

## Blogging Your PACS

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Acquiring, implementing, and maintaining a picture archiving and communication system (PACS) is an enduring and complex endeavor. A large-scale project such as this requires efficient and effective communication among a large number of stakeholders, sharing of complex documentation, recording ideas, experiences, and events such as meetings, and project milestones to succeed. Often, mass-market technologies designed for other purposes can be used to solve specific complex problems in healthcare. In this case, we wanted to explore the role of popular weblogging or "blogging" software to meet our needs. We reviewed a number of well-known blog software packages and evaluated them based on a set of criteria. We looked at simplicity of installation, configuration, and management. We also wanted an intuitive, Web-based interface for end-users, low cost of ownership, use of open source software, and a secure forum for all PACS team members. We chose and implemented the Invision Power Board for two purposes: local PACS administrative purposes and for a national PACS users' group discussion. We conclude that off the shelf, state-of-the-art, mass-market software such as that used for the currently very popular purpose of weblogging or "blogging" can be very useful in managing the variety of communications necessary for the successful implementation of PACS.

**KEY WORDS:** PACS, documentation, project planning, knowledge base, weblog

### INTRODUCTION

The process of purchasing, installing, configuring, operating, and evolving a picture archiving and communication system (PACS) is long and arduous. Unlike simple purchases of modality equipment, this process can and will last for many years. Documentation of a project of this magnitude is one of the keys to success. Whereas generic office documentation tools such as word processing packages and project management

software may fill one component of this documentation effort, there is a need for a more collaborative arrangement to capture the thoughts, actions, and activities of a potentially large number of PACS project participants, especially as the years progress and personnel on the project change.

As such, the need for a medium to publish, store, search, and exchange information and knowledge within communities, both public and private, exists. The Internet and World Wide Web (WWW) technology hold the promise of removing these inefficiencies and can be used for this purpose.

### WHY BLOG

Whereas E-mail is still the prevalent form of communication on the Internet today, it fails as a true medium for publishing and swapping ideas and comments because of an inability to easily create, maintain, and assign privileges to different participants in many mailing lists. Information broadcasts in this manner will only be available to individuals on the list. E-mail also lacks centralized archives for searching purposes. Some of these shortcomings of E-mail were addressed by

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*Online publication 2 September 2005*

*doi: 10.1007/s10278-005-7548-4*

the introduction of mailing list server software that simplified subscriber management, enabled searchable archives (limited to store only E-mails), and added security features. These mailing lists and their archives are, however, not ideally suited to act as a project knowledge repository.

Electronic bulletin boards (EBBs) were popular from the 1970s to the early 1990s. EBBs allowed members to use a telephone line to dial-in to modem pools to retrieve and upload information, software, and text messages. Limiting factors to this communication method included relatively slow transmission speeds, the potential for costly telephone bills, and the number of active, online users being constrained to the number of provider modem lines.

Newsgroups, also known as USENET, are online groups designed for threaded, multiparticipant discussions. A central server is set up to be the repository for submitted articles, or posts, from the members. A peer-to-peer network protocol then distributes the messages to other servers such that a discussion group may, at the owner's discretion, be available worldwide. Members can connect to the server and browse through the saved articles at their convenience, as opposed to having the articles and associated attached files forced upon them via E-mail. Most of the information transmitted is still in a plain text format. In recent years, USENET has begun to fall out of favor with many institutions as forums based on WWW technologies have gained in popularity because of their simplicity of use, accessibility, and richer text and graphic presentations.

