

**Java Shapefile Tool**

**Configuration and User Guide**

**November 2017**

Version 1.0

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# Introduction

**Java Shapefile Tool** is developed to allow extract and upload of Shapefiles from and to (respectively) Oracle database. This tool is a Jar file developed using APIs from [GeoTools](http://www.geotools.org/) ([13-beta](https://sourceforge.net/projects/geotools/files/GeoTools%2013%20Releases/13-beta/)) and [Oracle Spatial Java API (11.2.0.2)](https://docs.oracle.com/cd/E16338_01/appdev.112/e11829/toc.htm).

The tool can be used either as a **command-line tool** or **by loading in Oracle database**.

Following jars from GeoTools and Oracle Spatial + Bentley’s API for the tool are merged into a single jar for the ease of deployment.

|  |
| --- |
| **GeoTools API** |
| gt-api-13-beta.jar |
| gt-data-13-beta.jar |
| gt-epsg-hsql-13-beta.jar |
| gt-jdbc-oracle-13-beta.jar |
| gt-main-13-beta.jar |
| gt-metadata-13-beta.jar |
| gt-opengis-13-beta.jar |
| gt-referencing-13-beta.jar |
| gt-shapefile-13-beta.jar |
| hsqldb-2.2.8.jar |
| jai\_core-1.1.3.jar |
| jsr-275-1.0-beta-2.jar |
| jts-1.13.jar |
| vecmath-1.3.2.jar |

|  |
| --- |
| **Oracle Spatial Java API** |
| sdoapi.jar |
| sdoutl.jar |
| xdb.jar |

# Installation

**Staging folder** is the folder containing this document.

## System Requirements

### **Command Prompt Use Requirements**

1. **Java JRE** – **JRE 1.7**orlatermust be installed on the system from which the tool is to be used.
2. **Database Server Access** – The system running the tool must have access to the database server on which extract and upload operations are to be performed.

### **Database Use Requirements**

Oracle database in which the tool is to be loaded must have default Java version 1.7 or later (practically, Oracle Database 12c or later).

Use following command to get the default Java version of a database –

SELECT **dbms\_java.get\_ojvm\_property**(PROPSTRING => 'java.version') java\_version

FROM DUAL;

## Steps to Install

### **Command Prompt Use Installation**

1. **Installing Java Run Time Environment (JRE)**

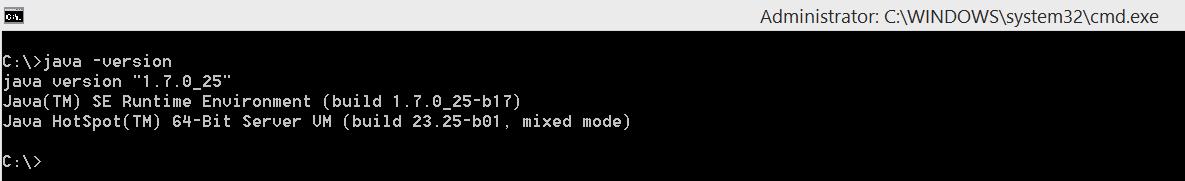
Install Java **JRE 1.7** on the system. While installing make sure that the installation directory **does not contain any white spaces**.

e.g. C:\Java\64\jre1.7.0\_25\

Open a **Command Window** and run the following command –

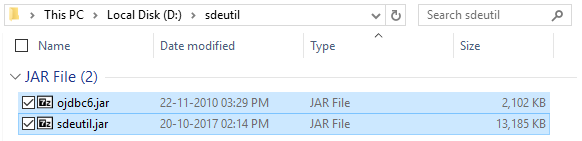
java –version

It should give an output like shown in the following image. Environment variable PATH might need to be updated to set the correct Java path.



1. **Copying the Jar files**

Create a directory on the system (e.g. sdeutil) at a suitable location (again not containing any white spaces). Copy sdeutil.jar and ojdbc6.jar from the staging folder to this directory.



1. **Setting shapefile-base-directory**

Create an Environment variable on client machine named – SDE\_UTIL\_PATH – and assign a path not containing any white spaces to it.

e.g. D:\sdeutil\

The path must already exist on the client machine.

This path will serve as base directory for the tool. If not set, location of sdeutil.jar will be used as base directory.

