FIBO Test Strategy – Theory and References

**Executive Summary**

**This Document:** theoretical underpinning of the Test Strategy, including summary of the principal ontology evaluation methodologies and techniques to be applied. With references and jump-off points to more detailed materials.

Forms the basis from which the more focused Test Strategy is derived.

Refers back to the more raw and detailed evaluation table from the 2013 hackathon.

The References section sets out a whole range of references on ontology evaluation.

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# Preamble: Scoping

See [1] Section 4.4 Use Cases.

The required scope must be understood in two dimensions (Fig1), and the tests and evaluation techniques differ for these.

Breadth: Industry Reference Terms Scope - securities, loans, derivatives etc.

Depth: semantic abstraction

**FND BE IND SEC LOAN etc.**

**Figure 1: Scoping Dimensions**

## Scoping Implications

### Breadth

The required instrument coverage e.g. Securities, derivatives, loans, and what constitutes these, is established by precedent in the EDM Council development of the original Semantics Repository (Red FIBO). This dimension of the required scope was established in collaboration with the industry members and is based on the stated scope of the physical and logical standards to which the early FIBO development made reference. These include ISO 20022 (specifically the ISO 20022 FIBIM model); FpML, FIX. Similar scoping commitments are made for Loan with regards to the MISMO standard. These standards in turn have evolved over a number of years to cover a range of use cases within the financial industry.

Coverage by FIBO of the terms in these standards will result in coverage of the same use cases as those for which the industry messaging and data standards have been developed.

### Depth

This refers to the question of how far to abstract the concepts which are used in building out the instrument and loan etc. terms. Also known as the “Where to stop” question.

This is what’s known as the “ontological commitment”. Just as a map with a scale of 1:1 is no use as a map, so an ontology must stop somewhere, in terms both of the level of detail and of the depth of abstraction to which it must go.

### Interoperability

Abstraction also has implications for the building out of future terms and in terms of interoperability with other standards. The extent to which interoperability is a use case for the ontology itself, will be part of what determines the required depth of the FIBO ontologies.

Subject to those requirements (which must therefore be recorded alongside business use cases), the ontology should provide all and only the details and abstractions needed to support the use cases we can anticipate for applications within the industry.

We will make use of user stories to determine what kinds of detail need to be in the ontology.

**Example:** if a use case exists for determining the financial risks of loans in terms of a post code area, then the address ontology needs to have object properties which are framed in terms of geospatial concepts including postcode areas. Other use cases would not need to do this and may need only datatype properties which are framed in terms of text. So the existence of the above use case would require that the ontology is “deeper” than it would otherwise need to be.

Since these questions go directly to the scope of the ontology, these user stories need to be in place at the beginning of the development or migration process. If this user story only came along later, this would require disruptive changes to the ontology to later replace datatype properties with object properties.

### Implications

We should be very careful about ruling out a given level or type of abstraction. Use cases like risk are typically quite far reaching: the more we know about a given thing, the less risk there is. So the risk application in and of itself would lead to an open ended scope.

Similarly, when supplying data to statisticians, the rule of thumb is that if there’s even a chance that some kind of information can exist, they would like it.

Risk assessment and central bank statistical analysis are both use cases which can be almost open ended in terms of the “depth” dimension of the use cases, i.e. the depth of the abstraction hierarchy and the granularity and detail of the things modeled.

# Test Strategy Principles

A Test Strategy embodies the following principles:

1. Verification

2. Validation

These are normally described with reference to programs, as follows:

* **Verification:** how well the program meets its formal specification(s)
* **Validation:** how well the program (and its specification) meets the stated business purposes.

## Applying to Ontology

### The Two Vs

For an ontology, the two Vs roughly translate to:

* **Verification:** tests with OWL Individuals framed according to the ontology itself
* **Validation:** tests against representative industry data

### Artifact Type Considerations

Ontologies differ from programs in the following two ways:

**1. Structural versus Behavioral:** programs and their use cases are to do with behavior whereas ontologies (like data models and message schemas) are structural;

**2. Conceptual versus Logical versus Physical:** ontologies may be conceptual or physical, with FIBO being explicitly conceptual, whereas tests are typically performed on physical artifacts with reference to conceptual artifacts.

