

# Computer Science and service learning: Empowering nonprofit organizations through open source content management systems

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## ABSTRACT

A new, civic-minded generation of students is enrolling in college. In order to combat decreasing enrollments, computer science programs must find ways of attracting this new generation. Free and Open Source Software (FOSS) provides an outstanding example of how individuals can collaborate to contribute to the greater good, and it provides a solid basis for integrating service learning into the computing curriculum. Content Management Systems (CMS) are the most popular type of free and open source software used in the nonprofit sector. Students can easily utilize open source CMS tools to build powerful web sites for organizations that provide community and humanitarian services. Such projects allow students to become involved with civic service and to fulfill their desire to contribute to their community.

## 1. INTRODUCTION

The number of students declaring a major in computer science in 2007 was half of what it was in 2000 [1]. The dramatic decline in enrollments has motivated computer science programs across America to search for new ways to attract students. During this same time period, a new generation emerged in the wake of the 9/11 tragedy. College student volunteering increased by 20 percent between 2002 and 2005, more than double the growth in the adult volunteering rate [2]. While students primarily volunteer in tutoring, mentoring, fund raising and general labor, they also look for opportunities to relate civic service to their intended college major. Computer science programs must evolve in order to attract this new generation of civic-minded students.

It has been well documented that students benefit from experiential learning, and the majority of computer science curricula include some type of capstone software engineering project. In the past, capstone projects often involved an external client from the commercial sector. There has been a growing trend however to encourage collaboration with social and

humanitarian organizations. The Accreditation Board of Engineering and Technology (ABET) Computing Accreditation Commission (CAC) includes the following criteria for accreditation of computer science programs: "there must be sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area" [3].

To strengthen student awareness of societal and ethical issues, the nonprofit sector is increasingly being turned to as a partner for undergraduate software projects. It is natural to integrate a service learning component into such projects. Research has shown that the incorporation of service learning into computer science curriculum has a positive effect on attracting and retaining women [4]. Recently, researchers are considering whether the use of Free and Open Source Software (FOSS) for the development of humanitarian service projects might also be a means to attract civic-minded students to computer science, particularly under-represented groups such as women and minorities [5, 6, 7].

Nonprofits are increasingly turning to FOSS, as it provides secure, stable and cost-effective solutions for organizations with limited or non-existent funding for technical personnel. A 2008 Nonprofit Open Source Initiative (NOSI) survey of nonprofit use of FOSS found that 52% of the nonprofits surveyed used FOSS applications regularly, 19% contributed to FOSS projects, and 65% were planning on implementing new FOSS tools in the coming year [8].

The remainder of this paper describes *CS444 Open and Adaptive Software Systems*, which is a new course offered at John Carroll University. The course covers open source software production processes and tools, with an emphasis on the adaptive plugin architectures that support customization and extension of Content Management Systems (CMS). In terms of service learning, students work in small teams to utilize open source CMS tools to build web sites for several local nonprofit service organizations. The students become involved with the nonprofits, volunteering their time with those who are serviced by the organizations, as well as training representatives from the nonprofit organizations on the use of the CMS in order to enable future self reliance. An underlying goal of CS444 is to encourage undergraduate students to view software programming as a socially beneficial activity, rather than simply a commercial enterprise. The hope is that exposure to the humanitarian applications of FOSS will mesh

with the strong community service interest among John Carroll University students, and ultimately increase interest in computing education.

## 2. FOSS AND SERVICE LEARNING

*CS444 Adaptive and Open Software Systems* is a new upper level elective taken by both Computer Science (CS) and Computer Information Systems (CIS) majors at John Carroll University. Thus, in addition to the common learning objectives found in many open source CS courses (e.g., FOSS methodology, tools, techniques, and participation in active open source projects), CS444 also integrates learning objectives targeted toward the CIS students, including the exploration of the business and societal benefit of FOSS. The primary goal of CS444 is to allow CS and CIS students to work together to investigate the impact that FOSS may have on organizations that provide community and humanitarian services.

As a Jesuit Catholic university, John Carroll's core values include a strong culture of service. The Center for Service and Social Action was established at John Carroll University in 1992. It is dedicated to "meeting real community needs, especially the needs of the most vulnerable members of our neighborhoods" [9]. The center works with more than 70 nonprofit service organizations, referred to as "community partners", and coordinates the service placements every semester for hundreds of students, faculty and staff. In 2007, over 1300 members of the JCU community participated in service.

Several nonprofit community partners were the subject of a set of case studies conducted by marketing majors from John Carroll University's Boler School of Business. The case studies concluded that in order to increase donations and improve volunteer recruitment, it was critical for the nonprofit organizations to improve their web presence.

To motivate someone to donate their money or their time, a nonprofit's web site must clearly illustrate the unique and vital contribution the organization provides to its community. Frequently updated personal stories and pictures of those who benefit from the services, online access to a current calendar of events and volunteer opportunities, secure online donation, and newsletter registration are some of the capabilities nonprofit websites *must* possess in order to survive in economically challenging times.

Nonprofits are often a step behind commercial organizations in capitalizing on new technology, usually due to lack of funding and technical expertise. NOSI (Nonprofit Open Source Initiative) provides a primer that examines how free and open source software can provide nonprofits with secure, stable and cost-effective ways to solve their technology problems [10]. Content Management Systems (CMS) are the most popular type of free and open source software in the nonprofit sector [10]. A CMS is an application used to create, edit, manage, and publish content in a consistently organized fashion. CMS applications are designed to make it easy for non-technical users to add, edit and manage a website. They typically include capabilities such as collaborative authoring, user management, blogs, forums, and podcasting.

