INFORMATICA CLOUD
CASE STUDY

The Order Entry Operational Data Model and Schema

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PROBLEM STATEMENT

The scenario is of a business which has some transactional data which needs to be loaded into a data warehouse.

The business offers a set of products for sale and those products fall into a hierarchy of product categories. Customers place orders with the business. Orders consist of multiple order items which are in turn made up of products. An order may be placed under a given promotion and sales rep(employee) may be assisting the customer with the ordering process.

OVERVIEW OF DATA SOURCE, STAGING DATABASE AND DATA WAREHOUSE

The loading of data to the data warehouse(target) is done in two parts.

First the data is loaded into the staging database and from there it is loaded into the data warehouse.

1. SOURCE FILES

The source consists of five CSV files with data related to customers, sales rep, products, promotions and orders.

1. customer_export.csv
2. salesrep_export.csv
3. products_export.csv
4. promotions_export.csv
5. orders_export.csv

Fig 1. Source csv format files

2. STAGING DATABASE

A staging database was designed which will act as the source for the data warehouse. A staging database serves a lot purposes.

1. It is used to perform data cleansing and validation before finally loading into the data warehouse.
2. It reduces redundancy from the source data by normalizing the tables suitably for loading into target.

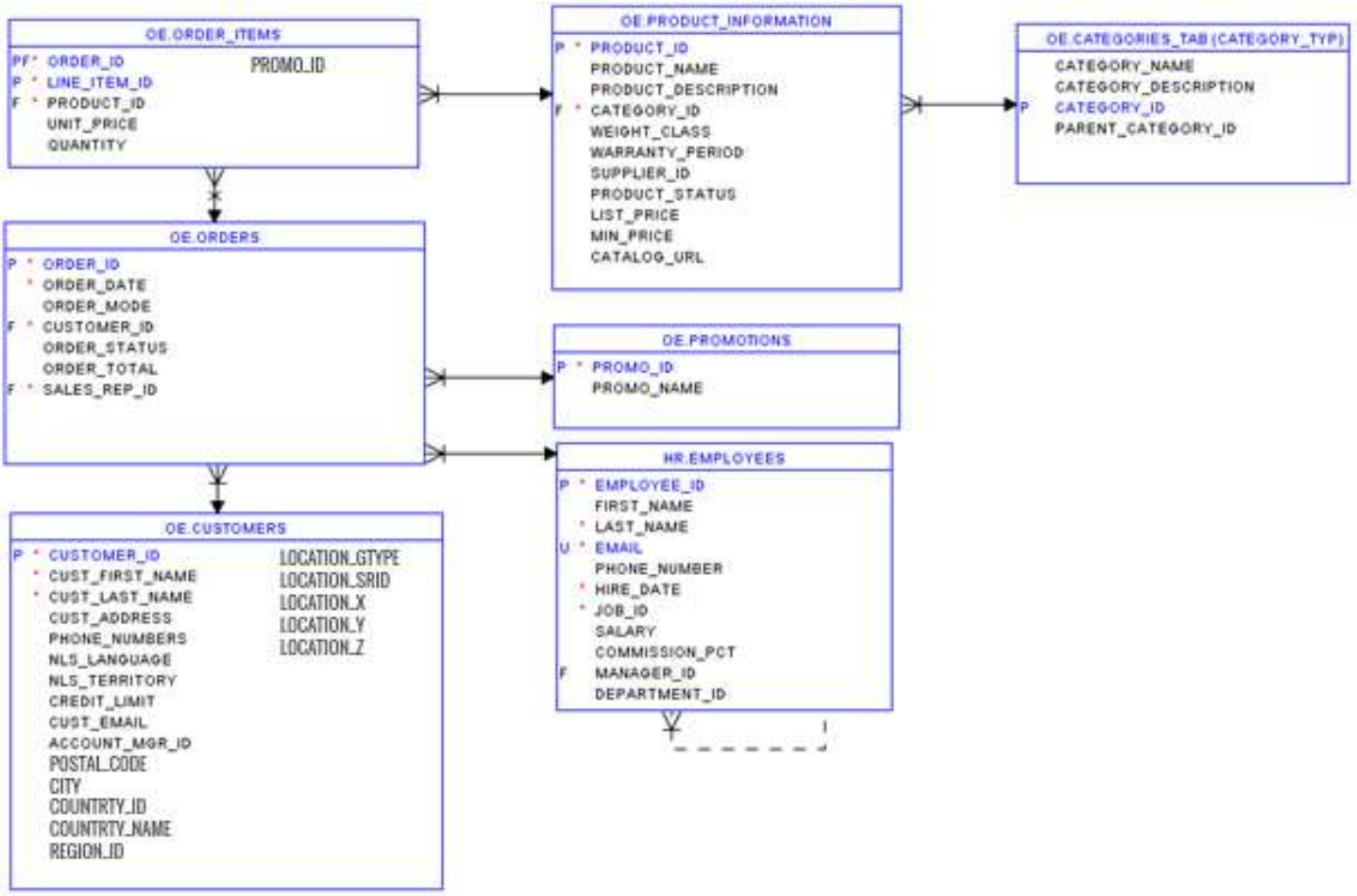


Fig 2. Staging Database Model

3. DATA WAREHOUSE

The data warehouse schema used is star schema. Each dimension is represented with only one dimension table and thus there are five dimension tables. There is a fact table at the center which is surrounded by dimension tables.

Fields like CUSTOMER_DIM_ID, SALESREP_DIM_ID, PRODUCT_DIM_ID, PROMOTION_DIM_ID, DATE_DIM_ID are included in the respective dimension tables as

primary keys. All these keys are included in the fact tale and combined they form the composite key of the fact table.

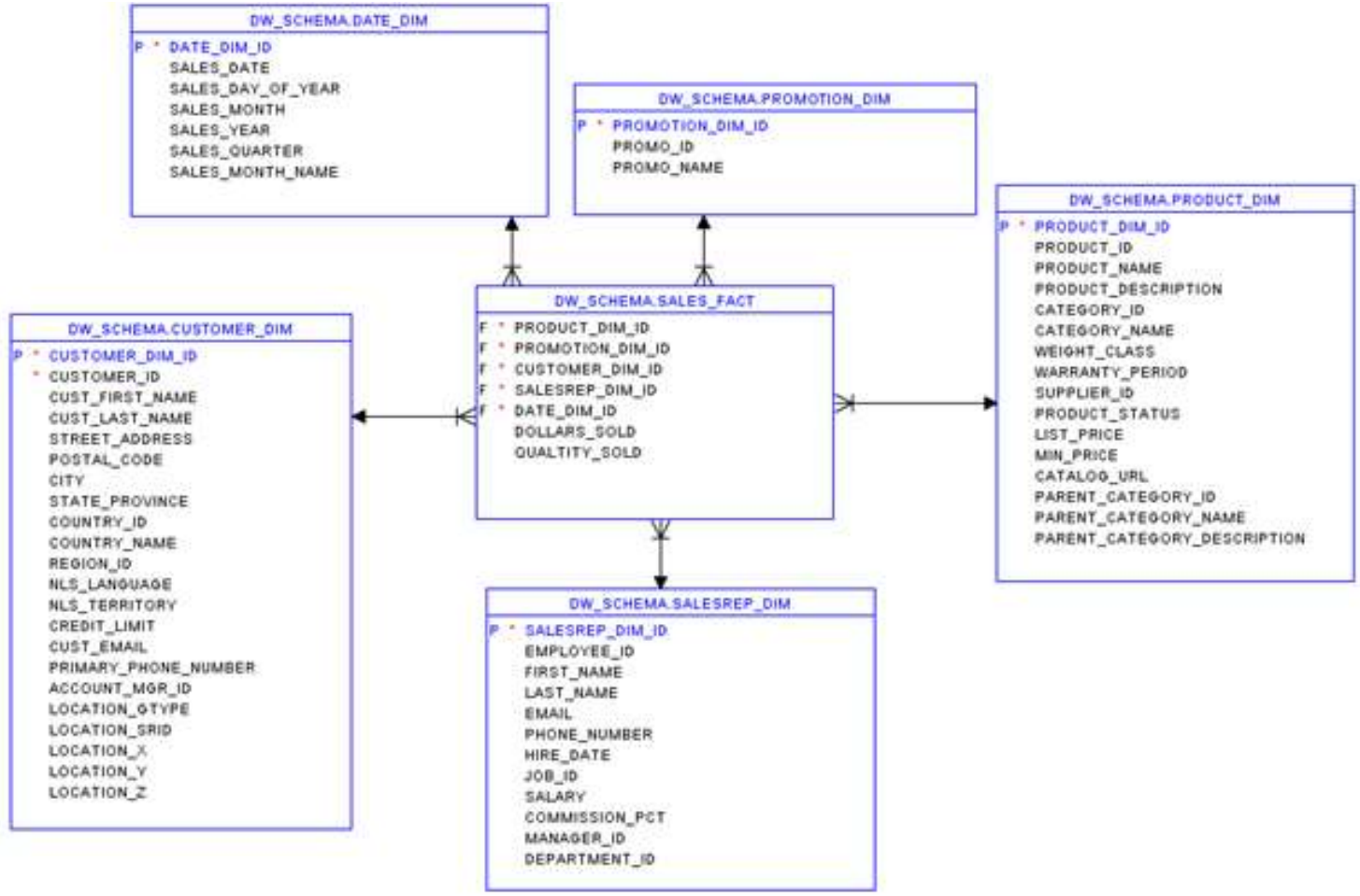


Fig 3. Data Warehouse Model

ETL PROCESS

1. FROM CSV FILES TO STAGING DATABASE

All the csv files are loaded into the staging database by creating respective tables.

Source File	Staging Table
customer_export.csv	customers
salesrep_export.csv	employees
products_export.csv	product_information & categories_tab
promotions_export.csv	promotions
orders_export.csv	orders & order_items

* For products and orders files the data is normalized into two different tables to reduce redundancy.

Mappings from csv source to staging database

Fig 4. CUSTOMERS MAPPING

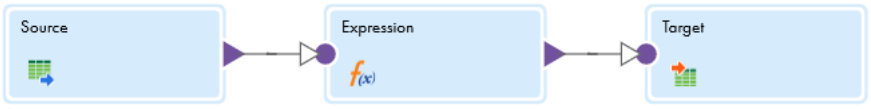


Fig 5. SALESREP MAPPING

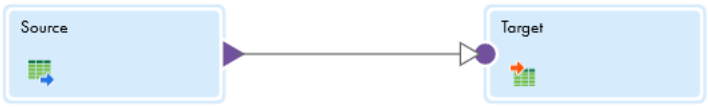


Fig 6. PRODUCT_INFORMATION MAPPING

Fig 7. CATEGORIES_TAB MAPPING

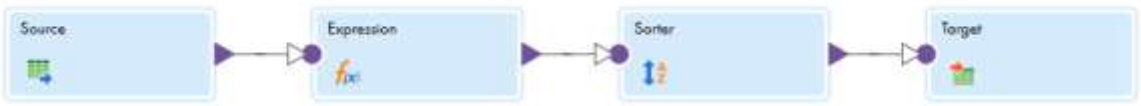


Fig 8. ORDERS MAPPING

Fig 9. PROMOTIONS MAPPING

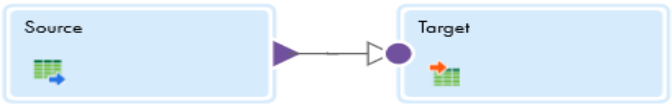


Fig 10. ORDER_ITEMS MAPPING

```
SQL> desc STG_DATE;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 CALENDAR_DATE                                      DATE

SQL>
```

```
SQL> INSERT INTO STG_DATE(CALENDAR_DATE) SELECT to_date('01-JAN-2000','DD-MON-YYYY') + level-1 calendar_date
  2  FROM dual connect by level <=
  3  (
  4   to_date('31-DEC-2025','DD-MON-YYYY') -
  5   to_date('01-JAN-2000','DD-MON-YYYY') + 1
  6  );

9497 rows created.

SQL> select count(*) from stg_date;

  COUNT(*)
----------
      9497

SQL>
```

Fig 11. STG_DATE TABLE CREATION IN STAGING DATABASE

A table with date values is created for using as a source to create a date dimension table in data warehouse.

