Cloud Computing Technology for Education Applications

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Cloud Computing Technology and Big Data Applications have been connected strongly to our daily work and life. Some peoples think that Cloud Computing is fourth revolution in Information Technology. Cloud Computing Applications that like Utility Computing also have been applied, used and developed for education and Smart Virtual Cloud Campus creations. Cloud computing technology is changing IT application development method and format on campus, and challenge and reform to the current IT computer infrastructures and applications. The cloud computing technology for application development in education can build robust applications in a short time and lower cost. The Cloud Computing Technology showed more and more important for our work, business, education and life. The Cloud Computing Technology like colorful cloud to decorate the beautiful IT sky to cover our campus. Anywhere and anytime we can access the data storage and applications in the Cloud Computing as like a super computer for our education without your installation of software and physical servers.

In general the Cloud Computing can be defined to access the storages and computer applications that based on Internet Web OS computing. The Cloud Computing Technology has become a very important Internet application. National Institute of Standards and Technology (NIST) has defined cloud computing is composed of five essential characteristics, three service models, and four deployment models.

Cloud Computing Technology has been applied to Education Applications quickly. Many campuses have provided Cloud Computing Services for the members of faculty and students. The personal and private Clouds are also easy, convenient and effective to provide the excellent services for faculty and students to teach and study. Cloud Computing Technology is a good tool for teaching and study on campus. Cloud Technology has been excellent to apply for Smart Virtual Cloud Campus Design and Development, and makes International Study and Education Exchange in like a same huge Cloud Computing classroom on the earth village.

Due to Cloud Computing Applications and development, we are sure that our current IT infrastructures and computer administrations on campus will be changed quickly. The new cloud computing technology will be widely applied for our education system, and promote and push the current education level. More and more peoples have education opportunity, and enjoy and share new technology and happy from education by cloud computing technology.

The cloud computing technology brings the power and success of IT applications for education in a new era of applications, and contained many benefits for education that included security, reliability, easy to use, upgradeability, mobile devices deployment, and application development. There’s no need to worry about computer servers managing and maintaining, because there is no physical computer servers for software installations on campus. The cloud computing technology challenges the traditional computer

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infrastructures and application development on campus, and indicates next generation computer technology and new IT architecture in education for a new Era.

**Fig. 1 Accessing Cloud Computing**

1. Introduction to Cloud Computing Technology and Development

1.1 Definition of Cloud Computing

What is Cloud computing? Here is no unifying definition for Cloud Computing. In general the Cloud Computer can be defined to access the storages and computer applications that based on Internet Web OS computing.

According to Special Publication 800-145, National Institute of Standards and Technology (NIST), the definition of cloud computing is composed of five essential characteristics, three service models, and four deployment models. The five essential characteristics are On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured Service. The three service models are Cloud
Software as a Service (SaaS), Cloud Platform as a Service (PaaS), and Cloud Infrastructure as a Service (IaaS). The four deployment models are Private cloud, Community cloud, Public cloud and Hybrid cloud.

The components of a Cloud Computing consist of a front end platform (computer clients, workstations, and mobile device), back end platforms (servers and storages), a cloud based delivery, and an Internet Web OS. The hybrid cloud is a cloud computing environment. The organization provides and manages resources in-house and has others provided externally in hybrid cloud.

1.2 Cloud Five Essential Characteristics

According to cloud definition, Cloud has five Essential Characteristics that included On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured service.

Fig. 2 Cloud Five Essential Characteristics

i. On-demand self-service:

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

ii. Broad network access:
Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

iii. Resource pooling:

The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

iv. Rapid elasticity:

Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

v. Measured service:

Cloud systems automatically control and optimize resource use by leveraging a metering capability1 at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

1.3 Cloud Categorizing Service Models

The Cloud Computing is delivering hosted services over the Internet Web OS, mobile applications, client and work stations or special commends. The services will be three categorizing services models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).
1) Software-as-a-Service (SaaS):

The consumers use the cloud provider’s applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser. The consumers do not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of provider-defined user-specific application configuration settings.

