



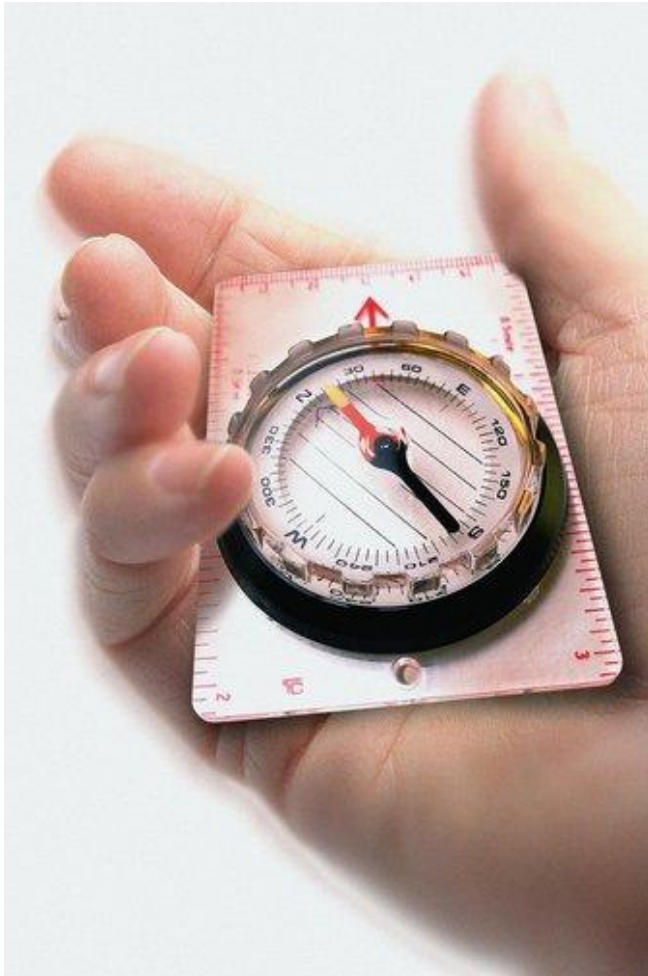
Managing Data Recovery





Course objectives

By completing this course, you will be able to:



- Realize different recovery
- Explain reasons for incomplete recovery
- Monitor the Flashback Database
- Perform transaction level recovery using Flashback Transaction query





Course topics

Course's plan:



- Recovering from Noncritical Losses
- Database Recovery
- Flashback Database
- Recovering from User Errors





Recovering from Noncritical Losses



Preview

- Recover temporary tablespaces
- Recover a redo log group member
- Recover index tablespaces
- Recover read-only tablespaces
- Re-create the password file





Recover temporary tablespaces

Recovery of Noncritical Files

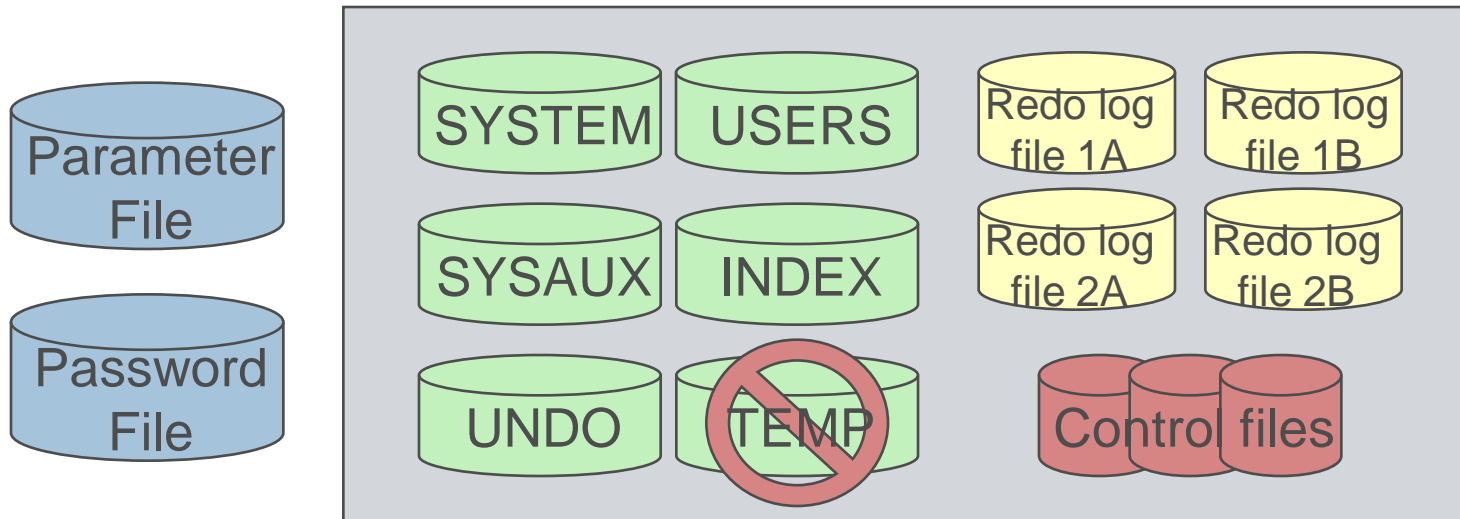
- Create a new file
- Rebuild the file
- Recover the lost or damaged files





Recover temporary tablespaces

Creating New Temporary Tablespaces



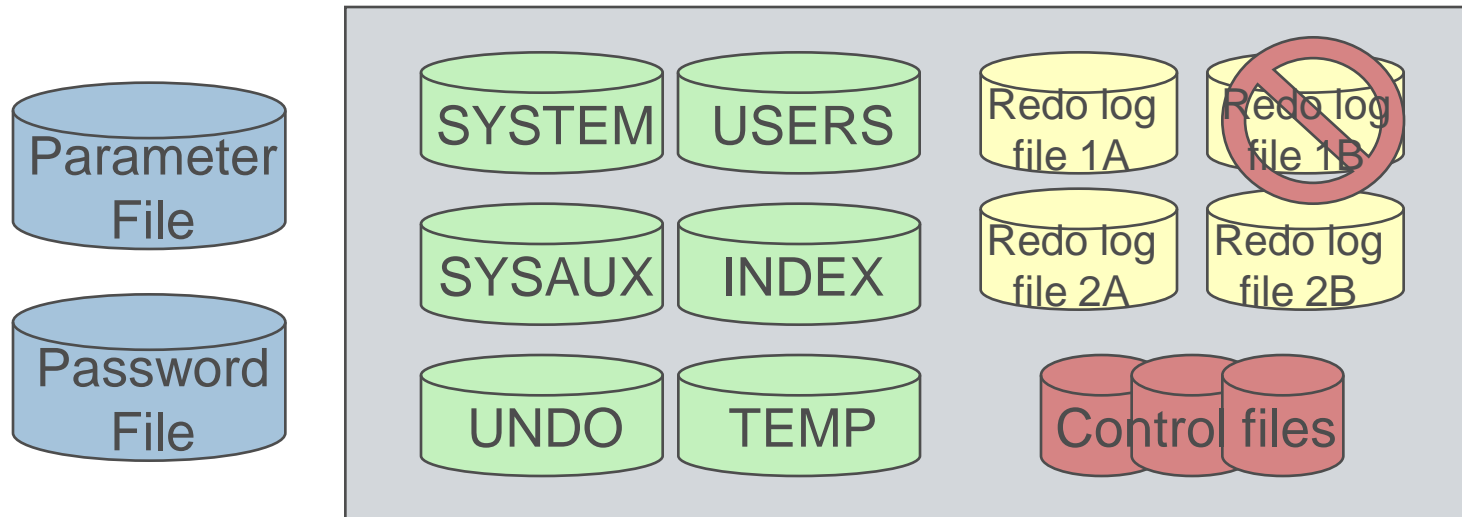
```
SQL> CREATE TEMPORARY TABLESPACE temp2  
2> TEMPFILE '/oradata/temp2_01.tmp'  
3> SIZE 25M;
```





Recover a redo log group member

Re-creating Redo Log Files



```
SQL> ALTER DATABASE DROP LOGFILE MEMBER
      2> '/oradata/redo01b.log' ;
SQL> !rm /oradata/redo01b.log
SQL> ALTER DATABASE ADD LOGFILE MEMBER
      2> '/oradata/redo01b.log'
      3> TO GROUP 1;
```





Recover a redo log group member

Re-creating Redo Log Files

ORACLE Enterprise Manager 10g Database Control

Setup Preferences Help Logout Database

Database: orcl.us.oracle.com > Redo Log Groups > Edit Redo Log Group: 2 Logged in As SYS

Edit Redo Log Group: 2

Show SQL Revert Apply

Group # 2
File size 10240 KB
Status UNUSED

Redo Log Members

Add Edit Remove

| Select | File Name | File Directory |
|----------------------------------|-------------|-------------------------------|
| <input type="radio"/> | redo02.log | /u01/app/oracle/oradata/orcl/ |
| <input checked="" type="radio"/> | redo02b.log | /u01/app/oracle/oradata/orcl/ |

Show SQL Revert Apply

Database | Setup | Preferences | Help | Logout

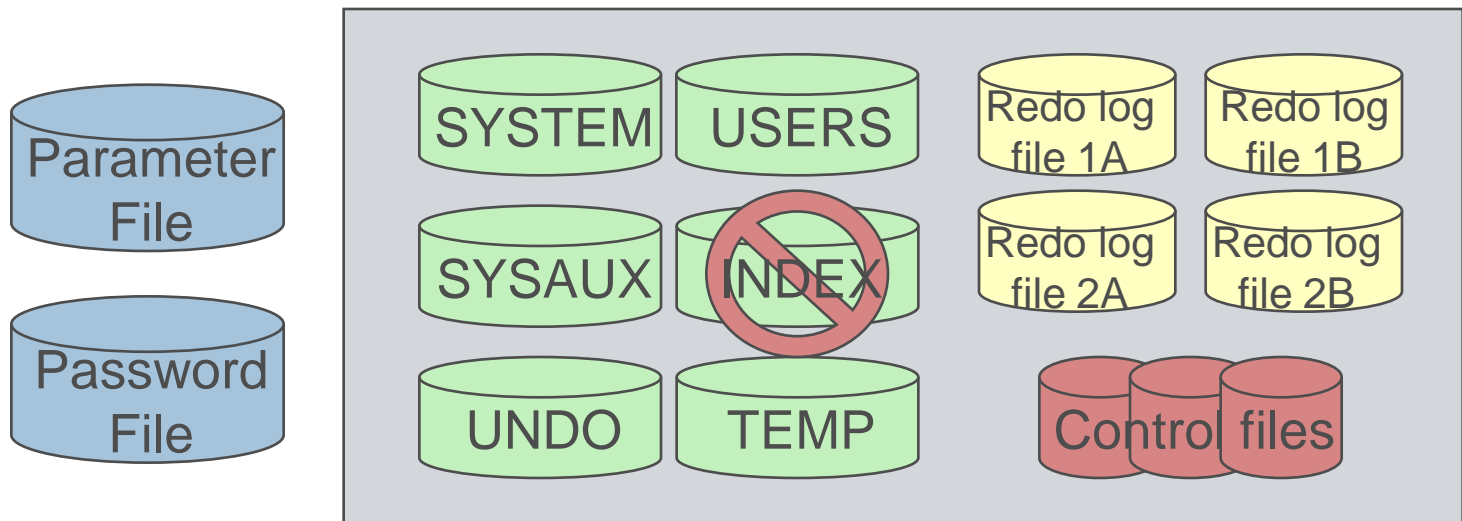
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Recovering from Noncritical Losses

Recover index tablespaces

Recovering an Index Tablespace



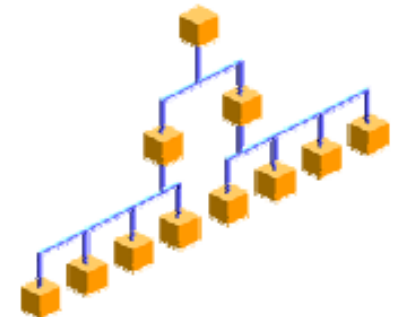


Recover index tablespaces

Re-creating Indexes

- Use options to reduce the time it takes to create the index:
 - **PARALLEL**
 - **NOLOGGING**

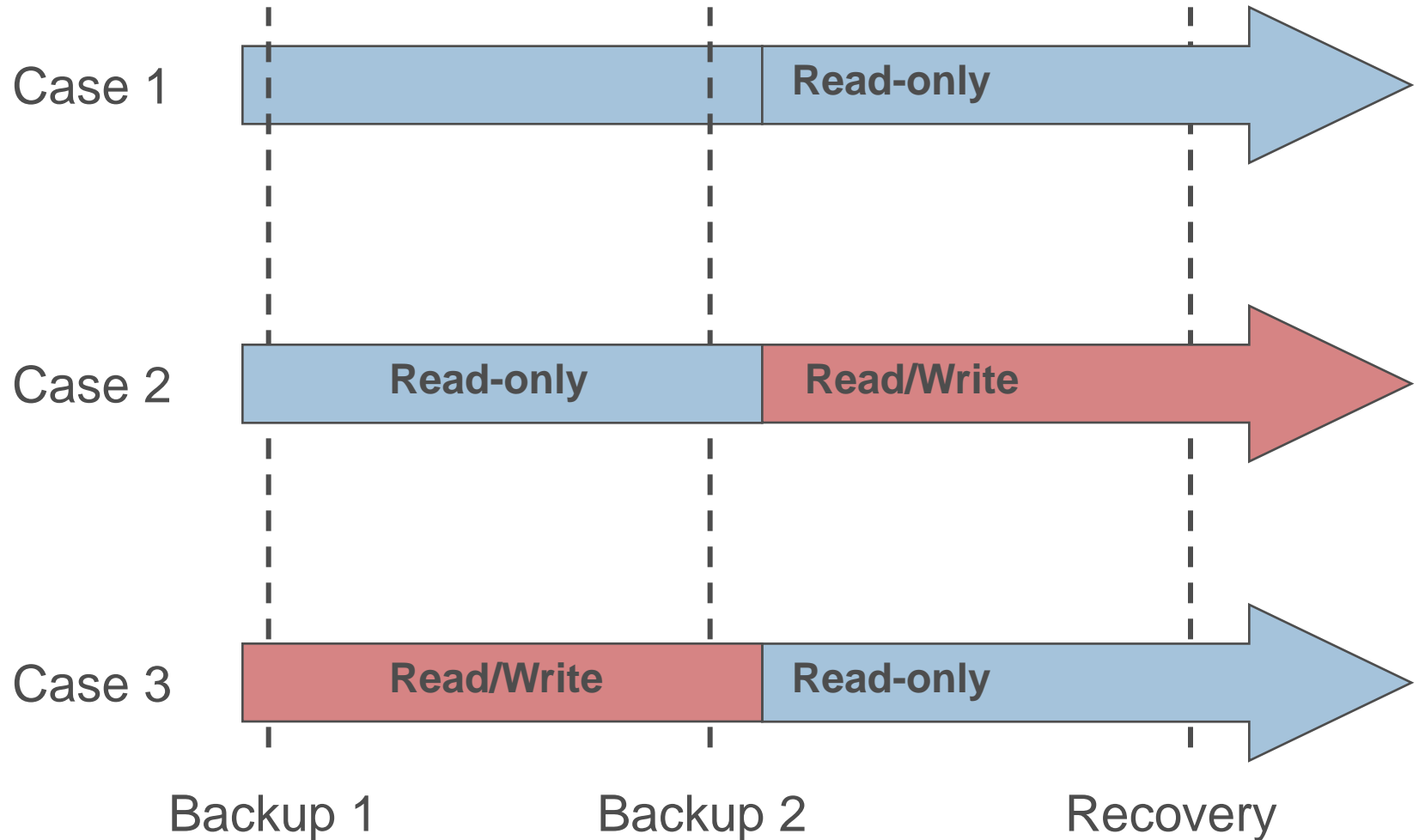
```
SQL> CREATE INDEX rname_idx  
2 ON hr.regions (region_name)  
3 PARALLEL 4;
```





