USING WORDPRESS AS A SIMPLE AND RELIABLE ELECTRONIC LOGBOOK FOR THE HEIDELBERG ION THERAPY CENTER (HIT) ACCELERATOR CONTROL SYSTEM

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Abstract

The HIT accelerator facility has used a web-based electronic logbook (elog) rather than other forms of logging since its commissioning. After the breakdown of the initially used java/XML based elog, the decision to use a more mature and reliable approach based on dynamic web and database technology was made. The target was to provide operators with a reliable and easily used system to record and discuss incidents during shifts, write error reports with screen shots and build and maintain a section of troubleshooting tips or "**F**requently **A**sked **Q**uestions" (FAQs). Several systems were evaluated and the combination of PHP scripting and MySQL database, as well as the excellent community support with plugins, customizations and bugfixing of the free publishing platform Wordpress, lead to a test installation. This test installation was then customized with themes and plugins to accommodate as much of the wishes of the operators as possible. After several months of live testing in the control room and some customization of the used plugins and theme, the HIT-Elog is now accepted by the operators and used on a daily basis.

THE HIT ACCELERATOR FACILITY

The Heidelberg Ion Therapy Center (HIT) is a dedicated hadron accelerator facility for radio-therapeutical treatment of tumour patients [1, 2]. The characteristic energy loss profile of hadron beams in irradiated materials lends itself to very precise radiation therapy with fewer side effects. The DNA destructive maximum of the particle occurs at the Bragg peak immediately before it comes to rest and very little energy is lost in the entry channel. The achieved energy range of 88-430 MeV/u for carbon ions and 48-221 MeV/u for protons is sufficient to reach a penetration depth of 20-300 mm in water. The facility is currently in the last phase of commissioning and the accelerator control system is nearly finished. Only certain functions from risk assessment and GUI revisions still need to be implemented [3]. The two horizontally fixed treatment places as well as the experimental area can be served with proton and carbon beams with qualified beam parameters, other ions like helium and oxygen have been tested. The first patient treatments are expected late in 2009.

ELECTRONIC LOGBOOKS

Starting with the commissioning of the HIT accelerator complex an electronic logbook was used to record shift activities, incidents and solutions to problems. During the early commissioning, an extensively modified version of the DOOCS eLogBook [4] (Fig. 1) was used, but in mid-2008 some critical functions in the java server technology, that the eLogBook relied on, broke down which lead to intermittent failures of search functionality. Because of a lack of java/tomcat expertise, the decision was made to switch to an Open Source based system which uses dynamic web and database technology and which could be better supported with available resources.

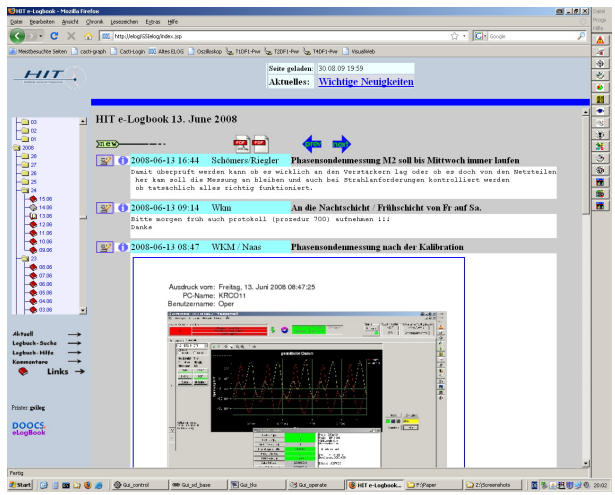

Figure 1: The initially used DOOCS eLogBook.

Finding a Replacement eLogBook

The primary requirements to finding a replacement were:

- Flexibility – easy to customize and make it look like the old eLogBook to help the transition.
- Usability – easy to use to promote posting of incidents and simplify shift reports
- Performance – no slowdowns with a large number of posts by many operators
- Maintenance – easy to maintain and large support community

Another requirement was to find a system that used stable and mature web technology. Because of available support know-how, a combination of a MySQL database and PHP scripts running on an Apache Web Server was chosen as preferred platform. After some preliminary investigation, blogging software, like the free online publishing platform Wordpress, promised to provide a flexible and rugged system, able to handle large amounts of content. Furthermore

these had been tested over and over in a wide variety of different environments and applications in millions of sites on the Internet. Further online inquiries were conducted and after some test installations of different software packages, Wordpress proved to meet and exceed all requirements.

