

Oracle 11g DBA Fundamentals Overview

Lesson 10: Managing Storage

Objectives



- After completing this lesson, you should be able to:
 - Describe how the Oracle database automatically manages space
 - Proactively monitor and manage tablespace space usage
 - Use the Segment Advisor
 - Reclaim wasted space from tables and indexes by using the segment shrink functionality
 - Manage resumable space allocation
 - Describe the concepts of transportable tablespaces and databases



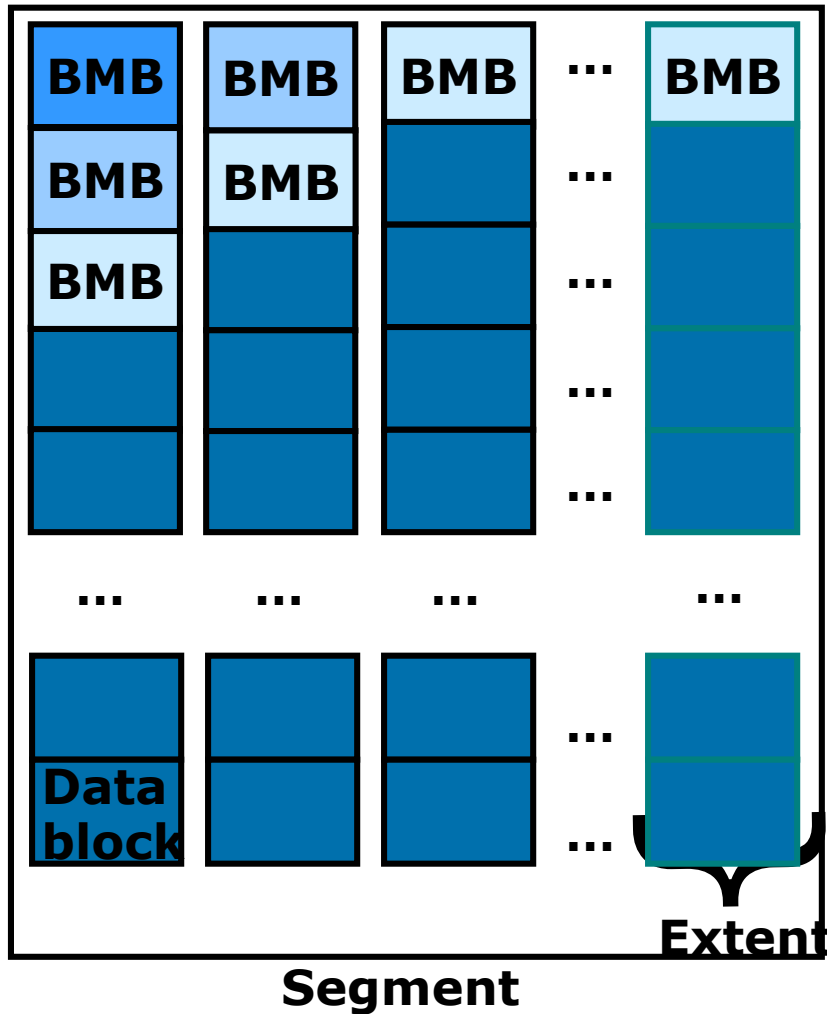


Space Management: Overview

Space is automatically managed by the Oracle database. It generates alerts about potential problems and recommends possible solutions. Features include:

- Oracle Managed Files (OMF)
- Free-space management with bitmaps (“locally managed”) and automatic data file extension
- Proactive space management (default thresholds and server-generated alerts)
- Space reclamation (shrinking segments, online table redefinition)
- Capacity planning (growth reports)

Free Space Management



- Automatic
- Enabled by the use of locally managed tablespaces
- Tracked by bitmaps in segments

Benefits:

- More flexible space utilization
- Run-time adjustment
- Multiple process search of BMBs



Types of Segments

A segment is a set of extents allocated for a certain logical structure. The different types of segments are:

- Data segment
- Index segment
- Temporary segment

Segments are dynamically allocated by the database.