Recover read-only tablespaces

Read-only Tablespace Recovery





Recover read-only tablespaces

Read-only Tablespace Recovery Issues

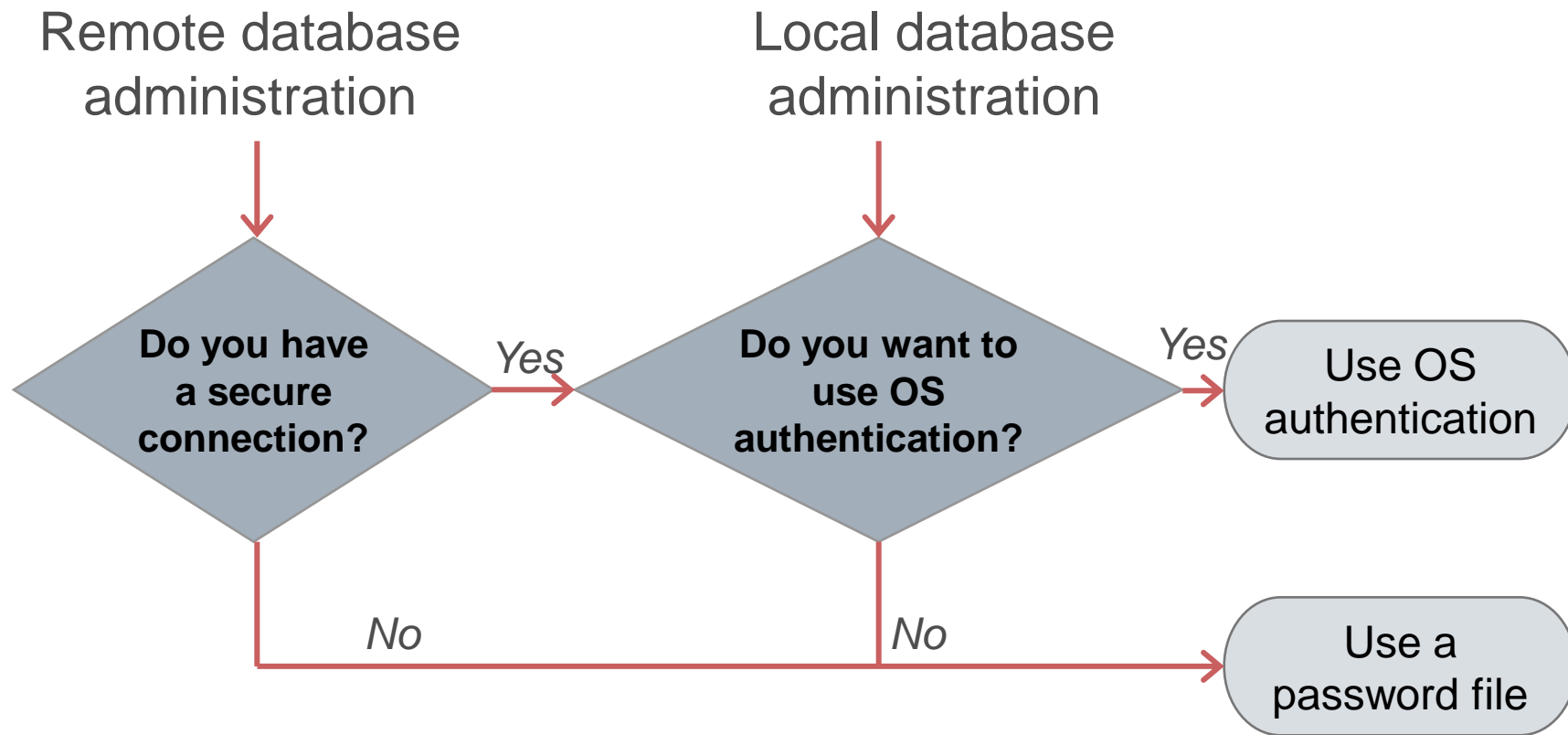
- Special considerations must be taken for read-only tablespaces when:
 - Re-creating a control file
 - Renaming data files
 - Using a backup control file





Re-create the password file

Authentication Methods for Database Administrators





Re-create the password file

Loss of Password Authentication File


- 1 Log in to the database using OS authentication.
- 2 Set the `REMOTE_LOGIN_PASSWORDFILE` parameter to `NONE` and restart the database
- 3 Re-create the password file using `orapwd`.

```
$ orapwd file=$ORACLE_HOME/dbs/orapwORCL  
password=admin entries=5
```
- 4 Set `REMOTE_LOGIN_PASSWORDFILE` to `EXCLUSIVE`.
- 5 Add users to the password file and assign appropriate privileges to each user.
- 6 Restart the instance.







Part 1 Summary



**Recover
temporary
tablespaces**




**Recover a
redo log group
member**



**Recover
index
tablespaces**



**Recover read-
only
tablespaces**



**Re-create the
password file**





Part 1 Stop-and-think

Do you have any questions ?





Database Recovery



Preview

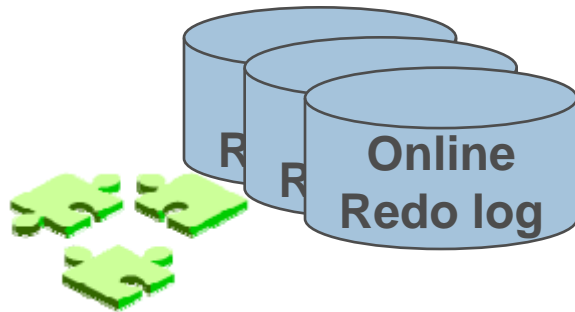
- Recover the control file
- Explain reasons for incomplete recovery
- Describe incomplete recovery methodology
- Recover the database to a specific point in time using



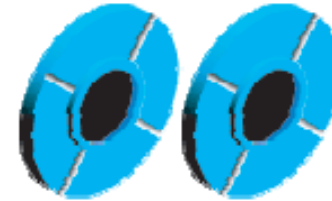


Recover the control file

Recovery Steps



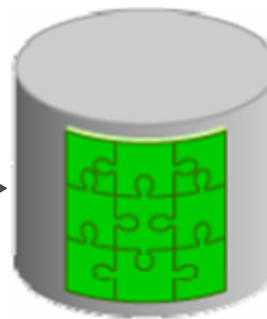
Changes applied



Undo applied



Restored data
files



Data files containing
committed and uncommitted
transactions



Recovered data
files





Recover the control file

Server Managed Recovery: RESTORE and RECOVER Commands

```
run{  
  sql "ALTER TABLESPACE indx_tbs OFFLINE IMMEDIATE";  
  RESTORE TABLESPACE indx_tbs;  
  RECOVER TABLESPACE indx_tbs DELETE ARCHIVELOG;  
  sql "ALTER TABLESPACE indx_tbs ONLINE";  
}
```





Recover the control file

User-Managed Recovery Procedures: RECOVER Command

- Restore all database files from backup and recover the database:

```
SQL> RECOVER DATABASE
```

- Restore the damaged data files from a backup and recover the data files:

```
SQL> RECOVER TABLESPACE index_tbs
```

- or

```
SQL> RECOVER DATAFILE  
2> '/oradata/indx01.dbf'
```

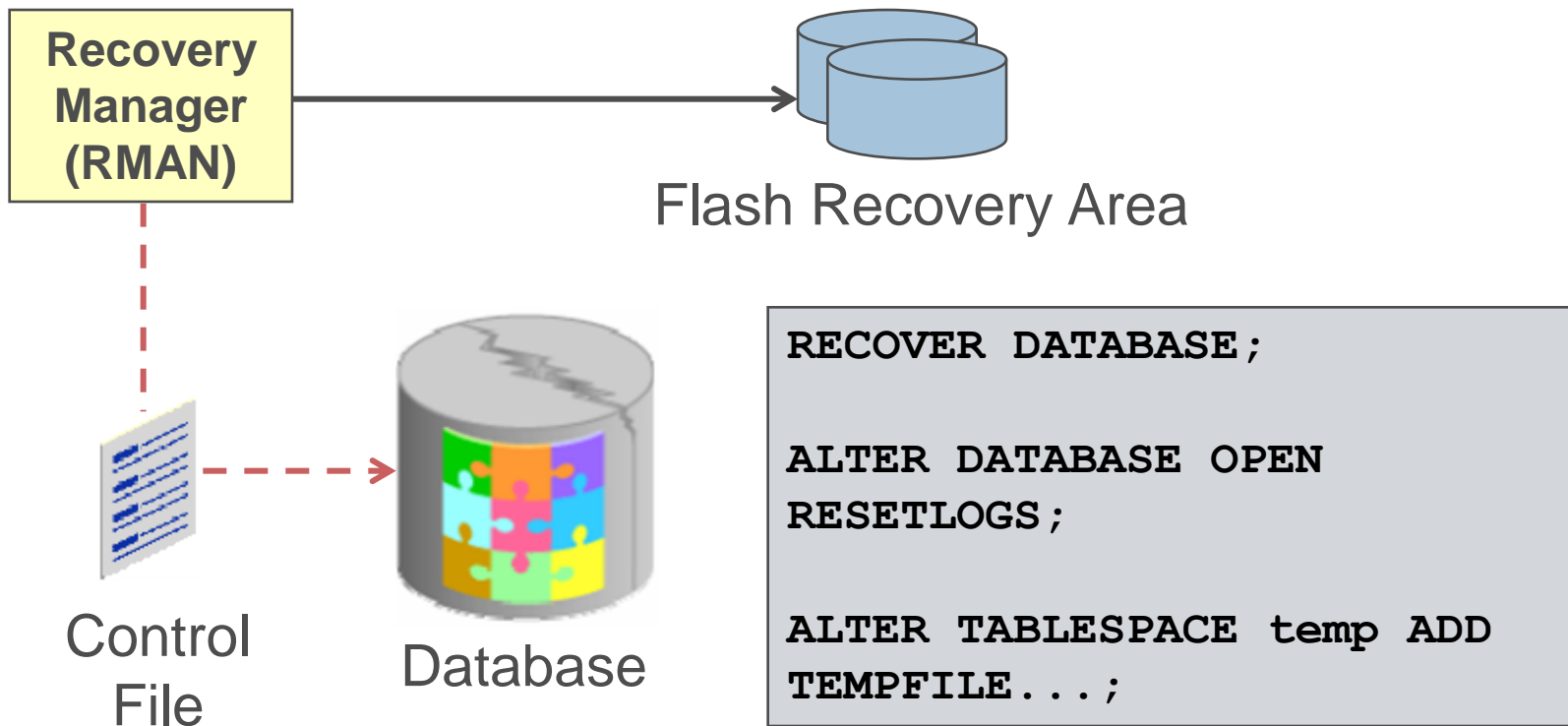




Recover the control file

Recovering a Control File Autobackup

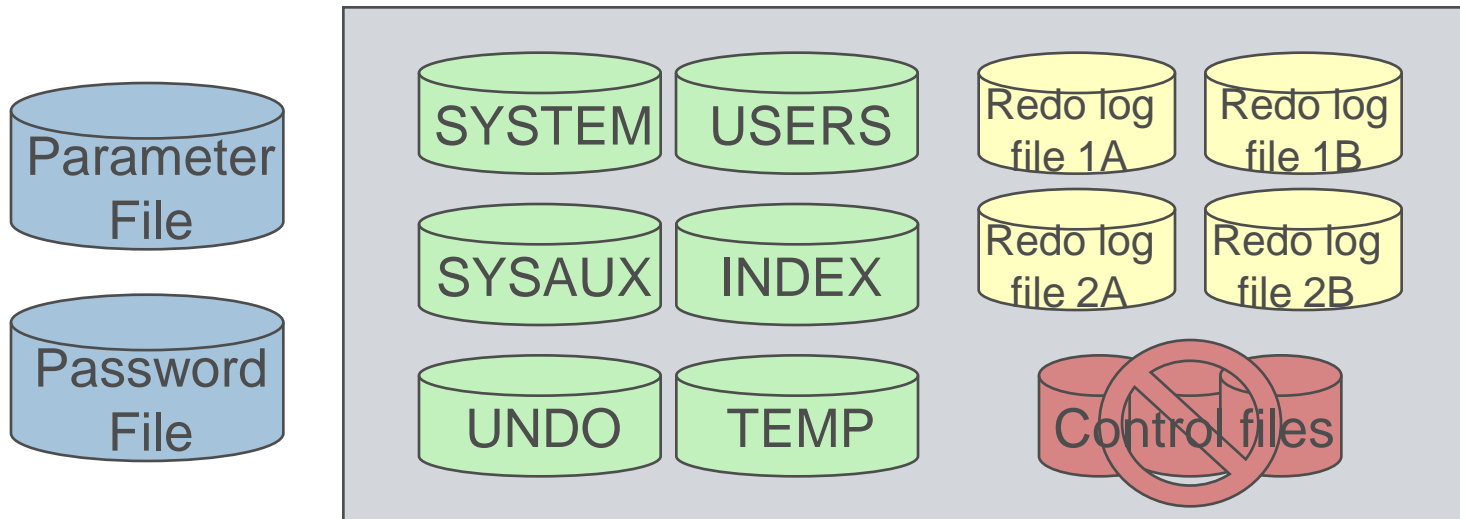
```
RMAN> RESTORE CONTROLFILE TO  
2> '/oradata/spfile.bak' FROM AUTOBACKUP;
```





Recover the control file

Creating a New Control File



```
SQL> ALTER DATABASE BACKUP CONTROLFILE  
      TO TRACE;
```





Recover the control file

Creating a New Control File

ORACLE Enterprise Manager 10g Setup Preferences Help Logout
Database Control Database

Database: [orcl.us.oracle.com](#) > Controlfiles Logged in As SYS

Controlfiles

General Advanced Record Section

Backup To Trace

Controlfile Mirror Images

Oracle strongly recommends that your database has a minimum of two control files and that they are located on separate disks. If a control file is damaged due to a disk failure, it could be restored using the intact copy of the control file from the other disk. You can specify their location in the database's initialization parameter file.

