



JDBC

J2EE:

- **J2EE** stands for Java 2 Enterprise Edition where 2 refers to the version.
- It contains **larger set of libraries** compared to J2SE using which some additional functionalities can be performed.

Need for J2EE:

- It is needed for the **Simplification of Web Application Development**.

JAR FILE

- **JAR** means Java Archive (**Compress**).
- It is a file format based on **ZIP file format** which is used to **compress many files into one Single file**.

Contents of Jar File:

- **.java (optional)**: Contains **source code** statement in it.
- **.class**: Contains **byte code** statements in it(**Machine level language**).
- **config files**: Contains **configuration data** in it.
- ❖ **.xml**: It is used to **configure the resource** with the help of **User-defined tags or Custom tags**.
- ❖ **.properties**: It is used to provide a **set of properties** in the form of **key and value pair** where key must be unique.

Need for Jar File:

- Jar File is needed to import the properties based on the requirement.
- ❖ Total inbuilt class in java are 6000+ present in **rt.jar** where rt refers to run-time.

Steps to create a Jar File:

- Right click on project and select **Export option**.
- Open java folder and select **jar file** and click on **next**.
- Browse for appropriate location to place the jar file and name the jar file and click on **Save and Finish**.

Steps to build a Java path:

- There are 2 different ways to build a java path to import the properties from a jar file namely
 - a) **Externally**
 - b) **Internally**
- (a) **Externally:**
 - Right click on **project** and select **properties option**.
 - Select **java build path** and click on **libraries tab**.
 - Click on **add external jars** and select a jar file from the respective path and click on **open and OK**.
- (b) **Internally:**
 - Right click on **project** and create a new folder with **name lib**.
 - Add the respective jar file into the **lib folder**.
 - Right click on **project** and select **properties option**.
 - Select **java build path** and click on **libraries tab**.
 - Click on **add jars** and select jar file from the **lib folder** of respective project and click on **Open and Ok**.

Note:

- ❖ It is always a good practice to import the properties from a jar file **Internally**.

Parameter:

- It is the one which holds an **argument**.

Note:

- ❖ Whenever the method parameter type is an **Interface**, then the argument for that method must be any of its **Implementation class object**.
- ❖ Whenever the method parameter type is **Super class**, then the argument for that method must be any of its **sub class object**.
- ❖ Whenever the method parameter type is an **Abstract class**, then the argument for that method must be any of its **sub class or implementation class object**.

Argument:

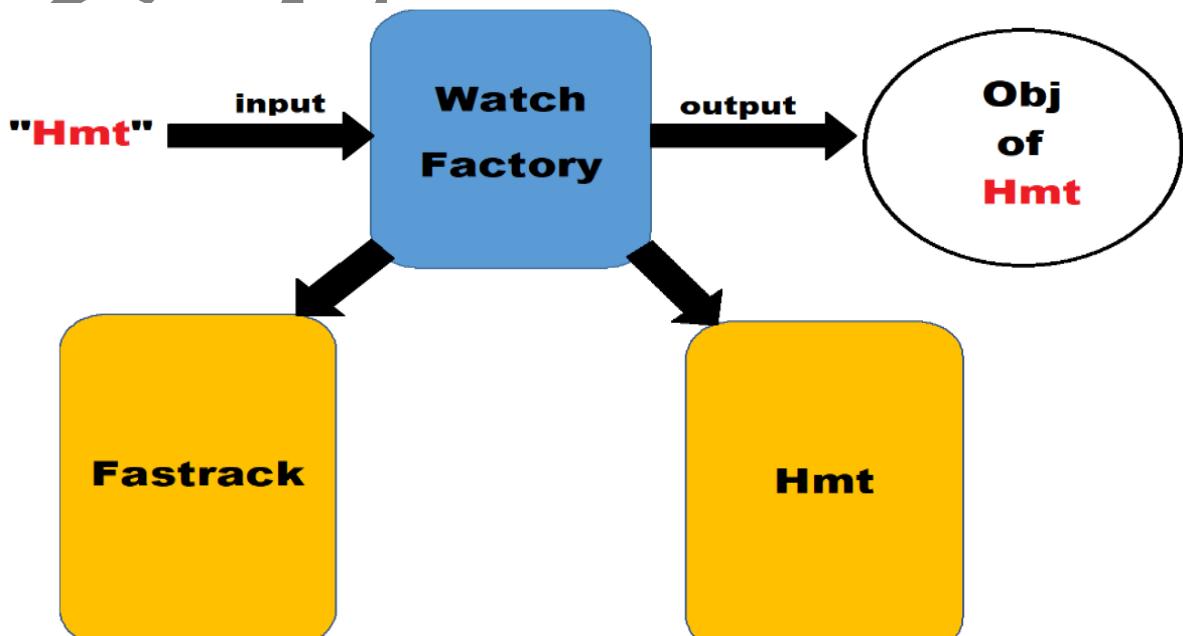
- Data or value passed to any methods is an **argument**.

DESIGN PATTERN

An optimized solution for commonly re-occurring design problems or design needs is known as a **Design Pattern**.

Eg: **MVC Architecture (Model View Controller)**.

- There are 2 different categories of **Design pattern** present namely
 - a) **Creational Design Pattern**
 - b) **Factory Design Pattern**
- ❖ **Creational Design Pattern:** It involves only **Object Creation logic**.
- ❖ **Factory Design Pattern:** It is the one which creates or produces “**Different Objects of same type**”.
- Factory generally takes an input of **String type**.



```

+ class WatchFactory (Factory Class)
{
    + static watch getWatch(String type) // Factory/Helper method
    {
        if(type.equalsIgnoreCase("Fastrack"))
        {
            return new Fastrack();
        }
        else if(type.equalsIgnoreCase("Hmt"))
        {
            return new Hmt();
        }
        else
        {
            System.out.println("No Watch Found!!!!");
        }
        return null;
    }
}

```

Factory Design pattern is always associated with 3 different types of logic namely:

- a) *Implementation Logic*
- b) *Object creation Logic*
- c) *Consumer or Utilization Logic*

(a) ***Implementation Logic:*** It is the basic fundamental logic which contains only *Implementations* according to which an *implementation object* has to be created.

(b) ***Object creation Logic:*** It is used to create *implementation object* according to the *implementation logic* by using a *factory or helper method* within the *factory class*.

(c) ***Consumer or Utilization Logic:*** It is the most important logic which is used to *access the functionalities* from the *Implementation Objects*.

Note:

- ❖ Without writing a *consumer or utilization logic*, none of the implementations will work.

- ❖ ***Costly Resources:*** Resources which makes use of *system properties* are known as *Costly resources*.

- ❖ **Factory or Helper method:** It is used to create **Implementation object**.
- ❖ **NullPointerException:** Pointing towards an object which is not present throws an exception called **NullPointerException**.

ABSTRACTION

*Hiding the implementation and providing functionalities to the user with the help of Interface is known as **Abstraction**.*

- The output of Abstraction is **Loose coupling** which can be achieved with the help of **Interface**.
- ❖ **Interface:** It is a media to communicate between **User and any Device**.
- ❖ **Loose Coupling:** Change in the implementation which does not affect the user is known as **Loose Coupling**.
- ❖ **Tight Coupling:** Change in the implementation which affects the user is known as **Tight Coupling**.

