



Experience Sharing on IPv6 Readiness

Che-Hoo CHENG 鄭志豪

The Chinese University of Hong Kong (CUHK) / Hong Kong Internet Exchange (HKIX)



		Measuring IPv6	
	2	labs.apnic.net/ipv6-measurement/Economies/	

World rankings by IPv6 Preference

Economy	v6pref v	3month avg hits/month	notes
RO	10.53%	318573	
LU	9.47%	1847	
EU	9.22%	488	
CH	8.88%	10488	
ER	5.65%	301043	
JP	4.63%	344801	
DE	4.59%	73946	
US	4.31%	432435	
BE	4.16%	48262	
BT	3.77%	209	
PE	3.41%	127003	
SG	2.80%	17566	
CZ	1.51%	67556	
NO	1.40%	14520	
NL	0.88%	78358	
GR	0.75%	183608	
PT	0.72%	40346	
UA	0.70%	63736	
SK	0.55%	33510	
AU	0.50%	29970	
CN	0.47%	687326	
JE	0.45%	225	
NZ	0.40%	18451	
TW	0.35%	97299	
SI	0.33%	17037	
RU	0.32%	132467	
CA	0.29%	107983	
BA	0.27%	50395	
AM	0.26%	12076	
LT	0.25%	28495	
KE	0.23%	3819	
SY	0.22%	456	
MY	0.21%	74440	
FI	0.21%	9726	
AF	0.20%	485	
SE	0.19%	21565	
ZA	0.19%	8751	
HK	0.19%	28556	
GB	0.17%	133962	
DK	0.16%	8606	



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IPv6 Adoption in HK



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< 🔊 🖄 🖄 www.google.com/ipv6/statistics.html#tab=per-country-ipv6-adoption—IPv6 - Coogle

Google | IPv6

Overview

Statistics

FAQs

Statistics

Google collects statistics about IPv6 adoption in the Internet on an ongoing basis. We hope that publishing this information will help Internet providers, website owners, and policy makers as the industry rolls out IPv6.





IPv6 Adoption Worldwide

< 🕨 🙆 😢 www.google.com/ipv6/statistics.html#tab=ipv6-adoption — IPv6 - Google

Google | IPv6

Overview

FAQs

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Statistics

IPv6 Adoption Per-Country IPv6 adoption

IPv6 Adoption

Statistics

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.



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IPv6 Overall Deployment - HK

A > Co Bab.cisco.com/stats/ - Cisco IPv6 Lab: IPv6 Deployment



World | Africa | Asia | America | Europe | Oceania Western Asia | Central Asia | Eastern Asia | Southern Asia | South-Eastern Asia





www.mis-asia.com/resource/internet/surve 🖒

Survey: IPv6 awareness remains low in Hong Kong

Sheila Lam and Teresa Leung | June 8, 2012





Public awareness of IPv6 is limited in Hong Kong while technical knowledge on the new Internet protocol is lacking, according to results of a survey released on Wednesday -- the day of World IPv6 Launch.

The online survey -- done in the first quarter of the year by the City University of Hong Kong -- was commissioned by the Internet Society Hong Kong.

Although 71% of the more than 600 respondents have basic knowledge of IPv4, only 24% of them are familiar with IPv6, survey results indicate.

Among all the industries, manufacturing, restaurants and hotels, and community, social and personal services got the lowest score in IPv6 awareness, according to the personin-charge of the survey, Daniel Tse, Department of Information Systems, City University of Hong Kong.

The survey suggests a huge lack of preparation among individual and business users, he pointed out. Although 63% of respondents agree that local enterprises must switch to IPv6 urgently, only 9.7% are ready to deploy IPv6, said Tse, adding that more than 90% of respondents have no plans to apply IPv6.

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Hong Kong, South Korea lag in IPv6 adoption

Summary: Both technologically-advanced nations are slower in migrating to the new Web protocol than countries such as Thailand, Malaysia and Sri Lanka, and this might impact their competitiveness.

20	By Li	au Yun Qing	Oct	ober 17, 2	012 -	- 10:15 GMT (1	8:15 SGT)	
13	y Fe	ollow @YQLia	uZDN	etAsia				
Comments	0	☆ Votes	0	Like	15	Tweet 49	in Share	more +

Asia's emerging markets are leading mature markets such as Hong Kong and South Korea in IPv6 adoption as these countries have faster growing mobile broadband populations and a smaller pool of IPv4 resources. The mature markets' slow uptake could hamper competitiveness in the long run, according to the Asia-Pacific Network Information Centre (APNIC).

