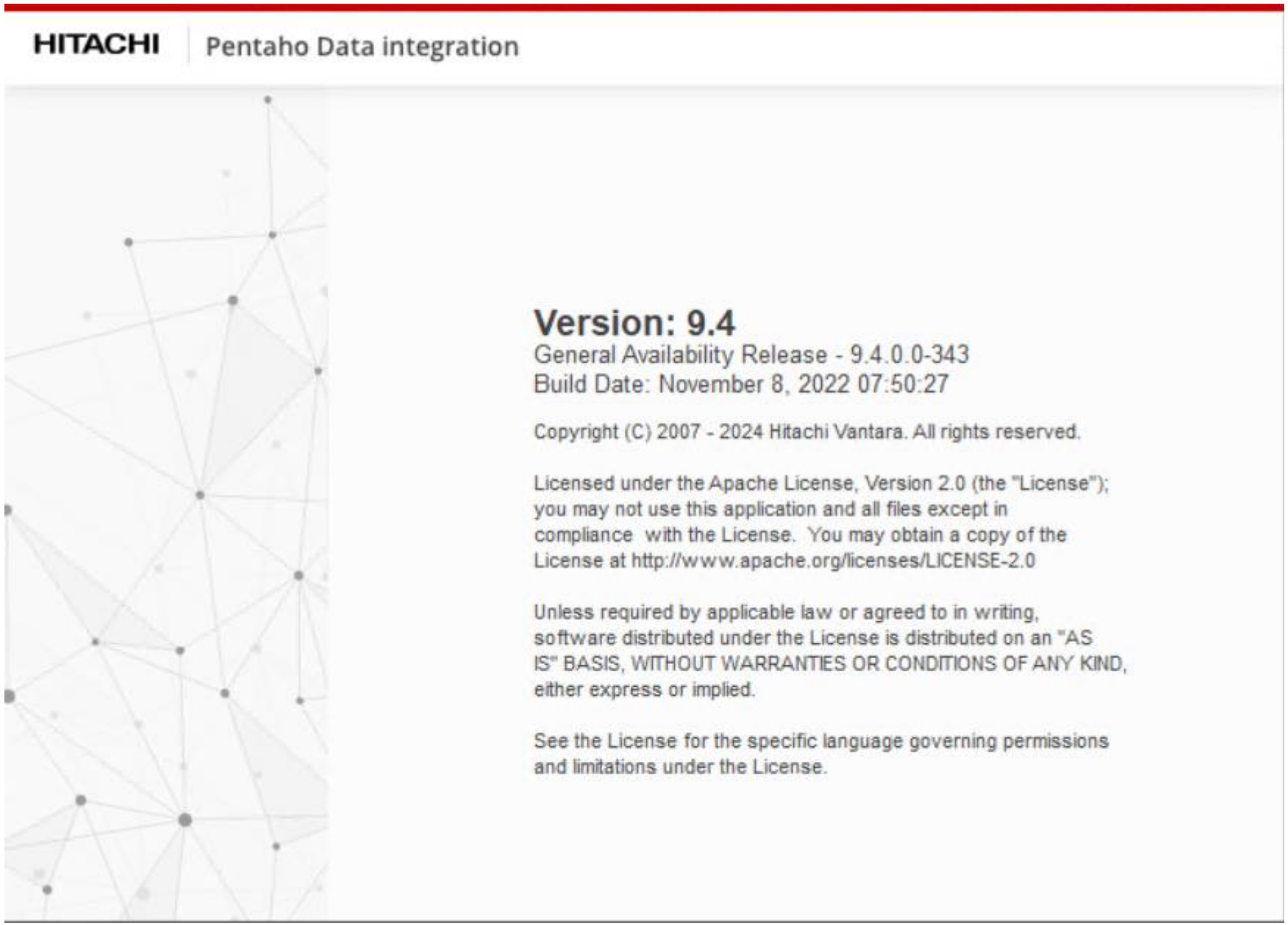
ETL

Pentaho Data Integration



History and ETL Projects

History

- The original data warehouse structure and ETL processes were created by 4Sight (a third-party vendor).
- It appears that it was initially designed for a tiny insurance company and later adapted to be more generalized for any insurance company.
- I did not receive any support or assistance from the vendor.
- The basic solution was substantially enhanced and tailored to meet the specific requirements of CSE.

ETL Projects

1. "SPInn" - Customized 4Sight data warehouse (DW) and ETL solution tailored to SPInn transactional system, with data staging from Microsoft SQL Server and later transitioned to AWS Aurora.
2. "SPInn Extra" - Custom DW tables and ETL process developed specifically for CSE, based on SPInn transactional system with data staging from AWS Aurora
3. "UU" - DW and ETL system developed based on text export files originating from InsurPAS (reinsurance).
4. “ICO" - DW and ETL system developed based on text export files originating from InsurPAS (reinsurance).
5. "MGA" - DW and ETL solution built upon SPInn transactional system, with data staging from AWS Aurora.

Issues

- The original ETL process was developed for a tiny company. When I began working at CSE, the incremental daily load took an astonishing 17 hours to complete.
- There were no conditions implemented to verify if the data in the source system were ready for processing. Consequently, in case of any issues during the daily cycle, the only approach was to intervene in the middle of the night to halt a scheduled process or restore from backups and restart the following day.
- The original ETL was designed around a different insurance source system. Despite attempts to adjust staging queries, some crucial information was lost in the data warehouse.
- The database structure and ETL processes were intended to be agnostic to any specific database platform. However, instead of utilizing SQL, T-SQL or PL/SQL stored procedures, JavaScript and Pentaho Spoon "lookups" were employed. This approach resulted in slow performance and excessive memory consumption. Notably, the AWS EC2 instance used for our ETL tasks was the largest in the company.
- Numerous dimensions, metrics, columns, lookups, and JavaScript functions within the ETL were redundant and remained unused.
- Conversely, essential attributes of the CSE business model were absent. Consequently, only basic financial metrics could be provided.
- The existing implementation of SCD type 2 did not make sense. The information within these dimensions was static in CSE.

