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Ontology-based proactive knowledge system

Xia Shixiong[1] Zhang Lei[1] Zhou Yong[1] Niu Qiang[1] Ding Qiulin[2]

([1] School of Computer Science and Technology, China University of Mining and Technology, Xuzhou 221008, China)

([2] Computer Application Institute, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China)

Abstract: With the aim to address the problems presented in knowledge utilization in knowledge-intensive enterprises, the ontology-based proactive knowledge system (OPKS) is put forward to improve knowledge utilization. Proactive knowledge service is taken as the basic idea in the OPKS. The user knowledge requirement is taken as the driving factor and described by the user knowledge requirement. Ontologies are used to present the semantic of heterogeneous knowledge sources and ontology mapping is used to realize the interoperation of heterogeneous knowledge sources. The required knowledge is found by matching the user knowledge requirement with knowledge sources and is provided to the user proactively. System analysis and design of OPKS is carried on by adopting UML. The OPKS is implemented in Java language. Application in a certain institute shows that the OPKS can raise efficiency of knowledge utilization in knowledge-intensive enterprises.

Key words: ontology; knowledge; proactive

The product structure and function in knowledge intensive enterprises are more and more complicated. It is necessary for product designers to have more knowledge to accomplish business activities. At the same time, a valuable repository of knowledge is accumulated in the enterprise. How to use and share the knowledge has become a major problem. The knowledge management system (KMS) manages knowledge sources, promotes the enterprise knowledge to be shared and reused, and helps the designer to discover related knowledge about his task in order to improve task performance[1].

Presently, the KMS mainly provides the knowledge retrieval function. The user gets the required knowledge through knowledge retrieval. This kind of knowledge utilization method has the following drawbacks:

1) The user usually does not know what he wants. It is more difficult for him to retrieve knowledge accurately using the right keywords.

2) The user's thinking is often interrupted by knowledge retrieval resulting in additional burden outside of the business task.

3) The knowledge required for different users to accomplish the same task is different due to differences in personalities. The personality cannot be expressed in knowledge retrieval.

Aiming to address the drawbacks mentioned above, some researchers[2–4] have proposed push-based knowledge use by combining knowledge management with business processes.

1 OPKS Architecture

OPKS architecture is presented in Fig. 1.

OPKS mainly includes four layers: knowledge source layer, knowledge description layer, knowledge middle layer and knowledge application layer.

1) Knowledge source layer It includes different knowledge sources in the enterprise. These knowledge sources have different formats, such as text file, relation database, object-oriented database, knowledge base, ontology etc. They have heterogeneity as regards semantics and structure.

2) Knowledge description layer Knowledge source ontologies (KMO), knowledge source uniform description (KSUD) and domain ontologies (DO) are used to describe knowledge sources. KSUD expresses knowledge sources uniformly. DO expresses domain knowledge in the enterprise and provides domain knowledge to the knowledge sources.

3) Knowledge middle layer It is the core in the OPKS. It consists of user knowledge requirement management, ontology management, heterogeneous knowledge source search and knowledge source management, etc.

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Biography: Xia Shixiong(1961—), male, professor, xiasx@cumt.edu.cn.

