K@Work — Earth Observation Knowledge at Work

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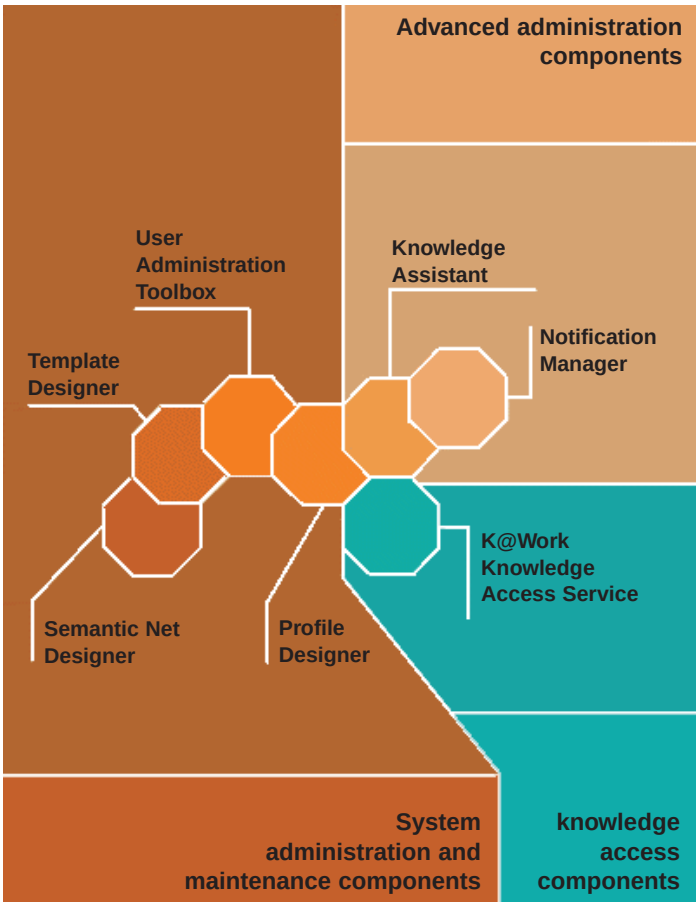
Résumé

Les futures applications de l'observation de la Terre, dans des domaines comme la gestion des catastrophes, l'agriculture ou la pêche, sont appelées à bénéficier des améliorations apportées par les systèmes de gestion des connaissances et les systèmes experts. L'Agence travaille depuis plusieurs années à des outils et méthodes permettant d'accéder plus facilement aux données, produits et services de télédétection. L'expérience acquise à cette occasion a ouvert la voie à la mise au point du logiciel K@Work.

Figure 1.
The components of k@work.



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Earth observation knowledge

The requirement for an effective knowledge management tool has been on the agenda of information managers for more than two decades. Data, information, best practice and know-how are the assets of a modern organisation. They increase competitiveness, sustain innovation, and maintain the quality of products and services. Knowledge management is also an issue in the exploitation of Earth Observation (EO) data, which have been acquired by a variety of instruments flown on board satellites, and the products and services derived from them by facilities of the corresponding ground segments.

Remote sensing applications need these data, products and services, as well as additional parameters and measurements taken from other sources. The identification, understanding, interpretation and exploitation of the EO data, products and services, and their possible integration with other data (like meteorological data) is often the work of experts. The expansion of the exploitation of the capabilities of satellite remote sensing for EO demands increasing involvement of non-specialists in remote sensing, who manage applications relying on many diversified and complex data types provided by different sources. Even the selection of the best EO sensors and products for a specific application requires a high level of user expertise. The integration of EO products and their exploitation in other areas of application like geographic information systems (GISs) and their use for specific purposes is also far from trivial.

For the past few years, ESA's Earth Observation Applications Department has been working on systems for the modelling, deployment and exploitation of knowledge, based on semantic networks and object oriented databases, with the purpose of offering an intelligent guide to the available EO products as well as an EO knowledge navigation system. The initial prototype, named Earth Observation Knowledge Navigational System (Eknos), has demonstrated the viability of the chosen approach. It also provides non-expert users with a simplified access to the EO products best suitable for a specific application, through the use of a semantic network populated with the concepts taken from an EO-specific thesaurus.

The product K@Work [1] is the industrial result of this line of activity and it is now being exploited to build the European Schools Portal for Learning Earth Observation.

