

Survey on Development Method of Ontology

Ria Andryani, Edi Surya Negara

Universitas Bina Darma

e-mail: ria@mail.binadarma.ac.id, e.s.negara@mail.binadarma.ac.id

Abstract

Ontology has strategic function in developing web based on knowledge. To develop the ontology, there is much methodologies which suggested by the researchers. This article will discuss and describe methodology methodology which has been developed in current decades. The methodologies are covered into many forms, such as: Uschold Methodology, Grninger and Fox Methodology (TOVE), METHONTOLOGY Methodology, IDEF5 Methodology, Ontolingua Methodology, SENSUS Methodology, CYC Mehtodology, Mikrosmos Methodology, PLINIUS Methodology, CommonKADS and Kactus Methodology, ONIONS Methodology (Ontologic Integration Of Naive Sources), On-To-Knowledge methodology, MENELAS Methodology, PHYSSYS Methodology, 101 Methodology, UPON Methodology (Unified Process for ONtology building), BORO Methodology.

Keywords : *Ontology, Development Method*

1 INTRODUCTION

Development and growth of ontology tend to strategic technique in developing knowledge based on system. Looking to the previous relevant research, there is much advantages which got from development of ontology, such as: a) knowledge sharing, b) re-using knowledge, c) innovation and acquisition on knowledge based on system, d) verification and maintenance, etc. Development knowledge based system refers to the design of web technology in the future. Explicitly, ontology determines concepts to development of knowledge based web. Moreover, the ontology has strategic role to develop application based on knowledge.

In information study, according to Smith (2003)[19] definition of ontology is term which formulated in canonical syntax and it will be designed to produce lexical conceptual or taxonomy to represent the knowledge that functioned to the different information system. Therefore, this article will discuss methodology the methodology on development of ontology in current decades. Moreover, this study will analyze each methodology by looking the criteria which has been determined and it will give deep concept which important to the current methodology.

2 LITERATURE REVIEWS

Nowadays, there is much ontology development method which specific to cover problems on ontology development. For this case, the writer will show survey method the method which is used to ontology development.

2.1 Uschold Methodology

Uschold Methodology has been developed by Mike Uschold and Martin King in 1995 [21]. Uschold Methodology refers to first methodology which develop to development enterprise ontology[4]. This methodology gets four phases to develop the ontology [21], , namely:

- Identify Purpose
- Building the Ontology
 - Ontology Capture
 - Ontology Coding
 - Integrating Existing Ontologies
- Evaluation
- Documentation

2.2 Grninger and Fox Methodology (TOVE)

Grninger and Fox Methodology or TOVE Methodology has been developed by Michael Gruninger and Mark S. Fox in 1995[10]. This methodology has offered to cover TOVE (Toronto Virtual Enterprise) project and it is used to develop methodology on - toloy which tends to business domain. In first phase, this methodology focuses to create regulations on ontology by handling informal description. Furthermore, it is used to transform the informal order to formal order. For this case, the first case can be called as logic ontology model [22]. Motivation scenario is used to get semantic which describe in informal order. The description and formulation have been created by first-calculus order. By composition and de-composition, it will help to integration the ontology. In deep, the procedure and evaluation of the ontology can be seen in figure 1.

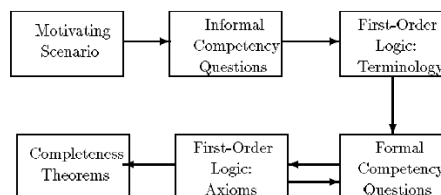


Figure 1: Procedure to design and evaluation the ontology (TOVE)

2.3 METHONTOLOGY Methodology

METHONTOLOGY Methodology is a structured method which functioned to create the ontology in the beginning form. [7]. METHONTOLOGY explains the activities and techniques which needed in partial way. To develop the creating ontology in knowledge level and to follow cycle life based on development prototype. The methodology covers the activities which oriented to development, which is specification, conceptualization, formulation, integration, and implementation, such as in the figure 2. METHONTOLOGY Methodology offers development prototype as cycle life which is compatible with ontology of life. The cycle allows to decrease or modification of definition in many situation. It is also allowed to develop knowledge acquisition, evaluation, integration, and documentation. Moreover, it has been tested by developing the ontology for the others domain, such as chemistry materials[7].

