

# **HPCC JDBC Driver**

**Boca Raton Documentation Team**



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|  |    |
|--|----|
| Introduction .....                     | 4  |
| Installation .....                     | 5  |
| Configuration .....                    | 6  |
| Using HPCC as a JDBC data source ..... | 7  |
| Index Annotations .....                | 7  |
| Supported SQL .....                    | 9  |
| CALL .....                             | 9  |
| SELECT .....                           | 10 |
| SELECT JOIN .....                      | 12 |
| Supported Aggregate Functions .....    | 14 |
| Java Example .....                     | 15 |

# Introduction

Java Database Connectivity (**JDBC**) is a standard Java API that enables Java applications or client tools that support JDBC to access data from a *presumably* SQL-compliant data source via the SQL language.

**JDBC** makes it possible to write a single database application that can run on different platforms and interact with different database management systems.

Currently there are JDBC Drivers available for interaction with many popular data sources; now the HPCC platform is available as a data source.

The HPCC JDBC Driver exposes HPCC logical files as RDB tables.

- HPCC Logical File <-> RDB Table
- HPCC Record Definition Fields <-> RDB Table Columns
- HPCC Published query <-> RDB Stored Procedure
- Provides access to HPCC system data and RDB metadata
- Supports subset of SQL syntax
- Read-only operations supported
- Non-transactional
- Provides means for utilizing HPCC index files for faster reads.

**Figure 1. An example SQL Client interface connected to an HPCC Platform with the JDBC driver**



# Installation

The HPCC JDBC driver is distributed in a self-contained JAVA jar file.

Follow the instructions for your SQL client for installation.

To utilize your HPCC platform, use the configuration settings in the next section. The manner in which you define these settings is dependent on your SQL client.

The driver's full class path is:

**org.hpccsystems.jdbcdriver.HPCCDriver**

**Note:** WsSQL must be installed on the target HPCC Platform to utilize a JDBC connection.

See <https://hpccsystems.com/download/free-modules/wssql> for details.

# Configuration

The HPCC JDBC driver supports the following configuration attributes:

| Property            | Description   | Default Value       | Req. |
|---------------------|---|---------------------|------|
| ServerAddress       | Target HPCC ESP Address (used to contact WsSQL).  | "localhost"         | Yes  |
| WsSQLPort:          | WsSQL port (WsSQL is a web service which must be installed with the HPCC platform. It typically runs on port 8015). | 8015                | Yes  |
| WsECLWatchAddress   | Target HPCC WsECLWatch address  | ServerAddress Value | No   |
| WsECLWatchPort      | Target HPCC WsECLWatch port   | 8010                | No   |
| username            | User name on Target HPCC, if needed   | ""                  | No   |
| password            | Password on Target HPCC, if needed  | ""                  | No   |
| PageSize            | Max Number of HPCC files or HPCC published queries reported as result of GetTables, or Get-Proc                     | 100                 | No   |
| ConnectTimeoutMilli | Timeout value to establish connection to HPCC (in milliseconds)   | 1000                | No   |
| ReadTimeoutMilli    | HPCC Connection <b>read</b> timeout value (in milliseconds)   | 1500                | No   |
| EclResultLimit      | Max result records returned (use ALL to return all records)   | 100                 | No   |
| LazyLoad            | Fetch HPCC file and query metadata on-demand (not at connect time)  | "true"              | No   |
| TargetCluster       | ECLDirect target cluster  | "hthor"             | No   |
| QuerySet            | Target published query (stored procedure) QuerySet  | "hthor"             | No   |
| TraceToFile         | When true, tracing is directed to file <b>./HPCCJDBC.log</b> , otherwise trace is sent to standard output (stdout)  | "false"             | No   |
| TraceLevel          | Trace Logging level, as defined in java.util.logging.level. Valid values: ALL, SEVERE, WARNING, INFO, FINEST, OFF   | INFO                | No   |

These configuration settings are used when creating an HPCC JDBC connection.

They can be passed to the JDBC driver using the JDBC connection URL or as part of the connection properties object. When passed through the connection URL, the values must be URL-encoded.

