Version 5.3

# Getting Started with PDI

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## Contact Us

Global Headquarters Pentaho Corporation Citadel International, Suite 460

5950 Hazeltine National Drive Orlando, FL 32822

Phone: +1 407 812-OPEN (6736)

Fax: +1 407 517-4575

http://www.pentaho.com

Sales Inquiries: sales@pentaho.com

# Introduction

Pentaho Data Integration (PDI) is an extract, transform, and load (ETL) solution that uses an innovative metadata-driven approach.

PDI includes the DI Server, a design tool, three utilities, and several plugins.

## Common Uses

Pentaho Data Integration is an extremely flexible tool that addresses a broad number of use cases including:

- Data warehouse population with built-in support for slowly changing dimensions and surrogate key creation
- Data migration between different databases and applications
- Loading huge data sets into databases taking full advantage of cloud, clustered, and massively parallel processing environments
- Data Cleansing with steps ranging from very simple to very complex transformations
- Data Integration including the ability to leverage real-time ETL as a data source for Pentaho Reporting
- Rapid prototyping of ROLAP schemas
- Hadoop functions: Hadoop job execution and scheduling, simple Hadoop MapReduce design, Amazon EMR integration

## Key Benefits

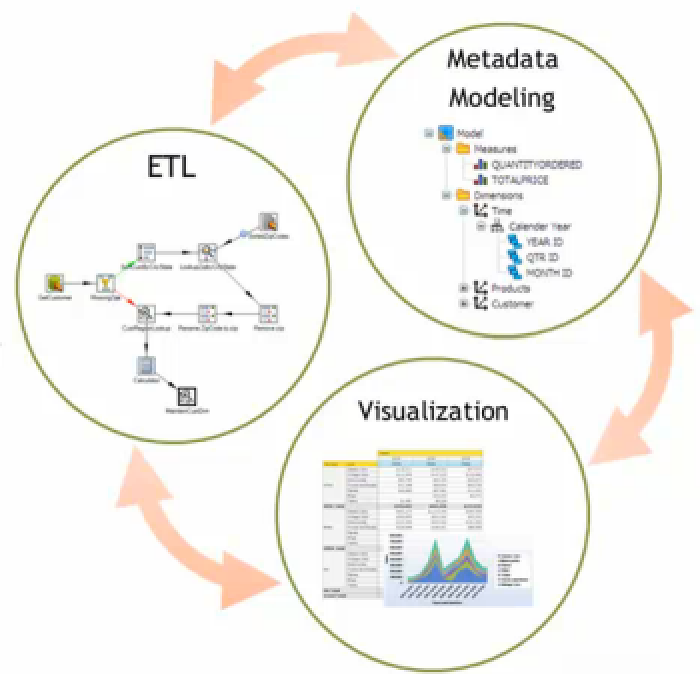
Pentaho Data Integration features and benefits include:

- Installs in minutes; you can be productive in one afternoon
- 100% Java with cross platform support for Windows, Linux, and Macintosh
- Easy to use graphical designer with over 100 out-of-the-box mapping objects including inputs, transforms, and outputs
- Simple plug-in architecture for adding your own custom extensions
- Enterprise Data Integration server providing security integration, scheduling, and robust content management including full revision history for jobs and transformations
- Integrated designer (Spoon) combining ETL with metadata modeling and data visualization, providing the perfect environment for rapidly developing new Business Intelligence solutions
- Streaming engine architecture provides the ability to work with extremely large data volumes
- Enterprise-class performance and scalability with a broad range of deployment options including dedicated, clustered, and/or cloud-based ETL servers

pentaho

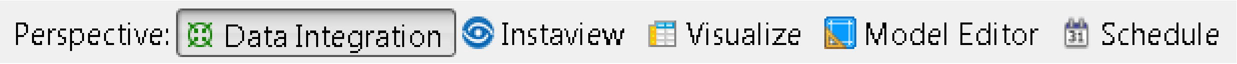
# Use Perspectives Within Spoon

Pentaho Data Integration (PDI) provides you with tools that include ETL, modeling, and visualization in one unified environment — the Spoon interface. This integrated environment allows you to work in close cooperation with business users to build business intelligence solutions more quickly and efficiently.



When you are working in Spoon you can *change perspectives*, or switch from designing ETL jobs and transformations to modeling your data, and visualizing it. As users provide you with feedback about how the data is presented to them, you can quickly make iterative changes to your data directly in Spoon by changing perspectives. The ability to quickly respond to feedback and to collaborate with business users is part of the Pentaho Agile BI initiative.

From within Spoon you can change perspectives using the **Perspective** toolbar located in the upper-right corner.



The perspectives in PDI enable you to focus how you work with different aspects of data.

- **Data Integration** perspective—Connect to data sources and extract, transform, and load your data
- **Model** perspective—Create a metadata model to identify the relationships within your data structure
- **Visualize** perspective—Create charts, maps, and diagrams based on your data

- **Instaview** perspective—Create a data connection, a metadata model, and analysis reports all at once with a dialog-guided, template-based reporting tool
- **Schedule** perspective—Plan when to run data integration jobs and set timed intervals to automatically send the output to your preferred destinations

# Create a Connection to the DI Repository

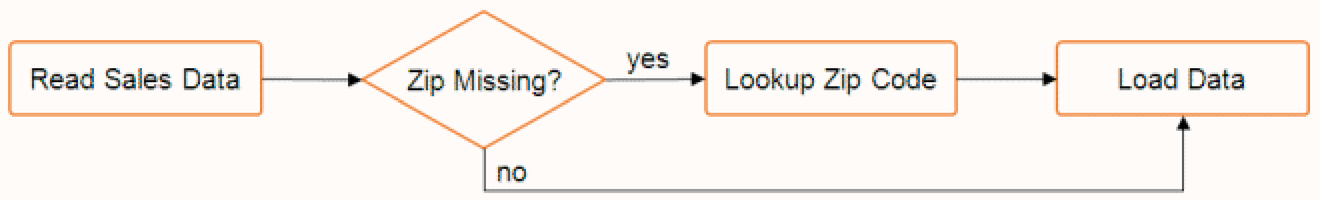
Transformations, jobs, and schedules are stored in the DI Repository.  Create a connection to the DI Server if you want to access these things, or use the DI Operations Mart audit feature.

1. Make sure the DI Server is running.
2. Select **Tools** > **Repository** > **Connect** to open the **Repository Connection** window.
3. If a connection to the DI Repository has not already been created:
    a. Click **Add**(+).  The **Select the repository type** window appears.
    b. Select **DI Repository:DI Repository** and click **OK**. The **Repository Configuration** window appears.
    c. Enter a **Name** and **Description** for your repository.
    d. Modify the URL associated with your repository if necessary, then click the **Test** button to ensure that the URL is properly configured.  If the test fails, make sure that the DI Server is up and the port number in the URL is correct.  (If you installed the DI using the Wizard, the correct port should appear in the `installation-summary.txt` file.  The file is in the root directory where you installed DI.)
    e. Click **OK** to close the **Success** dialog box.
    f. Click **OK** to close the **Repository Configuration** window. Your new connection appears in the list of available repositories.
4. To connect to the repository,  select the repository, then enter the admin (or non-admin) username and password for the repository.
5. Click **OK**.

# Create Transformations

The Data Integration perspective of Spoon allows you to create two basic document types: transformations and jobs. Transformations are used to describe the data flows for ETL such as reading from a source, transforming data and loading it into a target location. Jobs are used to coordinate ETL activities such as defining the flow and dependencies for what order transformations should be run, or prepare for execution by checking conditions such as, "Is my source file available?," or "Does a table exist in my database?"

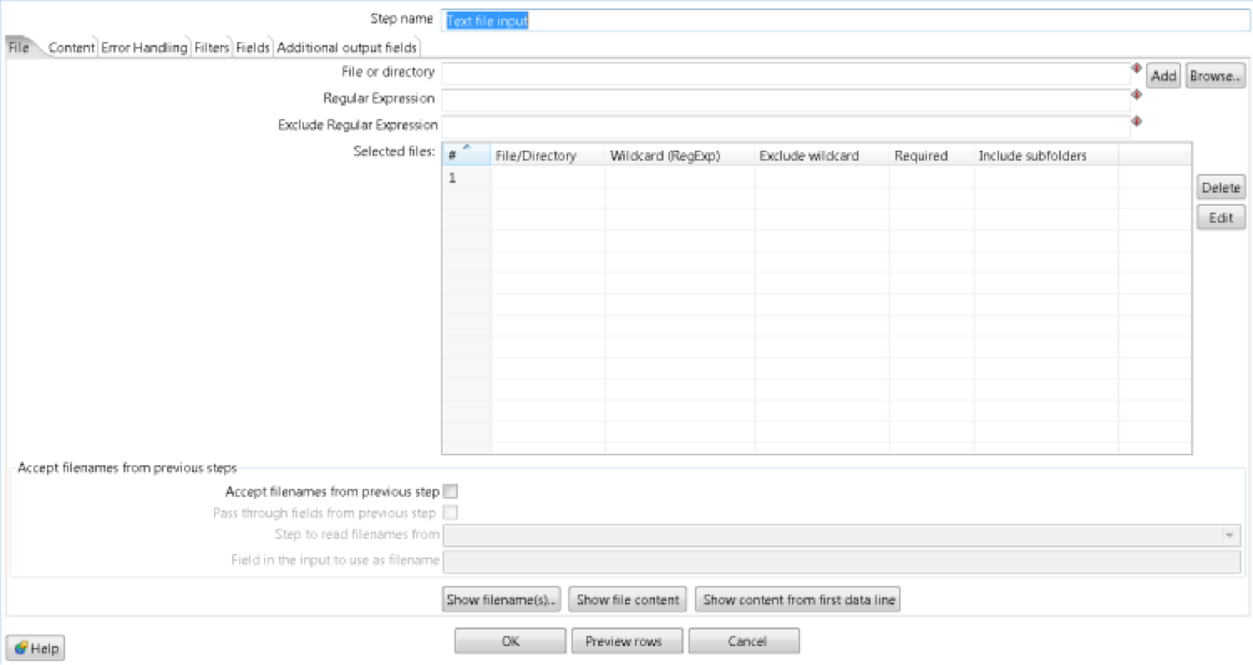
This exercise will step you through building your first transformation with Pentaho Data Integration introducing common concepts along the way. The exercise scenario includes a flat file (.csv) of sales data that you will load into a database so that mailing lists can be generated. Several of the customer records are missing postal codes (zip codes) that must be resolved before loading into the database. The logic looks like this:



# Retrieving Data from a Flat File

Follow the instructions below to retrieve data from a flat file.

