THE IMPLEMENTATION OF IPv6 HUMAN CAPACITY DEVELOPMENT PROGRAM FOR PUBLIC SECTORS IN MALAYSIA: A COMMUNITY KTP PROJECT

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ABSTRACT - In order to remain an important part of the global Internet and to benefit from its growth, Malaysian organizations such as Government agencies, Internet and content service providers, and enterprises must embrace the transition to the new Internet Protocol version 6 or IPv6. The key to a successful transition is the readiness of human resource in adopting and adapting the new Internet technology. The KTP IPv6 Project attempts to assist Malaysian public sectors in building their human capacity in IPv6 technology. The initial aim of the project is to train some 500 public sector ICT personnel to familiarize and possible to certify them on the IPv6 technology. The internal training for trainer program started in April 2012 until end of August 2012. Besides that, this training was extended to train a group of external trainers from Politeknik Sultan Azlan Shah (PSAS) in Behrang, Perak. The PSAS trainers successfully completed their training and passed the locally-developed certification program called the Certified InterNetWorks Professional in IPv6 (CIPv6). Collaborations with government ministries, various state governments, local agencies and statutory bodies such as MARA and LHDN, as well as educational institutions such as universities, polytechnics and matriculation colleges have resulted in a series of training sessions which spanned until end of June 2014, with a total participation of 803 personnel, making an average of 80 personnel trained per month. With the progress, the project has successfully over-achieved the Knowledge Transfer Program (KTP) project target to transfer IPv6 knowledge to more than 800 ICT personnel in the public sector.

Keywords: IPv6, Internet protocol, human capacity building, IPv6 transition

PERLAKSANAAN PROGRAM PEMBANGUNAN KAPASITI SUMBER MANUSIA IPv6 UNTUK SEKTOR AWAM DI MALAYSIA: SATU PROJEK KOMUNITI KTP

ABSTRAK - Dalam usaha untuk kekal sebagai sebahagian penting dalam Internet global dan mendapat manfaat daripada pertumbuhannya, organisasi di Malaysia seperti agensi-agensi kerajaan, pembekal perkhidmatan dan kandungan Internet, dan syarikat mesti beralih kepada Protokol Internet baru versi 6 atau IPv6. Kunci bagi peralihan yang berjaya adalah kesediaan sumber manusia dalam menerima dan mengamalkan teknologi Internet tersebut. Projek KTP IPv6 berusaha untuk membantu sektor awam di Malaysia dalam membina kapasiti manusia mereka dalam teknologi IPv6. Tujuan awal projek ini adalah untuk melatih seramai 500 kakitangan ICT sektor awam untuk membiasakan dan mempersijilkan mereka dengan teknologi IPv6. Latihan dalaman bagi program jurulatih bermula pada bulan April 2012 hingga akhir bulan Ogos 2012. Selain itu, latihan ini juga dilanjutkan untuk melatih sekumpulan jurulatih luar dari Politeknik Sultan Azlan Shah (PSAS) di Behrang, Perak. Pelatih PSAS berjaya menamatkan latihan mereka serta lulus program pensijilan tempatan yang dikenali sebagai *Certified interNetWorks Profesional in IPv6* (CIPv6). Kerjasama dengan kementerian, kerajaan-kerajaan Negeri, agensi-agensi tempatan termasuk dari badan-badan berkanun seperti MARA, LHDN, serta institusi pendidikan seperti universiti awam, politeknik dan kolej matrikulasi telah membolehkan sesi latihan dapat dilaksanakan hingga akhir Jun 2014, dengan jumlah peserta seramai 803 orang, menjadikan purata 80 orang peserta dilatih setiap bulan. Dengan kemajuan tersebut, projek ini telah berjaya melangkaui sasaran capaian Projek Pemindahan Ilmu (KTP) dengan memindahkan pengetahuan teknologi IPv6 kepada lebih 800 orang kakitangan ICT sektor awam.

Kata kunci: IPv6, protokol Internet, pembangunan kapasiti manusia, transisi IPv6

INTRODUCTION

Since its beginning in 1970s, the Internet uses the underlying 32-bit Internet Protocol version 4 (or IPv4) addresses for identifying network nodes, enabling communication amongst computers and routing data to the right destination. The IPv4 can handle only approximately 4.3 billion addresses, but the explosion of Internet-enabled devices and the growing number of Internet users nowadays has accelerated the demand for more IP addresses. In February 2011, the Internet Assigned Numbers Authority (IANA) handed out its last IPv4 address blocks to the five regional Internet registries (RIRs) marking the exhaustion of IPv4 addresses a real global crisis.