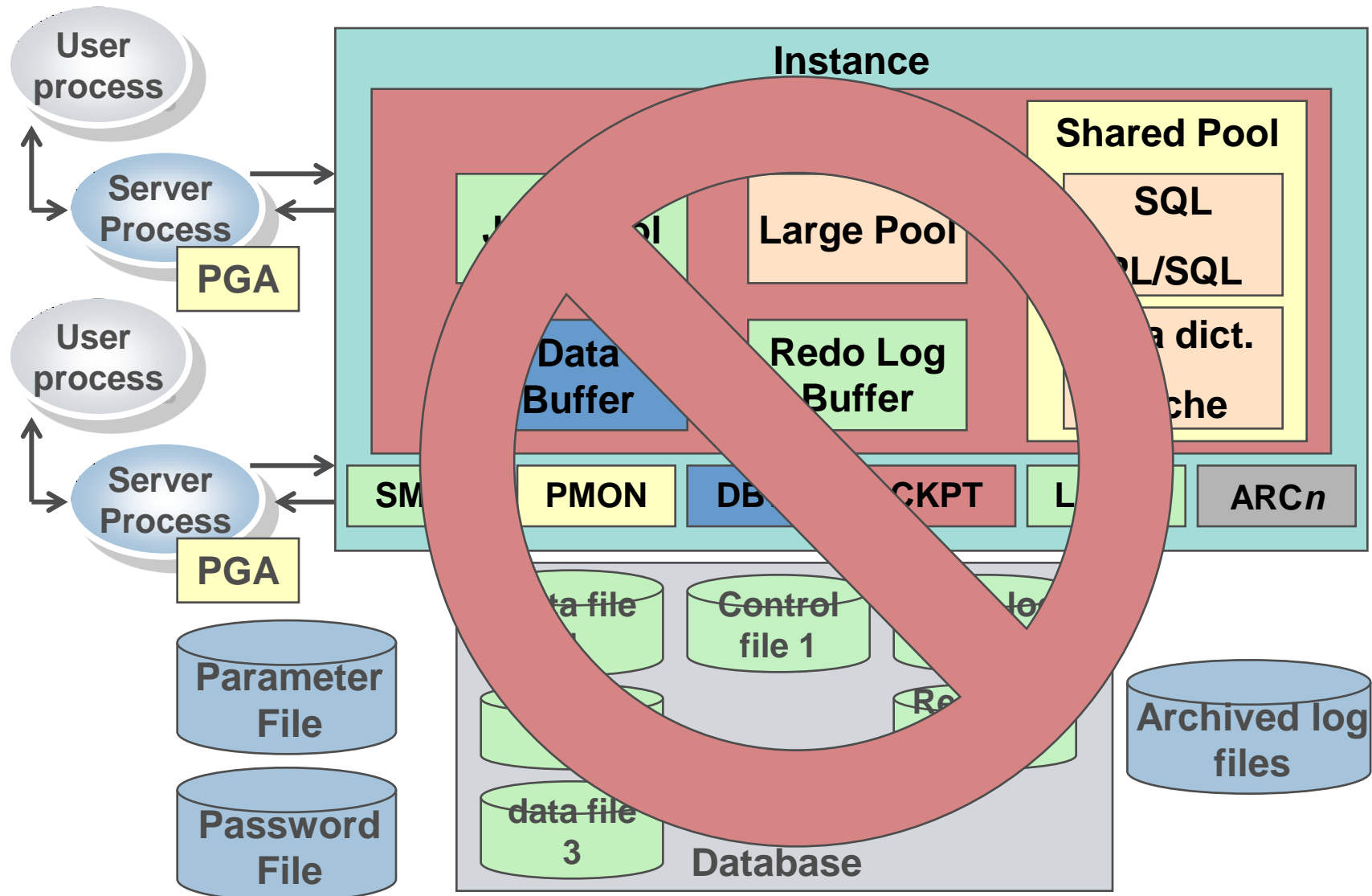
| Valid | File Name | File Directory |
|-------|---------------|-------------------------------|
| VALID | control01.ctl | /u01/app/oracle/oradata/orcl/ |
| VALID | control02.ctl | /u01/app/oracle/oradata/orcl/ |
| VALID | control03.ctl | /u01/app/oracle/oradata/orcl/ |





Explain reasons for incomplete recovery

Recovery Manager Features





Explain reasons for incomplete recovery

Situations Requiring Incomplete Recovery

- Complete recovery fails because of a missing archived log file
- One or more unarchived redo log files and a data file are lost
- A backup of the control file is used to open or recover the database

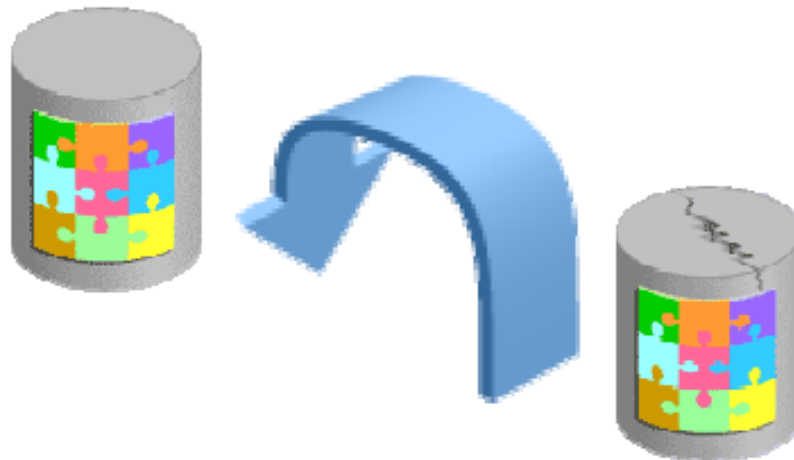




Describe incomplete recovery methodology

Types of Incomplete Recovery

- There are four types of incomplete recovery:
 - Time-based recovery
 - Cancel-based recovery
 - Change-based recovery
 - Log sequence recovery





Describe incomplete recovery methodology

Incomplete Recovery Best Practices

- Follow all steps carefully.
- Take whole database backups before and after recovery.
- Always verify that the recovery was successful.
- Back up and remove archived logs.





Describe incomplete recovery methodology

Using RECOVER for Incomplete Recovery

- Recover a database until time:

```
SQL> RECOVER DATABASE UNTIL  
2 TIME '2003-12-14 12:10:03';
```

- Recover a database until cancel:

```
SQL> RECOVER DATABASE UNTIL CANCEL;
```

- Recover using backup control file:

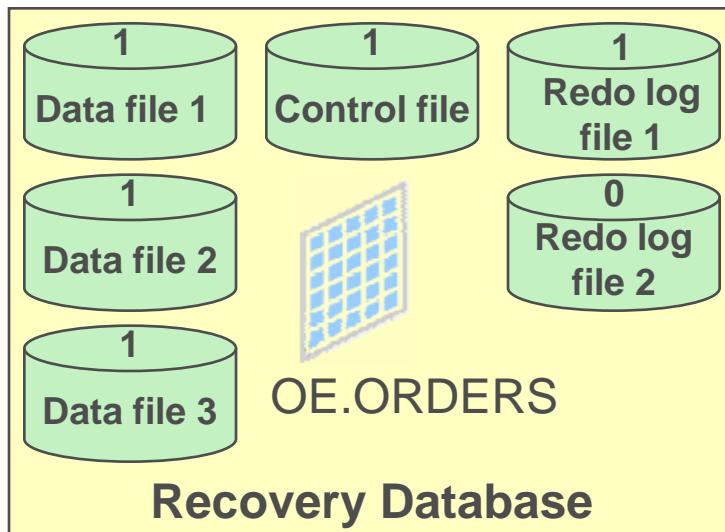
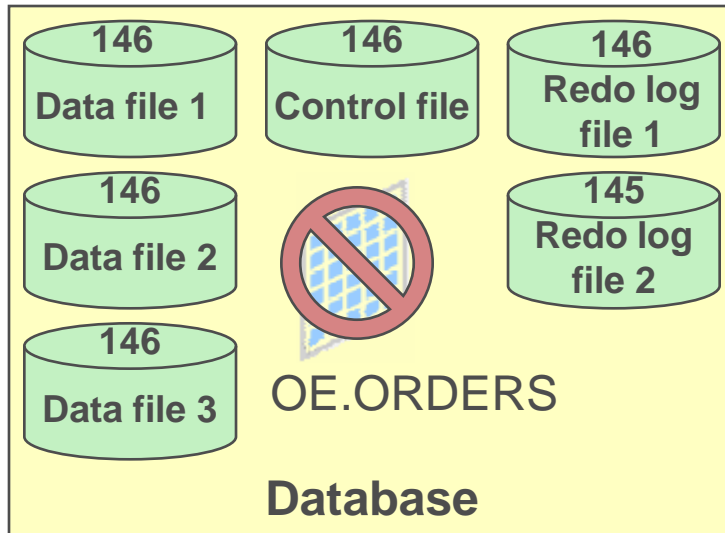
```
SQL> RECOVER DATABASE  
2 UNTIL TIME '2003-12-14 12:10:03'  
3 USING BACKUP CONTROLFILE;
```



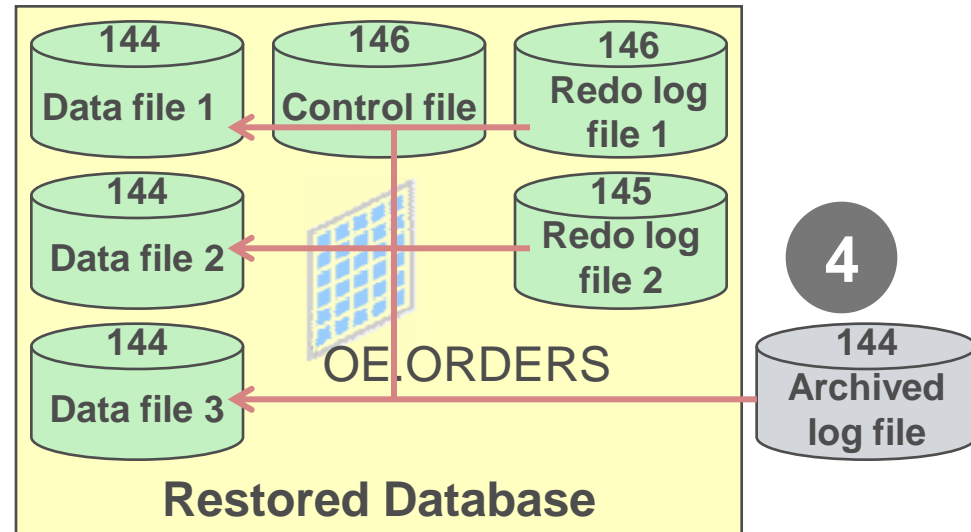


Describe incomplete recovery methodology

UNTIL TIME Recovery Example



- 1 Shut down and back up
- 2 Restore all data files
- 3 Mount the database



- 5 Open with Resetlogs
- 6 Back up the database



Recover the database to a specific point in time using

UNTIL TIME Recovery Steps

- 1 Shutdown database
- 2 Restore data files
- 3 Mount the database
- 4 Recover the database
- 5 Open database with **RESETLOGS** option
- 6 Backup the database

```
SQL> shutdown immediate
$ cp /BACKUP/* /u01/db01/ORADATA
SQL> startup mount
SQL> recover database until time '2004-05-
28:11:44:00';
SQL> alter database open resetlogs;
SQL> shutdown;
$ cp /u01/db01/ORADATA/* /BACKUP
```





Recover the database to a specific point in time using

Cancel-Based Recovery: Example

■ Scenario:

- The current time is 12:00 p.m. on May 28, 2004.
- The **ORDERS** table was dropped while someone was trying to fix corrupted data blocks.
- Log files exist on the same disk as the data files.
- The table was dropped at approximately 11:45 a.m.
- Staff are currently in a meeting.





Recover the database to a specific point in time using

Cancel-Based Recovery: Example

- Findings:
 - Redo logs are not multiplexed.
 - One of the online redo logs is missing.
 - The missing redo log is not archived.
 - The redo log contained information from 11:34 a.m.
 - Twenty-six minutes of data will be lost.
 - Users can recover their data.





Recover the database to a specific point in time using

Incomplete Recovery and the Alert Log

- Check the alert log before and after recovery
- Look for error information, hints, and SCNs
- Confirm steps in the recovery process were successful





Recover the database to a specific point in time using

Incomplete Recovery of a Database Using RMAN

- 1 Mount the database.
- 2 Allocate multiple channels for parallelization.
- 3 Restore all data files.
- 4 Recover the database by using **UNTIL TIME**, **UNTIL SEQUENCE**, or **UNTIL SCN**.
- 5 Open the database by using **RESETLOGS**.
- 6 Perform a whole database backup.





Recover the database to a specific point in time using

RMAN Incomplete Recovery UNTIL TIME: Example

```
RMAN> RUN {  
  2> SET UNTIL TIME = '2004-05-28 11:44:00';  
  3> RESTORE DATABASE;  
  4> RECOVER DATABASE;  
  5> ALTER DATABASE OPEN RESETLOGS; }
```





Recover the database to a specific point in time using

RMAN Incomplete Recovery UNTIL SEQUENCE: Example

```
RMAN> RUN {  
  2> SET UNTIL SEQUENCE 120 THREAD 1;  
  3> ALTER DATABASE MOUNT;  
  4> RESTORE DATABASE;  
  5> RECOVER DATABASE; # recovers through log  
119  
  6> ALTER DATABASE OPEN RESETLOGS;  
  7> }
```





Recover the database to a specific point in time using

Recovery Using Enterprise Manager

- Log in as a user with the **SYSDBA** privilege.

The screenshot shows the Oracle Enterprise Manager 10g Database Control login interface. At the top, the text "ORACLE Enterprise Manager 10g Database Control" is displayed in red and blue, with a "Help" link in the top right corner. Below this is a blue "Login" button. The main heading is "Login to Database:orcl.us.oracle.com". The login form includes three fields: "User Name" with the value "sys", "Password" (empty), and "Connect As" with a dropdown menu showing "SYSDBA". A "Login" button is located to the right of the "Connect As" field. At the bottom, the copyright notice "Copyright © 1996, 2004, Oracle. All rights reserved." is visible.

ORACLE Enterprise Manager 10g Database Control [Help](#)

Login

Login to Database:orcl.us.oracle.com

★ User Name

★ Password

Connect As ▼

Login

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Recover the database to a specific point in time using Recovery Using Enterprise Manager

- Click on the Maintenance tab.


ORACLE Enterprise Manager 10g
Database Control

Database: orcl.us.oracle.com

[Home](#) [Performance](#) [Administration](#) [Maintenance](#)

Page Refre

General

 [Shutdown](#)

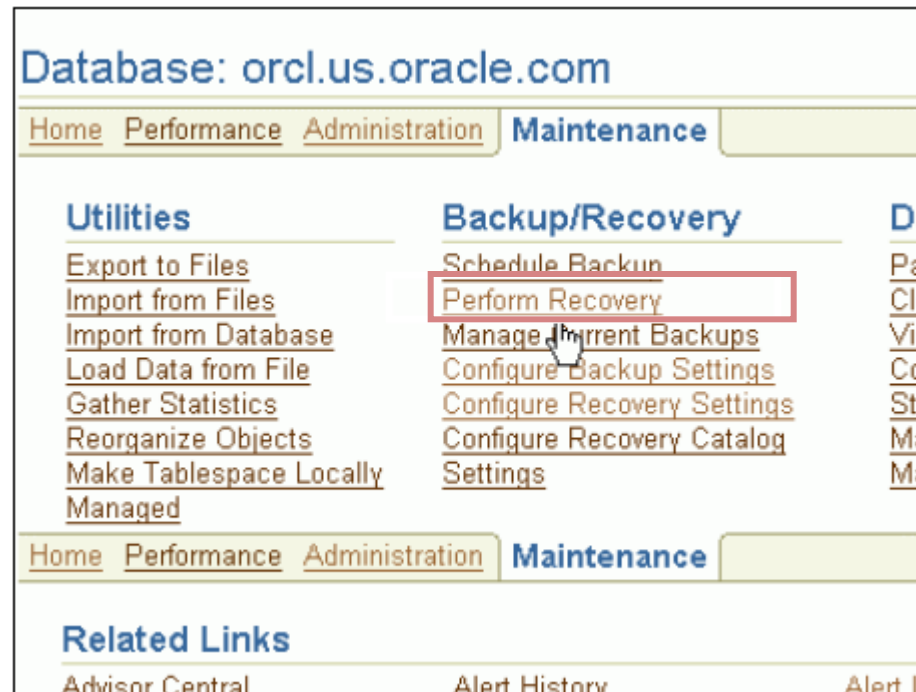
Status **Up**
Up Since **Feb 12, 2004 2:20:58 PM**
Time Zone **PST**
Availability (%) **100**
([Last 24 hours](#))
Instance Name **orcl**
Version **10.1.0.2.0**





Recover the database to a specific point in time using Recovery Using Enterprise Manager

- Select Perform Recovery.