### **Database Use Installation**

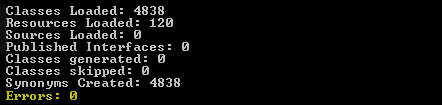
1. **Loading the Shapefile Java Tool in Oracle database**

Open a Command Window with staging folder as working directory and run following command –

loadjava\_sdeutil.bat db\_user/db\_password@tns\_name db\_role

where db\_user, db\_password, tns\_name are details to connect to database and db\_role is role that need to be granted the privilege to execute the tool from database (you may use PUBLIC to grant the execute privilege to all the database users).

This command may take some time to load the tool in database. At the end of execution, make sure that the Error count is zero as shown in below image –



1. **Setting shapefile-base-directory**

Create an Environment variable on database server named – SDE\_UTIL\_PATH – and assign a path not containing any white spaces to it.

e.g. D:\sdeutil\

The path must already exist on the database server.

This path will serve as base directory for the tool. If not set, <ORACLE\_HOME> will be used as base directory.

## Installing Java Shapefile Tool Database Components

This step is **required for both** command-line and database use.

1. **Logon** to **SQL\*Plus** with the database user account [[Note 1](#db_user_privileges)] you want to extract-upload shapefiles with and with staging folder as working directory.

At the prompt type –

START install\_sdeutil.sql

In case public synonyms are required for other database users to use Java Shapefile Tool, run –

START create\_sde\_synonyms.sql

**Exit** SQL\*Plus

**Note 1** – Database user logging in must have following database privileges to complete the installation successfully

CREATE TYPE

CREATE ROLE

CREATE TABLE

CREATE ANY INDEX

CREATE SEQUENCE

CREATE TRIGGER CREATE PROCEDURE

CREATE PUBLIC SYNONYM

1. **Logon** to **SQL\*Plus** with the database **SYS** user account **AS SYSDBA** with staging folder as working directory.

At the prompt type –

START sde\_sys\_grants.sql

**Exit** SQL\*Plus

# Usage

## Parameters

Following tables list all the parameters and their descriptions for the Java Shapefile Tool.

### **Table 1** – Java Shapefile Tool Parameters

|  |  |
| --- | --- |
| **Parameter** | **Description** |
| **-help** | To see the command line usage of Java Shapefile Tool |
| **-setup** | To setup shapefile-base-directory [[Note 2]](#shapefile_base_directory_setup) |
| **-sde2shp** | To extract a shapefile, followed by shapefile extractor parameters [[Table 2]](#_Table_2_–) |
| **-shp2sde** | To extract a shapefile, followed by shapefile uploader parameters [[Table 3]](#_Table_3_–) |

**Note 2** – Running Java Shapefile Tool with -setup option will create following directory structure in shapefile-base-directory –

<shapefile-base-directory>

|\_ column\_map

|\_ epsg\_db

| | \_ v8.6.0.0

| |\_ EPSG.data

| |\_ EPSG.properties

| |\_ EPSG.script

| |\_ EPSG\_creation\_marker.txt

|\_ extract

|\_ log

|\_ upload

|  |  |
| --- | --- |
| **Directory** | **Description** |
| **colum\_map** | Directory to keep column-name(attribute) mapping file (for extract and upload) |
| **epsg\_db** | Directory for EPSG database (for tool use only) |
| **extract** | Directory where Shapefiles will be extracted (for extract only) |
| **log** | Directory for System Log File [[Section 4.2]](#_System_Log_File) (for extract and upload) |
| **upload** | Directory where Shapefiles will be uploaded (for upload only) |

### **Table 2** – Java Shapefile Extractor Parameters

|  |  |
| --- | --- |
| **Parameter** | **Description** |
| **-help** | Specify this option to see the command line usage of Shapefile Extractor |
| **Mandatory Alternate Parameters Group 1** | |
| **Either** | |
| **-nc** | Specify this option, if the jar is loaded in database and called from a PL/SQL procedure or function (no values for this parameter) |
| **Or** | |
| **-h** | Host machine name/IP with existing Oracle database |
| **-p** | Host machine's port with existing Oracle database (e.g. 1521) |
| **-s** | Host machine's SID with existing Oracle database |
| **-u** | Database user's username |
| **-d** | Database user's password |
| **Mandatory Alternate Parameters Group 2** | |
| **Either** | |
| **-t** | Input feature table name and spatial column name (separated by **comma** only) |
| **-f** | File name of an output Shapefile **without extension** |
| **Or** | |
| **-whelp** | WHERE Clause ID for which details are required (use ID as '**all**' for details of all available WHERE clauses) |
| **Optional Parameters** | |
| **-w** | WHERE Clause ID for the query followed by any parameters enclosed in **square brackets []** separated by **space.** In case parameter value contains space itself, enclose the value in **double quotes**. **None** of the values in [] can have square brackets in turn. [[Note 3]](#sde2shp_where_sql_injection) |
| **-a** | File name containing column-name(attribute) mappings **with extension** |