1. Select **File** > **New** > **Transformation** in the upper left corner of the **Spoon** window to create a new transformation.
2. Under the **Design** tab, expand the **Input** node; then, select and drag a **Text File Input** step onto the canvas.
3. Double-click on the **Text File** input step. The **Text file input** window appears. This window allows you to set the properties for this step.



Step name: Text file input

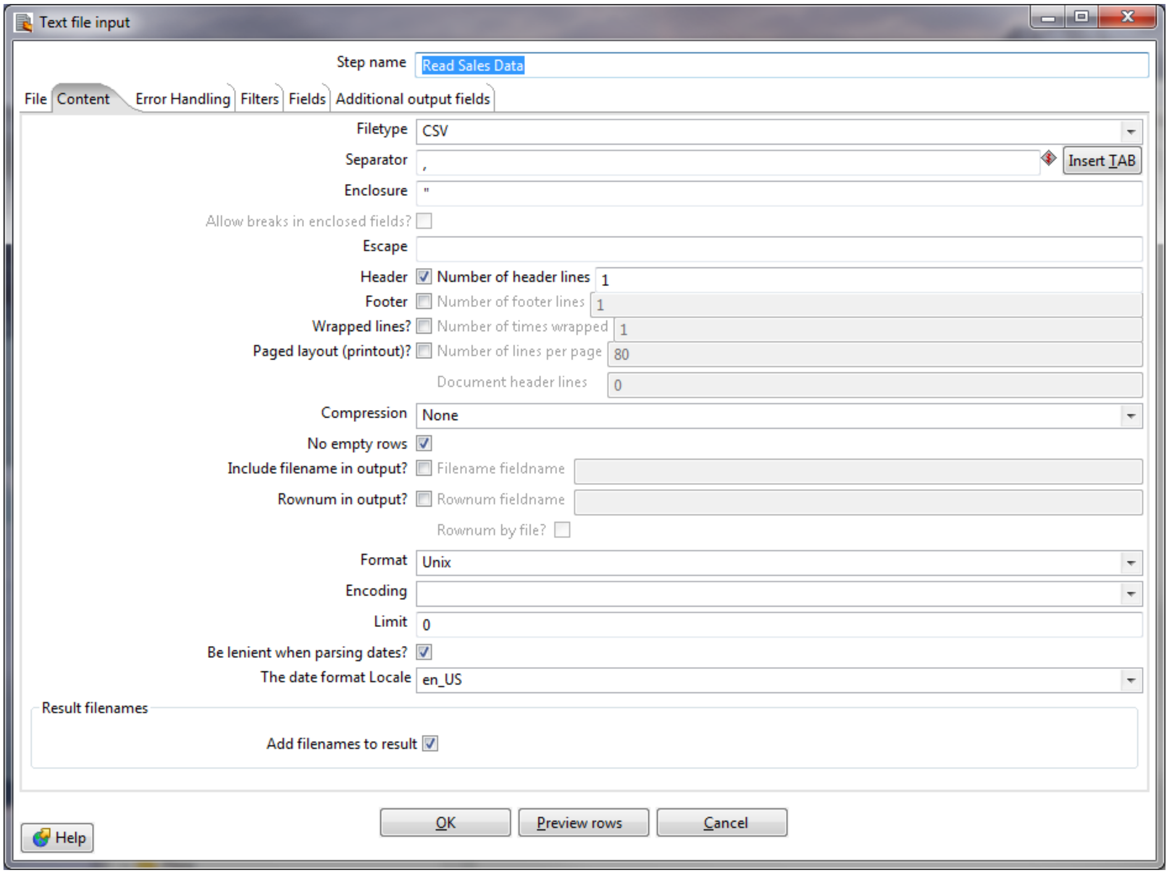
4. In the **Step Name** field, type **Read Sales Data**. This renames the **Text file input** step to **Read Sales Data**.
5. Click **Browse** to locate the source file, **sales_data.csv**, available at `...\design-tools\data-integration\samples\transformations\files`. Click **Open**. The path to the source file appears in the **File or directory** field.
6. Click **Add**. The path to the file appears under **Selected Files**.
7. To look at the contents of the sample file:
   a. Click the **Content** tab, then set the **Format** field to **Unix**.
   b. Click the **File** tab again and click the **Show file content** near the bottom of the window.
   c. The **Nr of lines to view** window appears. Click the **OK** button to accept the default.
   d. The **Content of first file** window displays the file. Examine the file to see how that input file is delimited, what enclosure character is used, and whether or not a header row is present. In the sample, the input file is comma (,) delimited, the enclosure character being a quotation mark (“) and it contains a single header row containing field names.

   e. Click the **Close** button to close the window.

8. To provide information about the content:

   a. Click the **Content** tab. The fields under the **Content** tab allow you to define how your data is formatted.

   b. Make sure that the **Separator** is set to comma (,) and that the **Enclosure** is set to quotation mark ("). Enable **Header** because there is one line of header rows in the file.



Text file input

Step name: Read Sales Data

File | Content | Error Handling | Filters | Fields | Additional output fields

Filetype: CSV

Separator: , [Insert TAB]

Enclosure: "

Allow breaks in enclosed fields? □

Escape:

Header ☑ Number of header lines: 1

Footer □ Number of footer lines: 1

Wrapped lines? □ Number of times wrapped: 1

Paged layout (printout)? □ Number of lines per page: 80

Document header lines: 0

Compression: None

No empty rows ☑

Include filename in output? □ Filename fieldname:

Rownum in output? □ Rownum fieldname:

Rownum by file? □

Format: Unix

Encoding:

Limit: 0

Be lenient when parsing dates? ☑

The date format Locale: en_US

Result filenames

Add filenames to result ☑

9. Click the **Fields** tab and click **Get Fields** to retrieve the input fields from your source file. When the **Nr of lines to sample** window appears, enter **0** in the field then click **OK**.

10. If the **Scan Result** window displays, click **OK** to close it.

11. To verify that the data is being read correctly:

    a. Click **Preview Rows**.

    b. In the **Enter preview size** window click **OK**. The **Examine preview data** window appears.

    c. Review the data, then click **Close**.

12. Click **OK** to save the information that you entered in the step.

13. To save the transformation, do these things.

    a. Select **File > Save** to save the transformation.

    b. The **Transformation Properties** window appears. In the **Transformation Name** field, type **Getting Started Transformation**.

    c. In the **Directory** field, click the folder icon.

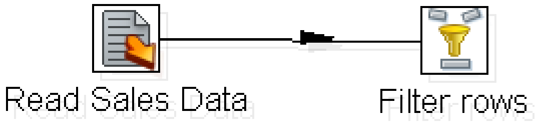
    d. Expand the **Home** directory and double-click the folder in which you want to save the transformation. Your transformation is saved in the DI Repository.

e. Click **OK** to close the **Transformation Properties** window. When prompted for a comment, enter one then click **OK.** Your comment is stored for version control purposes in the DI Repository.

# Filter Records with Missing Postal Codes

After completing Retrieve Data from a Flat File, you are ready to add the next step to your transformation. The source file contains several records that are missing postal codes. Use the Filter Rows transformation step to separate out those records so that you can resolve them in a later exercise.

1. Add a **Filter Rows** step to your transformation. Under the **Design** tab, select **Flow** > **Filter Rows**.
2. Create a hop between the **Read Sales Data** step and the **Filter Rows** step. Hops are used to describe the flow of data in your transformation. To create the hop, click the **Read Sales Data** (Text File input) step, then press the <**SHIFT**> key down and draw a line to the Filter Rows step.

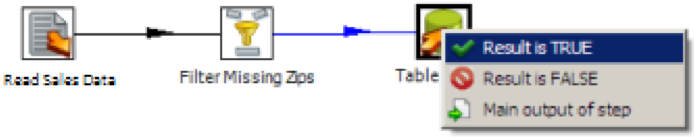


3. Double-click the **Filter Rows** step. The **Filter Rows** window appears.
4. In the **Step Name** field type, **Filter Missing Zips**.
5. Under **The condition**, click <field>. The **Fields** window appears. These are the conditions you can select.
6. In the **Fields** window select **POSTALCODE** and click **OK**.
7. Click on the comparison operator (set to = by default) and select the **IS NOT NULL** from the **Functions:** window that appears.
8. Click **OK** to close the **Functions:** window.
9. Click **OK** to exit the **Filter Rows** window.
   Note: You will return to this step later and configure the **Send true data to step** and **Send false data to step** settings after adding their target steps to your transformation.
10. Select **File** > **Save** to save your transformation.

# Loading Your Data into a Relational Database

After completing Filter Records with Missing Postal Codes, you are ready to take all records exiting the **Filter rows** step where the **POSTALCODE** was not null (the **true** condition), and load them into a database table.

1. Under the **Design** tab, expand the contents of the **Output** node.
2. Click and drag a **Table Output** step into your transformation. Create a hop between the **Filter Missing Zips** and **Table Output** steps. In the dialog that appears, select **Result is TRUE**.



3. Double-click the **Table Output** step to open its edit properties dialog box.
4. Rename your Table Output Step to **Write to Database**.
5. Click **New** next to the **Connection** field. You must create a connection to the database. The Database Connection dialog box appears.
6. Provide the settings for connecting to the database.

| **Connection Name** | Sample Data |
|---|---|
| **Connection Type:** | H2 |
| **Host Name** | localhost |
| **Database Name** | sampledata |
| **Port Number** | 9092 |
| **User Name** | sa |
| **Password** | Leave this blank. No password required to connect to this database. |

7. Click **Test** to make sure your entries are correct. A success message appears. Click **OK**.
   Note: If you get an error when testing your connection, ensure that you have provided the correct settings information as described in the table and that the sample database is running. See Starting the Data Integration Server for information about how to start the Data Integration Servers.
8. Click **OK**, to exit the **Database Connections** window.
9. Type **SALES_DATA** in the **Target Table** text field.