Web technologies initially allowed for greater freedoms as far as formatting, styled text, and linked graphics were concerned. Advancements in the areas of user management, message board functionality, and privacy controls have resulted in a tool known today as a weblog, or blog<sup>1,2</sup> for short. Blogs take the form of a frequently updated Web page. Blog entries are typically arranged chronologically with the most recent submissions at the top of the page. Each blog holds discrete and independent pieces of information. The basic anatomy of a blog consists of the blog title, name, E-mail, and URL of the author(s), uploaded images and files, message posting time, a quote from another message, rich site syndication (RSS) for syndication purposes, and links such as hot-text links (e.g., link to definition of PACS), discussion links, and permanent links (e.g., a pointer to other

blogs). The blog server can track and link headlines and articles from other private or public Web sites via RSS aggregators mechanism. Hypertext markup language (HTML) tags are mostly able to be used in the text body of a blog. Whereas blogs have recently emerged as a sort of digital personal publishing mechanism for the WWW in general, the software can also publish and manage private weblogs to the point where they can be used as an extremely effective tool for information exchange and dissemination among PACS project team members.

## MATERIALS AND METHODS

Our first step in selecting a weblog was to create a set of criteria (Table 1) that was required for our blog. We then gathered information from essential blogging<sup>1</sup> and blogging<sup>2</sup> and searched the Internet for other blogs. We selected a set of blogs for evaluation. We evaluated each blog and marked down their features.

Many weblog-related products are available today, ranging from a free software that enables users to publish and customize weblogs on their own servers to a fee-based services that set up, configure, host, and manage user's weblogs.

Choosing a full-service blogging package such as Blogger (<http://www.blogger.com>), by Pyra Labs, is a relatively simple way for novices to get started. Blogger provides the servers, weblog software, and support. New users can begin to publish to a personal, free blog account within minutes of completing a brief registration process. Blogger offers several easy-to-use features such as instant publishing, template-driven design, script compatibility, and file transfer protocol. The solution afforded by Blogger does not provide the advanced security mechanisms, advertisement control, and the access required to perform weblog searches. These were all necessary specifications of our project.

There are several do-it-yourself weblog solutions available for those willing and able to install weblog software and possibly utilize their own servers and support resources.

Radio<sup>3</sup>, by UserLand Software, Inc. (<http://radio.userland.com>), is one of the most widely used weblog solutions available. Its client software runs on Windows operating systems as well as Mac OS X. Installation is simple so that new users may begin creating organized posts and publishing pictures to the Web relatively quickly. It has an easy and intuitive interface, automatic syndication, templates, content management, and off-line content editing. The purchase price includes 1 year of Web hosting services.

Movable Type<sup>4</sup> (<http://www.movabletype.org>) is known for its highly configurable and expandable interface as well as an extensive feature set including archiving capabilities, entry categorization, data import, an E-mail notification system, and customizable templates. Overall, it is one of the most comprehensive weblog systems for personal, educational, commercial, or noncommercial use available with a license fee. Depending

**Table 1. Blog Requirements Matrix**

	Bblog	Blogger	Invision Power Board	Movable Type	phpbb	Radio	TikiWiki
Approval process and self registration			*		*		
Basic blog anatomy	*	*	*	*	*	*	*
Calendar	*	*	*	*		*	*
Centralized archives			*	*	*		*
Content search	*		*	*	*	*	*
E-mail to members		*	*	*	*	*	*
Hosting on our facility	*		*	*	*		*
Moderation features			*		*		
Polling			*		*		*
Post, reply, and view counter			*		*		
Rich text and graphics support	*	*	*	*	*	*	*
Topic or categorization	*		*	*	*	*	*
Security features (e-mail, IP and users ban, word censoring)	*	*	*	*	*	*	*
Upload and download files and images			*	*			*
User management		*	*	*	*	*	*
Web based internet access)	*	*	*	*	*	*	*

on the project complexity, tailoring the Movable Type system to meet specific needs may require a significant amount of effort by a skilled software engineer and a system administrator.

