Conceptual Ontology Training

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# Executive Summary

Hypercube Ltd. is pleased to offer three training courses presented by Mike Bennett on conceptual ontology modeling. In these courses, participants will learn about a new way of modeling the knowledge of the business in unambiguous technology-neutral language. This is called an ‘ontology’.

These tutorials teach a range of techniques to define the formal semantics of business information. Learn how to use high level abstractions to differentiate between concepts and how to classify these. Learn how these kinds of models can be put to work in addressing common data modeling problems, reducing integration costs and revealing new insights from your data.

The three courses teach similar material at differing levels of detail. These are:

**Course 1: One day Introduction to Conceptual Ontology Engineering.** This provides an accessible introduction to the principles of concept articulation and ontology modeling.

**Course 2: Two-day Intensive Course in Conceptual Ontology Engineering.** Recommended for attendees with some semantic modeling / ontology experience.

**Course 3: Three-day Comprehensive Course in Conceptual Ontology Engineering**. Covers the same content as the 2-day course but with more learning time and additional core ontology subject matter, plus industry-specific applications.

In Course 2 and Course 3, the first day also serves as an introduction for more senior decision-makers who need to know how this kind of model fits into the development ecosystem but may not need to originate concept models themselves. The material offered in these is focused toward to the financial services industry, including an introduction to the Financial Industry Business Ontology (FIBOTM) as developed by the author. These components can be varied for other industries or focused on specific aspects of the finance industry as required.

If you are a data architect, are responsible for development, risk or reporting in a data-intensive area (like finance) or if you are someone who wants to explore new opportunities in micro-finance, big data, Blockchain or data visualization, one of these courses is for you.

# One day Introduction to Conceptual Ontology Engineering

## Course Description

This one day introductory training sets out the basic principles of concept modeling, situating these kinds of models within a broader modeling framework that includes logical models, ontologies for reasoning applications and other technology artefacts. The course is focused on the development and use of ontologies as a kind of business concept model. Attendees will learn how to frame this kind of ontology artifact, how to think in terms of concepts and how to define these in formal logic.

The training course focuses on conceptual issues: understanding concepts, classification theory and the use of formal logics in ontology development and issues relating to terminology and vocabulary. Attendees will learn an overview of a number of ontology development techniques such as the use of common upper and cross-domain ontologies to provide disambiguation of similar concepts and how these abstractions address common data problems.

The course concludes by describing a number of ways in which conceptual ontologies may be used in various practical deployment architectures including integration, model driven development and inference processing applications, including the use of the Financial Industry business Ontology (FIBOTM).

No prior knowledge of ontology modeling is required. The training is focused primarily on a business view of data and knowledge management, showing how ontology is used as a management tool for IT assets such as data models, applications, message feeds and Semantic Web ontology applications.

This course is intended to describe conceptual ontology modeling techniques and does not cover the technical details of modeling ontologies in RDF and OWL, being intended to provide the groundwork for such work. Those who are interested in implementing RDF and OWL models for applications may wish to complement the learning from this course with a comprehensive course in Semantic Web OWL ontology modeling.

### Outcomes

By the end of this course attendees should understand how the use of ontologies as conceptual models can enhance software development and cut integration costs. Attendees will also understand how to derive technical artifacts from these for data integration and model driven development, as well as pragmatic, operational ontologies for semantically enabled reporting and inference processing applications.

### Intended Audience

This course is aimed at those responsible for the management of data assets within a firm, including data architects, chief data officers and business analysts. It is also immediately relevant to anyone tasked with developing formal ontologies for a range of different application areas, particularly in emerging technology areas such as micro-finance, distributed ledger technology (AKA Blockchain), big data, machine learning and the Internet of Things (IoT).

No prior knowledge of ontology modeling or standards is required. Some basic knowledge of information technology is assumed, including familiarity with the technology development lifecycle, but no prior knowledge of any language for programming, databases or modeling is assumed.