Two of the most popular open source CMS applications are Drupal [11] and Joomla [12], which both contain a powerful core that is modular and extensible. New functionality is easily added

through the development of custom modules. For example, Drupal and Joomla both have module extensions available that integrate Customer/Constituent Resource Management (CRM) capabilities to support online donation and allow an organization to keep track of individual donors, their donations, event attendance, etc.

John Carroll University's initial offering of *CS444* took place in the fall 2008 semester. The course required students to work in small teams to utilize open source CMS tools in order to build new web sites for three community partners: Brendan Manor, the Interfaith Hospitality Network of Greater Cleveland, and the Thea Bowman Center. Brendan Manor is a nonprofit group home that provides housing, recreational and support services to up to 16 low-income adults. Its residents are challenged by chronic health issues and/or mental health diagnoses. The Interfaith Hospitality Network of Greater Cleveland is a private, nonprofit organization providing hospitality, meals, and support to homeless families through a network of religious congregations and community organizations. The Thea Bowman Center (TBC) is a nonprofit organization that serves the Mt Pleasant Community, one of the most economically depressed areas within Cleveland. TBC offers a range of services, including computer labs, a music school, after school tutoring, and adult GED and job training.

Brendan Manor did not have an existing web site. One of the CS444 project teams utilized the Joomla CMS to develop a new site that allows the nonprofit organization to describe its service to the community through frequently updated stories and pictures of its residents. The new web site was also designed to inform prospective donors of funding opportunities as well as support online donation.

The Interfaith Hospitality Network (IHN) of Greater Cleveland had an existing web site [13]. However, it consisted of static web pages that were rarely updated due to the maintenance fees charged by the hosting company. Like many nonprofit web sites, the IHN site was structured around a 1990s-era model, providing primarily one-way information dissemination. The web site had limited means of supporting active community building with prospective volunteers and donors. A second CS444 project team used the Drupal CMS to implement a new web site for IHN. The new site was designed to provide online donation, volunteer registration, event scheduling, a forum for posting guest stories, and volunteer coordinator management.

The Thea Bowman Center (TBC) also had an existing web site that consisted of a set of static, outdated pages [14]. A third CS444 project team utilized the Joomla CMS to design a new site that incorporates online donation, event scheduling, and volunteer registration.

### 2.1 Computer Science Objectives

The CS444 students had previously taken several programming courses, including two semesters of web programming, as well as one semester of database programming. Thus, they were very familiar with the dynamic web technology underlying Drupal and Joomla. In addition to utilizing a CMS to develop the web site for their respective community partner, the CS444 students obtained an understanding of adaptive software architectures by studying component based software models, including the plugin architecture used in CMS tools. Each project team ran into numerous problems while using the open source CMS tools to

develop the web sites. The teams had to invest a significant amount of time reading through and understanding the open source code that they were using in order to develop patches for the problems they had encountered. Thus, they were able to experience the open source model of working with an existing code base.

## 2.2 Service Learning Objectives

While the students were enrolled in CS444, they were also concurrently taking the first of a two semester sequence of software engineering courses, which provided an understanding of agile software development methods. Agile methods promote frequent iterations, teamwork, and process adaptability. Agile methods also emphasize face-to-face communication over written documents. The CS444 teams met frequently with representatives from the nonprofit agencies. The meetings included discussions on the current design and functionality as well as end user training for the community partner representative on the use of the CMS in order to encourage self reliance in the web site maintenance. The CS444 students also participated in service events at their respective community partner's location in order to learn about the people affected by the software they were developing.

CS444 encourages students to explore the impact that FOSS may have on agencies that provide community and humanitarian services, and includes a variety of readings on the topic [8, 10, 15, 16, 17, 18, and 19]. Students also learn about *Software as a Service* (SaaS) and compare its benefit to nonprofits with those of FOSS [20, 21]. SaaS is a model of software deployment where an application is hosted as a service on the internet. SaaS reduces the burden of software maintenance by eliminating the need for the customer to install and run the application on their own computer. SaaS is increasingly becoming a popular model for nonprofits to manage fundraising, advocacy, communications marketing and constituent relationship management[21]. In terms of the CS444 projects, the students investigated a variety of SaaS providers that support Drupal and Joomla, including providers that cater to nonprofit organizations.

## 3. FUTURE PLANS

What happens when the semester is over and the students are potentially unavailable to update the project web sites? This was the primary concern that the nonprofit agencies had when initially approached and this was the primary reason for deciding to use CMS tools to develop the web sites. It was interesting to watch the CS444 students teach the CMS tools to their community partners. The students prepared tutorial-style user manuals that demonstrated how to maintain the web site. A portion of their final grade was based on the community partner's ability to step through the manuals and update the content to the web site by themselves. Clearly, Joomla and Drupal are powerful tools that are also accessible to the masses.

The Center for Service and Social Action at John Carroll University was invaluable in orchestrating the initial and ongoing contact with the community partners. With several dozen community partners in need of a better web presence, there are many opportunities for continued service learning in future offerings of CS444 as well as other CS courses. The author plans to work with the Center for Service and Social Action to develop a workshop to train non-CS majors on the use of CMS tools such as Joomla and Drupal. This could provide student volunteers

with a unique alternative to their existing service opportunities and might entice non-CS student volunteers to consider enrolling in a CS course to learn more about web site development.

## 4. CONCLUSION

Open source and nonprofit communities share many basic principles, most notably volunteerism, advocacy, accessibility, and freedom. Thus, nonprofits and FOSS go well together in computer science service learning. Community service agencies are becoming increasingly dependent upon technology for the delivery of services to their constituents. They often possess neither the expertise nor the budget to implement the applications required to carry out their mission. Undergraduate computing majors can provide this expertise, while also fulfilling their desire to contribute to their community.

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