



Data Warehouse

Exercises

District heating company

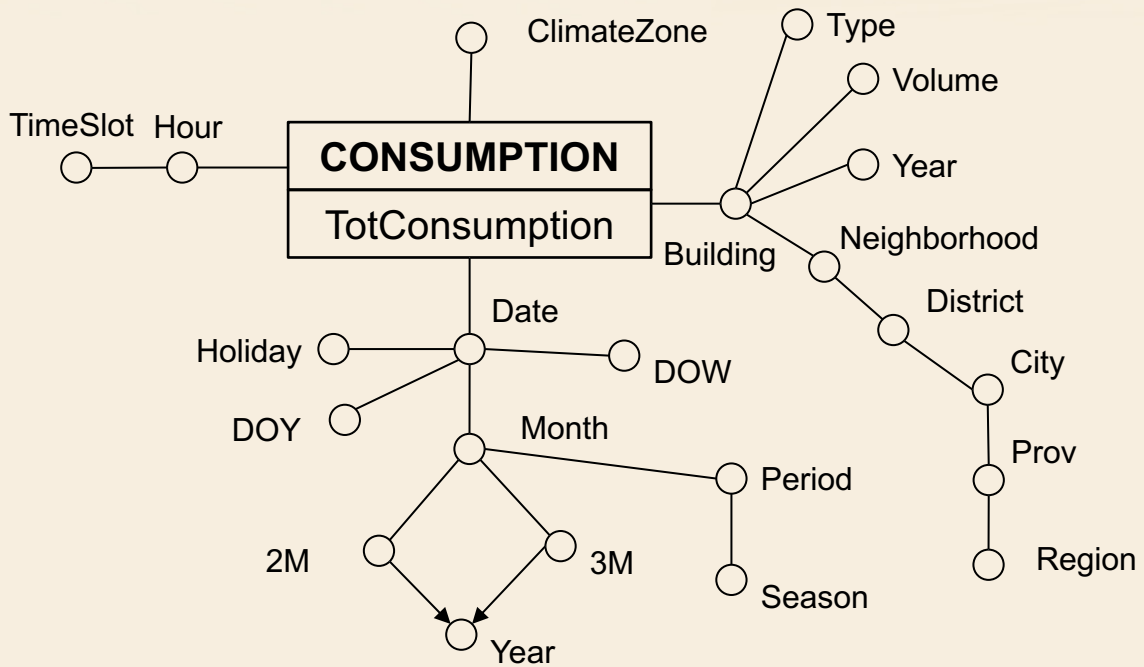
A district heating company provides its service in various Italian cities. Numerous buildings have been involved in the district heating network through a special system, which includes a counter capable of measuring the energy consumed for heating every 5 minutes. The energy counter also has an external sensor, which collects local data on temperature, humidity, pressure and wind speed every 5 minutes. These data are processed by the company to define a synthetic index of climate range, which can take a value between the following: hot, mild, cold, very cold. This index is updated once every hour, for each external sensor of each counter. For each building, some characteristics are also known such as the year of construction, the total volume of heated rooms in cubic meters, the type of building (residential, office, or public service), the address, neighborhood and ward of the city in which it is located.

District heating company

Build a data warehouse to analyze and compare the total consumption and the average hourly and daily consumption, according to:

- time of the day, time slot of the day (morning 6-12, afternoon 12-18, evening 18-22, night 22-6);
- date, day of the week, holiday or non-holiday, day of the year (1-365);
- month, bimonthly, quarter, year;
- period of the bill (periods are September-October-November, December-January, February-March, and April-May) and heating season (each season begins in September and ends in May);
- climate zone calculated from its own synthetic index;
- building, year of construction of the building, volume of the building in cubic meters, building type;
- neighborhood, district, city, province and region in which the building is located (it is assumed that each district belongs to a single district)

Conceptual design



Logical design

BUILDING (BID, Building, BuildingType, Volume, Year, Neighborhood, District, City, Prov, Region)

TIME (TID, Date, DOW, DOY, Holiday, Month, 2M, 3M, Year, Period, Season)

TIME_HOUR (THID, Hour, TimeSlot)

CONSUMPTION (BID, TID, THID, ClimateZone, TotConsumption)

Query 1

For each building, climate zone and time of day (morning, afternoon, evening, night), compute the average hourly consumption. Compare it (make the difference) with the overall hourly average consumption of each building (considering all climate zones and all time zones).

Query 1 - solution

```
SELECT Buiding, ClimateZone, TimeSlot,  
       AVG(TotConsumption),  
       AVG(TotConsumption) –  
       SUM(SUM(TotConsumption))/ SUM(COUNT(*))  
       OVER (PARTITION BY Building)  
FROM BUILDING B, TIME_HOUR T, CONSUMPTION C  
WHERE C.BID=B.BID AND C.THID=T.THID  
GROUP BY Buiding, ClimateZone, TimeSlot;
```

Query 2

For each type of building and heating season, compute the percentage of consumption made on different days of the week. Example: 22% consumed on Monday, 16% consumed on Tuesday, etc.

Query 2- solution

```
SELECT BuidingType, Season, DOW,  
       100 * SUM(TotConsumption)/  
       SUM(SUM((TotConsumption))  
           OVER (PARTITION BY BuidingType, Season))  
FROM BUILDING B, TIME T, CONSUMPTION C  
WHERE C.BID=B.BID AND C.TID=T.TID  
GROUP BY BuidingType, Season, DOW;
```