# Syllabus

| **Time** | **Topic** |
| --- | --- |
| Session 1  45 min | **Introduction:** Concepts and words; the data development lifecycle; use of computationally independent models. |
| Session 2  45 min | **Modeling Semantics:** Introducing ontology: a conceptual model for data and beyond. Principles of semantic modeling, illustrated with a rolling example. Defining concepts. |
| *30 min* | *Coffee* |
| Session 3  45 min | **Semantic Formalisms:** Classification and taxonomy; properties, the differentiating characteristics of concepts; Semantic Web basics – representation of classes, properties and logical restrictions. |
| Session 4  45 min | **Conceptual Issues:** Anatomy of a Concept; words, concepts and lexical space. Homonyms, heteronyms and some strange habits of words. Concepts without words. Different approaches to formal semantics. |
| *60 min* | *LUNCH* |
| Session 5  45 min | **Classification principles:** kinds of taxonomy; subsumption based taxonomies; faceted classification; logical unions and powertypes. |
| Session 6  45 min | **Introducing Data:** Distinguishing things from data about things; semantic ‘truth-makers’ versus data; real things that are data; establishing data applicability (semantic distance) for a given type of ontology; datatype properties in ontologies; Information kinds and the use of a ‘values’ ontology. |
| *30 min* | *Coffee* |
| Session 7  45 min | **Top Level Ontologies (TLOs) and Cross Domain Ontologies:** Why top level ontology? Understanding existing top level ontologies and standards. Semantic abstraction and re-use |
| Session 8  45 min | **Putting it to Work:** Introducing the Financial Industry Business Ontology (FIBOTM). Styles of ontology for different ontology uses: mapping, reporting, inference processing, Blockchain, graph analytics, machine learning, legal and regulatory (RegTech) and novel finance and micro-finance opportunities (FinTech). Getting to there: a roadmap for ontological maturity. |

# Two-day Intensive Course in Conceptual Ontology Engineering

Recommended for attendees with some semantic modeling / ontology experience.

## Course Description

This training course is focused on the development and use of ontologies as a kind of business concept model. Attendees will learn how to frame this kind of ontology artifact, how to think in terms of concepts and how to define these in formal logic. The training starts by explaining the basic principles of concept modeling, situating these kinds of models within a broader modeling framework that includes logical models, ontologies for reasoning applications and other technology artefacts.

The training focuses on conceptual issues: understanding concepts, classification theory and the use of formal logics in ontology development and issues relating to terminology and vocabulary. Attendees will learn ontology development techniques such as the use of common upper and cross-domain ontologies to provide disambiguation of similar concepts and how these abstractions address common data problems.

Specific uses of upper and cross-domain ontologies are covered o the second day, including contextually defined concepts (roles etc.), event and process modeling, contracts and transactions. This is a fairly intensive day and may require some prior familiarity with ontologies.

The course concludes by identifying the range of ways in which conceptual ontologies may be used in various practical deployment architectures including integration, model driven development and inference processing applications. This component covers how to use or extend popular ontologies such as the Financial Industry business Ontology (FIBOTM), with examples.

No prior knowledge of ontology modeling is required. The training is focused primarily on a business view of data and knowledge management, showing how ontology is used as a management tool for IT assets such as data models, applications, message feeds and Semantic Web ontology applications.

This course is intended to describe conceptual ontology modeling techniques and does not cover the technical details of modeling ontologies in RDF and OWL, being intended to provide the groundwork for such work. Those who are interested in implementing RDF and OWL models for applications may wish to complement the learning from this tutorial with a comprehensive course in Semantic Web OWL ontology modeling.

### Outcomes

By the end of this course attendees should be able to create their own conceptual ontologies and understand how the use of ontologies as conceptual models can enhance software development and cut integration costs. Attendees will also understand how to derive technical artifacts from these for data integration and model driven development, as well as pragmatic, operational ontologies for semantically enabled reporting and inference processing applications.

### Intended Audience

This course is aimed at data architects and business analysts. It is immediately relevant to anyone tasked with developing formal ontologies for a range of different application areas, particularly in emerging technology areas such as micro-finance, distributed ledger technology (AKA Blockchain), big data, machine learning and the Internet of Things (IoT).

