The Enterprise Ontology

OVERVIEW

The Enterprise Ontology is a collection of terms and definitions relevant to business enterprises. The ontology was developed in the Enterprise Project by the Artificial Intelligence Applications Institute at the University of Edinburgh with its partners: IBM, Lloyd's Register, Logica UK Limited, and Unilever. The project was support by the UK's Department of Trade and Industry under the Intelligent Systems Integration Programme(project no IED4/1/8032)

Conceptually, the Enterprise Ontology it is divided into a number of main sections -- these are summarised below.

ACTIVITIES and PROCESSES:

The central term is Activity. This is intended to capture the notion of anything that involves doing, in particular including action. The concept of Activity is closely linked with the idea of the Doer, which may be a Person, Organisational-Unit or Machine. These terms are defined in the Organisation section and are collectively referred to as Potential-Actor s. Have-Capability denotes the ability of a Potential-Actor to be the Doer of an Activity (or Skill if the Doer is a Person). Actors may have other Roles in respect of an Activity such as Activity-Owner.

Also closely related to Activity is Resource, which is something used or consumed in an Activity. An Activity can also have outputs or Effects. An Activity is linked to a Time-Range (i.e. an interval), which is defined in the Time section. An Activity may be large and complex and take a long time. This may be represented as composition of many Sub-Activity s.

An Activity can obviously have happened in the past and may be happening in the present. The term can also be used to refer to a hypothetical future Activity. However, there is a need to refer explicitly to specifications or plans for Activities. This is provided by the term Activity-Spec. An Activity-Spec specifies at some level of detail one or more possible Activities. If the Activity-Spec has an Intended-Purpose, it is called a Plan. The concept of repeatability of an Activity or Plan is captured in the term Process-Specification.

Control of doing of Activities is important to enterprises. This is provided by the Relationship Hold-Authority denoting that an Actor has the right to perform the Activities as specified in an Activity-Spec.

ORGANISATION:

Central to the Organisation section are concepts of Legal-Entity and ORGANISATIONAL UNIT (abbreviated as OU). Both of these refer to things which have a `gestalt' whether they are individual or composite. They differ in that a Legal-Entity is recognised as having rights and responsibilities in the world at large and by legal jurisdictions in particular, whereas Organisational-Unit need only have full recognition within an organisation.

Legal-Entity includes Person and Corporation. Larger Legal-Entities may wholly own other smaller Legal-Entities. An Organisational-Unit may be large and complex, even transcending Legal-Entities. Large OUs will normally be seen as being made up from smaller ones. The smallest may correspond to a single Person, in fact a particular Person could be seen as corresponding with more than one small OU.

A Machine is a non-human, non- Legal-Entity that may play certain Roles otherwise played by a Person or Ou (e.g. perform an Activity).

The Ownership of rights and responsibilities may only, from the legal point of view, lie with a Legal-Entity. Within an organisation, rights and responsibilities for Resources may be allocated to OUs. Therefore Ownership is defined to include this, with Legal-Ownership and Non-Legal-Ownership defined to enable the distinction where needed. OUs may be responsible for Activities.

Within an organisation the management structure is represented by Management Links. The term Manage represents assigning Purposes to OUs. An Organisational Structure will be defined as a pattern of Management Links between OUs. This can include multiple Management Links into any one OU with constraints on the different type of Purposes assigned through each link.

STRATEGY:

The central concept of the Strategy section is Purpose. Purpose captures the idea either of something which a PLAN can HELP ACHIEVE or that an ORGANISATION UNIT can be responsible for. In fact it includes any kind of PURPOSE, whether on a level of organisation and time scale which will normally be called strategic, or detailed and short term.

Like an OU, a Purpose can be composed or decomposed. That is, one statement of Purpose may relate to something which can also be seen to Help-Achieve some grander Purpose. By this means, a spectrum of widely used terms like Vision, Mission, Goal, and Objective can be represented without there being shared agreement on precisely how these terms are used.

Strategy is defined as a Plan to Achieve a high-level Purpose. Based on the concept of PLAN from the Activity section, the concepts key to Strategic Planning can be represented with the terms Decision, Assumption, Risk, and various types of Factor.

MARKETING:

The central concept of the Marketing section is Sale. A Sale is an agreement between two Legal-Entities for the exchange of a Product for a Sale-Price. Normally the Product is a good or service and the Sale-Price is monetary, however other possibilities are included. The Legal-Entities play the (usually distinct) Roles of Vendor and Customer. A Sale can have been agreed in the past, and a future Potential-Sale can be envisaged, whether or not the actual Product can be identified, or even exists.