**Note 3** – To avoid SQL-Injection and at the same time maintain the flexibility to use WHERE clause while extracting a Shapefile, a new way has been introduced. A table named – SDE\_WHERE – gets created while installing the database components of the tool with following structure –

**Name** **Null?** **Type**

----------------------------------------- -------- ----------------------

SW\_ID NOT NULL NUMBER

SW\_UNIQUE NOT NULL VARCHAR2(50)

SW\_WHERE\_CLAUSE NOT NULL CLOB

SW\_WHERE\_DESCR VARCHAR2(4000)

SW\_USER\_ROLE NOT NULL VARCHAR2(4000)

Where,

1. **SW\_ID** is an index column, autogenerated through a sequence
2. **SW\_UNIQUE** holds a 50 character long unique identifier, which will be used as a parameter for -w parameter while extracting a Shapefile
3. **SW\_WHERE\_CLAUSE** contains the actual WHERE clause definition. In case a user input is required, following placeholders can be used –
4. <<?NUMBER?>> for number type input
5. <<?VARCAHR?>> for character type input
6. <<?DATE?>> for date type input

e.g.

TREE\_AGE <= <<?NUMBER?>> AND TREE\_TYPE = <<?VARCHAR?>> AND TREE\_START\_DATE <= <<?DATE?>>

1. **SW\_WHERE\_SDECR** is optional, contains maximum of 4000 characters long description for the corresponding WHERE clause
2. **SW\_USER\_ROLE** contains a database role name. If kept **null**, will get automatically populated with SDE\_USER role. This indicates that user must have this role to use the WHERE clause to extract a Shapefile.

Database user with SDE\_ADMIN role only can insert, update, delete records in this table. This is to ensure the security from SQL-Injection.

For now, there is no UI to update this table, so SDE\_ADMIN must do it manually by firing insert, update, delete statements.

### **Table 3** – Java Shapefile Uploader Parameters

|  |  |
| --- | --- |
| **Parameter** | **Description** |
| **-help** | Specify this option to see the command line usage of Shapefile Uploader |
| **Mandatory Alternate Parameters** | |
| **Either** | |
| **-nc** | Specify this option, if the jar is loaded in database and called from a PL/SQL procedure or function (no values for this parameter) |
| **Or** | |
| **-h** | Host machine name/IP with existing Oracle database |
| **-p** | Host machine's port with existing Oracle database (e.g. 1521) |
| **-s** | Host machine's SID with existing Oracle database |
| **-u** | Database user's username |
| **-d** | Database user's password |
| **Mandatory Parameters** | |
| **-o** | Mode to add Shapefile data to a table. Possible Values - {**append**|**create**|**init**} |
| **-t** | Table name for the result |
| **-f** | File name of an input Shapefile **without extension** |
| **Optional Parameters** | |
| **-i** | Column name for unique numeric ID; if required |
| **-r** | Valid Oracle SRID for coordinate system; use 0 if unknown [[Note 4]](#srid_validation) |
| **-g** | Preferred or valid **SDO\_GEOMETRY** column name |
| **-x** | Bounds for the X dimension; use -180,180 if unknown |
| **-y** | Bounds for the Y dimension; use -90,90 if unknown |
| **-m** | Load tolerance fields (x and y) in metadata, if not specified, tolerance fields are 0.05 |
| **-n** | Start ID for column specified in **-i** parameter |
| **-c** | Commit interval. Default, only commits at the end of a run. |
| **-a** | File name containing column-name(attribute) mappings **with extension** |

**Note 4** – In case of *no projection* (i.e. prj file) available for the Shapefile being uploaded, SRID must be specified using

–r command line argument mentioned above. If not, upload process will be terminated.

