

ORACLE SPATIAL AND GRAPH RDF SEMANTIC GRAPH

RDF SEMANTIC GRAPH FEATURES

NEW IN RELEASE 11.2

- Triple-level Label Security
- SPARQL 1.1, SPARQL/Update endpoint support and Java APIs via open source Joseki /Jena & Sesame Adapters for Oracle Database
- Faster parallel and incremental inference, and owl:sameAs optimization
- More OWL support: union, intersection, oneOf, OWL 2 property chains, disjoint properties, keys, & RL profile
- W3C SKOS inference support
- OWL 2 EL profile support for NIH SNOMED comprehensive clinical ontology
- Semantic indexing for documents based on popular natural language tools
- Cytoscape plugin graph visualization

EXISTING FEATURES

- Proven scalability over 10 billion triples for RDF/OWL data
- Up to 75% reduction in storage required with data compression to enhance query, load, and inference performance
- High performance bulk load
- Scalable partitioning enhances load and inference performance and concurrent operations for large RDF data sets
- SPARQL 1.0 Java API and query support via Jena Adaptor
- Querying RDF/OWL via SQL, with embedded SPARQL graph patterns
- Native inference engine: RDFS, OWL, and user-defined rules
- Support for Virtual Models
- Ontology-assisted querying of relational data using SQL operators

As part of Oracle Spatial and Graph, an option for Oracle Database 11g Enterprise Edition, Oracle delivers an advanced RDF semantic graph data management capability not found in any other commercial or open source triple store. With native support for RDF/RDFS/OWL/SKOS standards, this RDF data store enables application developers to benefit from an open, scalable, secure, integrated, efficient platform for RDF and semantic applications. These RDF database features enable storing, loading, and DML access to RDF/OWL data and ontologies, inference using RDFS, OWL and SKOS semantics and user-defined rules, querying of RDF/OWL data and ontologies using SPARQL-like graph patterns embedded in SQL, and ontology-assisted querying of enterprise (relational) data.

Store, Load, and DML operations for the RDF Semantic Graph Store

RDF Semantic Graph features support storing, loading and DML operations on RDF/OWL models. Each model contains a set of subject – object – relationship triples organized as an RDF/OWL graph of directed labeled edges. The edge is the link (or relationship) that connects a subject node to an object node and is labeled by a predicate. A normalized, compressed and partitioned storage architecture manages the complexity arising from repeated usage of typically long URIs and literal values associated with the subjects, objects and predicates across triples. This provides space-efficient storage that requires 75% less disk hardware than uncompressed semantic data, and scalable and performant loading, querying, and inferencing.

Native Inference engine for OWL, RDFS, and user-defined rules

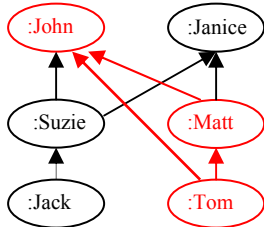
RDF Semantic Graph features include a native inference engine for efficient and scalable inference using the most used OWL semantics – OWL 2 RL profile. This OWL inference engine makes the existing native inference for RDF, RDFS, and user-defined rules (used for additional specialized inference capabilities) more efficient and scalable. Inference can be done using any combination of these supported entailment regimes.

New in release 11.2, are features to optimize inference performance for large owl:sameAs cliques with a compact data structure for inference, perform incremental inference to update entailments efficiently after triple inserts, and parallel inference on multi-core or multi-CPU architectures. Additional OWL

SQL-BASED SEMANTIC QUERIES

Find Tom's grandfather:

```
select y from
TABLE (SEM_MATCH
('{:Tom :hasParent ?x .
?x :hasFather ?y}',
SEM_Models('family'),
...);
```

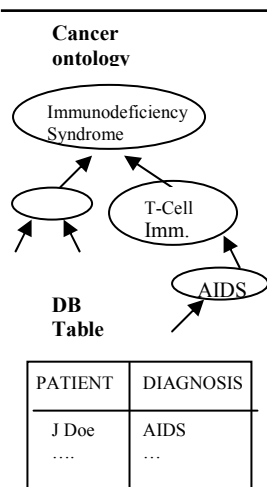


Add rule:

```
A :hasParent B,
B :hasFather C,
=> A :hasGrandFather C
```

Now find Tom's grandfather:

```
select x from
TABLE (SEM_MATCH
('{:Tom :hasGrandFather
?x}',
SEM_Models('family'), ...
```