10. Since this table does not exist in the target database, you will need use the software to generate the Data Definition Language (DDL) to create the table and execute it. DDLs are the SQL commands that define the different structures in a database such as CREATE TABLE.
    a. In the **Table Output** window, enable the **Truncate Table** property.
    b. Click the **SQL** button at the bottom of the **Table output** dialog box to generate the DDL for creating your target table.
    c. The **Simple SQL editor** window appears with the SQL statements needed to create the table.
    d. Click **Execute** to execute the SQL statement.
    e. The **Results of the SQL statements** window appears.  Examine the results, then click **OK** to close the **Results of the SQL statements** window.
    f. Click **Close** in the **Simple SQL editor** window to close it.
    g. Click **OK** to close the **Table output** window.
11. Save your transformation.

# Retrieving Data from Your Lookup File

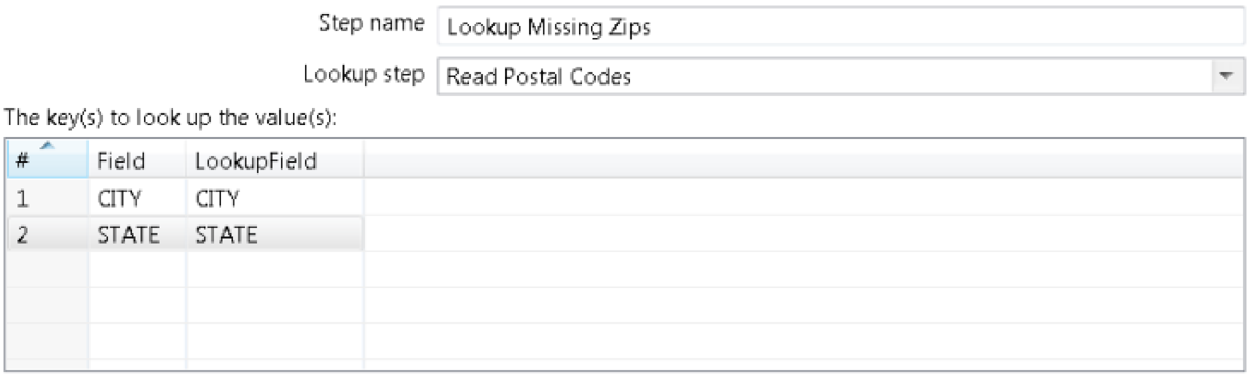
After you Load Your Data into a Relational Database, you are ready to retrieve data from your lookup file. You have been provided a second text file containing a list of cities, states, and postal codes that you will now use to look up the postal codes for all of the records where they were missing (the ‘false’ branch of your Filter rows step). First, you will use a Text file input step to read from the source file, then you will use a Stream lookup step to bring the resolved Postal Codes into the stream.

1. Add a new **Text File Input** step to your transformation. In this step you will retrieve the records from your lookup file.  Do not add a hop yet.
2. Open the **Text File Input** step window, then enter **Read Postal Codes** in the **Step name** window.
3. Click **Browse** to locate the source file, **`Zipssortedbycitystate.csv`**, located at `...\design-tools\data-integration\samples\transformations\files`.
4. Click **Add**. The path to the file appears under **Selected files**.
5. To look at the contents of the sample file:
    1. Click the **Content** tab, then set the **Format** field to **Unix**.
    2. Click the **File** tab again and click the **Show file content** near the bottom of the window.
    3. The **Nr of lines to view** window appears.  Click the **OK** button to accept the default.
    4. The **Content of first file** window displays the file.  Examine the file to see how that input file is delimited, what enclosure character is used, and whether or not a header row is present. In the example, the input file is comma (,) delimited, the enclosure character being a quotation mark (“) and it contains a single header row containing field names.
    5. Click the **Close** button to close the window.
6. In the **Content** tab, change the **Separator** character to a comma (,). and confirm that the **Enclosure** setting is a quotation mark (").   Make sure the **Header** option is selected.
7. Under the **Fields** tab, click **Get Fields** to retrieve the data from your .csv file.
8. The **Nr of lines to sample** window appears. Enter 0 in the field, then click **OK.**
9. If the **Scan Result** window displays, click **OK** to close it.
10. Click **Preview rows** to make sure your entries are correct.  When prompted to enter the preview size, click **OK**.  Review the information in the window, then click **Close.**
11. Click **OK** to exit the **Text File input** window.
12. Save the transformation.

# Resolving Missing Zip Code Information

After you Retrieve Data from your Lookup File, you can begin to resolve the missing zip codes.

1. Add a **Stream Lookup** step to your transformation. To do this, click the **Design** tab, then expand the **Lookup** folder and choose **Stream Lookup**.
2. Draw a hop from the **Filter Missing Zips** to the **Stream lookup** step. In the dialog box that appears, select **Result is FALSE**.
3. Create a hop from the **Read Postal Codes** step to the **Stream lookup** step.
4. Double-click on the **Stream lookup** step to open the **Stream Value Lookup** window.
5. Rename **Stream Lookup** to **Lookup Missing Zips**.
6. From the **Lookup step** drop-down box, select **Read Postal Codes** as the lookup step.
7. Define the **CITY** and **STATE** fields in the **key(s) to look up the value(s)** table. Click the drop down in the **Field** column and select **CITY**. Then, click in the **LookupField** column and select **CITY**. Perform the same actions to define the second key based on the **STATE** fields coming in on the source and lookup streams:

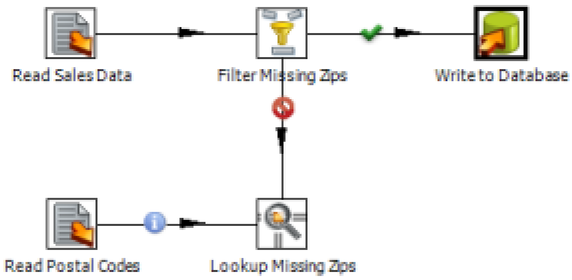


Step name: Lookup Missing Zips

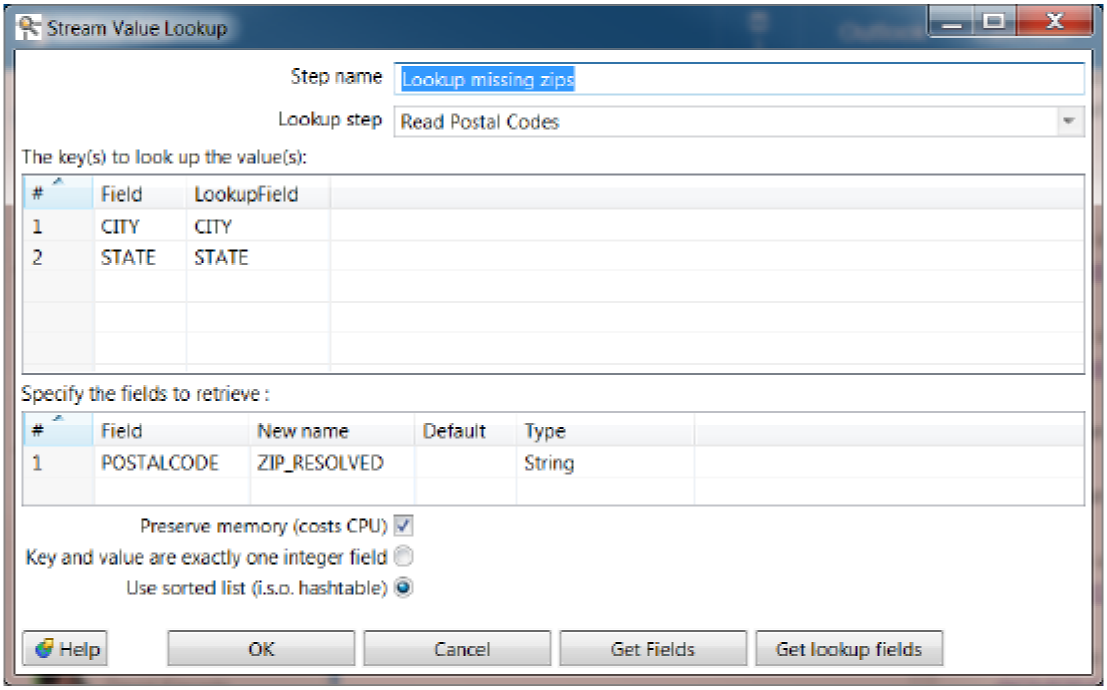
Lookup step: Read Postal Codes

The key(s) to look up the value(s):

| # | Field | LookupField |
|---|---|---|
| 1 | CITY | CITY |
| 2 | STATE | STATE |



8. Click **Get Lookup Fields**.
9. **POSTALCODE** is the only field you want to retrieve. To delete the **CITY** and **STATE** lines, right-click in the line and select **Delete Selected Lines**.
10. Give **POSTALCODE** a new name of **ZIP_RESOLVED** and make sure the **Type** is set to **String**.
11. Click **OK** to close the **Stream Value Lookup** edit properties dialog box.



Stream Value Lookup

Step name: Lookup missing zips

Lookup step: Read Postal Codes

The key(s) to look up the value(s):

| # | Field | LookupField |
|---|---|---|
| 1 | CITY | CITY |
| 2 | STATE | STATE |

Specify the fields to retrieve :

| # | Field | New name | Default | Type |
|---|---|---|---|---|
| 1 | POSTALCODE | ZIP_RESOLVED | | String |

Preserve memory (costs CPU) ☑

Key and value are exactly one integer field ○

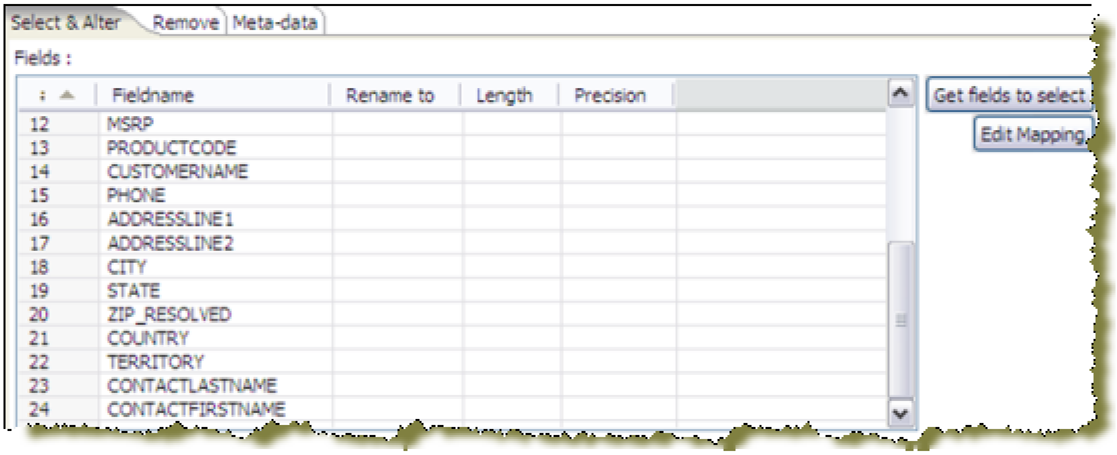
Use sorted list (i.s.o. hashtable) ●

12. Save your transformation.
13. To preview the data:
    a. In the canvas, select the **Lookup Missing Zips** step then right-click and select **Preview.**
    b. In the **Transformation debug dialog** window, click **Quick Launch** to preview the data flowing through this step.
    c. The **Examine preview data** window appears. Notice that the new field, **ZIP_RESOLVED**, has been added to the stream containing your resolved postal codes.
    d. Click **Close** to close the window.
    e. If the **Select the preview step** window appears, click the **Close** button.
    f. Note that the execution results near the bottom of the **Spoon** window shows updated metrics in the **Step Metrics** tab.