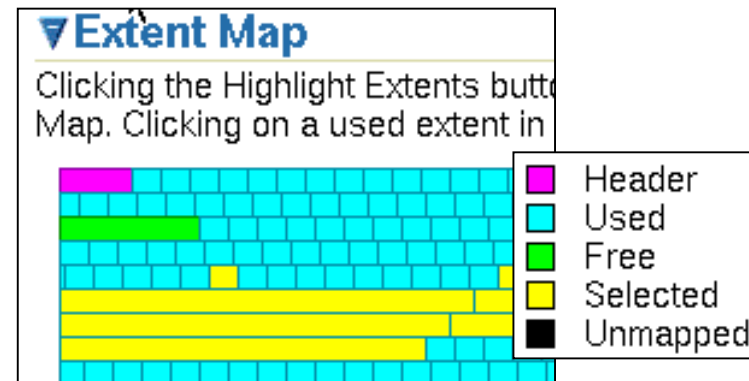


Allocating Extents

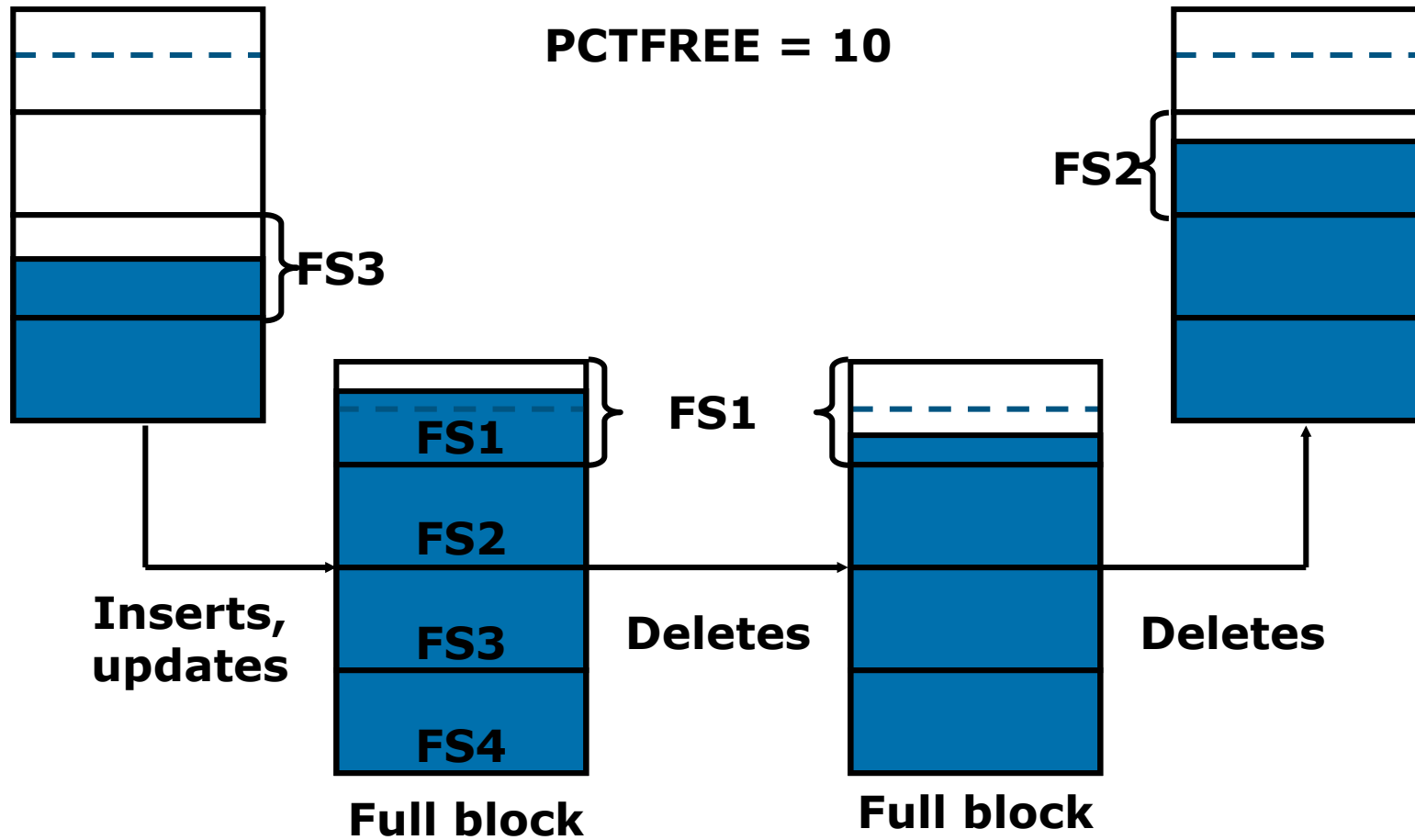
Searching the data file's bitmap for the required number of adjacent free blocks

Sizing extents with storage clauses:

- UNIFORM
- AUTOALLOCATE
- Viewing extent map
- Obtaining deallocation advice



Block Space Management

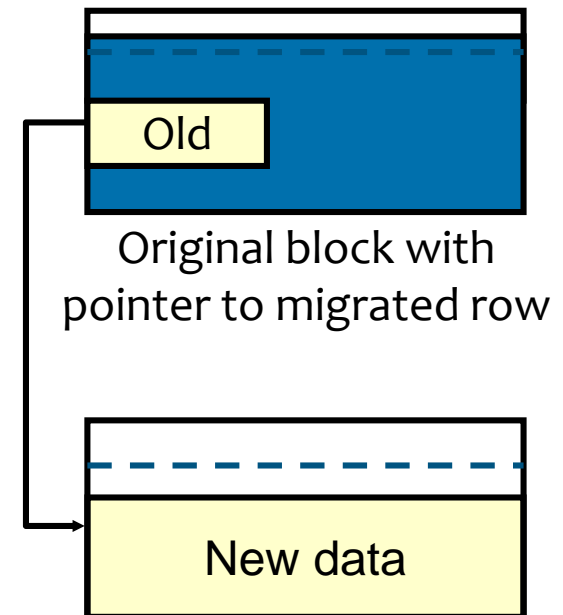




Row Chaining and Migration

Example:

- On update: Row length increases, exceeding the available free space in the block.
- Data needs to be stored in a new block.
- Original physical identifier of row (ROWID) is preserved.
- The Oracle database needs to read two blocks to retrieve data.
- The Segment Advisor finds segments containing the migrated rows.





Proactive Tablespace Monitoring

Edit Tablespace: EXAMPLE

Actions: Add Datafile

General **Storage** **Thresholds**

Name:

Bigfile tablespace: **No**

Extent Management

☒ Locally Managed
☐ Dictionary Managed

Type

☒ Permanent
☐ Temporary

☐ Set as default permanent tablespace
☐ Set as default temporary tablespace

Status

☒ Read Write
☐ Read Only
☐ Offline

Offline Mode:

Datafiles

Select Name: ☒ example01.

Space Used (%)

A warning or critical alert will be generated if the percentage of space used exceeds the corresponding threshold.

☒ Use Database Default Thresholds

Warning (%) **85**
Critical (%) **97**

☐ Specify Thresholds

Warning (%)
Critical (%)

☐ Disable Thresholds

General **Storage** **Thresholds**

Extent Allocation

Allocation Type: **Automatic**

Segment Space Management

Type: **Automatic**

Enable logging

☐ Yes
Generate redo logs for creation of tables, indexes and partitions, and for subsequent inserts. Recoverable

☒ No
Redo log entries are smaller, the above operations are not logged and not recoverable.

