Platforms and Possibilities for Teaching Cloud Computing

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ABSTRACT

The cloud represents for computing an area of extraordinary growth, both in terms of uptake from organisations wishing to offload some of their computing services and in terms of the expansion in the range of services available. As a result, it is important that students encounter the technologies and environments associated with the Cloud. This poster outlines a basic approach for offering a practical course in cloud services, specifically the intersection of public and private cloud environments and how these can be best managed with available tools and strategies.

Categories and Subject Descriptors

K.3 [**Computers and Education**]: Computer and Information Science Education - *computer science education, curriculum, information systems education.*

General Terms

Management, Documentation, Performance, Reliability, Security.

Keywords

Cloud computing, teaching resources, private cloud, public cloud.

1. INTRODUCTION

The Department of Computing at the Christchurch Polytechnic Institute of Technology (CPIT) will offer a new course on cloud computing in the first semester of 2014 called "Cloud Services". This is a response to the rapid proliferation and expansion of cloud-based offerings and graduates needing be informed of this vital area of computing. The challenge for teaching staff is how best to introduce students to the topic and provide them with a meaningful experience of these technologies. The course covers two main cloud options: the private cloud and the public cloud [1]. Each of these cloud options provide a different perspective on how organisations might utilise cloud computing, both now and in the future.

While offering students choices allows them to take greater responsibility for their learning, teaching staff must also ensure the choices offered will ultimately lead to a favourable outcome. To this end it has been decided to only allow choice from a selected range. If students decided that they wanted to pursue an option outside the offered range, teaching staff would have to carefully consider that option in a one-off basis.

2. CLOUD COMPUTING AT OTHER INSTITUTIONS IN NZ

A number of New Zealand universities currently offer courses that contain elements of cloud computing, but these focus on security. For instance Waikato University offers a 2014 course titled "COMP427/527 Cloud Computing Technologies and Security" [2]. Other institutions may teach some cloud computing but again it is done in relation to security, for instance Canterbury University offers "COSC 421: Special Topic: Advanced Topics in Security" [3] and University of Otago offers "INF0393 - Computer Security" [4]. There is more to the cloud than security and while this is critically important, it is ultimately just one aspect of this form of computing. Outside of the universities there are a number of vendor driven cloud computing courses delivered by institutes of technology and polytechnics [5] and private training establishments [6].

3. REQUIREMENTS

The Cloud Services course focuses on the major constraints related to virtualisation, networking, and storage. The choice of private cloud platform is limited to some extent by the hardware available. The teaching network at the Department of Computing at CPIT called TechLabs makes desktop-based virtualisation available to students, and this demands powerful hardware. One of the computer suites has machines with 32 GB of RAM and quad core Xeon CPUs. They run Windows 7 as their operating system and VMware Workstation 9 for the virtualisation software.

In addition to the hardware virtualisation requirements, shared networking and storage is also important. The network infrastructure, with its support for virtual LANs, enables students to work in groups and share their environments. TechLabs

switching equipment can be configured to accommodate the cloud computing course.

Along with the sharing of their machines, the sharing of their data allows students to be separated from the actual workstations and allow their virtual machines to be more easily shared between workstations. It is expected that new computers will be purchased in 2014 and machines of equal or more powerful configuration will be available. Any choice of platform for the private cloud will have to work within the constraints of the environment.

As for the public cloud choice, the main consideration is cost. As an academic institution, teaching staff have to be mindful of cost as public cloud offerings can be expensive if its use is not properly monitored.

4. POSSIBLE CLOUD CHOICES
Within the limitations outlined in section 3, the choices of platform for students in 2014 will be:

4.1 Private cloud computing
VMware Workstation allows guests to run their own hypervisor due to the feature. This feature allows VMware Workstation to host the following hypervisors: VMware's ESXi, Microsoft's Hyper-V, Citrix's XenServer, and open source project KVM. The ability of VMware Workstation to host these hypervisors allows a number of private cloud solutions to be supported within the TechLabs environment.

The private cloud solutions that would be offered to students are VMware's vCloud Director (which uses the ESXi hypervisor), Microsoft's Private Cloud (which uses the Hyper-V hypervisor), and OpenStack (which can use all the hypervisors supported by VMware Workstation).

4.2 Public cloud computing
Students will be given the choice of three major public cloud computing providers: Microsoft's Azure platform, HP Public Cloud and the Amazon Web Services (AWS)). While other platforms exist, Azure, HP Public Cloud, and AWS are attractive options because each offer academic programmes and/or free trials, allowing tertiary education access to free (but limited) use of resources [7] [8] [9]. Google also have a comprehensive offering but at present there is no academic pricing plan.

5. POSSIBLE PROJECT CHOICES
The project work on private cloud integral to the course will require students to explore the use of cloud technologies and automate the management of traditional infrastructure services such as file and print, identity, network administration, database and hosted applications. It will also focus on provisioning environments for testing and development by teams internal to the organisation.

The project work on the public cloud will focus on the types of deployments that organisations typically perform, from hybrid infrastructure to hosting elastic public facing services. The course will also involve transitioning from an in-house application to the cloud and that it involves.

6. CONCLUSIONS
There is little doubt that present and future graduates will encounter and interact with cloud computing in some form or other. The course provides students with an experience of different platforms and the range of possibilities of how this paradigm shift will affect their working lives. This involves the current interplay between public and private clouds and their actual and potential role in business. Moreover, as a level 7 course it contains an element of critical evaluation and comparison, not just in terms of functionality but also in terms of flexibility, scalability and cost.

7. REFERENCES

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