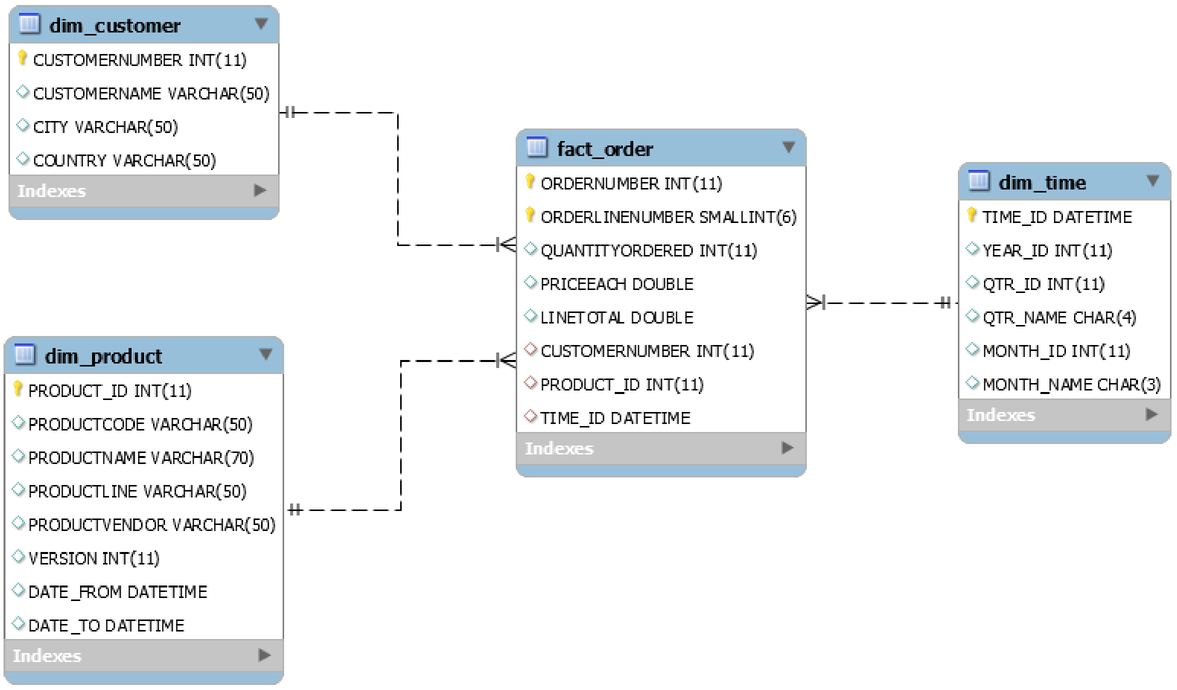
Data Analysis and Integration

Lab 8: Creating a Data Warehouse

In this lab, we are going to create a data warehouse from the steelwheels database. The data warehouse will have a star schema with one fact table and three dimension tables, as shown in the following figure:



The data warehouse will be created as a separate database (called **steelwheels_dw**) in MySQL. For convenience, the SQL instructions needed to create the data warehouse tables are already provided in the script **steelwheels_dw.sql**.

Creating the data warehouse

1. Download the file **steelwheels_dw.sql**.

2. Take a moment to inspect the contents of the **steelwheels_dw.sql** script.
   - Locate the CREATE DATABASE statement.
   - Locate all CREATE TABLE statements.
   - Check the columns and data types for each table.
   - Check the primary and foreign keys for each table.

3. Open a terminal and navigate to the folder where the **steelwheels_dw.sql** script is located.

4. Execute the following command to login to the local MySQL server: **mysql -u aid -p**
   Password: **aid**

5. On the MySQL prompt, execute the following command to create the database:
   source steelwheels_dw.sql

6. Execute the following command to show the existing databases:
   show databases;

7. Check that you have both the **steelwheels** database and the **steelwheels_dw** data warehouse.

8. Leave this terminal open. It will be useful in the next steps.

Creating a connection to the data warehouse

9. Open a new terminal and navigate to the folder: **~/Pentaho/data-integration**

10. Start Pentaho Data Integration (PDI) with: **./spoon.sh**

11. In the **File** menu, select **New > Transformation**.

12. In the left pane, switch from the **Design** to the **View** tab, and expand **Transformations > Transformation 1 > Database connections**.

13. Right-click **Database connections** and select **New**.

14. In the **Database Connection** dialog, specify the following:

Connection Name:	**steelwheels_dw**
Connection Type:	**MySQL**
Access:	**Native (JDBC)**
Host Name:	**localhost**
Database Name:	**steelwheels_dw**
Port Number:	**3306**
User Name:	**aid**
Password:	**aid**

15. Press **Test** to test the database connection. A new dialog should say that the connection is OK.

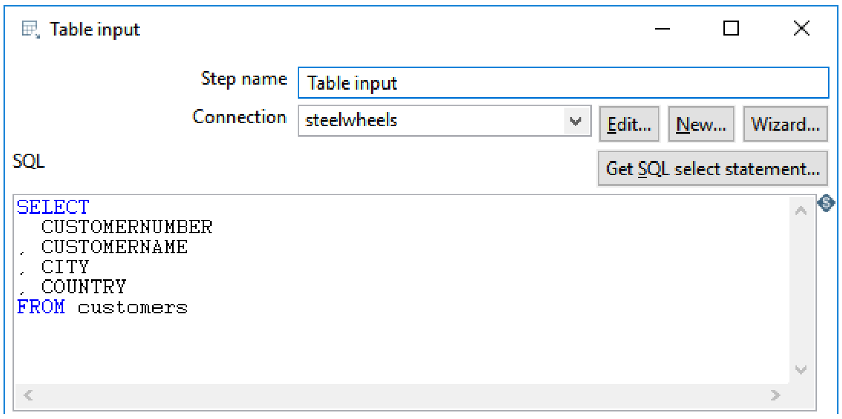
16. Close the **Database Connection** dialog with **OK**.

17. In the **View** tab, right-click the **steelwheels_dw** database connection and select **Share**. This will make the database connection available to other transformations.

*Note: In the previous lab, you have already created a connection to the **steelwheels** database. The connection to **steelwheels_dw** is very similar; the only changes are in the **Connection Name** and in the **Database Name**. In this lab, we will use both connections: **steelwheels** and **steelwheels_dw**.*

Creating the customer dimension

1. Add a **Table Input** to the transformation and configure it as follows:
   - In **Connection** select **steelwheels**
   - Press the **Get SQL select statement** button and select the **customers** table
   - **Do you want to include the field-names in the SQL?** Answer: **Yes**
   - Then remove every field except **CUSTOMERNUMBER**, **CUSTOMERNAME**, **CITY**, **COUNTRY**. (*See the following figure.*)

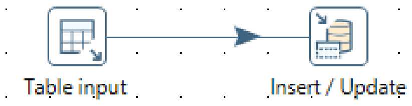


Step name: Table input

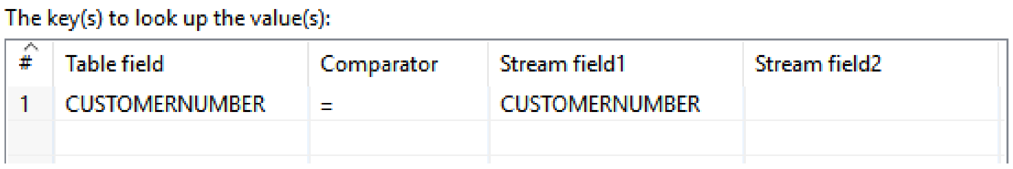
Connection: steelwheels

```
SELECT
  CUSTOMERNUMBER
, CUSTOMERNAME
, CITY
, COUNTRY
FROM customers
```

