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# An Ontology Driven Approach To Re Ective Middleware

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Towards the Semantic Web IGI Global

Engineering design involves a series of activities to handle data, including capturing and storing data, retrieval and manipulation of data. This also applies throughout the entire product lifecycle (PLC). Unfortunately, a closed loop of knowledge and information management system has not been implemented for the PLC. As part of product lifecycle management (PLM) approaches, computer-aided design (CAD) systems are extensively used from embodiment and detail design stages in mechanical engineering. However, current CAD systems lack the ability to handle semantically-rich information, thus to represent, manage and use knowledge among multidisciplinary engineers, and

to integrate various tools/services with distributed data and knowledge. To address these challenges, a general-purpose semantic annotation approach based on CAD systems in the mechanical engineering domain is proposed, which contributes to knowledge management and reuse, data interoperability and tool integration. In present-day PLM systems, annotation approaches are currently embedded in software applications and use diverse data and anchor representations, making them static, inflexible and difficult to incorporate with external systems. This research will argue that it is possible to take a generalised approach to annotation with formal annotation content structures and anchoring mechanisms described using general-purpose ontologies. In this way viewpoint-oriented annotation may readily be captured, represented and incorporated into PLM systems together with existing annotations in a common framework, and the knowledge collected or generated from multiple engineering viewpoints may be reasoned with to derive additional knowledge to enable downstream processes. Therefore, knowledge can be propagated and evolved through the PLC. Within this framework, a knowledge modelling methodology has also been proposed for developing knowledge models in various situations. In addition, a prototype system has been designed and developed in order to evaluate the core contributions of this proposed concept. According to an evaluation plan, cost estimation and finite element analysis as case studies have

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been used to validate the usefulness, feasibility and generality of the proposed framework. Discussion has been carried out based on this evaluation. As a conclusion, the presented research work has met the original aim and objectives, and can be improved further. At the end, some research directions have been suggested.

### Industrial Knowledge Management IOS Press

This book is about a significant step forward in software development. It brings state-of-the-art ontology reasoning into mainstream software development and its languages. *Ontology Driven Software Development* is the essential, comprehensive resource on enabling technologies, consistency checking and process guidance for ontology-driven software development (ODSD). It demonstrates how to apply ontology reasoning in the lifecycle of software development, using current and emerging standards and technologies. You will learn new methodologies and infrastructures, additionally illustrated using detailed industrial case studies. The book will help you: Learn how ontology reasoning allows validations of structure models and key tasks in behavior models. Understand how to develop ODSD guidance engines for important software development activities, such as requirement engineering, domain modeling and process refinement. Become familiar with semantic standards, such as the Web Ontology Language (OWL) and the SPARQL query language. Make use of ontology reasoning, querying and justification techniques to integrate software models and to offer guidance and traceability supports. This book is helpful for undergraduate students and professionals who are interested in studying how

ontologies and related semantic reasoning can be applied to the software development process. In addition, it will also be useful for postgraduate students, professionals and researchers who are going to embark on their research in areas related to ontology or software engineering.

Ontology-Based Multi-Agent Systems Regina : Department of Computer Science, University of Regina

Pharmacogenomics is the study of how genetic variants affect a person's response to a drug. With great advances to date, pharmacogenomics holds promise as one of the approaches to precision medicine. Yet, the use of pharmacogenomics in routine clinical care is minimal, partly due to the misperception that there is insufficient evidence to determine the value of pharmacogenomics and the lack of efficient and effective use of already existing evidence. Enormous efforts have been directed to develop pharmacogenomics knowledge bases; however, none of them fulfills the functionality of providing effective and efficient evidence assessment that supports decisions on adoption of pharmacogenomics in clinical care. In this context, my overall hypothesis was that a knowledge-based system that fulfills three critical features, including clinically relevant evidence, providing an evidence-based approach, and using semantically computable formalism, could facilitate effective and efficient evidence assessment to support decisions on adoption of pharmacogenomics in clinical care. My overarching research question has been: How can we exploit state-of-the-art knowledge representation and reasoning in developing a knowledge-based system with the intended features and applications as specified above. The first aim of this research was to develop a conceptual model to address the information needs and heterogeneity problem for the domain of pharmacogenomics evidence assessment. Faceted analysis and fine-grained characterization of clinically relevant evidence acquired from empirical pharmacogenomics studies were deployed to identify 3 information entities, 9 information components, 30 concepts, 49 relations and approximately 250 terms as building blocks of the conceptual model. These building blocks were then organized into a model,

