# Module: JDBC

**Module Overview**

- In this module, students will be able to familiarize themselves with the essential topics such as JDBC, JDBC driver types, JDBC Connection, execute queries, close connection object, etc.

## Module Objective

**At the end of this module, students should be able to demonstrate appropriate knowledge, and show an understanding of the following:**

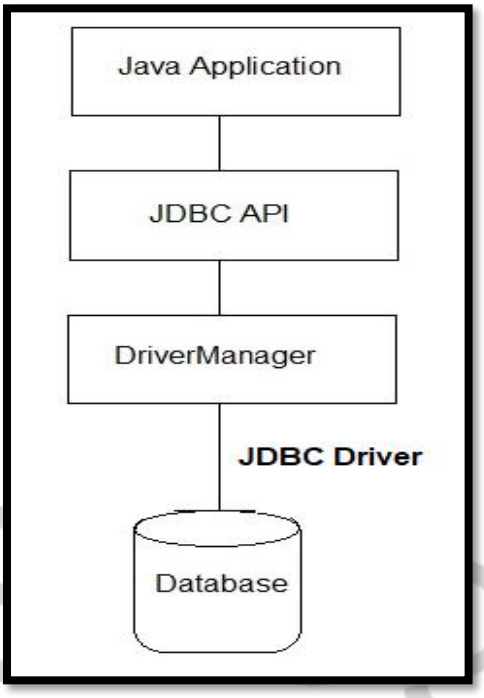
- To understand JDBC
- To know Type1: Jdbc-Odbc Bridge Driver
- To know Type2: Native-API driverAC
- To know Type3: Network Protocol driver
- To know Type4: Thin driver
- To understand JDBC Connection
- To understand Register JDBC Driver
- To understand how to create connection object
- To understand how to create statement object
- To know how to execute queries
- To understand close connection object

# Introduction to JDBC

- JDBC can also be defined as the platform independent interface between a relational database and Java programming.
- JDBC stands for Java Database Connectivity.
- JDBC is an Application Programming Interface(API).
- Java API is used to connect and execute the query with the database.
- JDBC is used to interact with various type of Database such as Oracle, MS Access, My SQL, SQL Server, etc.
- JDBC API uses JDBC drivers to connect with the database.

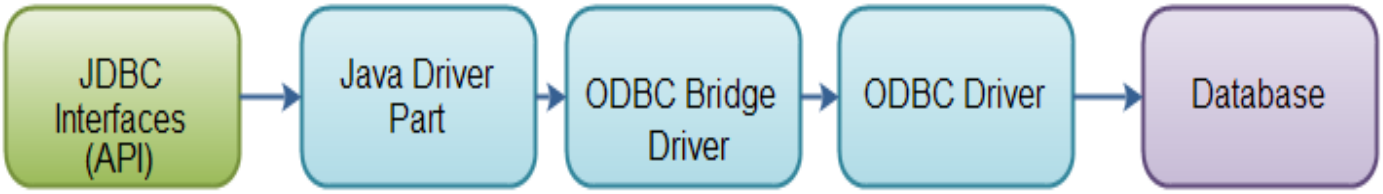
## Java JDBC

- Java Database Connectivity is the Java API that manages connecting to a database, issuing queries and commands, and handling result sets obtained from the database.
- The JDBC API makes is possible to query and update relational databases, as well as call stored procedures, and obtain meta data about the database.
- The Java JDBC API is a set of interfaces.
- JDBC drivers are actually a set of classes that implement these interfaces.
- JDBC API, helps us to save, update, delete and fetch data from the database.
- It is like Open Database Connectivity (ODBC) provided by Microsoft.
- JDBC works with Java on a variety of platforms, such as Windows, Mac OS, and the various versions of UNIX.
- There are 4 types of JDBC drivers, they are:
    1. Jdbc-Odbc Bridge Driver
    2. Native-API driver
    3. Network Protocol driver
    4. Thin driver




