Evolution of Mobile Networks and IPv6

Miwa Fujii <miwa@apnic.net>
APNIC, Senior Advisor Internet Development
25th April 2014
APEC TEL49
Yangzhou, China

Issue Date: [25/04/2014]
Revision: [3]

APNIC

Overview

- Growth path of the Internet
  - Asia Pacific region
- Evolution of mobile networks
- IPv6 deployment in mobile networks: Case study
- IPv6 deployment status update
- IPv6 in mobile networks: way forward

Growth path of the Internet

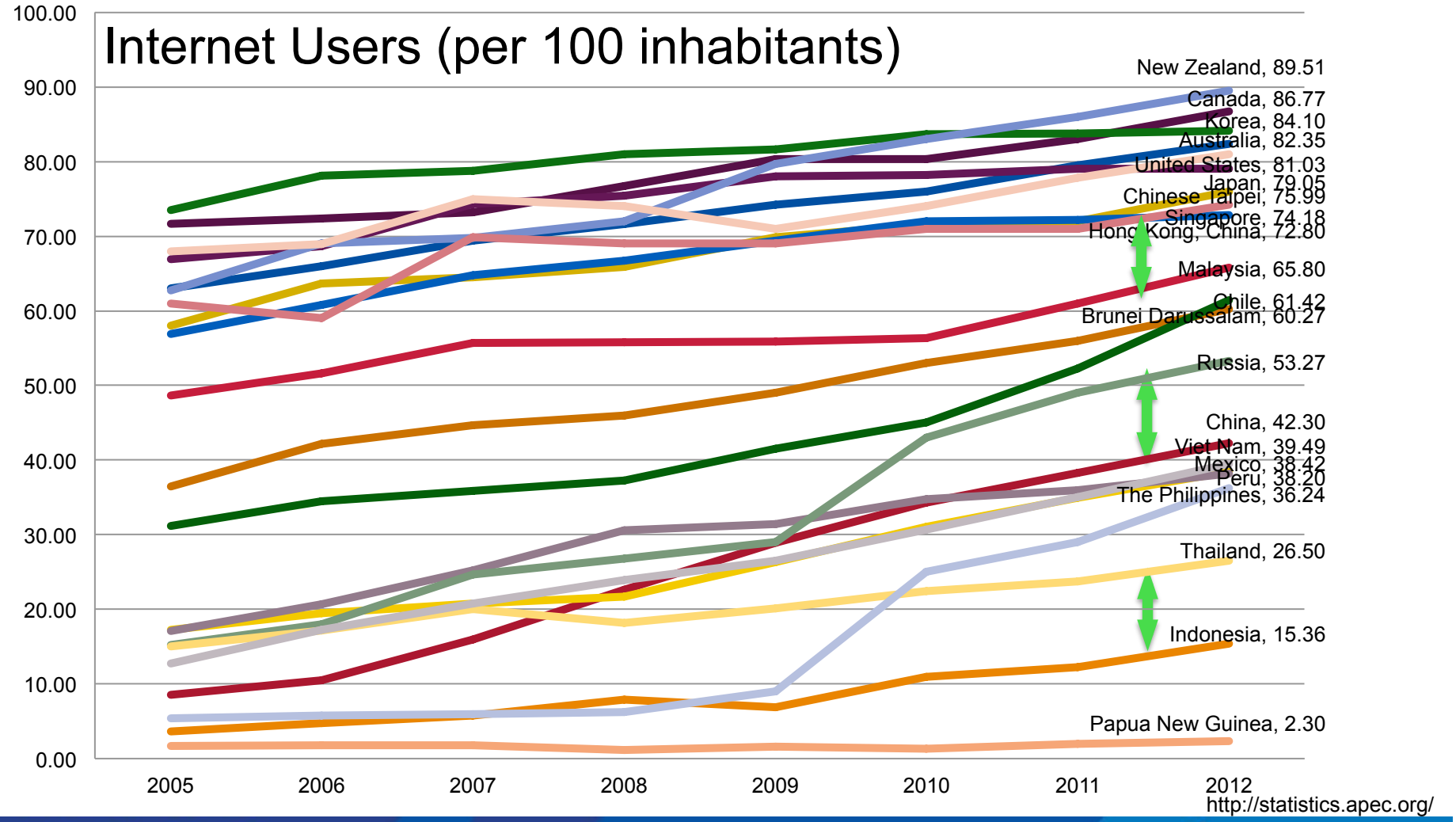
APNIC

The next wave of Internet growth