Block information

Block Size (B): **8192**

Space Management

t

> Proactive Monitoring

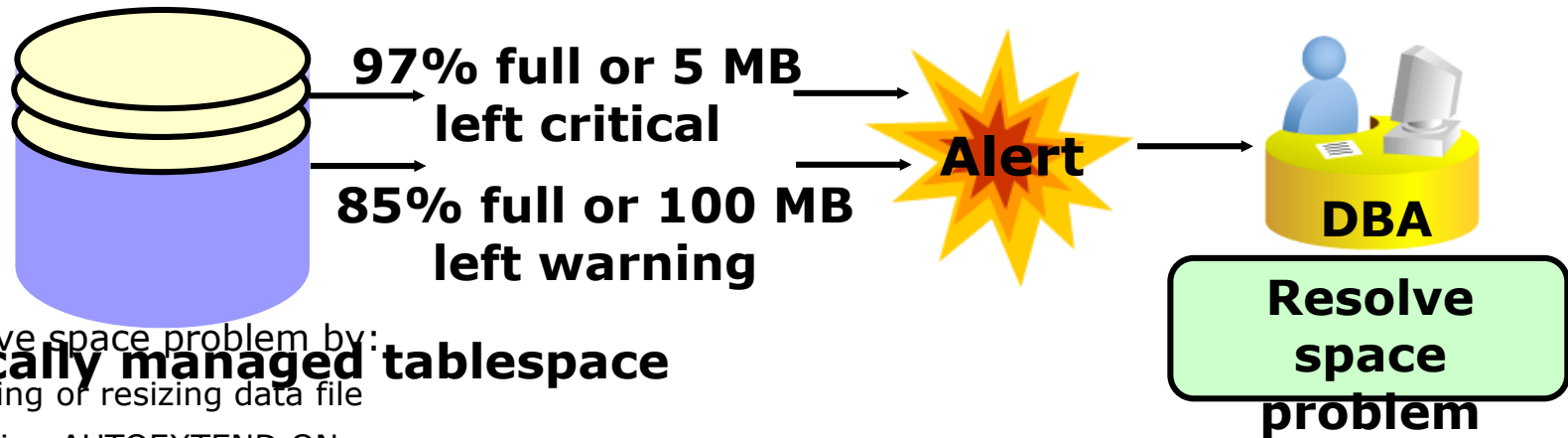
Seg. Advisor & Seg.Shrink

Resumable Allocation

Transportable TBS and DB



Thresholds and Resolving Space Problems

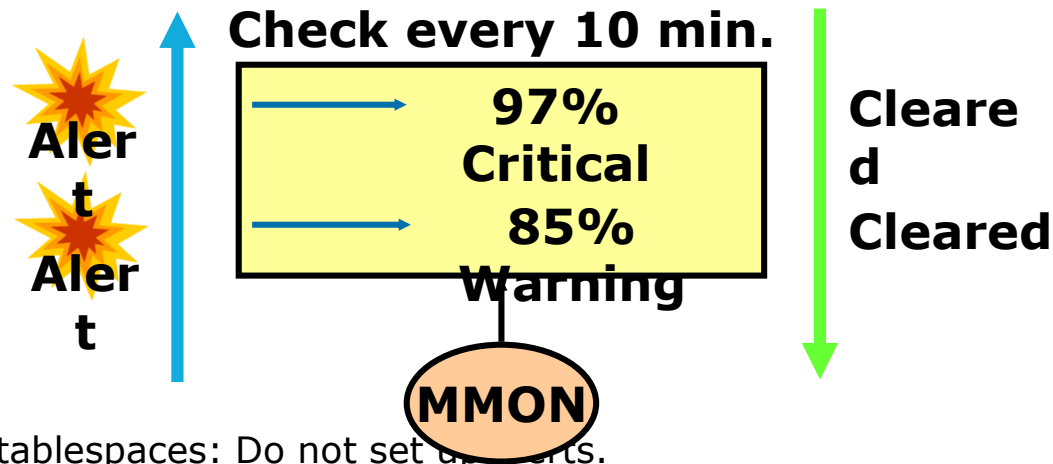


Resolve space problem by:

- **Locally managed tablespace**
- Adding or resizing data file
- Setting AUTOEXTEND ON
- Shrinking objects
- Reducing UNDO_RETENTION
- Checking for long-running queries in temporary tablespaces



Monitoring Tablespace Space Usage



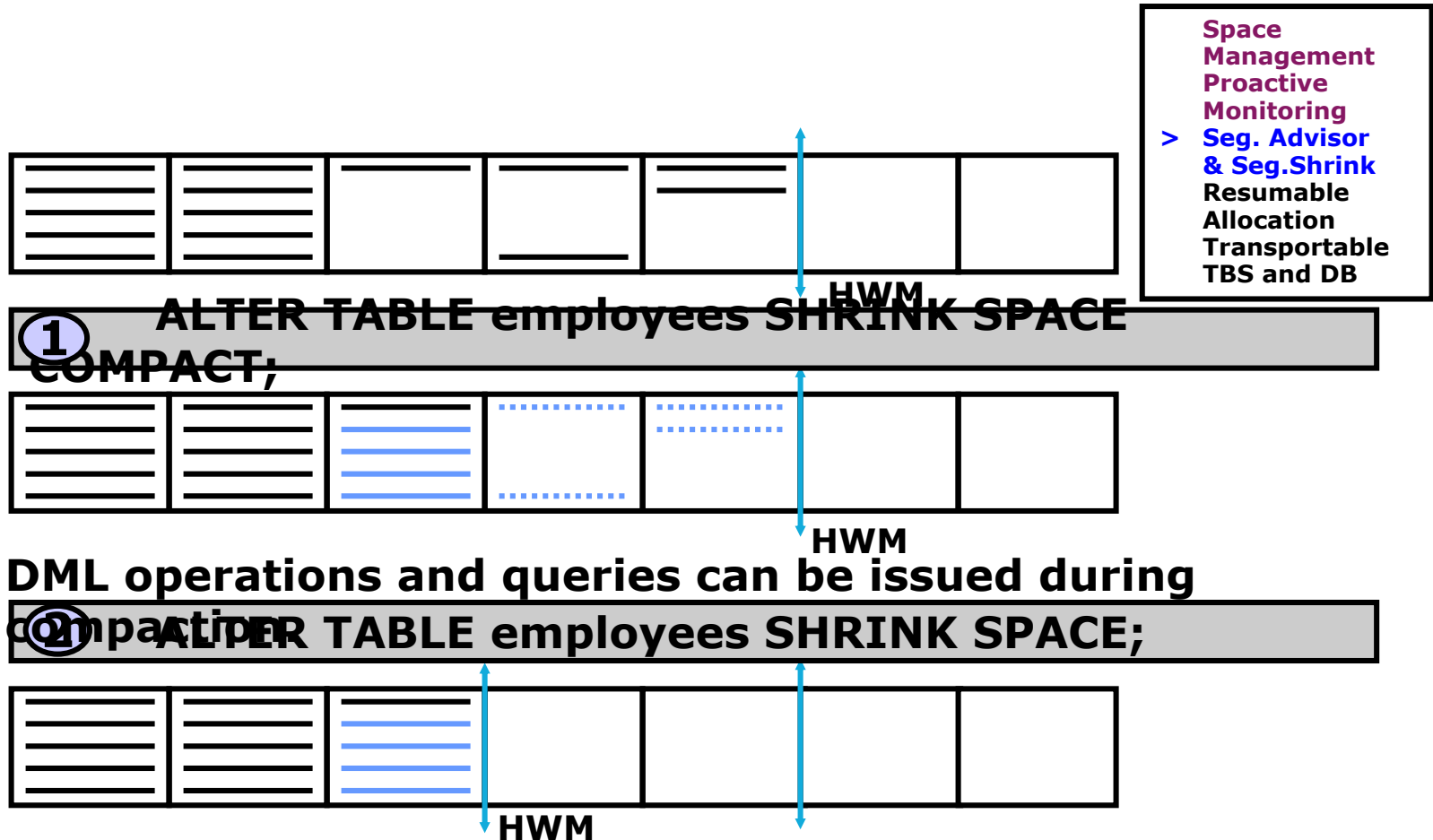
Read-only and offline tablespaces: Do not set up alerts.