## Type1: Jdbc-Odbc Bridge Driver

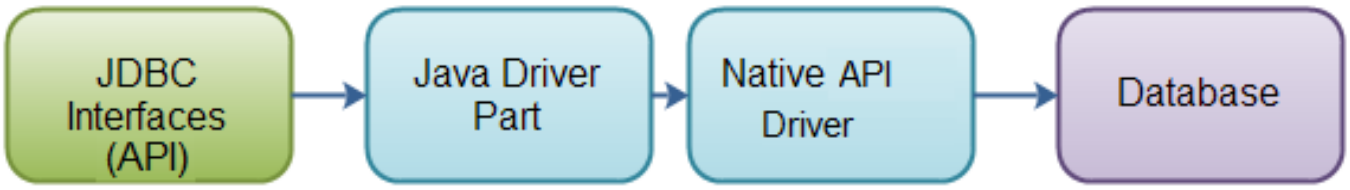
- This Driver will take the support of ODBC Driver to communicate with the database.
- Driver convert JDBC calls into ODBC calls and ODBC Driver convert ODBC calls into database-specific calls.



- **Advantages :**
  - It is database independent driver.
  - It is very easy to use.
  - Not require to install this driver separately
- **Disadvantages:**
  - It is the slowest driver.
  - Platform dependent driver.

## Type2: Native-API driverAC

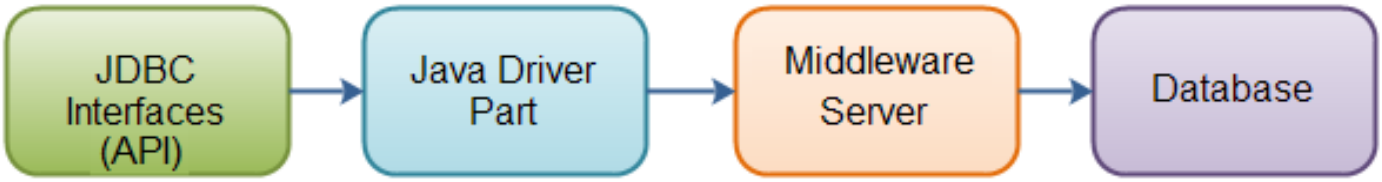
- The Native API driver uses the client side libraries of the database.
- Native API driver converts JDBC calls into database specific native libraries calls and these calls are directly understood by the database engine.
- Vendors like Oracle, IBM, etc. use this driver for their enterprise databases.




- **Advantages:**
  - Good performance as compared to the type1 driver.
  - Type2 Drivers are operating system specific.
- **Disadvantages:**
  - It is a database dependent driver.
  - It is a platform dependent driver.

## Type3: Network Protocol driver

- Network protocol driver converts JDBC calls into middleware specific calls, the middleware server convert middleware specific calls into database specific calls.
- A single driver can actually provide access to multiple databases.




- **Advantage**
  - It don't require any native library to be installed.
  - It is database independent driver.
  - No client side libraries are required.
- **Disadvantage**
  - Slow due to increase number of network call.
  - Maintenance of Network Protocol driver becomes costly.

## Type 4: Thin driver

- The thin driver converts JDBC calls directly into the client specific database protocol.
- Thin driver directly communicates with the database by using database specific native protocol provided by the database client.


- **Advantage:**
  - Better performance than all other drivers.
  - Platform independent Driver.
  - No software is required at the client.
- **Disadvantages:**
  - Drivers depend on the Database.

## Introduction to Database services

- A database is an organized collection of data, so that it can be easily accessed and managed.
- It can organize data into tables, rows, columns, and index that will make it easier to find relevant information.
- There are many databases available like MySQL, Sybase, Oracle, MongoDB, Informix, PostgreSQL, SQL Server, etc.
- Database is a systematic collection of data.
- It supports storage and manipulation of data.
- Databases make data management easy.

- It can organize data into tables, rows, columns, and index that will make it easier to find relevant information.
- Example: Let's us consider the face book. It needs to store, manipulate and present data related to members, their friends, member activities, messages, advertisements and lot more.

**JDBC**

- JDBC stands for Java Database Connectivity.
- JDBC is a Java API to connect and execute the query with the database.
- Basic database operations such as Create, Retrieve, Update and Delete (CRUD) can be performed using JDBC, which stands for Java Database Connectivity API.
- It is like Open Database Connectivity (ODBC) provided by Microsoft.