This Software-as-a-Service (SaaS) in the cloud computing, the program passed through the browser to thousands of users. It will save spending on servers and software licenses for users. The Cloud Computing only needs to maintain a program. This can reduce costs. SaaS has been used in Human Resource Management and Enterprise resource planning (ERP) that is business management software more commonly. Google Apps and Zoho Office https://www.zoho.com/ are also similar services.

Consumers control and manage the systems in terms of the operating systems, applications, storage, and network connectivity, but do not control the cloud infrastructure.
2) Platform-as-a-Service (PaaS):

The Cloud Computing provides the consumers is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumers does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Consumers purchase access to the platforms, enabling them to deploy their own software and applications in the cloud. The operating systems and network access are not managed by the consumer, and there might be constraints as to which applications can be deployed.

3) Infrastructure-as-a-Service (IaaS):

The Cloud Computing provides the consumers is to provision processing, storage, networks, and other fundamental computing resources where the consumers are able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud physical infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components. The Cloud Computing can be scalable server clusters, virtualization and provisioning servers on demand. For sample, VMware vCloud® Air™ is cloud Infrastructure-as-a-Service (IaaS) that helps customers extend and modernize their on-premises infrastructure using computing, networking, and storage resources they can manage with their tools and skill sets.

1.4 Cloud Four Deployment Models

There are four Deployment Models Private, Community, Public and Hybrid in the Cloud. According to your work environment and usage, you can choose different cloud Deployment Models.
Fig. 4 Cloud Four Deployment Models

a) Private cloud:
The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

b) Community cloud:
The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

c) Public cloud:
The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

d) Hybrid cloud:
The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or
proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

A University Private Cloud Computing can be operated solely on campus. The University IT staffs can manage this private cloud or we can invite third party to administrate the University private cloud. The members of faculty and students have account to access and login University Private Cloud Computing. Also, we can use Cloud Computing by agencies provided for the members of faculty and students.

2. Cloud Computing providers and their Cloud Solutions, Products and Services

Cloud brings raining. Cloud computing that is created and developed brings many providers and services development and growth. Cloud Computing Technology is critically important field to computer information technology, like security, infrastructure, applications and developments.

Many universities have accepted Cloud Computing Services from Cloud Computing providers on campuses. The Cloud Computing providers have provided excellent cloud services for education applications and development. Many famous and big companies AT & T, Verizon, Microsoft, Apple, Cisco, google, Amazon and so on have provided Cloud Computing Solutions, products and Services. Some good Cloud Computing providers will be listed as follows.
2.1 Cloud Solutions AT&T [https://www.synaptic.att.com/clouduser/](https://www.synaptic.att.com/clouduser/)

AT&T Cloud Solutions will help users’ needs for computer applications and development. Their main products for cloud computing included AT & T Synaptic compute, IBM Cloud Managed service with AT & T NetBoard, AT & T Synaptic Storage and AT & T NetBond.

- AT & T Synaptic compute

AT & T designed Synaptic compute as a Services, and help users to get quick, secure access to virtual infrastructure, servers and storage. They offer unlimited computing capacity and on-demand virtual machines and associated networking resources, while users provide and manage the operating system, database and application.

AT&T Synaptic Compute as a Service provides and manages the virtualization infrastructure, servers and storage, and Increase the flexibility of the network with their network-enabled cloud computing offers. When access using AT&T VPN, Cloud Computing services from AT&T also provides the cost-efficiency of
the cloud with the network-based security and performance of the global MPLS VPN network. To manage user service, choose either Graphical User Interface (GUI) or Application Programming Interfaces (APIs).

- **AT&T Synaptic Storage**

  AT&T Synaptic Storage as a Service is a cloud-based storage solution that easily change to any size you need. Users can store and access data from virtually anywhere and at any time. Expand on-demand. Never run out of storage space again.

  AT&T Synaptic Storage as a Service provides secure, virtualized storage, and supports managed networks and a multi-layer security approach.

  AT&T Synaptic Storage as a Service mobile business app enables Android users to access their AT&T Synaptic Storage account and offload data into a highly secure and scalable storage cloud. Users will be able to download/upload media assets, download/preview documents by mobile devices.

- **AT&T NetBond**

  AT&T NetBond, is a foundational element to provide a highly flexible and simple way for users to utilize their Virtual Private Networks (VPN) to connect to any cloud compute, and access to enterprise applications and data.