# Completing Your Transformation

After you resolve missing zip code information, the last task is to clean up the field layout on your lookup stream. Cleaning up makes it so that it matches the format and layout of your other stream going to the **Write to Database** step. Create a **Select values** step for renaming fields on the stream, removing unnecessary fields, and more.

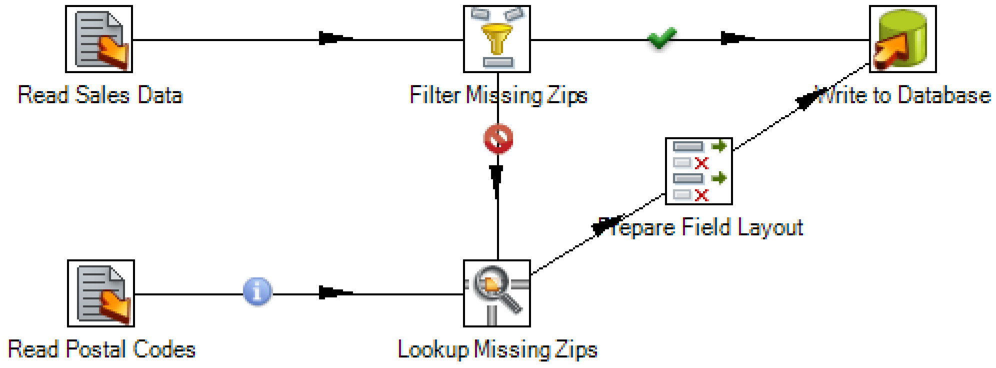
1. Add a **Select Values** step to your transformation by expanding the **Transform** folder and choosing **Select Values**.
2. Create a hop from the **Lookup Missing Zips** to the **Select Values** step.
3. Double-click the **Select Values** step to open its properties dialog box.
4. Rename the Select Values step to **Prepare Field Layout**.
5. Click **Get fields to select** to retrieve all fields and begin modifying the stream layout.
6. Select the **ZIP_RESOLVED** field in the **Fields** list and use <**CTRL**><**UP**> to move it just below the **POSTALCODE** field (the one that still contains null values).
7. Select the old **POSTALCODE** field in the list (line 20) and delete it.



Fields :

| # | Fieldname | Rename to | Length | Precision |
|---|---|---|---|---|
| 12 | MSRP | | | |
| 13 | PRODUCTCODE | | | |
| 14 | CUSTOMERNAME | | | |
| 15 | PHONE | | | |
| 16 | ADDRESSLINE1 | | | |
| 17 | ADDRESSLINE2 | | | |
| 18 | CITY | | | |
| 19 | STATE | | | |
| 20 | ZIP_RESOLVED | | | |
| 21 | COUNTRY | | | |
| 22 | TERRITORY | | | |
| 23 | CONTACTLASTNAME | | | |
| 24 | CONTACTFIRSTNAME | | | |

8. The original POSTALCODE field was formatted as an 9-character string. You must modify your new field to match the form. Click the **Meta-Data** tab.
9. In the first row of the **Fields to alter table the meta-data for** section, click in the **Fieldname** column and select **ZIP_RESOLVED**.
10. Type **POSTALCODE** in the **Rename** to column; select **String** in the Type column, and type **9** in the **Length** column. Click **OK** to exit the edit properties dialog box.
11. Draw a hop from the **Prepare Field Layout** (Select values) step to the **Write to Database** (Table output) step.
12. When prompted, select the **Main output of the step** option.
13. Save your transformation.


Read Sales Data
Filter Missing Zips
Write to Database
Prepare Field Layout
Read Postal Codes
Lookup Missing Zips

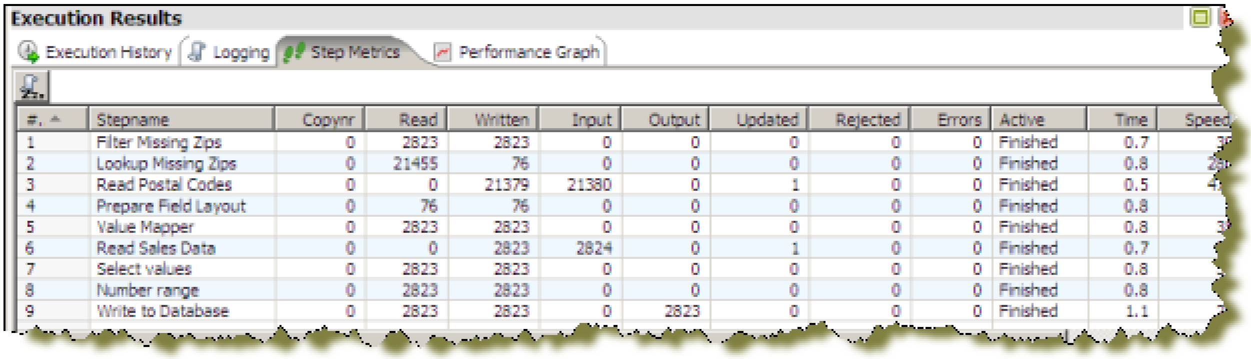
# Run Your Transformation

Pentaho Data Integration provides a number of deployment options depending on the needs of your ETL project in terms of performance, batch load window, and your other needs. The three most common approaches are:

| | |
|---|---|
| **Local execution** | Allows you to execute a transformation or job from within the Spoon design environment on your local machine. This is ideal for designing and testing transformations or lightweight ETL activities |
| **Execute remotely** | For more demanding ETL activities, consider setting up a dedicated Enterprise Edition Data Integration Server and using the Execute remotely option in the run dialog. The Enterprise Edition Data Integration Server also enables you to schedule execution in the future or on a recurring basis. |
| **Execute clustered** | For even greater scalability or as an option to reduce your execution times, Pentaho Data Integration also supports the notion of clustered execution allowing you to distribute the load across a number of data integration servers. |

This final part of the creating a transformation exercise focuses exclusively on the local execution option.

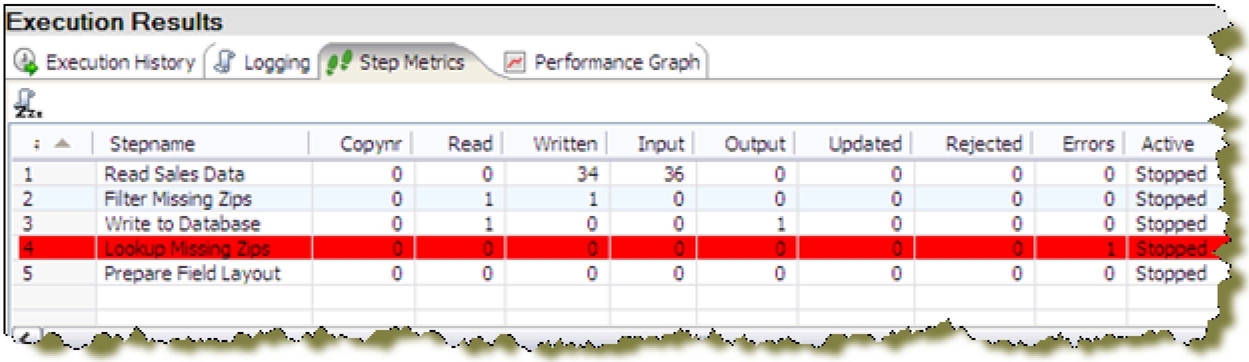
1. In the **Spoon** window, select **Action** > **Run This Transformation**.
2. The **Execute a transformation** window appears. You can run a transformation locally, remotely, or in a clustered environment. For the purposes of this exercise, keep the default as **Local Execution**.
3. Click **Launch**. The transformation executes. Upon running the transformation, the **Execution Results** panel opens below the canvas.



| #. | Stepname | Copynr | Read | Written | Input | Output | Updated | Rejected | Errors | Active | Time | Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Filter Missing Zips | 0 | 2823 | 2823 | 0 | 0 | 0 | 0 | 0 | Finished | 0.7 | 3 |
| 2 | Lookup Missing Zips | 0 | 21455 | 76 | 0 | 0 | 0 | 0 | 0 | Finished | 0.8 | 2 |
| 3 | Read Postal Codes | 0 | 0 | 21379 | 21380 | 0 | 1 | 0 | 0 | Finished | 0.5 | 4 |
| 4 | Prepare Field Layout | 0 | 76 | 76 | 0 | 0 | 0 | 0 | 0 | Finished | 0.8 | |
| 5 | Value Mapper | 0 | 2823 | 2823 | 0 | 0 | 0 | 0 | 0 | Finished | 0.8 | 3 |
| 6 | Read Sales Data | 0 | 0 | 2823 | 2824 | 0 | 1 | 0 | 0 | Finished | 0.7 | |
| 7 | Select values | 0 | 2823 | 2823 | 0 | 0 | 0 | 0 | 0 | Finished | 0.8 | |
| 8 | Number range | 0 | 2823 | 2823 | 0 | 0 | 0 | 0 | 0 | Finished | 0.8 | |
| 9 | Write to Database | 0 | 2823 | 2823 | 0 | 2823 | 0 | 0 | 0 | Finished | 1.1 | |

