

**PROVABILITY-BASED  
SEMANTIC INTEROPERABILITY  
BETWEEN KNOWLEDGBASES AND DATABASES  
VIA TRANSLATION GRAPHS**

By

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## ABSTRACT

This thesis presents *provability-based semantic interoperability* (PBSI), a type of semantic interoperability characterized by the ability to express complex relationships between ontologies, and to share information even in situations where information cannot be directly *translated* from one ontology to another. Relevant research in interoperability is reviewed, including languages and ontologies that have been designed to facilitate the exchange of information, as well as techniques for relating ontologies and automating information exchange between them. Work in the Rensselaer Artificial Intelligence and Reasoning (RAIR) Laboratory during a number of interoperability experiments is discussed, with particular respect to a new technique for enabling interoperability. Finally, *Translation Graphs* are introduced as a new formal structure for automatically extracting axiomatic relationships that govern the sharing of information between multiple ontologies, even in cases where information cannot be directly translated. The structure of Translation Graphs is described, and examples and a sample implementation is given.