IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

Mapping Cloud Based Facilities for Academic Use

Dr. S. Sujatha
Librarian
Prince Dr K Vasudevan College of Engineering and Technology, Ponmor, Chennai

Abstract: *The pay-as-you-use service model is one of the key factors for the success of cloud computing paradigm: resources are used only when needed and charged on basis of their actual usage. There are ICT services through cloud which are even provided free to educational institutions and institutions can benefit from these services. Universities necessarily do not have enough resources to spend on subscribing or establishing ICT facilities but these facilities are essential for improving the way faculty & student interact, communicate, and carry research activities. Faculty, staff and students have access to services like institutional email, 1 TB drive space, Office applications free which otherwise require purchased licenses. In this paper, the different free services provided for educational use are discussed, analysed for perception of its adoption. Further, case study of these services implemented at university of Kashmir has been chosen as the research methodology to discuss and demonstrate the educational cloud services. According to the results, clear understanding and operational ease, high reliability, ease of accessibility with no financial implications is achieved. This guarantees the desired performance level and minimises the expenditure otherwise to be incurred on setting up or subscribing to such services.*

Keywords: Cloud computing, Cloud services, Educational cloud, Hybrid computing, Mapped computing, Universities.

I. INTRODUCTION

Technology transforms the way information is disseminated and knowledge is shared between students, researchers, and faculty) is the Universities' transition to research Universities and ongoing update of the IT (Information Technology) infrastructure as foundation for educational activities and science research. With the evolution of technology, the number of services which migrate from traditional form to the online form grows as well. Faculty-student interaction is not limited to class room only. Achieving transparency and efficiency in academic processes particularly in activities pertaining to teaching, learning and continuous assessment with high reliability and accessibility is must in todays' times, in such scenario use of cloud computing becomes a necessity and not an option for many universities. This aspect is due to a multitude of factors such as costs increase, the pressure of income increase, students' success, institutional performance and competition in development. However, achieving this within the budgetary constraints has been a challenge for academic institutions. The tendency observed during the last few years within the higher education level is the Universities' transition to research Universities and ongoing update of the IT infrastructure as foundation for educational activities and science research. With the evolution of technology, the number of services which migrate from traditional form to the online form grows as well. For these specific services an adequate providing form must be found in the online environment. Cloud solutions can be used to support cooperative learning and socially oriented theories of learning, using computer technologies to support collaborative methods of instruction. The pay-as-you-use service model is one of the key factors for the success of cloud computing paradigm: resources are used only when needed and charged on basis of their actual usage and some educational services are even provided free of charge by tech giants like Google and Microsoft. The cloud environment entails great flexibility and availability of computing resources at different levels of abstraction at a lower cost. There are vendors who lease out cloud services to customers they are called Cloud Service Providers (CSPs)(e.g., Google. Microsoft, Amazon). Cloud computing resources and services that are dynamically utilized based on customer's demand according to a certain business model [27]. Common services of different application areas such as business, education and governance are provided to the customers online. These are accessed through a web browser, while data and software

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

programs are stored on the cloud servers located in the data centres (source: http:en.wikipedia.org.wiki/Cloud_computing).

II. CLOUD COMPUTING

The Cloud computing appears to have many definitions around. A study by McKinsey (the global management consulting firm) found that there are 22 possible separate definitions of cloud computing. The fact that there is no common standard or definition for cloud computing seems to exist [13,37]. A more commonly used definition described it as cluster of distributed computers (largely vast data centres and server farms) which provide on-demand resources and services over a networked medium (usually the internet) as cloud image in order to conceal the complexity that lies behind them [25].

Computing has had tremendous shifts, from the era of mainframe to client server model to the network model. Internet has changed the way computing through network model. Internet has changed the way computing through network model can take place from off-site locations without the need for the organizations to heavily invest on building its own infrastructure. The advent of cloud computing has made it possible, an innovative technology with dynamic scalability and usage of virtualized resources that can be shared by the users as a service through internet. It is regarded as potential solutions to advancing modern organizations' IT competitiveness and performance [5,10,12,41,36]. Users need not have in-depth background knowledge of the services. User can communicate with many computing servers at the same time and exchange of information can take place among themselves. Compute power, storage, memory resources can be shared among different servers without the need to physically relocate them. Resources are dynamically provided on a self-service basis over internet via web services from an offsite third-party provider.

III. CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing lowers the inefficient tendency of network architectures to over compensate client-server capacity during implementation phase for ensuring acceptable performance at peak loads [4].

National Institute of Science and Technology (NIST) accepted five general characteristics of cloud computing [3,11,21,23,30,38,22,43]:

- Automated self-service setup: Consumers can run and configure their own computing resources as required.
- Broad network accessibility: Cloud computing resources are universally available through internet and accessible via various devices.
- Pooled resources: Users do not have their own dedicated network, infra. Also multiple users can work on the infra and resources.
- Scalability: Consumers can keep control over the availability of computing power to them.
- Metered services: It is a metered service and consumers are charged on pay as you use basis i.e. as resources are used consumers are charged.

