IPv6 Deployment: Where are we now?

ICANN49, Singapore

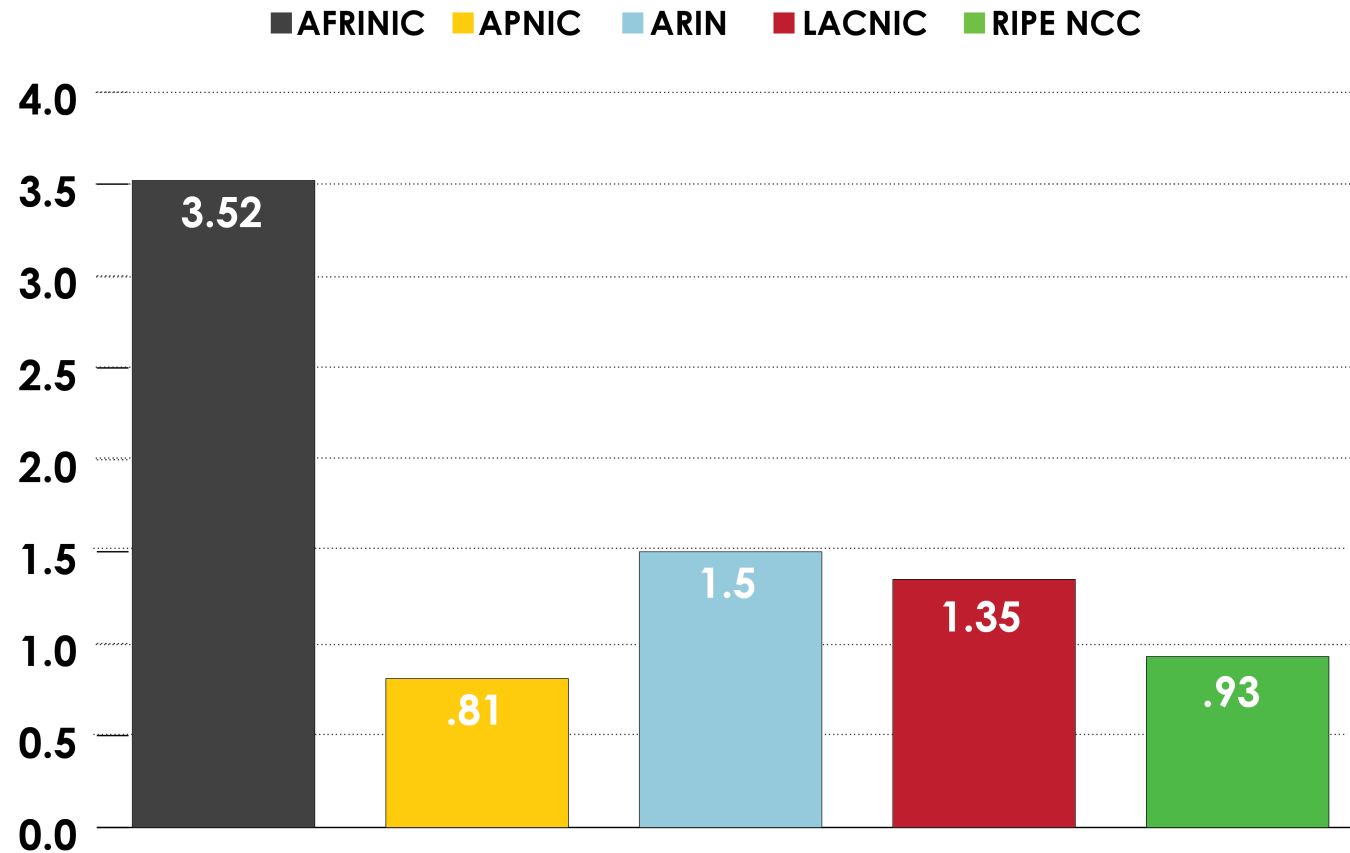March 2014

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Agenda

- Status update of IPv4 address exhaustion

- A quick overview of IPv6 readiness among in the AP region
  - Review of several statistics
  - Transit providers and Content Providers
  - IPv6 ready end users

- Review of IPv6 readiness statistics by economy
  - Partnership between public and private sectors

- Growth path of the Internet

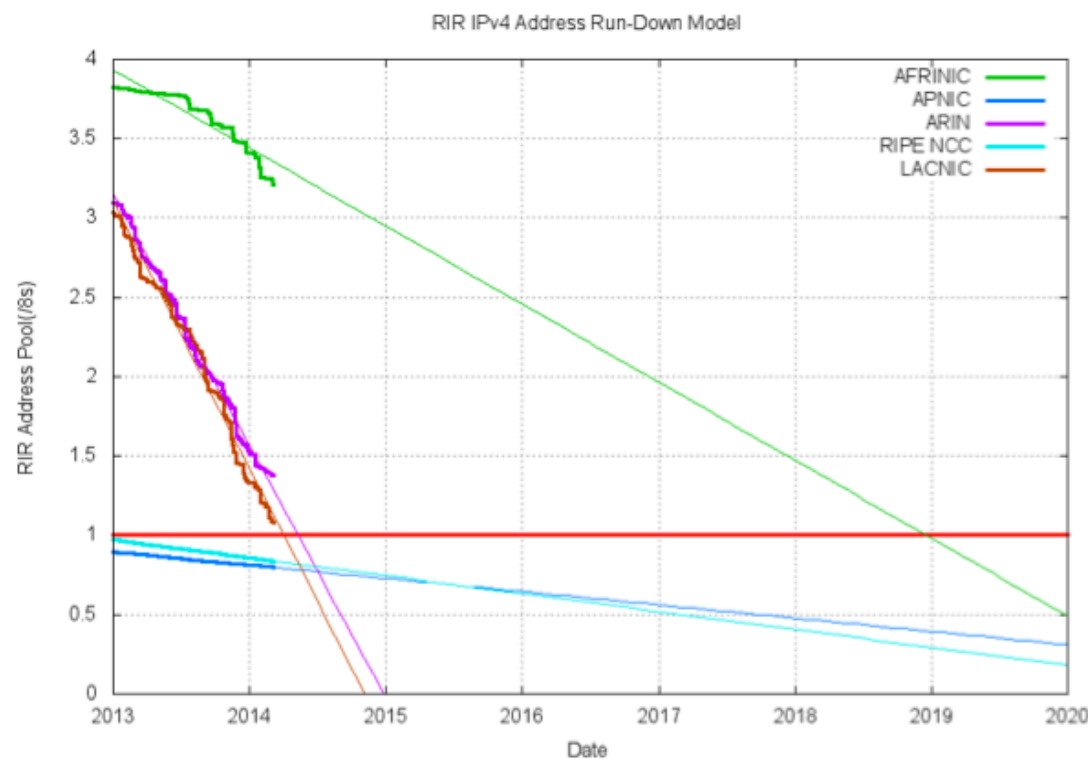- Conclusion

Status update of IPv4 address exhaustion

Review of several statistics

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Available IPv4 /8s in each RIR

■ AFRINIC ■ APNIC ■ ARIN ■ LACNIC ■ RIPE NCC

Value	RIR
3.52	AFRINIC
.81	APNIC
1.5	ARIN
1.35	LACNIC
.93	RIPE NCC

December 2013

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IPv4 address exhaustion Projection

RIR IPv4 Address Run-Down Model

Projection of consumption of Remaining RIR Address Pools

Projected RIR Address Pool Exhaustion Dates:

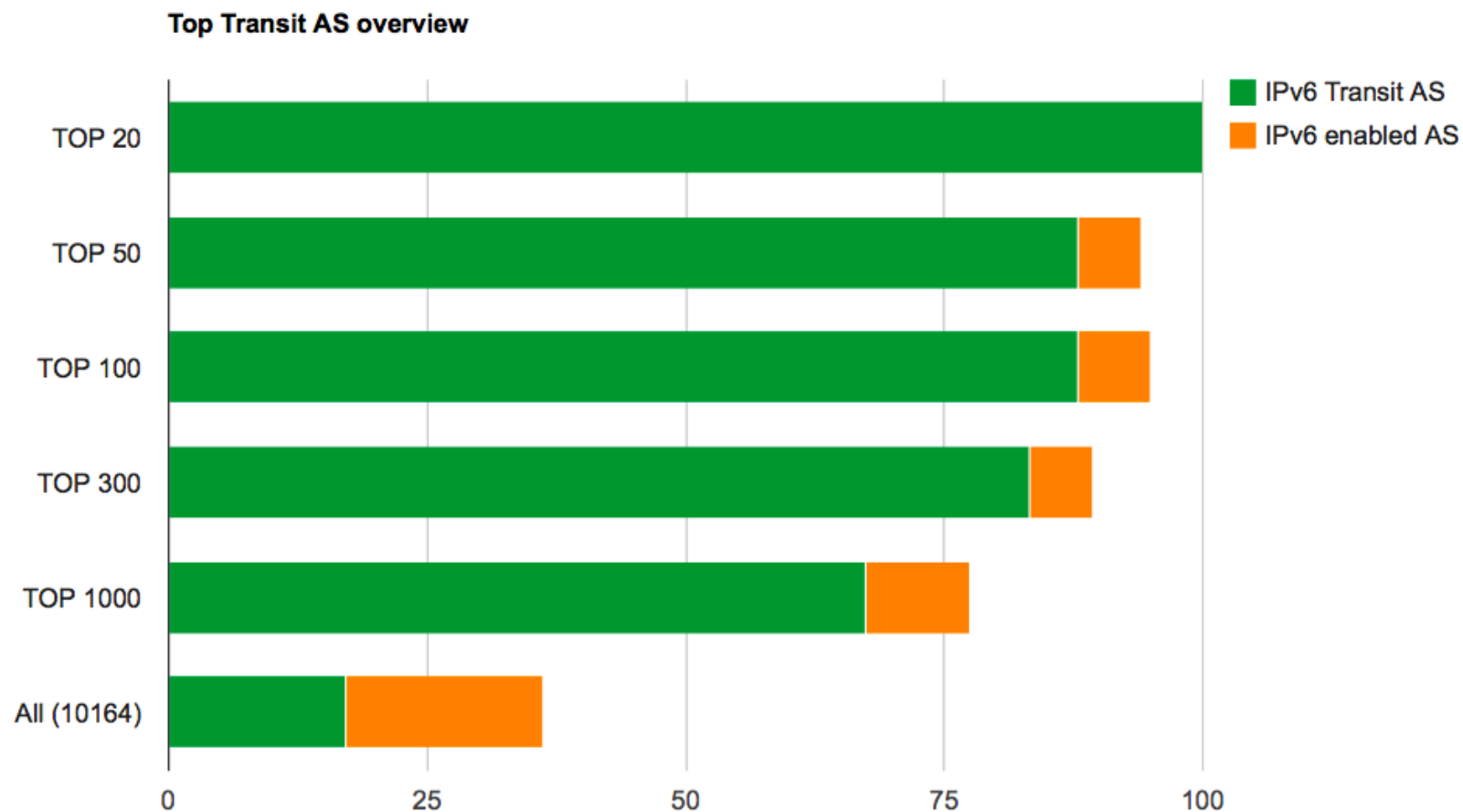| RIR	Projected Exhaustion Date
APNIC:	**19-Apr-2011** (actual)
RIPE NCC:	**14-Sep-2012** (actual)
LACNIC:	**09-Nov-2014**
ARIN:	**04-Mar-2015**
AFRINIC:	**22-Dec-2020**

http://www.potaroo.net/tools/ipv4/index.html

IPv6 readiness in the world

Review of several statistics

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IPv6 adoption in Internet core networks

http://6lab.cisco.com/stats/cible.php?country=world

World ranking
IPv6 ready web sites http://www.vyncke.org/ipv6status/

Rank	Country	Sample	Green	Orange
1	Vanuatu	42	40.5% (17)	0.0% (0)
2	Maldives	13	30.8% (4)	0.0% (0)
3	Slovenia	50	30.0% (15)	0.0% (0)
4	Czech Republic	50	30.0% (15)	0.0% (0)
5	Brazil	50	28.0% (14)	0.0% (0)
6	United States of America	50	22.0% (11)	2.0% (1)
7	Singapore	50	22.0% (11)	0.0% (0)
8	Netherlands	50	18.0% (9)	4.0% (2)
9	India	50	16.0% (8)	0.0% (0)
10	Switzerland	50	16.0% (8)	0.0% (0)

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IPv6 enabled web sites among Alexa top-50

IPv6-enabled Web Sites in worldwide countries followed since 2010 (2014-03-07) www.vyncke.org/ipv6status

