INFORMATION SYSTEMS EDUCATION JOURNAL

In this issue:

The **Information Systems Education Journal** (ISEDJ) is a double-blind peer-reviewed academic journal published by **EDSIG**, the Education Special Interest Group of AITP, the Association of Information Technology Professionals (Chicago, Illinois). Publishing frequency is six times per year. The first year of publication was 2003.

ISEDJ is published online (http://isedj.org). Our sister publication, the Proceedings of EDSIGCon (http://www.edsigcon.org) features all papers, panels, workshops, and presentations from the conference.

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Editors

Cloud Computing e-Communication Services in the University Environment

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Abstract

The use of cloud computing services has grown dramatically in post-secondary institutions in the last decade. In particular, universities have been attracted to the low-cost and flexibility of acquiring cloud software services from Google, Microsoft and others, to implement e-mail, calendar and document management and other basic office software.   These products have helped universities migrate from in-house legacy software platforms to current generation products. This paper explores the Google and Microsoft cloud service offerings for educational institutions, and compares the implementation experiences of six Canadian universities. However, although acquisition costs are minimal or non-existent, members of the academic community including faculty and students are often reluctant to entrust all of their emails, documents and calendar schedules to a complex, global, for-profit third party. The overwhelming tide is for cash-strapped university administrators to adopt third party cloud services, and cautiously manage privacy issues with alternate in-house services. Finally, the move from in-house to cloud services requires the universities to move to a cloud-aware governance model that is sensitive to information privacy and security issues.   Results of this research may lead to a better understanding of benefits, advantages, risks and challenges of the cloud computing initiatives at universities and may serve as an objective source of information for other public sector institutions which are considering cloud services implementation.

Keywords: Cloud Computing, Google Apps for Education, Microsoft Office 365, Information Privacy & Security, Software as a Service, IT Governance

1. INTRODUCTION

This paper reviews cloud computing e-communications implementations at six post-secondary educational institutions with emphasis on their implementation at Canadian universities. The majority of these universities considered utilizing cloud services for the systems which were traditionally hosted at the institution; systems that had become old and inefficient, systems which required significant financial investments to be brought up to current versions

and standards. Very often these systems would run old versions of software that were no longer supported and therefore were exposed to security and privacy risks. All these reasons lead to universities being more open to consider other options of providing systems and services utilizing Software as a Service (SaaS) through cloud computing offerings. Universities and other education entities have been attracted to the low-cost and flexibility of acquiring cloud software services from Google, Microsoft and others, to

implement e-mail, calendar and document management and other basic office software.

According to Educause (2016), cloud services are becoming a norm for higher education institutions, and Information Technology model in higher education is shifting from an independent in-house model to interdependent model. In order to exercise the advantages of cloud computing, it is necessary to make improvements of the management of university data and records through on-going education, development of standards and policies, governance and information security.

These changes in service provisioning, where services are not hosted in-house but rather off-premises creates the need to develop cloud-aware IT governance. Cloud aware IT governance must drive and support strategic decision process, balance opportunities and risks associated with cloud services and support top-down decision making process needed to accomplish strategic university goals with bottom up needs of students, faculty and staff (Educause, 2015).

Bohaker et al. (2015) argue that Canadian universities frequently utilize cloud services by outsourcing their email systems to one of two biggest vendors – Google and Microsoft. This trend began 10 years ago when Lakehead University in 2006 switched to Google Apps for Education.

The structure of this paper is as follows. First, overview of e-communication products available for educational institutions from Google (Google Apps for Education) and Microsoft (Microsoft 365 for Education) is discussed. Second, the implementation of these cloud services is examined at six Canadian Universities. Third, the overall trends are summarized from the six examples. Finally, a six stage implementation model is introduced, based on the examined university examples.

2. GOOGLE APPS FOR EDUCATION

Through Google Apps for Education, Google offers free services for educational institutions which help improve communication, collaboration, productivity and efficiency. Core services and applications available through Google Apps for Education include Gmail, Calendar, Contacts, Classroom, Drive, Docs, Forms, Groups, Sheets, Sites and Slides.