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which features a layered and modular structure so that heterogeneous information content of pharmacogenomics evidence could be expressed to reflect its intended meaning. The developed conceptual model was validated against a general ontology of clinical research (OCRe) to show its strength in modeling pharmacogenomics publications, studies and evidence in an extensible and easy-to-understand way. The second aim of this research was to exploit OWL 2 DL to build a knowledge-based system that enables formal representation and automatic retrieval of pharmacogenomics evidence for systematic review with meta-analysis. The conceptual model developed in Aim 1 was encoded into an OWL 2 DL ontology using Protégé. The constructed ontology provides approximately 400 formalized vocabularies, which were used in turn to formally represent 73 individual publications, 82 individual studies and 445 individual pieces of evidence, and thereafter formed a knowledge base. After a series of subsumption checking and instance checking using Hermit reasoner, the implemented knowledge-based system was verified as consistent and correct. The third aim of this research was to use the implemented knowledge-based system to provide four applications in pharmacogenomics evidence assessment. The first application focused on the ontology-driven evidence retrieval for meta-analysis. A total of 33 meta-analyses selected from 9 existing systematic reviews were used as test cases. The results showed that the ontology-based approach achieved a 100% precision of evidence retrieval in a very short time, ranging from 9 to 23 seconds. The second application addressed the evidence assessment of the clinical validity of CYP2C19 loss-of-function variants in predicting efficacy of clopidogrel therapy. The third application addressed the evidence assessment of the comparative effectiveness of genotype-guided versus non-genotype-guided warfarin therapy. These two applications focused on ontology-driven evidence classification to provide useful information to assist in the planning, execution, and reporting of a multitude of meta-analyses. The fourth application focused on ontology-driven interpretation of a multitude of synthesized evidence that was enabled by formal representation of synthesized evidence and typology of clinical significance in the context of assessing clinical validity and clinical utility of pharmacogenomics. In conclusion, the

major contributions of this research include: deriving an extensible conceptual model that expresses heterogeneous information content, constructing an ontology that exploits the advanced features of OWL 2 DL, and implementing a knowledge-based system that supports ontology-driven evidence retrieval, classification and interpretation. Future research would focus on (1) enhancing the system's applicability in pharmacogenomics evidence assessment by representing evidence of other sub-domains of pharmacogenomics such as cancer drugs, and (2) expanding the system's capability beyond pharmacogenomics evidence assessment by representing individuals' genomic profiles and providing evidence-based interpretation based on their individual genomic profiles. With the enhanced applicability, the pharmacogenomics knowledge-based system might improve pharmacogenomics evidence assessment as well as evidence-based interpretation of pharmacogenomics at the point of care, and ultimately increase the adoption of pharmacogenomics in routine clinical care.

**A Bilingual Fuzzy Ontology-based Approach to R&D Project Management** Springer Science & Business Media

With the advancements of semantic web, ontology has become the crucial mechanism for representing concepts in various domains. For research and dispersal of customized healthcare services, a major challenge is to efficiently retrieve and analyze individual patient data from a large volume of heterogeneous data over a long time span. This requirement demands effective ontology-based information retrieval approaches for clinical information systems so that the pertinent information can be mined from large amount of distributed data. This unique and groundbreaking book highlights the key advances in ontology-based information retrieval techniques being applied in the healthcare domain and covers the following

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areas: Semantic data integration in e-health care systems  
Keyword-based medical information retrieval  
Ontology-based query retrieval support for e-health implementation  
Ontologies as a database management system technology for medical information retrieval  
Information integration using contextual knowledge and ontology merging  
Collaborative ontology-based information indexing and retrieval in health informatics  
An ontology-based text mining framework for vulnerability assessment in health and social care  
An ontology-based multi-agent system for matchmaking patient healthcare monitoring  
A multi-agent system for querying heterogeneous data sources with ontologies for reducing cost of customized healthcare systems  
A methodology for ontology based multi agent systems development  
Ontology based systems for clinical systems: validity, ethics and regulation

