Resourceome for e-Government: Semantic Web Tool for Managing PA Resources

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1 Introduction

e-Government is a wide, complex and dynamic process that involves Public Administration (PA) into a mesh of social, technical, and organizational issues [otEC03]. To enable the success of e-government, PA has the need to introduce dynamic and flexible solutions and suitable tools both to organize, retrieve and keep up to date human, technical, environmental and financial resources and to drive service design. Quality of e-government service and the application of semantic web technology have been studied as possible approaches in such context [CPR08, CSP$^+$07, SRC$^+$09].

In this paper, we propose the use of Resourceome [CCM07, CFMV08] in the e-Government domain. Resourceome is an intuitive and user-friendly web-based tool for managing the resources through a semantic approach. It uses a multi-level knowledge model and supports the representation, visualisation, integration and querying of resources according to the application domain, in this case e-Government. In this context interesting solutions have been introduced. Athene [HNTvA07] provides an environment for graphical modeling of business processes that are automatically transformed into ontologies. It supports domain experts, without the need for them to be familiar with semantic web technologies. For what concerns the knowledge intensive services, Kiss [FHT07] provides a 3-phase procedure starting with a semi-formal representation, followed by a formal representation, leading to a machine executable representation. We believe that the integration of Resourceome into Athene following the Kiss's approach would provide a powerful tool to help civil servants and more general government administrations to convey towards a digital administration.

The rest of the paper is organized as follows. Section 2 provides an overview on Resourceome. Section 3 introduces our proposal in the integration of Resourceome into Athene following Kiss approach with the description of a possible scenario, and Section 4 concludes.

2 Resourceome: Multilevel Model and Semantic Web Tool

The Resourceome knowledge model is organized into multi-level ontology: Top knowledge (Upper ontology), Base knowledge (Domain and Resource ontology) and Application knowledge (Task and Rules ontology). It provides different abstraction levels of knowledge representation, according to Guarino's approach [Gua98]. Focusing on Base and Application knowledge, the Resourceome main characteristic is the separation between abstract concepts related to the specific domain considered - for example, in the e-government, domain the concept of *moving* or the concept of *citizenship* - and physical concepts related to their resources - e.g. the *legislative reference* that allows moving from a municipality to another and *registries* that store citizens sensible data. In this way, the Resource ontology, besides to formalize the resources concepts, links them to the proper domain that is specified in the Domain ontology.

The implementation of the Resourceome model has been carried out with an hybridization of the OWL-DL [Rec04] and SKOS [W3C] languages, the result of which makes the system flexible and allows relations between resource individuals and domain concepts. We represent concepts as individuals of SKOS-concepts class. SKOS can provide a bottom level for describing specific sub-concepts with less formalization than that needed by the is-a relationship.

Based on the Resourceome model described briefly above, we have developed a semantic web-based tool for the representation, visualisation, integration, storing and querying of resource knowledge using Semantic Web technologies. The tool provides an easy and precise guide to add and maintain resources, mapping them on the domain by means of a user-friendly web interface (see Figure 1). The Resourceome web tool is a system able to support interoperability, maintainability, reusability, scalability and performance. The system functionalities are organized into three tiers: Front End, Business Logic and Back End. The Front End of the system is characterized by a user friendly interface allowing the navigation of the Resourceome model through web-based interfaces or stand-alone applications. The communication with the business logic is based on SOAP messages. The Knowledge visualisation is provided by using the Grappa Java library [GN00]. The Business Logic provides both management of resources and execution of goals. At this level the reasoner supports the querying of ontologies and guarantees their integrity. The Back End stores OWL-DL/SKOS files encoding the ontologies of Resourceome.

The expressiveness of the Resourceome model and the functionalities of its management tool are suitable to support both workflow design and execution by providing to the user a clear view on domain-dependent resources, in particular those that can be managed at runtime.

