Ontology

M K M Nasution*

1Teknologi Informasi, Fasilkom-TI, Universitas Sumatera Utara, Padang Bulan 20155 USU, Medan, Indonesia
E-mail: mahyuddin@usu.ac.id

Abstract. Ontology has historically emerged from the meaning of this term against research methodology in order to the knowledge and technology developments. A term that has been known for a long time, but requires a meaning of abstraction in order to be developed to form a new understanding of a domain, and thereby make it easier to build an approach to the issues that are present with it. Of course, looking at the purpose of the ontology description, the approach taken is based on mathematics, which is described philosophically by the basis of the ontology of being, to be and existence. In some cases, this trait gives birth the relationship between the decisive parameters in the mathematical model of domain like the social actor in social network.

1. Introduction
Ontology not only influences the research method [1], but also about the meaning [2]: Ontology is a foundation of semantic, without ontology no semantic. Every stream of research affects the fields of science and knowledge seeking semantically such as ontology mapping, ontology evolution, taxonomy, and population ontology [3].

Philosophically, ontology speaks of the nature of being, to be, and existence, including the general idea of the existence of mathematics [4]. Mathematically, ontology pertain to abstraction, modeling and simulation, but the notion of simulating ontology is not implicitly so far seen, and may be explicitly doubtful because ontology refers to the reality around us. This paper is to formally do abstraction the ontology.

2. Review and Motivation
Mathematically, the existence of something is revealed when it is clearly stated through the definition [5]. In terminology, ontology is the knowledge of: what (what is), to be (what for), exist (what happened). They generally means to be descriptive, processed, and valuable [6]. Considering that ontology becomes a particular part of reality, ontology is the basis for carrying out plausible communication about that part of reality, a set of concepts and categories within the subject area or domain showing its properties and relationships between them. In other words, ontology for ontology can be formally stated. First, the "being" can be expressed as follows [7].

Definition 1. Assume $F$ the set of all thoughts, and denoted $\Sigma$ as what is known, everyone knows that it is in $\text{mod}(\Sigma)$ which is a part class of $M$, $M$ is the class of all possible world.
As time goes by, everyone gets experience from his environment or learn more. Therefore, "to be" can be expressed as follows.

**Definition 2.** Suppose $a$ is a member of $\text{mod}(\Sigma)$, i.e. all real situations with which knowledge $\Sigma$ can be used. "To be" is something to gain knowledge so that $\Sigma$ gets bigger and consequently $\text{mod}(\Sigma)$ shrinks.

For example, the alphabets written in this paper become members of $\text{mod}(\Sigma)$ that are known by someone. If $\ell \in M$, but $\ell \notin \text{mod}(\Sigma)$, then there are alphabets that cannot be written here so $\Sigma$ does not apply [7].

Existence demonstrates versatility and is expressed as follows.

**Definition 3.** If $\text{mod}(\Sigma)$ is positive, then $\text{mod}(\Sigma)$ is the applicability of knowledge. Conversely, if $\text{mod}(\Sigma)$ is negative, then $\text{mod}(\Sigma)$ indicates uncertainty.

Therefore, the ontology as a science of being has different meanings in context [8].

**Lemma 1.** Suppose $a, b \in M$ and $a, b \in \text{mod}(\Sigma)$, but $a \neq b$ and $a, b \notin F$, then $a$ and $b$ is not related to each other and free from (independent on) the others.

This lemma states that the world stands on its own, completely free of human thought. In ontology, the reality is the actual objective reality. The alphabet A is a reality outside the human self (the reader) and is independent of the author as well, and the alphabet A is a different embodiment of the alphabet B [5].

**Lemma 2.** Suppose $a, b \notin M$ and $a, b \notin \text{mod}(\Sigma)$, but $a, b \in F$, then $a$ and $b$ is related to each other and dependent on the another.

This lemma states that the world is not mutually exclusive [9]. In Ontology, although each subject has its own reality image, but there is not reality beyond the human. The alphabet A, for example, depends on the author and the reader. The letter A can be named according to human will, so between one alphabet A and the other alphabet A in the human being will be different or the same, they still has related. This is subjective reality [10].

**Proposition 1.** Suppose $a, b \in M$ and $a, b \in \text{mod}(\Sigma)$, but $a, b \in F$, then $a$ and $b$ is related or not, it depends on the condition.

This proposition explains that no absolute reality objectively and this also depends on subjectivity. Thus, in ontology, it is built and continually adjusted through negotiation to reach consensus among matters. The alphabet A is in specificity and publicity, so it is recognizable among the relativity that is thought, written by the author and read by the reader [5].

On the knowledge side, ontology is seen as the philosophical persistence associated with the hypothesis. The ontologies have practical applications in information and technology [11]. In general, an ontology based on definition by involving a word of "is" or "are", "to express", "to define", and other words; or the including by a word of "have", "to involve", and other words; or also decipher with the word of "to reveal" until the word "to prove". In other words, it’s all about question researches, i.e. what, who, where, when, why, and how, also about how long, how much, how many, etc (in brief is 5wh). All of these are related to Lemma 1, Lemma 2
and Proposition 1. By considering it we develop a methodology for getting ontology about any domain.