Factory Code implementing all three different types of logic:

```
package org.btm.lightApp;
public interface ISwitch
{
    void sOn();
    void sOff();
}

package org.btm.lightApp;
public class TubeLightImpl implements ISwitch
{ @Override
    public void sOn()
    {
        System.out.println("TubeLight is On !!");
    }
    @Override
    public void sOff()
```

```
{  
    System.out.println("TubeLight is Off !!");  
}  
}  
}
```

```
package org.btm.lightApp;  
public class LedLightImpl implements ISwitch  
{ @Override  
    public void sOn()  
    {  
        System.out.println("LedLight is On!!");  
    }  
    @Override  
    public void sOff()  
    {  
        System.out.println("ledLight is Off!!");  
    }  
}
```

```
package org.btm.lightApp;  
public class LightFactory  
{  
    public static ISwitch getLight(String type)  
    {  
        if (type.equalsIgnoreCase("ledLight"))  
        {  
            return new LedLightImpl();  
        }  
        else if (type.equalsIgnoreCase("TubeLight"))  
        {  
            return new TubeLightImpl();  
        }  
        else  
        {  
            System.err.println("No such light found");  
        }  
        return null;  
    }  
}
```

```

package org.btm.lightApp;
import java.util.Scanner;
public class Test
{
    public static void main(String[ ] args)
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the type of Light");
        String type = sc.next();
        sc.close();
        ISwitch is= LightFactory.getLight(type);
        if (is != null)
        {
            is.sOff( );
            is.sOn( );
        }
    }
}

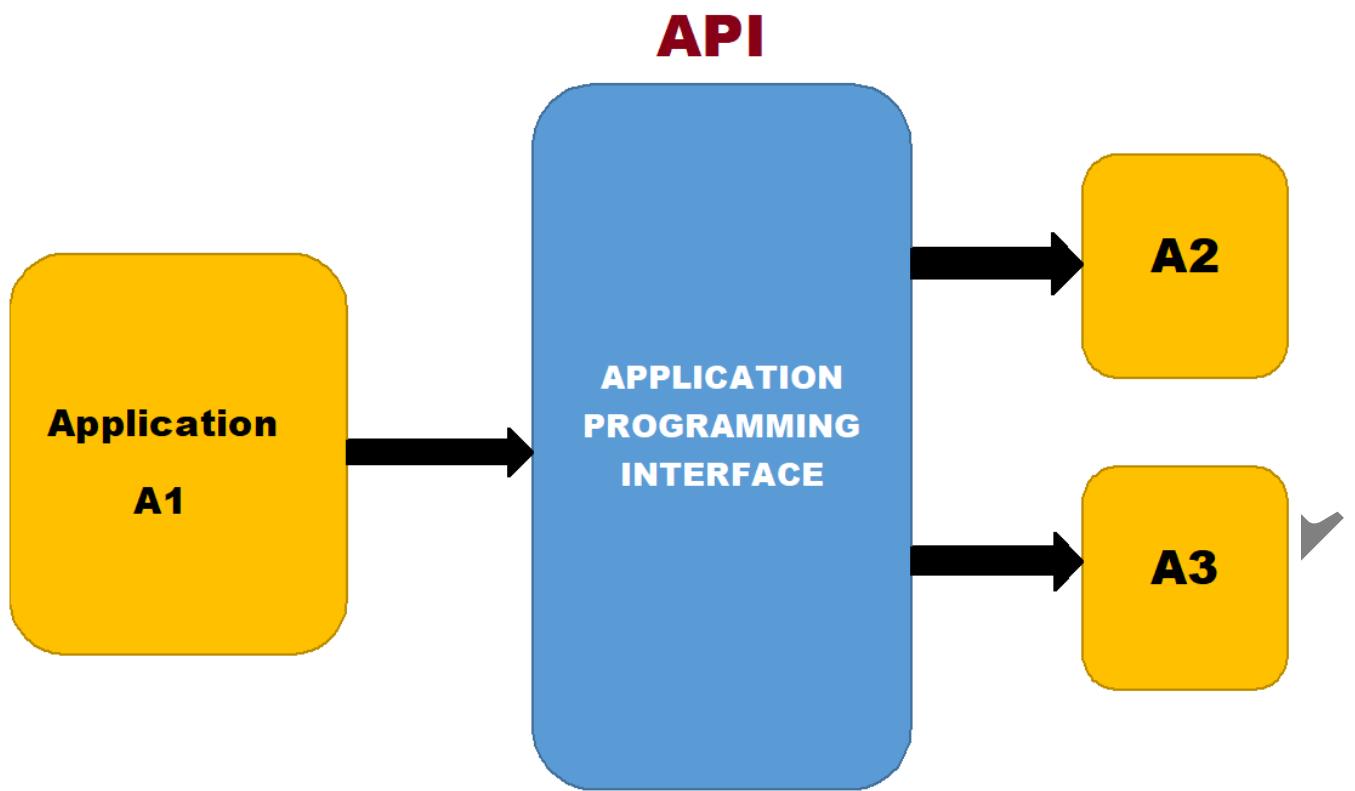
```

Note:

- ❖ Whenever the User provides implementation, then the same user has to even **create an object of implementation**.
- ❖ Whenever the Vendor provides implementation, then the same Vendor has to even **create an object of implementation**.

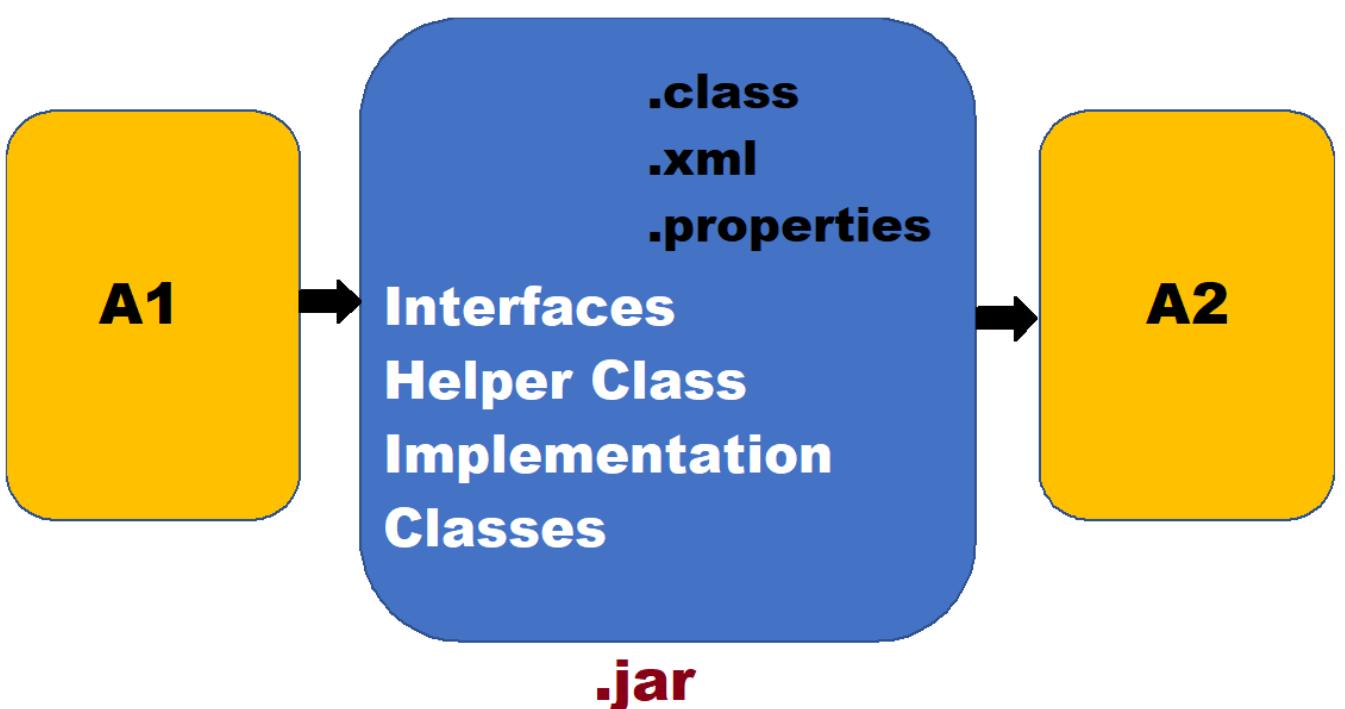
APPLICATION PROGRAMMING INTERFACE(API)

- API used for inter-application communication i.e. one application can communicate with other application with the help of API to achieve **Loose coupling**.
- Backbone of API is **Abstraction**.
- The output of Abstraction is **Loose Coupling** which is achieved with the help of **Interface**.



Example for API's are: Apache POI, Jaxcel, JDBC, Server...etc.

Contents of API:



The contents of API are **Interfaces, Helper Class and Implementation Classes** in the form of Jar file.

Note: Whenever the API's are given in the form of jar files, then such API's developed using java as programming language.

There are two different forms of API present namely:

- (a) 1st form of API
- (b) 2nd form of API

a) **1st form of API:**

- This form of API contains **interfaces, helper classes and implementation classes** in the form of jar file.
- This form of API is exposed to the developer or the programmer to write the **consumer or utilization logic**.

Eg: Apache PoI, Jaxcel, etc

Note: A **consumer or utilization** logic can always be written only after the implementations are known.

b) **2nd form of API:**

JDBC API:

- It was given by **Sun micro System** to achieve loose coupling between Java application and Database Server.
- It contains **Interfaces and Helper Class** in the form of jar file.
- It is distributed into 2 different packages namely **java.sql and javax.sql**
- The interfaces of **JDBC API** are **Driver, Connection, Statement, PreparedStatement, CallableStatement, ResultSet, MetaData, etc.**
- **JDBC API** contains only one helper class in it by name **DriverManager**.

JDBC DRIVER:

- It is an implementation of **JDBC API**.
- It contains implementation classes in the form of jar file.
- It is always specific to the particular Database Server or Vendor.
- These are provided by respective Database Server or Vendors.

Eg: Jdbc, Servlets, etc.

Note:

- ❖ For us to communicate with any Database Server and perform any data base operation, we need to have two different components mandatorily namely **JDBC API and JDBC DRIVER**.
- ❖ In Java JDBC program we always write only the **Consumer or Utilization logic**.

Advantages of JDBC:

- ❖ We can achieve loose coupling between Java Application and Database Server.
- ❖ Platform-independent.

Port Number: It is the one which helps us to get connected to a **particular server**.

Different port numbers:

- ❖ **Oracle=1521**
- ❖ **MySQL=3306**
- ❖ **MS-SQL=1433**
- ❖ **Derby=1527**

Thin-client application:

It is a **light-weight software** which is used to communicate with **a particular Database Server or Database Vendor**.

There are 2 different categories of thin client application present namely

- a) **Mobile client application**
- b) **Database client application**

a) **Mobile client application:** Banking software, Facebook, Messenger, etc.

b) **Database client application:** Toad, Squirrel, SQL workbench, SQL Developer, SQLyog, SQLultima, etc.

Host: It is a **Platform** on which all the **Applications can be executed**.

There are 2 different types of host present namely

- a) **Local Host** b) **Remote Host**

a) **Local Host:** In this case, the applications are restricted or limited only to that particular System.

Eg: **Standalone application**.

b) **Remote Host:** In case of remote host, the applications are not limited or restricted to any particular system.

Eg: **Any Real time application**.

URL (Uniform Resource Locator): It is the path using which we can access the resources uniquely over the network.

