

Managing globally distributed expertise with new competence management solutions – a big-science collaboration as a pilot case

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Introduction

In today's global organisations and networks, a critical factor for effective innovation and project execution is appropriate competence and skills management. The challenges include selection of strategic competences, competence development, and leveraging the competences and skills to drive innovation and collaboration for shared goals. This paper presents a new industrial web-enabled competence management and networking solution and its implementation and piloting in a complex big-science environment of globally distributed competences.

The difficulties related to the acceptance of a new solution among users are well known. The paper discusses different options to use the solution on different organisational levels and presents several important aspects and steps we have found of crucial importance in facilitating the successful implementation and winning common acceptance of a new management solution, and the features that differentiate the solution from commercially available competence management solutions and services. Some key technical and system-specific issues, for instance the user and access management, database and security issues, various software versions, application servers and hosting service options are also discussed.

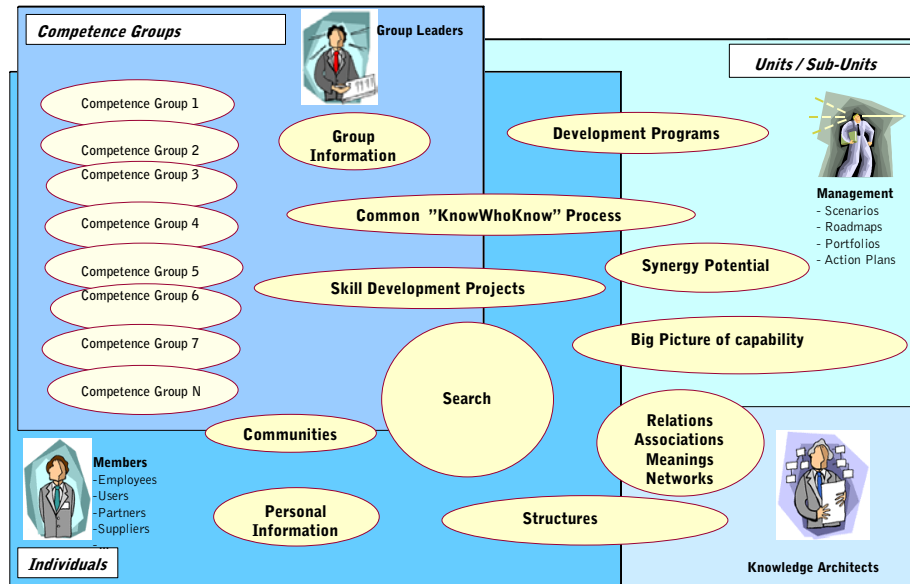
1. New Web-enabled solution for competence management

Discussions with representatives from several industrial organisations have made it evident that traditional top down approach of managing organisations' competences does not necessarily yield optimal results. Such competence management practices tend to result in static information that quickly gets outdated. Competence management tool in question was developed with this observation in mind.

The driving force was to both create a tool suitable for the management of an organisation to get a bird's eye view of the competence assets of an organisation at any given time and simultaneously make this information widely available to the employees.

Pre-requisite for systematic competence management is the existence of common knowledge management taxonomy and definitions within an organisation. Knowledge architects are in charge of maintaining this taxonomy based on requirements from the business. Top-level categories of taxonomy are technology, competence, partner, customer, project, product and process.

Fig. 1. The competence management concept



Each employee is then personally responsible for maintaining his or her competence profile, which can also include associations between various knowledge items and non-formal items such as description of work experience. Maintaining the profile includes self-assessment against defined levels of competence. Individuals also have a possibility to propose new knowledge items to be included in the taxonomy. Personal profiles, excluding the self-assessment ratings, are published across the whole organisation. This enables a common *know-who-knows* process to be established. Individuals can also establish and join informal communities for the purpose of sharing experiences on topics of interest.

Individual competence information is used collaboratively in planning and following the development of an employee's personal competence. Storing competence profiles at the level of individual employees, allows anyone in a managerial position to create roll-up reports of competence information, hence making it possible to analyse the overall competence level of an organisation in relation to the business challenges. Privacy protection is implemented through access rights management.

It is also possible to define job profiles within the tool. This feature makes it possible to define optimal competence requirements for any given position. When filling a position it is possible to easily search for individuals with the required competencies.

Technically speaking the competence and networking solution in question is entirely web based with a centralised database and an application server. Application itself is written in Java and is J2EE compliant. End-users access the system over the Internet using either an HTML client or a Java client depending on role. Web-traffic is encrypted with SSL, using a 128-bit encryption key, and authentication and access control is based on software certificates. Personal service profiles are stored in an LDAP directory.

2. Piloting with Big-Science

The web-enabled competence management and networking solution is being implemented and piloted in a complex Big-Science environment of globally scattered competencies. The environment is the global Muon Collaboration of the ATLAS Experiment. ATLAS is building an enormous scientific instrument to be assembled underground in the CERN¹ Laboratory on the Swiss-French frontier. Due to switch on in 2007 for detecting physics collisions, ATLAS detector will be used for some 10 to 15 years. The goal is to explore the fundamental nature of matter and the basic forces that shape our universe.