IV. CLOUD COMPUTING SERVICE MODELS

The cloud computing is divided into three service models [22, 25, 31, 43]

- *Infrastructure as a Service (IaaS):* Services offered through this service model include the remote delivery of a full computer infrastructure consisting of processing, storage, networks, and other fundamental computing resources. Consumer can deploy and run arbitrary software, which can include operating systems and applications but does not manage or control the essential cloud infrastructure, have control over operating system, storage, deployed applications and possibly few networking components (e.g., host firewalls)
- *Platform as a Service (PaaS*): Under this service model, a virtual developing environment for application deployment is provided which otherwise under traditional computing model required each application to be managed locally by having own hardware, an operating system, a database, middleware, web servers and other software together with a team of network, database, and system management experts to keep everything up and running.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

- *Software as a Service (SaaS):* This layer has the capability to provide the consumer provider's applications running on a cloud infrastructure for use. The applications functionality ranges from productivity (e.g., office-type) to programs such as Customer Relationship Management (CRP) or Enterprise- Resource Management and are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumer has limited access to the user specific applications as it does not manage or control the main cloud infrastructure like as network, servers operating systems, storage or even individual application capabilities.

V. CLOUD DEPLOYMENT MODELS

There are four common deployment models[24]:

- *Private Cloud*: This type of cloud infrastructure is run solely for a single organization and can be managed by the organization or a third party which may exist on-premises or off-premises.
- *Community Cloud*: This type of cloud infrastructure is pooled by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy or compliance considerations). It can exist on-premise or off-premise and may be managed by the organizations or a third party.
- *Public Cloud*: the type of cloud infrastructure is meant for general public or a large industry group and is owned by an organization selling cloud services.
- *Hybrid cloud*: This type of cloud infrastructure is a composition of two or more clouds such as private, community or public that stands as unique entities. They are bound together by standardized technology that enables data and application portability.

VI. CLOUD BASED SERVICES FOR ACADEMIC INSTITUTIONS

Cloud based services offers integration management with automated problem resolution, manages security end-to-end, and helps expenditure control based on actual usage of data. Cloud architectures can benefit institutions to reduce duplicate efforts and increase utilization of resources. This will in-turn enable to go green, reducing pollution and effective waste management.

With immergence of technology there is a growing demand of the faculty, students and researchers to have transparent and efficient system in place. It is the technology which has made it possible to have efficient system in place and if the appropriately applied, Universities can also leverage the benefit of cloudy by collaborative resource sharing and service-usage through cloud computing. Primarily adopting cloud computing is to ensure improved quality in disseminating education and administration; establish dynamic and need based communication with various internal, external and peer entities; and conforming to regulations. Cloud computing for universities will potentially lower the cost of procuring solutions and provide better services to the stake holders. Some of the cloud services are even provided free for academic use and universities can leverage the benefits of such services. Use of such services on cloud will lessen the burden of the internal IT service & support department of the universities who otherwise have to establish them in-house. They can provide students, researches and staff with institutional email, office application software's with dedicated file storage for their documentation, e-tutorial and e- learning purposes.

Academic institutions otherwise have to establish their own services that caters to the needs of students, researchers, faculty and management and all these requirements need continuous upgrades, patches while incurring recurring operational expenditure. However, this can be reduced drastically by migrating most of the services to cloud and these services will be ideally accessed through web. Some of the providers for cloud-based productivity tools offer great variety of services for academic use. More specifically, G Suite for education is provided by Google apps for Education. Microsoft offers its Microsoft Office 365 for education.

A. Google Apps For Education is a Cloud-Based Productivity Suite that Integrates Many Applications and Provides Services to Educational Institutions Free. Google Under the G Suite for Education Provide the following Services:

- Online access to Google Docs, Sheets and Slides.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

- Online collaboration with web browser allows students to create, edit docs, share and auto save changes.
- Easy to create sites with security controls provide students with classroom workspace and sharing.
- Unlimited storage or 1 TB per user if fewer than 5 users.
- Access from any device to 30GB of online storage in Google Drive for file syncing and instant sharing
- 30 GB email inbox with access to online calendars, business-class email & contacts.
- Google Forms allows creating surveys, quizzes, and questionnaires and then analyzing the results with built-in analytics.
- Google classroom app allows to easily create, share and grade assignments. Advances Classroom tools help to improve student communication and keeps classroom organized.
- Advanced search functions help to locate files and export to different formats.
- Access to auditing and reporting insights for Drive content and sharing.
- Access to Google Vault for e-Discovery recovering docs, files, emails and chats.
- Compliance solutions helps place and enforce litigation holds on inboxes
- Data protection tools allow to set message retention policies and archive emails.
- Retain and search for emails and chats. Export these files to Google Drive to keep records of communications.
- Advanced tools allow to place litigation holds on email inboxes.
- 99.9% guaranteed uptime backed by a Service Level Agreement (SLA).
- Customized security and admin controls provide a way to set permissions and user credentials.
- Enterprise-class data security.
- Full administrative control over all user accounts and data.
- No advertisement.
- 24/7 phone & email support.