For (1) there are assessment criteria which would not apply to programs, which must be assessed for an ontology. Some of these would be covered by tests; others are covered by other measures given in the literature on ontology evaluation;

For (2) any tests carried out on a physical implementation of a given ontology will validate some aspect of the ontology itself.

### Theory

Figure 1 shows where conceptual ontologies, and by extension FIBO, fit in. Note that for many physical implementations it may be possible to stand up the implementation directly from the full computationally independent FIBO. For others this will not be the case. Part of validation of FIBO is its ability to support each of the kinds of application which may be stood up from or derived from it.



**Figure 1: Zachman Framework (part)**

### Comment:

An ontology like FIBO is a conceptual artifact, like a use case. However, with the addition of A-Box material, the combination becomes a physical model, which of course can be tested.

The simplest verification and validation of an ontology is therefore that it can be stood up with A-box (instance data, OWL Individuals) and that the results can be reasoned over and that queries can be executed which return expected results. This is the core of the test strategy.

Since FIBO is intended for use as a conceptual model in a range of architectures, other things which need to be validated include the ability to map to conventional data models. This includes being able to create SPARQL queries with reference to the ontology and returning results from conventional data sources.

# Validation and Verification

Applying the principles of validation and verification, we have:

## Verification

Tests on physical ontologies, which return expected results.

These verify that a physical application, consisting of the ontology plus some datastore and some reasoning, querying etc. infrastructure, works as expected.

**Test data:** data which is framed according to the ontology itself will verify that the ontology is consistent, but do nothing to validate that the classes and properties in the ontology correspond to real world things.

## Validation

Identifying that the concepts presented in the ontology correspond to things in the domain of discourse, are modeled consistently, include the full scope of the intended concepts and so on.

Validation is often achieved by inspection of (for systems) by the completion of system integration tests.

**Test data:** data which is sourced from existing industry data, translated into suitable OWL individuals and data facts, will validate that the concepts in the ontology can correspond to the things which representative data sources describe.

# Evaluation Tools and Techniques

The tools and techniques which are recommended are listed below:

* GOEF
* OQuaRE
* OOPS!
* OntoQA
* OntoClean
* Other techniques from the literature

## Description of Evaluation Techniques in the Literature

### GOEF

GOEF [2] provides a high level methodology focused on how the use case is split down into separate components, including the semantics component which is relevant to FIBO.

GOEF would therefore provide a general framework within which to frame the tests and other measures to be carried out.

### OQuaRE

OQuaRE [3] uses a cross-reference table which references the specific quality measures to be applied.

The initial table created at the Ontology Summit 2013 Hackathon can be streamlined, such that some tests or measures would be used to cover multiple formal requirements.

OQuaRE also supports a number of automated or semi-automated tests. These could be enhanced with further development effort by the OQuaRE developers, for example to identify what are the thresholds required for a pass / fail of a given measure for FIBO. These thresholds may differ between conceptual and operational ontologies for some of these measures.

### OOPS!

The Ontology Pitfall Scanner [4] has an on line location where ontologies may be presented and results returned against a range of measures. The integrated table created under OQuaRE will provide the cross reference between the required metrics for the FIBO ontologies and the OOPS! pitfall tests to be carried out.

OOPS! also supports a number of automated or semi-automated tests. These could be enhanced with further development effort by the OOPS! developers, for example to identify what are the thresholds required for a pass / fail of a given measure for FIBO. Again these thresholds may differ between conceptual and operational ontologies for some of these measures.

### OntoQA

OntoQA [5] assesses knowledge bases only and would not be used directly in tests on FIBO.

OntoQA could be used to perform coverage metrics tests on the test data to be used in tests on FIBO.

### OntoClean

OntoClean [6] is a methodology for analyzing ontologies based on formal, domain-independent properties of classes (the metaproperties). OntoClean was the first attempt to formalize notions of ontological analysis for information systems. The idea was to justify the kinds of decisions that experienced ontology builders make, and explain the common mistakes of the inexperienced.

Tests under OntoClean would be carried out on operational ontologies, including as part of validating the correctness of the conceptual ontology from which this is derived.

Tests carried out on the operational ontologies will contribute to the confidence levels in the conceptual ontology. Since the conceptual ontology is unconstrained by implementation considerations, we may need to extract tractable sub-sets of the BCO on which to carry out these tests.

