Governmental Policy and IPv6 Adoption:
Strategic Linkages

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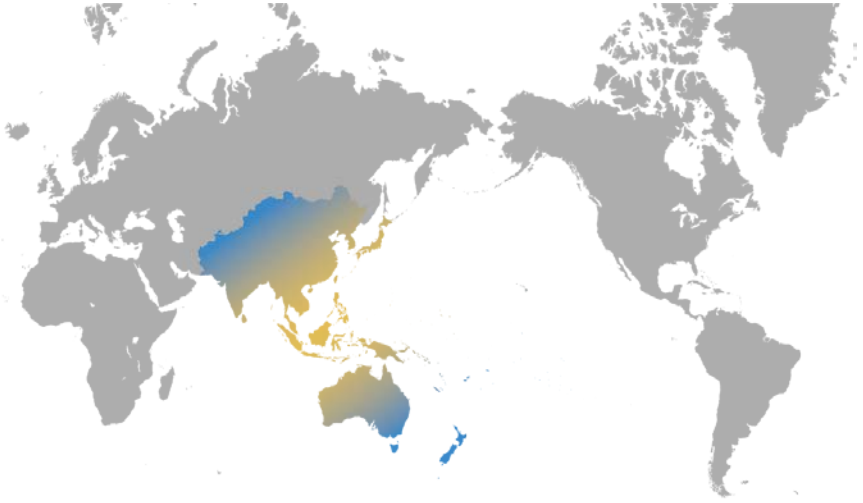
Agenda

- About the Internet and APNIC
  - About Internet Protocol: IPv4 and IPv6
- IPv4 addresses exhaustion and need to adopt IPv6
- IPv6 readiness in the world
- Linkage between government policies and IPv6 adoption
- Recommendations

Asia Pacific Network Information Centre (APNIC)

- One of five Regional Internet Registries (RIRs)
- Open membership-based industry bodies
  - Non-profit, neutral, and independent
- Internet number resource allocation and registration
- Other services such as
  - Training & capacity building
  - Supporting infrastructure
  - Community cooperation

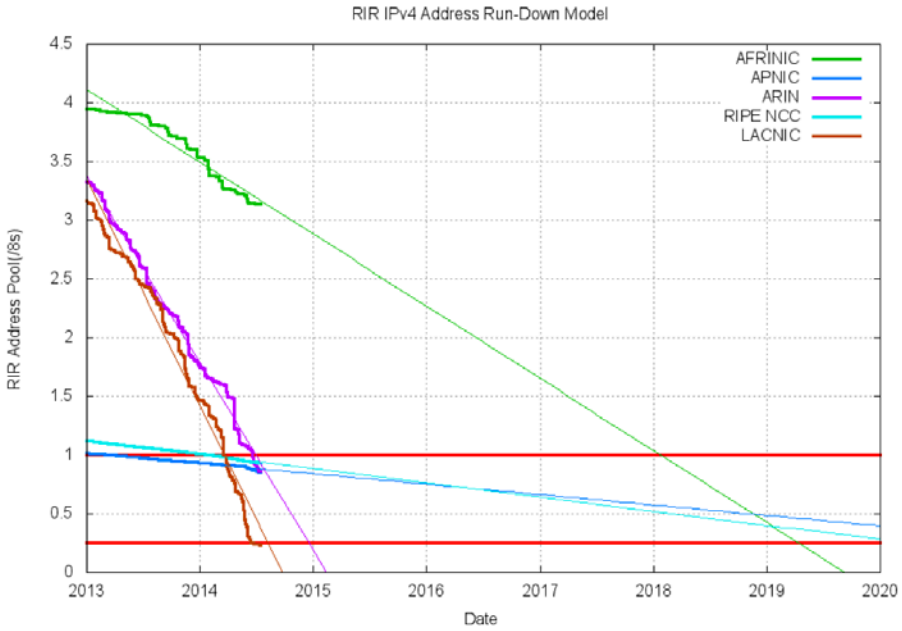


The Internet

- A global system of interconnected computer networks
  - Internet Engineering Task Force (IETF)
  - Internet Protocol (IP) provide connectivity
- Every device directly connected needs a unique IP address
  - Not the same as a domain name
  - Packets, addressing, and routing
  - IPv4 and IPv6 addresses = Internet number resources
  - IP address space is finite

IPv4 address exhaustion

- IPv4 addresses reached the final free pool
  - APNIC (April 2011)
  - RIPE (Sept 2012)
  - LACNIC (June 2014)
- APNIC members
  - /22 from the final pool
  - /22 from IANA returned pool