B. Microsoft Provides Collection of Services Free through Cloud for Education that Allows to Collaborate and Share Academic Work. These Services are for Free to Students, Faculty & Staff of an Academic Institution. Under the Microsoft's Office 365 for Education following Services are Provided:

- Access to online versions of Office apps including Word, PowerPoint and Excel.
- Class Notebook app provides a content library and workspace for each student. A collaboration space is also included for creative project collaboration and classrooms lessons.
- OneNote Staff Notebooks help teachers collaborate, organize classroom materials, and record classroom activities.
- School Data Sync allows to sync class rosters and automate classroom management and class materials.
- 1TB (terabyte) file storage and file sharing for each user.
- 50GB (gigabyte) email inbox with access to calendars, business-class email and contacts.
- Microsoft Forms allows to create surveys, quizzes, and questionnaires and then analyze the results with built-in analytics
- Access to Instant Messaging (IM), audio, High Definition (HD) video, and web conferencing with unlimited access to online meetings.
- Intranet site for student team project collaboration with security settings that can be customized.
- Social network allows teachers and staff to work together across different buildings and departments.
- Digital storytelling tools help to create educational project reviews, web-based lessons, newsletters, & interactive assignments using mobile device or web browser.
- Work management tools help students to collaborate, share files and tasks, and communicate together.
- Search and discovery tools allow students to search Office 365 for files and documents.
- Video portal provides video sharing across classroom or school.
- Enterprise app management helps with computer sharing, setting group policies, and data collection using telemetry.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

- Business Intelligence tools assist with analyzation & visualization of data using Excel.
- Compliance solutions provide internal site search, mailbox search, auditing and archiving, legal holds, and e-Discovery.
- Data protection and loss prevention including Rights Management for emails.
- 99.9% guaranteed uptime backed by a Service Level Agreement (SLA).
- Active Directory for managing permissions and user credentials.
- Enterprise-class data security.

VII. G SUITE FOR EDUCATION VS. MICROSOFT OFFICE 365 FOR EDUCATION.

The question that surfaces is, "which platform is better?" The G Suite for Education vs. Microsoft Office 365 for Education debate keeps tempering on as there are hundreds of comparison points with lot of subjective biases. Many similarities down the line with each of the primary features, table I below gives an insight about their similarities

TABLE I: GOOGLE APPS FOR EDU. AND MICROSOFT OFFICE 365 FEATURES

Feature	*Google Apps for Edu*	*Microsoft Office 365*
Browser	Chrome	Internet Explorer / Edge
Word processing	Docs	Word
Spreadsheets	Sheets	Excel
Presentations	Slides	PowerPoint / Sway
Email	Gmail	Exchange / Outlook
Pages	Sites	Office 365 Sites / SharePoint
Drive storage	Drive	OneDrive
Instant messaging	Talk	Lync / Skype / Yammer
Video conferencing	Hangouts	Lync / Skype
Social networks	Google+ / Groups	Yammer / So.cl
Notes	Keep	OneNote
Native search engines	Google search	Bing / Fast Search
Service status dashboards	App status dashboard	Office 365 service health dashboard

Table 1: Google Apps for Edu and Microsoft Office 365 features

A. Analyzing Some of the Key Features & Differences

There are a lot of different points to consider when evaluating whether to use Google Apps for Education or Microsoft Office365 for Education, in the following sub sections of this paper we analyze some of the key differences between them and the features offered. They will certainly play a vital role in an institution deciding on identifying the right one for their use

Security & Privacy

- Microsoft Office 365 for Education
- Microsoft data centres are audited on a regular basis.
- Microsoft does not share your data with others
- Data that is uploaded is protected by strong security and encryption.
- Data is stored in geographically distributed data centres within the Microsoft network with 24/7 monitoring
- Data is stored for as long as one requires Microsoft to keep it.
- Encryption in transit with SSL/TLS protects data transmission.
- Built-in security with redundancy reduces data loss, equipment failure, and environmental risks.
- Access to data centres is limited to select Microsoft employed and personnel.
- Multi-factor authentication, including biometric scanning, controls and secured data centre access.
- Data is protected like your own server. Unauthorised parties cannot access your data.
- Security is in compliance with the family Educational Rights and Privacy Act.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

- School/University officials know where the data resides and who has access.