  AT&T NetBond extends MPLS VPN to the cloud computing platform, isolating traffic from other traffic, creating a private network connection.

  AT&T NetBond is well suited for users who want to avoid exposure to the public Internet and risk of DDOS attacks, as well as, have a highly available and high-performance connection to the cloud resources.

- **IBM CMS with AT&T NetBond**

  IBM Cloud Managed Service with AT&T NetBond is a managed hybrid cloud solution that combines the AT&T cloud network enablement technology with IBM Cloud Managed Service computing capability.

  IBM Cloud Managed Service with AT&T NetBond is a fully managed, hosted infrastructure with committed service level agreements (SLAs) and with management of instances above the hypervisor level.


  Verizon Cloud provides users the agility to implement ideas faster, scale quickly and drive growth. By cloud services and support to meet users’ needs, users can make workloads to the cloud effectively.
Verizon Cloud Services are included Cloud compute & storage services, cloud onboarding & Professional service, flexible services for any workload, access oracle on Verizon Cloud when you need it and Verizon Cloud Marketplace continues to drive your business.

- Cloud computing & storage services

Verizon Cloud offers secure compute and storage resources with the flexibility and control through the cloud console. Verizon Cloud provides public, private and hybrid clouds services. Verizon Cloud supports diverse performance, security and cost requirements with Public Cloud and Virtual Private Cloud deployment models.

Users can quickly deploy with public cloud. In the Public Cloud, users can choose from predefined Virtual Machine (VM) configurations of CPUs and RAM. For block storage, the Public Cloud provides shareable SSD-based disks with reserved performance, tunable NIC bandwidth, and Software Defined Networking.

The virtual private cloud is well worked for workload profiles that require a higher level of sophistication. Virtual Private Cloud provides users greater flexibility for virtual machine configurations and enhanced options such as access to managed backup, monitoring and patching services. The Virtual Private Cloud space will be provisioned based upon resource needs and workload characteristics such as performance, network, and security.

- Easing the Transition with Professional Services & Migration Services

Verizon provides the upfront planning, migration tools and experienced staff to simplify cloud migration. Verizon Cloud Onboarding Services provide users with planning, and best practices in cloud API implementation, application migration and application optimization.

- Flexible Services for Any Workload

Verizon Cloud services provide flexible support users’ needs and workload requirements. The users can choose Cloud Service Tier with common feature sets.

The Base Service is providing users with the fundamental management and configuration tools needed for success. Additionally, many features and tools such as snapshots, backups, self-service monitoring and advanced performance aspects can be added by incremental monthly fees.

Guided Service provides users with additional support expertise and designated response. The users can access to Verizon Global Support Operations Service Center with 24x7 phone. The users will receive live access to skilled technical support personnel for greater insight and advice on running workloads in the Verizon Cloud infrastructure.

- Access Oracle Applications on Verizon Cloud

The user can build Oracle database applications on Verizon Cloud, and can access Oracle databases and middleware software without the long wait or hassle. The Oracle Applications will be included Oracle Database 11g and 12c with standard and Enterprise editions.
• Verizon Cloud Marketplace Continues to Drive Your Business

The Verizon Cloud Marketplace enables users to quickly procure Verizon Cloud Services and save time on configuration, deployment and fine tuning, deploying directly into Verizon Cloud with the applications you need, when you need them, to drive your business.

Verizon Cloud Marketplace offers world-class applications on Verizon Cloud that include Development and operations tools, big-data solutions, monitoring and automation tools, templates and virtual appliances.


Microsoft Cloud Platform included two sections: Solutions and Products. Microsoft Cloud Solutions offer Cloud infrastructure, Data management and analytics, Enterprise mobility, Internet of Things, Application development and other. Microsoft Cloud Products provided Windows Server, Microsoft Azure, System Center, SQL Server, Converged System and others.

2.3.1 Microsoft Cloud Solutions

• Cloud infrastructure

Cloud infrastructure solutions will be working for Application management, Business continuity, Cloud computing, Converged systems, Hybrid cloud, Integration, Public cloud, Service delivery, Software-defined networking, Storage, Virtualisation, Virtualisation and private cloud, and Virtualising enterprise applications.