ATLAS is the largest collaborative effort ever attempted in the physical sciences, with some 2000 individuals participating from more than 150 research institutes and universities in 34 countries. These individuals form a global network of experts who have to work together as a team while being thousands of miles apart and spread over the world. In the Muon Collaboration alone, there are 44 institutes in 10 countries, including institutes such as MIT and Harvard in the USA, Saclay in France, INFN in Italy, Weizmann Institute in Israel, KEK in Japan, Dubna in Russia and Nanjing University in China.

The successful design and construction of a large and complex state-of-the-art detector requires the creative participation of many people. There are numerous subsystems and sub-subsystems enabling people to work mostly in small groups. All the systems must fit and work together, and be affordable. The challenge is to have the best world-class expertise available to execute all the planned as well as the unexpected tasks within a tight project schedule and budget. A big global one-off project of such magnitude needs to be well prepared for surprises as the project advances.

In the case of ATLAS, competence management case is not so much for developing new products but to make sure the gained expertise is available in the existing knowledge matrix; and in cases where expertise is identified to disappear, to train and educate new people to take over in time. Expertise is centred around geographically localised points and the system aims at securing this by exposing the skills base on a global level, exerting indirect peer pressure to the local centres concerned to maintain their knowledge base (if not exposed, others might not notice disappearing skills before it is too late).

In a scientific environment, it is important to maintain the hierarchical structure within the knowledge network; each participating institute has a group leader, which acts as a 'node' or gate keeper towards the collaboration. In practice, these 'nodes' represent the entire knowledge base towards the collaboration even though it is well understood the work is factorised across the member institute personnel. This same structure is maintained in the competence tree (see Fig.2), thus not identifying skills on an individual basis even though for external skills-seekers this would be more desirable.

The team leader is thus responsible for maintaining the knowledge base in his/her institute. The aim of the use of the software tool is to make sure this remains so and if there is a potential problem, the collaboration has time to react in the overall interest of the community. A typical problem could be e.g. the need to rebuild parts of the detector or the maintenance of a piece of hardware or software

¹ CERN is the European Organisation for Nuclear Research, the world's largest particle physics centre. CERN exists primarily to provide particle physicists with particle accelerators and the related infrastructure and administrative services. Founded in 1954, the laboratory was one of Europe's first joint ventures and includes now 20 Member States.

developed by people that have left the collaboration. In ATLAS, such tasks are not normally taken over by individuals, as it would not be very efficient to form a group of individuals from different groups. The solution is to spot a group or a few groups that can take the responsibility. Logically, the use of the tool on group level, instead of individual level, seems to be more suited to ATLAS needs.

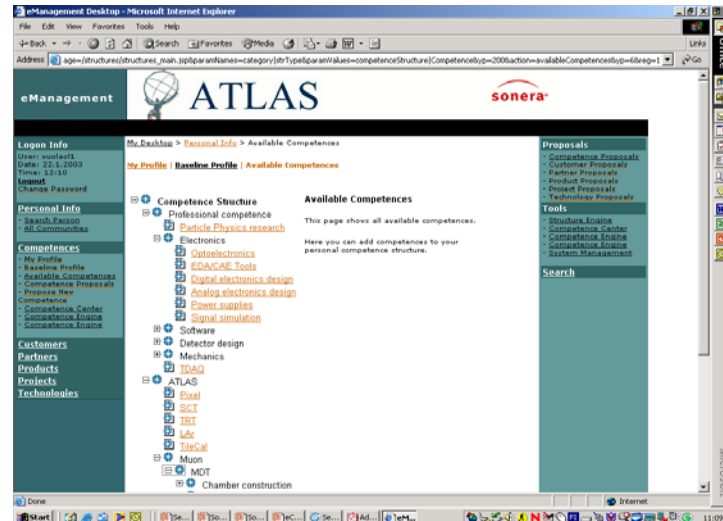


Fig. 2.

Previous experience with implementing management tools within ATLAS has not been always very encouraging. Two major reasons were found for unsuccessful implementation. First, scientific collaboration is very different from the industry: One cannot force scientists and member institutes to share such tools even if agreed upon the collaboration level. Unless such tools provide direct benefits to the groups concerned they will not use them. Institutes and individual scientists are keen to maintain their academic independence and consider often such tools as intruding. Secondly, unless pushed by the project management, the use of such software tools did not gain critical mass.

Technical issues

Piloting experience covers also various technical and system-specific issues, including user and access management, database and security issues, various application software versions, application server environment and hosting service options.

Unexpected problems were encountered, for example, when implementing strong authentication based on software certificates. Java clients packaged for delivery with Java Web Start seized to start when using SSL. This problem was identified to being related with Java Web Start version 1.0.1 and was resolved by upgrading it to version 1.2. Also the R&D of the application software advanced in parallel with the pilot project and two different versions of the software were tested by ATLAS.

The biggest problems, however, were related to the application servers. Originally Sonera developed the application for BEA WebLogic application server, which was not available at CERN. J2EE architecture allowed for porting the application to another application server environment and the HP-AS application server was chosen as the environment for initial piloting. However, there were complications in porting the components that access the underlying ORACLE database. Problems were eventually sorted out, but the actual amount of work totalled more than double the estimated.