G Suite for Education

- Google undergoes several independent third-party audits on a regular basis.
- Google does not share your data with others except as noted in the privacy policy.
- Data is stored in geographically distributed data centres within Google network with 24/7 monitoring.
- Data is stored for as long as one requires Google to keep it.
- Encryption in transit with SSL/TLS protects data transmission.
- Computing clusters are designed with redundancy to reduce data loss, equipment failure and environmental risks.
- Access to data centres is limited to select Google employees and personnel.
- Multi-factor authentication, including biometric scanning, controls and secured data centre access.
- Data is protected like your own server. Unauthorised parties cannot access your data
- Security is in compliance with the family Educational Rights and Privacy Act
- School/University officials know where the data resides and who has access.

Compliance

- Microsoft Office 365 for Education
- Office 365 and data centres are SSAE 16/ISAE 3402 Type II SOC 2-audited and have achieved ISO 27001certification.
- Microsoft has signed the student Privacy pledge.
- Office 365 complies with the Family Educational Rights and Privacy Act (FERPA).
- Schools/Universities using Office 365 Education get the parental consent required by COPPA (Children's Online Privacy Protection Act).

G Suite for Education

- G Suite and data centres are SSAE 16/ISAE 3402 Type II SOC 2-audited and have achieved ISO 27001certification.
- Google has signed the student Privacy pledge
- G Suite complies with the Family Educational Rights and Privacy Act (FERPA).
- Schools/Universities using G Suite Education get the parental consent required by COPPA (Children's Online Privacy Protection Act)

Deployment

- Microsoft Office 365 for Education
- Deployment is both cloud-based and hybrid.

G Suite for Education

- Deployment is cloud-based.

Anywhere Access

- Microsoft Office 365 for Education
- Access to email, file& productivity-ready tools allow to work using almost any device
- On-the-go access allows to wok productively with online versions of Office, OneDrive, and online meetings.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

G Suite for Education

- Completely cloud-based with easy to access to applications, emails, messages, calendars and schedules, Google Drive, Google Classroom, stored files and documents.

Offline Access

Microsoft Office 365 for Education

- Desktop versions of the latest Office apps are installed on the computer when first Office 365 is activated.
- Office 365 mobile apps are designed to integrate with desktop-installed Office apps.
- OneDrive can be synced with computer prior to going offline. Documents are stored on your hard drive for Offline access. The next time one goes online, any document edits are automatically uploaded to OneDrive.

G Suite for Education

- Downloaded file on the computer can be synced with Google Drive for Offline access and editing. The files remain on hard drive and in Google Drive to allow access with any device.
- G Suite is completely cloud-based and does not offer Offline sharing between applications.
- Gmail can be configured to work Offline to allow one to view emails and compose new emails without an internet connection. The messages you composed while Offline will be automatically sent when one goes back online.
- Data automatically syncs while working online and even when Offline one still has access to the most recent emails Gmail Offline.
- Offline access for Google Calendar can be set up and used through Google Chrome to view dates and events without an internet connection. Calendar is then read-only and events cannot be created or edited.

Collaboration

Microsoft Office 365 for Education

- Works on Office files with anyone, in any location.
- Create, store, and share documents, spreadsheets, presentations, projects and notebooks online.
- Unlimited online meetings, IM, HD video, audio, social network and web conferencing.

G Suite for Education

- Online collaboration in real-time shows changes to document edits as they are being typed.
- Create, store and edit documents, spreadsheets, and presentations online and in real-time.
- Social network and Google Hangouts allow teachers and staff to work together across different buildings and departments.

Online Meetings

- Microsoft Office 365 for Education
- Unlimited online meetings, instant messaging and high definition video conferencing.

Collaborate with Skype.

- Communicate with school-wide social network.

G Suite for Education

- Schedule events in Google Calendar in real-time.
- Get meeting reminders directly to Gmail inbox.
- Join a video meeting in one-click through Google Hangouts.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

Compatibility & Mobile Access

Microsoft Office 365 for Education

- Office 365 apps are downloaded from the app store icon on smart phone/device and by signing into Microsoft account.

G Suite for Education

- G Suites apps are included with Android phones, tablets, and Chromebooks.

VIII. COST

Microsoft Office 365 for Education

- Free for Students.
- Free for Faculty & Staff.

G Suite for Education

- Free for Students.
- Free for Faculty & Staff.

IX. WEIGHING MORE THAN JUST THE FEATURES

Many factors play a role in determining which cloud productivity application to deploy and the decision of Google vs. Microsoft likely comes down to a few key issues:

The existing approach to user account management and identity services within the IT network at an educational institution;

- Existing email infrastructure and services;
- Existing document management methodologies;
- Microsoft productivity applications versus Google productivity applications with user adoption and skill level in using.
- General philosophy towards IT & automation and institutions administrative and IT team skills.

