Triggers

- **Trigger**: stored program that is executed by the DBMS whenever a specified event occurs
- Associated with a table [or view]
- Two [or three] trigger types: **BEFORE, AFTER, [and INSTEAD OF]**
- Each type can be declared for INSERT, UPDATE, or DELETE
Uses for Triggers

- Provide complex default values
- Enforce data constraints
- Update views – not in MySQL
- Perform referential integrity actions

Create Trigger – MySQL Syntax

CREATE TRIGGER trigger_name
  trigger_time trigger_event
  ON table_name
  FOR EACH ROW trigger_code

trigger_time: BEFORE, AFTER
trigger_event: INSERT, DELETE, UPDATE
Trigger for Enforcing a Data Constraint – Update CQPR - MySQL

DELIMITER $$ /* change default delimiter */

CREATE TRIGGER UpdateCQPR /* provide trigger name */
AFTER UPDATE ON Enrolled /* specify when trigger should be invoked */
FOR EACH ROW
BEGIN
  DECLARE varNewCQPR double;

  IF (new.Grade is not null) THEN
    /* create a variable @newGPA to compute and store the new gpa value */
    set varNewCQPR = (select avg(PointGrade)
      from Enrolled E, Grade G
      where E.Grade = G.LetterGrade and E.Alpha = new.Alpha);

    /* update the Students table with the new GPA value */
    update Students set CQPR = varNewCQPR where Alpha = new.Alpha;
  END IF;
END;
DELIMITER ; /* restore the default delimiter */

 arbitrator exercise

- Students (Alpha, SName, Email, Gender, ClassYear, GPA)
- Define a trigger: if inserted email is null, change the Email to mxxx@usna.edu, where xxx is the SNb.
  - Hint: in MySQL, CONCAT(a,b) will return the concatenate the two string a and b
- Insert rows to test the trigger
Today

- Triggers
- Stored procedures

Stored Procedures

- A stored procedure or a stored function is a program that is stored within the database and is compiled when used

- Stored procedures can receive input parameters and they can return results

- Stored procedures can be called from:
  - Standard languages
  - Scripting languages
  - SQL command prompt
Stored Procedure Advantages

- Greater security as store procedures are always stored on the database server
- SQL can be optimized by the DBMS compiler
- Code sharing resulting in:
  - Less work
  - Standardized processing
  - Specialization among developers

Create And Execute Stored Procedures

- CREATE PROCEDURE `proc_name`
  `(param_list)`
  `proc_code`

- call `proc_name`(value1, …)
Stored Procedure Example

- Students (Alpha, LastName, FirstName, Email, ClassYear, Major)

- Procedure: Insert a student only if ClassYear > 2013

Students (Alpha, LastName, FirstName, Email, ClassYear, Major) - MySQL

DELIMITER $$
CREATE PROCEDURE insertStudents (Alphavar char(6), 
    LastNamevar varchar(50), FirstNamevar varchar(50), 
    Emailvar varchar(100), ClassYearvar int, Majorvar char(4)) 
BEGIN 
    if ClassYearvar > 2013 then 
        INSERT INTO Students(Alpha, LastName, FirstName, Email, ClassYear, Major) 
            VALUES (Alphavar, LastNamevar, FirstNamevar, Emailvar, ClassYearvar, Majorvar); 
    end if; 
END $$
DELIMITER ;

To run: call insertStudents('141111', 'Doe', 'John', 'jdoe@usna.edu', 2014, null)
Class Exercise

- Add code to the previous procedure to prevent anyone named ‘Doe, John’ to be inserted into the DB.

- Test the procedure (call ....)

Class Exercise Solution

DELIMITER $$
CREATE PROCEDURE insertStudents (Alphavar char(6), LastNamevar varchar(50), FirstNamevar varchar(50), Emailvar varchar(100), ClassYearvar int, Majorvar char(4))
BEGIN
if ClassYearvar > 2013 AND (LastNamevar != 'Doe' OR FirstNamevar != 'John') then
    INSERT INTO Students(Alpha, LastName, FirstName, Email, ClassYear, Major)
    VALUES (Alphavar, LastNamevar, FirstNamevar, Emailvar, ClassYearvar, Majorvar);
end if;
END $$
DELIMITER ;
To run: call insertStudents('141112', 'Doe', 'John', 'jdoe@usna.edu', 2014, null)
Triggers vs. Stored Procedures

• Trigger
  — Module of code that is called by the DBMS when INSERT, UPDATE, or DELETE commands are issued
  — Assigned to a table or view
  — Depending on the DBMS, may have more than one trigger per table or view
  — Triggers may issue INSERT, UPDATE, and DELETE commands and thereby may cause the invocation of other triggers

• Stored Procedure
  — Module of code that is called by a user or database administrator
  — Assigned to a database, but not to a table or a view
  — Can issue INSERT, UPDATE, and DELETE commands
  — Used for repetitive administration tasks or as part of an application