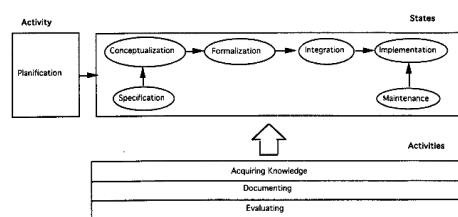


Figure 2: Parts and activities on METHONTOLOGY Methodology

2.4 IDEF5 Methodology

IDEF5 Methodology tends to methodology which developed based on development prototype model and independent application [11]. This methodology supports to maintenance phases through two languages order. In the beginning, the ontology is known by using schema language and it looks for graphic notion which describe general information of ontology. The language schematic is used as communication tools between expert domain and the ontology developer. But, the language is used in the first order later it analyze and transform into structural language based on KIF [11]. In the simple way, the process of development IDEF5 ontology includes into five activities, such as following elaboration. [11]

1. Organizing and Scoping

This activity includes into determining the goals, concepts, and context to development ontology project and sharing application and function for each members of team.

2. Data Collection

This activity aims to get authentic data which needed to develop the ontology.

3. Data Analysis

This activity aims to analyze data in order it is able to extract the ontology.

4. Initial Ontology Development

This activity includes first ontology development from data that got by the team.

5. Ontology Refinement and Validation

This activity refers to the part of re-check and validation of the ontology to solve the process of development.

2.5 Ontolingua Methodology

Ontolingua Methodology is a methodology ontology which shows a usefully concept. The ontology defines term which oriented to the object and language frame. On-tolingua server has expanded the source language in two ways. First, it gives explicit link to create possible ontology module, later it expands and keep into new ontology. Second, it allows generating certain lock between presentation and representation ontology [5].

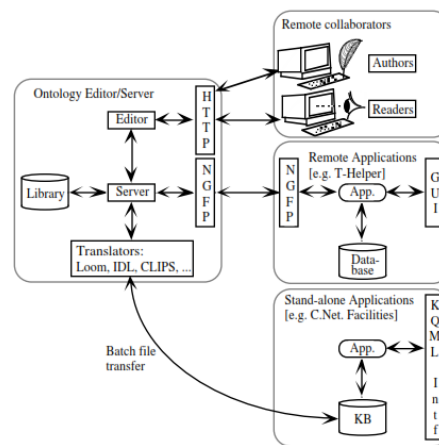


Figure 3: Architecture of Ontolingua Server

Phase Development Ontolingua Methodology [5] :

1. Browsing Ontologies
2. Building Ontologies
 - (a) Maintaining Ontologies
 - (b) Sharing Ontologies
 - (c) Collaboratively Developing Ontologies
 - (d) Ease of Use
3. Using Ontologies

2.6 SENSUS Methodology

SENSUS Methodology is a methodology which support to the concept reusability, redesign and both of them links with natural language processing (NPL) domain, it likes concept on Ontolingua Methodology. SENSUS Methodology has been developed by using many sources, such as: PENMAN Upper Model, ONTOS, WordNet and many e-dictionary (English, Spanish

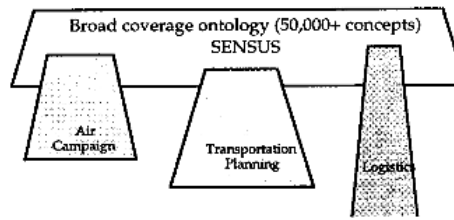


Figure 4: Links between Domain at SENSUS Methodology

and Japanese)[18]. In the figure 4 has been showed the links between domain and prerequisite on SENSUS Methodology.

SENSUS Methodology runs by looking these steps: 1) identify important terminologies (seed); 2) create link terminologies to Sensus manually; 3) add the node from path to root; 4) re-add sub-tree with rules heuristic if much node in a relevant sub-tree meaning [22]. SENSUS Methodology offers a basic concept of hierarchy structure in which the term is used as proof in expressing Interlingua to translator machine. The term of abstract on hierarchy show the linguistic generalization even the term middle and low levels have been familiar or daily terminologies [18]. See figure 5.

