Novel Developments in Ontology-Based Data Access and Integration: Part 2. Systems and Use Cases

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OBDA is by now a mature technology

Ontology-based querying of relational data sources is supported by several systems, both open-source and commercial:

- Mastro [C., De Giacomo, et al. 2011] [1]
  Sapienza Università di Roma & OBDA systems SRL, Italy
- Morph [Priyatna, Corcho, and Sequeda 2014] [2]
  Technical University of Madrid, Spain
- Ontop [C., Cogrel, et al. 2017] [3]
  Free University of Bozen-Bolzano, Italy
- Stardog [4], Stardog Union, US
- Ultrawrap [Sequeda and Miranker 2013] [5], Capsenta, US
- Oracle Spatial and Graph [6]

[1] http://www.obdasystems.com/it/mastro
[2] https://github.com/oeg-upm/morph-rdb
[3] http://ontop.inf.unibz.it
[4] http://www.stardog.com
[5] https://capsenta.com/ultrawrap
[6] http://www.oracle.com/technetwork/database/options/spatialandgraph

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http://ontop.inf.unibz.it/

- State-of-the-art OBDA system developed at the Free University of Bozen-Bolzano.
- Compliant with all relevant Semantic Web standards:
  RDF, RDFS, OWL 2 QL, R2RML, and SPARQL
- Supports all major relational DBs:
  Oracle, DB2, MS SQL Server, Postgres, MySQL, Denodo, Teiid, Exareme, etc.
- Open-source and released under Apache 2 license.
- Development of *Ontop*:
  - development started in 2009
  - already well established and widely adopted:
    +200 members in the mailing list
    +9000 downloads in last 2 years
  - main development was carried out in the context of the EU project Optique

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Selected Use Cases of OBDA

- Oil & Gas: Statoil [Kharlamov et al. 2017a]
- Turbine Diagnoses: Siemens [Kharlamov et al. 2017b]
- Development of data integration solutions: SIRIS Academic SL Barcellona [Mosca, Rondelli, and Rull 2017]
- Log Extraction in Process Mining – Euregio financed project KAOS [Calvanese, Kalayci, et al. 2017]
- Cultural heritage: EPNet project [Calvanese, Liuzzo, et al. 2016]
- Maritime security: EMSec project [Brüggemann et al. 2016]
- Manufacturing [Petersen et al. 2017]
- Health care: electronic health records [Rahimi et al. 2014]
- Public debt: the Italian Ministry of Economy and Finance [Antonioli et al. 2014]
- Smart cities: IBM Ireland [López et al. 2015]
- ...

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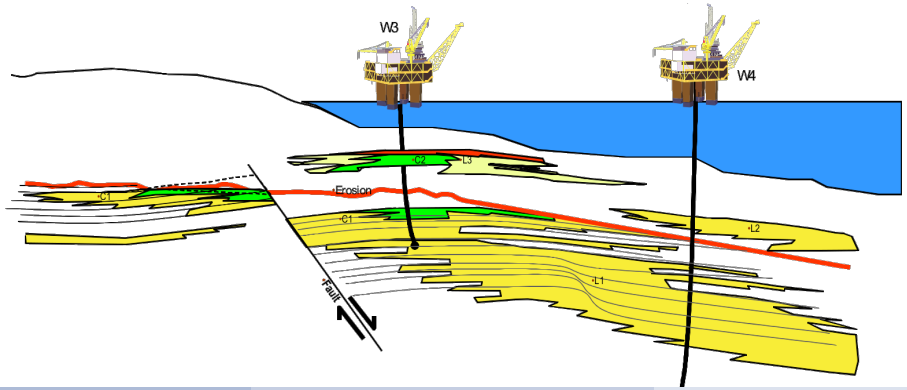
Statoil

- Optique use case partner
- Exploration domain: analyse existing relevant data in order to find exploitable accumulations of oil or gas
- Improve the efficiency of the information gathering routine for geologists
- Efficient, creative data collection from multiple large volume data sources