SOURCE/TARGET RESULTS AFTER RUNNING THE MAPPINGS

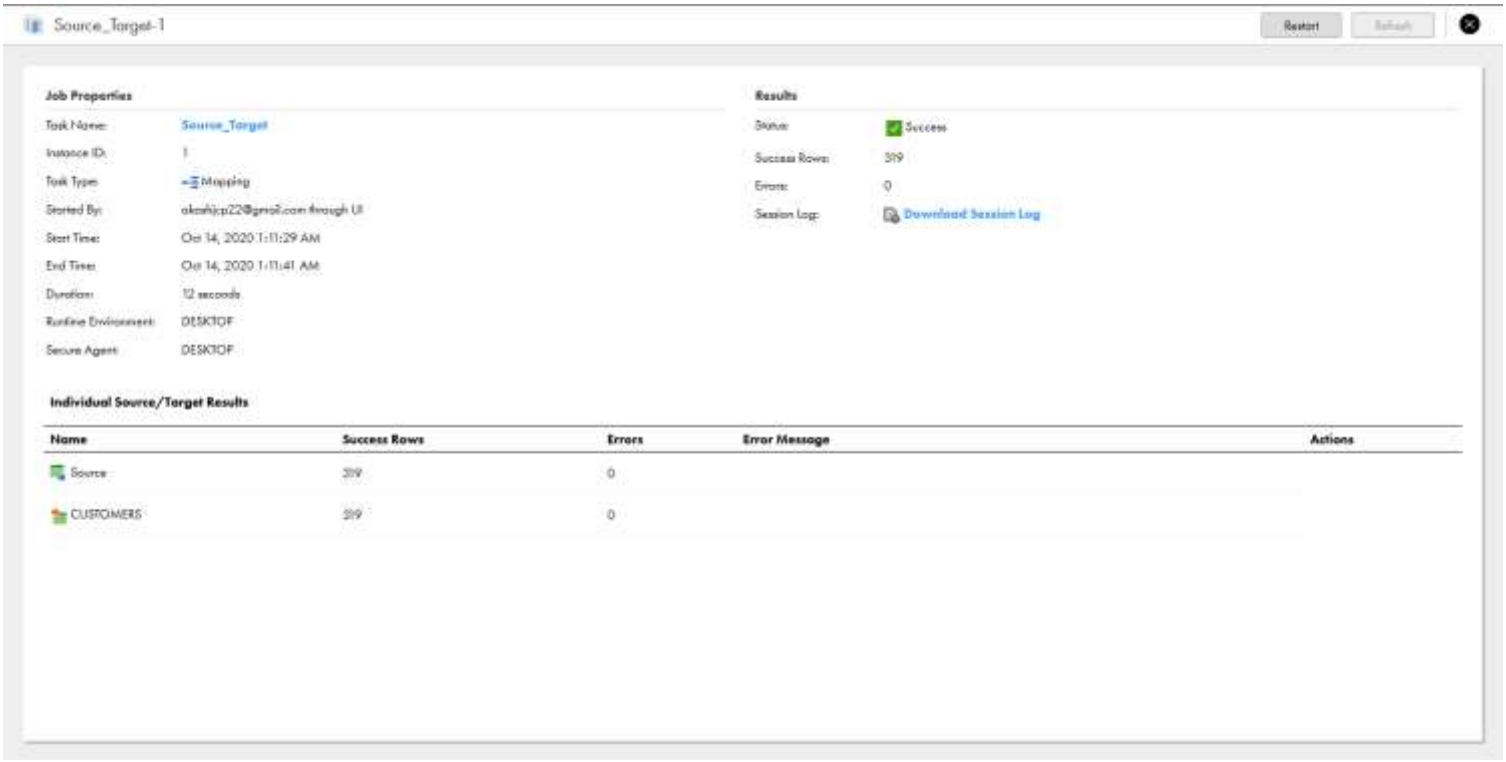


Fig 12. CUSTOMER TABLE

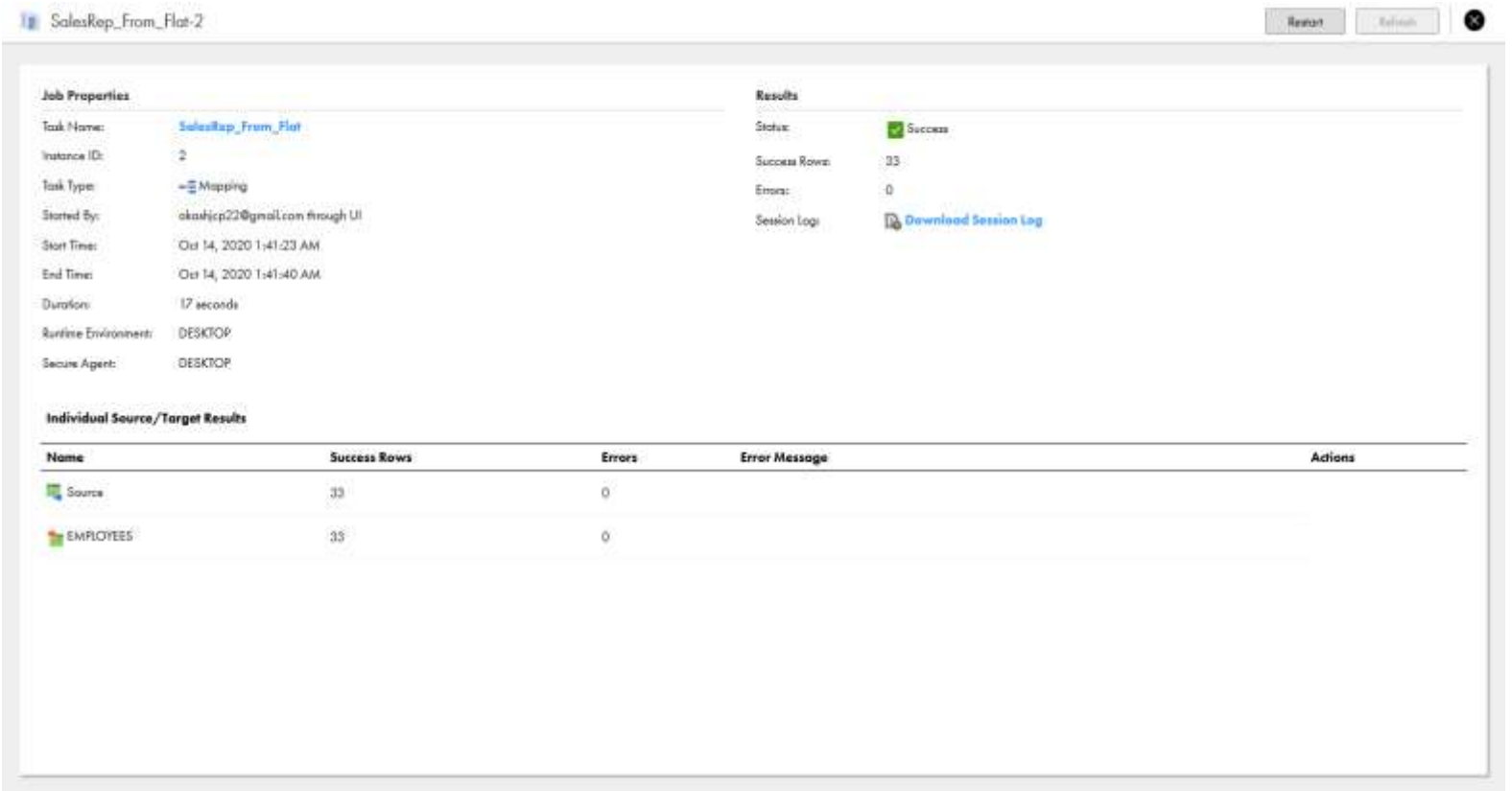


Fig 13. EMPLOYEES TABLE

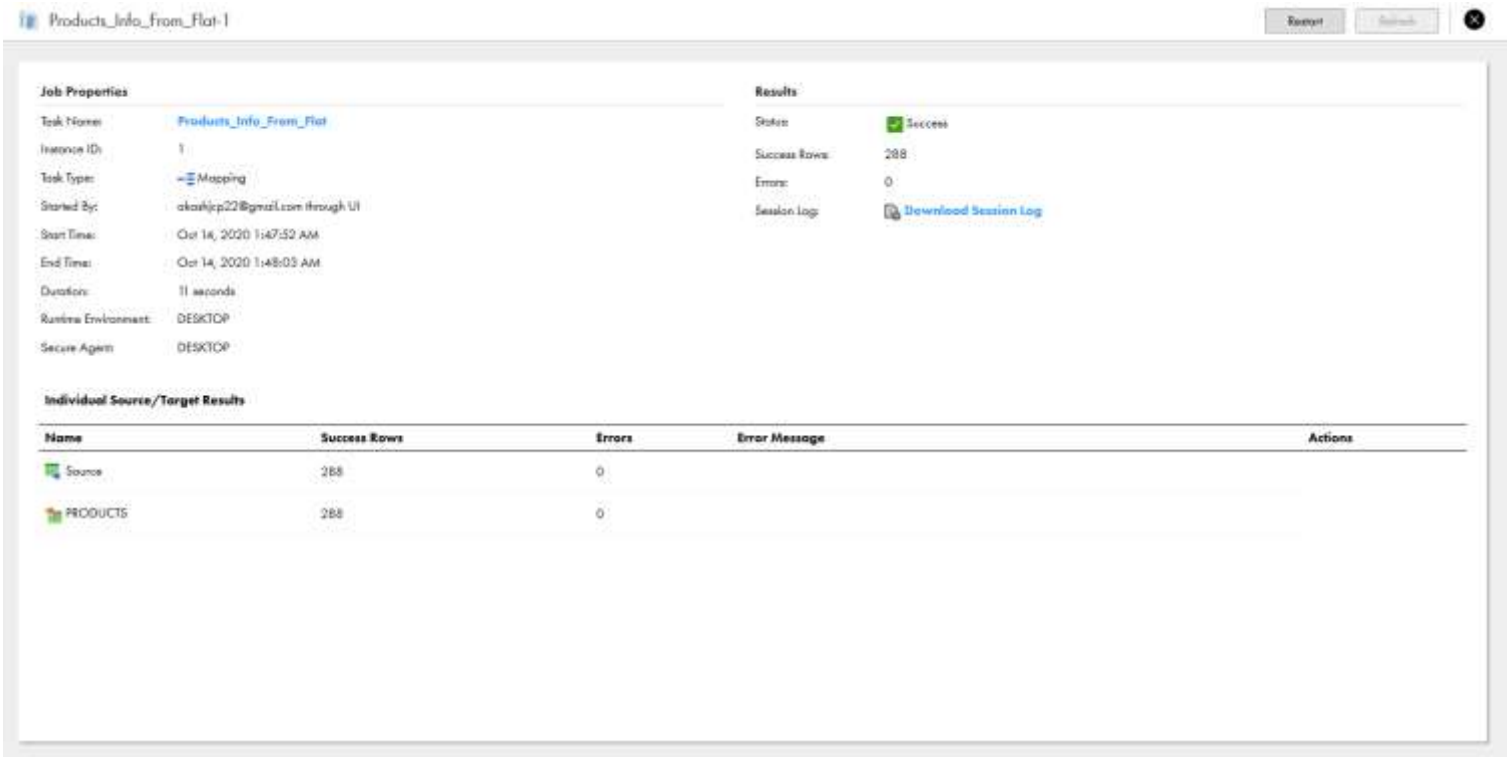


Fig 14. PRODUCT_INFORMATION TABLE

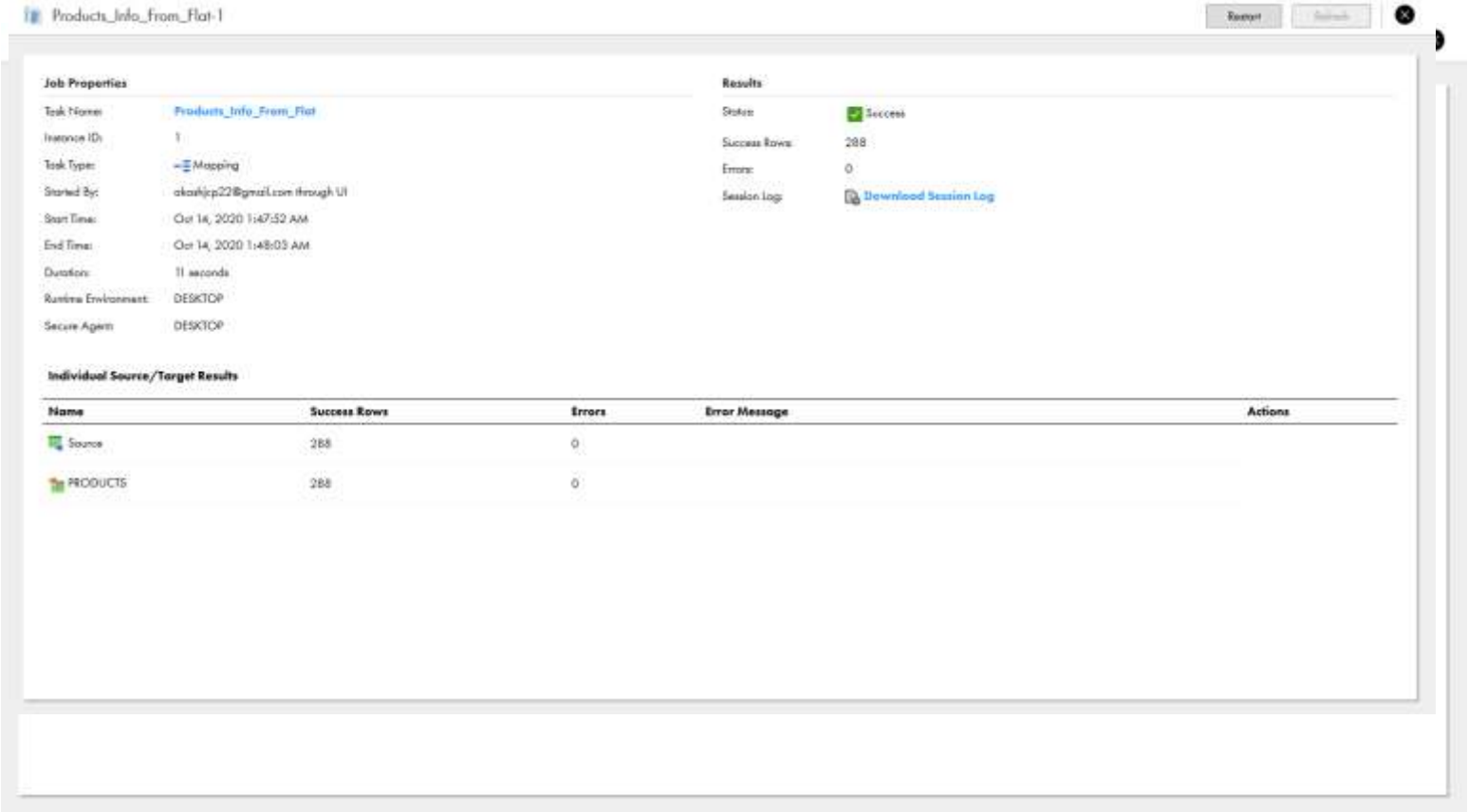


Fig 14. CATEGORIES_TAB TABLE

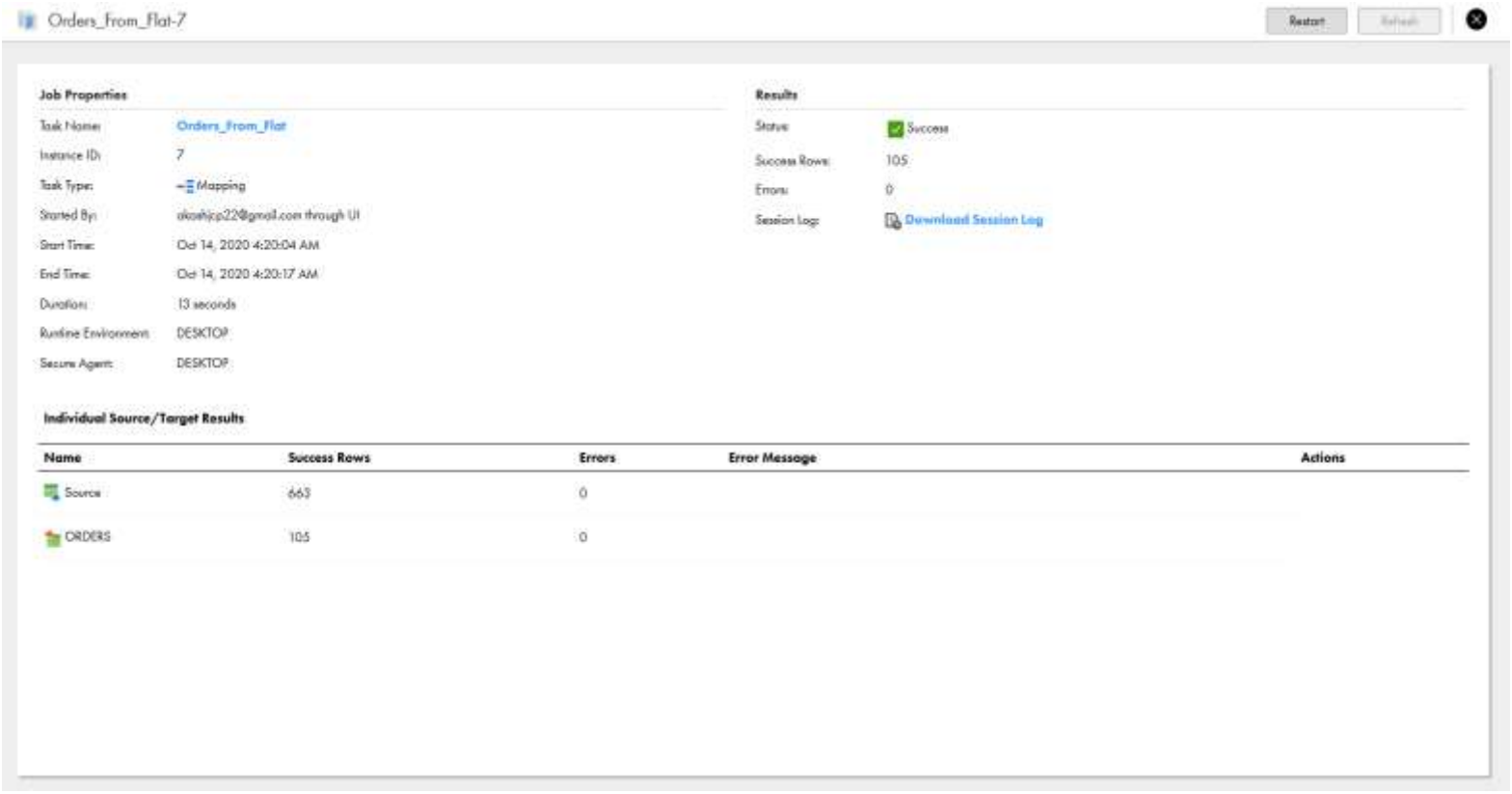


Fig 15. ORDERS TABLE

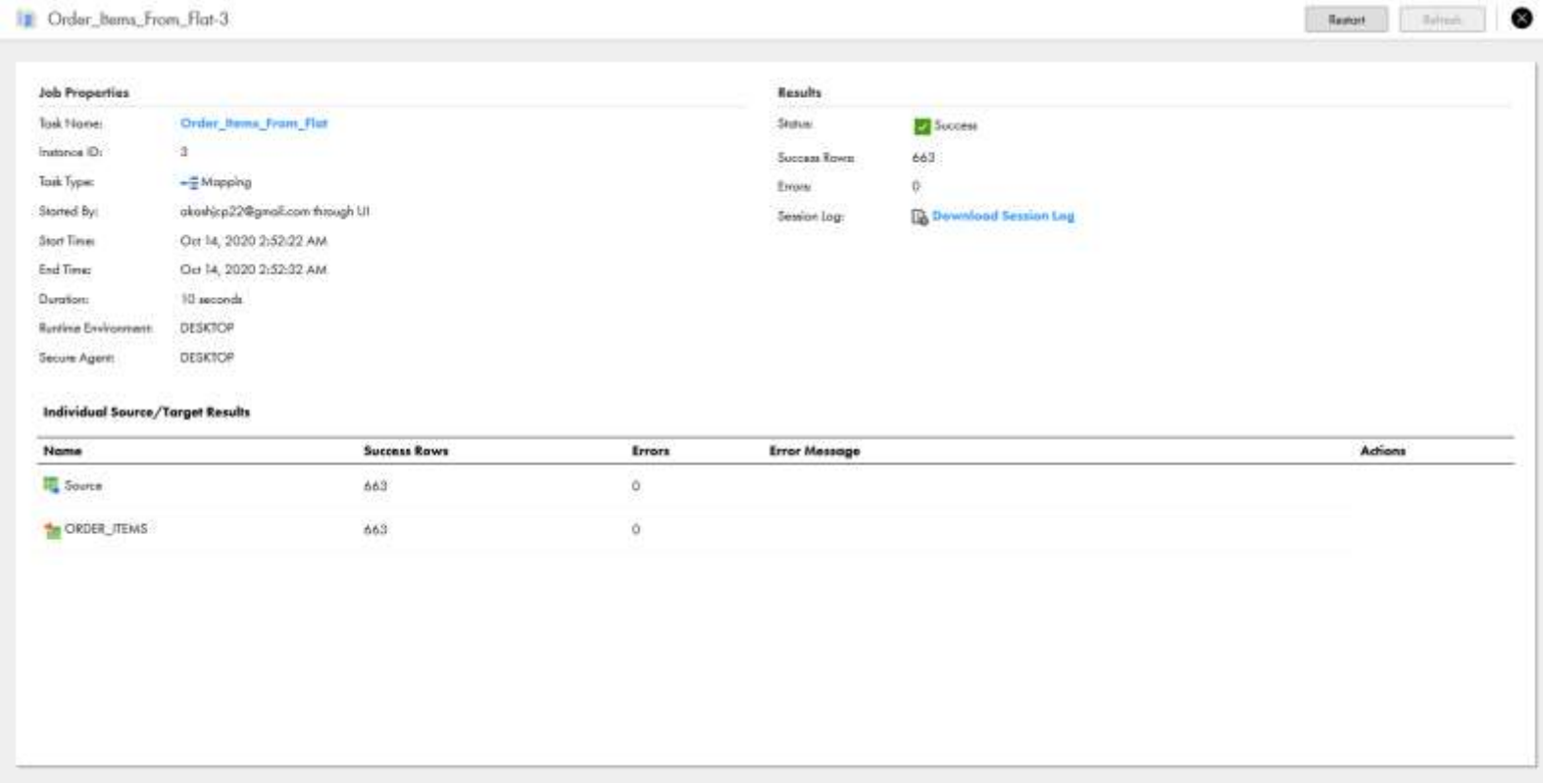


Fig 16. ORDER_ITEMS TABLE

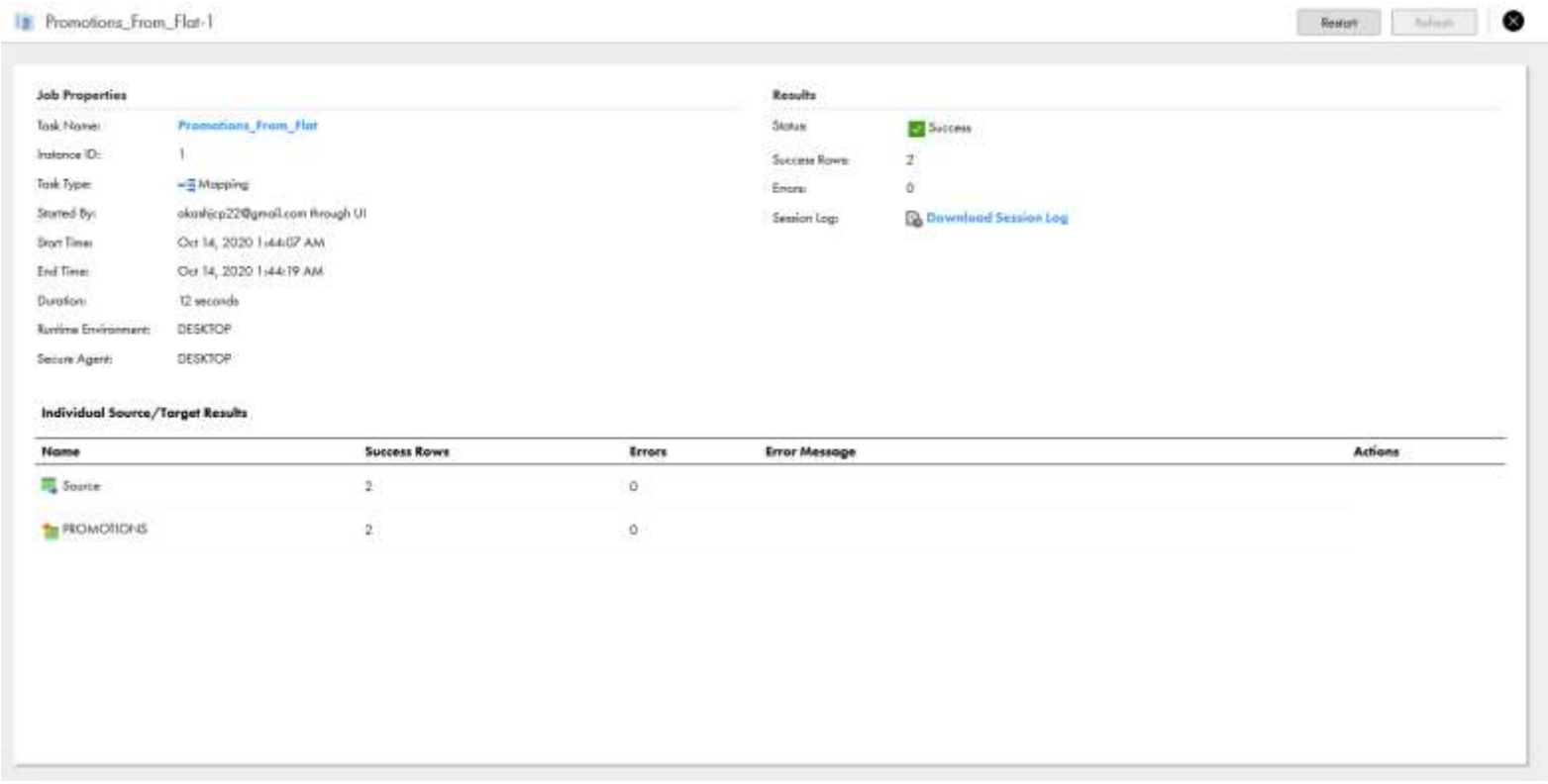


Fig 17. PROMOTIONS TABLE

Here it can be seen that the number of target success rows are lesser for the ORDERS and CATEGORIES_TAB tables. This is because we are passing only distinct values to these tables from source. Because in staging database we want to remove the redundancy from the source.

From the source data it can be seen that the fields included in ORDERS and CATEGORIES_TAB tables are getting repeated. So we need to normalize the data to reduce redundancy.

Here from complete orders details data is divided into two tables ORDER_ITEMS and ORDERS. All repeating value fields are added to the ORDERS table and we load only distinct values into this table. The same happens in the case of product details, data is divided into two tables PRODUCT_INFORMATION and CATEGORIES_TAB and only distinct values get loaded to CATEGORIES_TAB table.

2. FROM STAGING DATABASE TO DATA WAREHOUSE

Staging Table	DWH Table
customers	customer_dim_scd2
employees	salesrep_dim_scd2
product_information & categories_tab	products_dim
promotions	promotions_dim
orders & order_items	sales_fact
stg_date	date_dim

In data warehouse customer and salesrep tables are done in SCD2 and products and promotions tables are done in SCD1. Date_dim table is directly mapped with some extra fields created from an expression table. Sales_fact table is created by taking in fields from orders and order_items table along with primary keys from other dimension tables.

TYPES OF SLOWLY CHANGING DIMENSIONS IMPLEMENTED FOR DIMENSION TABLES

1) SLOWLY CHANGING DIMENSION TYPE 1 (SCD1)
2) SLOWLY CHANGING DIMENSION TYPE 2 (SCD2)

1. SLOWLY CHANGING DIMENSION TYPE 1