With the depletion of IPv4 addresses, new devices and networks will be unable to obtain IPv4 addresses and will therefore need to use a new version of IP - the Internet Protocol version 6 (IPv6). Hence, in the foreseeable future, new Internet contents, applications, services and end-users will be assigned the 128-bit IPv6 addresses. In anticipation of this, a migration of existing networks and services to IPv6 has started in many parts of the world.

Since the World IPv6 Launch Day organized by the Internet Society on 6 June 2012, thousands of companies, including Google, Facebook, YouTube, and Yahoo!, and millions of Internet sites now permanently enabled the next generation of Internet Protocol (IPv6) for their products and services. The IPv6 enablement is essential to ensure the Internet can continue to grow and connect billions more people and devices around the world.

Nevertheless, Malaysia is remarkably lagging behind its main trading partners with respect to IPv6 awareness and deployment. IPv6 expertise and awareness exists in Malaysia, but is concentrated in a very small number of people and organizations. Surprisingly, Tanzania which is considered less developed than Malaysia has the highest number of Web sites (92) among top 500 reachable over IPv6 on 28 July 2013 (6lab.cisco.com, 2013).

Realizing the urgency for the migration to IPv6, the Malaysian government has taken initial action towards implementing IPv6 with the preparation of the Strategic Plan Implementation of IPv6 in Malaysia in 2008 as a basis to determine the direction and implementation of IPv6 activities for the public and private sectors in Malaysia. On 25 November 2011, the Malaysian Cabinet has approved the implementation schedule of IPv6 in Malaysia that the IPv6 environment must be made available in dual stack IPv6 mode by the end of 2013, and later be made available in the native IPv6 mode by the end of 2015.

In order to ensure that the transition to IPv6 can be carried out in accordance with the above mentioned timeline, Malaysian public services ICT workers must possess sufficient skills and knowledge of the IPv6 technology. In responding to the need, the UUM IPv6 Knowledge Transfer Program (UUM KTP IPv6) community project was initiated which aims to assist the Malaysian public sector organizations in meeting the IPv6 transition schedule set by the Malaysian Government. The KTP IPv6 project involves transferring IPv6 knowledge and technology to at least 500 public sector ICT personnel in the effort to familiarize them with the IPv6 technology.

This paper describes the implemention of the 24-month UUM KTP IPv6 Community Project. The subsequent section provides some background and literature on the IPv6 migration issues and challenges, followed by the description of the UUM KTP IPv6 Project implementation. Next, the outcomes and opportunities of the project are discussed. The last section draws the summary of the paper.

BACKGROUND AND RELATED WORKS

Malaysia's largest trading partners have embraced IPv6 for their digital economy strategies. They recognize that international trade and e-commerce depend on Internet technologies, and that the Internet is moving to IPv6. To continue to be part of the global Internet and to benefit from its growth, Malaysian organizations such as Government agencies, Internet and content service providers, and enterprises need to migrate to IPv6. Most mainstream ICT products are now IPv6-capable and carrying IPv6 traffic in other countries.

Every change in technology will come together with challenges. This is also true in the case of IPv6 deployment. There will always be obstacles and challenges in implementing IPv6 that hold back the implementation processes. With no exception, the same problem faced by government agencies in Malaysia during the transition from IPv4 to IPv6 network technology. These problems, slow the transition processes.

Alan Durand (Durand, 2001) expected two obstacles to the deployment of IPv6. First, the smaller number of IPv6 users, comparable to IPv4 with less applications or services cannot attract users and, thus, is not as interesting as a mature, well established network. Second, the missing infrastructure required for realistic production-level deployment of the protocol such as hardware support, operating systems, middleware, applications, management tools, and trained technical personnels are needed in order to complete the deployment.

Raja Azlina (Mahmood, 2002) supported Alan Durand's statement. The same situations also happen in Malaysia. There are five reasons for the slow deployment of IPv6 in Malaysia. Two of the reasons are from the network operators. Network operators were aware of an uncertain risk of implementing IPv6. They perceive that migrating towards IPv6 is a very complex process and require many resources in terms of manpower, time and money. Network operators also feel unclear differentiating benefits of IPv6 to them.