3. Methodology: Developing ontology
Ontology is one cornerstone of many scientific fields. The manifestation of mathematics as a science in ontology is the most basic and the abstract form of knowledge [12]: If philosophy is a mother of knowledge, then mathematics is a father of knowledge. Here, the mathematics cannot be broken down into parts or factors or even more to basic patterns, except for its meanings such as set theory, algebra, arithmetic, trigonometry, and others. Through modelling as a process of being, mathematics describes consecutive fields of basic science such as physics, chemistry, and biology. The application of mathematics to the real world is physics, which seeks to explain what happens in nature through mathematics. Chemistry is also a science that involves physics to understand the arrangement of particles that manifest all matter. Biology staged its own field, but still involves a physics environment and a chemical understanding. Although chemistry does not study antimatter, it has an influence or awareness that is key to the presence of psychology [13, 14]. While sociology is the study of human systems and their interaction for engineering social so that human life better, it as a result of not the imbalance of absorption of matter and antimatter.

In ontology itself, the ontology is stated or expressed using TBox in Fig. 1 [15]. The approach involves TBox describing matters relating to being, to be, and existence, which in domain has ranges from each of the properties revealed from research questions: 5wh. In this approach, the future entity and the future properties are more details about each of the entities and properties needed to decompile the domain.

4. Discussion: Ontology engineering
Ontology engineering uses taxonomic, class, individual and property constructions to create a knowledge model formally [5]. However, ontology engineering on something must consider being, to be, and existence of something [19]. Suppose social actors are expressed in the following

Figure 1. TBox ontology for ontology domain
notation: \( a = \{a_i|i=1,2,\ldots,I\} \), where \( a_i \) represents the \( i \)th name of social actor [16]. In ontology, the names of social actors as the being of them. So, as to be of them, each of social actors has activities. They or other people record their activities to documents. A document \( d \) consist of a sequence of \( J \) words we denote by \( W = \{w_j|i=1,2,\ldots,J\} \). In a document, there is one or more names of social actors [17].

A collection of documents is called corpus, denoted by \( D = \{d_k|k=1,2,\ldots,K\} \) [18], and therefore each document has a probability for selected, i.e. \( p(d) \) [19, 20]. Suppose the document is persent in a repository, the document will be recorded in the Web and indexed by search engine, i.e. \( \Omega = \{(t, \omega)_j\} \) where \( t_j \) is a term that contains some words and \( \omega_k \) is a webpage [21]. Thus, by involving the name of the social actor \( t_a \) in the query that submits to search engine and then we obtain the resultant [22, 23, 24]. That is, for a set social actors \( a \), the first condition of social network extraction (SNE) is \( \gamma_1 : a \xrightarrow{1:1} V \) where \( V \neq \emptyset \), \( V = \{v_i|i=1,2,\ldots,I\} \) is a set of vertices in a graph \( G \) [25]. One way to prove the being of the social actor in global space, if the cardinality \( |\Omega_a| > 0, \forall t_a \in \omega \) [26]. Furthermore, to be of social actors based on capacity building, it requires cooperation: No ability without cooperation. Therefore, the second condition of SNE is \( \gamma_2 : a \times a \rightarrow E \) where \( E = \{e_n|n=1,\ldots,N\} \) is a set of edges in graph \( G \) [27]. A way to prove the to be of the social actor in global space, if the cardinality \( |\Omega_1 \cap \Omega_2| > 0 \forall t_a, t_b \in \omega \), where the strength relation between two social actors \( a, b \in a \) based on the similarity measurement [28].

The existence of social actors can be proved through the social role it carries [29]. For example, the existence of a lecturer is expressed through the development of knowledge has been done that lecture in his/her research, or role as a researcher [30, 31]. In the document, the research is a word that to be latent class [32]. In mathematic the documents, social actors, words, and latent class we note as variables \( d, a, w \), and \( z \), respectively. In taxonomy, we have some relations between them: relationship in a pair among documents, social actors, words, or latent class. All relations form specially a network of variables, and then optimized into a tree, it is a subset of the graph [32]. A joint probability of those variables is \( p(d, a, w) = p(d)p(a, w|d) \), and as focus to the meaning of existence we get a formula as follows

\[
p(d, a, w) = \sum_{z \in Z} p(z)p(d|z)p(w|z)p(a|z),
\]

where \( Z \) is a set of latent classes [33]. To further develop the Eq. (1) based on the requirements of the analysis, TBox can be used to derive the variables that are the analysis parameters from the discussed domain [34].

Each social actor has name or alias as a manifestation of "being". A manifestation becomes the "to be" in ontology is a change, and then it becomes the proof of its existence, which is mathematically modelled and formulated abstractly [38]. On the other hand, mathematics as an abstraction that builds methods and approaches from its ontology point of view has a basic nature, whereby mathematically the "being" is changed such as it needs to understand about all of domains, e.g. change into physic is a mathematical change to maintain basic and abstract, but in the physics of that basic has been applied and the abstract is applied to an formulation. Some definitions derived from an ontology based understanding [36]. Specially, it reveal a change of physics from the mathematic in the form of modelling natural science. This modelling gives the birth about many disciplines where one another fills together, the physics is in the first layer,
while social science lies in the last layer. Chemistry, biology, medicine, psychology, engineering, and others are in between them. They have the same root ontologically, one with the other has its distinction at the beginning and has different at the end [37]. Therefore, they cannot stand on its own. As mentioned above, social networks are physically intangible but the reality exists in social and proven ontologically tangible. This is based on the model expressed through graph theory as a template in constructing an approach for processing it [38]. Physically social actors are connected by network media and computers (in computer networks) and interconnect and reshape social communication and other communities socially. Surely an ontologically existence must be mathematically proven to have value, so new models of social networks are formed to measure the power of scientific development in one field or by research group.

5. Conclusion
Ontology offers a comprehensive representation of the domains in question, which can be abstracted on the basis of mathematics. Thus, ontology directly sort out the required variables based on the taxonomy and relationship among the variables. In this regard, examples are taken of being, to be and existence of social actors, and this example has shown the role of ontology.

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