In SCD1 dimension table only current values are stored there is no record of previous values i.e, only new rows are inserted and updates are done on the existing rows itself.

In this case study PRODUCT_DIM and PROMOTIONS_DIM tables are implemented in SCD1.

There are some columns which we add extra in the target tables of data warehouse(can be seen in the product target metadata Fig 18.). These are for better analyzing the data.

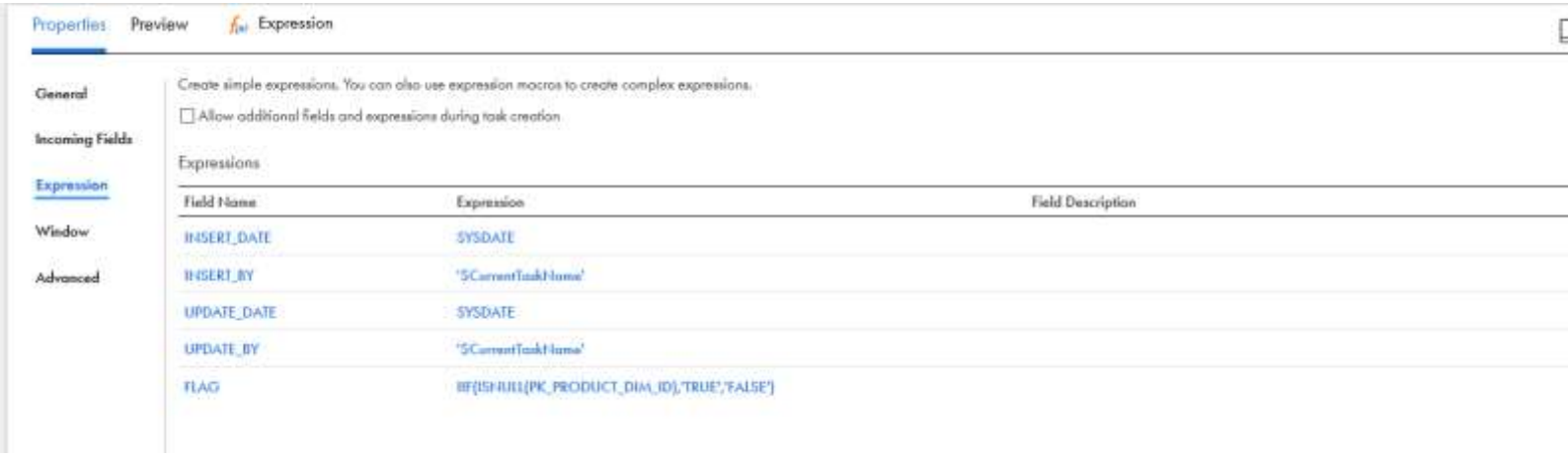


Fig 18. Extra columns in expression table of a SCD1 mapping

2. SLOWLY CHANGING DIMENSION TYPE 2

In SCD2 dimension table we keep the current value as well as the historical value in the data warehouse. So we add two columns to keep track of the history called VERSION AND FLAG. We also have all columns except FLAG from Fig 19. We also add two columns called START_DATE and END_DATE which helps to keep track of history.

We also use some columns in the expression table for various purposes about which we will see in detail.

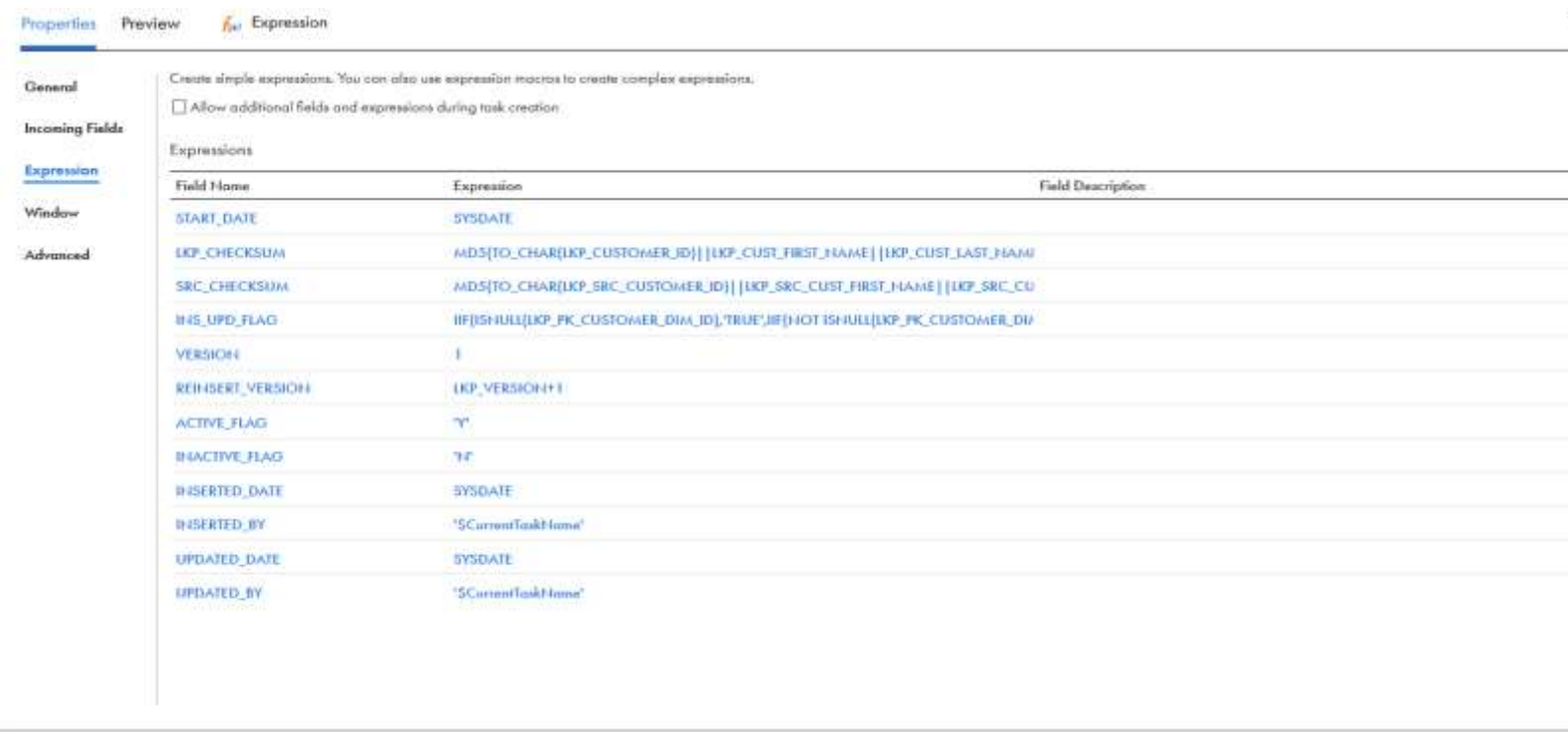


Fig 19. Extra columns in expression table of a SCD2 mapping

START_DATE

Denotes the start date of the record.

LKP_CHECKSUM

This field is made as a variable. It uses MD5() hash function which takes in a string of any length and returns a 128 bit hashed value. We pass in the fields from lookup table into this function for generating a unique value for that particular record.

SRC_CHECKSUM

Same function as of LKP_CHECKSUM here instead of lookup fields we pass in source fields to generate the unique value.

INS_UPD_FLAG

This field determines whether the row from source should be treated as a new row or as an update to an existing row. First it checks whether the primary key from lookup is null or not.

If it is null then field is set to ‘TRUE’ if not null and the

LKP_CHECKSUM != SRC_CHECKSUM then field is set to ‘FALSE’.

ACTIVE_FLAG

Value is set to ‘Y’. Used to map to the final FLAG in target table. FLAG=’Y’ if it is the latest version.

INACTIVE_FLAG

Value is set to ‘N’. Used to map to the final FLAG in target table. FLAG=’N’ if it is not the latest version.

