Lily: A Geo-Enhanced Library for Location Intelligence

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Agenda

- Location Intelligence – Definition
- State of the art (Literature and Industry)
- Lily
  - Features
  - Architecture
  - Typical flows
  - Technological stack
- Example – Vodafone Italy
- Summary and future work

Location Intelligence - Definition

Over 80% worldwide companies take their business decisions based on data characterized by a spatial component.

- *Location Intelligence* is a set of tools and techniques to integrate a **geographical dimension** into **BI platforms**, aimed at enhancing their capability of better monitoring and interpreting **business events**. It supports advanced **maps visualizations and interactions** together with all typical **BI systems functions for exploring information**.

State of the art - Literature

- Many researches on SOLAP (Spatial OLAP): integration of GIS and OLAP technologies.
  - **Architectures**
  - **Data models** (to deal with spatial dimensions)
  - **Operators and algorithms** (extend expressiveness of traditional OLAP in querying)

- Three-level architecture:
  - Multidimensional/spatial query engine
  - Relational-multidimensional DBMS supporting spatial data
  - GUI

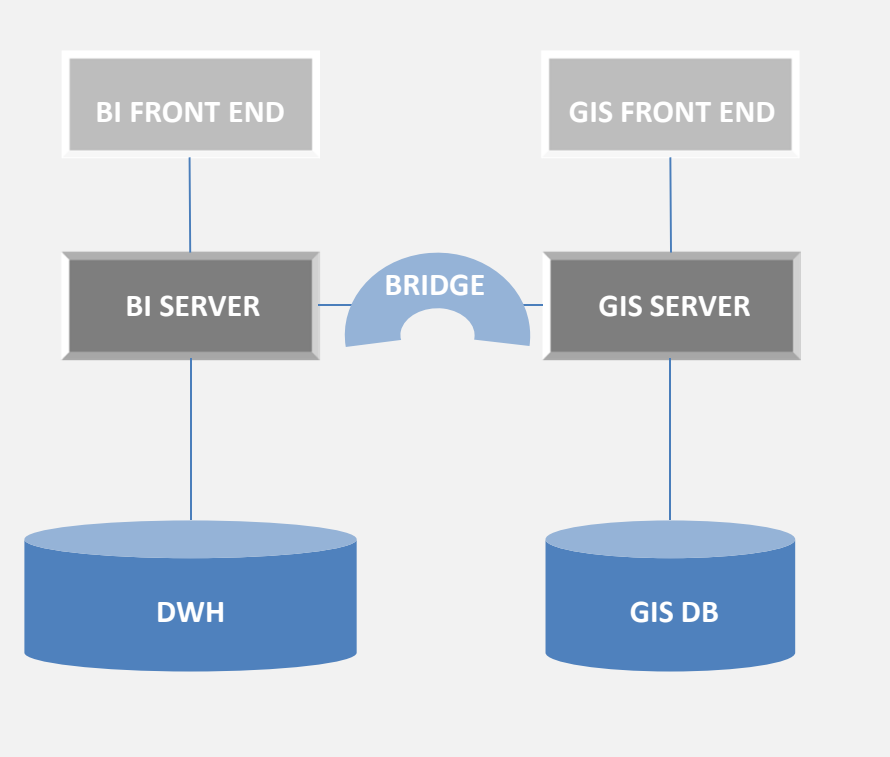
- Architecture classification:
  - **Loosely-coupled:** import-export-reformatting or mapping data between GIS and OLAP.
  - **Semi-tightly coupled:** GIS-dominant or OLAP-dominant solutions.
  - **Tightly-coupled:** fully-integrated Spatial OLAP technology.

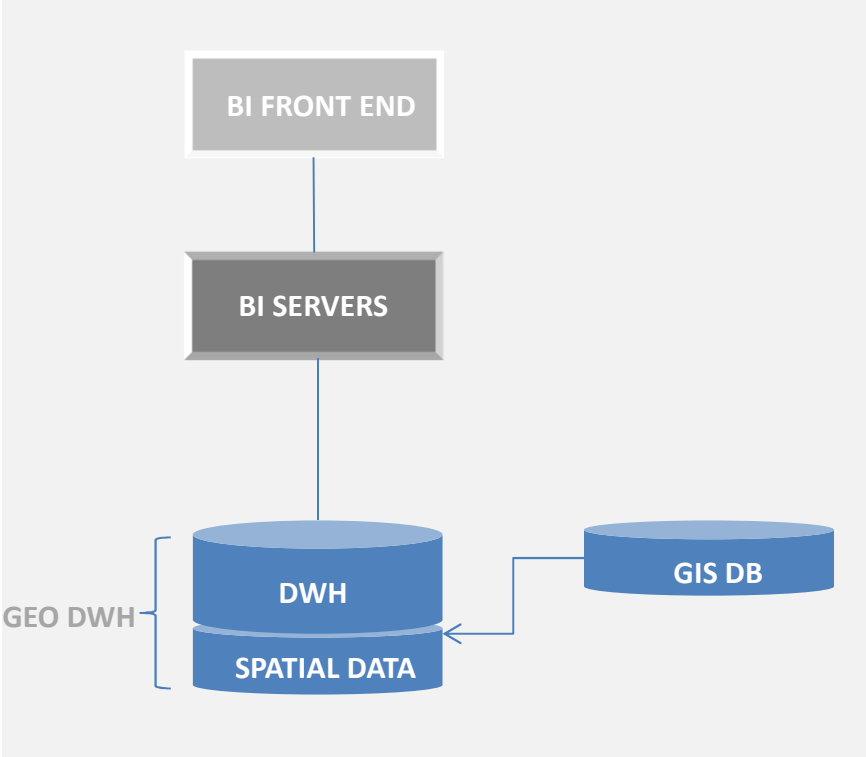
State of the art - Industry

- BI Vendors have been including basic spatial features since very old-dated versions.