The contents of **URL** are **Protocol, Host +Port Number / Domain name, Resource Name, Data (optional)**.

- The protocol for web applications are ***http or https.***
- The protocol for JDBC is ***jdbc:sub-protocol .***
- In case of ***URL***, data refers to Key and Value pair which is provided by the user which is Optional.

Standard way of writing JDBC URL:

mainprotocol: subprotocol://Host+Port/dbname(optional)

For MySQL Database [user name must be ***root*** password ***Any***]

Local Host: `jdbc:mysql://localhost:3306/Studentdb?user=root&password=admin`

`jdbc:mysql://localhost:3306?user=root&password=admin`

Remote Host: `jdbc:mysql://192.168.10.16:3306/Studentdb?user=root&password=admin`

`jdbc:mysql://192.168.10.16:3306?user=root&password=admin`

For Oracle Database [user name must be ***Scott*** password must be ***Tiger***]

Local host: `jdbc:oracle://localhost:1521/Studentdb?user=scott&password=tiger`

`jdbc:oracle://localhost:1521?user=scott&password=tiger`

Remote Host: `jdbc:oracle://192.168.10.16:1521/Studentdb?user=scott&password=tiger`

`jdbc:oracle://192.168.10.16:1521?user=scott&password=tiger`

CLASS LOADING

Loading a ***dot class file*** into the ***JVM memory*** is known as ***Class Loading.***

- ❖ A class is generally loaded in 2 different ways namely:
- By calling any of the members of a class which can either be ***a constructor, methods, variables, blocks etc.***
- By using a static method called ***forName()*** which is present in ***java.lang*** package and whenever we use this method, it throws an exception called ***ClassNotFoundException.***

Syntax:

`Class.forName("Fully Qualified Class Name");`

1st Way:

```
package org.btm.loadApp;
public class Snake
{
    void eat()
    {
        System.out.println("Eating frog");
    }
}
public class Test
{
    public static void main(String[ ] args)
    {
        Snake s =new Snake();
        s.eat();
    }
}
```

2nd way:

```
package org.btm.loadApp;
public class Snake
{
    void eat()
    {
        System.out.println("Eating frog");
    }
}
package org.btm.loadApp;
public class Test
{
    public static void main(String[ ] args)
    {
        try
        {
            Class.forName("org.btm.loadApp.Snake");
        }
        catch(ClassNotFoundException e)
        {
            e.printStackTrace();
        }
    }
}
```

```

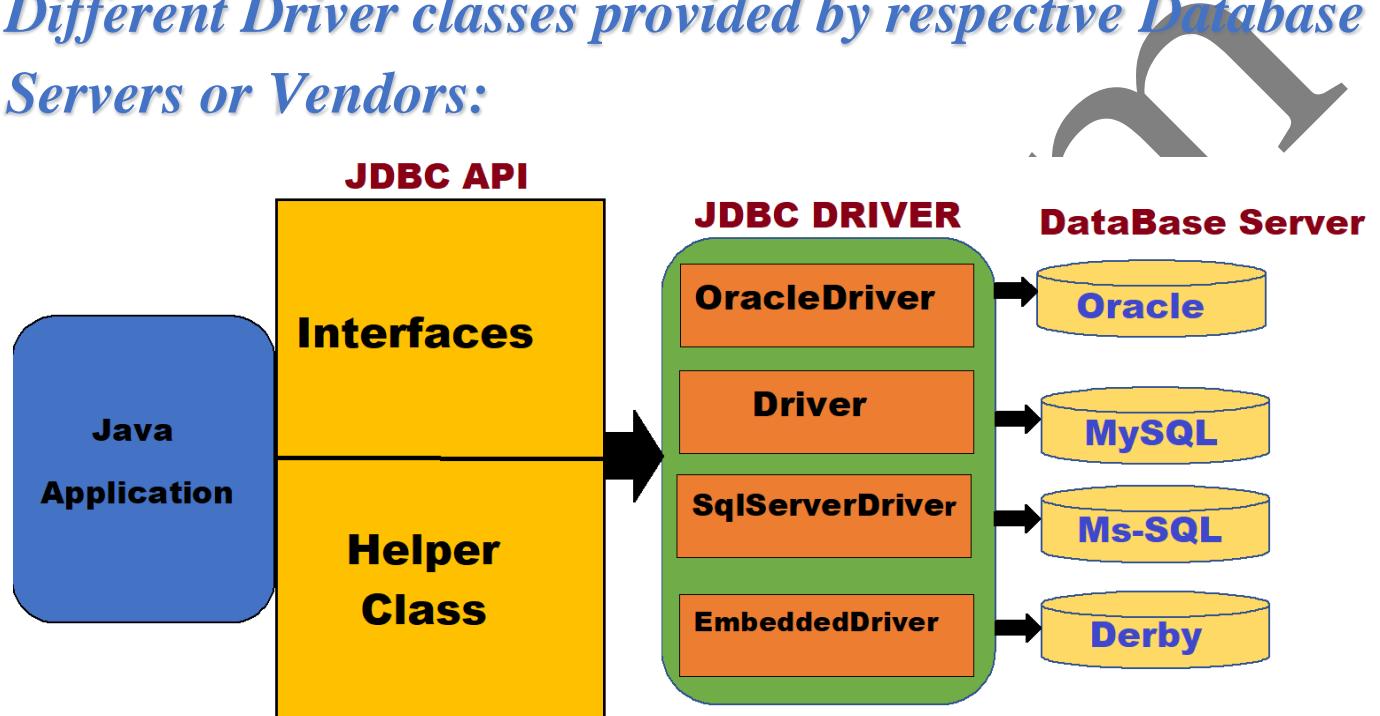
    }
}

}

```

Note: *Driver Classes* are provided by the respective Database Servers or vendors in the form of jar file.

Different Driver classes provided by respective Database Servers or Vendors:



- All the **Driver Classes** which is a part of JDBC Driver are provided by respective Database Servers or vendors in the form of jar file.
- All the **Driver classes** must mandatorily implements **java.sql.Driver** Interface which is a part of **JDBC API**.

Specifications of JDBC:

- ❖ All the **Driver classes** must contain one **Static block** in it.
- ❖ All the **Driver classes** must mandatorily implement **java.sql.Driver** Interface which is a part of **JDBC API**.
- ❖ All the **Driver classes** must mandatorily be registered with **DriverManager** using a static method called **registerDriver()**.

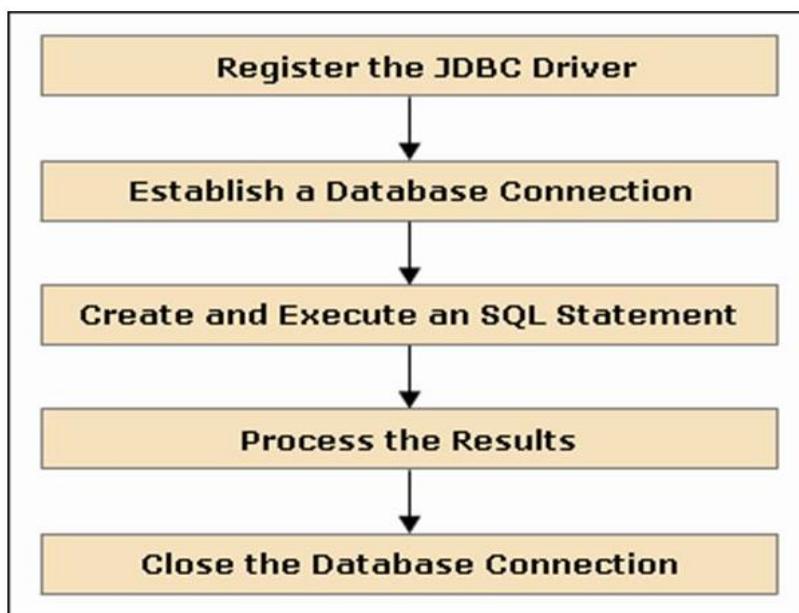
Definition of JDBC:

(Java Data Base Connectivity) is a specification given in the form of abstraction API to achieve *loose coupling between Java application and Database server*.

Steps of JDBC:

- a) Load and Register the Driver (Driver refers to Driver class provided by respective Database server or vendor).
- b) Establish a connection with the Database Server.
- c) Create a Statement or Platform.
- d) Execute the Sql Queries or Sql Statement.
- e) Process the Resultant data (optional).
- f) Close all the Costly resources.

Steps to Develop a JDBC Application



a) Load and Register the Driver:

- In this step, we have to load and register the **Driver classes** which is a part of **JDBC Driver** which are provided by respective **Database Server or Vendors.**
- **Driver classes** can be loaded and registered in 2 different ways namely:

Manually: In this case an object of the **Driver class** is created by user and then registered with **DriverManager** using static method called **registerDriver().**

Syntax:

```
Driver d =new Driver();
```

```
DriverManager.registerDriver(d);
```

Note:

- ❖ This is not a good practice since it causes tight coupling between java application and Database Server.

b) By using a static method called **forName()**, we can load and register the **Driver classes** provided by respective **Database Servers or Vendors.**

syntax:

```
Class.forName("com.mysql.jdbc.Driver");  
  
package org.btm.jdbcApp;  
public class JdbcDemo  
{  
    public static void main(String[ ] args)  
    {  
        try  
        {  
            Class.forName("com.mysql.jdbc.Driver");  
            System.out.println("Driver class loaded and registered");  
        }  
        catch(ClassNotFoundException e)  
        {  
            e.printStackTrace();  
        }  
    }  
}
```

Costly Resources:

- Resources which make use of System properties in the form of Stream are known as **Costly Resources**.
- It is always a good practice to close all the costly resources since it decreases the performance of an application.
- All the **Costly resources** must be closed within the finally block using an if condition to avoid **NullPointerException**.