VERSION

Field is always set to 1. Used to map to the VERSION field of target if the row is new.

REINSERT_VERSION

Field is VERSION+1. Used to map to the VERSION field of target if the row is getting updated.

INSERTED_DATE

Denotes the inserted date of the row into the data warehouse.

INSERTED_BY

Denotes the name of the person or entity who inserted the row into the data warehouse.

UPDATED_DATE

Denotes the updated date of the row in the data warehouse.

UPDATED_BY

Denotes the name of the person or entity who updated the row in the data warehouse.

MAPPINGS FROM STAGING DATABASE TO DATA WAREHOUSE

1. CUSTOMER_DIM_SCD2

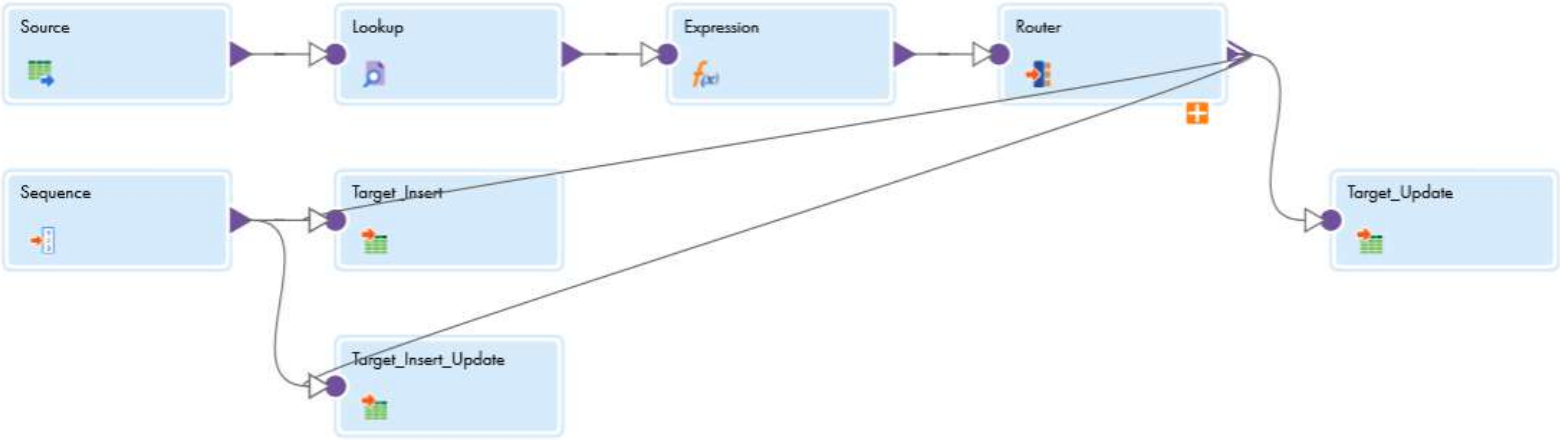


Fig 20. CUSTOMER_DIIM_SCD2 MAPPING

Process Flow

The input is from CUSTOMERS table of staging database. The business key from source, here it is the CUSTOMER_ID is passed to the lookup table. The lookup object is CUSTOMER_DIM_SCD2 table in the data warehouse. In lookup it checks whether the CUSTOMER_ID from source matches with CUSTOMER_ID in target. In lookup SQL Override is done to select the primary key only with FLAG=’Y’ (denotes latest version of the record). The primary key CUSTOMER_DIM_ID is connected from lookup to the next transformation which is an expression. Inside expression transformation we add as well as compute all fields shown in Fig 19. From expression, fields are mapped to next transformation which is a router transformation. Inside router two groups (INSERT, UPDATE) are created. In INSERT group the condition is INS_UPD_FLAG=’TRUE’ and in UPDATE group the condition is INS_UPD_FLAG=’FALSE’. A sequence generator transformation is used to create the running sequence needed for the primary key.

From INSERT group of router, fields are mapped to the target table. The primary key will be from sequence generator.

From UPDATE group of router, fields are mapped to the target table. Here also the primary key is from sequence generator the change is REINSERT_VERSION is mapped to the VERSION of target table. This inserts the update in a new row with different version and flag.

From UPDATE group of router, only CUSTOMER_DIM_ID, INACTIVE_FLAG, UPDATED_DATE, UPDATED_BY are mapped to an update strategy which are then mapped to the target table accordingly. This is for changing the old records flag and updated columns.

```
SELECT CUSTOMER_DIM_SCD2.PK_CUSTOMER_DIM_ID as PK_CUSTOMER_DIM_ID, CUSTOMER_DIM_SCD2.CUST_FIRST_NAME as CUST_FIRST_NAME,
CUSTOMER_DIM_SCD2.CUST_LAST_NAME as CUST_LAST_NAME, CUSTOMER_DIM_SCD2.STREET_ADDRESS as STREET_ADDRESS,
CUSTOMER_DIM_SCD2.POSTAL_CODE as POSTAL_CODE, CUSTOMER_DIM_SCD2.CITY as CITY, CUSTOMER_DIM_SCD2.STATE_PROVINCE as STATE_PROVINCE,
CUSTOMER_DIM_SCD2.COUNTRY_ID as COUNTRY_ID, CUSTOMER_DIM_SCD2.COUNTRY_NAME as COUNTRY_NAME, CUSTOMER_DIM_SCD2.REGION_ID as
REGION_ID, CUSTOMER_DIM_SCD2.NLS_LANGUAGE as NLS_LANGUAGE, CUSTOMER_DIM_SCD2.NLS_TERRITORY as NLS_TERRITORY,
CUSTOMER_DIM_SCD2.CREDIT_LIMIT as CREDIT_LIMIT, CUSTOMER_DIM_SCD2.CUST_EMAIL as CUST_EMAIL, CUSTOMER_DIM_SCD2.PRIMARY_PHONE_NUMBER
```

Fig 21. Lookup SQL OVERRIDE in CUSTOMER MAPPING

```
MD5(TO_CHAR(LKP_CUSTOMER_ID)||LKP_CUST_FIRST_NAME||LKP_CUST_LAST_NAME
||LKP_STREET_ADDRESS||TO_CHAR(LKP_POSTAL_CODE)||LKP_CITY||LKP_STATE_PROVIN
CE||LKP_COUNTRY_ID||LKP_COUNTRY_NAME||TO_CHAR(LKP_REGION_ID)||LKP_NLS_L
ANGUAGE||LKP_NLS_TERRITORY||TO_CHAR(LKP_CREDIT_LIMIT)||LKP_CUST_EMAIL||LKP
_PRIMARY_PHONE_NUMBER||LKP_PHONE_NUMBER_2||TO_CHAR(LKP_ACCOUNT_MGR
_ID)||TO_CHAR(LKP_LOCATION_GTYPE)||TO_CHAR(LKP_LOCATION_SRID)||TO_CHAR(LK
P_LOCATION_X)||TO_CHAR(LKP_LOCATION_Y))
```

Fig 22. LKP_CHECKSUM for CUSTOMER MAPPING

```
MD5(TO_CHAR(LKP_SRC_CUSTOMER_ID)||LKP_SRC_CUST_FIRST_NAME||LKP_SRC_CUST_
LAST_NAME||LKP_SRC_STREET_ADDRESS||TO_CHAR(LKP_SRC_POSTAL_CODE)||LKP_SRC
_CITY||LKP_SRC_STATE_PROVINCE||LKP_SRC_COUNTRY_ID||LKP_SRC_COUNTRY_NAME
||TO_CHAR(LKP_SRC_REGION_ID)||LKP_SRC_NLS_LANGUAGE||LKP_SRC_NLS_TERRITOR
Y||TO_CHAR(LKP_SRC_CREDIT_LIMIT)||LKP_SRC_CUST_EMAIL||LKP_SRC_PRIMARY_PHON
E_NUMBER||LKP_SRC_PHONE_NUMBER_2||TO_CHAR(LKP_SRC_ACCOUNT_MGR_ID)||T
O_CHAR(LKP_SRC_LOCATION_GTYPE)||TO_CHAR(LKP_SRC_LOCATION_SRID)||TO_CHAR
(LKP_SRC_LOCATION_X)||TO_CHAR(LKP_SRC_LOCATION_Y))
```

Fig 23. SRC_CHECKSUM for CUSTOMER MAPPING

```
IIF(ISNULL(LKP_PK_CUSTOMER_DIM_ID),'TRUE',IIF(NOT
ISNULL(LKP_PK_CUSTOMER_DIM_ID) AND LKP_CHECKSUM<>SRC_CHECKSUM,'FALSE'))
```

Fig 24. INS_UPD_FLAG for CUSTOMERS MAPPING

Testing the CUSTOMER_DIM_SCD2 table

For testing the working of SCD2 implemented, in the source file (customer_export.csv)

the last row is updated and a new row is also added at the end. Below is the screen shot of last few rows of source files before updating.

317	627	Sivaji	Gielgud	1667 2010	61311	Batavia	Ker	IN	India	3 hi	INDIA	500	Sivaji.Giel	+91 80 012 4931	148
318	715	Malcolm	Field	Piazza Sviz	361187	Roma		IT	Italy	1 i	ITALY	2400	Malcolm.F	+39 6 012 +39 6 083	147
319	727	Margaret	Ustinov	Via Dello C	361193	Roma		IT	Italy	1 i	ITALY	1200	Margaret.	+39 6 012 4531	147
320	755	Kevin	Cleveland	Via Notori	361235	Ventimiglia		IT	Italy	1 i	ITALY	700	Kevin.Clev	+39 10 012 4387	147
321															

Fig 25. CUSTOMER_EXPORT.CSV BEFORE UPDATING

317	627	Sivaji	Gielgud	1667 2010	61311	Batavia	Ker	IN	India	3 hi	INDIA	500	Sivaji.Giel	+91 80 012 4931		148
318	715	Malcolm	Field	Piazza Sviz	361187	Roma		IT	Italy	1 i	ITALY	2400	Malcolm.F	+39 6 012 4507	+39 6 083	147
319	727	Margaret	Ustinov	Via Dello C	361193	Roma		IT	Italy	1 i	ITALY	1200	Margaret.	+39 6 012 4531		147
320	755	Kevin123	Cleveland	Via Notori	361235	Ventimiglia		IT	Italy	1 i	ITALY	700	Kevin.Clev	+39 10 012 4387		147
321	999	Akash	J	ABCD	678678	SDFSS		YY	SDFF	2 hi	DSFS	786	ASDA	67567		567
322																

Fig 26. CUSTOMER_EXPORT.CSV AFTER UPDATING

Now after loading this data to the staging database and then loading that to the data warehouse the SCD2 was working as expected. Below image is taken from SQL DEVELOPER by connecting to the data warehouse.

315	1845	607 Shamila	Fonda	1648 Anamika St	361168 Cochin	Ker	IN	India	3 hi	INDIA	500 Shama
316	1846	627 Sivaji	Gielgud	1667 2010 St	61311 Batavia	Ker	IN	India	3 hi	INDIA	500 Sivaj
317	1847	715 Malcolm	Field	Piazza Svizzera	361187 Roma	(null)	IT	Italy	1 i	ITALY	2400 Malco
318	1848	727 Margaret	Ustinov	Via Dello Croce 93	361193 Roma	(null)	IT	Italy	1 i	ITALY	1200 Marga
319	1849	755 Kevin	Cleveland	Via Notoriosa 1943	361235 Ventimiglia	(null)	IT	Italy	1 i	ITALY	700 Kevin
320	1850	755 Kevin123	Cleveland	Via Notoriosa 1943	361235 Ventimiglia	(null)	IT	Italy	1 i	ITALY	700 Kevin
321	1851	999 Akash	J	ABCD	678678 SDFSS	(null)	YY	SDFF	2 hi	DSFS	786 ASDA

Fig 27. LAST ROWS OF CUSTOMER_DIM_SCD2 TABLE IN DATA WAREHOUSE

In CUSTOMER_DIM_SCD2 as SCD2 was implemented, the table got inserted with 2 rows one was the update made to the last row other was a completely new record(new row added at the end in source).

2. SALESREP_DIM_SCD2

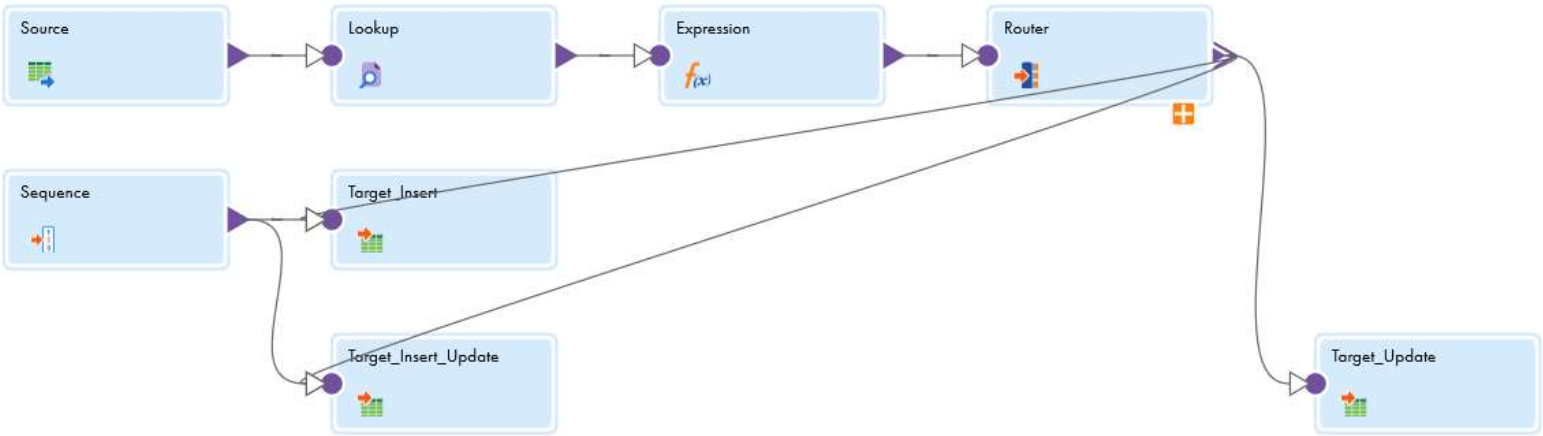


Fig 28. SALESREP MAPPING

Process Flow

The input is from EMPLOYEES table of staging database. The business key from source, here it is the EMAIL is passed to the lookup table. The lookup object is SALESREP_DIM_SCD2 table in the data warehouse. In lookup it checks whether the EMAIL from source matches with EMAIL in target. In lookup SQL Override is done to select the primary key only with FLAG='Y' (denotes latest version of the record). The primary key SALESREP_DIM_ID is connected from lookup to the next transformation which is an expression. Inside expression transformation we add as well as compute all fields shown in Fig 19. From expression, fields are mapped to next transformation which is a router transformation. Inside router two groups (INSERT, UPDATE) are created. In INSERT group the condition is INS_UPD_FLAG='TRUE' and in UPDATE group the condition is INS_UPD_FLAG='FALSE'. A sequence generator transformation is used to create the running sequence needed for the primary key.

From INSERT group of router, fields are mapped to the target table. The primary key will be from sequence generator.

From UPDATE group of router, fields are mapped to the target table. Here also the primary key is from sequence generator the change is REINSERT_VERSION is mapped to the VERSION of target table. This inserts the update in a new row with different version and flag.