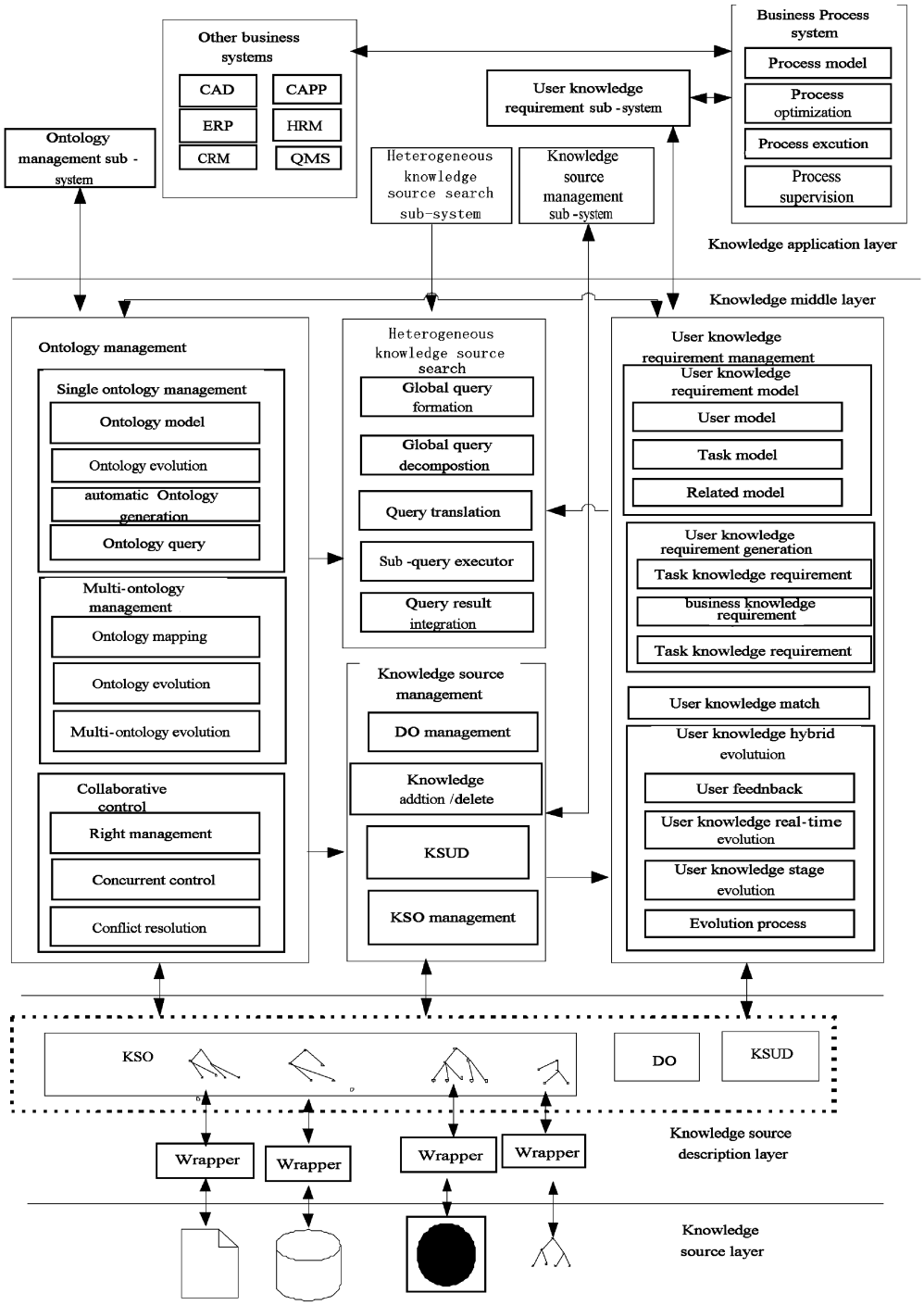

Fig. 1 OPKS architecture

4) Knowledge application layer It consists of other business systems, the process management system, the ontology management sub-system, the user knowledge requirement sub-system, the heterogeneous knowledge source search sub-system, and the knowledge source management sub-system etc.

2 OPKS Operation Process

OPKS operation process is shown in Fig. 2.

① User constructs the user model. The user model expresses the basic user information and the knowledge level etc.

② Knowledge engineer establishes domain ontology, knowledge source ontology and knowledge source uniform description to carry out knowledge source management.

③ Process instance is executed in the process engine. The work-list is delivered to user. The user performed his task by the aid of the business system.