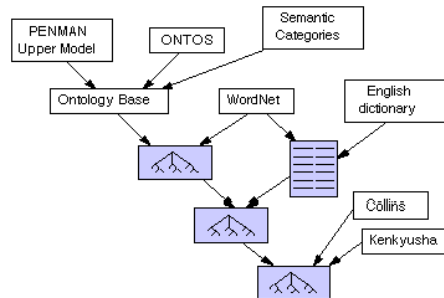


Figure 5: Combination Strategy by SENSUS Methodology

2.7 CYC Methodology

CYC Methodology is a methodology which developed based on knowledge. Ontology is core component from CYC Knowledge [12]. In developing, CYC methodology gets three phase [6], namely:

- First phase offers manual coding, implicitly and implicitly in source knowledge without supporting from natural language and learning system. This phase is done manually because natural language and learning systems cannot explore general or new knowledge.
- Second phase offers re-coding knowledge which support by tools knowledge on CYC Knowledge base.

- Third phase determines delegation to create tools. The people just will recommended source of knowledge which possible to read, and they will explain difficult part from the text.

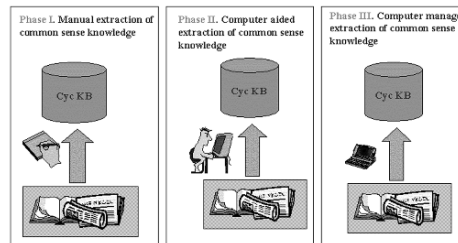


Figure 6: Building phase of CYC Knowledge Base

2.8 Mikrosmos Methodology

Mikrosmos methodology is ontology development which includes into natural language processing (NLP) development, and machine translation (MT) [13]. Ontology on natural language processing (NPL) tends to the concept of knowledge which explores: a) repository symbol primitive to present a meaning, b) regulator symbols which subsumption hierarchy, and c) inter-connection symbols with semantic systems. In deep, this ontology looks as database into the following information [13]:

1. what categories (or concepts) exist in the world/domain,
2. what properties they have,
3. and how they relate to one another

In machine translation (MT), the main reasons to use ontology are following elaboration: [13]

1. Give a basis to delegate meaning of text in Interlingua.
2. To activation lexicons for different languages, especially to share knowledge.
3. To analyze source language and target language in sharing knowledge.

2.9 PLINIUS Methodology

Plinius Methodology is a ontology method which extracts semi-automatic knowledge from natural language text. Plinius ontology is developed to support the translating sentences from natural-language to expression on knowledge representation language [14]. The principles to create the ontology are following explanation.

1. The opposite statements with entity can find in easy way if the concept has been showed maximally.

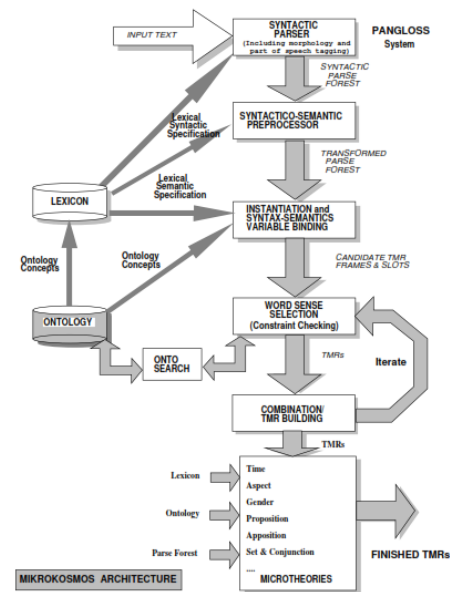


Figure 7: Mikrokosmos Methodology at NLP Architecture

2. The previous formal theory is got and the domain of ontology cannot determine the logical construct from semantics.
3. Ontology should independent from knowledge representation language.
4. Conceptual principle should construct to show the ontology has been arranged from primitive concepts and regulation construction which shows the others primitive concepts.
5. An approach bottom-up is taken to show the complete ontology that should be filled.
6. The ontology development should be created based on policies of innovation, such as: policy about cost-benefit analysis.
7. The ontology should evaluate from completely work view.

