



# Apache Derby

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## About the Tutorial

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Apache Derby is a **R**elational **D**atabase **M**anagement **S**ystem which is fully based on (written/implemented in) Java programming language. It is an open source database developed by Apache Software Foundation.

## Audience

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This tutorial is prepared for beginners to help them understand the basic concepts related to Apache Derby. This tutorial will give you enough understanding on the various SQL queries of Apache along with JDBC examples.

## Prerequisites

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Before you start practicing with various types of examples given in this tutorial, I am assuming that you are already aware about what a database is, especially the RDBMS and what is a computer programming language.

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# 1. Apache Derby – Introduction

Apache Derby is a **Relational Database Management System** which is fully based on (written/implemented in) Java programming language. It is an open source database developed by Apache Software Foundation.

Oracle released the equivalent of Apache Derby with the name JavaDB.

## Features of Apache Derby

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Following are the notable features of Derby database:

- **Platform independent:** Derby uses on-disc database format where the databases in it are stored in a file in the disc within the directory with the same name as the database.
- **No modifying data:** Because of this, you can move derby databases to other machines without modifying the data.
- **Transactional support:** Derby provides complete support for transactions ensuring data integrity.
- **Including databases:** You can include pre-build/existing databases into your current derby applications.
- **Less space:** Derby database has a small footprint, i.e., it occupies less space and it is easy to use and deploy it.
- **Embed with Java Application:** Derby provides an embedded database engine which can be embedded in to Java applications and it will be run in the same JVM as the application. Simply loading the driver starts the database and it stops with the applications.

## Limitations of Apache Derby

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Following are the limitations of Apache Derby:

- Derby does not support indexes for datatypes such as BLOB and LONGVARCHAR.
- If Derby does not have enough disc space, it will shut down immediately.

## Data storage

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While storing data, Apache Derby follows a concept known as **conglomerate**. In this, data of a table will be stored in a separate file. In the same way, each index of a table is also stored in a separate file. Thus, there will be a separate file for every table or index in the database.

## Apache Derby Library/Components

Apache Derby distribution provides various components. In the **lib** folder of the apache distribution you have downloaded, you can observe jar files representing various components.

Jar file	Component	Description
derby.jar	Database Engine and JDBC driver	The Database engine of Apache Derby is an embedded relational database engine which supports JDBC and SQL API's.  This also acts as embedded Driver, using which you can communicate to Derby using Java applications.
derbynet.jar derbyrun.jar	Network server	The Network Sever of Apache Derby provides the client server functionality, where the clients can connect to the Derby server through a network.
derbyclient.jar	Network client JDBC driver	
derbytools.jar	Command line tools	This jar file holds tools such as <b>sysinfo</b> , <b>ij</b> , and <b>dblook</b> .
derbyoptionaltools.jar	Optional command line utilities (tools)	This jar file provides optional tools: databaseMetaData optional tool, foreignViews optional tool, luceneSupport optional tool, rawDBReader optional tool, simpleJson optional tool, etc.
derbyLocale_XX.jar	Jar files to localize messages	In addition to the above mentioned jar files, you can see several derbyLocale_XX.jar (es, fr, hu, it, ja, etc.). Using these, you can localize the messages of Apache Derby.

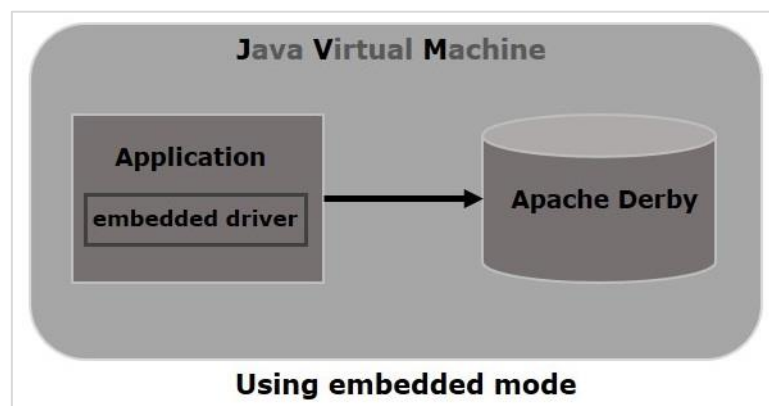
## 2. Apache Derby – Deployment Modes

You can deploy apache derby in two modes, namely embedded mode and server mode.