- Different approaches (from very simple to sophisticated):
  - Static maps:
    - Coarse-grained, non interactive, simple indicators represented on maps.
    - Typically, colored SVG images.
    - ➢ Hyperion Web Analysis, Microsoft Reporting Services, Business Object Xcelsius, …
  - Bridge between legacy BI platforms and GIS:
    - High interaction, full GIS capabilities.
    - Still two separate systems: business data inside data warehouse, spatial data inside GIS
    - ➢ Apos LIS (SAP BO <-> ESRI), Business Geografic (QlikView/SAP BO <-> custom GIS), Galigeo, …
  - Fully-integrated SOLAP technology:
    - Spatial data is stored together with business data in a spatial data warehouse
    - Larger querying capabilities, better scalability and efficiency.
    - ➢ Oracle DB + Spatial option, PostgreSQL + PostGIS, Microsoft SQL Server, …

Architectures for Location Intelligence





Semi-tightly coupled

- No mixed queries
- Low performances and management of small data volumes
- Multiple versions of truth

Tightly coupled

- Mixed queries
- Good performance & management of large data volumes
- Integrated visualization

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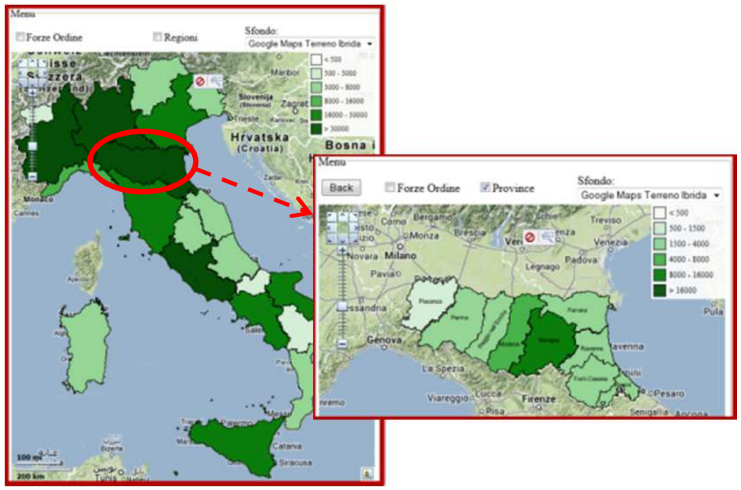
Lily

Lily is a geo-enhanced library that adds true Location Intelligence capabilities to existing BI platforms.

- Lily is a Javascript + AJAX library.
- Layer of abstraction **between the map renderer and the BI platform**.
- It helps the development of a Location Intelligence solution by:
  - maximizing performances;
  - dramatically reducing development time.
- It fits a tightly-coupled architecture.
- Mash-up approach.
  - Fast deployment.
  - Possibility of reusing existing services.