• Data management and analytics

Data management and analytics solutions included Big Data, Business analytics, Business intelligence, Data security and compliance, High availability, In-Memory, Modern data warehouse, Online transaction processing, and SQL Server cloud backup and recovery.

• Enterprise mobility

Enterprise mobility solutions will solve the problems for Desktop virtualization, Hybrid identity management, Information protection, and Mobile device and application management.

• Internet of Things

Internet of Things solutions are running for Internet of Things in health, Internet of Things in manufacturing, Internet of Things in public sector, and Internet of Things in retail.

• Application development
Application development solutions will be related with Agile planning, Application, Lifecycle, Management (ALM), Development and Operations (DevOps), Development test applications and Software quality.

- Other

Other solutions also are for Small or midsize business.

2.3.2 Microsoft Cloud Products

- Windows Server


- Microsoft Azure


- System Center

Microsoft System Center products embody System Center 2012 R2, System Center 2012 R2 Configuration Manager, System Center Advisor, and System Center Global Service Monitor.

- SQL Server

Microsoft SQL Server products involved SQL Server, SQL Server Editions, and SQL Server benchmarks and performance.

- Converged Systems

Microsoft Converged Systems products included Analytics Platform System, and Cloud Platform System.

- Other products

Microsoft Other products have BizTalk, Enterprise Mobility Suite, Forefront Identity Manager, Microsoft Intune, Power BI for Office 365, StorSimple hybrid cloud storage, and Visual Studio.

Microsoft Cloud Platform is different with Amazon Web Services (AWS) and VMware. Microsoft Azure enables users to extend their on-premises investments into the public cloud and choose from infrastructure or platform services, providing flexibility to choose the best solution for their needs. Comparing with VMware’s high cost and limited cloud solutions, Microsoft Cloud enables users to shape a comprehensive, flexible, and cost-effective IT environment.

Microsoft Cloud Platform provided True Hybrid Cloud, True Hybrid Storage, First Class Hybrid Integration, Best Identity Platform, Full Cloud Options With PaaS, First Class Security In The Cloud, Committed To Cloud Privacy, and Comprehensive DevOps Experience. Unlike AWS’s cloud-only
approach, Microsoft Azure gives users lots of options for an effective hybrid cloud strategy, without forcing users to snap to a rigid all-or-nothing approach.

Microsoft Cloud Platform also offered complete Cloud Platform, Hyper Scale, and Low Total cost of ownership (TCO). VMware’s cloud is still new and doesn’t offer customers many first party services to choose from. While VMware is new to the cloud and only runs a small number of datacenters themselves, Microsoft has nearly doubled its cloud capacity every 6 months for the last two years. VMware software can be quite expensive, sometimes as much as four times higher than a comparable Microsoft solution.

2.4 Apple iCloud [https://www.apple.com/icloud/]

Apple iCloud can be connected to Apple devices, and makes sure users always have the latest versions of documents, apps, notes, and contacts. Let users easily share photos, calendars, locations, and more with friends and family. Apple iCloud can help users find the device if lose it. And iCloud does it all automatically.

Fig. 6 Login Apple iCloud

With iCloud Drive, users can safely store all their presentations, spreadsheets, PDFs, images, and other kinds of documents in Apple iCloud. So users are always accessible from iPhone, iPad, iPod touch, Mac, or even PC.
Apple iCloud offers Family Sharing. Now up to six members of family can share their iTunes, iBooks, and App Store purchases, along with family photos, calendars, locations, and more. It’s the easy way to bring harmony to family’s digital life.

Apple iCloud makes it easy to show off just the photos and videos you want to just the people you want to see them. Invite your friends and family and they can add their own photos, videos, and comments as well. And iCloud Photo Library, in beta, stores every photo and video you take, making them accessible from your iPhone, iPad, iPod touch, and iCloud.com.

With iCloud, whatever you buy in iTunes, iBooks, and the App Store is immediately accessible on all your devices. And iTunes Match lets you store your entire music collection in iCloud, even songs you’ve imported from CDs or purchased somewhere other than iTunes.

