PILOT PROJECT DEPLOYING NETWORKING PUBLIC CLOUD SYSTEM NATIONWIDE IN MYANMAR, EXTENDING FROM THE PRIVATE CLOUD SYSTEM AT UIT, FOR BOTTOM UP ICT SKILL AND ACADEMIC VALIDATION (CATEGORY J3)

Final Report

July 10th, 2017

University of Information Technology (UIT)
Waseda University
National Institute of Information and Communications Technology (NICT)
Okayama Prefectural University
KDDI foundation
Fujitsu Limited

INDEX

1. Glossary

APT	Asia-Pacific Telecommunity
APAN	Asia Pacific Advanced Network
CU (Dawei)	Computer University, Dawei
CU (Hinthada)	Computer University, Hinthada
CU (Hpaan)	Computer University, Hpaan
CU (Mandalay)	Computer University, Mandalay
CU (Monywa)	Computer University, Monywa
CU (Magway)	Computer University, Magway
CU (Maubin)	Computer University, Maubin
CU (Pathein)	Computer University, Pathein
CU (Pyay)	Computer University, Pyay
CU (Taunggoo)	Computer University, Taunggoo
CU (Thaton)	Computer University, Thaton
CU (Taunggyi)	Computer University, Taunggyi
LMS	Learning Management System
mmREN	Myanmar Research and Education Network
NICT (Japan)	National Institute of Information and Communications Technology
SINET	Science Information Network (Japan)
UIT	University of Information Technology
UCSM	University of Computer Studies, Mandalay
UCSY	University of Computer Studies, Yangon
YTU	Yangon Technological University

2. Executive Summary

In the past half-decade, Myanmar took the helm to the open democratic policy and then is completing forward to reorganization of the government. After transformation of the policy, University of Information Technology, Yangon (UIT) and partners from Japan conducted APT J2 project titled as "THE PROJECT FOR DEPLOYING PRIVATE CLOUD SYSTEM FOR VIRTUALIZED LABORATORIES FOR ICT HIGHER EDUCATION" to introduce private cloud to UIT and it had successfully completed. And we did start next step APT J3 project that was experimentally implementing the cloud system connected with the limited numbers of 5 universities (Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University) who had capabilities to share this extension. This project is to provide cloud based learning environment for those universities to evaluate its effects of bridging the gap in ICT human resource development in the selected areas in Myanmar.

We held the Kickoff meeting, Site survey, and On-the-Job Trainings and technical discussion in both Japan and Myanmar. Through discussions and trainings, we decided the appropriate cloud system design for this pilot project, discussed on the future plans, and prepared design sheet and installation manuals with support of members in Japan. Japan members transferred practical skills for configuration including the processes for preventing troubles in the actual configuration work to UIT technical members, such as tools to save the logs and some countermeasures for specific errors. We also arranged the lectures and workshops for the faculties of UIT and other universities to share the knowledge of cloud and to determine the service menus based on their expectations and budget limitation. These skill transferring and knowledge sharing were the key factors not only for the configuration work but also for the sustainable use of the cloud services and future expansion. According to the skill transfer, technical members of UIT successfully configured the OpenStack based cloud system with support from Japan members and introduced it to the members from other universities as the cloud service users. UIT has just started to provide Virtual Machines and 2 services: Samba (File sharing) and Moodle (Learning Management System: LMS) for the first step. We have created the teams for the operation and contact persons have been decided. We need more discussions to consider and create appropriate policies and rules according to the actual usage through this network of human resources among the member universities.

For the next phase, we are planning to expand this cloud network nationwide towards the far more remoted areas in Myanmar and challenging to build up an advanced ICT educational environment for transferring the advanced cloud technology from Japan to Myanmar. We also discussed to introduce capacity building in cybersecurity area for the system sustainability. We believe that we can build and strengthen the platform for the continuous discussion on the further visions what ICT network for higher ICT educational institutes in Myanmar should be, through the practical capacity buildings and

experiences of the cloud network usage.

The project in 2017-2018, based on our pilot project in 2016, is to build-up the Myanmar nationwide academic environment among the ICT related universities, in a step-by-step manner. By extending APT J3 project in 2016, it will be a pilot academic network of mmREN (Myanmar Research and Education Network). Later on, it will be very helpful for not only fostering the research and innovative works collaboration among ICT related universities but also contributing to the development of Myanmar.

3. Introduction

3-1. PROJECT NAME AND OBJECTIVES

Project Name:

Pilot project deploying networking Public Cloud System nationwide in Myanmar, extending from the Private Cloud System at UIT, for bottom up ICT skill and academic validation (Category J3)

Reference: APT ref.: APT/J2J3/Result/App/2015

Objectives:

1) To introduce the pilot platform for cloud services for ICT education and to conduct trials for broadband connectivity in the urban and remote areas.
2) To organize academic workshop for the curriculum development of ICT higher education in computer universities in Myanmar, utilizing “Curriculum for Developing HR with High ICT Capability” developed by Ministry of Internal Affairs and Communications in Japan.
3) To set up the broadband network and deploy the cloud infrastructure and applications for virtual learning and administration services through UIT cloud system.
4) To exchange and motivate the ICT research experiences and knowledge between project teams in Myanmar and in Japan.

3-2. STATUS BEFORE PROJECT

In 2013-2014, UIT performed APT J2 program and it has successfully finished. In this project, private cloud system has been established in UIT to support computing resources of the virtual laboratories for the demonstration of the model of developing and utilizing the private cloud in one university. UIT faculties had experience to set up the private cloud for internal use and the students could get the chance to deploy Virtual Machines, to access the course management system and other contents on the private cloud. Based on the experience and result of above J2 project, UIT decided to apply APT project for developing a pilot cloud system for offering virtual learning environment and administration services for other universities to evaluate the effectiveness of cloud services for remote areas to improve the digital divide in the ICT human resource development in Myanmar.

3-3. PURPOSE OF THIS PROJECT

1) To create the favorable teaching and learning environment that allows universities in remote areas to access the cloud platform.
2) To transfer the cloud technology from Japan, including system configuration skills and operation knowhow and conducting On-the Job Training for system configuration, maintenance and operation for sustainable use of the system.
3) To foster the telecommunication framework for ICT higher education institutes by supporting to establish the broadband network deployment of cloud based virtual learning and administration services in Myanmar.
4) To offer a community platform for exchanging good practices and making resources available, and training in digital tools and usage to bridge the educational gaps in ICT human resource development in the remote areas.

3-4. PARTNERS IN THIS PROJECT

Applicant:	Dr. Myat Thida Mon (Ms) University of Information Technology
Project Coordinator:	Mr. U Kyaw Zwa Soe Ministry of Education
Accounting Coordinator:	Mr. Yosuke Uchiyama KDDI Foundation
Organization	
Myanmar:	University of Information Technology (UIT) Ministry of Education *Department of Advanced Science and Technology (DAST)*
Japan:	Waseda University *(Global Information and telecommunication Studies)* National Institute of Information and Communication Technology Okayama Prefectural University KDDI Foundation Fujitsu Limited

3-5. MILESTONE (SIGNIFICANT PHASES) IN PROPOSAL

Acceptance to APT refer to the selection

1) Reconfirmation of this project among members
2) Kickoff meeting in Myanmar
3) Research and study in each organization
4) Interim Report to APT
5) Research and Discussion in Japan
6) Design and procurement
7) Practical installation/experiment phase 1
8) Evaluation
9) Practical installation/experiment phase2
10) Evaluation in Myanmar
11) Skill up (included improvement of system) and presentation
12) Final report to APT
13) Presentation at ADF

3-6. EXPECTED OUTPUT AND CONTRIBUTION

1) To demonstrate the conducting ICT education through cloud environment within campus and with the clients outside of the campus, connecting a couple of sites
2) To access and utilize the cloud infrastructure efficiently and effectively among a couple of universities as the trials for connecting 26 computer universities in Myanmar. We would like to establish the inter university network based on the cloud computing in Asian countries in collaboration with Japanese partners in the future. Through this J3 project, UIT and other universities can establish and strengthen partnership with the academic organizations and private companies in Japan as a first step.
3) To obtain the knowledge and skill for minimizing the costs for setting up, upgrading, operating and managing IT infrastructures in universities.
4) To establish the telecommunication framework for ICT higher education institutes to be support for the broadband deployment of cloud system for offering virtual learning and administration services in Myanmar
5) To evaluate the effectiveness of education cloud service for the universities of computer studies based on the above outputs.

3-7. APPROVED BUDGET BY APT

Equipment procurement	136,000.00US$
Shipping fee & Correspondence expenses	900.00 US$
Business trips	62,612.50 US$
Miscellaneous	480.00 US$
Total amount	199,992.50 US$

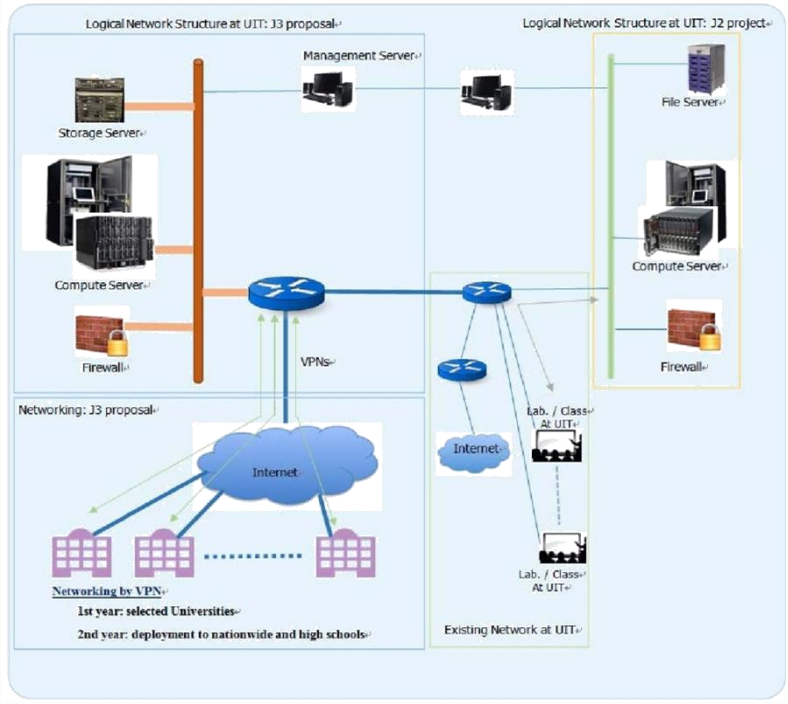
4. General Information of Myanmar and her aspect

Myanmar is now opening up to reform, especially ICT Infrastructure for education system that plays an important role for national development goal. There are 26 Computer Universities located in remote areas and urban areas around the country. They are now facing the insufficient resources of teaching staff and education materials and tools, especially in the remote areas. Therefore, this project aims to narrow the digital divide in the ICT human resource development field and promote the enhancement and expansion of advanced ICT education with a collaboration of Japan for the sustainable social and economic development of Myanmar. In 2013, University of Information Technology, UIT performed APT J2 program titled as "THE PROJECT FOR DEPLOYING PRIVATE CLOUD SYSTEM FOR VIRTUALIZED LABORATORIES FOR ICT HIGHER EDUCATION" and it has successfully completed. Based on this previous project, the proposed pilot project distributes the computing resources into other universities for not only academic learning and researching but also for management purpose. In order to improve further collaboration between organizations & institutes from Japan and UIT, Broadband Deployment and Application for E-Learning System will be setup on the extension of hybrid Cloud infrastructure underlying of the existing academic cloud system. Relying on the Cloud System deployment, the additional research issues and challenging will be addressed such as Mobile Cloud Application for LMS to establish the Cloud based E-Education System.

This proposed pilot project expected to be a model to develop the framework for infrastructure development in ICT institutions which are located in rural area that can be taken on the experience of implementation for Cloud based E-Education System development.

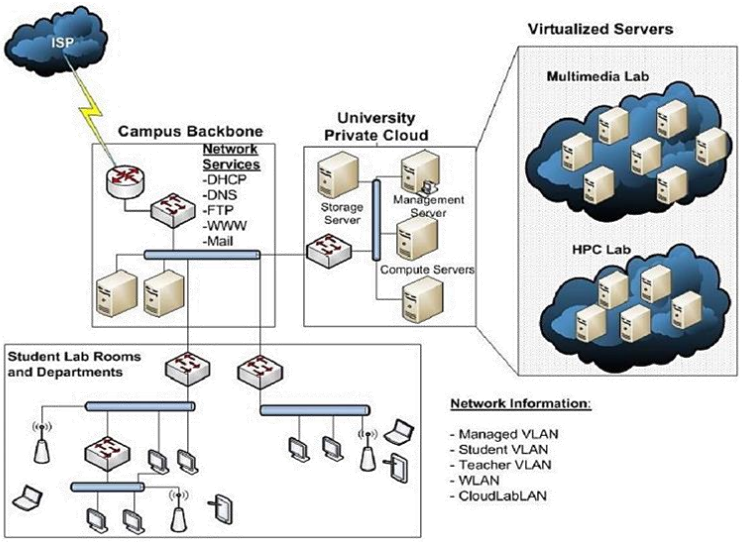
5. Rough plan at proposal

The proposed pilot project was to extend J2 project which had been to deploy the private cloud computing laboratory underlying UIT backbone. The blue section describes the logical network structure of J2 Project. The dotted-line section designates the extension of cloud system of UIT for J3 Project. This system enables some of the computer universities to connect and access the virtual learning and administrative services. The logical network for J3 pilot project is indicated by red line in the following figure.



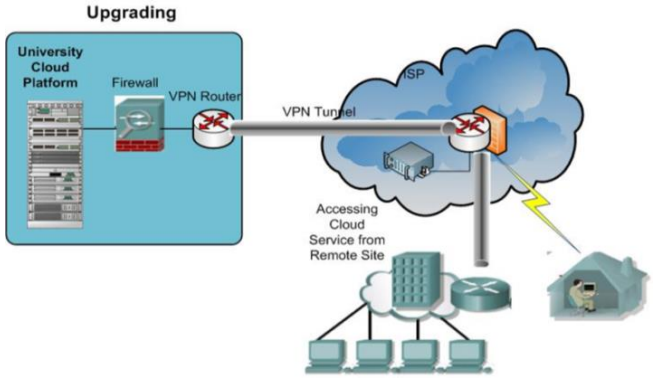
Overview of the proposed project

The existing cloud platform planned to be upgrade to provide the services for virtual learning and administration. In this phase, the project members between UIT and partner institutions such as GITS Waseda University, NICT, Fujitsu and KDDI cooperate to operate this platform together. We also conduct the On-the Job Training for system configuration, operation, and maintenance for sustainable use of the system.

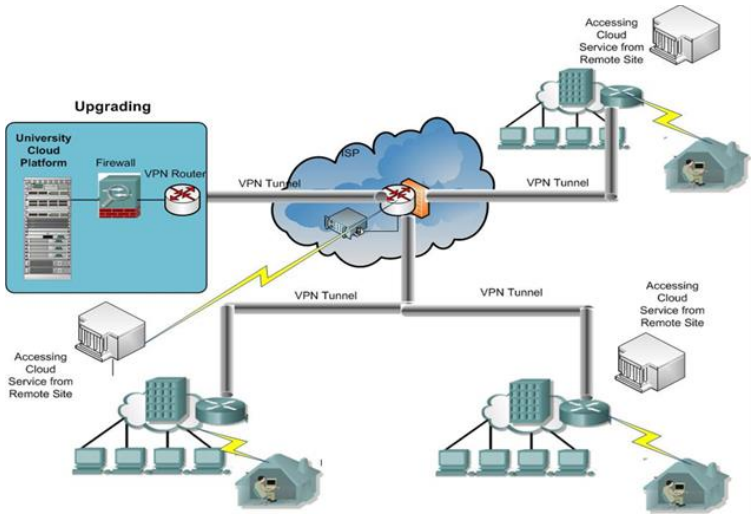


Existing Private Cloud Infrastructure in which services are only accessed in UIT

The existing academic cloud is upgraded to expense the virtual learning and administration services to become cloud infrastructure in which the students and lecturers from remote universities those who can access these services through cloud and also UIT's students and lecturers can access lectures and other teaching contents from their home at any time. We conduct workshops for the generation of teaching materials and tools for cloud services and its maintenance. In addition, we introduce "Curriculum for Developing HR with High ICT Capability" developed by Ministry of Internal Affairs and Communications in Japan. Cloud Computing and Big Data courses for the teaching staffs are included.

