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PTC Product Focus

Pro/Engineer ModelCHECK

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PTC Product Focus

Oracle for Windchill : Understanding the Basic Database Structure

One of the most common reasons for application failure consists of space and growth related errors. The causes of these errors do not lie within the application but are a result of inappropriate space and growth management within the database. Management of space and growth requires in-depth growth analysis, capacity planning, space configuration, and constantly monitoring. If either of the area did not get adequate attention, it is easily result in an unmanageable, intermingled quagmire of segments, extents, and blocks with fragments of unusable space between them.

This article will introduce a brief understanding on database structures and how to reduce/prevent tablespace fragmentation, part of space and growth management.

Understanding the Basic Database Structure

An Oracle *database* is a collection of data that is treated as a unit. The purpose of a database is to store and retrieve related information. The database has *logical structures* and *physical structures*. Because the physical and logical structures are separate, the physical storage of data can be managed without affecting the access to logical storage structures.

Physical Database Structures

The physical structures of an Oracle database include files and blocks.

Datafiles

Every Oracle database has one or more physical *datafiles*. A database's datafiles contain all the database data. The data of logical database structures such as tables and indexes is physically stored in the datafiles allocated for a database.

The characteristics of datafiles are:

- A datafile can be associated with only one database.
- One or more datafiles form a logical unit of database storage called a tablespace.

Redo Log Files

Every Oracle database has a set of two or more *redo log files*. The primary function of the redo log is to record all changes made to data. Should a failure prevent modified data from being permanently written to the datafiles, the changes can be obtained from the redo log and work is never lost.

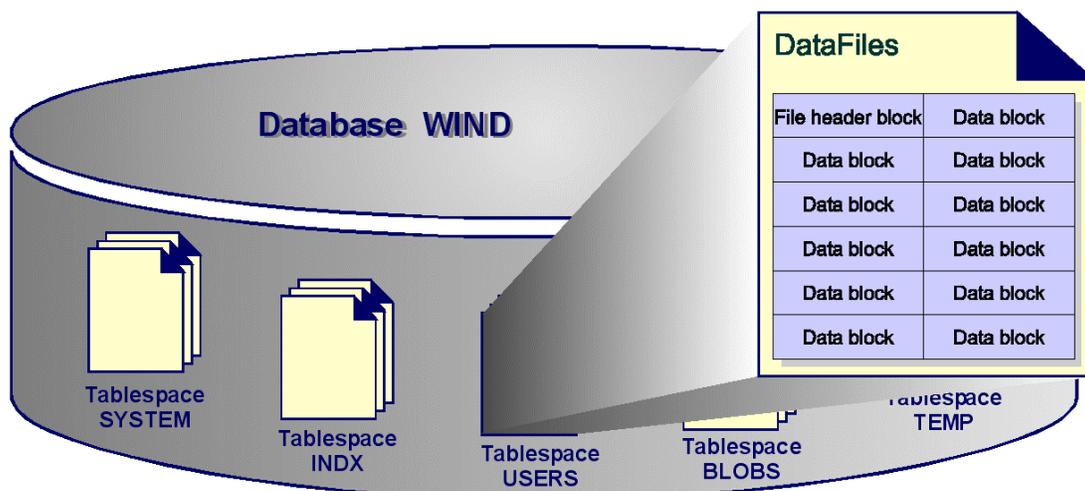
Control Files

Every Oracle database has a *control file*. A control file contains entries that specify the physical structure of the database. For example, it contains the following types of information:

- Database name
- Names and locations of datafiles and redo log files
- Time stamp of database creation

Blocks

From a physical perspective, blocks are literally the building blocks of each file within Oracle database. The size of the block is determined at the time of creation according to the value specified by the initialization parameter `DB_BLOCK_SIZE`. A block is broken up into various components such as header and data.



The logical structures of an Oracle database include tablespaces, schema objects, data blocks, extents, and segments.

Tablespaces

A database is divided into logical storage units called *tablespaces*, which group related logical structures together.

Schema Objects

A *schema* is a collection of database objects. *Schema objects* are the logical structures that directly refer to the database's data. Schema objects include such structures as tables, views, sequences, stored procedures, synonyms, indexes, clusters, and database links.