2.10 Common KADS and Kactus Methodology

CommonKADS and Kactus Methodology is development project which focuses on ontology development issues. Innovation approach on ontology adopted which look to modular design. [2]. The ontology is developed from a library in small scale which map between the old ontology and the new one. Kactus Methodology gets many phases, such as following statements [1]:

1. Specification from application;
2. First design base on top-level ontology;
3. Finishing and re-constructing ontology.

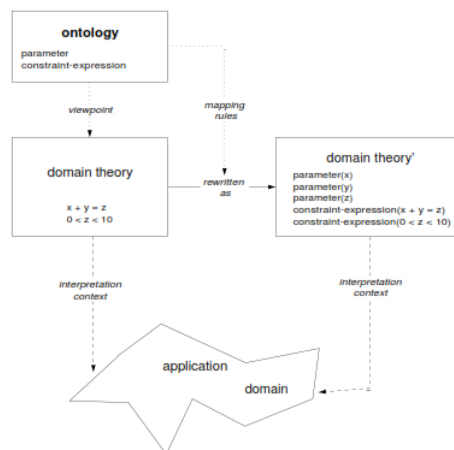


Figure 8: Ontology as meta-model which describes domain theories on CommonKADS and Kactus Methodology

2.11 ONIONS Methodology (Ontologic Integration Of Naive Sources)

ONIONS Methodology is development method which develop by motivation to integrate sources of information which heterogenic in knowledge acquisition. For this case, the specific aspect in ONIONS approach is ontology acquisition method. This acquisition will produce non-formal ontology. Furthermore, the following elaborations tend to show phases of ontology development based on ONIONS Methodology [9].

1. Phase I
 - (a) Extraction of source terms
 - (b) The medical sources
2. Phase II
 - (a) Local (or surface) definition of terms
3. Phase III
 - (a) Multi-local (or shallow) definition of terms: triggering theories related to distinctions made in local definitions
4. Phase IV
 - (a) Multi-local (or shallow) definition of terms: triggering theories for top-level categories design
 - (b) A guide in the general ontology forest: the ontological frame of a State of Affairs
5. Phase V
 - (a) Multi-local (or shallow) definition of terms: merging local definitions and top-level categories

6. Phase VI

- (a) Formalization of an Integrated Model
- (b) The current state of the implemented medical ontology as an output of ONIONS

2.12 On-To-Knowledge methodology

On-To-Knowledge methodology shows an approach which aims to make balancing between human solve problem and automatic IT solution. This methodology focuses on knowledge of meta- process and knowledge process. [20]. On-To-Knowledge methodology has many phases like following statements [20]:

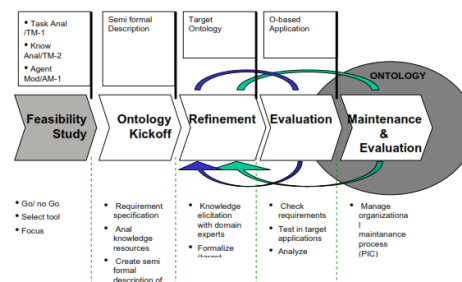


Figure 9: On-To-Knowledge (OTK) Methodology

1. Feasibility study,
2. Ontology kickoff,
3. Refinement,
4. Evaluation and refinement-evaluation.

2.13 MENELAS Methodology

MENELAS Methodology tends to ontology method which design as part of natural language system in medical domain [3]. This method has developed by using graphic concept as the core formal. MENALAS gets four principles to develop taxonomy knowledge, namely: similarity, specifies, opposition, and access unique semantic. All of them are used to support acquisition control and re-form ontology. But, this methodology has point of view that ideal taxonomy which affects it incompatible for others domain.

2.14 PHYSSYS Methodology

PHYSSYS Methodology tends to ontology development which uses to solve problem in e-library. This method aims to facilitate the choosing to current ontology method based on construction dynamic knowledge. There are two types of this ontology, namely:

1. Primary (domain from many views)
2. Secondary (shows the others distinction from the object)

2.15 101 Methodology

101 Methodology is ontology method which used to develop ontology domain [16]. The phases on ontology development of 101 Methodology are following statements:

1. Defines class on ontology,
2. Arranges the class into subclass and super-class hierarchy taxonomy.
3. Defines slot and describes values which allows to slot.
4. Analyze the value of slot.

