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## **Project Renaissance: A Semantic Web Based Java Framework for Knowledge Management**

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### **ABSTRACT**

Knowledge Management services support universal mapping, discovery, creation and communication of knowledge. Web portals are well-known Knowledge Management services. The Resource Description Framework (RDF) adds Artificial Intelligence to web portals, transforming them into Semantic Webs. RDF enables inference queries to discover knowledge from Semantic Webs. Today, the most well-known form of web portal is the centralized, consumer-oriented hub. In this work, a distributed, collaborative form of a semantic web portal is described, the personal knowledge service. This paper presents Project Renaissance, an open-source Semantic Web based Java framework for Knowledge Management applications, which focus on the human being as a knowledge creator.

### **Keywords**

Knowledge Management, Semantic Web, RDF, portal, Java.

### **1. INTRODUCTION**

Project Renaissance is an open-source effort to build a Java framework for platform independent Knowledge Management applications, including portal, workflow and collaboration services.

The name "Renaissance" is inspired by the creative european movement between the XV and XVI centuries, a cultural rebirth in the arts and sciences powered by the invention of the press. Project Renaissance refers to a similar revolution happening again within the new Knowledge Society, powered by the Internet. Its anthropocentric style shifts the focus of the knowledge technologies from the machine to the human being as the source of innovation. Project Renaissance builds upon the vision that technology should be used to augment human intellectual skills and to support the freedom of expression in a free world.

Project Renaissance emphasizes the production of knowledge (innovation) by offering support for personal productivity hubs. The Project Renaissance model abstracts from the centralized and distributed (peer-to-peer) models with an unified model. This model supports the concept of a personal knowledge server, which is a semantic web server working as a personal media server.

The objective of Project Renaissance is to create a metamodel for Knowledge Management applications around knowledge maps, leveraging the Resource Description Framework (RDF) and other Semantic Web technologies. This metamodel shall integrate seamlessly with the Semantic Web models at the syntactic and semantic levels.

### **2. KNOWLEDGE SERVICES**

Knowledge is useful information, but information can only be useful if it can be easily accessible. Web portals are considered a great solution to Knowledge Management, and Java offers a richer user experience as well as platform independent portal applications. With the Semantic Web, Java can leverage the web intrinsic potential for Knowledge Management as hypermedia with a standard platform for knowledge servers.

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A web portal is characterized by a combination of directory services, search engines, personalized content delivery and convenience services. Among the web portal features, one of the most interesting is its application of knowledge maps in directories and search engines. Semantic Web technologies enable smart portals, offering a true Knowledge Management infrastructure to deliver information of better quality.

A knowledge server supports the creation, distribution and universal access to knowledge. A true knowledge server must support the concept of a collective intelligence, which is the union of the knowledge of all the actors within a virtual community, both humans and robots. Knowledge as innovation, is considered the only long term sustainable resource in the Knowledge Society, for it's unexhaustible and its value increases with the use, and declines with the time. Knowledge is created within communities, being corporations, education sites or other collaboration groups.

The Project Renaissance Knowledge Management Framework offer an unified metamodel for organizing knowledge services which supports and simplifies the development of Knowledge Management applications. This unified metamodel builds upon existing and emerging Semantic Web standards, like RDF, to represent knowledge maps.

### **3. AN ARCHITECTURE FOR KNOWLEDGE MANAGEMENT**

Project Renaissance offers a Java API and an open-source Reference Implementation. Both are free, and the API is implementation independent. There can be other implementations of the API, both commercial and free software.

The Project Renaissance API is meant to support the development of the following kinds of both centralized and distributed Knowledge Management applications:

- digital libraries
- directories
- search engines
- personalized content delivery
- webmail
- discussion forums
- instant messaging
- intelligent whiteboards
- videoconferencing
- peer-to-peer collaboration
- brainstorming and creativity
- schedules
- project management
- web-based CASE tools
- process workflows
- case-based reasoning
- skills management
- e-learning
- knowledge trees

The Project Renaissance API must offer an universal model for organizing knowledge services which support all of these kinds of applications. This unified model builds upon the open standards Java and XML, and it must integrate seamlessly with other Java APIs like J2EE and J2ME, and peer-to-peer standards Jini and JXTA.

The framework is comprised of the following layers: UNION, Service, Channel, and Agent layers. The core layer is the UNION (Universal Object Network). It contains the knowledge metamodel classes, along with the actors hierarchy, which include creators (users) and servants (robots). There's also interest group classes to support the collective intelligence.