Data Blocks

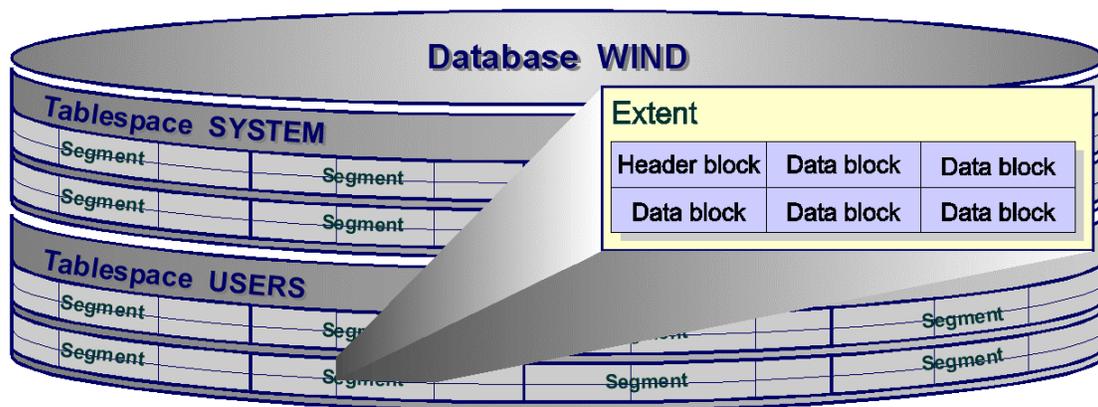
At the finest level of granularity, Oracle database data is stored in *data blocks*. One data block corresponds to a specific number of bytes of physical database space on disk. A data block size is specified for each Oracle database when the database is created. A database uses and allocates free database space in Oracle data blocks.

Extents

The next level of logical database space is called an extent. An *extent* is a specific number of contiguous data blocks, obtained in a single allocation, and used to store a specific type of information.

Segments

Segments are the actual entities that reside within a tablespace. Each segment is broken up into one or more extents, each comprising a set of contiguous data-blocks. There are several types of segments: data segment, index segment, rollback segment, and temporary segment.



The size and number of extents that the table occupies are determined by the STORAGE parameter defined during its creation.

```
CREATE TABLE WTPartMaster (  
    defaultUnit VARCHAR2(30) NOT NULL,  
    name VARCHAR2(60) NOT NULL,  
    WTPartNumber VARCHAR2(32) NOT NULL,  
    createStampA2 DATE,  
    modifyStampA2 DATE,  
    classnameA2A2 VARCHAR2(200),  
    idA2A2 NUMBER NOT NULL,
```


order by BLOCK_ID
/

Tablespace Name	Block ID	Number of Blocks	Table Name
USERS	2390	10	WTDATEDEFFECTIVITY
USERS	2400	65	WTDOCUMENT
USERS	2465	2	WTDOCUMENTCONFIGSPEC
USERS	2467	2	WTDOCUMENTDEPENDENCYLINK
USERS	2469	65	WTDOCUMENTMASTER
USERS	2534	2	WTDOCUMENTMASTERKEY
USERS	2536	2	WTDOCUMENTUSAGELINK
USERS	2538	2	WTGROUP
USERS	2540	10	WTINCORPORATIONDATE
USERS	2550	2	WTINCREMENTALUPDATE
USERS	2552	2	WTLOTEFFECTIVITY
USERS	2554	65	WTMARKUP
USERS	2619	65	WTPART
USERS	2684	10	WTPARTALTERNATELINK
USERS	2694	10	WTPARTCONFIGSPEC
USERS	2704	65	WTPARTDESCRIBELINK
USERS	2769	70	WTPARTMASTER
USERS	2839	65	WTPARTMASTERKEY
USERS	2904	70	WTPARTREFERENCELINK
USERS	2974	15	WTPARTSUBSTITUTELINK
USERS	2989	65	WTPARTUSAGELINK
USERS	3054	2	WTPIDESCRIBELINK
USERS	3056	2	WTPIREFERENCELINK
USERS	3058	15	WTPRODUCT
USERS	3073	10	WTPRODUCTCONFIGMASTER

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Tips of the Week

Associative Shrinkwrap Using Envelopes

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Tips of the Week

Oracle for Windchill : Avoiding and Fixing Tablespace Fragmentation

Avoiding and Fixing Fragmentation

Fragmentation can appreciably hurt the performance of a database. To avoid and/or fix fragmentation, the followings are recommended:

Use the correct table size

Fragmentation occurs because tables extend into multiple extents, records are updated and the blocks, which contain the data, don't have enough room to store the changes. The key to eliminating fragmentation is rebuilding the table or specifying the correct size in the first place. Ensure that the INITIAL and NEXT for each storage clause are multiples of the DB_BLOCK_SIZE.

Plan for large and highly access table

There are no limits on the physical size of tables and extents. You can specify the keyword UNLIMITED for MAXEXTENTS, thereby simplifying your planning for large objects, reducing wasted space and fragmentation, and improving space reuse. However, keep in mind that while Oracle allows an unlimited number of extents, when the number of extents in a table grows very large, you may see an impact on performance when performing any operation requiring that table.

If you have such tables in your database, consider the following recommendations:

- Separate the table from its indexes.

