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# *The Practicality of Cloud Computing*

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**Abstract** Since its inception, cloud computing has become the current paradigm. Organizations of different size and type have embraced the concept because of its both technological and economic advantages. Sacred Heart University Library has recently published its newly-designed website on the cloud. For a small academic library, what does it mean to put their online data on the cloud? This paper will analyze and discuss the advantages of cloud computing, and some potential obstacles created by it through the author's observations. This paper hopes the uniqueness of the case will contribute to the improvement of cloud computing experience of other libraries.

*information system; cloud computing; virtualization; service delivery; technology assessment, service quality*

## I. INFLUENCE OF CLOUD COMPUTING ON LIBRARIES

Cloud computing is widely embraced these days and the adoption of the concept is still on the rise [1] mainly because it reduces the cost of both hardware and software, allows data stored and managed on the Internet, and alleviates the burden of IT (Information Technology) professionals. Especially the idea of pay-as-you-go [2] benefits organizations such as academic libraries, whose IT developments are limited by either the budget restraints or the IT capabilities. Academic libraries utilize the model of software as a service (SaaS), infrastructure as a service (IaaS) or platform as a service (PaaS) to avoid the upfront investment [3]. "What makes cloud computing so powerful is that it is based on a system of modularity. The use of virtualization and a cloud platform allows organizations to break down services and systems into smaller components, which can function separately or across a widely distributed network. [4]" Most importantly, using any of these models is a big relief for librarians. Even though both librarians and IT are specialized in parsing and manipulating information, these two types of information professionals possess quite different skill sets: librarians are trained to discover the information with the assistance of technology, and they may not necessarily understand how technology works

behind the scene, but IT professionals typically deal with computer architecture of systems, and their relationships with humans and organizations. Cloud computing allows librarians to focus on what matters the most to them while still utilize the most advanced technology to enhance the services they provide to the patrons.

## II. BACKGROUND

Before 2007, the Sacred Heart University Library's web site was not a stand-alone site; it was comprised of sub pages of the university website. Because the university site was run on a content management system (CMS) administered by the representatives of the company, which designed the university website, and library lacked the power of doing changes to the library site, library staffs were often frustrated by its inflexibility and inaccessibility.

2006 the library got consent from the university to design and run its own website. A web committee was quickly organized and started to operate. Since the library had some expertise of building a website, and it was recognized that saving costs was one of the major goals of the project, the library decided to undertake the project itself. For the library, it is mission-critical to have a website that delivers accurate, up-to-date information to its users and allows new contents to be updated regularly. During the initial planning meetings, the website committee focused on these issues:

- Applications used to design, implement and manage the site
- Hosting and maintaining issues
- Backup mechanism and statistics

### A. Applications Used to Construct the Site

Because the primary goal of the library's website was to serve as a pathfinder to assist its key constituencies in discovering relevant information with certain level of interaction, static HTML (Hyper Text Markup Language) would be sufficient to build the site. Prior to constructing this site, the author had already extensively used Dreamweaver, and other Macromedia software (now Adobe's Creative Suite) to build websites; therefore, the committee decided to use Dreamweaver to design and edit web pages, and load or update the site contents to the web server through its built-in FTP function; Fireworks would be used for graphic editing; Adobe

Contribute would be ideal for group collaboration as it has the functionality that allows group to edit or review contents, and the site administrator to control the publishing of created contents.

### *B. Site hosting and server maintenance*

Before the library started the website project, the Office of Instructional Technology (OIT) of the library obtained a Windows-based server which was used to host several programs such as Video on Demand, and Flex-based applications to assist both classroom and online instruction. Microsoft IIS was used as web server; Microsoft Access database was created to store the information; ColdFusion, which would be used for dynamic contents, was installed in the server. The director of the office who had extensive experience in server technology, was to be responsible for the maintenance and updates or upgrades of the server. University IT Department agreed to customize the DNS to accommodate the new library website.

### *C. Backup and Statistics*

The administrator would manually back up newly-created or updated contents in different versions to a local drive, but the server would also have system backup for disaster recovery purpose. The library used both commercial software called Weblog and Google's Analytics to track the usage of the site.

With the available expertise in designing a website, and hosting solution was in place, the project was quickly moved along. In February 2007, the library launched its first independent website.