Some users fear about the ownership of their data once the data goes to the cloud, hosted by Google. According to Google (2016), the company does not own data and only keeps the personal information of its users. At any given time, if the organization decides to stop using Google, the data can be "taken back", downloaded and then migrated to another solution. Google ensures the security and privacy of its users' data and it has signed the Students' Privacy Pledge as its commitment to secure students' personal information. The company does not share personal information of Google Apps for Education users with third parties unless required by law, nor sells the user data. This applies to core services only.

However, a group of students at the University of California at Barkley filed a suit against Google claiming that the company violated the Electronic Communications Privacy Act. The plaintiffs claimed that Google created advertising profiles by using their Google Apps for Education email accounts without their notification or consent (Nichols, 2016). Google users who use other applications outside of core applications may see ads. In order to ensure compliance with policies and standards, Google engaged services of an independent auditor, Ernst & Young, to review the company's data protection practices with the goal to ensure that the company's practices, Google Apps and data centers are compliant with ISO standards (Google, 2016b).

Additional product information about Google Apps for Education and a case study are provided in Appendix 2.

3. MICROSOFT OFFICE 365

Microsoft Office 365 is another cloud-based e-communications suite which includes email and calendaring, secure file sharing and storage and text and video chat capabilities. There are more than 100 million users of Office 365 worldwide. Office 365 for Education is now free of charge to educational institutions. Some of the products included in the offerings are Exchange for emailing, calendaring and storing contacts, OneNote, Skype, 1 TB of OneDrive for cloud storage, Word, Excel and Classroom. According to Microsoft (2016a), the company guarantees 99.9% uptime, financially backed service level agreements, web support for IT related questions and issues and 24/7 phone support for critical issues. Using Active Directory integration, users' credentials and permissions can be easily managed (Microsoft, 2016b).

Additional information about Microsoft Office 365 for Education and a case study are provided in Appendix 2.

4. CLOUD COMPUTING SERVICES AT CANADIAN UNIVERSITIES

For the purpose of this paper, initiatives related to assessment and implementation of e-communication systems as cloud services were analyzed and researched at the following six Canadian Universities:

1. Lakehead University (Google)
2. University of Toronto (Microsoft)
3. University of Alberta (Google)
4. Ryerson University (Google)
5. Queen's University (Microsoft)
6. Western University (Microsoft)

Canada has 96 universities with approximately 865,000 full-time undergraduate students and 157,000 full-time graduate students (Universities Canada, 2015). The 2015 full time student enrollment figures for these six universities are presented in Table 1 in the Appendix. The six universities described below represent 19% of the undergraduate and 22% of the graduate population of full time students in Canada.

These universities were selected because they had publicly announced their plans to move to cloud based e-communications and each university is a large well established institution with a diverse population of students, faculty, administrators and alumni.

The research approach was two-fold. First, the research team at Ryerson University conducted interviews with those responsible for the Google implementation. Data presented in the Ryerson section (4.4) below reflects semi-structured interviews conducted by the research team and access to source documents such as emails, plans etc. The second research approach was to examine the public websites of the five other universities, through a content analysis approach and limited interviews with the university implementation team. Further research plans described below in section 6 will include semi-structured interviews with members of each university's e-communication team and members of the university administration.

Result of this research will lead to better understanding of benefits, advantages, risks and challenges of the cloud computing initiatives at universities and may serve as an objective source of information for other public sector institutions which are considering cloud services implementation. The descriptions that follow are sequenced according to the year of implementation, from Lakehead University in 2006 to Western University in 2015.

4.1 Lakehead University
In its goals to reinvent itself, Lakehead University stands as the first Canadian university to utilize cloud services for its email and calendaring systems. In 2006, the University signed a deal to start using Google Apps for Education for its email and calendaring. A decision to move to cloud services was described as a strategic decision which would put the University in a better position to be up front with the technology and to mitigate issues related to server overcapacity, email system crashes, slow response time or messages not being delivered (Abaya, 2006).

Migration of Lakehead University accounts from Sun 2003 Microsystem servers to Google Apps for Education started at the end of November 2006 (Jackson, 2009). In a week, 38,000 student, staff, faculty and alumni accounts were migrated to Google Apps for Education (Abaya, 2006). Google implementation did not require any payment and all support was provided by Google.