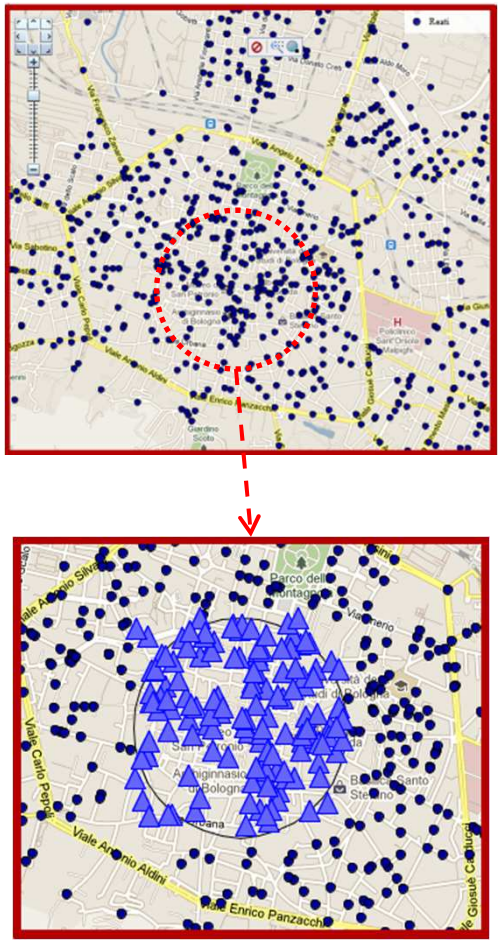
Lily - Features

- Geo-enhanced query formulation
  - Spatial drill



  - Geo-coding

  - SOLAP queries



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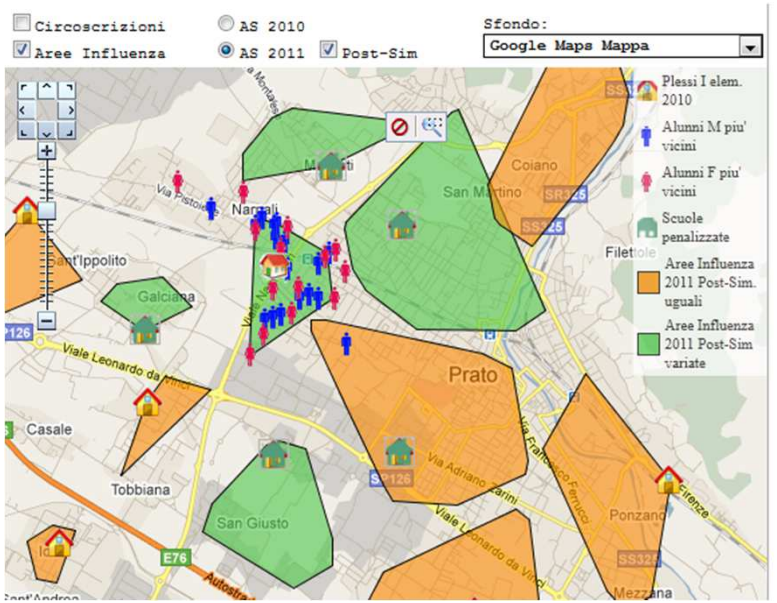
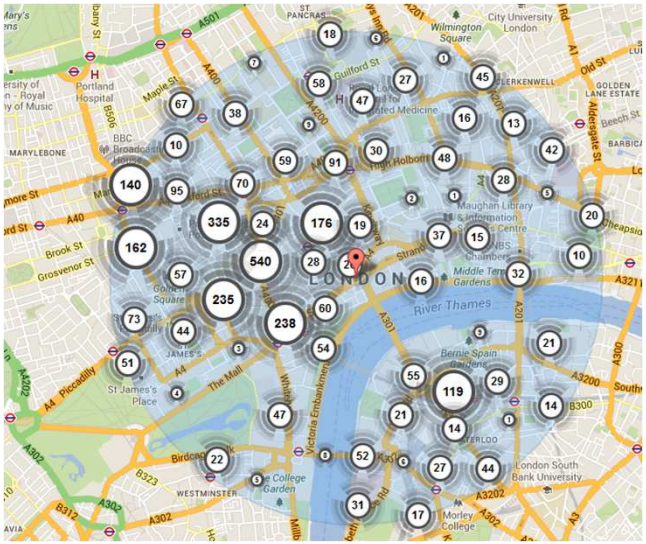
Lily - Features (2)

- Geo-enhanced processing
  - Spatial triggering



  - Spatial clustering



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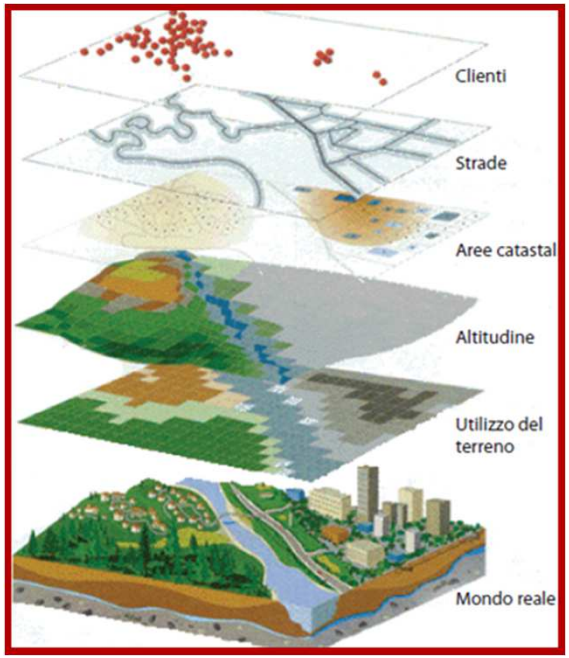
Lily - Features (3)

- Geo-enhanced data visualization (1/2)
  - Integration of external maps

  - Multi-layer representation



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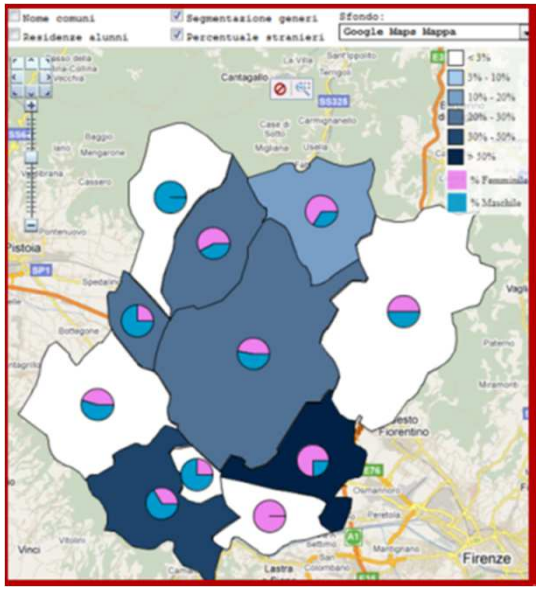
Lily - Features (4)