From UPDATE group of router, only SALESREP_DIM_ID, INACTIVE_FLAG, UPDATED_DATE, UPDATED_BY are mapped to an update strategy which are then mapped to the target table accordingly. This is for changing the old records flag and updated columns.

```
SELECT SALESREP_DIM.PK_SALESREP_DIM_ID as PK_SALESREP_DIM_ID, SALESREP_DIM.FIRST_NAME as FIRST_NAME, SALESREP_DIM.LAST_NAME as LAST_NAME,
SALESREP_DIM.EMAIL as EMAIL, SALESREP_DIM.PHONE_NUMBER as PHONE_NUMBER, SALESREP_DIM.HIRE_DATE as HIRE_DATE, SALESREP_DIM.JOB_ID as JOB_ID,
SALESREP_DIM.SALARY as SALARY, SALESREP_DIM.COMMISSION_PCT as COMMISSION_PCT, SALESREP_DIM.MANAGER_ID as MANAGER_ID,
SALESREP_DIM.DEPARTMENT_ID as DEPARTMENT_ID, SALESREP_DIM.VERSION as VERSION, SALESREP_DIM.SALESREP_ID as SALESREP_ID FROM SALESREP_DIM
WHERE FLAG = 'Y'
```

Fig 29. SALESREP LOOKUP SQL OVERRIDE

```
MD5(TO_CHAR(SALESREP_ID)||FIRST_NAME||LAST_NAME||EMAIL||PHONE_NUMBER||
TO_CHAR(HIRE_DATE)||TO_CHAR(JOB_ID)||TO_CHAR(SALARY)||TO_CHAR(COMMISSIO
N_PCT)||TO_CHAR(MANAGER_ID)||TO_CHAR(DEPARTMENT_ID))
```

Fig 30. SALESREP LKP_CHECKSUM

```
MD5(TO_CHAR(SRC_EMPLOYEE_ID)||SRC_FIRST_NAME||SRC_LAST_NAME||SRC_EMAIL|
|SRC_PHONE_NUMBER||TO_CHAR(SRC_HIRE_DATE)||TO_CHAR(SRC_JOB_ID)||TO_CHA
R(SRC_SALARY)||TO_CHAR(SRC_COMMISSION_PCT)||TO_CHAR(SRC_MANAGER_ID)||T
O_CHAR(SRC_DEPARTMENT_ID))
```

Fig 31. SALESREP SRC_CHECKSUM

```
IIF(ISNULL(PK_SALESREP_DIM_ID),'TRUE',IIF(NOT
ISNULL(PK_SALESREP_DIM_ID) AND LKP_CHECKSUM<>SRC_CHECKSUM,'FALSE'))
```

Fig 32. SALESREP INS_UP_FLAG

Testing the SALESREP_DIM_SCD2 table

For testing the working of SCD2 implemented, in the source file (salesrep_export.csv)

the last row is updated and a new row is also added at the end. Below is the screen shot of last few rows of source files before updating.

30	175	Alyssa	Hutton	AHUTTON	011.44.16	########	SA_REP	8800	0.25	149	80
31	176	Jonathon	Taylor	JTAYLOR	011.44.16	########	SA_REP	8600	0.2	149	80
32	177	Jack	Livingston	JLIVINGS	011.44.16	########	SA_REP	8400	0.2	149	80
33	178	Kimberely	Grant	KGRANT	011.44.16	########	SA_REP	7000	0.15	149	
34	179	Charles	Johnson	CJOHNSOI	011.44.16	04-Jan-08	SA_REP	6200	0.1	149	80
35											

Fig 33. SALESREP_EXPORT.CSV BEFORE UPDATING

30	175	Alyssa	Hutton	AHUTTON	011.44.16	########	SA_REP	8800	0.25	149	80
31	176	Jonathon	Taylor	JTAYLOR	011.44.16	########	SA_REP	8600	0.2	149	80
32	177	Jack	Livingston	JLIVINGS	011.44.16	########	SA_REP	8400	0.2	149	80
33	178	Kimberely	Grant	KGRANT	011.44.16	########	SA_REP	7000	0.15	149	
34	179	Charles12	Johnson	CJOHNSOI	011.44.16	04-Jan-08	SA_REP	6200	0.1	149	80
35	200	Akash	J	asdad	234		asd	32	0.8	345	78
36											

Fig 34. SALESREP_EXPORT.CSV AFTER UPDATING

Now after loading this data to the staging database and then loading that to the data warehouse the SCD2 was working as expected. Below image is taken from SQL DEVELOPER by connecting to the data warehouse.

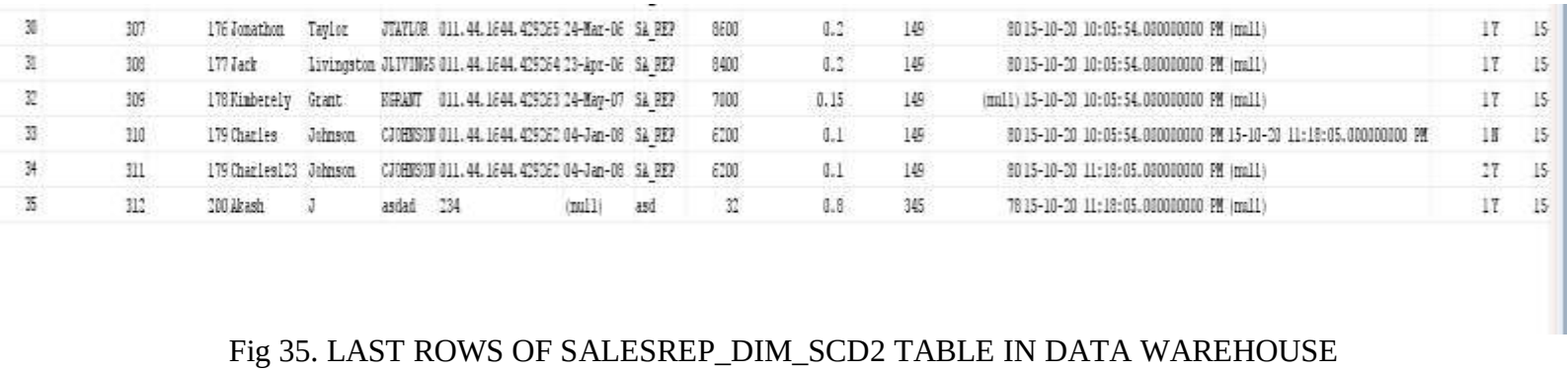


Fig 35. LAST ROWS OF SALESREP_DIM_SCD2 TABLE IN DATA WAREHOUSE

In SALESREP_DIM_SCD2 as SCD2 was implemented, the table got inserted with 2 rows one was the update made to the last row other was a completely new record(new row added at the end in source).

3. PRODUCTS_DIM

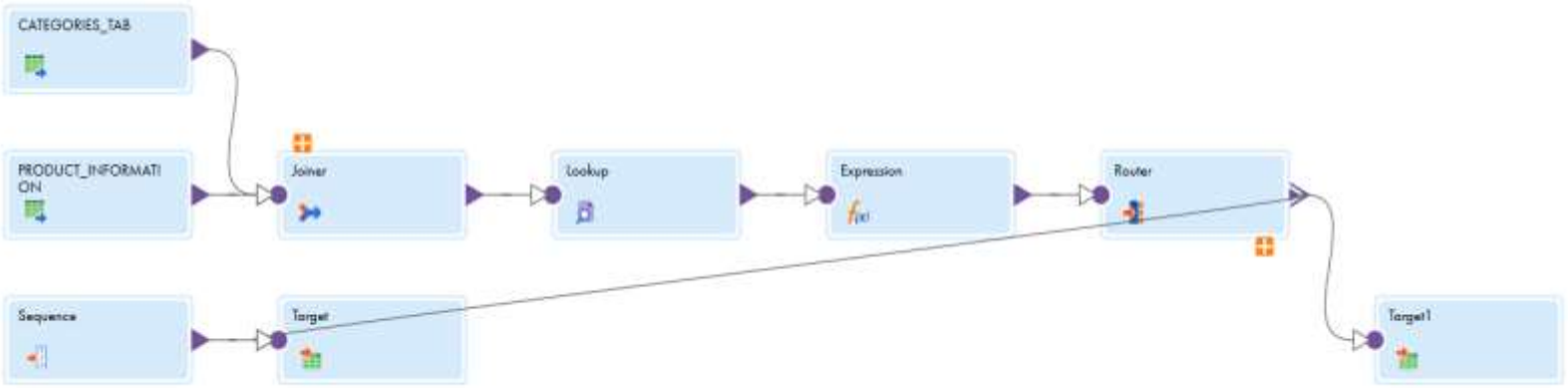


Fig 36. PRODUCTS MAPPING

Process Flow

The input is PRODUCT_INFORMATION and CATEGORIES_TAB tables from the staging database. Both the tables are inner joined on CATEGORY_ID. The resulting table is the source for the mapping. A lookup table with PRODUCTS_DIM as lookup object is created. The PRODUCT_ID which is the business key here is taken into the lookup. In lookup a condition is made to check whether the PRODUCT_ID from source exists in target. The primary key PRODUCT_DIM_ID is then mapped to the expression transformation. In expression transformation all extra fields (Fig 18.) are added. FLAG is set to 'TRUE' or 'FALSE' depending on the primary key.

All fields from the expression transformation is then passed to the router transformation. Inside router two groups (INSERT, UPDATE) are created. In INSERT group the condition is FLAG='TRUE' and in UPDATE group the condition is FLAG='FALSE'. A sequence generator transformation is used to create the running sequence needed for the primary key.

From INSERT group of router, fields are mapped to the target table. The primary key will be from sequence generator.

From UPDATE group of router, fields are mapped to the target table. Here the primary key is from lookup and all fields are mapped from update strategy accordingly.

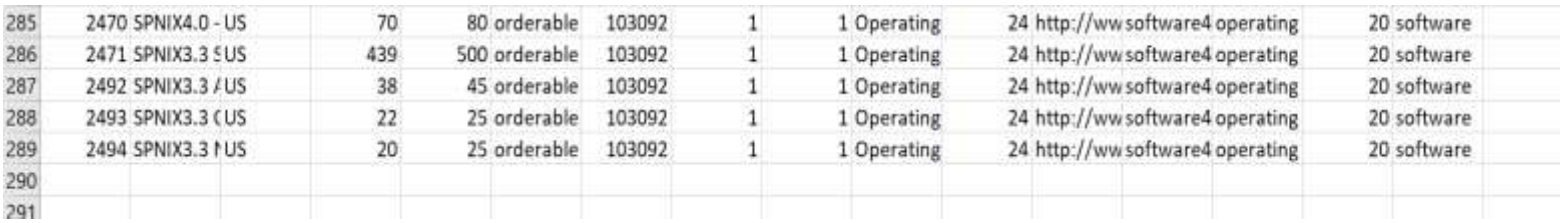
```
IIF(ISNULL(PK_PRODUCT_DIM_ID),'TRUE','FALSE')
```

Fig 37. FLAG IN PRODUCTS MAPPING

Testing the PRODUCT_DIM table

For testing the working of SCD1 implemented, in the source file (product_export.csv)

the last row is updated and a new row is also added at the end. Below is the screen shot of last few rows of source files before updating.



285	2470	SPNIX4.0 -	US	70	80	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
286	2471	SPNIX3.3 S	US	439	500	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
287	2492	SPNIX3.3 A	US	38	45	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
288	2493	SPNIX3.3 C	US	22	25	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
289	2494	SPNIX3.3 N	US	20	25	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
290																
291																

Fig 38. PRODUCT_EXPORT.CSV BEFORE UPDATING

286	2471	SPNIX3.3	US	439	500	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
287	2492	SPNIX3.3	US	38	45	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
288	2493	SPNIX3.3	US	22	25	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
289	2494	SPNIX3.3	IN	999	25	orderable	103092	1	1	Operating	24	http://ww	software4	operating	20	software
290	3000	SDF	RE	534	32	ASDA	324242	3	3	ASDA	100	SDAD	SDAD	ASD	66	ASDASD
291																

Fig 39. PRODUCT_EXPORT.CSV AFTER UPDATING

Now after loading this data to the staging database and then loading that to the data warehouse the SCD1 was working as expected. Below image is taken from SQL DEVELOPER by connecting to the data warehouse.

284	3747	2470	SPNIX4.0 - NL	US	70	80	orderable	103092	1	1 Operating System Software: SPNIX V4.0 - Additional network access license.
285	3748	2471	SPNIX3.3 SU	US	439	500	orderable	103092	1	1 Operating System Software: SPNIX V3.3 - Base Server License Upgrade to V4.0.
286	3749	2492	SPNIX3.3 AU	US	38	45	orderable	103092	1	1 Operating System Software: SPNIX V3.3 - V4.0 upgrade; class A user.
287	3750	2493	SPNIX3.3 C/DU	US	22	25	orderable	103092	1	1 Operating System Software: SPNIX V3.3 - V4.0 upgrade; class C or D user.
288	3751	2494	SPNIX3.3 NU	IN	999	25	orderable	103092	1	1 Operating System Software: SPNIX V3.3 - V4.0 upgrade; network access license.
289	3752	3000	SDF	RE	534	32	ASDA	324242	3	3 ASDA

Fig 40. LAST ROWS OF PRODUCT_DIM TABLE IN DATA WAREHOUSE

4. PROMOTIONS_DIM

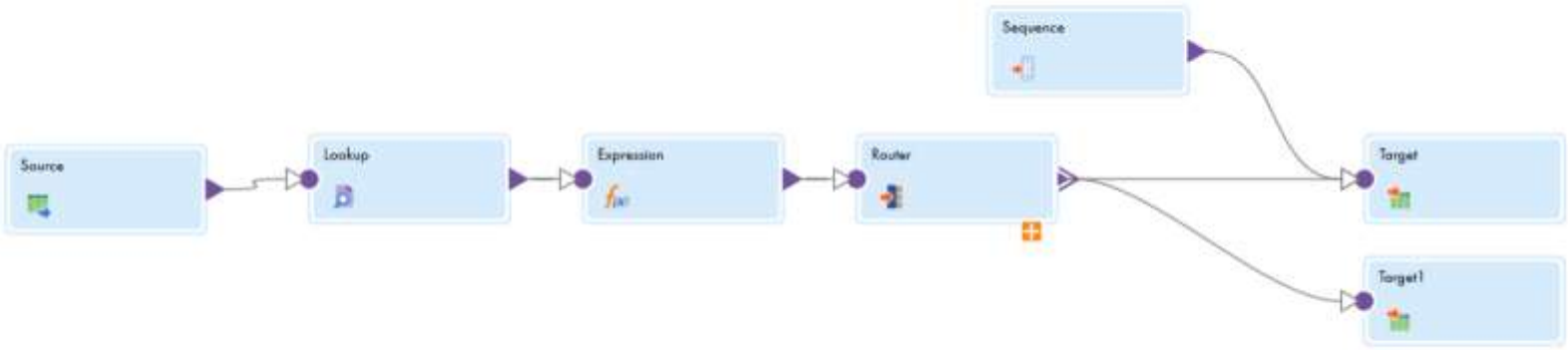


Fig 41. PROMOTIONS MAPPING

Process Flow

The input is PROMOTIONS table from the staging database. A lookup table with PROMOTIONS_DIM as lookup object is created. The PROMO_ID which is the business key here is taken into the lookup. In lookup a condition is made to check whether the PROMO_ID from source exists in target. The primary key PROMOTION_DIM_ID is then mapped to the expression transformation. In expression transformation all extra fields (Fig 18.) are added. FLAG is set to 'TRUE' or 'FALSE' depending on the primary key.

All fields from the expression transformation is then passed to the router transformation. Inside router two groups (INSERT, UPDATE) are created. In INSERT group the condition is FLAG='TRUE' and in UPDATE group the condition is FLAG='FALSE'. A sequence generator transformation is used to create the running sequence needed for the primary key.

From INSERT group of router, fields are mapped to the target table. The primary key will be from sequence generator.

From UPDATE group of router, fields are mapped to the target table. Here the primary key is from lookup and all fields are mapped from update strategy accordingly.

```
IIF(ISNULL(PK_PROMO_KEY),'TRUE','FALSE')
```

Fig 42. FLAG IN PROMOTIONS MAPPING

Testing the PROMOTIONS_DIM table

For testing the working of SCD1 implemented, in the source file (promotions_export.csv) the last row is updated and a new row is also added at the end. Below is the screen shot of last few rows of source files before updating.

	A	B	C	D
1	PROMO_I	PROMO_NAME		
2	1	everyday low price		
3	2	blowout sale		
4				

Fig 43. PROMOTIONS_EXPORT.CSV BEFORE UPDATING

	A	B
1	PROMO_I	PROMO_NAME
2	1	everyday low price
3	2	blowout sale123
4	3	HAHA
5		

Fig 44. PROMOTIONS _EXPORT.CSV AFTER UPDATING

Now after loading this data to the staging database and then loading that to the data warehouse the SCD1 was working as expected. Below image is taken from SQL DEVELOPER by connecting to the data warehouse.