Recover the database to a specific point in time using

Recovery Using Enterprise Manager

- Select Whole Database and enter OS login credentials.

Database: orcl.us.oracle.com

Perform Recovery: Type

 **Warning**
The database will be shut down to perform this operation.
Operation - You cannot restore or recover the whole database and the database must be shut down and brought to the MOUNTED state.

Type

Object Type Whole Database ▾

Operation ☒ Recover to the current time or a previous point-in-time
Type Datafiles will be restored from the latest usable backup as required.
☐ Restore all datafiles
Need to specify Time, SCN or log sequence. The backup taken at or prior to that time will be used.
☐ Recover from previously restored datafiles

Host Credentials

To perform recovery, supply operating system login credentials.

★ Username

★ Password

☒ Save as Preferred Credential





Database Recovery

Recover the database to a specific point in time using Recovery Using Enterprise Manager

- Select data files.

ORACLE Enterprise Manager 10g Database Control

Setup Preferences Help Logout

Database

Datafiles Rename Review

Perform Recovery: Datafiles

Cancel Step 1 of 3 Next

Database: orcl.us.oracle.com
Object Type: Datafiles
Operation Type: Restore and Recover

Populate this table with the datafiles you want to recover. Use the Add button to add new datafiles.

Select All | Select None

| Select | Datafile Name |
|-------------------------------------|--------------------------------------------|
| <input checked="" type="checkbox"/> | Au01/app/oracle/oradata/orcl/sysaux01.dbf |
| <input checked="" type="checkbox"/> | Au01/app/oracle/oradata/orcl/users01.dbf |
| <input checked="" type="checkbox"/> | Au01/app/oracle/oradata/orcl/example01.dbf |

Return to Recovery Type Selection

Database | Setup | Help | Logout

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About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g Database Control

Setup Preferences Help Logout

Database

Datafiles Rename Review

Perform Recovery: Rename

Cancel Back Step 2 of 3 Next

Database: orcl.us.oracle.com
Object Type: Datafiles
Operation Type: Restore and Recover

Do you want to restore the files to a different location? If so, the controlfile will be updated to use the new location.

☐ No. Restore the files to the default location.
☐ Yes. Restore the files to a new, common location.
☒ **TIP** This option will execute an RMAN 'rename' operation.

Location:

Return to Recovery Type Selection

Cancel Back Step 2 of 3 Next

Database | Setup | Preferences | Help | Logout

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About Oracle Enterprise Manager 10g Database Control





Database Recovery

Recover the database to a specific point in time using Recovery Using Enterprise Manager

■ Final review

The screenshot shows the Oracle Enterprise Manager 10g Database Control interface. At the top, there's a navigation bar with 'Setup', 'Preferences', 'Help', and 'Logout'. Below it, a breadcrumb trail shows 'Database' > 'Datafiles' > 'Rename' > 'Review', with 'Review' being the active step. The main heading is 'Perform Recovery: Review'. Below this, there are buttons: 'Cancel', 'Edit RMAN Script', 'Back', 'Step 3 of 3', and 'Submit'. The configuration details are as follows:

| | |
|----------------|-----------------------------|
| Database | orcl.us.oracle.com |
| Object Type | Datafiles |
| Operation Type | Restore and Recover |
| Backup | The most recent backup |
| Point-in-time | Recover to the current time |

Click on the 'Edit RMAN Script' button to view or edit the RMAN script before submitting the operation.

RMAN Script

```
run { sql 'alter database datafile 3 offline'; sql 'alter database datafile 4 offline'; sql 'alter database datafile 5 offline'; restore datafile 3,4,5; recover datafile 3,4,5; sql 'alter database datafile 3 online'; sql 'alter database datafile 4 online'; sql 'alter database datafile 5 online'; }
```

Datafiles

| | |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| Datafiles | /u01/app/oracle/oradata/orcl/sysaux01.dbf /u01/app/oracle/oradata/orcl/users01.dbf /u01/app/oracle/oradata/orcl/example01.dbf |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------|

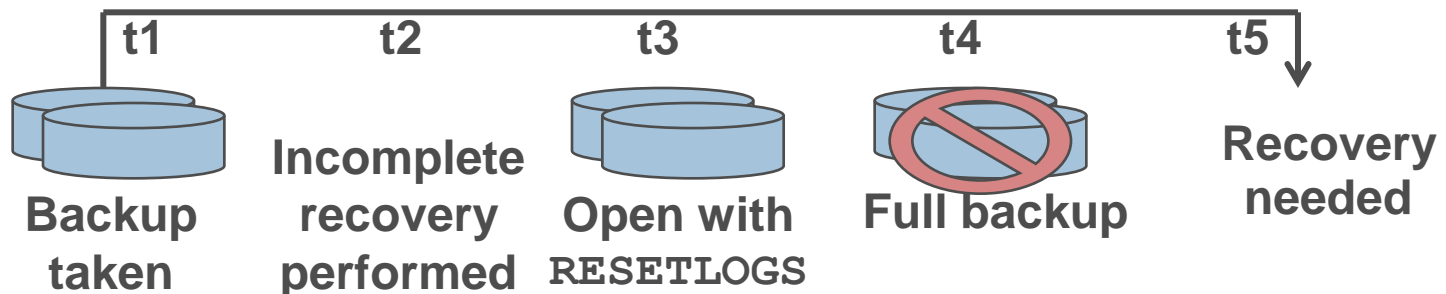
At the bottom, there's a 'Return to Recovery Type Selection' link and another set of buttons: 'Cancel', 'Edit RMAN Script', 'Back', 'Step 3 of 3', and 'Submit'. The footer navigation bar includes 'Database', 'Setup', 'Preferences', 'Help', and 'Logout'.



Recover the database to a specific point in time using

Simplified Recovery Through RESETLOGS

- The database can be opened immediately after **RESETLOGS**. (No longer need to take a full backup)
- No changes are required to existing scripts.
- Recovery through **RESETLOGS** can be used for:
 - Incomplete recovery
 - Recovery using a backup control file





Recover the database to a specific point in time using

Recovery Through RESETLOGS: Changes

```
LOG_ARCHIVE_FORMAT="LOG%t_%s_%r.arc"
```

```
SQL> SELECT recid, thread#, sequence#,  
2         resetlogs_change#, resetlogs_time  
3 FROM v$log_history;
```

```
SQL> SELECT recid, file#,  
2         resetlogs_change#, resetlogs_time  
3 FROM v$offline_range;
```

```
SQL> SELECT incarnation#, resetlogs_id,  
2         prior_incarnation#, status  
3 FROM v$database_incarnation;
```






Part 2 Summary




**Recover the
control file**



**Explain reasons
for incomplete
recovery**



**Describe incomplete
recovery
methodology**



**Recover the
database to a
specific point in
time using**





Part 2 Stop-and-think

Do you have any questions ?





Flashback Database



Preview

- Describe Flashback Database architecture
- Configuring Flashback Database
- Monitor the Flashback Database
- Use the Enterprise Manager Recovery Wizard





Describe Flashback Database architecture

Flashback Technology Benefits

- Flashback technology is a revolutionary advance in recovery
- Traditional recovery techniques are slow
 - Entire database or file has to be restored, not just the incorrect data
 - Every change in the database log must be examined
- Flashback is fast
 - Changes are indexed by row and by transaction
 - Only the changed data is restored
- Flashback commands are easy
 - No complex multi-step procedures





Describe Flashback Database architecture

When to Use Flashback Technology

| Object level | Scenario | Flashback Technology |
|--------------|-------------------------------------------------------------------|----------------------|
| Database | Drop User | Flashback Database |
| | Truncate Table | Flashback Database |
| | Batch job : partial changes | Flashback Database |
| Table | Drop table | Flashback Drop |
| | Update with wrong WHERE clause | Flashback Table |
| | Comparing current data against the data at some time in the past | Flashback Query |
| Tx | Batch Job runs twice, but not really sure of the objects affected | Flashback Query |

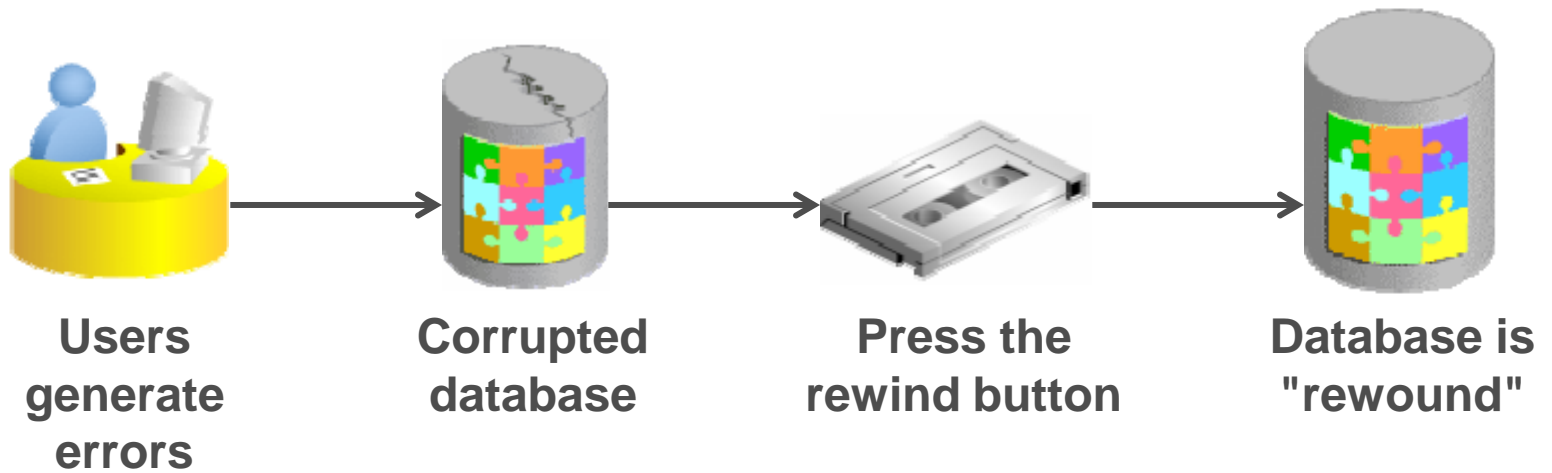




Describe Flashback Database architecture

Flashback Database Overview

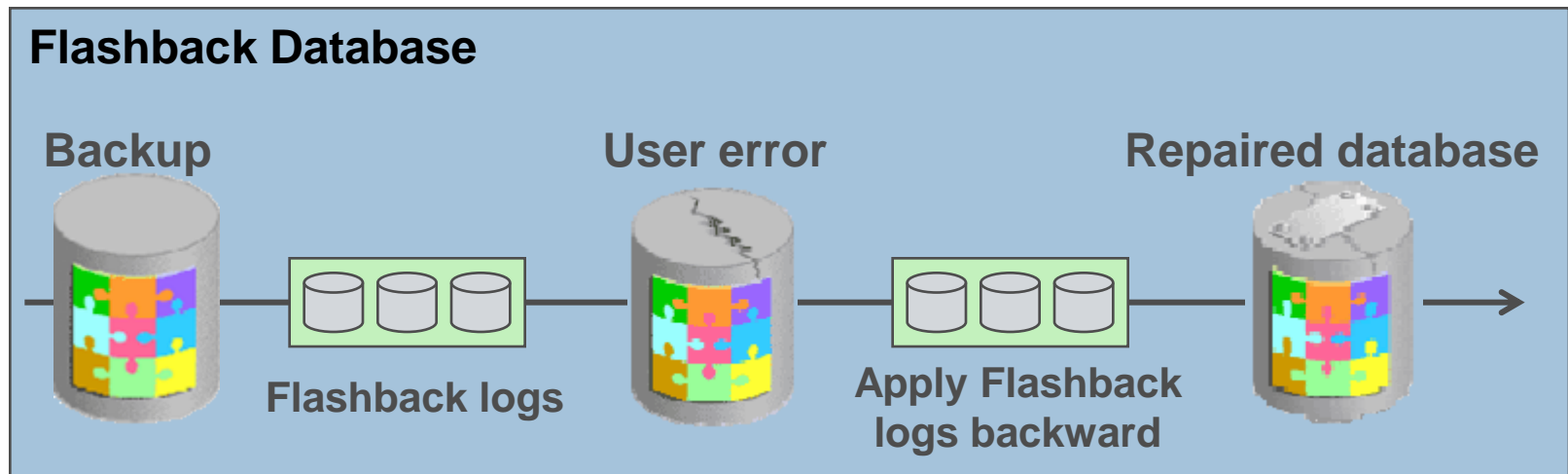
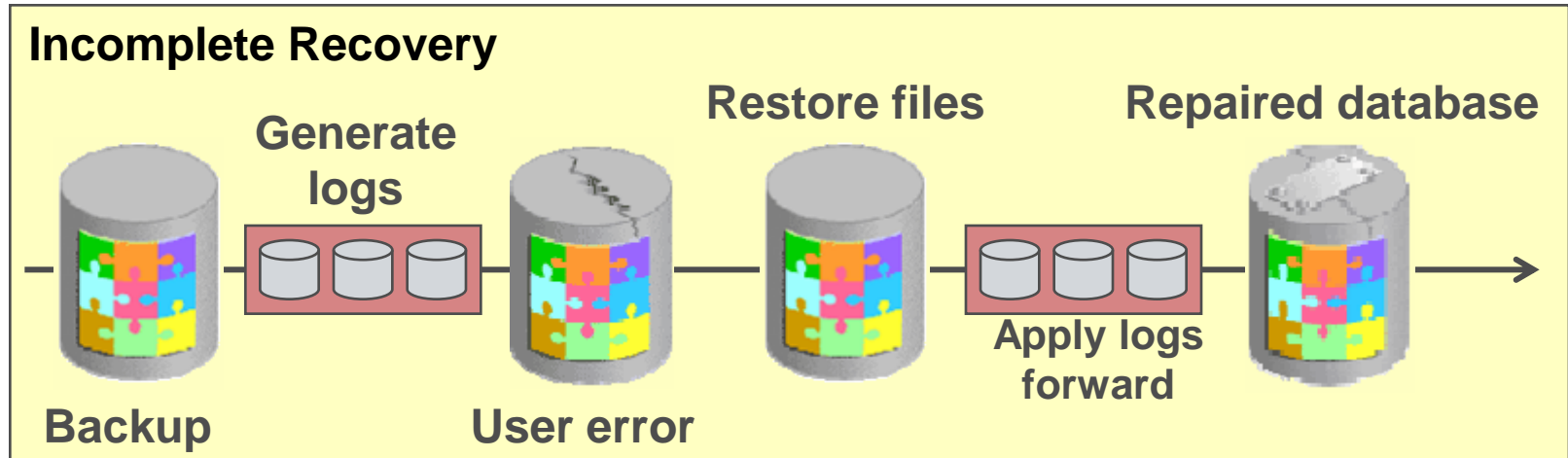
- The Flashback Database operation:
 - Works like a rewind button for the database.
 - Can be used in cases of logical data corruptions made by users.