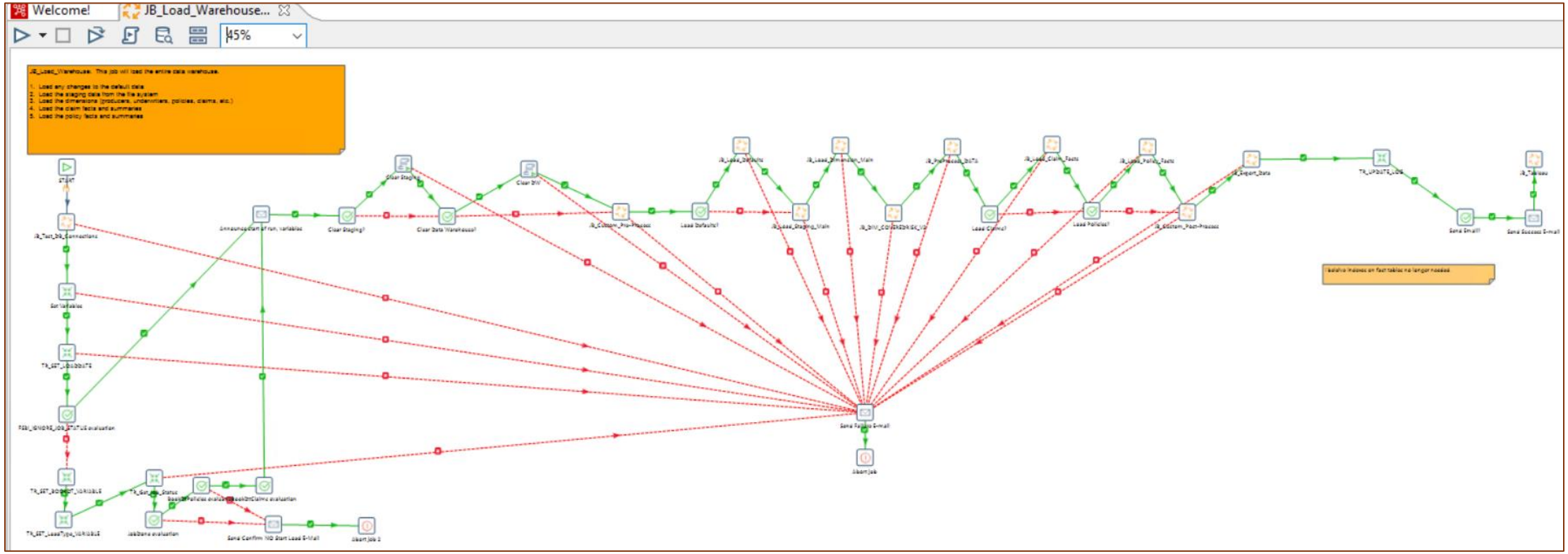
Enhancements and Adjustments

- The first enhancement I implemented was a source system log check in a Pentaho Job to prevent false starts, along with a specialized schedule to verify source system readiness.
- I conducted a comprehensive cleanup of the existing ETL process, removing unnecessary lookups, calculations, and other artifacts.
- To boost ETL performance, I introduced parallel operations and implemented structural and database optimizations such as adding indexes and temporary tables.
- As a result of these optimizations, the ETL process now completes in 2 hours, where 1 hour is dedicated to loading data into Redshift.
- Unneeded SCD type 2 was removed and instead additional SCD2 dimensions were added in the structure. It allowed to build large number of data feeds and Tableau dashboards related to the quality of risk portfolio.
- In addition to dimensional attributes, I incorporated new metrics derived from complex calculations performed across Aurora, Microsoft SQL Server, and Redshift.
- I created 2 more, similar, but smaller, DW and ETLs for other companies' data sets based on text files.
- Recognizing the limits of further improvement within Pentaho Data Integration, I developed a new ELT process using Redshift/Matillion. Data movement from Aurora to Redshift is facilitated by Fivetran.

ETL Steps

- Set Variables
- Test Database Connections
- Set Load Date
- Evaluate Start/No Start Automatic Load
- Set Incremental Load date range
- Load Staging from AWS Aurora
- Load Dimensions in MS SQL
- Load Policy Facts in MS SQL
- Load Claim Facts in MS SQL
- Export Data to Redshift
- Update Log tables for automatic incremental load
- Start Tableau dashboards refresh

Load Warehouse Job



Fragments of Configuration File

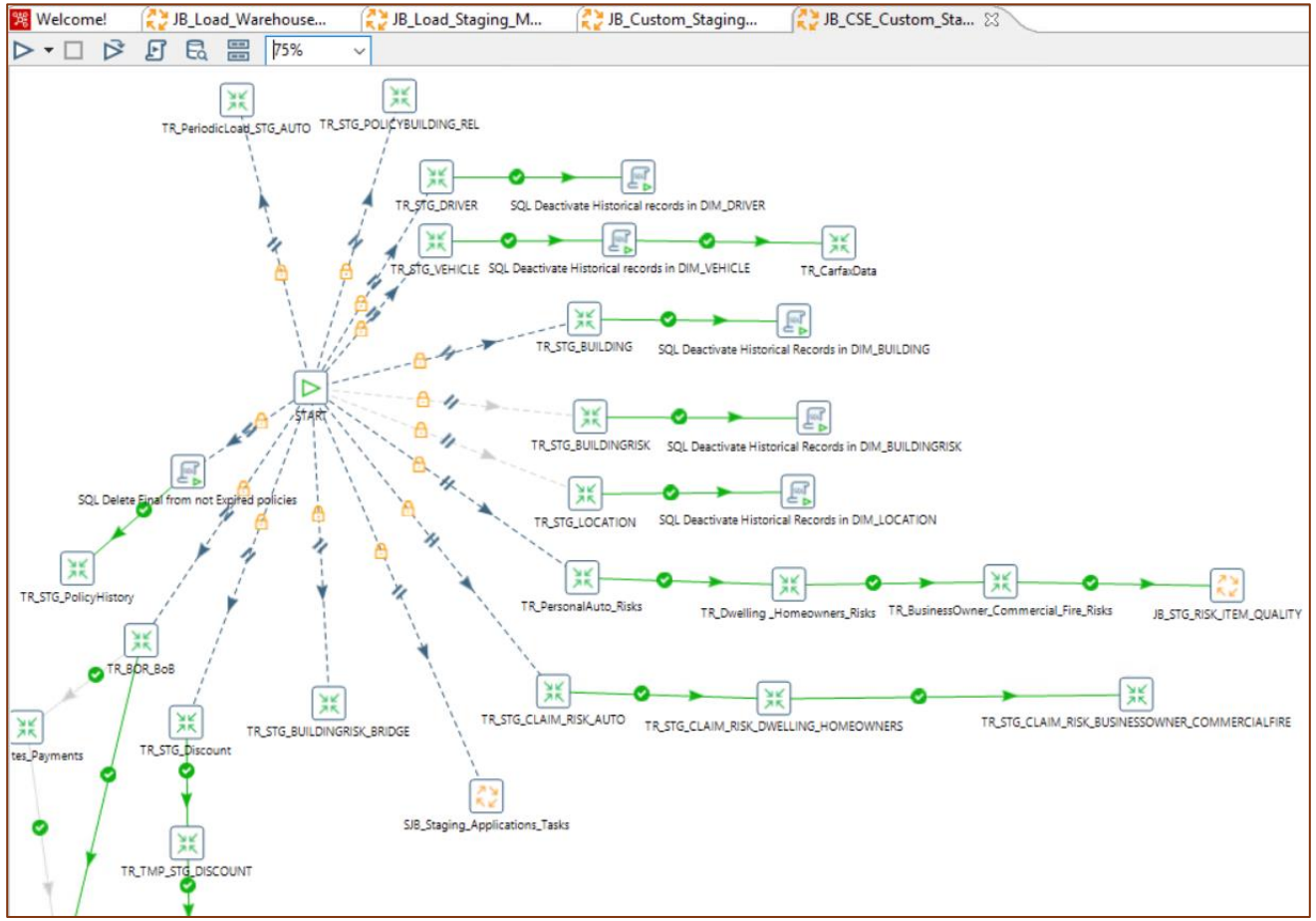
4sightbi_config.SPINN.properties | 4sightbi_config.SPINN_EXTRA.properties | 4sightbi_config.UUICO.properties | 4sightbi_config.UU.properties

```
38
39  FSBI_PROC_COUNT=2
40  FSBI_HIGH_PROC_COUNT=4
41
42  ## Define which parts of the ETL to run, put a Y to run or N not to run
43
44  FSBI_CLEAR_DATAWAREHOUSE=N
45  FSBI_CLEAR_STAGING=N
46  FSBI_LOAD_DEFAULTS=N
47
48  FSBI_LOAD_CUSTOM_STAGING=Y
49
50  FSBI_LOAD_DIMENSIONS=Y
51  FSBI_LOAD_CUSTOM_DIMENSIONS=Y
52  FSBI_LOAD_DIM_COVEREDRISK=Y
53
54  ## FACT_POLICYAUTO_REL FACT_POLICYBUILDING_RELO FACT_CATASTROPHY_REL
55  FSBI_PreProcess_DATA=Y
56
57  FSBI_LOAD_CLAIMS=Y
58  FSBI_LOAD_CLAIM_TRANSACTIONS=Y
59  FSBI_LOAD_CLAIM_SUMMARIES=Y
60
61  FSBI_LOAD_POLICIES=Y
62  FSBI_LOAD_POLICY_TRANSACTIONS=Y
63  FSBI_LOAD_POLICY_SUMMARIES=Y
64
65
66
67  ## FSBI_EXPORT_DATA can be one of these three values:  NONE,DIFF,FULL
68  FSBI_EXPORT_DATA=DIFF
69  FSBI_UPLOAD_TO_S3=Y
70  FSBI_LOAD_REDSHIFT=Y
71
```