Projection of consumption of Remaining RIR Address Pools

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

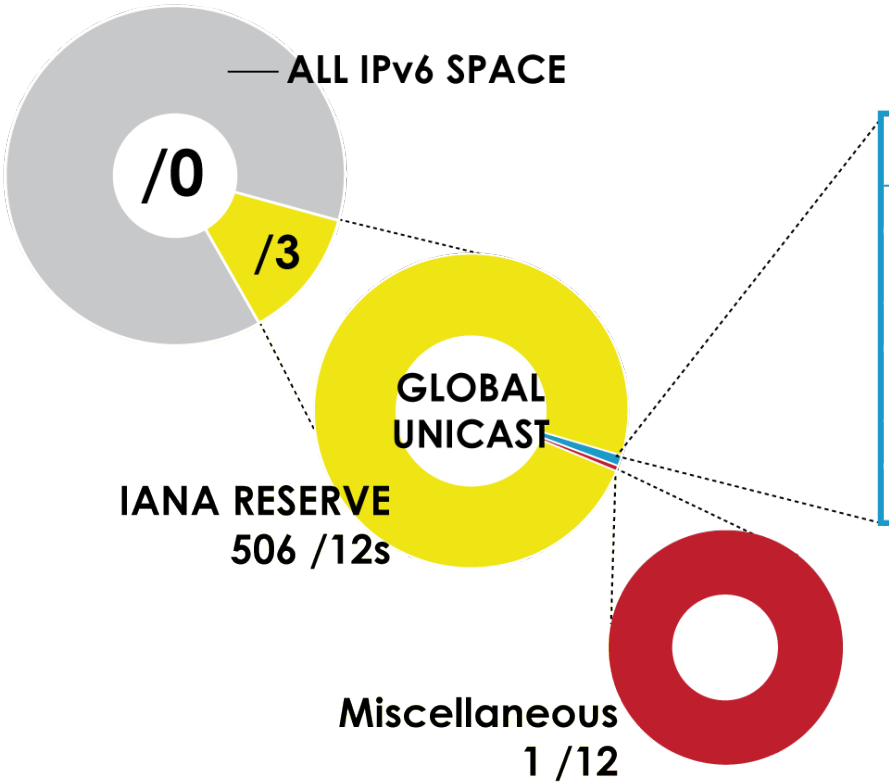
The IP Addresses

IPv4	IPv6
Deployed 1981	***Deployed 1999***
32-bit address 192.149.252.76	***128-bit address*** ***2001:DB8:0234:AB00:0123:4567:8901:ABCD***
Address space 2^{32} = ~4,000,000,000	***Address space*** ***2^{128} = ~340,000,000,*** ***000,000,000,000,000,*** ***000,000,000,000,000***
Security, autoconfig, QoS, mobility added later (IPSec etc)	***Security, autoconfig, QoS*** ***"built-in" (IPSec etc)***
Reached the final /8: April 2011	***Projected lifetime: Indefinite****

* We don't know how long IPv6 will last, but the RIRs cannot contemplate IPv6 exhaustion in the foreseeable future

IPv6 address space

How much has been allocated to the RIRs?

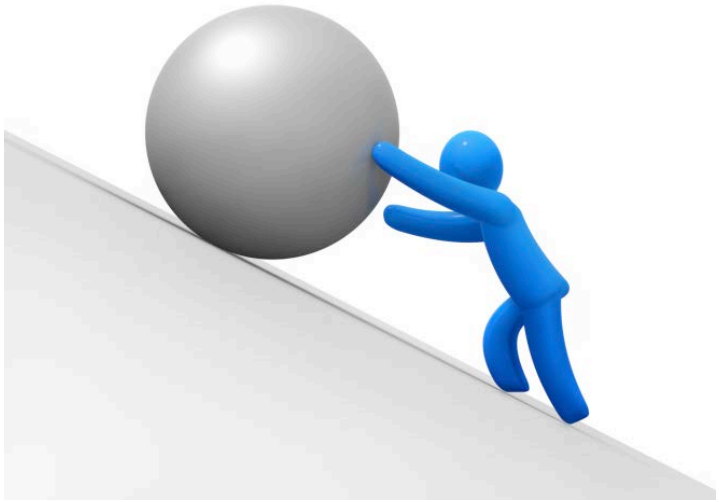


RIRs 5 /12s (October 2006)

RIR	IPv6 ADDRESS
AfriNIC	2C00:0000::/12
APNIC	2400:0000::/12
ARIN	2600:0000::/12
LACNIC	2800:0000::/12
RIPE NCC	2A00:0000::/12

What does this mean to all of us?