Describe Flashback Database architecture

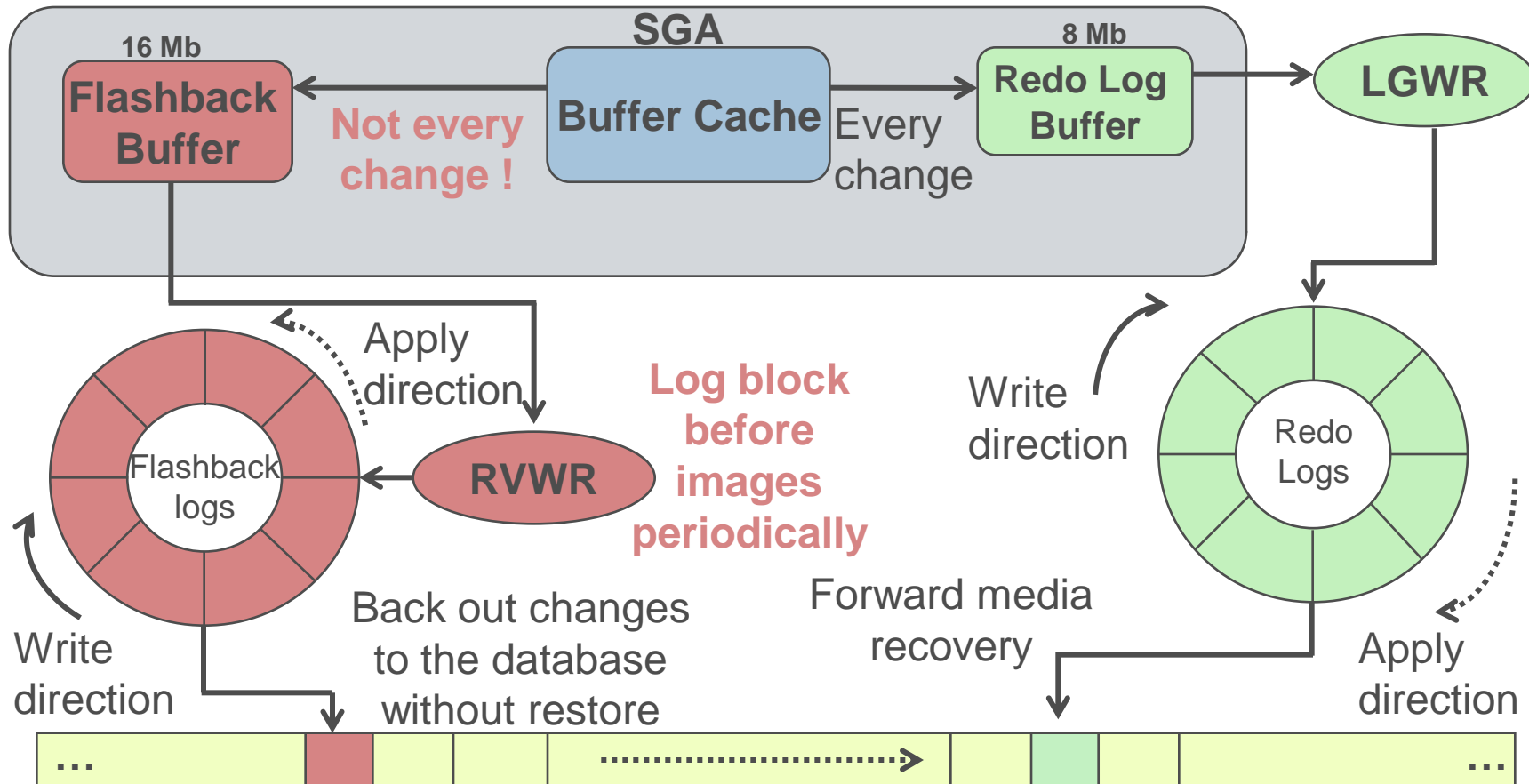
Flashback Database Reduces Restore Time





Describe Flashback Database architecture

Recovery Manager Features





Describe Flashback Database architecture

Flashback Database Considerations

- When the Flashback Database operation completes, open the database:
 - In read-only mode to verify that the correct target time or SCN was used
 - With a **RESETLOGS** operation to allow for updates
- The opposite of flashback is recover
- You cannot use Flashback Database in the following situations:
 - The control file has been restored or re-created.
 - A tablespace has been dropped.
 - A data file has been shrunk.
 - You want to flashback before **RESETLOGS** operation.





Describe Flashback Database architecture

Flashback Database Examples

```
RMAN> FLASHBACK DATABASE TO TIME =  
  2> TO_DATE('2004-05-27 16:00:00',  
  3> 'YYYY-MM-DD HH24:MI:SS');  
  
RMAN> FLASHBACK DATABASE TO SCN=23565;  
  
RMAN> FLASHBACK DATABASE  
  2> TO SEQUENCE=223 THREAD=1;
```

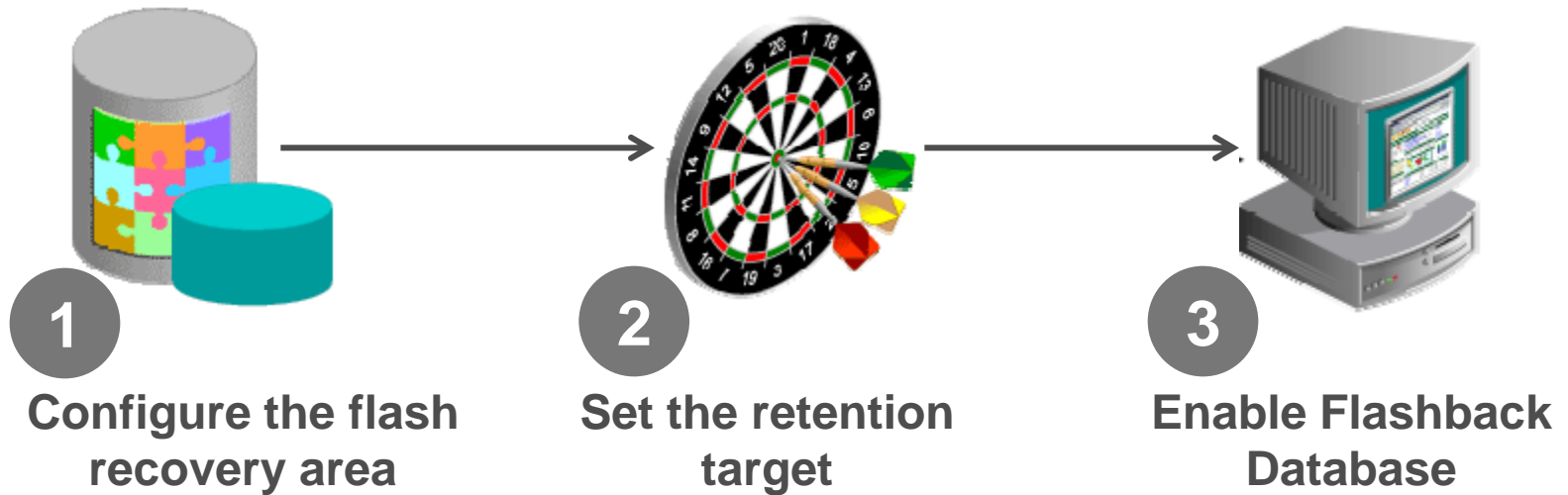
```
SQL> FLASHBACK DATABASE  
  2 TO TIMESTAMP(SYSDATE-1/24);  
  
SQL> FLASHBACK DATABASE TO SCN 53943;
```





Configuring Flashback Database

Configuring Flashback Database



```
SQL> ALTER SYSTEM SET  
      2 DB_FLASHBACK_RETENTION_TARGET=2880  
      3 SCOPE=BOTH;
```

```
SQL> ALTER DATABASE FLASHBACK ON;
```





Configuring Flashback Database

Best Practices for the Database and Flash Recovery Area

- Use the flash recovery area for recovery-related files:
 - Simplifies location of database backups
 - Automatically manages the disk space allocated for recovery files
 - Does not require changes to existing scripts
 - Puts database backups, archive logs, and control file backups in the flash recovery area





Configuring Flashback Database

Flash Recovery Area Space Usage

- Configure the retention policy to the minimum value appropriate for your database
- Backup the archive log files regularly and delete the files upon completion of the backup
- Use the RMAN **REPORT OBSOLETE** and **DELETE OBSOLETE** commands to remove unneeded backups and file copies





Configuring Flashback Database

Configure Flashback Database with EM

- Make sure the database is in **ARCHIVELOG** mode.

Media Recovery

The database is currently in ARCHIVELOG mode. In ARCHIVELOG mode, hot space for logs. If you change the database to ARCHIVELOG mode, you should cold backups and data may be lost in the event of database corruption.

☒ ARCHIVELOG Mode*

Log Archive Filename Format*

The naming convention for the archived log files. %s: log sequence number; %t: thread





Configuring Flashback Database

Excluding Tablespaces from Flashback Database

```
ALTER TABLESPACE <ts_name> FLASHBACK {ON|OFF}
```

```
SQL> SELECT tablespace_name, flashback_on  
2 FROM v$tablespace;
```

- Take the tablespace offline before you perform the Flashback Database recovery.
- Drop the tablespace or recover the offline files with traditional point-in-time recovery.





Configuring Flashback Database

Configure Flashback Database with EM

- Enable Flashback logging and specify flash recovery area

| | | | |
|----|---------------------------|-----|-------|
| 10 | USE_DB_RECOVERY_FILE_DEST | n/a | VALID |
|----|---------------------------|-----|-------|

☒ **TIP** It is recommended that archive log files be written to multiple locations spread across the different disks.

☒ **TIP** You can specify up to 10 archive log destinations.

Flash Recovery Area

It is highly recommended that you use flash recovery area to automate your disk backup management.

Flash Recovery Area Location

Flash Recovery Area Size

Flash Recovery Area Size must be set when the location is set

Used Flash Recovery Area Size (MB) **124.195**

☒ **Enable flashback logging for fast database point-in-time recovery***

The flash recovery area must be set to enable flashback logging. When using flashback logs, you may recover your entire database to a prior point-in-time without restoring files. Flashback is the preferred point-in-time recovery method in the recovery wizard when appropriate.

Specify how far back you wish to flash the database in the future

Flashback Retention Time





Monitor the Flashback Database

Monitoring Flashback Database

- Adjust the flash recovery area disk quota:

```
SQL> SELECT estimated_flashback_size,  
2          flashback_size  
3 FROM    V$FLASHBACK_DATABASE_LOG;
```

- Determine the current flashback window:

```
SQL> SELECT oldest_flashback_scn,  
2          oldest_flashback_time  
3 FROM    V$FLASHBACK_DATABASE_LOG;
```

- Monitor logging in the Flashback Database logs:

```
SQL> SELECT *  
2 FROM    V$FLASHBACK_DATABASE_STAT;
```





Monitor the Flashback Database

Monitoring Flashback Database with EM

Flash Recovery Area

It is highly recommended that you use flash recovery area to automate your disk backup management.

Flash Recovery Area Location

Flash Recovery Area Size

Flash Recovery Area Size must be set when the location is set

Used Flash Recovery Area Size (MB) **124.195**

☒ Enable flashback logging for fast database point-in-time recovery*

The flash recovery area must be set to enable flashback logging. When using flashback logs, you may recover your entire database to a prior point-in-time without restoring files. Flashback is the preferred point-in-time recovery method in the recovery wizard when appropriate.

Specify how far back you wish to flash the database in the future

Flashback Retention Time

Current size of the flashback logs(GB) **n/a**

Lowest SCN in the flashback data **n/a**

Time of the lowest SCN in the flashback data **n/a**





Monitor the Flashback Database

Monitoring Flash Recovery Area with EM

All Metrics

Expand All | Collapse All

Metrics

▼ orcl.us.oracle.com

▶ Alert Log

▶ Alert Log Content

▶ Alert Log Error Status

▶ Archive Area

▶ Database Files

▶ Database Job Status

▶ Database Limits

▶ Database Services

▶ Deferred Transactions

▶ Dump Area

▶ Efficiency

▶ Invalid Objects

▶ Invalid Objects by Schema

▶ Recovery Area

▶ Response

▶ SGA Pool Wastage

▶ SQL Response Time

Database: orcl.us.oracle.com > All Metrics > RECOVERY AREA

Recovery Area Free Space (%): Recovery Area RECOVERY AREA

Latest Data Collected From Target Feb 17, 2004 9:52:29 AM

Recovery Area RECOVERY AREA

Statistics for Last 24 Hours

Last Known Value 6.53

Average Value 1.91

High Value 6.53

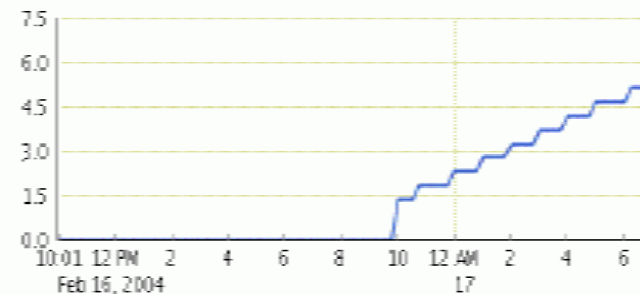
Low Value 0

Warning Threshold Not Defined

Critical Threshold Not Defined

Threshold Occurrences No data

Metric Value, From Repository



orcl.us.oracle.com





Use the Enterprise Manager Recovery Wizard

Backing Up the Flash Recovery Area

ORACLE Enterprise Manager 10g Database Control

Database: orcl.us.oracle.com

Schedule Backup: Strategy

Based on your disk and/or tape configuration, Oracle provides an automated backup strategy, or you can develop your own backup strategy with customized options.

Backup Strategy: **Customized**

Object Type:

- ☐ Whole Database
- ☐ Tablespaces
- ☐ Datafiles
- ☐ Archivelogs
- ☒ All Recovery Files on Disk
These files include all archivelogs and disk backups that are not already backed up to tape.

Host Credentials

To perform a backup, supply operating system login credentials.

* Username:

* Password:

☒ Save as Preferred Credential

Backup Strategies

Oracle-suggested:

- Provides an out-of-the-box backup strategy based on the backup destination. Options may vary based on the database version.
- Sets up recovery window for backup management
- Automates backup management
- Schedules recurring backups

Customized:

- Specify the objects to be backed up
- Choose a disk or tape backup destination
- Override the default backup settings
- Schedule the backup

Cancel Continue

RMAN> BACKUP RECOVERY FILES;






Use the Enterprise Manager Recovery Wizard

Flashback Database with EM

Select object and
operation type

Perform Recovery: Type



Warning

The database will be shut down to perform this operation.