AAAA for www.* reachable

http://www.vyncke.org/ipv6status/plotsite.php?metric=w&global=legacy&pct=y07/03/2014
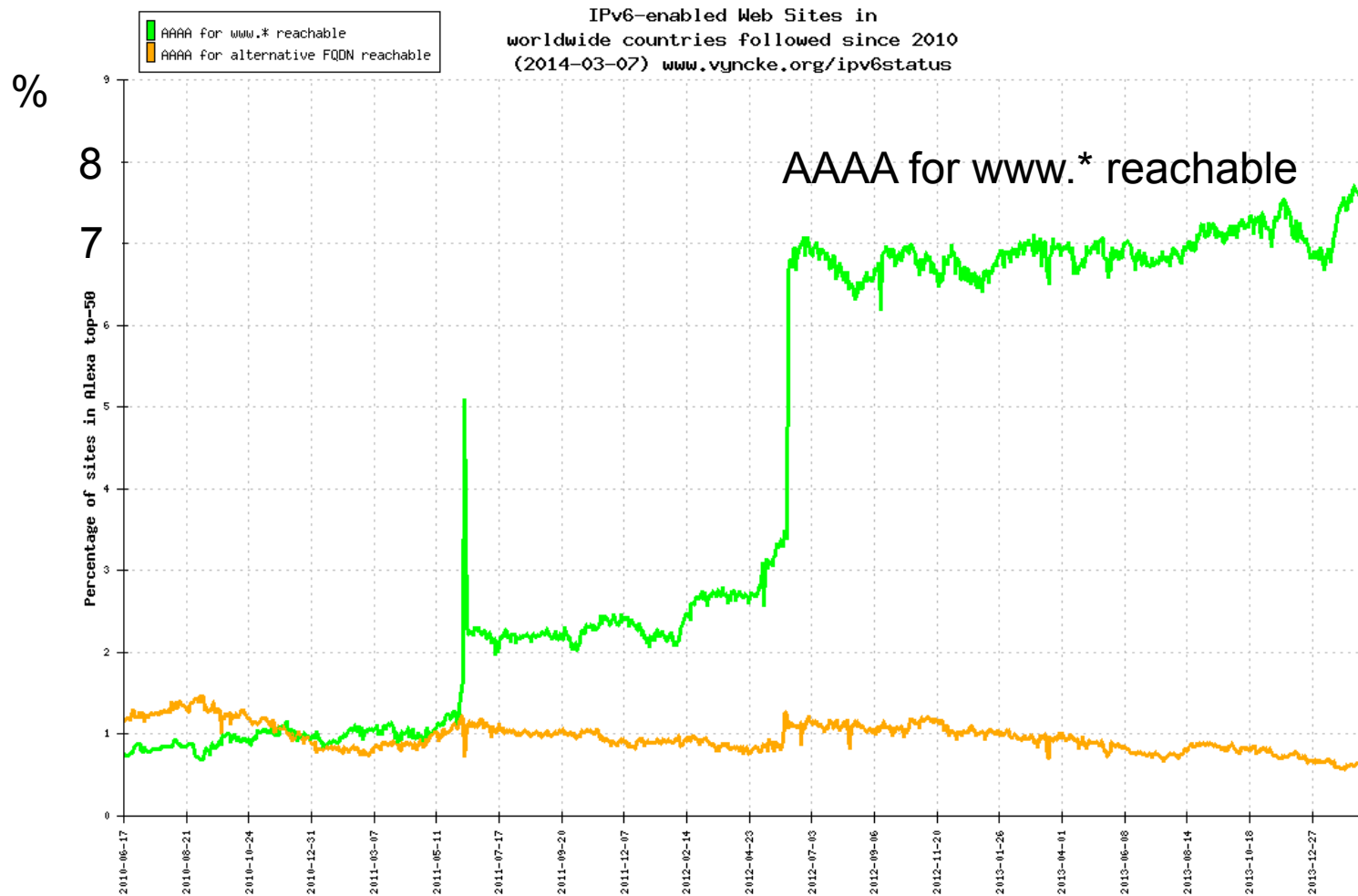
IPv6 measurement
End user readiness: World
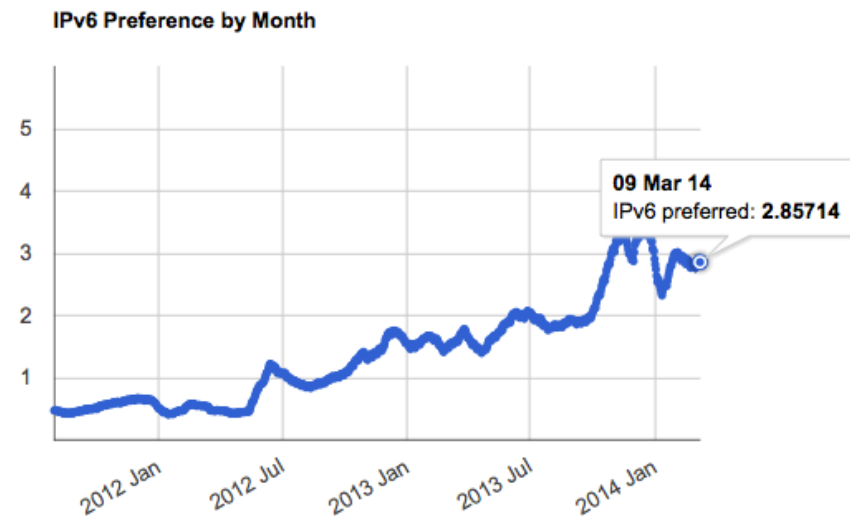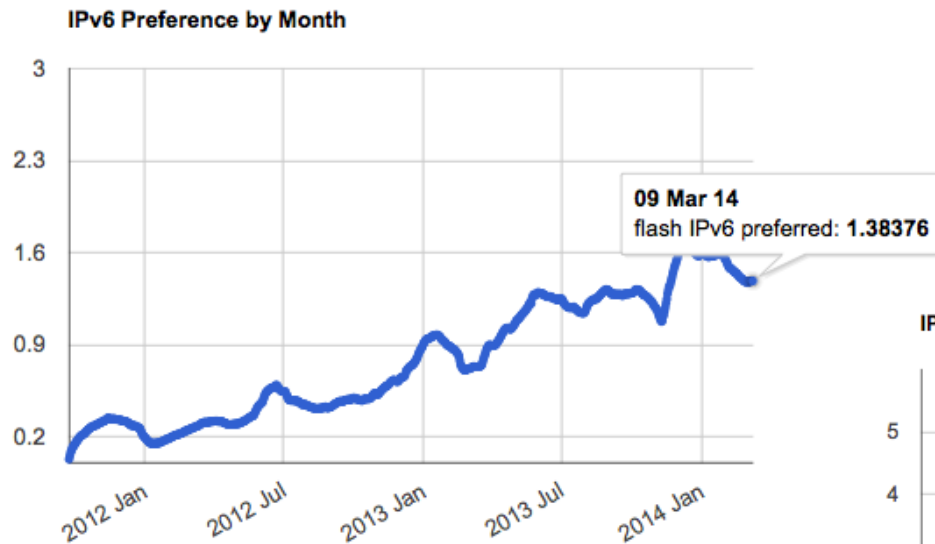
http://labs.apnic.net/ipv6-measurement/Regions/001%20World/ as of 6/2/2014

Data source from "flash" and "JavaScript" and including viewers from mobile devices

IPv6 deployment leaderboard in the World (commercial operators)

ASN	Entity	Economy	IPv6 preferred rate
22394	Cellco Verizon Wireless	US	55.60
18126	CTCX Chubu Telecommunications Company; Inc.	JP	37.59
55430	STARHUBINTERNET-AS-NGNBN Starhub Internet Pte Ltd	SG	36.55
2516	KDDI CORPORATION	JP	30.06
3303	Swisscom (Switzerland)	CH	27.43
8708	RSC & RDS SA	RO	24.38
12322	PROXAD Free SAS	FR	22.89
20825	Unitymedia NRW GmbH	DE	22.19
6389	Bellsouth net Inc.	US	20.26
7018	AT&T Services Inc.	US	18.41
4739	INTERNODE-AS Internode Pty Ltd	AU	17.76
7922	Comcast Cable Communications	US	16.90
23655	Snap Internet Limited	NZ	15.87
21928	T-Mobile USA	US	12.26
4773	MobileOne Ltd Mobile/Internet Service Provider	SG	10.49

http://labs.apnic.net/ipv6-measurement/AS/ March 2014

IPv6 in ICANN 2013 RAA

- ICANN has updated their "Registrar Accreditation Agreement (RAA)" in June 2013
  - All ICANN accredited registrars must sign to continue their affiliation with ICANN
  - "3.19 Additional Technical Specifications to implement IPv6, DNNSEC and IDNs. Registrar shall comply with the Additional Registrar Operations Specification attached hereto."
    - Registrar shall provide an interactive web page and a port 43 Whois service via both IPv4 and IPv6

http://www.icann.org/en/resources/registrars/raa/proposed-agreement-07mar13-en.pdf

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Observation

- IPv6 deployment status is varied among regions, economies and individual ASN (network operators)
  - IPv6 deployment is not happening all at once
  - Some economies have been very active in terms of IPv6 deployment
  - Some ASNs have been very active in terms of IPv6

- Let's look into some statistics and anecdotal evidences of some economies in the AP region

IPv6 deployment status in the AP region

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China

- Announcement made by the Chinese State Council in Nov 2011
  - IPv6 mandates to the Industry
    - "China will put Internet Protocol version 6 (IPv6) into small-scale commercial pilot use and form a mature business model by the end of 2013, the State Council recently said at an executive meeting about the main goals and road map for the China Next Generation Internet project" (People's Daily Online, Jan 2012, http://english.people.com.cn/90778/7696495.html)
    - 3 million users for each operators by 2013
    - 25 million users by 2015
  - SPs in China are responding to this mandate

China

## IPv6 Plan of e-Government Extranet

CNIC
中国互联网络信息中心
CHINA INTERNET NETWORK INFORMATION CENTER

■Chinese authorities pay great attention on the Next Generation Internet based on IPv6 and have issued a series of announcements to specify the target and roadmap of development of next generation Internet, providing policy and financial supporting measures

■Following the important principle 'Government network must go first for the informatization', national e-government extranet (e-government public infrastructure) will take the lead in the field of e-government planning, deployment and pilot IPv6 related technologies