- Internet industry is facing a big challenge; the biggest since inception of the Internet
- Internet multi-stakeholders need to transit to IPv6
- Government support for IPv6 deployment is critical to maintain global competitiveness



Growth path of the Internet

- The next wave of Internet growth
- Planning future growth of your business

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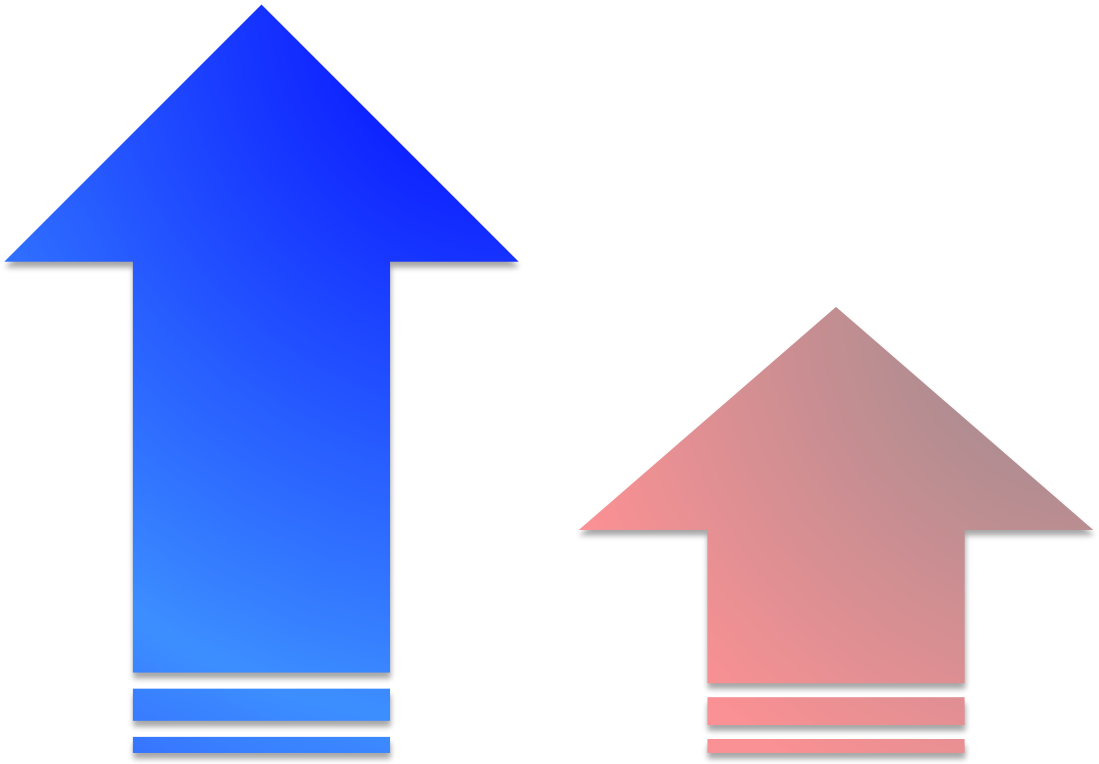
The Internet: Phenomenal growth