For advanced computer users and programmers, TikiWiki<sup>5</sup> (<http://www.tikiwiki.org>) offers an abundant and sophisticated set of functionalities including blog, calendar, chat room, FAQ, Web mail, poll, quizze, RSS feed, site search, tracker, task, Web site content management, and work group collaboration. The TikiWiki platform requires a significant amount of time and effort to install, configure, and maintain.

bBlog<sup>6</sup> (<http://www.bblog.com>) is a free, template-driven, php-based software that allows users to maintain a simple yet fast and low-cost way of collaborating. The installation process is simple and quick. bBlog supports a content formatting plugin, links manager, calendar, and RSS feeds. This system utilizes the so-called Smarty tags, which allows users to customize their Blog easily, without applying any programming skills. This software lacks user management and security features.

phpbb<sup>7</sup> (<http://www.phpbb.com>) is another free php-based software with a very simple installation process. Its features include unlimited forums and categories creations, moderation, message posting, polling, user permissions, and site administration. It does not provide upload and download functionality. Managing large numbers of categories and user permissions requires more effort than our selected software below, but this software has a community of supporters, which makes it easy to resolve any issues that arise during the use of phpbb.

Invision Power Board<sup>8</sup>, by Invision Power Services, Evergreen, VA (<http://www.invisionboard.com>), was the final product under consideration for this project. Invision Power Board is moderately priced and offers several support options. It has met our requirements. The installation process was uncomplicated, and minimal configuration was required in preparation for use. Elegant design makes administration of this secure and robust tool straightforward.

We have deployed the Invision Power Board weblog software. The system requires a Web server (Microsoft IIS 5.0/6.0, Microsoft, Redmond, WA) and a database (MySQL

4.0.13, <http://www.mysql.com>) as well as ActivePerl 5.8 (Active State Programmer Network, <http://www.activestate.com>) and PHP 4.3.3 (Apache Software Foundation, <http://www.php.net>). The complete installation process, including downloading the necessary software components and configuring the system, took approximately 2 h.

The blog software can be run on a Linux or Windows platform. The process is relatively straightforward:

#### 1. Downloading software.

- Invision Power Board—<http://www.invisionboard.com>.
- ActivePerl—<http://www.activestate.com>.  
Practical extraction and report language (Perl) is an open-source interpreted programming language freely available on many operating systems such as Apple Macintosh, MS DOS, Linux, MVS, VMS, Windows, and UNIX. It is optimized for string manipulation, I/O, system administration tasks, World Wide Web development, and Internet services. It is fast and portable with abundant and easy-to-use libraries for quick software development. ActivePerl is an implementation of Perl for Windows platforms.
- MySQL—<http://www.mysql.com>.  
MySQL is an open-source database, available in GNU Library General Public License and commercial license, implementation of relational database management system. It uses structured query language (SQL) to create, manipulate, store, retrieve, and delete information stored in a database. Data are stored in tables. MySQL can run in conjunction with other programming language such as C, Java, Perl, and PHP via a database connectivity mechanism such as ODBC and JDBC.
- PHP—<http://www.php.net>.  
Hypertext preprocessor (PHP) is a well-known open-source server-side scripting language that is suited for World Wide Web development. It is also known to be used for command line scripting and desktop applica-

tions. It can be embedded into HTML pages to generate dynamic Web pages and supports a wide range of databases. PHP tags encompass PHP scripts similar to ASP, Cold Fusion, and JSP. Before an HTML page containing PHP code is sent to a client, the Web server calls a PHP parser to interpret and execute the PHP script. Source code on a PHP page cannot be seen by Web viewers because a page is processed on the server-side.

2. Install Active Perl (version 5.8.0.806).
3. Install MySQL (version 4.0.13).
4. Install PHP (version 4.3.3).
5. Install Invision Power Board.

6. Configure Microsoft Internet Services Manager (Web server).
7. Configure Invision Power Board.

## DISCUSSION

A typical blog site is primarily composed of weblog entries. Entries are time-stamped and arranged chronologically with the most recent

The screenshot shows a web browser window titled "NU Radiology Power Board (Powered by Invision Power Board) - Microsoft Internet Explorer". The page features a header with the "NORTHWESTERN RADIOLOGY POWER BOARD" logo and navigation links like "Help", "Search", "Members", and "Calendar". A user is logged in as "aimee". Below the header, a section titled "NU Radiology Power Board" displays a welcome message and a table of discussion topics under the heading "NMH PACS Administration".