### Other techniques from the literature

For a complete review of the literature, see the References list. So far, the techniques identified above are the ones we intend to use. See the extended References section for a more complete treatment.

## Applying the Ontology Evaluation Techniques

### The GOEF Methodology

GOEF methodology: splits the use case into:

* Functional Objective
* Design objective and requirements specification
* Semantic components required to achieve above

This describes the use case for an individual application. Since FIBO is a proposed standard, it must support all of the use cases which may be considered relevant for the business subject matter. Given that these are potentially infinite, we need to identify a number and range of representative use cases, in the form of competency questions which the ontology should address.

Since a standard is used not only for semantic technology applications, but in the integration of conventional data sources and the conceptual underpinning of conventional technology applications, the full set of use cases to which the standard will be put goes well beyond semantic querying. While competency questions would provide confidence in the use of the ontology in most of those applications, we need to consider the use cases of those existing applications and identify what semantic queries would provide confidence that the data being used by those other applications is semantically correct and complete.

This comes under the “Design objective” part of GOEF. Our requirement is to ensure that FIBO is able to provide the necessary semantics for the applications designed within a full range of design architectures.

#### Applying GOEF

To follow the GOEF methodology we simply need to:

* Identify a use case
* Identify the design objective for a solution which would implement that use case
* Describe all of the concepts which are needed for such a system to satisfy that use case

Then extract from the FIBO ontology under test, the ontologies which contain those concepts. If any are missing, then this is noted ahead of any tests, as an issue.

For each use case, the test application would simply consist of a set of SPARQL queries representing the information required for that use case.

These also form the basis of regression tests going forward.

### The OQuaRE Methodology (combined with OOPS! and OntoQA)

OQuaRE [3] takes an existing software evaluation methodology (SQuaRE), and addresses the “Behavioral v Structural” question by adding a set of criteria for structural artifacts (models). Then these and the existing criteria each have tests or other measures which assess the conformance of the model to that criterion. OQuaRE sets out a number of evaluation measures, both automated and manual, against the entries in this table.

### The FIBO Combined OQuaRE / OOPS! / OntoQA Evaluation Framework

A table has been created for a FIBO implementation of OQuaRE [7]. This came out of the 2013 ontology Summit Hackathon [8]. The hackathon participants took the OQuaRE table as a starting point and added tests and other evaluation measures set out in OOPS!, against the relevant criteria.

***FIBO Test Strategy Comment:*** *The existing table is quite complex – however we should be able to frame a number of tests and other measures which satisfy multiple evaluation criterial, giving us a fairly simple regression test suite.*

In addition, there are many evaluation criteria which are not relevant to FIBO, either:

a. as a conceptual ontology (criteria which apply to physical ontology applications only) or;

b. as being irrelevant to FIBO as a proposed industry standard language

A column in the FIBO-OQuaRE tables indicates which evaluation criteria apply to Conceptual and which to Operational ontologies. The majority of the criteria apply to both. Some evaluation measures return a numbered result, and the desired numbers may vary between a conceptual and an operational ontology.

#### Types of Evaluation Criteria in OQuaRE / OOPS!

Measures in OQuaRE and OOPS! include objective measures of the ontology such as depth of subsumption hierarchies, clustering of concepts and so on, many of which are not a pass/fail but a measure of something about the ontology.

For many of these measures we should therefore identify what we want the results of those measurements to look like. In some cases these will vary between conceptual and operational ontologies.

Some of these measures may be used to provide an objective measure of the semantic completeness or clarity of the model. One thing we want to be able to determine for the overall Conceptual Ontology is the extent to which each concept in a given FIBO ontology may be traced to the semantic primitive concepts which underpin meaning within FIBO – for example the semantic grounding of each instrument term in the fundamentals of contractual terms.

Sometimes the requirement may differ between an operational ontology and a conceptual ontology. The detailed table (Reference 1) identifies these distinctions. Sometimes a numeric measure of the ontology may have a different requirement for operational and for conceptual ontologies. That is, these tests measure the trade-offs between expressivity and tractability in reasoners.

For many of these existing OQuaRE and OOPS! measures, we need to determine what the required numeric values of the test results ought to be for a given style (C versus O) of FIBO.