Features of Wordpress

Wordpress.org calls Wordpress

> "a state-of-the-art publishing platform with a focus on aesthetics, web standards, and usability." [5]

We take a closer look at the key features of Wordpress in the context of the primary requirements in this section.

Flexibility The front end of a Wordpress installation can be customized with the use of themes. More than 900 different themes can be found on the themes section of the Wordpress homepage [6]. These themes differ in column layout, color schemes, sidebar placements, etc. They provide widgets which can be placed into sidebars to help filter and navigate the content with e.g. monthly and daily summaries or category and tag filtering (see Fig. 2).

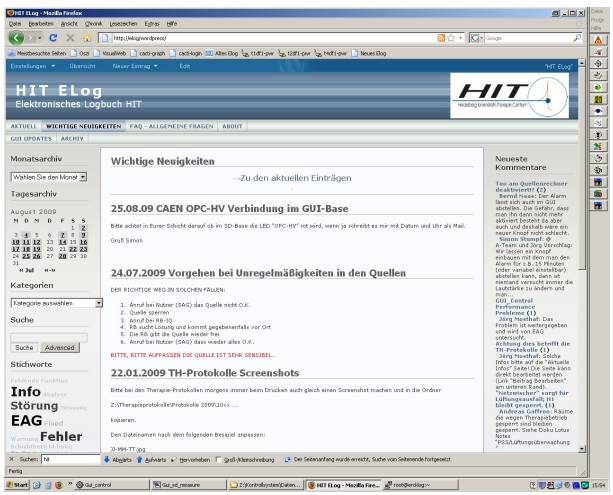

Figure 2: The Elog news page showing the chosen theme with filter and navigation widgets in the sidebars.

Another way to customize a wordpress installation, is to use plugins. There are more than 6.000 plugins available on the plugins section of the Wordpress homepage [7]. Plugins provide additional widgets or specialized functions. One example of a plugin used in the HIT Elog installation is the FAQ (**F**requently **A**sked **Q**uestions) plugin. It allows maintenance groups to record solutions to frequently appearing and easily fixed problems in an easy to use way. This reduces calls to on-call personnel for such problems.

Usability The back end focuses on usability and speed and makes creating and editing posts very easy. Standard formatting and editing tools are available in the WYSIWYG (**W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et) editor window which is similar to a word processor and allows easy uploading and embedding of image and other files (see Fig. 3). A source code editor allows more precise control over the content. Additional elements surrounding the edi-

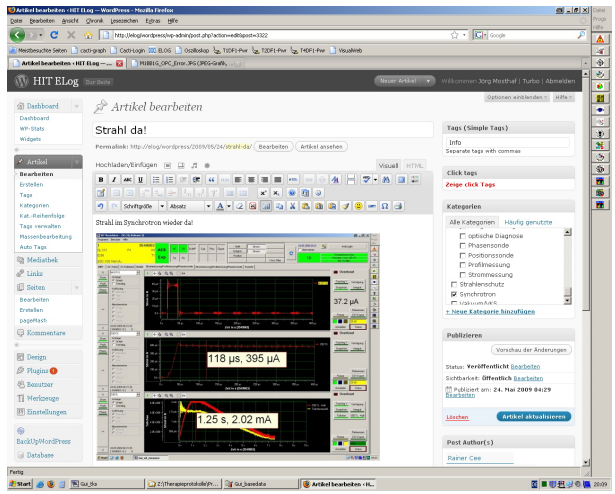

Figure 3: The editor page showing the WYSIWYG editor window and controls.

tor window on the editor page allow the operator to set the meta data of a post, including category, tags and multiple authors. Every change of a post is recorded and displayed at the bottom of the editor page along with auto-saves of content and can be compared to the current content and recovered. Every operator can arrange the layout of the editor page by dragging the elements to the desired location and hide unwanted ones.