Besides providing more addresses to clients, many local network operators or Internet Service Providers (ISP) still couldn't comprehend the business value proposition of IPv6 just yet. Third reason was about the IPv6 application itself. In 2002, no applications have been introduced in IPv6 due to a wide variety of applications that are already available. Peoples in the research institute still lack of technical experience. They are good in IPv6 theory but lacking of practical experience. The last reason was about the awareness of IPv6 among public. Since the Internet Protocol is transparent to the end users, many of them are not aware of the changes made in this protocol. Hence, the importance of IPv6 remains unknown and this creates lack of demand for IPv6 network.

Recent Global IPv6 Deployment Survey (Global Networked Knowledge Society (GNKS) Consult, 2011) found that there are five challenges for organizations in deploying IPv6 in their organizations. The challenges are business case for non-technical decision makers, vendor support, availability of (knowledge) personnel, information security and costs (required financial investment/time of personnel).

IPv6 deployment process is cross-functional and network wide so project team should be selected judiciously (Dooley & Rooney, 2013). A well-documented project plan generally helps streamline the deployment phase, though unforeseen issues are inevitable. The general deployment process requires three steps, the first involving current vendors as needed to coordinate upgrades for IPv6 compliance, the second with new vendors for the

new network, IP management, security, or network management components, and the third with internal or consulting personnel in assigning and managing tasks. IPv6 deployment needs to be qualified in a non-production or laboratory environment to minimize possible disruption with the production IPv4 network. While the project plan defines the implementation of network devices and systems, the test plan serves as the final gate through which these systems must pass before production deployment.

According to Arkko and Baker (Arkko & Baker, 2010), there is no single right model for IPv6 deployment because the goals, constraints, and opportunities for IPv6 deployment differ from one case to another. Therefore, IPv6 deployment requires some effort, resources, and expertise. While, Kehinde Oladipo Williams (Kehinde, 2009) argues that IPv6 will come to solve many problems related to the existing address. Besides, it is generally observed with new technological solutions it would also introduce so many security issues. The issues that would be introduced are variants.

In summary, a successful migration and deployment of IPv6 requires careful planning and competent technical workforce. Thus, IPv6 human capacity development among the public services, ICT personnel is a key ingredient for a successful IPv6 migration in the public sector agencies in Malaysia.

THE UUM KTP IPv6 PROJECT IMPLEMENTATION

The UUM KTP IPv6 Is a community knowledge transfer project entitled “IPv6 Human Capacity Development Program for Public Sectors In Malaysia”. The community project officially started on 1 September 2012 for a 24-month duration which ended on 31 August 2014. The project team is led by Professor Dr Suhaidi Hassan and comprises of two other principal members, two graduate interns, one project officer and four UUM trainers. The Ministry of Higher Education allocated a funding amount of RM 142,311.00 for the project under its Knowledge Transfer Program. The project is conducted with initial collaboration from the Malaysian Communications and Multimedia Commission (SKMM).

The objective of this project is to assist Malaysian public sectors in building their human capacity in IPv6 technology, specifically to produce at least 500 trained IPv6 professionals among public services ICT personnel, through local development of IPv6 training syllabus, learning material and certification program. To deliver the objective, the UUM InterNetWorks Research Laboratory has undertaken the role as the IPv6 training center. This project started with the development of training material, which lincludes bulding the e-Learning Management System (LMS) and training syllabus. The training delivery method uses blended learning approach which include interactive lectures, laboratory exercises, e-forum, self-learning assignments and online assessments. The locally-developed training syllabus was completed in October 2012.

A total of nine IPv6 trainers and a special officer involved in delivering training sessions under this KTP IPv6 project. The 10-member KTP IPv6 trainer team, listed in Table 1, includes principal project members, expert trainers and graduate interns led by Prof. Dr. Suhaidi Hassan from the InterNetWorks Research Laboratory, UUM School of Computing. Each 4-day training session provide understanding on the foundations of IPv6 technology and hands-on technical exposure of the Internet Protocol version 6 (IPv6), its structure, operation, and technical features. IPv6 addressing and architecture were discussed in detail, and the issues related to the deployment, transition and coexistence with IPv4 are examined. This training also includes hands-on IPv6 configuration of host computers/routers as well as IPv6 network building and configuration scenarios. Under this project, the trainees have had opportunities to work on lab exercises related to IPv6 deployment in a dual-stack environments as well as native IPv6 transition.

Table 1: UUM KTP IPv6 Training Team Members

NO.	NAME	ROLE
1	Prof. Dr. Suhaidi Hassan	Project Leader
2	Dr. Ahmad Suki bin Che Mohamed Arif	Principal Member
3	Dr. Shahrudin Awang Nor	Expert Trainer
4	Mr. Mohd Samsu bin Sajat	Principal Member
5	Mr. Amran bin Ahmad	Graduate Intern
6	Mr. Ahmad Hanis bin Mohd Shabli	Graduate Intern
7	Mr. Adi Affandi bin Ahmad	Expert Trainer
8	Mr. Fazli bin Azzali	Expert Trainer
9	Mr. Adib Monzer Habbal	Expert Trainer
10	Ms. Syamimi Noor binti Shofi	Special Officer

The internal training for trainer program started in April 2012 and later, in November 2012, extended to train a group of external trainers from Politeknik Sultan Azlan Shah (PSAS) in Behrang, Perak. The PSAS trainers successfully completed their training and passed the locally-developed certification program called the Certified InterNetWorks Professional in IPv6 (CIPv6). Later, a series of trainings have been conducted for various public services ICT personnel, including those from the state governments and statutory bodies such as MARA and LHDN. Collaborations with government ministries as well as educational institutions such as universities, polytechnics and matriculation colleges have resulted in a series of training sessions which ended in June 2014, with a total of 803 public services personnel trained, making an average of 80 personnel trained per month. With the progress, the UUM KTP IPv6 team has successfully surpassed the initial Knowledge Transfer Program (KTP) project target by transferring IPv6 knowledge to more than 800 ICT personnel in the Malaysian public sectors. The training session progress status is shown in Table 2 while Figure 2 shows a standard training schedule.

Table 2: UUM KTP IPv6 Training Progress Status

No.	Training Date	Training Venue	No. of Trainees
1	22-26 April 2012	UUM InterNetWorks Research Lab (Series 1)	16
2	12 June 2012	INSPEM, Putrajaya	28
3	5-8 November 2012	UUM InterNetWorks Research Lab (Series 2)	18
4	6-9 May 2013	Kolej MARA Kulim	7
5	28 May 2013	UUM InterNetWorks Research Lab (Series 3)	14
6	4-7 June 2013	Institut Latihan Kecemerlangan MARA, Jawi, Pulau Pinang	19
7	11-14 June 2013	Parlimen Langkawi/LADA, Kedah	35
8	17-20 June 2013	Jabatan Pengajian Politeknik @ Politeknik Mersing, Johor	29
9	1-4 July 2013	Akademi Percukaian Malaysia, Bangi, Selangor	34
10	20-23 August 2013	Kementerian Pendidikan Malaysia, Putrajaya (Series 1)	28
11	26-29 August 2013	Kementerian Pendidikan Malaysia, Putrajaya (Series 2)	29
12	17-20 September 2013	Kolej Komuniti Langkawi, Kedah (Series 1)	18
13	23-26 September 2013	Pejabat Setiausaha Kerajaan Negeri Kelantan	59
14	1- 4 October 2013	Kolej Komuniti Langkawi, Kedah (Series 2)	15
15	7-10 Oktober 2013	Pejabat Setiausaha Kerajaan Negeri Kedah	116
16	28-31 Oktober 2013	Kolej Profesional MARA Beranang	28
17	6-8 November 2013	Universiti Malaysia Pahang	19
18	10-13 November 2013	Pejabat Setiausaha Kerajaan Negeri Terengganu	30
19	11-14 November 2013	Kolej Matrikulasi Banting, Selangor	15
20	25-28 November 2013	Jabatan Pengajian Politeknik @ Politeknik Dungun/PSMZA	29
21	20-23 Januari 2014	UUM InterNetWorks Research Lab (Series 4)	18
22	13, 20, 27 March 2014	UUM InterNetWorks Research Lab (Series 5)	32
23	14-17 April 2014	Jabatan Pengajian Politeknik @ Politeknik Ipoh/PUO	25
24	22-25 April 2014	Institut Tadbiran Awam Negara, INTAN Sabah	30
25	19-22 May 2014	Universiti Teknologi Malaysia (UTM)	35
26	9-12 June 2014	Universiti Malaysia Sarawak (UNIMAS)	30
27	16-19 June 2014	Kolej Matrikulasi Gopeng, Perak	21
28	16-19 June 2014	Jabatan Pendidikan Negeri Kedah	26
		Total No. of Trainees	**803**

HARI / MASA	8.30 PG. - 10.30 PG.	11.00 PG. - 1.00 TGH.	2.30 PTG. - 4.30 PTG.
15.6.2014 (AHAD)	Perjalanan Peserta Untuk Menghadiri Kursus IPv6		*Check-in*
16.6.2014 (ISNIN)	***PRE-TEST*** ***THE INTERNET PROTOCOL*** - *Review of TCP/IP* - *IPv4 Addressing and Subnetting* *(Prof. Dr. Suhaidi Hassan)*	***IPv6 ADDRESS ARCHITECTURE AND SCHEME*** - *IPv6 Address Architecture* - *IPv6 Address Types and Scope* - *IPv6 Subnetting Scheme* *(Prof. Dr. Suhaidi Hassan)*	***LAB ACTIVITY 1*** - *Introduction to Packet Tracer* - *Basic Devices Configuration using IPv4 and IPv6* *(Encik Amran bin Ahmad)*
17.6.2014 (SELASA)	***ICMPv6 and NEIGHBOUR DISCOVERY*** - *Static Configuration* - *Stateless Auto configuration (SLAAC)* - *SLAAC with Privacy Extension* *(Dr. Ahmad Suki bin Che Mohamed Arif)*	***IPv6 ADDRESS ASSIGNMENT*** - *Static Configuration* - *Stateless Auto configuration (SLAAC)* - *SLAAC with Privacy Extension* - *Stateless DHCPv6* - *Stateful DHCPv6* *(Dr. Ahmad Suki bin Che Mohamed Arif)*	***LAB ACTIVITY 2*** - *IPv6 SLAAC Configuration* - *IPv6 stateless DHCP Configuration* *(Dr. Ahmad Suki bin Che Mohamed Arif)*
18.6.2014 (RABU)	**INTRODUCTION TO IPv6 ROUTING** - IPv6 Static Routing - IPv6 Dynamic Routing *(Encik Amran bin Ahmad)*	***IMPLEMENTING IPv6 ROUTING IN CAMPUS NETWORK Part 1 (LAB ACTIVITY 3)*** *- IPv6 Static Routing Configuration* *- RIPng Configuration* *(Encik Amran bin Ahmad)*	***IMPLEMENTING IPv6 ROUTING IN CAMPUS NETWORK Part 2(LAB ACTIVITY 4)*** *- OSPFv3 Configuration* *- EIGRP for IPv6 Configuration* *(Encik Amran bin Ahmad)*
19.6.2014 (KHAMIS)	***IPv6 TRANSITION MECHANISMS*** - *Dual Stack* - *Tunnelling* - *Translation* *(Encik Amran bin Ahmad)*	***LAB ACTIVITY 5*** - *IPv6 Dual Stack Configuration* - *IPv6 Tunnel Configuration* - *(Encik Amran bin Ahmad)*	***POST-TEST*** ***PENUTUP*** *(Encik Amran bin Ahmad)*
20.6.2014 (JUMAAT)	*Check-out dan Perjalanan Pulang ke Pusat Masing-masing*		

Figure 2: A Standard UUM KTP IPv6 Training Schedule

The training sessions covers both theoretical and practical aspects of the IPv6 technology. Training management and material were delivered via the CIPv6 e-Learning Management System (LMS), shown in Figure 3, developed and maintained by one of the graduate interns.

Figure 3: CIPv6 Online Learning Management System

During the lab sessions, the trainees are exposed to Cisco's Packet Tracer network simulation software. The use of Packet Tracer enables each trainees to configure working IPv6 networks of their own. Figure 4 shows an example of Packet Tracer network snapshot configured during training a training session.

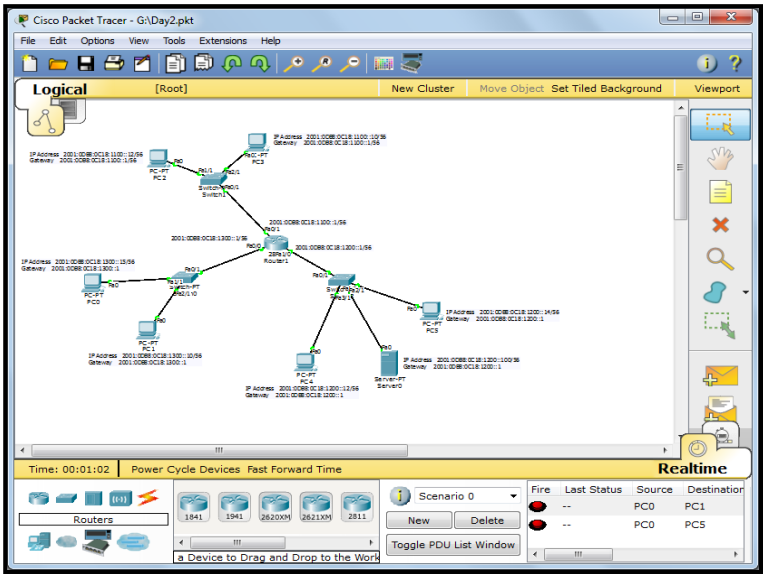

Figure 4: Cisco Packet Tracer Interface

In each training session, the trainees are required to take a 30-minute pre-test to gauge their prior understanding of the technology. At the end of the 4-day training session, each trainee is required to sit for another 45-minute post-test to assess their overall performance and understanding. At the end of the training sessions, trainees should be able to explain the differences between IPv4 and IPv6 network protocol environments, analyze and explain the operation and features of IPv6 protocol, design a functional IPv6 network to suit the need of organization and implement the IPv6 protocols in their department or campus networks. Trainees who participate fully in the training and pass the assessment criteria will be given a certificate of completion, shown in Figure 5, at the end of their training session.

Figure 5: UUM KTP IPv6 Certificate of Completion

OUTCOMES, OPPORTUNITIES AND DISCUSSIONS

There are many outcomes and opportunities gained and explored from this project. Among those outcomes and opportunities are listed as follows:

a. *Local development of IPv6 training syllabus, learning material and certification program*. The UUM KTP IPv6 project has developed a comprehensive IPv6 training syllabus and material to support the IPv6 training. In this KTP rolling phase, the silver-grade training syllabus and material has been fully developed and used according to the Internet Engineering Task Force (IETF) standards. In addition, a professional certification program known as the Certified InterNetWorks Professional in IPv6 (CIPv6) has also been developed to complement the training syllabus and material. The project has also developed a learning management system (LMS), depicted in Figure 6, to facilitate IPv6 training where learning material, course management and evaluation can be conducted via online mode. In the future, it will be feasible to market all of these at the global market as a product or service from a Malaysian IHL.

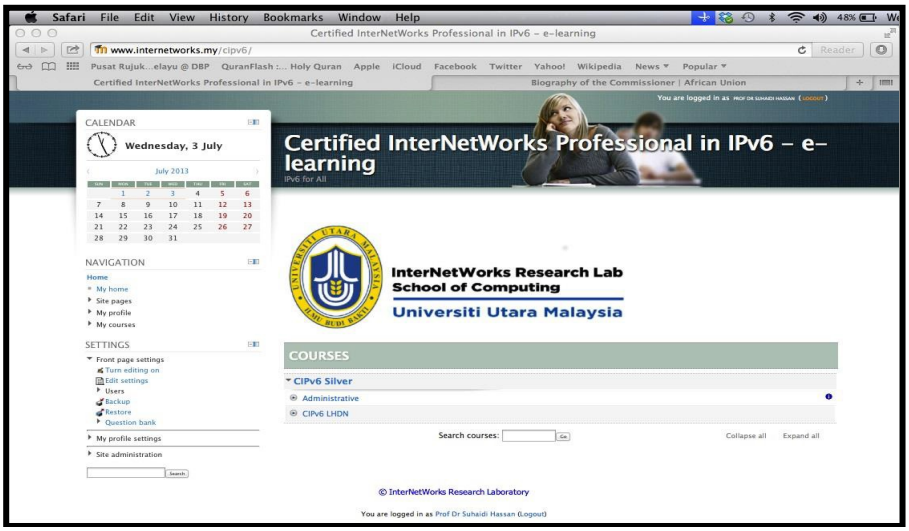

Figure 6: The CIPv6 Online Learning Management System

b. *Human capacity development in IPv6 technology for Malaysian public services ICT workforce.* The UUM KTP IPv6 project initially aimed toward producing of at least 500 people trained IPv6 workforce within the Malaysian public sector. The program strengthens the competency of the public sector ICT personnel in IPv6 technology through the face-to-face, in-house training and the certified InterNetWorks Professional certifications in IPv6 technology. The experience gained from these training sessions can be extended to train the workforce in other Malaysian service sectors. In addition, the project has also produced more than 30 certified trainers in IPv6 technology whom can be utilized for future trainings.

