Data warehouse business concept for a company importing ordered goods

Written by

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Overview

An example of solving the problem of designing a data warehouse for a Belarusian business importing goods from other countries on order.

Business Background

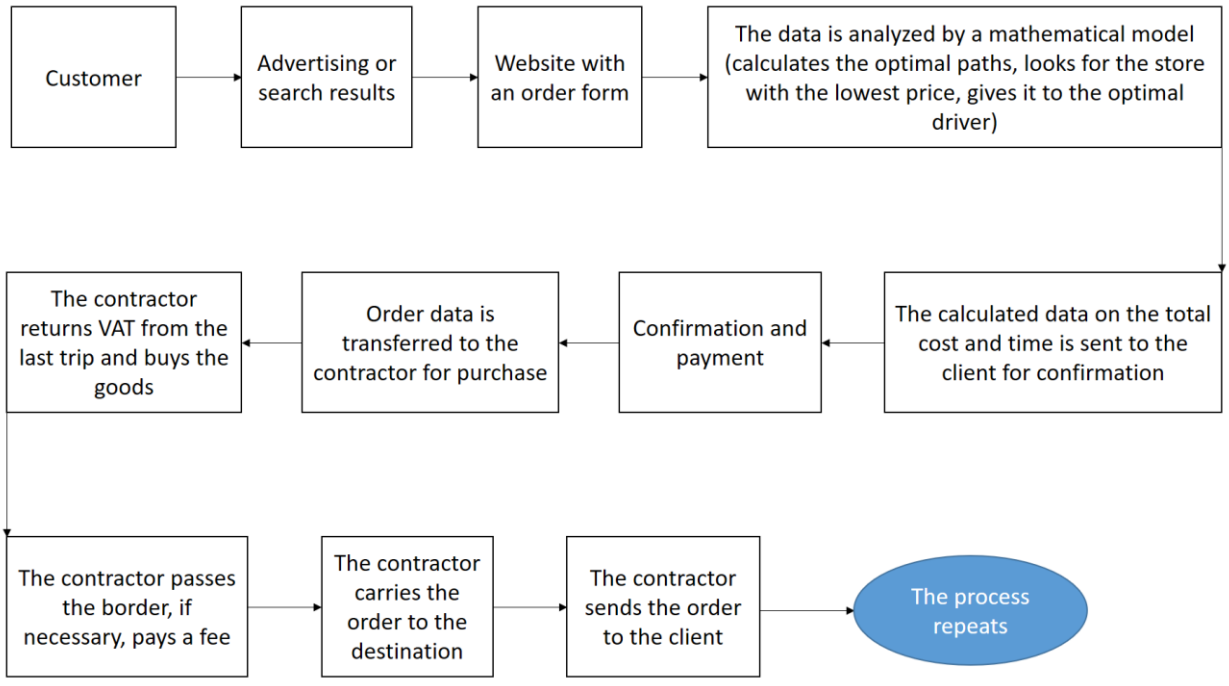
Business for the import of foreign products under the order. In the countries of the European Union, when exporting goods abroad, when revisiting the country, you can return VAT in the form of a tax deduction and prices for many types of goods are lower. 50 kg of products can be exported without duty.

The customer receives the product at a lower price.

Business earns from:

1. The difference in price in Belarus and abroad.
2. Tax deduction when revisiting the country.
3. Exchange rate difference of currencies (the company can buy currency on the exchange, where the exchange rate is more profitable).

The business process diagram shown below.



International business with high turnover requires a data warehouse to quickly access all operations, be able to update quickly and work under load in the range of 1000-3000 orders per day.

Benefit

The proposed solution should be useful for the company to:

1. Storing large amounts of data on all transactions for their analysis and sampling for training mathematical models based on neural networks.
2. Simplification of accounting by storing data in a single system and saving the history of data changes.
3. Accelerating the interaction of the site with the database.
4. Reducing the cost of physical storage due to the ability to use more powerful storage for fresh information and slow, old storage for historical information.
5. Increasing data security from leaks and unauthorized changes, due to the possibility of sharing access between an employee and departments.
6. Possibility to create representations (view) with the aggregated information to a management, for acceptance of strategic decisions.