- The Internet has experienced phenomenal growth in the last 20 years
  - 16 million users in 1995 and 2.8 billion users in 2013
- And the Internet is still growing: Research indicates that by 2017, there will be about 3.6 billion Internet users
  - Over 40% of the world's projected population (7.6 billion)
- The next wave of Internet growth will have a much larger impact on the fundamental nature of the Internet
  - It is coming from mobile networks

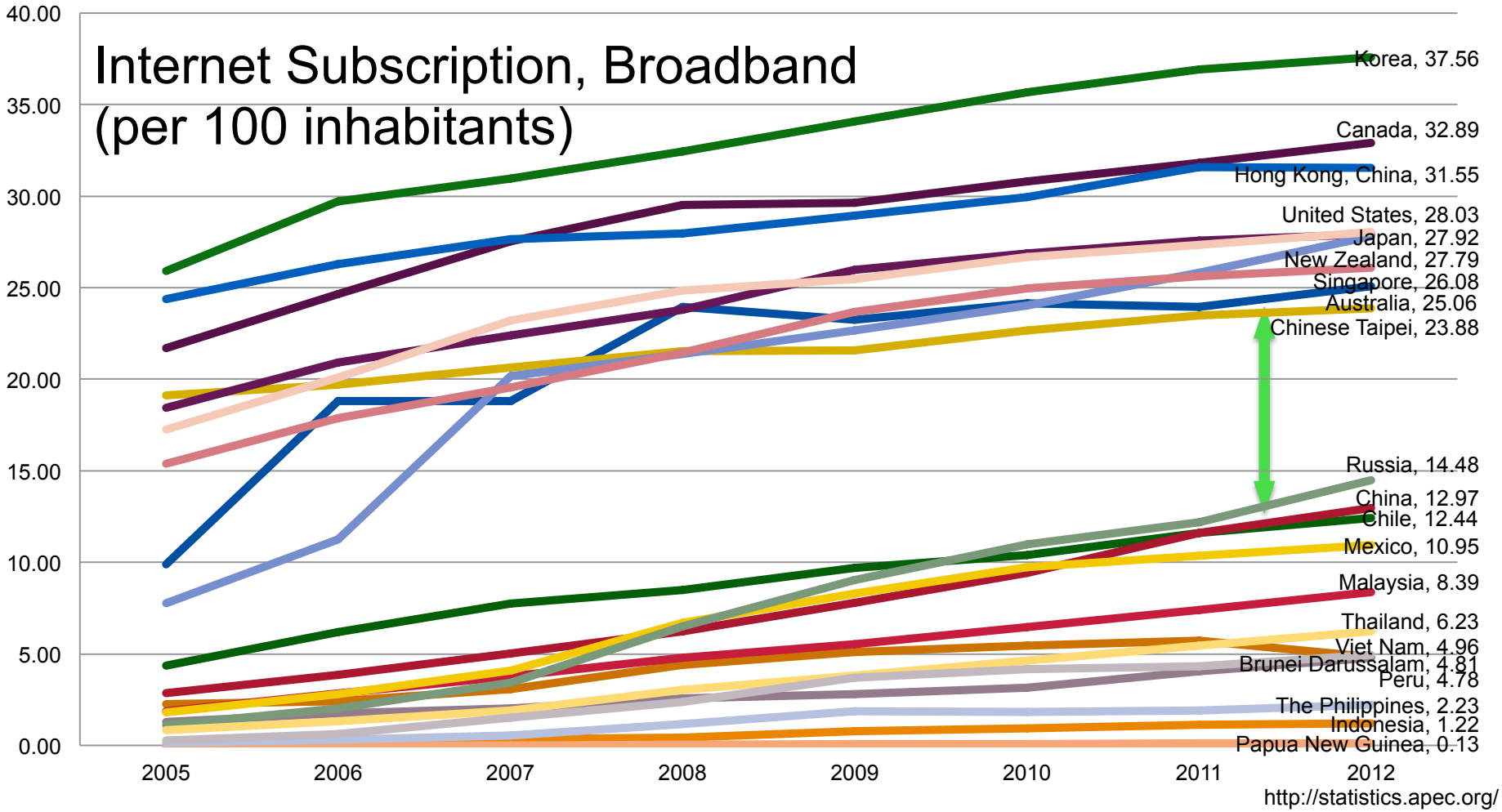
http://www.allaboutmarketresearch.com/internet.htm

