**The migration of The University of Poppleton's E-Learning material and
student grades from its native platform (Moodle) to a Cloud based Service provider.
A Discussion of the professional, legal and ethical issues.**

ABSTRACT

Cloud technologies (CT) create innovative, cost-efficient and secure decentralised models for access to shared computer resources, Ford (2018). Cloud computing (CC) provides greater flexibility and user experience, Zdravev (2021) and offers data storage to be accessed over the internet anywhere, anytime via digital devices. The success of CC is its dynamic architecture, performance, cost-efficiency and scalable solutions to its users. Its service-oriented model provides services through layers corresponding to infrastructure, platform and software. Its generic architecture is beneficial for applications in academia and education Khan (2020) however, storing metadata has been controversial leading to new policies. This essay will address the ethical, legal and professional issues with migrating e-learning material and academic results to a cloud based system (CBS) and analyse these dimensions, drawing from case studies/ examples and put into perspective this technological advancement alongside the risks it carries.

INTRODUCTION

Below are some definitions for the processes and the structure of CC as a whole.

Xiong H et al (2013) researched migrations based on expert interviews and focus groups with major international cloud solution providers and independent consultants. They highlighted concerns such as costs, skills and technologies and focused on determining the principle cloud migration processes which are summarised below:

- Software as a Service - SaaS.

Move existing on-premises applications to a cloud environment. Application vendors want to evaluate a cloud platform on which to deploy a new application.

- Platform as a Service - PaaS

Moving from the use of one software operating and deployment environment to another environment. Customers don't manage their virtual machines (VM), but rely on the infrastructures layers compute and storage resources. They create applications within an existing API or programming language.

- Infrastructure as a Service - IaaS

Offers VM as a (compute) service to users, like moving from one VM to another, or managing or interoperating the different VMs. Storage/network capabilities can be provided. Instead of purchasing servers or hosted services, IaaS customers procure/operate servers, data storage systems, or networking resources at will.

Their work provides a summary for migration solutions and point pitfalls for stakeholders such as IT specialists such as fear of losing control and status (as software is created and managed elsewhere). This would be a great case study if UOP were to consider going ahead.

Learning Management Systems (LMS) like Moodle comprise different modules, Zdravev et al (2021):

• Course management
• Student management
• Online examination management
• Online assessment module
• Online course material management
• Feedback management

The National Institute of Standards and Technology, NIST (2011) demonstrates CC, shown in Fig 1.
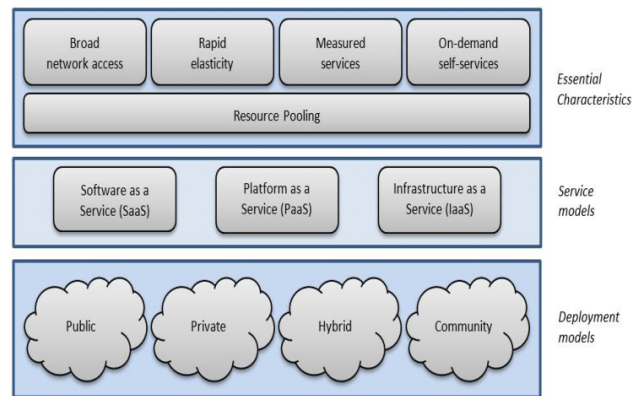

Fig 1

CC is being widely used in STEM fields, economics, finance, humanities, arts, and social sciences. Data from 80 cloud educators and researchers worldwide shows the potential of CC in accelerating research, enhancing collaboration, and enriching education which is illustrated in the XSEDE survey report 2013, Lifka et al (2013).

ETHICAL, LEGAL AND PROFESSIONAL CONSIDERATIONS

Privacy matters. When considering CC, we think of personal data (PD) transferring to an external company such as Google, Amazon or Microsoft which are considered reputable companies in this space, Ford (2018). PD can be described as anything that can be traced directly back to you without the need for additional information, Murgia (2017).