■IPv6 is a must for the e-government extranet, because with the expanding coverage of e-government network and increasing services& applications, IPv4 shortage is a big barrier for system deployment and providing new services

http://conference.apnic.net/data/36/cnnic-update_2013.8.27_1377563880.pdf

China: Stats
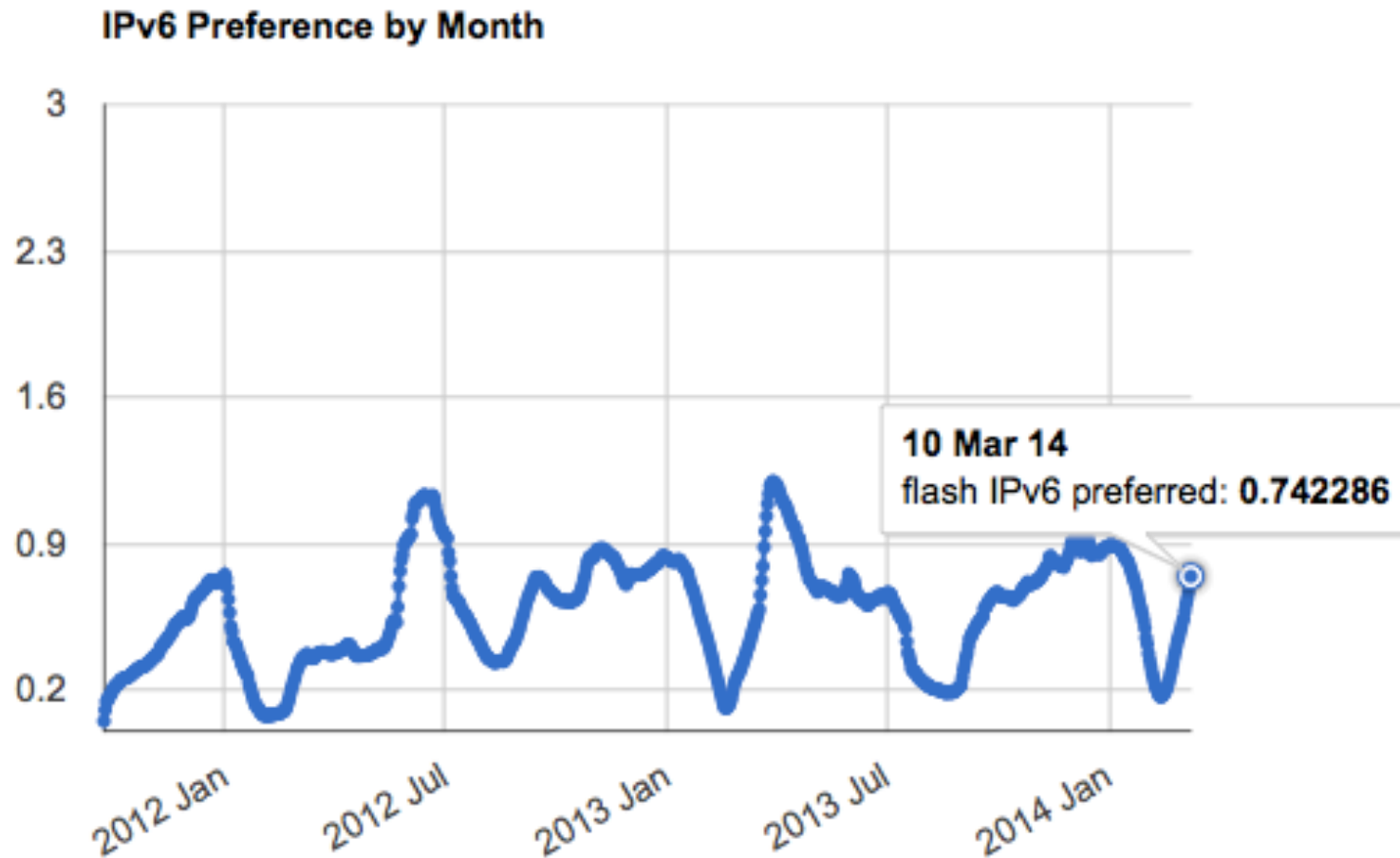
Hong Kong

- Series of initiative provided by Hong Kong OGCIO
    - Supported academic research on IPv6 since 2003
    - Government backbone network was enabled with IPv6 in 2008
    - Government Internet Gateway systems was enabled with IPv6 in 2009
        - Public facing government services (200 website) are on IPv6
    - Supported the ISOC Hong Kong to organize the "IPv6 in Action!" project in 2012
        - APNIC provided our expertise for this project

http://www.ogcio.gov.Hong Kong/en/business/tech_promotion/ipv6/ipv6_development_in_Hong Kong.htm

Hong Kong: Stats

IPv6 Preference by Month

03 Mar 14
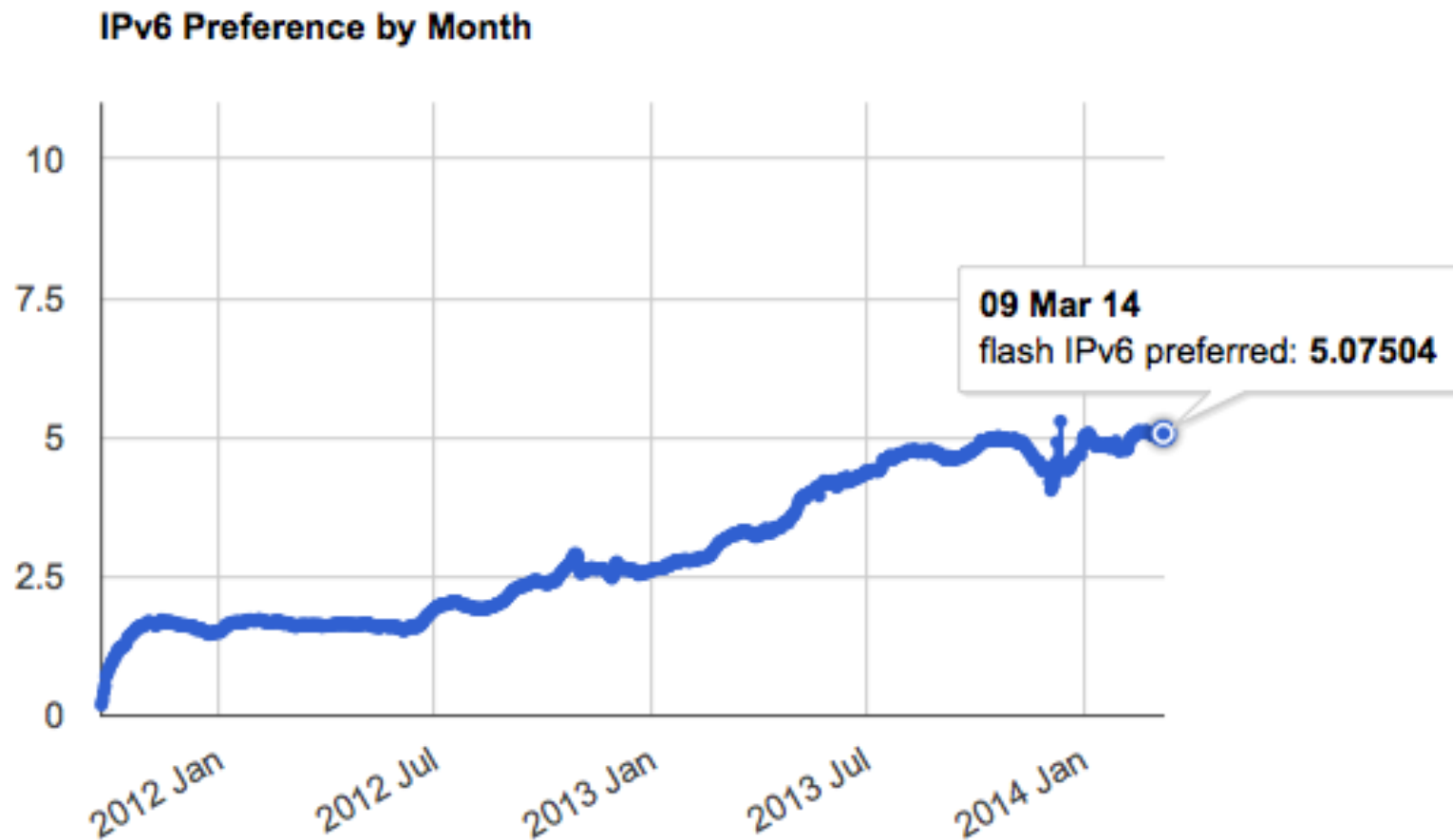flash IPv6 preferred: **0.288966**
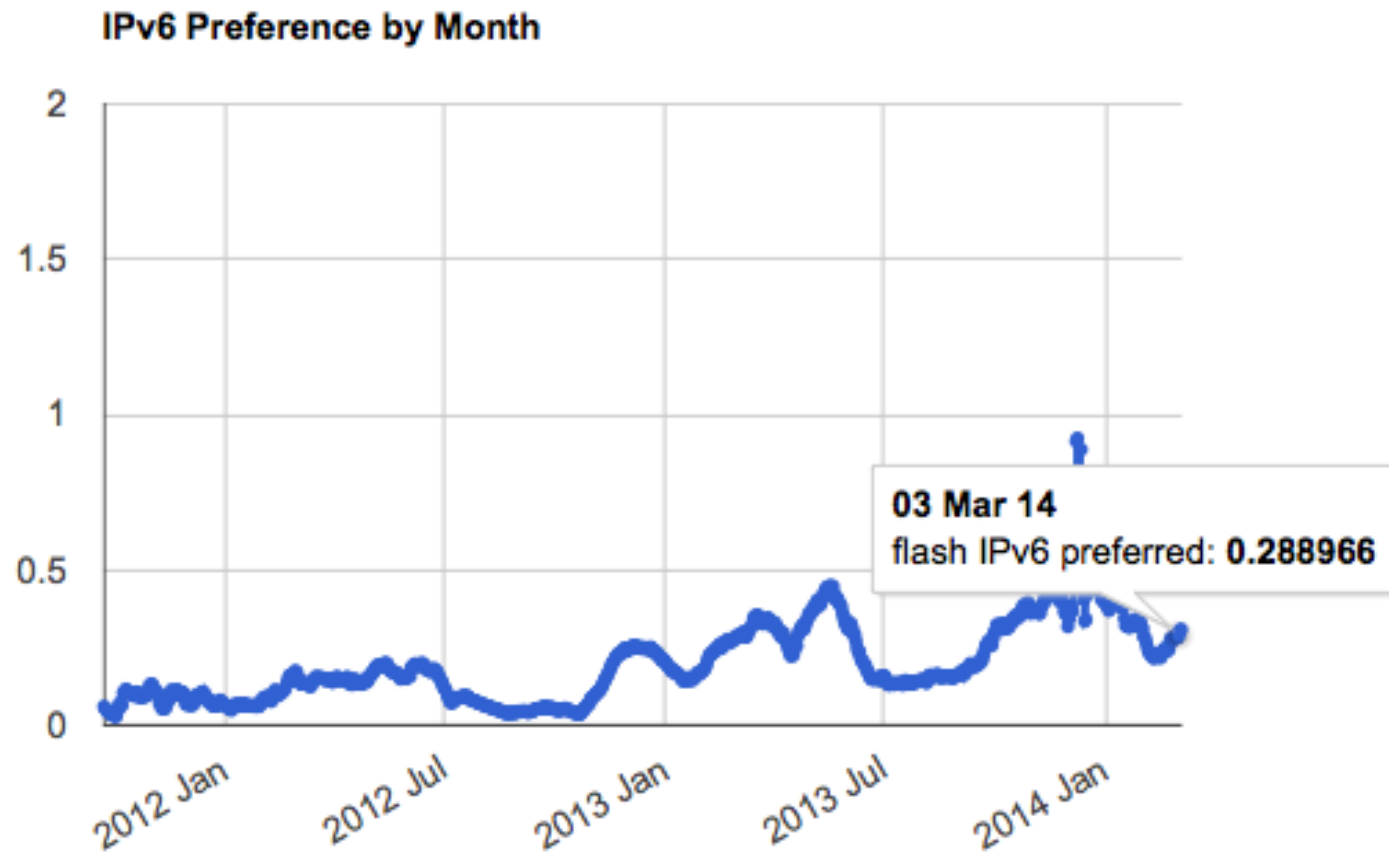
Japan

