

# TAKE

## Toolkit for Agent-based Knowledge Extraction

An important component in the design of new software systems, both with respect to schedule and cost, is the possible reuse of existing systems and knowledge sources in the new design. In other words, how can the redesign of a system's ontology—the unique interrelations among the system's components and entities—most effectively utilize existing systems and sources in meeting the needs that drive the new design? KBSI, leveraging their experience in knowledge based applications, tackled these challenges in a U.S. Navy sponsored project that is seeking automated methods and technologies for rapidly and cost effectively analyzing, redesigning, and reengineering complex systems.

### Advanced technologies for advanced systems development

At the heart of the Navy's concern, as with any large scale enterprise focused on continual improvement, is the need for agility—the ability to respond quickly, proactively, and aggressively to unpredictable change. For the Navy and other armed forces, unpredictable change, particularly in the current climate of global terror, is an especially prevalent reality. Achieving organizational agility requires, as a prerequisite, agility in the systems that support decision making in the operation of the enterprise. This requirement, in turn, necessitates agility in the knowledge bases and in the automated reasoning tools that use these knowledge bases. The design and development of new software systems that support Navy operations must, therefore, include technology that facilitates the dynamic update and enhancement of knowledge bases and the dynamic reconfiguration of applications that use them. New knowledge based systems, to put it simply, must provide mechanisms for continually updating their internal models of the world.

KBSI's innovative Toolkit for Agent-based Knowledge Extraction (TAKE) provides these mechanisms. TAKE uses a hybrid approach that combines ontology engineering methods with cutting-edge knowledge discovery techniques to extract, analyze, and map ontologies from distributed and disparate knowledge and data sources.

Central to this ontology engineering is extracting the essential nature of concepts in the ontology domain and representing this knowledge in a structured manner. This reaches beyond traditional information capture, which merely asserts the

existence of relations in a domain, by "axiomatizing" relations: that is, documenting the behavior of relations in terms of the sanctioned inferences that can be made with them. KBSI, in an earlier Air Force sponsored project, designed the IDEF5 Ontology Description Capture Method, a comprehensive method for ontology acquisition, representation, and analysis that has become the DoD standard for ontology modeling. IDEF5 was used as the backbone for ontology engineering in TAKE, enabling the comprehensive mapping and harmonization of the knowledge and data sources that were the subject of the Navy study. These ontology maps can then be used to guide the analysis and redesign of complex software systems that utilize the data sources.

### Agile systems analysis and design

The TAKE methodology and technology have resulted in significant reductions in the time and effort needed for extracting knowledge from distributed data and knowledge sources, allowing the Navy to explore a significantly larger number of system design alternatives at constant cost and time. The current phase of the TAKE project is addressing the immediate needs of the Command and Control Information Exchange Data Model (C2IEDM) and Multilateral Interoperability Program (MIP) end user communities. TAKE is also being applied in support of the shipbuilding industry's Common Parts Catalog (CPC) legacy mapping application and is helping to provide a rapid return on the estimated \$3M+ Navy investment in the CPC. TAKE's automated knowledge extraction methods for ontology revision also show promise for ongoing DoD funded force protection and homeland security technology development efforts.

