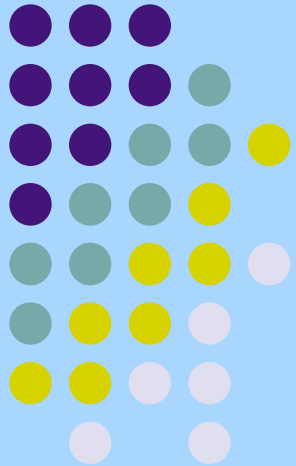
Examples on Triggers



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WPI

Example 1

If the employee salary increased by more than 10%, make sure the 'rank' field is not empty and its value has changed, otherwise reject the update

If the trigger exists, then drop it first

```
Create or Replace Trigger EmpSal
Before Update On Employee
For Each Row
Begin
      IF (:new.salary > (:old.salary * 1.1)) Then
          IF (:new.rank is null or  :new.rank = :old.rank) Then
              RAISE_APPLICATION_ERROR(-20004, 'rank field not correct');
          End IF;
      End IF;
End;
/
```

Compare the old and new salaries

Make sure to have the "/" to run the command

Example 2

If the employee salary increased by more than 10%, then increment the rank field by 1.

In the case of **Update** event only, we can specify which columns

```
Create or Replace Trigger EmpSal
Before Update Of salary On Employee
For Each Row
Begin
      IF (:new.salary > (:old.salary * 1.1)) Then
          :new.rank := :old.rank + 1;
      End IF;
End;
/
```

We changed the new value of ***rank*** field

The assignment operator has ":"

Example 3: Using Temp Variable

If the newly inserted record in employee has null hireDate field, fill it in with the current date

```
Create Trigger EmpDate
Before Insert On Employee
For Each Row
Declare
      temp date;
Begin
       Select sysdate into temp from dual;
       IF (:new.hireDate is null) Then
             :new.hireDate := temp;
       End IF;
End;
/
```

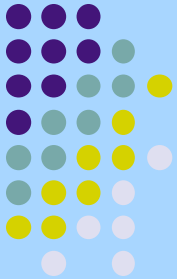
Since we need to change values, then it must be "**Before**" event

Declare section to define variables

Oracle way to select the current date

Updating the new value of hireDate before inserting it

Example 4: Maintenance of Derived Attributes



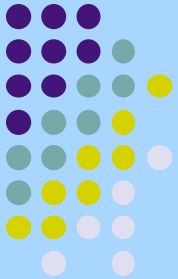
Keep the bonus attribute in Employee table always 3% of the salary attribute

```
Create Trigger EmpBonus
Before Insert Or Update On Employee
For Each Row
Begin
    :new.bonus := :new.salary * 0.03;
End;
/
```

Indicate two events at the same time

The bonus value is always computed automatically

Combining Multiple Events in One Trigger



- **If you combine multiple operations**
  - Sometimes you need to know what is the current operation

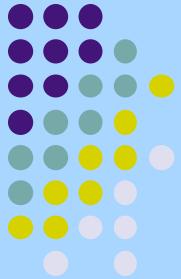
```
Create Trigger EmpBonus
Before Insert Or Update On Employee
For Each Row
Begin
      IF (inserting) Then  … End IF;

      IF (updating) Then … End IF;
End;
/
```

Combine ***Insert*** and ***Update***

Can do something different under each operation

Before vs. *After*



- **Before Event**
  - **When checking certain conditions that may cause the operation to be cancelled**
    - E.g., if the name is null, do not insert
  - **When modifying values before the operation**
    - E.g., if the date is null, put the current date

- **After Event**
  - **When taking other actions that will not affect the current operations**
    - The insert in table X will cause an update in table Y

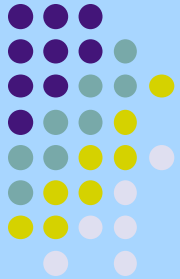
Before Insert Trigger:

```
:new.x := ….        //Changing value x that will be inserted
```

After Insert Trigger:

```
:new.x := …         //meaningless because the value is already inserted
```

Row-Level vs. Statement-Level Triggers

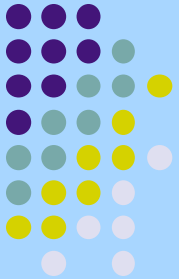


- **Example:** *Update emp set salary = 1.1 * salary;*
  - Changes many rows (records)

- **Row-level triggers**
  - Check individual values and can update them
  - Have access to ***:new*** and ***:old*** vectors

- **Statement-level triggers**
  - Do not have access to ***:new*** or ***:old*** vectors (only for row-level)
  - Execute once for the entire statement regardless how many records are affected
  - Used for verification before or after the statement