With Apple iCloud, you now have your inbox, calendar, contacts, and other important information in your pocket and on your desktop. When you delete an email, add a calendar event, update a contact, edit a note, or check off a to-do item, iCloud makes the changes everywhere.

You have all sorts of important stuff on your iPhone, iPad, and iPod touch, like your photos and videos. Apple iCloud automatically backs it up daily anytime your device is plugged in and connected to Wi-Fi. You don’t have to do a thing. And you can use your backup to restore your device or set up a new one.

Apple takes data security and the privacy of your personal information very seriously, and iCloud features are designed with your privacy in mind.
http://www.iCloud.com is a great way to access your information when you’re away from your iOS devices. You can sign in to iCloud.com from any Mac or PC to view all the documents you saved in iCloud Drive. And you can also use iCloud.com to access features like Photos, Find My iPhone, Mail, Calendar, Contacts, iWork for iCloud, and more.

All Apple users can get 5GB of iCloud storage free, and other storage plans start at $0.99 for 20 GB per month.

2.5 Cisco Cloud Computing in Education
http://www.cisco.com/web/strategy/education/cloud_computing.html

Cisco Cloud has provided special educational Services that combined Cisco Unified Data Center, Cisco Cloud Intelligent Network, and innovative cloud services. This integrated architecture help educators deliver highly secure, cloud-based services.

2.5.1 Deploying Cloud Collaboration for education and meet education needs

We can deploy Cloud Collaboration for education according to Cisco Cloud products and services.

Cisco Unified Data Center brings together computing, network, and storage resources into an integrated platform for delivery IT services within and between data centers.

Cisco Cloud Intelligent Network enhances Cisco routing and switching solutions with cloud intelligence and integrates with Cisco Unified Data Center to create a platform for delivering cloud services to teachers, administrators, and students. It also connects your networks with other clouds and automates management.

Cisco SecureX Architecture provides context-aware security and policy enforcement in both traditional computing and cloud-computing environments.

Cisco Unified Communications, Cisco TelePresence solutions, and customer contact, meetings, instant messaging, presence, and mobility applications can be hosted. Cisco Collaboration Cloud Portfolio provides a comprehensive, interactive, and compelling user experience.

Cisco Services supports Cisco Cloud with a portfolio of Cisco Cloud Enablement Services to help schools quickly realize the full value of cloud computing. Flexible terms help education leaders reduce the risk of moving to cloud-based service delivery.

Cisco Cloud in education offers a wide range solutions and services to make it easy to build and deploy cloud networks, offer cloud services, or consume applications to meet the education needs.

2.5.2 Benefits of Cisco Cloud for Education

The benefits of Cisco Cloud for Education will be included as follows:
• Reshaping teaching by extending interactive multimedia learning environments to anyone, anywhere
• Accelerating delivery of administrative services
• Simplifying operations, saving time, and cutting cost
• Reducing risk and strengthening security

Cisco Cloud-based collaboration solutions in education help educational organizations meet key strategic objectives. Cisco Cloud collaboration provides a variety of tools to enable distance-learning programs, from presence and instant messaging (IM), to web conferencing, to telepresence and virtual classrooms.

Professors can communicate and share research findings with fellow researchers at another campus within the country or abroad. Similarly, students can participate in projects using the features available via cloud collaboration services in education. Cloud collaboration in education can directly reduce TCO.

3. Cloud Computing Applications on campus is a good tool for faculty to teach and students to study

Cloud Computing Applications on campus is a good tool for faculty to teach and students to study. Cloud Computing has provided much advantages for education applications that included data and files storage, computers’ backup and restore, contents online for teach and study, show and share, search, sort and access the data and files by mobile devices ipad, tablet and smart cell phone, lower cost for computer applications, and accessing data and files any time and any locations.
3.1 Good data and files Storage

Cloud Computing has provided huge space for data and files Storage. Members of faculty and students can save their data and files in their folders anytime and anywhere. These data and files can be any format and types included video, audio, photos and music. The size of the storage in the cloud also can be extended according to your needs.

3.2 Good location for computers’ backup and restore

Cloud Computing can be configured to back up and restore your computers in time according to your schedule. You don’t need to worry about lost data and files, because you have back up your computer by Cloud Computing. You also can restore the files immediately if computer crashes or accident to delete the files.