Up to August 2011, the library website had been sharing the server's space with OIT. Before the director of OIT departed the university, the library website ran smoothly: librarians updated the contents, the author maintained the site, and the director of OIT monitored the development of the server. In year 2007, within the year in which the library's new website was published, the director of OIT left the university. Updating or upgrading the server became increasingly difficult: although the physical server box was situated in one of IT's server stacks, the director of OIT, who used to be in charge, was no longer able to practice the responsibilities. From day one when the library website was hosted on this server, the library was not granted the full administrative access to the server; the only part of server that the library could access was the library website. Consequently, the server was left in a dangling situation. In 2010 we accidentally discovered the server license had already expired almost two years; the server was soon running out storage space; there was no contingency backup option for the data. What made the situation even difficult was the person who helped the ex-director of OIT customize the OIT server got a position in another institution and left the university, and the

new System Technician was not familiar with this specific server.

## III. GOING TO CLOUD

In recent years, a growing number of social networking sites (SNSs) such as YouTube, Facebook and Twitter have gained much popularity, and the versatility and user-centered essence of these social networking sites have captured the spotlight of online world. The way that these sites allow users to interact and share information forces libraries to rethink their positions as information service providers. In the past, library users had to passively accept what they were fed because they were confined by the sources of receiving information. The new way of information resource sharing has empowered the users to take active roles, and such role changing compels libraries to reconsider their strategies of how to engage their users. Sacred Heart University Library feels the same impetus: the interactive limitations and one-way communication of its website shunned away lots of its users. To rebuild a website that would overcome the limitations of the old site and attract all types of clientele became meaningful.

At the beginning of 2011, a new website committee was formed. Since HTML lacks the capability of creating dynamic contents, the author who chaired the committee suggested using Drupal, a PHP (Hypertext Preprocessor) based open source content management to build the site. Drupal enables users to create community-driven web sites. It overcomes the inflexibilities of static HTML allowing contents to be created on the fly, and more importantly, it supports collaborative authoring environment [5]. The suggestion got unanimous consensus from the committee members. The library director contacted a website designing company whose expertise largely focuses on Drupal site creation.

When it came to who and how to host the website, the complication of past practices such as updating the physical server, monitoring the usage of storage, or backing up data enticed the library to find a solution that would simplify the data processing side, minimize the demand of IT knowledge, and allow librarians to focus more on the content creation. The author discussed with the university IT Architecture Engineer and System Security Officer about what optimized solution that library could have. Both experts suggested we take advantage of university's virtual computing environment, which can be easily customized and help the library avoid both hardware and software investment. In addition, it would alleviate the burden of the library of getting required expertise. However, the Security Officer also emphasized the university's computing is largely in window-based environment and IT does not have specific personnel to support LAMP (Linux, Apache, MySQL, PHP), the software framework for Drupal. During the discussion, the IT experts and the author tried to list all the pros and cons of applying cloud computing concept to the new website.

The author was convinced that using cloud computing would make the project more affordable because the infrastructure was already in place, the library did not need to

buy the hardware, and all the software involved in this project would be open source. Therefore, it made perfect sense that the library website be placed on virtual space. Besides all the known benefits, the author also expressed the concerns about common issues with cloud computing such as security, and reliability [8]. As reviewed in large amount of literature and real case studies, security is the number one concern of cloud computing because “the user’s data has to be released to the cloud and thus leaves the protection-sphere of the data owner. [6]” The hacker’s attack on Amazon’s EC2 (Elastic Compute Cloud) reminded cloud computing users the risk of putting their data on the cloud. [7] The Security Officer reported that the IT has its protection strategy that prevents possible attacks on the university data. Regarding the reliability of data, the author was convinced that the university works with reputable virtualization service providers; plus, IT has additional contingency plans that fend off any foreseen problems. In addition, they promised the library had full control over their data, and they can access the data anytime and anywhere as long as they had the Internet connection. Although IT would not be able to fully support LAMP operation, the contract signed by the designing company included software maintenance and updates, so the library would not need to provide the expertise.

After talking to the IT experts, the author briefed the committee members of the discussion with IT. Most of members showed their optimism. Since the advantages of applying cloud computing weighed more than disadvantages, the committee decided to give it a shot.

#### IV. OUTCOMES

The DNS cut-over occurred on August 11, 2011 and the new library website went live before the beginning of fall semester. Since the launch of the new website, librarians have collected the feedbacks by asking users in the library, on the phone, or in Information Literacy classes. The responses were generally satisfying. Users like the content presentation of the new site and easiness of finding the information; the number of new site usages went up in the very first few days; most important of all, the way that the new site is managed greatly reduced library staff’s worry; they became very optimistic to the future of the site. The director was content because no expense was required on hardware, and software both short and long term for the website; librarians appreciated the easiness of updating the contents; the working load of the site administrator was cut down significantly.

However, the new website does not run without hurdles: only within the first week, one day during the normal business hours, the website was down. The author contacted the designing company and Sacred Heart University IT right away. The IT staff of the designing company immediately looked into the system and server logs but did not find anything suspicious. Meanwhile, Sacred Heart University IT staff reported that Apache, the web server seemed to run out of resources and was going to crash. As anticipated, the university IT stopped the web server.

After the initial investigation, the two IT teams had some guesses: one was whether the amount of memory allocated to the web server was too low (.5GB), but the university IT believed the size was properly apportioned because the website was running on a virtual machine and the LAMP server was dedicated to only one site, and therefore, the concurrent traffic was fairly low. Another guess was whether the system was hacked and the system settings were changed. While the two IT teams tried to figure out the problem that brought the site down, the library had to deal with frustrated users and waited helplessly for the recovery of the site. After the site became inaccessible for several hours, some users started to question the viability of the new site. Eventually, the problem was discovered, which was said to be a memory issue related to VMware performance.

The first incident was still fresh in the librarians’ memory when one morning when the course of IL101 (Information Literacy 101) run by the library was in session, the library website became unavailable again. The librarians had to change the course content because online resources were unavailable. Although this time with the joint effort of IT staff from SHU and the designing come, the issue was quickly recognized and resolved, the concern still remained: is the cloud computing a right solution for the library?

#### V. SPECULATIONS

Studies about cloud computing have showed that the change of IT industry infrastructure has brought benefits as well as challenges to the end users [9]. Besides those obvious advantages and disadvantages that virtualization brings forward, there are some less noticeable, potential obstacles specifically imposed on small size organizations since these organizations usually do not have or have limited expertise to manage the data on the cloud. For instance, in the case of the new library website, Sacred Heart University library has to rely on their university IT department and a third party company to manage the data on the cloud. Such dependency is problematic, because even though it seems the library can unlimitedly access the site through the Internet, how the data is managed is rather opaque.

Sometimes the asynchronous communication between the library and the university IT and the supporting company leaves the library in a defenseless situation and the library service suffers thereby. As matter of fact while the author is writing this paper, the website encounters a difficulty again, and unfortunately, several layers of troubleshooting have caused more problems than necessary. Frustratingly, the library feels very powerless because the library has to rely on a middleman, the designing company to troubleshoot the site on the virtual server managed by the university IT.

Like many small or medium-size organizations, whose primary intention of adopting cloud computing is to create cost-effective computing environment, and avoids difficult situations caused by the shortage of IT capability, SHU library

has pushed their online data on virtual space, aiming at saving money and reducing technological demand. Nonetheless, the incidents mentioned above force the library to think of some alternatives to prevent the unforeseen issues so that such issues will not become imminent. In fact, the SHU library recently has started to look into the possibility of adopting a more pragmatic cloud computing model that can meet the specific need of the library.

It is believed that virtualization is the future of computing and therefore, is worth exploring. These days the multifaceted nature of cloud computing offers organizations options to have better way to manage their cloud data. "...true private clouds emerged as key complements to public clouds, and companies now have unprecedented choice among cloud infrastructure alternatives, including public, private and hybrid clouds...[10]" The experience the author has had suggests that when applying cloud computing, organizations should understand their immediate and long-term need and conduct technology assessments to the selected cloud computing model thereafter. As a result, the selected type of cloud computing will suit well the nature of the organization and therefore, avoid repercussions that ill-fitted cloud computing may bring. In this way, the organizations are able to focus on the business development while still taking advantage of the benefits of cloud computing. Once the right model of cloud computing is selected, however, the organization should quickly adapt themselves to the virtual environment so that the short term gain will not lead to long term lose.

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