Based on the above analysis and the factors outlined, the Microsoft 365 for Education has been implemented at one of the premium university (University of Kashmir) in the state of Jammu and Kashmir at India. An insight of the implementation and deployment of the Office 365 for Education at University of Kashmir is being presented in the next section through a case study.

X. THE UNIVERSITY OF KASHMIR : CASE STUDY

University of Kashmir has been founded in year 1948, it offers programmes in all the major faculties; Arts, Business& Management Studies, Education, Law, Applied Sciences & Technology, Biological Sciences, Physical & Material Sciences, Social

Sciences, Medicine, Dentistry, Engineering, Oriental Learning and Music & Fine Arts. In order to cater to the needs and demand of the aspiring students the University has been constantly introducing new innovative programmes [source www.uok.edu.in].

The University of Kashmir (UOK) has more than 15,000 students enrolled for post graduate (PG) programme and 2,50000 students enrolled for undergraduate programme (UG). PG courses are taught at University campuses and UG courses at affiliated (govt. and pvt.) colleges of the University. In order to improve efficiency and bring transparency in the University system, University of Kashmir has established e-governed services and these e-governed services cater to highly critical process of the university involving student admissions process from online form submission to compilation of results and preparation of merit lists, online examination forms awards and results compilation, academic and administrative processes.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

University of Kashmir has taken lot of e-governance initiatives and they have not only brought improvement in the system but also these services have made information available to the stake holders round the clock in a convenient, efficient and transparent manner resulting in good governance by attaining its eight major characteristics - Participation, Transparency, Effectiveness and Efficiency, Responsiveness, Accountability, Equity and Inclusiveness, Rule of Law, as in for the effective and efficient governance [28].

XI. INTERNAL DEPLOYMENT AND CLOUD CONCERNS OF UNIVERSITY OF KASHMIR

The University of Kashmir's entire e-services solutions are designed, developed in- house and are deployed at the University's' data centre in the main campus on its internally deployed servers. Also, university has deployed its own DNS servers for its DNS related services and these DNS servers are accessible through dedicated internet leased links of the University, one provided to university under National Knowledge Network project and another subscribed by university through an alternative service provider. DNS servers contain database of university's public IP addresses and their associated hostnames, mx records of university, and in most cases, serves to resolve, or translate, those common names to IP addresses as requested. The e-services of the university are also deployed live through the dedicated internet links of the university and their domain names are resolved by the internal DNS servers.

Prior to moving its mail service to cloud, mail server of the university was also deployed internally and ensuring its high availability, accessibility had always been challenging because of the frequent internet link failures which due to hilly terrain and harsh weather in the state of Jammu and Kashmir is effected and has not been like the connectivity to other states of the country. Also, at times internet to this part of the world is barred due to political uncertainty. All these factors have been having a huge impact on availability and accessibility of e- services of the university and relying entirely on internal deployments didn't allow achieving high availability, efficiency and reliability.

The concerns of moving all its e-services completely on cloud had also been a matter of concern for the university, especially concerns relating to privacy, security, control, vendor lock and high recurring expenditures. However, ignoring cloud completely was also not a solution, in case the university wanted to overcome the problems and issues faced with their internal deployments. It first decided to move its mail service to cloud in order to have a better, reliable and more feature full service in place.

XII. MAPPING U NIVERSITY DOMAINS WITH CLOUD SERVICE FOR EDUCATION

The university has three domain names (uok.edu.in,kashmiruniversity.net and kashmiruniversity.ac.in) and these domain names and their sub domains are pointed & resolved through the internal DNS servers of the institution. Till the time mail service was deployed internally MX records of these domain names were pointing to internal mail servers. Internal mailing system deployed was facing few issues and users were abandoning it in favour of their personal email system. Every time university's internet links failed or went down, external mails would bounce back and delivery to university mail server used to fail. Official communication through emails to external world would come to standstill and only internal mail 'receive& sent' worked, which resulted in hue and cry by users. Other issues like spam identification and growing storage demand also started creeping in. Moving mail service to a reliable system had become inevitable and university had to take an immediate call and find means for improving and enhancing its mail system. The decision of moving its mailing services to Google cloud for education was taken. For this migration to cloud, the sub domain name for mail along with the mx records needed to be mapped as per the cloud service provider's configurations.