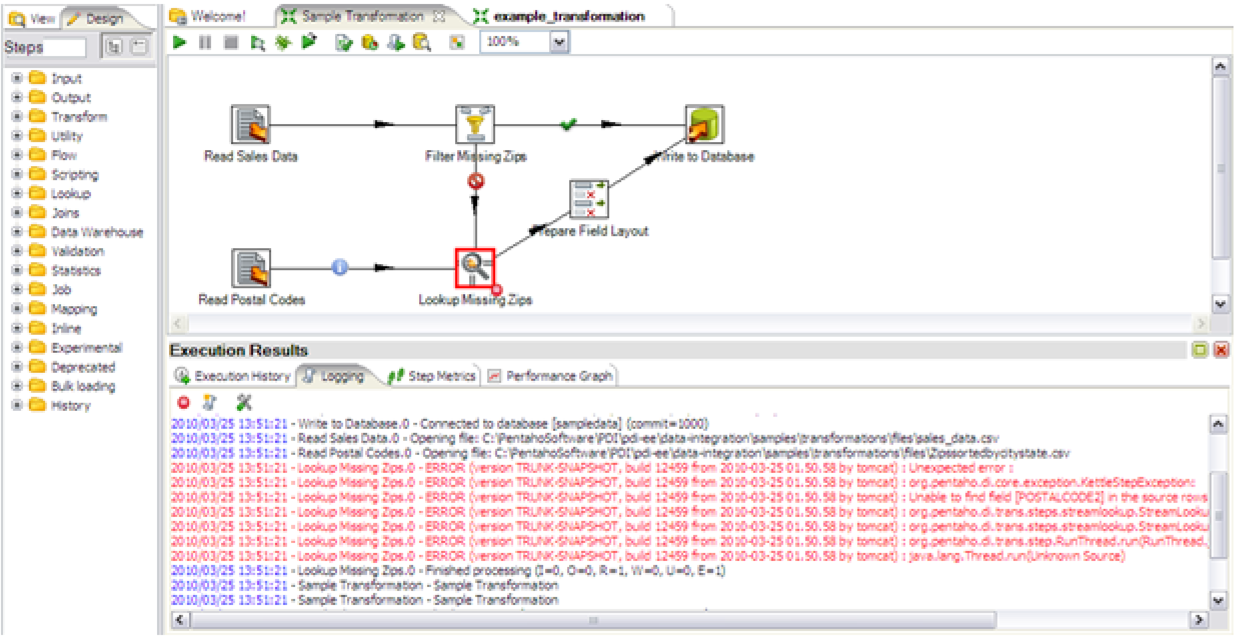
4. The **Execution Results** section of the window contains several different tabs that help you to see how the transformation executed, pinpoint errors, and monitor performance.

- **Step Metrics** tab provides statistics for each step in your transformation including how many records were read, written, caused an error, processing speed (rows per second) and more.  This tab also indicates whether an error occured in a transformation step.  We did not intentionally put any errors in this tutorial so it should run correctly.  But, if a mistake had occured, steps that caused the transformation to fail would be highlighed in red.  In the example below, the **Lookup Missing Zips** step caused an error.



| # | Stepname | Copynr | Read | Written | Input | Output | Updated | Rejected | Errors | Active |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Read Sales Data | 0 | 0 | 34 | 36 | 0 | 0 | 0 | 0 | Stopped |
| 2 | Filter Missing Zips | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Stopped |
| 3 | Write to Database | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | Stopped |
| 4 | Lookup Missing Zips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Stopped |
| 5 | Prepare Field Layout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Stopped |

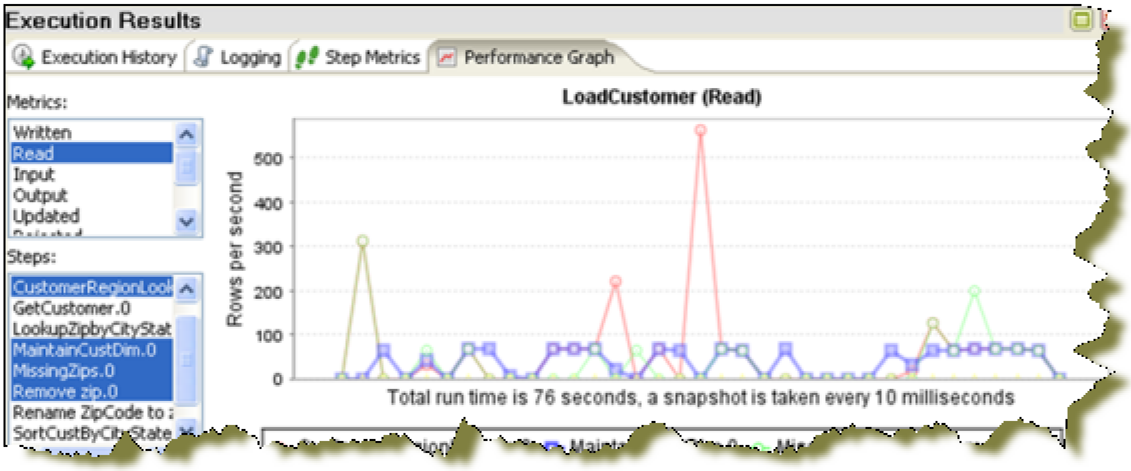
- The **Logging** tab displays the logging details for the most recent execution of the transformation. It also allows you to drill deeper to determine where errors occur.  Error lines are highlighted in red.  In the example below, the **Lookup Missing Zips** step caused an error because it attempted to lookup values on a field called **POSTALCODE2**, which did not exist in the lookup stream.



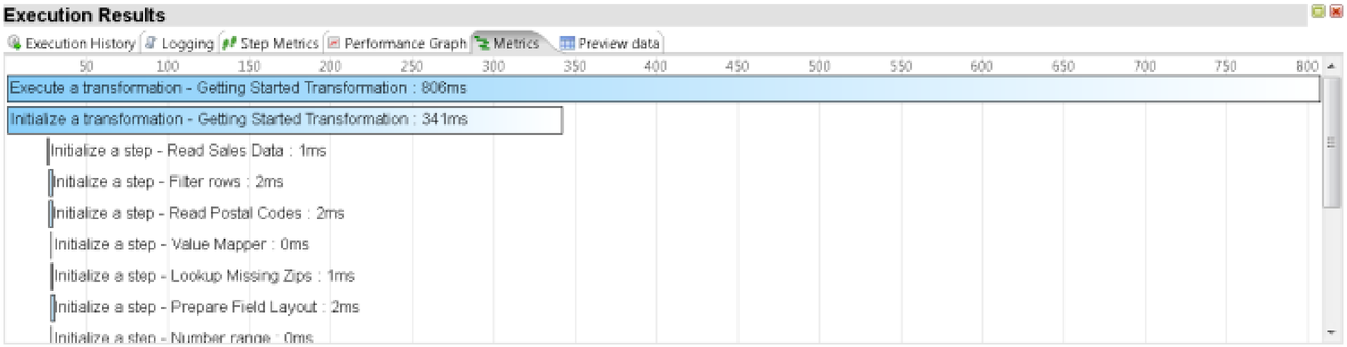
```
2010/03/25 13:51:21 - Write to Database.0 - Connected to database [sampledata] (commit=1000)
2010/03/25 13:51:21 - Read Sales Data.0 - Opening file: C:\PentahoSoftware\PDI\pdi-ee\data-integration\samples\transformations\files\sales_data.csv
2010/03/25 13:51:21 - Read Postal Codes.0 - Opening file: C:\PentahoSoftware\PDI\pdi-ee\data-integration\samples\transformations\files\Zipssortedbycitystate.csv
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : Unexpected error :
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : org.pentaho.di.core.exception.KettleStepException:
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : Unable to find field [POSTALCODE2] in the source rows
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : org.pentaho.di.trans.steps.streamlookup.StreamLooku
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : org.pentaho.di.trans.steps.streamlookup.StreamLooku
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : org.pentaho.di.trans.step.RunThread.run(RunThread.
2010/03/25 13:51:21 - Lookup Missing Zips.0 - ERROR (version TRUNK-SNAPSHOT, build 12459 from 2010-03-25 01.50.58 by tomcat) : java.lang.Thread.run(Unknown Source)
2010/03/25 13:51:21 - Lookup Missing Zips.0 - Finished processing (I=0, O=0, R=1, W=0, U=0, E=1)
2010/03/25 13:51:21 - Sample Transformation - Sample Transformation
2010/03/25 13:51:21 - Sample Transformation - Sample Transformation
```

- The **Execution History** tab provides you access to the Step Metrics and log information from previous executions of the transformation. This feature works only if you have configured your transformation to log to a database through the Logging tab of the Transformation Settings dialog. For more information on configuring logging or viewing the execution history, see Create DI Solutions.

- The **Performance Graph** allows you to analyze the performance of steps based on a variety of metrics including how many records were read, written, caused an error, processing speed (rows per second) and more.  Like the Execution History, this feature requires you to configure your transformation to log to a database through the **Logging** tab of the **Transformation Settings** dialog box.



- The **Metrics tab** allows you to see a Gantt charter after the transformation or job has run. This shows you information such as how long it takes to connect to a database, how much time is spent executing a SQL query, or how long it takes to load a transformation.



Execute a transformation - Getting Started Transformation : 806ms

Initialize a transformation - Getting Started Transformation : 341ms

Initialize a step - Read Sales Data : 1ms

Initialize a step - Filter rows : 2ms

Initialize a step - Read Postal Codes : 2ms

Initialize a step - Value Mapper : 0ms

Initialize a step - Lookup Missing Zips : 1ms

Initialize a step - Prepare Field Layout : 2ms

Initialize a step - Number range : 0ms

- The **Preview Data** tab displays a preview of the data.