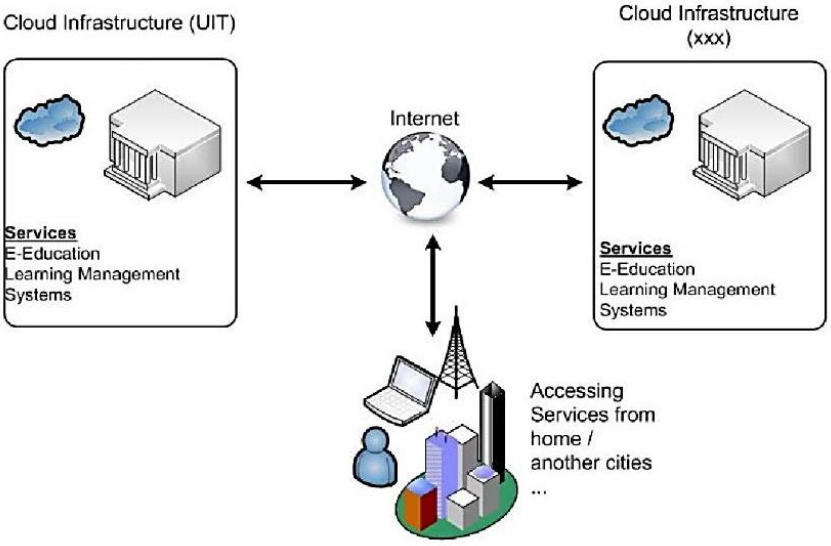


Existing Private Cloud can be accessed both in UIT and through Internet



Upgrade cloud to be accessed E-Education and LMS service through the internet

The virtual learning and administrating services provided by the Cloud Platform would be tested. The students and lecturers are able to access those services through their computers at their home and also from remote sites. These services include the broadcast video conferencing lectures, attending the Cisco networking academy, lecturing the video file, sitting the online examination by using Moodle system and curriculum development.



Overall Infrastructure of Cloud based E-Learning and LMS System

The demonstration of the Machine Translation and any other collaborative research would be conducted among the member universities. Regard to the Machine Translation, University of Computer Studies, Yangon and NICT (Japan) had already signed the Memorandum of Understanding for the natural language processing research area. As a research trend this proposal are going to demonstrate machine translation between Myanmar language and Japanese language by text-based and vocal (under development) on the cloud system. The significant application such as language processing, speech recognition, speaker identification for security purposed support for teaching, learning, understanding and communicating for all area. Multi-language translation which is the primary part of the pilot project can be accessed from all remote universities through the proposed cloud system.

6. Activities timeline of our project

We have built the cloud system to provide the virtual learning and administration services to not only the classrooms in UIT but also to other universities through Virtual Private Network (VPN). Some teaching and learning materials and/or provide virtual environment would be shared on the cloud for the other universities especially in remote areas.

Timeline: In the period from January 2016, the following activities had been planned.

Item	Activities	Term(Actual)
Preparation to start the Project	To re-establish the project team and to fix the Kickoff meeting schedule and agenda.	From January, 2016
Kickoff meeting in Myanmar	To agree with and confirm the objectives, milestones and role for each Party in detail. To fix the detailed schedule and action items.	February 2016
Site survey	To conduct the survey of environment and place for the system and to discuss on technical issues such as system design, configuration and trainings.	March 2016
On-the-Training and Technical discussion in Japan	Researchers from Myanmar will visit relevant enterprises, government and organizations to take On-the-Job Training and Site visits to particular environments for Parties' project reference.	April 2016
System and environment design	To design system and testing environment. To procure and to ship. To fix the schedule and to prepare for installation and tools/installments.	June 2016

Lecture and Workshop	To share the knowledge of cloud to members in Myanmar including faculties of other 5 universities. To discuss and agree on the cloud service menus.	July 2016
Interim report	To summarize activities including next phase plan and to report the up-to-date activities and financial results.	September 2016
Installation, practical experiment and evaluation	To discuss on experimental system by each site To operate and to evaluate.	October -November 2016
Trial of Cloud services	To introduce the service menus including advanced ICT human resource development education and other experimental education.	November 2016 to March 2017
Evaluation, final discussion and final presentation/ceremony	To discuss finally about the results of practice of operation as well as installation, future plan, policy, and strategy.	March - April 2017
Preparation of Final Report and submission	To submit the Final Report and the Accounting Report.	May-July, 2017

7. On-The-Job Trainings

7-1. ON-THE-JOB TRAINING AND TECHNICAL DISCUSSION IN JAPAN

4 main members; Dr. Myat Thida Mon, Dr. K Zin Lin, Dr. Aye Myat Myat Paing, and U Zaw Myint Naing Oo of UIT visited Japan to take On-the-Job Training and conduct technical discussion. Through this visit, Fujitsu and Waseda University transferred the knowledge and skills to configure the cloud system and we discussed on the future plans.

#	Date	day		Place	Activity
1	**25 Jun**	SAT	AM		
			PM	RGN	Departure
2	**26 Jun**	SUN	AM	NRT	Arrival
			PM	Washington Hotel Shinjuku	Bus from Airport to Hotel
3	**27 Jun**	MON	AM	09:30 Hotel Lobby(3rd Floor)	Oedo Line Subway from Tochomae to Shiodome
				10:30-12:00 **Fujitsu**(Shiodome)	Opening Meeting
			PM	13:30-15:00 Fujitsu: **Security Initiative Center**(Toranomon)	Fujitsu's Cyber Security Solutions
				16:30-17:30 **Asia Pacific Advanced Network**(KDDI Otemachi)	APAN Facility Visit
4	**28 Jun**	TUE	AM	10:00-12:00 Fujitsu(Odaiba)	**On-the-Job Training**
			PM	13:00-16:00(TBD) Fujitsu(Odaiba)	**On-the-Job Training**
5	**29 Jun**	WED	AM	10:00-12:00 Fujitsu(Odaiba)	**On-the-Job Training**
			PM	13:00-16:00 Fujitsu(Odaiba)	**On-the-Job Training**
				18:30-20:30 Dinner(Shinbashi)	Welcome Dinner
6	**30 Jun**	THU	AM	8:45 Hotel Lobby(3rd Floor)	
				9:45-12:00 **Waseda University**	Example of Cloud Server in Use
			PM	15:00-17:00 **National Institute of Informatics**	Academic Network in Japan
7	**01 Jul**	FRI	AM	09:30-11:00 **KDDI Foundation** (Iidabashi)	Technical Discussion
				11:00-12:00 **KDDI Corporation**	Meeting
			PM	13:00-16:00 **KDDI Foundation** (Iidabashi)	Closing Meeting
8	**02 Jul**	SAT	AM	Washington Hotel Shinjuku	Bus from Hotel to Airport
				NRT	Departure
			PM	RGN	Arrival

Japan Visit Schedule

7-1-1. ON-THE-JOB TRAINING FOR CLOUD CONFIGURATION

(Date: June 28th to 29th, 2016 at Fujitsu Odaiba Office)

On-the-Job Training was held at Fujitsu Odaiba Office for 2days and had the lecture part and the practice part. In former section, Fujitsu member and instructors explained the tentative system configuration and actual processes such as revising answer sheet for the installation of OpenStack to UIT members. During this part, all the participants discussed about appropriate hardware spec for this system again. In the practice part, UIT members tried to set and configure CentOS and OpenStack according to the design sheet, the installation manuals and testing environment which was prepared in the server room of Fujitsu Odaiba Office.

Fujitsu instructor's remarks during this training were as follows;

1) To take the log of command lines with time stamp and take screen captures so that we can review if the errors happen during the installation. In case of web installation, please use screen

capture, such as Win Shot, to record the screen.

2) In case of stoppage by the disconnection of internet, it is better to restart from the CentOS7 installation so that the remaining data would cause the errors.
3) To prepare for the shutdown, please take the backup, using DUMP feature and kept them in the external storage, before you change the settings. If there is no external storage, you can store the back up of each server in the other servers alternatively, such as backup Server A in Server B, Server B in Server C and Server C in Server A.
4) The recommended orders for tuning on and shut-down: Turning on from Controller Node => Storage Node, =>Compete Node. Shut-down in the opposite order.
5) The name of backlog file: to describe the data, server name and serial number.


June 28th and 29th, 2016 On-the-Job Training in Odaiba

7-1-2. SITE VISIT FOR STUDY AND DISCUSSION

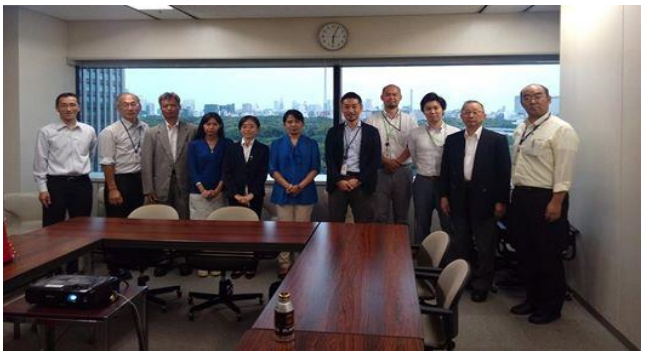
(Date: June 27th, 2016)

We discussed on the future plans for this project to decide the objectives and scopes of the proposal for the second year. We agreed on the future direction to add human resource development in the cybersecurity area in order for the continuous and safety utilization of ICT system in Myanmar nationwide and to offer and set-up an academic community platform for exchanging good practices, making educational resources available and training of digital tools usage to mitigates the digital educational divide in the field of ICT human resource development. For this discussion, we visit and arrange the following study tours;

1) Security Initiative Center (Fujitsu)
   - Study the trends of cyberattacks and cybersecurity solutions
2) Asia Pacific Advanced Network (KDDI):
   - Study the history and roles of APAN (Asia Pacific Advanced Network) and other academic networks

- Discuss on the current status of academic network in Myanmar for future possible inter-connection

3) Waseda University: Server room tour:
   - Learn the actual usage and operation of the cloud system in the university
4) National Institute of Informatics:
   - Learn from the experience in constructing academic network in Japan, Science Information Network (SINET)
     - ❖ SINET covers 100% of national, 84% of municipal and 59% of private universities. Total number of organizations covered by SINET is 844.
     - ❖ SINET facilitates resource-sharing of research facilities in various scientific areas fosters secure collaboration among researchers, promotes cloud services and enhances educational environment of universities.
     - ❖ SINET usage examples are shared such as High-Energy Physics, Nuclear Fusion Science, Astronomy, High-Performance Computing, Seismology, Medical Information Backup, 8K Ultra HDTV Transmission and Cloud Services.
   - Discuss on the future academic network



June 30th, 2016 Site Visit in Tokyo

7-2. LECTURE AND WORKSHIP FOR PREPARATION

(Date: July 25thand 26th, 2016, Place: UIT, Fujitsu ICT Laboratory)

UIT and Fujitsu conducted 2-days cloud lecture and workshop for UIT and other universities' members. The lecture included the presentation about the cloud system which we will construct in UIT and its future plan. This Lecture and workshop was aimed to share the basic knowledge of private cloud and the information of the cloud system of this project and to discuss and determine the service menu among the service provider (UIT) and users (other universities). Agenda and participants list were as follows;

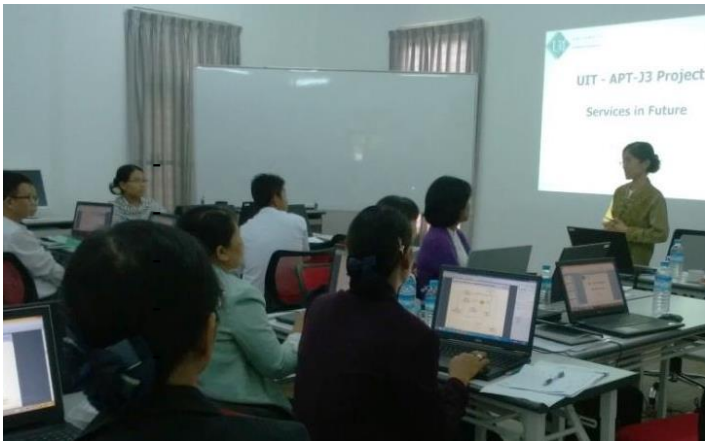
#	Date	day		Agenda	Remarks
1	**25 Jul**	MON	AM	10:00-12:00 Lecture and Presentation	
				・Overview of Private Cloud	
				・Element Technologies and architecture of Cloud	
				・Introduction of APT Cloud: design, schedule and future plan	
			PM	13:00-15:00 Groupwork and Lecture	Lecturer: Fujitsu Presenter: UIT, Fujitsu Participants: UIT, UCSY, YTU, UCSM, CU Taunggyi, CU Dawei
				・Discussion on the expectation for the Cloud	
				・Difference between Private Cloud and Conventional Systems	
2	**26 Jul**	TUE	AM	10:00-12:00 Lecture	
				・Requirement Definition of Private Cloud ; Process and Service menu	
			PM	13:00-15:30 Workshop	
				・To discuss and determine the service menu for the Cloud	

#	Name	Education	University
1	Dr. Ei Chaw Htoon	Ph.D. (IT)	UIT (University of Information Technology)
2	Dr. Myat Pwint Phyu	Ph.D. (IT)	UIT (University of Information Technology)
3	Dr. Tin Tin Yee	Ph.D. (IT)	UIT (University of Information Technology)
4	Dr. Hsu Mon Kyi	Ph.D. (IT)	UIT (University of Information Technology)
5	Ms Swe Zin Phyo	M.C.Sc.	UIT (University of Information Technology)
6	Dr. Thant Zin Tun	Ph.D. (IT)	UIT (University of Information Technology)
7	Mr. Zaw Myint Naing Oo	M.I.Sc.	UIT (University of Information Technology)
8	Ms. Kyawt Kyawt Khin	M.C.Tech.	UIT (University of Information Technology)
9	Ms. Aei Su Su Kyi	M.C.Tech.	UIT (University of Information Technology)
10	Dr. Myat Thida Mon	Ph.D. (IT)	UIT (University of Information Technology)
11	Dr. Ei Phyu Zaw	Ph.D. (IT)	UCSY (University of Computer Studies, Yangon)
12	Dr. Kyar Nyo Aye	Ph.D. (IT)	UCSY (University of Computer Studies, Yangon)
13	Dr. Wint Thida Zaw	Ph.D. (IT)	UCSM (University of Computer Studies, Mandalay)
14	Mr Hlaing Myo Zaw	M.C.Sc.	UCSM (University of Computer Studies, Mandalay)
15	Dr. Khin May Win	Ph.D. (IT)	Computer University (Taunggyi)
16	Dr. Kyu Kyu Win	Ph.D. (IT)	Computer University (Taunggyi)
17	Dr. Zin Mar Win	Ph.D. (IT)	Computer University (Dawei)
18	Dr. Moh Moh Khaing	Ph.D. (IT)	Computer University (Dawei)
19	Dr. Win Zaw	Ph.D. (IT)	YTU (Yangon Technological University)
20	Mr. Kyi Thar Ko	M.E. (IT)	YTU (Yangon Technological University)

List of the Participants

Participants well understood the basic cloud lecture, the structure of the cloud system for this project and its future vision. In the group work and the workshop, we made 4 groups and each group discussed and wrote down their expectations in detail for the cloud system. Most of them actively joined the discussion and workshop. As a conclusion of the workshop, all the participants agreed that following 3 expectations were more important than other expectations and decided to install Samba and Moodle on the cloud.