The connection URL syntax is as follows:

```
jdbc:hpcc[;urlencodedkey=urlencodedvalue]*
```

**Note:** The **jdbc:hpcc** prefix is required.

# Using HPCC as a JDBC data source

Once connected, the HPCC JDBC driver will process submitted SQL statements and generate dynamic ECL code. The code is submitted to and executed by your HPCC Platform. The resultset is returned to your application or SQL client.

**Note:** The HPCC JDBC driver **only supports files which contain the record definition in the logical file's metadata**. Sprayed files do not contain this metadata. This metadata exists on any file or index which is written to the HPCC Distributed File System. Sprayed data files typically undergo some processing and an OUTPUT of the transformed data to disk before use, so this should not interfere with the driver's usefulness.

In addition, you can utilize indexes on the HPCC in one of two ways:

1. Provide SQL hints to tell driver to use a specific index for your query.

For example:

```
USEINDEX(TutorialPersonByZipIndex)
```

2. Specify the related indexes in the HPCC logical file description.

## Index Annotations

The JDBC driver attempts to perform index based reads whenever possible. However, in order to take advantage of index reads, the target HPCC files need to be annotated with the pertinent index file names. This is accomplished by adding the following key/value entry on the file's description using ECL Watch.

From a logical file's details page, enter the information in the Description entry box, then press the **Save Description** button.

This information is used by the driver to decide if an index fetch is possible for a query on the base file.

### On source file:

**XDBC:RelIndexes=** [*fullLogicalFilename1*; *fullLogicalFilename2*]

Example:

```
XDBC:RelIndexes=[tutorial::yn::peoplebyzipindex;  
                 tutorial::yn::peoplebyzipindex2;  
                 tutorial::yn::peoplebyzipindex3]
```

In this example, the source file has three indexes available.

### On the index file:

**XDBC:PosField=**[*indexPositionFieldName*]

Example:

```
XDBC:PosField=[fpos]
```

The FilePosition field (fpos) can have any name, so it must be specified in the metadata so the driver knows which field is the fileposition.

Simply enter the information in the description entry box, then press the **Save Description** button.

**Note:** You should enter this information BEFORE publishing any query using the data file or indexes. Published queries lock the file and would prevent editing the metadata.



# Supported SQL

## CALL

**Call** *queryname* ([*param list*])

queryName                      The published query name or alias

paramList                      The parameters exposed by the published query (comma-separated)

Call executes a published ECL query as if it were a stored procedure.

Example:

```
Call SearchPeopleByZipService ('33024')
```

# SELECT

**select** [distinct] *columnList* **from** *tableList* [USE INDEX(*indexFileName* | 0 )]

[**where** *logicalExpression*] [**group by** *columnList*<sup>1</sup>] [**having** *logicalExpression*<sup>2</sup>]

[**order by** *columnList*<sup>1</sup> [asc | desc] ] [**LIMIT** *limitNumber*]

**NOTE:** Identifiers can be unquoted or within double quotes, literal string values must be single quoted.

*columnList*                      columnreference1[,columnreference2,columnreference3,...,columnreference<sub>n</sub>]  
The column(s) to return (comma-separated list). In addition, these aggregate functions are supported : COUNT, SUM, MIN, MAX, and AVG. These work in a similar manner as their ECL counterparts.

*columnreference*              [tablename.]columnname[ [AS] alias ]

*distinct*                      [distinct] col1, col2,... col<sub>n</sub>  
The result set will only contain distinct (unique) values.

*tableList*                      tableref1[,tableref2,tableref3,...,tableref<sub>n</sub>]  
One or more tables, separated by commas.  
**NOTE:** A table list with multiple tables creates an (one or more) implicit inner join using the where clause logical expression as the join condition which must contain an equality condition.

*tableref*                      tableName[ [AS] alias ]  
The Name of the table as referenced, optionally defining its alias.

*alias*                          The alias used to refer to the corresponding table or field reference.

*logicalExpression*           Logical expression based on standard SQL filtering syntax. Compound operators such as NOT IN or IS NULL must be in ALL CAPS or all lower case and can have one and only one space between the words. (NOT IN, not in, IS NULL, is null, etc.)

BOOLEAN Only supports *True* or *False*, do not use Y, N, 0, or 1.

**Valid operators:**

= Equal (e.g., age=33)

<> Not equal (e.g., age <>33)

> Greater than (e.g., age >55)

< Less than (e.g., age < 18)

>= Greater than or equal (e.g., age >=21)

<= Less than or equal (e.g., age <=21)

*limitNumber*

IN(value1,value2,...,valuen) where values are comma separated homogeneous types.

