

Three Greenwich Case Studies in Private Cloud migration and adoption

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Abstract

Cloud Computing Business Framework (CCBF) is a framework for designing and implementation of Could Computing solutions. This paper focuses on how CCBF can help to address migration in Cloud Computing implementations in the Educational domain. The University of Greenwich has three case studies: Sharepoint, Media Server and Supply Chain private clouds to present current status and demonstrate portability to private cloud. These benefits include automation of administrative process, supporting learning and teaching, integration of procurement activities, cost-saving, agility and efficiency improvement. Future work will include Business Integration as a Service (BIaaS) to improve integration and quality of different activities and services.

1. Introduction

The JISC has announced Cloud Computing is increasingly attractive for research and education, and they believe there are the following five reasons for University Cloud adoption [6]:

- Reduce environmental and financial costs - where functions are only needed for short periods.
- Share the load - when a university is working with a partner organisation so that neither organisation need develop or maintain a physical infrastructure
- Be flexible and pay as you go - researchers may need to use specialized web-based software that cannot be supported by in-house facilities or policies
- Access data centres, web applications and services from any location.
- Make experiments more repeatable - write-ups of science experiments performed in the cloud can contain reference to cloud applications like a virtual machine, making the experiment easier to replicate.

An increasing number of Universities are adopting Cloud computing, either private cloud or hybrid cloud, to save operational costs, enhance quality of service and improve efficiency. Indeed, Cloud Computing offers a variety of benefits including cost-saving, agility, efficiency, resource consolidation, business opportunities and green IT [2, 4, 5, 7, 8, 9]. As more organisations adopt Cloud, technical and business challenges emerge. To address these increasing requirements, a structured framework is necessary to support business needs and recommend best practice which can be adapted to different domains and platforms. Cloud Computing Business Framework (CCBF) is the proposed solution [6]. The objective is to help organisations achieve good Cloud design, deployment and services, and deliver solutions, recommendations and case studies to businesses.

The CCBF is proposed to deal with four research areas: (i) Classification; (ii) Organisational Sustainability; (iii) Portability and (iv) Linkage. [2, 3]. Amongst these four research areas, Portability is the third research question and is the focus of this paper.

2. Portability and CCBF Overview for the University of Greenwich

Portability involves migrating entire applications from desktops to clouds and between different Clouds in a way which is transparent to users so they may continue to work as if still using their familiar systems [1, 2]. CCBF also works in Education domain. The University of Greenwich has three active projects described in our three case studies. These private cloud developments which are at different stages of development all aim to achieve progress towards the major benefits JISC describes. The three projects are:

(i) Sharepoint migration: The plan is to migrate the existing Business School Sharepoint 2007 to Sharepoint 2010. A public cloud is initially used to save costs, time and resources. Additional private applications are written to integrate with the public cloud, which is a hybrid solution using both public and private cloud resources. The current stage is the hybrid cloud aiming to provide proof of concept. Upon successful deployment, the University of Greenwich will fully adopt private cloud approach, which will be the ultimate aim.

(ii) Media Server private cloud: The University of Greenwich is developing a media server project to support e-Learning activities for teaching. The University is also developing an open-source Moodle platform and is in the process of moving WebCT to Moodle, where the media server helps with video-streaming, blogs and online learning activities. This is a private cloud solution.

(iii) Supply chain private cloud: The University of Greenwich uses e-Procurement to support supply chain activities. The use of integrated technologies is crucial for private cloud development.

Each of three projects is presented between Section 3 and 5.

3. Sharepoint Development

The University of Greenwich started using Lotus Notes in 2001 for document repository, and moved to Sharepoint 2007 in 2009 to improve the quality of service. Currently 150 academic members of staff are using Sharepoint 2007, and the development and migration process to Sharepoint 2010 have started in 2011, with plans to be delivered by the

end of September 2011. This offers the Business School scalability of current deployment, integration with critical applications (such as Banners) and improvement in functionality such as QoS, reliability, availability, performance and security (particularly this). In addition, Sharepoint configuration and advanced scripting have been in place and also under further development. The Business School has used Sharepoint Workflow to automate the administrative process, which saves time and improves efficiency for administrative work. There are three workflow examples described as follows.

- Examination Papers Workflow: This allows course leaders, moderator, Head of each group, examination officer and external examiners to work together in a sequence of events, review process and approval process related to development of examination paper. All processes are automated.
- Plagiarism Workflow: When plagiarism is detected by staff using Turnitin, it informs the quality team to start with a sequence of events, such as arranging interviews with students, academic staff and administrators. The interview panel makes the decision, which will influence how markers and quality team follow up. Markers will update results, and quality team will respond to decisions.
- Conference Attendance Request Workflow: This allows staff to apply for conferences, and goes through an approval process in an automated way.

These workflow systems are fully incorporated into Sharepoint to make Software as Service (SaaS) for administration. The members of staff find SaaS not only time-saving, cost-effective, but also make the administrative process organised and structured. The Sharepoint project has progressed from public to hybrid cloud, and will eventually become a fully private cloud implementation for security and data protection.

4. Media Server Development

Different types of technologies have been reviewed and investigated. PHP Motion has been chosen as it enables upload and sharing of videos in a fast and efficient manner, and also its easy integration with Moodle. Media server based on PHP Motion is implemented to serve for uploading and sharing of videos related to training and learning. It provides a central platform for learning technologists, academic staff and students to watch lectures and videos made by students and staff, which allow them to share their thoughts and discussions in the media server and virtual learning environments.