- To store the teaching materials such as pdf files and movies
- To provide LMS (Learning Management System) for the universities which have no LMS so far
- To provide the virtual environment services



July 25th and 26th, 2016, Lecture and workshop for UIT and other universities

7-3. OJT AND WORKSHOP FOR THE CLOUD OPERATION FOR OTHER UNIVERSITIES

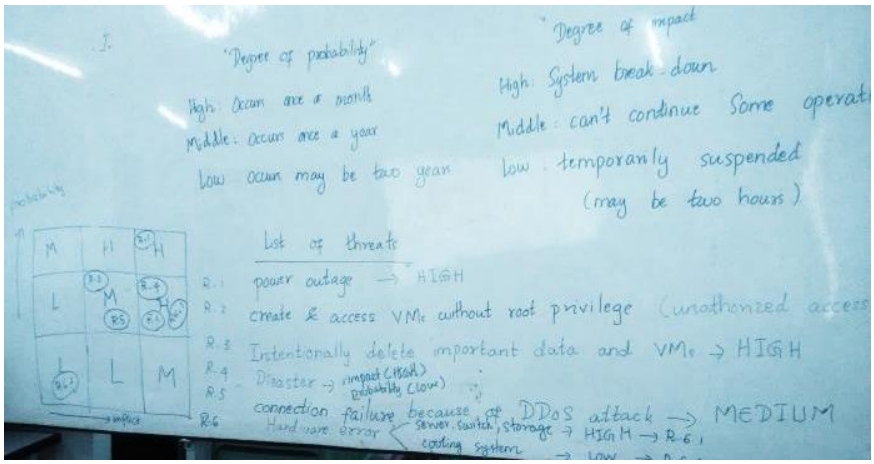
(Date: December20th-22nd, 2016, Place: UIT, Server room and Fujitsu ICT Laboratory)

Fujitsu provided 1-day OJT to write shell script for automatic shutdown to avoid an abnormal shutdown caused by sudden electricity failure and trouble in the generator. Then UIT and Fujitsu conducted 2-days Lecture. This Lecture was aimed to share the status and achievement of this project, to introduce the cloud system through the demonstration to the other universities and explain the potential risks and its countermeasures in operation of the cloud system. At the first session, UIT introduced the progress of configuration of cloud system, hardware configuration and network design.

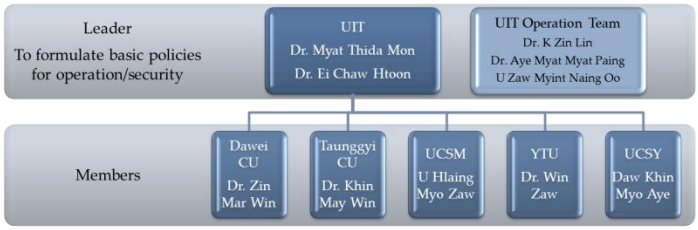
#	**Date**	day		Agenda	Remarks
1	**20 Dec**	MON	AM	9:30-12:00 OJT for operating cloud system	Lecturer: Fujitsu Operator: UIT
			PM	13:00-15:30 To set up the automation program to shut down VMs.	
2	**21 Dec**	TUE	AM	9:30-11:30 Introduction and Demonstration ・Project status update/ APT Cloud System introduction ・Explanation about VPN network and Network devices ・Demonstration to create and delete VMs for other member universities	
			PM	12:30-15:30 Lecture and Workshop for System Operation(1) ・Potential Risks and Countermeasures(1)	Presenters: UIT, KDDI Myanmar Demonstrater: UIT Lecturer: Fujitsu Participants: UIT, UCSY, YTU, UCSM, CU Taunggyi, CU Dawei
2	**22 Dec**	TUE	AM	9:30-11:30 Workshop for System Operation(2) ・Potential Risks and Countermeasures(2)	
			PM	12:30-15:30 Workshop for establishing the operation structure ・To discuss and determine the operation policy ・To determine the operation team, security policy team, and contact persons	


December 21st and 22nd, 2016 System Demonstration at UIT

After the introduction of cloud system itself and examples of the potential risks such as data missing, data leakage, unauthorized use, and their impacts on other universities, all the participants discussed in small groups about actual risks in the cloud operation and categorized in 3x3 matrix based on their potential impact and probability as below.



Then we moved on to the next workshop for establishing the operation structure; organize the team for operation, communication and formulation of the basic policy including detailed action items, frequency, and role sharing as below. Collaboration among the universities would be more important to run and maintain the cloud system because all the universities must utilize the cloud services according to the common rule and it should be prepared and revised by ourselves. So, we determined the representatives from each university to be involved in the discussion on the policy and operation.



7-4. LECTURE AND WORKSHIP OFTHE FURTHER OPERATION

(Date: March, 23rd and 24th, 2017, Place: UIT, Fujitsu ICT Laboratory)

UIT and Fujitsu conducted 2-days cloud lecture and workshop for UIT and other universities' members. The lecture included the presentation about to have experiences to upload and provide/use the contents on the cloud. This Lecture and workshop was aimed to share the basic knowledge of the further steps for the cloud operation. The lecturer emphasized that the system cut over is not the end, and we need to maintain it with regular meeting among operation members and we should determine and continuously revise the common rules for every end-user.

#	**Date**	day		Agenda	Remarks
1	**23 Mar**	MON	AM	9:30-11:30 Overview and Further Perspective of Cloud Operation	
				・To reconfirm the Objective and further goals	
				・Future vision and necessary steps to maintein the cloud platform	
			PM	12:30-15:30 Cloud System Trial	
				・ Preparation for the stress testing	
				Installation and Setting up of Samba for the Virtual Machine	Lecturer: Fujitsu Presenter: UIT, Fujitsu Participants: UIT, UCSY, CU Dawei
2	**24 Mar**	TUE	AM	10:00-12:00 Stress Testing →Configuration (Troubleshooting)	
				- Troubleshooting -	
				To try to complete Samba setting and Moodle configuration	
			PM	13:00-15:30 Workshop	
				・To determine the date for service cut over and milestones	
				・Advices on making rules and to do lists for the cut over and operation	

#	Name	Education	University
1	Dr. Ei Chaw Htoon	Ph.D.(IT)	UIT(University of Information Technology)
2	Dr. K Zin Lin	Ph.D.(IT)	UIT(University of Information Technology)
3	Mr. Zaw Myint Naing Oo	M.I.Sc.	UIT(University of Information Technology)
4	Dr. Aye Myat Myat Paing	Ph.D.(IT)	UIT(University of Information Technology)
5	Dr. Hsu Mon Kyi	Ph.D.(IT)	UIT(University of Information Technology)
6	Dr. Myat Pwint Phyu	Ph.D.(IT)	UIT(University of Information Technology)
7	Dr. Tin Tin Yee	Ph.D.(IT)	UIT(University of Information Technology)
8	Dr. Thant Zin Tun	Ph.D.(IT)	UIT(University of Information Technology)
9	Daw Swe Zin Phyo	M.C.Sc.	UIT(University of Information Technology)
10	Daw Aie Su Su Kyi	M.C.Tech.	UIT(University of Information Technology)
11	Dr. Ei Phyu Zaw	Ph.D.(IT)	UCSY(University of Computer Studies Yangon)
12	Daw Khin Myo Kye	M.C.Sc.	UCSY(University of Computer Studies Yangon)
13	Dr. Zin Mar Win	Ph.D.(IT)	Computer University(Dawei)

List of the Participants

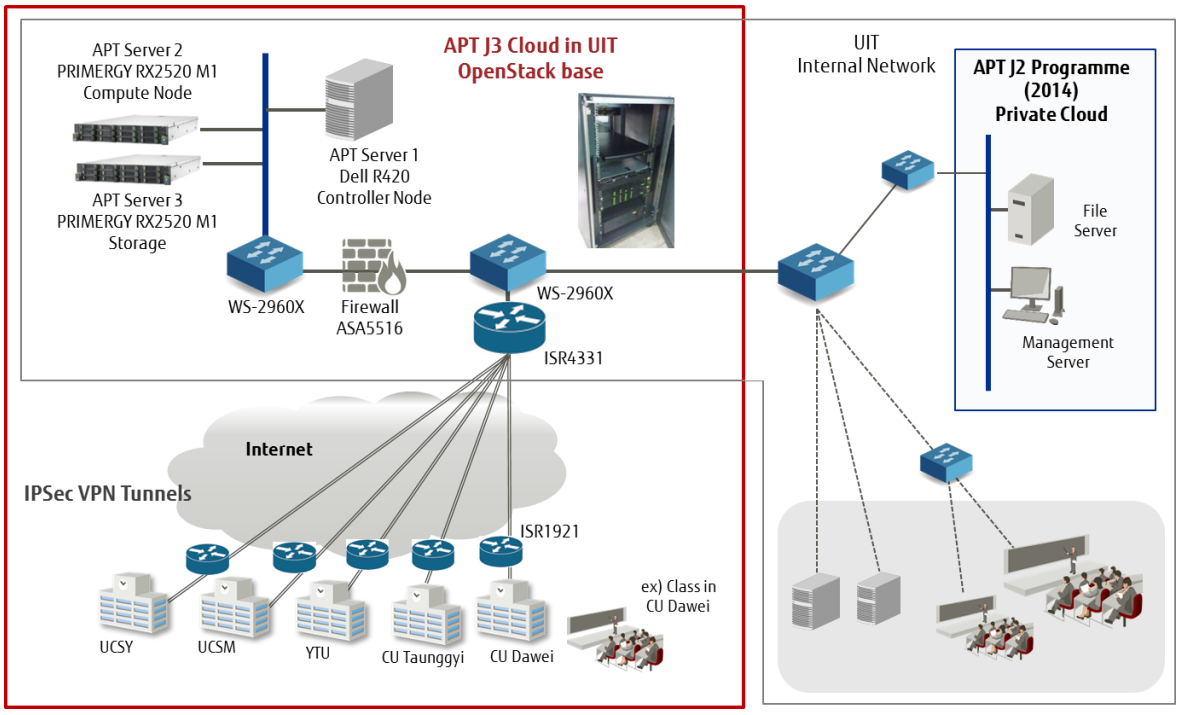
In the group work and the workshop, we made 3 groups and each group discussed and wrote down their expectations in detail for the cloud system. Most of them actively joined the discussion and workshop. As a conclusion of the workshop, all the participants agreed that to install the one of the service for launching the cloud system workshop and tentatively defined the date of workshop and kickoff meeting.

March 23rd and 24th, 2017 System Demonstration at UIT

8. System Design for the Cloud at UIT

8-1. SYSTEM OVERVIEW

The overview of the Cloud system is as follows. The inside of the red squire indicate the private cloud of UIT and the connection to other universities as users. We will build this cloud with 3 servers (Controller Node, Compute Node, and Storage), firewall, switch and routers to share educational resources to 5 universities (Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University). Server 1 is for Controller, Management server, and Server 2 is for compute node which runs the virtual machines, and server 3 is for storage. And VPN tunnels will be configured by routers for each university.



System Overview

8-2. SOFTWARE SELECTION

We choose OpenStack for its future growth. OpenStack has huge community with so many contributors from all over the world, and our OpenStack release is kilo because the latest version often has some risks generally. For the distribution of OpenStack, we will use RDO (Redhat Package Manager) which is free and comparatively stable. Regarding the hypervisor, we will use KVM (Kernel based virtual machine) for creating Virtual Machine for APT Cloud. KVM's delivery type is called Hypervisor type or Kernel

based type depending on the person. Because KVM is the software for virtualization which has hypervisor function and do not need host OS, but is integrated in Linux Kernel. And CentOS7, latest version of free Linux Distribution will be adopted.

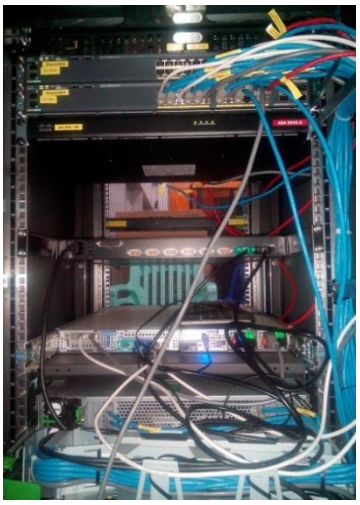
9. Installation and Experimentation of "Private cloud system at UIT"

9-1. INSTALLATION HARDWARE

- Firmware update for 2 servers
- Configure BIOS parameter
- Setup iRMCH/W check without error
- RAID Configuration
- Setup Rack Mount server
- Mount Display, KVM, UPS 5K and Network device
- Connect KVM cable,
- LAN cable (internal rack), Power cable,
- Make cable tags
- Configure IP on UPS
- OS installation
- Wiring cable out of Rack3
- Power chute install
- Network configuration