Internet development in AP region: Internet users

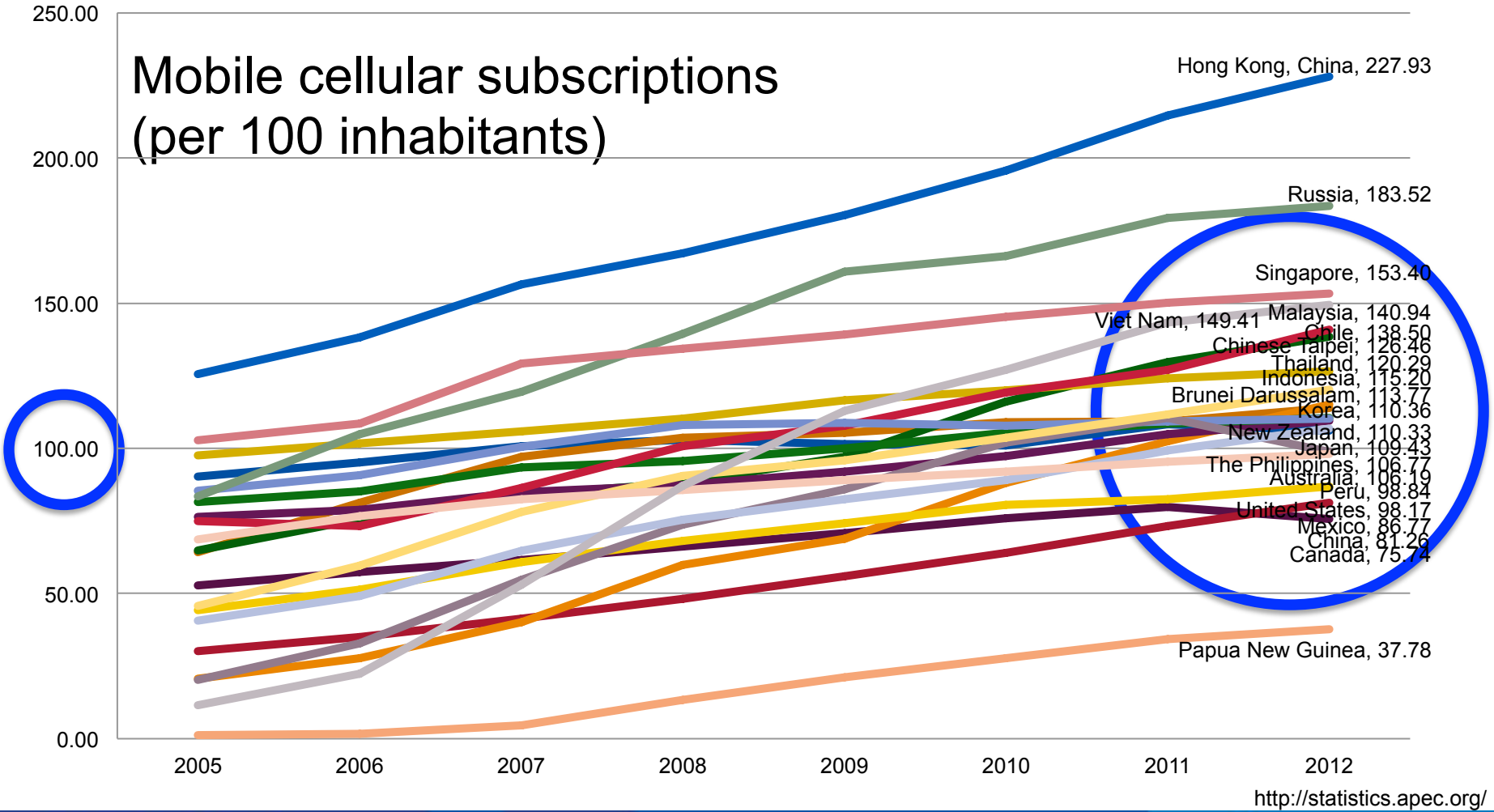


http://statistics.apec.org/

Internet development in AP region: Broadband subscription



Internet development in AP region: Mobile cellular subscriptions



http://statistics.apec.org/

Growth path of the Internet

- While fixed network broadband still provides an important base for Internet users, mobile network access to the Internet has became a major development