# Create Jobs

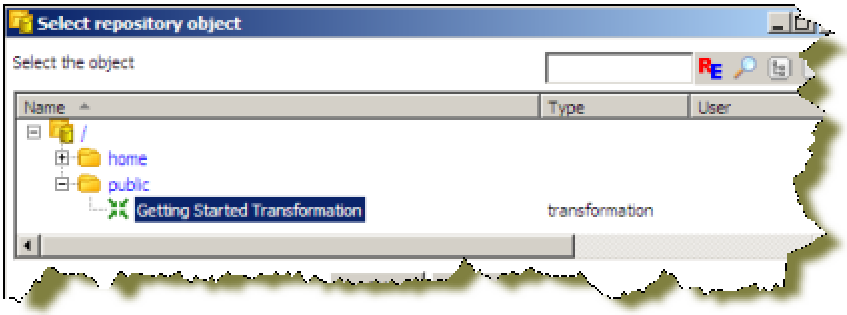
Jobs are used to coordinate ETL activities such as:

- Defining the flow and dependencies for what order transformations should be run
- Preparing for execution by checking conditions such as, "Is my source file available?," or "Does a table exist?"
- Performing bulk load database operations
- File Management such as posting or retrieving files using FTP, copying files and deleting files
- Sending success or failure notifications through email

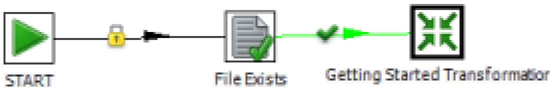
For this exercise, imagine that an external system is responsible for placing your **sales_data.csv** input in its source location every Saturday night at 9 p.m. You want to create a job that will check to see that the file has arrived and run your transformation to load the records into the database. In a subsequent exercise, you will schedule the job to be run every Sunday morning at 9 a.m.

To complete this exercise, you must have completed the exercises in the Create Transformations section.

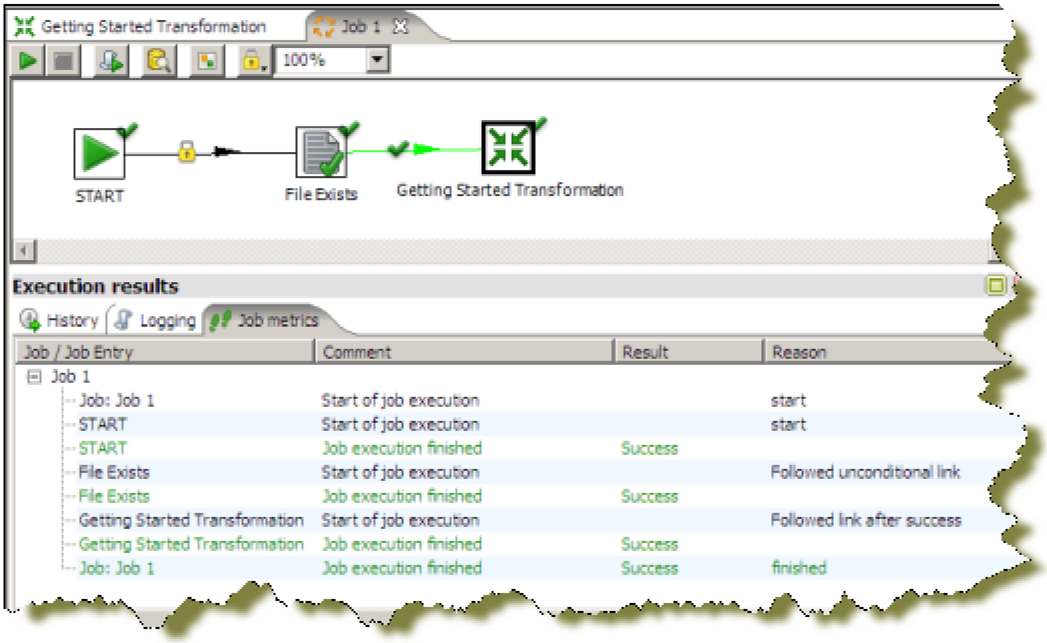
1. Go to **File** > **New** > **Job**.
2. Expand the **General** folder and drag a **Start** job entry onto the graphical workspace. The **Start** job entry defines where the execution will begin.
3. Expand the **Conditions** folder and add a **File Exists** job entry.
4. Draw a hop from the **Start** job entry to the **File Exists** job entry.
5. Double-click the **File Exists** job entry to open its edit properties dialog box. Click **Browse** and select the **`sales_data.csv`** from the following location: `...\design-tools\data-integration\samples\transformations\files`. Be sure to set the filter to CSV files to see the file.
6. Click **OK** to exit from the **Open File** window.
7. Click **OK** to exit from the **Check if a file exists ...** window.
8. In Spoon, expand the **General** folder and add a **Transformation** job entry.
9. Draw a hop between the **File Exists** and the **Transformation** job entries.
10. Double-click the **Transformation** job entry to open its edit properties dialog box.
11. Select the **Specify by name and directory** option. Click **Select a transformation to run from the current repository** button.  The **Select repository object** window opens.
12. Expand the repository tree to find your sample transformation. Select it and click **OK**.



13. Save your job as **Sample Job**.



14. Click **Run Job**. When the **Execute a Job** dialog box appears, choose **Local Execution** and click **Launch**. The **Execution Results** panel should open showing you the job metrics and log information for the job execution.

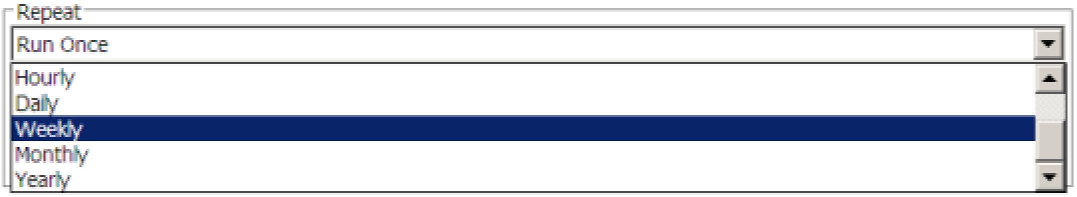


| Job / Job Entry | Comment | Result | Reason |
|---|---|---|---|
| Job 1 | | | |
| Job: Job 1 | Start of job execution | | start |
| START | Start of job execution | | start |
| START | Job execution finished | Success | |
| File Exists | Start of job execution | | Followed unconditional link |
| File Exists | Job execution finished | Success | |
| Getting Started Transformation | Start of job execution | | Followed link after success |
| Getting Started Transformation | Job execution finished | Success | |
| Job: Job 1 | Job execution finished | Success | finished |

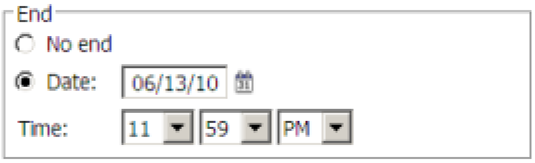
# Schedule Jobs

The Enterprise Edition of the DI Server provides scheduling services that allow you to schedule the execution of jobs and transformations in the future or on a recurring basis. In this example, you will create a schedule that runs your **Sample Job** every Sunday morning at 9 o'clock.

1. Open your sample job.
2. In the menubar, select **Action** > **Schedule**. The **Schedule** window appears.
3. For the **Start** option, select the **Date**, click the calendar icon. When the calendar appears, choose the next **Sunday**.
4. Click **OK**.
5. Under the **Repeat** section, select the **Weekly** option. Enable the **Sunday** check box.



6. For the **End** date, select **Date** and then enter a date several weeks in the future using the calendar picker.


End
○ No end
● Date: 06/13/10
Time: 11 59 PM

7. Click **OK** to complete your schedule.
   Note: The scheduler includes full support for PDI's parameters, arguments, and variables. For more detailed information on scheduling options, please refer to Schedule and Script PDI Content.
8. To view, edit and manage all scheduled activities, click the **Schedule** perspective on the main toolbar. In the **Schedule perspective** you can view a list of all schedules along with information such as when the next scheduled run will take place, when the last run took place and its duration and who scheduled the activity.
9. If the scheduler is stopped, you must click **Start Scheduler** on the sub-toolbar. If the button appears with a red stop icon, the scheduler is already running. Your scheduled activity will take place as indicated at the **Next Run** time.
   Note: You can also start and stop individual schedules by selecting them in the table and using the Start and Stop buttons on the sub-toolbar.

# Building Business Intelligence Solutions Using Agile BI

Historically, starting new Business Intelligence projects required careful consideration of a broad set of factors including:

### Data Considerations

- Where is my data coming from?
- Where will it be stored?
- What cleansing and enrichment is necessary to address the business needs?

### Information Delivery Consideration

- Will information be delivered through static content like pre-canned reports and dashboards?
- Will users need the ability to build their own reports or perform interactive analysis on the data?

### Skill Set Considerations

- If users need self-service reporting and analysis, what skill sets do you expect them to have?
- Assuming the project involves some combination of ETL, content creation for reports and dashboards, and meta-data modeling to enable business users to create their own content, do we have all the tools and skill sets to build the solution in a timely fashion?

### Cost

- How many tools and from how many vendors will it take to implement the total solution?
- If expanding the use of a BI tool already in house, what are the additional licensing costs associated with rolling it out to a new user community?
- What are the costs in both time and money to train up on all tools necessary to roll out the solution?
- How long is the project going to take and when will we start seeing some ROI?

Because of this, many new projects are abandoned before they even begin. Pentaho's Agile BI initiative seeks to break down the barriers to expanding your use of Business Intelligence through an iterative approach to scoping, prototyping, and building complete BI solutions. It is an approach that centers on the business needs first, empowers the business users to get involved at every phase of development, and prevents projects from going completely off track from the original business goals.

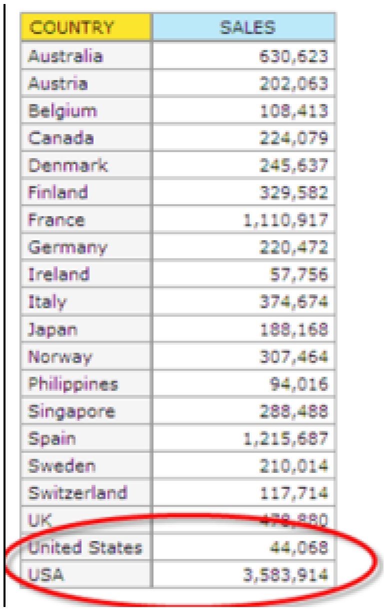
In support of the Agile BI methodology, the Spoon design environment provides an integrated design environment for performing all tasks related to building a BI solution including ETL, reporting and OLAP metadata modeling and end user visualization. In a single click, Business users will instantly be able to start interacting with data, building reports with zero knowledge of SQL or MDX, and work hand-in-hand with solution architects to refine the solution.