Note:

- ❖ All the **Interfaces of JDBC API** are considered to be costly resources of **JDBC**.
- ❖ **Interfaces of JDBC API** are **Driver, Connection, Statement, PreparedStatement, CallableStatement, ResultSet, etc.**

b) Establish a Connection between Java Application and Database Server:

- In this step, we have to establish a connection between the Java application and the Data base Server by using **getConnection()**.
- **getConnection()** is static factory/helper method which is used to create and return an implementation object of Connection Interface **based on URL**.
- Hence, the return type for the **getConnection()** method is Connection interface.
- There are 3 diff overloaded variants of **getConnection()** method present namely
getConnection(String URL)
getConnection(String URL, Properties info)
getConnection(String URL, String User, String password)
- Whenever we use either of the overloaded variants of **getConnection()** it throws a checked exception called **SQLException**.

Syntax:

```
java.sql.Connection con=DriverManager.getConnection("URL");
```

java.sql.Connection:

- It is an interface which is a part of **JDBC API** and the implementations are provided by respective Database Servers or Vendors as a part of **JDBC Driver**.
- It is always a good practice to close **Connection** Interface since it is considered to be a **Costly Resources** which decreases the performance of the application.

java.sql.DriverManger:

- It is a Helper class which is a part of **JDBC API** which contains two important static methods in its namely **registerDriver() and getConnection().**

c) Create a Statement or Platform:

- We need to create a Statement or Platform to **execute the Sql queries or Sql Statements.**
- A Platform can either be created by using **Statement or PreparedStatement or CallableStatement** Interface which are the part of **JDBC API.**

java.sql.Statement:

- It is the **Interface** which is the part of **JDBC API** and the implementations are provided by respective Database Servers or Vendors as a part of **JDBC Driver.**
- **createStatement()** is a factory method which is used to create and return implementation object of **Statement Interface.**
- Hence, the return type for **createStatement()** is **Statement Interface.**

Syntax:

```
java.sql.Statement stmt=con.createStatement();
```

```
package org.btm.jdbcApp;
import java.sql.*;
public class JdbcDemo
{
    public static void main(String[ ] args)
    { Connection con = null;
        Statement stmt = null;
        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?user
                                         =root&password=tiger");
            System.out.println("Connection Established");
            stmt = con.createStatement( );
            System.out.println("Platform created");
        }
        catch (ClassNotFoundException | SQLException e)
```

```
{  
    e.printStackTrace();  
}  
finally  
{  
    if (stmt!= null)  
    {  
        try {  
            stmt.close();  
        }catch (SQLException e){e.printStackTrace();}}  
if(con!=null)  
{  
    try  
    {  
        con.close();  
    }  
    catch (SQLException e)  
    {  
        e.printStackTrace();  
    }  
}  
}  
}
```

d) Execute the Sql queries or Sql Statements:

- To execute the different types of Sql Statement or Queries, there are three different methods present namely ***execute(), executeUpdate(), executeQuery().***
 - All these methods are declared in ***Statement Interface*** but it can be used either with ***Statement or PreparedStatement or CallableStatement Interface*** which is a part of ***JDBC API.***

execute();

- It is a **Generic method** since it is used to *execute any type of Sql queries or statements.*
 - Hence, return type of **execute()** is **boolean**.
 - **execute()** returns a **boolean true** value in case of **DQL** and **boolean false** in case of **DML or DDL**.

Syntax:

stmt.execute("Generic SQL Queries");

Note:

The outcome of **DML** is **0 to n Integer value** which gives the total no of records affected in the data base server.

executeUpdate():

- This method is a Specialized method which is used to execute only DML Queries.
- Hence, the return type for **executeUpdate()** is **Integer**.
- Whenever we try to execute a **DDL or DQL** query using this method, it throws an exception called **SQLException**.

+ int executeUpdate("Only DML")

Syntax: stmt.execute("DML");

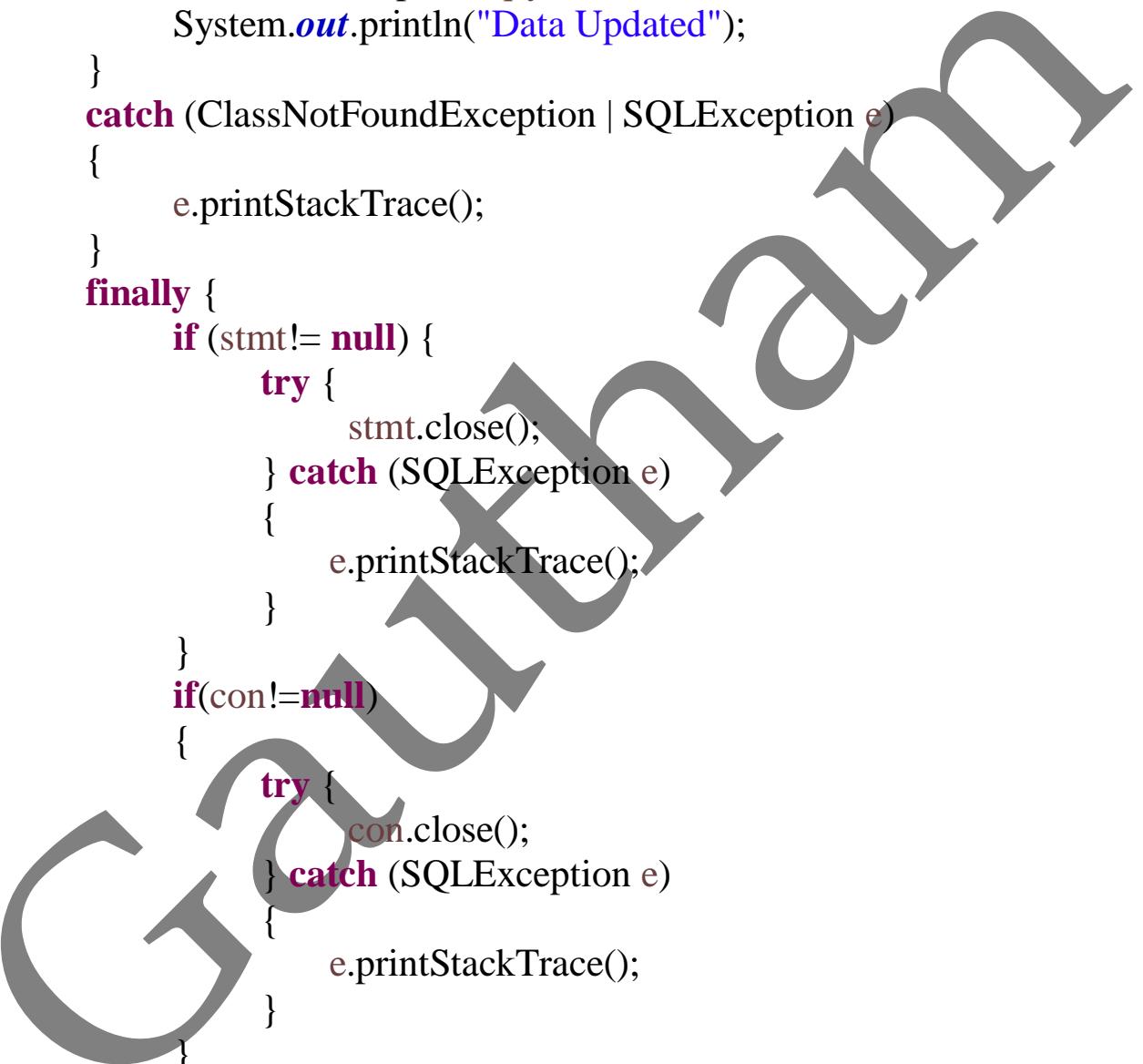
Code to Insert Single Record into the Database Server using Statement Interface:

```
package org.btm.jdbcApp;
import java.sql.*;
public class JdbcDemo
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        Statement stmt = null;
        String qry= "insert into btm.student values(1, 'Arvind', 56.77)";
        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
                                         user=root&password=tiger");
            System.out.println("Connection Established");
            stmt = con.createStatement();
            System.out.println("Platform created");
            stmt.executeUpdate(qry);
            System.out.println("data Inserted");
        }
    }
}
```

```
        catch (ClassNotFoundException | SQLException e)
    {
        e.printStackTrace();
    }
finally {
    if (stmt!=null) {
        try {
            stmt.close();
        } catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if(con!=null)
    {
        try {
            con.close();
        } catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
}
```

Code to Update a Record in the Database Server using Statement Interface:

```
package org.btm.jdbcApp;  
import java.sql.*;  
public class JdbcDemo  
{  
    public static void main(String[ ] args)  
    {  
        Connection con = null;  
        Statement stmt = null;  
        String qry= " update btm.student set name='Raj' where id=1";
```



```
try {
    Class.forName("com.mysql.jdbc.Driver");
    System.out.println("Driver class loaded and register ");
    con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
                                user=root&password=tiger");
    System.out.println("Connection Established");
    stmt = con.createStatement();
    System.out.println("Platform created");
    stmt.executeUpdate(qry);
    System.out.println("Data Updated");
}
catch (ClassNotFoundException | SQLException e)
{
    e.printStackTrace();
}
finally {
    if (stmt!= null) {
        try {
            stmt.close();
        } catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if(con!=null)
    {
        try {
            con.close();
        } catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
}
```