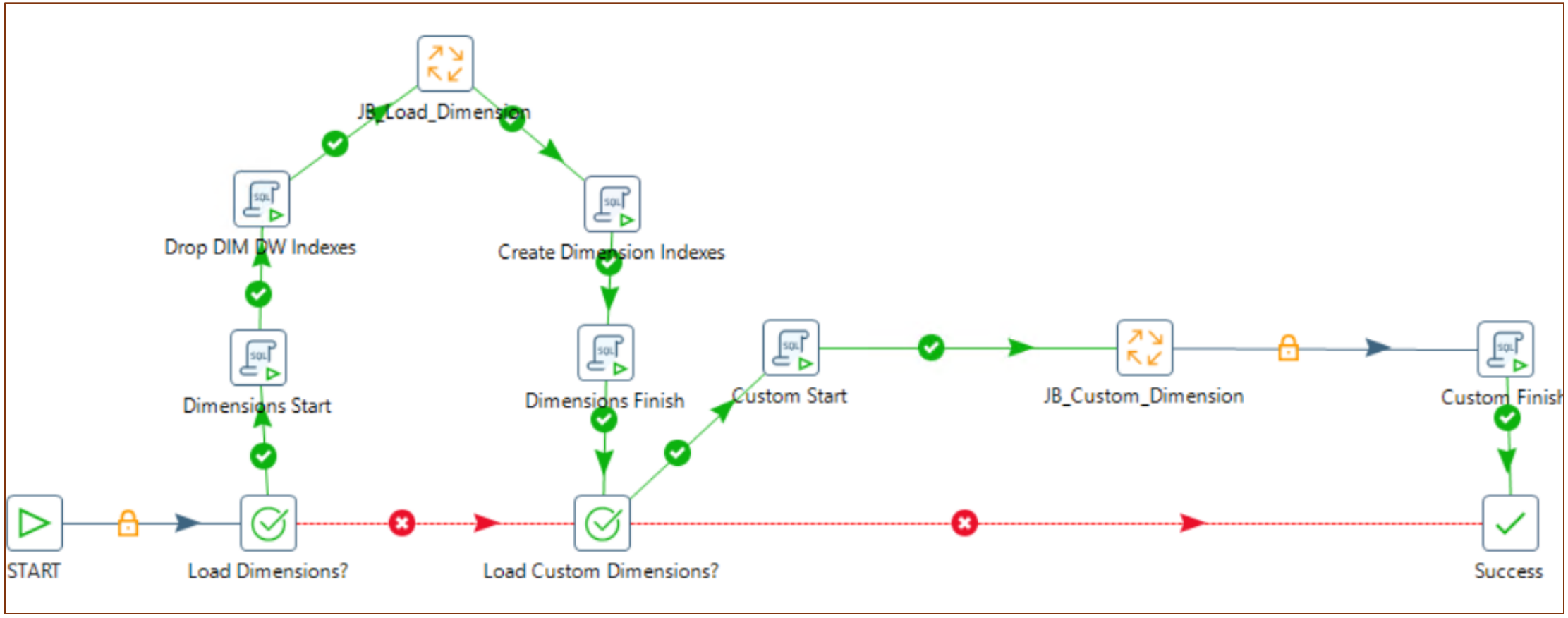
4sightbi_config.SPINN.properties | 4sightbi_config.SPINN_EXTRA.properties | 4sightbi_config.UUICO.properties | 4sightbi_config.UU.properties

```
113
114 ## Paths to file locations needed for ETLs
115
116 FSBI_LOG_PATH=C:\\4SightBI_Data\\SPINN\\Logs\\
117 FSBI_STAGING_PATH=C:\\4SightBI_Data\\SPINN\\Source_Data\\
118 FSBI_DEFAULTS_PATH=C:\\4SightBI_Data\\SPINN\\Default_Data\\
119 FSBI_SQL_SCRIPT_PATH=C:\\4SightBI_Data\\SPINN\\SQL_Scripts\\
120 FSBI_CUSTOM_SQL_SCRIPT_PATH=C:\\4SightBI_Data\\SPINN\\Custom_SQL_Scripts\\
121 FSBI_CSV_OUTPUT_PATH=E:\\Exports\\SPINN\\
122 FSBI_TEMP_DIR=E:\\temp\\SPINN\\FSBI_TEMP_DIR\\
123
124 ## Delimiter used in CSV staging files
125
126 FSBI_CSV_DELIMITER=|
127
128 ## Date format for dates in staging files
129
130 ##FSBI_DATE_FORMAT=yyyy-MM-dd HH:mm:ss.SSS
131 FSBI_DATE_FORMAT=yyyy-MM-dd
132
133 ## Default values used if data is blank/missing in staging files or tables
134
135 FSBI_DEFAULT_DATE=01/01/1900
136 FSBI_DEFAULT_NUMBER=0
137 FSBI_DEFAULT_TEXT=~
138
139 ## E-mail connection information for sending ETL success and failure messages
140
141 FSBI_EMAIL_SMTP_SERVER=email-smtp.us-west-2.amazonaws.com
142 FSBI_EMAIL_AUTHENTICATION_USER=
143 FSBI_EMAIL_AUTHENTICATION_PASSWORD=
144 FSBI_EMAIL_SMTP_PORT=465
145
146 FSBI_EMAIL_SENDER_ADDRESS=prod-etl-notifications@cseinsurance.com
147 FSBI_EMAIL_DESTINATION_ADDRESS=BITeam@cseinsurance.com
148 FSBI_EMAIL_SENDER_NAME=ETL Process (PROD-ETL SPINN)
149 FSBI_EMAIL_DESTINATION_CC_ADDRESS=
```

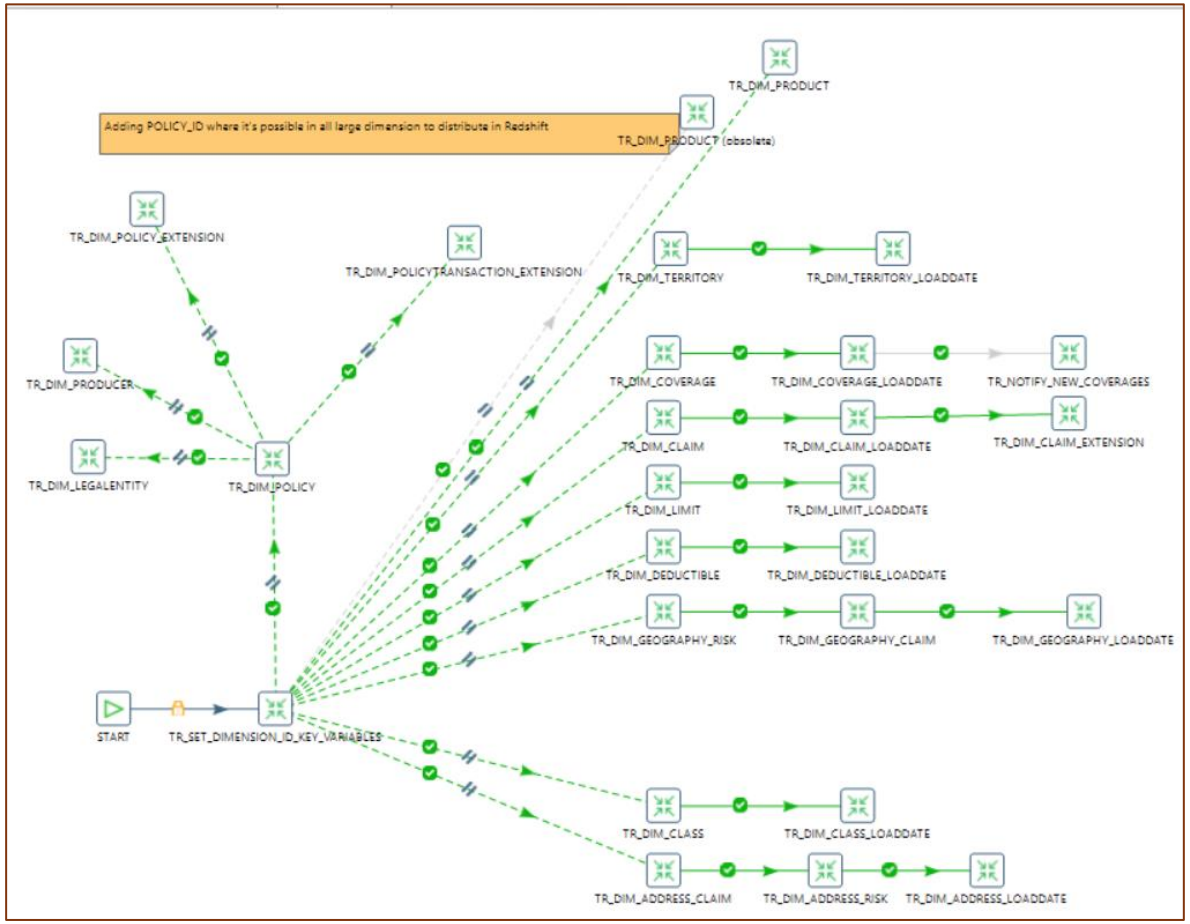
Load Staging



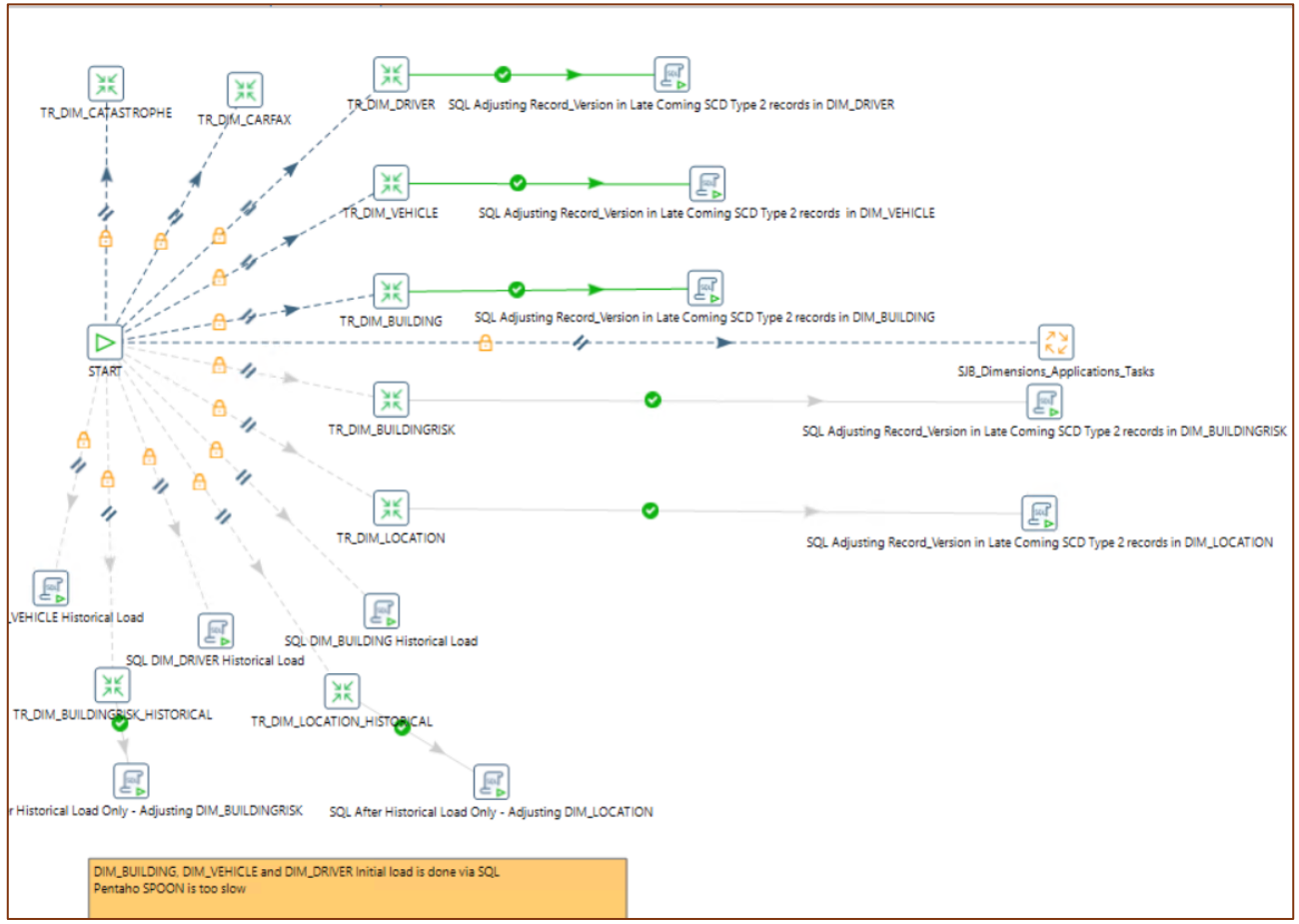
Load Dimensions



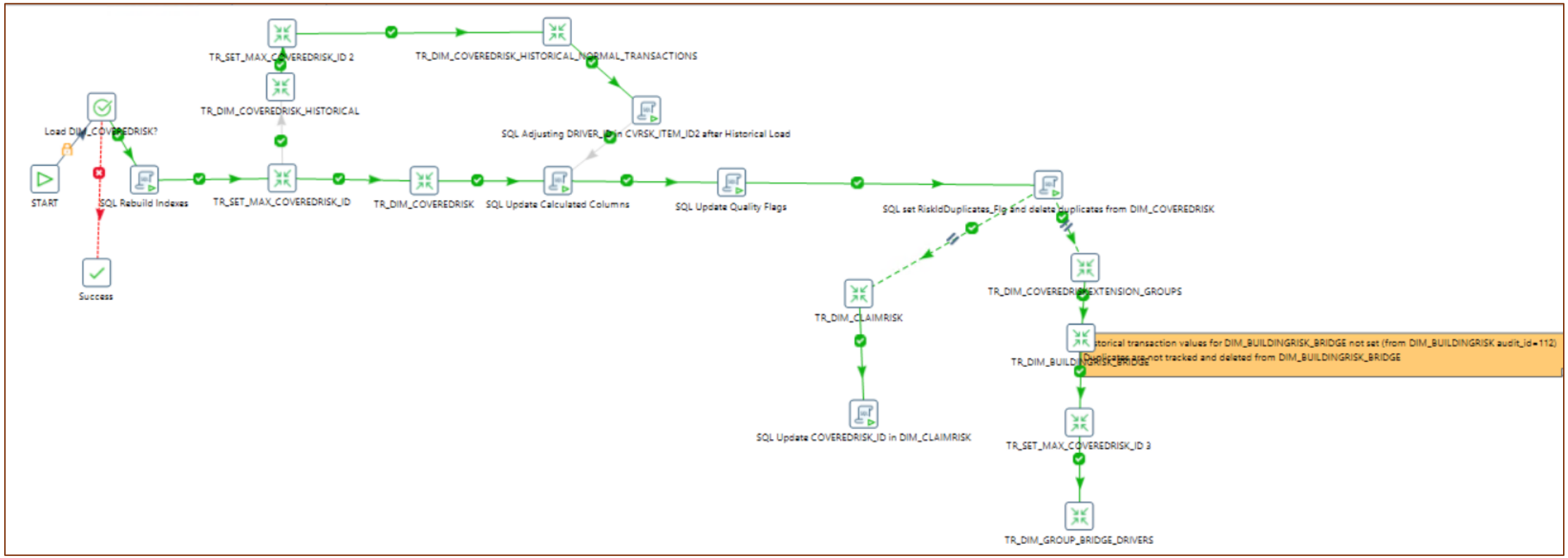
Load Dimensions



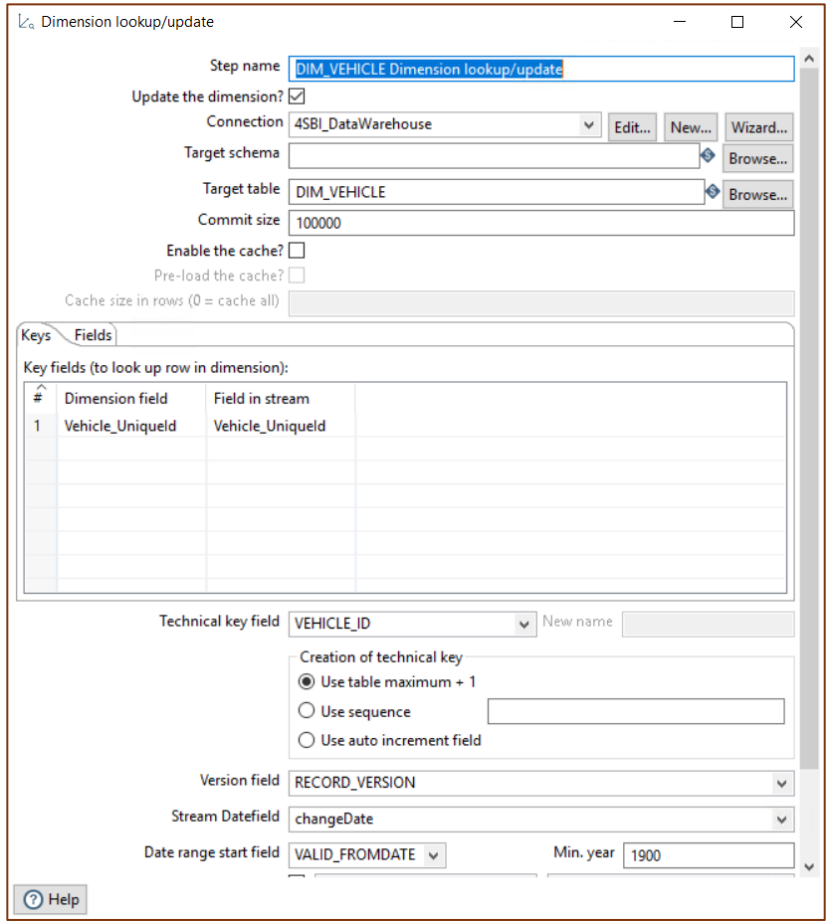