- Geo-enhanced data visualization (2/2)
  - Real-time refresh

  - Spatial KPI visualization



  - Temporal slider

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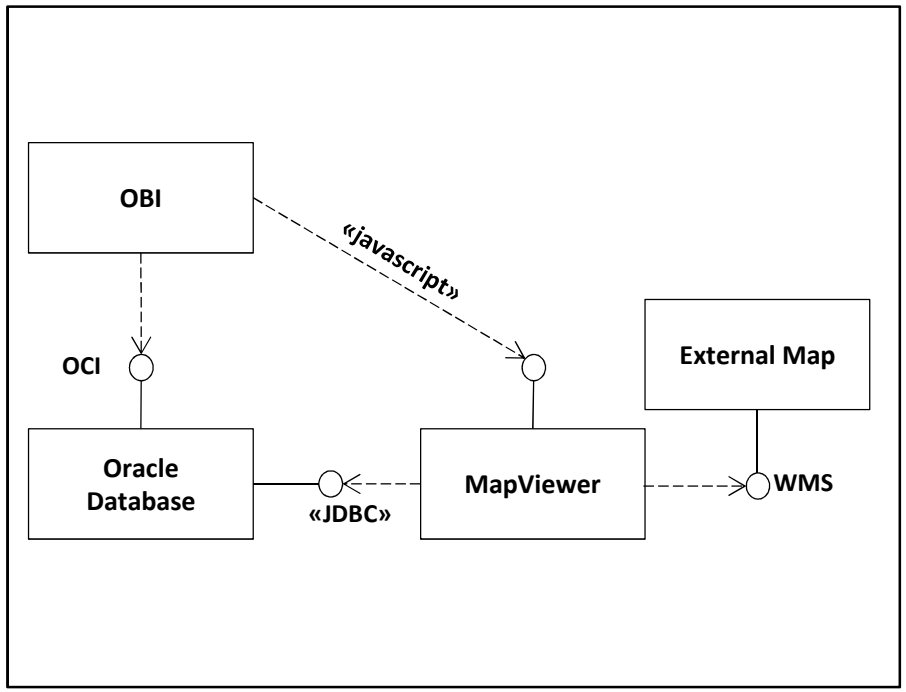
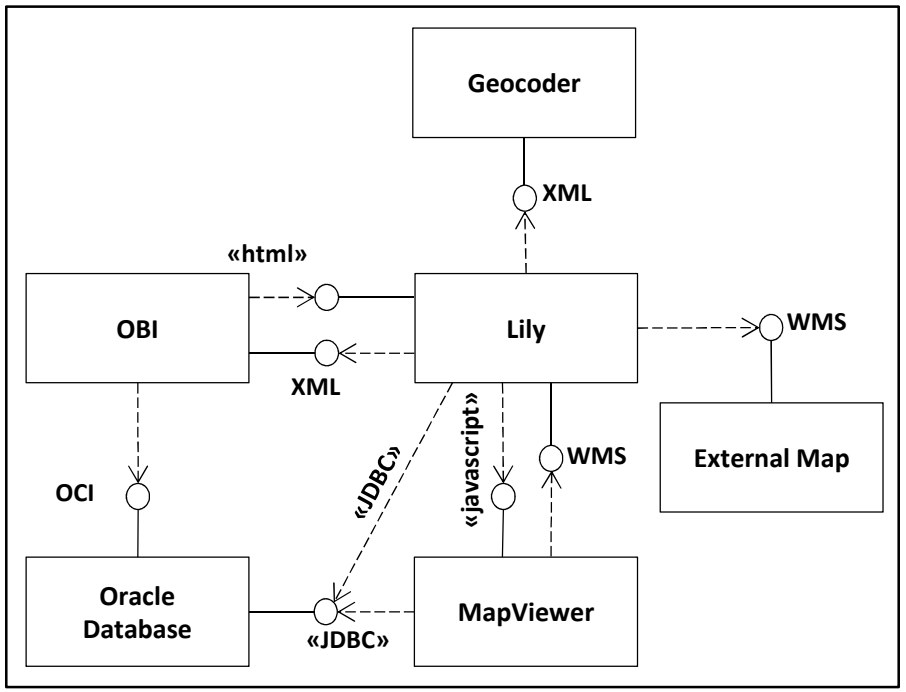
Lily - Architecture

- Lily can be interposed between Oracle Business Intelligence and Oracle MapViewer.