3 Integrating Resourceome with Athene and Kiss

In a previous work [CMM04], we proposed a three-layered software architecture specifically designed for a middleware supporting the execution of distributed applications for

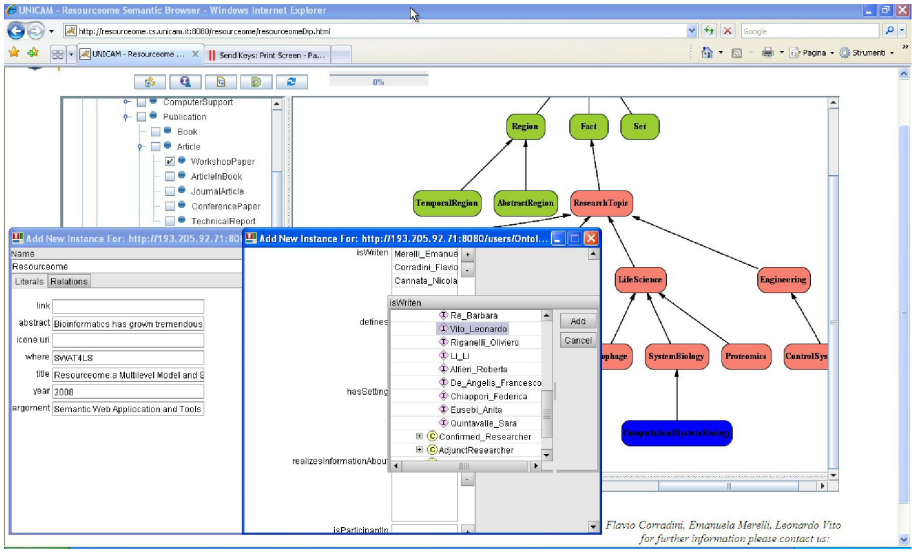

Figure 1: Resourceome Web Tool Interface.

the orchestration of human/system activities. At the top of the architecture, a *User Layer* enables the specification of a workflow of activities. In the middle of the architecture, the *System Layer* provides the needed environment to map a user-level workflow into a pool of software agents - workflow executors - which implements a set of more primitive activities. At the bottom of the architecture, the *Run-Time Layer* provides the access through specialized wrapper agents to all tools, services and resources needed to support the run-time execution of system level agents. The dynamic generation of an agent-based workflow engine using a knowledge base - resources ontology - of a specific application domain [BCM06] was developed over Hermes [CM05], a middleware for mobile computing. In [CEMR04] we have also defined the architecture of an agent-based matchmaker to support the resource discovery that fulfills the knowledge base. In a recent work we have proposed to integrate the Resourceome concept within the three-layered architecture - by implementing the knowledge base component - and providing a concrete architecture for the Knowledge Grid [CCM07].

Resourceome lays in the *System Layer* and it is supported by three main components: the *Resourceome manager* and the two agents *Resource discoverer* and *QoR (Quality of Resources)* certification authority. The *Resourceome manager* is responsible to maintain and interface the Resourceome, monitoring also resource availability. To this purpose, this component interacts with the other two agents. *Resource discoverer* localizes new resources available in large scale open and distributed systems. Besides localizing resources, it is necessary to filter them to assure their quality. This is the role of the *QoR* certification authority. The above described system can play the role of the “resource allocation execution management service” and the “knowledge discovery service”.