### Embedded mode

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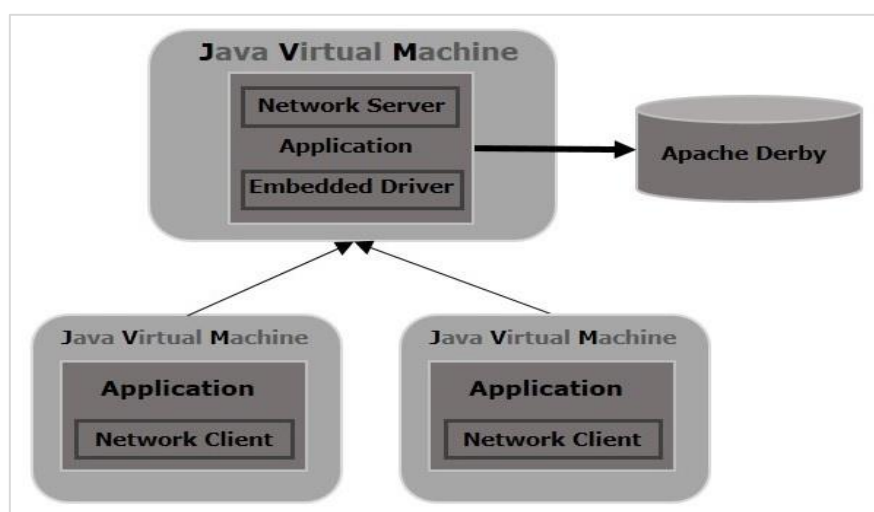
You can run derby in embedded mode using Java application (using embedded driver). If you deploy Derby in embedded mode, the database engine will run in the same JVM as the Java application. It starts and stops with the application. You can access the database only with this application.



### Server mode

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In the server mode, derby will be run in the JVM of an application server where you can send a request to the server to access it. Unlike in embedded mode, multiple applications (java) can send a request to the server and access the database.



