財團法人台灣網路資訊中心因公出國人員報告書

104 年 8 月 31 日

報告人 姓　名	呂愛琴 顧靜恆	服務單位及職稱	副執行長 網址組組長
出國期間	104 年 8 月 25-29 日	出國地點	緬甸仰光
出國事由	參加 The 9th International Conference on Genetic and Evolutionary Computing (ICGEC 2015) 研討會		
報告書內容應包含： 一、出國目的 二、考察、訪問過程 三、考察、訪問心得 四、建議意見 五、其他相關事項或資料 （內容超出一頁時，可由下頁寫起）			
授權聲明欄	本出國報告書同意貴中心有權重製發行供相關研發目的之公開利用。 授權人：　　（簽章）		

附一、請以「A4」大小紙張，橫式編排。出國人員有數人者，依會議類別或考察項目，彙整提出報告。
註二、請於授權聲明欄簽章，授權本中心重製發行公開利用。

一、出國目的

本次第九屆基因和演化計算國際研討會議(The 9th International Conference on Genetic and Evolutionary Computing，ICGEC 2015)，是由 Springer，緬甸科技部(Ministry of Science and Technology)，仰光計算機研究大學(University of Computer Studies, Yangon)，日本宮崎大學(University of Miyazaki)，台灣高雄應用科技大學(Kaohsiung University of Applied Science)，中國大陸福建工程學院(Fujian University of Technology)及捷克VSB-俄斯特拉發技術大學(VSB-Technical University of Ostrava) 所共同合作舉辦。會議內容包括國際最新基因和演化計算，以及網路相關技術與應用等方面的研究論文發表與專題演講。

此次 ICGEC 2015 研討會議於 2015 年 8 月 26 日至 28 日假緬甸仰光資訊與通信技術園區(MICT Park)舉行，參加此研討會除與各國專家學者進行經驗與學術交流，並於會中舉辦 IPv6 Operational Technologies and Network Applications 場次，及為投稿的論文進行發表報告，論文題目為 A Study of the IPv6 Service Availability Measurement。ICGEC 2015 年論文集將刊登在普林格(Springer)系列叢書的智能與軟體計算進展(Advances in Intelligent and Soft Computing)中。

二、考察、訪問過程

此次研討會安排了許多論文發表的場次以及大會所規劃特別主題的專題演講，大會海報及會場照片請見圖一：

圖一、ICGEC 2015 大會

8 月 26 日至 28 日論文發表議程中，大會特地於 26 日上午場次邀請國際專家學者做專題演講，其餘為投稿論文發表的場次，所有報告都以英文進行簡報，大會議程如下：

The Ninth International Conference on Genetic and Evolutionary Computing
(ICGEC 2015)

Conference Schedule

Conference Venue: MICT Park, Yangon

August 26, 2015 (Wednesday)	
08:30 | 17:00	Registration Venue: Main Lobby (1F)

August 26, 2015				
09:00 | 10:00	Opening Ceremony Venue: Main Hall			
10:00 | 10:40	Exhibition Event and Poster Section			
10:40 | 11:00	Coffee Break			
11:00 | 12:00	Invited Keynote Speech I – Prof. Jun Murai, Keio University, JAPAN. *Title: Internet Intelligence*			
12:00 | 13:30	Lunch Break			
13:30 | 14:00	Invited Keynote Speech II – Prof. Masugi Maruyama, University of Miyazaki, Japan Dr. Nato Kume, Kyoto University, Japan *Title: EHR Development and Future Services in Japan*			
14:00 | 15:00	Room A	Room B	Room C	Room D
	Workshop I Prof. Keiko Ogawa	Session 1 (Part I)	Session 2 (Part I)	Session 3 (Part I)
15:00 | 15:20	Coffee Break			
15:20 | 16:50	Room A	Room B	Room C	Room D
	Workshop II Prof. Tsuneo Yamada	Session 1 (Part II)	Session 2 (Part II)	Session 3 (Part II)
18:00 | 20:00	Welcome Dinner			

