Manipulating Data

Objectives

- After completing this lesson, you should be able to do the following:
  - Describe each data manipulation language (DML) statement
  - Insert rows into a table
  - Update rows in a table
  - Delete rows from a table
  - Control transactions

Data Manipulation Language

- A DML statement is executed when you:
  - Add new rows to a table
  - Modify existing rows in a table
  - Remove existing rows from a table
- A *transaction* consists of a collection of DML statements that form a logical unit of work.

Database Transactions

- A database transaction consists of one of the following:
  - DML statements that constitute one consistent change to the data
  - One DDL statement
  - One data control language (DCL) statement

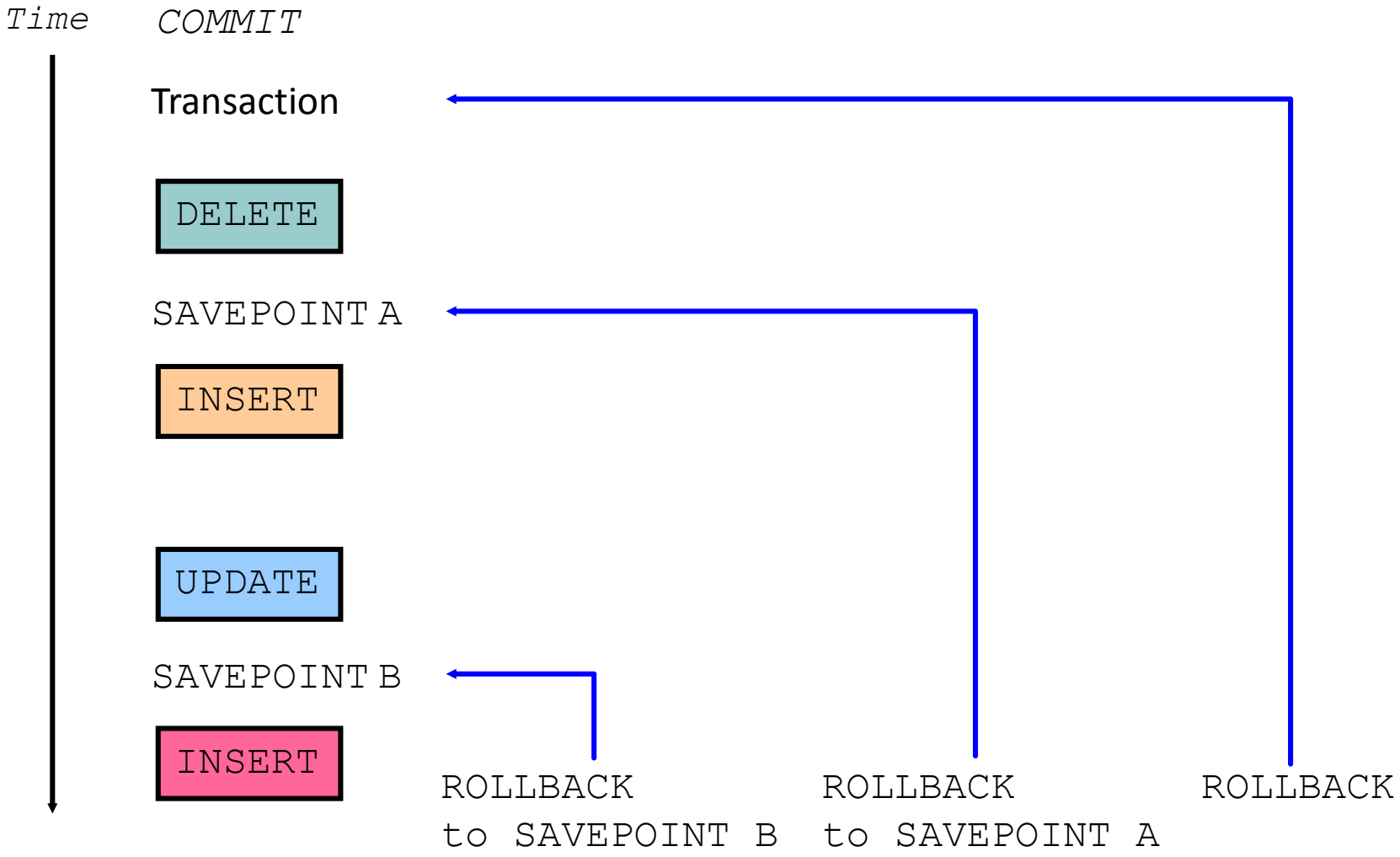
Database Transactions

- Begin when the first DML SQL statement is executed.
- End with one of the following events:
  - A **COMMIT** or **ROLLBACK** statement is issued.
  - A DDL or DCL statement executes (automatic commit).
  - The user exits SqlDeveloper.
  - The system crashes.

