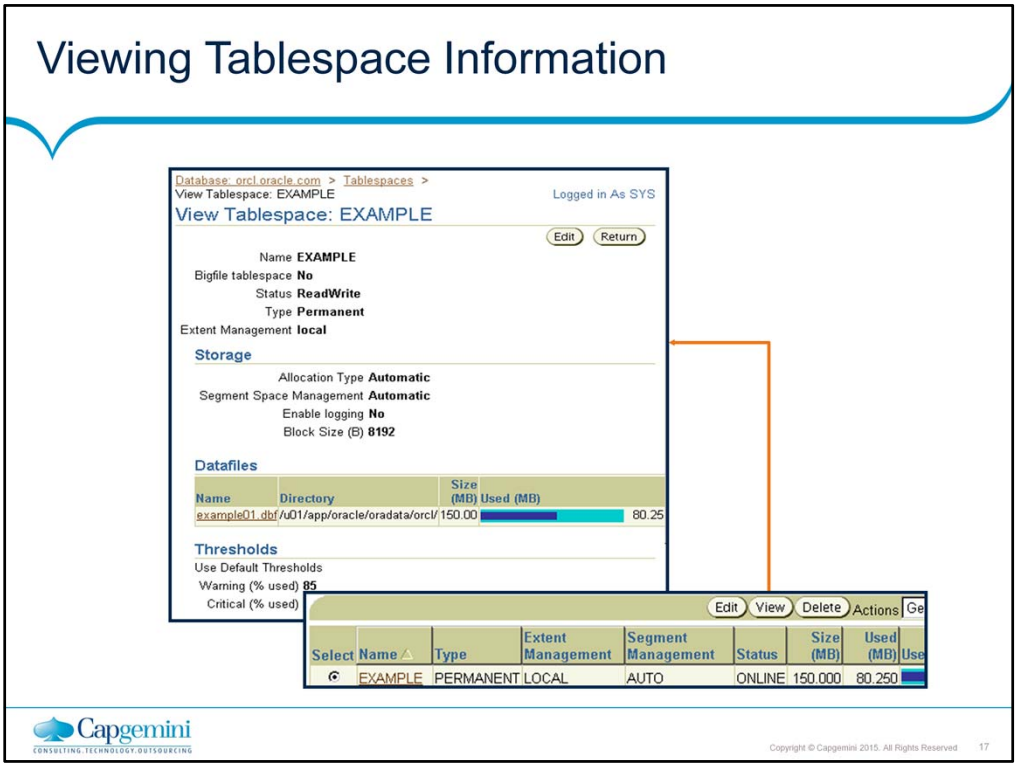


Dropping Tablespaces

You can drop a tablespace and its contents (the segments contained in the tablespace) from the database if the tablespace and its contents are no longer required. You must have the DROP TABLESPACE system privilege to drop a tablespace.

When you drop a tablespace, the file pointers in the control file of the associated database are removed. You can optionally direct Oracle to delete the operating system files (data files) that constituted the dropped tablespace. If you do not direct Oracle to delete the data files at the same time that it deletes the tablespace, you must later use the appropriate commands of your operating system to delete them.

You cannot drop a tablespace that contains any active segments. For example, if a table in the tablespace is currently being used or the tablespace contains undo data that is needed to roll back uncommitted transactions, you cannot drop the tablespace. The tablespace can be online or offline, but it is best to take the tablespace offline before dropping it.



Viewing Tablespace Information

Click View to see information about the selected tablespace. In the View Tablespace page, you can also click edit to alter the tablespace.

Obtaining tablespace and data file information can also be obtained by querying the following:

- Tablespace information:
  - DBA_TABLESPACES
  - V$TABLESPACE
- Data file information:
  - DBA_DATA_FILES
  - V$DATAFILE
- Temp file information:
  - DBA_TEMP_FILES
  - V$TEMPFILE

Locally Managed Tablespaces

- Fast, concurrent space operations. Space allocations and deallocations modify locally managed resources (bitmaps stored in header files).
- Enhanced performance
- Readable standby databases are allowed, because locally managed temporary tablespaces do not generate any undo or redo.
- Space allocation is simplified, because when the AUTOALLOCATE clause is specified, the database automatically selects the appropriate extent size.
- User reliance on the data dictionary is reduced, because the necessary information is stored in file headers and bitmap blocks.
- Coalescing free extents is unnecessary for locally managed tablespaces.

Bigfile Tablespaces

- A **bigfile tablespace** is a tablespace with a single, but very large (up to 4G blocks) datafile. Traditional smallfile tablespaces, in contrast, can contain multiple datafiles, but the files cannot be as large.
- Bigfile tablespaces can reduce the number of datafiles needed for a database.

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Temporary Tablespaces

- A temporary tablespace contains transient data that persists only for the duration of the session.
- It improve the concurrency of multiple sort operations, reduce their overhead, and avoid Oracle Database space management operations

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Altering Tablespace Availability

- Taking Tablespaces Offline
- Bringing Tablespaces Online

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Using Read-Only Tablespaces

- Making a tablespace read-only prevents write operations on the datafiles in the tablespace.
- The primary purpose of read-only tablespaces is to eliminate the need to perform backup and recovery of large, static portions of a database.
- Read-only tablespaces also provide a way to protecting historical data so that users cannot modify it.
- Making a tablespace read-only prevents updates on all tables in the tablespace, regardless of a user's update privilege level.

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Renaming Tablespaces

- Using the RENAME TO clause of the ALTER TABLESPACE, you can rename a permanent or temporary tablespace.
- For example, the following statement renames the users tablespace:
- ALTER TABLESPACE users RENAME TO usersts;

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