Now, Lakehead University has more than 68,000 Google accounts provided for its students, faculty, staff and alumni. It is estimated that by utilizing cloud services offered by Google, the university saves between $200,000 and $250,000 annually (all financial values are in Canadian dollars). Lakehead University is frequently used as an example of pioneering cloud computing in higher education and often gets calls from other universities which are interested in Google Apps for Education (Marar, 2012).

The Google Apps for Education implementation at the Lakehead University was not without some controversy. Some faculty members at the University expressed their concerns about email system being hosted by Google and email users being subject to the US Patriot Act. A case was brought to an external arbitrator who determined that, according to the Collective Agreement, the university was not required "to provide privacy assurance for email communications" (Jackson, 2009) and that email communications should be considered to be as confidential as postcards. Later, in 2014, after the Freedom of Information and Protection of Privacy Act (FIPPA) was submitted to the University, Shaw (2014) reported that it was found out that there was no

signed contract between the University and Google; neither the University nor Google were able to locate the signed contract – only an unsigned draft was found. It was concluded that both the Lakehead University and Google are bound by the general Google Apps for Education agreement terms. It was also reported that the Privacy Impact Assessment (PIA) was included in general research when the University was exploring other options to its old and unstable email system, but the main results of the assessment were produced in 2007 after the Lakehead University completed migration to Google Apps for Education in 2006 (Shaw, 2014).

4.2 University of Toronto

In order to review the students' communication systems and services offered at the University of Toronto such as email or other communication services, in November 2009 a consultation group was created with a mandate to review the range and adequacy of these systems, to make recommendations to the CIO about future communication services to improve student's engagement and experience and be aligned with financial priorities of the institution and identify any concerns related to protection of privacy and information security. The consultation group was made of representatives from around the institution including students, faculty and staff from all three university campuses (University of Toronto, n.d.b). In addition, a full PIA was completed after which two vendors were short listed: Microsoft with its Office 365 for Education and Google with Google Apps for Education. After further evaluation and assessment, a decision was made that University of Toronto should implement Office 365 for Education email system for its students with an option for students to opt-out and receive a University of Toronto domain address. At the same time, it was determined that due to the identified privacy concerns and risk, staff email addresses would remain on the University of Toronto internal hosted email services: Microsoft Exchange and UTORmail (University of Toronto, n.d.b).

The biggest concern related to implementation of Office 365 for Education was related to potential exposing of the users to the laws of governments outside of Canada. Email and other communication services offered to the University of Toronto students available through Office 365 for Education are hosted on the servers in the United States and therefore subject to the United States Patriot Act. The Patriot Act allows the US Government, in case of the investigation which will protect national security or help intelligence activities, with a court order or a National Security Letter, to get access and disclosure of any personal information, including emails or other information that are housed in servers in the US territory (University of Toronto, n.d.b).

With email cloud services for students being provided by Microsoft, student email servers will be hosted by the vendor which will ensure data integrity, protection, security and virus protection and will not have any corporate advertising. This will lead to improved efficiencies, reduction of the cost related to infrastructure, heating, cooling and software licensing and will enable the University to take on other initiatives which will be aligned with University's mission and its strategic planning.

Since its rollout in 2010, more than 162,000 of eligible students and alumni have switched to Office 365 for Education. Office 365 for Education provides University of Toronto students with various email and communication features such as 1TB Inbox & OneDrive, Calendar and contacts, OneDrive (used for collaboration and online document editing), as well as it offers free Microsoft Office for students which are currently enrolled in the courses offered at the University of Toronto (University of Toronto, n.d.b).

After successful implementation of Office 365 for Education for students at the University of Toronto, with direction of the provost, the University started faculty and staff e-communications consultation process which lasted from September 2013 to September 2014. The e-communications Advisory Committee, in collaboration with Information Technology Services at University of Toronto was tasked to assess how University of Toronto can enhance its existing communication system (University of Toronto, n.d.a). It was found that the current email system does not meet industry standards. This ultimately impacts efficiency of the work done at the institution, as well as it has negative impact to work done with the institution's partners both in Canada and aboard (University of Toronto, 2014).