Columns | Data | Model | Constraints | Grants | Statistics | Triggers | Flashback | Dependencies | Details | Partitions | Indexes | SQL

Sort... Filter:

	PROMOTION_DIM_ID	PROMO_ID	PROMO_NAME	INSERTED_DATE	INSERTED_BY	UPDATED_DATE	UPDATED_BY
1	23	1	everyday low price	15-10-20 10:06:00.000000000 PM	Administrator	15-10-20 11:18:14.000000000 PM	Administrator
2	24	2	blowout sale123	15-10-20 10:06:00.000000000 PM	Administrator	15-10-20 11:18:14.000000000 PM	Administrator
3	25	3	HAHA	15-10-20 11:18:14.000000000 PM	Administrator	15-10-20 11:18:14.000000000 PM	Administrator

Fig 45. LAST ROWS OF PRODUCT_DIM TABLE IN DATA WAREHOUSE

5. DATE_DIM

Fig 46. DATE MAPPING

Process Flow

The STG_DATE table in staging database acts as the source. The fields are connected to an expression transformation were six extra columns are added.

Columns added:

1. SALES_DATE
2. SALES_DAY_OF_THE_MONTH
3. SALES_MONTH
4. SALES_YEAR
5. SALES_QUARTER
6. SALES_MONTH_NAME

SALES_DATE is mapped directly to CALENDAR_DATE which is the input field from source.

Get_Date_Part(CALENDAR_DATE,'DD')

Fig 47. SALES_DAY_OF_THE_MONTH

Get_Date_Part(CALENDAR_DATE,'MM')

Fig 48. SALES_MONTH

Get_Date_Part(CALENDAR_DATE,'YYYY')

Fig 49. SALES_YEAR

```
TO_INTEGER(TO_CHAR(CALENDAR_DATE,'Q'))
```

Fig 50. SALES_QUARTER

```
TO_CHAR(CALENDAR_DATE,'MONTH')
```

Fig 51. SALES_MONTH_NAME

9483	85459	17-12-25	17	12	2025	4	December
9484	85460	18-12-25	18	12	2025	4	December
9485	85461	19-12-25	19	12	2025	4	December
9486	85462	20-12-25	20	12	2025	4	December
9487	85463	21-12-25	21	12	2025	4	December
9488	85464	22-12-25	22	12	2025	4	December
9489	85465	23-12-25	23	12	2025	4	December
9490	85466	24-12-25	24	12	2025	4	December
9491	85467	25-12-25	25	12	2025	4	December
9492	85468	26-12-25	26	12	2025	4	December
9493	85469	27-12-25	27	12	2025	4	December
9494	85470	28-12-25	28	12	2025	4	December
9495	85471	29-12-25	29	12	2025	4	December
9496	85472	30-12-25	30	12	2025	4	December
9497	85473	31-12-25	31	12	2025	4	December

Fig 52. LAST FEW ROWS OF DATE_DIM TABLE CREATED IN DATA WAREHOUSE

6. SALES_FACT

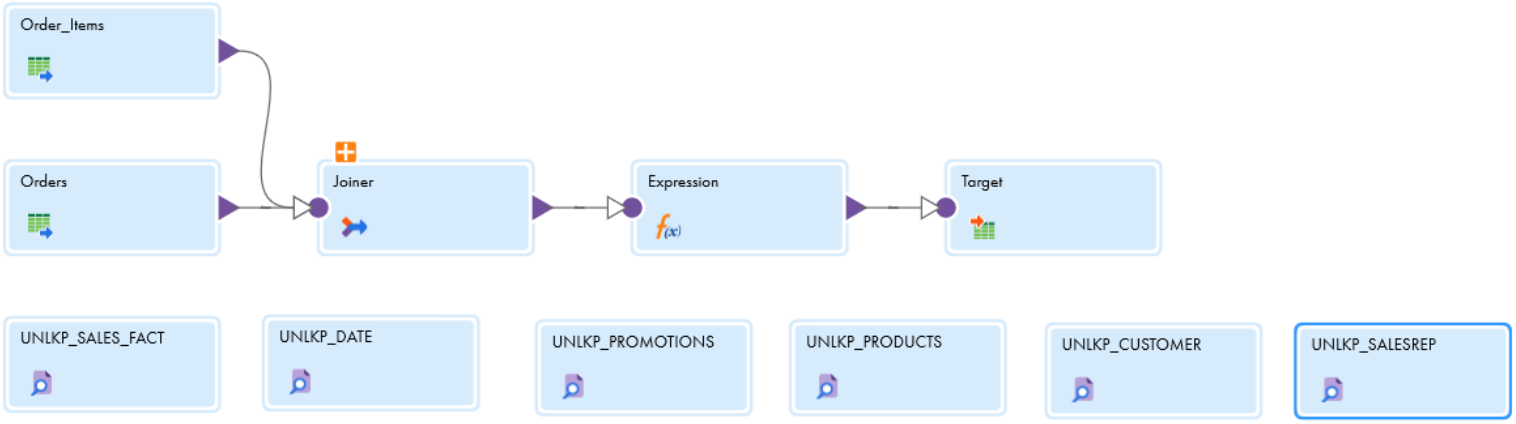


Fig 53. SALES_FACT TABLE MAPPING

Process Flow

Here ORDERS and ORDER_ITEMS tables from the staging database acts as the source.

The tables are inner joined on ORDER_ID. From joiner all fields are passed to an expression transformation. In expression transformation primary keys of other dimension tables are found using their unconnected lookups and added into the fact table. The business keys of the respective dimension tables are passed to their unconnected lookups which in turn returns the corresponding primary key.

Here unconnected lookup is used instead of sequence generator for generating the primary key for fact table. This generation of running sequence using unconnected lookup uses extra fields which are developed in the expression table.

Extra fields used for creation of running sequence primary key for fact table

V_CNT	V_CNT+1
V_MAX_VAL	IIF(V_CNT=1,:LKP.UNLKP_SALES_FACT(1) ,IIF(ISNULL(V_MAX_VAL) OR V_MAX_VAL=0,1,'
V_SEQ	IIF(ISNULL(V_MAX_VAL) OR V_MAX_VAL=0,1,V_CNT+V_MAX_VAL)

V_CNT

A value which is used for calculating the running sequence. It is always increasing.

V_MAX_VAL

A value which is used for calculating the running sequence. It will be always 1.

V_SEQ

Denotes the final running sequence generated.

```
SELECT SALESREP_DIM.PK_SALESREP_DIM_ID as PK_SALESREP_DIM_ID, SALESREP_DIM.SALESREP_ID as SALESREP_ID FROM SALESREP_DIM
WHERE FLAG = 'Y'
```

Fig 54. SQL OVERRIDE GIVEN IN THE UNCONNECTD LOOKUP OF SALES_FACT TABLE

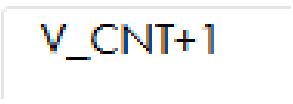


Fig 55. VALUE OF V_CNT FIELD IN EXPRESSION

```
IIF(V_CNT=1,:LKP.UNLKP_SALES_FACT(1) ,IIF(ISNULL(V_MAX_VAL) OR
V_MAX_VAL=0,1,V_MAX_VAL))
```

Fig 56. VALUE OF V_MAX_VAL FIELD IN EXPRESSION

```
IIF(ISNULL(V_MAX_VAL) OR V_MAX_VAL=0,1,V_CNT+V_MAX_VAL)
```

Fig 57. VALUE OF V_SEQ FIELD IN EXPRESSION

```
SELECT CUSTOMER_DIM_SCD2.PK_CUSTOMER_DIM_ID as PK_CUSTOMER_DIM_ID, CUSTOMER_DIM_SCD2.CUSTOMER_ID as CUSTOMER_ID FROM
CUSTOMER_DIM_SCD2
WHERE FLAG = 'Y'
```

Fig 58. SQL OVERRIDE GIVEN IN UNCONNECTED LOOKUP OF CUSTOMER TABLE

```
SELECT SALESREP_DIM.PK_SALESREP_DIM_ID as PK_SALESREP_DIM_ID, SALESREP_DIM.FIRST_NAME as FIRST_NAME, SALESREP_DIM.LAST_NAME as LAST_NAME,
SALESREP_DIM.EMAIL as EMAIL, SALESREP_DIM.PHONE_NUMBER as PHONE_NUMBER, SALESREP_DIM.HIRE_DATE as HIRE_DATE, SALESREP_DIM.JOB_ID as JOB_ID,
SALESREP_DIM.SALARY as SALARY, SALESREP_DIM.COMMISSION_PCT as COMMISSION_PCT, SALESREP_DIM.MANAGER_ID as MANAGER_ID,
SALESREP_DIM.DEPARTMENT_ID as DEPARTMENT_ID, SALESREP_DIM.VERSION as VERSION, SALESREP_DIM.SALESREP_ID as SALESREP_ID FROM SALESREP_DIM
WHERE FLAG = 'Y'
```

Fig 59. SQL OVERRIDE GIVEN IN UNCONNECTED LOOKUP OF SALESREP TABLE

Testing the SALES_FACT table

	A	B	C	D	E	F	G	H	I	J	K
1	ORDER_ID	ORDER_D	CUSTOME	ORDER_ST	ORDER_TO	SALES_REI	PROMO_ID	LINE_ITEM	PRODUCT_	UNIT_PRIC	QUANTITY
2	2491	25-Oct-08	107	3	31574	160	0	1	3106	46	36
3	2520	########	146	3	29249.1		0	1	2322	22	22
4	2531	########	169	8	15760.5	156	1	1	3112	72	5
5	2563	########	107	3	31574	160	0	1	3114	99	30
6	2601	########	159	2	69286.4	161	0	1	2986	123	3
7	2615	27-Oct-08	143	3	27132.6		0	1	3187	2.2	25
8	2642	########	144	6	62303	159	0	1	2311	86.9	5
9	2689	07-Oct-08	101	8	33893.6	161	1	1	2308	54	30
10	2724	########	169	8	15760.5	156	0	1	3124	84	14
11	2743	########	107	3	31574	160	0	1	3150	17	45
12	2764	########	109	1	77727.2	155	0	1	3165	37	71
13	2799	########	150	4	282694.3		2	1	2308	56	41
14	2824	07-Oct-08	119	9	16447.2		0	1	3163	30	13
15	2859	28-Oct-08	170	9	66816	158	0	1	3167	54	42
16	2876	27-Oct-08	147	3	1636	159	1	1	3197	44	3
17	2899	########	101	8	33893.6	161	0	1	2264	199.1	15
18	2941	########	158	0	25270.3	161	2	1	2289	44	15
19	2980	########	148	10	21116.9		0	1	2365	77	9
20											

Fig 60. ORDERS_EXPORT_NEW.CSV IS ADDED TO STAGING DATABASE ORDERS AND ORDER_ITEMS TABLE FOR TESTING FACT TABLE

The above csv file is loaded to the staging database ORDERS and ORDER_ITEMS table.

From there it is loaded to SALES_FACT table. The count in fact table increased from 663 to 681. Below image is taken from SQL DEVELOPER by connecting to the data warehouse.

Fig 61. LAST FEW ROWS OF FACT TABLE

```
SQL> SELECT SUM(QUANTITY) , SUM(QUANTITY*UNIT_PRICE) FROM ORDER_ITEMS;

SUM(QUANTITY) SUM(QUANTITY*UNIT_PRICE)
------------- ------------------------
        30373                3684777.3
```

Fig 62. SUM OF QUANTITY AND (UNIT_PRICE * QUANTITY) FROM ORDER_ITEMS TABLE OF STAGING DATABASE

```
SQL> SELECT SUM(QUANTITY_SOLD), SUM(DOLLARS_SOLD) FROM SALES_FACT;

SUM(QUANTITY_SOLD) SUM(DOLLARS_SOLD)
------------------ -----------------
             30373         3684777.3
```

Fig 63. SUM OF QUANTITY AND DOLLARS_SOLD FROM SALES_FACT TABLE

In SALES_FACT table the new records from ORDERS_EXPORT_NEW.CSV was added and a comparison of SUM(QUANTITY) and SUM(UNIT_PRICE * QUANTITY) was made between ORDER_ITEMS and SALES_FACT table to check whether all records were updated in fact table. Both the results were exactly matching proving that the ETL is working.