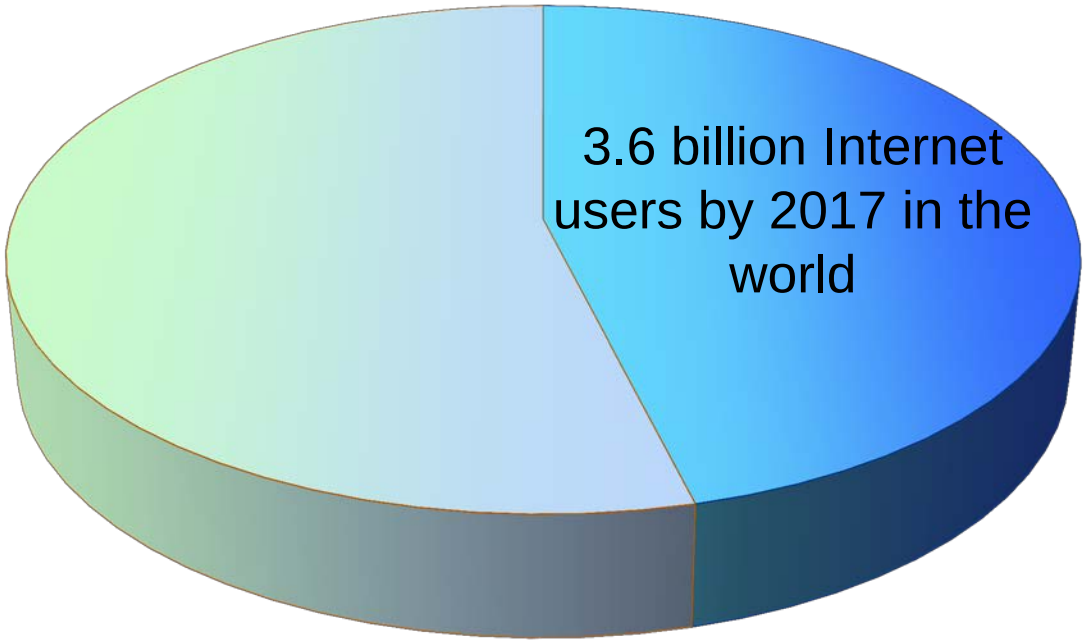


World
16 million users in 1995
2.8 billion users in 2013

Asia:
115 million users in 2000
1 billion users in 2013

http://newsroom.cisco.com/release/1197391/, http://www.internetworldstats.com/stats3.htm#asia, http://www.internetworldstats.com/emarketing.html

And the Internet is still growing



Over 47% of the world's projected population (7.6 billion)

http://newsroom.cisco.com/release/1197391/, http://www.internetworldstats.com/stats3.htm#asia, http://www.internetworldstats.com/emarketing.html

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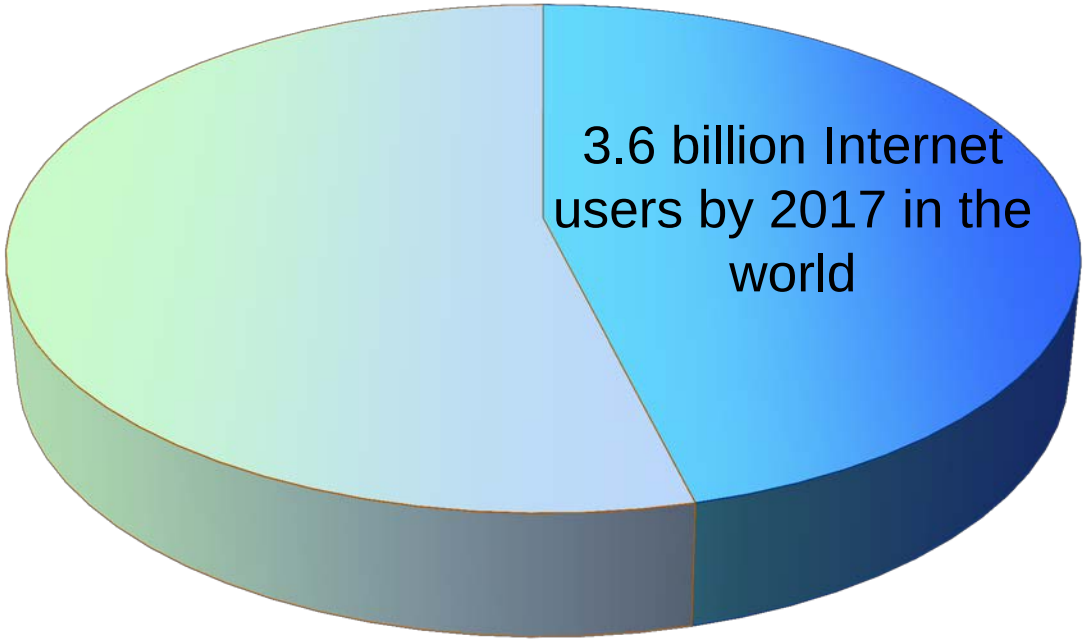