Temporary tablespace: Threshold corresponds to space currently used by sessions.

Undo tablespace: Threshold corresponds to space used by active and unexpired extents.

Autoextensible files: Threshold is based on the maximum file size.

Shrinking Segments



DML operations and queries can be issued during compactation.

DML operations are blocked when the HWM is adjusted.



Results of Shrink Operation

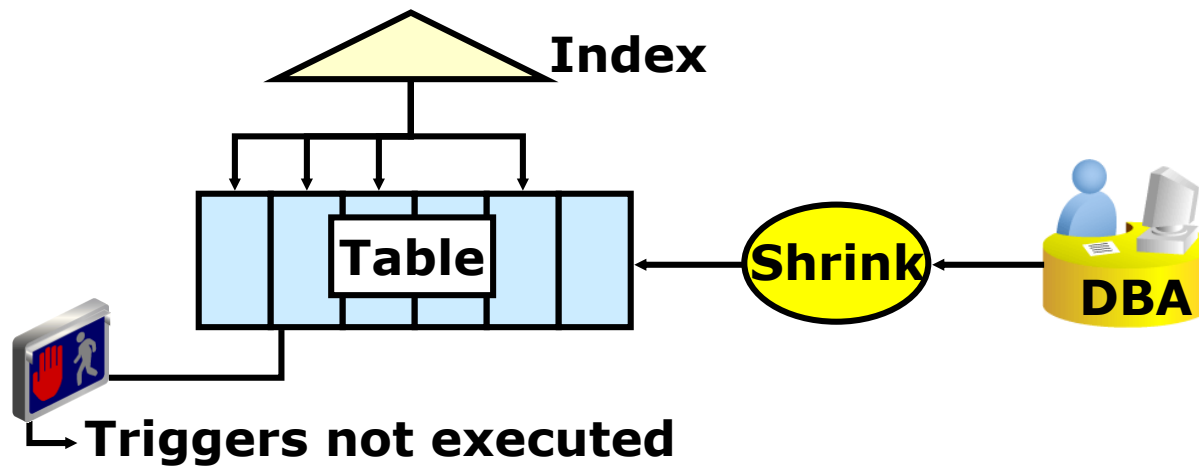
Improved performance and space utilization

Indexes maintained

Triggers not executed

Number of migrated rows may be reduced

Rebuilding secondary indexes on IOTs recommended





Space Reclamation with ASSM

Online and in-place operation

Applicable only to segments residing in ASSM tablespaces

Candidate segment types:

- Heap-organized tables and index-organized tables
- Indexes
- Partitions and subpartitions
- Materialized views and materialized view logs



Segment Advisor: Overview



Automatic Segment Advisor Information

Beginning in Oracle Database 10.2, Oracle provides an Automatic Segment Advisor job which automatically detects segment issues. Any segment issues that have already been detected can be viewed using the link below.

[Segment Advisor Recommendations](#)

Segment Advisor: Scope

Database **orcl.oracle.com**

Logged In As **SYS**

[Cancel](#)

Step 1 of 4

[Next](#)

You can get advice on shrinking segments for individual schema objects or entire tablespaces.

- ☒ Tablespaces
- ☐ Schema Objects

Overview

The segment advisor determines whether objects have unused space that can be released, taking estimated future space requirements into consideration. The estimated future space calculation is based on historical trends.

Segment Advisor



Segment Advisor: Review

Database **orcl.oracle.com**

Logged In As **SYS**

[Cancel](#)

[Show SQL](#)

[Back](#)

Step 4 of 4

[Submit](#)

Task Name **SEGMENTADV_3712320**

Task Description **Get shrink advice based on object growth trend**

Time Limit for Analysis (mins) **Unlimited**

Advisory Results Retention
(days) **30**

Selected Objects

<u>Tablespace</u>	<u>Type</u>
EXAMPLE	PERMANENT



Implementing Recommendations

Database Instance: orcl.oracle.com > Advisor Central > Segment Advisor Task: SEGMENTADV_2730408

Segment Advisor Task: SEGMENTADV_2730408

The following table contains the minimum reclaimable space summary for the evaluated segments in that tablespace. Based on growth trends, the advisor takes into consideration estimated future space requirements. Oracle recommends shrinking or reorganizing these segments to release wasted space. Select the Recommendation Details button to view and implement the recommendations.

Task Name **SEGMENTADV_2730408** Started **Aug 25, 2005 10:04:55 AM**
Status **COMPLETED** Ended **Aug 25, 2005 10:05:09 AM**
Running Time (seconds) **14** Time Limit (mins) **UNLIMITED**

Recommendation Details

Select	Tablespace	Recommendations	Tablespace Size (MB)	Evaluated Space (%)	Reclaimable Space (MB)	Extent Management	Segment Space Management
<input checked="" type="checkbox"/>	TBSALERT	3	120.00	57.50	34.46	LOCAL	AUTO

Recommendation Details for Tablespace: TBSALERT

The following table contains the reclaimable space information for the evaluated segments in the selected tablespace. Based on growth trends, the advisor takes into consideration estimated future space requirements. Oracle recommends shrinking or reorganizing these segments to release wasted space. Select the segment to implement the recommendation.

Task Name **SEGMENTADV_2730408** Started **Aug 25, 2005 10:04:55 AM**
Status **COMPLETED** Ended **Aug 25, 2005 10:05:09 AM**
Running Time (seconds) **14** Time Limit (mins) **UNLIMITED**

Schema Segment Partition Minimum Reclaimable Space (MB)

Select All | Select None

Select	Schema	Segment	Allocated Space	Used Space	Segment
<input checked="" type="checkbox"/>	SYS	EMPLOYEES1	alter table "SYS"."EMPLOYEES1"	shrink space	
<input checked="" type="checkbox"/>	SYS	EMPLOYEES2	alter table "SYS"."EMPLOYEES2"	shrink space	
<input checked="" type="checkbox"/>	SYS	EMPLOYEES3	alter table "SYS"."EMPLOYEES3"	shrink space	



Database Control and Segment Shrink

Create

Edit View Delete Actions Shrink Segment Go

Select	Schema	Table Name	Tablespace	Partition Type	Partitions	Subpartitions	IOT	Clustered
<input type="radio"/>	HR	COUNTRIES	EXAMPLE		0		0 IOT	NO
<input type="radio"/>	HR	DEPARTMENTS	EXAMPLE		0		0	NO
<input checked="" type="radio"/>	HR	EMPLOYEES	EXAMPLE		0		0	NO

Shrink Segment: Options

Segment Name **HR.EMPLOYEES** Show SQL Cancel Continue

Object Type **Table**

The shrink operation compacts fragmented space and, optionally, frees the space. The shrink operation will take some time and will be scheduled as a job.