SOURCE/TARGET RESULTS AFTER RUNNING THE MAPPINGS FOR DWH

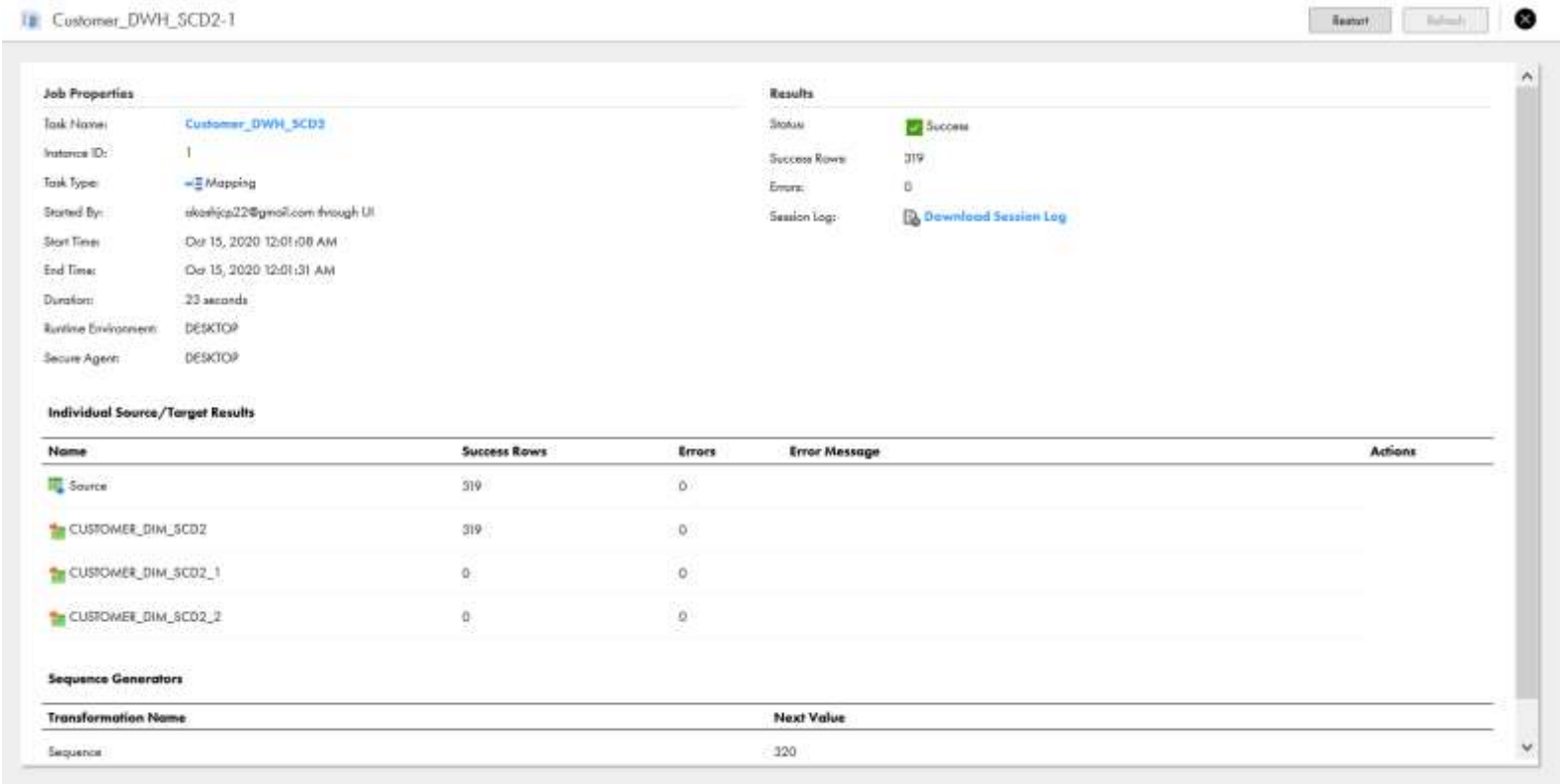


Fig 64. CUSTOMER_DIM_SCD2

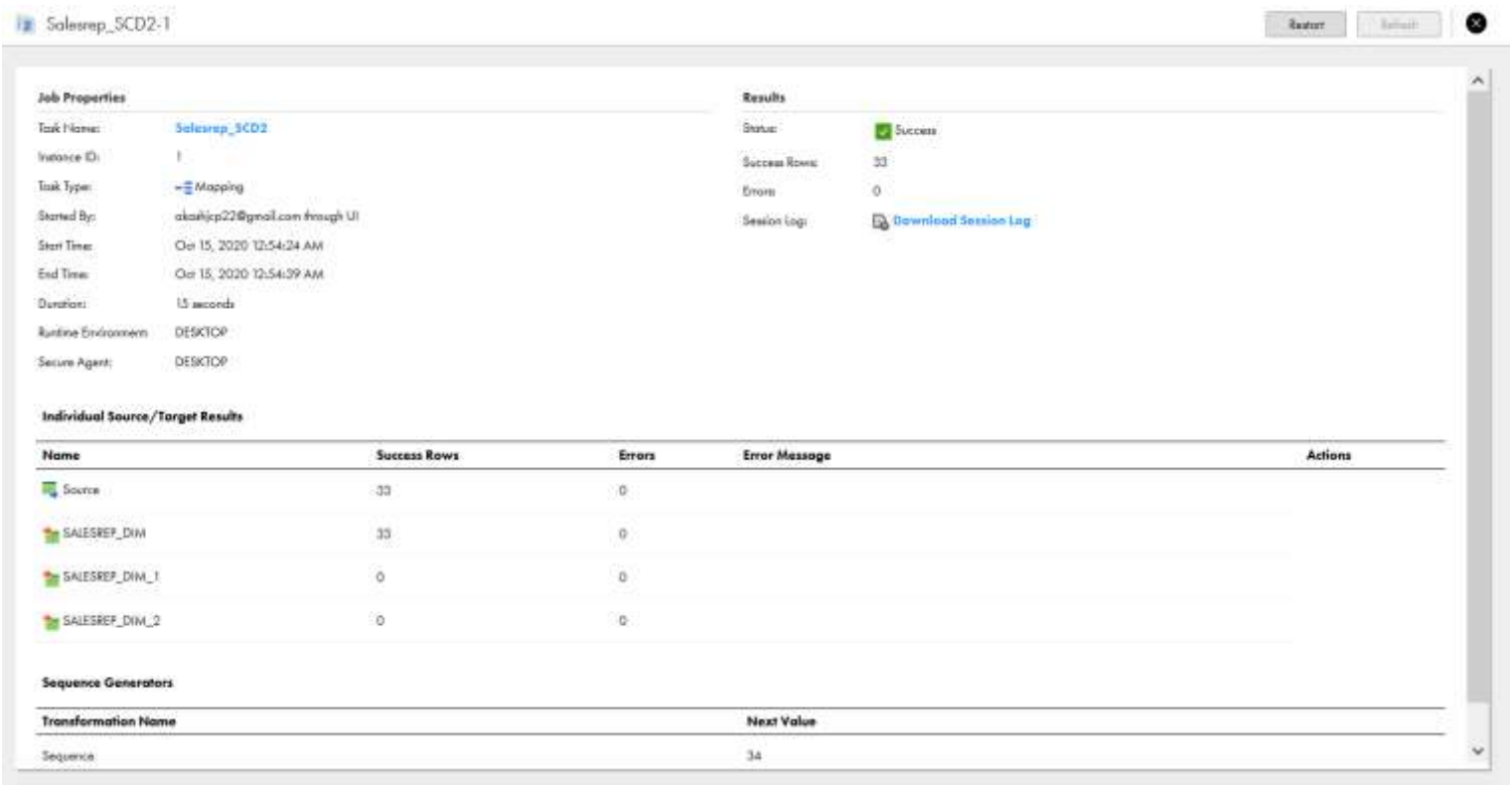


Fig 65. SALESREP_DIM_SCD2

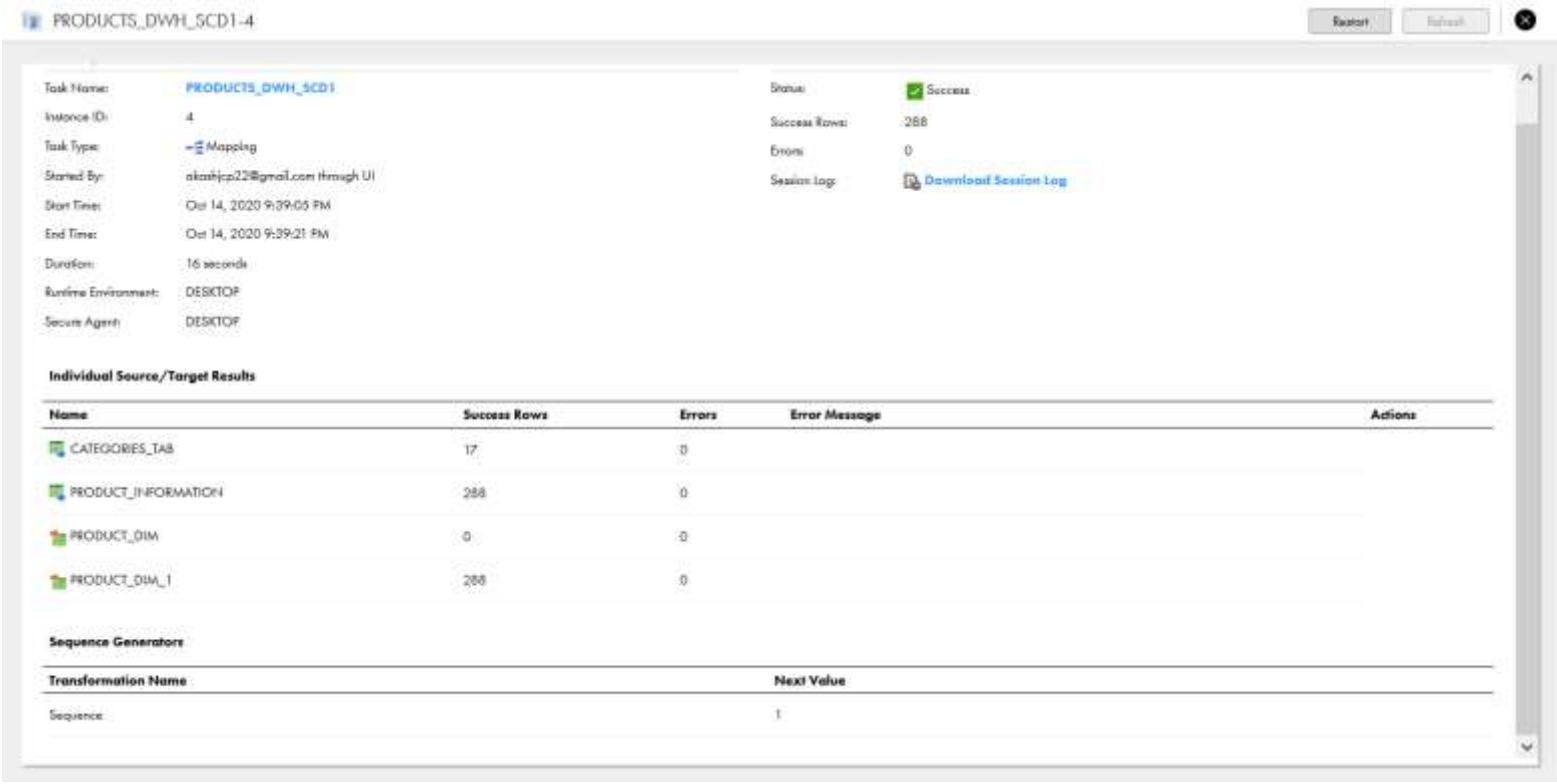


Fig 66. PRODUCTS_DIM

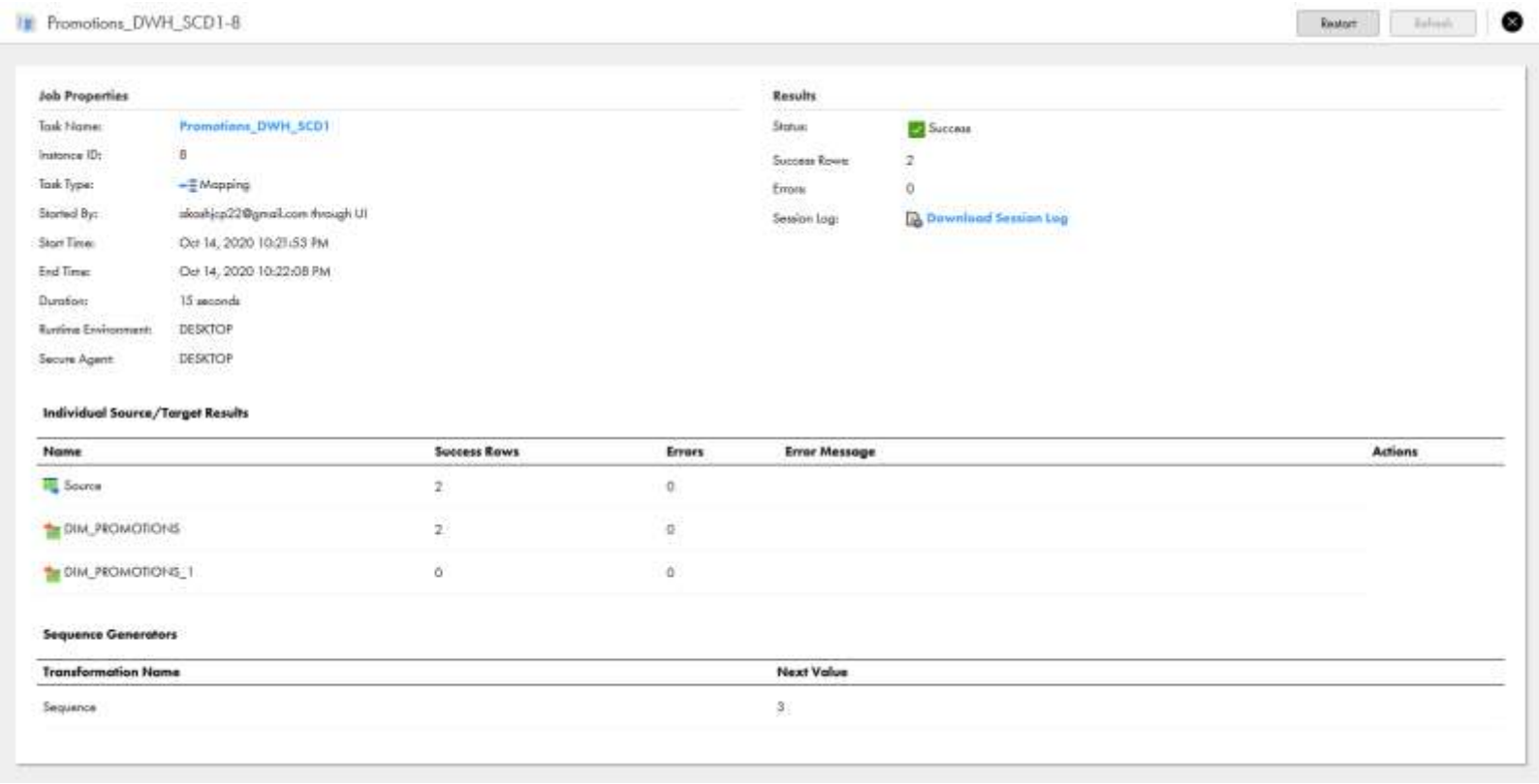


Fig 67. PROMOTIONS_DIM

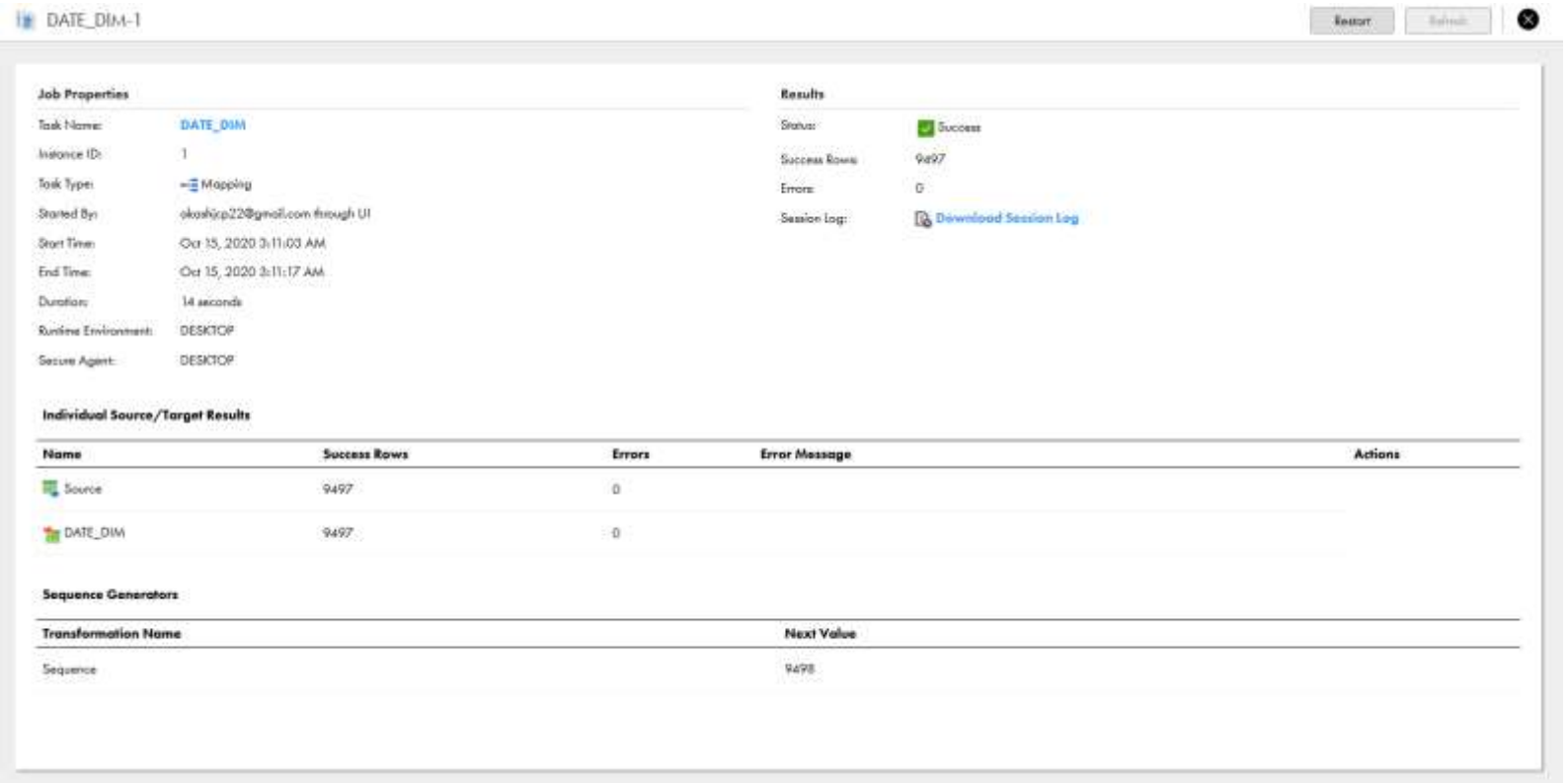


Fig 68. DATE_DIM

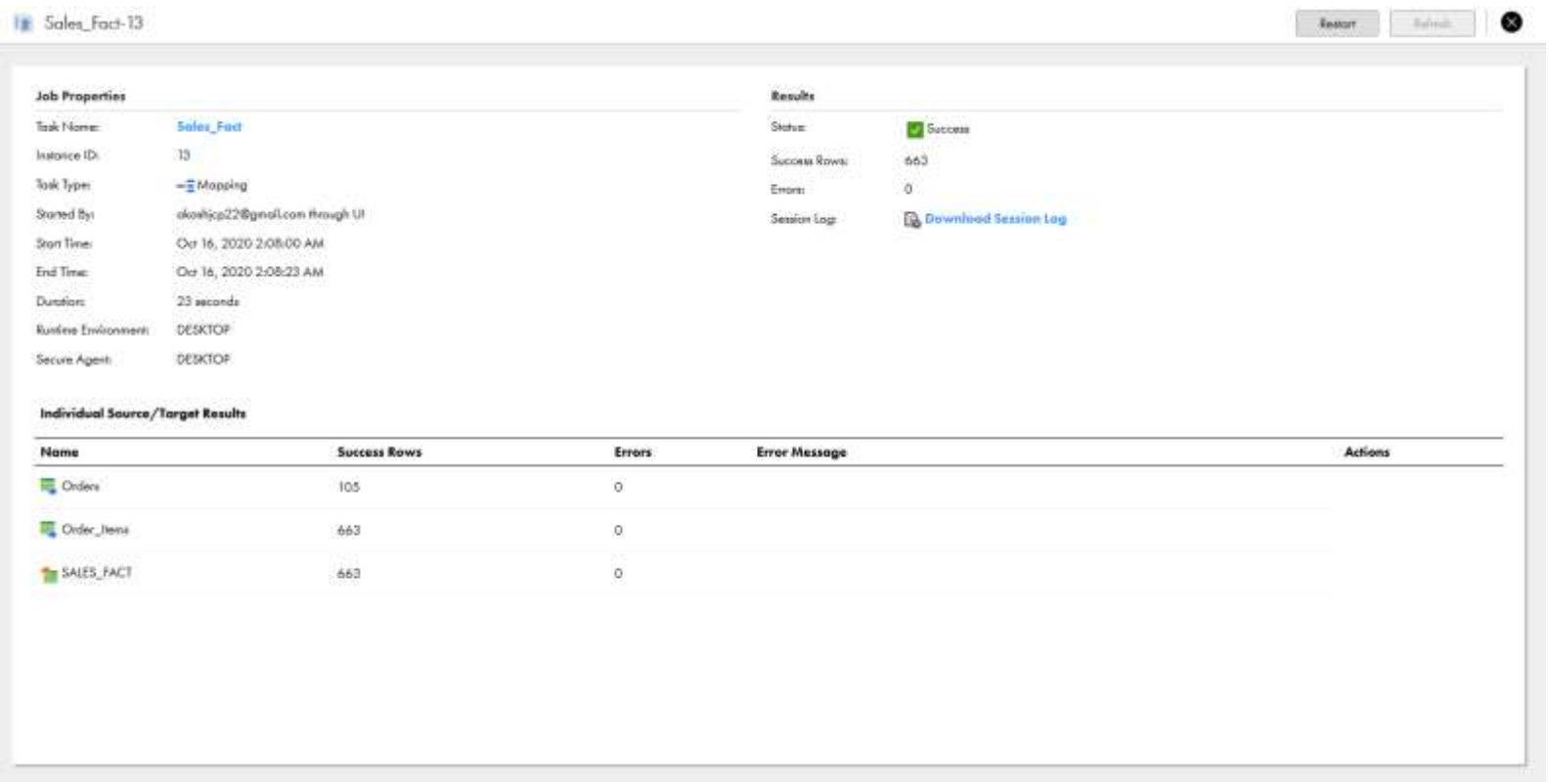


Fig 69. SALES_FACT

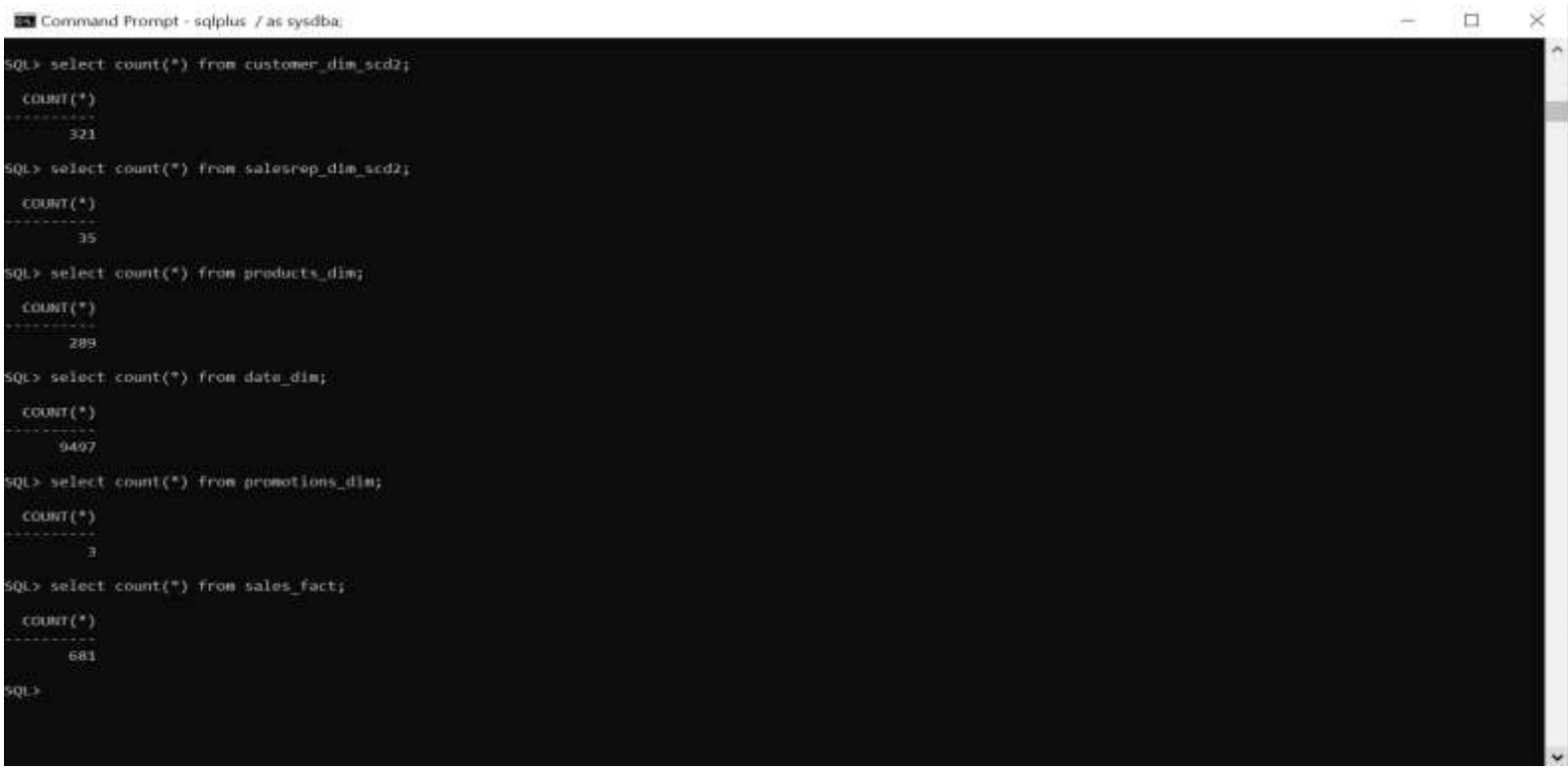


Fig 70. COUNT OF ALL TABLES IN DATA WAREHOUSE AFTER RUNNING TESTS

CONCLUSION

All the transactional data from various sources was successfully loaded into a staging database which follows a certain model to reduce the redundancy in the incoming data. This data was further loaded into a star schema data warehouse were it was divided into various dimension tables following different slowly changing dimensions and into a fact table.

Thus the data warehouse has been successfully loaded with proper data which can be further used for all analytical purposes.

SCRIPTS USED FOR TABLE CREATION IN STAGING DATABASE AND IN DATA WAREHOUSE

```
CREATE TABLE CUSTOMERS
(
    CUSTOMER_ID          number,
    CUST_FIRST_NAME      nvarchar2(25),
    CUST_LAST_NAME       nvarchar2(25),
    STREET_ADDRESS       nvarchar2(50),
    POSTAL_CODE          number,
    CITY                 nvarchar2(25),
    STATE_PROVINCE       nvarchar2(25),
    COUNTRY_ID           nvarchar2(5),
    COUNTRY_NAME         nvarchar2(50),
    REGION_ID            number,
    NLS_LANGUAGE         nvarchar2(25),
    NLS_TERRITORY        nvarchar2(25),
    CREDIT_LIMIT         number,
    CUST_EMAIL           nvarchar2(60),
    PRIMARY_PHONE_NUMBER nvarchar2(25),
    PHONE_NUMBER_2       nvarchar2(25),
    ACCOUNT_MGR_ID       number,
    LOCATION_GTYPE       number,
    LOCATION_SRID        number,
    LOCATION_X           number,
    LOCATION_Y           number
);
```

```
CREATE TABLE EMPLOYEES
(
    EMPLOYEE_ID    number,
    FIRST_NAME     nvarchar2(25),
    LAST_NAME      nvarchar2(25),
    EMAIL          nvarchar2(60),
    PHONE_NUMBER   nvarchar2(25),
    HIRE_DATE      nvarchar2(15),
    JOB_ID         nvarchar2(10),
    SALARY         number,
    COMMISSION_PCT number,
    MANAGER_ID     number,
    DEPARTMENT_ID  number
);

CREATE TABLE PRODUCT_INFORMATION
(
    PRODUCT_ID          number,
    PRODUCT_NAME        nvarchar2(50),
    LANGUAGE_ID         varchar2(10),
    PRODUCT_DESCRIPTION nvarchar2(1000),
    CATEGORY_ID         number,
    WEIGHT_CLASS        number,
    WARRANTY_PERIOD     number,
    SUPPLIER_ID         number,
    PRODUCT_STATUS      nvarchar2(30),
    LIST_PRICE          number,
    MIN_PRICE           number,
    CATLOG_URL          nvarchar2(100)
);
CREATE TABLE CATEGORIES_TAB
(
    CATEGORY_ID              number,
    SUB_CATEGORY_NAME        varchar2(20),
    SUB_CATEGORY_DESCRIPTION varchar2(100),
    CATEGORY_NAME            nvarchar2(50),
    PARENT_CATEGORY_ID       number
);
```

```
CREATE TABLE PROMOTIONS
(
    PROMO_ID   number,
    PROMO_NAME nvarchar2(30)
);

CREATE TABLE ORDERS
(
    ORDER_ID     number,
    ORDER_DATE   varchar(19),
    ORDER_MODE   nvarchar2(25),
    CUSTOMER_ID  number,
    ORDER_STATUS number,
    ORDER_TOTAL  number,
    SALES_REP_ID number
);
CREATE TABLE ORDER_ITEMS
(
    ORDER_ID     number,
    LINE_ITEM_ID number,
    PRODUCT_ID   number,
    UNIT_PRICE   number,
    QUANTITY     number,
    PROMO_ID     varchar(20)
);

CREATE TABLE STG_DATE
(
  CALENDAR_DATE DATE
);

CREATE TABLE CUSTOMER_DIM_SCD2
(
    CUSTOMER_DIM_ID      number NOT NULL PRIMARY KEY,
    CUSTOMER_ID          number,
    CUST_FIRST_NAME      nvarchar2(25),
    CUST_LAST_NAME       nvarchar2(25),
    STREET_ADDRESS       nvarchar2(50),