Ontology-Based Information Retrieval for Healthcare Systems John Wiley & Sons

Development of high throughput data acquisition in a number of domains (e.g., biological sciences, space sciences, etc.) along with advances in digital storage, computing, and communication technologies have resulted in unprecedented opportunities in scientific discovery, learning, and decision-making. In practice, the effective use of increasing amounts of data from a variety of sources is complicated by the autonomous and distributed nature of the data sources, and the heterogeneity of structure and semantics of the data. In many applications e.g., scientific discovery, it is necessary for users to be able to access, interpret, and analyze data from diverse sources from different perspectives in different contexts. This thesis presents a novel ontology-driven approach, which builds on recent advances in artificial intelligence, databases, and distributed computing to support

customizable information extraction and integration in such domains. The proposed approach has been realized as part of a prototype implementation of INDUS, an environment for data-driven knowledge acquisition from heterogeneous, distributed, autonomous data sources in Bioinformatics and Computational Biology.

*An Ontology-based Approach to Personalized E-learning Framework Design and Development* Springer Nature

"Ontologies are now increasingly used to integrate, and organize data and knowledge, particularly in data and knowledge-intensive applications in both research and industry. The book is devoted to semantic data mining--a data mining approach where domain ontologies are used as background knowledge, and where the new challenge is to mine knowledge encoded in domain ontologies and knowledge graphs, rather than only purely empirical data."--page [4] of cover.

Data Integration in the Life Sciences John Wiley & Sons

Enter a magical world of friendship and fun! In the sixth book of the first Secret Kingdom series, every fairy in the kingdom is at Glitter Beach to watch the magic being renewed in the kingdom for another year. But Queen Malice is also nearby... Can Ellie, Summer and Jasmine save the glitter dust and keep the magic alive? Secret Kingdom is a brand new series full of the things girls love most: special friendships, secrets and magical adventures. Newly confident readers will be swept away by the magical stories of three children whose courage and resourcefulness save a fantastical land from disaster. Full of all the things little girls love best: special friendships, secrets and magical

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adventures, all set in an incredible kingdom! Eye-catching illustrations throughout. Become best friends with Ellie, Summer and Jasmine - plus Trixi the pixie! Help Ellie, Summer and Jasmine save the Secret Kingdom from wicked Queen Malice and her naughty storm sprites. A new exciting adventure in each and every book.

Developing an Ontology-driven Requirements Analysis Tool (OntoRAT) Springer Science & Business Media

This book constitutes the refereed proceedings of the First International Workshop on Data Integration in the Life Sciences, DILS 2004, held in Leipzig, Germany, in March 2004. The 13 revised full papers and 2 revised short papers presented were carefully reviewed and selected from many submissions. The papers are organized in topical sections on scientific and clinical workflows, ontologies and taxonomies, indexing and clustering, integration tools and systems, and integration techniques.

*Ontology-driven Translation of Geospatial Data* IOS Press

ABSTRACT: The ontology approach has been accepted as a very promising approach to semantic integration today. However, because of the diversity of focuses and its various connections to other research domains, the core concepts, theoretical and technical approaches, and research areas of this domain still remain unclear. Such ambiguity makes it difficult to develop a complete framework to evaluate and improve various ontology tools and systems developed for the purpose of semantic integration, and may also limit future in-depth study and system development due to the

lack of a comprehensive review of present work and unsolved problems. This research reviewed the past research on semantic integration from the ontology driven perspective, and formalized its related concepts and elements into a framework with four major dimensions. By utilizing such a framework, this research identifies various necessary tasks for each dimension, therefore clarifying the major components for the ontology driven semantic integration, and such an approach could be a cornerstone for building an ontology of ontology integration research in the near future.