#### Applying the OQuaRE Methodology (with OOPS! and OntoQA)

To do this, we simply set out the evaluation criteria defined for OQuaRE and identify tests or other measures (both in OOPS! and in OQuaRE) which would validate the ontology against those criteria.

The FIBO OMG submissions (and many other FIBO published ontologies) have the additional use case that it must be possible to derive operational ontologies directly from them. For evaluation of ontologies which are to meet this requirement, it would be necessary to reevaluate the application of the criteria in the table. These ontologies may require a combination of “Conceptual” and “Operational” criteria.

#### The OQuaRE Assessment Criteria

These are:

* Structural
	+ Formalization
	+ Formal Relations support
	+ Cohesion
	+ Tangledness
	+ Redundancy
	+ Consistency
	+ Cycles
	+ Structural Accuracy
	+ Domain Coverage
* Compatibility
	+ Replaceability
	+ Interoperability
* Operability
	+ Appropriateness
	+ Recognizability
	+ Learnability
	+ Ease of Use
	+ Helpfulness
* Transferability
	+ Portability
	+ Adaptability
* Reliability
	+ Error Detection
	+ Recoverability
	+ Availability
* Maintainability
	+ Modularity
	+ Reusability
	+ Analyzability
	+ Changeability
	+ Modification Stability
	+ Testability
* Quality in Use
	+ Usability in use
	+ Flexibility in use
* Functional Adequacy
	+ Reference ontology
	+ Controlled vocabulary
	+ Schema and Value Reconciliation
	+ Consistent search and query
	+ Knowledge Acquisition
	+ Clustering and Similarity
	+ Indexing and linking
	+ Results representation
	+ Classifying instances
	+ Text analysis
	+ Guidance and decision trees
	+ Knowledge reuse
	+ Inferencing
	+ Precision
* Performance
	+ Response time
	+ Resource utilization

Some of these are not applicable to an ontology, e.g. performance related. Tests can be framed which ensure that an application using the ontology will itself conform to those criteria but this would be beyond the scope of FIBO testing.

### Applying OntoQA

This provides measures of a knowledge base. While not applicable to FIBO, the measures here can be applied to the A-box instance data files which make up the test applications.

In particular, OntoQA gives a coverage metric, which should be applied to the test data set to measure how much of the ontology it covers.

# Modeling and Mapping Considerations

One of the evaluation measures given in the Test Strategy is to be able to take existing data and know how to map it into a new ABox representation of that data, with reference to the FIBO ontology which is being evaluated and with reference to the available guidance material.

Some understanding and treatment of “Relative Thing” is required. An example may help. In this example we also consider the requirements for deriving operational ontologies for a given use case.

## The Party Conundrum

Consider a model of an option transaction, with parties identified generically as Party A and Party B or more specifically as Buyer and Seller. This brings up an interesting conundrum about usage of “relative thing” concepts.

The word “Party” is widely used in two separate but related senses:

1. In the legal sense, to mean that which has some part in some formal arrangement (agreement, transaction etc.) i.e. is “party to” that arrangement;
2. In the data modeling sense, as any independent entity which could at some time be party to some such participatory context

This often causes problems when mapping data. Data models typically do not make this distinction since the context is usually apparent and is predicated on some specific use case(s).

### In the Swap Example

The “Party” as defined here is highlighted in the context of the agreement to which both parties are identified as “a party”, and the commitments made by each party in that context.

What does this mean for the ontology?

Joe Bloggs is very definitely an Entity. He is also a party to the commitment made as part of the agreement between him and another party.

So if I reference Joe Bloggs as a party to a commitment, I would typically use the term “Party”, but is this meant in the sense of a relative thing (FIBO PartyInRole) or an independent thing (FIBO IndependentParty or AutonomousAgent)? Or both?

In addition to the properties of his association to the commitment (e.g. when he entered, where he wants his money etc.), Joe Bloggs also has attributes that are not dependent on the commitment e.g. he will have one or more bank accounts and these may be quite independent of the commitment but one of them (perhaps the only one) is relevant to the commitment in the sense that it is to be used for settlement.

That's a good reason to segregate those concepts. In the context of an individual instrument definition the distinction doesn't show up, but across many separate trades it will become important.