3.3 Good contents online for teach and study
Cloud Computing provided contents online to share with faculties and students. Faculties and students don’t need to spend time to copy and printing, and save these materials in the personal bags and storages. Faculties can be free to upload the teaching materials to the storage in the cloud. Students can be repeated to access these contents for their study.

3.4 Good show and share for teach and study

a. Teaching materials: E-books and Documents on show and sharing

All teaching materials that included text books, homework, lab and projects assignments can be saving for show and sharing on Cloud. Students don’t spend the cost for text books. These e-books will be saving much paper and labors to printing, and create a green environment on campus.

b. Homework assignment on show and sharing

Faculties can assign the homework online for show and sharing with students on Cloud. Students will be easy to get the homework assignment from Cloud in time. Students can post the questions about homework for show and sharing.

c. Publications about research and academic on show and sharing

The publications about research and academic can be in the Cloud for show and sharing. The reports and papers bout research results and new projects can be published immediately. The publications will be more fast and easy than the publications agencies.

3.5 Good search, sort and access the data and files by mobile devices iPad, tablet and smart cell phone

The members of faculty and students can be convenience to search, sort and access the data and files by mobile devices iPad, tablet and smart cell phone, not really need PC or laptops, because the Cloud Computing has provided the mobile devices to internet communication.

3.6 Lower cost for computer applications and virtual IT environment

Many Cloud Computing providers have provided the free accessing or lower cost plan and strategy. Faculties and students can be easy to get a user account from Cloud Computing providers with free and lower cost. Also, campus computer center can create own campus cloud for faculties, staff and students. Many cloud providers have provided computer applications that included Microsoft office, database, and virtual computing with lower cost. Cloud computing applications will save IT and administration cost and budget on campus.

3.7 Accessing and uploading data and files in virtual computer applications any time and any locations

Faculties and students can access their data and files in the cloud anytime and any locations by using internet. Cloud Computing is working for 24 hours and 7 days per week. Users will not be limited with
time and locations. Faculties and students can make any schedule to upload your data and files or access the Cloud.

As educators and students on campus should take Cloud Technology’s advantages, and use this good Cloud Computing tool for the teaching and studying.

4. Smart Virtual Cloud Campus Design and Development by Cloud Computing Technology

Due to Development of Internet Applications and Web OS, many distance learning courses and e-campuses have been created and developed on the world. These distance learning and e-campuses are based on Internet and Web OS applications. Smart Cloud Campuses are different with the current distances learning and e-campuses. Smart Cloud Campuses are able to create and develop by using Cloud Computing Technology independently. Comparing with current distance learning courses and e-campuses, Smart Cloud Campuses will have more effective and advantages, because Smart Cloud Campuses have all Cloud Computing Technology’s Characteristics: On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured service. Cloud Computing Technology has provided higher speed, anytime and anywhere accessing, more reliability and effective for Smart Cloud Campuses. Comparing with the current distance learning and e-campus there is no physical web server, software installations and IT administrators in Smart Cloud Campus (c-campus).

Comparing with the current distance learning and e-campus there is no physical web server, software installations and IT administrators in Smart Cloud Campus (c-campus). According to Cloud Service Models, Smart Cloud Campuses can be completely created by Cloud Computing Technology. Smart Cloud Campuses will be based on virtual computer Servers, network and storage environment in the Cloud. Smart Cloud Campus mostly are same with real smart campus. There are four essential sections Virtual Learning Server, Virtual Video Content Server, Virtual Video show and Sharing Server and Storage for faculties, administrators and students in the Smart Cloud Campus.
4.1 Virtual Learning Server in the Cloud Campus

First, Cloud Campus can create Virtual Learning Server in cloud by Cloud Computing Services. The computer operation system of Virtual Learning Server can be Windows or Linux Server.

Virtual Learning Server in the Cloud can provide the information about Cloud Campus by using Web homepages. It means the Virtual Learning Server has Web Server applications. The information about Cloud Campus will be included Student Admission Applications, Courses list for Degree programs, list of faculties, Administration office and Contact Information.