2.16 UPON Methodology (Unified Process for ONtology building)

UPON is ontology development method which comes from Unified Software Development Process[15]. UPON Methodology uses Unified Process (UP) and Unified Modeling Language(UML) to support planning of Blue Print on a project ontology. UPON is developed to facilitate the user even human or automatic system to produce ontology.

UPON get cycle, phase, iteration, and work procedures. Every cycle includes with four phase, namely: a) inception, b) elaboration, c) construction and d) transition. Every phase has divided into iteration. For each iteration, there are five work procedures, namely: a) requirements, b) analysis, c) design, d) implementation and e) test [15].

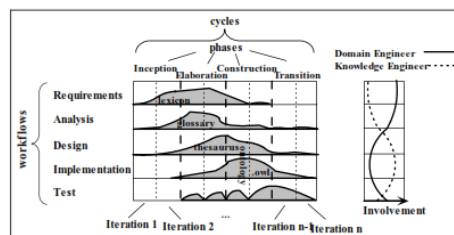


Figure 10: UPON Framework

2.17 BORO Methodology

BORO Methodology is an approach to develop model of ontology or semantic for wide complex operational application which include of ontology and process in developing ontology. This methodology, in the beginning, it is developed as method to determining ontology from legacy system it is used as first phase to transform architecture [8] or modernization of software. For this case, it is also used to allow semantic inter-operation between legacy systems. In fact, it tends to analyze method for development and maintenance on civil defense department of AS Architecture Framework (DoDAF) Meta Model (DM2).

BORO Methodology is cycle processes which develop formal ontology in simple way. This method takes extensional approach to develop ontology. The advantages of BORO from the others method is to have foundation in physic reality. It means that this method always produces similar ontology if it get similar stimulus [8]. For this case, BORO rise to be filled

to compare with many sources of semantic comparison/ un-similar and to re-innovate many legacy systems to be a unity or coherent (it tends to new monolite or many methods which design current federation system). The development BORO methodology aims to improve information quality and model information, to integrate sources of information and extract hidden semantic [17].

The aims of this method is to re-engineer the others sources of data into general model [8]. For this case, it gives benefit point at semantic analyze and it determines whether two concepts are similar, whether if they are controversial, or whether they are not link each other. In other side, traditional method of analyze data tends to linguistics and comparison concepts based on label concepts. This method tends to modern that shows in semantically in which analyze will tend to analysis meaning behind the word. But, this method tends to produces accurate comparison and wider, according to domain analyzes knowledge and linguistic interpretation [17].

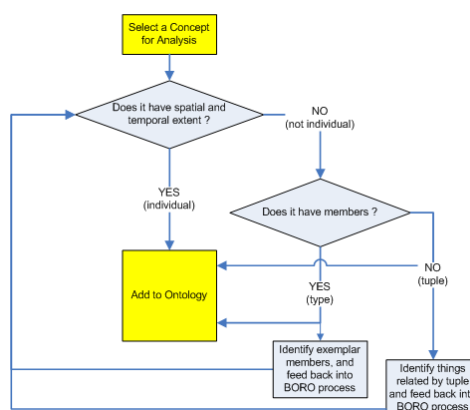


Figure 11: BORO Methodology

3 CONCLUSION

This article has been discussed several ontology development methodology, including the Uschold Methodology, Grninger and Fox Methodology (TOVE), METHONTOLOGY Methodology, IDEF5 Methodology, Ontolingua Methodology, SENSUS Methodology, CYC Methodology, Mikrosmos Methodology, PLINIUS Methodology, CommonKADS and Kactus Methodology, ONIONS Methodology (Ontologic Integration Of Naive Sources), On-To-Knowledge methodology, MENELAS Methodology, PHYSSYS Methodology, 101 Methodology, UPON Methodology (Unified Process for ONtology building), BORO Methodology. ontology development methodology is a guideline in developing ontology. There are some advantages and disadvantages of each - each methodology. Degree of maturity of the methodology of the discussion above with order maturity is OTK, Methontology, Grninger & Fox, Uschold & King, Census and Kactus. Census has a very different approach compared to other methodologies. This condition refers to the further research in order to develop a methodology that more mature is important.