c. *Enhancing Malaysia's competitiveness in the global high-value Internet-based economy.* The UUM KTP IPv6 project aimed to assist the Government of Malaysia in realizing the targeted IPv6 implementation in Malaysia by the end of 2015, therefore contributed in enhancing the country's competitiveness in the development of high value Internet-based economy globally.

d. *Strengthening ties between IHL and the community*. The UUM KTP IPv6 project has helped to strengthen ties between the community. It also created a unique

collaboration between IHL academic staff and civil servants in the context of national development (nation building). In addition, the IHL gained recognition of its expertise and at the same time can promote IHL academic programs and services to the public. On the other hand, the civil service officers could learn about opportunities offered by the IHL, interacted with academic staff as well as enhancing their life-long learning.

e. *Training cost effectiveness and savings of public (tax-payer's) money*. The UUM KTP IPv6 project presented a significant cost savings of the public (tax-payer's) money in training and re-training public services personnel with regard to IPv6 technical competency. Table 3 presents the cost comparison for the training as well as the cost saving. The money saved from the training exercise can be utilized for other future beneficial use.

Table 3: IPv6 Training Cost Effectiveness

	Training Provider A	Training Provider B	UUM KTP IPv6 Training
Training cost/trainee	RM 7000	RM 3000	RM 180
Total cost (800 trainees)	RM 5,600,000	RM 2,400,000	RM 145,000
Cost saving	**RM 3,200,000 to RM 5,455,000**		

f. *Human capacity development in IPv6 technology for Malaysian public services ICT workforce.* Figure 7 shows some demographic information of the trainees.

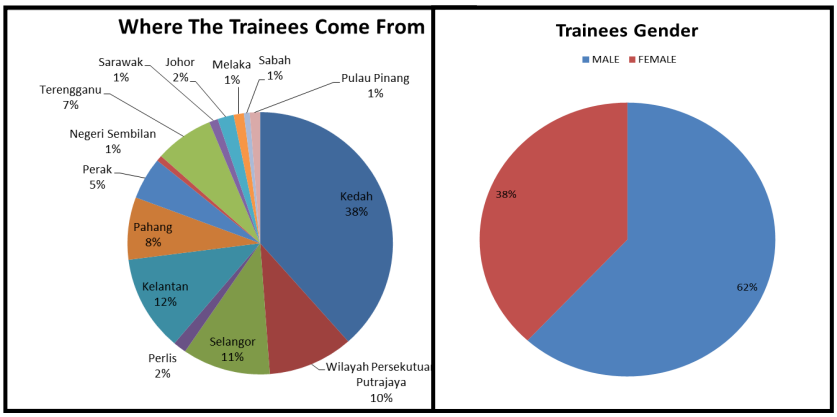

Figure 7: UUM KTP IPv6 Trainee Composition

CONCLUSION AND FUTURE WORK

The key for a successful IPv4-to-IPv6 transition is the readiness of human resource in adopting and adapting the new Internet technology. The UUM KTP IPv6 Project attempted to assist Malaysian public sector agencies in building their human capacity in IPv6 technology. This paper describes the UUM KTP IPv6 project, and outlining its achievements. The project initially aimed to train some 500 public sector ICT personnel to familiarize and possibly to certify them on the IPv6 technology. With more than 800 public ICT personnel trained, the project has outstandingly surpassed the initial target of training a mere 500 ICT personnel – a 160+% achievement – cost-effectively delivered for the people of this beloved country.

Looking forward, the project team envisions to offer technical assistance to the public services organizations in their actual migration to IPv6 environment and to support in strengthening the Government effort toward the 2015's native IPv6 implementation in the public sector. One of the important activities to accelerate the success of this important initiative is to provide a comprehensive manual or guidebook that details implementation steps from the transition period towards the native IPv6 environment in an easy-to-follow and practical way. The team also plans to extend the IPv6 knowledge transfer services to other countries in collaboration with national, regional and international organizations such as the Asia Pacific Network Information Center (APNIC) and the International Telecommunication Union (ITU).

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