- Ministry of Internal Affairs and Communications conducts regular IPv6 Study Group
  - Partnership between the public and private sectors
    - Detailed field level discussions
  - Most recent one on July 2013
    - Active discussion on CGN: concerns on its relatively high costs, possible negative impact to end users
    - Update on usage of existing IPv6 test bed (APs and CPs)
    - Discussion on potential formats of IPv6 service deliveries: Default IPv6 services
      - Some providers are experiencing positive result
    - Discussion on IPv6 services in mobile networks
    - Discussion on developing IPv6 security guidelines

http://www.soumu.go.jp/main_sosiki/joho_tsusin/policyreports/chousa/ipv6_internet/02kiban04_03000222.html

Japan: Stats

IPv6 Preference by Month

09 Mar 14
flash IPv6 preferred: **5.07504**

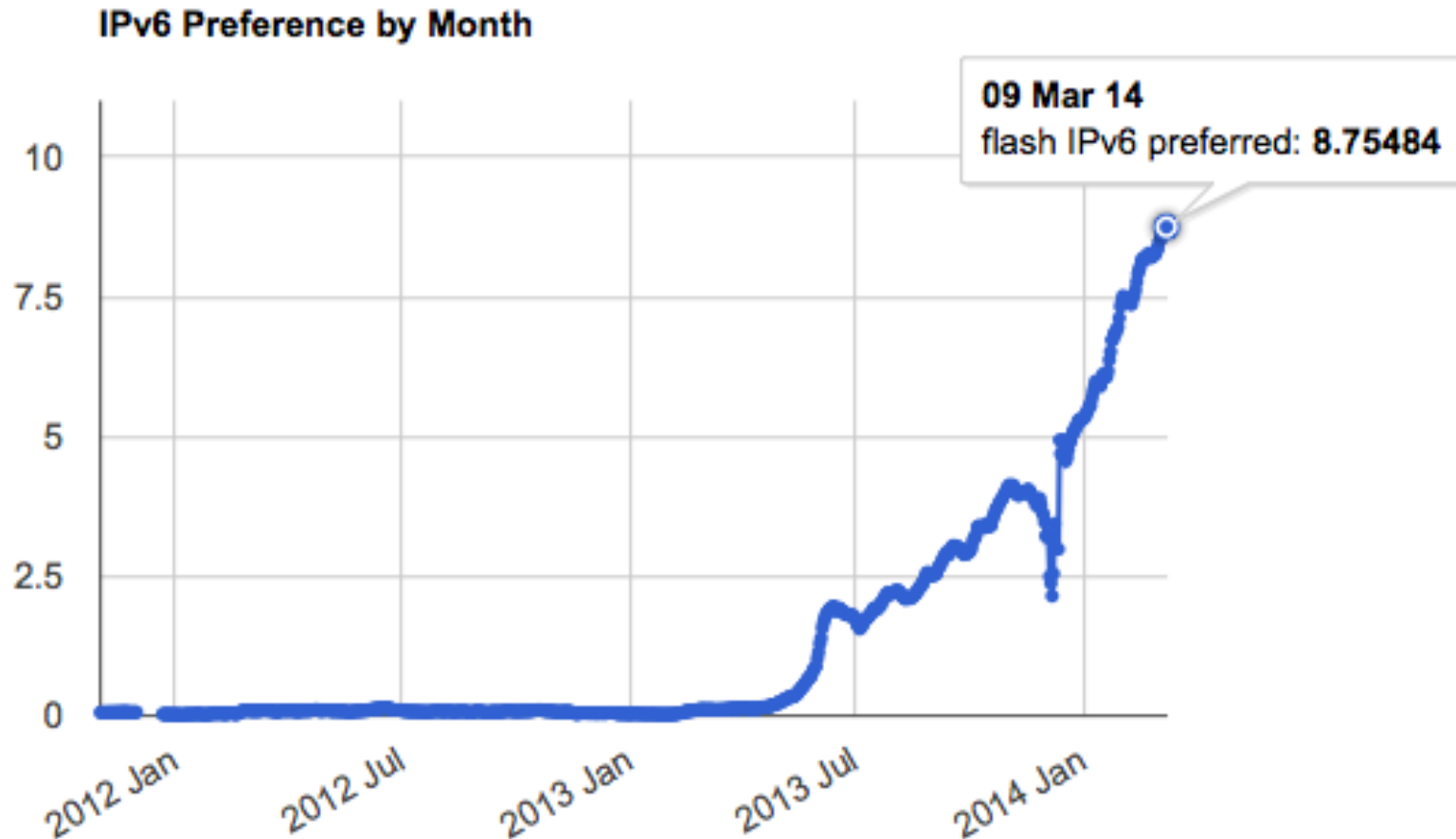http://labs.apnic.net/ipv6-measurement/Economies/JP/