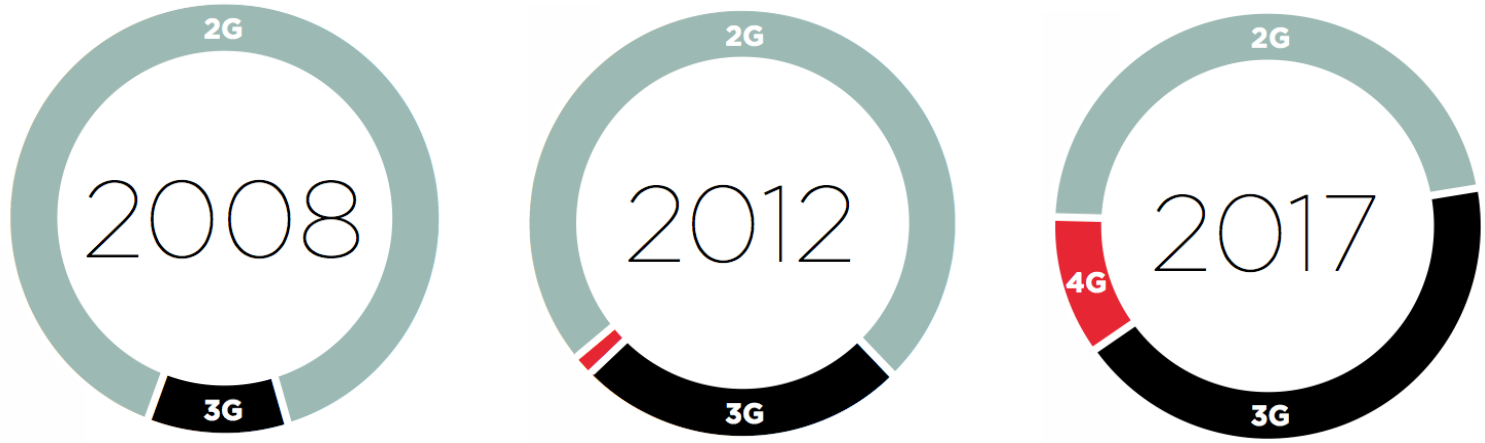
Over 47% of the world's projected population (7.6 billion)

1.33 billion Internet users in Asia by 2015, +30 % from 2013

http://newsroom.cisco.com/release/1197391/, http://www.internetworldstats.com/stats3.htm#asia, http://www.internetworldstats.com/emarketing.html

The next wave of Internet growth

- Mobile networks with always on mobile devices
  - IP-based services
  - Much larger impact on the fundamental nature of the Internet
- Research suggests 3G and 4G market share to increase to 53% by 2017



http://www.gsmamobileeconomy.com/GSMA%20Mobile%20Economy%202013.pdf

Impact of IPv4 address exhaustion

- Immediate impact
  - ISPs will no longer be able to obtain IPv4 addresses from APNIC
    - Survive for a short time of period with their own pool
    - Business continuity of ISPs and other Internet multi-stakeholders in question
  - Need to find alternative source for IPv4 addresses
    - No sustainable alternative options
- Prolonged impact
  - Difficulties to maintain sustainable Internet growth
  - No more new entries to the Internet market place
  - Impediment of further technological development

In preparation for exhaustion…

- Soft landing
- Liquidity and supply
- Transition support

What measures did the APNIC policy community take to prepare for IPv4 exhaustion and the deployment of IPv6?

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Multistakeholder policy development

- Open
  - Anyone can propose, discuss, and help decide policy
- Transparent
  - APNIC publicly documents all policy discussions and decisions
- Bottom up
  - Policy Development Process (PDP) and the policies are determined by the community they serve

Resource management goals

- Conservation
  - Efficient use of resources
  - Based on demonstrated need
- Aggregation
  - Limit routing table growth
  - Support provider-based routing
- Registration
  - Ensure uniqueness
  - Facilitate trouble shooting

Goals

Uniqueness

Registration

Aggregation

Conservation

Fairness

Minimized Overhead

Conflict of goals

Soft landing austerity measures

- Restrictions on access to the free pool
- Enabled assignments from the final /8
- Reduced the minimum delegation size for the final /8 policy

APNIC address transfer services

- Pre-approval service, with opt-in anonymous listing
- Broker listing service
- Mailing list for discussion and sourcing
- Public transfer log (transparency)
- Transfer fees apply (user pays)

