



Data Base and Data Mining Group of Politecnico di Torino

## Database Management Systems

Politecnico di Torino

### Data warehousing in Oracle – Practice 3

The practice purpose is to write some queries, in extended SQL, to retrieve data from the data warehouse described in Point 1. Furthermore, it will be necessary to create some materialized views in order to improve the performance of frequent queries.

#### 1. Problem specifications

A telephone company is interested in analyzing its own data to improve customer services. At present, the company has a database with call logs. For each call, the caller and receiver phone numbers, the duration, the type of charge (e.g., peak, off-peak rates), the start time (date, hour, minute, second) are known.

The managers want to obtain very fast the information about the telephone traffic on the company lines and the daily income based on the caller location, the day and the phone rate.

In particular, the managers want to analyze the following situations:

- Monthly net income and number of calls for each caller city.
- Monthly net income and number of calls for each receiver city.
- Monthly net income and number of calls for each caller province and region.
- Monthly net income and number of calls for each receiver province and region.
- Daily net income and number of calls for each caller province.
- Yearly net income and number of calls for each caller province and region.
- Monthly net income and number of calls for each phone rate (type of charge).
- Net income and number of calls for each day of the week and phone rate.
- Daily number of calls for each caller region.
- Daily number of calls for each receiver region.

The OLTP database of the telephone company is reported in Table 1.

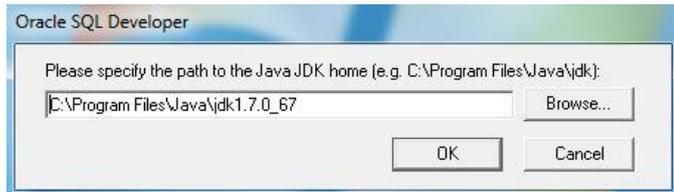
#### 2. Querying the data warehouse

In Table 2 the proposed solution for the data warehouse is shown. The corresponding tables have already been created in Oracle and they contain some sample data. Use these tables as source for the following queries.

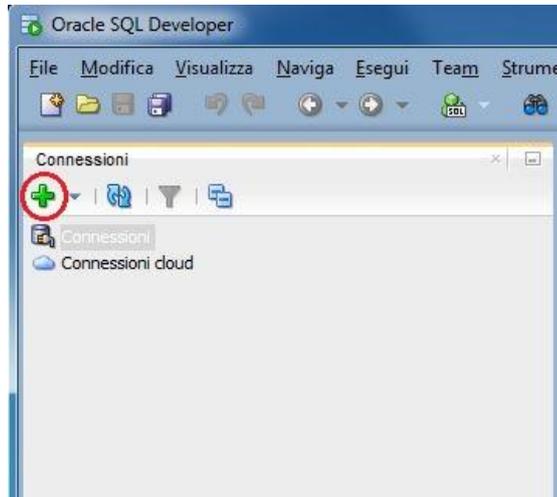
1. Select the yearly income for each phone rate, the total income for each phone rate, and the total yearly income.
  2. Select the monthly number of calls and the monthly income. Associate the RANK() to each month according to its income (1 for the month with the highest income, 2 for the second, etc., the last month is the one with the least income).
  3. For each month in 2003, select the total number of calls. Associate the RANK() to each month according to its total number of calls (1 for the month with the highest number of calls, 2 for the second, etc., the last month is the one with the least number of calls).
  4. For each day in July 2003, select the total income and the average income over the last 3 days.
  5. Select the monthly income and the cumulative monthly income from the beginning of the year.
- Estimate the cardinality of the data warehouse tables (facts and dimensions) and decide whether and which materialized views are needed to improve performance of the previous queries.
  - Create the materialized views you consider convenient and compare the execution plan cost of the queries using and without using the materialized views.

### 3. Connection to the database

1. Open the Oracle SQL Developer program (from Start Menu-All programs)
2. Select the Java SDK path



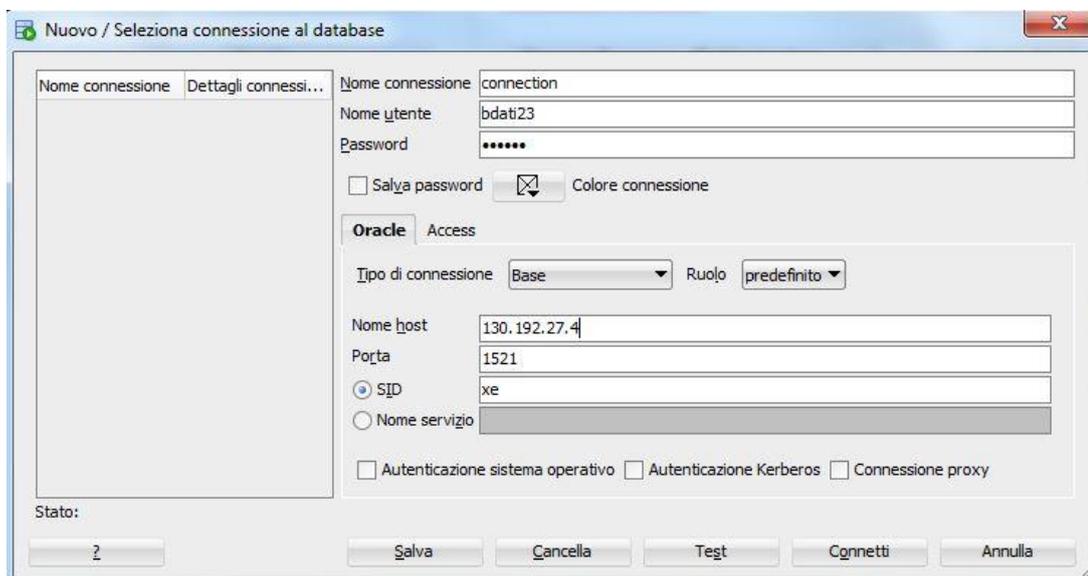
3. Click on the green "plus" button on the left to create a new connection