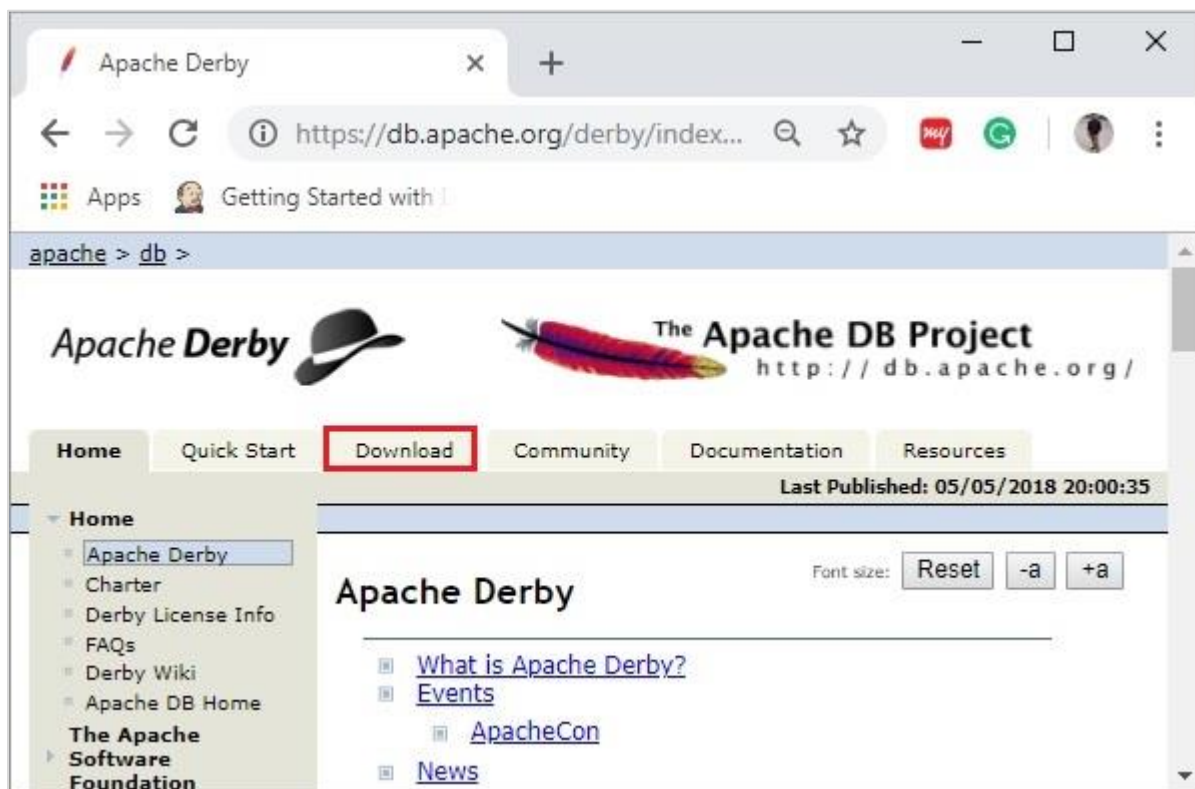


# 3. Apache Derby – Environment Setup

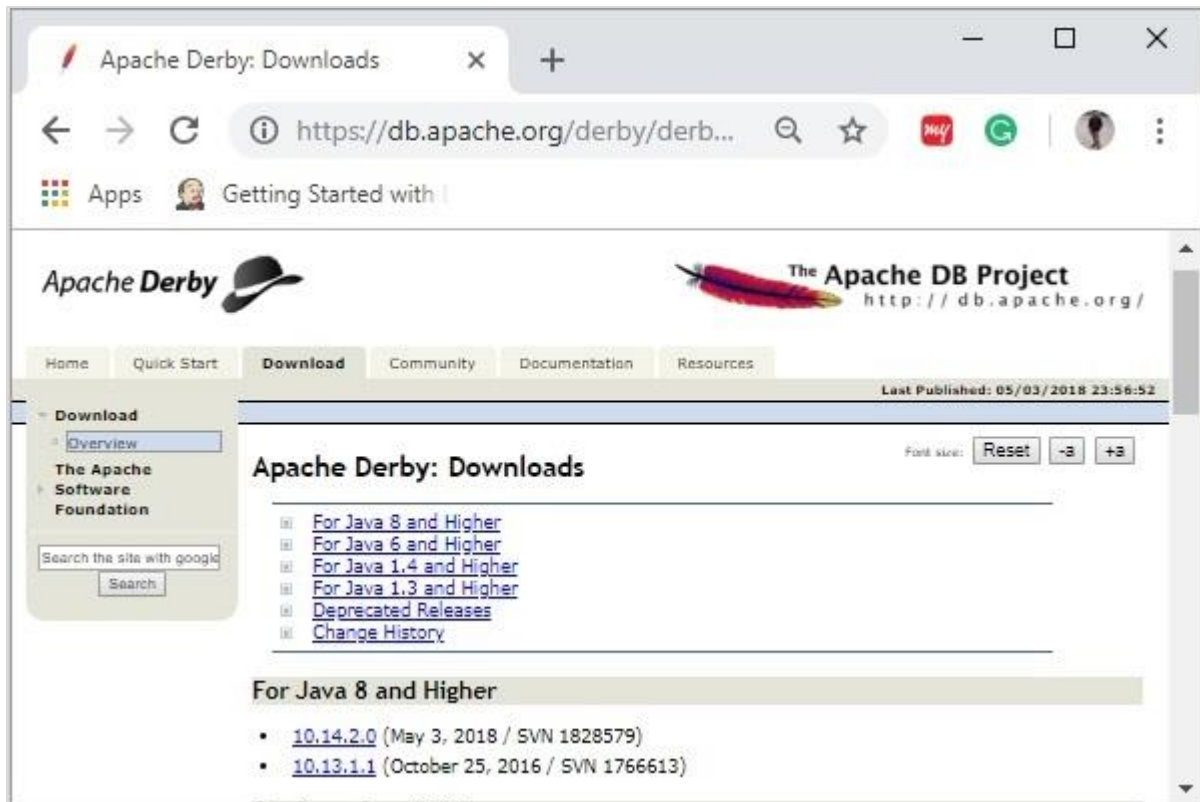
Following chapter explains how to download and install Apache Derby.

## Downloading Apache Derby

Visit the home page of Apache Derby home page <https://db.apache.org/derby/>. Click the Download tab.



Select and click on the link of the latest version of Apache Derby.



On clicking the selected link, you will be redirected to the **Distributions** page of apache derby. If you observe here, derby provides distributions namely, *db-derby-bin*, *db-derby-lib.zip*, *db-derby-lib-debug.zip*, and *db-derby-src.zip*.