In order to gather information from community members, various meetings took place - from town hall and committee meetings to meetings with departments including Office 365 demo and question period. Community members were also able to provide their feedback about this consultation initiative through web site (University of Toronto, n.d.a).

In September 2014, Vice President and Provost of University of Toronto provided official response to the report. Some of the major risks that were identified were the end of the cycle of the technology systems which are very often unsupported and which can easily be compromised, as well as across the institution practice of using cloud services which more often than not have not been risk assessed (University of Toronto, 2014).

According to the report produced by e-communications Advisory Committee, new services need to ensure security and protection of the valuable assets which will be supported by data encryption. The report also indicated and emphasized a need for educating users on best IT security practices including how to best protect and handle information.

The Committee was not able to reach unanimous recommendation if the faculty and staff at University of Toronto should switch to Office 365 for Education. As discussed earlier, from 2010, all students and recent alumni were required to use Office 365 for Education. The report also identified that, if the University was to implement Office 365 for Education, it will be free for the University and will not require any one-time-only (OTO) investments or any additional annual investments. Some other options were also considered such as in house and off-premise alternatives. However, these alternatives would not be free of charge for the University. It was estimated that the in house alternative would cost the University just over $1.3 million in OTO and then $1.2 million annually. Off-premise alternatives would not require any OTO spending, but it was estimated that it would cost the university $3.4 million annually (University of Toronto, 2014).

To date, a decision has not been made about future of cloud services for University of Toronto faculty and staff.

4.3 University of Alberta
Prior to making a decision to move its e-communications to cloud, IT services at the University of Alberta were supported by two centrally-supported IT services and with 30-50 small IT groups across the campus. At the time, there were 82 independent email systems across the University. This led to duplication of systems and resources, privacy and security issues, the lack of calendaring system, numerous Blackberry servers etc. (University of Alberta, 2010a). In order to eliminate these issues, the Office of Vice

Provost (Information Technology) made a proposal that all 82 email systems be replaced by a single, centrally supported email, calendaring and Blackberry service which will potentially be provided by an external provider. It was suggested that centralization would enable IT professionals to spend more time on initiatives related to their own units and would free up physical space and reduce power needs. Centralization would lead to unification of all email addresses, improve email security and enable consolidation of Blackberry services. At the same time, some potential concerns related to centralization of services were identified such as reluctance for change - faculty and staff would need to learn a new system and they would need to let go of their own systems (University of Alberta, 2010a).

For almost a year University of Alberta assessed the possibility of implementing a central email and calendaring system either hosted in house or outsourced. Two alternatives for in-house service Microsoft and Zimbra required a multimillion dollar up-front investment, and on-going annual cost associated with ever-greening, resources, space, heating and cooling were determined not to be viable and it was recommended that central email and calendaring solution be provided by Google utilizing Google Apps for Education (University of Alberta, 2010a).

Even though Google was recommended as a vendor, actual implementation did not start until all technical issues were resolved, the University got official approval by the planning committee, a PIA was completed and the contract signed by Google (Scaeffer, 2010). Finally, in December 2010, it was announced that University of Alberta is moving to Gmail. Through a phased approach and adoption, in March 2011, the University invited first 7,760 people to test Google Apps and at the end of the month it allowed all students to switch to Google. In less than two weeks, more than 29,000 students switched to Google. By the September 2011, over 60,000 users switched go Google and migration teams started migration of departments and business units. By the end of 2011, over 89,000 users migrated to Google Apps, central webmail server was put to read-only mode and efforts were put in place to start migration of the departmental servers to uAlberta Google Apps (University of Alberta, 2010a). With so many departmental email servers to be migrated, complete migration was estimated to go well into 2012 (University of Alberta, 2010b). It is estimated that now there are more than

120,000 uAlberta accounts hosted by Google (Contact North, 2012).

