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## Ontology revision on the semantic web: integration of belief revision theory

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# **Ontology Revision on the Semantic Web: Integration of Belief Revision Theory**

A thesis submitted in (partial) fulfilment of the requirements for the award of the degree.

**PhD in Information Systems**

from

**UNIVERSITY OF WOLLONGONG**

by

**Seung Hwan Kang**

Honours Master of Information Systems, University of Wollongong

Master of Information Systems, University of Wollongong

Bachelor of Commerce (Business Information Systems), University of Wollongong

**Information Systems**

**School of Information Systems and Technology**

**2007**

# Thesis Certification

## CERTIFICATION

I, Seung Hwan Kang, declare that this thesis, submitted in partial fulfilment of the requirements for the award of the Degree of PhD, in the School of Information Systems and Technology, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Seung Hwan Kang

9 November 2007

## List of Publications

This is a list of referred conference papers that is related to this research work.

Kang, S. and Lau, S. (2007) 'Ontology Revision on the Semantic Web: Integration of belief revision theory', in Proceedings of the 40th Hawaii International Conference on System Sciences, 3 - 6 January 2007, Hawaii, USA.

Kang, S. and Lau, S. (2007) 'ONTOLOGY REVISION: An Application of Belief Revision Approach', in Ontologies: A Handbook of Principles, Concepts and Applications in Information Systems, (Eds.) Sharman, R., Kishore, R. and Ramesh, R., Springer, New York, pp.297-318.

Kang, S. and Lau, S. (2005) 'A Framework of Ontology Revision on the Semantic Web: A Belief Revision Approach', in Proceeding of the 7th International Conference on Information Integration and Web Based Applications and Services, 19 - 21 September 2005, Kuala Lumpur, Malaysia. pp.939-943.

Kang, S. and Lau, S. (2004) 'Ontology Revision Using the Concept of Belief Revision', in Proceeding of the Eighth International Conference on Knowledge-Based Intelligent Information & Engineering Systems, 20 - 24 September 2004, Wellington, New Zealand. pp.8-15.

Kang, S. and Lau, S. (2004) 'The Use of the Belief Revision Concept to Ontology Revision', in Proceeding of the Eighth Pacific-Asia Conference on Information Systems, 8 - 11 July 2004, Shanghai, China. pp.1627-1640.

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# List of Abbreviations

|        |  |
|--------|--|
| AI     | Artificial Intelligence                            |
| AGM    | Alchourrón, Gärdenfors and Makinson                |
| DAML   | DARPA Agent Markup Language                        |
| DARPA  | US Defence Advanced Research Projects Agency       |
| DSL    | Decision Systems Laboratory                        |
| EE     | Epistemic Entrenchment                             |
| HL7    | Health Level Seven                                 |
| HPL    | Hewlett-Packard Labs                               |
| HTML   | Hypertext Markup Language                          |
| IS     | Information Systems                                |
| NS     | Name Space   |
| OIL    | Ontology Inference Layer                           |
| OWL    | Ontology Web Language                              |
| RDF    | Resource Description Framework                     |
| RDQL   | RDF data Query Language                            |
| RIM    | Reference Information Model                        |
| SHOE   | Simple HTML Ontology Extensions                    |
| TMS    | Truth Maintenance System                           |
| TOVE   | TOronto Virtual Enterprise                         |
| UNSPSC | United Nations Standard Products and Services Code |
| URI    | Uniform Resource Identifier                        |
| URL    | Uniform Resource Locator                           |

|      |  |
|------|--|
| W3C  | World Wide Web Consortium                      |
| WWW  | World Wide Web                                 |
| XML  | eXtensible Markup Language                     |
| XSLT | eXtensible Stylesheet Language Transformations |

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# Abstract

The vision of the Semantic Web is to enable content of web resources to be interpreted and processed by software agents. Ontology provides a means to share and reuse data associated with web resources in a manner that can be autonomously performed by software agents. In the context of knowledge representation, ontology represents the abstract world of web resources in the Semantic Web. The Semantic Web will comprise of small, simple ontologies constructed by individual users. It is unlikely that ontology will be built from scratch each time. On the other hand, it is more likely that ontology will be adopted and modified from existing ontology. Why is ontology revision important? Very often, ontology exists in a particular period of timeline is designed based on the purpose of a specific domain of interest at that instance of time. Over time, ontology needs to be revised due to changes in domain, content, requirements, or structural representation. In this regard, ontology is the beliefs that the agents need to reference to in order to perform task in an autonomous way. As ontology evolves, beliefs in agents also evolve and knowledge gained by agents must be reflected in the ontology.

This research investigates issues of ontology revision from the theoretical foundation of the belief revision theory. The AGM model of the coherence theory in belief revision is of particular relevant in this research. The AGM model uses three operations of expansion, contraction and revision in conjunction with the concept of



epistemic entrenchment to revise the belief set. This research develops an ontology revision framework to manage the ontology revision process. The research will also illustrate a vision in which the practicability of this approach can be applied in e-commerce.

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*Seung Hwan Kang*