	Forum	Topics	Replies	Last Post Info
ipb	<b>Workstation topics</b> Issues related to PACS Workstation	9	6	Dec 10 2004, 08:47 PM In: » <a href="#">Not able to logon</a> By: <a href="#">administrator</a>
ipb	<b>Database Topics</b> Issues related to Database	3	1	Dec 10 2004, 08:38 PM In: » <a href="#">Schema</a> By: <a href="#">administrator</a>
ipb	<b>ASP Topics</b>	4	0	Dec 10 2004, 08:39 PM In: » <a href="#">Stop working</a> By: <a href="#">administrator</a>
ipb	<b>Modalities</b>	5	2	Dec 14 2004, 04:11 PM In: » <a href="#">Holder2</a> By: <a href="#">administrator</a>
ipb	<b>Broker Issues</b>	2	0	Dec 10 2004, 08:43 PM In: » <a href="#">holder</a> By: <a href="#">administrator</a>
ipb	<b>DAS / LOTS Issues</b>	4	3	Dec 10 2004, 08:44 PM In: » <a href="#">holder</a> By: <a href="#">administrator</a>
ipb	<b>Miscellaneous</b>	3	0	Dec 14 2004, 04:12 PM In: » <a href="#">Holder</a> By: <a href="#">administrator</a>
ipb	<b>User Issues Requiring Discussion</b>	1	0	Dec 10 2004, 08:44 PM In: » <a href="#">holder</a> By: <a href="#">administrator</a>
ipb	<b>Downtime</b> Used to record downtime	5	0	Dec 14 2004, 04:11 PM In: » <a href="#">Holder</a> By: <a href="#">administrator</a>
ipb	<b>Tcon Issues</b> Weekly Tcon Issues	1	0	Dec 10 2004, 08:43 PM In: » <a href="#">start t-con</a> By: <a href="#">administrator</a>

Fig 1. Northwestern Radiology Discussion Topics.

posts appearing at the top of the page. Entries are generally any combination of blocks of text, images, hyperlinks to other Web sites, or embedded audio and video files. Each entry may contain links used to traverse related posts in the same thread. Lengthy entries are typically truncated, but the entire contents are always available by following a link to the entire entry. The blog administrator can set member policies and privileges to control how users may use the blog site for mes-

sage viewing, posting, commenting, e-mailing, and polling.

Blog archives allow users to browse and search older content not appearing on the main weblog page. Indexing and archiving weblogs are usually performed on a monthly basis. Weblogs can even be linked and cross-published to each other through the use of rich site syndication or RSS. This poses an interesting opportunity for multiple institutions utilizing similar PACS technol-

The screenshot displays the 'NU Radiology Power Board' website within a Microsoft Internet Explorer browser window. The address bar shows 'http://server4.radiology.nmh.org - NU Radiology Power Board -> Workstation topics'. The website header includes the 'NORTHWESTERN RADIOLOGY POWER BOARD' logo and navigation links for 'Help', 'Search', 'Members', and 'Calendar'. A user is logged in as 'aimee', with links for 'Log Out', 'My Controls', '0 New Messages', 'View New Posts', and 'My Assistant'. The main content area is titled 'Workstation topics' and features a table with the following data:

	Topic Title	Topic Starter	Replies	Views	Last Action
8	<a href="#">Not able to logon</a>	<a href="#">administrator</a>	1	8	10th December 2004 - 08:47 PM Last Post by: <a href="#">administrator</a>

Below the table, it indicates '1 User(s) are browsing this forum (0 Guests and 0 Anonymous Users)' and '1 Members: [aimee](#)'. A sorting section shows 'Showing 1 of 1 topics sorted by last post date in descending order from the last 30 days'. There are buttons for 'NEW TOPIC' and 'NEW POLL'. A search section includes a 'Search this forum:' input field and a 'Go' button. At the bottom, there are links to 'Mark this forum as read' and 'Subscribe to this forum', along with technical information: '[ Script Execution time: 0.2810 ] [ 10 queries used ] [ GZIP Enabled ]' and 'Powered by Invision Power Board(U) v1.2 © 2003 IPS, Inc.'.