Code to Delete a Record from the Database Server using Statement Interface:

```
package org.btm.jdbcApp;
import java.sql.*;
public class JdbcDemo
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        Statement stmt = null;
        String qry= " delete from btm.student where id=3";
        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
                                         user=root&password=tiger");
            System.out.println("Connection Established");
            stmt = con.createStatement();
            System.out.println("Platform created");
            stmt.executeUpdate(qry);
            System.out.println("Data Deleted");
        }
        catch (ClassNotFoundException | SQLException e)
        {
            e.printStackTrace();
        }
        finally {
            if(stmt!=null) {
                try {
                    stmt.close();
                } catch (SQLException e)
                {
                    e.printStackTrace();
                }
            }
            if(con!=null)
            {
                try {
                    con.close();
                } catch (SQLException e)
                {

```

```

        {
            e.printStackTrace();
        }
    }

}

```

Code to Insert Multiple Record into the Database Server using Statement Interface:

```

package org.btm.jdbcApp;
import java.sql.*;
public class JdbcDemo
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        Statement stmt = null;

        String qry1= "insert into btm.student values(1, 'Arvind', 86.23)";
        String qry2= "insert into btm.student values(2, 'Raju', 76.67)";
        String qry3= "insert into btm.student values(3, 'Rahul', 84.17)";

        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
                                            user=root&password=tiger");

            System.out.println("Connection Established");
            stmt = con.createStatement();
            System.out.println("Platform created");
            stmt.executeUpdate(qry1);
            stmt.executeUpdate(qry2);
            stmt.executeUpdate(qry3);
            System.out.println("Data Inserted");
        }
    }
}

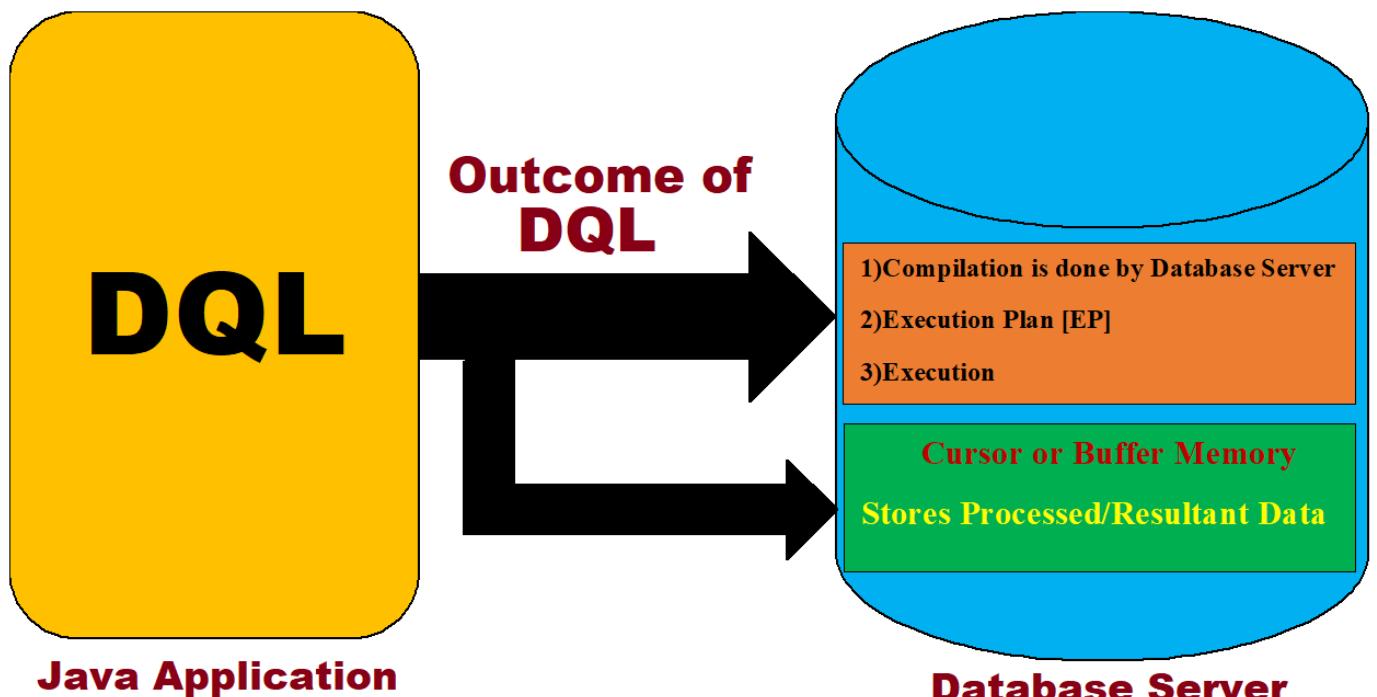
```

```
        catch (ClassNotFoundException | SQLException e)
        {
            e.printStackTrace();
        }
    finally
    {
        if (stmt!=null) {
            try {
                stmt.close();
            } catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
        if(con!=null)
        {
            try {
                con.close();
            } catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
    }
}
```

Note:

- ❖ Since ***Compilation takes place each time along with Execution*** whenever we execute query using Statement interface, ***Performance of an application decreases.***
 - ❖ Hence, it is a good practice to make use of ***PreparedStatement*** Interface to deal with multiple records.

Fetching the Data from Database Server:



- Whenever we execute a **DQL query or DQL Statement** we may get a result which is referred as **Processed or Resultant data**
- The **Processed or Resultant data** is stored in the **Cursor or Buffer memory**, which can be fetched by using **ResultSet** interface which is a part of **JDBC API**.
- The Structure of Cursor or Buffer memory may differ from the Structure of Database.

Note:

- ❖ **Column name** is also known as **column label**.
- ❖ **Column number** is also known as **column index**.

`java.sql.ResultSet:`

- It is an **Interface** which is a part of **JDBC API** and the implementations are provided by respective Database Servers or vendors as a part of **JDBC Driver**.
- A set of methods of **ResultSet** interface are used to fetch the processed or resultant data from the cursor or buffer memory which are known as **getXXX()**.
- There are two different overloaded variants of **getXXX()** present namely:
 - + **XXX getXXX(int columnnumber)**
 - + **XXX getXXX(String Columnname)**

If datatype is integer:

+int getInt(int columnNumber)

(or)

+int getInt(String columnname)

If datatype is String:

+String getString(int columnNumber)

(or)

+String getString(String columnname)

If datatype is double:

+double getDouble(int columnNumber)

(or)

+ double getDouble(String columnname)

Note:

- ❖ By default, the **ResultSet** interface does not point to any record in the Cursor or Buffer memory.

next():

- It is used to check whether the **next record** is present in the cursor or buffer memory and returns a **boolean** value called **true or false** but not the record.
- It can be used whenever there are **minimum no of records** present in the cursor or buffer memory.
+ **boolean next()**

absolute():

- It is used to check whether a **particular record** present is present in the cursor or buffer memory based on the parameter called **int rownumber** and returns a **boolean** value called **true or false** but not the record.
- It can be used whenever there are **n number of records** present in the cursor or buffer memory.

+ boolean *absolute*(int rownumber)

executeQuery():

- It is a **Specialized method** which is used to execute only **DQL Queries**.
 - The outcome of **DQL** is Processed or Resultant data which is stored in the cursor or buffer memory which can be fetched with the help of **ResultSet Interface** which is a part of **JDBC API**.
 - Hence, the return type for *executeQuery()* is **ResultSet Interface**.
 - whenever we try to execute a **DML or DDL** query using this method, it throws an exception called **SQLException**.
- + **ResultSet** *executeQuery*("Only DQL")

Creating an implementation object of ResultSet interface:

- There are 2 different ways to create an implementation object of **ResultSet Interface** which are as follows:

1st way:

```
boolean val= stmt.execute("DQL Query");
if(val)
{
    java.sql.ResultSet rs =stmt.getResultSet();
}
```

2nd way:

```
ResultSet rs =stmt.executeQuery("DQL") ;
```

PlaceHolder

- It is a parameter which holds **Dynamic values** at the run time by the **User**.
- In case of **JDBC**, place holder is represented as **?**

Declaration of Placeholder in the Query:

```
String inqry="insert into btm.student values(?, ?, ?);
```

```
String upqry ="update btm.student set name=? where id=?";
```

```
String delqry="delete from btm.student where id=?";
```

```
String selqry="select * from btm.student where id=?";
```

Rules to set the data for a PlaceHolder:

- There are 3 different rules to set the data for a **PlaceHolder** namely:
 - a) We have to set the data for a **PlaceHolder before the execution.**
 - b) The number of data must exactly match the number of **PlaceHolder**.
 - c) We have to set the data for a **PlaceHolder** by using **setXXX()**.