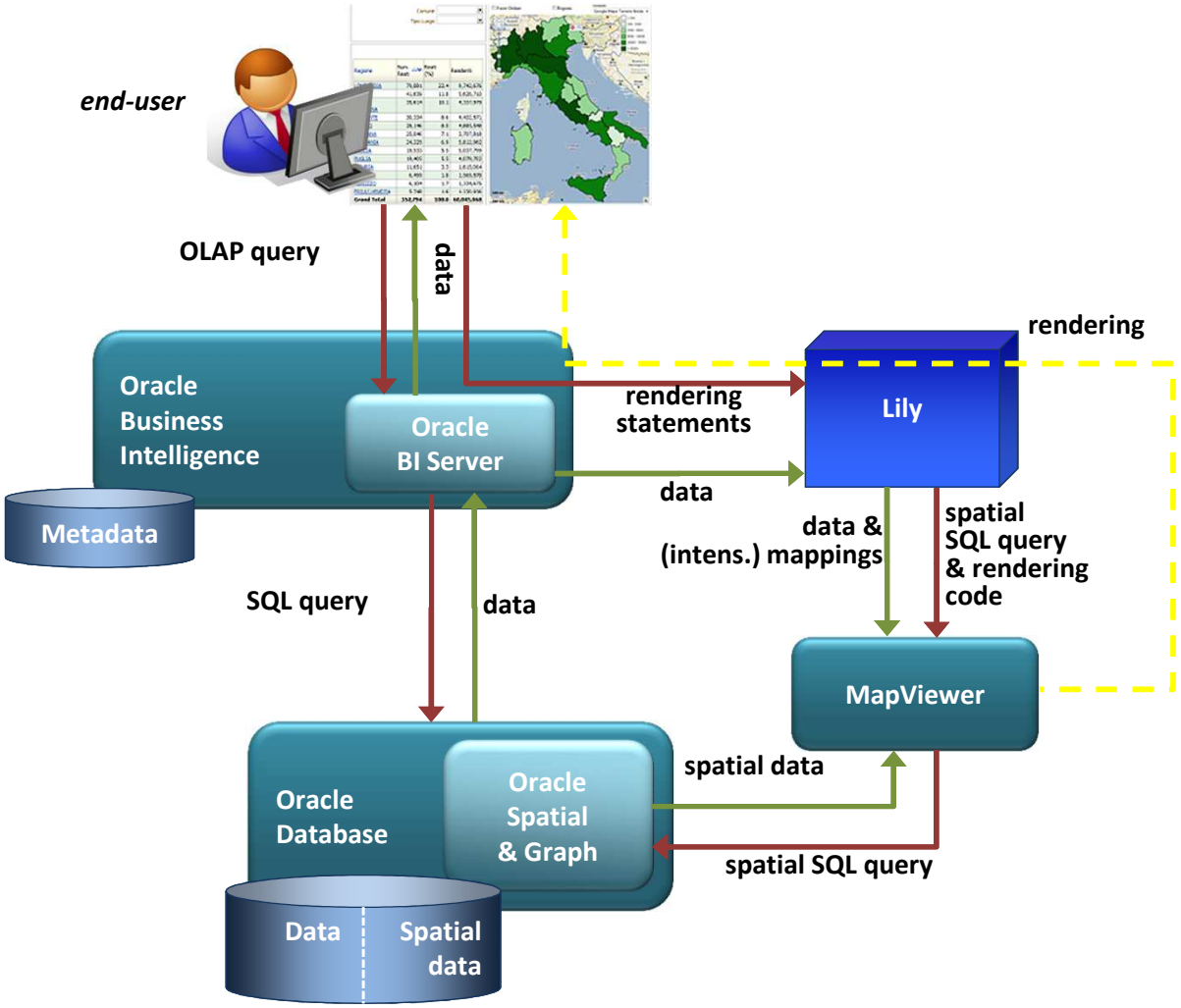
Without Lily



With Lily

Lily – Flows (OLAP)

- Typical flows for an OLAP query



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Lily – Flows (SOLAP)

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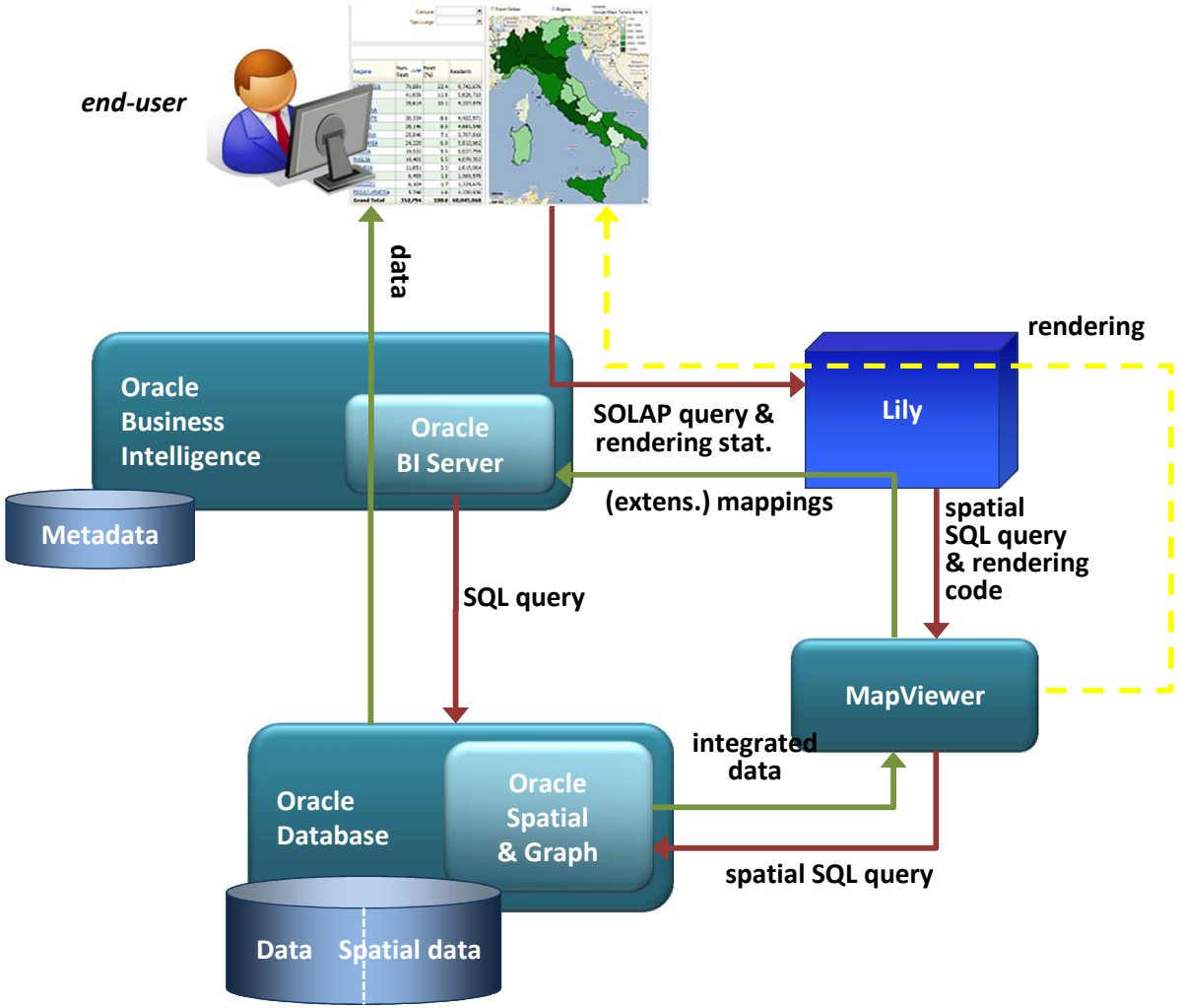
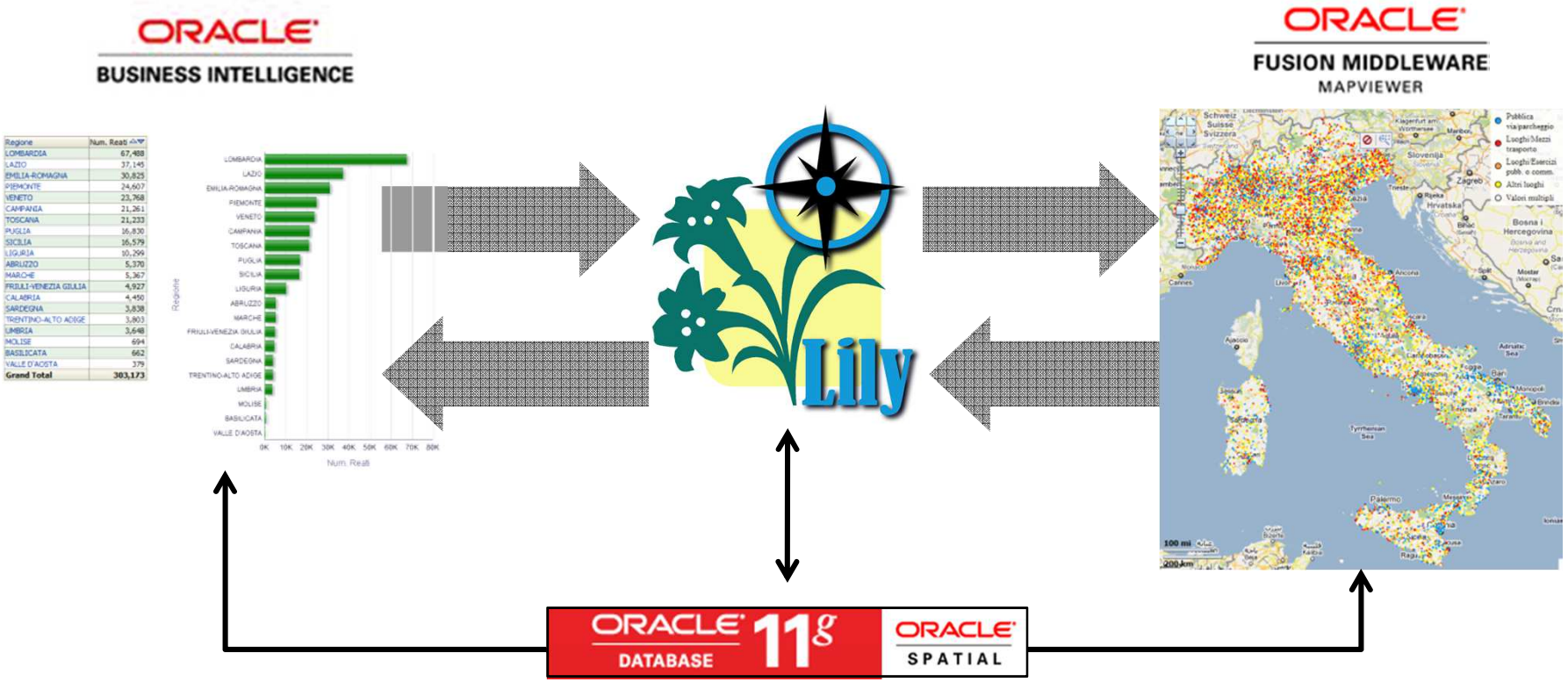