According to a recent study by APNIC, the estimated IPv6 users in Hong Kong and South Korea as a percentage of the overall Internet population are 0.02 percent and 0.01 percent, respectively.

Comparatively, the study showed Thailand, Malaysia, Sri Lanka and Indonesia had higher IPv6 penetration than the two developed markets. Thailand had 0.16 percent of IPv6 users, Malaysia and Sri Lanka both had 0.13 percent, while Indonesia had 0.10 percent, the study revealed.

The top 5 Asian markets in IPv6 adoption were Japan, which came in tops at 2.4 percent, followed by China at 0.67 percent. Australia had 0.42 percent, while Taiwan had 0.19 percent and Singapore 0.17 percent.

In a phone interview with ZDNet Asia Wednesday, Paul Wilson, the director general of APNIC, explained the number of Internet users is growing faster in emerging markets than mature ones such as Hong Kong and South Korea.

This growth, driven by rising mobile broadband subscribers, means more new IP addresses are needed and increases the adoption of IPv6 address, Wilson said, adding this need to adopt IPv6 is not so pronounced in established markets.









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	Guinea-Bissau (<u>gw</u>)		0/3 0/3				1
	Guyana (gy)		0/2 4/6				1
	Haiti (<u>ht</u>)		0/0 2/4				1
	Heard Island and McDonald Islands (<u>hm</u>)		0/3 0/3				
	Honduras (hn)		1/2 2/3				1
\langle	Hong Kong (hk)		9/10 9/10	>			1
	Hungary (hu)		4/6 5/7				1
	Iceland (is)		2/3 5/7				1
	in-addr.arpa (<u>in-addr.arpa</u>)		0/0 6/6				1
	India (<u>in</u>)		1/2 7/8				1
	Indonesia (id)		3/5 4/6				1
	info (<u>info</u>)		3/3 6/6			8	1
	int (int)		0/0 3/5				1







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	Antarctica (aq)		0/13/4				1
	Antigua and Barbuda (<u>ag</u>)		0/0 6/6				1
	Argentina (<u>ar</u>)		0/3 2/5				1
	Armenia (<u>am</u>)		0/0 6/6				1
	Aruba (<u>aw</u>)		0/2 1/3				1
	Ascension Island (ac)		0/2 2/7]
\langle	asia (<u>asia</u>)	\langle	2/2 6/6	>			1
	Australia (au)		9/10 9/10]
	Austria (<u>at</u>)		6/8 6/8				1
	Azerbaijan (<u>az</u>)		0/2 3/5				1
	Bahamas (<u>bs</u>)		0/2 0/3]
	Bahrain (<u>bh</u>)		0/4 0/4]
	Bangladesh (<u>bd</u>)		0/3 0/3			9]
	Barbados (bb)		0/0 0/2				1



IPv6 Certification





The Hurricane Electric IPv6 Certification service provides you a free means to test your IPv6 knowledge and skills. Every day new users sign up for the service. These are the stats showing where the users with the higest certification level are based.

IPv6 Sages are broken down by US state and country.

There are 7,745 IPv6 Sages in 118 countries

Sign up today at http://ipv6.he.net/



Top 20 IPv6 Sage Countries





IPv6 Certification in Asia

	00			IPv6 Sages	by Reg	lion		H ₂
			ww.tunnelbrok	er.net /usag	e/sages	.php	(C Reader
	Asia							
	Count	ry	IPv6 Sages	%	Count	гу	IPv6 Sages	%
<	*	Hong Kong	178	28.16%	\triangleright	Saudi Arabia	6	0.95%
		Indonesia	77	12.18%	٠	Lebanon	6	0.95%
		India	52	8.23%		Nepal	5	0.79%
	*)	China	46	7.28%		Armenia	4	0.63%
		Thailand	43	6.80%		Sri Lanka	3	0.47%
		Taiwan	30	4.75%	• •	Georgia	3	0.47%
		Japan	28	4.43%	Ċ	Pakistan	3	0.47%
	•	Malaysia	25	3.96%		Qatar	2	0.32%
		United Arab Emirates	21	3.32%		Maldives	2	0.32%
	C	Singapore	19	3.01%		Republic of Korea	2	0.32%
		Philippines	13	2.06%	ŵ.	Mongolia	2	0.32%
	\$	Israel	12	1.90%		Bahrain	2	0.32%
	*	Vietnam	11	1.74%	9	Afghanistan	1	0.16%
	C+	Turkey	9	1.42%		Uzbekistan	1	0.16%
		Kazakhstan	8	1.27%	1. S.	Bhutan	1	0.16%
		Cambodia	8	1.27%	٠	Macao	1	0.16%
		Bangladesh	7	1.11%	-60	Azerbaijan	1	0.16%