Operation - You cannot restore or recover the whole database. The database will be shut down and brought to the MOUNTED state.

Type

Object Type Whole Database ▾

Operation Type ☒ Recover to the current time or a previous point-in-time
Datafiles will be restored from the latest usable backup as required.

☐ Restore all datafiles
Need to specify Time, SCN or log sequence. The backup taken at or prior to that time will be used.

☐ Recover from previously restored datafiles

Host Credentials

To perform recovery, supply operating system login credentials.

★ Username oracle

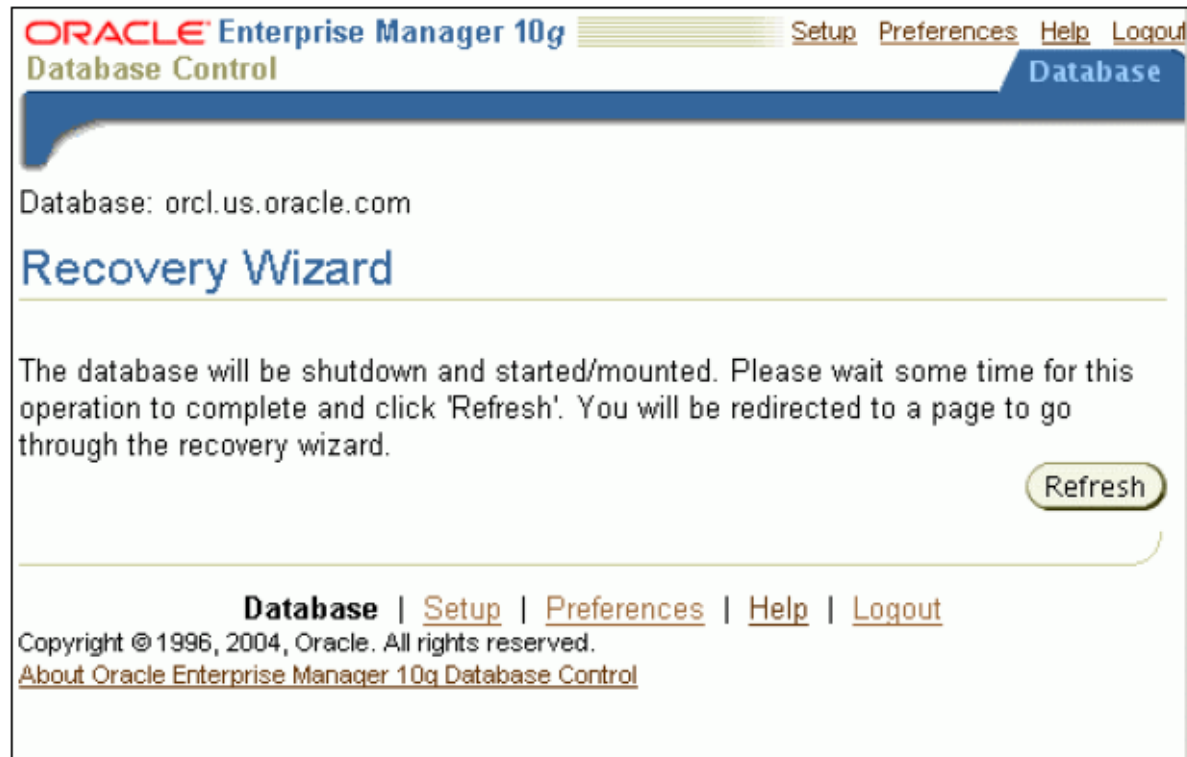




Use the Enterprise Manager Recovery Wizard

Flashback Database with EM

■ Launching Recovery Wizard





Use the Enterprise Manager Recovery Wizard

Flashback Database Using EM

ORACLE® Enterprise Manager 10g Database Control Help Database

Point-in-time Flashback Rename **Review**

Perform Recovery: Review

[Cancel](#) [Edit RMAN Script](#) [Back](#) **Step 4 of 4** [Submit](#)

| | |
|----------------|-----------------------------------------|
| Database | orcl |
| Object Type | Whole Database |
| Operation Type | Restore and Recover |
| Point-in-time | Recover to a prior point-in-time |
| SCN | 2683418 |

Click on the 'Edit RMAN Script' button to view or edit the RMAN script before submitting the operation.

RMAN Script


| | |
|-------------|--------------------------------------------------------------------------------------|
| RMAN Script | run { flashback database to scn 2683418; alter database open resetlogs; } |
|-------------|--------------------------------------------------------------------------------------|

[Return to Recovery Type Selection](#) [Cancel](#) [Edit RMAN Script](#) [Back](#) **Step 4 of 4** [Submit](#)





Part 3 Summary



**Describe
Flashback
Database
architecture**



**Configuring
Flashback Database**



**Monitor the
Flashback
Database**



**Use the
Enterprise
Manager
Recovery Wizard**





Part 3 Stop-and-think

Do you have any questions ?





Recovering from User Errors



Preview

- Perform Flashback operations
- Manage the recycle bin
- Using Flashback Versions Query
- Flashback Tables
- Perform transaction level recovery

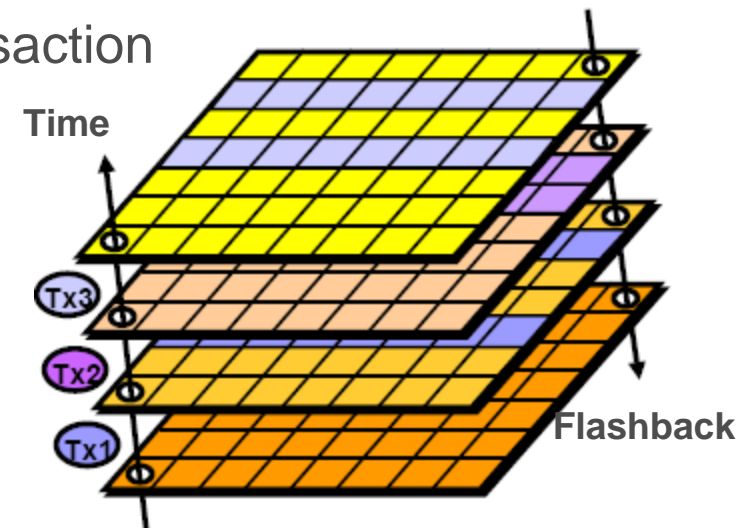




Perform Flashback operations

Flashback Time Navigation

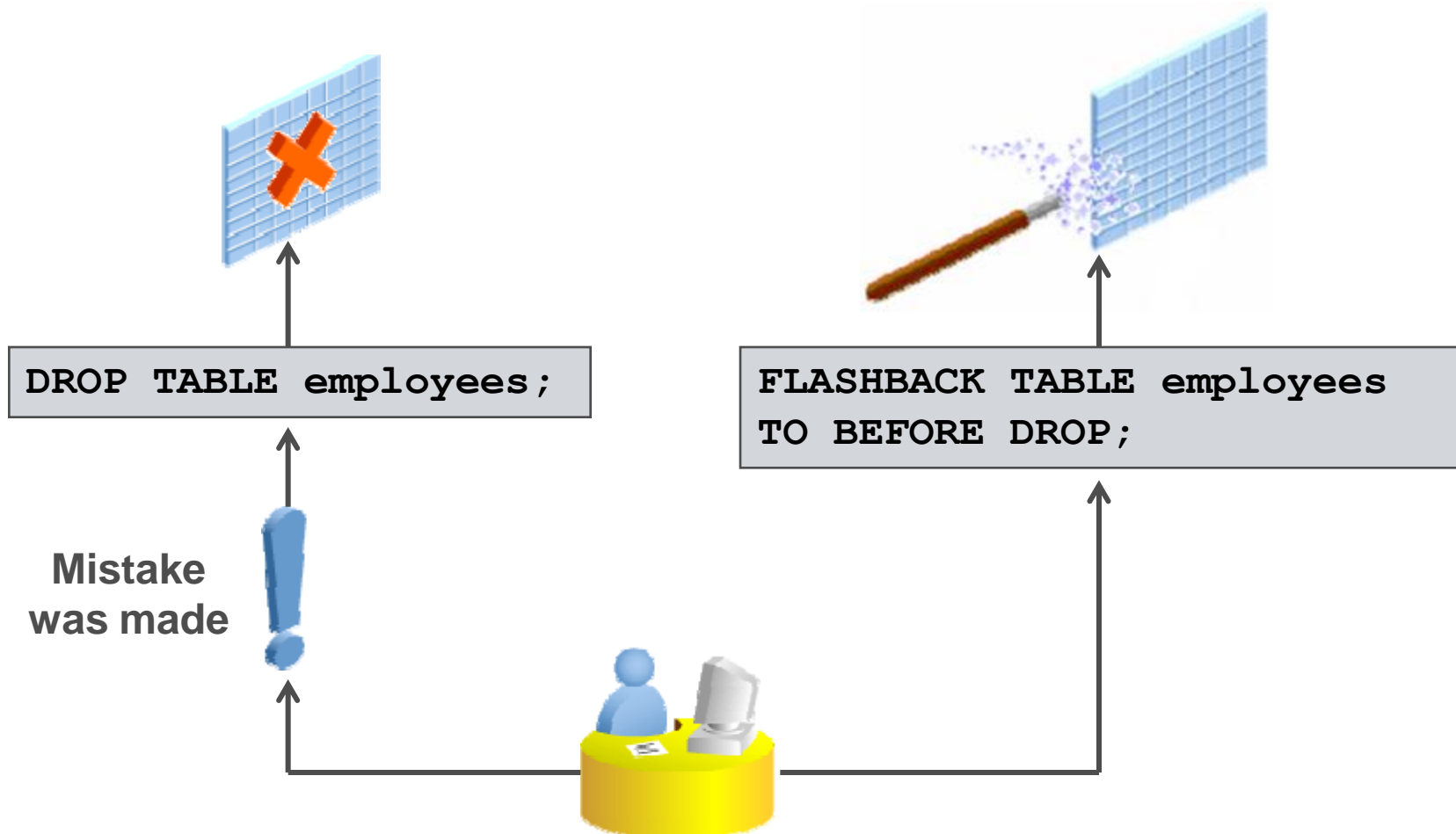
- Flashback Query
 - Query all data at a specified point in time•
- Flashback Versions Query
 - See all versions of a row between two times
 - See the transactions that changed the row
- Flashback Transaction Query
 - See all changes made by a transaction





Perform Flashback operations

Flashback Drop Overview





Perform Flashback operations

SCN and Time Mapping Enhancements

- The mapping granularity is three seconds.
- The mapping is retained for
Max(five days, **UNDO_RETENTION**)
- Access the mapping by using the following SQL functions:
 - **SCN_TO_TIMESTAMP**
 - **TIMESTAMP_TO_SCN**

```
SELECT current_scn, SCN_TO_TIMESTAMP(current_scn)
FROM v$database;
```

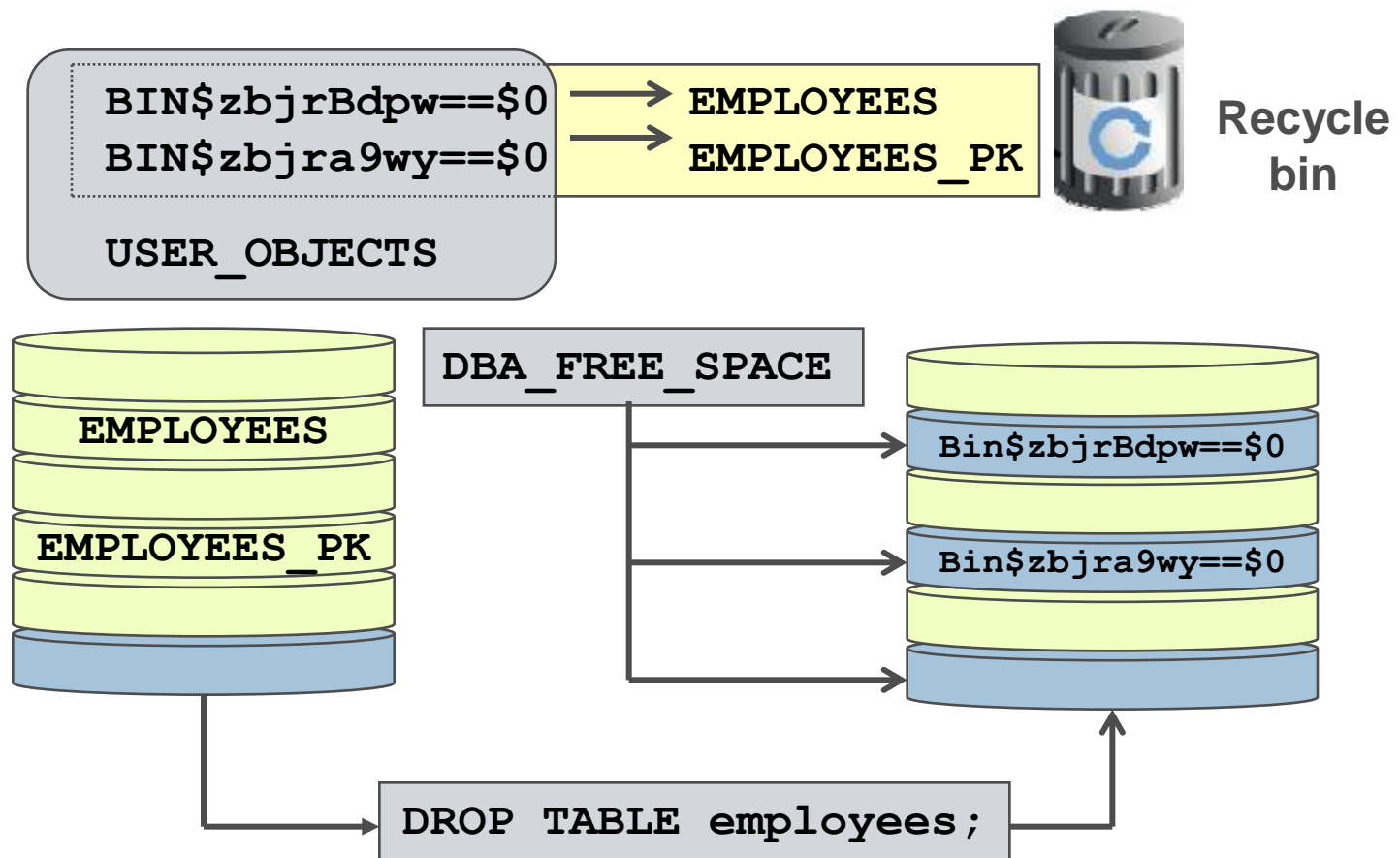
| CURRENT_SCN | SCN_TO_TIMESTAMP(CURRENT_SCN) |
|-------------|---------------------------------|
| 3274940 | 23-SEP-03 02.56.03.000000000 AM |





Manage the recycle bin

Recycle Bin





Manage the recycle bin

Querying the Recycle Bin

```
SELECT owner, original_name, object_name,  
       type, ts name, droptime, related, space  
FROM   dba_recyclebin  
WHERE  can_undrop = 'YES';
```

```
SELECT original_name, object_name,  
       type, ts name, droptime, related, space  
FROM   user_recyclebin  
WHERE  can_undrop = 'YES';
```

```
SQL> SHOW RECYCLEBIN
```





Manage the recycle bin

Flashback Dropped Tables Using EM

Perform Recovery: Dropped Objects Selection

[Cancel](#) [Step 1 of 3](#) [Next](#)

Object Type **Tables**
Operation Type **Flashback Dropped Tables**

Select the tables from the Recycle Bin that you would like to recover. The Results table shows dependent objects that will also be recovered when the selected tables are recovered.

