

Triggers

1

What is a Trigger?

- A trigger is a PL/SQL block that is automatically called when certain events occur in the database.
- Triggers can be made to run when rows are inserted, deleted or updated.
- Triggers can be run before or after the action.
- Triggers can be run once per statement or once per row affected.

2

General Form of a Trigger

```
CREATE [or REPLACE] TRIGGER trig_name
{BEFORE | AFTER | INSTEAD OF}
{DELETE | INSERT | UPDATE [of column [,
column] ...] }
[or {DELETE | INSERT | UPDATE [of column
[, column] ...] } ...]
on {table_name | view_name}
[FOR EACH ROW]
[WHEN (condition)]
PL/SQL block
```

3

Creating Triggers

- Trigger timing
 - For table: BEFORE, AFTER
 - For view: INSTEAD OF
- Triggering event: INSERT, DELETE or UPDATE (possibly of specific columns)
- On table or view
- Trigger type: Row or statement
- When clause: Restricts when trigger is run
- Trigger body: PL/SQL block

4

Before/After/Instead of Trigger

- Trigger timing: When should the trigger fire?
- BEFORE: Execute the trigger body before the triggering DML event on a table.
- AFTER: Execute the trigger body after the triggering DML event on a table.
- INSTEAD OF: Execute the trigger body instead of the the triggering statement. Used for VIEWS that are not otherwise modifiable.

5

Row/Statement Trigger

- Should the trigger body execute for each row the statement affects or only once?
- Statement: The trigger body executes once for the triggering event. This is the default.
- Row: The trigger body executes once for each row affected by the triggering event.
- Is it possible that a Statement trigger will run more times than a row trigger?

6

Backing Up Data

```
create table sailors(  
  sid number,  
  sname VARCHAR2(30),  
  rating number check(rating <= 10),  
  age number  
);
```

```
create table sailors_audit(  
  who varchar2(30),  
  when_changed date,  
  sid number,  
  old_rating number,  
  new_rating number  
);
```

7

Backing Up Data

```
CREATE or REPLACE TRIGGER  
backup_sailors_trig  
AFTER UPDATE of Rating on Sailors  
FOR EACH ROW WHEN (old.rating < new.rating)  
BEGIN  
  
INSERT INTO sailors_audit  
VALUES (USER, SYSDATE, :old.sid,  
       :old.rating, :new.rating);  
  
END;  
/
```

- What happens if update fails?
- Why AFTER Trigger?

8

Ensuring Upper Case

```
CREATE or REPLACE TRIGGER sname_trig  
BEFORE INSERT or UPDATE of sname  
on Sailors  
FOR EACH ROW  
BEGIN  
  
:new.sname := UPPER(:new.sname);  
  
END;  
/
```

- Why BEFORE Trigger?

9

Instead Of Trigger

```
create view sailors_reserves as  
select sailors.*, reserves.bid, reserves.day  
from sailors, reserves  
where sailors.sid = reserves.sid;
```

```
CREATE or REPLACE TRIGGER view_trig  
INSTEAD OF INSERT  
on sailors_reserves  
FOR EACH ROW  
BEGIN  
INSERT INTO sailors values(:new.sname,  
:new.sid, :new.rating, :new.age);  
INSERT INTO reserves values(:new.sid,  
:new.bid, :new.day);  
END;  
/
```

10

Statement Trigger

```
CREATE or REPLACE TRIGGER shabbat_trig  
BEFORE INSERT or DELETE or UPDATE  
on reserves  
DECLARE  
  shabbat_exception EXCEPTION;  
  
BEGIN  
  if (TO_CHAR (sysdate, 'DY')='SAT') then  
    raise shabbat_exception;  
  end if;  
  
END;  
/
```

- What happens if exception is thrown?
- Why BEFORE Trigger?

11

Mutating Table

- You cannot select/insert/delete/update a table in a trigger, that is currently being affected by the DML operation
- Such a table (that is currently affected) is said to be "mutating"

12

Bad Trigger

```
CREATE or REPLACE TRIGGER mutating_trig
BEFORE DELETE
on reserves
DECLARE
    empty_table_exception EXCEPTION;
    cnt NUMBER;
BEGIN
    SELECT count(*)
    INTO cnt
    FROM reserves;

    if (cnt = 1) then
        raise empty_table_exception;
    end if;
END;
/
```

13

Additional Types of Triggers

- Can also define triggers for
 - logging in and off
 - create/drop table events
 - system errors
 - etc.

14