This project aims at distributing EO knowledge to secondary schools across Europe.

Knowledge @ work

Building on the experience gained in the design of Eknos, AIS SpA has continued to invest in, and engineer, the various software components developed during the prototyping of K@Work, performed under contract to ESA. The kernel of this knowledge repository employs an object-oriented database which can quickly model the knowledge base. Dynamic access to the stored knowledge is provided by a semantic network, through which users navigate the knowledge base. K@Work represents knowledge with a two-level information model: one level is dedicated to user concepts and the other to the instances of knowledge. The two-level model allows the expansion of K@Work to include features like the spreading activation of the query or the semantic association function described below.

A classical problem in knowledge modelling and management arises because different users have (and need) different views of the same information and knowledge. A typical scenario for teaching EO in schools provides the teacher with a view that is different from that offered to the pupil. The issue of providing views over knowledge may become more challenging when one envisages the use of EO products and data together with GISs for decision support in disaster management. In such cases, multiple views are needed: one for the EO specialist, and others for the geologists, the civil protection authority, the land office, and so on .... All of these cases can be handled by the administration console of K@Work, through which user profiles can be designed and managed and the appropriate knowledge views exploited.

K@Work allows several navigation and information retrieval models to be built on a single knowledge base. This ability, combined with the profile designer (Figure 1) associates with each user his chosen way to exploit the knowledge base allowing him to navigate the semantic network in his own way.

One of the largest problems faced by knowledge engineers is the design and modelling of the knowledge base. To meet the challenge posed by this problem and the other issues of knowledge management, K@Work has a modular structure, in which each module addresses a specific knowledge management issue.

The architecture of K@Work implements a three-tier model, which separates the user interface (any web browser) from the web and application server and from the object oriented knowledge database.

The three-tier model and the modular software structure allow K@Work to run on most popular platforms. To cater for enhanced functional expandability, the server architecture has been built on several software components (Figure 2):

- knowledge access service, providing information through the knowledge portal;
- search engine facilities, permitting to search and retrieve the desired information;
- knowledge management server (including the semantic association function);
- administration console;
- knowledge repository and repository manager.

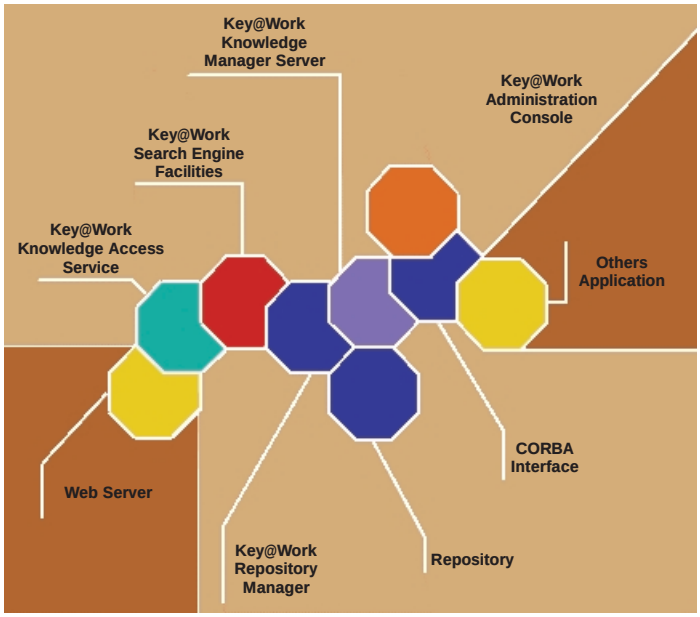

Figure 2.
The multiple tier architecture of k@work.

The knowledge access service allows the user to browse the information contained in the semantic network or (together with the search engine facilities) to retrieve it via a guided search and retrieval tool. Queries sent to the retrieval engine are supported by modules which can suggest what to search and can be expanded automatically by the spread activation engine. The web-based user interface can be easily customised according to the corporate look and feel. The knowledge access service allows the construction of an effective Internet knowledge portal which integrates seamlessly the existing web servers. The knowledge management server has a common object request broker architecture (CORBA) interface, through which it can be integrated with other distributed applications, to effectively manage and build the knowledge network.

[1]http://www.katwork.com