Total IPv6 Sages: 632



- ISPs in HK cannot get new IPv4 addresses from APNIC anymore after getting their last /22 (for APNIC members only)
 - But larger providers still have some spare IPv4 addresses
- Trading of IPv4 addresses seemingly become active
- Cost of running IPv4 will inevitably become higher and higher
 - IPv4 addresses are more and more expensive to acquire
 - NAT equipment is not cheap
- Deploying IPv6 is more about business survival
 - You may lose business if you do not support IPv6





IPv6 in Hong Kong (1/2)

- Backbone ISPs: Most can provide IPv6 transit service in HK
- **Business-Oriented ISPs:** At least 6 can provide IPv6 access service in limited scale
- **Residential Broadband ISPs:** None can provide IPv6 service yet but it is believed they have started trial
- Mobile Operators: It is believed they have started trial
- Content / Data Center / Web Hosting Service Providers: They are starting to realize the importance of IPv6; At least
 6 Data Centers and at least 2 Web Hosting companies
 support IPv6





IPv6 in Hong Kong (2/2)

- **Government Networks:** They are deploying IPv6 in big scale
 - Most of Government websites are now IPv6 accessible!!!
 - Hong Kong Observatory launched IPv6 NTP service in Mar 2012!!!
 - They even support IPv6 email transport!!!
- Universities: All have IPv6 transport enabled but still need to do a lot of work on servers, network infrastructure and other parts
- Public IPv6 Tunnel Brokers and Teredo / 6to4 Relays in HK providing free services
- **Websites:** More and more are supporting IPv6...







- HKIX is committed to help Internet development in HK
- IPv6 supported by HKIX since Mar 2004
 - Dual stack
- Today, 121 AS'es (out of 200 AS'es in total) have their IPv6 enabled at HKIX (i.e. 60.5%)
- Today, ~8,300 IPv6 routes served by HKIX MLPA route servers
- Most Root / TLD servers at HKIX support IPv6 transport

HK







HK





IPv6 Traffic at HKIX





IPv6 Traffic Contributors









- Check the following link for the full list:
 - http://www.hkix.net/hkix/participant.htm





- People should be fully aware of APNIC's policy change of IPv6 initial allocation criteria
 - Getting independent IPv6 addresses is not difficult
 - Enterprises can get IPv6 addresses (in addition to IPv4 addresses) directly from APNIC after joining as members
- Need TLD servers to support AAAA glue records and run IPv6 transport in order to have full IPv6 experience
 - .HK **Done!**
 - .ASIA Done!
 - Registrars' support is increasing
- Should not just do IPv6 for websites
 - Should also do IPv6 for email, DNS and all other services (such as NTP services e.g. ntp.cuhk.edu.hk)
 - World IPv6 Day/Launch should have given people motivation



IPv6 Readiness Among Universities in HK



IPv6 Survey IPv6 Survey Reader

Hong Kong Universities

Organisation (domain)	Web	Mail	DNS	NTP	XMPP	SIP	Access	Submit
City University of Hong Kong (cityu.edu.hk)	www.ipv6	FAIL	0/3 0/3					
Hong Kong Baptist University (<u>hkbu.edu.hk</u>)	FAIL	FAIL	0/2 0/2					
Lingnan University (In.edu.hk)	FAIL	FAIL	0/21/3					
The Chinese University of Hong Kong (cuhk.edu.hk)	SUCCESS	FAIL	4/4 4/4	Stratum 2		FAIL		>
The Hong Kong Institute of Education (ied.edu.hk)	FAIL	FAIL	0/5 0/5					
The Hong Kong Polytechnic University (polyu.edu.hk)	FAIL	FAIL	0/2 0/2					
The Hong Kong University of Science and Technology (<u>ust.hk</u>)	PROBLEM	FAIL	0/2 0/2	PROBLEM				
The University of Hong Kong (hku.hk)	PROBLEM	FAIL	4/4 5/5	FAIL				