Download the **db-derby-bin** folder. Copy its contents to a separate folder where you wanted to install Apache Derby. (for example, say **C:\Derby**)

Now, to work with Derby,

- Make sure that you already have set the **JAVA\_HOME** variable by passing the location of bin folder of Java Installation folder, and include the **JAVA\_HOME/bin** in the PATH variable.
- Create a new environment variable, **DERBY\_HOME** with value **C:\Derby**.
- The bin folder of db-derby-bin distributions (we changed it as C:\Derby\bin) contains all the required jar files.

As discussed, Apache Derby can be installed/deployed in two ways as follows:

- **Embedded mode:** In this, you need to access the database using Embedded Derby JDBC driver. You can start and stop derby through Java application. Both Database engine and your application will run on the same JVM.
- **Network Server mode:** In this mode, you can access Derby in a typical client-server fashion, where Derby is embedded in the server system. Then, the client machines running in different JVM's (that of the Server) will send requests to the server, and the server responds to those requests.

The client can be another JVM in the same system machine of the server or a Java application from a remote system.

## Installing Derby in Embedded Mode

To install Apache Derby in embedded mode, include the jar file **derby.jar** in your CLASSPATH.

Or, you can set the classpath for required jar files by running the **setEmbeddedCP** command. Browse through the **bin** directory of Apache Derby and run this file as shown below:

```
C:\Users\MYUSER>cd %DERBY_HOME%/bin
C:\Derby\bin>setEmbeddedCP.bat
C:\Derby\bin>SET DERBY_HOME=C:\Derby
C:\Derby\bin>set
CLASSPATH=C:\Derby\lib\derby.jar;C:\Derby\lib\derbytools.jar;C:\Derby\lib\derby
optionaltools.jar;C:\Users\Tutorialspoint\Google
Drive\Office\Derby\derby_zip\New folder\db-derby-10.12.1.1-
bin\lib;C:\EXAMPLES_\Task\jars\*;C:\EXAMPLES\jars\mysql-connector-java-5.1.40-
bin.jar;C:\Users\Tutorialspoint\Google Drive\Office\37.Junit
Update\jars;C:\Program Files\Apache Software Foundation\Tomcat
8.5\lib\*;C:\Derby\lib\*;
```

After setting up Apache Derby, to access it, run Java programs using the embedded driver.

## Verification

You can verify the setup using the **ij** tool as shown below:

```
C:\Derby\bin>ij
ij version 10.14
ij> connect 'jdbc:derby:SampleDB;create=true';
ij>
```

## Installing Derby in Network Server Mode

To install Apache Derby in network server mode, you need to include **derbynet.jar** and **derbytools.jar** files to the CLASSPATH.

Or, you can set the class path for required jar files by running the **setNetworkServerCP** command. Browse through the **bin** directory of Apache Derby and run this file as shown below:

```
C:\Users\MYUSER>cd %DERBY_HOME%/bin
C:\Derby\bin>setNetworkServerCP.bat
C:\Derby\bin>SET DERBY_INSTALL=C:\Derby
```

```
C:\Derby\bin>set
CLASSPATH=C:\Derby\lib\derbynet.jar;C:\Derby\lib\derbytools.jar;C:\Derby\lib\derbyoptionaltools.jar;C:\Users\Tutorialspoint\Google Drive\Office\Derby\derby_zip\New folder\db-derby-10.12.1.1-bin\lib;C:\EXAMPLES_\Task\jars\*;C:\EXAMPLES\jars\mysql-connector-java-5.1.40-bin.jar;C:\Users\Tutorialspoint\Google Drive\Office\37.Junit Update\jars;C:\Program Files\Apache Software Foundation\Tomcat 8.5\lib\*;C:\Derby\lib\*;
```

## Starting Derby in Server Mode

You can start Network Server by running the command **startNetworkServer**. Browse through the **bin** directory of Apache Derby and run this command as shown below:

```
C:\Derby\bin>startNetworkServer

Fri Jan 04 11:20:30 IST 2019 : Security manager installed using the Basic server security policy.

Fri Jan 04 11:20:30 IST 2019 : Apache Derby Network Server - 10.14.2.0 - (1828579) started and ready to accept connections on port 1527
```

Or, you can start the server using **derbyrun.jar** as shown below:

```
C:\Users\MYUSER>cd %DERBY_HOME%/lib
C:\Derby\lib>java -jar derbyrun.jar server start

Fri Jan 04 11:27:20 IST 2019: Security manager installed using the Basic server security policy.

Fri Jan 04 11:27:21 IST 2019: Apache Derby Network Server - 10.14.2.0 - (1828579) started and ready to accept connections on port 1527
```