This Virtual Learning Server will provide the courses for degree programs for students to access these courses. The members of Faculty in Cloud Campus can design and create the courses and assign homework for students in the Virtual Learning Server in the Cloud.

4.2 Virtual Video Content Server in the Cloud Campus
Recording teaching video and lecturing video capture in Cloud Campus are very important tools for courses study in the Cloud Campus. Students can be anytime and anywhere to watch teaching video repeatedly until students can understand faculties teaching. All recording teaching video and lecturing video capture files will be stored in the virtual video content server in the cloud.

It is easy to create virtual video content server in the cloud by Cloud Computing Services. We can use Windows or Linux operation system for the video content server. The video content server will contain Database applications and Web Server, so computer administrators will be easy to check the video files in the content server. Facilities and students also can be easy to access the video content server.

All lecturing video capture from Cameras and microphone in the End point will be saving in the content Server. The video in the Content Server can be viewed by members of faculty and students. The members of faculty can define the permission to access the video for students. The format of storing video can adopted database applications, so faculties and students will be easy to access, view and sort video in the database.

The video content server provides Capture video using any device that included smartphone, tablets and desktop, transform the video for optimized viewing on different devices, from mobile devices and PCs to large high-definition displays in the conference room or smart classroom, and share the video with people anywhere in the world and in real time.

Faculty and students can view video any time at their convenience from the content server if they could not attend the class or meeting. The members of faculty and students can view live or archived video from the content server anywhere. The devices to view video from the content server can be any device that included mobile devices, laptops and PCs.

The video content server has become an important tool for learning, and it will be easy to provide the courses repeatedly from Cloud Campus.

4.3 Virtual Video Show and Sharing Server in Cloud Campus

We need to have Virtual Video Show and Sharing Server by Web OS in Cloud Campus, because Virtual Video Show and Sharing Server is a good teaching tool through Web OS for Smart Cloud Campus. Faculties can upload their lecturing video capture for their courses to Show and Sharing Server. Students can watch the lecturing video capture repeatedly from Video Show and Sharing Server in Smart Cloud Campus.

The Video Show and Share Server is a webcasting and video sharing applications that helps faculties and students create secure video communities. The Show and Share provides the ability to create live and on-demand video content and define who can watch specific content. The Show and Share is a secured social network for collaboration, communication, learning, and pleasure—unlimited by time and place. People use Show and Share to improve information and each other. As a Show and Share administrator, we set the system-wide preferences and settings, assign user permission, integrate other devices with Show and Share, and manage content in Cloud Campus.
4.4 Data Center for faculties, students and administrators in Cloud Campus

Data Center can be created in the Smart Cloud Campus by virtual environment in the Cloud. The Data Center in the Cloud Campus can be used for the Cloud Campus needs. The Data Center can provide big data storage services and database, Disaster Recovery solutions, virtualization for running Microsoft Windows Applications Servers and SQL Server, and others software applications operations for teaching, studying and administrations in the Cloud Campus.

Data Center also provides a wide variety of information by database for faculties, students and administrators in the Cloud Campus. The members of the Cloud Campus can upload and access the information in the Data Center according to their permission of user accounts. The information can be included students’ transcript, dropout status, Lecture video capturing, disciplinary action and human resources.

4.5 Virtual Network system in the Smart Cloud Campus

Many cloud services agencies provide a network enabled cloud solution, allows users to extend their multi-protocol label switching (MPLS) Virtual Private Network (VPN) for the delivery of Cloud Campus applications through fast and highly secure connectivity.

The virtual network in the Cloud Campus can be defined by the computer and network administrators of Cloud Campus. The administrators can control over the virtual networking environment, including selection of own IP address range, creation of subnets, and configuration of route tables and network gateways.

The administrators of Cloud Campus will be easy to configure the Cloud network for the Cloud Campus needs. Cloud Campus can create a public section subnet for the webservers that has access to the Internet, and place the backend systems such as databases or application servers in a private section subnet with no Internet access. The multiple layers of security, including security groups and network access control lists can be set up in each subnet.

Cloud Campus also can create a Hardware Virtual Private Network (VPN) connection to users’ datacenter and computers as an extension of Cloud Campus datacenter.