The Market is all Sales and Potential Sales within a scope of interest. The Market may include Sales by Competitors. The Market may be decomposed into Market Segments in many ways in many levels of detail. This can be done by any properties of the Product, Vendor, Customer, Sale-Price or of anything else associated with a Sale. These properties are Segmentation-Variables.

Analysis of a Market may involve understanding of Features of Products, Needs of Customers, and Images of Brands, Products, or Vendors. Promotions are Activities whose Purposes relate to the Image in a Market.

TERMS DEFINED

The following is a complete list of the terms defined in the Enterprise Ontology.

Activity	Activity Specification, Execute, Executed Activity Specification, T-Begin, T-End, Pre-Conditions, Effect, Doer, Sub-Activity, Authority, Activity Owner, Event, Plan, Sub-Plan, Planning, Process Specification, Capability, Skill, Resource, Resource Allocation, Resource Substitute.
Organisation	Person, Machine, Corporation, Partnership, Partner, Legal Entity, Organisational Unit, Manage, Delegate, Management Link, Legal Ownership, Non-Legal Ownership, Ownership, Owner, Asset, Stakeholder, Employment Contract, Share, Share Holder.
Strategy	Purpose, Hold Purpose, Intended Purpose, Strategic Purpose, Objective, vision, Mission, Goal, Help Achieve, Strategy, Strategic Planning, Strategic Action, Decision, Assumption, Critical Assumption, Non-Critical Assumption, Influence Factor, Critical Influence Factor, Non-Critical Influence Factor, Critical Success Factor, Risk.
Marketing	Sale, Potential Sale, For Sale, Sale Offer, Vendor, Actual Customer, Potential Customer, Customer, Reseller, Product, Asking Price, Sale Price, Market, Segmentation Variable, Market Segment, Market Research, Brand Image, Feature, Need, Market Need, Promotion, Competitor.
Time	Time Line, Time Interval, Time Point.

AVAILABILITY

- The formal Ontolingua encoding of the Enterprise Ontology is held in the Library of Ontologies maintained by Stanford University's Knowledge Systems Lab (KSL). The code was produced using the Ontology Editor at KSL; read about our experiences using Ontolingua and KSL Services.

  An earlier development version is held here - http://www.aiai.ed.ac.uk/project/enterprise/enterprise/ontology-code/.

- The **natural language description** of the Enterprise Ontology is published in (Uschold et. al. 1998). This article may be downloaded from the papers section immediately below. For those interested in the historical development of the Enterprise Ontology, the old version (1.0) is still available (postscript 144k).

PUBLICATIONS

- Mike Uschold, Martin King, Stuart Moralee and Yannis Zorgios (1998) *The Enterprise Ontology* The Knowledge Engineering Review , Vol. 13, Special Issue on Putting Ontologies to Use (eds. Mike Uschold and Austin Tate).
  Also available from AIAI as AIAI-TR-195: (postscript 1472k)

  Abstract
  This is a comprehensive description of the Enterprise Ontology, a collection of terms and definitions relevant to business enterprises. We state its intended purposes, describe how we went about building it, define all the terms and describe our experiences in converting these into formal definitions. We then describe how we used the Enterprise Ontology and give an

evaluation which compares the actual uses with original purposes. We conclude by summarising what we have learned.

The Enterprise Ontology was developed within the Enterprise Project, a collaborative effort to provide a framework for enterprise modelling. The Ontology was built to serve as a basis for this framework which includes methods and a computer tool set for enterprise modelling.

We give an overview of the Enterprise Project, elaborate on the intended use of the Ontology, and give a brief overview of the process we went through to build it. The scope of the Enterprise Ontology covers those core concepts required for the project, which will appeal to a wider audience.

We present natural language definitions for all the terms, starting with the foundational concepts (e.g. entity, relationship, actor). These are used to define the main body of terms, which are divided into the following subject areas: activities, organisation, strategy and marketing.

We review some of the things learned during the formalisation process of converting the natural language definitions into Ontolingua. We identify and propose solutions for what may be general problems occurring in the development of a wide range of ontologies in other domains. We then characterise in general terms the sorts of issues that will be faced when converting an informal ontology into a formal one.

Finally, we describe our experiences in using the Enterprise Ontology. We compare these with the intended uses, noting our successes and failures. We conclude with an overall evaluation and summary of what we have learned.

- Mike Uschold & Michael Gruninger (1996) *Ontologies: Principles, Methods and Applications* Knowledge Engineering Review; Volume 11 Number 2, June 1996
  Also available from AIAI as AIAI-TR-191: (postscript 150k)

  Abstract
  This paper is intended to serve as a comprehensive introduction to the emerging field concerned with the design and use of ontologies. We observe that disparate backgrounds, languages, tools, and techniques are a major barrier to effective communication among people, organisations, and/or software systems. We show how the development and implementation of an explicit account of a shared understanding (i.e. an `ontology') in a given subject area, can improve such communication, which in turn, can give rise to greater reuse and sharing, inter-operability, and more reliable software.

  After motivating their need, we clarify just what ontologies are and what purposes they serve. We outline a methodology for developing and evaluating ontologies, first discussing informal techniques, concerning such issues as scoping, handling ambiguity, reaching agreement and producing definitions. We then consider the benefits of and describe, a more formal approach. We re-visit the scoping phase, and discuss the role of formal languages and techniques in the specification, implementation and evaluation of ontologies. Finally, we review the state of the art and practice in this emerging field, considering various case studies, software tools for ontology development, key research issues and future prospects.

- Mike Uschold (1996) *Converting an Informal Ontology into Ontolingua: Some Experiences* (postscript 49k) (also available from AIAI as AIAI-TR-192)

A slightly abridged version of this paper appears
in the Proceedings of the Workshop on Ontological Engineering
to be held in conjunction with ECAI 96 in Budapest.

Abstract
We report our experiences of converting a carefully defined informal ontology expressed in natural language into the formal language: Ontolingua. The objectives of this paper are 1) to explore some of the nitty gritty details of formalising ontology definitions and 2) to serve as a basis for clarifying the relationship between this and other approaches to ontology construction (e.g. using competency questions), for the eventual aim of producing a comprehensive methodology.

We first discuss concepts in the meta-ontology, including entities, classes, instances, relationships, roles, sets and states of affairs. With respect to roles, we define a special meta-class to classify objects whose existence necessarily depends on their being in a relationship with some other entity (e.g a customer). We describe a mechanism for classifying states of affairs which can be used to restrict what can be in certain relationships (e.g pre-condition).

We then note some general issues that arise when producing formal definitions of the main terms; e.g. representing terms from a difference perspective, and identifying when and how new terms must be introduced. The need for new terms arises not only to fill gaps, but also to make explicit facts and logical dependencies that were only implied by the text definitions.

- Mike Uschold (1996) *Building Ontologies: Towards a Unified Methodology*
(postscript 57k) (also available from AIAI as AIAI-TR-197)

  Presented at Expert Systems '96 Conference in Cambridge, UK

  Abstract
  The use and importance of ontologies is becoming more widespread, however building ontologies is largely a black art. The aim of this paper is to identify and characterise what we currently know and to move towards the longer term goal of developing a comprehensive unified methodology.

  We first identify dimensions for characterising ontologies, to be used as a basis for noting which techniques and guidelines for building ontologies apply in different circumstances. We then give an overview of the current state of the art, noting that most work addresses just a small part of the life cycle. The very few more complete methods are limited to case studies involving single ontologies and they are hard to compare. In the main part of this paper, we examine two such methods and give a framework for comparing and unifying them. We emphasise that different approaches are required for difference circumstances, and give some guidelines for when to use which techniques. We conclude by considering how to further advance our understanding of building ontologies.

- M. Uschold, M. King, S. Moralee and Y. Zorgios (1995) *The Enterprise Ontology*
(postscript 100k)

  Abstract
  This document presents the Enterprise Ontology, a collection of terms and definitions relevant to business enterprises. It was developed as part of the Enterprise Project, a collaborative effort to provide a framework for enterprise modelling. The Enterprise

Ontology will serve as a basis for this framework which includes methods and a computer toolset for enterprise modelling.

We give an overview of the Enterprise Project, elaborate on the intended use of the Ontology, and discuss the process we went through to build it. The scope of the Enterprise Ontology is limited to those core concepts required for the project, however it is expected that it will appeal to a wider audience. It should not be considered static; during the course of the project, the Enterprise Ontology will be further refined and extended.

- Mike Uschold & Martin King (1995) *Towards a Methodology for Building Ontologies* (postscript 68k) (also available from AIAI as AIAI-TR-183)

  Presented at Workshop on Basic Ontological Issues in Knowledge Sharing
  Held in conjunction with IJCAI-95 in Montreal.

  Abstract
  We outline some requirements for a comprehensive methodology for building ontologies, and review some important work that has been done in the area which could contribute to this goal. We describe our own experiences in constructing a significant ontology, emphasising the ontology capture phase.

  We first consider the very general issue of categorisation in modelling, and relate it to the process of ontology capture. We then describe the procedure that we used to identify the terms and produce definitions. We describe a successful way to handle ambiguous terms, which can be an enormous obstacle to reaching a shared understanding. Other important findings include: it may not be necessary to identify competency questions before building the ontology; the meta-ontology can be chosen after detailed text definitions are produced; defining terms which are 'cognitively basic' first can lead to less re-work.

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