To the light of our experience we propose to join our approach to that proposed by the competence center in “Information and knowledge management” of University of Applied Sciences Northwestern Switzerland named Athene and Kiss. We believe that it is important to support knowledge intensive domains such as e-government. A preliminary study is summarized by Figure 2 that shows the impact of the integration within the three-layered architecture. Our proposal is twofold. On the one hand, our aim is to provide an environment to support civil servants in the business process specification according to needs of process related tasks in the e-Government domain. To reach this aim we introduce Athene at *User Layer*. It takes advantage of the Resourceome modeling capabilities in splitting domain and resources. On the other hand, we guarantee the agile process modeling approach via the integration of Kiss’s three-phase procedure into our three-layered architecture. In particular, phase one is supported by *User Layer* and it captures knowledge from business users. Phase two transforms models into a precise, machine understandable form in line with the resources specification and thanks to the Resourceome functionalities. It is implemented in *System Layer*. Finally, phase three support to the run-time model execution that is dynamically generated thanks to agent-based workflow engine. Last but not least, we believe that such integration is able to guarantee an holistic quality-based approach focusing on domain-dependent characteristics such as resource sharing, coordination, transparency and control impacting on the three layered software architecture [CHPR09].

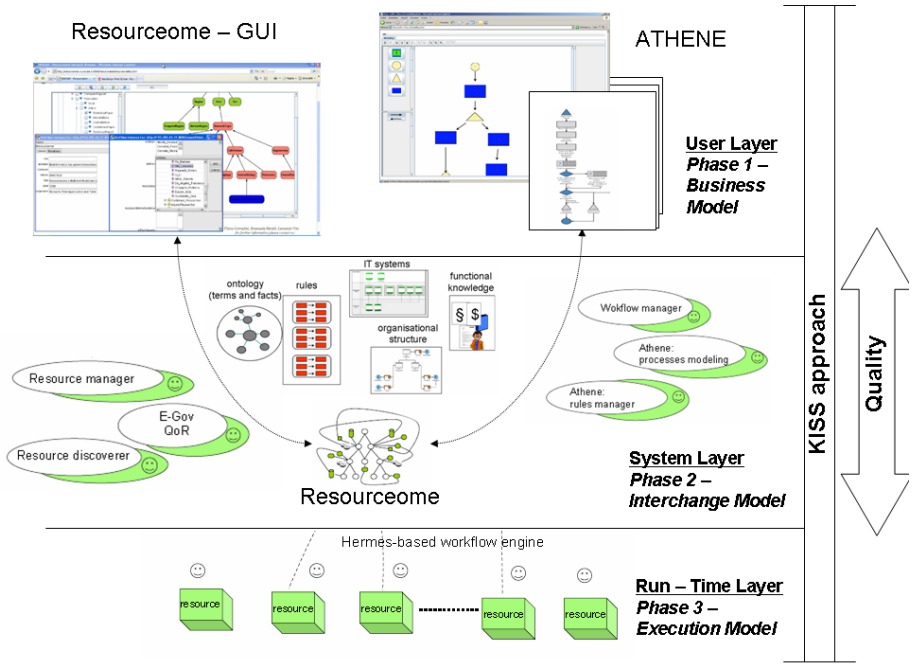

Figure 2: Integrated Resourceome Systems Architecture.

To make clear the potentiality of our proposal we refer to one of the main e-government

service. Suppose to use our environment at design time for the *moving service* implementation. Part of the work system (human participants, machine, information, technology and other resource) is already specified in Resourceome ontology. The civil servant design the moving service business process using Athene. He/she recognizes the different participants (registration and deregistration municipalities, citizens, vehicle licence office, ...) and implements the set of work steps that are performed within the work system. Then the execution of the service is supported by the system and run-time layers according to the service specification and the available resources (i.e. civil servant times, registry offices, municipality organization, PAs' software and hardware infrastructures). Their availability is dynamically guaranteed by Resourceome and by the quality policies controlling the service delivery.

4 Conclusion

The integrated Resourceome vision proposed in this paper is intended to provide a suitable environment to help civil servants and more general government administrations to convey towards a digital administration.

Preliminary results showed that Resourceome is very promising for resource management in bionfiormatics [CCG+07]. In the e-government domain the integrate version of Resourceome seems to be a promising solution. We believe that the integration of Resourceome into Athene following Kiss's approach would provide a powerful and user-base environment suitable to satisfy PA's needs.

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