*Semantic Knowledge Management: An Ontology-Based Framework* Springer

Scientific Study from the year 2020 in the subject Computer Science - General, language: English, abstract: Information shared over the web keeps escalating gradually and rapidly. Due to this fast and steady growth, well-known problems are associated with retrieving desired information when needed. However, a few initiatives were introduced in the previous decade with the development of search engine technology. The search engine technology aids in the collection, storage and pre-processing a wide range of information to deliver relevant resources instantly in response to users' needs. Nevertheless, users sometimes need more effort to obtain desired information. This paper discusses the concept of information retrieval with some emphasis on the different information retrieval models. Furthermore, this paper will describe how documents are

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analyzed and ranked using different models.

An Ontology-based Approach to Management of Model Knowledge

LAP Lambert Academic Publishing

Current methods for specifying data models lack well-defined descriptions of the expressions, which represent data types, attributes, attribute values, and operations. It is impossible to define clear translation rules for data models, because the relation between source and target data model elements is not computable.

Furthermore, translation has to account for imprecision caused by conceptual heterogeneities and measurement error. In this thesis we use the DOLCE foundational ontology to provide a semantic reference frame for geospatial data. Available extensions to DOLCE are profiled and additional geospatial characteristics, such as topological relations, are included. Annotating (or semantically referencing) expressions, which are used to define geospatial data models, with this frame supports computability and allows for selecting appropriate translation rules on the attribute level. Using a logic-based approach, semantically referenced data models allow for inferring relations between source and target attributes. This includes inference on applicable translation operations and the detection of match types (exact, upper bound, and lower bound) between attributes. If detected match types fit the user's purpose, translation scripts are extracted. The scripts are executed using an algebraic theory, which includes propagation of measurement errors. The approach allows for specifying data model semantics and imprecision. A demonstrator is provided as proof of concept. Our research is guided by an example of translating information about road width from a national data model (ATKIS road data model) to an international one (INSPIRE Data Specification for Transport Networks). IOS Press is an international science, technical and medical publisher of high-quality books for academics, scientists, and professionals in all fields. Some of the areas we publish in: -Biomedicine -Oncology -Artificial

intelligence -Databases and information systems -Maritime engineering -Nanotechnology -Geoengineering -All aspects of physics -E-governance -E-commerce -The knowledge economy -Urban studies -Arms control -Understanding and responding to terrorism -Medical informatics -Computer Sciences

**Ontology-Based Interpretation of Natural Language** Springer

Ontologies are now increasingly used to integrate, and organize data and knowledge, particularly in data and knowledge-intensive applications in both research and industry. The book is devoted to semantic data mining – a data mining approach where domain ontologies are used as background knowledge, and where the new challenge is to mine knowledge encoded in domain ontologies and knowledge graphs, rather than only purely empirical data. The introductory chapters of the book provide theoretical foundations of both data mining and ontology representation. Taking a unified perspective, the book then covers several methods for semantic data mining, addressing tasks such as pattern mining, classification and similarity-based approaches. It attempts to provide state-of-the-art answers to specific challenges and peculiarities of data mining with use of ontologies, in particular: How to deal with incompleteness of knowledge and the so-called Open World Assumption? What is a truly “semantic” similarity measure? The book contains several chapters with examples of applications of semantic data mining. The examples start from a scenario with moderate use of lightweight ontologies for knowledge graph enrichment and end with a full-fledged scenario of an intelligent knowledge discovery assistant using complex domain ontologies for meta-mining, i.e., an ontology-based meta-learning approach to full data mining processes. The book is intended for researchers in

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the fields of semantic technologies, knowledge engineering, data science, and data mining, and developers of knowledge-based systems and applications.

*A PRACTICAL PLANNING INTEGRATION FRAMEWORK FOR ONTOLOGY-DRIVEN APPLICATIONS.* Springer Science & Business Media

"This book addresses the Semantic Web from an operative point of view using theoretical approaches, methodologies, and software applications as innovative solutions to true knowledge management"--Provided by publisher.

*Ontologies* IGI Global

Presenting an autonomic approach of QoS Management, Multimedia Ontology Driven Architecture for QoS Management in Home Networks focuses on QoS management for multimedia applications in the context of home networks. The book presents a QoS framework, taking into account user preferences as well as QoS application requirements. Written for computer science students and lecturers as well as IT professionals, the book shows how semantic models facilitate and drive QoS management while considering context information, such as user preferences.