IPv6 Deployment

- IPv6 supply – Kickstart
- Training & Capacity Building
- Measurement

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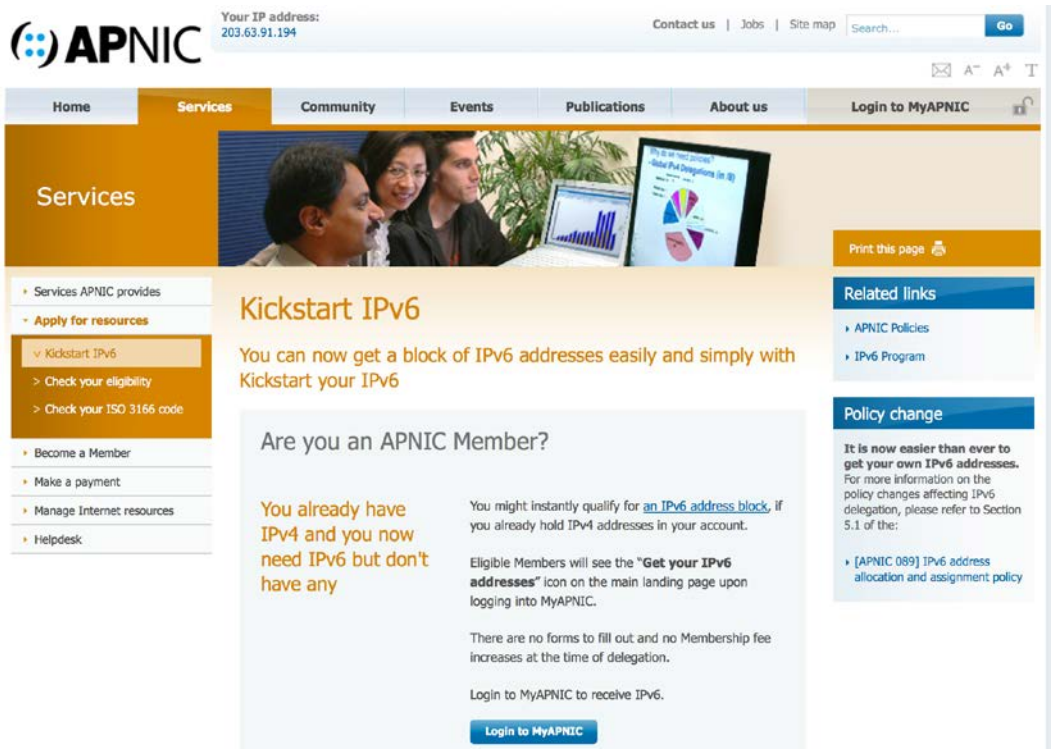
IPv6 Kickstart

- Make it very easy
  - Members with an IPv4 delegation
  - One or two clicks
  - No technical assessment
- No additional cost
  - For many Members



APNIC partnering for development

- IPv6 capacity development
  - “IPv6 Workshops” in collaboration with regional organizations
- APNIC works closely with external partners and community groups to share knowledge and information
  - 15 NOGs in the region (and more to come)
  - APEC TEL, APT, ASEAN, ITU, and SPC, etc.
- Contribute to multi-stakeholder outreach efforts
  - Regional conferences

APNIC Training and Engineering Assistance

- Building capacity with APNIC Training
  - To support resilient and scalable Internet infrastructure
    - IPv4 to IPv6 Transition, IPv6 Workshop, Network Security, Routing and BGP etc.

