

## Database Trigger

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## Triggers

- Often called event-condition-action rules.
  - Event = a class of changes in the DB
  - Condition = a test as in a where-clause for whether or not the trigger applies.
  - Action = one or more SQL statements.When an events occurs, test condition; if satisfied, execute action.
- Oracle version and SQL3 version; not in SQL2.
- Differ from checks or SQL2 assertions in that:
  - Event is programmable, rather than implied by the kind of check.
  - Condition not available in checks.

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## Trigger Option (1)

- Possible event include
  - **INSERT ON** *table*
  - **DELETE ON** *table*
  - **UPDATE [OF *attribute*] ON** *table*
- Trigger can be
  - Row-level: activated FOR EACH ROW modified
  - Statement-level: activated for each modification statement

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## Trigger Option (2)

- Action can be executed
  - **AFTER** the triggering event
  - **BEFORE** the triggering event
  - **INSTEAD OF** the triggering event
- Condition and action can reference
  - **OLD** tuple and **NEW** tuple in a row-level trigger
  - **OLD\_TABLE** and **NEW\_TABLE** in a statement level trigger

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## An Example

EMPLOYEE(SSN, Name, DNO, Salary), DEPARTMENT(DNO, Total\_sal)

What happen if:

- (1) have a new employee be added?
- (2) update the salary of one employee?
- (3) delete a employee from the database?
- (4) an employee change department?

```
CREATE TRIGGER TotalSal1
AFTER INSERT ON EMPLOYEE
FOR EACH ROW
WHEN (NEW.DNO IS NOT NULL)
UPDATE DEPARTMENT SET Total_sal = Total_sal + NEW.Salary
WHERE DNO = NEW.DNO
```

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## Notes

- There are two special variables *NEW* and *OLD*, representing the new and old tuple in the change.
  - *old* makes no sense in an insert, and *new* makes no sense in a delete.
- The action is a PL/SQL statement.
  - Simplest form: surround one or more SQLstatements with BEGIN and END.

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## Notes

- Dot and *run* cause the definition of the trigger to be stored in the database.
  - Oracle triggers are elements of the database, like tables or views.
- Important Oracle restriction
  - the action cannot change the relation that triggers the action.
  - the action cannot even change a relation connected to the triggering relation by a constraint, e.g., a foreign-key constraint.

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## SQL3 Triggers

- Some differences
  - Position of FOR EACH ROW.
  - The Oracle restriction about not modifying the relation of the trigger or other relations linked to it by constraints is not present in SQL3
  - Oracle is real; SQL3 is paper.
  - The action in SQL3 is a list of SQL3 statements, not a PL/SQL statement.

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