Shrink Options

☒ Compact Segments and Release Space
This will first compact the segments and then release the recovered space to the tablespace. During the short space release phase, any cursors referencing this segment may be invalidated and queries on the segment could be disrupted.

☐ Compact Segments
Compacting will compact segment data without releasing the recovered space. After compacting the data, the recovered space can be quickly released by running Compact Segments and Release Space.

Segment Selection

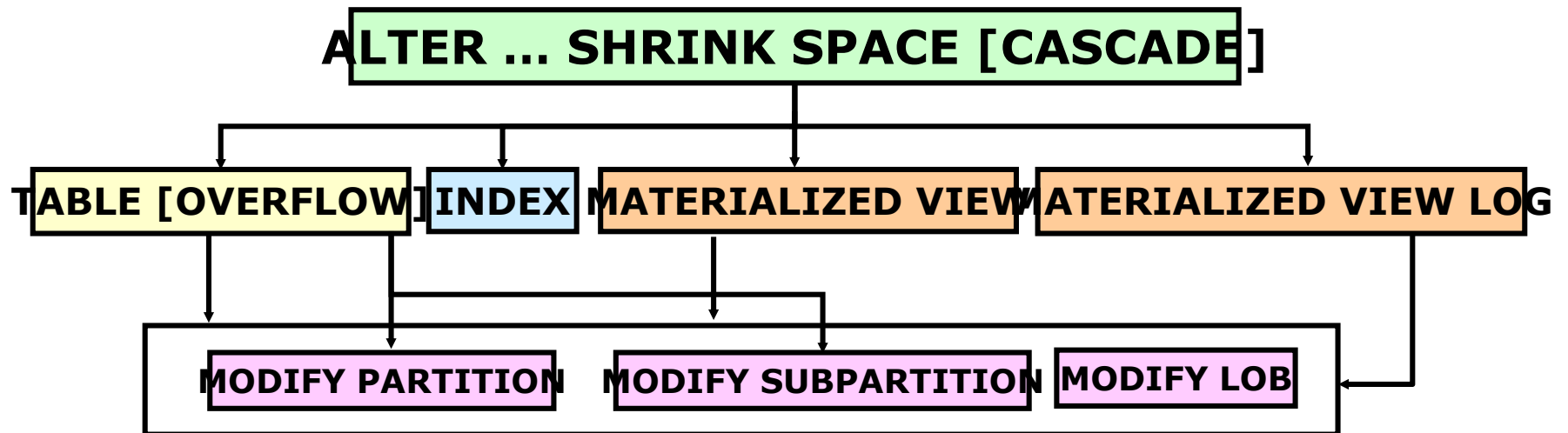
☒ Shrink HR.EMPLOYEES Only

☐ Shrink HR.EMPLOYEES and All Dependent Segments

Dependent Segments

Schema	Segment Name	Type	Tablespace
HR	EMPLOYEES	TABLE	EXAMPLE
HR	EMP_EMAIL_UK	INDEX	EXAMPLE

Shrinking Segments by Using SQL



ALTER TABLE employees ENABLE ROW MOVEMENT;

①

ALTER TABLE employees SHRINK SPACE CASCADE;

②

ALTER TABLE employees MODIFY LOB(resume) (SHRINK SPACE);

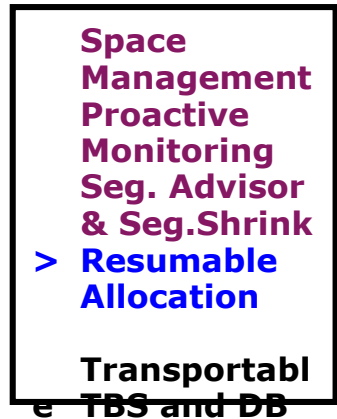
③

ALTER TABLE employees OVERFLOW SHRINK SPACE;

④



Managing Resumable Space Allocation



A resumable statement:

- Enables you to suspend large operations instead of receiving an error
- Gives you a chance to fix the problem while the operation is suspended, rather than starting over
- Is suspended for the following conditions:
 - Out of space
 - Maximum extents reached
 - Space quota exceeded



Using Resumable Space Allocation

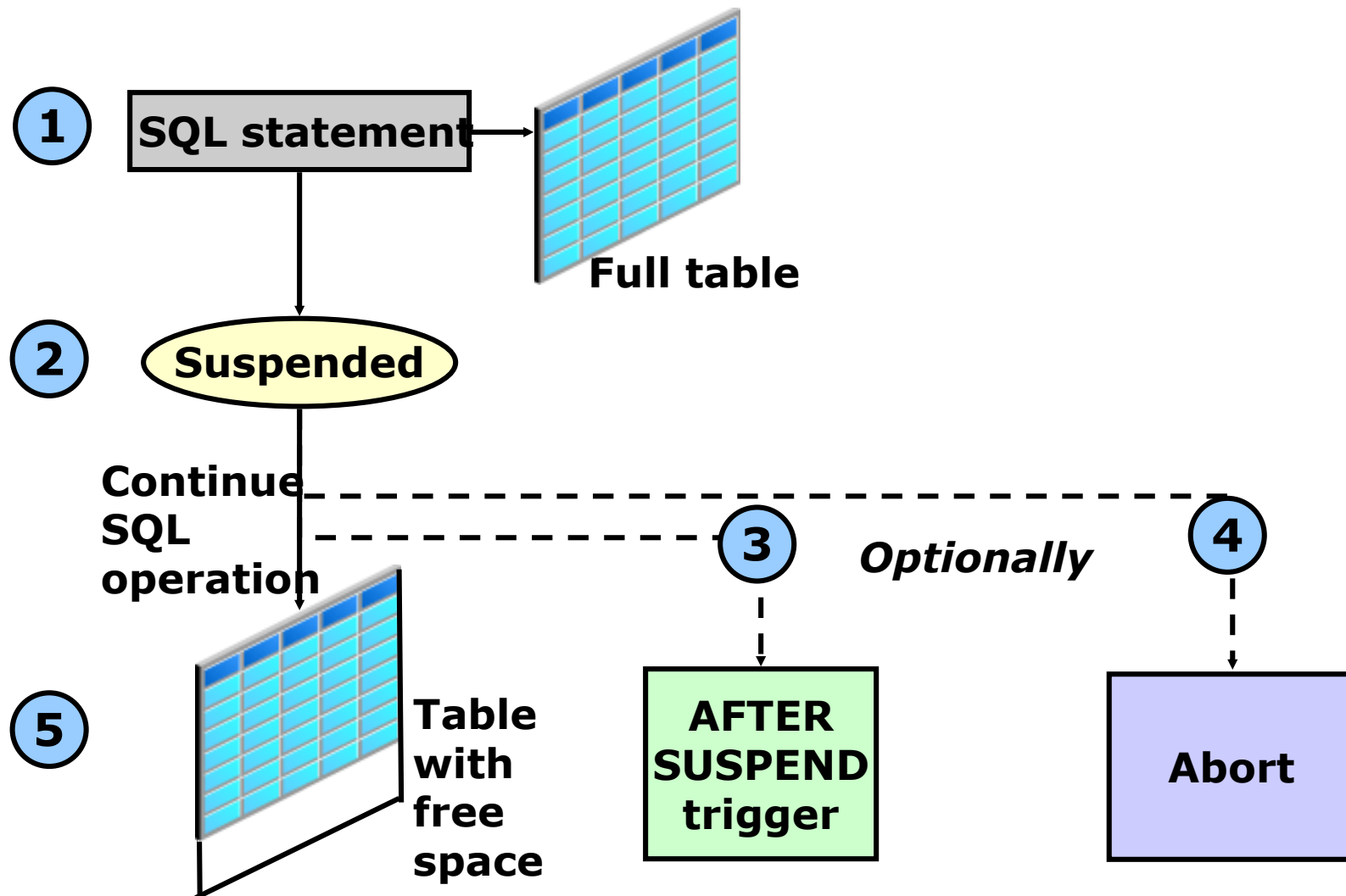
Queries, DML operations, and certain DDL operations can be resumed if they encounter an out-of-space error.