  - Mobile broadband subscriptions growing very rapidly in developing economies
- Phenomenal growth of mobile broadband is changing user behavior
  - Rapid increase of mobile-only Interent access, i.e., users do not or very rarely use desktop/laptop computers to access the Internet
  - Welcome to the world of apps: Mobile-health, mobile-learning, mobile-government services, etc.

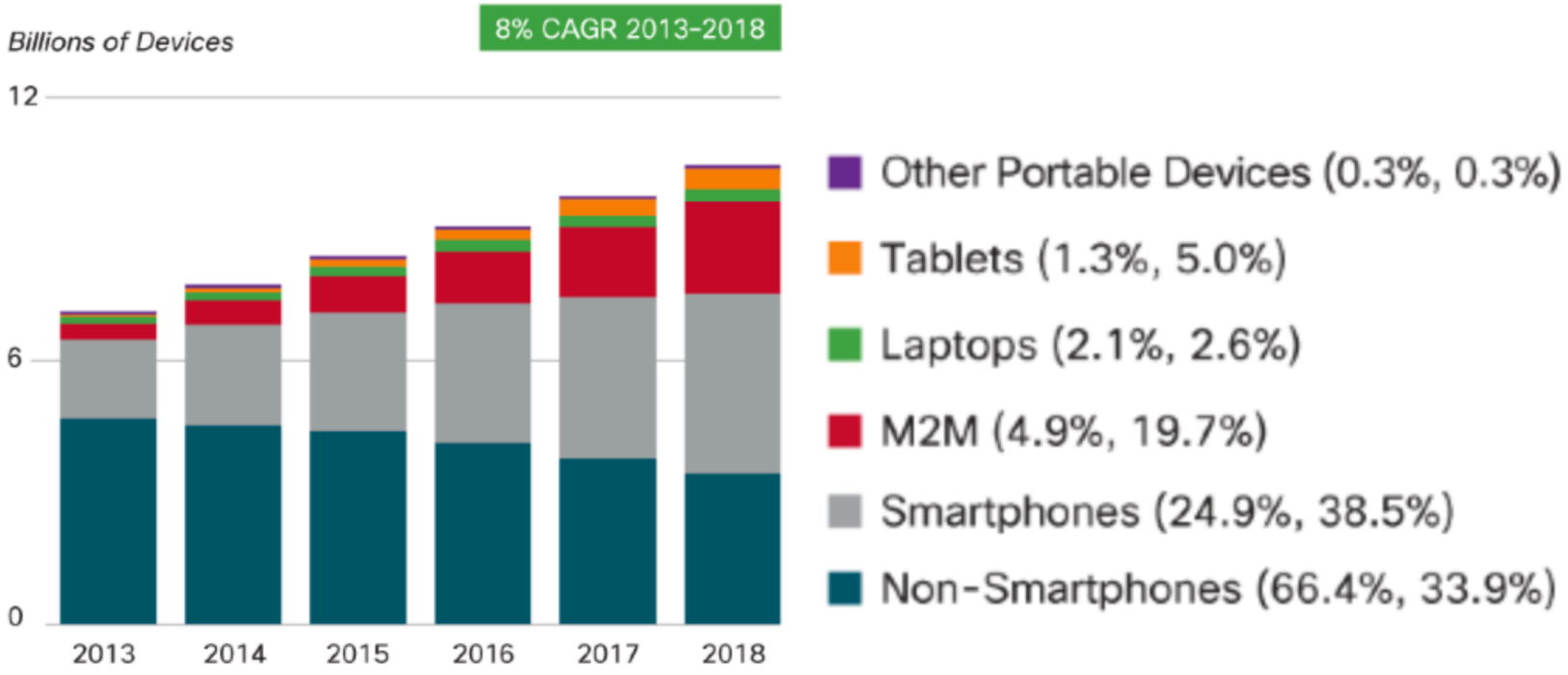
http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/b#mobilebroadband