Lily - Technological stack

- Currently, Lily is Oracle-based.
- The chosen architecture is open to other technologies.
  - The main requirement is a DBMS with spatial support (e.g., MS SQL Server, PostgreSQL+PostGIS)



Geo Data Warehouse

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Example – Vodafone Italy

- Main features:
  - Points-of-sales Analysis
    - Geo-dashboard
    - Volumes
    - Sustainability
    - Points-of-sales Analysis

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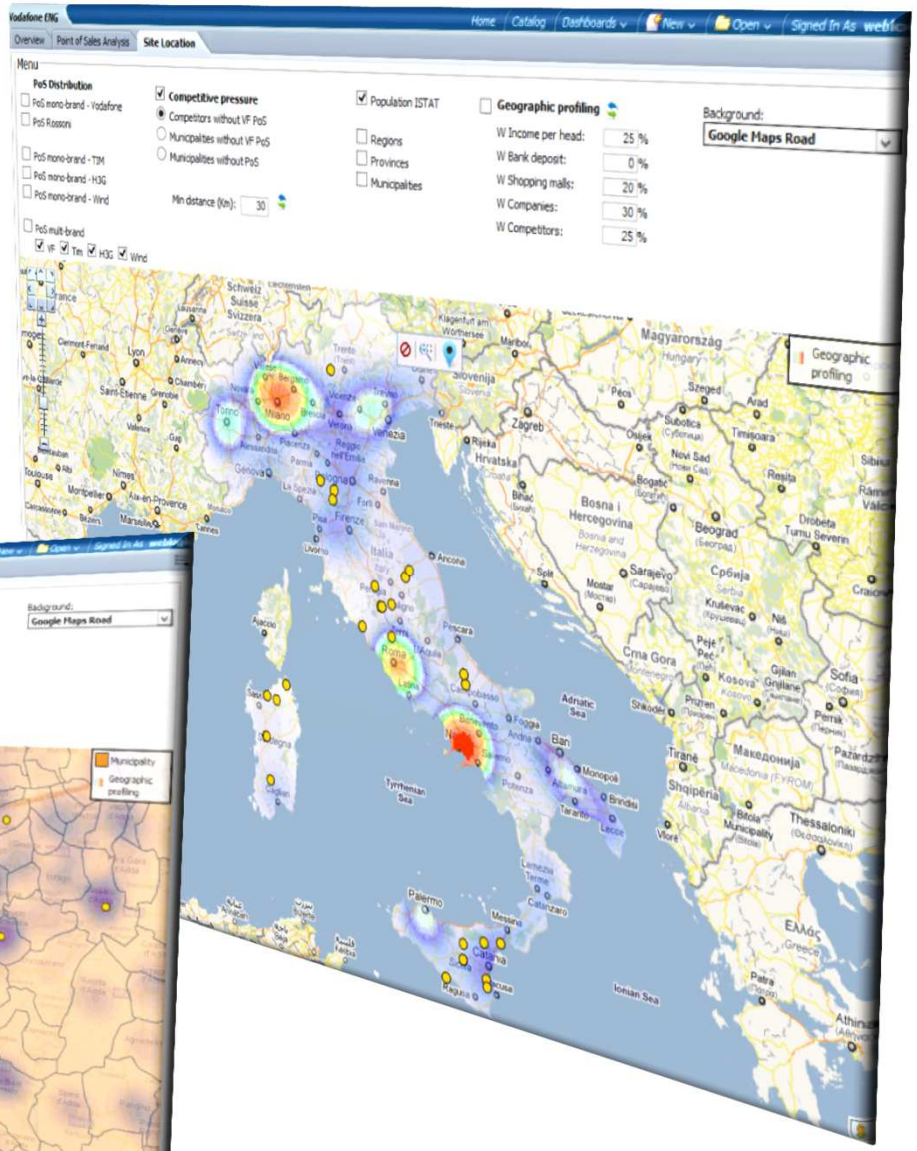
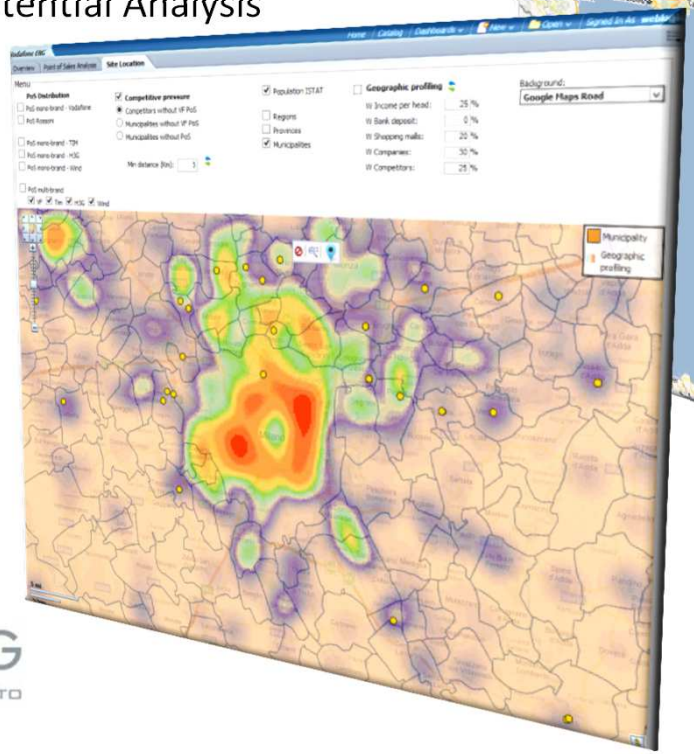
Example – Vodafone Italy (2)

- Main features:
  - Points-of-sales Analysis
    - Geo-dashboard
    - Volumes
    - Sustainability
    - Points-of-sales Analysis
  - Territory Potential Analysis