### Use Case and Testing Implications

For a given use case, we must identify whether the person is important or the relationship. For instance I may say that Joe Bloggs is a party to a deal which is really a truncation of the statement that a person whose name is Joe Bloggs is a party to a deal. Alternatively I may talk about a seller which is a role in the deal. The seller party happens to be the person Joe Bloggs.

In the first case above, we would take “party” to mean some kind of independent person. In the second case, we would take “party” to refer to some person playing the role of seller.

For many simple use cases, the person alone is all that is needed (that is, the independent thing). For other use cases, especially those which deal with persons in more than one role (or more than one context), the relative “party in role” concept is needed. An ontology which aims to cover multiple use cases needs to do the latter. We would then need to be able to extract an operational ontology to meet the former requirement, which simply collapses the independent “Person” and relative “Party”(FIBO PartyInRole) concepts into one class.

### General Implications: Mapping and ABox Data

Context-specific concepts are by definition relative. So it should be clear to the modeler that the concepts Buyer and Seller in the option example are relative thing concepts, specifically (for FIBO) PartyInRole concepts. However, when mapping terms from existing data sources or messages, there is likely to be a mix of properties of the business entity in and of itself, and properties which are features of the role which it plays or the relationships it participates in. When mapping from non-ontology source data into ontology ABox content, the mapper must identify and segregate these.

It must therefore be possible for users of given part of FIBO to:

1. Identify when to map a given piece of data to a “relative thing” class;
2. Identify and segregate those properties of a party which are independent of the context, and those which belong to the PartyInRole concept;
3. Be able to extract operational ontologies in which (in a different namespace) they can conflate pairs of relative and independent thing classes across the “hasIdentity” property or one of its descendants, so as to achieve a consistent stand-alone model which satisfies that application use case.

# References

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1. [date]\_FIBO build test deploy maintain.docx – FIBO working document (current ref is to 20140908 version)
2. “Ontology Evaluation: Methods and Metrics”, MITRE Research Interest, Dr. Joanne Luciano in collaboration with: Dr. Leo Obrst, PhD, Suzette Stoutenberg, Kevin Cohen, Jean Stanford.
3. OQuaRE: <http://miuras.inf.um.es/evaluation/oquare/>
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7. FIBO OQuaRE Table – see document “OQuaRE FIBO Table v1.docx” on GitHub (where v1 is the current version)
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## General References

### Survey of Ontology Evaluation Techniques

Available at:

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<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.88.2772>

### Gomez-Perez Et Al

"Ontological Engineering", Asunción Gómez-Pérez, Mari Carmen Suárez-Figueroa, Boris Villazón, Introduction to the Semantic Web Tutorial, ISWC 2008. Available at:

<http://kmi.open.ac.uk/events/iswc08-semantic-web-intro/slides/03%20-%20Asun.pdf>

## Ontology Summit 2013: Ontology Evaluation Across the Ontology Lifecycle

http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologySummit2013

### Track C

**Track Title:** Track-C: Building Ontologies to Meet Evaluation Criteria

#### Track C Session February 7, 2013

**Session Topic:** Ontology Development Methodologies for Integrating Ontologies

<http://ontolog.cim3.net/cgi-bin/wiki.pl?ConferenceCall_2013_02_07>

Papers by:

* Barry Smith
* Chris Partridge
* Anatoly Levenchuk
* Mike Bennett

##### Smith

“Ontological realism as a strategy for integrating ontologies”, Barry Smith, Ontology Summit February 7, 2013, Track C. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-02-07_OntologySummit2013_OntologyEvaluation-Quality-Methodology/OntologySummit2013_Realism-Integration--BarrySmith_20130207.pdf>

##### Partridge

“Ontology Architecture: Top Ontology Architecture”, Chris Partridge, Ontology Summit February 7, 2013, Track C. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-02-07_OntologySummit2013_OntologyEvaluation-Quality-Methodology/OntologySummit2013_Top-Ontology-Architecture--ChrisPartridge_20130207.pdf>

##### Levenchuk

“ISO 15926 Reference Data Engineering Methodology”, Anatoly Levenchuk, Ontology Summit February 7, 2013, Track C. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-02-07_OntologySummit2013_OntologyEvaluation-Quality-Methodology/OntologySummit2013_ontology_methodology--AnatolyLevenchuk_20130207.pdf>