## Network Client

In client, add the jar files **derbyclient.jar** and **derbytools.jar** to the CLASSPATH. Or, run the **setNetworkClientCP** command as shown below:

```
C:\Users\MYUSER>cd %DERBY_HOME%/bin
C:\Derby\bin>setNetworkClientCP
C:\Derby\bin>SET DERBY_HOME=C:\Derby
C:\Derby\bin>set
CLASSPATH=C:\Derby\lib\derbyclient.jar;C:\Derby\lib\derbytools.jar;C:\Derby\lib\derbyoptionaltools.jar;C:\Derby\lib\derby.jar;C:\Derby\lib\derbytools.jar;C:\Derby\lib\derbyoptionaltools.jar;C:\Users\Tutorialspoint\Google Drive\Office\Derby\derby_zip\New folder\db-derby-10.12.1.1-bin\lib;C:\EXAMPLES_\Task\jars\*;C:\EXAMPLES\jars\mysql-connector-java-5.1.40-bin.jar;C:\Users\Tutorialspoint\Google Drive\Office\37.Junit Update\jars;C:\Program Files\Apache Software Foundation\Tomcat 8.5\lib\*;C:\Derby\lib\*;
```

Then from this client, you can send requests to the server.

## Verification

You can verify the setup using the **ij** tool as shown below:

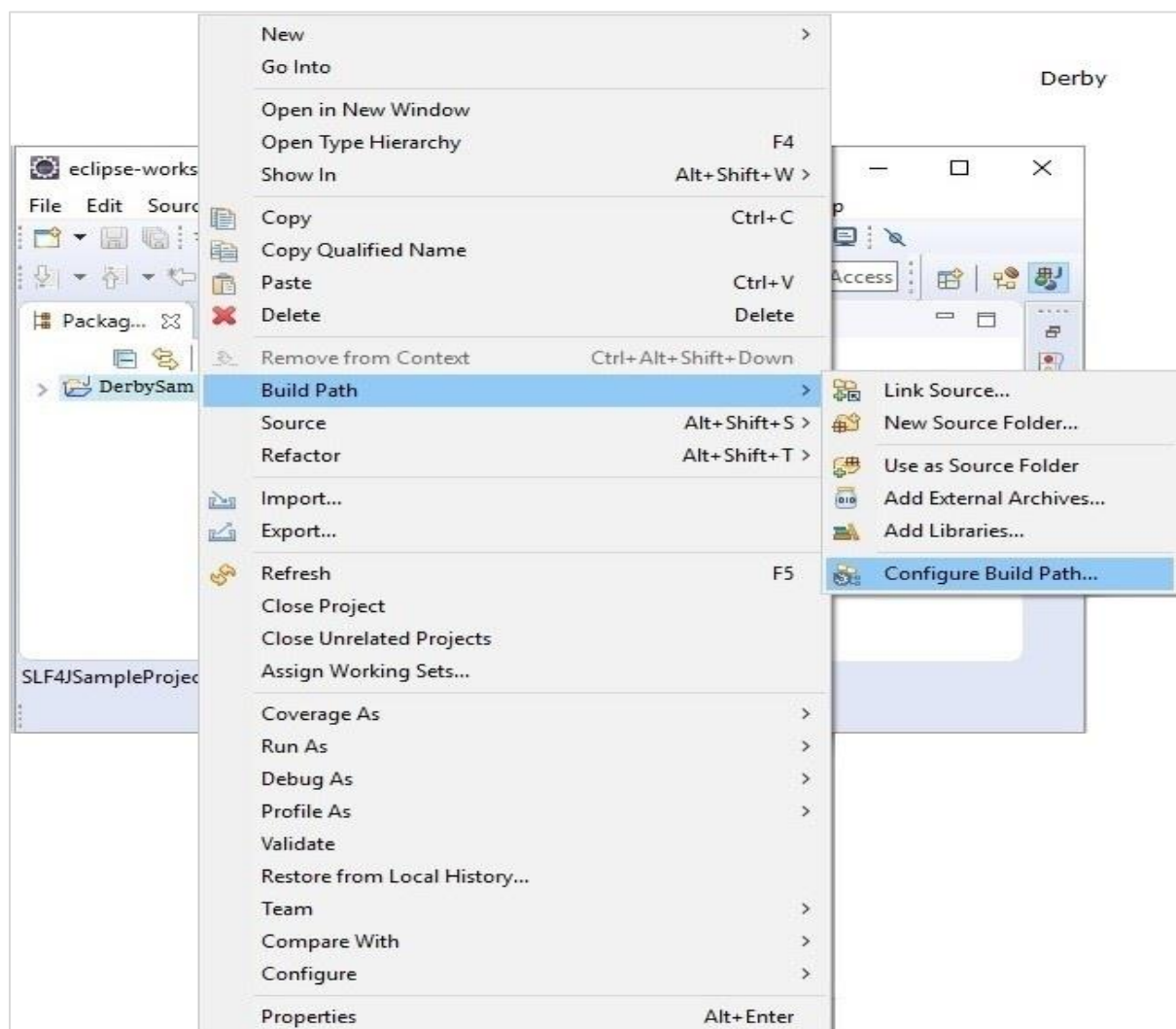
```
C:\Derby\bin>ij
ij version 10.14
ij> connect 'jdbc:derby://localhost:1527/SampleDB;create=true';
ij>
```