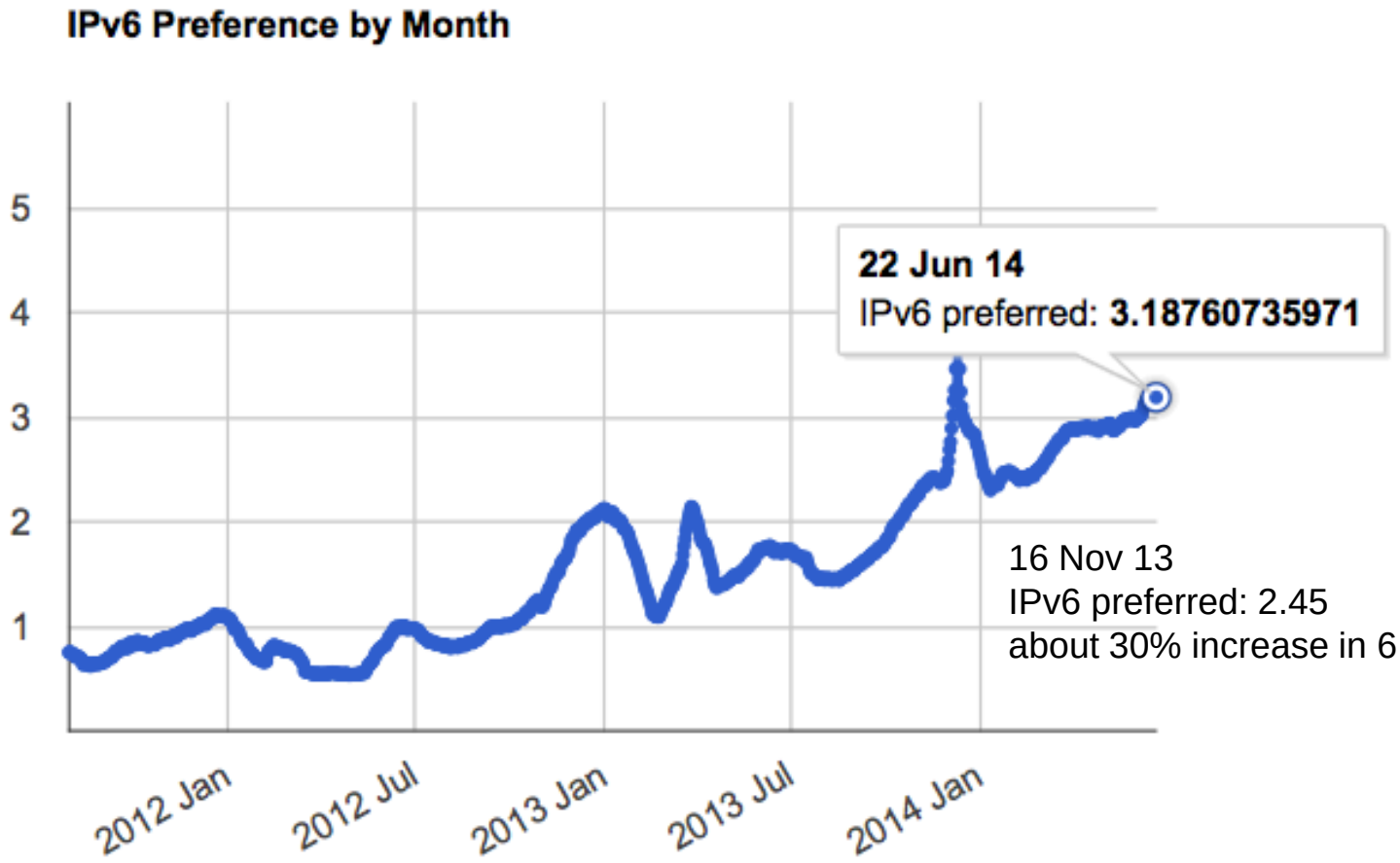
- Engineering Assistance provided by Internet experts
  - Cost recovery basis direct assistance – IP peering, IPv4 and IPv6 network, Internet infrastructure security

APNIC Training in 2013 (2012)

APNIC Labs: IPv6 measurement

- Comprehensive reports on IPv6 uptake
  - Global, economy, and network levels
- IPv6 Capability Tracker
  - Free tool for website operators to measure client IPv6 capabilities
- Measuring IPv6
  - IPv6 readiness data for intergovernmental organizations and economies
- http://labs.apnic.net

IPv6 measurement - End user readiness: World



Data source from “flash” and “JavaScript” and including viewers from mobile devices

http://labs.apnic.net/ipv6-measurement/Regions/001%20World/ as of 24/06/2014

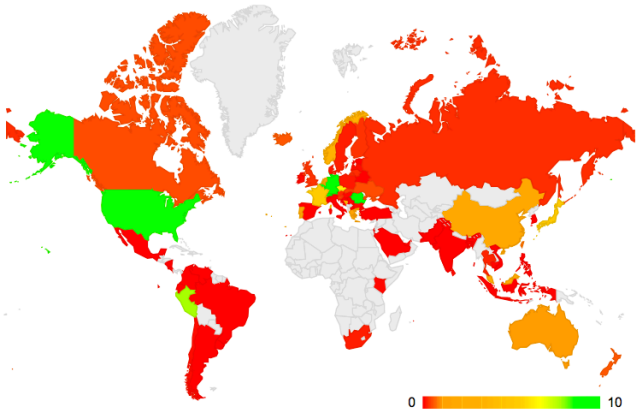
Global IPv6 deployment leaderboard (commercial operators)