+void **setXXX(int placeholdernumber/placeholderindex ,XXX data)**

Eg: `setInt(1,34);`

```
setString(2,"Rakesh");  
setDouble(3,55.55);
```

Note:

- ❖ By default, the return type for **getXXX()** method is **respective data-types**, where as the return type for **setXXX()** method is **void**.

java.sql.PreparedStatement:

- It is an interface which is the part of **JDBC API**, and its implementation are provided by respective Database Servers or Vendors as a part of **JDBC Driver**.
- **PreparedStatement** interface is **sub-interface of Statement interface**.
- It supports the concept of **PlaceHolder** to take dynamic values at the run time by the user
- It supports the concept of **compile once and execute many times (Execution plan)**.
- In case of **PreparedStatement**, the **query** is passed at the time of implementation object creation of **PreparedStatement** interface but **not in the execute()**.

- ❖ Hence, **PreparedStatement** are also known as **Pre-compiled Statement**.

Syntax:

```
java.sql.PreparedStatement pstmt=con.prepareStatement(Query);
```

- ***prepareStatement()*** is factory or helper method which creates and returns implementation object of ***PreparedStatement interface***.
- Hence, the return type for ***prepareStatement()*** is ***PreparedStatement interface***.

Note:

- ❖ Hence, ***PreparedStatement*** is faster in performance compared to ***Statement Interface***.

Code to Insert multiple data into the Database Server using PreparedStatement interface with PlaceHolder:

```

package org.btm.jdbcApp;
import java.sql.*;
public class InsertMultiple
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt = null;
        String inqry="insert into btm.student values(?, ?, ?)";
        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(inqry);
            System.out.println("Platform created");
            // SET THE VALUE PLACE HOLDER BEFORE EXECUTION //
            pstmt.setInt(1, 1);
            pstmt.setString(2, "Dhanush");
            pstmt.setDouble(3, 75.00);
            pstmt.executeUpdate();

            pstmt.setInt(1, 2);
            pstmt.setString(2, "Kalyan");
            pstmt.setDouble(3, 70.00);
            pstmt.executeUpdate();
        }
    }
}

```

```
        pstmt.setInt(1, 3);
        pstmt.setString(2, "Adam");
        pstmt.setDouble(3, 80.00);
        pstmt.executeUpdate();
        System.out.println("Data Inserted Successfully");
    } catch (ClassNotFoundException | SQLException e)
    {
        e.printStackTrace();
    }
    finally
    {
        if (pstmt!= null)
        {
            try
            {
                pstmt.close();
            }
            catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
        if(con!=null)
        {
            try {
                con.close();
            }
            catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
        System.out.println("All Costly Resources Closed");
    }
}
```

Code to Fetch all Records from the cursor or buffer memory by using ResultSet Interface:

```
package org.btm.jdbcApp;
import java.sql.*;
public class FetchData
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;
        String qry = "select * from btm.student ";

        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(qry);
            System.out.println("Platform created");
            rs = pstmt.executeQuery();
            while (rs.next())
            {
                int id = rs.getInt("id");
                String name = rs.getString(2);
                double per = rs.getDouble(3);
                System.out.println(id + " " + name + " " + per);
            }
        } catch (ClassNotFoundException | SQLException e)
        {
            e.printStackTrace();
        }
        Finally
        {
            if (rs != null) {
                try {
                    rs.close();
                }
                catch (SQLException e)
                {
                    e.printStackTrace();
                }
            }
            if (pstmt != null)
```

```

    {
        try {
            pstmt.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (con != null) {
        try {
            con.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    System.out.println("All Costly Resources Closed");
}
}

```

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Code to Fetch a Record from the cursor or buffer memory by using ResultSet Interface:

```

package org.btm.jdbcApp;
import java.sql.*;
public class FetchData
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;
        String qry = "select * from btm.student ";

        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(qry);
            System.out.println("Platform created");
            rs = pstmt.executeQuery();
        }
    }
}

```

```
if (rs.next())
{
    int id = rs.getInt("id");
    String name = rs.getString(2);
    double per = rs.getDouble(3);
    System.out.println(id + " " + name + " " + per);
}
} catch (ClassNotFoundException | SQLException e)
{
    e.printStackTrace();
} finally {
    if (rs != null) {
        try {
            rs.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (stmt != null)
    {
        try {
            stmt.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (con != null){
        try {
            con.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    System.out.println("All Costly Resources Closed");
}
```

Code to Fetch a Particular Record from the cursor or buffer memory where id=?

```
package org.btm.jdbcApp;
import java.sql.*;
import java.util.Scanner;
public class FetchDataOnId
{
    public static void main(String[ ] args)
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter Id??");
        int id=sc.nextInt();
        sc.close();
        Connection con = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;
        String qry = "select * from btm.student where id=?";

        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            Con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(qry);
            System.out.println("Platform created");

// SET THE VALUE FOR PLACEHOLDER BEFORE EXECUTION //
            pstmt.setInt(1,id);
            rs = pstmt.executeQuery();
            if (rs.next())
            {
                String name = rs.getString(2);
                double per = rs.getDouble(3);
                System.out.println(name + " " + per);
            }
            else
            {
                System.err.println("No Data found for Id " +id);
            }
        catch (ClassNotFoundException | SQLException e)
```

```
{  
    e.printStackTrace();  
}  
}  
finally {  
    if (rs != null)  
    {  
        try {  
            rs.close();  
        }  
        catch (SQLException e)  
        {  
            e.printStackTrace();  
        }  
    }  
    if (stmt != null) {  
        try {  
            stmt.close();  
        }  
        catch (SQLException e)  
        {  
            e.printStackTrace();  
        }  
    }  
    if (con != null) {  
        try {  
            con.close();  
        }  
        catch (SQLException e)  
        {  
            e.printStackTrace();  
        }  
    }  
    System.out.println("Closed All Costly Resources");  
}  
}
```

Code to Fetch a Particular Record from the cursor or buffer memory where name=?

```
package org.btm.jdbcApp;
import java.sql.*;
import java.util.Scanner;
public class FetchDataOnName
{
    public static void main(String[ ] args)
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter Name??");
        String name=sc.next();
        sc.close();
        Connection con = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;
        String qry = "select * from btm.student where name=?";

        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            Con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(qry);
            System.out.println("Platform created");

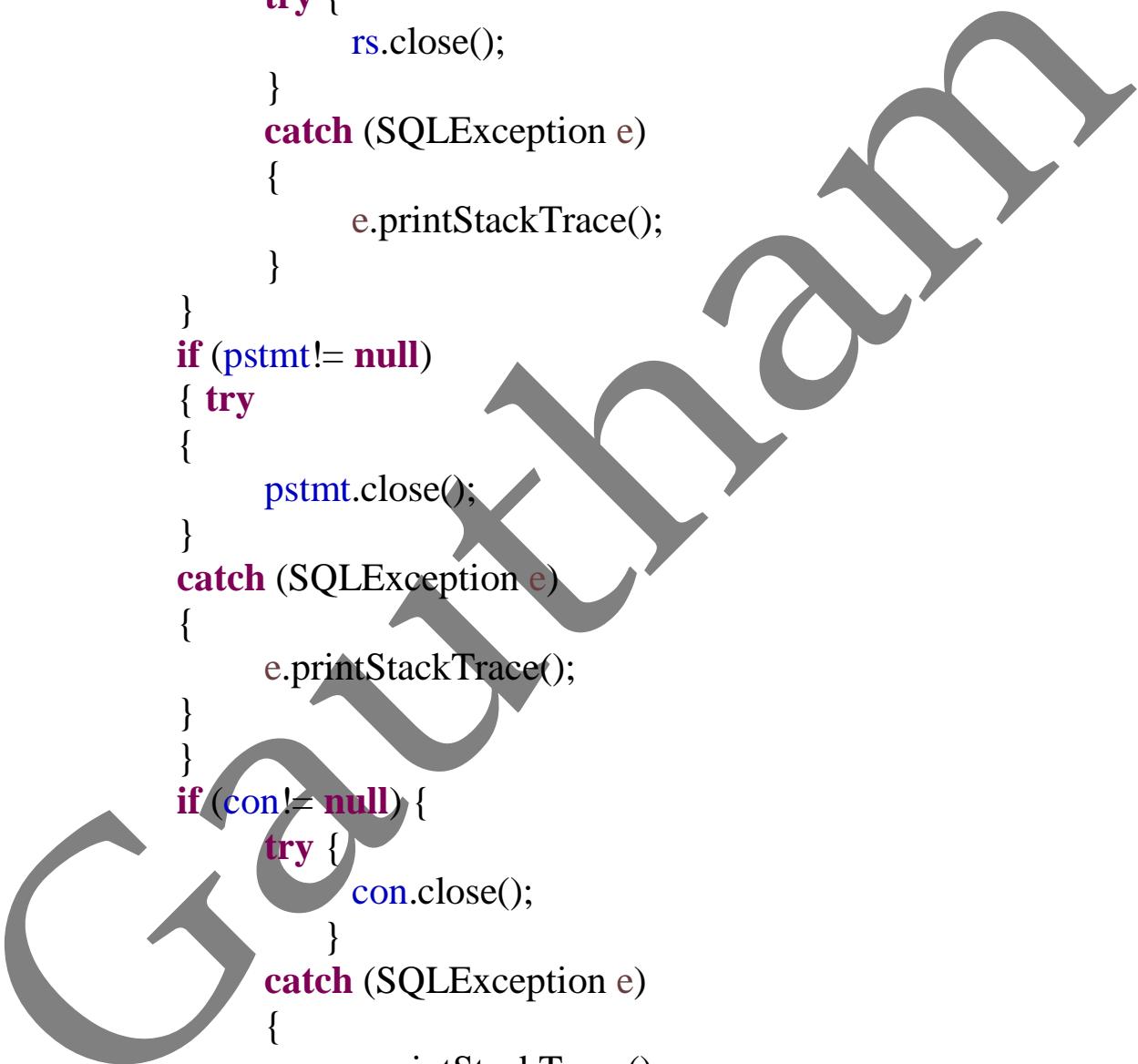
// SET THE VALUE FOR PLACEHOLDER BEFORE EXECUTION //
            pstmt.setInt(1,id);
            rs=pstmt.executeQuery();
            if (rs.next())
            {
                int id= rs.getInt(1);
                double per=rs.getDouble(3);
                System.out.println(id + " " + per);
            }
            else
            {
                System.err.println("No Data found for Name " +name);
            }
        }
    }
}
```

```
        catch (ClassNotFoundException | SQLException e)
        {
            e.printStackTrace();
        }
    }
finally
{
    if (rs != null)
    {
        try {
            rs.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (stmt != null) {

        try {
            stmt.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (con != null) {
        try {
            con.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    System.out.println("Closed All Costly Resources");
}
```