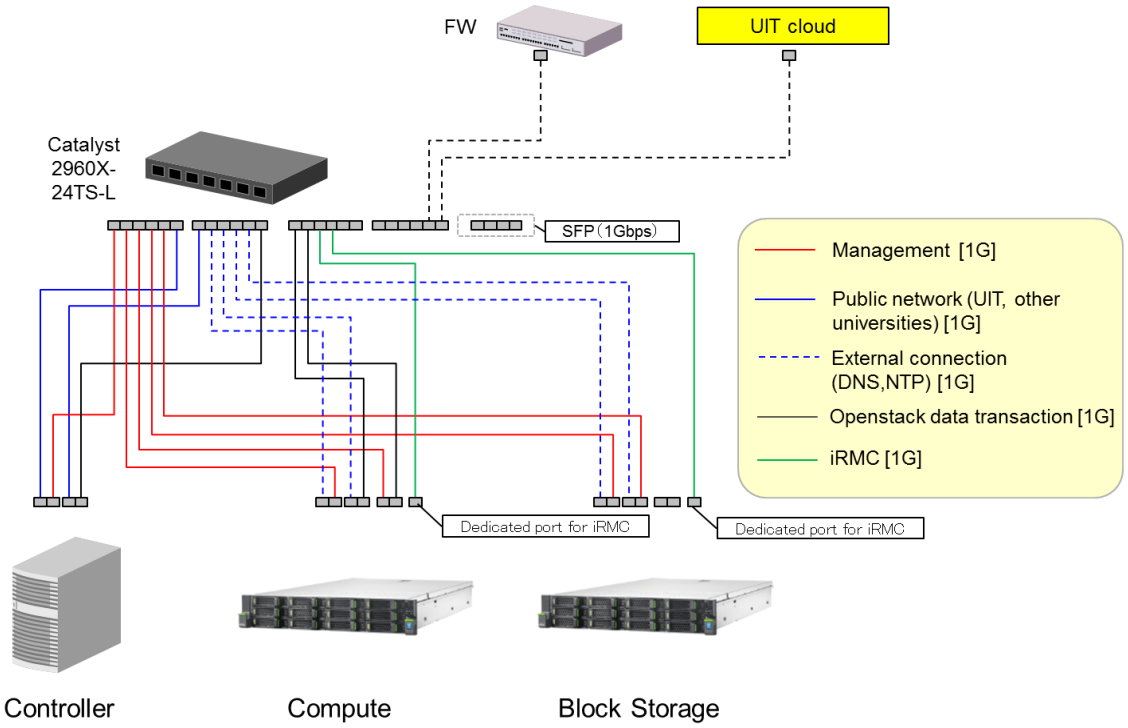
Front End

Back End

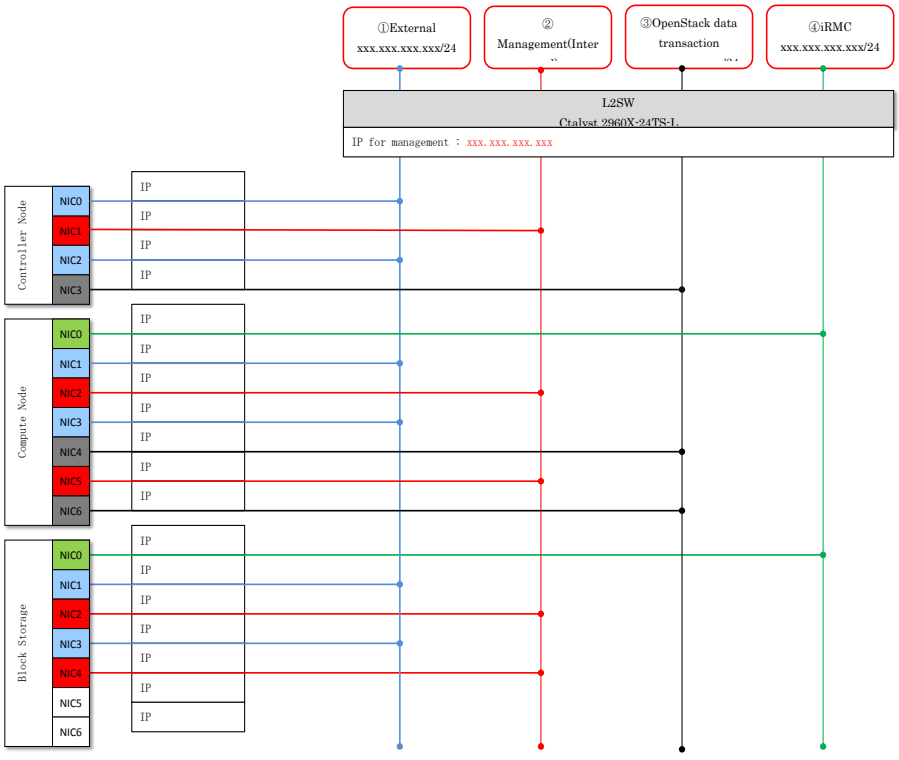


9-2. NETWORK CONFIGURATION AND DIAGRAM

Physical network configuration



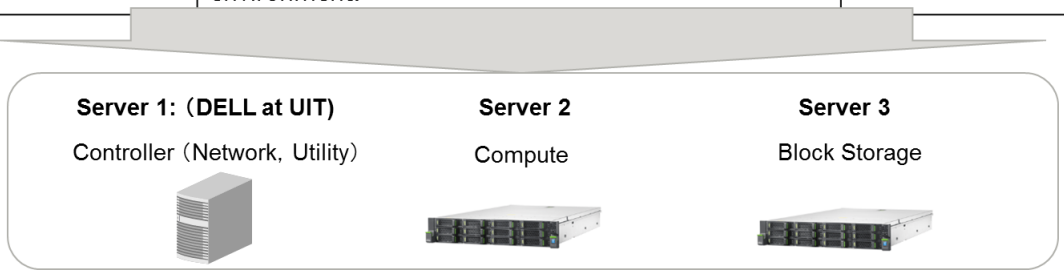
Network diagram between servers and switch



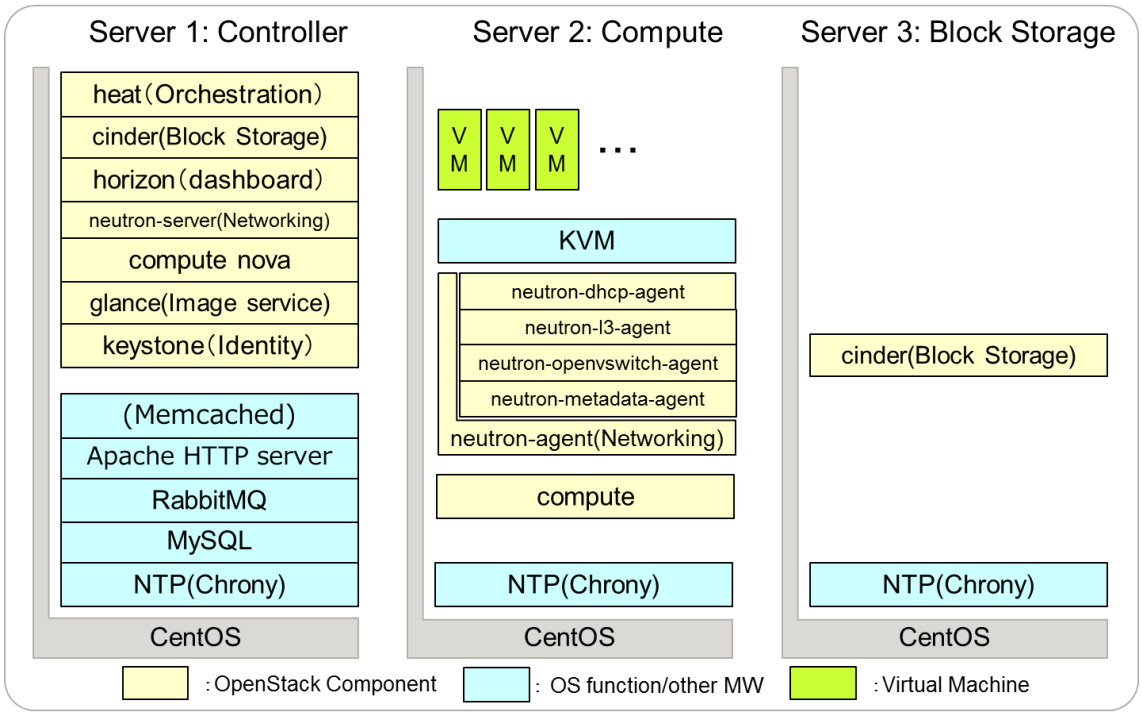
9-3. PREPARING THE CONFIGURATION OF THE CLOUD COMPUTER ENVIRONMENLT

Basic Node Configuration for APT Cloud

Node type	explanation	Implementation
Controller Node	To run the management software service for OpenStack environment	**1 Node**
Compute Node	To execute VM instances in OpenStack	**1 Node**
Storage Node	To store all the data for the environment Independent machine is recommended for its performance	**1 Node Or mounted on Controller Node**
Network Node	To execute virtual networking. Independent machine is recommended if you need to expand the system capacity in future.	**Mounted on Controller Node**
Utility Node	Internal management staff uses for multiple basic system management function to maintain the Hardware/OS/Software, which operate the cloud environment.	**Mounted on Controller Node**

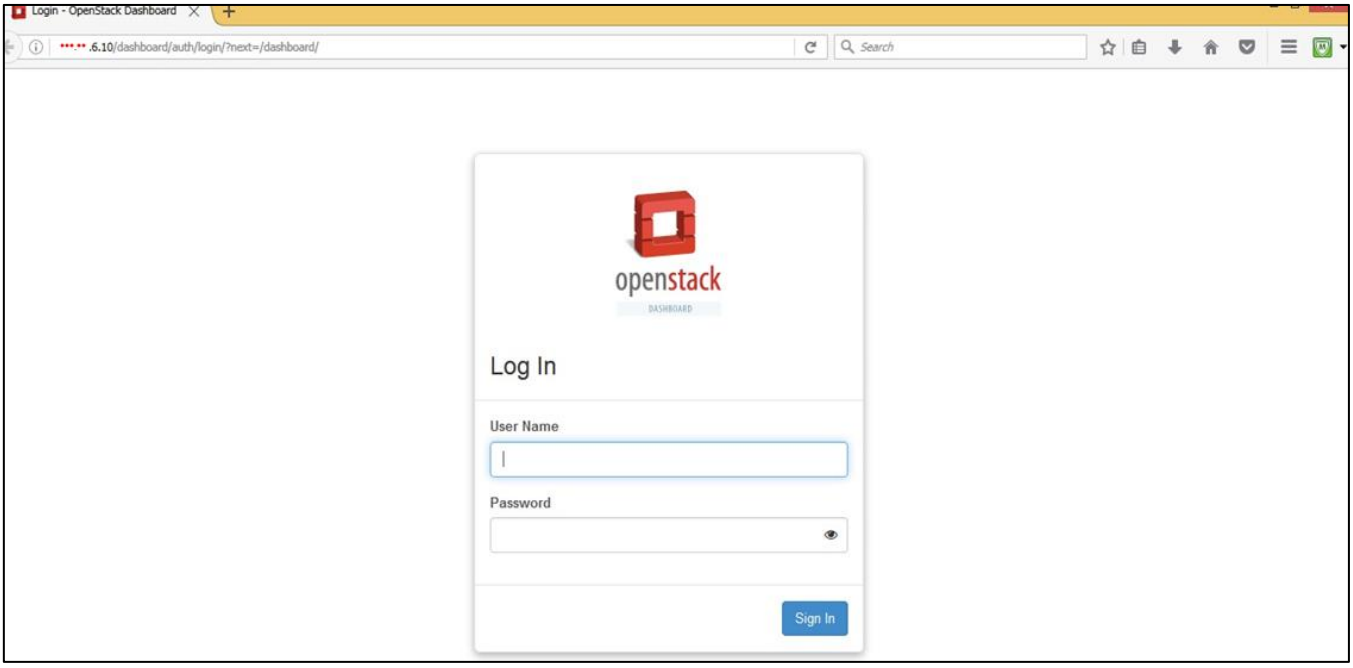


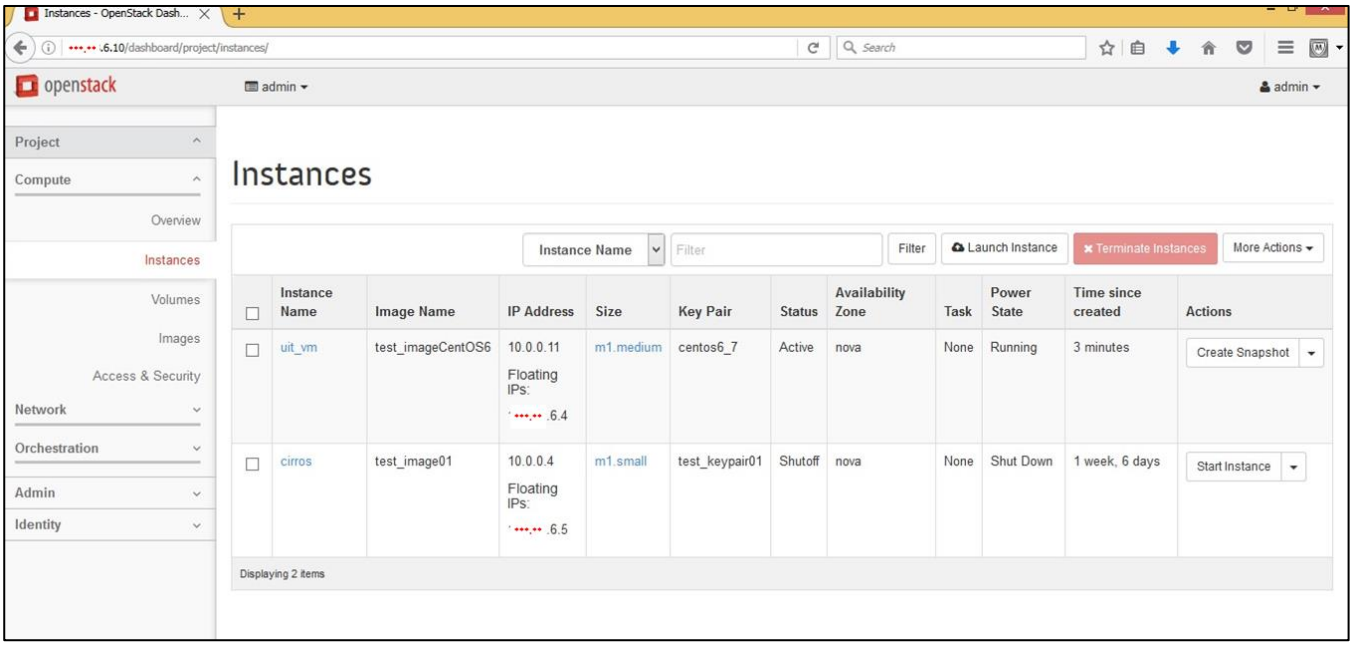
Software Configuration



9-4. INSTALLATION AND ITS WORK

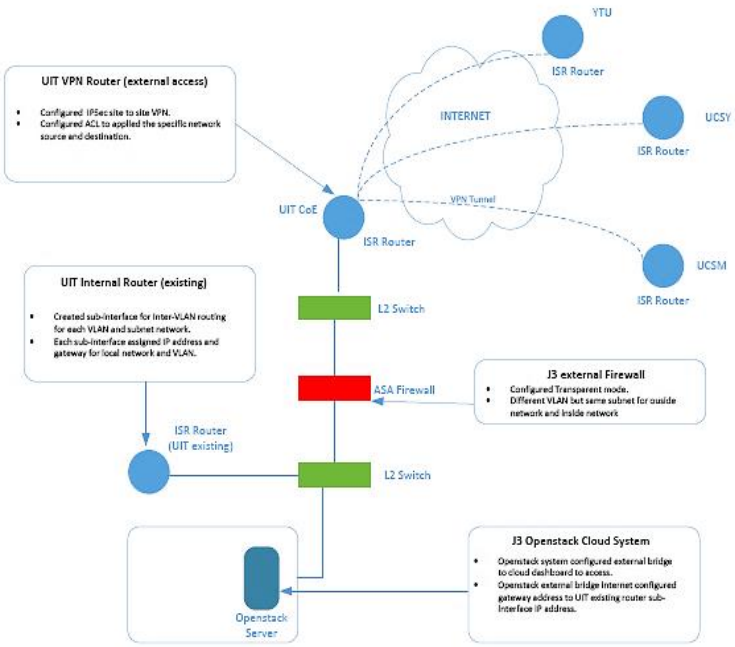
The following figures show that UIT has successfully connected the OpenStack dashboard and created instances. " ***.** " indicates network segment of APT J3 project.