4.4 Ryerson University
In January 2011, the Advisory Committee on Academic Computing (ACAC) and Computing and Communications Services (CCS) at Ryerson University initiated a consultation process with the community members to assess and determine the future of email and collaboration systems for the University. At the time, Ryerson used two central mail systems (RMail which was available for students, faculty and staff and GroupWise which was available for faculty and staff) as well as some departmental email systems. The mandate of the team was that, through consultation process with the Ryerson community, determine benefits and risks of using cloud services versus in-house services and to make recommendation on improvements or replacement of the email and collaboration system to the Provost and Vice President Academic, and to the Vice President Administration and Finance (Lesser, 2011). As part of the consultation process, various town hall and departmental meetings took place, as well as a symposium was organized by the Ryerson's Privacy and Cyber Crime Institute: *Exploring the Future of E-mail, Privacy, and Cloud Computing at Ryerson.*

According to Lesser (2011), community requirements were gathered, an RFP was posted, proposals were received and the unanimous recommendation by the ACAC was to acquire Google Apps for Education. It was also recommended that students and faculty who do not want to use Google for their email could choose to stay with the 1990s Ryerson e-Mail (RMail) system. The recommendation was accepted in January 2012 by the Provost and Vice President Academic and the Vice President Administration and Finance, when the University started negotiating a contract with Google and extending the privacy risk assessment, as well as financial risk assessment (Lesser, 2012).

Starting in August 2012, the University began migration of RMail and GroupWise accounts to Google Apps. The phased approach was used by migration of the pilot users first – "alpha phase", then CCS staff, followed by selected "early adopters" users. Then, in October 2012, all staff and faculty and students who opted in to use Gmail instead of Ryerson RMail system were migrated to Gmail. Over the Thanksgiving long weekend in 2012, 138,830 new Google accounts were created and 19,266 email accounts were migrated to Gmail (Ryerson, 2012c). Currently, there are over 87,000 active Ryerson Gmail accounts.

Some of the identified benefits provided by Google were large/unlimited storage, enhanced organization of the messages, real-time collaboration functionality and calendar sharing (Ryerson, 2012b).

4.5 Queen's University
IT governance at Queen's University is driven by a strong partnership between the Office of the CIO and Associate Vice-Principal, Information Technology Services department and various steering and advisory committees who together with the community members ensure that information technology initiatives support Queen's university Academic and Strategic Research plans (Queen's University, 2014).

After extensive consultations about the new student email and calendaring solution and completion of an independent privacy risk assessment, Queen's implemented Office 365 for students in January 2013. This was the first time the institution had used cloud services hosted outside of the University. By switching to Office 365, students got 250 times more storage than what they had before migration. The University was able to decommission six servers which were no longer needed (Queen's University, 2013).

After the success of Office 365 implementation for Queen's undergraduate and graduate students, the Associate Vice-Principal and Chief Technology Officer lead a year-long consultation process with various groups at the University as well as with the individual faculty and staff members about exploring implementation of Office 365. Similar to cloud service implementation at other universities, increased security and privacy risks were identified as a potential showstopper for Microsoft 365 implementation. The consultation and assessment process revealed that Microsoft can provide better system security than can be provided by the institution (Leroux, 2016). It was also determined that features and functionality offered by cloud based services, including large storage and better security outperform current services available at the University (Queen's University, 2015).

In February 2016, Queen's University began migration of its faculty and staff email system to Office 365 for Education which provided access to email, calendar and file sharing and file storage. Queen's University faculty members had an

option to opt-out of using Office 365 with an option to opt-in to using Office 365 at a later time, if they chose to do so (Leroux, 2016).

4.6 Western University
Starting January 2015, Western University started with migration of the student accounts to Office 365. The initial migration included pilot users - students who have chosen to participate in the pilot migration. In the following months and until August 2015, all undergraduate and graduate students as well as new students were migrated to Office 365. In July 2015, migration of Administrative support units' accounts started with Information Technology Services being the first unit to be migrated to Office 365, followed by migration of other units throughout Fall of 2015 (Western, 2015a).

