Open Source Strategies for Educational Multimedia

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Abstract: ePresence is an educational multimedia system for producing interactive webcasts that are accessible in real-time by remote viewers and retrospectively by archive viewers who can browse and search for what they want to see. This paper briefly presents the system, motivates our decision to release it using a combined open source and "community source" model, and highlights major challenges that lie ahead. Four classes of challenge are identified: technology, community, legal framework, and business model. Responses to the challenges are described.

The ePresence System

ePresence Interactive Media (Baecker 2002b; Baecker 2003; Baecker Moore and Zijdemans 2003; Baecker Wolf and Rankin 2004; Rankin Baecker and Wolf 2004) is a web-based streaming (webcasting) and collaboration tool for large-scale broadcast of events over the Internet — from university lectures to public health briefings to annual meetings to rock concerts. Events are streamed live and can later be easily deployed as browsable, searchable archives accessed through a customizable web portal. Webcasting itself is non-interactive, which is overcome by combining it with interactive features. For example, ePresence currently employs text chat as a mechanism for allowing interaction among remote participants, and between these individuals and the speaker via a moderator.

For both live and archived events, ePresence provides a rich multimedia experience for viewers connecting over the Internet using desktop and mobile clients. During a live event, end-users have access to an audio-video feed, navigable slide images, and a text chat system. Live events can be quickly and easily archived, and made available to users via the portal. Archives are full-text searchable, and provide an interactive timeline and two-level table of contents for easy browsing and navigation. The concept of hierarchically structured video is based in part on work previously described in Baecker, et al. (1996) and Baecker and Smith (2003).

More specifically, ePresence currently includes support for:
- video, audio, slide, and live desktop demos;
- slide review;
- moderated chat, private messages, and the submission of questions; and
- the automated creation of structured, navigable, searchable event archives.

ePresence also allows configurable live and archive interfaces through tailorable "skins". The media capturing and streaming engines run under Windows or Linux; client viewers exist for the IBM PC, the Macintosh, and Linux. Media may be transmitted using Windows Media, Real Media, and MPEG4. Webcasts may be received with bandwidths as low as a 56K modem. The software is implemented with .NET technology and is highly modular.

ePresence is a powerful platform for research into large-scale collaboration and communication, and new features are always under development. For example, we are working on enhanced interactivity for all users, including those present in the local audience, those viewing remotely, and those viewing the archives, through both text and voice modalities. More specifically, we are studying the use of voice over IP with spatial audio (Kilgore, et al., 2003) for discussions among remote viewers (Schick, Scheffel-Dunand, and Baecker, 2005) and ultimately also questions to the speaker. Studies of how viewers use structured, navigable, searchable archives (Dufour, et al., 2004, 2005; Toms et al., 2005) are underway, as is work on the automatic recognition of speech and especially of the keywords on the audio track.

The project has generated significant interest. ePresence has now been adopted by over fifteen universities and medical schools, with more signing up each month. This has caused us to think about how to make the technology more widely available. The approach we have adopted is open source software.

Open Source Software

The concepts of "open source" and "free software" represent international movements in the collective development of software and other knowledge media. Open source refers to the practice of sharing source code with a community that is encouraged and empowered to read, comment, amend, and augment it (DiBono, Ockman, and Stone, 1999; Weber, 2004: see also http://www.opensource.org/. Free software refers to a philosophical belief that software should be open and must remain open when redistributed, which some interpret to imply that only related services and not the software itself should cost money (Williams, 2002; see also http://www.fsf.org/).

These intertwined movements are arguably two of the most important forces shaping today's knowledge media industries (Benkler, 2002; Boyle, 2003). They are transforming the artifacts and the business and social practices of the software industry, but also are more broadly impacting the production and use of other knowledge media such as encyclopedias, scientific journals, and digital audio and video. In these latter manifestations, the movements sometimes go under the names of "open content" and "open access" (Lessig, 1999, 2001, 2004; see also http://creativecommons.org/).

The two most notable examples of successful open source software development are the Linux operating system (Moody, 2001) and the Apache web server. Yet it is important to realize that the principles and practice of open sources are not limited to system software, and have relevance to software applications in general (see, for example, http://www.osafoundation.org/) and educational multimedia systems in particular.

A Case Study of Open Source Educational Multimedia

ePresence is currently being released under an open source framework.

Our primary reason for pursuing the open source approach is to give ePresence adopters maximum flexibility in tailoring the system to their needs. Many of those interested in the system intend to use it in eLearning, where appropriate technology must fit the organizational culture and philosophy of an educational institution. Every organization that has adopted the system or used it in collaboration with us has approached its use in a different manner. Feedback from early adopters suggests that this will be an important source of differentiation from an already crowded marketplace of proprietary software vendors.