Singapore

- IPv6 Transition Program lead by Infocomm Development Authority (iDA) of Singapore
  - To apply multi-stakeholder approach in conjunction with "pull" and "push" strategies to support IPv6 adoption
    - Create Initial IPv6 demand by enterprises, government agencies, content and application providers
    - Create IPv6 supply by network providers
    - Drive competency across multi-stakeholders
    - Ensure IPv6 and IPv4 performance equity by hardware and software vendors
    - Raise awareness on IPv6 across multi-stakeholders
    - Managing IPv4 address exhaustion mainly by network providers
  - To address the issue of IPv4 exhaustion and to facilitate the smooth transition of the Singapore inforcomm ecosystem to IPv6
  - To promote IPv6 adoption in the local industry

http://www.ida.gov.sg/Infocomm-Landscape/Technology/IPv6

Singapore: Stats

IPv6 Preference by Month

09 Mar 14
flash IPv6 preferred: **8.75484**

http://labs.apnic.net/ipv6-measurement/Economies/SG/
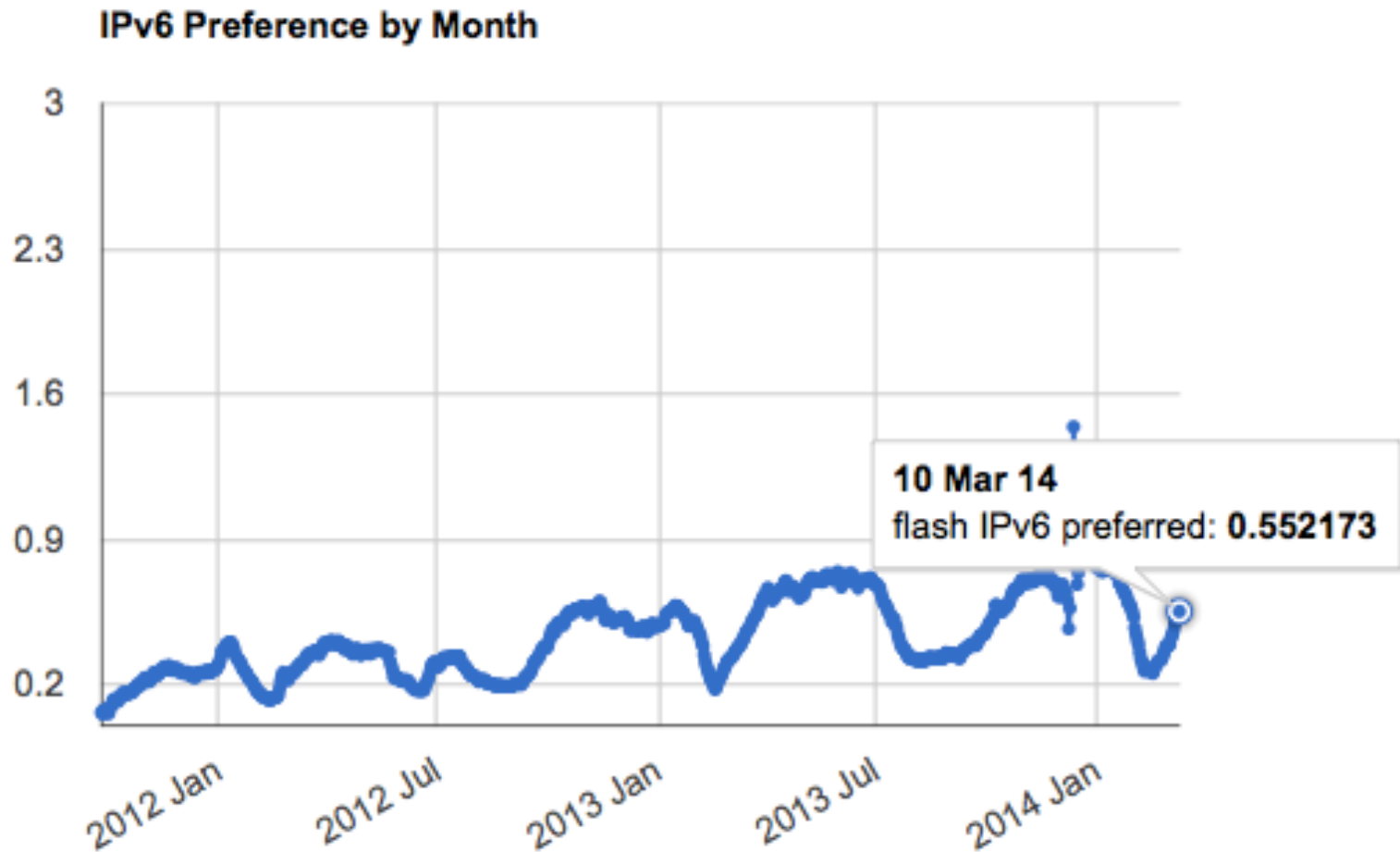
Taiwan

- "IPv6 Upgrade Promotion Program" lead by Ministry of Transportation and Communications

- Objectives
  - Seamless transfer from IPv4 to IPv6 network environments in Chinese Taipei
  - National Information and Communication's Initiative to actively promote the gradual upgrade to IPv6
    - By 2013: Enable dual stack among 50% of public network services (Web, DNS, email)
    - By 2015: Enable dual stack the remaining public network services
    - Around 2016: All governments related network services to be IPv6 enabled around 2016
  - Monitoring IPv6 deployment status
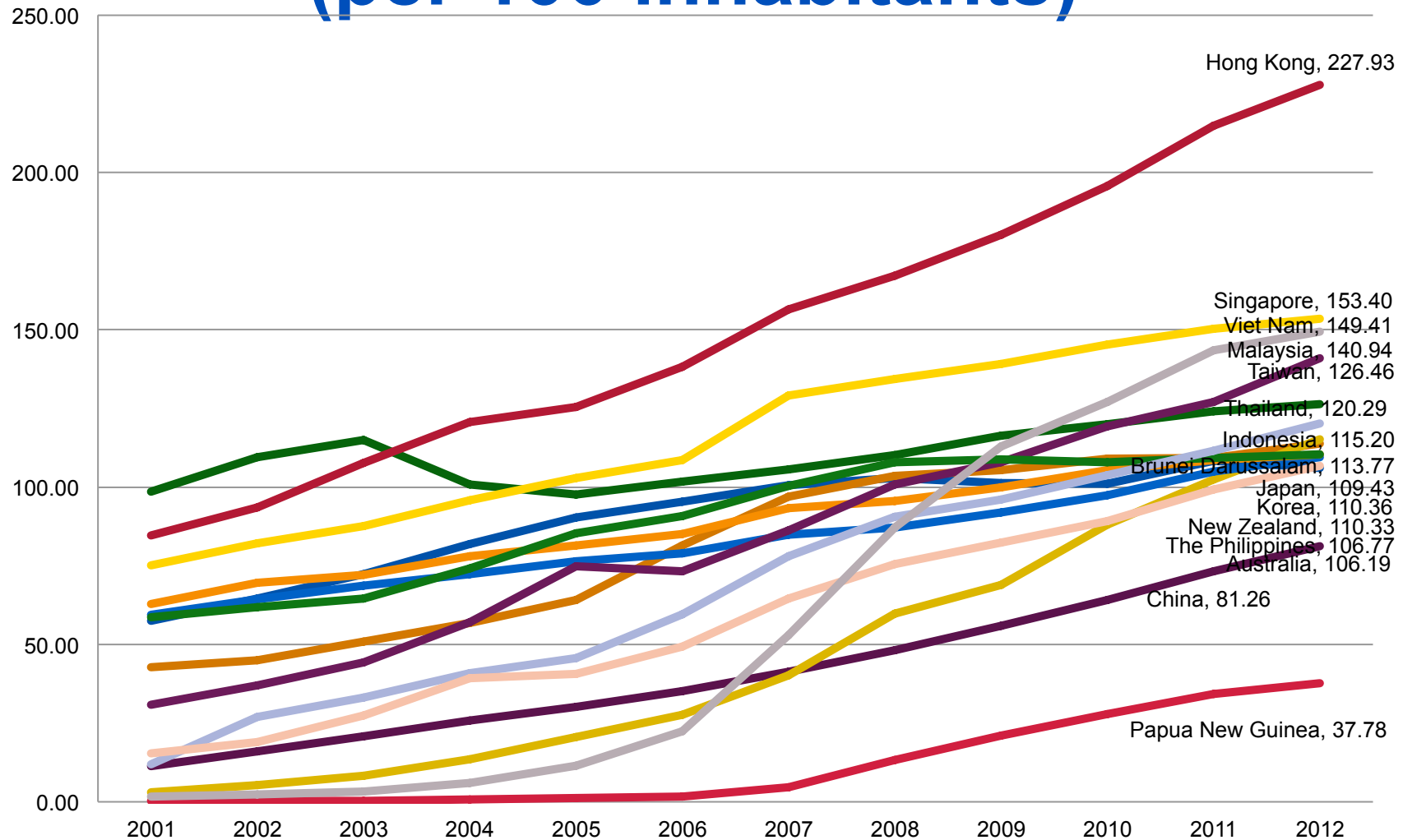 - Active engagement among multi stakeholders