Mapping with Google Cloud for Education- The mapping with Google cloud for education has been done on the two domain names (uok.edu.in and kashmiruniversity.ac.in) and done by modifying the Mail Exchange records (MX) of the two domain names (@uok.edu.in and @kashmiruniversity.ac.in) pointed through two internal DNS servers (DNS-1 & DNS-2) of the university and are further supported by Google cloud DNS services (CDNS) to the google service for mail solution. Fig.1 below gives an insight about the flow of the google email service mapped through internal DNS (DNS-1 & DNS-2) and google cloud DNS (CDNS)

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

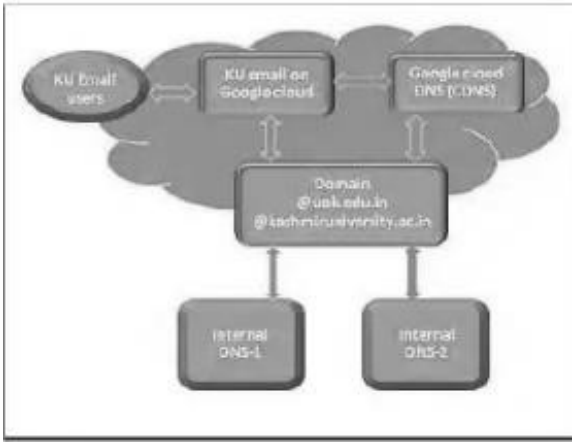

Fig. 1: Mapping Email Service on Google Cloud through Internal & Cloud DNS

The requests are being primarily served/resolved through on- premise DNS services and in case the internal DNS service doesn't respond, the requests are served / resolved by the Cloud DNS.

The migration not only enabled achieve high availability of email solution but also extended other valuable features with 'Google suite for education'. These features have been extended to the faculty and staff on the two domain names mapped. Google cloud helped in achieving credibility of university mailing solution and users opted back to university mailing solution under domain names '@kashmiruniversity.ac.in or@uok.edu.in'. Through this email solution, each user gets around 25 Gb storage and has features like document sharing, cloud drive, virtual classroom, calendar etc. In addition to providing staff and students a good experience, there was also an economic reason behind the university's decision to adopt Google mail solution for education. The cost of using Google suite for education is free.

Mapping with Microsoft Office 365 for Education- The mapping with Microsoft office 365 for education has been done on the domain name (kashmiruniversity.net) and the mapping has been done by modifying the Mail Exchange records (MX) of the domain name (@kashmiruniversity.net) pointed through two internal DNS servers (DNS-1 & DNS-2) of the university and further supported by Google cloud DNS services (CDNS) to the google service for mail solution. The requests are being primarily served/resolved through on-premise DNS services and in case the internal DNS service doesn't respond, there quests are served/resolved by the Cloud DNS. Fig. 2 below gives an insight about the flow of mapping to office 365 for education through internal DNS (DNS-1 & DNS-2) and google cloud DNS (CDNS).

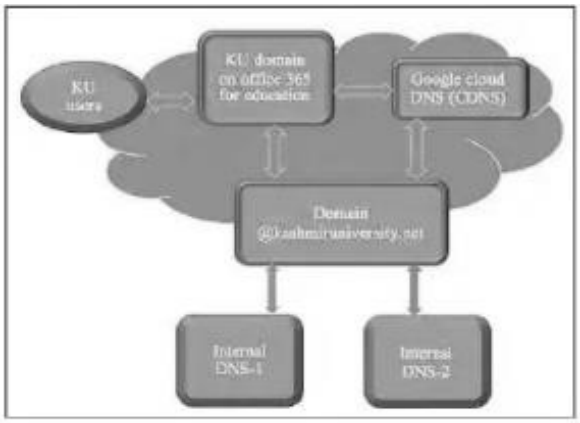

Fig. 2: Mapping Office 365 for Education on University Domain through Internal & Cloud DNS

The migration to Microsoft office 365 for education has not only enabled achieve high availability of email solution for students and researchers but also has extended other valuable features provided under the office 365. Each user

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

has a minimum of 1Tb drive space and has other valuable services as highlighted in table I of section 7 of this paper. This service has been extended to the students and researchers under @kashmiruniversity.net domain name.

XIII. RESULTS & DISCUSSIONS

The results from implementation of the Google cloud for education and Microsoft office 365 for education at the case institution have provided initial support for the adoption of free cloud computing solutions/services at academia.

First with the deployment of 'Google suite for education' at the case university, enabled the university to establish a reliable and hassle free services (mail, drive, calendar, vault, docs, etc.) for faculty and staff.

Second the faculty is able to create lessons, distribute assignments, send feedback and see everything in one place; instant and paperless. Also, students and teachers can have immediate conversations and collaborate on assignments

Moreover, students and researchers have got a recognized digital identity under university domain and this has helped them to a large extend while communicating with external world especially with external faculty and researchers.

Reliability, availability and cost effectiveness achieved are:

- 99.9% uptime;
- Apps work on any computer, tablet or phone;
- No advertisements;
- Security and Privacy enhancements
- 24/7 support at no additional cost;
- Cost of using 'Google suite for education' and 'Microsoft office for education' is free;
- Eliminating the need to invest on building & upgrading IT infra for email, drive, vault etc. solutions for staff, faculty, students and researchers;
- On-premise man power for maintaining and supporting these services is not required anymore.