IPv6 Readiness Among Networks in HK



HKIX





IPv6 Policy at CUHK

- IPv6 Policy endorsed by IT Policy Committee of CUHK
 - Campus-Wide IPv6 Deployment as CUHK's IT direction
- Deployment Strategy
 - Backbone is IPv6 ready (dual-stack)
 - Main public-facing services be implemented first
 - DNS, Main Websites and NTP services are done
 - Email services and other services to be done
 - IPv6 as mandatory requirement of all purchases of hardware, software and equipment
 - Gradually replace old hardware/software with new ones that support IPv6
 - Support departments
 - Selection of H/W, S/W and equipment
 - Implementation guidelines and configuration templates are being set up
 - Training



Network Interconnections **HK** at CUHK – IPv4 & IPv6 Dual Stack





Deployment Status at CUHK



- An APNIC member
 - Have gotten the last /22 from APNIC already
 - Also gotten a few /24's from HARNET (AS3662)
- IPv4: ~1.4 x /16 (AS3661 & AS4641)
- IPv6: 1 x /32 (AS3661) and 1 x /32 (AS4641)
- Deploying native IPv6 for dual-stack
- Firewalls, email security gateways and others being upgraded one by one
- Shortage of IPv4 addresses within campus is already happening
 - While adding IPv6 capability to services like WiFi and VPN, NAT44 for WiFi and VPN is being deployed to save IPv4 addresses
- Most departmental networks and servers are not IPv6 enabled yet



Deployment Issues Faced **HK** at CUHK (1/2)

- IPv6 Addressing Scheme
 - Doing renumbering from IPv4-address-related to VLAN#-related
- Backbone Routers
 - Relatively easy for dual-stack
 - HSRPv6 support to be added
- DNS servers
 - Relatively easy
 - Had waited for registry/registrar's support for authoritative servers
 - Distribution of DNS Resolver IPv6 addresses?
 - Not using DHCPv6 so cannot do it
 - Dual stack so IPv4 addresses are fine for now
 - Not to forget about Reverse DNS for servers
- Email Security Gateways
 - Not really mature so waiting for the next software version
- Exchange 2010
 - Need IPv6 to install, should disable 6to4
- Web servers
 - Only <u>www.cuhk.edu.hk</u> and <u>www.hkix.net</u> for now
 - Cluster on Solaris does not support IPv6
 - Use dynamic DNS for HA purpose
 - Need to push for other web servers (if not behind load balancers)



Deployment Issues Faced HK at CUHK (2/2)



- Bigger FWs for servers finally upgraded for consistent IPv4/IPv6 policies
- Virtual FWs not ready for IPv6
- Load Balancers
 - Not support IPv6 because of old models
 - With new models, will use dual-stack even on the private network side
- Desktops
 - Takes time
 - Need to push hard
- WiFi
 - Under trial, not stable enough yet
- VPN
 - Not quite support IPv6 yet
- Other Security Devices
 - A lot of security devices do not quite support IPv6
- Network / System Management
 - Takes time
- Still a lot of work remaining but we will keep on the hard work and be persistent







- IPv4 addresses are really running out
- NAT is being used more and more extensively
 But it cannot sustain in long term
- IPv6 is the only long-term solution
- Business/Residential broadband ISPs are the main hurdles
 - Technical users are starting to complain hard
 - ISPs must work hard on the deployment
 - Otherwise, they will lose business to their competitors which support IPv6



Users can help push IPv6 to happen faster



- Most updated equipment and software support IPv6
- When replacing old equipment and software, make IPv6 as mandatory requirements
- If providers or vendors are not 100% ready, FORCE them to be 100% ready immediately!
 - Should give preference to providers and vendors which have started IPv6 earlier because they have more experience





Hong Kong is slowly progressing on IPv6 **Competition will help drive IPv6 deployment** Persistence is the key to

<u>success</u>





Thank you!