Advantages of COMMIT and ROLLBACK Statements

- With COMMIT and ROLLBACK statements, you can:
  - Ensure data consistency
  - Preview data changes before making changes permanent
  - Group logically related operations

Controlling Transactions



Rolling Back Changes to a Marker

- Create a marker in a current transaction by using the `SAVEPOINT` statement.
- Roll back to that marker by using the `ROLLBACK TO SAVEPOINT` statement.

```
UPDATE...
SAVEPOINT update_done;
Savepoint created.
INSERT...
ROLLBACK TO update_done;
Rollback complete.
```

Implicit Transaction Processing

- An automatic commit occurs under the following circumstances:
  - DDL statement is issued
  - DCL statement is issued
  - Normal exit from SqlDeveloper, without explicitly issuing `COMMIT` or `ROLLBACK` statements
- An automatic rollback occurs under an abnormal termination of SqlDeveloper or a system failure.

State of the Data Before COMMIT or ROLLBACK

- The previous state of the data can be recovered.
- The current user can review the results of the DML operations by using the SELECT statement.
- Other users *cannot* view the results of the DML statements by the current user.
- The affected rows are *locked*; other users cannot change the data in the affected rows.

State of the Data After COMMIT

- Data changes are made permanent in the database.
- The previous state of the data is permanently lost.
- All users can view the results.
- Locks on the affected rows are released; those rows are available for other users to manipulate.
- All savepoints are erased.

Committing Data

– Make the changes:

```
DELETE FROM employees
WHERE  employee_id = 99999;
1 row deleted.

INSERT INTO departments
VALUES (290, 'Corporate Tax', NULL, 1700);
1 row created.
```

– Commit the changes:

```
COMMIT;
Commit complete.
```

State of the Data After ROLLBACK

- Discard all pending changes by using the ROLLBACK statement:
  - Data changes are undone.
  - Previous state of the data is restored.
  - Locks on the affected rows are released.

```
DELETE FROM copy_emp;
22 rows deleted.
ROLLBACK ;
Rollback complete.
```

State of the Data After ROLLBACK

```
DELETE FROM test;          -- ups!, it's a mistake
25,000 rows deleted.

ROLLBACK;                  -- correct the mistake
Rollback complete.

DELETE FROM test WHERE  id = 100; -- it's ok
1 row deleted.

SELECT * FROM   test WHERE  id = 100;
No rows selected.

COMMIT;                     -- make it permanent
Commit complete.
```

Statement-Level Rollback

- If a single DML statement fails during execution, only that statement is rolled back.
- The Oracle server implements an implicit savepoint.
- All other changes are retained.
- The user should terminate transactions explicitly by executing a `COMMIT` or `ROLLBACK` statement.

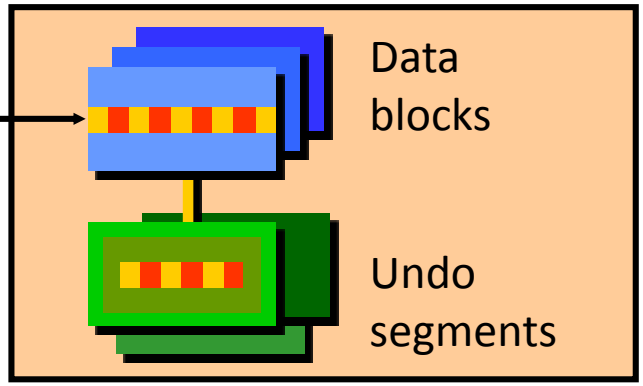
Read Consistency

- Read consistency guarantees a consistent view of the data at all times.
- Changes made by one user do not conflict with changes made by another user.
- Read consistency ensures that on the same data:
  - Readers do not wait for writers
  - Writers do not wait for readers

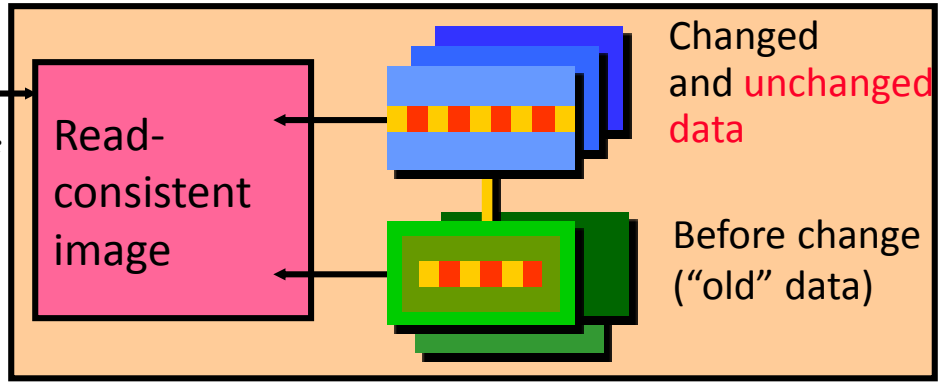
Implementation of Read Consistency

User A

```
UPDATE employees
SET    salary = 7000
WHERE  last_name = 'Grant';
```



```
SELECT  *
FROM userA.employees;
```



User B

Summary

- In this lesson, you should have learned how to use the following statements:

Function	Description
INSERT	Adds a new row to the table
UPDATE	Modifies existing rows in the table
DELETE	Removes existing rows from the table
COMMIT	Makes all pending changes permanent
SAVEPOINT	Is used to roll back to the savepoint marker
ROLLBACK	Discards all pending data changes