2. Add an **Insert/Update** step to the transformation, and create a hop from the previous step.



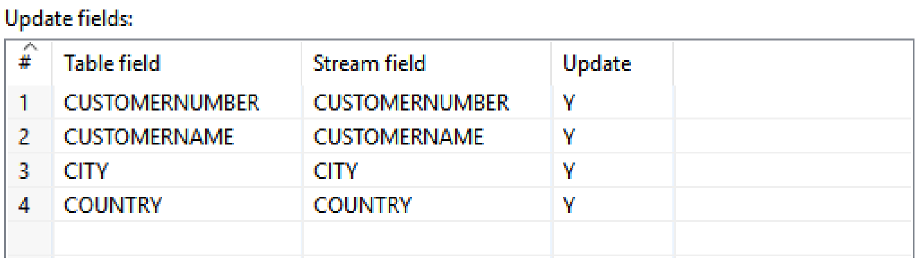
3. Configure the **Insert/Update** step as follows:
   - In **Connection** select **steelwheels_dw**
   - In **Target table** click **Browse** and select the **dim_customer** table
   - The key that will be used to check if a customer already exists in the dimension table is **CUSTOMERNUMBER**. Therefore, configure **The key(s) to look up the value(s)** as follows:



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

#	Table field	Comparator	Stream field1	Stream field2
1	CUSTOMERNUMBER	=	CUSTOMERNUMBER	

   - The dimension table stores the following fields for each customer: **CUSTOMERNUMBER**, **CUSTOMERNAME**, **CITY**, **COUNTRY**. These fields will have to be inserted or updated in the table. Therefore, configure **Update fields** as follows:



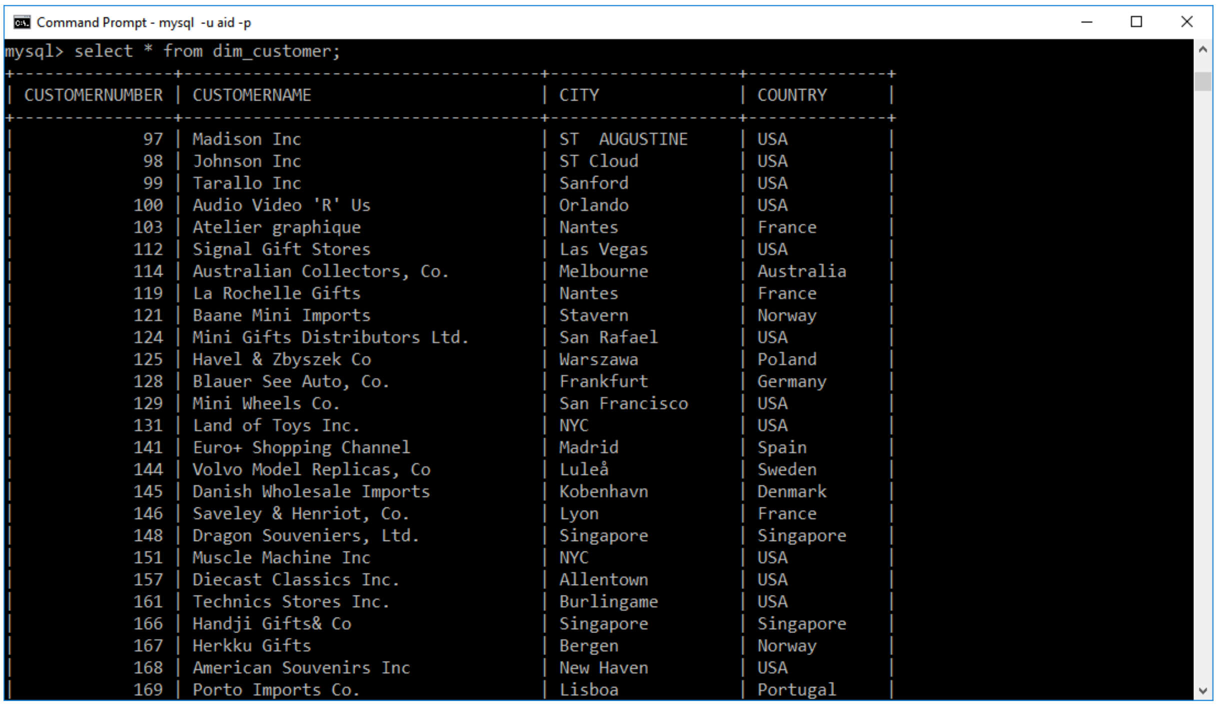
Update fields:

#	Table field	Stream field	Update
1	CUSTOMERNUMBER	CUSTOMERNUMBER	Y
2	CUSTOMERNAME	CUSTOMERNAME	Y
3	CITY	CITY	Y
4	COUNTRY	COUNTRY	Y

4. Save the transformation as **/home/aid/Downloads/dim_customer.ktr** (if you are on the VM).

5. Run the transformation.

6. Using the command line, check that the data has been loaded into the **dim_customer** table in the **steelwheels_dw** data warehouse.
   (*See the following figure.*)



Command Prompt - mysql -u aid -p

```
mysql> select * from dim_customer;
+----------------+------------------------------------+--------------------+---------------+
| CUSTOMERNUMBER | CUSTOMERNAME                       | CITY               | COUNTRY       |
+----------------+------------------------------------+--------------------+---------------+
|             97 | Madison Inc                        | ST  AUGUSTINE      | USA           |
|             98 | Johnson Inc                        | ST Cloud           | USA           |
|             99 | Tarallo Inc                        | Sanford            | USA           |
|            100 | Audio Video 'R' Us                 | Orlando            | USA           |
|            103 | Atelier graphique                  | Nantes             | France        |
|            112 | Signal Gift Stores                 | Las Vegas          | USA           |
|            114 | Australian Collectors, Co.         | Melbourne          | Australia     |
|            119 | La Rochelle Gifts                  | Nantes             | France        |
|            121 | Baane Mini Imports                 | Stavern            | Norway        |
|            124 | Mini Gifts Distributors Ltd.       | San Rafael         | USA           |
|            125 | Havel & Zbyszek Co                 | Warszawa           | Poland        |
|            128 | Blauer See Auto, Co.               | Frankfurt          | Germany       |
|            129 | Mini Wheels Co.                    | San Francisco      | USA           |
|            131 | Land of Toys Inc.                  | NYC                | USA           |
|            141 | Euro+ Shopping Channel             | Madrid             | Spain         |
|            144 | Volvo Model Replicas, Co           | Luleå              | Sweden        |
|            145 | Danish Wholesale Imports           | Kobenhavn          | Denmark       |
|            146 | Saveley & Henriot, Co.             | Lyon               | France        |
|            148 | Dragon Souveniers, Ltd.            | Singapore          | Singapore     |
|            151 | Muscle Machine Inc                 | NYC                | USA           |
|            157 | Diecast Classics Inc.              | Allentown          | USA           |
|            161 | Technics Stores Inc.               | Burlingame         | USA           |
|            166 | Handji Gifts& Co                   | Singapore          | Singapore     |
|            167 | Herkku Gifts                       | Bergen             | Norway        |
|            168 | American Souvenirs Inc             | New Haven          | USA           |
|            169 | Porto Imports Co.                  | Lisboa             | Portugal      |
```

Creating the product dimension

7. Create a new transformation in PDI (Spoon).

8. Add a **Table Input** to the transformation and configure it as follows:
   - In **Connection** select **steelwheels**
   - Press the **Get SQL select statement** button and select the **products** table
   - **Do you want to include the field-names in the SQL?** Answer **Yes**
   - Then remove every field except **PRODUCTCODE**, **PRODUCTNAME**, **PRODUCTLINE**, **PRODUCTVENDOR**.