ASN	Entity	Economy	IPv6 preferred rate
22394	Cellco Verizon Wireless	US	63.39
6848	Telenet N.V	BE	45.73
10091	StarHub Cable Vision Ltd	SG	43.48
18126	CTCX Chubu Telecommunications Company; Inc.	JP	37.72
31334	Kabel Deutschland Vertrieb und Service GmbH	DE	34.78
2516	KDDI KDDI CORPORATION	JP	30.29
3303	Swisscom Ltd	CH	27.00
29562	Kable BW GmbH	DE	25.88
55430	STARHUBINTERNET-AS-NGNBN Starhub Internet Pte Ltd	SG	24.93
21928	T-Mobile USA	US	24.81
41164	GET Norway	NO	20.38
7018	AT&T	US	20.36
12322	Free SAS	FR	19.89
7922	Comcast Cable Communications	US	19.83
4739	INTERNODE-AS Internode Pty Ltd	AU	19.37

http://labs.apnic.net/ipv6-measurement/AS/ 24/06/2014

Summary

- IPv6 deployment is increasing steadily
  - But varies among regions, economies, and individual ASNs
  - Not happening simultaneously
  - Some economies and ASNs have been very active in terms of IPv6 deployment
    - Once they enable IPv6 in their network and handsets, their end user readiness grows VERY rapidly



Conclusion

- Linkage between government policies and IPv6
- Recommendations

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IPv6 informaton for Governments
www.apnic.net/ipv6

Information sharing: Governments

- China
  - Great leadership shown by the Chinese State Council
  - IPv6 mandates to the industry in Nov 2011: SPs in China are responding to this mandate
- India
  - Department of Telecommunications announced a plan to mandate state government ministries, departments, and public sector to transit to IPv6 by March 2012, and updated it March 2013
- Singapore
  - IPv6 Transition Program lead by Infocomm Development Authority (iDA) of Singapore since 2010
  - Published IPv6 Adoption Guide for Singapore in March 2011

http://www.apnic.net/community/ipv6-program/ipv6-for-governments

Information sharing: APEC TEL IPv6 Guidelines

- Published in 2010
  - APNIC contributed its development
- Scope of the document
  - **Lead the industry by example in adopting IPv6**
    - Ensuring governments' online presence via IPv4+IPv6
    - **New procurement requirements** with IPv6
      - Be ready with transition – do not buy legacy equipment!
  - **Partnership between governments and industry**
    - Periodic information exchange and collaboration
  - **Human capacity development**
    - Enhance IPv6 skills of technical staff
    - IPv6 training programs to be shared
  - **International and cross-agency cooperation**
    - Sharing information on IPv6 Best Current Practice
    - Avoid duplicating efforts IPv6 implementation

http://www.apec.org/~/media/Files/Groups/TEL/2010_APEC-TEL-IPv6-guidelines-FINAL.doc

Recommendations

- Mandate for IPv6 readiness in government procurement forms for ICT goods and services
- Conduct research on IPv6 readiness in the industry
- Develop policies, guidelines, and roadmaps to enable IPv6 in government and network infrastructure
- Subsidize IPv6 skilling up for industry members to support human capacity development
- Lead the industry by example in adopting IPv6
- Partnership between government and industry
- Include the necessity of IPv6 deployment in ministerial statements

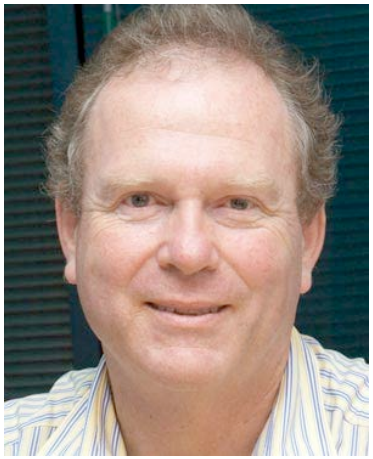
http://www.apnic.net/community/ipv6-program/ipv6-for-governments

Recipe for proactive IPv6 support

- Many encouraging activities in the AP region
  - Updating government ICT procurement criteria with IPv6
  - Policies to support deploying IPv6 in government networks with clear mandate goals and timeframe
    - Leading the industry by example in adopting IPv6
  - Partnership between public and private sectors, e.g.,
    - Establishing certification mechanism to recognize “IPv6 ready” products
    - Launching IPv6 project to raise IPv6 awareness among key stakeholders
    - Promoting IPv6 activities through media, events, competitions, awards etc.
  - Human capacity development
    - Supporting IPv6 skill up trainings to the industry

You're Invited!

- APNIC 38: Brisbane, Australia, 9-19 Sep 2014



Hon. Malcolm Turnbull | Eric Vyncke | Geoff Huston | Paul Vixie

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