http://conference.apnic.net/36/program#/speaker/Sheng-Wei%20Kuo

Taiwan: Stats

IPv6 Preference by Month

10 Mar 14
flash IPv6 preferred: **0.552173**

http://labs.apnic.net/ipv6-measurement/Economies/TW/

Growth path of the Internet

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Mobile cellular subscription (per 100 inhabitants)

Hong Kong, 227.93
Singapore, 153.40
Viet Nam, 149.41
Malaysia, 140.94
Taiwan, 126.46
Thailand, 120.29
Indonesia, 115.20
Brunei Darussalam, 113.77
Japan, 109.43
Korea, 110.36
New Zealand, 110.33
The Philippines, 106.77
Australia, 106.19
China, 81.26
Papua New Guinea, 37.78

Mobile cellular subscription (per 100 inhabitants)

- More than one subscription per person
- Hong Kong : 225, Singapore: 150, Vietnam: 150, Malaysia: 140, Taiwan: 125, Thailand: 120, Indonesia: 115
- We can conclude that aspiring economies are moving straight to Mobile networks.

Hong Kong, 227.93

153.40
149.41
140.94
126.46
120.29
115.20
113.77
109.43
110.36
110.33
The Philippines, 106.77
Australia, 106.19
China, 81.26
Papua New Guinea, 37.78

http://statistics.apec.org/index.php/key_indicator/index

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Global LTE growth focus

Millions of Subscriptions

Global LTE Subscriptions will surpass 1 billion by 2018.

9 — 2011
63 — 2012
134 — 2013
252 — 2014
406 — 2015
633 — 2016
947 — 2017

Source: Informa Telecoms & Media, Subscription Forecast, February 2013
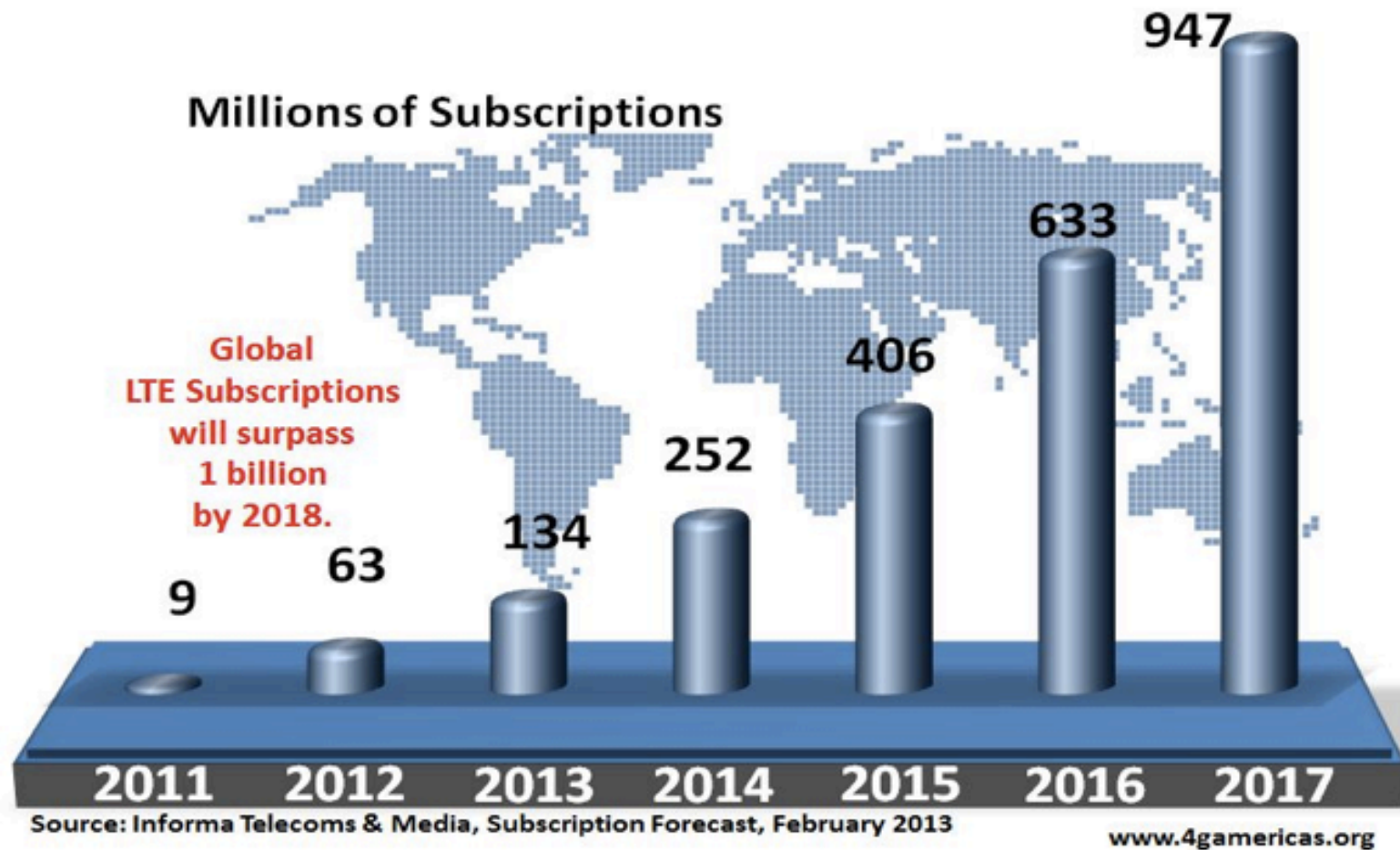
www.4gamericas.org