Requirements

Business Requirements

ID	Description
B01	The ability to calculate the state of the company's financial resources at the current moment and any day in a historical perspective up to 5 years.
B02	The ability to analyze changes in key company metrics (general income, average income per client, income structure by its sources, total payback, average payback per order, number of unique customers, number of customers who placed an order in the last 30 days, the most profitable countries for import, quantity employees) at intervals of a month, a quarter, a year, and a period set manually.
B03	The ability to link information about the client with his location (accurate to the address) and order.
B04	Send a notification to the head of the department in which the employee has worked a certain amount of time for a recommendation for a promotion or salary increase.
B05	The ability to analyze which of the contractors brought the most income.
B06	Possibility to compare the selection by any of the stored metrics in comparison with the same periods of previous years.

Technical Requirements

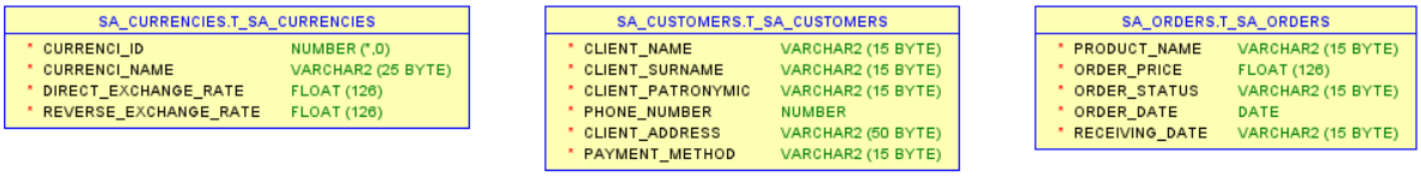
ID	Description
T01	Process data on approximately 1000 orders per day, with the possibility of increasing around holidays and global sales (Black Fridays).
T02	Reading data from csv files generated on the back-end of the site.
T03	Logical checks on the entered data should carried out (impossibility to order for yesterday or for 3022).
T04	Separation of access rights to tables according to the position held. In particular, to maintain the anonymity of clients, the inability to change financial historical information and delete any information (without obtaining permission from the director).
T05	Ability to quick access new information: store new data on fast media, old data on slower media.
T06	Access to the database from anywhere in the world, at any time of the day (In particular, the ability to replace physical components without having to turn off the server).
T07	Storing the history of operations with the database, the ability to restore information.
T08	Storing information in a normalized form.

Solution Sketch

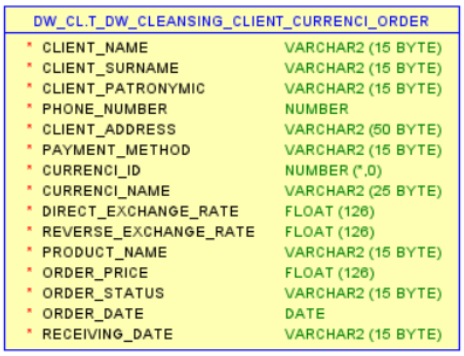
Source Tables structure

The data that needs to be loaded into the storage generated by the back-end part of the site. They are stored in csv documents (customer and order data). It is also necessary to update the data received from the API of the exchange where the company performs currency exchange operations. Data is updated at the time of order payment.

As a result, to solve the problem, it is proposed to organize an SA-level consisting of three tables (the diagram is presented below).