Evolution of mobile networks

APNIC

Transition to smart mobile devices globally

- Global growth of mobile devices



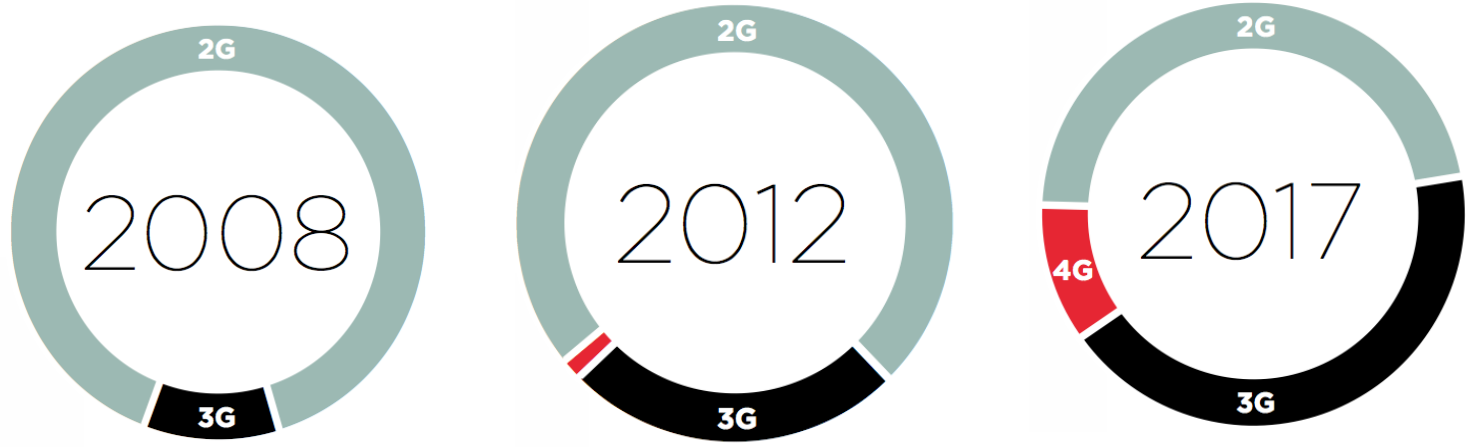
Figures in parentheses refer to device or connections share in 2013, 2018.