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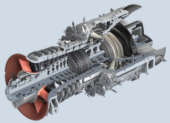
Siemens use case

- Optique use case partner
- Siemens energy department
- streaming and temporal data

- Siemens
  - produces huge appliances, e.g., turbines
  - installs them in plants



- Siemens service centers
  - offers constant monitoring and diagnostics service
  - over 50 service centers world wide
  - each SC is responsible for several thousands appliances
  - their job: monitoring and diagnostic of turbine
- Monitoring and diagnostic tasks
  - reactive and preventive diagnostics
    - offline, after an issue is detected
  - predictive analyses
    - real-time, to avoid issues

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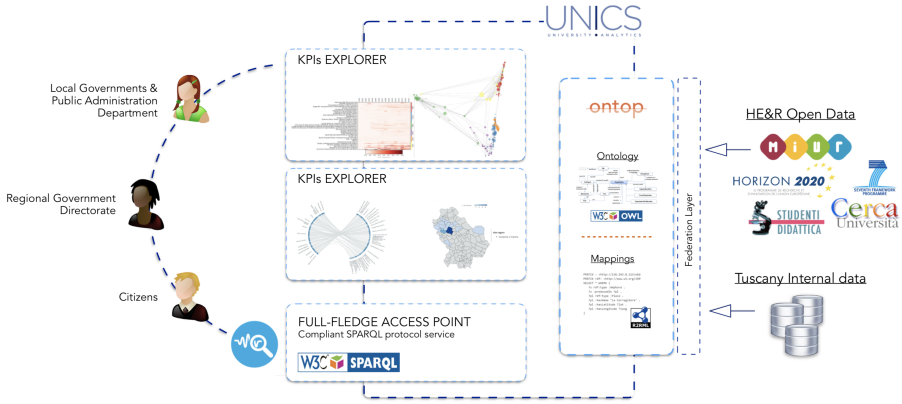
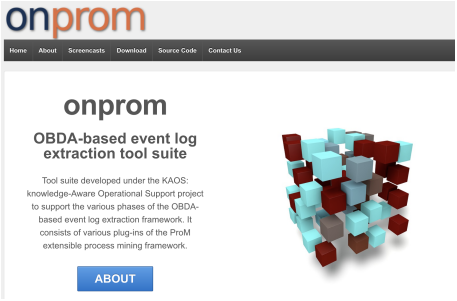
Tuscany's Observatory of Research and Innovation

- Carried out by SIRIS Academic SL Barcellona and the Tuscany Region
- Support the Higher Education and Research system, and promoting innovation in the Tuscan territory [Mosca, Rondelli, and Rull 2017]



Log Extraction in Processing Mining

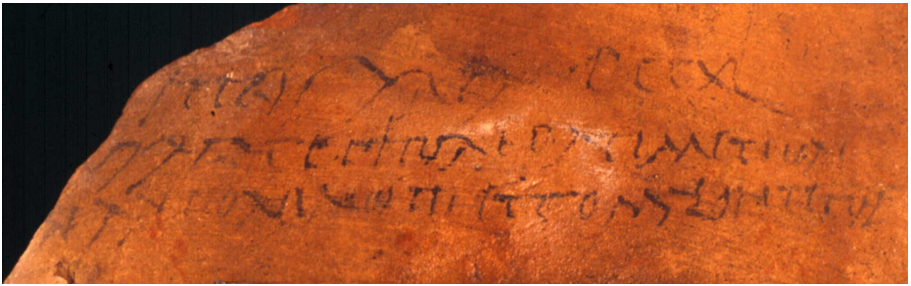
- Process Mining as a way to reconcile model-driven management and the real behaviours
- Processing mining tools (e.g. Disco [fluxicon.com]) require data in a particular format (XES)
- Data preparation is an issue in presence of legacy data
- onprom[7] is an effective tool chain for extracting event logs from legacy databases