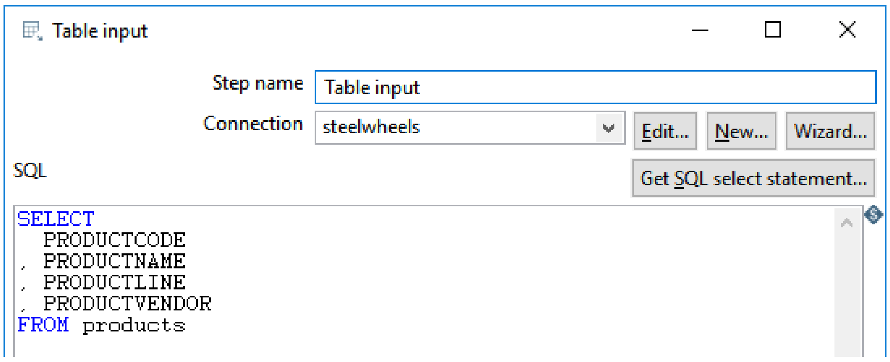


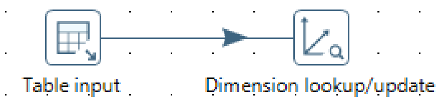
Table input

Step name: Table input
Connection: steelwheels

SQL

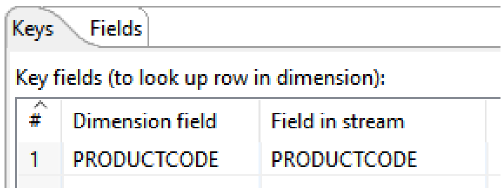
```
SELECT
  PRODUCTCODE
, PRODUCTNAME
, PRODUCTLINE
, PRODUCTVENDOR
FROM products
```

9. Add a **Dimension lookup/update**, and create a hop from the previous step.



10. Configure the **Dimension lookup/update** as follows:
    - In **Connection** select **steelwheels_dw**

- In **Target table** click **Browse** and select the **dim_product** table
- The key that will be used to check if a product already exists in the dimension table is **PRODUCTCODE**. Therefore, configure **Keys** as follows:

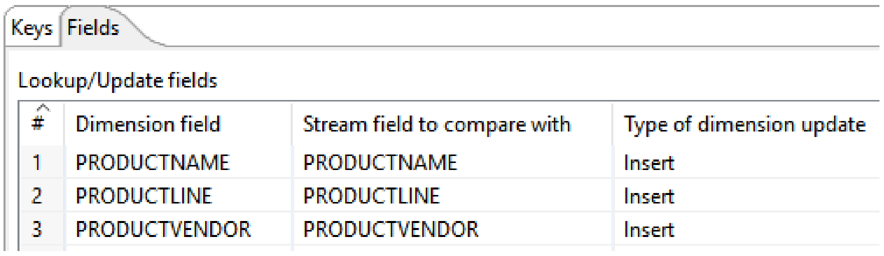


Keys | Fields

Key fields (to look up row in dimension):

#	Dimension field	Field in stream
1	PRODUCTCODE	PRODUCTCODE

- In addition, the dimension table stores the following fields for each product: **PRODUCTNAME**, **PRODUCTLINE**, **PRODUCTVENDOR**. Therefore, configure **Fields** as follows:

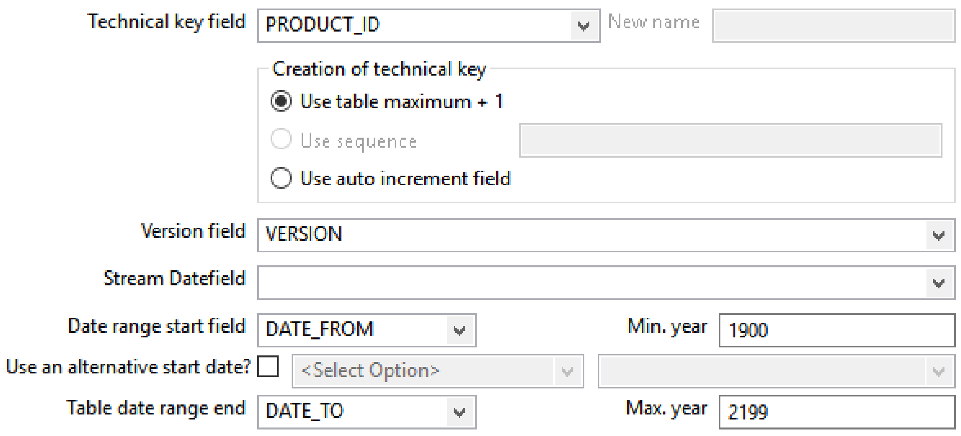


Keys | Fields

Lookup/Update fields

#	Dimension field	Stream field to compare with	Type of dimension update
1	PRODUCTNAME	PRODUCTNAME	Insert
2	PRODUCTLINE	PRODUCTLINE	Insert
3	PRODUCTVENDOR	PRODUCTVENDOR	Insert

- Finally, configure the **Technical key field**, the **Version field**, the **Date range start field**, and the **Table date range end** as follows:



Technical key field: PRODUCT_ID
New name:

Creation of technical key
[✓ Use table maximum + 1]
Use sequence
Use auto increment field

Version field: VERSION
Stream Datefield:
Date range start field: DATE_FROM
Min. year: 1900
Use an alternative start date? ☐ <Select Option>
Table date range end: DATE_TO
Max. year: 2199

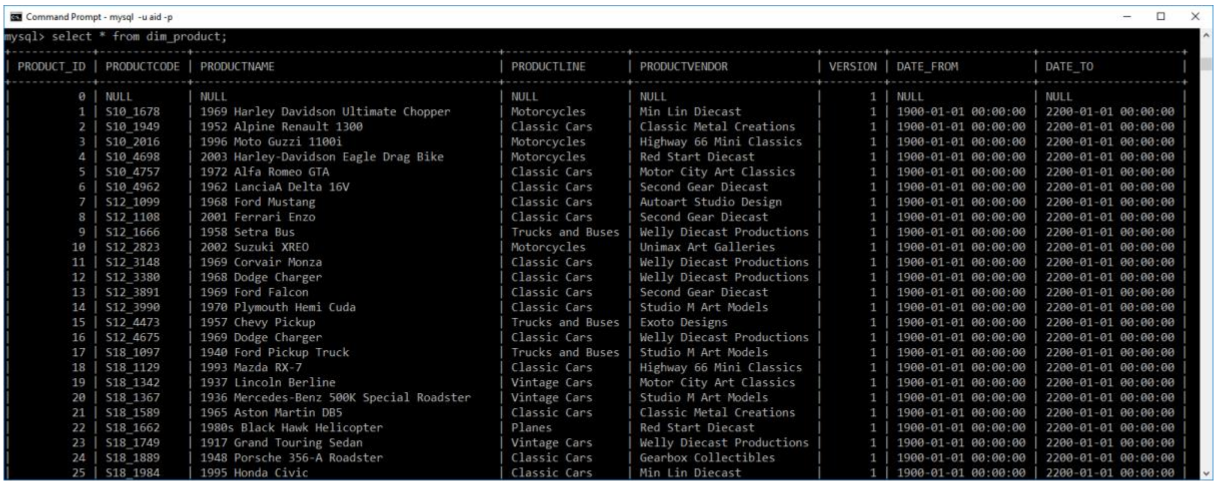
*Note: The **dim_product** dimension table will not use **PRODUCTCODE** as key. Instead, it will use **PRODUCT_ID** (an integer) as technical/surrogate key.*

*Note: **dim_product** is a **slowly-changing dimension**, meaning that there may be multiple versions of the same product, if the information about the product changes over time.*