No prior knowledge of specific ontology modeling languages is required though some familiarity with ontology modeling in some form is expected for the second day. Some basic knowledge of information technology is assumed, including familiarity with the technology development lifecycle, but no prior knowledge of any language for programming, databases or modeling is assumed.

The first day of this course is relevant to anyone responsible for the management of data assets within a firm, and senior personnel such as chief data officers may opt to attend the first day only.

## Syllabus

### Day One: Principles of Conceptual Ontology Engineering

| **Time** | **Topic** |
| --- | --- |
| Session 1  45 min | **Introduction:** Concepts and words; the data development lifecycle; use of computationally independent models. Introducing ontology: a conceptual model for data and beyond. |
| Session 2  45 min | **Modeling Semantics:** principles of semantic modeling, illustrated with a rolling example. Defining concepts. Classification and taxonomy; properties, the differentiating characteristics of concepts; |
| *30 min* | *Coffee* |
| Session 3  45 min | **Semantic Formalisms:** Understanding formal logic and set theory. Semantic Web basics – representation of classes, properties and logical restrictions. |
| Session 4  45 min | **Conceptual Issues:** Anatomy of a Concept; words, concepts and lexical space. Homonyms, heteronyms and some strange habits of words. Concepts without words. Different approaches to formal semantics. |
| *60 min* | *LUNCH* |
| Session 5  45 min | **Classification principles:** kinds of taxonomy; subsumption based taxonomies; faceted classification |
| Session 6  45 min | **Powertypes:** Powertypes; union axioms and their representations. |
| *30 min* | *Coffee* |
| Session 7  45 min | **Introducing Data:** Distinguishing things from data about things; semantic ‘truth-makers’ versus data; real things that are data; establishing data applicability (semantic distance) for a given type of ontology; datatype properties in ontologies; Information kinds and the use of a ‘values’ ontology. |
| Session 8  45 min | **Top Level Ontologies (TLOs) and Cross Domain Ontologies:** Why top level ontology? Understanding existing top level ontologies and standards. Semantic abstraction and re-use |

### Day Two: Ontology Topics Deep Dive

| **Time** | **Topic** |
| --- | --- |
| Session 2-1  45 min | **Top Level Ontologies (TLOs) and Cross Domain Ontologies:** Dimensions of a top level ontology. Some popular top level ontologies. Things defined by their context; things that happen; other partitioning considerations. Realism versus concept-centric ontology. |
| Session 2-2  45 min | **Recommended Mid-level Ontologies:** Authoritative Sources of Meaning: identifying meaningful published concept definitions and adapting these into the ontology framework using TLO (with examples). The REA ontology for transactions; LKIF and other legal ontologies; ontologies for business process and other common problem areas. |
| *30 min* | *Coffee* |
| Session 2-3  45 min | **TLOs In Depth: Contextual Things** Deep dive session on things in roles and other contextual matter. Examples of these using customer and counterparty data modeling issues. |
| Session 2-4  45 min | **TLOs In Depth: Contextual Things** Different conceptualization and modeling options for roles and relators. Applying the ‘Relatives’ principles to different business cases. |
| *60 min* | *Lunch* |
| Session 2-5  45 min | **TLOs In Depth: Things that Happen** Deep dive session on continuant and occurrent things (endurants and perdurants). Classifying kinds of occurrent. Different conceptualization options for things that ought to happen or might happen. The semantics of plans and risks. Modeling business processes as ontology. |
| Session 2-6  45 min | **Conceptual Ontology Development:** Framing ‘Simplest kind of Thing’ concepts (archetypes); top down, bottom up and middle out ontology development; the use of the ‘wire frame’ upper ontology for pragmatic conceptual ontology development. |
| *30 min* | *Coffee* |
| Session 2-7  45 min | **Putting it to Work:** Business concept ontologies versus application ontologies. Putting these to use: mapping, reporting, inference processing, Blockchain, graph analytics, machine learning, legal and regulatory (RegTech) and novel finance and micro-finance opportunities (FinTech). |
| Session 2-8  45 min | **Putting it to Work:** Introducing the Financial Industry Business Ontology (FIBOTM) Standard. Styles of ontology for different ontology uses (with examples). Getting to there: a roadmap for ontological maturity. |

# Three-day Comprehensive Course in Ontology Engineering

Covers the same content as the 2-day course but with more learning time and additional core ontology subject matter.