## JDBC Connection

- There are some simple steps to connect any java application with the database using JDBC.
- The following 5 steps are the basic steps involve in connecting a Java application with Database using JDBC.
- Those simple steps are as follows:
    1. Register JDBC Driver
    2. Create connection object
    3. Create statement object
    4. Execute queries
    5. Close connection object

# Register JDBC Driver

- The registration is done only once in program, a JDBC driver can be register in one of two following ways.
- Method 1: The most common approach to register a driver is to use **Class.forName()** method.
- This method is preferable because it allows the driver registration configurable and portable.

- The **forName()** method of class is used to register the driver class.
  - Method 1 : **Class.forName()**

    We just need to put vender's jar in the classpath, and then JDBC driver manager can detect and load the driver automatically.
  - Syntax :

    ```
    Class.forName("com.mysql.jdbc.Driver");
    ```

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- Method 1: The most common approach to register a driver is to use **Class.forName()** method.
- This method is preferable because it allows the driver registration configurable and portable.

  - Method 2 : DriverManager.registerDriver()

    The second approach you can use to register a driver, it accepts an object of the driver class as a parameter and, registers it with the JDBC driver manager.
  - Syntax :

    ```
    Driver myDriver = new com.mysql.jdbc.Driver();
    DriverManager.registerDriver(myDriver);
    ```

- Method 2: The second approach to register a driver, is to use the Static **DriverManager.registerDriver()** method.
- This method is used when we use a non JDK compliant JVM.

# Create connection object

- Connecting to a database, connection object is required.
- The Connection object uses a DriverManager.
- DriverManager has a method called getConnection.
- Following are the three forms of method to create a connection object.

1. Using Database URL : It includes the username and password and has the following general syntax form.

- Syntax :

```
String URL = "jdbc:oracle:thin:username/password@amrood:1521:EMP";
Connection conn = DriverManager.getConnection(URL);
```

- DriverManager has a method called getConnection. This needs a host name (which is the location of your database), a username, and a password. If a connection is successful, a Connection object is created.

2. Using Database URL with username and password:

   It takes database URL, a user name and password as arguments and has the following general syntax form.

- Syntax:

```
String URL = "jdbc:oracle:thin:@localhost:1521:IoTDB";
String USER = “Jetking";
String PASS = “Skillking“;
Connection conn = DriverManager.getConnection(URL, USER, PASS);
```

3. Using a Database URL and Properties Object : It takes a database URL and a Properties object as argument.

- Syntax :

```
String URL = "jdbc:oracle:thin:@IoTDB";
```

```
Properties properties = new Properties();
properties.put("user", “Skillking");
properties.put("password", “jetking");
Connection conn = DriverManager.getConnection(URL, properties);
```

## Create statement object

- Once a connection is established we can interact with the database.
- There are 3 types of Statements, as given below:
  - JDBC Statement,
  - Callable Statement
  - Prepared Statement
- The object of statement is responsible to execute queries with the database.
- Syntax :
  - public Statement createStatement() throws SQLException
- Example to create a SQL statement
  - Statement s = con.createStatement();

- **JDBC Statement :**

It can be used for general purpose access to the database. It is useful when you are using static SQL statements at runtime.

- **Callable Statement:**
  It can be used when we want to access database stored procedures.

- **Prepared Statement:**

  It can be used when same SQL statement is use many times. The Prepared Statement interface accepts input

  parameters at runtime.

## Execute queries

- The executeQuery() method of Statement interface is used to execute queries to the database.
- This method returns the object of ResultSet that can be used to get all the records of a table.
- This method can be used to get all the records.
- There are multiple types of queries. Some of them are as follows:
  - Query for updating table in a database.
  - Query for inserting table in a database.
  - Query for retrieving data, etc.
- Syntax :
  - public ResultSet executeQuery(String sql)throws SQLException

## Close connection object

- Once we are done with using Connection, we need to explicitly close it by calling close() method.
- The close() method of Connection interface is used to close the connection.
- Any connection left open is waste of resource and lead to various exceptions.
- **Syntax :**
  - public void close() throws SQLException

- **Example:**
  - con.close();

**Lab Activity:**

Trainer will ask the participants to refer to the LMS and observe the lab on JDBC connection & perform the same.

## Lab activity

- Connect java application with the database using JDBC.

Post completion of the activity lab, discuss with trainer for any query.