There are multiple Connectivity Options for the virtual network system in the Cloud Campus. The virtual computer servers and data Center in the Cloud Campus can be connected to the Internet or keep private.

The virtual computer servers in Cloud Campus can be connected to the Internet directly. Faculties and students can send and receive traffic from the Internet. If you do not want to be directly addressable from the Internet, you can use Network Address Translation (NAT) to private subnets without exposing their private IP address by routing.
You can make webservers, application servers and databases in a publicly accessible subnet. You can control access between the servers and subnets using inbound and outbound packet filtering provided by network access control lists and security groups.

You can create a VPC where instances in one subnet, such as webservers, communicate with the Internet while instances in another subnet, such as application servers, communicate with databases on your corporate network. A VPN connection between your VPC and your network helps secure all communication between the application servers in the cloud and databases in the datacenter. Webservers and application servers in the VPC can be Auto Scaling features to grow and shrink as needed. You can create a VPC to support this use case in Cloud Campus by selecting "VPC with Public and Private Subnets and Hardware VPN Access" in the Cloud Computing providers.

You can periodically backup your critical data and files from your datacenter and computer to storage in Cloud Campus by Cloud VPN. You also can import your backup images to the storage. When the disaster is over, you can send the critical data and files back from Cloud Campus to your datacenter and computer.

The Smart Cloud Campus is a new campus with next generation technology for education system. The creation of Smart Cloud Campus will provide a good and new way for the education system, and challenge the classical education format. We can believe that faculties and students will enjoy and share the advantages from Smart Cloud Campus to develop our current education system.

5. International studies and education exchange programs by Cloud Computing Technology

The Cloud Computing Technology has provided many good benefits and tools for applications and developments of International studies and education exchange programs. The International students can be studying in the virtual classrooms by cloud services to obtain the degree. The students can be staying in native country for international studies and education exchange programs. The cloud high speed transfers for big data applications make our International studies and education exchange programs quickly and effectively. The unique Earth Classroom for International studies and programs on world has been created by Cloud Computing Technology.
5.1 Degree Programs for International students in the Cloud

Many universities have offered Degree Programs for International students in the Cloud applications. The International students can study the courses for their degree program from Cloud Campus. The students can access their classrooms in the Cloud from anywhere you have the Internet with 24 hours and seven days per week.

5.2 Staying in native country for international studies and education exchange programs

The Cloud Computing Technology has provided International students can be staying in native country for international studies and education exchange programs, so International students can save much
time and cost for international travel and living overseas. The students can concentrate on study for international programs at native country effectively.

5.3 Speed up the international studies and education exchange programs in time

The Cloud Computing Technology provides more fast speed to exchange international studies and education programs. Cloud Services have offers the best transfer speeds. The typical average speed is about 12.9 Mbps down and 17.8 Mbps up. This delivering high-speed transfers in cloud have applied for big data applications, and can be real time international communications synchronously for study and exchange information.

5.4 Unique Earth Classroom for International studies and programs on world

World is but a little place, after all. Cloud Computing provides a unique Earth Classroom for International studies and exchange programs on world. Peoples all over world are studying in the Cloud Campus together, and exchange international programs each other in the earth classroom that shared cloud computer technology advantages.

Many universities have taken the benefits from cloud computing technology for education applications. The Cloud Computing Technology has provided a new method to change the current IT infrastructures and computer administrations on campus. The members of faculty and students can use cloud applications directly to store data and files, backup, share the contents and teaching materials, search, sort and access by mobile devices, and accessing and uploading data and files any time and any locations without any physical servers on campus. The Cloud Computing applications are lower cost comparing with the traditional IT cost, because there is no physical computer servers and reduce IT staffs and computer administrators. The Smart Virtual Cloud Campus completely can be created by Cloud Computing Technology, and take all advantages from Cloud Computing Technology. We can believe that the Smart Virtual Cloud Campus (c-campus) will replace the current distance learning and e-campus near future. The c-campus will be a new style and format for distance learning. Due to Cloud computing technology applications and developments, a unique Earth Classroom will be created for International studies and exchange programs on world. People will be happy to enjoy work and life under Cloud Computing Technology.