By early 2016, all students and Administrative staff have been migrated to Office 365. Faculty accounts were scheduled to be migrated from May 2016 to July 2016. Faculty members had an option until March 31, 2016 to choose to delay that their accounts be migrated to Office 365 until Microsoft provides hosting of email servers in Canada. Office 365 users at Western got 50 gigabytes of email storage which was 1000 times more for the undergraduate students than they had before migration (Western, 2016).

Western University completed a full PIA prior to making decision to move to Office 365. The assessment was completed by Western's Information Technology office, Legal Counsel and Privacy Office. The PIA document was prepared in August 2014 and then revised and updated in October 2015. The document was also reviewed prior to making a decision to migrate faculty and academic accounts to Office 365 and it was determined that there was no need for any material change to the document (Western, 2015b). The assessment outlined issues and deficiencies related to an old email and calendaring system (Convergence) hosted in-house and growing needs of Western users for more efficient and robust systems. It was reported that authentication and identification information such as email address, full name and email token, user created content such as emails or calendar info and system captured content such as cookies will be "shared with, collected and used by Microsoft in delivering Microsoft Office 365" (Western, 2015b). The report outlined data usage and destruction issues, potential privacy risks such as the loss of data management and user data, access by foreign governments, student calendar being exposed to other users as

well as recommended solutions to mitigate potential risks. Being a late entrant to cloud services for e-communication, Western was able to benefit from knowledge and experiences from other universities which have already migrated their email and calendaring systems to cloud and through consultation leverage at the technical and legal levels (Western, 2015b).

5. DISCUSSION

This paper shows that majority of Canadian institutions who switched to using cloud services for their email and calendaring system as well as for document sharing and collaboration, have chosen one of two dominant commercial vendors – Google with Google Apps for Education or Microsoft with Office 365 for Education.

From the six examples above, the key stages in evaluating and migrating to cloud communication services are as follows;
A. Establish a university committee with broad representation including students, administration and faculty members, to assess the costs, risks and opportunities of moving to cloud communications.
B. Consult widely with stakeholder groups: faculty members, administrative staff, students and alumni. Review the experience of comparable universities with similar projects.
C. Conduct a PIA using a third party, and prepare a business case that focuses on cost reduction and improved services. Identify benefits for each stakeholder group.
D. Confirm and communicate the plan with executive level commitment, such as Provost, Vice President or President. The changes will have a major impact on the university.
E. Plan a phased implementation, typically with student groups migrating first.
F. Consider options for stakeholders who resist migration, such as remaining on the legacy in-house system.

Table 1 in Appendix 1 provides a summary of the six implementations.

6. CONCLUSION AND FURTHER RESEARCH

Cloud computing became an important strategic resource for the high education institutions because it enables them to provide efficient and scalable services for its students, faculty and staff while freeing its resources to do the work they are

committed to do – provide support for academic and business goals of the organization. Cloud computing e-communications implementation in these six Canadian Universities and around the world shows that there are many benefits associated with cloud computing such as free and on demand e-communication services which are available at anytime from anywhere, smaller operational expense, less infrastructure cost such as power, heating and cooling costs. It also shows that the major e-communications service providers – Google and Microsoft have their servers hosted outside of Canada which creates some issues and concerns related to data privacy and security. It also shows that before making decision to switch to any cloud service, there is a need to complete a full PIA and, through consultation process, to involve all university stakeholders and decision makers into the process. This will lead to better customer engagement, make users happier and most likely lead to creation of better positive outcomes for the universities as well as for their community members.

This report shows a strong competition between Google and Microsoft in gaining and continuing to keep their presence at educational institutions. Out of six Canadian universities, three chose Google and three chose Microsoft for their e-communication service providers. With free e-communications offerings available for educational institutions, it is expected that educational institutions will continue gaining benefits of cloud computing offered by two of the world's most valuable companies.

Further research is underway by the research team, to develop the findings presented in this paper. A series of semi-structured interviews are being conducted at each of the six universities with two or three representatives from the university administration and a similar set of representatives from the implementation team, typically in the IT department. This further research will endeavor to answer two questions: 1) are there measurable differences between Microsoft and Google in terms of implementation or user satisfaction, and 2) what are the long-term costs of allowing some members to opt-out?