Search

Schema Name

Table



[Go](#)

Results

[Select All](#) | [Select None](#) | [Expand All](#) | [Collapse All](#)

| Select | Object Name | Schema | Object Type | Tablespace | Drop Time | Create Time | Si |
|--------------------------|---------------|--------|-------------|------------|---------------------|-----------------------|----|
| <input type="checkbox"/> | ▼ Recycle Bin | | | | | | |
| <input type="checkbox"/> | EMP | HR | TABLE | USERS | 2004-02-18:08:26:50 | 2004-02-18:08:20:10.8 | |





Manage the recycle bin

Restoring Objects from the Recycle Bin

- Use the **FLASHBACK TABLE ...** command to restore dropped tables and dependent objects.
- If multiple recycle bin entries have the same original name:
 - Use unique system-generated names to restore a particular version.
 - When using original names, restored table is LIFO.
- Rename the original name if that name is currently used.

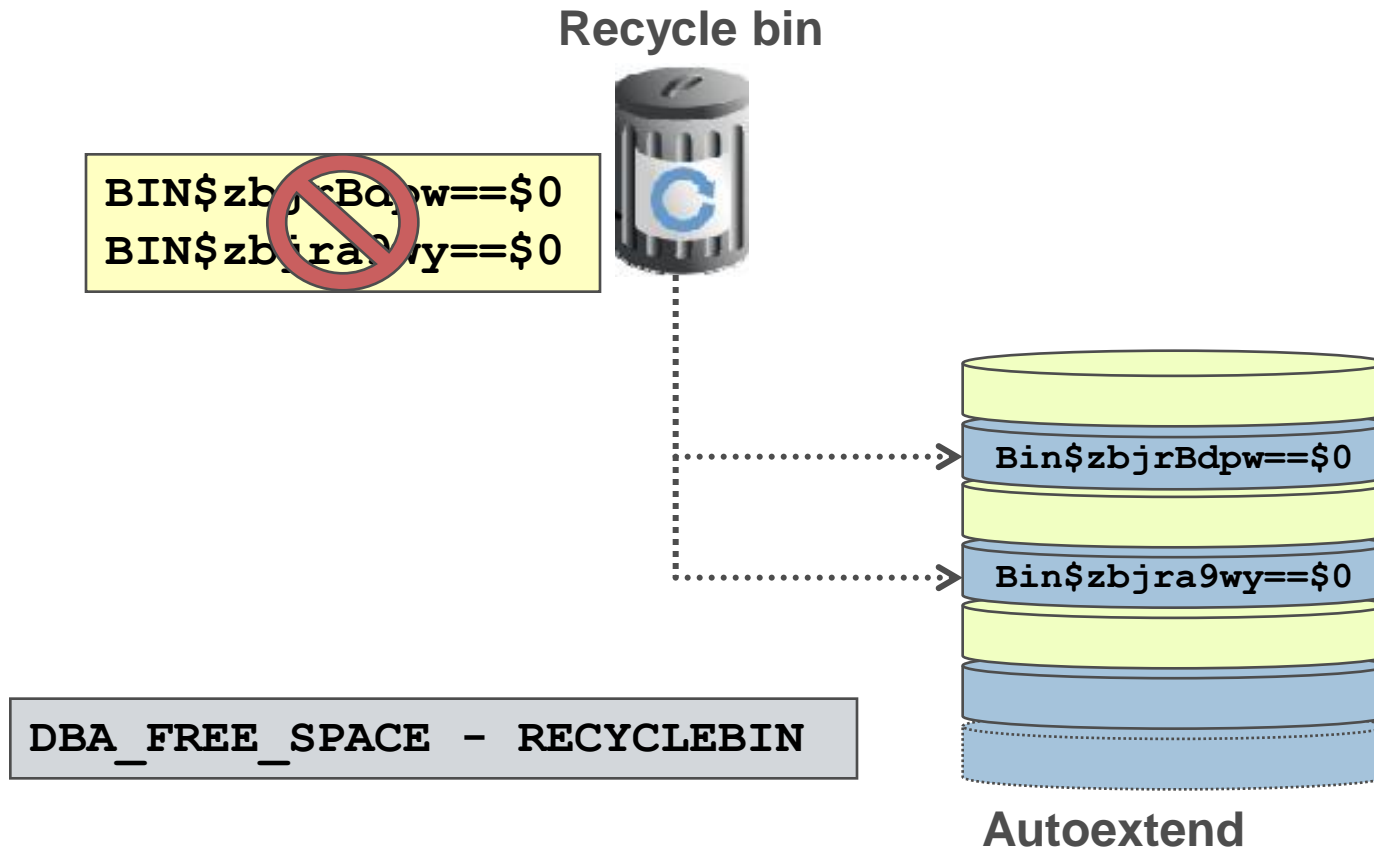
```
FLASHBACK TABLE <table_name>  
TO BEFORE DROP [RENAME TO <new_name>]
```





Manage the recycle bin

Recycle Bin Automatic Space Reclamation





Manage the recycle bin

Recycle Bin Manual Space Reclamation

```
PURGE {TABLE <table_name>|INDEX <index_name>}
```

```
PURGE TABLESPACE <ts_name> [USER <user_name>]
```

```
PURGE [USER_|DBA_]RECYCLEBIN
```

Recycle Bin

When you drop a table, Oracle does not immediately reclaim the space associated with the table. Oracle places the table and any associated objects in Recycle Bin, where, in case the table was dropped in error, it can be recovered (Flashback Drop) at a later time.

Search

Schema Name
JFV

Table
Go

Results

| | | | | | | | Purge | Rollback-Drop |
|----------------------------------------------------------------------------------------------------------------------|-------------|--------|-------------|------------|---------------------|---------------------|-------|------------------------------|
| Select All Select None Expand All Collapse All | | | | | | | | |
| Select | Object Name | Schema | Object Type | Tablespace | Drop Time | Create Time | Size | Operation |
| <input type="checkbox"/> | Recycle Bin | | | | | | | View Content |
| <input type="checkbox"/> | EMP | JFV | TABLE | JFVTS | 2003-12-11 01:16:38 | 2003-12-11 01:15:15 | 8 | View Content |





Manage the recycle bin

Bypassing the Recycle Bin

```
DROP TABLE <table_name> [PURGE] ;
```

```
DROP TABLESPACE <ts_name>  
[INCLUDING CONTENTS] ;
```

```
DROP USER <user_name> [CASCADE] ;
```






Manage the recycle bin

Querying Dropped Tables

| USER_OBJECTS | |
|--------------------|-----------------------------------|
| DROPPED | TABLE_NAME |
| NO | SALES |
| YES | BIN\$zbjrBdpw==\$0 → EMPLOYEES |
| YES | BIN\$zbjra9wy==\$0 → EMPLOYEES_PK |
| NO | SALES_PK |
| DROPPED INDEX_NAME | |
| USER_INDEXES | |

Recycle bin



```
SELECT ...  
FROM BIN$zbjrBdpw==$0 [AS OF ...]  
WHERE ...
```





Manage the recycle bin

Flashback Drop Considerations

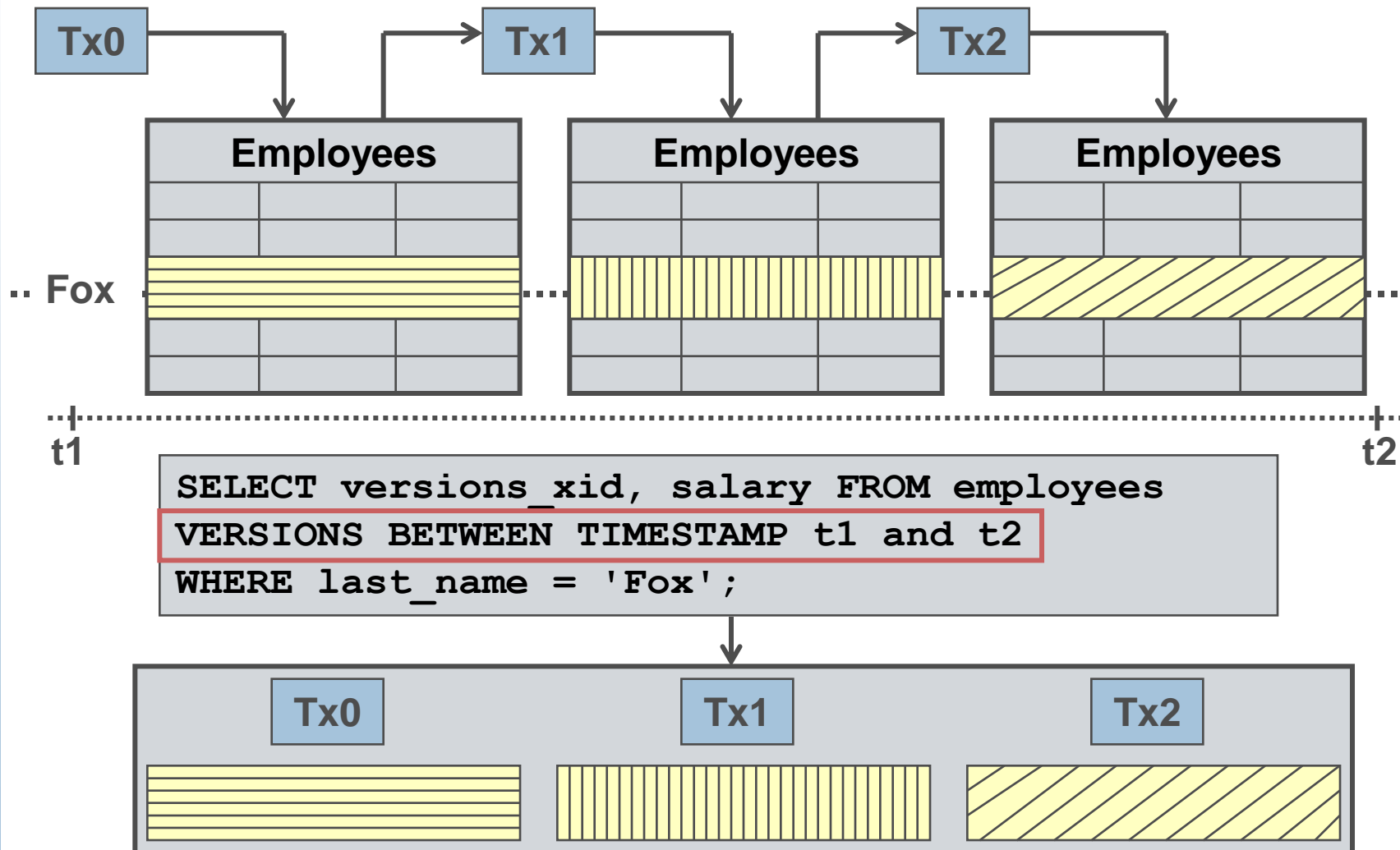
- Protected tables:
 - Are non-**SYSTEM** tablespace tables
 - Are stored in locally managed tablespaces
 - Do not use fine-grained auditing or virtual private database
- The following dependencies are not protected:
 - Bitmap-join indexes
 - Materialized view logs
 - Referential integrity constraints
 - Indexes dropped before tables
- Purged tables cannot be flashed back





Using Flashback Versions Query

Flashback Versions Query Overview





Recovering from User Errors

Using Flashback Versions Query

Flashback Versions Query Using EM

Perform Recovery: Flashback Versions Query Filter

[Cancel](#) [Show Flashback Versions Query SQL](#) [Back](#) [Step 2 of 7](#) [Next](#)

Object Type **Tables**

Operation Type **Flashback Existing Tables**

Table Name **HR.EMP**

Flashback Versions Query allows you to query metadata and historical data within a time interval. Select the filter conditions that allows you to retrieve the different versions of rows in a table that existed in a specific time interval.

Step 1. Choose Columns

Available Columns

EMAIL
PHONE_NUMBER
HIRE_DATE
JOB_ID
SALARY
COMMISSION_PCT
MANAGER_ID
DEPARTMENT_ID

[Move](#)
[Move All](#)
[Remove](#)
[Remove All](#)

Perform Recovery: Choose SCN

[Cancel](#) [Back](#) [Step 3 of 7](#) [Next](#)

Object Type **Tables**
Operation Type **Flashback Existing Tables**
Table Name **HR.EMP**

Following is the history of the row. Select the version you wish to remove. Additionally, all versions later than this version will be removed.

Flashback Versions Query Result

| Flashback | Flashback | | | | | |
|-----------------------------------------|-------------------------|--------------------|-----------|-------------|------------|-----------|
| Select SCN | Timestamp | Transaction ID | Operation | EMPLOYEE_ID | FIRST_NAME | LAST_NAME |
| <input checked="" type="radio"/> 940222 | Feb 18, 2004 9:26:36 AM | 06001 E001 E010000 | DELETE | 205 | Shelley | Higgins |
| <input type="radio"/> 940211 | Feb 18, 2004 9:26:05 AM | 06001 D001 E010000 | INSERT | 205 | Shelley | Higgins |

Step 2. Bind The Row Value

Specify a where clause based on the columns & set of values.

WHERE last_name = 'Higgins'





Using Flashback Versions Query

Flashback Versions Query Syntax

```
SELECT [Pseudocolumns]...
FROM ...
      VERSIONS BETWEEN
      {SCN|TIMESTAMP{expr|MINVALUE}AND
      {expr|MAXVALUE}}
      [AS OF{SCN|TIMESTAMP expr}]
WHERE [Pseudocolumns...]...
```

| Pseudocolumn | Description |
|-----------------------------------------|--------------------------------------|
| VERSIONS_STARTTIME VERSIONS_STARTSCN | Version validity range lower bound |
| VERSIONS_ENDTIME VERSIONS_ENDSCN | Version validity range upper bound |
| VERSIONS_XID | Transaction that created the version |
| VERSIONS_OPERATION | Operation that produced the version |





Using Flashback Versions Query

Flashback Versions Query Example

```
SELECT versions_xid AS XID,  
       versions_startscn AS START_SCN,  
       versions_endscn AS END_SCN,  
       versions_operation AS OPERATION,  
       first_name  
FROM   employees  
VERSIONS BETWEEN SCN MINVALUE AND MAXVALUE  
AS OF SCN 5525300  
WHERE  employee_id = 111;
```

| XID | START_SCN | END_SCN | O | FIRST_NAME |
|------------------|-----------|---------|---|------------|
| 8C0025003A000000 | 5525293 | | I | Tom |
| 8C0024003A000000 | 5525291 | | D | Mike |
| 8C0022003A000000 | 5525277 | 5525291 | I | Mike |





Using Flashback Versions Query

Flashback Versions Query Considerations

- The **VERSIONS** clause cannot be used to query:
 - External tables
 - Temporary tables
 - Fixed tables
 - Views
- The **VERSIONS** clause cannot span DDL commands.
- Segment shrink operations are filtered out.