www.4gamericas.org/index.cfm?fuseaction=page&pageid=1781

LTE user devices 2011 - 2013
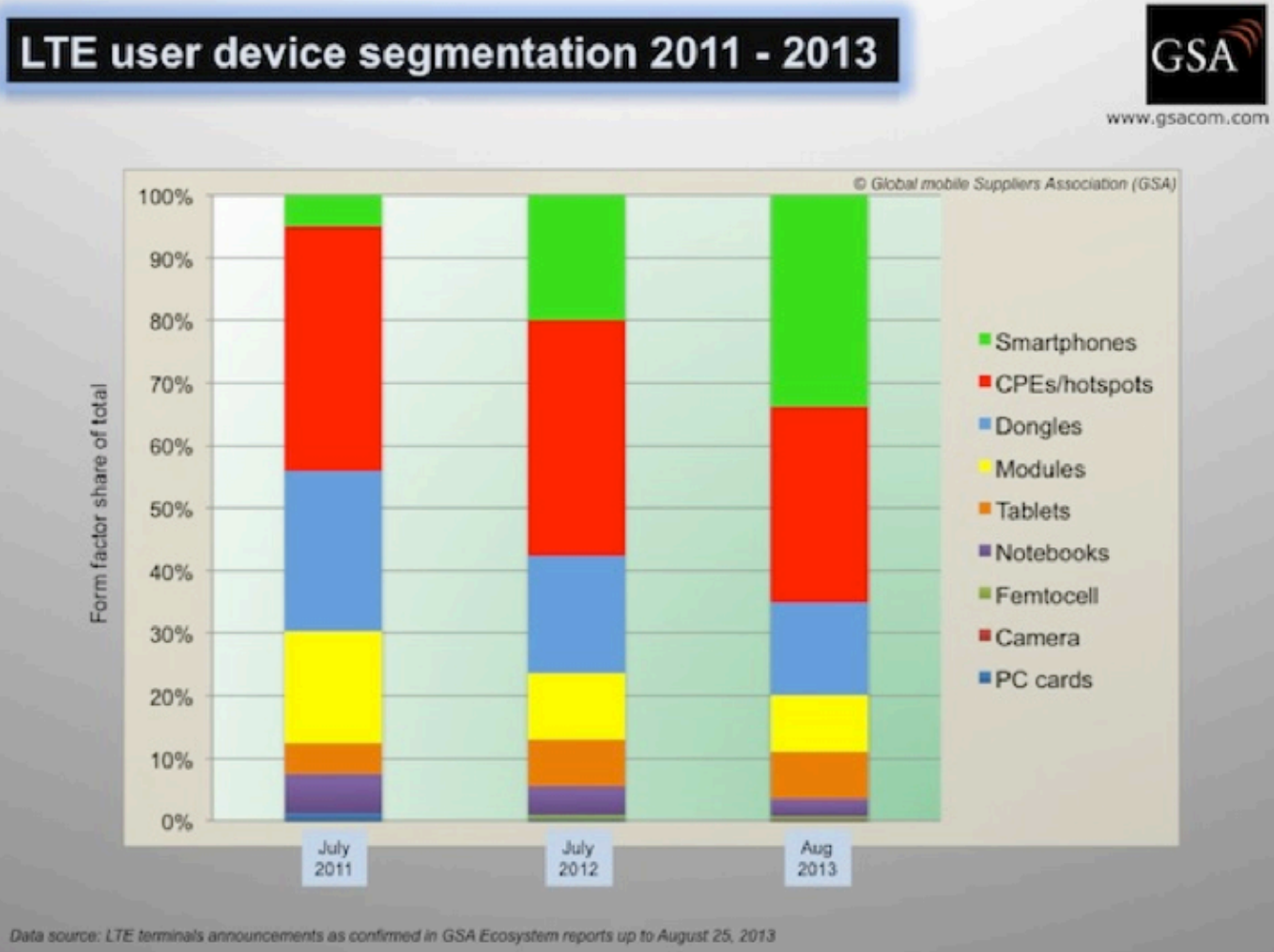
http://www.gsacom.com/news/gsa_387.php

Mobile networks

- ## The business competency of mobile network operators:
  - Shifting from being a traditional voice and messaging provider to a mobile broadband service provider
  - Services on voice, messaging and data are converging on IP based services
  - Rapidly increasing LTE deployment in the region

- ## Decision makers' (mobile network operators) view
  - Ready to move to Voice over LTE?
  - Mobile cloud computing on top of the LTE network?
  - What are key building blocks of all-IP strategy?

http://lteconference.wordpress.com/

Case Study
T-Mobile USA IPv6 on LTE Story

- Lack of IPv4 address space combined with rapid growth in "always-on" devices prompted a re-think on IP addressing strategy in late 2009
  - IPv4 does not fit the business need
  - IPv6 deployment in 3GPP is easy

- Feasibility study and impact assessment on IPv6 deployment took about 9 months

- T-Mobile USA started IPv6 friendly user trial in 2010 on their 2G/3G/HSPA network
  - Currently settled with IPv6-Only + 464XLAT transition technology to make everything work with IPv6-Only

- T-Mobile USA did not spent any CAPEX to deploy IPv6

- Introduction feature to handsets is a slow and careful process

http://conference.apnic.net/__data/assets/pdf_file/0010/58870/tmo-ipv6-feb-2013_1361827441.pdf

Conclusion

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Support the current and future growth

- The end-to-end Internet principle allows many stakeholders to interact directly, and provide foundation for innovation
  - The Internet is a highly diverse and flexible amalgam of many components
  - The speed of innovation is rapid

- Internet industry is at a critical turning point
  - Choosing technologies that support the current business model, while establishing a foundation for a future business model is no simple task
    - There is no one strategy that fits all
  - Key success factor: Information sharing and continuous collaboration among multi-stakeholders of the Internet

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www.apnic.net/ipv6

www.apnic.net/ipv6

> Key IPv6 messages

> IPv6 data and statistics

> IPv6 transition stories

> IPv6 for governments

> IPv6 Best Current Practices

> IPv6 for Decision Makers

> IPv6 for CTOs

> About CGN

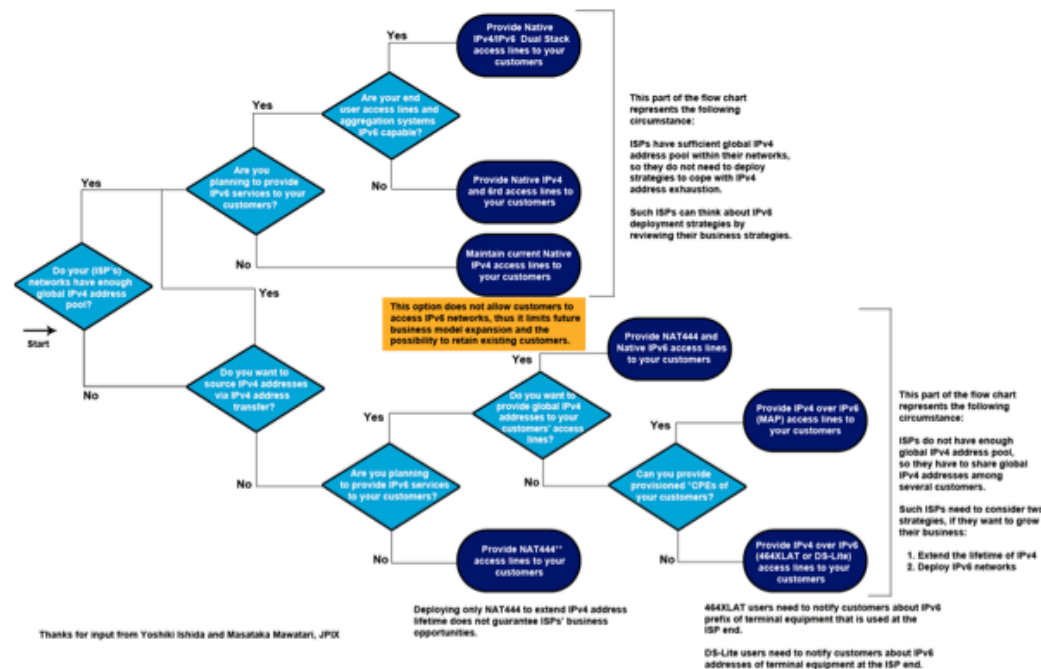# IPv6 for CTOs

http://www.apnic.net/community/ipv6-program/ipv6-cto

A quick glance of the options currently available:

IPv6 transition while extending IPv4 address life time:

Thank you!

This presentation file is available at:

<www.apnic.net/presentations>