A resumable statement can be issued through SQL, PL/SQL, SQL*Loader, or the Oracle Call Interface (OCI).

To run a resumable statement, you must first enable resumable statements for your session.

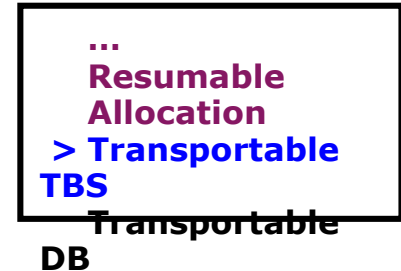
```
ALTER SESSION ENABLE RESUMABLE;  
INSERT INTO sales_new SELECT * FROM sh.sales;  
ALTER SESSION DISABLE RESUMABLE;
```

Resuming Suspended Statements





Transporting Tablespaces .



Concept: Cross-platform transportable tablespaces:

- Simplify data distribution between data warehouse and data marts
- Allow database migration from one platform to another
- Supported platforms:

Solaris[tm] OE (32-bit)	HP-UX (64-bit)	Microsoft Windows IA (64-bit)
Solaris[tm] OE (64-bit)	HP Tru64 UNIX	IBM zSeries Based Linux
Microsoft Windows IA (32-bit)	HP-UX IA (64-bit)	Linux 64-bit for AMD
Linux IA (32-bit)	Linux IA (64-bit)	Apple Mac OS
AIX-Based Systems (64-bit)	HP Open VMS	Microsoft Windows 64-bit for AMD
		Solaris Operating System (x86)