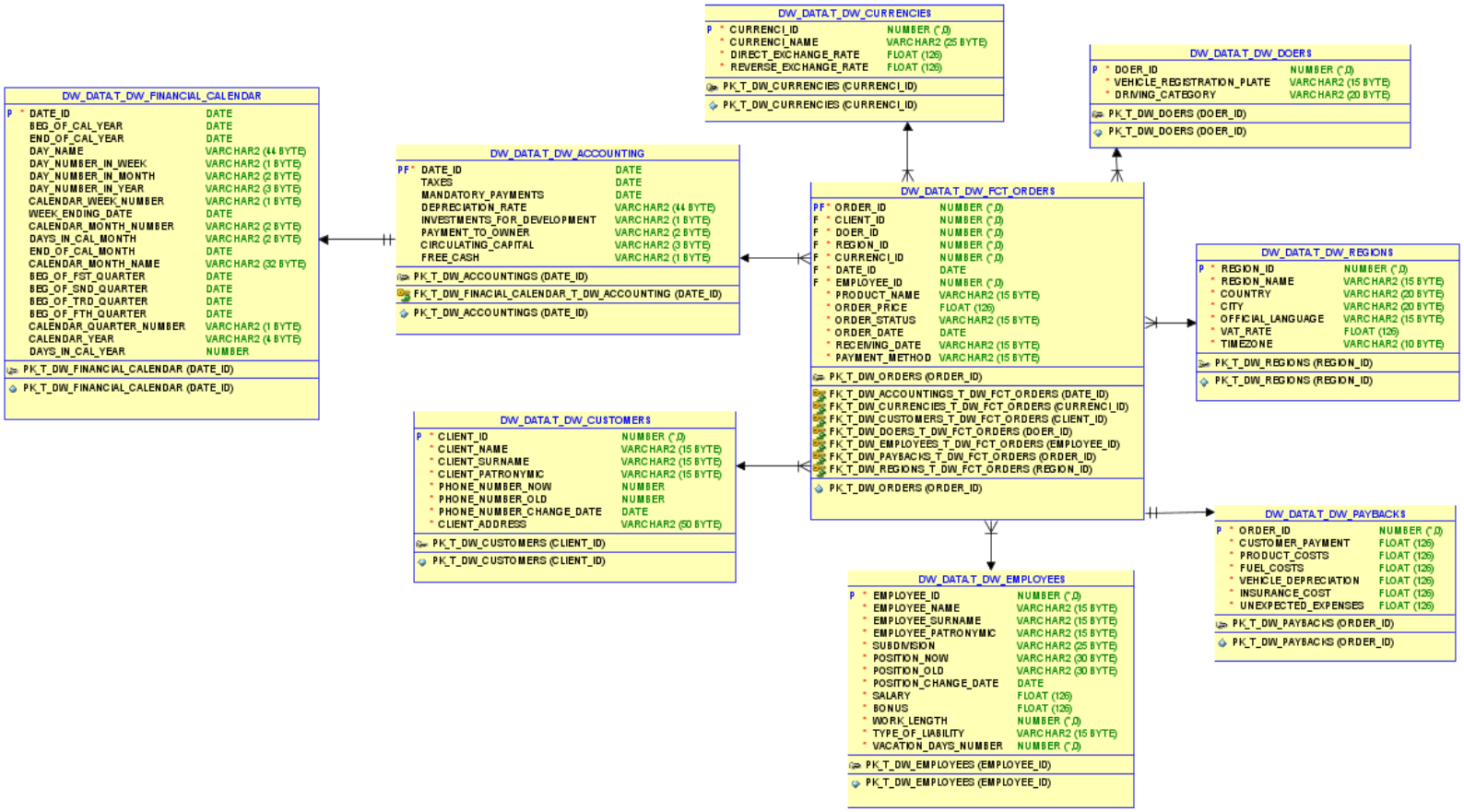


The logical separation of tables storing data about customers and orders is due to the fact that one customer can place several orders at once. Further, it is supposed to establish a logical correspondence of each order to a specific client. Further, the data, using the appropriate procedure, gets to the cleansing level, into a single table, where logical checks take place.



Summarize Data Plan

To solve the problem set by the business, it is supposed to use the storage STAR scheme presented below.



Characteristics of the presented scheme:

- Dimension tables joined to a fact table using a foreign key.
- Dimension tables not connected to each other, except for the table with the company's financial calendar and the table with the main financial indicators, to create convenient selections by period.
- STAR scheme is easy to understand and provides optimal memory usage.
- Scheme is widely supported by BI Tools.