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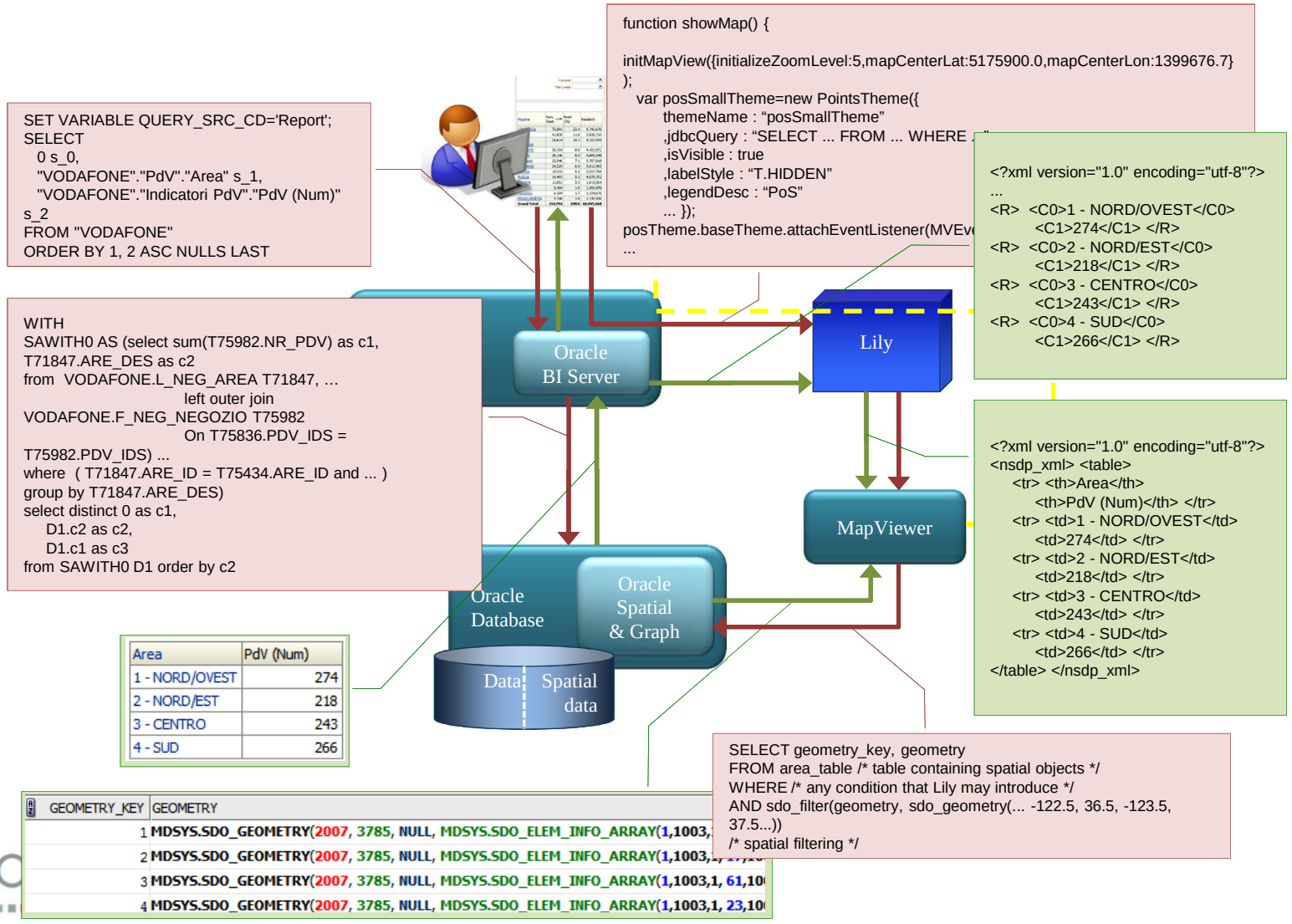
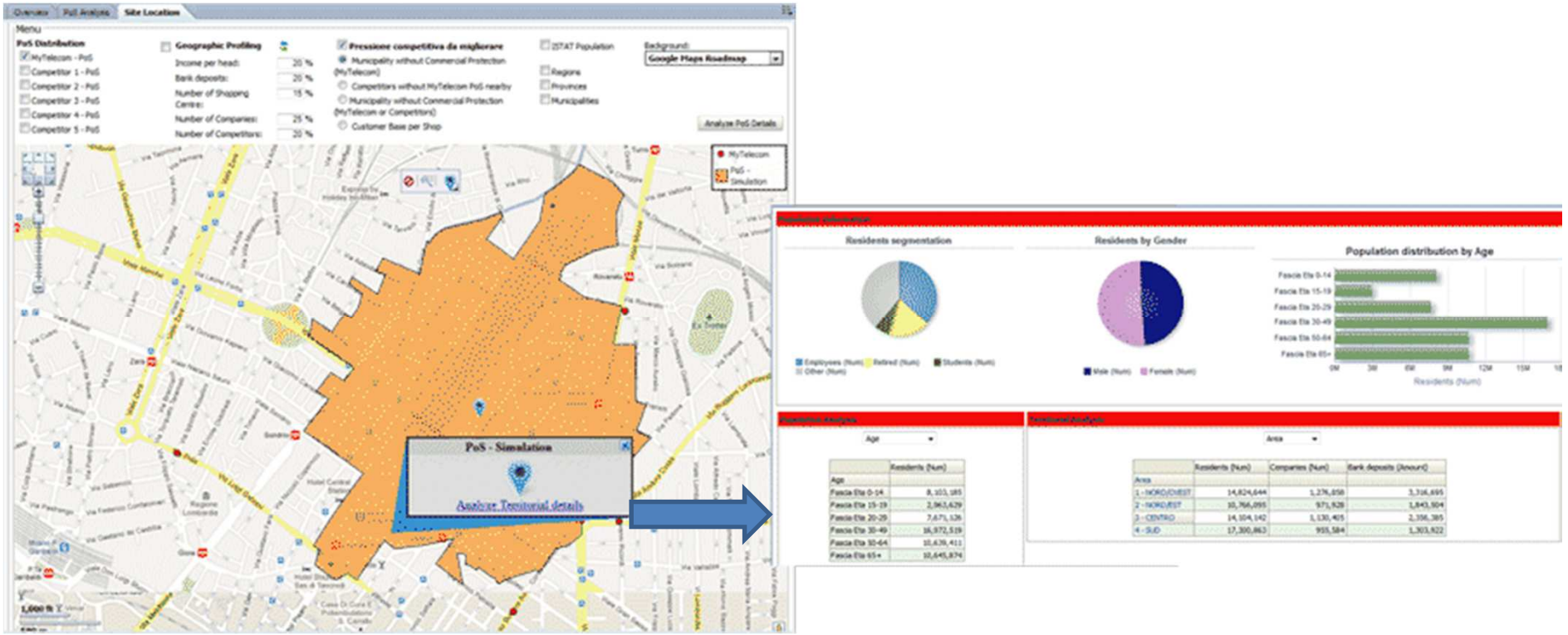
Example – Vodafone Italy (3)

- Query and data flows involved in the drawing of pie charts



Example – Vodafone Italy (4)

- SOLAP query: data is filtered and analyzed based on spatial and OLAP filters



Summary and Future work

- Business Intelligence tools lack from the spatial analysis perspective.
- Lily enables a quick development of a tightly-coupled Location Intelligence solution with unmatched geo-enhanced features.

- Future work:
  - Although Lily has been designed to be open, the current implementation is Oracle-based. Further developments will make it independent of:
    - BI platform.
    - DBMS (and spatially-enabled DBMS would be compatible).
    - Map renderer.

Thank you

Questions?

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