NOT IN(value1,value2,...,valuen) where values are comma separated homogeneous types.

IS NULL

The number of rows to return. This overrides the driver's configuration attribute (EclResultLimit ) but cannot be set to ALL.

<sup>1</sup>Aliasing not supported

<sup>2</sup>Can only contain references to aggregate functions if used with *having* clause.

Aggregate functions can only be expressed in logicalExpressions by using *Group by* and *having*

**Examples:**

Select \* from tableList where Sum(F1 > 100) /\* is NOT SUPPORTED \*/

Select \* from tableList Group by F1 Haveing Sum (F1 > 100) /\* IS SUPPORTED \*/

**Example:**

```
Select fname, lname, state from TutorialPerson where
  state='FL' OR (lname='Smith' and fname='Joe')
//returns data that looks like this:
John Doe FL
Jim Smith FL
Jane Row FL
Joe Smith CA
```

```
Select fname, lname, state from TutorialPerson where state='FL' AND lname <> 'Smith'
//returns data that looks like this:
John Doe FL
Jane Row FL
```

The driver supports SQL index hints, which gives the SQL user the option to specify the most appropriate HPCC index for the current SQL query. This also allows you to disable the use of an index.

**select** *columnList* **from** *tableName* **USE INDEX**(*hpcc::index::file::name*) **where** *logicalExprssions*

**USE INDEX(0)** forces the system to avoid seeking an index for the current query.

**Example:**

```
Select fname, lname, zip, state from TutorialPerson
USEINDEX(TutorialPersonByZipIndex)where zip='33024'

//returns data that looks like this:
John Doe FL 33024
Jim Smith FL 33024
Jane Row FL 33024
```

# SELECT JOIN

**select** *columnList* **from** *tableName* [**as** *alias*]

[<outer | inner > **JOIN** *join* *TableName* [ **as** *alias*] **on** *joinCondition*]

[**USE INDEX**(*indexFileName* | 0 )]

[**where** *logicalExpression*] [**group by** *fieldName*]

[**order by** *columnNames* [asc | desc] ] [**LIMIT** *limitNumber*]

*columnList*                      columnreference1[,columnreference2,columnreference3,...,columnreference*n*]  
The column(s) to return (comma-separated list). In addition, these aggregate functions are supported : COUNT, SUM, MIN, MAX, and AVG. These work in a similar manner as their ECL counterparts.

*columnreference*                [tablename.]columnname[ [AS] *alias* ]

*distinct*                        [distinct] col1, col2,... col*n*  
The result set will only contain distinct (unique) values.

*alias*                             The alias used to refer to the corresponding table or field reference.

**outer | inner**                  The type of JOIN to use.

*joinTableName*                The JOIN file to use.

*joinCondition*                Specifies the relationship between columns in the joined tables using logical expression.

*logicalExpression*            Logical expression based on standard SQL filtering syntax. Compound operators such as NOT IN or IS NULL must be in ALL CAPS or all lower case and can have one and only one space between the words. (NOT IN, not in, IS NULL, is null, etc.)

BOOLEAN Only supports *True* or *False*, do not use Y, N, 0, or 1.

**Valid operators:**

= Equal (e.g., age=33)

<> Not equal (e.g., age <>33)

> Greater than (e.g., age >55)

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>= Greater than or equal (e.g., age >=21)

<= Less than or equal (e.g., age <=21)

IN(value1,value2,...,valuen) where values are comma separated homogeneous types.

NOT IN(value1,value2,...,valuen) where values are comma separated homogeneous types.

IS NULL

*limitNumber*

Optional. The number of rows to return. This overrides the driver's configuration attribute (EclResultLimit ) but cannot be set to ALL.

<sup>1</sup>Aliasing not supported

<sup>2</sup>Can only contain references to aggregate functions if used with *having* clause.

Aggregate functions can only be expressed in logicalExpressions by using *Group by* and *having*

**Examples:**

Select \* from tableList where Sum(F1 > 100) /\* is NOT SUPPORTED \*/

Select \* from tableList Group by F1 Having Sum (F1 > 100) /\* IS SUPPORTED \*/

Example:

```
Select t1.personname, t2.address
  from persontable as t1 inner join addresstable as t2
  on (t1.personid = t2.personid AND
      (t1.firstname = 'jim' AND
       t1.lastname = 'smith' ))
```

The JDBC driver does not convert parameter list or column list values to string literals.