This is a private cloud project based on the integration of Cloud technologies and Web 2.0. It has used LDAP and Kerberos as the core security technology, and has been subjected to a series of security tests. Media server supports Platform as a Service (PaaS), where additional functions and features can be developed by PHP, and this includes tagging user names to the video, making video URL private

for limited sharing and advanced access control. Several application developments are in progress. The media server has physical and virtual images, and the backup process is automated and consolidated with the use of Storage Area Network (SAN). The physical server is used as the central server for 24/7 services. So in case of server breakdown, the recovery process can be quick and efficient due to the use of virtualisation and backup. Data and services can be resumed promptly to reduce business risks. Full and partial virtualisation are available.

Currently Media Server fulfils requirements as private cloud for the following reasons:

- It uses virtualisation and Infrastructure as a Service (IaaS) for backup, automation and service recovery.
- It uses PaaS for PHP and application development to improve the content and quality of media server, as well as integration with Moodle.

5. Supply Chain Private Cloud

The University of Greenwich has started Supply Chain private cloud with an emphasis in e-Procurement. The University of Greenwich feels it helps consolidating purchase and procurement as a managed process, in which e-Procurement is able to meet business requirements and improve on the business process. The e-Procurement provides a central platform to access to different products, services and suppliers, and is easy to use. It improves the efficiency in procurement, and the end of each stage, the output is passed on to the respective approvers. For example, an IT Manager chooses a list of required products for his School, and follows a list of recommended steps to complete the e-Procurement process. This is then sent to a Senior Finance Officer to review. Upon approval, it is sent to one of the Directors, often the Director of Resources, to review and approve. Upon the second approval, the suppliers receive order forms, and then check and package items for delivery. The process can take as little as two days from the time of making orders to the time of receipt goods.

Apart from quantitative and computational approach, qualitative methods such as interviews, surveys and case studies are used to obtain regular feedback to improve services and identify any areas that result in dissatisfaction. Interviews with the Head of University Procurement, Senior Finance Officer and Head of IT have been in progress and videoed, so that they can be archived, stored and shared in the Media Server and virtual learning environments. New proof of concepts is in the development.

6. Discussions

6.1 The upward and downward relations in the CCBF

Chang et al. [4] demonstrate the CCBF is a working framework defining relationship between different services, and how they are connected to each other. They also explain the upward and downward relation within the CCBF. Upward relation means when a service should be

upgraded to the next level. When a service is developed to a certain stage, upgrade is necessary, and collaborators can use the CCBF to determine when and how to upgrade. The downward relation means the dependency of the service. Referring to Media server case study, the extent of success of PHP PaaS relies on the infrastructure to be robustness, availability and reliability. If regular uses are common with an increase workload on bandwidth, and video or data exchange, it will then upgrade to a better platform, or to SaaS.

6.2 Integrations between three case studies

The three Greenwich case studies have served their purpose for Cloud Computing migration and development of private clouds. There would be more added values if the three different projects could work together, and the outcome of one project be used for another. For example, interviews and case studies for Supply Chain private Cloud and Sharepoint migration can be videoed and uploaded into the Media Server, which will provide a platform to use and share resources. When application development is fully completed on Media Server, they can be used as a SaaS, which will be planned to interact with or link to SaaS development on Sharepoint. Procurement and supply chain activities can be extracted, summarised and uploaded onto Media Server and Sharepoint.

Chang et al. [4, 10, 11] also demonstrate Business Integration as a Service (BIaaS) that can further improve the process and integration of different activities. Conceptual BIaaS can be used to demonstrate how these three activities can work together.

6.3 The role of CCBF and Portability for Educational Cloud Computing

CCBF has helped several Universities in their design, deployment and migration to Cloud services. The examples can be summed up as follows:

- King's College of London (KCL) and Guy's and St Thomas' NHS Trusts have developed Cloud Storage based on IaaS and PaaS solutions. Services are in place to help researchers with backup, automation and data integration.
- The University of Southampton has used CCBF in measuring its performance in cost-saving, and also to demonstrate how risk modelling can be calculated and performed in different Clouds and domains. Data about user satisfaction is in the process of collection and further analysis.
- MyExperiment, an e-Science platform developed by the Universities of Manchester and Oxford, has used BIaaS (part of CCBF) to demonstrate how different activities in analysing, processing and sharing digital music can be jointly used.
- The University of Greenwich presents three case studies in the development and migration of Sharepoint, Media Server and Supply Chain private cloud.

7. Conclusion and Future Work

Cloud migration has been designed, implemented and serviced at participating organisations to provide added values such as efficiency improvement and time reduction in code development and execution time. This is particularly important for Universities to adopt Cloud strategies and migration. Three Greenwich case studies are presented to demonstrate portability to private cloud, or in the process of moving from hybrid cloud to private cloud. BIaaS will be developed to integrate different activities in Sharepoint, Media Server and Supply Chain private cloud to achieve cost-saving, agility, resource consolidation and efficiency improvement.

The CCBF is useful and has helped the Universities to achieve good private cloud design, deployment and services while meeting their requirements and challenges. This paper also strongly supports JISC vision of University Cloud adoption which offers key benefits to education and research.

8. References

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