```

```
POSTAL_CODE          number,
    CITY                 nvarchar2(25),
    STATE_PROVINCE       nvarchar2(25),
    COUNTRY_ID           nvarchar2(5),
    COUNTRY_NAME         nvarchar2(50),
    REGION_ID            number,
    NLS_LANGUAGE         nvarchar2(25),
    NLS_TERRITORY        nvarchar2(25),
    CREDIT_LIMIT         number,
    CUST_EMAIL           nvarchar2(60),
    PRIMARY_PHONE_NUMBER nvarchar2(25),
    PHONE_NUMBER_2       nvarchar2(25),
    ACCOUNT_MGR_ID       number,
    LOCATION_GTYPE       number,
    LOCATION_SRID        number,
    LOCATION_X           number,
    LOCATION_Y           number,
    START_DATE           timestamp(6) NOT NULL,
    END_DATE             timestamp(6),
    VERSION              number NOT NULL,
    FLAG                 nvarchar2(10) NOT NULL,
    INSERTED_DATE        timestamp(6) NOT NULL,
    INSERTED_BY          nvarchar2(20) NOT NULL,
    UPDATED_DATE         timestamp(6) NOT NULL,
    UPDATED_BY           nvarchar2(20) NOT NULL
);

CREATE TABLE SALESREP_DIM_SCD2
(
    SALESREP_DIM_ID number NOT NULL PRIMARY KEY,
    EMPLOYEE_ID     number,
    FIRST_NAME      nvarchar2(25),
    LAST_NAME       nvarchar2(25),
    EMAIL           nvarchar2(60),
    PHONE_NUMBER    nvarchar2(25),
    HIRE_DATE       nvarchar2(15),
    JOB_ID          nvarchar2(10),
    SALARY          number,
```

```
    COMMISSION_PCT  number,
    MANAGER_ID      number,
    DEPARTMENT_ID   number,
    START_DATE      timestamp(6) NOT NULL,
    END_DATE        timestamp(6),
    VERSION         number NOT NULL,
    FLAG            nvarchar2(10) NOT NULL,
    INSERTED_DATE   timestamp(6) NOT NULL,
    INSERTED_BY     nvarchar2(20) NOT NULL,
    UPDATED_DATE    timestamp(6) NOT NULL,
    UPDATED_BY      nvarchar2(20) NOT NULL
);

CREATE TABLE PRODUCTS_DIM
(
    PRODUCT_DIM_ID           number NOT NULL PRIMARY KEY,
    PRODUCT_ID               number,
    PRODUCT_NAME             nvarchar2(50),
    LANGUAGE_ID              nvarchar2(2),
    MIN_PRICE                number,
    LIST_PRICE               number,
    PRODUCT_STATUS           nvarchar2(30),
    SUPPLIER_ID              number,
    WARRANTY_PERIOD          number,
    WEIGHT_CLASS             number,
    PRODUCT_DESCRIPTION      nvarchar2(1000),
    CATEGORY_ID              number,
    CATALOG_URL              nvarchar2(100),
    SUB_CATEGORY_NAME        nvarchar2(25),
    SUB_CATEGORY_DESCRIPTION nvarchar2(1000),
    PARENT_CATEGORY_ID       number,
    CATEGORY_NAME            nvarchar2(25),
    INSERTED_DATE            timestamp(6),
    INSERTED_BY              nvarchar2(15),
    UPDATED_DATE             timestamp(6),
    UPDATED_BY               nvarchar2(15)
);
```

```
CREATE TABLE PROMOTIONS_DIM
(
    PROMOTION_DIM_ID number NOT NULL PRIMARY KEY,
    PROMO_ID         number,
    PROMO_NAME       nvarchar2(30),
    INSERTED_DATE    timestamp(6),
    INSERTED_BY      nvarchar2(15),
    UPDATED_DATE     timestamp(6),
    UPDATED_BY       nvarchar2(15)
);

CREATE TABLE DATE_DIM
(
    DATE_DIM_ID           number NOT NULL PRIMARY KEY,
    SALES_DATE            date,
    SALES_DAY_OF_THE_YEAR number,
    SALES_MONTH           number,
    SALES_YEAR            number,
    SALES_QUARTER         number,
    SALES_MONTH_NAME      nvarchar2(25)
);

CREATE TABLE SALES_FACT
(
    PK_SALES_FACT_KEY number NOT NULL PRIMARY KEY,
    ORDER_ID          number,
    CUSTOMER_DIM_ID   number,
    SALESREP_DIM_ID   number,
    PRODUCT_DIM_ID    number,
    PROMOTION_DIM_ID  number,
    DATE_DIM_ID       number,
    DOLLARS_SOLD      number,
    QUANTITY_SOLD     number,
    INSERT_DATE       timestamp(6) NOT NULL,
    INSERT_BY         nvarchar2(20) NOT NULL,
    UPDATE_DATE       timestamp(6) NOT NULL,
    UPDATE_BY         nvarchar2(30) NOT NULL
);
```