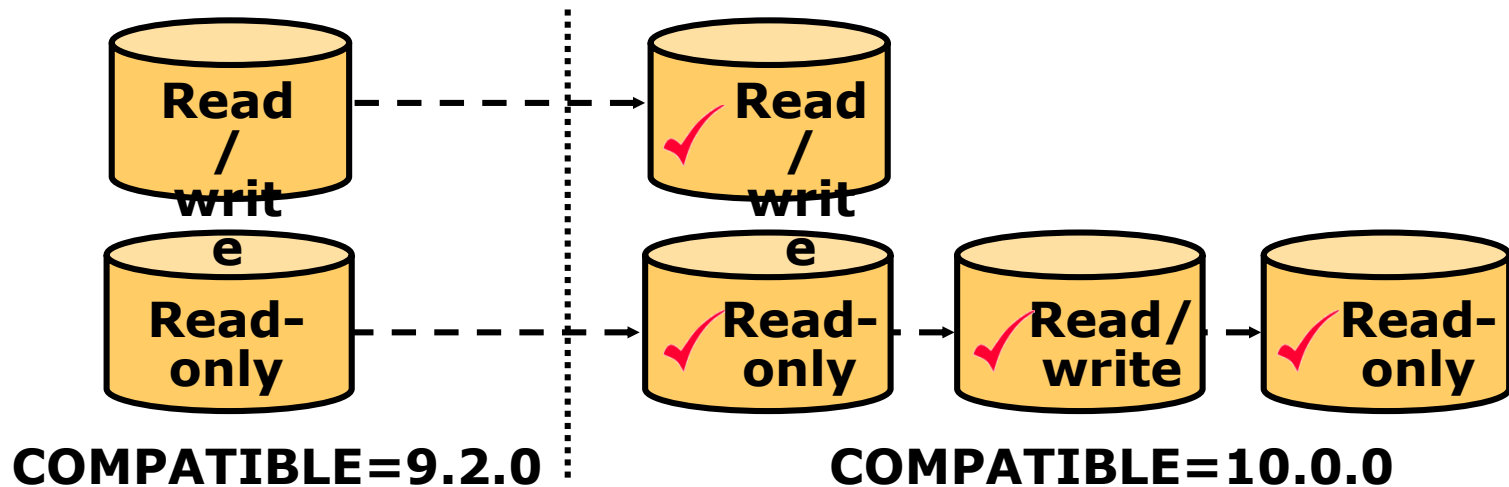


Concept: Minimum Compatibility Level

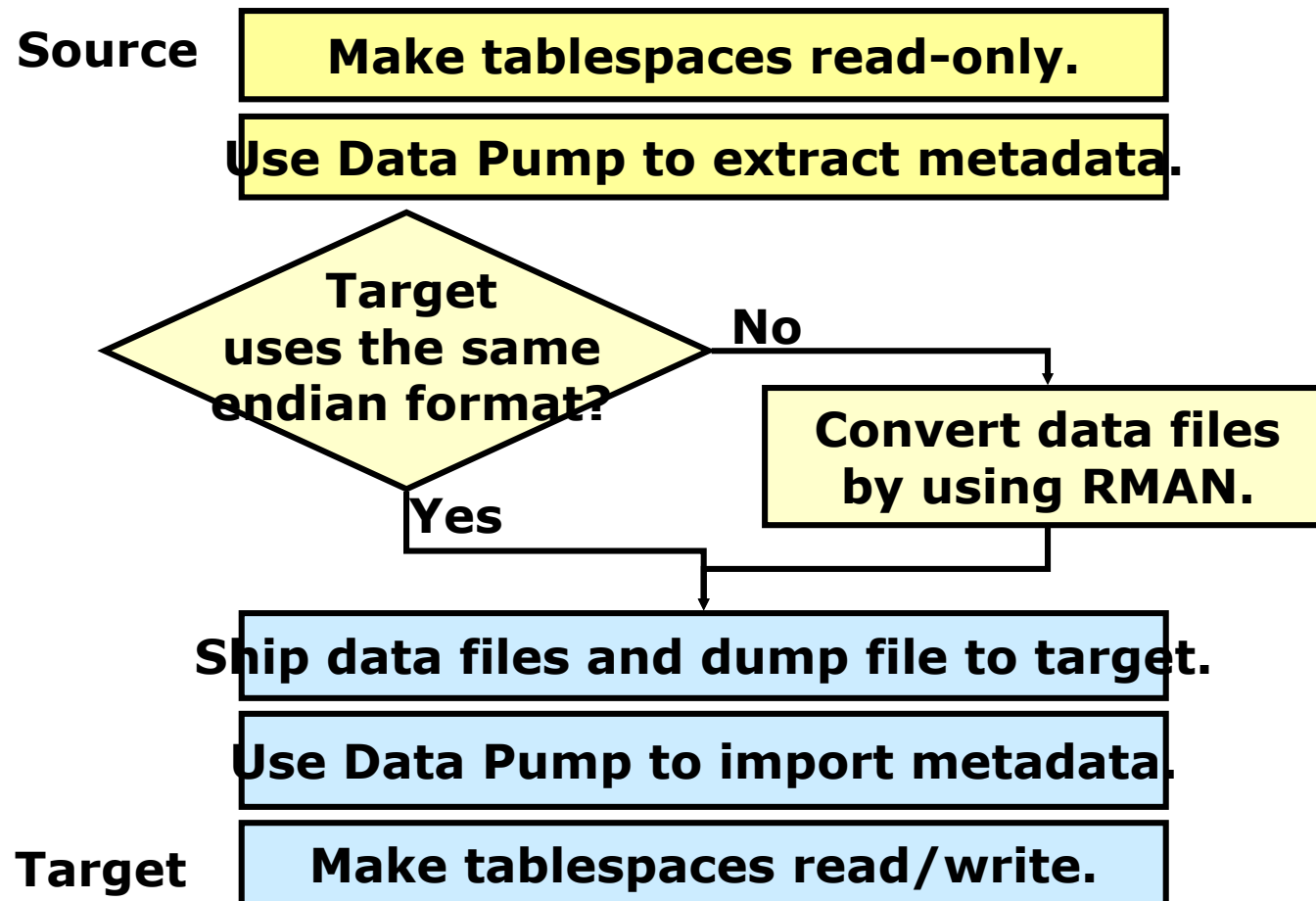
Both source and target databases must have COMPATIBLE set to 10.0.0 or higher.

Data file headers are platform-aware.

Before transporting, make sure that all read-only and offline files are platform-aware.



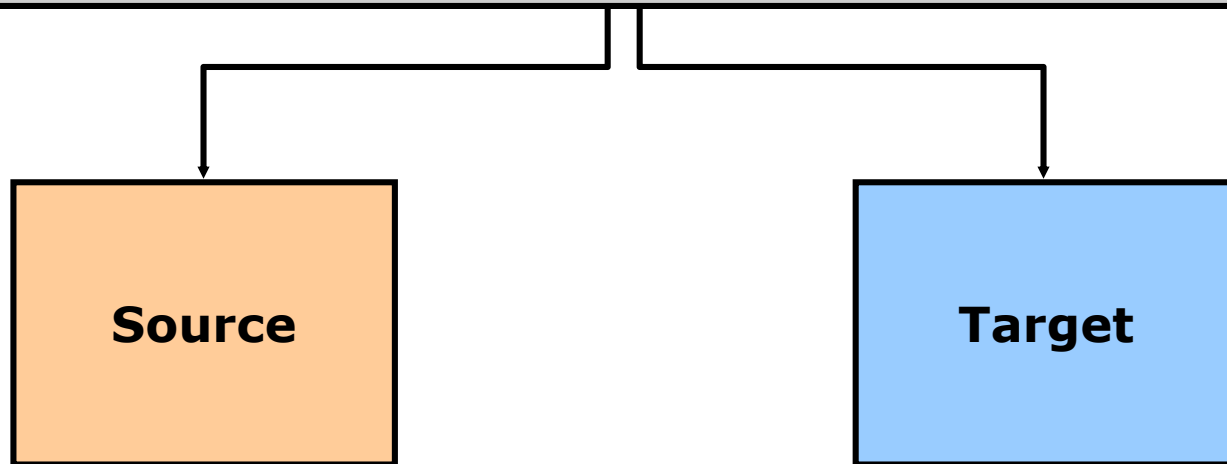
Transportable Tablespace Procedure





Determining the Endian Format of a Platform

```
SELECT tp.endian_format  
FROM v$transportable_platform tp,  
v$database d  
WHERE tp.platform_name = d.platform_name;
```