[7] http://onprom.inf.unibz.it/

EPNet project

- Ontology-based data integration for humanities and archaeologists
- ERC advanced grant EPNet "Production and distribution of food during the Roman Empire: Economics and Political Dynamics".
- Linking three datasets:
  1. the EPNet relational repository
  2. the Epigraphic Database Heidelberg
  3. the Pleiades dataset



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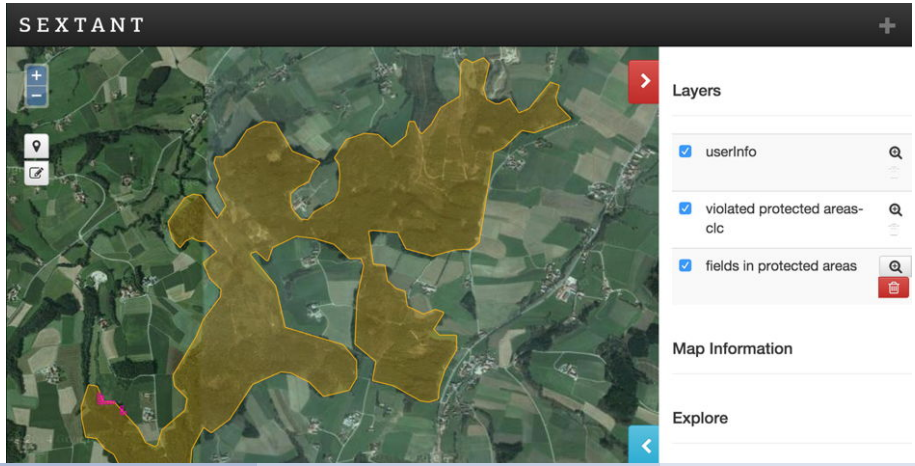
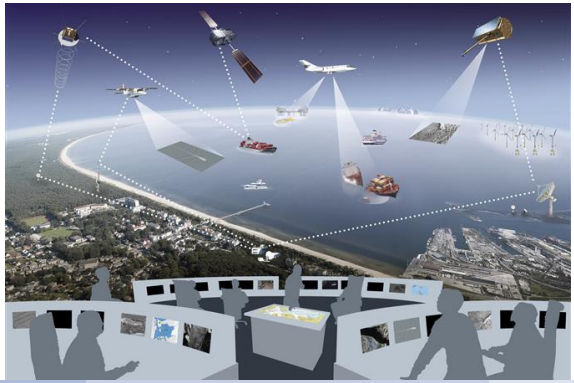
Melodies project

- EU FP7 Melodies project: working with Open Data, 16 partners.
- Geospatial extension Ontop-spatial used for accessing geospatial data
- Use cases: urban development, land management, disaster management



EMSec project

- German BMBF project EMSec, collaborated with Airbus:
- real-time services for maritime security
- Geo-spatial support by *Ontop*-spatial (developed as a fork of *Ontop*)
- SPARQL federation to access different kinds of data sources:
  - SPARQL endpoints of *Ontop* over *in situ* data
  - open SPARQL endpoints: Geonames, DBPedia



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Hands-on with Ontop

- Scenario: Integration of the information systems of two universities
- Requirements
  - Java 8
  - H2 with preloaded datasets
  - Protégé bundle with Ontop for editing ontologies and mappings
  - Tomcat bundle with Ontop for deploying a SPARQL endpoint
- Programme
  - Mapping the first data source
  - Mapping the second data source
  - Deploying a SPARQL endpoint
- Instruction: Session 1 of the Ontop Tutorial:
  `https://github.com/ontop/ontop-examples/edit/master/ontop-v3-tutorial/`

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Tips

- Protégé does not work with newer versions (>8) of Java
- Reasoner needs to be restarted whenever ontology or mapping are changed. Reasoner "stop" and "start" is more reliable than "synchronize".
- The SPARQL endpoint part can be done independently

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