Using Flashback Versions Query

Guaranteed Undo Retention

```
SQL> CREATE UNDO TABLESPACE undotbs1  
2 DATAFILE 'undotbs01.dbf'  
3 SIZE 100M AUTOEXTEND ON  
4 RETENTION GUARANTEE ;
```



```
SQL> SELECT tablespace_name, RETENTION  
2 FROM dba_tablespaces;
```

| TABLESPACE_NAME | RETENTION |
|-----------------|-----------|
| UNDOTBS1 | GUARANTEE |

```
SQL> ALTER TABLESPACE undotbs1  
2 RETENTION NOGUARANTEE ;
```

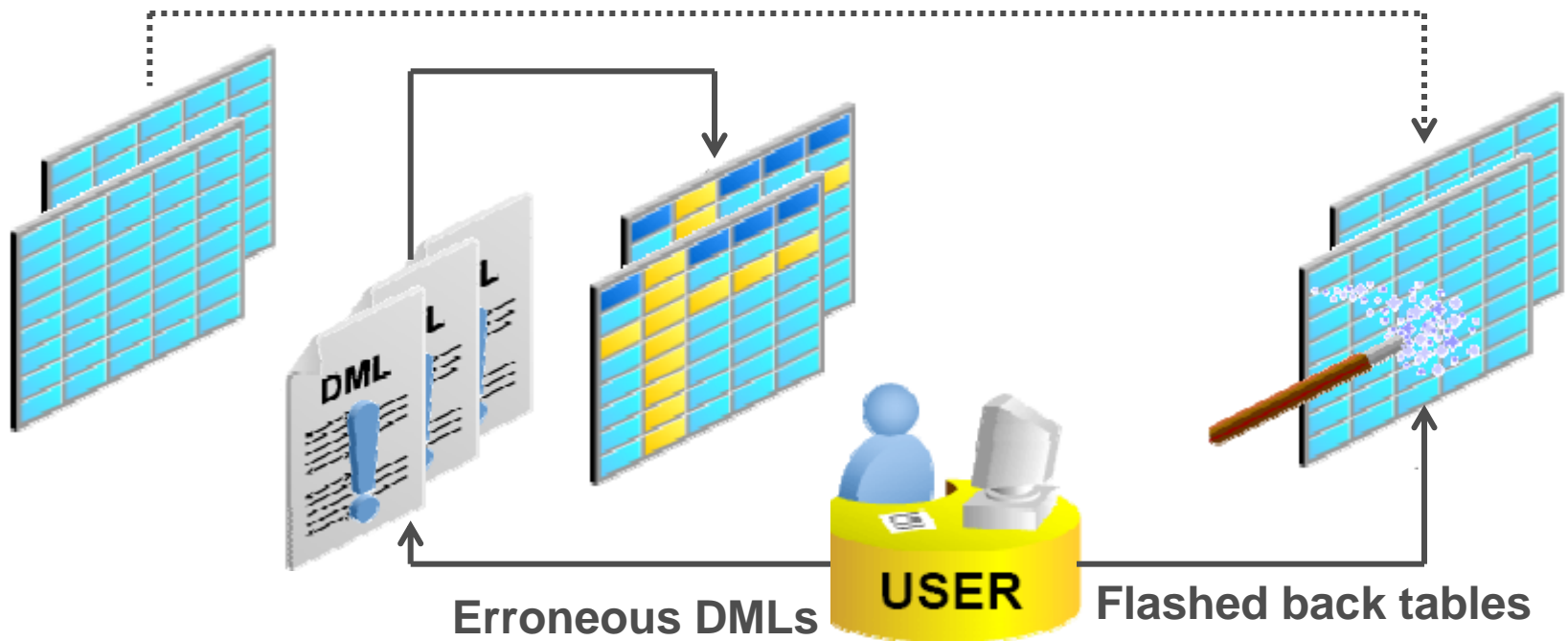




Flashback Tables

Flashback Table Overview

- Recover tables to a specific point in time
- Flashback Table is an in-place operation
- Database stays online





Recovering from User Errors

Flashback Tables

Using EM to Flashback Tables

ORACLE Enterprise Manager 10g Database Control

Setup Preferences Help Logout Database

Point-in-Time Flashback Versions Query Filter Change SCN **Flashback Tables** Dependency Options Dependencies More

Perform Recovery: Flashback Tables

Cancel Back Step 4 of 7 Next

Object Type **Tables**
Operation Type **Flashback Existing Tables**

Specify the tables you would like to flashback.

Flashback Time **Dec 11, 2003 02:39 AM**
Flashback SCN **1060503**

Tables To Flashback

EMPLOYEES
DEPARTMENTS

Add Tables

Example: scott.emp, one table name per row

[Return to Recovery Type Selection](#) Cancel Back Step 4 of 7 Next





Flashback Tables

Flashback Table Example

```
ALTER TABLE employees ENABLE ROW MOVEMENT;
```

```
FLASHBACK TABLE employees  
TO TIMESTAMP (SYSDATE-1);
```

```
ALTER TABLE employees ENABLE ROW MOVEMENT;
```

```
ALTER TABLE departments ENABLE ROW MOVEMENT;
```

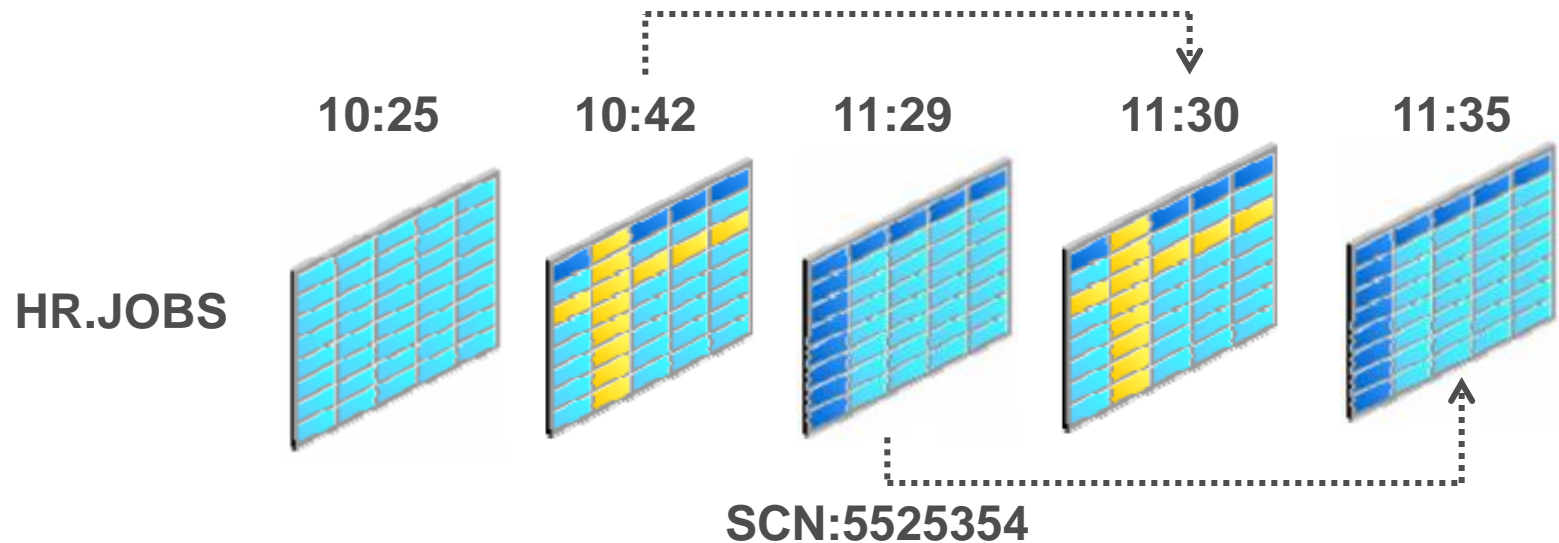
```
FLASHBACK TABLE employees, departments  
TO SCN 5525293 ENABLE TRIGGERS;
```





Flashback Tables

Rolling Back a Flashback Table Operation



11:30

```
FLASHBACK TABLE jobs  
TO TIMESTAMP to_timestamp('10:42','hh24:mi');
```

11:35

```
FLASHBACK TABLE jobs  
TO SCN 5525354;
```





Flashback Tables

Flashback Table Considerations

- The **FLASHBACK TABLE** command executes as a single transaction, acquiring exclusive DML locks.
- Statistics are not flashed back.
- Current indexes and dependent objects are maintained.
- Flashback Table operations:
 - Cannot be performed on system tables
 - Cannot span DDL operations
 - Are written to the alert log file

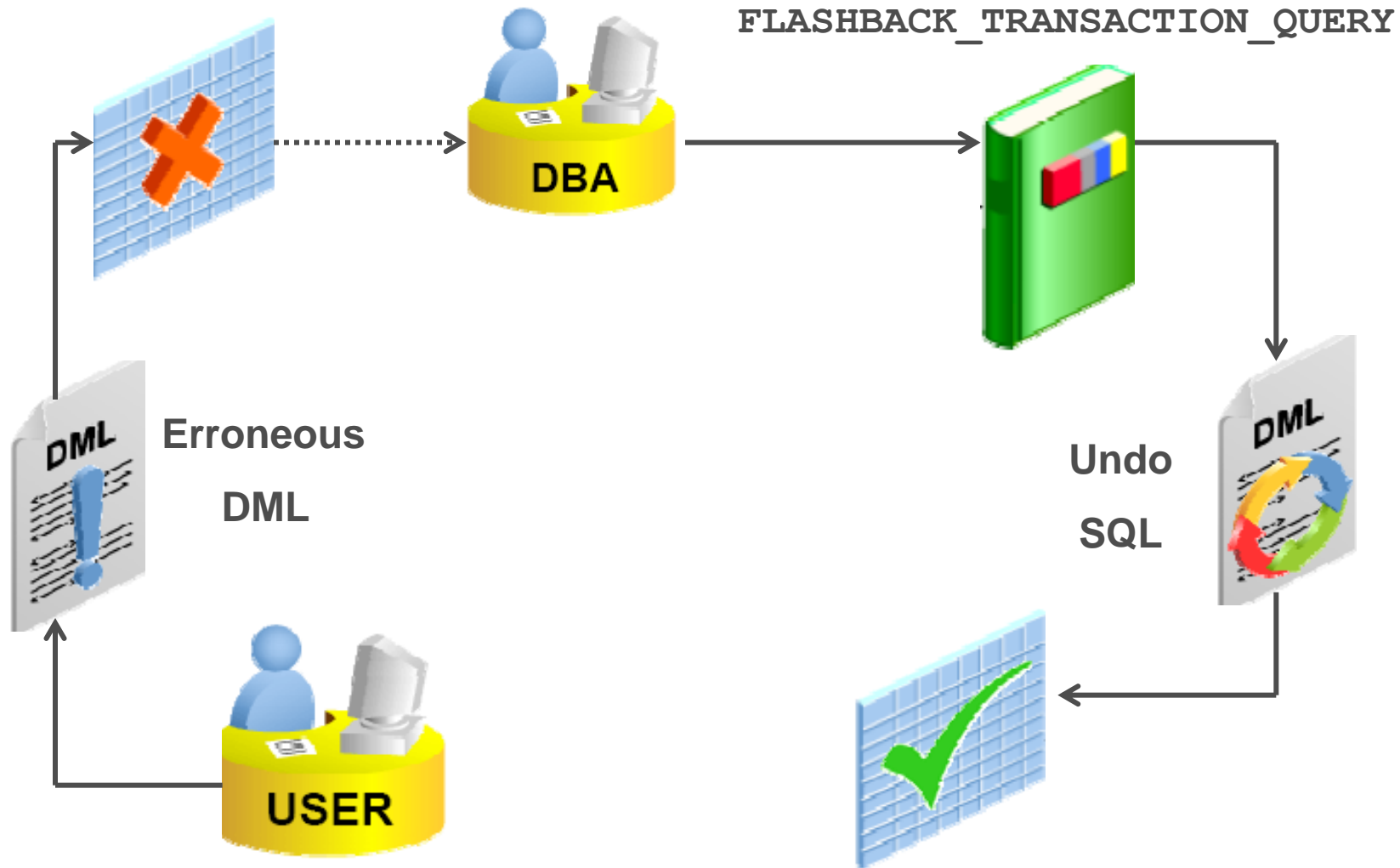




Recovering from User Errors

Perform transaction level recovery

Flashback Transaction Query Overview





Perform transaction level recovery

Querying FLASHBACK_TRANSACTION_QUERY

```
SELECT operation, undo_sql, table_name  
FROM    FLASHBACK_TRANSACTION_QUERY;
```

```
SELECT operation, undo_sql, table_name  
FROM    FLASHBACK_TRANSACTION_QUERY  
WHERE   xid = HEXTORAW('8C0024003A000000')  
ORDER BY undo_change#;
```

```
SELECT operation, undo_sql, table_name  
FROM    FLASHBACK_TRANSACTION_QUERY  
WHERE   start_timestamp >= TO_TIMESTAMP  
        ('2003-10-21 11:00:00', 'YYYY-MM-DD HH:MI:SS')  
AND     commit_timestamp <= TO_TIMESTAMP  
        ('2003-10-21 11:30:00', 'YYYY-MM-DD HH:MI:SS');
```





Perform transaction level recovery

Using Flashback Versions Query and Flashback Transaction Query

```
SELECT versions_xid, first_name  
FROM hr.employees  
VERSIONS BETWEEN SCN MINVALUE AND MAXVALUE  
WHERE employee_id = 111;
```

```
SELECT operation, undo_sql  
FROM FLASHBACK_TRANSACTION_QUERY  
WHERE xid= HEXTORAW('8C0024003A000000');
```





Perform transaction level recovery

Flashback Transaction Query Using EM

Database Control

Database

Point-in-time Flashback Versions Query Filter **Choose SCN** Flashback Tables Dependency Options Dependencies More

Choose SCN: Transaction Details

Transaction ID **03000C00BB090000**
User **SYS**
Commit SCN **1609354**
Commit Time **Mar 16, 2004 12:00:00 AM**

| Operation | Table Owner | Table Name | Undo SQL |
|-----------|-------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| DELETE | HR | DEPARTMENTS2 | insert into 'HR', 'DEPARTMENTS2' ('DEPARTMENT_ID', 'DEPARTMENT_NAME', 'MANAGER_ID', 'LOCATION_ID') values ('270', 'Payroll', NULL, '1700'); |
| DELETE | HR | DEPARTMENTS2 | insert into 'HR', 'DEPARTMENTS2' ('DEPARTMENT_ID', 'DEPARTMENT_NAME', 'MANAGER_ID', 'LOCATION_ID') values ('260', 'Recruiting', NULL, '1700'); |

OK

OK





Perform transaction level recovery

Flashback Transaction Query Considerations

- DDLs are seen as dictionary updates.
- Dropped objects appear as object numbers.
- Dropped users appear as user identifiers.
- Minimal supplemental logging may be needed:

```
ALTER DATABASE ADD SUPPLEMENTAL LOG DATA;
```





Part 4 Summary

**Perform
Flashback
operations**

**Manage the
recycle bin**

**Flashback
Tables**

**Using Flashback
Versions Query**

**Perform
transaction
level recovery**





Part 4 Stop-and-think

Do you have any questions ?





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**Oracle Technologies
Managing Data Recovery**



The end