In the 2016 Cambridge Analytica scandal, data of 87 million Facebook profiles was collected through an app "This is Your Digital Life" by data scientist Aleksander Kogan in 2013 and influenced the 2016 presidential campaign leading to a $5Billion fine for Facebook. 25th May 2018, the General Data Protection Regulation (GDPR) was implemented across the EU. This allowed prosecution for non-compliance of the GDPR to anyone(s) handling PD, Delta-net (2022).

Companies cannot legally process any PD without explicit permission from the user. However there are exceptions causing debate; one being the trade off between national security and personal privacy. ico.org (2022) explains the exceptions for use of PD:

• Consent
• Contract
• Legal Obligation
• Vital interests
• Public task
• Legitimate interests

Although the act implemented strict laws to hinder the use of our PD, the stain of corruption and deceit still lingers and the public are still abhorrent of companies having control over their data.

How has this affected us? The UK law now states that all identifiers relating to PD are removed such as name and national insurance number. However, the internet is a global entity and no single country can apply its laws to the entire internet, Ricardo et al (2015).

How do we know if the data of all the students and faculty won't exploited for the gains of massive corporations? We don't. Most (third party agency-run) educational software programs use and gather personal information and metadata from students outside of the premises and control of the institutions. This data is consistently being used to research development education strategies, pedagogical/behavioural control tools from learning analytics, Alier M. et al (2021)

who goes on to describe how these studies lack an ethical and moral perspective, with a number of cases of where the information has been leaked.

The Duke University 2014 study which led to thousands of students' photos being added to a dataset was made public and downloaded mostly by Chinese private companies and military academies to improve their facial recognition systems. China has been accused of using artificial intelligence to monitor and oppress ethnic minorities such as the Muslim Uyghur population. The only sign of consent that has been admitted was the use of posters around the surveilled area on campus to warn people, Satisky J (2019).

These examples show the long lasting effect of collecting huge amounts of data. Potentially created with good intensions, they may be nefariously adapted for the benefits of groups with unethical intentions.

Most reputable companies will use an array of encryption techniques for the data being processed either on arrival or end-to-end. While nothing is ever foolproof, these measures are considered extremely safe from hacks and breaches, Ford (2018). Edge-of-cloud encryption is considered the blanket encryption of all data and while it has the most overhead provides the most security.

Rahman A. et al (2016) conducted an empirical and theoretical study on the security of e-learning CBS and found when merged they give enormous benefits to academic users but compromises security facets.

Aydin H (2021)'s study discusses challenges relating to information and communication technologies (ICT) and CC being a solution. They conceptualise four models, 'Public Cloud Model', 'Private Cloud Model, 'Hybrid Cloud Model' and 'Community Cloud Model'.