9-5. COMPLETION OF INSTALLATION AND ADJUSTMENT/IMPROVEMENT

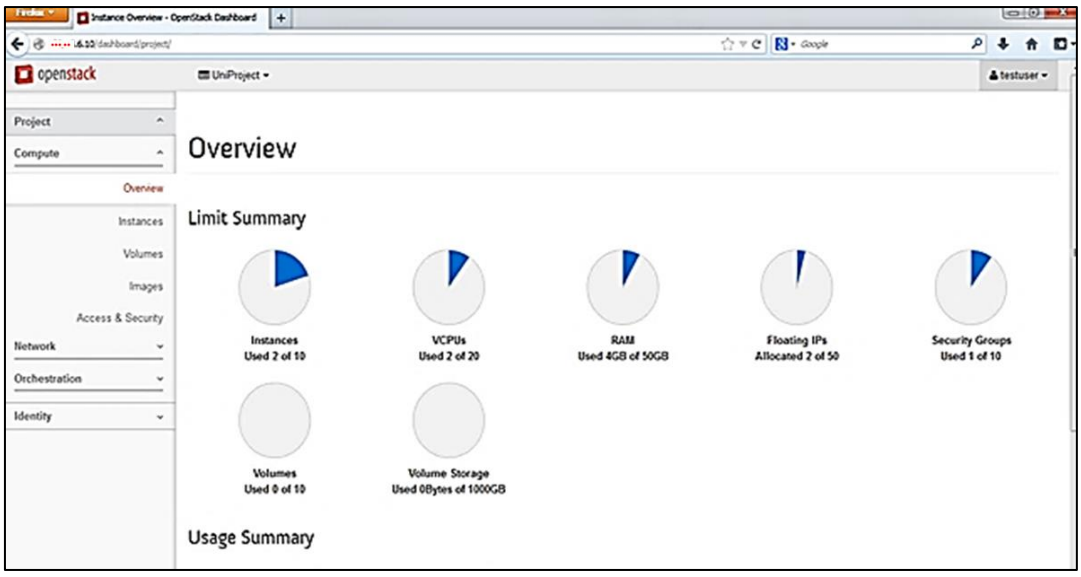
J3 Cloud Network Image: YTU, UCSY, and UCSM are just the samples in this chart, so Computer University Dawei and Taunggyi were connected in the same manner as those 3 universities.



The following figures show that UIT cloud is successfully connected from other universities and they can access the resources such as VMs on the cloud.

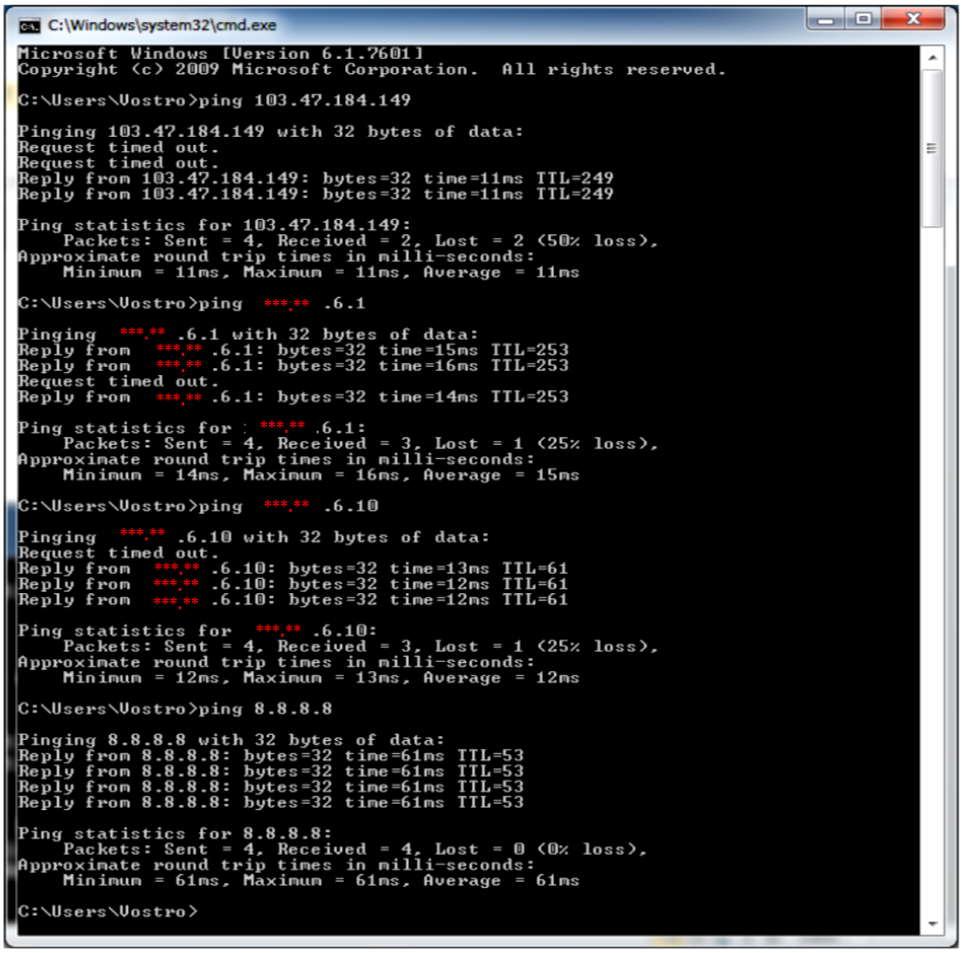
SCREEN SHOTS FROM TAUNGGYI COMPUTER UNIVERSITY

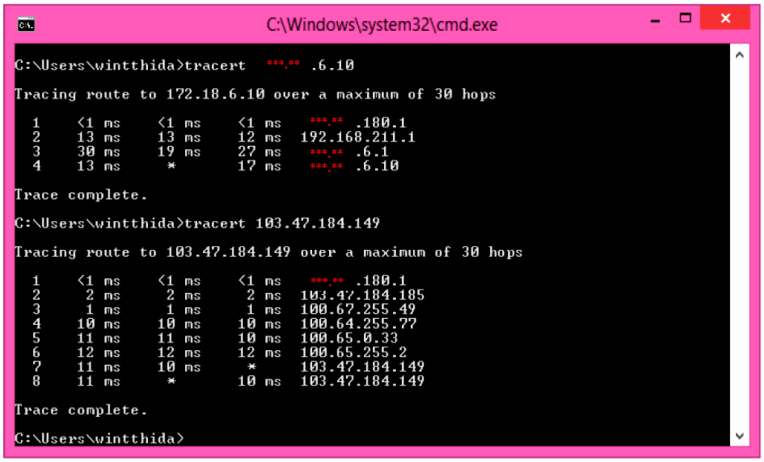
The following figure shows that Taunggyi Computer University can connect J3 cloud and they can open OpenStack dashboard and use supporting VMs.

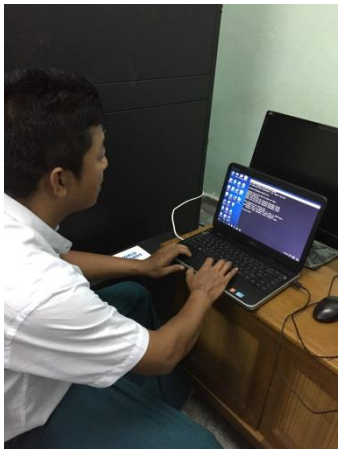


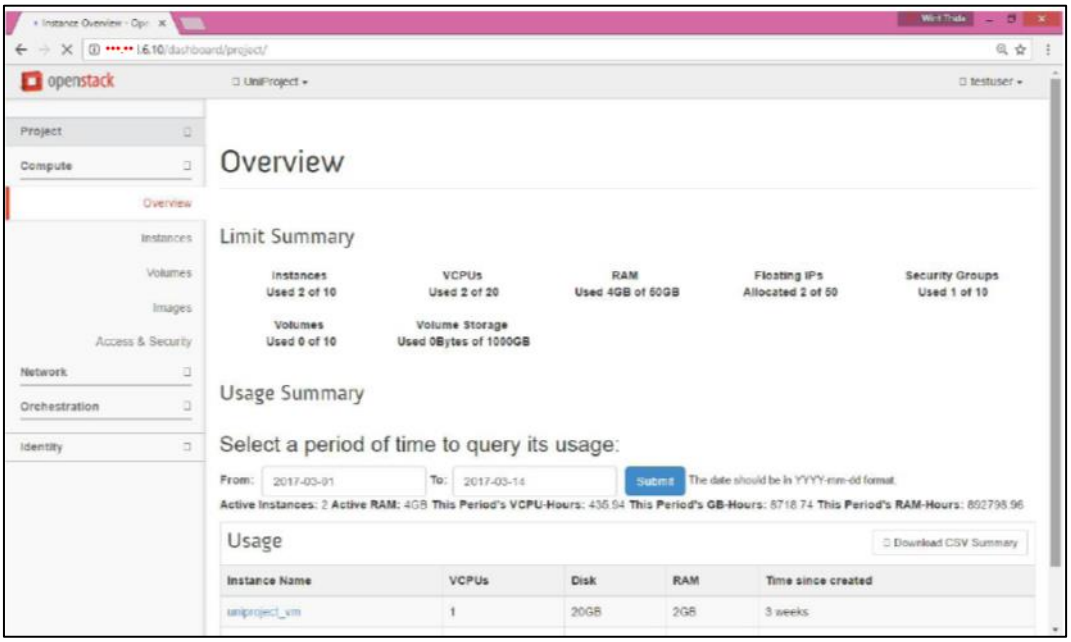
SCREEN SHOTS FROM UNIVERSITY OF COMPUER STUDIES, MANDALAY

The following three figures and a photo: Ping results and OpenStack screen show the connectivity and how they can see the OpenStack dashboard from University of Computer Studies, Mandalay. They can also successfully connect and share the knowledge and education environments.



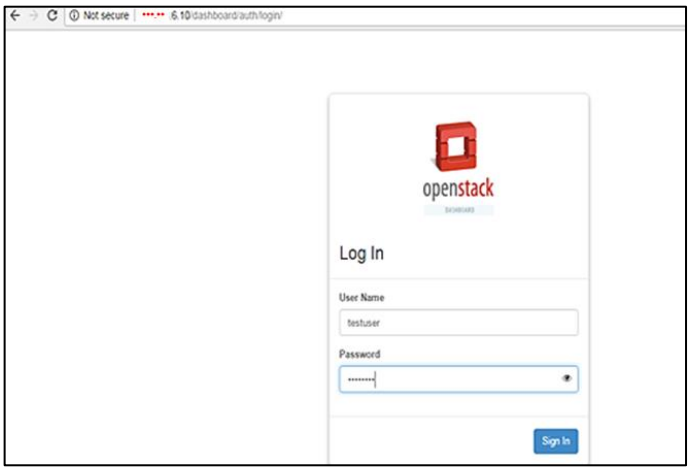




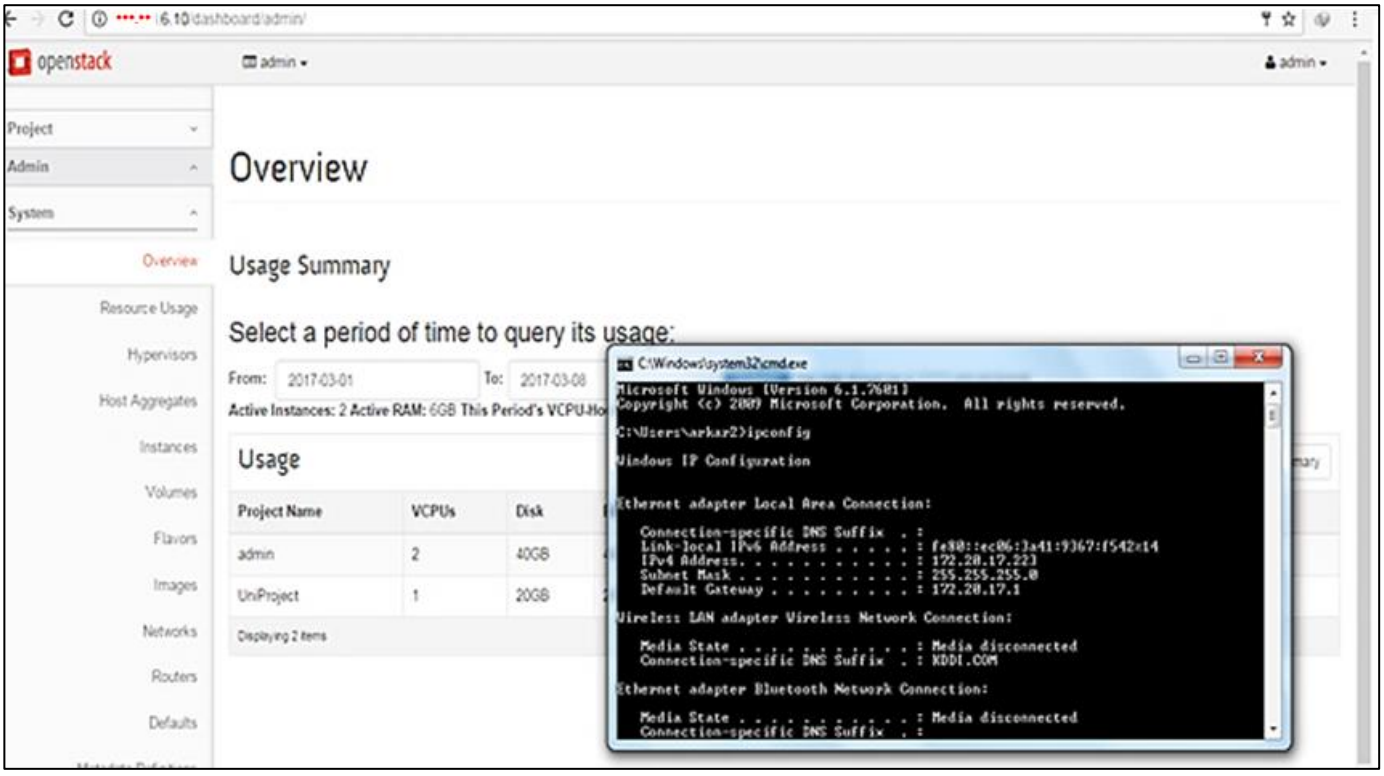


SCREEN SHOTS FROM YANGON TECHNOLOGY UNIVERSITY

The following three figures show the connection from Yangon Technology University, YTU. They can also access the OpenStack dashboard of UIT and use the VM services by creating VM instances.