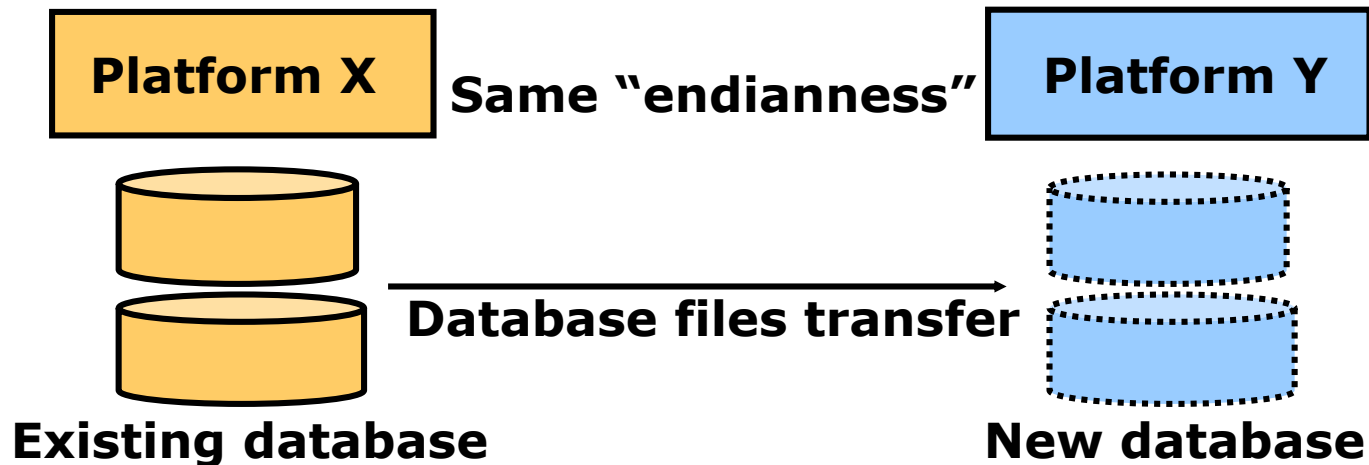
Transporting Databases

Generalize the transportable tablespace feature.

Data can easily be distributed from a data warehousing environment to data marts on smaller platforms.

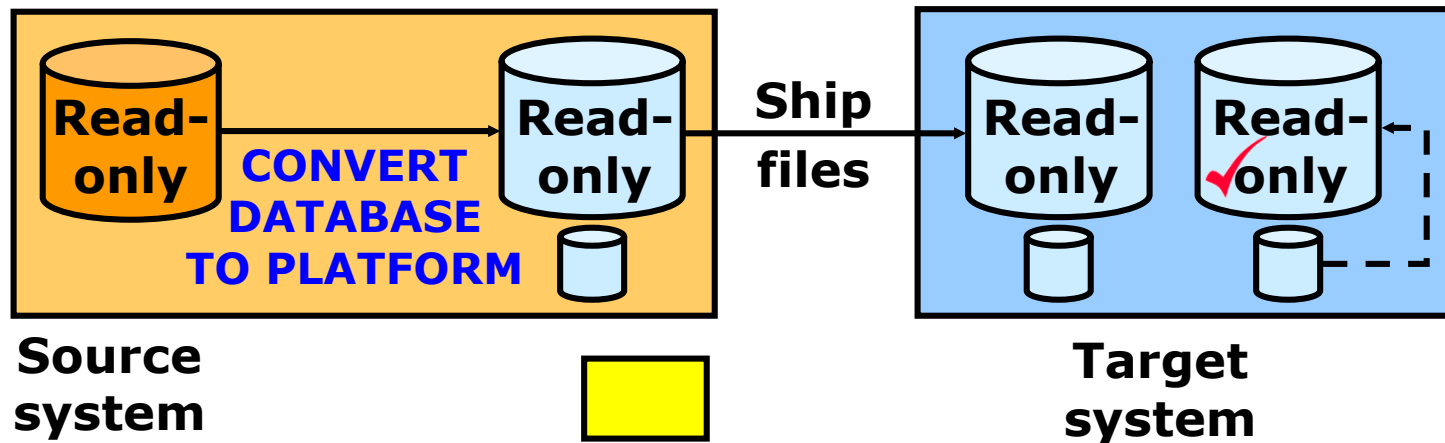
A database can be migrated from one platform to another very quickly.

...
Resumable
Allocation
Transportable
TBS
→ Transportable
DB





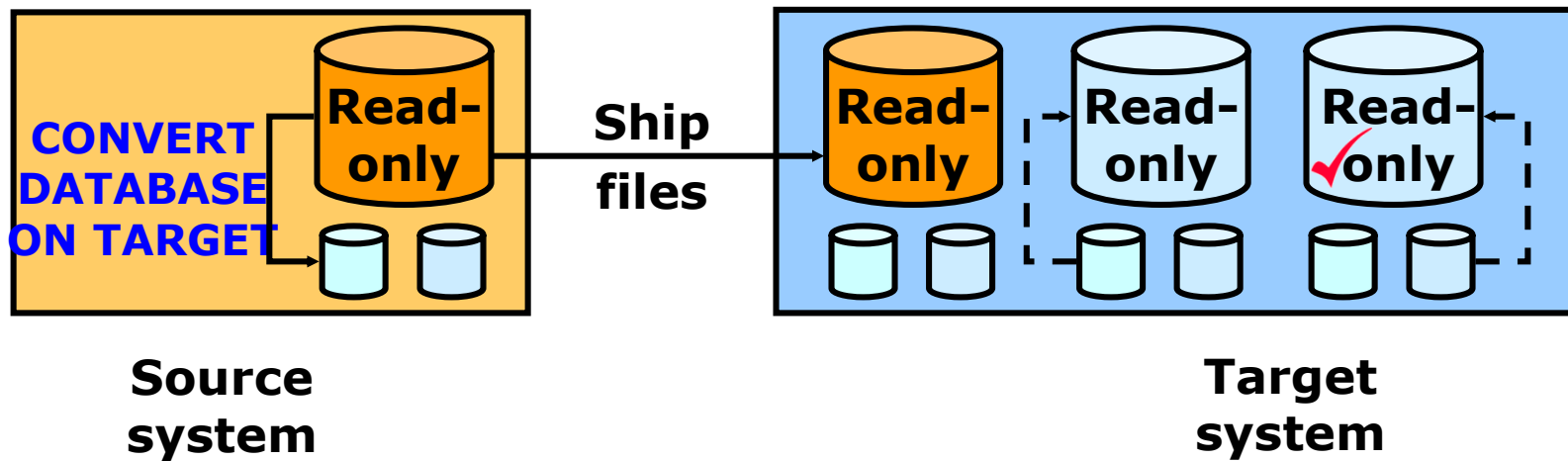
Open database in **READ ONLY** mode
and **COMPATIBLE=10.0.0**



Database Transportation Procedure: Target System Conversion



Open database in **READ ONLY** mode
and **COMPATIBLE=10.0.0**





Database Transportation: Considerations

Create the password file on the target platform.
Transport the BFILEs used in the source database.
The generated pfile and transport script use OMF.
Use DBNEWID to change the DBID.

SUMMARY

- In this lesson, you should have learned how to:
 - Use the Oracle database to automatically manage space
 - Proactively monitor and manage tablespace space usage
 - Use the Segment Advisor
 - Reclaim wasted space from tables and indexes by using the segment shrink functionality
 - Manage resumable space allocation
 - Describe the concepts of transportable tablespaces and databases