**An Ontology-based Approach to Data Cleaning** John Wiley & Sons

With the current changes driven by the expansion of the World Wide Web, this book uses a different approach from other books on the market: it applies ontologies to electronically available information to improve the quality of knowledge management in large and distributed

organizations. Ontologies are formal theories supporting knowledge sharing and reuse. They can be used to explicitly represent semantics of semi-structured information. These enable sophisticated automatic support for acquiring, maintaining and accessing information. Methodology and tools are developed for intelligent access to large volumes of semi-structured and textual information sources in intra- and extra-, and internet-based environments to employ the full power of ontologies in supporting knowledge management from the information client perspective and the information provider. The aim of the book is to support efficient and effective knowledge management and focuses on weakly-structured online information sources. It is aimed primarily at researchers in the area of knowledge management and information retrieval and will also be a useful reference for students in computer science at the postgraduate level and for business managers who are aiming to increase the corporations' information infrastructure. The Semantic Web is a very important initiative affecting the future of the WWW that is currently generating huge interest. The book covers several highly significant contributions to the semantic web research effort, including a new language for defining ontologies, several novel software tools and a coherent methodology for the application of the tools for business advantage. It also provides 3 case studies which give examples of the real benefits to be derived from the adoption of semantic-web based ontologies in "real world" situations. As such, the book is an excellent mixture of

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theory, tools and applications in an important area of WWW research. \* Provides guidelines for introducing knowledge management concepts and tools into enterprises, to help knowledge providers present their knowledge efficiently and effectively. \* Introduces an intelligent search tool that supports users in accessing information and a tool environment for maintenance, conversion and acquisition of information sources. \* Discusses three large case studies which will help to develop the technology according to the actual needs of large and or virtual organisations and will provide a testbed for evaluating tools and methods. The book is aimed at people with at least a good understanding of existing WWW technology and some level of technical understanding of the underpinning technologies (XML/RDF). It will be of interest to graduate students, academic and industrial researchers in the field, and the many industrial personnel who are tracking WWW technology developments in order to understand the business implications. It could also be used to support undergraduate courses in the area but is not itself an introductory text.

A Knowledge-based System for Intelligent Support in Pharmacogenomics Evidence Assessment

"This book provides an opportunity for readers to clearly understand the notion of ontology engineering and the practical aspects of this approach in the domains of two interest areas: Knowledge Management Systems and Enterprise Systems"--  
*Ontology-driven Information Extraction and Integration from Heterogeneous Distributed Autonomous Data Sources*

For humans, understanding a natural language sentence or discourse is so effortless that we hardly ever think about it. For machines, however, the task of interpreting natural language, especially grasping meaning beyond the literal content, has proven extremely difficult and requires a large amount of background knowledge. This book focuses on the interpretation of natural language with respect to specific domain knowledge captured in ontologies. The main contribution is an approach that puts ontologies at the center of the interpretation process. This means that ontologies not only provide a formalization of domain knowledge necessary for interpretation but also support and guide the construction of meaning representations. We start with an introduction to ontologies and demonstrate how linguistic information can be attached to them by means of the ontology lexicon model lemon. These lexica then serve as basis for the automatic generation of grammars, which we use to compositionally construct meaning representations that conform with the vocabulary of an underlying ontology. As a result, the level of representational granularity is not driven by language but by the semantic distinctions made in the underlying ontology and thus by distinctions that are relevant in the context of a particular domain. We highlight some of the challenges involved in the construction of ontology-based meaning representations, and show how ontologies can be exploited for ambiguity resolution and the interpretation of temporal expressions. Finally, we present a question answering system that combines all tools and techniques introduced



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throughout the book in a real-world application, and sketch how the presented approach can scale to larger, multi-domain scenarios in the context of the Semantic Web. Table of Contents: List of Figures / Preface / Acknowledgments / Introduction / Ontologies / Linguistic Formalisms / Ontology Lexica / Grammar Generation / Putting Everything Together / Ontological Reasoning for Ambiguity Resolution / Temporal Interpretation / Ontology-Based Interpretation for Question Answering / Conclusion / Bibliography / Authors' Biographies