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Appendix 1 – Table of Comparison

University	Full time undergrad / graduate students enrolled in 2015	Cloud Service Provider and Product	Implementation Year (start)	The latest recorded number of accounts – students, faculty, staff, alumni	User Group	Opt-out available
Lakehead University	5,800/ 880	Google Apps for Education	2006	68,000	Students, faculty and staff	No
University of Toronto	63,800/ 15,900	Microsoft Office 365 for Education	2010	162,000	Students	Yes
University of Alberta	27,470/ 5,950	Google Apps for Education	2011	120,000	Students, faculty, staff	No
Ryerson University	25,150/ 2,200	Google Apps for Education	2012	87,250	Students, faculty and staff	Yes (students and faculty only)
Queen's University	19,200/ 4,200	Microsoft Office 365 for Education	2013	See note below	Students	No
		Microsoft Office 365 for Education	2016	See note below	Faculty and staff	Yes (faculty only)
Western University	22,600/ 5,300	Microsoft Office 365 for Education	2015	See note below	Students and staff	No
		Microsoft Office 365 for Education	2016	See note below	Faculty	Yes (only if they opted out by March 2016)

Table 1 – Summary of cloud service implementations at Canadian Universities

Note: According to information from Microsoft, there are currently tens of thousands users of Office 365 for Education at this institution.

Appendix 2 –Product Information and Case Studies

Additional Google Apps for Education information

According to Google (2016b), Google Apps for Education is used by more than 50 million users in more than 190 countries all over the world, including seven out of eight Ivy League Schools. Google states that it is an affordable and easy-to-use system supported by the top 500 engineers; Google Apps for Education provides the best security measures for data privacy and protection.

The initial offering of Google Apps for Education included a 30GB storage limit for Google Drive files and Gmail messages. In October 2014, Google removed this storage limit and it now offers unlimited storage with the only restriction that files cannot be larger than 5TB in size.

According to Google, the service provides 99.978% availability without scheduled downtime. Robust and scalable infrastructure ensures fast and reliable services including more than 100 billion search queries each month. System redundancy and data replication over clustered servers ensure that data will be accessible at any given time and will not be lost in case of one data center failure (Google, 2016c). Google not only ensures system reliability by robust infrastructure, network and applications but also by a business continuity plan which accounts for major disasters such as earthquakes. The plan is designed to ensure the delivery of services in situations when major people and services may not be available for up to a month (Google, 2016c).

The number of users using Google Apps for Education is growing quickly. In just two years, from 2010 to 2012, the number of Google Apps for Education users doubled, from 10 million to 20 million. Many K-12 students in the United States are using Google Apps for Education including the state of Oregon which adopted Google Apps for Education for all K-12 classrooms (Koetsier, 2013). Now, with 60 million users worldwide, Google is proving its dominance in the cloud computing market.

More than 10 million of 60 million Google Apps for Education users are using Google Classroom, the tool which was created in collaboration with teachers in order to help them save time, be more efficient and improve communication with students (Google, 2016a). Using Google Classroom, teachers can create classes, organize documents, manage multiple classes, distribute paperless assignments and quizzes, transfer grades to be uploaded to other systems and communicate with the class. Google Classroom works with other Google products such as Gmail, Google Drive, Google Documents or Google Calendar and benefits not only teachers, but also students who can access class documents on Google Drive or see assignments on Google Calendar (Google, 2016a). Classroom is receiving a great uptake and Google is focusing its efforts to making enhancements to the application based on feedback from users (Panettieri, 2016). Google Classroom can be integrated with more than 20 applications.

According to Panettieri (2016), the majority of Google's educational customers are North American customers. In 2011, 61 of the top 100 US universities including Yale University, the University of Notre Dame and Boston University selected Google as a provider of e-communications and collaboration systems offered through Google Apps for Education (Google, 2011). This was another testament of Google's strong dominance in the US education sector. Google is also expanding its free offerings to educational institutions in Europe, Asia and other regions.