UOP could adopt a hybrid model of 'public' and 'community' that meets the expectations of a university in a cloud environment in a cost-effective manner, see Fig 2. UOP could use their own private/community CT's where security and privacy are more of a concern and public CT's where security can be kept minimal Aydin H (2021).
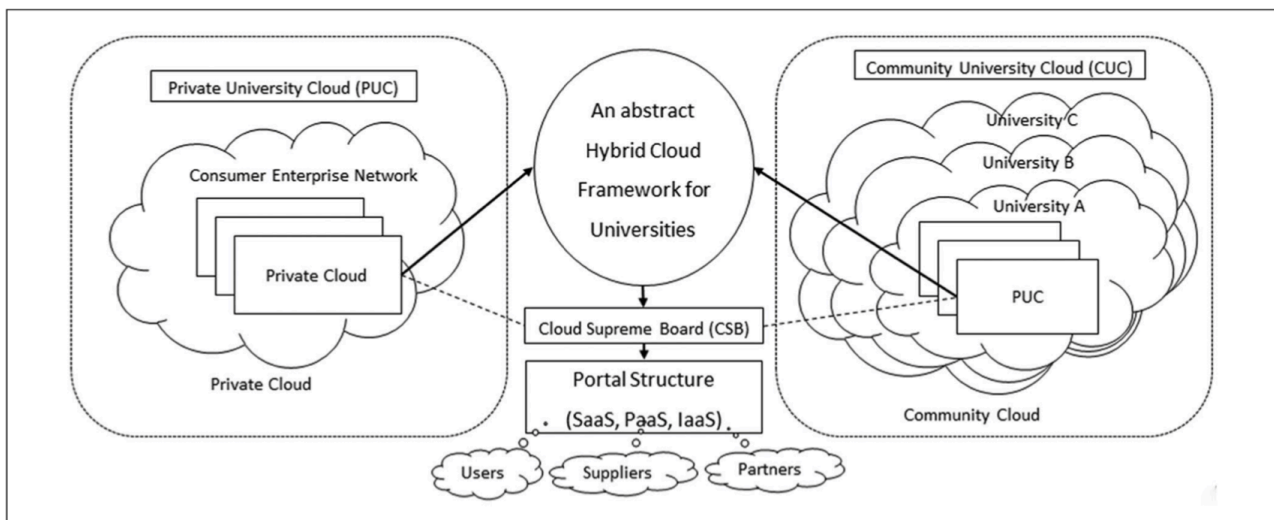

Fig 2

Public Cloud:

- Private cloud established by each university through their own IT.
- Data processes managed by each university.
- Structure belongs to each uni to to deliver SaaS, PaaS and IaaS.
- IT staff/admins located only in their universities.

Community Cloud:

- Covers information services of member universities.

- Members provide services/applications to the cloud and access them via a portal structure.

- Using their IT resources, they deliver selected cloud services.

- To share any service/application the user will do so in the community cloud. When and how depends on the members.

- Users are instructors, students, researchers, IT staff and administrators.

- Essentially allows university members to share resources in a cloud environment and disaster recovery/back-up will be implemented jointly.

CONCLUSIONS

The use of CC for e-learning can offer a lot of benefits to the users:

• Scalability
• Flexibility
• Work from anywhere
• Cost savings
• Automatic updates
• Disaster Recovery
• Security

However, the benefits of using such a system come with concerns. Choice of provider is important to the sustainability of savings. The provider should show commitment to ensuring security, usability, data integrity and have the technical infrastructure to fulfil their commitments, Henkoglu, T (2013).

Creation of apps and software systems to assist education has led to data-driven education management, development of pedagogy and policy making Alier M. Et al (2021). Issues relating to physical/intangible security, ownership of intellectual property and privacy are important. The risk of unauthorised access and disclosure of data can be increased if stored on third party systems. Alier M. et al (2021) suggested three hypothesis:

- Evolution in tech - led to difficulty in students ensuring and protecting their privacy.

- Incentives to gather/mine/exploit PD on students activity exist and don't align with their interests/ethics.

- Laws/policies created aren't sufficient to protect privacy/keep up with technological advances.

Studying these statements and considering the benefits/risks of using a CBS, this essay supports these hypotheses. Further research should be made for a solution that benefits from savings and security of CBS's while mitigating the risks of data misuse.

Mateescu G et al (2014) developed a web based tool to audit migration by quantifying the advantages and challenges pre-migration. It questions an auditor when considering cloud adoption and the answers are scored according to the risk inserted in the company with a recommended provider. This tool could be used for UOP into a hybrid model discussed earlier.

Khan et al (2020) provides a survey and summarises the challenges faced aside privacy with cloud adoption as:

• Familiarity with CC - Learning curve involved for teachers and students.
• Transfer existing infrastructure - Adequate planning and strategies like pay-as-you-go pre-built models/conversion to layered architecture mapping existing resources.
• Connectivity/Network delays - Internet speed and bandwidth, it is all inclusive?
• Lecture/Lab materials - Literature and industry still lacking online materials/exercises for specific courses/topics.
• Cloud suitability - Is it suitable for the topics being taught? Consider physical labs or hardware topics?

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