*An Ontology-driven Approach to Personalised MHealth Application Development*

Effectively documenting data services is a crucial issue in any organization, not only for governing data but also for interoperation purposes. Indeed, in order to fully realize the promises and benefits of a data-driven society, data-driven approaches need to be resilient, transparent, and fully accountable. This book, *Abstraction in Ontology-based Data Management*, proposes a new approach to automatically associating formal semantic description to data services, thus bringing them into compliance with the FAIR (Findable, Accessible, Interoperable, and Reusable) guiding principles. The approach is founded on the Ontology-based Data Management (OBDM) paradigm, in which a domain ontology is used to provide a high-level semantic layer mapped to the source schema of an organization containing data, thus abstracting from the technical details of the data layer implementation. A formal framework for a novel reasoning task in OBDM, called *Abstraction*, is introduced in which a data service is assumed to be expressed as a query over the source schema, and the aim

is to derive a query over the ontology that semantically describes the given data service best with respect to the underlying OBDM specification. In a general scenario that uses the most popular languages in the OBDM literature, an in-depth complexity analysis of two computational problems associated with the framework is carried out. Also investigated is the problem of expressing abstractions in a non-monotonic query language as well as the impact of adding inequalities. Regarding the latter, the problem of answering queries with inequalities over lightweight ontologies is first studied. Lastly, the author illustrates how the achieved results contribute to new results in the Semantic Web context and in the Relational Database theory. The book will be of interest to all those engaged in Artificial Intelligence and Data Management.

#### Semantic Data Mining

During the last two decades, the idea of Semantic Web has received a great deal of attention. An extensive body of knowledge has emerged to describe technologies that seek to help us create and use aspects of the Semantic Web. Ontology and agent-based technologies are understood to be the two important technologies here. A large number of articles and a number of books exist to describe the use individually of the two technologies and the design of systems that use each of these technologies individually, but little focus has been given on how one can - sign systems that carryout integrated use of the two different technologies. In this book we describe ontology and agent-based systems individually, and highlight advantages of integration of the two different and complementary technologies. We also present a methodology that will guide us in the design of the - tegrated ontology-based multi-agent systems and

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illustrate this methodology on two use cases from the health and software engineering domain. This book is organized as follows:

- Chapter I, Current issues and the need for ontologies and agents, describes existing problems associated with uncontrollable information overload and explains how ontologies and agent-based systems can help address these - sues.
- Chapter II, Introduction to multi-agent systems, defines agents and their main characteristics and features including mobility, communications and collaboration between different agents. It also presents different types of agents on the basis of classifications done by different authors.

#### *An Ontology-Driven Sociomedical Web 3.0 Framework*

Although electronic health record (EHR) has been used for decades and progress has been made in its adoption, paper or document based forms are still in wide use in various clinical settings such as epilepsy center, movement disorder program, and cancer center. Effective data management approaches and systems are needed to be able to make use of the data generated from patient care in order to improve outcomes. In this thesis, we present the design, implementation, and evaluation results from three live clinical web systems: Trial Prospector, Ontology-driven Patient Information Capture system for epilepsy (OPIC), and DataBase system for Deep Brain Stimulation (DBSDB). These systems are for different clinical programs and have different application purposes, but the challenges faced in these programs are common and the methods and solutions introduced for these systems are general and interrelated. These methods work together to effectively complete clinical data management tasks, such as data capture, navigation, query, and visualization. The contributions of the

thesis consist of: a generic configurable role-based access control management module to systematically authorize different group of users to the system according to their specific responsibilities; a design methodology of ontology-guided data capture; an ontology-driven interactive interface to build comprehensive queries for patient cohort identification; a new approach for data organization using a technique called active dashboard; and an improved method for agile software development. Trial Prospector manages 85 active clinical trials and has matched more than 5,374 patients to these trials to find eligible participants; OPIC has generated 1140 discharge summaries; DBSDB has captured more than 1,000 clinical data forms for 264 patients. DBSDB has 16 active users, Trial Prospector has 68 active users, and OPIC has active 100 users. Feedback from these users indicate that our systems are robust and user friendly.