

## Invited Paper

# Ontology – What and Why?

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**Abstract:** *Today ontologies are very popular in many areas of computer science including Knowledge Management and are being used in a variety of applications. There are many definitions for the term “Ontology”. Also, different applications use different contents and structures in building ontologies. This paper gives a brief account on why ontologies are needed, how they are defined and used in knowledge management.*

**Key words:** Ontology, Knowledge Sharing, Knowledge Management

## 1. Introduction

Today, the term “Ontology” has become a popular term in the fields of Knowledge Management and the World Wide Web (WWW). It can be seen in the literature that the term “Ontology” has been used in different applications in many different ways with different meanings ranging from list of terms to comprehensive knowledge structures. In many recent publications the term “Ontology” has been used loosely without providing a proper definition and describing the structure and the composition.

Historically, the concept of “Ontology” was born in Metaphysics, a branch of philosophy. In the Oxford dictionary [5] the term “Ontology” is defined as “the branch of metaphysics dealing with the nature of being” and in many other dictionaries the term is given a similar meaning. It is believed that the term has introduced first by Aristotle in his attempt to classify things in the real world. During 1990’s the Artificial Intelligence (AI) community has introduced the term to knowledge management research to facilitate knowledge sharing and reuse.

Knowledge is indispensable for intelligent systems and Knowledge bases are used to capture the encode knowledge. AI research community has realized the value of comprehensive knowledge bases and the difficulty and complexity in constructing them ever since they have started constructing knowledge bases. Hence, they were searching for ways for reusing knowledge across different applications and communities. However, disparate vocabularies, implicit constraints and representations used to encode knowledge in knowledge bases makes knowledge sharing difficult. One of the approaches proposed by them to accomplish a shared understanding of knowledge is to agreeing on an appropriate way to conceptualize the domain of interest, and then to make it explicit in some language. They have coined the term “Ontology” for such knowledge representations.

## 2. Definition of Ontology

In AI, Ontology is defined as **a formal, explicit specification of a shared conceptualization** [1]. A conceptualization is an abstract, simplified view of the world or some phenomena intended to be used for some purpose [3]. Conceptualizations are intentional semantic structures that encode implicit

knowledge of objects, relationships and constraints on objects and live on the minds of the people (Figure 1). An explicit description of such a conceptualization represented by using an agreed upon formalism is generally referred to as an Ontology.

Conceptualizations are language independent, while ontologies depend on languages. Also, an ontology should be machine-readable. One other important aspects of an Ontology is that it should represent some consensual knowledge (reflecting a shared conceptualization) of a group of people.

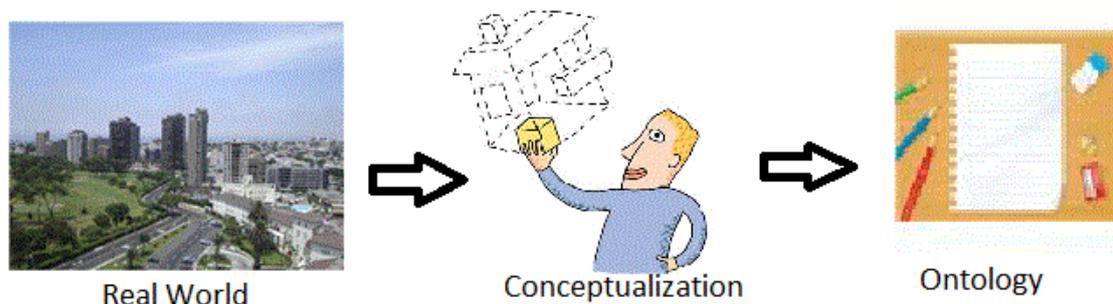


Figure 1: Real World Vs Ontology

A typical ontology comprises of names of entities representing the objects and phenomena in the universe of discourse with descriptions of what the names mean, and formal axioms that constrain the interpretation and use of these terms.

Ontologies are often confused with taxonomies. A taxonomy typically classifies data in a particular domain in a hierarchical form whereas an ontology is a statement of a logical theory. There are a number of key differences between an ontology and a taxonomy.

1. ontologies need not to be limited to taxonomic hierarchies (Example WordNet [6], CYC [4])
2. An Ontology has a richer internal structure as it includes both relations and constraints between the concepts.
3. An Ontology represents a certain consensus among the intended users.
4. Ontology is machine readable.

### 3. Use of Ontologies.

To build intelligent systems and AI applications, knowledge must be captured, processed, reused, and communicated. Ontologies can be used to facilitate all these tasks. Ontology based system development binds the developers to use the objects and relationships in the universe of discourse consistent with the ontology. This allows knowledge to be shared among developers in a consistent manner. Since ontologies are machine readable, application can be developed to process knowledge automatically.

Ontologies are used in many different applications. Some of these applications are listed below.

- Information retrieval.
- Knowledge representation and sharing.
- Semantic Web.
- Software engineering.

- Natural-Language processing.
- Multi-agent systems.
- Database design.

The following diagram illustrates an example of how an ontology can be used to share operational data among several application [2].

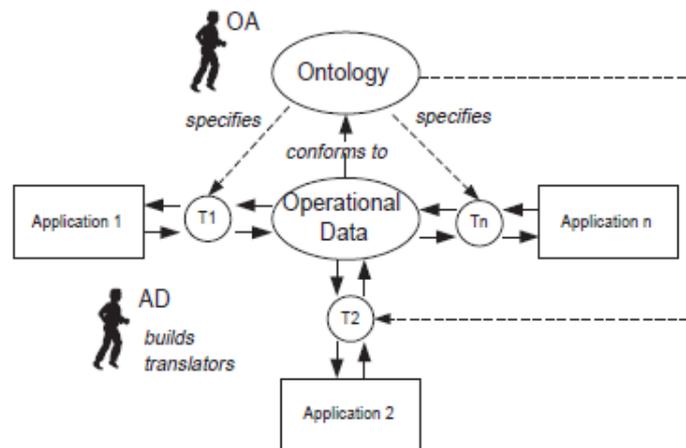


Figure 3: Sharing knowledge among applications by using an ontology

Today, Ontologies have taken an indispensable part of the Semantic Web and in future Ontologies are expected to play a major role in a variety of applications.

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