#### 4. Login

- a. To logon you have to insert the following parameters:
  - i. Nome utente (username): bdati[choose a number between 1-100]
  - ii. Password: orac[choose a number between 1-100]
  - iii. Nome host (host name): 130.192.27.4
  - iv. Port: 1521
  - v. SID: xe

For example, if you are working on pc number 23, the corresponding username is bdati23 and the password is orac23.



5. Execute the query and create the materialized views by means of the interface.

Tables	Description
<b>DWABD . PHONERATES</b> <pre>(   phoneRateType          INT          NOT NULL,   phoneRateName          VARCHAR(20)  NOT NULL,   phoneRate_CostPerSecond  FLOAT      NOT NULL,   PRIMARY KEY(phoneRateType) );</pre>	Different phone rates  7 rows
<b>DWABD . PLACES</b> <pre>(   Places_ID              INT          NOT NULL,   City                   VARCHAR(20)  NOT NULL,   Province               VARCHAR(20)  NOT NULL,   Region                 VARCHAR(20)  NOT NULL,   PRIMARY KEY(Places_ID) );</pre>	Places  1500 rows
<b>DWABD . CALLS</b> <pre>(   CallerPhoneNumber      VARCHAR(20)  NOT NULL,   ReceiverPhoneNumber    VARCHAR(20)  NOT NULL,   CallerLocation         INT          NOT NULL,   ReceiverLocation       INT          NOT NULL,   FullDate               DATE         NOT NULL,   StartTimeHour          INT          NOT NULL,   StartTimeMinute        INT          NOT NULL,   StartTimeSecond        INT          NOT NULL,   CallDuration           FLOAT        NOT NULL,   phoneRateType          INT          NOT NULL,   PRIMARY KEY(CallerPhoneNumber,ReceiverPhoneNumber,FullDate,StartTimeHour ,StartTimeMinute,StartTimeSecond),   FOREIGN KEY(phoneRateType) REFERENCES PhoneRates(phoneRateType) ON DELETE CASCADE,   FOREIGN KEY(CallerLocation)REFERENCES Places(Places_ID) ON DELETE CASCADE,   FOREIGN KEY(ReceiverLocation) REFERENCES Places(Places_ID) ON DELETE CASCADE );</pre>	Calls in 2003 and 2004  ~ 1300000 rows

**Table 1 – Source data base with single call information**

Tables	Description
<b>DWABD . TIMEDIM</b> <pre>(   ID_time          INT          NOT NULL,   DayOfWeek        CHAR(15)    NOT NULL,   DateMonth        INT          NOT NULL,   DateYear         INT          NOT NULL,   PRIMARY KEY(ID_time) );</pre>	Time dimension  10 rows
<b>DWABD . PHONERATE</b> <pre>(   ID_phoneRate     INTEGER      NOT NULL,   phoneRateType    VARCHAR(20)  NOT NULL,   PRIMARY KEY(ID_phoneRate) );</pre>	Phone rate dimension  7 rows
<b>DWABD . LOCATION</b> <pre>(   ID_location      INTEGER      NOT NULL,   City             VARCHAR(20)  NOT NULL,   Province         CHAR(20)     NOT NULL,   Region          CHAR(20)     NOT NULL,   PRIMARY KEY(ID_location) );</pre>	Place dimension  1500 rows
<b>DWABD . FACTS</b> <pre>(   ID_time          INTEGER NOT NULL,   ID_phoneRate     INTEGER NOT NULL,   ID_location_Caller  INTEGER NOT NULL,   ID_location_Receiver INTEGER NOT NULL,   Price           FLOAT   NOT NULL,   NumberOfCalls   INTEGER NOT NULL,   PRIMARY KEY(ID_time, ID_phoneRate, ID_location_Caller, ID_location_Receiver), FOREIGN KEY(ID_time) REFERENCES timeDim(ID_time), FOREIGN KEY(ID_phoneRate) REFERENCES phoneRate(ID_phoneRate), FOREIGN KEY(ID_location_Caller) REFERENCES location(ID_location), FOREIGN KEY(ID_location_Receiver) REFERENCES location(ID_location) );</pre>	Fact table  7809 rows

**Table 2 – Proposed solution - Data warehouse tables**