# Use Agile BI

This exercise builds upon your sample transformation and highlights the power an integrated design environment can provide for building solutions using Agile BI.

For this example, your business users have asked to see what are the top 10 countries based on sales. Furthermore, they want the data broken down by deal size where small deals are those less than $3,000, medium sized deals are between $3,000 and $7,000, and large deals are over $7,000.

1. Open or select the tab containing the sample transformation you just created in Create Transformations.
2. Right-click the **Write to Database** step, and select **Visualize** > **Analyzer**. In the background, PDI automatically generates the OLAP model that allows you to begin interacting immediately with your new data source.
3. Drag the **COUNTRY** field from the **Field** list on the left onto the report.
4. Drag the **SALES** measure from the **Field** list onto the report.  Immediately you can see that there is another problem with the quality of the data. Some records being loaded into the database have a COUNTRY value of *United States*, while others have a value of *USA*. In the next steps, you return to the **Data Integration** perspective to resolve this issue.

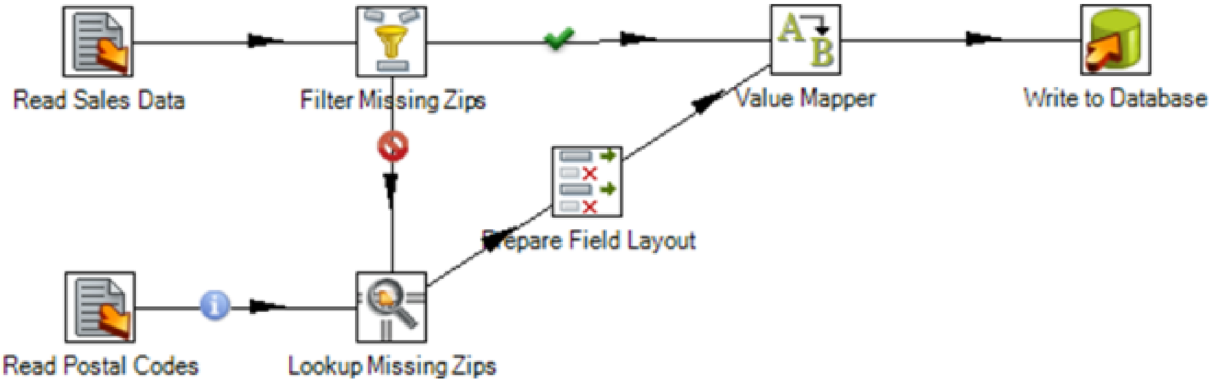


| COUNTRY | SALES |
|---|---|
| Australia | 630,623 |
| Austria | 202,063 |
| Belgium | 108,413 |
| Canada | 224,079 |
| Denmark | 245,637 |
| Finland | 329,582 |
| France | 1,110,917 |
| Germany | 220,472 |
| Ireland | 57,756 |
| Italy | 374,674 |
| Japan | 188,168 |
| Norway | 307,464 |
| Philippines | 94,016 |
| Singapore | 288,488 |
| Spain | 1,215,687 |
| Sweden | 210,014 |
| Switzerland | 117,714 |
| UK | 478,880 |
| United States | 44,068 |
| USA | 3,583,914 |

# Correct Data Quality

Follow these instructions to correct the data quality issue.

1. Click on the **Data Integration** perspective in the main toolbar.
2. Right-click the **Write to Database** step from the flow and choose **Detach step**. Both hops are detached.
3. Expand the **Transform** folder in the **Design** tab and add a **Value Mapper** step to the transformation.
4. Draw a hop from the **Filter Missing Zips** step to the **Value Mapper** step and select **Result is TRUE**.
5. Draw a hop from the **Prepare Field Layout** step to the **Value Mapper** step. When prompted to select the output type, select **Main Output of Step**.
6. Draw a hop from the **Value Mapper** step to the **Write to Database** step.



7. Double-click the **Value Mapper** step to open its edit step properties dialog box.
8. In the **Fieldname to use** field, select **COUNTRY**.
9. In the first row of the **Field Values** table, type **United States** as the **Source value** and **USA** as the **Target value**. Click **OK** to exit the dialog box.
10. Save and run the transformation.
11. Click **Visualize** in the main toolbar.
12. Select the **More actions and options** button, then select **Administration > Clear Cache. When a note indicating that the Analyzer and Mondrian caches have been cleared, click OK.**
13. From the menu select **View > Show Visualization Properties**.
14. Click **Refresh** under the data section of the **Visualization Properties** data in the current view button near the top left of the report window. panel and notice that the data has been cleansed.

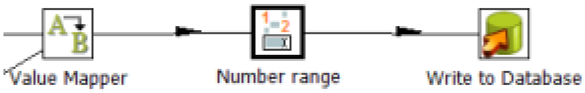
# Create a Top Ten Countries by Sales Chart

1. Right-click the **COUNTRY** header and select **Top 10**, and so on.
2. Confirm that the default settings are set to return the Top 10 **COUNTRY** members by the **SALES** measure. Click **OK**.
3. Click **Chart** and select **Stacked Bar** to change the visualization to a bar chart.

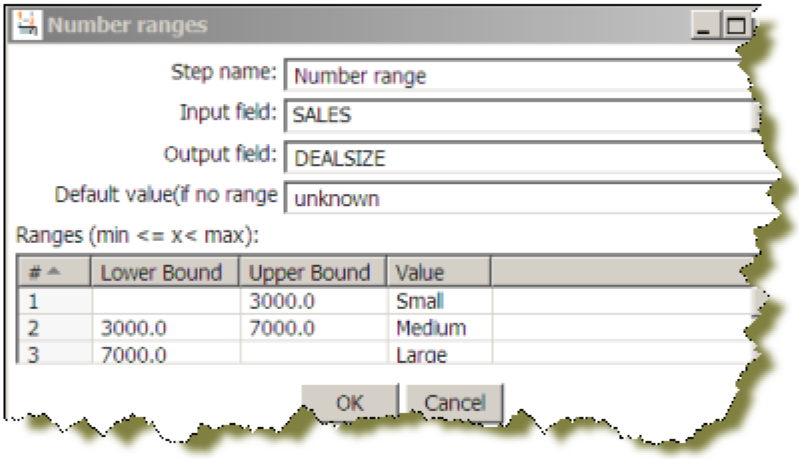
# Breaking Down Your Chart by Deal Size

Your source data does not contain an attribute for Deal Size. Use the **Data Integration** perspective to add this new field.

1. Click **Data Integration** in the main toolbar.
2. Expand the **Transform** folder and drag a **Number Range** step onto the graphical workspace between the **Value Mapper** step and the **Write to Database** (Table Output) step. Click **Yes** to split the hop. (You will need to click on the hop.)



3. Double-click **Number range** to open its edit properties dialog box.
4. Choose the **SALES** field as your Input field.
5. Type **DEALSIZE** as the name for the **Output** field.
6. In the **Ranges** table, define number ranges as shown in the example below. Click **OK**.



Step name: Number range

Input field: SALES

Output field: DEALSIZE

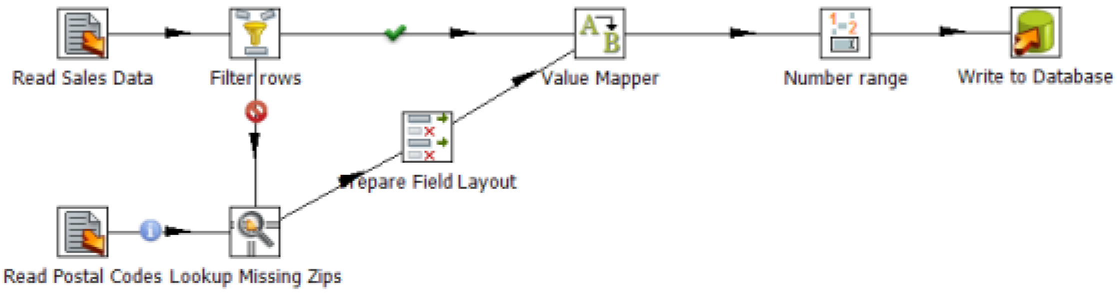
Default value(if no range unknown

Ranges (min <= x< max):

| # | Lower Bound | Upper Bound | Value |
|---|---|---|---|
| 1 | | 3000.0 | Small |
| 2 | 3000.0 | 7000.0 | Medium |
| 3 | 7000.0 | | Large |

Note: Because this step adds a new field into the stream, you must update your target database table to add the new column in the next steps.

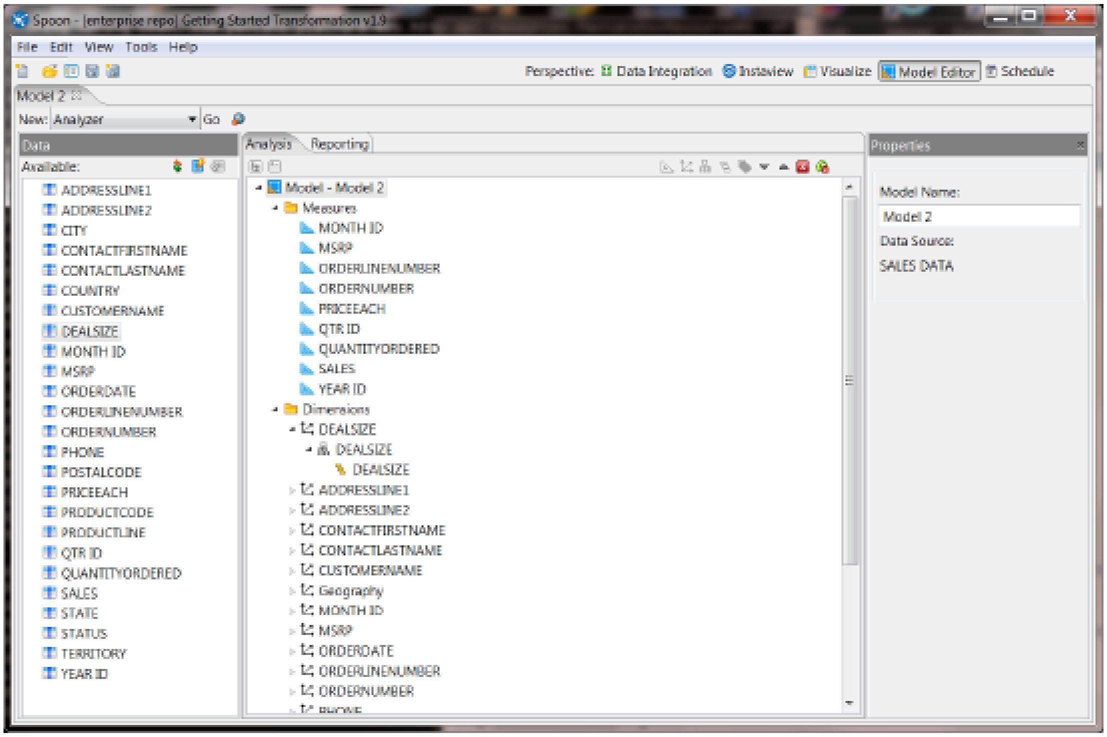
7. Double-click on the **Write to Database** (Table output) step.
8. Click **SQL** to generate the DDL necessary to update the target table.
9. Click **Execute** to run the SQL. Click **OK** to close the results dialog box. Click **Close** to exit the **Simple SQL Editor** dialog box. Click **OK** to close the edit step properties dialog.
10. Save and run your transformation to re-populate your target database.