Example 5: Statement-level Trigger



Store the count of employees having salary > 100,000 in table R

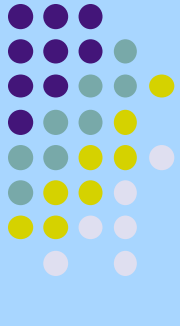
Indicate three events at the same time

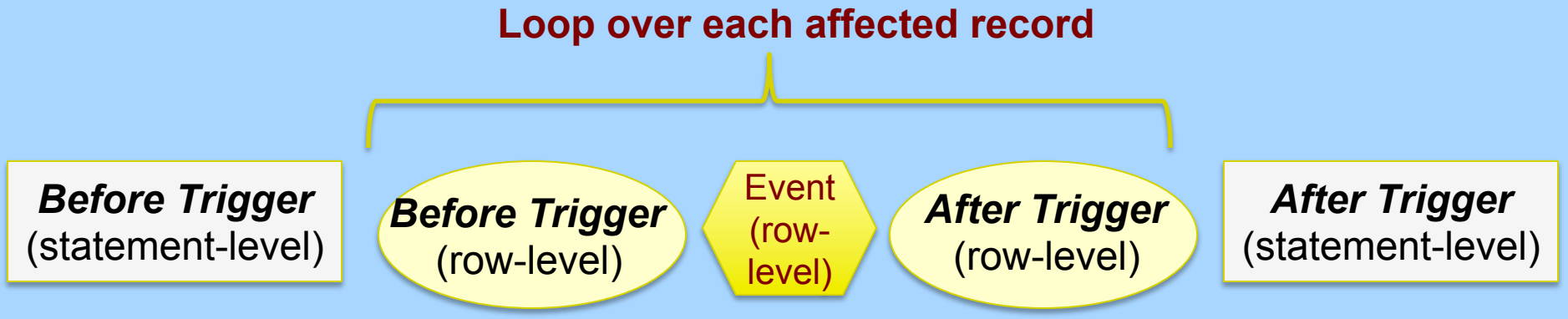
```
Create Trigger EmpBonus
After Insert Or Update of salary Or Delete On Employee
For Each Statement
Begin
    delete from R;
    insert into R(cnt) Select count(*) from employee where salary > 100,000;
End;
/
```

Remember: In Oracle, it is not written

Delete the existing record in R, and then insert the new count.

Order Of Trigger Firing





Some Other Operations

- **Dropping Trigger**

SQL> Drop Trigger *<trigger name>;*

- **If creating trigger with errors**

SQL > Show errors;

It displays the compilation errors

Example on Triggers

- branch (branch_name, branch_city, assets)
- customer (customer_name, customer_street, customer_city)
- account (account_number, branch_name, balance)
- loan (loan_number, branch_name, amount)
- depositor (customer_name, account_number)
- borrower (customer_name, loan_number)

Sum of loans taken by a customer does not exceed 100,000…
Assume primary keys cannot be updated

- Which table ? ➔ Borrower & Loan
- Which event ? ➔ Borrower (Insert) & Loan (update)
- Which Timing ? ➔ ??? Lets see
- Which Granularity ? ➔ row-level

- branch (branch_name, branch_city, assets)
- customer (customer_name, customer_street, customer_city)
- account (account_number, branch_name, balance)
- loan (loan_number, branch_name, amount)
- depositor (customer_name, account_number)
- borrower (customer_name, loan_number)

Part 1

Sum of loans taken by a customer does not exceed 100,000

```
Create Trigger CustMaxLoan1
After Insert On Borrower
For Each Row
Declare
    sumLoan int;
Begin
    Select sum(amount)  into sumLoan
     From loan L, Borrower B
     where L.loan_number = B.loan_number
     And B.customer_name = :new.customer_name;

   IF  sumLoan > 100,000  Then
          RAISE_APPLICATION_ERROR(-20004, 'Cannot insert record.');
  End IF;
End;
/
```

Takes into account the new loan assigned to the customer (because it is "After Insert"

- branch (branch_name, branch_city, assets)
- customer (customer_name, customer_street, customer_city)
- account (account_number, branch_name, balance)
- loan (loan_number, branch_name, amount)
- depositor (customer_name, account_number)
- borrower (customer_name, loan_number)

Part 2

Sum of loans taken by a customer does not exceed 100,000

```
Create Trigger CustMaxLoan2
After Update of amount On Loan
For Each Row
Declare
    sumLoan  int;  custName varchar2(100);
Begin
    Select customer_name into custName From Borrower
            Where loan_number = :new.loan_number;

    Select sum(amount)  into sumLoan
     From loan L, Borrower B
     where L.loan_number = B.loan_number
     And B.customer_name = custName;

   IF  sumLoan > 100,000  Then
          RAISE_APPLICATION_ERROR(-20004, 'Cannot insert record.');
  End IF;
End;
/
```

Get the customer to whom the updated loan belongs

Get the sum of loans for this customer

Example 2

- branch (branch_name, branch_city, assets)
- customer (customer_name, customer_street, customer_city)
- account (account_number, branch_name, balance)
- loan (loan_number, branch_name, amount)
- depositor (customer_name, account_number)
- borrower (customer_name, loan_number)

What if you are requested to enforce this part ???

Sum of loans taken by a customer does not exceed 100,000…

Assume primary keys cannot be updated

For each table, create "Before Update" trigger preventing a change on PK columns

```
Create Trigger PK-No-Update
Before Update of loan_number On Loan
For Each Row
Begin
    RAISE_APPLICATION_ERROR(-20004, 'Cannot Update PK…');
End;
/
```