##### Bennett

“Quality Considerations for an Industry Standard Ontology”, Mike Bennett, Ontology Summit February 7, 2013, Track C. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-02-07_OntologySummit2013_OntologyEvaluation-Quality-Methodology/OntologySummit2013_Quality-Considerations-for-Industry-Standard-Ontology--MikeBennett_20130207.pdf>

#### Track C Session March 14 2013

**Session Topic:** Ontology Development Methodologies for Reasoning Ontologies

**Panelists:**

* Dr. Joanne Luciano
* Dr. Leo Obrst

##### Luciano

“The General Ontology Evaluation Framework (GOEF): A Proposed Infrastructure for the Ontology Development Lifecycle”, Dr Joanne Luciano, Rensselaer Polytechnic Institute. Presentation to Ontology Summit 2013, Track C, 14 March 2013. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-03-14_OntologySummit2013_OntologyEvaluation-Quality-Methodology-2/OntologySummit2013_GOEF_iChoose--JoanneLuciano_20130314.pdf>

##### Obrst

“Developing Quality Ontologies Used for Reasoning”, Dr Leo Obrst, MITRE. Presentation to Ontology Summit 2013, Track C, 14 March 2013. Available at:

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### Hackathon 2013

Hackathon reference: “(HC-03) Evaluation of OOPS!, OQuaRE and OntoQA for FIBO Ontologies”, available at:

http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologySummit2013\_Hackathon\_Clinics\_FIBO\_OOPS\_OQuaRE

FIBO OQuaRE Table:

*See separate document:* OQuaRE FIBO Table v1.docx (GitHub)

Source materials:

* OOPS!
* OQuaRE
* OntoQA

#### Description

See next section for presentation from each of the above at the Track A session on 31 Jan 2013

* OOPS! Is an Ontology Pitfall Scanner on line tool developed by Ms. Maria Poveda-Villalon, Dr. Mari Carmen Suarez-Figueroa and Dr. Asuncion Gomez-Perez of the Universidad Politécnica de Madrid;
* OQuaRE is an ontology evaluation framework developed by Jesualdo Tomás Fernandez-Breis and Astrid Duque-Ramos at the Departamento de Informática y Sistemas, Universidad de Murcia, Spain;
* OntoQA is an evaluation approach geared towards knowledge base quality and metrics. It was developed by Samir Tartir, at the Philadelphia University of Jordan alongside I. Budak Arpinar, University of Georgia, Amit P. Sheth Wright State University.

These were all described at an earlier Ontology Summit 2013 session on Track A as follows:

### Track-A: Intrinsic Aspects of Ontology Evaluation

#### OOPS!

“A Pitfall Catalogue And OoPS!: An Approach To Ontology Validation”, María Poveda-Villalón, Mari Carmen Suárez-Figueroa and Asunción Gómez-Pérez, Ontology Engineering Group, Departamento de Inteligencia Artificial, Facultad de Informática, Universidad Politécnica de Madrid.

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-01-31_OntologySummit2013_OntologyEvaluation-IntrinsicAspects/OntologySummit2013_Ontology-pitfalls-OOPS--PovedaVillalon-SuarezFigueroa-GomezPerez_20130131.pdf>

#### OQuaRE:

“OQUARE: A SQuaRE-based Quality Evaluation Framework for Ontologies”, Astrid Duque-Ramos, Jesualdo Tomás Fernández-Breis, Robert Stevens, Nathalie Aussenac-Gilles. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-01-31_OntologySummit2013_OntologyEvaluation-IntrinsicAspects/OntologySummit2013_OQuaRE--FernandezBreis-DuqueRamos-RobertStevens-AussenacGilles_20130131.pdf>

#### OntoQA

Summit Presentation:

“Ontology Evaluation and Ranking using OntoQA”, Samir Tartir, Philadelphia University, Jordan, I. Budak Arpinar, University of Georgia, Amit P. Sheth Wright State University. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2013/2013-01-31_OntologySummit2013_OntologyEvaluation-IntrinsicAspects/OntologySummit2013_OntoQA--SamirTartir-IsmailcemBudakArpinar-AmitSheth_20130131.pdf>