Load Dimensions

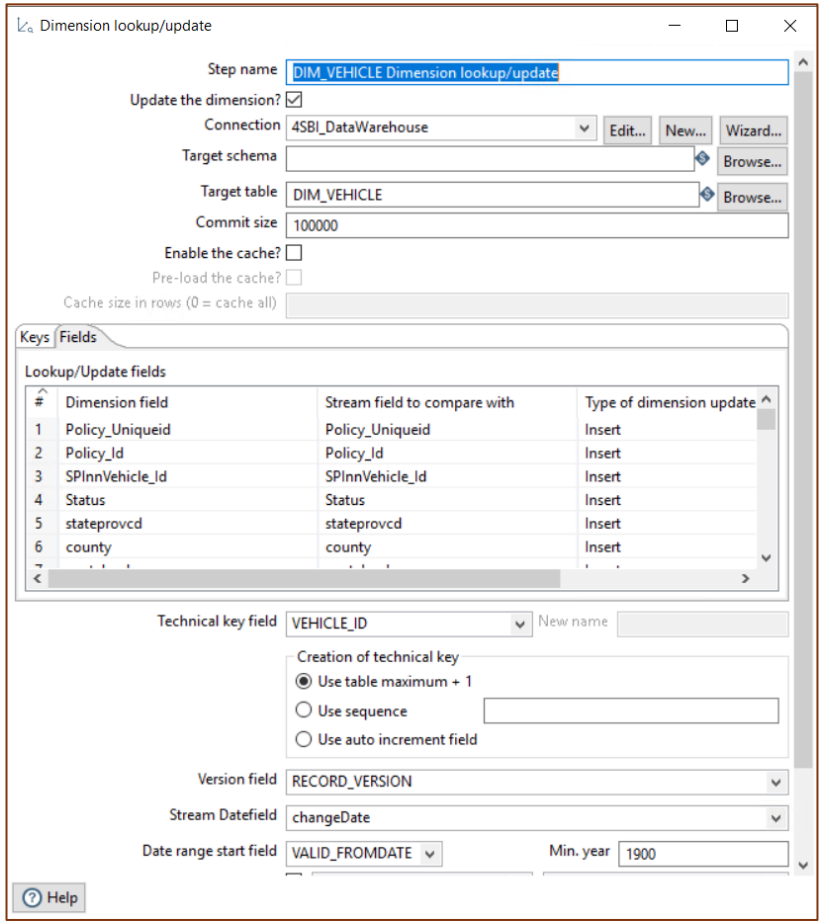


Load Risk related Dimensions

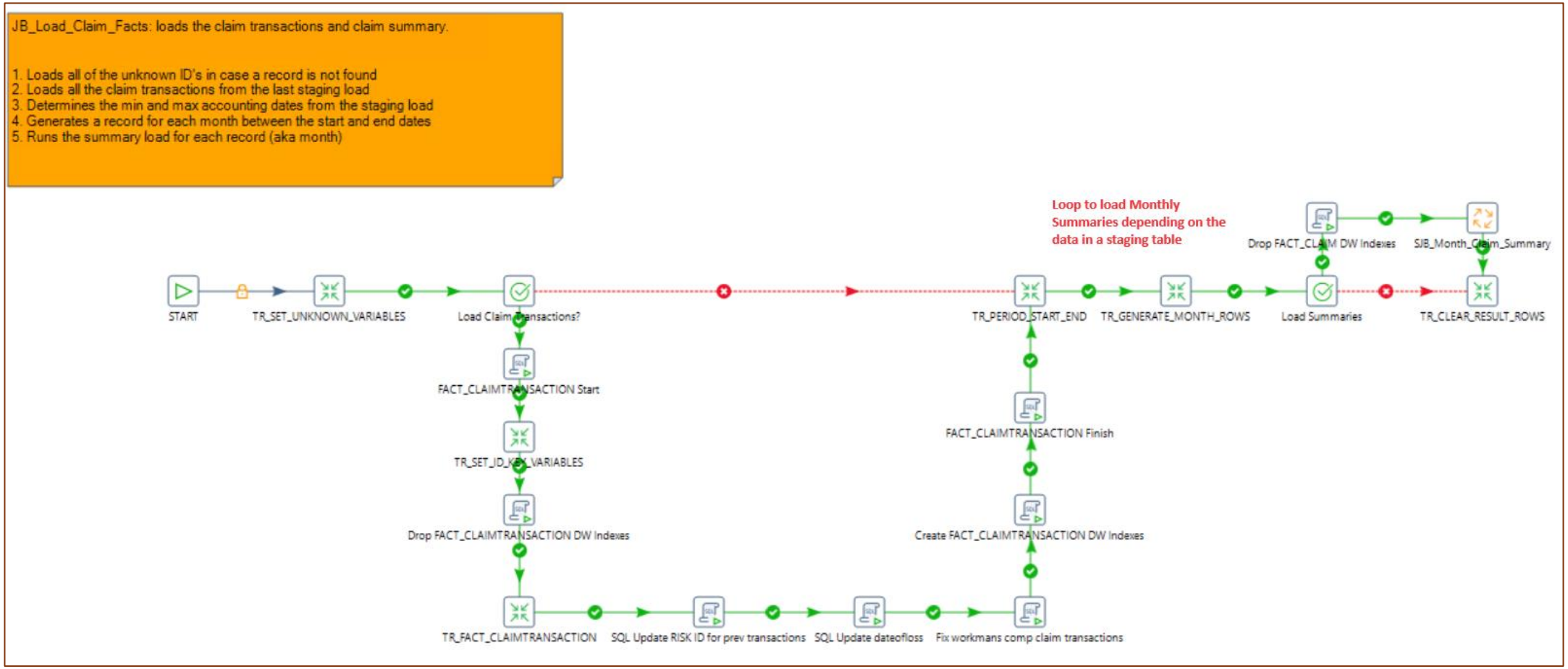


SCD Type 2 Dimension

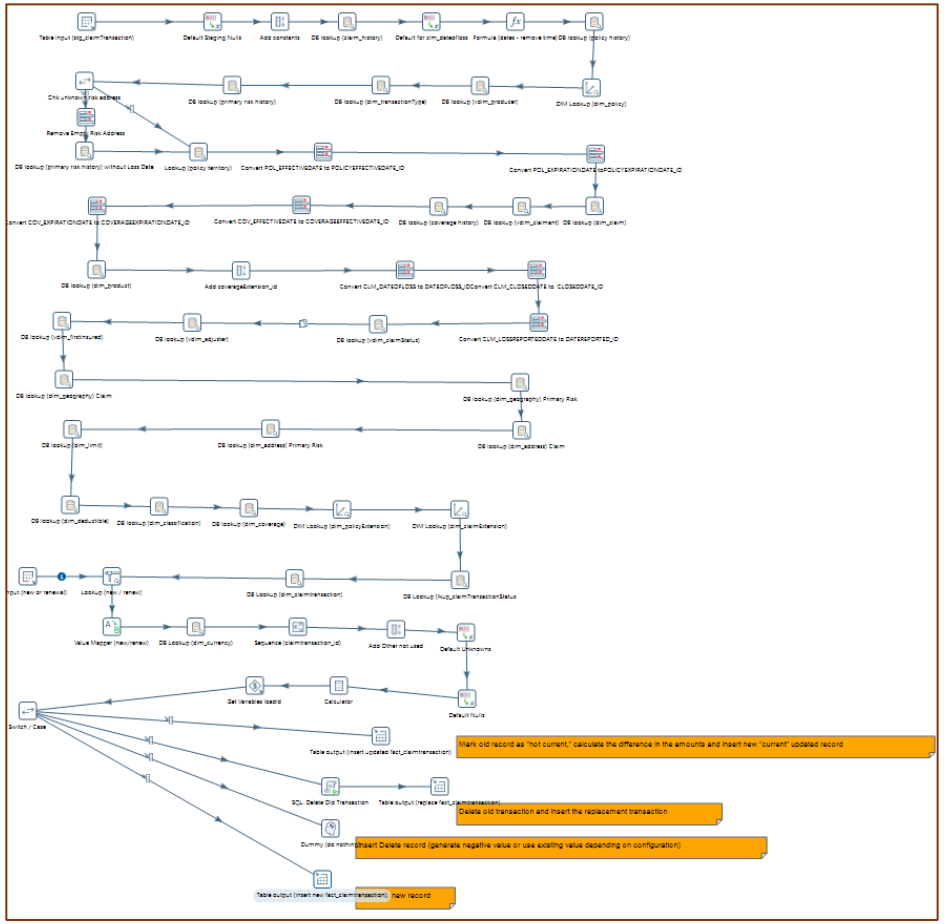