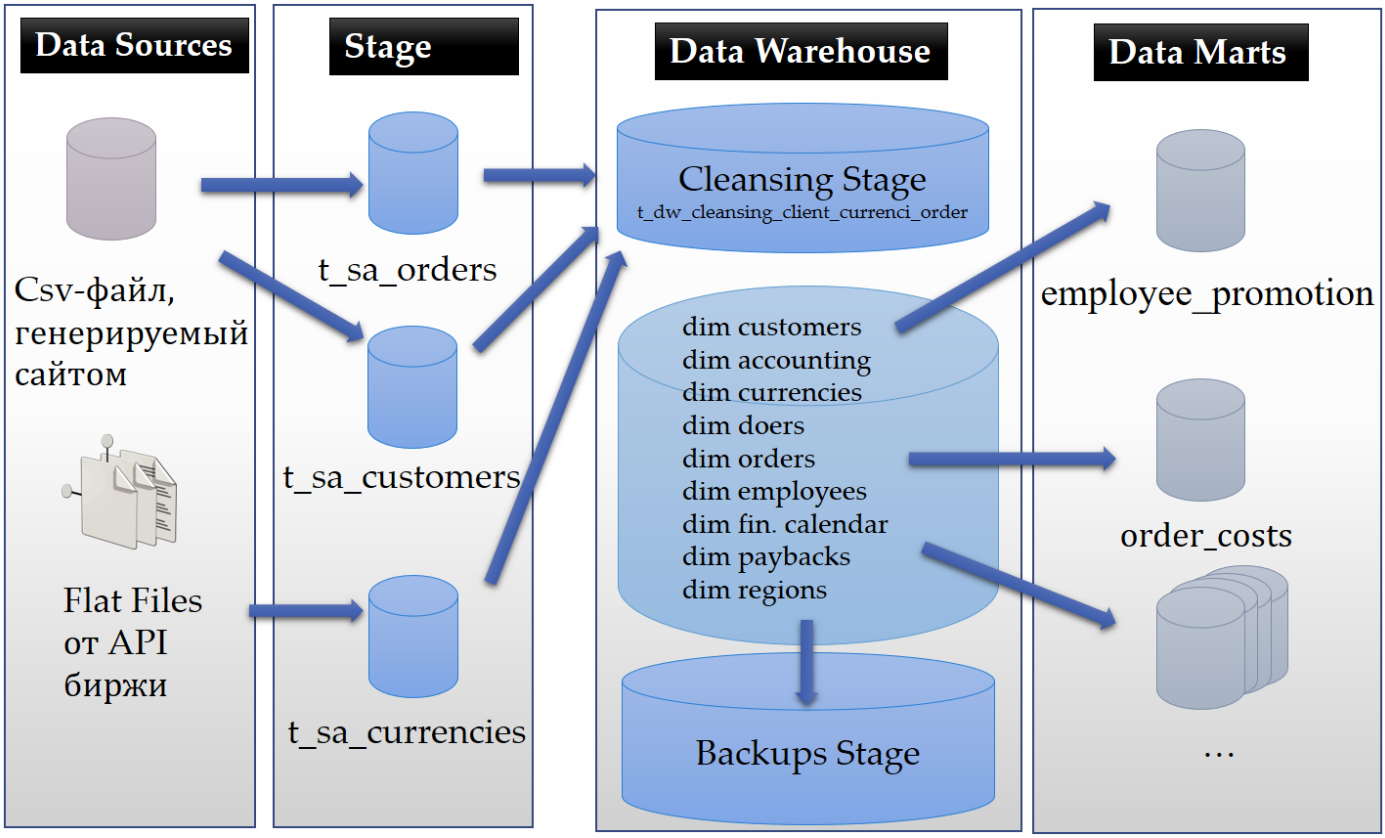
To improve security and access separation, it proposed to use several tablespaces in the storage, with a separate user for each. The storage tier structure shown below:

Level Type	Object Name	Tablespace	Desctiption
Storage level SA_*	SA_CUSTOMERS	ts_sa_customers_data_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Loaded from csv file, contains first name, last name, patronymic, phone number, payment status (paid / not)
	SA_ORDERS	ts_sa_orders_data_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Loaded from a csv file, contains the product name, order amount, order status (accepted/purchased/delivered to the client)
	SA_CURRENCIES	ts_sa_currencies_data_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 50M, Autoextend clause ON next 10M)	Loaded from a file, contains the name of the currency, direct conversion rate and reverse conversion rate
DW - Cleansing Level	DW_CL	ts_dw_cl_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 100M)	Loads information from the Storage level, prepares it for further cleaning
DW – Level	DW_DATA	ts_dw_data_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Loads information from Cleansing level, normalizes data.
DW– Prepare Star Cleansing Level	SAL_DW_CL	ts_dw_star_cls_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Loads information from the DW level. Contains representations (view), combining objects from the DW level.
STAR - Cleansing	SAL_CL	ts_sal_cl_01 (AUTOALLOCATE,	Loads information from the DW_CL level. Contains views of

		SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	the previous level, but without redundancy.
STAR – Level	DM_EMPLOYEES	ts_dm_employees_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 50M, Autoextend clause ON next 10M)	Stores information about dim employees
	DM_CUSTOMERS	ts_dm_customers_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Stores information about dim customers
	DM_ORDERS	ts_dm_orders_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Stores fact information (in t_dw_fct_orders table)
	DM_CURRENCIES	ts_dm_currencies_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 100M, Autoextend clause ON next 10M)	Stores information about dim currencies
	DM_DOERS	ts_dm_doers_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 50M, Autoextend clause ON next 5M)	Stores information about dim doers
	DM_PAYBACKS	ts_dm_paybacks_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 150M, Autoextend clause ON next 50M)	Stores information about dim paybacks
	DM_ACCOUNTINGS	ts_dm_accounting_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 100M, Autoextend clause ON next 10M)	Stores information about dim accounting and dim financial calendar

	DM_REGIONS	ts_dm_regions_01 (AUTOALLOCATE, SEGMENT SPACE MANAGEMENT AUTO, LOGGING, Size 70M, Autoextend clause ON next 15M)	Stores information about dim regions

DataFlow of the storage is presented below:

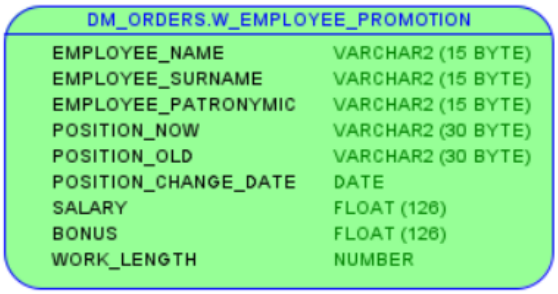


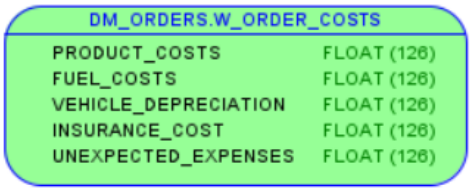
In storage, it is recommended to use partitioning by time periods (for example, advertising campaigns) and hash subpartitioning (for example, client_id) to optimize requests and disk space.

```
PARTITION BY RANGE (date_id)
    subpartition by hash(client_id) subpartitions 4
(
    PARTITION FST_ADVERTISING_PERIOD VALUES LESS THAN(TO_DATE('19-02-2022','dd-mm-yy'))
    (
      subpartition FST_ADVERTISING_PERIOD_sub_1,
      subpartition FST_ADVERTISING_PERIOD_sub_2,
      subpartition FST_ADVERTISING_PERIOD_sub_3,
      subpartition FST_ADVERTISING_PERIOD_sub_4
    ),
    PARTITION SND_ADVERTISING_PERIOD VALUES LESS THAN(TO_DATE('10-04-2022','dd-mm-yy'))
    (
      subpartition SND_ADVERTISING_PERIOD_sub_1,
      subpartition SND_ADVERTISING_PERIOD_sub_2,
      subpartition SND_ADVERTISING_PERIOD_sub_3,
      subpartition SND_ADVERTISING_PERIOD_sub_4
```

Since dimentions change most often in the system: client, order and employee (because the company is large). Therefore, it is most logical to use parallel computing in the DW, CL and SA levels to update data about them. However, parallel computing can be used also in DM - data mart levels, when designing views related to finance. Because they are frequently updates due to the large number of transactions, and accountants, marketers, etc. reliable and up-to-date information is required.

The most used views in business are listed below.





Conclusion

As a conclusion, the presented technical solution will help the business to get additional profit on:

1. Simplification of accounting by storing data in a single system and saving the history of data changes.
2. Increase conversion by accelerating the interaction of the client with the site (by accelerating the response from the database).
3. Reducing the cost of physical media due to the ability to use more powerful media for fresh information and slow, old media for historical information.
4. Increasing the security of data from leaks and unauthorized changes, which means incurring reputational and material costs.
5. 5. Improving the efficiency of the marketing department due to the ability to create views with aggregated information for decision making.