Place indexes in separate tablespaces from other objects, and on separate disks if possible. If you ever need to drop and re-create an index on a very large table (such as when disabling and enabling a constraint, or re-creating the table), indexes isolated into separate tablespaces can often find contiguous space more easily than those in tablespaces that contain other objects.

- Move large and highly access table to it own tablespace

Create a new tablespace and move the large table from other objects to the new tablespace. If possible, store the tablespace's datafiles on separate disk to reduce I/O contention.

Use Oracle Export/Import utilities to compress a fragmented table

If a table is fragmented, the easiest way to compress its data into a single extent is to rebuild the table with the proper storage parameters. Since the INITIAL parameter cannot be changed after the table has been created, a new table must be created with the correct storage parameters.

Before dropping the old table, insert the data from the old table into the new table.

This process can be automated via the Export/Import utilities. The table can be exported with option COMPRESS=Y. This option will cause Export, when reading the table, to determine the total amount of space allocation to that table. It will then write to the export dump file a new INITIAL storage parameter, equivalent to the total of the allocated space, for the table. The following is an example of Export command for table WTPart:

```
exp wind/wind file=wtpart.dmp compress=Y grants=Y indexes=Y
```

After dropping the table, Import can be used to re-create the table and import the data, and then its data should all fit in the new, larger initial extent. Here is an example of Import command:

```
imp wind/wind file=wtpart.dmp commit=Y full=Y buffer=64000
```

The option COMMIT=Y is used to minimize the rollback are needed by committing during the table import. The buffer is also set higher to increase the speed of the import.

Note this technique is best for medium size table. For very large size of table, it will be discussed in another article.

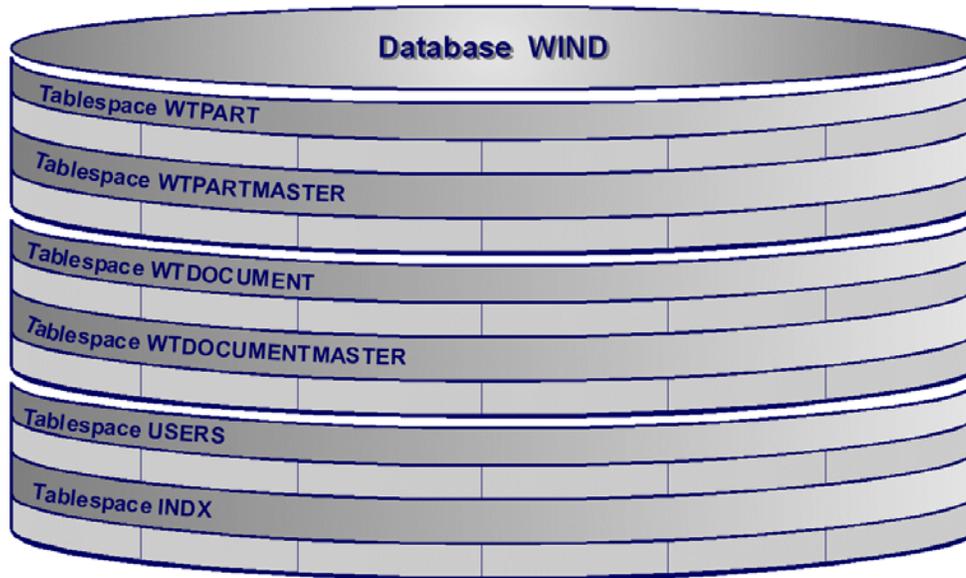
Increase the size of the next extent

When you do not have time or space to rebuild the table, you can alter the table's storage by increasing the size of the next extent to prevent further fragmentation.

Conclusion

To avoid and/or fix the fragmentation, the followings should be kept in mind:

- Build the correct table and index sizes to avoid fragmentation.
- Use standardized storage clauses for each segment-type to reduce fragmentation and use of space more optimally.
- Create a new tablespace for large and highly access table.
- Separate table from its indexes.
- Defragment the data by exporting, compressing, and then re-importing the table.



By eliminating fragmentation, we can reduce excessive I/O and CPU usage, streamlining data accesses. By reducing overhead and unnecessary I/O, we improve system performance.

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Announcements

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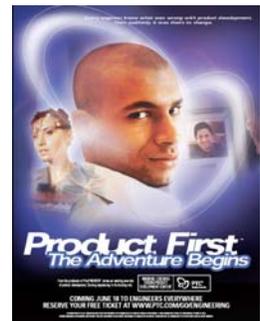
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PTC

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- 1) Inform you on events related to PTC products (user groups, conferences, training schedules, etc.)
- 2) Educate you on products that are available at PTC
- 3) Tips & Techniques using PTC Products

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