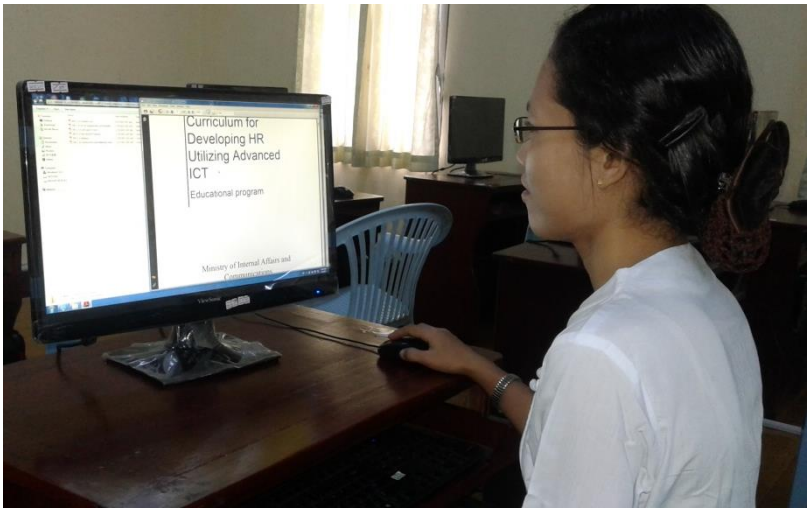


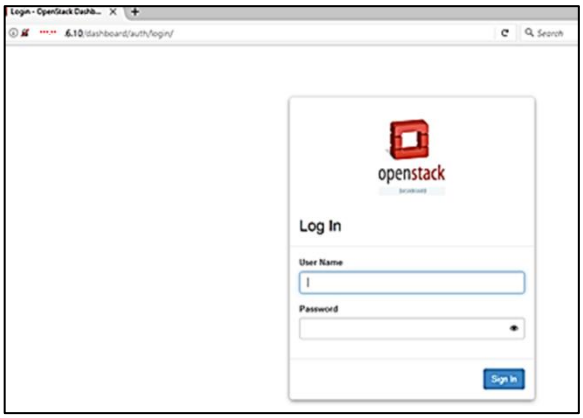

6.10/dashboard/project/
UniProject
testuser
Project
Compute
Overview
Instances
Volumes
Images
Access & Security
Network
Orchestration
Identity
Instances
Used 1 of 10
VCPUs
Used 1 of 20
RAM
Used 2GB of 50GB
Floating IPs
Allocated 1 of 50
Security Groups
Used 1 of 10
Volumes
Used 0 of 10
Volume Storage
Used 0Bytes of 1000GB
Select a period of time to query its usage:

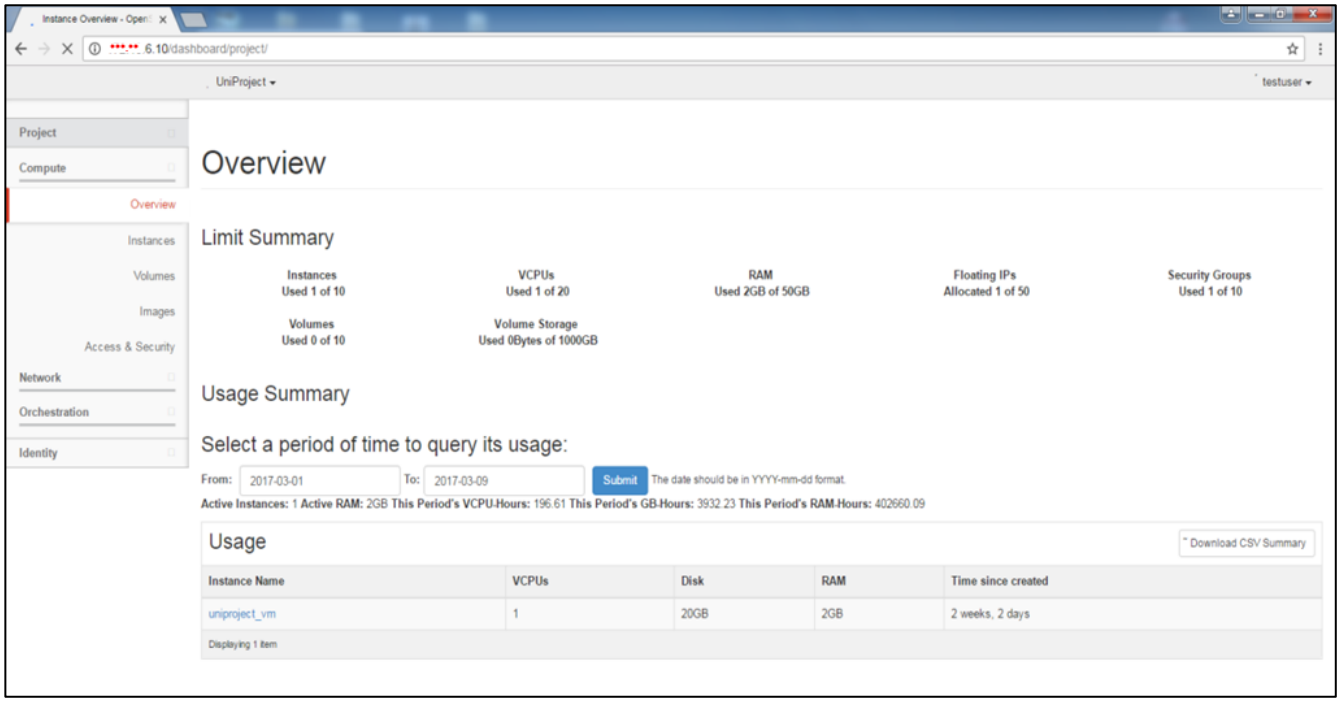

6.10/dashboard/admin/
openstack
admin
admin
Project
Admin
System
Overview
Resource Usage
Hypervisors
Host Aggregates
Instances
Volumes
Flavors
Images
Networks
Routers
Defaults
Overview
Usage Summary
Select a period of time to query its usage:
From: 2017-03-01
To: 2017-03-08
Active Instances: 2 Active RAM: 6GB This Period's VCPU-Ho
Usage
Project Name
VCPUs
Disk
admin
2
40GB
UniProject
1
20GB
Displaying 2 items
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
C:\Users\arkar2>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::ec86:3a41:9367:f542%14
IPv4 Address. . . . . : 172.20.17.223
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 172.20.17.1
Wireless LAN adapter Wireless Network Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : KDDI.COM
Ethernet adapter Bluetooth Network Connection:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :

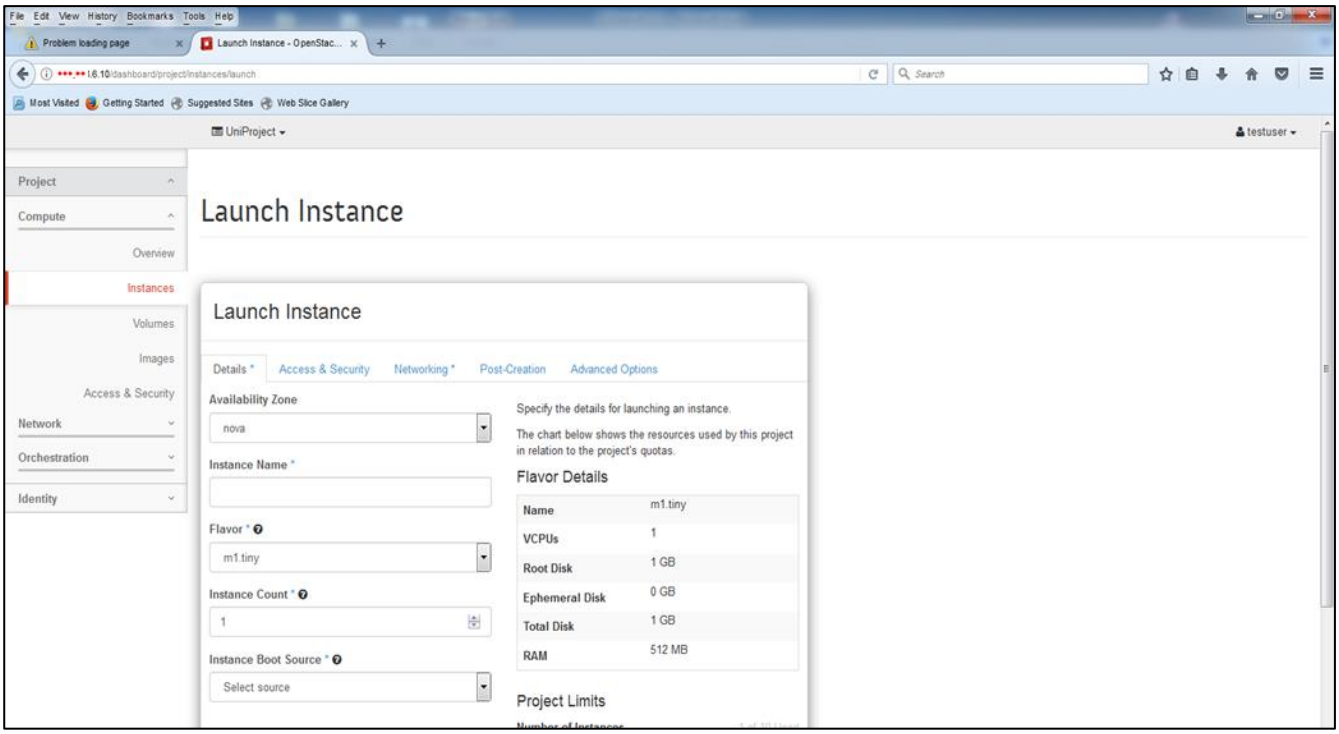
SCREEN SHOTS FROM DAWEI COMPUTER UNIVERSITY

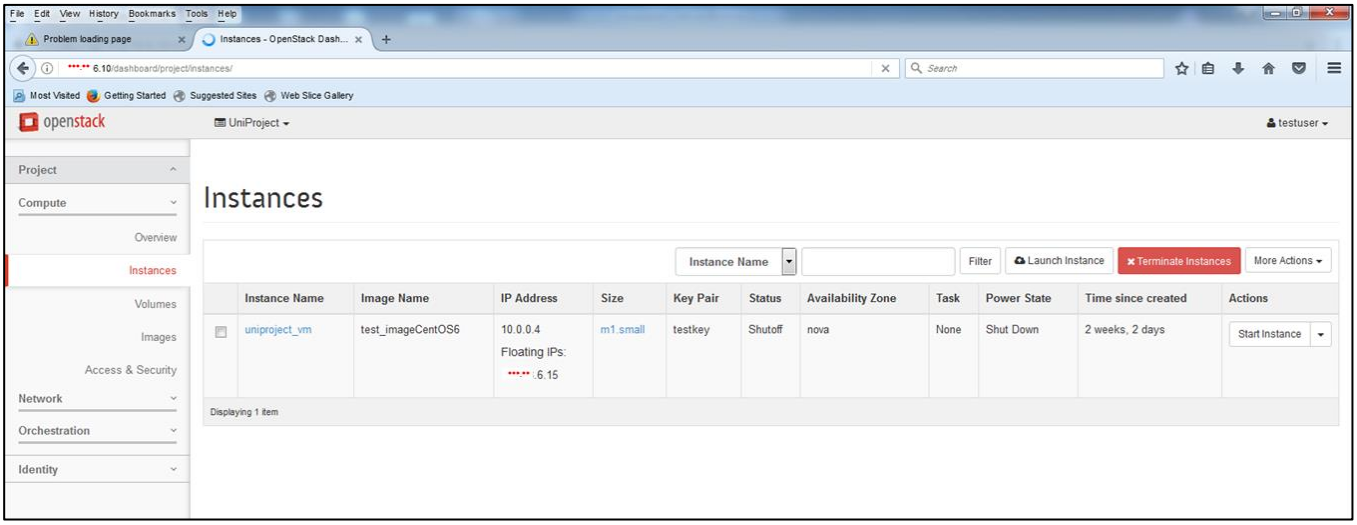
The following four figures show the accessibility to OpenStack server from Computer University (Dawei). They can access the OpenStack dashboard and also create their own VMs (instances) , and some materials such as texts made by MIC Japan on the VMs as below.





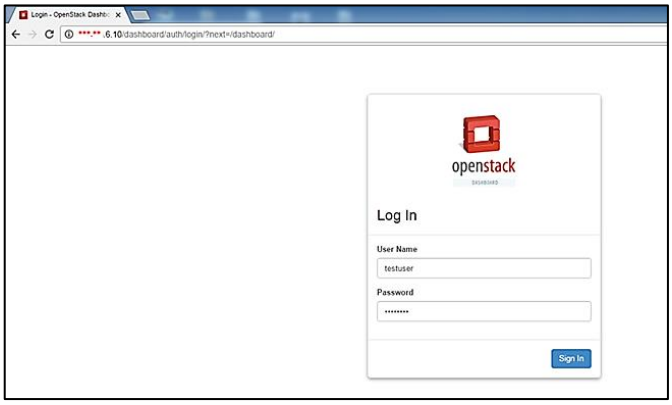


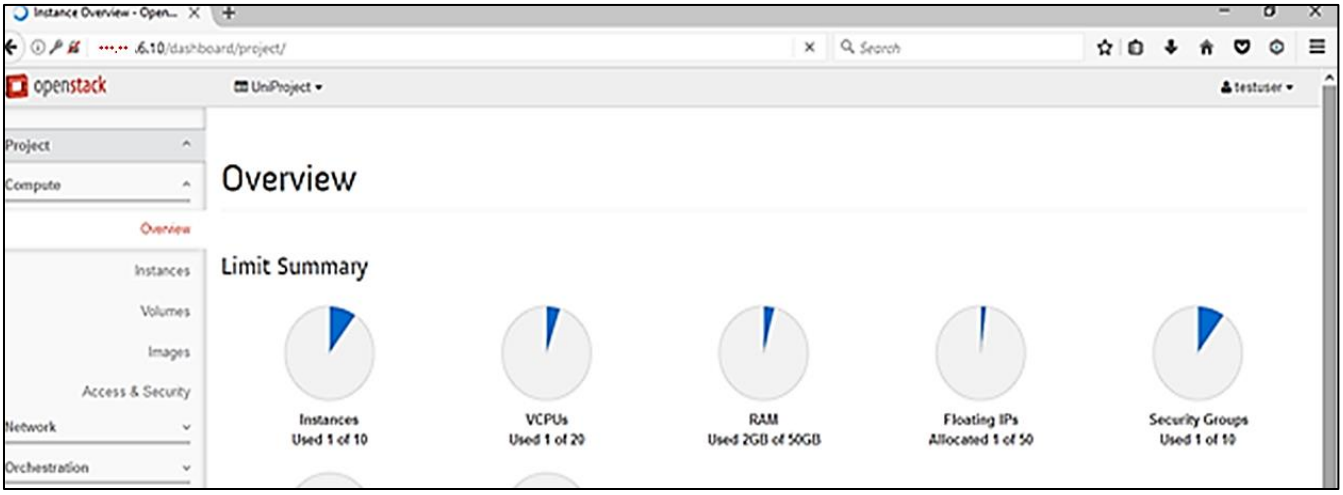

Launch Instance
Launch Instance
Details *
Access & Security
Networking *
Post-Creation
Advanced Options
Availability Zone
nova
Instance Name *
Flavor *
m1.tiny
Instance Count *
1
Instance Boot Source *
Select source
Specify the details for launching an instance.
The chart below shows the resources used by this project in relation to the project's quotas.
Flavor Details
Name m1.tiny
VCPUs 1
Root Disk 1 GB
Ephemeral Disk 0 GB
Total Disk 1 GB
RAM 512 MB
Project Limits


Instances
Instance Name
Filter
Launch Instance
Terminate Instances
More Actions
Instance Name
Image Name
IP Address
Size
Key Pair
Status
Availability Zone
Task
Power State
Time since created
Actions
uniproject_vm
test_imageCentOS6
10.0.0.4
Floating IPs:
m1.small
testkey
Shutoff
nova
None
Shut Down
2 weeks, 2 days
Start Instance
Displaying 1 item

SCREEN SHOTS FROM UNIVERSITY OF COMPUTER STUDIES, YANGON

The following two figures show the login page of open stack from University of Computer Studies, Yangon, (UCSY) and they can also access to J3 cloud.