Initial piloting at CERN proved that there were serious stability and performance problems with the HP-AS application server that made it nearly impossible to use the application as intended. Performance comparison tests proved that the problems were related to HP-AS and not to network issues, and it was decided that piloting would be continued in the BEA WebLogic environment at Sonera. The database and application were moved from CERN to Sonera's environment in Finland and the performance improved remarkably.

3. Present status and future prospects

Piloting has provided Sonera with valuable user feedback and also both technical and process specific experience. The users find the present version practical, useful and user-friendly and easy to use. Technical problems of the developed competence management solutions are solved and, from the technical point of view, the solution is ready for commercial launch. Based on the results collected from the Muon collaboration, wider implementation in ATLAS is planned later this year and the pilot use has raised interest also in the ATLAS member universities and institutes.

Also CERN organisation is now considering the implementation of the solution. Requirements for an implementation at CERN include the following:

- Access and user management: The system should be "open" and be able to plug into an existing authentication system. A web-based mechanism for single-sign login for distributed web-based applications and services is implemented at CERN.
- Architecture: The system should run on any J2EE compliant Application Server that the client might already have selected and is using. It is very expensive, in terms of operation and implementation, to enforce a specific server. In addition, more client side logic is wanted to be moved to the server side.
- The application: For an effective implementation on a general scale within the laboratory the application would require to be used on an individual level with an emphasis on end users maintaining their own data. It is clear that it would be essential to recuperate data from legacy systems and to integrate with and interface to the existing corporate HR related applications.

Any eventual general implementation would be preceded by a small scale pilot implementation with usage at the individual level followed by an evaluation of the effectiveness of the system at the level of recording and correlating competence data at this level with reference to the financial cost and resources needed for a full scale implementation. An evaluation would also be required of the potential benefits in laboratory HR management at a strategic level, i.e. medium to long term planning, internal personnel mobility and the external recruitment process.

4. Lessons learned

The basic approach of the tool being based on the self-assessment of each individual's skills and competences, it is strongly recommended to implement the tool on the individual level. The individual-level use sets requirements to both the system and the organisation in question: User and access management, including the delivery process of new users, usernames, passwords and security certificates, as well as the elimination of obsolete users and control should be well defined, designed and executed. On the other hand, the organisational obstacles should be identified and, if possible, eliminated by skilful management, encouragement and discussion on all levels of the organisation. ATLAS is a special case in many ways, especially because of its special collaborative character based on voluntary contributions.

On the other hand, we were positively encouraged that the tool was well suited also for managing competencies on group level rather than on individual level. Some minor software modifications are necessary to make the user interface clearer by eliminating features that concern solely the individual-level use. Consequently, only a few of all the multiple features of the tool will then be available. In any case, it was clearly demonstrated that the tool is applicable also to group-level use, if ever the organisation is willing to take that approach. One of the advantages of this approach is the decreased need for training. The disadvantage is that since the individuals do not manage their personal information and thus do not enter and update their own information, group-level users have to enter and update all information for the whole group. This might actually become a major obstacle to a full organisation-wide implementation.

Problems with user acceptance is a typical concern raised by organisations planning and considering to implement an ICT solution. We conclude with some general findings and recommendations for a successful implementation:

- Clearly specify the needs related to competence management and development in the organisation. If the needs are not clear, invest enough resources into the needs analysis. Benefits have to be demonstrated in the early phase.
- Start with the process definition and design. If the necessary competence development processes and related management practices are not yet in place, it takes time as some cultural changes may be necessary (because of implementing the process approach, not because of the tool... tool is to help the implementation of the chosen process and practices).
- Management support - and full commitment - is essential in the organisation-wide implementation of the new approach and related tools. Management is also responsible for communicating the implementation project and its importance throughout the organisation.
- Organise user training. With ATLAS, the pilot users easily learned to use the tool even with very limited training. Our pilot users, however, might be more familiar with IT systems than an average user of a typical average organisation. Probably much more training is needed in normal case, even more when implementing on individual level. Internal or external consultation and facilitation and workshops are highly recommended. Further information should be available and easily accessible for the users.
- The implementation in general should be well designed and executed: needs analysis, process re-engineering, specification, installation, facilitation, training, access delivery processes.
- Invest in the user interface: easy-to-use, simple and user-friendly. The user comes first, not the technology or fancy features. The tool has to be attractive and useful to all users on all levels of the organisation supposed to use it and enter information into it. It has to give more than take.
- None of the above mentioned precautions and actions help if the tool does not work properly and the overall system has technical problems. Even one single unexpected error when starting to use the application may heavily discourage the new user to such extent that the user will never try the second time. Extensive testing and piloting preceding product launch is necessary and important. Too often ICT solutions are sold without proper testing and pilot use, resulting in big trouble to the customer and bad reputation to the entire ICT sector. We encourage decision-makers, prior to the purchase decision, to require test results and to take advantage of the organisations earlier experience.

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