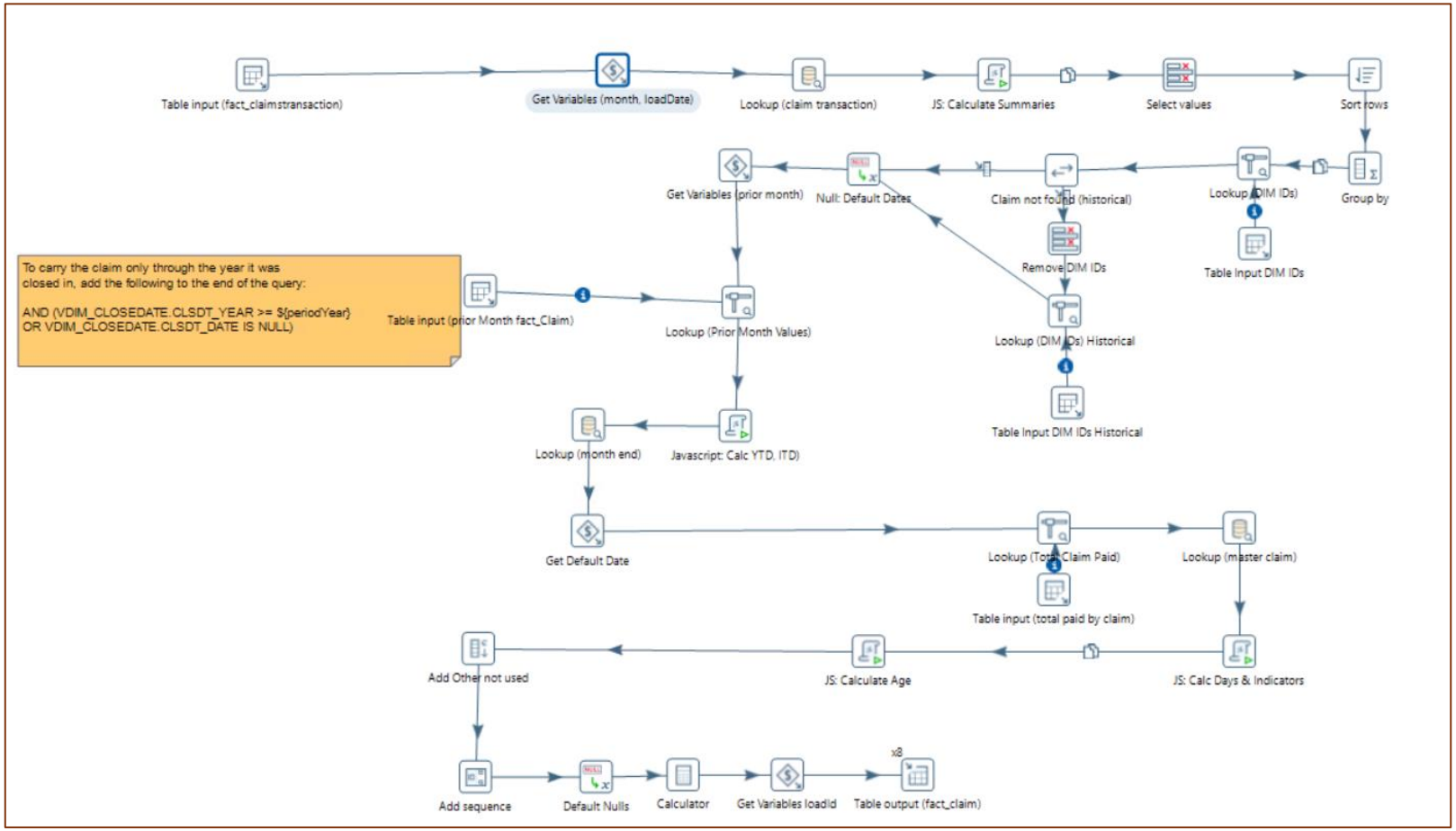
Load Claim Fact Tables



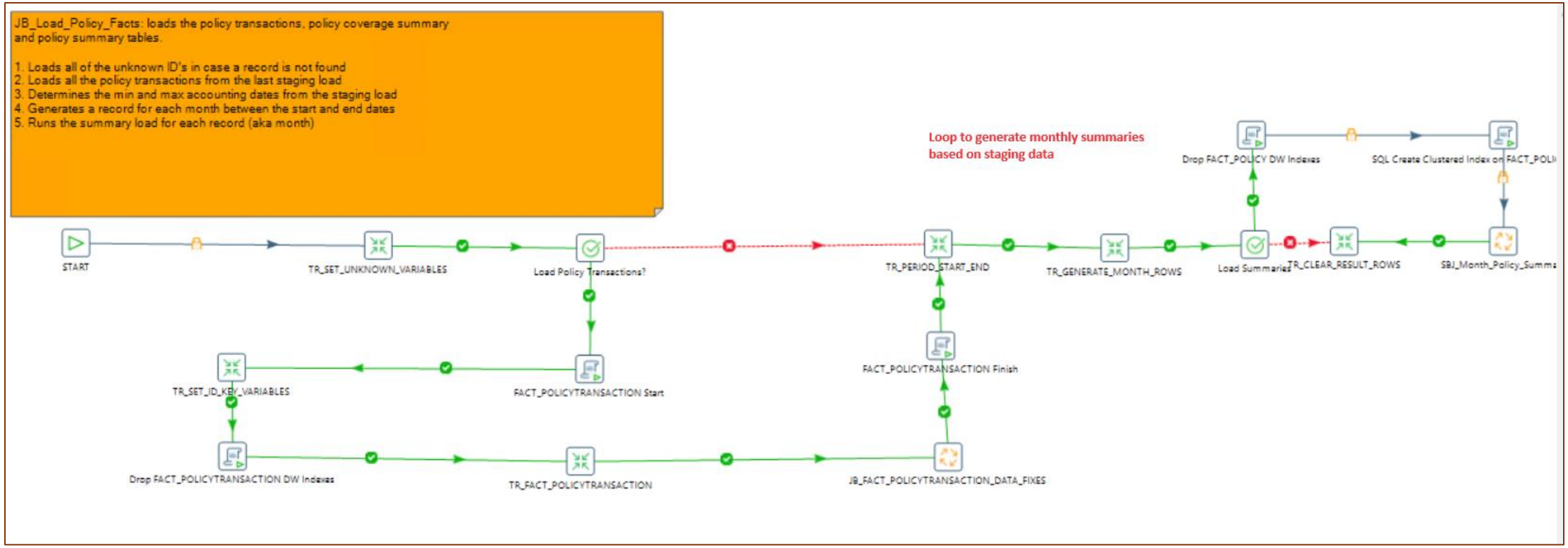
Load Claim Fact Transactions



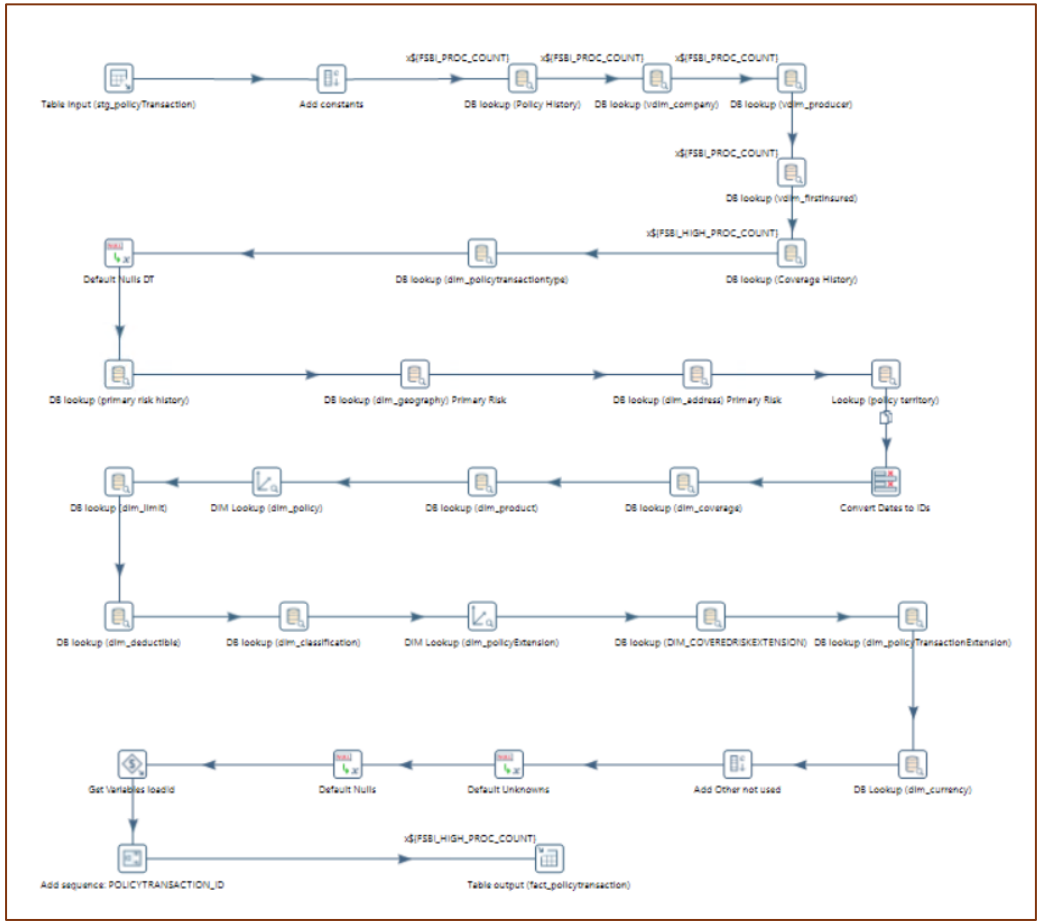
Load Claim Fact Monthly Summaries