11. Save the transformation as **/home/aid/Downloads/dim_product.ktr** (if you are on the VM).

12. Run the transformation.

13. Check that the data has been loaded into the **dim_product** table in the data warehouse. (*See the following figure.*)



```
mysql> select * from dim_product;
+------------+-------------+--------------------------------------------+------------------+---------------------------+---------+---------------------+---------------------+
| PRODUCT_ID | PRODUCTCODE | PRODUCTNAME                                | PRODUCTLINE      | PRODUCTVENDOR             | VERSION | DATE_FROM           | DATE_TO             |
+------------+-------------+--------------------------------------------+------------------+---------------------------+---------+---------------------+---------------------+
|          0 | NULL        | NULL                                       | NULL             | NULL                      |       1 | NULL                | NULL                |
|          1 | S10_1678    | 1969 Harley Davidson Ultimate Chopper      | Motorcycles      | Min Lin Diecast           |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          2 | S10_1949    | 1952 Alpine Renault 1300                   | Classic Cars     | Classic Metal Creations   |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          3 | S10_2016    | 1996 Moto Guzzi 1100i                      | Motorcycles      | Highway 66 Mini Classics  |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          4 | S10_4698    | 2003 Harley-Davidson Eagle Drag Bike       | Motorcycles      | Red Start Diecast         |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          5 | S10_4757    | 1972 Alfa Romeo GTA                        | Classic Cars     | Motor City Art Classics   |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          6 | S10_4962    | 1962 LanciaA Delta 16V                     | Classic Cars     | Second Gear Diecast       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          7 | S12_1099    | 1968 Ford Mustang                          | Classic Cars     | Autoart Studio Design     |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          8 | S12_1108    | 2001 Ferrari Enzo                          | Classic Cars     | Second Gear Diecast       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|          9 | S12_1666    | 1958 Setra Bus                             | Trucks and Buses | Welly Diecast Productions |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         10 | S12_2823    | 2002 Suzuki XREO                           | Motorcycles      | Unimax Art Galleries      |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         11 | S12_3148    | 1969 Corvair Monza                         | Classic Cars     | Welly Diecast Productions |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         12 | S12_3380    | 1968 Dodge Charger                         | Classic Cars     | Welly Diecast Productions |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         13 | S12_3891    | 1969 Ford Falcon                           | Classic Cars     | Second Gear Diecast       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         14 | S12_3990    | 1970 Plymouth Hemi Cuda                    | Classic Cars     | Studio M Art Models       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         15 | S12_4473    | 1957 Chevy Pickup                          | Trucks and Buses | Exoto Designs             |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         16 | S12_4675    | 1969 Dodge Charger                         | Classic Cars     | Welly Diecast Productions |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         17 | S18_1097    | 1940 Ford Pickup Truck                     | Trucks and Buses | Studio M Art Models       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         18 | S18_1129    | 1993 Mazda RX-7                            | Classic Cars     | Highway 66 Mini Classics  |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         19 | S18_1342    | 1937 Lincoln Berline                       | Vintage Cars     | Motor City Art Classics   |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         20 | S18_1367    | 1936 Mercedes-Benz 500K Special Roadster   | Vintage Cars     | Studio M Art Models       |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         21 | S18_1589    | 1965 Aston Martin DB5                      | Classic Cars     | Classic Metal Creations   |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         22 | S18_1662    | 1980s Black Hawk Helicopter                | Planes           | Red Start Diecast         |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         23 | S18_1749    | 1917 Grand Touring Sedan                   | Vintage Cars     | Welly Diecast Productions |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         24 | S18_1889    | 1948 Porsche 356-A Roadster                | Classic Cars     | Gearbox Collectibles      |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
|         25 | S18_1984    | 1995 Honda Civic                           | Classic Cars     | Min Lin Diecast           |       1 | 1900-01-01 00:00:00 | 2200-01-01 00:00:00 |
```

Testing the slowly-changing dimension

14. In the MySQL prompt, change to the **steelwheels** database with the command:
    use steelwheels

15. Search for cars with the following query:
    select PRODUCTCODE, PRODUCTNAME, PRODUCTLINE
    from products
    where PRODUCTLINE **like** '%Cars%' **order by** PRODUCTNAME;

16. You will see a list of **Vintage Cars** and **Classic Cars**. The first Classic Car that appears in this list is a **Porsche Roadster from 1948** (**S18_1889**). We will change this product to a Vintage Car.

17. Execute the following query:
    update products **set** PRODUCTLINE='Vintage Cars'
    where PRODUCTCODE='S18_1889';

18. Switch back to PDI (Spoon), and run the **dim_product** transformation again.

19. Now go back to the MySQL prompt, and change to **steelwheels_dw**:
    use steelwheels_dwyear_id

20. Execute the following query:
    select * **from** dim_product **where** PRODUCTCODE='S18_1889';

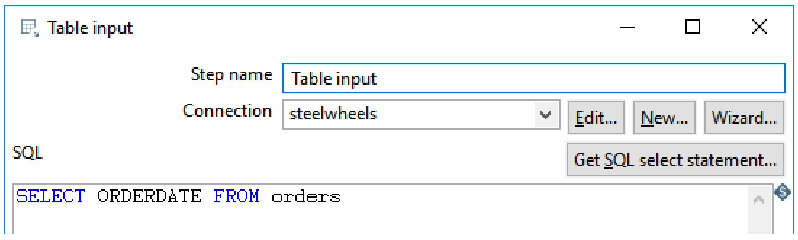
21. You will see that there are now two versions of the same product (same **PRODUCTCODE**, but different **PRODUCT_ID**). In version 1, the Porsche Roadster is listed as a Classic Car, and in version 2 it is listed as a Vintage Car.

22. Check the **DATE_FROM** and **DATE_TO** fields of the two versions. When did the change from version 1 to version 2 occur? At the present time, which version is valid?

Creating the time dimension

23. Create a new transformation in PDI.

24. Add a **Table Input** to the transformation and configure it as follows:
    - In **Connection** select **steelwheels**
    - Press the **Get SQL select statement** button and select the **orders** table
    - **Do you want to include the field-names in the SQL?** Answer **Yes**
    - Then remove every field except **ORDERDATE**.

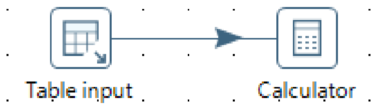


Step name	Table input
Connection	steelwheels

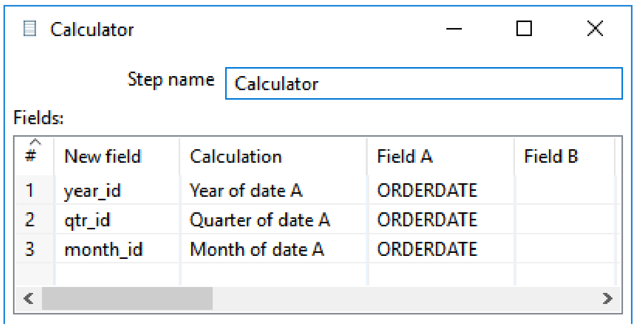
SQL

```
SELECT ORDERDATE FROM orders
```

25. Add a **Calculator** step to the transformation, and create a hop from the previous step.



26. Configure the **Calculator** as follows:

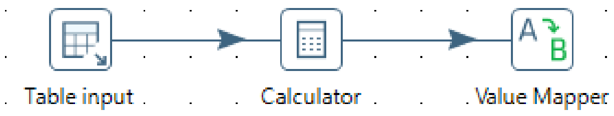


Step name	Calculator

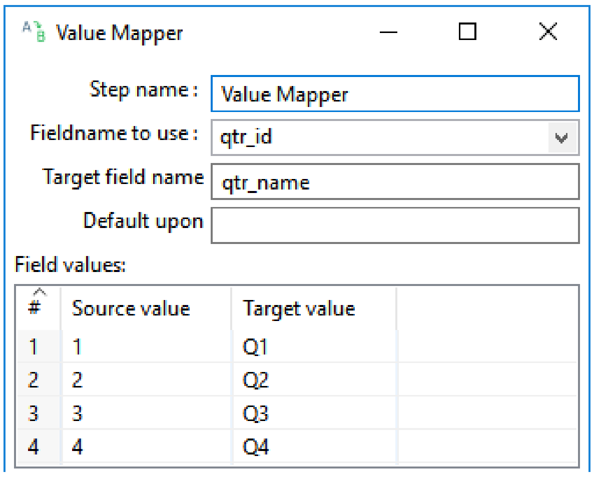
Fields:

#	New field	Calculation	Field A	Field B
1	year_id	Year of date A	ORDERDATE	
2	qtr_id	Quarter of date A	ORDERDATE	
3	month_id	Month of date A	ORDERDATE	

27. Add a **Value Mapper** to the transformation, and create a hop from the previous step.



28. Configure the **Value Mapper** as follows:



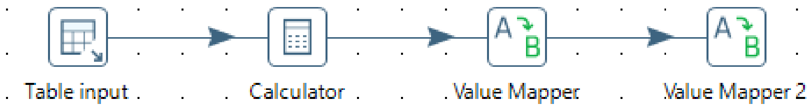
Value Mapper

Step name :	Value Mapper
Fieldname to use :	qtr_id
Target field name	qtr_name
Default upon	