XIV. CONCLUSION

The above discussion on cloud computing as a technology and the various existing applications uses in the educational sector or the development of cloud based applications do give the students, faculty & staff at the institution a lot of flexibility and dynamism to the information sharing. For quality, efficient and transparent educational sector there is a lot of demand for information sharing and use of technological tools for quality education so as to make the things more efficient and transparent from different views of the stakeholders. The cloud computing architecture gives many options for efficient use of data, memory and computing power so as to make green computing a reality. In this paper, we explored some of the services and applications provided free for educational use by Google and Microsoft. Their features and differences were compared to give an institution a clear insight before deciding on adopting the right one fitting their requirements. The above analysis was followed an implementation at the case institution where both the Google and Microsoft solution for education have been implemented by the corresponding author for university use.

REFERENCES

[1] A. K. Gupta, and G. Kaur, "Benefits and security issues in cloud computing," International Journal of Emerging Research in Management & Technology, vol. 2, no. 1, pp. 108-114, 2013.

[2] A. Aleem, and C. R. Sprott, "Let me in the cloud: analysis of the benefit and risk assessment of cloud plat-form," Journal of Financial Crime , vol. 20, no. 1, pp.6-24, 2012.

[3] R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I.Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility, "Future Generation Computer Systems, vol. 25, no. 6, pp. 599-616, 2009.

[4] C. Cadregari, and A. Cutaia, "Every silver cloud has a dark lining: A primer on cloud computing, regulatory and data security risk," ISACA Journal , vol. 3, no. 12, pp. 1-4, 2011.

[5] D. Catteddu, and G. Hogben, "Cloud computing: Benefit, risks and recommendations for information security," European Network and Information Security Agency (ENISA), pp. 1-125, 2009.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

[6] C. Mukundha, C., P. Gayathri, and I. S. Prabha,"Load balance scheduling algorithm for serving of re-quests in cloud networks using software defined networks, " International Journal of Applied Engineering Research , vol. 11, no. 6, pp. 3910-3914, 2016.
[7] D. C. Wyld, "The cloudy future of government IT: Cloud computing and the public sector around the world," International Journal of Web & Semantic Technology , vol. 1, no. 1, pp. 1-20, 2010.
[8] D. K. Gupta, A. Mishra, and G. Sahoo, "Cloud computing: Solving availability problem in future frame work for e-governance, " International Journal of Computer Applications & Information Technology, vol. 2, no. 11, pp.16-20, 2013
[9] D.H.Shin, "User centric cloud service model in public sectors : Policy implications of cloud services," Government Information Quarterly, vol. 30, no.
[10] T. Ercan, "Effective use of cloud computing in educational institutions," Procedia-Social and Behavioral Sciences , vol. 2, no. 2, pp. 938-942, 2010.
[11] B.Furht, B. (2010). Cloud computing fundamentals. In Handbook of cloud computing, US: Springer, pp. 3-19, 2010.
[12] A. Goscinski, and M. Brock, "Toward dynamic and attribute based publication, discovery and selection for cloud computing," Future Generation Computer Systems , vol. 26, no. 7, pp. 947-970, 2010.
[13] R. L. Grossman, "The case for cloud computing," IT Professional , vol. 11, no. 2, pp. 23-27, 2009
[14] S. Hashemi, K. Monfaredi, and M. Masdari, "Using cloud computing for e- government: Challenges and benefits," International Journal of Computer, Information, Systems and Control Engineering , vol. 7, no. 9, pp. 596-603, 2013
[15] A. Hussein, and O. Mohamed, "Cloud computing and its effect on performance excellence at higher education institutions in Egypt (An analytical study)," European Scientific Journal, vol. 11, no. 10, pp. 163-176, 2015
[16] I. Kaur, and K. Bala, "E-governance: Benefits and challenges of cloud based architecture," International Journal of Computer Science and Technology , vol. 6,no. 3, pp. 35-37, 2015
[17] K. Mukherjee, and G. Sahoo, "Cloud computing: Future framework for e- governance," International Journal of Computer Applications, vol. 7, no. 7, pp. 31-34, 2010
[18] KPMG. "The Cloud changing the business eco system: Survey report," Available https://www.kpmg.com/IN/en/IssuesAndInsights/Thought Leadership/The_Cloud_Changing_ the_Business_Ecosystem.pdf (accessed 13 November, 2016)
[19] K. Vats, S. Sharma, and A. Rathee, "A review of cloud computing and e- governance," International Journal of Advanced Research in Computer science and Software Engineering , vol. 2, no. 2, 2012.
[20] M. Dash, and R. N. Panda, "Cloud in Indian e-governance model ," International Journal of Recent Development in Engineering and Technology , vol. 2, no. 2, pp. 13-15, 2014.
[21] S. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, and A. Ghalsasi, "Cloud computing- The business perspective," Decision Support Systems , vol. 51, no. 1, pp. 176-189, 2011.
[22] M. Yuvaraj, Problems and prospects of implementing cloud computing in university libraries: A case study of Banaras Hindu University library system," Library Review, vol. 64, no. 8/9, pp. 567-582, 2015.
[23] P. Mell, and T. Grance, "The NIST Definition of cloud computing," Available http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf (accessed11 November, 2016)
[24] Microsoft. "Cloud Computing: What is Infrastructure as a Service," TechNet Magazine 2011, Available https://technet.microsoft.com/en- us/library/hh509051.aspx (accessed 12 November, 2016)
[25] N. Sultan, Cloud computing for education: A new dawn?" International Journal of Information Management , vol. 30, no. 2, pp. 109-116, 2010.
[26] P. Samimi, Y. Teimouri, and M. Mukhtar, "A combinatorial double action resource allocation model in cloud computing," Information Sciences, vol. 357, no. C pp.201-216, 2016.
[27] R. Prodan, and S. Ostermann, "A survey and taxonomy of infrastructure as a service and web hosting cloud providers," In 10th IEEE/ACM International Conference on Grid computing, pp. 17-25, 2009.
[28] E. M. N. Qadri, E-governance at University of Kashmir: Bringing efficiency & transparency, International Journal of Information and Computation Technology , vol. 4, no. 2, pp. 119-126, 2014