Code for Login Validation using standard steps of JDBC:

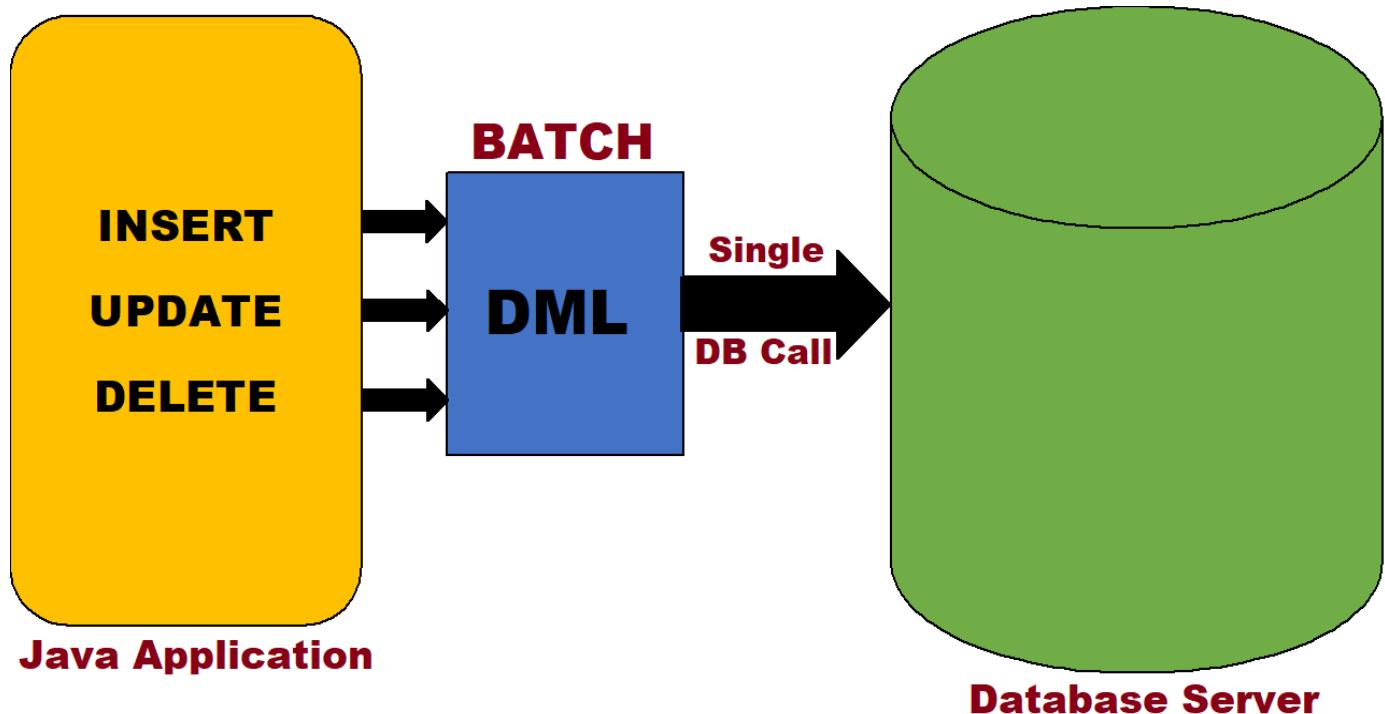
```
package org.btm.jdbcApp;
import java.sql.*;
import java.util.Scanner;
public class LoginValidation
{
    public static void main(String[ ] args)
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter Name??");
        String name=sc.next();
        System.out.println("Enter Password??");
        String password=sc.next();
        sc.close();
        Connection con = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;
        String qry = "select username from btm.user where name=? and
                     password=?";
        try
        {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=tiger");
            System.out.println("Connection Established");
            pstmt = con.prepareStatement(qry);
            System.out.println("Platform created");
            // SET THE VALUE PLACE HOLDER BEFORE EXECUTION //
            pstmt.setString(1,name);
            pstmt.setString(2,password);
            rs=pstmt.executeQuery();
            if (rs.next())
            {
                String username=rs.getString(1);
                System.out.println("Welcome "+username);
            }
            else
            {
                System.out.println("Invalid name or password");
            }
        }
```



```
        }
    catch (ClassNotFoundException | SQLException e)
    {
        e.printStackTrace();
    }
finally
{
    if (rs!= null) {
        try {
            rs.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    if (stmt!= null)
    { try
    {
        stmt.close();
    }
    catch (SQLException e)
    {
        e.printStackTrace();
    }
    }
    if (con!= null){
        try {
            con.close();
        }
        catch (SQLException e)
        {
            e.printStackTrace();
        }
    }
    System.out.println("All Costly Resources are Closed");
}
}
```

BATCH UPDATE

- Each and every individual DB call which is made from java application to the Database Server is considered to be a **Costly Operation**.
- The more no of DB call reduces the performance of an application. Hence, it is better to use **Batch update**.



Definition for Batch: Batch is collection of only **DML Queries**.

Need for Batch: Batch update is needed to make one single DB call and affect multiple records of multiple tables **at once**.

Advantage of Batch

- It *greatly* improves the performance of an application.

Process of Batch

- It is applicable only for **DML query**.
- In case of **Batch Update**, after adding all the **DML queries** into the batch, the entire batch will be executed only once by making **one single DB call**.
- It can be used both with **Statement** as well as **PreparedStatement** interface.
- There are two different methods associated with Batch namely:
 - a) **addBatch()**
 - b) **executeBatch()**

a) *addBatch()*: It is used to add all the **DML query into the Batch**.

b) *executeBatch()*: It is used to execute all **DML queries** present in the Batch only once by ***making one single DB call***.

❖ *executeBatch()* returns an **Integer array**.

- The **size** of this array represent the total number of **DML queries added into the Batch**.
- **Sequence** of the Integer array is same as the **sequence in which the DML queries are added into the batch**.

Code for Batch with Statement interface:

```
package org.btm.jdbcApp;
import java.sql.*;
public class BatchStmt
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        Statement stmt = null;
        String inqry =" insert into btm.user values( 1 , ' Adam ' , 65.99 ) ";
        String delqry =" delete from btm.student where perc=55.55 ";
        String upqry =" update btm.student set perc=89.99 where id=4 ";
        try {
            Class.forName("com.mysql.jdbc.Driver");
            System.out.println("Driver class loaded and register ");
            con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
user=root&password=root");
            System.out.println("Connection Established");
            stmt = con.createStatement();
            System.out.println("Platform created");

            // ADD DML QUERIES INTO BATCH //

            stmt.addBatch(inqry);
            stmt.addBatch(delqry);
            stmt.addBatch(upqry);

            // EXECUTE BATCH //
            int arr[ ] = stmt.executeBatch( );
            for (int i : arr)
```

```

        {
            System.out.print(i);
        }
    } catch (ClassNotFoundException | SQLException e)
    {
        e.printStackTrace();
    }
    finally
    {
        if (stmt != null)
        {
            try {
                stmt.close();
            } catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
        if (con != null)
        {
            try {
                con.close();
            } catch (SQLException e)
            {
                e.printStackTrace();
            }
        }
        System.out.println("Closed All Costly Resources");
    }
}
}

```

Code for Batch with PreparedStatement Interface:

```

package org.btm.jdbcApp;
import java.sql.*;
public class BatchPstmt
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt=null;
        PreparedStatement pstmt1=null;
        String inqry = "insert into btm.user values(42, 'Ayush', 65.44)";

```



```
String delqry = "delete from btm.student where perc=55.55";
try {
    Class.forName("com.mysql.jdbc.Driver");
    System.out.println("Driver class loaded and register ");
    con=DriverManager.getConnection("jdbc:mysql://localhost:3306?
        user=root&password=root");
    System.out.println("Connection Established");
    pstmt = con.prepareStatement(inqry);
    System.out.println("Platform created");
    // ADD DML QUERY INTO BATCH //
    pstmt.addBatch( );
    int arr[ ] = pstmt.executeBatch();
    for (int i : arr)
    {
        System.out.print(i);
    }
    pstmt1 = con.prepareStatement(delqry);
    System.out.println("Platform created");
    pstmt1.addBatch();
    int arr1[ ] = pstmt1.executeBatch();
    for (int j : arr1)
    {
        System.out.print(j);
    }
}

catch (ClassNotFoundException |SQLException e)
{
    e.printStackTrace( );
}
finally
{
    if (pstmt1 != null)
    {
        try
        {
            pstmt1.close( );
        }
        catch (SQLException e)
        {
            e.printStackTrace( );
        }
    }
    if (pstmt != null)
    {
        try
        {
```

```
        pstmt.close( );
    }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
if (con != null)
{
    try
    {
        con.close( );
    }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
System.out.println("All Costly Resources are Closed");
}
```

- Whenever we use **Batch with Statement Interface**, then **one single batch** can contain **all types of DML Queries in it.**
 - Whenever we use **Batch with PreparedStatement** Interface, then **one single batch** can contain **only one DML Query in it.**

- ❖ Hence, **Batch with Statement** Interface is **Faster in Performance.**

JDBC Transaction

Exchange of data or information between two media is known as Transaction.