August 27, 2015				
08:30-12:00 Venue: Main Hall				
08:30 | 09:15	Invited Keynote Speech III – Prof. Chin-Chen Chang, IEEE and IET Fellows, Feng Chia University, Taiwan. *Title: Minimizing Turtle-Shell Based Stego Image Distoriton Using Particle Swarm Optimisation*			
9:15 | 9:30	Coffee Break			
09:30 | 12:00	Room A	Room B	Room C	Room D
	Session 4	Session 5	Session 6	Session 7
12:00 | 13:30	Lunch Break			
13:30 | 14:15	Invited Keynote Speech IV – Professor Yutaka Ishibashi, Nagoya Institute of Technology *Title: Quality of Service in Multi-sensory Communication*			
14:15 | 14:35	Coffee Break			
14:35 | 16:50	Room A	Room B	Room C	Room D
	Workshop III Mr. OGINO Tsugunobu	Session 8	Session 9	Session 10
18:00 | 20:00	Conference Banquet			

August 28, 2015 (Friday)	
09:00 | 13:30	Scientific Tour (including Lunch)
14:00 | 16:00	University-Industry-Government Collaboration Event
17:00 | 19:00	Farewell Party

此次大會安排了多場專題演講，8月26日邀請了日本 Keio University 的 Jun Murai 教授（見圖二）介紹 Internet Intelligence，日本 Universityof Miyazaki 的 Masugi Maruyama 教授及 Kyoto University 的 Nato Kume 博士介紹 EHR Development and Future Services in Japan。8月27日邀請了台灣逢甲大學的張真誠教授介紹 Minimizing Turtle-Shell Based Stego Image

Distorition Using Particle Swarm Optimisation，日本 Nagoya Institute of Technology 的Yutaka Ishibashi 教授介紹 Quality of Service in Multi-sensory Communication。

圖二、開幕專題演講日本 Jun Murai 教授

日本 Jun Murai 教授在 Internet Intelligence 專題演講中提及，在網際網路經過30年的的發展和佈建，現今的電腦計算與許多重要的電腦、資料與網路新技術息息相關。尤其當高速研究網路已經開始可以達到100Gbps，大量不同語言的資料也經由人類行為，例如Web以及社群網路，讓大數據的開始產生新的計算模式。此外，物聯網的發展讓新的裝置和感測器可以直接連接網際網路，也增加了大數據計算的新類型。伴隨著網際網路速率的增加，分散式計算的力量已經急遽增加，基於網際網路與電腦上的先進技術與新智能將令人期待。Jun Murai 教授於演講中介紹了幾項物聯網智能應用的實例。

三、考察、訪問心得

本次會議中由亞洲大學曾憲講座教授負責主持8月27日上午 Session 4：IPv6 Operational Technologies and Network Applications 論文發表的場次，曾憲雄講座教授（見圖三）與本中心同仁呂愛琴副執行長、顧靜恆組長、郭晟偉工程師及蔡更達工程師共同發表的論文題目為 A Study of the IPv6 Service Availability Measurement，並由顧靜恆組長（見圖四）於會議中代表進行論文報告，論文詳見附件一。

本場次發表的論文來自多個國家，其中有三篇為台灣所發表，除了上述發表的論文之外，另外兩篇論文分別為由台南大學與亞洲大學共同發表的 Building the Virtual Experiment Learning Activities to Facilitate IPv6 Online Training 以及由中山大學和中國文化大學共同發表的 Defense Denial-of Service Attacks on IPv6 Wireless Sensor Networks。其餘論文分別來自泰國（見圖五），中國大陸，日本以及緬甸(見圖六)等國家，泰國發表的論文為 Automated Home Agent Configuration for Mobile IPv6，中國大陸 CNNIC 發表的論文為 RPKI Deployment: Risks and Alternative Solutions，每一篇論文報告時間為 12 分鐘，並且接受大家的提問。該場次有 10 篇論文發表，詳細議程如下：