Use the ontology to retrieve the row with 'AIDS' when 'Immunodeficiency Syndrome' is specified in the query:

```
select patient,
diagnosis from patients
where sem_related(
diagnosis,
'rdfs:subClassOf'
'Immunodeficiency
Syndrome',
'Cancer_ontology')= 1
```

constructs are supported for: union, intersection, oneOf, OWL 2 property chains, disjoint properties, and keys, and more OWL 2 RL/RDF rules are supported. A new CREATE_ENTAILMENT component supports the US NIH comprehensive clinical Systematized Nomenclature of Medicine (SNOMED) ontology. A new rulebase supporting the emerging W3C Simple Knowledge Organization System (SKOS) standard on RDF enables easy sharing of controlled and structured vocabularies such as thesauri, taxonomies, and classification schemes.

Query Semantic Data in Oracle Database

Full SPARQL 1.1 and 1.0 support is provided through open source SPARQL endpoints and Java APIs using Joseki and the Jena Adapter for Oracle Database or Sesame Adapter for Oracle Database. RDF/OWL data can be queried using SQL. The SEM_MATCH table function, which can be embedded in a SQL query, has the ability to search for an arbitrary pattern against the RDF/OWL models, and optionally, data inferred using RDFS, OWL, and user-defined rules. The SEM_MATCH function meets most of the requirements identified by W3C SPARQL standard for graph queries. Support for virtual models, a view-like feature for combining models and optionally corresponding entailments from a UNION or UNION ALL operation, can be used in a SEM_MATCH query. New in release 11.2, the SPARQL FILTER, UNION, and OPTIONAL keywords are supported in the SEM_MATCH table function.

Ontology-assisted Query for Relational Data

Queries can extract more semantically complete results from relational data by associating relational data with ontologies that organize the domain knowledge of the relational data. RDF Semantic Graph includes support for the semantic operator SEM_RELATED (and optionally its SEM_DISTANCE ancillary operator) for efficient ontology-assisted querying of relational data.

Fine-grained Security

The default access control to RDF Semantic Graph data in Oracle Database is at the model level. New in release 11.2, security administrators can define sensitivity labels on individual triples and users that conditionally restrict a user's access to individual triples stored in an RDF model using the Oracle Label Security Option.

Semantic Indexing for Documents

New in release 11.2, semantic indexing for documents introduces an index type that makes use of third party information extractors and annotators that locate and extract meaningful information from unstructured documents to semantically index documents stored in relational tables. Documents indexed semantically can be searched using SEM_CONTAINS operator within a standard SQL query. The search criteria for these documents are expressed using SPARQL query patterns that operate on the information extracted from the documents.

RESOURCES

Search for “Oracle RDF”

Advanced Performance and Scalability for Semantic Web Applications

RDF Semantic Graph supports compression, partitioning and Real Applications Clusters (RAC) for the most demanding enterprise-class performance and scalability. **Oracle Spatial and Graph RDF Semantic Graph requires licenses for Oracle Database Enterprise Edition and the Partitioning option.**

Incorporate Leading Partner Tools Into An Open Data Management Solution

RDF Semantic Graph features are directly integrated with the leading third party RDF semantic graph tools and applications. New in release 11.2 is a plug-in that allows the open source Cytoscape tool to visualize RDF semantic graph data in Oracle Database. Since the RDF and OWL data type is compliant with open W3C standards, Oracle Database can serve as an interoperable knowledge base. Semantic data can be shared more easily within organizations, and across the enterprise, so you can realize increased return on knowledge bases while reducing costs.

Oracle consistently works to help shape, drive, implement and support the latest open standards for the Semantic Web. Oracle is W3C member and actively participates in various technical working groups, such as the W3C RDF, SPARQL, RDB2RDF, OWL working groups and OGC GeoSPARQL Standard Working Group. As a result, Oracle is also committed to supporting standards specifications for RDF, SPARQL, RDFS, OWL, SKOS and GeoSPARQL.

With RDF Semantic Graph features, Oracle brings the power and value of semantic analysis to your business applications. These advanced knowledge management features support semantic applications in domains ranging from national intelligence and financial fraud detection to the data integration in life sciences. Only Oracle provides world-class performance, scalability, security, and manageability to your semantic data assets, while reducing costs, with support from the leading tools vendors.

Copyright 2012, Oracle. All Rights Reserved.

This document is provided for information purposes only, and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor is it subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document, and no contractual obligations are formed either directly or indirectly by this document. This document may not be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without our prior written permission.

Oracle, JD Edwards, PeopleSoft, and Siebel are registered trademarks of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners.