STANDARD ONTOLOGY: Reality/ Uniscience and Wise Web

Towards Unified Representation of the World

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SYNOPSIS: Standard Ontology as the Standard Model of Reality, Representation and Reasoning

The Standard Ontology (SO) is the fundamental science defining the common categorical standards of reality, representation and reasoning fit for humans and machines. As such, it is a top-level foundation ontology dealing with the canonic descriptions of reality, its nature, composition, structure, meanings, and classes, as thing, nothing, unity, identity, group, substance, state, change, and relation. As invariant content of all existence, reality is assumed to constitute the base ground of the world, the totality of all things and the universe of entities and relations. Being a common, foundational, upper, higher-level universal system, the SO underlays the definitive basics and standard fundamentals (principles, facts, axioms, meanings, truths, and rules) with a view to define the whole of existence, and its domains and levels, in the most concise, consistent and comprehensive ways.

In particular, the Standard Model of Reality is examining such critical issues as:

1. What is the scope or extent of standard ontology?
2. Which basic categories of things make up the canonical classes of entities and relationships?
3. What is the basic level of the standard scheme?
4. How the standard classes are organized?
5. Are the standard categories defined by members (extension) or properties (intension)?
6. How domain ontologies and data models are structured by standard ontology?
7. How world knowledge is integrated by standard ontology?
6. What formal languages are most effective to represent the standard classes and relations? Etc.

The truth, validity, goodness and utility of the standard ontology are confirmed by its power to make radical changes in the established models of the world (unifying causal topology), science (the unity of science, ontological integration of all research domains) and technology (generic knowledge applications, intelligent Internet and knowledge web).

In the SO modeling, the largest thing and the most complex entity, the world, is constructed as consisting of four distinct but interdependent sub-worlds: the universe of Nature (World I), the domain of Mind (World II), the domain of Society and Human Culture (World III), and the realm of Technology and Engineering and Industry (World IV). Every realm of the universe is causally opened to each other, and all is interconnected via single reality, and its rudimentary classes, truths, principles, rules and laws, as in the global integrative structure:

<REALITY; NATURE, MIND, SOCIETY, TECHNOLOGY>
=
THE WORLD, THE UNIVERSE, EXISTENCE, BEING

Assuming such a hierarchically integrative networking architecture of world structure, there has been developed the transdisciplinary unification of science and technology, designated as UNISCIENCE, replacing obsolete specialized and departmentalized models of research domains. The integral whole of all possible knowledge domains is built as a federate union of all existent sciences and possible knowledge fields and interfield subjects, centralized by foundation ontology and fundamental sciences of mathematics, logics, epistemology, and semantics. Thus the SFO works as a guiding pattern for the Global Research Framework of Science and Technology, encompassing rising international knowledge areas, with the built-in frameworks, programs, organizations, platforms, and initiatives, like as the European Research Area. Also, it's knowledge application shows why the old knowledge fields partitions used by the European Research Council, managing the 'Ideas Programme' of the EU's Seventh Research Framework Programme (FP7), is blocking multidisciplinary innovative research projects, transcending "established frontiers of knowledge and the boundaries of disciplines".

The synthesis of federate sciences and technologies, dealing with special aspects and pieces of the world, is created with the assumptions that the current unstable, shifting world is the product of experts, specialists and separated sciences and social and political paradigms. However, the real world is the reach of integrated sciences; and a scientific wisdom about the universe and human life is a necessary condition for building an intelligent world, distinguished by a genuine social stability and global progression in all sphere of human life and culture.

In the new sphere of knowledge systems and semantic technology, an engine of knowledge world, the SFO provides a semantic interoperability standards framework for a multitude of automated ontologies and knowledge bases and domain representations and existing standards in science, engineering, industry, and healthcare. Some authoritative studies suggest that the lack of semantic interoperability standards exceeds hundreds of billions of US dollars per year.

The SO, as a meaningful core of globally federate ontology, supplies the semantic standards foundation for the infinitude of heterogeneous, autonomous and distributed web resources, thus allowing for New Wise Web:

[STANDARD ONTOLOGY, UNIFIED FOUNDATION ONTOLOGY, FEDERAL GLOBAL ONTOLOGY]
+
[FEDERATED ONTOLOGIES, WEB ONTOLOGY, UPPER ONTOLOGIES, DOMAIN ONTOLOGIES +KNOWLEDGE BASES]

+

[ENCYCLOPAEDIA BRITANNICA + WIKIPEDIA + WORDNET]

+

UNIFIED SCIENCE AND TECHNOLOGY BASE [UNISCIENCE]

+

WORLD WIDE WEB [SEMANTIC WEB, WEB INTELLIGENCE]

=

THE WISE, "ALL-KNOWING" WEB

[GLOBALLY FEDERATED KNOWLEDGE BASE, Intelligent Internet, iWeb]

Presently, in the computing and information science, most research funds are allocated for the special issues of ontology engineering such as: methodology, construction, population, extraction, mapping, translation, matching, alignment, interoperability, integration, merging, evolution, dynamics, version, modularization, composition, visualization, usability, documentation, registry, certification, evaluation, validation, management, and applicability in technology, industry, commerce and government. There are currently a large number of ontology-dependent research projects costing hundreds millions euros, like as:

1. FP6 projects: ICT technologies, Knowledge and Content Technologies, Semantic foundations, 20 projects, such as:

ALVIS,..., MESH,..., NeOn,...,TripCom, http://cordis.europa.eu/ist/kct/fp6_projects_semantic.htm

2. FP 7 projects, ICT technologies, 15 projects, such as:

ACTIVE,..., LaRK,..., OKKAM, ONTORULE,..., WeKnowIt, http://cordis.europa.eu/fp7/ict/content-knowledge/projects_en.html

The deliverables were/are promised to be: open networked ontologies, SW services infrastructure, generic semantic reference infrastructure, semantic architecture, semantic-based search engines, integration of heterogeneous data sources, mashups, knowledge content objects, argumentation systems, knowledge-based business intelligence, even the large knowledge collider.

But the issue of issues is the critical problem of ontology standardization, where most effort and funding should be directed, since the results to be expected is a unifying semantic framework with the inbuilt general mechanisms of meaningful processing. Without a common standard ontology as a common code of meanings and rules, there is no base and foundation for the whole enterprise of ontological semantic technology, a new class of real world knowledge machines and large-scale semantic applications.

Only the common foundation ontology can handle the whole world as the largest hierarchy of distinct kinds of things organized by distinct types of real relationships. For the goal of such study is to formulate the overall patterns and fundamental laws of the universe, with its practical role to set the efficient and standardized world models, rules, and reasoning algorithms for advanced information technology and universal knowledge applications. For a universal information space of web resources, the SO is a necessity for building a single universal identification scheme embracing both information web resources, and non-information things, concrete and abstract.

We are not suggesting a centralized, unitary ontology system governed by a single global schema. But rather we are after a realistic, flexible and scalable model of a top-bottom globally federated (web) ontology, having a hierarchical network topology, and capable of interrelating an innumerable number of particular ontologies, distributed, autonomous and heterogeneous, with their specific local schemas, semantics, languages, formats, data models, and structures. What also suggests a strong regulative role of standard ontology: to head off large-scale knowledge engineering projects missing sound theoretical and semantic foundations. Among other things, the priceless role of SO will be in its capacity to filter out all sorts of conceptual impurities, nonsensical ontologies, concocted models, false schemes, fictitious sciences, formal languages, speculative research projects, unfounded, political, social, and economic programs (as a fictitious $531 trillion US market of speculative financial instruments).

Crucially, the big cause of Standard Ontology is a big social networking project; for it is open for everybody's knowledge contribution. For the contributions to such a Global Federate Ontology are largely of two kinds: 1. the central federal ontology of categorical standards of reality, representation and reasoning; 2. an extensive number of federated ontologies, domain knowledge bases, lexicons, subject classification systems, large-scale databases, etc.

Below the first rudiments of standard ontology have been systematically summarized; namely: the basics and fundamentals of the universe of all things, ranging from reality, or being in general, to entity to process to relation to the world, universe, or existence to representations. All is given with their basic definitions and meanings, extension and context, axioms and truths, from which special models and truths can be derived, to be extended and applied farther in science, technology, industry, society, individual life and practice.

REALITY and the WORLD: The Global Schema of Things

http://www.ontopaedia.org/

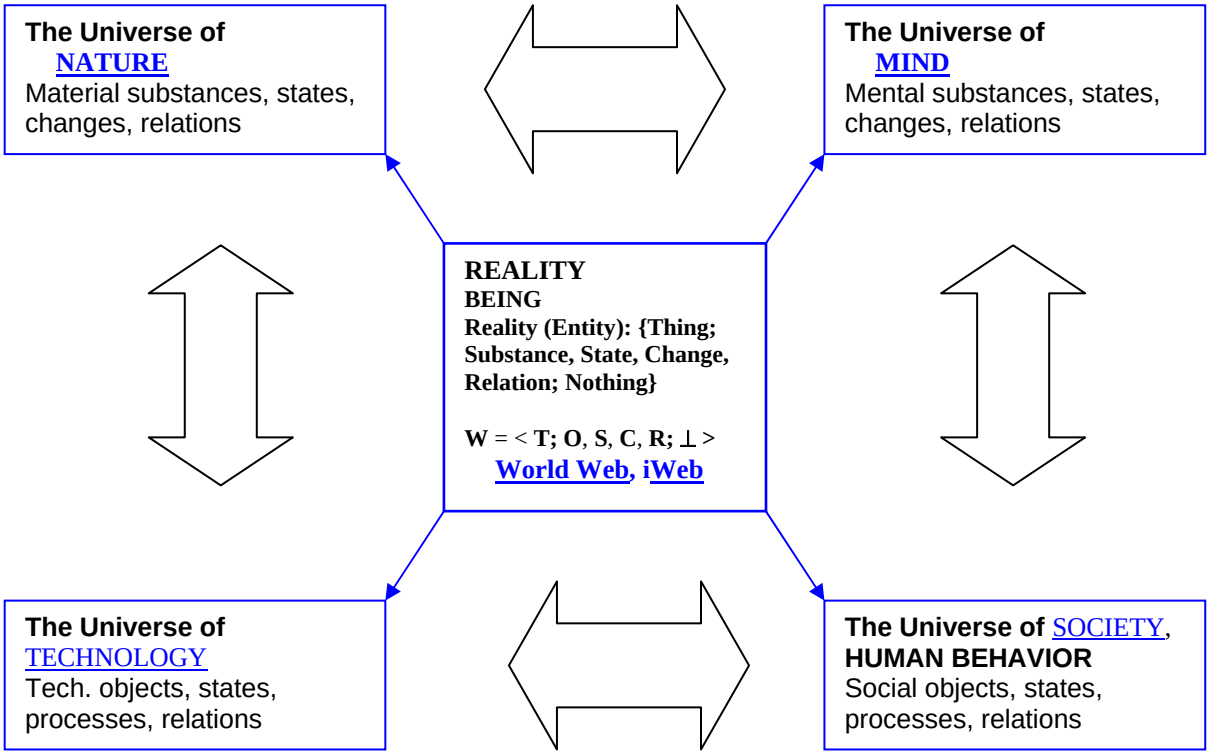

Fig. 1. The Federated Architecture of the World: the Universal Schema

The Reality-World Schema is grounded on the model of the universe as consisting of four distinct but interdependent parts of the world: the world of Nature (World I), the world of Mind (World II), the world of Society and Human Culture (World III), and the world of Technology and Engineering and Industry (World IV), which causally opened and interconnected via fundamental reality, the central part of the world. The Reality4Worlds account is the replacement to the well-known Three Worlds view, where the universe is modeled as consisting of three different but interacting worlds: the physical world (World 1), the subjective world of mental things, states and processes (World 2), and the abstract world of thought contents and human culture, the products of the human mind (World 3). The Three Worlds model is missing the mastering role of reality and the growing autonomy of technology, particularly knowledge technology, as a newly emerging realm of intelligent machines and systems.

As any valid scientific theory, **the Reality-World Model** marked by three characteristics: **unity**, interrelating and unifying all the key research domains and engineering sciences; **productivity**, showing new problem-solving strategies and predicting novel spheres of knowledge and research; **testability** by facts, evidence and experimentation. **The Reality-World Model** is essentially a holistic theory (the whole world is greater than the sum of its universes) equally applied to the consistuent parts of the world and to their domains of knowledge and research (see Uniscience). At bottom, there are three fundamental assumptions on which the whole structure of SO is constructed:

Axiom 1. The world is one universe made up of all entities and relations;
Axiom 2. Reality is the core of the world forming its real nature and real order;
Axiom 3. The real world is the largest interacting web of Nature, Mind, Society, and Technology.

INTEGRATING COMPUTABLE UPPER ONTOLOGIES

, thing, or being: the universal class of all kinds of things

The Basic Kinds of Entity: Substance or Object; State or Property and Quality and Quantity; Change, Action or Process; Relation, Relationship, Association, and Connection

, substrate, stuff: the general class of substances (objects, material or nonmaterial, spatial or non-spatial, physical or mental, concrete or abstract)

WordNet 2.0: entity {thing; causal agent or cause; substance or matter; object or physical object (whole or unit, natural object, living or animate thing (plant, flora; animal, fauna; person, human being)); artifact or artifact)}, group or grouping, psychological feature {cognition, knowledge (mind, head, brain, psyche or nous, content or mental object, lexis, vocabulary, information, place, and public knowledge, history)}, abstraction (set);

WordNet 2.1: entity {physical entity (thing; object, physical object; substance, matter; causal agent); abstract entity (group, grouping; set, psychological feature (mental object, content, cognitive content), otherworld (spiritual being))}

Roget's Thesaurus: matter;

EDR: subject or human (person, animal, body or group, supernatural being), matter (thing or concrete object, objective subject);

SUMO: physical object (self-connected object, collection, agent, region), abstract object (set or class, graph);

CYC: individual (spatial thing), mathematical or computational thing (set or collection), groups, parts of objects, composition of substances, agents, organizations, actors, materials, devices, construction, food, clothing);

DOLCE: aggregate (amount of matter, arbitrary collection), object (physical object, mental object, social object), feature (relevant part, place)};

Sowa: objects;

Knowledge Machine Component Library: entities (things, or objects);

WebKB-2: entities (spatial objects and non-spatial objects);

OWL: classes and individuals

, the general class of properties, qualities, and quantities

WordNet 2.0: state, phenomenon (state of matter), abstraction (attribute (property, quality, shape or form), quantity and amount or measure or quantum), possession, psychological feature (cognition, knowledge (ability, inability, attitude);

WordNet 2.1: abstract entity {attribute (state; quality, property; shape, form; human nature, character, personality); measure, quantity, amount};

Roget's Thesaurus: quantity, number;

EuroWordNet: 2nd order entity (static situation and situation component, condition, existence, quantity);

EDR: event/occurrence (condition/state);

SUMO: abstract object (quantity, attribute, internal);

CYC: intangible individual (static situation, attribute value);

DOLCE: quality (color, size, shape, smell), quality region (qualia), occurrence (state)

KM Component Library: properties, states;

OWL: properties (monadic)

, the general class of actions, activities, and processes

WordNet: event (happening, occurrence or natural event), phenomenon (natural phenomenon, consequence or effect, process), act, human action or human activity, abstraction (relation, change), psychological feature (cognition, knowledge, process; feeling; motive, motivation or need);

WordNet 2.1: entity {physical entity (cause; process, physical process), abstract entity (psychological feature (cognition, knowledge; motivation, motive, need; event)};

Roget's Thesaurus: change;

EuroWordNet: 2nd order entity (situation type, dynamic, situation component, cause, experience);

EDR: event or occurrence (phenomenon, action or deed, movement, change in state or change in condition);

Sowa: processes;

SUMO: physical process (internal change, intentional change, dual object change, shape change, motion);

CYC: partially intangible (event), doing, transformations, changes of state, transfer of possession, movement, emotion, perception, waves;

DOLCE: occurrence (dynamic events, processes and accomplishments);

KM Component Library: events (actions and processes)

RELATION, the general class of all relations

WordNet 2.0: abstraction (relation, time, space), state (relationship, relationship);
WordNet 2.1: entity {abstract entity (relation; communication; attribute (time, space, or infinite, temporal property)};

Roget's Thesaurus: relation, causation, order, time, space

EuroWordNet: 2nd order entity (situation type, static, relation, situation component, communication);

EDR: location, locale, place, time;

SUMO: abstract object (relation, proposition, attribute, relational);

CYC: mathematical object (relation, formal), temporal relations (times and dates), spatial relations;

DOLCE: quality (position and place, time interval), quality region (space, time);

KM Component Library: entity (object)-to-entity (object) relations, event-to-event relations, event-to-object relations;

WebKB-2: entity (object)-to-entity (object) relations;

OWL: set-theoretical properties (relations)

There are two general criteria to test the real value of world schemes, knowledge systems, languages, models, or ontologies; namely, to see how they:
1. treat the category of Thing or Entity;
2. define the ontological status of Relationships.
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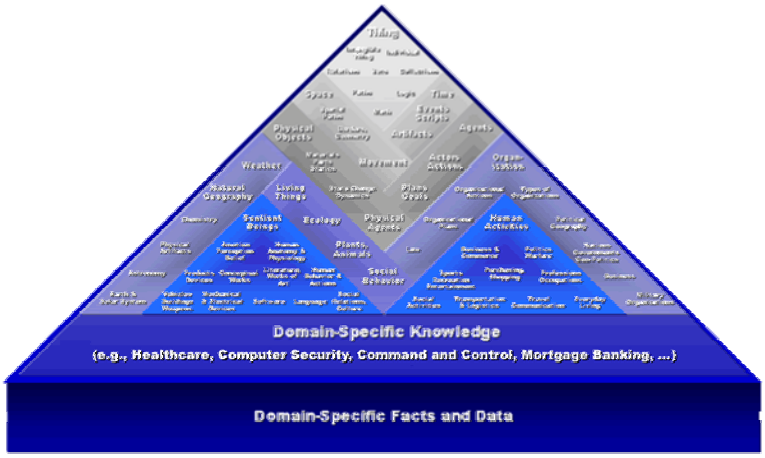
Here is a large listing of ontology projects, http://www-ksl.stanford.edu/kst/ontology-sources.html; http://www.cs.utexas.edu/users/mfkb/related.html, ongoing and past away, to check up the rule.
As an example, we shortly examine how the rule works out for the CYC KB Pyramid:

CYC WORLD'S KNOWLEDGE BASE



The Cyc Knowledge Base is so large that it can seem unwieldy and difficult to navigate at first glance. So we have put together a snapshot of the Knowledge Base. Click on the thumbnail above to see more detail on some of the kinds of knowledge contained in the Cyc Knowledge Base.

The top stuff is Thing, dubbed as "universal collection", being actually the world, of which everything is a member. The ontological distinction between universals and particulars, classes and members, collections and individuals, is confusing.
Thing is divided into Individual ("the collection of all things that are not collections, abstract and concrete, include physical objects, events, numbers, relations, and groups") and Intangible Thing ("things that are not physical, including events...and ideas"). Individuals, concrete and abstract, and Intangible, not having physical substance, both are neither separate classes, nor disjoint things. What are then events? Individuals or intangible things?
The third level is made of relations, sets, and collections, or natural kinds and classes, with elements, supercollections and subcollections . The relationship is wrongly treated as a formal entity. It is put among "sets" and "collections"; and deprecated as "relationship is a mathematical object". Any generic ontological model is badly flawed when missing to include both things and the relationships between things as equally standing real entities.

The CYC upper ontology shows one plain thing: a strong need for standard foundation ontology, to head off large-scale knowledge engineering projects without a solid reference framework of meanings.

GLOBAL FEDERATED ONTOLOGY (GFO) AS STANDARD ONTOLOGY

The contributions to the cause of Global Federate Ontology are largely of two kinds: 1. the core federal ontology; 2. an extensive number of federated ontologies, research domains, domain knowledge bases, lexicons, subject classification systems, large-scale databases, etc.

While dealing with the terms 'to unite' or 'to unify' [Ontologies], one have various synonyms, as 'amalgamate, blend, cement, cohere, consolidate, combine, compound, connect, federate, integrate, link, merge, fuse, join', etc, but all with specific differences in meanings. What is effectual with the term 'federate', it suggests 'the act of unifying autonomous entities under a central authority', which can be naturally interpreted as 'core, fundamental, or federal ontology". As a result, the senses of “federation” involves such effective connotations and implications as "ontology federation", "federal union", "global federated ontology", "federated global schema", "federated ontology architecture", and "federated ontology technology". The notion proved its viability in politics as a federal form of government, where power is divided between a central authority and regional authorities. Also, it was successfully applied in the database theory and practice, as "a federated architecture for database systems" or "a federated architecture for information management". Alike with the power, knowledge is divided between central, fundamental ontology and regional, particular ontology domains.

Keeping in mind its practical meanings in the government politics as well as in the data base systems like IBM federated database technology for information integration, we can talk about a top-bottom globally federated knowledge and research, having a flexible hierarchical network topology; the star, the mesh, the loop, and the bar.

Then a federation of ontologies can be modeled as consisting of a core fundamental ontology (maintaining the global schema and the semantics and general reasoning and the entry of new ontologies with their mapping and matching), upper ontologies and a multitude of ontology domains, autonomous, heterogeneous, distributed, but members of the ontology federation. As a global scheme of all resources, capable to integrate all sorts of particular schemes, data models, and views, the central federal ontology masters the topology, federated mechanism, semantic management, schemas integration and coordination, search, information retrieval and query processing. Basing on the Reality World Theory, the viability of the concept of Globally Federated Ontology looks more promising than the nonfederated systems of ontologies, either unitary and centralized or loose and unconnected, which sorts are currently prevailing on the Web.

It is all-important that the whole world’s mechanisms work in the same way: real entities are interconnected under a core reality, its fundamental elements, principles, laws, and restraints, as the federate network of interacting realms of the world; in the physical world, it is matter and energy, fundamental forces and interactions, gravitation, electromagnetism, weak and strong forces. So the process of federating of particular ontologies with local schemas, specific semantics, languages, formats, data models, and structures will follow the life cycle of knowledge integration:

Standard Foundation Ontology (UFO, Unified Foundation Ontology) = Basal Knowledge of the Universe
>
Global Federated Ontology (GFO),
>
(Unified Web Ontology, UWO)
>
A Framework for Representing Data in the Web of Knowledge
>
the Global Web Intelligence

The Basic Characteristics of Standard Ontology

The SO reference as the standard model of reality is marked by the following attributes:

1. real (dealing with reality and its basic domains);
2. scientific (based on sciences, theoretical and empirical, practical and technological);
3. axiomatic (organized as a universal deductive theoretical system);
4. formal (encoded by mathematical language);
5. canonic (a body of prime categories, principles and rules established as valid and fundamental in all fields of knowledge).

The standard ontology employs philosophical ontology, science, mathematics, epistemology, semantics, and logic, lifting up their concepts and rules and laws to the highest level of application. The classes of categories come from the sciences (fundamental, theoretical, empirical, practical, engineering, and formal) and technology, while standard ontology is aimed to organize all the knowledge about the world, scientific, philosophical, and common sense, in the most concise, consistent and comprehensive ways.

Comments on the Semantic Web Ontologies integration

One can merge ontologies of different schemes, languages, scope, degree, and depth in several characteristic ways as much as the different cultures in a human society:

a) Multiculturalism (multi-ontologies, like a bottom-up folksonomy, a people's taxonomy);
b) Melting pot (mixing and amalgamating ontologies);
c) Monoculturism (absorbing all numerosity of ontologies into a single whole, like CYC);
d) Core culture (Leitkultur, a top-bottom globally federated ontology, "E pluribus unum ontology project", ‘’out of many, one”).

Instead of a variety of diverse, modular, individual ontologies, the Semantic Web implies an integrated collection of domain ontologies (knowledge bases) supported by a common global schema as a "standard ontology for machines and people". Second, the "network ontology model" hardly can be modelled as a mere extension of the set theory, where sets just replaced by ontologies, operations on sets by operations on ontologies; relations involved in set theory, by the "ontology mapping metamodel" (like the 14 m EUR NeOn Ontology project, http://www.neon-project.org/web-content/index.php?option=com_weblinks&view=categories&Itemid=73). The logical ontological languages can not properly define the real semantics, serve as a global scheme for individual ontologies, function as the infrastructure for the large-scale semantic applications, etc.

Thus the viable SW ontology is a Federated Network of Ontologies interrelating distributed upper schemas and heterogeneous domain ontologies via a global meta-ontology, thus constituting the general framework classification for world knowledge in various spheres of science, technology, commerce and industry.