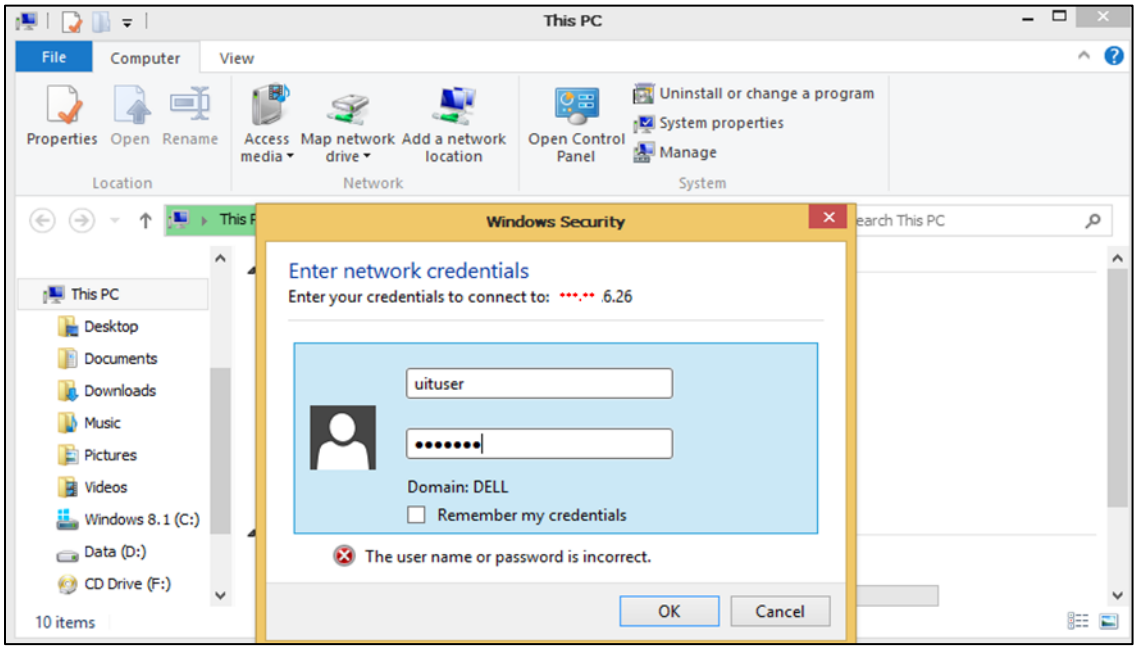


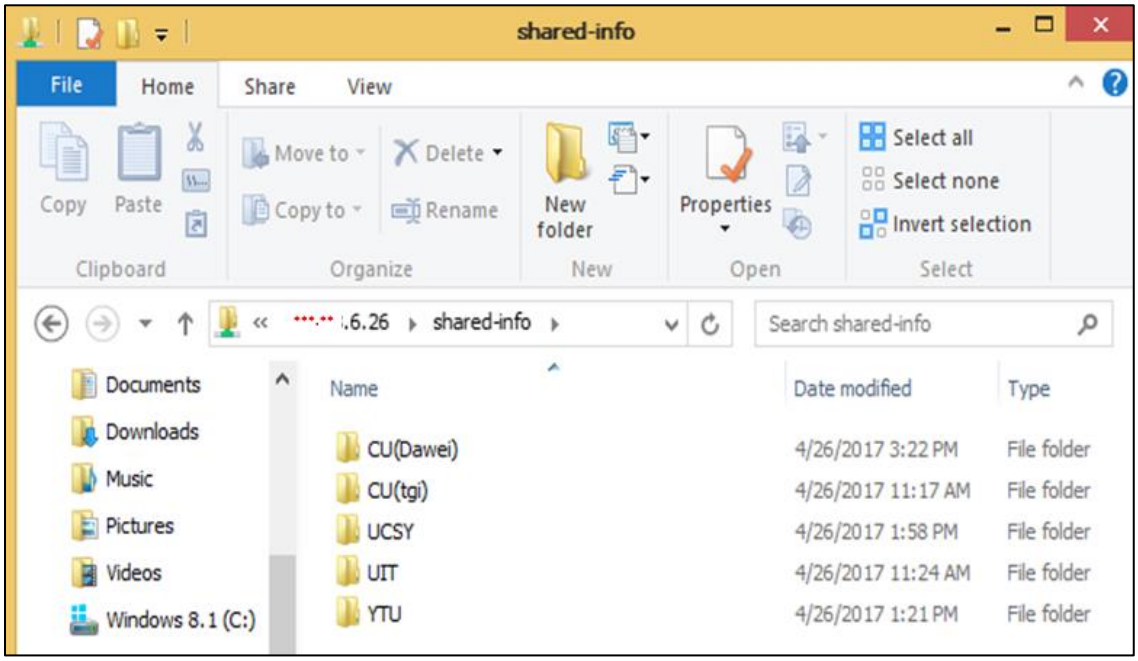


9-6. INSTALL APPLICATION IN THE CLOUD

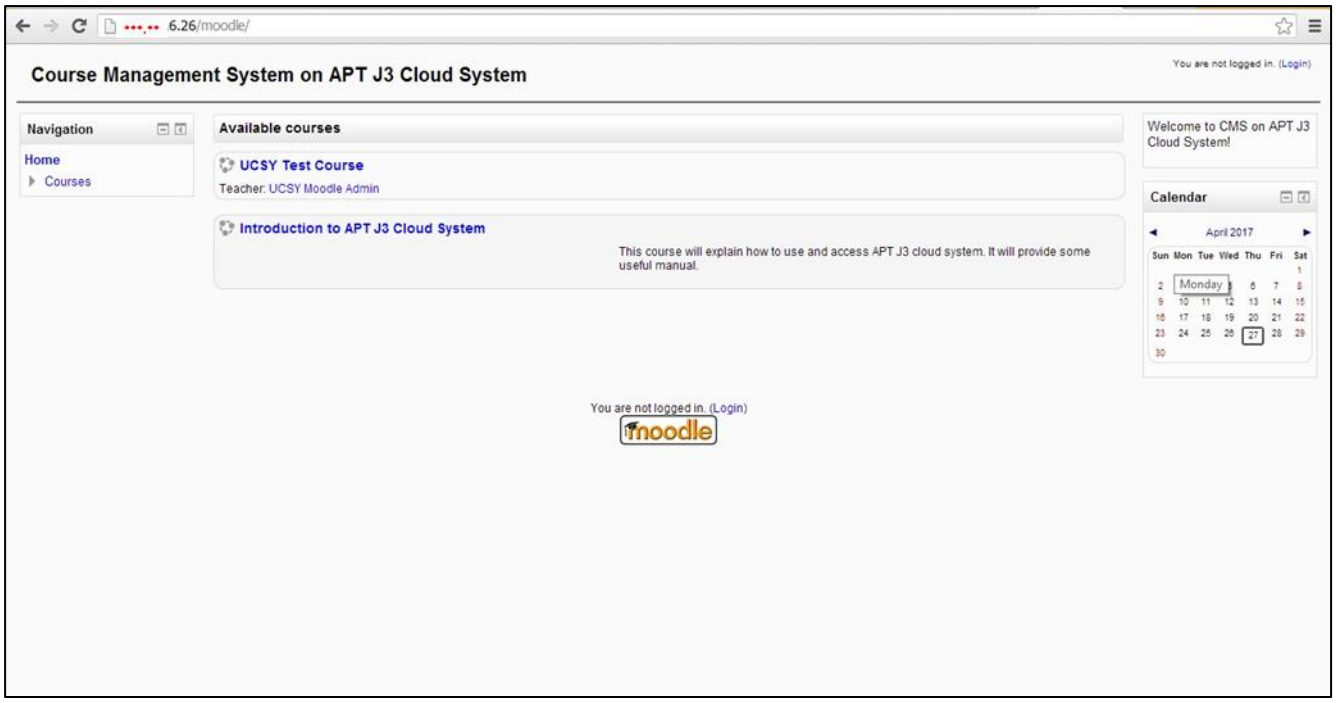
Providing Services on J3 Cloud :

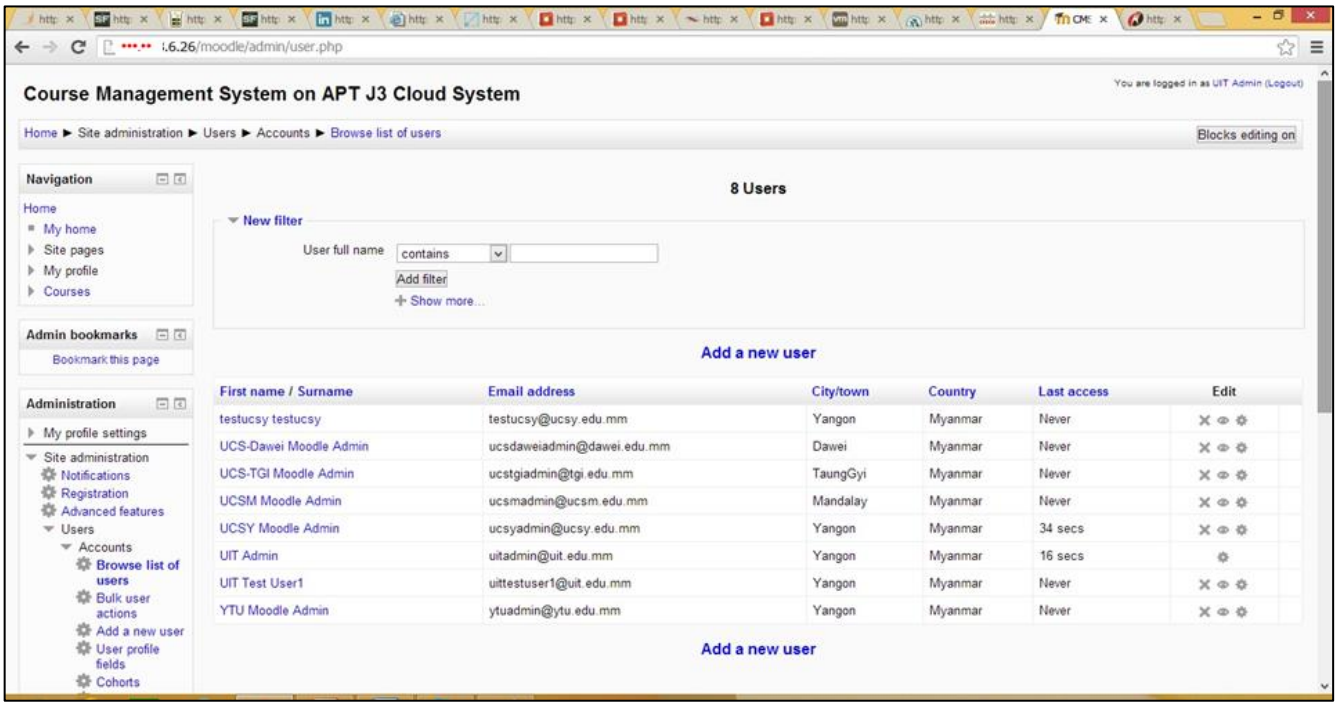
The file sharing service on J3 Cloud can be share the teaching material via Samba file with server IP: ***.**.6.26, User: ***. The following figures show how to access samba service on J3 Cloud and some universities have already tried to create their own files on J3 cloud in UIT.

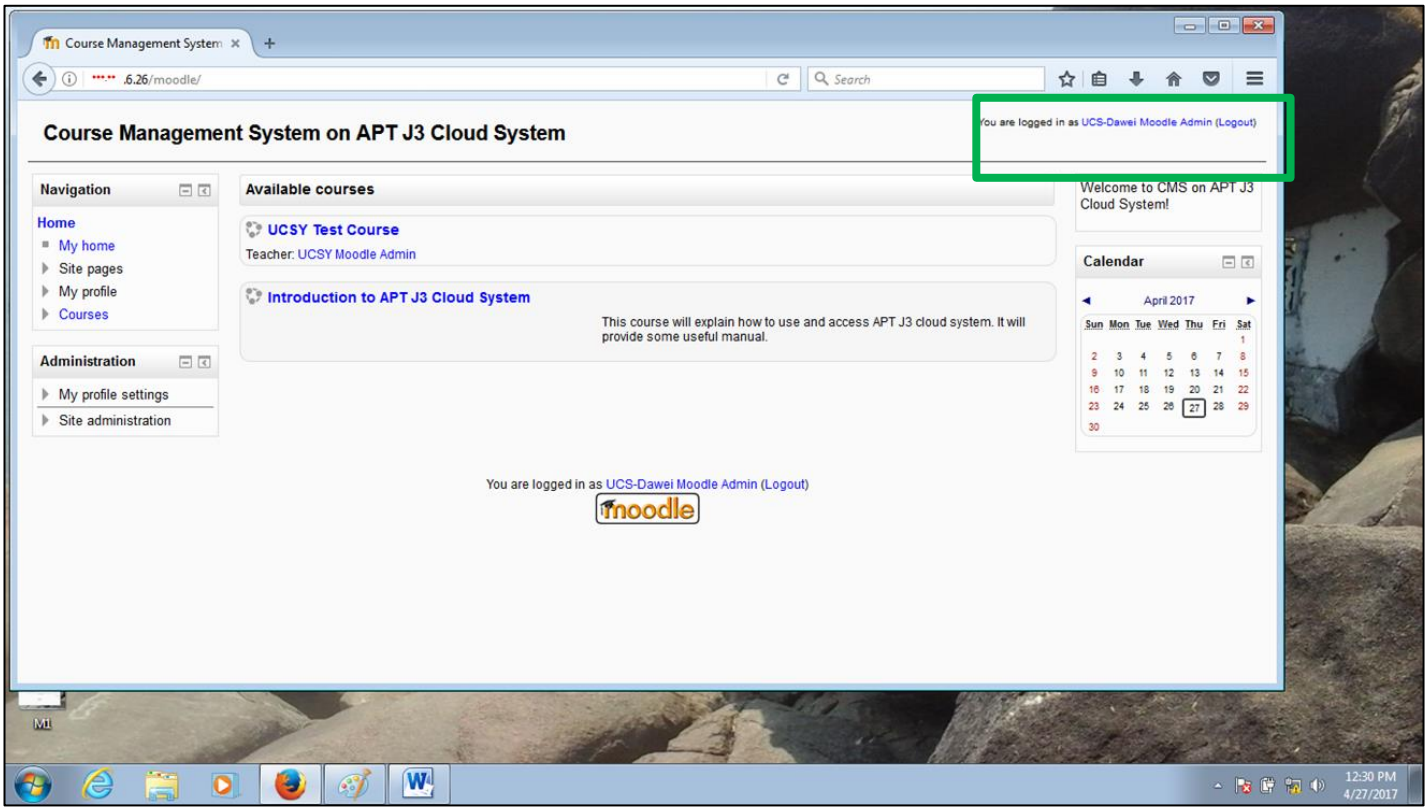


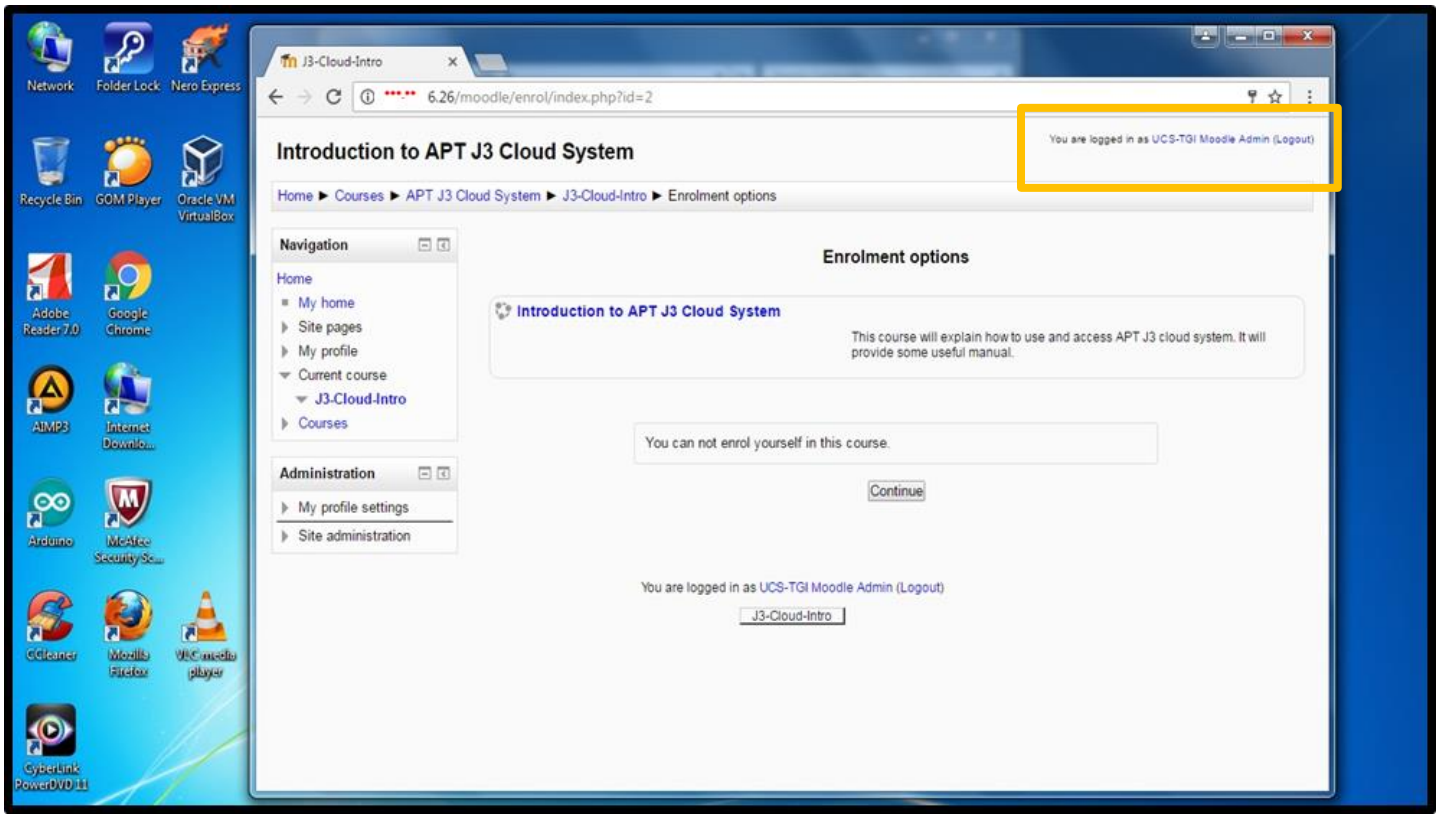


For the second service provided through this cloud, Moodle, one of Course Management Systems was configured and now can be accessed on J3 Cloud via URL: http://***.**.6.26/moodle and 'course creator' role for each member university is created. The following figures show moodle interfaces and how to access moodle by member universities.