## Ontology Summit 2014: Big Data and Semantic Web Meet Applied Ontology

http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologySummit2014

### Track A:

**Track Title:** Common Reusable Semantic Content

#### Track A Session 23 Jan 2014

**Session Title:** “Use and Reuse of Semantic Content - The Problems and Efforts to Address Them"

Presentations of note for ontology evaluation methodology:

##### Session Intro and References (Berg-Cross)

Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-01-23_OntologySummit2014_Common-Reusable-Semantic-Content-1/OntologySummit2014-s02_Use-and-Reuse-of-Semantic-Content--GaryBergCross_20140123.pdf>

##### Hitzler:

“Towards ontology patterns for ocean science repository integration”, Pascal Hitzler, DaSe Lab for Data Semantics, Wright State University. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-01-23_OntologySummit2014_Common-Reusable-Semantic-Content-1/OntologySummit2014-s02_Towards-ontology-patterns-for-ocean-science-repository-integration--PascalHitzler_20140123.pdf>

##### Westerinen

“Reuse of Content from ISO 15926 and FIBO”, Andrea Westerinen, Nine Points. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-01-23_OntologySummit2014_Common-Reusable-Semantic-Content-1/OntologySummit2014-s02_Reuse_ISO15926-FIBO--AndreaWesterinen_20140123.pdf>

#### Track A Session 6 March 2014

**Session Title:** “Experiences in Knowledge Sharing: Lessons from research and experience in Big Data, Linked Data and Semantic Web Applications"

Presentations:

##### Session Intro (Bennett, Berg-Cross, Westerinen)

Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-03-06_OntologySummit2014_Common-Reusable-Semantic-Content-2/OntologySummit2014-s08_Content-2_intro--MikeBennett-GaryBergCross-AndreaWesterinen_20140306.pdf>

##### Sowa

“Historical Perspectives On Problems of Knowledge Sharing”, John F Sowa.

Notes: Large-scale overview of the AI space and history, bringing ontology evaluation into context.

Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-03-06_OntologySummit2014_Common-Reusable-Semantic-Content-2/OntologySummit2014_history--problems-of-knowledge-sharing--JohnSowa_20140306.pdf>

also available via the author at:

Latest version: <http://www.jfsowa.com/talks/history.pdf>

##### Dumontier

“Tactical Formalization of Linked Open Data”, Michel Dumontier, Associate Professor of Medicine (Biomedical Informatics), Stanford University. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-03-06_OntologySummit2014_Common-Reusable-Semantic-Content-2/OntologySummit2014_Tactical-Formalization-of-Linked-Open-Data--MichelDumontier_20140306.pdf>

##### Idehen

“Ontology Driven Data Integration & Big Linked Open Data”, Kingsley Idehen, Founder & CEO, OpenLink Software. Available at:

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-03-06_OntologySummit2014_Common-Reusable-Semantic-Content-2/OntologySummit2014_Ontology-Driven-Data-Integration--KingsleyIdehen_20140306.pdf>

### Hackathon

**Hackathon title:** “Ontology Design Patterns and Semantic Abstractions in Ontology Integration”

#### Report

Status summarized on line on the Hackathon wiki page, at:

<http://ontolog.cim3.net/cgi-bin/wiki.pl?OntologySummit2014_Hackathon_DesignPatternsAndAbstractions>

Slides for this (ahead of the hackathon itself):

<http://ontolog.cim3.net/file/work/OntologySummit2014/2014-02-27_OntologySummit2014_Hackathon-Launch/OntologySummit2014_Hackathon-Launch_ODP--MikeBennett-GaryBergCross_20140227.pdf>

#### Trajectory Ontology

Created for the following paper”

"A Geo-Ontology Design Pattern for Semantic Trajectories", Yingjie Hu, Krzysztof Janowicz, David Carral, Simon Scheider, Werner Kuhn, Gary Berg-Cross, Pascal Hitzler, Mike Dean, and Dave Kolas. Spatial Information Theory, Lecture Notes in Computer Science Volume 8116, 2013, pp 438-456.