Open source also seems to be the best strategy to allow the technology to be adopted by individuals and small groups who want to make use of educational multimedia but lack the infrastructure and means to adopt an expensive proprietary solution.

Another advantage of the open source model is the enhanced opportunity for testing and improving the technology. The goal is to form a strong community of institutions and individuals who will collaborate on future research and development.

Challenges, and our Responses to the Challenges

To succeed with this strategy in a proprietary software world, we need to solve several critical problems.

Technology

Challenge: Traditional software engineering teaches us the wisdom of centrally-organized development teams with well-defined top-down patterns of authority, responsibility, and control. Open source development is distributed and bottom-up (Raymond, 1999), and is controlled as much by individual initiative, reputation, and shared values as it is by the occasional charismatic leader such as Linus Torvalds (Torvalds and Diamond, 2001). The challenge is to produce high-quality, well-structured, readable, and reliable code despite the distributed nature of software development.

Response: All contributed code proposed for inclusion in the system will be reviewed. A shared context will be established through the use of bug reporting and feature request mechanisms. The intention is to form a distributed synergistic development community with shared values.

Community

Challenge: Linux (or, strictly speaking, GNU/Linux) began as two individual Herculean efforts of individuals with remarkable wisdom, insight, and skill — Richard Stallman and Linus Torvalds. Torvalds especially was successful in attracting a worldwide community of passionate and skillful developers who were able to form a community that generally functioned effectively and harmoniously. Many more recent open source developments began from or have been sponsored by corporations or occasionally now even universities. The challenge is to nonetheless stimulate and nurture a willingness of numerous far-flung individuals to participate in a collective effort.

Response: Communication among members of an emerging community will be supported by listservs and blogs. Training and support will be provided beginning in July 2005 to Consortium members (see below) using ePresence media that are visual explanations of ePresence (Baecker, 2002a). An Annual Conference will start in 2006.

Legal Frameworks

Challenge: As of the writing of this paper, there are 54 licenses approved by the Open Source Inititative (OSI) and listed on http://www.opensource.org/licenses/. The situation is actually more complex than it is for proprietary software. Open source licenses preserve the concept of copyright, but use it to encourage widespread copying, modification, and reuse of software rather than to discourage it. Perhaps the most fundamental difference is between those licenses that follow the pattern of the GNU General Purpose License (GPL), which insist that all derivative works be distributed under the GPL ("copyleft"), and those licenses that do not enforce this notion. The challenge is to master and employ to advantage one of these many licensing frameworks.

Response: Working through the legal framework to do this from the University of Toronto has taken time. We first had to assign our "invention" of ePresence to the University, using their precedents all of which are rooted in proprietary concepts. The University then had to assign management of the invention back to the Knowledge Media Design Institute where it had originated. A business plan and a budget had to be developed and approved.

The next steps were to develop a set of legal documents that formalized the "community source" arrangements under which all the source code would be shared among Consortium members (see below). Final touches on these agreements are being finalized as of the date of submission of this manuscript (2005 May 3). The last step will be to choose or develop an appropriate license for the open source release of the core technology.

Business Models

Challenge: Perhaps the must puzzling and critical issue is that of business or revenue models. If one "gives away" the software, how does one make money, or generate revenues sufficient to sustain research, development, and support? A classic solution is through the sale of packaged systems and services, a strategy employed skillfully by companies such as Red Hat (Young and Goldman Rohm, 1999). In other cases, such as MySQL, companies release their software under dual-license framework that includes both a GPL version for no charge and a commercial version that generates revenue.

Response: With ePresence, we have adopted the strategy of releasing the source code of the core technologies for media capture and web publishing under a GPL-like license, and of releasing the source code for the advanced technologies (such as those for live webcasting) only to paying members of an ePresence Open Source Consortium, an approach that some have termed "community source". Consortium members receive guaranteed levels of support, access to ePresence training materials, invitations to an annual meeting, and access to those technologies deemed "advanced". The intention is to migrate advanced technologies into the core system from time to time, and to generate a continued flow of new advanced technologies through research. For further details, see http://epresence.tv.

Concluding Remark

Open source challenges traditional methods of technology transfer from universities that have until now relied exclusively on the packaging of proprietary products and on their protection through legal approaches such as copyright, patents, and trade secrets. The proprietary approach is clearly appropriate for hardware and pharmaceuticals, but needs re-examination in its use for software and educational multimedia. We suspect that a balance between both approaches will be the norm by the latter part of this decade.

We are currently conducting a survey of major North American universities to see to what extent they are releasing software and other educational multimedia using open source strategies and what approach they are taking to the four issues of technology, community, legal framework, and business model. Results may be found in Hoss (2005).

Acknowledgements

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