## Course Description

This comprehensive training course sets out the basic principles of concept modeling, situating these kinds of models within a broader modeling framework that includes logical models, ontologies for reasoning applications and other technology artefacts. The course is focused on the development and use of ontologies as a kind of business concept model. Attendees will learn how to frame this kind of ontology artifact, how to think in terms of concepts and how to define these in formal logic.

The training course focuses on conceptual issues: understanding concepts, classification theory and the use of formal logics in ontology development and issues relating to terminology and vocabulary. Attendees will learn ontology development techniques such as the use of common upper and cross-domain ontologies to provide disambiguation of similar concepts and how these abstractions address common data problems. Specific examples of upper and cross-domain ontologies are covered in depth, including contextually defined concepts (roles etc.), event and process modeling, contracts and transactions, with reference to well-attested ontologies in these fields. This component covers most or all of the core ontology content needed for business and finance.

The course concludes by identifying the range of ways in which conceptual ontologies may be used in various practical deployment architectures including integration, model driven development and inference processing applications. This component covers how to use or extend popular ontologies such as the Financial Industry business Ontology (FIBOTM), with examples.

No prior knowledge of ontology modeling is required. The training is focused primarily on a business view of data and knowledge management, showing how ontology is used as a management tool for IT assets such as data models, applications, message feeds and Semantic Web ontology applications.

This course is intended to describe conceptual ontology modeling techniques and does not cover the technical details of modeling ontologies in RDF and OWL, being intended to provide the groundwork for such work. Those who are interested in implementing RDF and OWL models for applications may wish to complement the learning from this tutorial with a comprehensive course in Semantic Web OWL ontology modeling.

### Outcomes

By the end of this course attendees should be able to create their own conceptual ontologies and understand how the use of ontologies as conceptual models can enhance software development and cut integration costs. Attendees will also understand how to derive technical artifacts from these for data integration and model driven development, and how to create operational ontologies for semantically enabled reporting and inference processing applications.

### Intended Audience

This course is aimed at data architects and business analysts. It is immediately relevant to anyone tasked with developing formal ontologies for a range of different application areas, particularly in emerging technology areas such as micro-finance, distributed ledger technology (AKA Blockchain), big data, machine learning and the Internet of Things (IoT).

No prior knowledge of ontology modeling languages is required. Some basic knowledge of information technology is assumed, including familiarity with the technology development lifecycle, but no prior knowledge of any language for programming, databases or modeling is assumed.

The first day of this course is relevant to anyone responsible for the management of data assets within a firm, and senior personnel such as chief data officers may opt to attend the first day only.

## Syllabus

### Day One: Principles of Conceptual Ontology Engineering

| **Time** | **Topic** |
| --- | --- |
| Session 1  45 min | **Introduction:** Concepts and words; the data development lifecycle; use of computationally independent models. Introducing ontology: a conceptual model for data and beyond. |
| Session 2  45 min | **Modeling Semantics:** principles of semantic modeling, illustrated with a rolling example. Defining concepts. Classification and taxonomy; properties, the differentiating characteristics of concepts; |
| *30 min* | *Coffee* |
| Session 3  45 min | **Semantic Formalisms:** Understanding formal logic and set theory. Semantic Web basics – representation of classes, properties and logical restrictions. |
| Session 4  45 min | **Conceptual Issues:** Anatomy of a Concept; words, concepts and lexical space. Homonyms, heteronyms and some strange habits of words. Concepts without words. Different approaches to formal semantics. |
| *60 min* | *LUNCH* |
| Session 5  45 min | **Classification principles:** kinds of taxonomy; subsumption based taxonomies; faceted classification |
| Session 6  45 min | **Powertypes:** Powertypes; union axioms and their representations. |
| *30 min* | *Coffee* |
| Session 7  45 min | **Introducing Data:** Distinguishing things from data about things; semantic ‘truth-makers’ versus data; real things that are data; establishing data applicability (semantic distance) for a given type of ontology; datatype properties in ontologies; Information kinds and the use of a ‘values’ ontology. |
| Session 8  45 min | **Top Level Ontologies (TLOs) and Cross Domain Ontologies:** Why top level ontology? Understanding existing top level ontologies and standards. Semantic abstraction and re-use |

