A Web portal for the Engineering and Equipment Data Management System at CERN

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Abstract. CERN, the European Laboratory for Particle Physics, located in Geneva - Switzerland, has recently started the Large Hadron Collider (LHC), a 27 km particle accelerator. The CERN Engineering and Equipment Data Management Service (EDMS) provides support for managing engineering and equipment information throughout the entire lifecycle of a project. Based on several both in-house developed and commercial data management systems, this service supports management and follow-up of different kinds of information throughout the lifecycle of the LHC project: design, manufacturing, installation, commissioning data, maintenance and more. The data collection phase, carried out by specialists, is now being replaced by a phase during which data will be consulted on an extensive basis by non-experts users. In order to address this change, a Web portal for the EDMS has been developed. It brings together in one space all the aspects covered by the EDMS: project and document management, asset tracking and safety follow-up. This paper presents the EDMS Web portal, its dynamic content management and its “one click” information search engine.

1. INTRODUCTION

CERN, the European Laboratory for Particle Physics, has recently started up the Large Hadron Collider (LHC) [1][2], a 27 km particle accelerator. The equipment data life-cycle management of this project is provided by the Engineering and Equipment Data Management System (EDMS) [3][4]. The CERN EDMS service was launched in 1997 with the goal of providing the LHC project with an advanced information system together with industrial best practice, for managing engineering information throughout the project’s entire life cycle.

Using an Oracle database as data repository, the service supports document and equipment data management throughout the entire life cycle of the LHC project: design, manufacturing, installation, commissioning and maintenance. The data collection phase, carried out by specialists, is now being replaced by a phase during which data will be consulted on an extensive basis by non-experts users.

The EDMS is a Product Life Cycle (PLM) [5] management system. Since the beginning of the production phase the system has grown significantly. Now the system manages about 1’000’000 equipment, approximately the same amount of documents, 76’000 projects and has around 6,000 registered users. And this is just the tip of the iceberg. The objects mentioned above have their own data. Today’s amount of stored information and scope of the users needs have prompted the EDMS team to redesign the EDMS home page, creating a new service portal to facilitate access to the system’s different modules and the increasing volume of information stored in the EDMS system.

In October 2008 the EDMS team launched a new EDMS portal, offering EDMS users a fast improved search functionality, quick navigation, last user actions display (which is called “user top 10 actions”) and categorized menus for accessing other modules.

2. EDMS PORTAL CONCEPTS AND STRUCTURE

The EDMS portal is the information hub of the system. Its main goal is to reduce the number of user clicks to get to the desired information (fig. 1).
As shown on Figure 1 the EDMS Portal consists of four parts:

- EDMS Web Portal categorized menu
- EDMS Web Portal search field
- My EDMS top 10
- Information

The categorized menu is a combination of the most important and frequently accessible parts of the EDMS. For instance in the menu part «Projects» the main EDMS projects with Sub-Projects are available (fig. 2).

![Figure 1. The EDMS Portal](image1)

![Figure 2. The EDMS Portal: projects](image2)

The EDMS being the CERN repository for technical documentation and equipment data, management of safety inspection reports was naturally integrated some years ago [6]. This is the reason of the «Safety» menu.

The most important functionality of the EDMS Web Portal is search. It is available in two ways. The first is through the categorized menus which guide users to the category specific search. The second and generic way of searching is the global EDMS portal search (the EDMS search field on fig. 1). In chapter 3 there is short description of the search possibilities and the search engine which lies behind the EDMS Web Portal. This search uses global EDMS metadata and Oracle Text technology to perform full text information search. It operates on about 2,000,000 EDMS metadata records.

The next block of the EDMS Web Portal is «My EDMS top 10». This functionality allows users to easily access documents, structures and equipment that they seem to be the most relevant to him. This
3. EDMS PORTAL SEARCH

In this chapter the EDMS Web Portal full text search and the search engine are presented. In general all searches in EDMS are related to types of EDMS information [7]. For instance, there is a document search, equipment search etc… The goal of the search engine is that it is not necessary to know the type of information a user is searching for.

The default behaviour is to search through all registered EDMS metadata.

The full text search is based on Oracle Text technology. This technology provides a mechanism to build a search index on accumulated metadata which makes context searching possible on the given information. «Context searching» means – search with any word, part of word, number, date etc… It provides a simple way of retrieving information and supports very advanced search syntax at the same time.

There are many default syntax functions provided by the Oracle Text functionality. Using these functions and applying them to developed rules for writing search requests, a flexible searching functionality is provided to users. The search engine recognizes the following reserved characters:

- «+» – AND
- «|» – OR
- «"…)» – Exact match

By default the search engine works in «AND» mode, whitespace is a string delimiter, and an exact match for a particular word has a higher relevance score. See example on fig. 3: the search result of a search on «LHC magnet dipole».

![Figure 3. Search result for « LHC magnet dipole»](image)

It is to be noted that access rights are checked for all records. If the given user has no access a red “stop sign” is displayed in front of the line.

The search result is categorized by the type of found information. The following example shows how powerful a search request can be, for instance a user search request is «synchronization|LHC+magnet+dipole+released» (fig. 4)
Figure 4. Search result for «synchronization|LHC+magnet+dipole+released»

It can be seen that equipment search results are related to the «synchronization» word but at the same time in the documents there are results for «LHC+magnet+dipole+released». This approach allows users to combine logically different searches in a simple and intuitive way. There are a few more advanced features [8] of the search engine but these are beyond the scope of this paper.

4. USER EDMS TOP 10 ACTIONS

EDMS logs the activity of users, so that the most frequently accessed pages will appear in a specific list. The EDMS top 10 actions mechanism is provided to allow users fast access to such commonly used pages. When a user is logged into the system every action (opening of a document, project, item etc…) is stored in the database.

In order to compute the relevance of an action, two metrics are used: the last time when the action has been executed (LOG_DATE) and number of times it has been executed (EXEC_COUNT). To compute action relevance the following parameters are defined:

\[ N_{hrd} \quad \text{- Number of high relevance days (number of days when action gets highest relevance value)} \]
\[ N_{drd} \quad \text{- Number of decreasing relevance days (number of days during which action relevance is decreasing)} \]
\[ C_p \quad \text{- Power factor for the count relevance (power coefficient for the EXEC_COUNT)} \]

The relevance of an action \( A \) is computed as follows: first, we obtain the time elapsed since the last execution of \( A \):

\[ \Delta_A = \text{SYSDATE} - \text{LOG_DATE}_A \]

Then, time relevance \( T_A \) is computed:

\[
T_A = \begin{cases} 
1, & \Delta_A < N_{hrd} \\
\cos \left( \frac{\pi}{2} \cdot \frac{\Delta_A - N_{hrd}}{N_{drd}} \right), & N_{hrd} \leq \Delta_A < N_{hrd} + N_{drd} \\
0, & \text{otherwise} 
\end{cases}
\]

and count relevance \( C_A \) is computed:

\[ C_A = (\text{EXEC_COUNT}_A)^{C_p} \]

The relevance of the given action \( R_A \) is then simply given by:

\[ R_A = T_A \cdot C_A \]

So, the time relevance graph looks as shown in fig. 5.
5. EXPLOITATION & FUTURE

Since the EDMS Portal was released in October 2008 some statistical information were collected. This information is used to investigate activity of the users and mark EDMS future improvements. Some gathered statistical information is presented on the fig. 6.

In the short term, EDMS Web Portal evolution will mainly concern internal functionality. The use of AJAX (Asynchronous JavaScript and XML) technology is being considered in background processing to provide better information access. Also, due to the start up of the LHC, new challenges are ahead relating to information representation and accessibility. In the future, other types of the information stored in the EDMS might become searchable through the full text search functionality, like for instance file names.

6. CONCLUSION

The EDMS Web Portal brings a new level of information access to the EDMS system. It provides faster access to the information, easier and more intuitive browsing through millions of documents, projects and equipment. It is built on user oriented dynamic content and full search information search functionality.

The architecture of the EDMS Web Portal allows its future extension to follow the evolution of the LHC onto its operational phase.
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