REFERENSI

- [1] A. Bernaras, L. Laresgoiti, and J. Corera, "Building and reusing ontologies for electrical network applicationh," in 12 th European Conference on Artificial Intelligence, 1996, pp. 298–302.
- [2] G. S. Bob, B. Wielinga, and W. Jansweijer, "The kactus view on the 'o' word," in In IJCAI Workshop on Basic Ontological Issues in Knowledge Sharing, 1995, pp. 159–168.
- [3] J. Bouaud, B. Bachimont, J. Charlet, and P. E. Zweigenbaum, "Acquisition and structuring of an ontology within conceptual graphs," in Proceedings of Workshop on Knowledge Acquisition using Conceptual Graph Theory, 1994.
- [4] O. Corcho, M. Fern, and A. Gomez-perez, "Methodologies, tools and languages for building ontologies. where is their meeting point," *Data & Knowledge Engineering*, vol. 46, pp. 41–64, 2003.
- [5] A. Farquhar, R. Fikes, and J. Rice, "The ontolingua server: a tool for collaborative ontology construction," *International journal of human-computer studies*, vol. 46, no. 6, pp. 707–727, 1997.
- [6] M. Fernandez-Lopez and A. Gomez-Pérez, "Overview and analysis of methodologies for building ontologies," *The Knowledge Engineering Review*, vol. 17, no. 02, pp. 129–156, 2002.
- [7] M. Ferndndez, A. G.-P. rez, and N. Juristo, "Methontology: From ontological art towards ontological engineering," AAI Technical Report SS-97-06. Compilation copyright 1997, AAI (www.aaai.org). All rights reserved., 1997.
- [8] B. G, "Nine things you can do with old software." *IEEE Software*, vol. 25, no. 5, pp. 93–94, September 2008.
- [9] A. Gangemi, G. Steve, and F. Giacomelli, "Onions: An ontological methodology for taxonomic knowledge integration," in *ECAI-96 Workshop on Ontological Engineering*, 1996.
- [10] M. Grninger and M. S. Fox, "Methodology for the design and evaluation of ontologies," 1995.
- [11] J. Holden, J. MacDougall, and R. McGuire, "Information integration for concurrent engineering (iice) ideo5 method report," *Armstrong Laboratory AL/HRGA*, 1994.
- [12] D. B. Lenat and R. V. Guha, *Building Large Knowledge-Based Systems: Representation and Inference in the CYC Project*. Reading, Massachusetts: Addison-Wesley, 1990.
- [13] K. Mahesh, "Ontology development for machine translation: Ideology and methodology," 1996.

- [14] N. MARS, W. TER STAL, H. DE JONG, P. VAN DER VET, and P.-H. SPEEL, "Semi-automatic knowledge acquisition in plinius: An engineering approach," in Proc. 8th Banff Knowledge Acquisition for Knowledge-based Systems Workshop, Banf, ser. 4.1-4.15, January 30th-February 4th 1994.
- [15] A. D. Nicola, M. Missikoff, and R. Navigli, "A proposal for a unified process for ontology building: Upon," in In Proceedings of 16th International Conference on Database and Expert Systems Applications (DEXA, 2005.
- [16] N. F. Noy and D. L. McGuinness, "Ontology development 101: A guide to creating your first ontology," Stanford University, 2001.
- [17] C. Partridge, Business Objects: Re-Engineering for Re-Use [2nd Edition]. BORO Centre, 2005, no. ISBN 0-9550603-0-3.
- [18] R. Patil, K. Knight, and T. Russ, "Towards distributed use of large-scale ontologies," in In AAAI Spring Symposium on Ontological Engineering, 1997.
- [19] B. Smith, "Ontology," The Blackwell guide to the philosophy of computing and information, pp. 153–166, 2003.
- [20] Y. Sure, S. Staab, R. Studer, and O. Gmbh, "On-to-knowledge methodology (otkm)," in Handbook on Ontologies, International Handbooks on Information Systems. Springer, 2003, pp. 117–132.
- [21] M. Uschold and M. King, "Towards a methodology for building ontologies," in In Workshop on Basic Ontological Issues in Knowledge Sharing, held in conjunction with IJCAI-95, 1995.
- [22] I. W. S. WICAKSANA, "Survei dan evaluasi metode pengembangan ontology," in Komputer dan Sistem Inteligen (KOMMIT 2004), Agustus 2004.