The priority to get the SRID will be –

1. prj File
2. SRID specified with –r option

In both the above cases, if the mode to add Shapefile data is append or init, and SRID **differs** the present SRID for **table**, **geometry-column** combination (i.e. existing record in user\_sdo\_geom\_metadata in database) of the system to which the Shapefile is being uploaded, upload process will be **terminated**.

## Command-line Usage

The jar can be executed through a **Command Window** on system, like –

java -jar "D:\sdeutil\sdeutil.jar" [parameters]

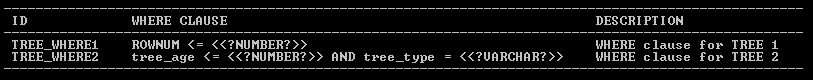
Here are few examples –

1. Command to setup shapefile-base-directory

java -jar "D:\sdeutil\sdeutil.jar" -setup

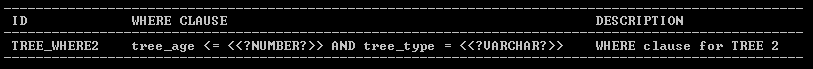
1. Command to see all available WHERE clauses

java -jar "D:\sdeutil\sdeutil.jar" -sde2shp -h db-server.example.com -p 1521 -s ORCL -u HIGHWAYS -d highways -whelp all



1. Command to see a WHERE clause ID details

java -jar "D:\sdeutil\sdeutil.jar" -sde2shp -h db-server.example.com -p 1521 -s ORCL -u HIGHWAYS -d highways -whelp TREE\_WHERE2



1. Command to extract a Shapefile

java -jar "D:\sdeutil\sdeutil.jar" -sde2shp -h db-server.example.com -p 1521 -s ORCL -u HIGHWAYS -d highways -t TREE\_LOCATIONS,SHAPE -w TREE\_WHERE2 [20 "MANGO"] -f TREE\_LOCATIONS\_EXTRACT -a extract\_tree\_loc\_attributes.txt

1. Command to upload a Shapefile

java -jar "D:\sdeutil\sdeutil.jar" -shp2sde -h db-server.example.com -p 1521 -s ORCL -u HIGHWAYS -d highways -t TREE\_LOCATIONS -f TREE\_LOCATIONS\_UPLOAD -i TREE\_ID -r 4326 -g SHAPE -x -180,180 -y -90,90 -m 0.05 -o create -n 1 -c 12 -a upload\_tree\_loc\_attributes.txt

**Note 5** – (-h, -p, -s, -u, -d) must be used from alternate [mandatory parameters group 1](#sde2shp_ma_parameters_g1) to inform the tool to create a database connection using the connection details passed.

## Database Usage

Once the Java Shapefile Tool is loaded in the database, it can be called using a PL/SQL block. An Oracle **Collection TYPE** gets created while installing database components for the tool – SDE\_VARCHAR\_ARRAY.

This type must be used to configure the parameters required for the tool to execute a command. Below is an example to perform a Shapefile Extract –

DECLARE

v\_command sde\_varchar\_array := sde\_varchar\_array();

v\_result VARCHAR2(**32767**);

BEGIN

-- SDE2SHP

v\_command.EXTEND(**14**);

*--*

v\_command(1) := '**-sde2shp**';

v\_command(2) := '**-nc**';

v\_command(3) := '-t';

v\_command(4) := 'TREE\_LOCATIONS,SHAPE';

v\_command(5) := '-w';

v\_command(6) := 'TREE\_WHERE2';

v\_command(7) := '[';

v\_command(8) := '20';

v\_command(9) := 'MANGO';

v\_command(10) := ']';

v\_command(11) := '-f';

v\_command(12) := 'TREE\_LOCATIONS\_EXTRACT';

v\_command(13) := '-a';

v\_command(**14**) := 'extract\_tree\_loc\_attributes.txt';

*--*

-- RESULT

v\_result := **sde\_util.shputil**(v\_command);

**dbms\_output.put\_line**(v\_result);

END;

/

Key Points –

1. -nc parameter must be used from the [alternate mandatory parameters group 1](#sde2shp_ma_parameters_g1) to inform the tool to use the same database connection as the one executing the PL/SQL block, called - nested database connection.
2. The command is similar to the one that gets formulated in command-line usage, just that each key and each value needs to be added to SDE\_VARCHAR\_ARRAY as a separate parameter. Check the formulation of -w parameter, two values (20 and MANGO) are passed as two separate parameters, the square brackets can optionally be combined with start and end values, like –

v\_command(7) := '[20';

v\_command(8) := 'MANGO]';

1. The size of SDE\_VARCHAR\_ARRAY (i.e. v\_command.EXTEND(14)) must match the number of parameters being passed to it.
2. The size of the variable holding the result of the command must be 32767 (e.g. v\_result VARCHAR2(32767)).
3. The command needs to be called using a predefined function sde\_util.shputil that gets created while installing the database components for the tool.