String values should be single quote encapsulated. Field identifier can be left unquoted or double quoted.

For example, the table **persons** has columns Firstname(String) and Zip (numeric)

```
Select Firstname from persons where Firstname = 'Jim' and zip > 33445      /* works */
Select Firstname from persons where Firstname = 'Jim' and "zip" > 33445    /* also works */
Select Firstname from persons where Firstname = Jim and zip > 33445        /* doesn't work */
Select Firstname from persons where Firstname = 'Jim' and zip > '33445'    /* doesn't work */
```

## Supported Aggregate Functions

**COUNT**(*[DISTINCT]columnName*)

**DISTINCT**(*columnName*)

**SUM**(*columnName*)

**MIN**(*columnName*)

**MAX**(*columnName*)

**AVG**(*columnName*)

These aggregate functions are supported. They behave as their ECL counterparts. See the **ECL Language Reference** for details.

|                   |   |
|-------------------|---|
| COUNT             | Counts the occurrences of <i>columnName</i> in the result, always an integer.                             |
| DISTINCT          | Returns only distinct values of <i>columnName</i> in the result, output type is dependent on input type.  |
| SUM               | Returns the sum of the values of <i>columnName</i> in the result, output type is dependent on input type. |
| MIN               | Returns the minimum value for of <i>columnName</i> in the result, output type is dependent on input type. |
| MAX               | Returns the minimum value for of <i>columnName</i> in the result, output type is dependent on input type. |
| AVG               | Returns the average of the values of <i>columnName</i> in the result, always a real number.               |
| <i>columnName</i> | The column to aggregate.  |

Example:

```
Select fname, lname, state, COUNT(zip) from TutorialPerson where zip='33024'
```

## Supported String Modifiers

**UPPER**(*columnName*)

**LOWER**(*columnName*)

|                   |   |
|-------------------|---|
| UPPER             | Returns with all lower case characters converted to upper case. |
| LOWER             | Returns with all upper case characters converted to lower case. |
| <i>columnName</i> | The column to aggregate   |

# Java Example

```
/* Obtain instance of JDBC Driver */
Driver jdbcdriver = DriverManager.getDriver("jdbc:hppc");

/* Establish Connection */

HPCCConnection connection = null;
try
{
    /*populate JAVA properties object with pertinent connection options */
    Properties connprops = new Properties();
    connprops.put("ServerAddress", "192.168.124.128");

    /*or create JDBC connection url string with pertinent connection options*/
    /* the connection values must be URL-encoded */
    String jdbcurl = "jdbc:hppc;ServerAddress=HTTP%3A%2F%2F192.168.124.128";

    /*provide all necessary connection properties either by URL, or props object */
    connection = (HPCCConnection) driver.connect(jdbcurl, connprops);
}

catch (Exception e) { System.out.println("Error");}
/* create HPCCStatement object for single use SQL query execution */

    HPCCStatement stmt = (HPCCStatement) connection.createStatement();

/* Create your SQL query */
String mysql = "select * from tablename as mytab limit 10";

/* Execute your SQL query */
HPCCResultSet res1 = (HPCCResultSet) stmt.executeQuery(mysql);

/*Do something with your results */
printOutResultSet(res1);

/* Or create a prepared statement for multiple execution and parameterization */
String myprepsql = "select * from persons_table persons where zip= ? limit 100";
HPCCPreparedStatement prepstmt =
(HPCCPreparedStatement)createPrepStatement(connection, myprepsql);

/* provide parameter values and execute */
for (int i = 33445; i < 33448; i++)
{
    prepstmt.clearParameters();
    prepstmt.setString(1, "" + Integer.toString(i, 10) + "");
    HPCCResultSet qrs = (HPCCResultSet) ((HPCCPreparedStatement) prepstmt).executeQuery();

/*Do something with your results */
    printOutResultSet(qrs);
}
```

More code samples are available from:

<https://github.com/hpcc-systems/hpcc-jdbc/tree/master/src/test/java/org/hpccsystems/jdbcdriver/tests>