Available at: [http://link.springer.com/chapter/10.1007%2F978-3-319-01790-7\_24](http://link.springer.com/chapter/10.1007/978-3-319-01790-7_24)

Also available at:

<http://geog.ucsb.edu/~jano/semantic_trajectories.pdf>

## Other Evaluation Literature

Primary contributors to ontology evaluation literature:

* OOPS!
* OQuaRE
* OntoQA
* Luciano (GOEF methodology)
* Gomez-Perez
	+ And others from his ecosystem
* ODiSE Feedback

### GOEF

**Primary Reference:**

“Ontology Evaluation: Methods and Metrics”, MITRE Research Interest, Dr. Joanne Luciano in collaboration with: Dr. Leo Obrst, PhD, Suzette Stoutenberg, Kevin Cohen, Jean Stanford.

<http://www.slideshare.net/joanneluciano/luciano-pr-08849ontologyevaluationmethodsmetrics-8294436>

Also refers to Ontology Summit 2008.

Also Ontology Summit 2007, where “No consensus” on ontology evaluation.

### OOPS!

**Primary Reference:**

“Did you validate your ontology? OOPS!”, María Poveda-Villalón, Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez, Ontology Engineering Group, Departamento de Inteligencia Artificial, Facultad de Informática, Universidad Politécnica de Madrid. Available at:

<http://2012.eswc-conferences.org/sites/default/files/eswc2012_submission_322.pdf>

### OQuaRE

**Primary reference (web page with the whole framework):**

<http://miuras.inf.um.es/evaluation/oquare/>

**OQuaRE General Refs**

<http://miuras.inf.um.es/oquarewiki/>

### OntoQA

**Primary reference:**

“OntoQA: Metric-based ontology quality analysis” (2005), by Samir Tartir , I. Budak Arpinar , Michael Moore , Amit P. Sheth , Boanerges Aleman-meza, IEEE Workshop on Knowledge Acquisition from Distributed, Autonomous, Semantically Heterogeneous Data and Knowledge Sources

Available at:

<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.131.2087>

### OntoClean

**Primary reference:**

“Guarino, Nicola and Chris Welty. 2002. Evaluating Ontological Decisions with OntoClean”, *Communications of the ACM.* 45(2):61-65. New York:ACM Press

**Wikipedia article**

http://en.wikipedia.org/wiki/OntoClean

### Gomez Perez

**Primary reference:**

"Evaluation of ontologies", Asunción Gómez-Pérez, International Journal of Intelligent Systems, Special Issue: Verification and Validation Issues in Databases, Knowledge-Based Systems, and Ontologies, Volume 16, Issue 3, pages 391–409, March 2001

**Slideshare:**

“Ontology Engineering and Resource Re-engineering”, Asuncion Gomez-Perez, presentation at SSSW 2011.

<http://www.slideshare.net/sssw2011/asun-gomez-perezs-presentation-at-sssw-2011-8791833?sunpass=1>

## Other References

“A methodology for ontology integration”, Pinto and Martins, at K-CAP'01

**Available at:**

[https://www.l2f.inesc-id.pt/~joana/prc/artigos/10b%20A%20methodology%20for%20ontology%20integration%20-%20Sofia%20Pinto,%20Pavao%20Martins.pdf](https://www.l2f.inesc-id.pt/~joana/prc/artigos/10b%20A%20methodology%20for%20ontology%20integration%20-%20Sofia%20Pinto%2C%20Pavao%20Martins.pdf)

“Case studies on ontology reuse”, by Elena Paslaru Bontas, Malgorzata Mochol, Robert Tolksdorf, In Proceedings of the 5th International Conference on Knowledge Management IKNOW05. Available at:

<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.88.2772>

“Reusing ontologies on the Semantic Web: A feasibility study”, Elena Paslaru Bontas Simperl. Data Knowl. Eng. 68(10):905-925 (2009).

**Available via:**

<http://www.bibsonomy.org/bibtex/276a607da26ff2cb5433212b507ca3f77/dblp>

**Available at:**

<http://www.sciencedirect.com/science/article/pii/S0169023X0900007X>

Notes: Simperl argues for the need for a context- and task-sensitive treatment of ontologies, and identifies reuse processes which could profit from such an approach. She argues for the need for ontology-reuse methodologies which optimally exploit human and computational intelligence to operationalize those reuse processes.