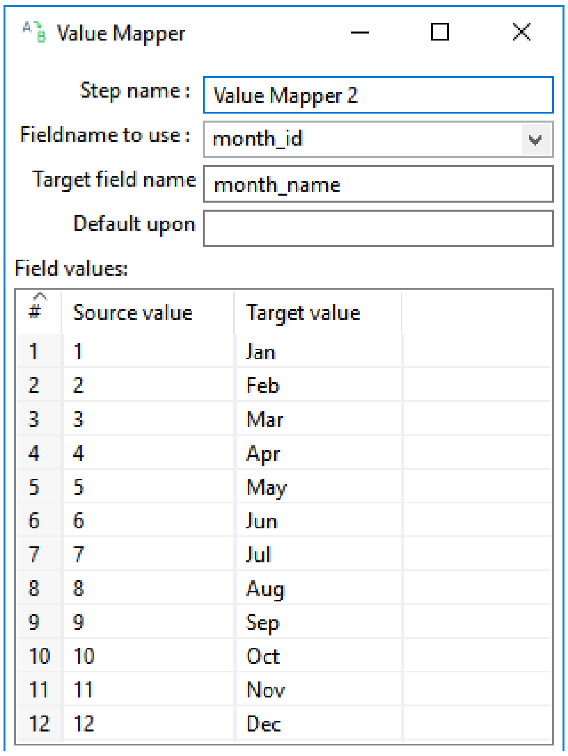
Field values:

#	Source value	Target value
1	1	Q1
2	2	Q2
3	3	Q3
4	4	Q4

29. Add a second **Value Mapper** to the transformation and connect it to the previous step.



30. Configure **Value Mapper 2** as follows:



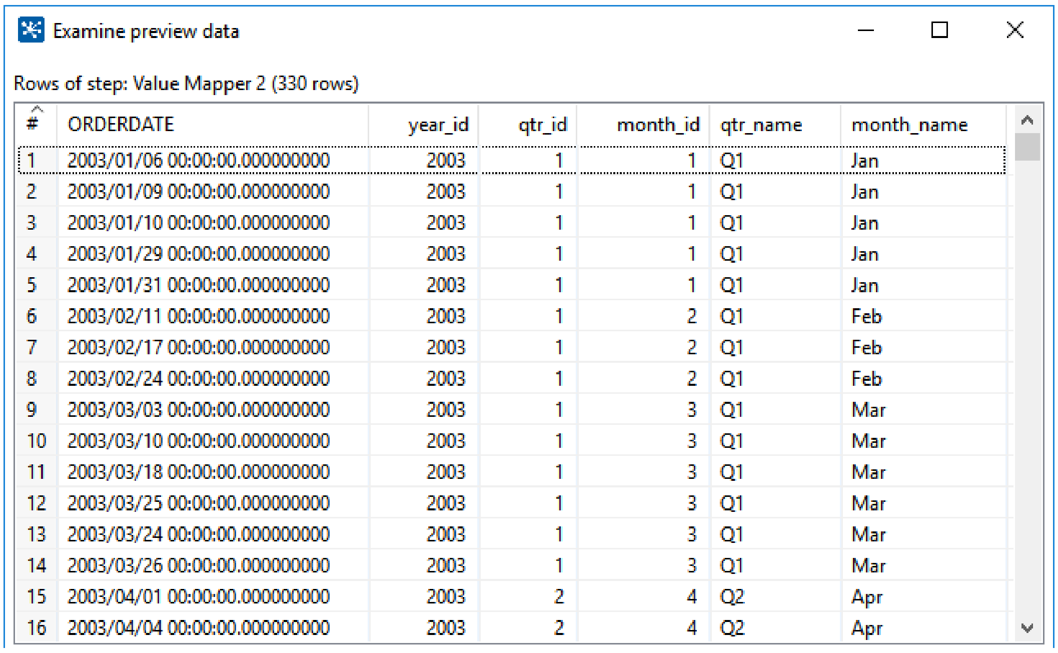
Value Mapper

Step name :	Value Mapper 2
Fieldname to use :	month_id
Target field name	month_name
Default upon	

Field values:

#	Source value	Target value
1	1	Jan
2	2	Feb
3	3	Mar
4	4	Apr
5	5	May
6	6	Jun
7	7	Jul
8	8	Aug
9	9	Sep
10	10	Oct
11	11	Nov
12	12	Dec

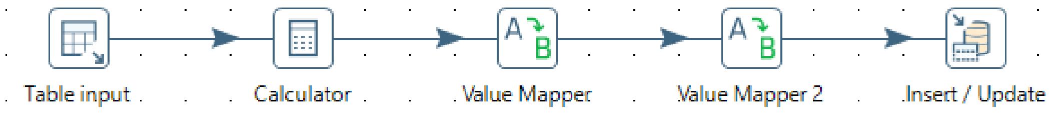
31. Do a **Preview** of **Value Mapper 2** and check that you have the following results:


Examine preview data

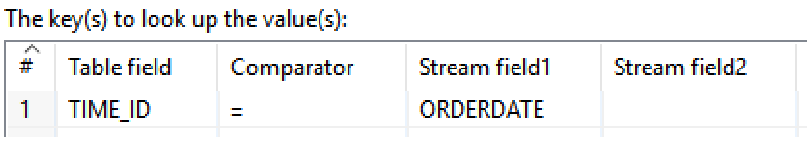
Rows of step: Value Mapper 2 (330 rows)

#	ORDERDATE	year_id	qtr_id	month_id	qtr_name	month_name
1	2003/01/06 00:00:00.000000000	2003	1	1	Q1	Jan
2	2003/01/09 00:00:00.000000000	2003	1	1	Q1	Jan
3	2003/01/10 00:00:00.000000000	2003	1	1	Q1	Jan
4	2003/01/29 00:00:00.000000000	2003	1	1	Q1	Jan
5	2003/01/31 00:00:00.000000000	2003	1	1	Q1	Jan
6	2003/02/11 00:00:00.000000000	2003	1	2	Q1	Feb
7	2003/02/17 00:00:00.000000000	2003	1	2	Q1	Feb
8	2003/02/24 00:00:00.000000000	2003	1	2	Q1	Feb
9	2003/03/03 00:00:00.000000000	2003	1	3	Q1	Mar
10	2003/03/10 00:00:00.000000000	2003	1	3	Q1	Mar
11	2003/03/18 00:00:00.000000000	2003	1	3	Q1	Mar
12	2003/03/25 00:00:00.000000000	2003	1	3	Q1	Mar
13	2003/03/24 00:00:00.000000000	2003	1	3	Q1	Mar
14	2003/03/26 00:00:00.000000000	2003	1	3	Q1	Mar
15	2003/04/01 00:00:00.000000000	2003	2	4	Q2	Apr
16	2003/04/04 00:00:00.000000000	2003	2	4	Q2	Apr

32. Add an **Insert/Update** step to the transformation, and create a hop from the previous step.



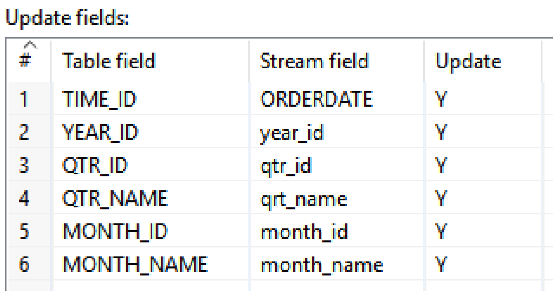
33. Configure the **Insert/Update** step as follows:
    - In **Connection** select **steelwheels_dw**
    - In **Target table** click **Browse** and select the **dim_time** table
    - The key that will be used to check if a time already exists in the dimension table is **ORDERDATE**. Therefore, configure **The key(s) to look up the value(s)** as follows:


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

#	Table field	Comparator	Stream field1	Stream field2
1	TIME_ID	=	ORDERDATE	

*Note: The **TIME_ID** in the dimension table is mapped to the **ORDERDATE** stream field. This means that a **TIME_ID** in the data warehouse corresponds to an **ORDERDATE** in the original database.*

- The dimension table stores the following fields for each time: **TIME_ID, YEAR_ID, QTR_ID, QTR_NAME, MONTH_ID, MONTH_NAME**. These fields will have to be inserted or updated in the table. Therefore, configure **Update fields** as follows:

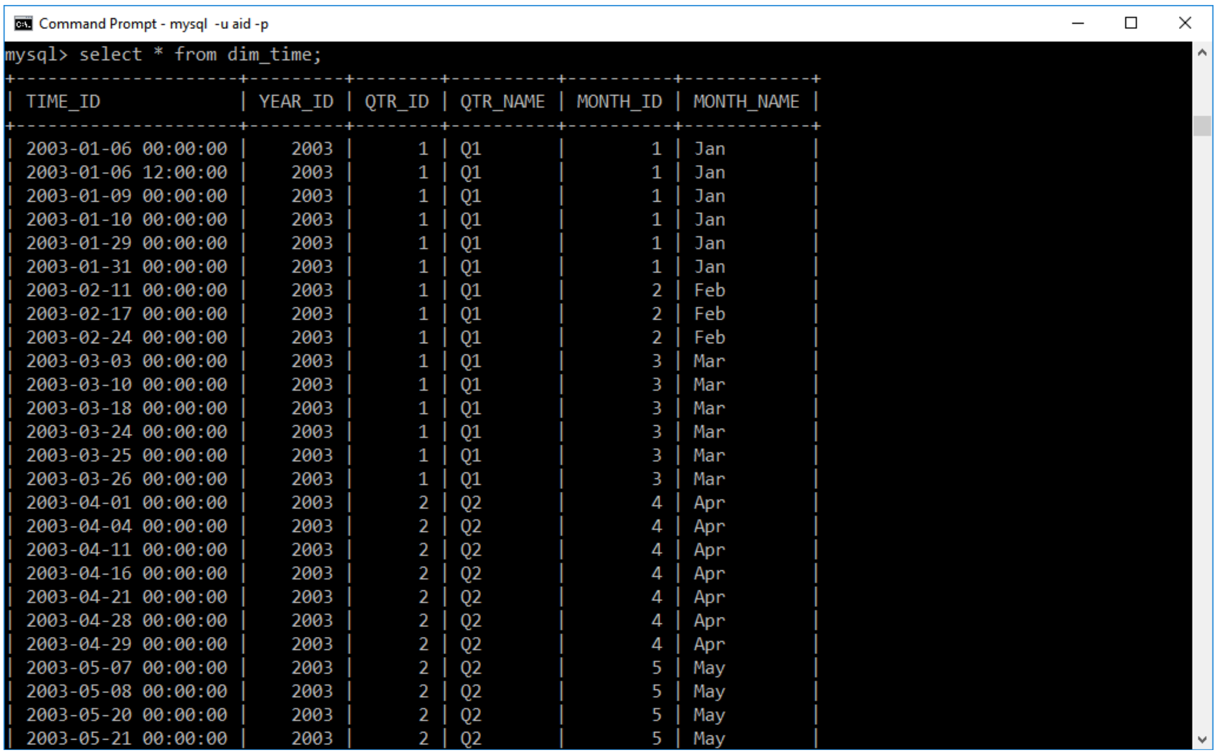

Update fields:

#	Table field	Stream field	Update
1	TIME_ID	ORDERDATE	Y
2	YEAR_ID	year_id	Y
3	QTR_ID	qtr_id	Y
4	QTR_NAME	qrt_name	Y
5	MONTH_ID	month_id	Y
6	MONTH_NAME	month_name	Y

34. Save the transformation as **/home/aid/Downloads/dim_time.ktr** (if you are on the VM).

35. Run the transformation.

36. Check that the data has been loaded from the **orders** table in the **steelwheels** database to the **dim_time** table in the data warehouse.
(*See the following figure.*)



Command Prompt - mysql -u aid -p

```
mysql> select * from dim_time;
+---------------------+---------+--------+----------+----------+------------+
| TIME_ID             | YEAR_ID | QTR_ID | QTR_NAME | MONTH_ID | MONTH_NAME |
+---------------------+---------+--------+----------+----------+------------+
| 2003-01-06 00:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-01-06 12:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-01-09 00:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-01-10 00:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-01-29 00:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-01-31 00:00:00 |    2003 |      1 | Q1       |        1 | Jan        |
| 2003-02-11 00:00:00 |    2003 |      1 | Q1       |        2 | Feb        |
| 2003-02-17 00:00:00 |    2003 |      1 | Q1       |        2 | Feb        |
| 2003-02-24 00:00:00 |    2003 |      1 | Q1       |        2 | Feb        |
| 2003-03-03 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-03-10 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-03-18 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-03-24 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-03-25 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-03-26 00:00:00 |    2003 |      1 | Q1       |        3 | Mar        |
| 2003-04-01 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-04 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-11 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-16 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-21 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-28 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-04-29 00:00:00 |    2003 |      2 | Q2       |        4 | Apr        |
| 2003-05-07 00:00:00 |    2003 |      2 | Q2       |        5 | May        |
| 2003-05-08 00:00:00 |    2003 |      2 | Q2       |        5 | May        |
| 2003-05-20 00:00:00 |    2003 |      2 | Q2       |        5 | May        |
| 2003-05-21 00:00:00 |    2003 |      2 | Q2       |        5 | May        |
```

Creating the fact table

37. Create a new transformation in PDI.

38. Add a **Table Input** to the transformation and configure it as follows:
    - In **Connection** select **steelwheels**
    - In **SQL** write the following query:
      SELECT * FROM orders **INNER JOIN** orderdetails

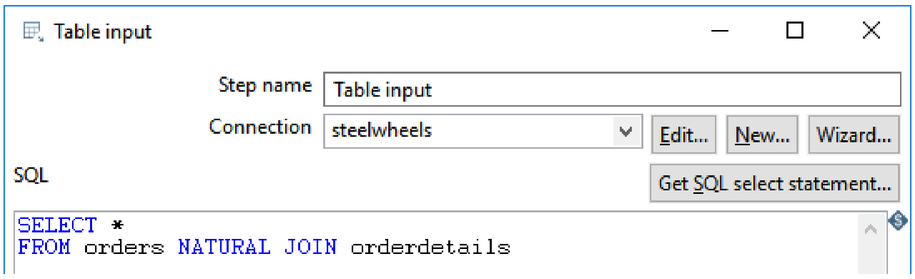
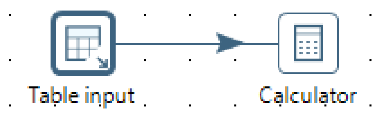


Table input

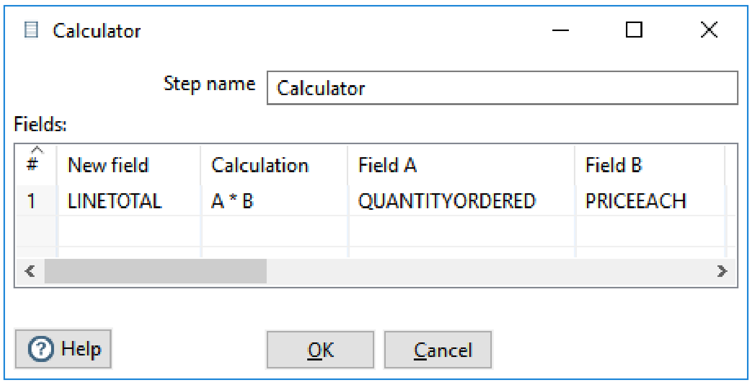
Step name: Table input
Connection: steelwheels

```
SELECT *
FROM orders NATURAL JOIN orderdetails
```

39. Add a **Calculator** step to the transformation, and create a hop from the previous step.



40. Configure the **Calculator** as follows:

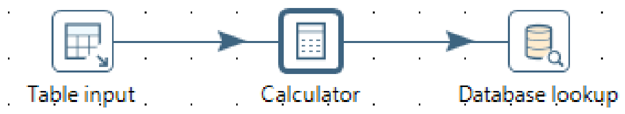


Step name: Calculator

Fields:

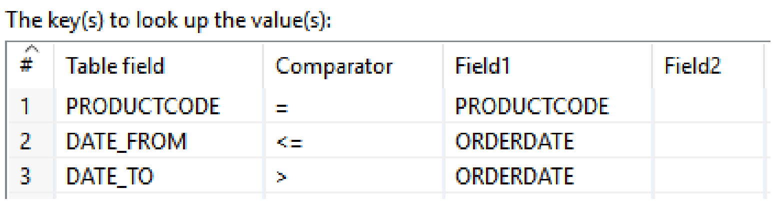
#	New field	Calculation	Field A	Field B
1	LINETOTAL	A * B	QUANTITYORDERED	PRICEEACH

41. Add a **Database lookup** step to the transformation, and create a hop from the previous step.



*Note: The purpose of this **Database lookup** is to get the **PRODUCT_ID** (the technical/surrogate key) for the **PRODUCTCODE** that comes from the **steelwheels** database.*

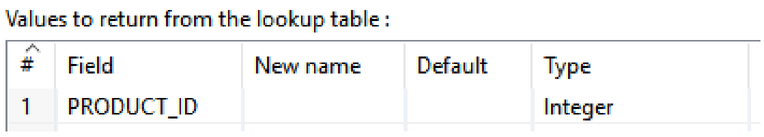
42. Configure the **Database lookup** as follows:
    - In **Connection** select **steelwheels_dw**
    - In **Lookup table** click **Browse** and select the **dim_product** table
    - The key that will be used to lookup the product in the dimension table is **PRODUCTCODE**. However, since a product may have multiple versions, we want to retrieve the version that was valid at the time when the order was placed. Therefore, configure **The key(s) to look up the value(s)** as follows:



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

#	Table field	Comparator	Field1	Field2
1	PRODUCTCODE	=	PRODUCTCODE	
2	DATE_FROM	<=	ORDERDATE	
3	DATE_TO	>	ORDERDATE	

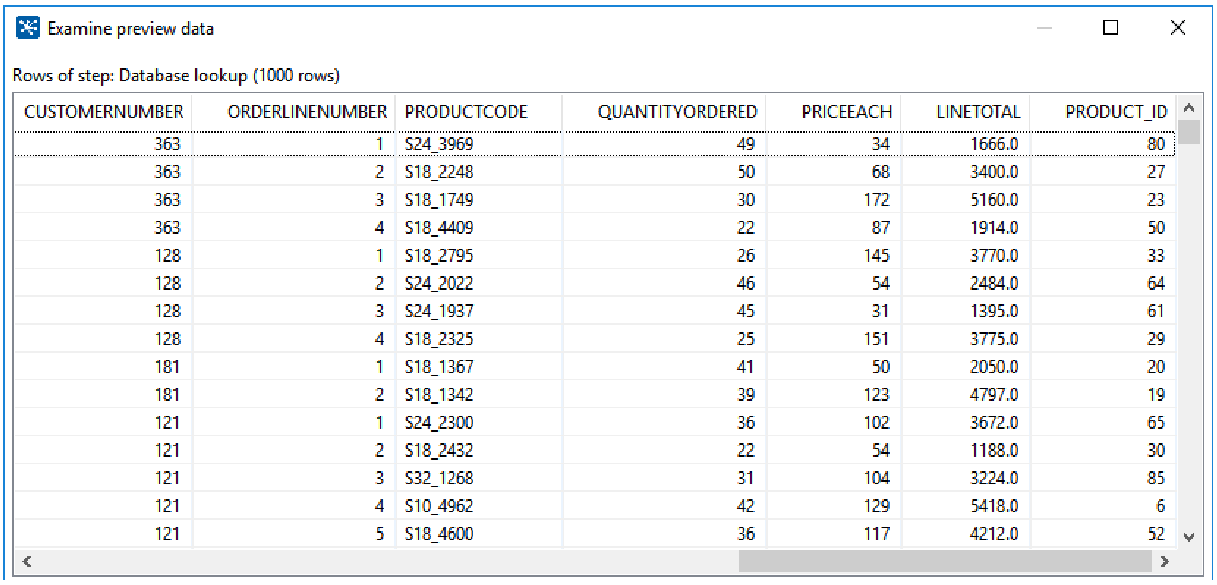
- The information that we want to retrieve from the dimension table is the **PRODUCT_ID** (the technical/surrogate key). Therefore, configure the **Values to return from the lookup table** as follows:



Values to return from the lookup table :

#	Field	New name	Default	Type
1	PRODUCT_ID			Integer

43. Do a **Preview** of the **Database lookup** in order to check that the **PRODUCT_ID** is being retrieved. (*See the following figure.*)

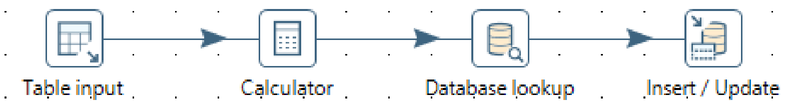


Examine preview data

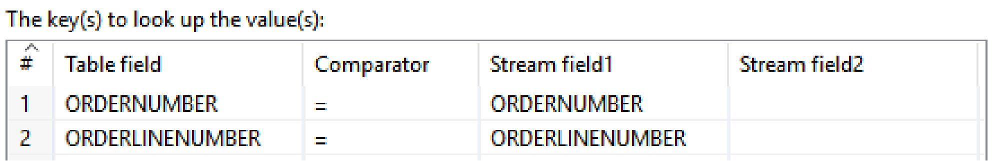
Rows of step: Database lookup (1000 rows)

CUSTOMERNUMBER	ORDERLINENUMBER	PRODUCTCODE	QUANTITYORDERED	PRICEEACH	LINETOTAL	PRODUCT_ID
363	1	S24_3969	49	34	1666.0	80
363	2	S18_2248	50	68	3400.0	27
363	3	S18_1749	30	172	5160.0	23
363	4	S18_4409	22	87	1914.0	50
128	1	S18_2795	26	145	3770.0	33
128	2	S24_2022	46	54	2484.0	64
128	3	S24_1937	45	31	1395.0	61
128	4	S18_2325	25	151	3775.0	29
181	1	S18_1367	41	50	2050.0	20
181	2	S18_1342	39	123	4797.0	19
121	1	S24_2300	36	102	3672.0	65
121	2	S18_2432	22	54	1188.0	30
121	3	S32_1268	31	104	3224.0	85
121	4	S10_4962	42	129	5418.0	6
121	5	S18_4600	36	117	4212.0	52

44. Add an **Insert/Update** step to the transformation, and create a hop from the previous step.



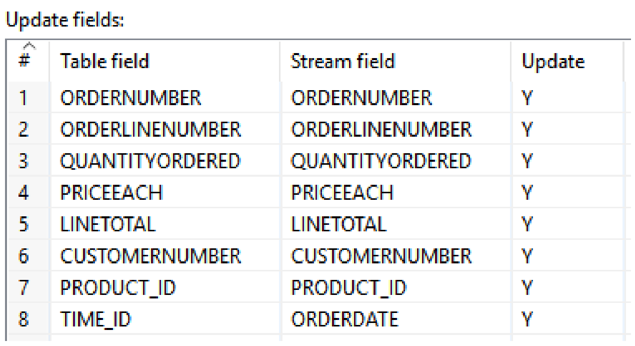
45. Configure the **Insert/Update** step as follows:
   - In **Connection** select **steelwheels_dw**
   - In **Target table** click **Browse** and select the **fact_order** table
   - The key that will be used to check if a fact already exists in the fact table is **ORDERNUMBER** and **ORDERLINENUMBER**. Therefore, configure **The key(s) to look up the value(s)** as follows:



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

#	Table field	Comparator	Stream field1	Stream field2
1	ORDERNUMBER	=	ORDERNUMBER	
2	ORDERLINENUMBER	=	ORDERLINENUMBER	

   - The fact table stores the following fields for each fact: **ORDERNUMBER, ORDERLINENUMBER, QUANTITYORDERED, PRICEEACH, LINETOTAL, CUSTOMERNUMBER, PRODUCT_ID, TIME_ID**. These fields will have to be inserted or updated in the table. Therefore, configure **Update fields** as follows:



Update fields:

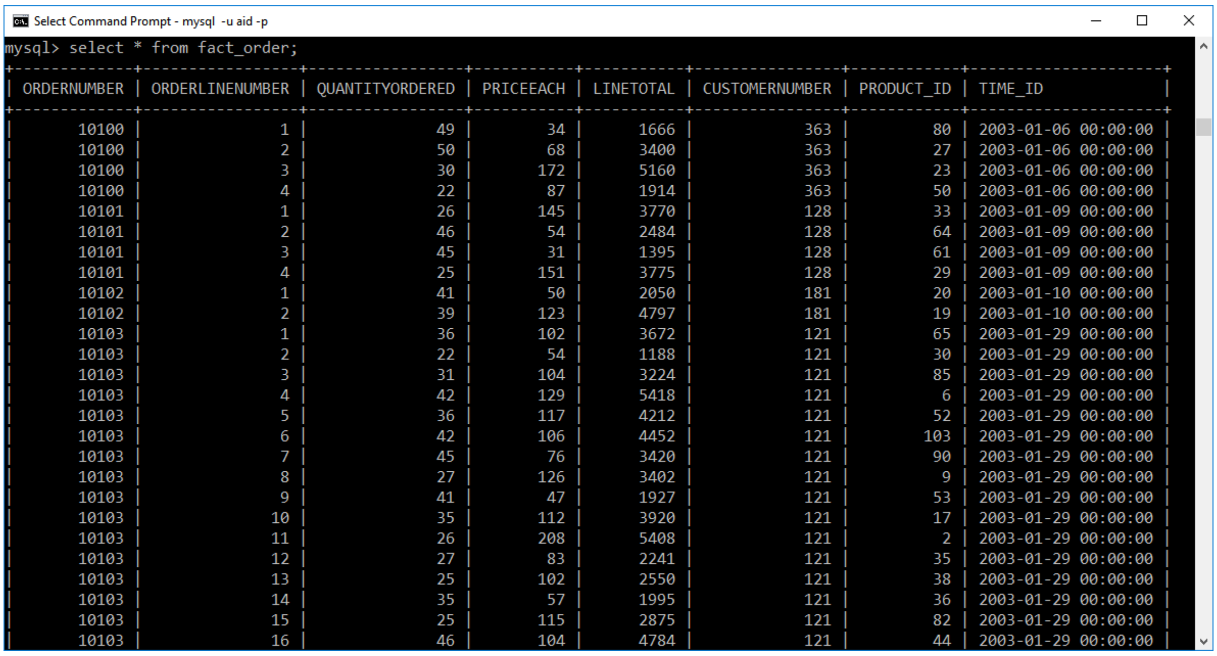
#	Table field	Stream field	Update
1	ORDERNUMBER	ORDERNUMBER	Y
2	ORDERLINENUMBER	ORDERLINENUMBER	Y
3	QUANTITYORDERED	QUANTITYORDERED	Y
4	PRICEEACH	PRICEEACH	Y
5	LINETOTAL	LINETOTAL	Y
6	CUSTOMERNUMBER	CUSTOMERNUMBER	Y
7	PRODUCT_ID	PRODUCT_ID	Y
8	TIME_ID	ORDERDATE	Y

*Note: The **TIME_ID** table field is mapped to the **ORDERDATE** stream field.*

46. Save the transformation as **/home/aid/Downloads/fact_order.ktr** (if you are on the VM).

47. Run the transformation.

48. Check that the data has been loaded into the **fact_order** table in the data warehouse.


Select Command Prompt - mysql -u aid -p

```
mysql> select * from fact_order;
+-------------+-----------------+-----------------+------------+-----------+----------------+------------+---------------------+
| ORDERNUMBER | ORDERLINENUMBER | QUANTITYORDERED | PRICEEACH  | LINETOTAL | CUSTOMERNUMBER | PRODUCT_ID | TIME_ID             |
+-------------+-----------------+-----------------+------------+-----------+----------------+------------+---------------------+
|       10100 |               1 |              49 |         34 |      1666 |            363 |         80 | 2003-01-06 00:00:00 |
|       10100 |               2 |              50 |         68 |      3400 |            363 |         27 | 2003-01-06 00:00:00 |
|       10100 |               3 |              30 |        172 |      5160 |            363 |         23 | 2003-01-06 00:00:00 |
|       10100 |               4 |              22 |         87 |      1914 |            363 |         50 | 2003-01-06 00:00:00 |
|       10101 |               1 |              26 |        145 |      3770 |            128 |         33 | 2003-01-09 00:00:00 |
|       10101 |               2 |              46 |         54 |      2484 |            128 |         64 | 2003-01-09 00:00:00 |
|       10101 |               3 |              45 |         31 |      1395 |            128 |         61 | 2003-01-09 00:00:00 |
|       10101 |               4 |              25 |        151 |      3775 |            128 |         29 | 2003-01-09 00:00:00 |
|       10102 |               1 |              41 |         50 |      2050 |            181 |         20 | 2003-01-10 00:00:00 |
|       10102 |               2 |              39 |        123 |      4797 |            181 |         19 | 2003-01-10 00:00:00 |
|       10103 |               1 |              36 |        102 |      3672 |            121 |         65 | 2003-01-29 00:00:00 |
|       10103 |               2 |              22 |         54 |      1188 |            121 |         30 | 2003-01-29 00:00:00 |
|       10103 |               3 |              31 |        104 |      3224 |            121 |         85 | 2003-01-29 00:00:00 |
|       10103 |               4 |              42 |        129 |      5418 |            121 |          6 | 2003-01-29 00:00:00 |
|       10103 |               5 |              36 |        117 |      4212 |            121 |         52 | 2003-01-29 00:00:00 |
|       10103 |               6 |              42 |        106 |      4452 |            121 |        103 | 2003-01-29 00:00:00 |
|       10103 |               7 |              45 |         76 |      3420 |            121 |         90 | 2003-01-29 00:00:00 |
|       10103 |               8 |              27 |        126 |      3402 |            121 |          9 | 2003-01-29 00:00:00 |
|       10103 |               9 |              41 |         47 |      1927 |            121 |         53 | 2003-01-29 00:00:00 |
|       10103 |              10 |              35 |        112 |      3920 |            121 |         17 | 2003-01-29 00:00:00 |
|       10103 |              11 |              26 |        208 |      5408 |            121 |          2 | 2003-01-29 00:00:00 |
|       10103 |              12 |              27 |         83 |      2241 |            121 |         35 | 2003-01-29 00:00:00 |
|       10103 |              13 |              25 |        102 |      2550 |            121 |         38 | 2003-01-29 00:00:00 |
|       10103 |              14 |              35 |         57 |      1995 |            121 |         36 | 2003-01-29 00:00:00 |
|       10103 |              15 |              25 |        115 |      2875 |            121 |         82 | 2003-01-29 00:00:00 |
|       10103 |              16 |              46 |        104 |      4784 |            121 |         44 | 2003-01-29 00:00:00 |
```

At this point, you have successfully loaded the data into the data warehouse. However, this requires running several transformations. We will now create a job to automate this ETL process.

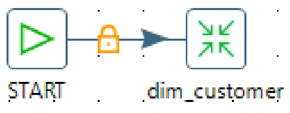
Creating a job

49. Create a new job in PDI (Spoon).

50. In the **Design** tab, expand **General**, and drag a **START** step to the canvas.

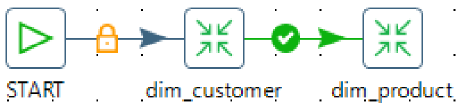
51. Add a **Transformation** step, and create a hop from the previous step.

52. Configure the **Transformation** as follows:
   - In **Entry Name** write **dim_customer**
   - In **Transformation**, write **/home/aid/Downloads/dim_customer.ktr** (if you are on the VM)



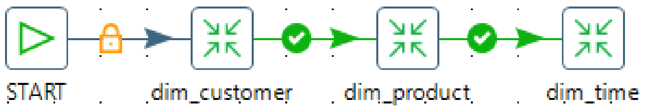
53. Add a new **Transformation** step, and create a hop from the previous step.

54. Configure the **Transformation** as follows:
    - In **Entry Name** write **dim_product**
    - In **Transformation**, write **/home/aid/Downloads/dim_product.ktr** (if you are on the VM)



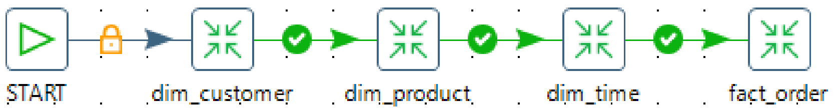
55. Add a new **Transformation** step, and create a hop from the previous step.

56. Configure the **Transformation** as follows:
    - In **Entry Name** write **dim_time**
    - In **Transformation**, write **/home/aid/Downloads/dim_time.ktr** (if you are on the VM)



57. Add a new **Transformation** step, and create a hop from the previous step.

58. Configure the **Transformation** as follows:
    - In **Entry Name** write **fact_order**
    - In **Transformation**, write **/home/aid/Downloads/fact_order.ktr** (if you are on the VM)



59. Save the job as **/home/aid/Downloads/load_dw.kjb** (if you are on the VM)

60. Run the job.
    Note: The job runs a sequence of transformations. Each transformation runs upon successful completion of the previous one. You can run this job whenever you need to reload or update the data warehouse.