Here is an example to perform Shapefile Upload –

DECLARE

v\_command sde\_varchar\_array := sde\_varchar\_array();

v\_result VARCHAR2(**32767**);

BEGIN

-- SHP2SDE

v\_command.EXTEND(**26**);

*--*

v\_command(1) := '-shp2sde';

v\_command(2) := '-nc';

v\_command(3) := '-t';

v\_command(4) := 'TREE\_LOCATIONS';

v\_command(5) := '-f';

v\_command(6) := 'TREE\_LOCATIONS\_UPLOAD';

v\_command(7) := '-i';

v\_command(8) := 'TREE\_ID';

v\_command(9) := '-r';

v\_command(10) := '4326';

v\_command(11) := '-g';

v\_command(12) := 'SHAPE';

v\_command(13) := '-x';

v\_command(14) := '-180,180';

v\_command(15) := '-y';

v\_command(16) := '-90,90';

v\_command(17) := '-m';

v\_command(18) := '0.05';

v\_command(19) := '-o';

v\_command(20) := 'create';

v\_command(21) := '-n';

v\_command(22) := '1';

v\_command(23) := '-c';

v\_command(24) := '12';

v\_command(25) := '-a';

v\_command(**26**) := 'upload\_tree\_loc\_attributes.txt';

*--*

-- RESULT

v\_result := **sde\_util.shputil**(v\_command);

**dbms\_output.put\_line**(v\_result);

END;

/

# Logging

There are three logging levels depending on when and where an error encounters –

## Shapefile Log File

It refers to a log file in the folder where the Shapefile being extracted (i.e. <shapefile-base-directory>\extract\) or uploaded (i.e. <shapefile-base-directory>\upload\) and having same name as the Shapefile under operation. It contains information about various steps being followed while executing the extract or upload of the Shapefile and any errors encountered while executing the command.

This logging level generally logs errors related to wrong parameter-values and errors at database level like wrong username/password, table does not exist, shape column not found etc.

## System Log File

It refers to a log file contained in folder – <shapefile-base-directory>\log\.

This log file contains a list of parameters and their values passed to the command (mentioned the tables of Section 4.2).

This logging level generally logs errors related to passing wrong number of parameters, absence of files mentioned in the command and those that are thrown before creation of Shapefile Log file.

## Command/Database Level Log

### **Command Level Log**

It refers to the command line output while executing the extract/upload process. In case of successful execution, the output shows –

1. Complete path to the System Log file.
2. A message – “success” – indicating the process completed successfully. This message can be used in the *PL/SQL way* as explained in Section 4.2.

This logging level generally logs errors related to abnormal termination of the extract/upload process and those that are thrown before creation of System Log file.

### **Database Level Log**

It’s same as command level log, just that any success/error messages are returned as a string (at max 32767 characters long) by sde\_util.shputil function instead of printing on console.

# GeoTools Source Code Changes

GeoTools being an open source API, below mentioned Java class files were edited to suit the requirements.

## Class – org.geotools.data.shapefile.ShapefileDataStore

ShapefileDataStore – was forcing the data type NUMBER to be NUMBER (33, 31). This was causing problem as it allows only two digits before decimal point and hence truncating numbers in essential records of database.

It is changed to make it – NUMBER (19, 9).

Precision and scale were selected to be 19 and 9 respectively to match the ESRI Shapefile specifications.

## Class – org.geotools.data.shapefile.dbf.DbaseFileWriter

DbaseFileWriter – was replacing a NULL Date with eight ‘0’s – default length for a Date type column in a Shapefile being eight characters.

It is changed to show null dates as NULL only instead of ‘0’s.

## Class – org.geotools.data.shapefile.shp.ShapefileReader

ShapefileReader -> private boolean hasNext(boolean checkRecno) method was not checking for null shxReader (i.e. Shapefile Index file reader object), which was causing java.lang.NullPointerException at some places unwantedly.

The check for null shxReader is added.