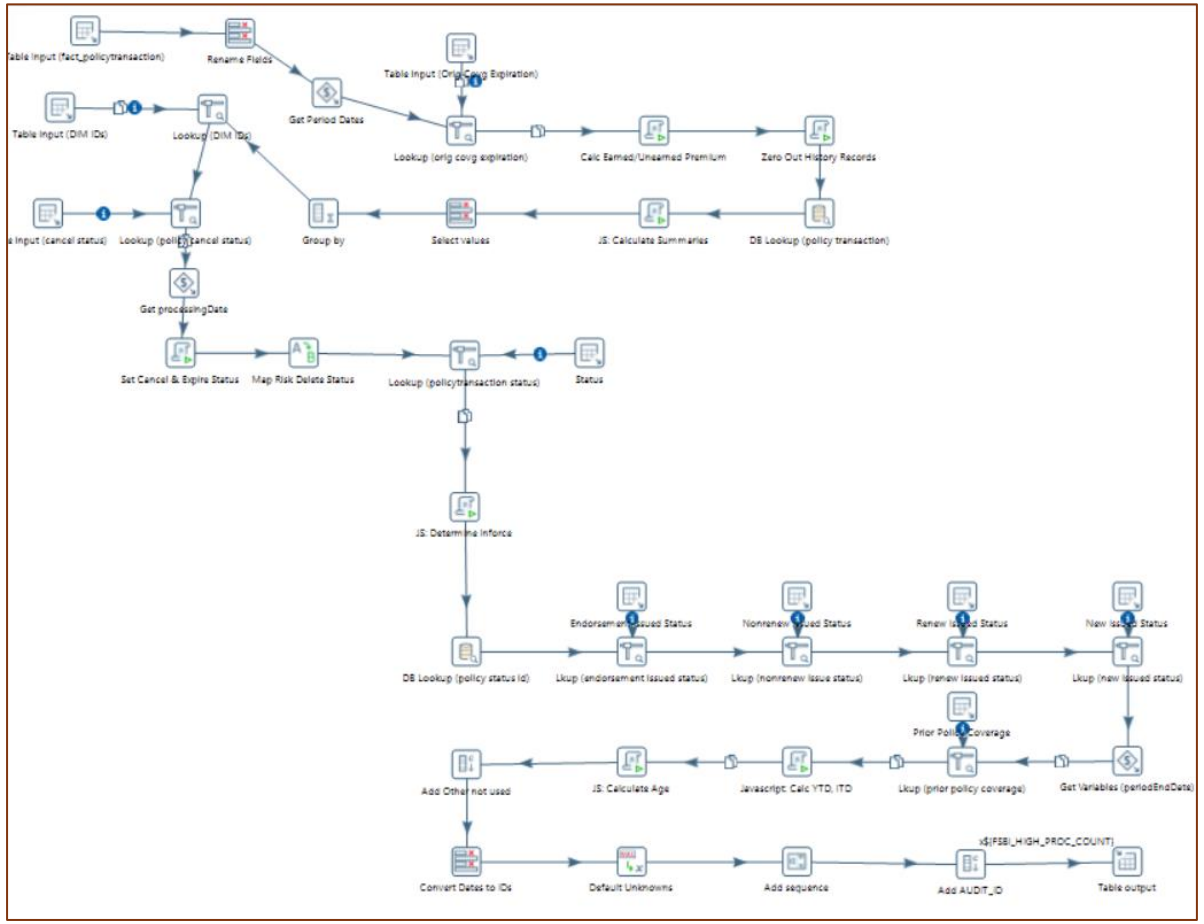
Load Policy Fact Tables



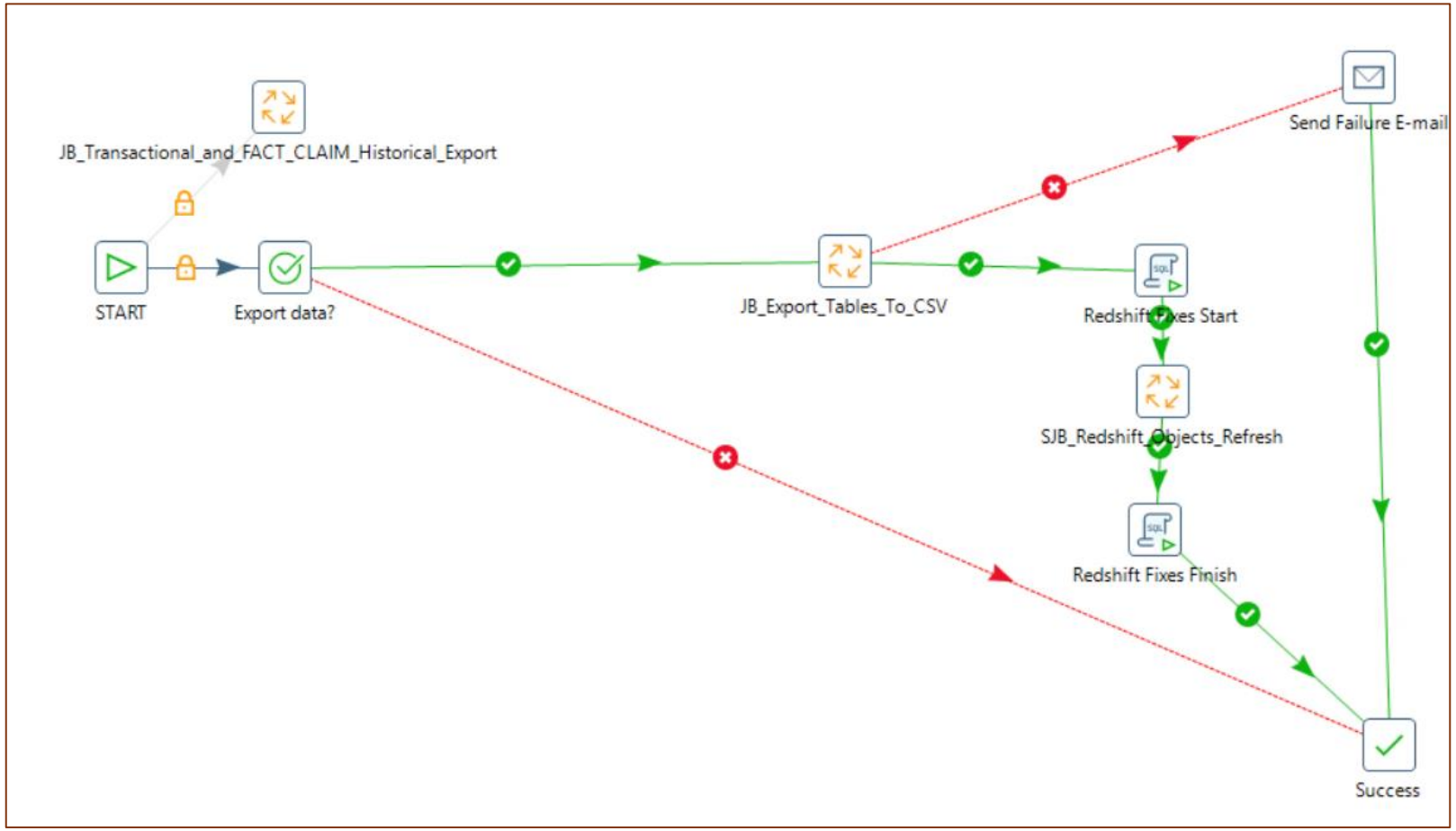
Load Fact Transactions



Load Policy Fact Monthly Summaries



Export to CSV -> AWS S3 -> AWS Redshift