Fig 2. Blog title example.

http://server4.radiology.nmh.org - NU Radiology Power Board -> Not able to logon - Microsoft Internet E...

File Edit View Favorites Tools Help

**NORTHWESTERN RADIOLOGY POWER BOARD**

NU Radiology Power Board · NU Radiology Power Board Guidelines

Help Search Members Calendar

Logged in as: **administrator** ( Log Out · Admin CP · Mod CP ) **My Controls** · 0 New Messages · View New Posts · My Assistant

NU Radiology Power Board -> NMH PACS Administration -> Workstation topics

CLOSED NEW TOPIC NEW POLL

Not able to logon

Track this topic | Email this topic | Print this topic

**administrator** Posted: Dec 10 2004, 02:30 PM Report Edit Quote

Administrator  
Group: Admin  
Posts: 25  
Member No.: 1  
Joined: 24-September 03

DSC was unable to logon using workstation at 448 E. Ontario suite 300.

IP: [ ] PM E-Mail

**administrator** Posted: Dec 10 2004, 02:47 PM Report Delete Edit Quote

Administrator  
Group: Admin  
Posts: 25  
Member No.: 1  
Joined: 24-September 03

The database has been fixed.

IP: [ ] PM E-Mail

1 User(s) are reading this topic (0 Guests and 0 Anonymous Users)

1 Members: **administrator**

« Next Oldest | **Workstation topics** | Next Newest »

CLOSED NEW TOPIC NEW POLL

Moderation Options Go - Workstation topics Go

javascript:scroll(0,0); Internet

Fig 3. Blog post and reply example.

ogies to share information about their individual installations.

In the particular case of a site's PACS, the blog can be used in the prepurchase phase as the department documents its workflow practices, existing equipment (including technical details needed later), etc. All of this information comes in multiple forms: E-mail, presales marketing materials, and internally generated spreadsheets and databases. All of this can be referenced and discussed in the context of a blog.

After the purchase, there will be an installation process wherein a number of practical, real-world issues must be discussed and decisions be made. The blog can serve as a vehicle for these discussions and to document the decisions (and more importantly the rationale for the decision) at the time the decision was made. This will be very valuable information in retrospect when these decisions are questioned or need to be changed based on evolution of the system.

During on-going operation of the PACS, there are daily discussions and decisions that reflect operational imperatives. The blog can be used to document these discussions and decisions as well.

Lastly, the blog can be used to document situations when error or other unusual conditions arise. This documentation can be very useful for auditing these events, performing root cause analysis, and including these scenarios in future testing (e.g., for upgrades).

## RESULTS

We have deployed the Invision Power Board on two occasions. One is dedicated to a group that supports hospital-wide PACS (see Figures 1–3). It is used to notify maintenance personnel of downtime and scheduled maintenance as well as to serve as a discussion forum on numerous issues related to PACS' functionality and issues related to its operation.

The second implementation was rolled out in time for the RSNA 2003 and has been used since by the GE PACS User Group. Until November 2003, this user group's forum was maintained as a listserv. Lack of archives and inability to refer-

ence between threads convinced us to switch to a Web board format. This board deals with issues related to GE PACS, users' experiences at using different versions and migration between versions, as well as discussions on new features. This blog has 42 topics and 116 posts, including 66 replied messages. A total viewing as of early July 2004 is about 1194 views. We currently have 183 registered members.

## CONCLUSION

Relatively cheap and easily installed weblogs can facilitate efficient and effective communication among team members on a PACS project. The blog is well suited to capture discussion of PACS issues in the context of meetings and teleconferences as well as documenting interventions in the PACS by local PACS administration resources, vendor field engineers, and remote vendor personnel.

The basic format of a weblog provides an accessible and organized forum that allows a group to identify, track, and focus on topics that matter the most to them. Granular access levels make it possible to ensure the privacy and security of sensitive discussions. They can be very powerful weapons in the armamentarium of the PACS administration.

This paper is not an endorsement of any products. It is an example of an evaluating process to help users choose a package that most suits their needs.

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