### Day Two: Ontology Topics Deep Dive: Top Level and Mid-level Ontologies; Contextual Things

| **Time** | **Topic** |
| --- | --- |
| Session 2-1  45 min | **Top Level Ontologies (TLOs) and Cross Domain Ontologies:** Dimensions of a top level ontology. Some popular top level ontologies. Things defined by their context; things that happen; other partitioning considerations. Ontological stance: Realism versus concept-centric ontology. |
| Session 2-2  45 min | **Recommended Mid-level Ontologies:** Authoritative Sources of Meaning: identifying meaningful published concept definitions and adapting these into the ontology framework using TLO (with examples). |
| *30 min* | *Coffee* |
| Session 2-3  45 min | **Contextually Defined Things** Deep dive session on things in roles and other contextual matter. Examples of these using customer and counterparty data modeling issues. |
| Session 2-4  45 min | **Contextually Defined Things** Different conceptualization options for roles and relators. Applying the ‘Relatives’ principles to different business cases. |
| *60 min* | *Lunch* |
| Session 2-5  45 min | **Mereology:** The Ontology of Wholes and Parts. Parts, pieces and components and their formal modeling. |
| Session 2-6  45 min | **Transactions and Accounting Ontology:** Introducing the Resource, Entity, Agents (REA) ontology for transaction accounting. |
| *30 min* | *Coffee* |
| Session 2-7  45 min | **Accounting Ontology Extensions:** Extending the REA ontology – double-entry book-keeping; XBRL reporting. |
| Session 2-8  45 min | **Legal Ontologies:** LKIF and other legal ontologies; contracts and agreements; legal frameworks and jurisdictions. |

### Day 3: Other Top Level Ontology Topics; Process Ontology; Putting it to Work

| **Time** | **Topic** |
| --- | --- |
| Session 3-1  45 min | **Things that Happen** Deep dive session on continuant and occurrent things. Classifying kinds of occurrent. |
| Session 3-2  45 min | **Things that Might Not Happen:** Different conceptualization options for things that ought to happen or might happen. The semantics of plans and risks. |
| *30 min* | *Coffee* |
| Session 3-3  45 min | **Business Process Ontology:** Modeling business processes as ontology. |
| Session 3-4  45 min | **Conceptual Ontology Development:** Framing ‘Simplest kind of Thing’ concepts (archetypes); top down, bottom up and middle out ontology development; the use of the ‘wire frame’ upper ontology for pragmatic conceptual ontology development. |
| *60 min* | *Lunch* |
| Session 3-5  45 min | **Pulling it Together:** Extending and integrating the core concepts in a single practical ontology for commitments, contractual and legal concepts, commitment lifecycles, business process and ledger accounting. |
| Session 3-6  45 min | **Putting it to Work:** Putting these to use - styles of ontology for different uses (with examples): mapping, reporting, inference processing, Blockchain, graph analytics, machine learning, legal and regulatory (RegTech) and novel finance and micro-finance opportunities (FinTech). |
| *30 min* | *Coffee* |
| Session 3-7  45 min | **Putting it to Work – FIBOTM and Beyond:** Introducing the Financial Industry Business Ontology (FIBOTM) Standard. Understanding and applying FIBO concepts in different usage scenarios. |
| Session 3-8  45 min | **Getting to there:** a roadmap for ontological maturity. From data dictionaries to taxonomies and ontologies; deriving business terminological resources and data management assets from ontology. |