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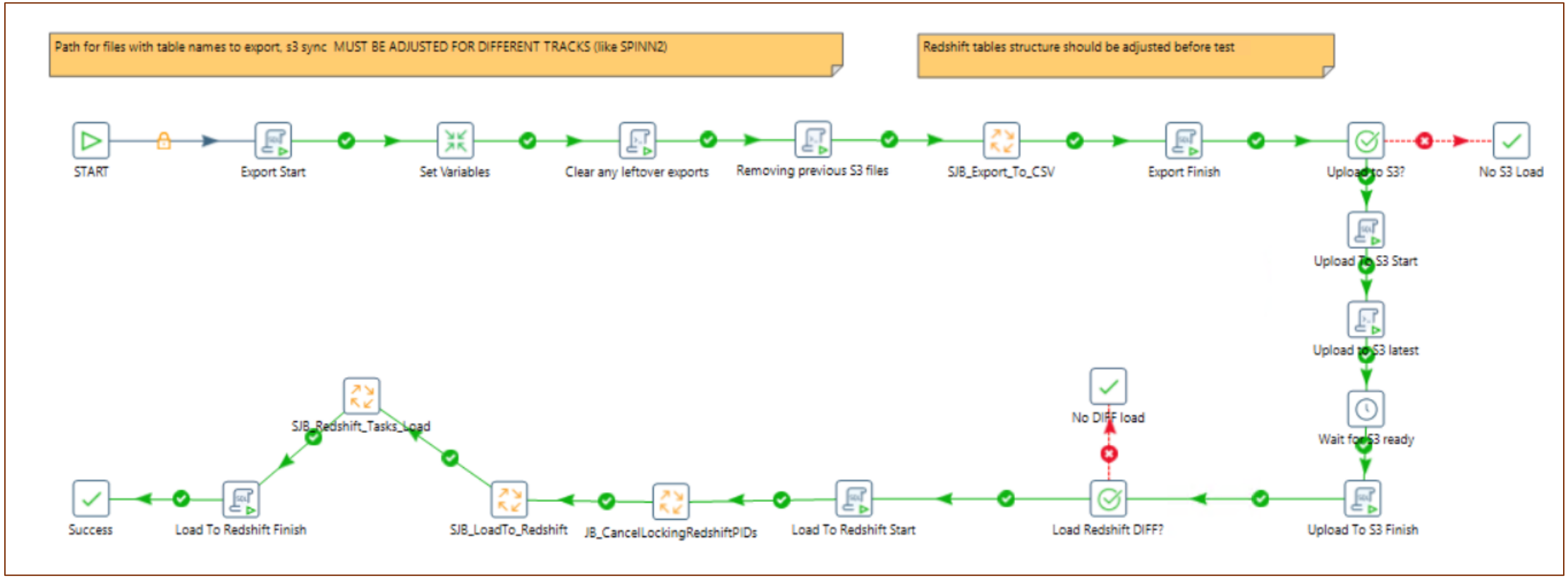

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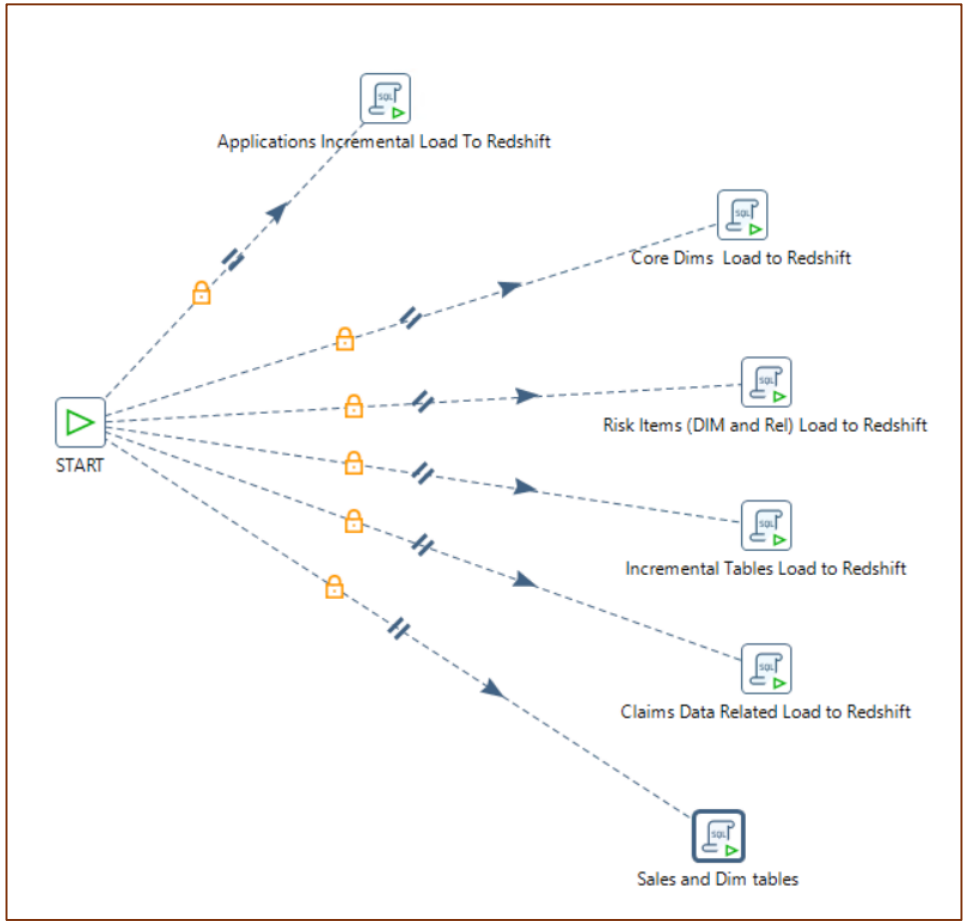

Start Tableau Dashboards Refresh