Performance Wordpress is based on a PHP script system using a MySQL database as storage. The MySQL database is very fast and scales well [8] and is used in several large projects [9]. All content is stored in indexed tables in the database and is displayed dynamically according to filtering options. The server running the Elog is an industry standard 19" rack server with 1 GB of RAM and has never exceeded a load average of 0.4 since running Wordpress (see Fig. 4).

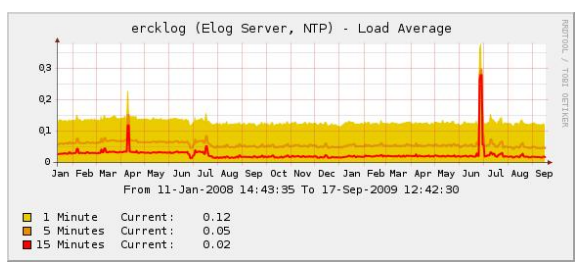

Figure 4: Average load of the elog server June 2008 to August 2009.

Subjective performance of the Wordpress installation is

very good for a web based software, no perceivable delays even with complicated search filters. Retrieval of single posts and daily or monthly archives is also instantaneous.

Maintenance Wordpress comes with a variety of maintenance tools to help keeping the installation running fast and clean. The built-in media library helps in finding and deleting orphaned media files. The article overview page helps in finding posts without tags or categories and helps in correcting problems. With the help of several plugins, maintenance of Wordpress can be made even easier and can be automated to a high degree. The "WP-DBManager" [10] reorganizes and cleans the database in intervals and also allows backups of the database content. "Wordpress Backup" [11] automatically does SQL- and full backups of all uploaded files and content and provides a simple interface to manage and restore backups (see Fig. 5).

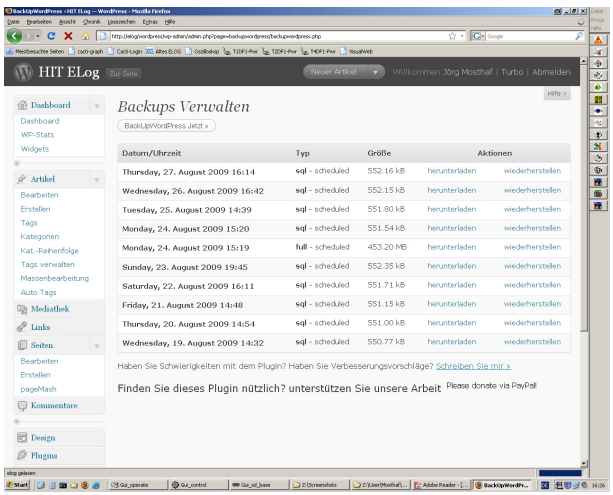

Figure 5: The Wordpress backup plugin.

Other plugins help with tasks like tagging and categorizing of many posts at once, posting and commenting statistics and many more. All in all, the HIT-Elog uses at the moment of writing a total of 26 plugins to help with maintenance and provide additional tools for administrators and operators alike. The user authentication system allows restricting of posting and commenting privileges to logged in users and also record all activity of users, making accidental deletions or changes of posts impossible.

Putting it All Together: Shift Reports One of the most important goals of the HIT-Elog was to give operators a flexible and easy-to-use tool to create shift reports. With the powerful editing tools Wordpress provides and the possibility of inserting a variety of media files into an article, standardized shift reports are easy to create. Templates in spreadsheets (for beam statistics) or in HTML can easily be pasted into an article and can then be customized and filled out by an operator.

ACCEPTANCE AND FUTURE

After several months of testing in parallel with the DOOCS ELogBook it is clear, that an Elog based on the open source publication software Wordpress is a workable alternative to proprietary electronic logbooks. Most operators have accepted the new HIT-Elog and use it extensively. It was necessary to customize the themes and use several plugins to get as close as possible to the DOOCS ELogBook. There are still some features that are difficult to get without custom made plugins (e.g. the ability to print screenshots directly to the Elog without having to upload them to the server), but some plugins are already in development, that provide similar features. Some features of Wordpress still cannot be used with the current network setup. E-mail notification of comments, FAQ requests and changes as well as posting articles by email are e.g. not possible without a dedicated mail server. Integration of accelerator data and statistics into automated shift reports is also planned for future developments. Wordpress, and with it the HIT-Elog, is still evolving fast to accommodate new needs and features.

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