Case Studies of Google Apps for Education in Europe
The Vedruna Schools of Catalonia in Spain have approximately 22,000 students from Kindergarten up to High School located in 36 centres across the region. In their goals to increase digital literacy of their students and enable competency-based teaching and learning, in 2013, the Vedruna Schools started a pilot project with 150 Chromebooks and Google Apps for Education (Google, 2016e). The pilot lasted three months and showed good results. Students appreciated the benefits that Google Apps brought to their learning results and their relationships with their teachers. Teachers identified benefits of using the Google Groups product available through Google Apps core products to communicate with their students. The success of the pilot lead to a second implementation in January of 2014, followed by 2,000 new Chromebooks and 3,000 users using Google Apps for Education (Google, 2016e).

According to a case study report prepared by Google (2016e), some of the benefits identified by the introduction of Google Apps and Chromebooks included improved digital competency of students which went from 30% before their introduction to 80% after they were widely used, a new teaching methodology, improved communication between teachers and students and greater motivation and learning capacity. It is expected that with elimination of maintenance and licensing costs, the Vedruna Schools will save more than 600,000 euros due over the next four years.

Microsoft Office 365 for Education information

Similar to Google Classroom, Office 365 for Education now includes Microsoft Classroom.
The application enables teachers to manage their classes, organizes classes into sections, create assignments and set due dates, post them in Outlook calendar and provide feedback to students. Students can access their assignments not only on their computers, but also on their mobile devices using Microsoft Classroom for iOS or Android (Microsoft, 2016a).

To increase its openness and transparency, Microsoft launched an Office 365 for Education Roadmap which provides information about updates currently planned for applicable subscribers. The roadmap includes information about updates that are in the development phase, updates that are beginning to roll-out, fully released updates as well as previously planned updates that are being cancelled (Microsoft, 2016c).

Microsoft Office 365 for Education in Australia
During the summer of 2013, the majority of Australian universities including the University of Technology Sydney, Curtin University, Victoria University, Flinders University, Sydney University, the University of Wollongong and the University of NSW who in the past used Microsoft Live@edu email services either migrated or have scheduled an upgrade of free services offered by Microsoft to Office 365 for Education. At that time, CIOs of Australian universities were given the option for their data to be hosted either in the United States or Singapore. Some universities chose to store their data in the United States due to "perceived similarities between United States and Australian privacy law" (Coyne, 2013). For the University of Technology Sydney (UTS) or the University of Wollongong, having data stored in United States servers was not a big issue. Over 60% of UTS users were forwarding their emails to another email accounts. In addition, there were indications that similar rules would apply in Australia as in the United States – if the Australian Federal Government and Police asked that data be handed to them, the university would need to comply with this.

Other universities, such as Victoria University, chose to have their data stored in Microsoft data centers located in Singapore. According to Zoran Sugarevski, the acting director of Information Technology Operations at Victoria University, hosting data in Singapore was better aligned to Australian law. By completing a regular, six-month assessment of all companies the university has contracted with, the university ensures that its contractors, including Microsoft, follow policies, practices and procedures related to data storage and security, as well as data archival and destruction (Coyne, 2013).

In 2014, Information Integrity Solutions (IIS), a large consulting company in the Asia Pacific region which provides services in data protection and information privacy (Information Integrity Solutions, n.d.a), prepared a PIA report for the Education and Training Directorate (ETD), Australian Capital Territory (Information Integrity Solutions, n.d.b). A PIA was conducted on planned implementations of Microsoft Office 365 for Education and Google Apps for Education. The goal of this engagement was to make an assessment of the implementation of the cloud offerings available from Microsoft and Google. Based on the assessment done by IIS, "the risk of privacy harms to students and teachers through misuse or inappropriate disclosure of personal information collected about students and teachers" by using Google Apps for Education was identified as low, and through Microsoft Office 365 was identified as minimal (Information Integrity Solutions, 2014). The report stated that Google has a complex privacy framework, making it difficult to understand its approach to privacy and data protection. Google reduced a risk associated with advertising by its announcement that it will not scan Gmail for advertising purposes for users of Google Apps for Education. The report also indicated that even though both companies state their commitment to privacy and data protection, Microsoft was more transparent in its approach to achieve those objectives and the company was prepared to undertake such contractual agreements which would ensure its commitment to privacy and security.