## Apache Derby Eclipse Environment

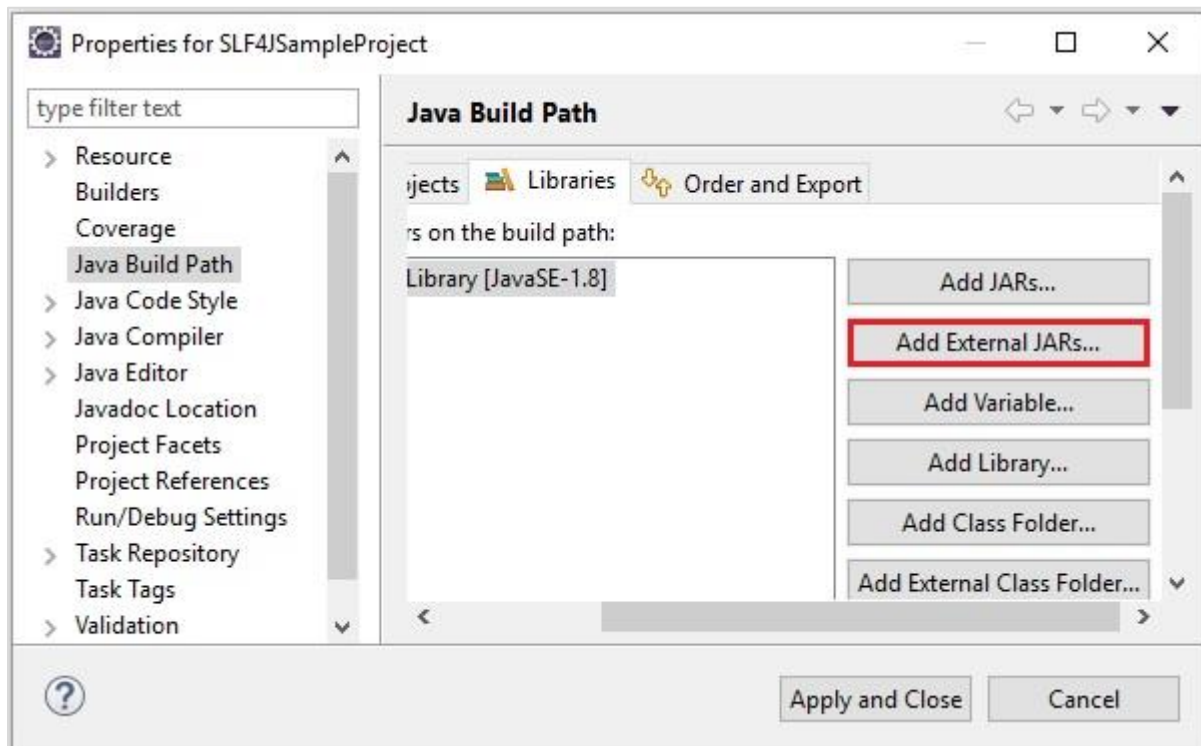
While working with Eclipse, you need to set the build path for all the required jar files.

### Step 1: Create a project and set build path

Open eclipse and create a sample project. Right click on the project and select the option **Build Path -> Configure Build Path** as shown below:



In the **Java Build Path** frame in the **Libraries** tab, click on **Add External JARs**.



And select the required **jar** files in the lib folder of the Derby installation folder and click on **Apply and Close**.

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