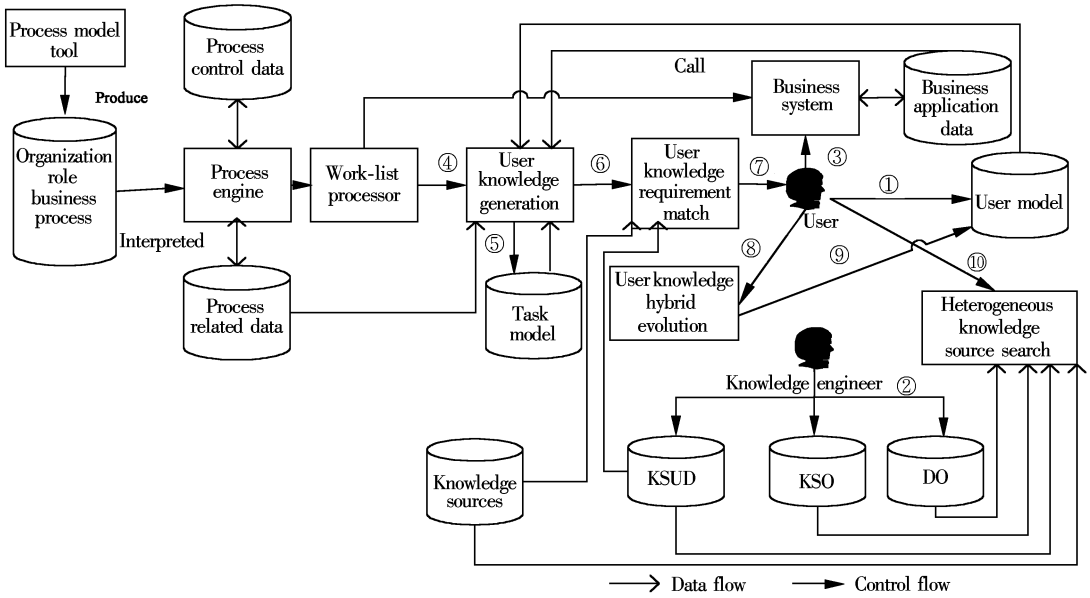

Fig. 2 OPKS operation process

④ Work-list triggers knowledge requirement.

⑤ User knowledge requirement generation obtains task model from the process model and related data.

⑥ User knowledge requirement generation produces user knowledge requirement according to the user model and the task model and delivers it to user knowledge requirement match.

⑦ User knowledge requirement match matches knowledge sources according to user knowledge requirement and delivers actively acquired related knowledge sources to user.

⑧ User knowledge hybrid evolution supervises feedback from the user for the recommended knowledge sources, carries on evolution to the user knowledge according to the user feedback.

⑨ User knowledge hybrid evolution modifies the user model to reflect the change in the user knowledge.

⑩ The user can obtain satisfactory results through heterogeneous knowledge source search if he is dissatisfied with the recommended knowledge.

3 OPKS Implementation

Rational ROSE is taken to analyze and design the OPKS. The OPKS system analysis based on UML is shown in Fig. 3. Parts of the OPKS system analysis class diagram are shown in Fig. 3.

Java language is adopted and web service is developed combining the axis web service engine in the OPKS. Parts of running interfaces of the OPKS are shown in Fig. 4.

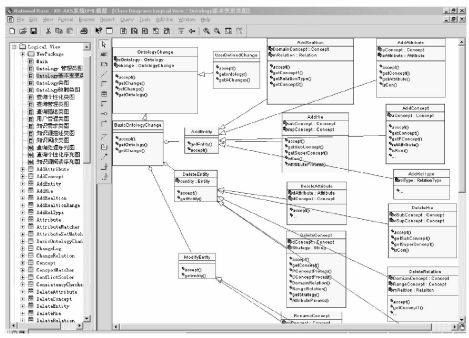

Fig. 3 OPKS system analysis based on UML

Fig. 4 Knowledge source ontology edit

4 Conclusion

Knowledge management demand in a knowledge-intensive enterprise is analyzed and the OPKS is put forward in this paper. The OPKS architecture is given and the main contents of each layer are introduced. The OPKS operation process is provided. The OPKS is analyzed and designed in UML. Parts of class diagrams and running interfaces are shown. The proposed OPKS can promote knowledge utilization and exploitation efficiency of the knowledge lift by proactive knowledge supply in the knowledge-intensive enterprise.

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基于本体的主动式知识系统

夏士雄[1]　张　磊[1]　周　勇[1]　牛　强[1]　丁秋林[2]

([1] 中国矿业大学计算机科学与技术学院, 徐州 221008)
([2] 南京航空航天大学计算机应用研究所, 南京 210016)

摘要:针对知识密集型企业知识利用中存在的问题,提出了基于本体的主动式知识系统 OPKS,以促进知识的利用. OPKS 以主动式知识服务为基本思想,以用户知识需求为驱动因素,通过用户知识需求模型描述用户知识需求的决定因素. 利用本体描述异构知识源语义,利用本体映射实现异构知识源互操作. 通过用户知识需求与知识源匹配找到所需的知识,主动提供给用户. 采用 UML 对 OPKS 进行系统分析和设计,采用 Java 语言进行实现. 某研究所应用表明 OPKS 能提高知识密集型企业知识利用效率.

关键词:本体;知识;主动式
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