The knowledge metamodel is a resource-centric, content-addressable memory model. The concept of "resource" in the Project Renaissance API is not necessarily the same as RDF's. It corresponds roughly to an "object" in the Smalltalk pure object-oriented model. Anything is a resource, even an association. A resource is a composite, it aggregates other resources. This way, one can always ask, "

Resources are contained in contexts, or mindspaces, which can be seen as multidimensional resource pools or knowledge maps or models. Mindspaces are resources too, of course. Resources can reference resources

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in other mindspaces, either locally using memory references, or globally using URIs.

The UNION layer contains mindspaces, actors and groups. Project Renaissance focus on the human being as a knowledge creator. It represents users as creators (artists) which are supported by servants and participate in collaboration groups with other creators. Creators own mindspaces, servants don't. Mindspaces can be copied and shared by groups, but there's always only one owner for each mindspace instance.

The Service layer plugs service providers to handle communication at the protocol level. It offers an unified view of communication. There is a WebService for HTTP, MailService for SMTP-POP-IMAP, DirectoryService for LDAP-DNS-FileSystem (via JNDI), SearchService, RelationalService (via JDBC), RmiService (for CORBA, EJB), JiniService, JxtaService etc.

Next is the Channel layer. Channels are also known as portlets, or web portal components, but "channel" is a more widely known name and better reflects the concept. Channels implement content formatting and delivery, using XSLT. Channels can be minimized, maximized and customized. Minimized channels are just links. Maximized channels are full pages. Customized channels are one or more channels integrated by a personalization channel. The personalization channel applies user layout preferences over the content for presentation.

Content management in Project Renaissance is performed by a controller, in an MVC-like fashion. The controller manages the workflow of the session, activating the channels chosen by the creator. The channels exchange messages with the world through services. Messages contain documents, which are, again, resources.

The Project Renaissance API supports intelligent agents as a kind of servant. Agents are built in the Agent layer. Support for mobile agents is still to be addressed in Project Renaissance. It's not the focus.

#### **4. DISCUSSION**

Most of the discussion relate to mindspaces. The greatest challenge in Project Renaissance is to build a metamodel for the Semantic Web. It started with RDF and a content-addressable memory model as a metamodel, the mindspace. Several design choices were considered for a mindspace, namely, a collection of resources, a collection of associations and a collection of resources and associations. Each one has its strength and weakness. A collection of associations was considered for it's similarity with the RDF model, but it's more specific and not resource-centric. A collection of resources and associations was considered for it's a familiar approach to graph modeling and diagram drawing. The choice was a collection of resources because it's the most abstract and resource-centric model.

There are questions about web services, and integration issues with SOAP and XML-RPC, WSDL, UDDI, and others. Also, questions regarding JMS, the Java Messaging Service and JAXM, the Java API for XML Messaging. The position is that Project Renaissance must be as much light-weight as possible. Project Renaissance is not meant to run on a smart card, or on a refrigerator, but it could be interesting to see it running on a PDA, and on a cellular phone, personal communication appliances. Although its modular structure scales for heavy configurations.

In this moment, Project Renaissance is been bootstrapped. There is a special requirement that the tool is to be built with itself. The project web portal, [www.project-rennaissance.org](http://www.project-rennaissance.org), and the collaboration tools will be built with the evolving prototype. This portal is meant to be many things to many people. Beyond Project Renaissance, it's a portal of Knowledge Management, Semantic Web, and Renaissance Community projects. For the future, it's planned a Renaissance Foundation to support Project Renaissance and its applications in social fields, particularly in education.

#### **Acknowledgements**

I would like to thank Bill Joy from Sun Microsystems, Daniel Schwabe from Pontificia Universidade Catolica do Rio de Janeiro, Gina de Oliveira from Universidade Presbiteriana Mackenzie, Valdemar Setzer from Universidade de Sao Paulo, Fernando Giorno from Pontificia Universidade Catolica de Sao Paulo, Vera Vidal from Fundacao Instituto Oswaldo Cruz, and the Renaissance community for their support and encouragement, as well as the following open-source communities for their contribution: Java, Jini, JXTA, OpenOffice, NetBeans, Apache, Mozilla, Linux, BSD, GNU, RDF and Semantic Web.

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## Biography

Marcus Miguel Maciel is a Java consultant and instructor for Sun Microsystems in Brazil. He has 17 years of experience with software development, including 11 years doing Object-Oriented and Knowledge Management research and development, and five years working with Java. He has developed CASE tools, Artificial Intelligence applications, multiplatform GUI architectures, Object-Oriented environments and web portal tools. He has taught courses on Object-Oriented software development, C++, Java and UML, and gives lectures in universities and conferences. His areas of most interest include Knowledge Management and Cognitive Science.