- By default, the ***AutoCommit*** mode is set to ***boolean true*** value because of which all the data are automatically saved into the Database Server whenever we perform any Database operation.
 - We can explicitly ***disable AutoCommit*** mode by using ***setAutoCommit()*** and passing a boolean false argument.

Syntax: +void **setAutoCommit()**

Eg: con.setAutoCommit(false);

Note:

- ❖ We have to disable the **AutoCommit** mode before we **begin the transaction but after establishing a connection with Database Server.**

- Once the **AutoCommit** mode is disabled we have to explicitly save the data into the Database Server by using **commit()** at the **end of the transaction.**

Syntax: +void **commit()**

Eg: con.commit();

- If any one of the Database operation fails, then the **rollback** operation is called which is used to rollback **Entire executed Database Operation and transaction starts from beginning.**

Syntax: +void **rollBack()**

Eg: con.rollBack();

con.setAutoCommit(false);

Begin Transaction

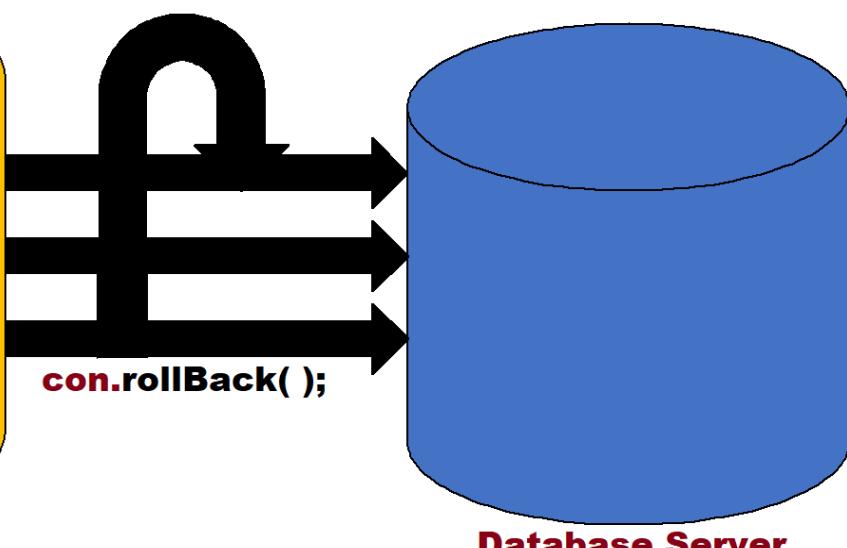
Operation 1
Operation 2
Operation 3

con.rollBack();

End Transaction

Java Application

con.commit();



Definition for JDBC Transaction:

- **JDBC Transaction** is considered to be a **Single Business Unit** Which may have **multiple SQL Statements which must be executed.**

Need for JDBC Transaction:

- **JDBC Transaction** is needed to maintain **Data consistency in the Database Server.**

Advantage of JDBC Transaction:

- It is used to achieve **ACID properties or rules** where **A refers to Atomicity, C for Consistency, I for Isolation and D for Durability.**

Atomicity: Atomicity means **Do Everything or Do Nothing.**

- **Do Everything** refers to **Complete or Successful transaction** where if all the Database operation are successfully executed, **then the data's are saved into the Database Server leading to Data Consistency.**
- **Do Nothing** refers to **Incomplete or Unsuccessful transaction** where if any one of Database operation fails, then the **rollBack operation** is called which is used to roll back the **Entire executed Database operation and transaction starts from beginning without saving any data into the Database Server due to Data Inconsistency.**

Code for JDBC Transaction:

```
package org.btm.jdbcApp;
import java.sql.*;
import java.util.Scanner;
public class Transaction
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt = null;
        PreparedStatement pstmt1 = null;
        String inqry1= "insert into btm.student1 values(?,?,?,?,?)";
        String inqry2 = "insert into btm.student2 values(?,?,?,?)";
        Scanner sc =new Scanner(System.in);
        System.out.println("Enter Id?");
        int id =sc.nextInt();
        System.out.println("Enter Name?");
        String name=sc.next();
        System.out.println("Enter Dept?");
        String dept=sc.next();
```

```
System.out.println("Enter Perc?");  
double perc=sc.nextDouble();  
System.out.println("Enter Place?");  
String place=sc.next();  
sc.close();  
try  
{  
    Class.forName("com.mysql.jdbc.Driver");  
    con=DriverManager.getConnection("jdbc:mysql://localhost:3306?  
user=root&password=tiger");  
    // Disable AutoCommit() //  
    con.setAutoCommit(false);  
    pstmt=con.prepareStatement(inqry1);  
    pstmt.setInt(1, id);  
    pstmt.setString(2, name);  
    pstmt.setString(3, dept);  
    pstmt.setDouble(4,perc);  
    pstmt.executeUpdate();  
    System.out.println("Student Educational Details Executed");  
  
    pstmt1=con.prepareStatement(inqry2);  
    pstmt1.setInt(1, id);  
    pstmt1.setString(2, name);  
    pstmt1.setString(3, place);  
    pstmt1.executeUpdate();  
    System.out.println("Student Personal Details Executed");  
    con.commit();  
}  
catch (ClassNotFoundException | SQLException e)  
{  
    try  
    {  
        con.rollback();  
        System.out.println("Operations Rolled Back");  
    }  
catch (SQLException e1)  
{  
    e1.printStackTrace();  
}  
e.printStackTrace();  
}  
finally  
{  
    if (pstmt1 != null)  
    {  
        try
```

```

        {
            pstmt.close( );
        }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
if (stmt!= null)
{
    try
    {
        pstmt.close( );
    }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
if (con!= null)
{
    try
    {
        con.close( );
    }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
System.out.println("All Costly Resources are Closed");
}
}

```

Savepoint:

Syntax:

java.sql.Savepoint sp=con.setSavepoint();

- **setSavepoint()** is a *factory or helper method* which is used to *create and return implementation object of Savepoint interface*.
- Hence, the return type of **setSavepoint()** is **Savepoint interface**.

Code for JDBC Transaction using Savepoint Interface:

```
package org.btm.jdbcApp;
import java.sql.*;
import java.util.Scanner;
public class Transaction
{
    public static void main(String[ ] args)
    {
        Connection con = null;
        PreparedStatement pstmt = null;
        PreparedStatement pstmt1 = null;
        Savepoint sp= null;
        String inqry1= "insert into btm.student1 values(?, ?, ?, ?)";
        String inqry2 = "insert into btm.student2 values(?, ?, ?)";
        Scanner sc =new Scanner(System.in);
        System.out.println("Enter Id?");
        int id =sc.nextInt();
        System.out.println("Enter Name?");
        String name=sc.next();
        System.out.println("Enter Dept?");
        String dept=sc.next();
        System.out.println("Enter Perc?");
        double perc=sc.nextDouble();
        System.out.println("Enter Place?");
        String place=sc.next();
        sc.close();
        try
        {
            Class.forName("com.mysql.jdbc.Driver");
            con =DriverManager.getConnection("jdbc:mysql://localhost:3306?
            user=root&password=tiger");
            //Disable AutoCommit( ) //
            con.setAutoCommit(false);
            pstmt=con.prepareStatement(inqry1);
            pstmt.setInt(1, id);
            pstmt.setString(2, name);
            pstmt.setString(3, dept);
            pstmt.setDouble(4,perc);
            pstmt.executeUpdate();
            System.out.println("Student Educational Details Executed")
            sp=con.setSavepoint( );
            pstmt1=con.prepareStatement(inqry2);
            pstmt1.setInt(1, id);
            pstmt1.setString(2, name);
```

```
pstmt1.setString(3, place);
pstmt1.executeUpdate( );
System.out.println("Student Personal Details Executed");
con.commit();

}

catch (ClassNotFoundException | SQLException e)
{
    try
    {
        con.rollback(sp);
        con.commit( );
        System.out.println("Operations Rolled Back");
    }
    catch (SQLException e1)
    {
        e1.printStackTrace( );
    }
    e.printStackTrace( );
}
finally
{
    if (pstmt != null)
    {
        try
        {
            pstmt.close( );
        }
        catch (SQLException e)
        {
            e.printStackTrace( );
        }
    }
    if (pstmt!= null)
    {
        try
        {
            pstmt.close( );
        }
        catch (SQLException e)
        {
            e.printStackTrace( );
        }
    }
    if (con!= null)
    {
        try
```

```
        {
            con.close( );
        }
    catch (SQLException e)
    {
        e.printStackTrace( );
    }
}
System.out.println("All Costly Resources are Closed");
}
```

Gautham

Gautham