Session 4: IPv6 Operational Technologies and Network Applications

(27 August) 09:30-12:00

A Study of the IPv6 Service Availability Measurement……...
Shian-Shyong Tseng, Ai-Chin Lu, Ching-Heng Ku, Sheng-Wei Kuo, Geng-Da Tsai

Automated Home Agent Configuration for Mobile IPv6……..……..
Wuttipon Noopetch

RPKI Deployment: Risks and Alternative Solutions……
Xiaowei Liu, Zhiwei Yan, Guanggang Geng, Xiaodong Lee, Shian-Shyong Tseng, Ching-Heng Ku

Building the Virtual Experiment Learning Activities to Facilitate IPv6 Online Training……..……
Jun-Ming Su, Shian-Shyong Tseng, Ting-Wei Lin

Defense Denial-of Service Attacks on IPv6 Wireless Sensor Networks.....
Chia-Mei Chen, Sung-Chien Hsu, Gu-Hsin Lai

Filtering Duplicated Location in Tracking Traffic Data……..……...
Swe Swe Aung, Thinn Thu Naing

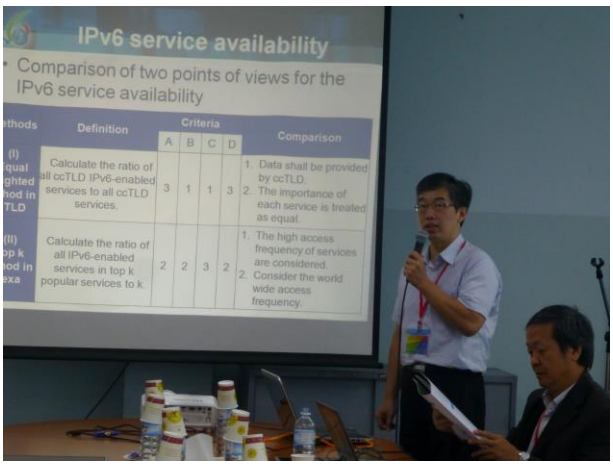
Finding Shortest Path and Transit Nodes in Public Transportation System……..
Myat Thu Zar, Myint Myint Sein

Modified Priority Search Tree for Location Aware Extracting Services…..
Linn Linn Phway, Myint Myint Sein

A Novel Research Topic Ranking System in Academic Networks…..……
Thi Thi Zin, Pyke Tin, Hiromitsu Hama

SLA Guaranteed Migration Decision Model Using MCDM Approach…...
Zar Lwin Phyo

圖三、呂愛琴副執行長、曾憲雄講座教授及顧靜恆組長於會場合影



圖四、顧靜恆組長進行論文發表

圖五、泰國 Wuttipon Noopetch 進行論文發表

圖六、緬甸 Zar Lwin Phyo 進行論文發表

本次會議有許多國際專家學者都出席參加，藉此機會互相觀摩學習，在會議中並安排了許多展示的攤位(見圖七)，有學校成果推廣及廠商產品介紹展示，讓與會者可以參觀交流，增加對目前新興發展成果的觀摩與了解。

圖七、會場展示攤位

四、建議事項

(一) 隨著網際網路的普及與發展，大數據與物聯網智能應用的實例將會越來越多，結合行動通訊與 IPv6 的特性在未來物聯網應用發展上，將是重要的發展趨勢。

(二) 網際網路的應用越來越廣泛，在智慧資料的分析上是重要的發展，各國發表的論文成果值得多加學習。

(三) 借由此研討會與來自各國的教授互相交流，建立彼此相互合作的機會，對於未來 IPv6 的推動有很大的幫助。

附件一：

A Study of the IPv6 Service Availability Measurement

Shian-Shyong Tseng[1], Ai-Chin Lu[2], Ching-Heng Ku[2*],
Sheng-Wei Kuo[2], Geng-Da Tsai[2]

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Abstract. While confronting the global IPv4 address exhaustion, it is important and crucial for the entire Internet environment to smoothly upgrade to the next generation Internet Protocol, IPv6. Based on the statistics of the user availability of Google, the global usage of the IPv6 is still very low. As we knew, the service availability is one of the key factors affecting user availability, how to handle the IPv6 service availability measurement becomes a critical topic for the IPv6 upgrade.

In previous researches, two points of views for estimating the IPv6 service availability have been proposed. One is to calculate the ratio of all ccTLD IPv6-enabled services to all ccTLD services, and the other is to calculate the ratio of all IPv6-enabled services in the top k popular services to k. In the former method, the importance of each service is treated as equal and the related data need to be provided by its ccTLD. In the latter method, the top k popular services representing the all services are used to calculate the IPv6 service availability and the related data could be obtained by certain public web sites. In this study, we proposed a hybrid method to analyze the service availability using the global top one million popular web sites and top 500 ccTLD's popular web sites from Alexa.

In this study, four criteria have been defined and experiments have been made to verify our hypothesis.

Keywords: IPv6 Readiness, service availability

1 Introduction

Network measurement [1] is a measurement activity of network characteristics. It measures the network features, including network topology, network routing, network traffic, the network anomalies, network performance bottlenecks, etc. Generally, the collected measurement information can be used to improve the network operation and management.

In order to measure different network characteristics, the so-called Network Measurement Infrastructure was proposed [2]. It used multiple measuring points in differ-

ent locations on the network to obtain the measurement results from each measurement point to infer the status of network environment.

Some distributed measurement architectures have been proposed [3], where the common features of these architectures rely on a few (e.g., dozens) of distributed measurement nodes, to measure large-scale network. Besides, the different type of the distributed measurement architecture [4] based on point to point type to construct a large-scale measurement system was also proposed. In the large-scale network measurement, data acquisition can be divided into direct access to the actual data and indirect estimation of the data in order to increase measurement accuracy.

Facing the depletion of IPv4 address, how to find a feasible approach which can smoothly and steadily upgrade from the IPv4 network to IPv6 network environment is a globally concerned issue.

Based on the statistics of the user availability of Google, the global usage of the IPv6 is still very low. As we knew, the service availability is one of the key factors affecting user availability, how to handle the IPv6 service availability measurement becomes a critical topic for the IPv6 upgrade.

In this study, four criteria, such as representativeness, popularity, accessibility, and coverage, have been defined and experiments have been made to verify our hypothesis. The hypothesis is that the ratio of the IPv6 web service availability for popular web services is at least higher than 5 times of the overall web services for any ccTLD in 2015. The gap will be slightly decreasing every year. The hypothesis can be used to predict the IPv6 service availability of a certain ccTLD in the next few years.

2 Related Works

The global organization, the Internet Corporation for Assigned Names and Numbers (IANA), allocated the last five IPv4 blocks to Regional Internet Registries (RIRs) on February 3, 2011[5]. The regional organization, Asia-Pacific Network Information Center (APNIC) managing the IP address in the Asia-Pacific region announced that the IPv4 address is exhausted and will stop the normal allocation of IPv4 addresses for Asia-Pacific countries on 15 April, 2011[6].

The Network Working Group of the Global Internet Engineering Task Force, IETF, pass through the RFC 5211 in July 2008 to announce an Internet Transition Plan [7], which proposed the stage and schedule planning for the smooth transition of IPv4 networks to IPv6 network as a global reference basis for network deployment.

Until the end of April 2012, there are 184 countries/economies around the world have been allocated of the IPv6 address [8]. It means that many countries have paid attention to the development of IPv6 networks. Besides, many developed countries also give the priority to the IPv6 network upgrade in the government to promote the development of the IPv6 industry and the private enterprise.

There are some IPv6 development surveys in the world. The Internet Association Japan [9] and the European Commission [10] had started the IPv6 penetration survey to understand IPv6 development. In addition, the international IPv6 Status Survey [11] provides five measurement indicators. S. S. Tseng, et al. [12] proposed an IPv6

readiness model with seven criteria as the promotion indicators of IPv6 readiness. The IPv6 Taiwan Directory [13] shows the list of IPv6-enabled web sites. A service-based IPv6 readiness architecture, including five measurement criteria from the perspectives of service, software, and core network, is shown in Fig. 1.

Services	• **Ratio of public network Services on the IPv6 Web, E-mail, DNS, FTP**
Software	• **Ratio of the supporting IPv6 in the Operation System** • **Ratio of the supporting IPv6 in Service Software**
Core Network	• **Ratio of the supporting IPv6 in the network equipment for the access** • **Ratio of the supporting IPv6 in the network equipment for the management**

Fig 1. Measurement Model of IPv6 Readiness with five measurement criteria

We assume that the popular services can represent the coverage of the service usage in the user availability. In this study, a hypothesis for IPv6 service availability is proposed. The hypothesis is that the ratio of the IPv6 web service availability for popular web services is at least higher than 5 times of the overall web services for any ccTLD in 2015. The global top one million web sites and ccTLD's top 500 popular web sites from Alexa are used to estimate the service availability of ccTLD. The statistical results successfully show our hypothesis for ccTLD's IPv6 service availability is true.

3 Methods for Service Availability

In this study, two points of views for the IPv6 service availability are proposed. One is to calculate the ratio of all ccTLD IPv6-enabled services to all ccTLD services, and the other is to calculate the ratio of all IPv6-enabled services in top k popular services to k, where top k web services are ranked by Alexa (www.alexa.com).

In the former method, the importance of all services is treated as equal and the data need be provided by every ccTLD. This method focuses on the domestic services and does not consider the access frequency of services.

In the latter method, top k popular services representing the most important services and used to calculate the IPv6 service availability by considering the access frequency of services, where the data could be obtained from Alexa[14].

Alexa publishes the popular websites by collecting and ranking over 1,000GB web sites' usage information. It is currently owned by the largest number of URL, ranking the most detailed information publishing site. Alexa website ranking mainly in two ways: ranking and classification rankings. Ranking also called absolute ranking, ie a specific site in which there website ranking. Alexa published every three months the new site ranking. This ranking is based on the number of links user (Users Reach) and

the number of page views (Page Views geometric mean) three-month cumulative.[14]

Alexa ranks sites based primarily on tracking a sample set of internet traffic [14] — users of its toolbar for the Internet Explorer, Firefox and Google Chrome web browsers.[15][16] It also allows the user to rate the site and view links to external, relevant sites. This caused some controversy over how representative Alexa's user base was of typical Internet behavior, [17] especially for less-visited sites.[16]

In this study, we proposed four criteria, such as representativeness, popularity, accessibility, and coverage, for the evaluation of the measurement method for the IPv6 service availability. The degree of these criteria can be shown in the Table 1.

Table1. The degrees of four criteria for the evaluation of the measurement method of the IPv6 service availability

Criteria	Definition	Degree
(A) Representativeness	Measured services are sufficient to represent the overall number of services.	1. Low 2. Moderate 3. High
(B) Popularity	Measured services are considered from the different importance by the access frequency.	1. Non 2. World wide 3. Domestic 4. Both
(C) Accessibility	Data can be automatically acquired.	1. Low 2. Moderate 3. High
(D) Coverage	The ratio of the number of measured services to overall number of services.	1. Low 2. Moderate 3. High

The higher representativeness the measured services are, the more suitable the overall number of services represent. The popularity considers the access frequency of measured services that are considered from the different importance measured in the domestic or that in the world wide. The accessibility can be determined whether the measured data can be automatically acquired or not. In other words, the data is more difficult to be acquired, so the accessibility is low. The coverage means the ratio of the number of measured services to overall number of services. The larger the ratio means that the higher the coverage. Based on the four criteria, the comparison of two points of views for the IPv6 service availability is shown in Table 2.

Table2. Comparison of two points of views for the IPv6 service availability

Methods	Definition	Criteria				Comparison
		A	B	C	D	
(I) Equal Weighted method in ccTLD	Calculate the ratio of all ccTLD IPv6-enabled services to all ccTLD services.	3	1	1	3	1. Data shall be provided by ccTLD. 2. The importance of each service is treated as equal.
(II) Top k method in Alexa	Calculate the ratio of all IPv6-enabled services in top k popular services to k.	2	2	3	2	1. The high access frequency of services are considered. 2. Consider the world wide access frequency.

4 Statistical Analysis for IPv6 Service Availability Measurement

In this study, we use the above criteria to analyze the measurement methods of the IPv6 service availability and proposed the hypothesis for the statistics of the IPv6 service availability. Based upon the collected service data from Taiwan, New Zealand, Singapore, and Vietnam, we want to verify the proposed hypothesis. Furthermore, the trend of the IPv6 service availability can also be estimated in the future.

In this study, we proposed a hypothesis that the ratio of the IPv6 web service availability for popular web services is at least higher than 5 times of the overall web services for any ccTLD.

The results of four measurement methods for Taiwan are shown in Table 3. In the first method, we calculate the ratio of all .tw IPv6-enabled services to all .tw services. In the second method, we calculate the ratio of the number of IPv6-enabled .tw web services to the number of .tw web services in top 1 million of Alexa. In the third method, we calculate the ratio of the number of IPv6-enabled web services to 500, top 500 web services of Taiwan ranked by Alexa.

Table3. Result of four measurement methods of the IPv6 service availability for Taiwan

Method for measured data	# of measured Services (A)	# of IPv6-enabled services (B)	Ratio of IPv6 web service availability (B)/(A)
(I).tw web services	396,486	7,074	1.78%
(II-1) .tw web service in top 1 million of Alexa	4,694	364	7.75%
(II-2) Taiwan web service in top 500 of Taiwan ranked by Alexa	500	64	12.8%

As mentioned above, we knew that the accessibility for the data acquisition of the method (I) is low, because not all ccTLD registries are willing to provide users' data. On the opposite, the top 1 million service data in Alexa has cover at least 200 ccTLD services. Therefore, we want to estimate the IPv6 service availability based on the public data of Alexa web site. According to our previous knowledge and experience on the IPv6 readiness measurement, we make the following hypothesis.

Hypothesis: The ratio of the IPv6 web service availability for popular web services is at least higher than X times of the overall web services for any ccTLD.

$$X = 5 * \left\{1 - \frac{1}{10} * (n - 2015)\right\}, \quad 2015 \leq n < 2020, n \; is \; the \; year$$

The popular web services in the above hypothesis are acquired from top 500 of a country ranked by Alexa. We collect the ccTLD service data of May 2015 from Taiwan, New Zealand, Singapore, and Vietnam to observe the proposed hypothesis. The definition of three measurement methods is shown in Table 4.

Table4. Definition of four measurement methods of the IPv6 service availability

Methods	Definition
(I)	% of IPv6-enabled ccTLD web services
(II)	% of IPv6-enabled ccTLD web services of the ccTLD services in Top 1 million of Alexa
(III)	% of IPv6-enabled web services in top 500 of a country ranked by Alexa

The Comparison of four ccTLD in different measurement methods of the IPv6 service availability is shown in Table 5.

Table5. Comparison of four ccTLD in different measurement methods of the IPv6 service availability

Methods	Taiwan (.tw)	New Zealand(.nz)	Singapore (.sg)	Vietnam (.vn)
(I)	7,074/396,486 =1.78%	8,202/640,788 =1.28%	3,147/172,899 =1.82%	3,072/278,364 =1.10%
(II)	364/4,694=7.75%	55/1,315=4.18%	204/1,323=15.42%	73/3,554=2.05%
(III)	64/500=12.80%	40/500=8.00%	64/500=12.80%	43/500=8.60%
(III)/(I)	7.2	6.3	7.0	7.8

Based on the four ccTLD data in the above, we observe that the ratio of the IPv6 web service availability for popular web services is at least 6 times of the overall web services. This statistical result shows our hypothesis for ccTLD's IPv6 service availability is true.

Besides, we hope to know the relation of the IPv6 service availability and the IPv6 user availability in a country. We use APNIC IPv6 user availability to compare the IPv6 service availability at measurement method (II) in top 1 million of Alexa, shown in Table 6.

Table6. Comparison of APNIC IPv6 user availability and proposed IPv6 service availability at measurement method (II)

Country (Country code)	IPv6 User Availability from APNIC	(B/A) IPv6 Service Availability of ccTLD in top 1 million of Alexa	(A) # of ccTLD in top 1 million of Alexa	(B) # of IPv6-enabled services in (A)
Belgium (.BE)	**38.66%**	**4.56%**	**2563**	**117**
Germany (.de)	**19.53%**	**12.56%**	**28193**	**3540**
United States of America (.us)	**17.90%**	**6.18%**	**2607**	**161**
Norway (.no)	**11.01%**	**6.71%**	**2431**	**163**
Switzerland (.ch)	**10.14%**	**5.08%**	**2856**	**145**
Czech Republic (.cz)	**9.21%**	**16.17%**	**4719**	**763**
Japan (.jp)	**9.03%**	**1.37%**	**21796**	**298**
Greece (.gr)	**8.99%**	**13.05%**	**5550**	**724**
Romania (.ro)	**8.54%**	**4.09%**	**3518**	**144**
France (.fr)	**5.57%**	**6.50%**	**11948**	**777**
Austria (.at)	**4.27%**	**5.62%**	**2649**	**149**
Taiwan (.tw)	**0.71%**	**7.75%**	**4694**	**364**
China (.cn)	**0.54%**	**0.53%**	**11261**	**60**

Among the top 1 million web services of Alexa, there are around 0.43 million web services belonging to 246 ccTLDs. Because the number of web services collected by Alexa is too small for certain ccTLD, the ccTLD that has more than 2,000 ccTLD web services in Alexa can be chosen for the comparison in this study.

We observe that there is no positive correlation between the IPv6 user availability measured by APNIC and the IPv6 service availability based on Alexa top 1 million web services for a country.

5 Conclusion

Facing the depletion of IPv4 address, how to find a feasible approach which can smoothly and steadily upgrade from the IPv4 network to IPv6 network environment is a globally concerned issue. Based on the statistics of the user availability of Google, the global usage of the IPv6 is still very low. As we knew, the service availability is one of the key factors affecting user availability, how to handle the IPv6 service availability measurement becomes a critical topic for the IPv6 upgrade.

We assume that the popular services can represent the coverage of the service usage in the user availability. The global top one million and top 500 popular web sites from Alexa are used to estimate the service availability of ccTLD.

In this study, we proposed a hypothesis and four criteria, such as representativeness, popularity, accessibility, and coverage, for the evaluation of the measurement method for the IPv6 service availability. The hypothesis is that the ratio of the IPv6 web service availability for popular web services is at least higher than X times of the overall web services for any ccTLD. The X is 5 in Year 2015 and will be decreased 10% every year up to 2020. The popular web services in the above hypothesis are acquired from top 500 of a country ranked by Alexa. Based upon the collected service data from Taiwan, New Zealand, Singapore, and Vietnam, we verified the proposed hypothesis.

Based on the four ccTLD data in the above, we observe that the ratio of the IPv6 web service availability for popular web services is at least 6 times of the overall web services. The statistical results successfully show that our hypothesis for ccTLD's IPv6 service availability is true. The trend of the IPv6 service availability will be estimated based on our methods in the future.

Acknowledgement

This paper is partially sponsored by Ministry of Transportation and Communications, Republic of China, under Grant 1040212coco, and Taiwan Network Information Center (TWNIC).

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