Course Management System
Course Management System on APT J3 Cloud System
You are logged in as UCS-Dawei Moodle Admin (Logout)
Navigation
Home
My home
Site pages
My profile
Courses
Administration
My profile settings
Site administration
Available courses
UCSY Test Course
Teacher: UCSY Moodle Admin
Introduction to APT J3 Cloud System
This course will explain how to use and access APT J3 cloud system. It will provide some useful manual.
Welcome to CMS on APT J3 Cloud System!
Calendar
April 2017
You are logged in as UCS-Dawei Moodle Admin (Logout)
moodle


J3-Cloud-Intro
6.26/moodle/enrol/index.php?id=2
Introduction to APT J3 Cloud System
You are logged in as UCS-TGI Moodle Admin (Logout)
Home ▶ Courses ▶ APT J3 Cloud System ▶ J3-Cloud-Intro ▶ Enrolment options
Navigation
Home
My home
Site pages
My profile
Current course
J3-Cloud-Intro
Courses
Administration
My profile settings
Site administration
Enrolment options
Introduction to APT J3 Cloud System
This course will explain how to use and access APT J3 cloud system. It will provide some useful manual.
You can not enrol yourself in this course.
Continue
You are logged in as UCS-TGI Moodle Admin (Logout)
J3-Cloud-Intro

10. Workshop and Completion Ceremony

UIT organized the final presentation/ workshop and completion ceremony for this project at UIT on 28th April, 2017 with the guests from MCF (Myanmar Computer Federation), Ministry of Transport and Communications, and the representatives from all 5 member universities (Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University) and other 10 universities that will be involved in our next phase project. After the speeches from guests, UIT conducted brief demonstration to show actual usage and accessibility from other universities with support from other universities' members. They operated the cloud from their sites to show how it worked to the audience and it finished successfully.
The Agenda was as below:

Final Presentation / Workshop & Completion Ceremony APT J3 Project

Time :	09:30 am - 12:00 am
Venue :	Assembly Hall (University of Information Technology)
09:30 am - 10:30 am	Welcome Speech by Dr. Saw Sanda Aye, Rector,University of Information Technology Congratulatory Speech by U Thein Oo, Chairman of COE Steering Committee Cogratulatory Speech by U Than Htun Aung, Director, Ministry of Transport and Communication Progress, Achievement of J3 Project and Future plan by Dr. Myat Thida Mon, UIT and Ms. Maho Nakagawa, Fujitsu Limited
10:30 am - 10:50 am	Coffee Break
10:50 am - 12:00 am	Expansion of Cloud Platform in Myanmar Universities and Proposal of KDDI Foundation Contest by Mr. Yosuke Uchiyama, KDDI Foundation Explanation of System Design and Configuration / System Demonstration by Dr. Ei Chaw Htoon, UIT Closing / Photo Session
12:00 am - 1:00 pm	Lunch

Welcome Speech by Dr. Saw Sanda Aye, Rector, University of Information Technology

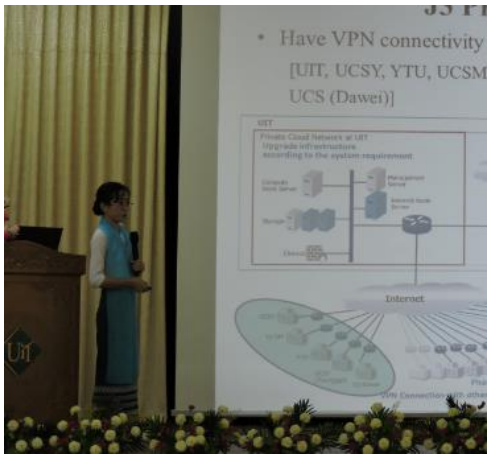
Congratulatory Speech by U Thein Oo, Chairman of COE Steering Committee

Congratulatory Speech by U Than Htun Aung, Director, Ministry of Transport and Communication

Progress, Achievement of J3 Project and Future plan by Dr. Myat Thida Mon

Progress, Achievement of J3 Project and Future plan in details by Ms. Maho Nakagawa

Expansion of Cloud Platform in Myanmar Universities and Proposal of KDDI Foundation Contest by Mr. Yosuke Uchiyama



Explanation of System Design and Configuration by Dr. Ei Chaw Htoon, Professor, Faculty of Computer Science

Group Photo

11. Evaluation

All the member universities got the assessments from this project such as moodle service, educational materials from each university by sharing from samba server and VM services. In addition, UIT student's projects, contents and events can be shared to other member universities and network infrastructure can also be shared. The students from member universities can learn the project and event from UIT and it may provide them when they apply their own idea and they contribute to the new project. Also, research collaboration and research plan can be established among these universities and new research areas can be developed in the future. Besides, the educational material "Curriculum for Developing HR with High ICT Capability" developed by MIC Japan has already installed to one of the VMs on the J3 Cloud, and now all the member universities can access and download the materials. We will continue to assess its effectiveness and feasibility in actual usage from the feedback of especially rural areas.

Achieved:

1) To introduce the pilot platform for cloud services for ICT education and to conduct trials for broadband connectivity in the urban and remote areas.
2) To organize the workshop for the sharing the resources such as "Curriculum for Developing HR with High ICT Capability" developed by Ministry of Internal Affairs and Communications in Japan.
3) To set up the VPN (Virtual Private Network) network and deploy the cloud infrastructure and applications for virtual learning and administration services through UIT cloud system.
4) To exchange and motivate the ICT research experiences and knowledge between project teams in Myanmar and in Japan including system configuration skills and operation knowhow and conducting On-the Job Training for system configuration, maintenance and operation for sustainable use of the system.

To Be Achieved:

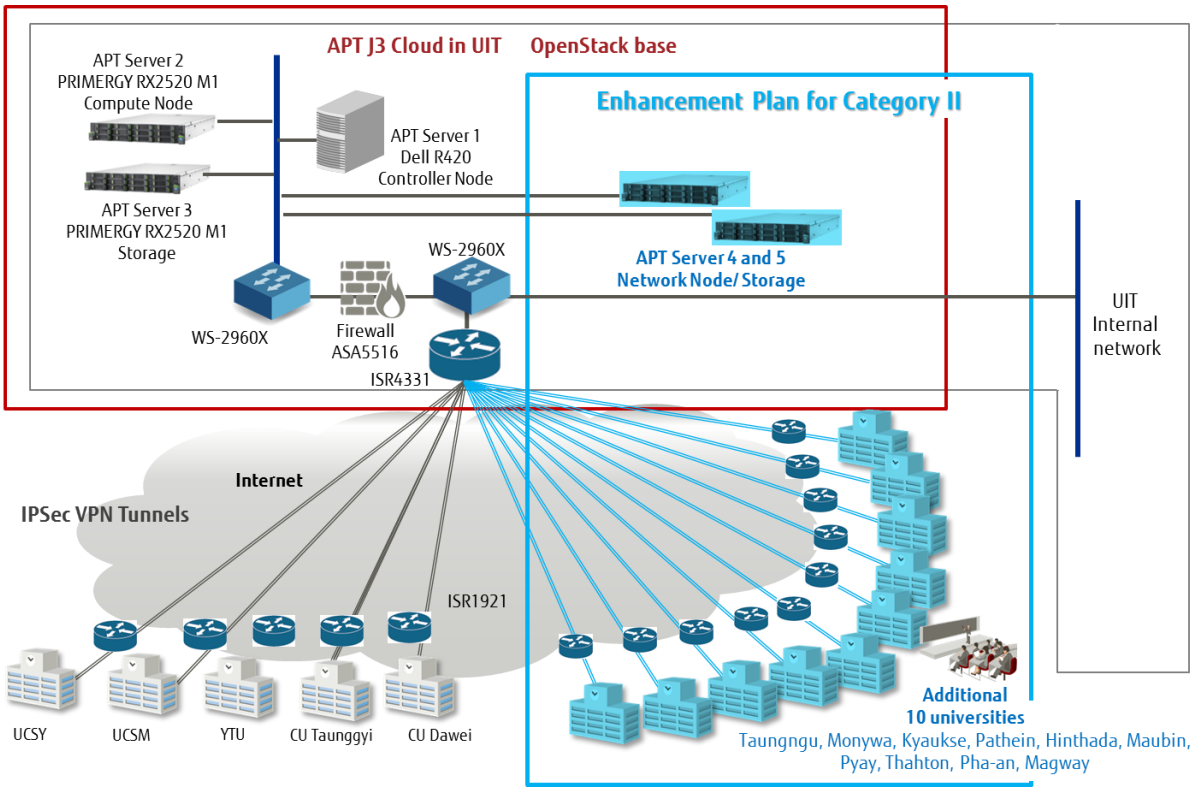
1) To expand broadband network to accommodate future information sharing.
2) To offer a community platform for exchanging good practices and making resources available, and training in digital tools and usage to bridge the educational gaps in ICT human resource development in the remote areas.

12. Improvement

5 member universities (Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University) can access J3 Cloud system at UIT successfully, however the electricity and the network bandwidth is not sufficient and stable. Therefore we have prepared the additional UPSs (Donated by KDDI Foundation) and will make automatic shut down and restart procedure for the next step. Besides, we need to optimize the contents size and sharing process to the narrow bandwidth. The cloud platform needs strong operating team among the universities. Therefore we need to discuss regularly about the status of each university's usage of cloud services and to create and revise continuously the policy and rules for the operation. And regarding the human resources for the operation, the main members would be busy at certain period in every year and some have to transfer to another university during the project activities because most of the members are universities' professors and lecturers. Therefore regularly updating and sharing common policy, rules and annual schedule for the cloud operation are essential, and each university should assign the small team among two or three people in case of the member's transfer.

13. Next Phase

We planned to extend this cloud system nationwide in Myanmar to build up an advanced ICT educational environment for transferring the advanced cloud technology from Japan to Myanmar, and offer the stable and sustainable platform for exchanging good practices, making new educational resources such as materials and trainings of digital tools usage. It will not only mitigates the digital educational divide in the field of ICT human resource development, but also become the academic community to discuss on what ICT network for higher ICT educational institutes in Myanmar should be. The next step is to increase the team members and accelerate the knowledge sharing and skill transfer with the extended network through enhancement of J3 cloud. We have studied the experiences of other broadband networks for the academic communities in Asia in site visits, and already selected next ten member universities for the second year project according to their environment of infrastructure and human resources.



System overview for the next phase (blue ink)

Besides, we learned the risks of cyberattacks and ICT trends through the activities and discussions so far and consider adding more educational contents regarding cybersecurity and other important technologies for Myanmar. Increasing number of cyberattack incidents has been causing shortage of cybersecurity experts all over the world. Myanmar is not the exception. Cybersecurity capacity building is essential factor for stable and sustainable cloud platform and timely and appropriate introduction of the new cybersecurity technologies has significant meanings to build up the academic platform by eliminating the harmful ICT risks in Myanmar. And UIT currently negotiates to do a telemedicine project which will be collaborated with Universitat Duisburg Essen from Germany and Department of Public Health under of Ministry of Health and Sport. That telemedicine service can be provided over UIT cloud as well. Moreover, e-Learning contents and materials developed by MIC Japan will be shared more to the member universities. UIT, a member of ASEAN Cyber University, will develop several e-learning lecture contents and intends to share these original contents to the other member universities upon permission.

We will be able to create the sustainable platform for the continuous discussion on the visions for ICT network for higher ICT educational institutes in Myanmar. Though this will be small practical foundation, it has high potential contribution to not only ICT universities but also to other sectors. In Myanmar, mmREN project has also started to create nationwide network among universities. This APT pilot project should be the good practice for mmREN. We will share and discuss based on our experiences through

this J3 cloud network.

For further expansion, on 20th March 2017, UIT, KDDI Foundation, and Fujitsu visited Ministry of Education in Nay Pyi Taw to introduce the achievement of this project in detail to Deputy Union Minister, Mr. Win Maw Tun and Deputy Director General, Ms. New Ni. Deputy Union Minister advised and requested to consider the enhancement plans to contribute not only to ICT higher education but also to whole education sector. Because National Education Strategic Plan 2016-2021 has just been published in February 2017 and according this new plan, education in Myanmar is now drastically changing and facing several challenges. Therefore the next step is to connect to additional Computer Universities as we stated before, but we also start to consider and discuss about new collaboration with other major universities and other educational organizations in the future.

14. Final Accounting

The total amount of approved budget is USD 199,992.50 and the actual project expenditure was USD 174,689.69. The balance was USD 25,302.81 and it is under the approved budget. The balance was larger than expected due to fluctuation of currency exchange rate between Japanese Yen and US dollars.

In order to improve the electricity issue described on 12. Improvement, KDDI Foundation has provided USD 5,712.00 for UPS equipment.

15. Conclusion

We have successfully performed APT J3 project and now 5 member universities (Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University) are able to access UIT cloud system though we had some problems in configuration and still have challenges in the operation because of limitation of infrastructure and network bandwidth. UIT is providing the file sharing service and LMS for other 5 universities and continuously preparing more contents and services.

16. Acknowledgement

- We would like to thank Asia-Pacific Telecommunity for sponsor this ICT Pilot Project
- We would like to thank Ministry of Internal Affairs and Communications of Japan for the fund by the Extra Budgetary Contribution from Japan.
- We would like to thank Ministry of Education for very warm support to the project.
- We would like to thank Ministry of Transport and Communication of Myanmar for very warm support to the project.
- We would like to thank the leaders of the member universities, Computer University Dawei, Computer University Taunggyi, University of Computer Studies Mandalay, University of Computer Studies Yangon and Yangon Technological University for very effective support to the project team to successfully implement the project.
- We would like to thank the leaders and staffs of the University of Information Technology, Fujitsu Limited, Waseda University, National Institute of Informatics/Okayama Prefectural University and KDDI Foundation for their very warm hospitality and cooperation and support to the project team to successfully implement the project.