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 6, March 2024

[29] Q. Zhang, L. Cheng, and R. Boutaba, "Cloud computing: State-of-the-art and research challenges," Journal of Internet Services and Applications , vol. 1, no. 1, pp.7-18, 2010.
[30] L. Qian, Z. Luo, Y. Du, and L. Guo, "Cloud computing: An overview," Cloud Computing , vol. 5931, pp. 626-631, 2009.
[31] V. Rajaraman, "Cloud computing," Resonance, vol. 19, no. 3, pp. 242-258, 2014.
[32] S.M.K. Quadri, M. Zaman, and M. N. Qadri, E-governance development: Agile Perspective, 2014
[33] S. Okai, M. Uddin, A. Arshad, R. Alsaqour, and A. Shah, "Cloud computing adoption model for universities to increase ICT proficiency," SAGE Open, vol. 4, no. 3, pp.1-10, 2014
[34] S.Paquette, P. T. Jaeger, and S. C. Wilson, "Identifying the security risks associated with governmental use of cloud computing," Government Information Quarterly , vol. 27, no. 3, pp. 245-253, 2010
[35] Smitha, K. K., Thomas, T., & Chitharanjan, K. (2012). Cloud based e- governance system: A survey. Procedia Engineering, 38 , 3816-3823.
[36] P. Y. Thomas, "Cloud computing: A potential paradigm for practicing the scholarship of teaching and learning," The Electronic Library , vol. 29, no. 2, pp. 214-224, 2011.
[37] J.Voas, and J.Zhang, "Cloud computing: New wine or just a new bottle?" IT Professional , vol. 11, no. 2, pp. 15-17, 2009.
[38] L. Wang, G. V. Laszewski, A. Younge, X. He, M. Kunze,J. Tao, and C. Fu, "Cloud computing: A perspective study," New Generation Computing , vol. 28, no. 2, pp.137-146, 2010.
[39] W. W. Wu, L. W. Lan, and Y. T. Lee, "Factors hindering acceptance of using cloud services in university: A case study," The Electronic Library , vol. 31, no. 1, pp. 84-98,2013.
[40] W.Lin, J.Z.Wang, C.Liang, and D.Qi, "A threshold based dynamic resource allocation scheme for cloud computing," Procedia Engineering, vol. 23, pp. 695-703, 2011.
[41] W. W. Wu, "Mining significant factors affecting the adoption of SaaS using the rough set approach," Journal of Systems and Software , vol. 84, no. 3,pp. 435-441,2011
[42] W. W. Wu, L. W. Lan, and Y. T. Lee, "Exploring decisive factors affecting an organization's SaaS adoption: A case study," International Journal of Information Management , vol. 31, no. 6, pp. 556-563, 2011.
[43] M. Yuvaraj, Cloud computing software and solutions for libraries: A comparative study," Journal of Electronic Resources in Medical Libraries , vol. 12, no. 1, pp. 25-41, 2015.
[44] http://en.wikipedia.org/wiki/Cloud_computing See https://edu.google.com/higher-education/
[45] https://products.office.com/en-in/academic/compare-office-365-education-plans
[46] https://www.microsoft.com/en-in/education/products/office /default.aspx