Read Sales Data
Filter rows
Value Mapper
Number range
Write to Database
Prepare Field Layout
Read Postal Codes
Lookup Missing Zips

# Wrapping it Up

Follow these instructions to complete your Agile BI exercise:

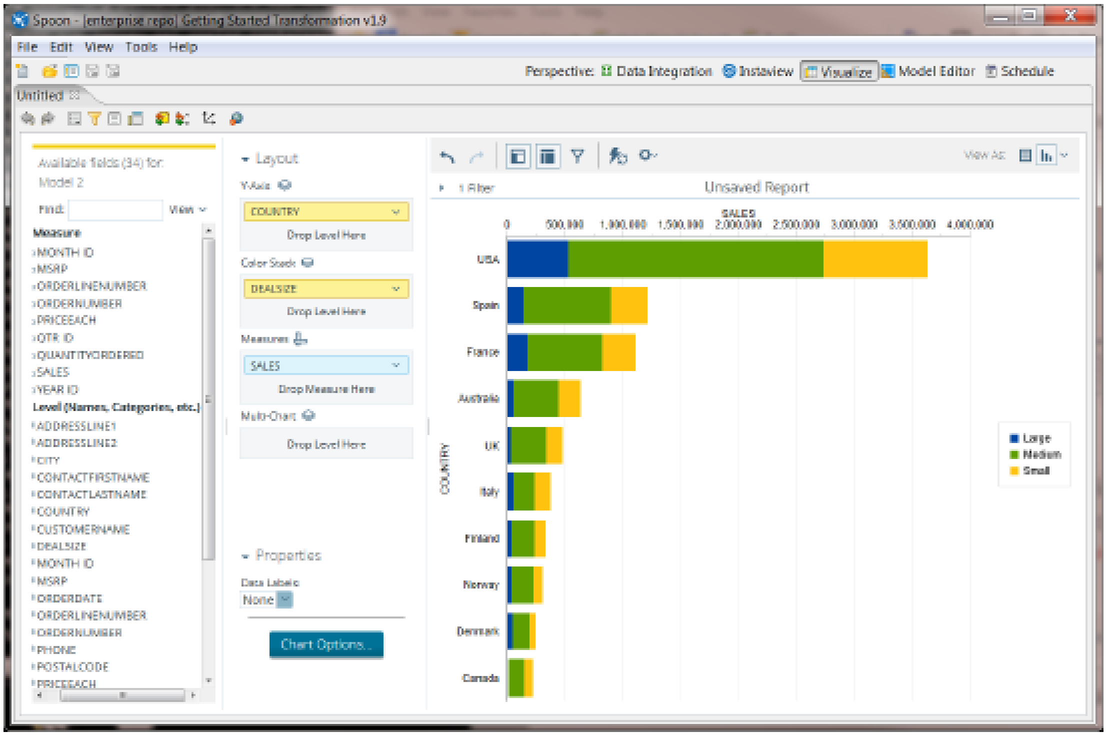
1. Click **Visualize** to return to your **Top 10 Countries** chart. Next, you will update your dimensional model with the new **Deal Size** attribute.
2. Click **View** in the **Visualizations Properties** to view the current model in the **Model Editor** perspective.
3. Click **Refresh Table Metadata**. The **DEALSIZE** field is listed as one of the available fields.
4. Drag the **DEALSIZE** field from the list of available fields on the left onto the Dimensions folder in the Model panel in the middle. This adds a new dimension called **DEALSIZE** with a single default hierarchy and level of the same name.



Model Name: Model 2

Data Source: SALES DATA

5. Click **Save** on the main toolbar to save your updated model. Click **Visualize** to return to your Top 10 Countries chart.
6. Click **Reload Current Model** to update your field list to include the new **DEALSIZE** attribute.
7. Click **Toggle Layout** to open the **Layout** panel.
8. Drag **DEALSIZE** from the field list on the left into the **Color Stack** section of the **Layout** panel.
9. Click **Toggle Layout** to close the Layout Panel. You have successfully delivered your business user’s request


Y-Axis COUNTRY

Color Stack DEALSIZE

Measures SALES

Multi-Chart Drop Level Here

Data Labels None

# Getting Started with PDI and Hadoop

Pentaho provides a complete big data analytics solution that supports the entire big data analytics process. From big data aggregation, preparation, and integration, to interactive visualization, analysis, and prediction, Pentaho allows you to harvest the meaningful patterns buried in big data stores. Analyzing your big data sets gives you the ability to identify new revenue sources, develop loyal and profitable customer relationships, and run your organization more efficiently and cost effectively.

# Pentaho, Big Data, and Hadoop

The term big data applies to very large, complex, or dynamic datasets that need to be stored and managed over a long time. To derive benefits from big data, you need the ability to access, process, and analyze data as it is being created. However, the size and structure of big data makes it very inefficient to maintain and process it using traditional relational databases.

Big data solutions re-engineer the components of traditional databases—data storage, retrieval, query, processing—and massively scales them.

## Pentaho Big Data Overview

Pentaho increases speed-of-thought analysis against even the largest of big data stores by focusing on the features that deliver performance.

- **Instant access**—Pentaho provides visual tools to make it easy to define the sets of data that are important to you for interactive analysis. These data sets and associated analytics can be easily shared with others, and as new business questions arise, new views of data can be defined for interactive analysis.
- **High performance platform**—Pentaho is built on a modern, lightweight, high performance platform. This platform fully leverages 64-bit, multi-core processors and large memory spaces to efficiently leverage the power of contemporary hardware.
- **Extreme-scale, in-memory caching**—Pentaho is unique in leveraging external data grid technologies, such as Infinispan and Memcached to load vast amounts of data into memory so that it is instantly available for speed-of-thought analysis.
- **Federated data integration**—Data can be extracted from multiple sources, including big data and traditional data stores, integrated together and then flowed directly into reports, without needing an enterprise data warehouse or data mart.

# About Hadoop

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage. Rather than rely on hardware to deliver high-availability, the library itself is designed to detect and handle failures at the application layer, so delivering a highly-available service on top of a cluster of computers, each of which may be prone to failures.

A Hadoop platform consists of a Hadoop kernel, a MapReduce model, a distributed file system, and often a number of related projects—such as Apache Hive, Apache HBase, and others.

A Hadoop Distributed File System, commonly referred to as HDFS, is a Java-based, distributed, scalable, and portable file system for the Hadoop framework.

# Big Data Resources

- Pentaho Big Data Analytics Center
- Pentaho Big Data Wiki
- Apache Hadoop project -- A project that contains libraries that allows for the distributed processing of large data sets across clusters of computers using simple programming models. There are several modules, including the Hadoop Distributed File System (HDFS), which is a distributed file system that provides high-throughput access to application data and Hadoop MapReduce, which is a key algorithm to distribute work around a cluster.
- Avro—A data serialization system
- Cassandra—A scalable multi-master database with no single points of failure
- HBase—A scalable, distributed database that supports structured data storage for large tables
- Hive—A data warehouse infrastructure that provides data summarization and on-demand querying
- Pig—A high-level, data-flow language and execution framework for parallel computation
- ZooKeeper—A high-performance coordination service for distributed applications
- MongoDB— A NoSQL open source document-oriented database  system developed and supported by 10gen
- Splunk - A data collection, visualization and indexing engine for operational intelligence that is developed by Splunk, Inc.
- CouchDB—A NoSQL open source document-oriented database  system developed and supported by Apache
- Sqoop—Software for transferring data between relational databases and Hadoop
- Oozie—A workflow scheduler system to manage Hadoop jobs

# Why Choose Enterprise Edition?

Enterprise Edition enables you to deploy Pentaho Data Integration with confidence, security, and far lower total cost of ownership than proprietary and open source alternatives. Benefits of Pentaho Data Integration Enterprise Edition include:

- Professional, Technical Support
- Enterprise Edition Features
- Certified Software Releases

# Professional, Technical Support

- Live support provided by a knowledgeable team of product experts that consistently rates higher in customer satisfaction than the BI megavendors
- Dedicated customer case triage providing faster response times and increased priority for customer reported defects and enhancements

# Enterprise Edition Features

- Enterprise security with granular control over content and actions that can be performed by users and roles. Enterprise security can be managed directly in Pentaho Data Integration Enterprise Edition or configured to integrate with your existing LDAP or Active Directory implementation
- Centralized content management facilitating team collaboration including secured sharing of content, content versioning (revision history), and transformation and job locking
- Integrated scheduler allowing you to schedule job and transformations for future or recurring execution; schedules are created and managed directly in the easy-to-use, graphical designer (Spoon)
- Additional transformation steps and job entries for integrating with third-party applications, messaging architectures and more

# Certified Software Releases

- All certified software releases go through rigorous quality testing and a managed release process to ensure the stability of your production deployments
- Only subscription customers get access to maintenance releases containing critical defect resolutions

Note: Binary distributions of Community Editions are provided with major product releases only. If you have a critical defect or improvement that has been addressed as part of a minor or patch release, you must wait for and upgrade to the next major release of Pentaho Data Integration.

Pricing for Pentaho Data Integration Enterprise Edition can be found at http://www.pentaho.com/explore/how-to-buy/. For more information or to start your subscription today, contact us at http://www.pentaho.com/contact/.