Source: Cisco VNI Mobile, 2014

http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.pdf P7

Transition to higher generation mobile networks globally

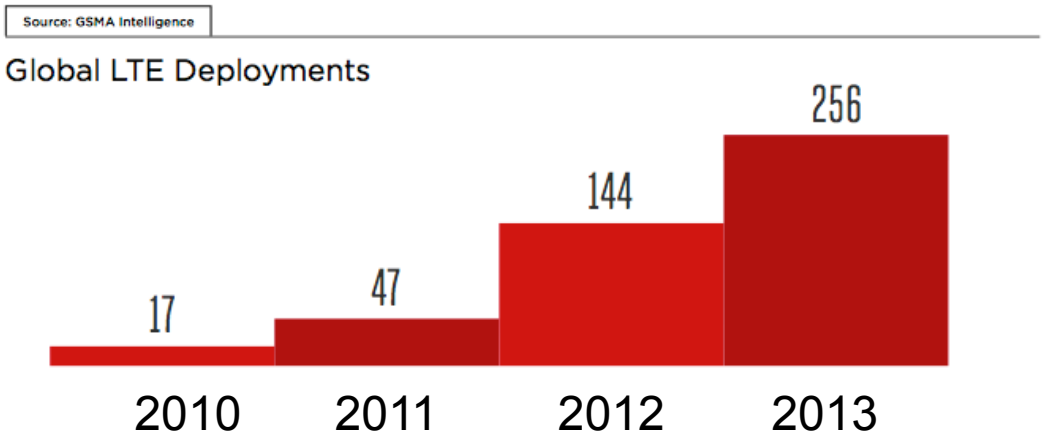
- Mobile networks are evolving from lower (2G) to higher generation (3G, 3.5G, and 4G (LTE, TD-LTE etc.) network connectivity
- Research projects 3G and 4G market share to increase to 53% by 2017



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

Transition to higher generation mobile networks globally

- Increasing 4G connections
- Research projects that LTE networks will reach more than 500 in 128 economies by 2017
  - And at a economy level, the growth of LTE network deployment will shift from the US, Japan and South Korea to include other Asian economies



http://www.gsmamobileeconomy.com/ P14

What does this transition mean?

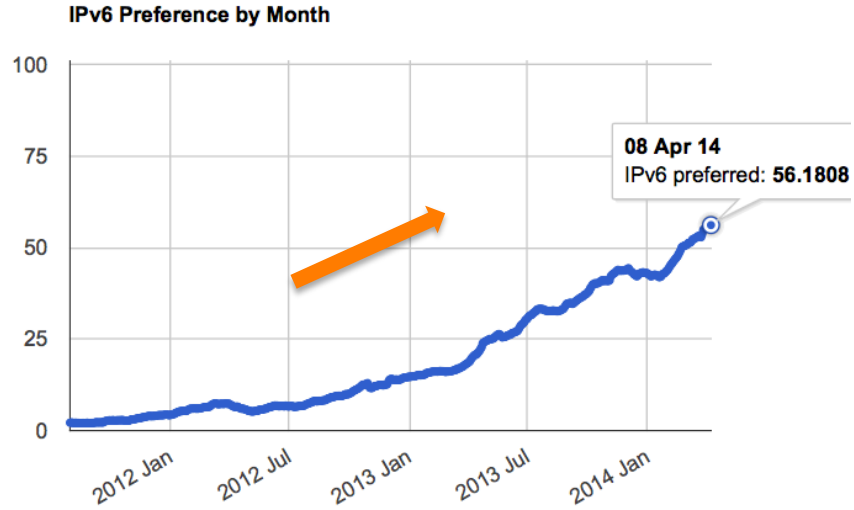
- Business competency of mobile network operators is affected:
  - Shifting from a traditional voice and messaging provider to a mobile broadband service provider
  - Services on voice, messaging and data are converging on IP-based services
  - IP to be deployed in sensors and other smart objects
    - Internet of Everything
  - Increasing downloadable rich media applications and content
  - Demand for IP addresses will only increase: More devices connecting for a longer time, all needing IP addresses

What does this transition mean?

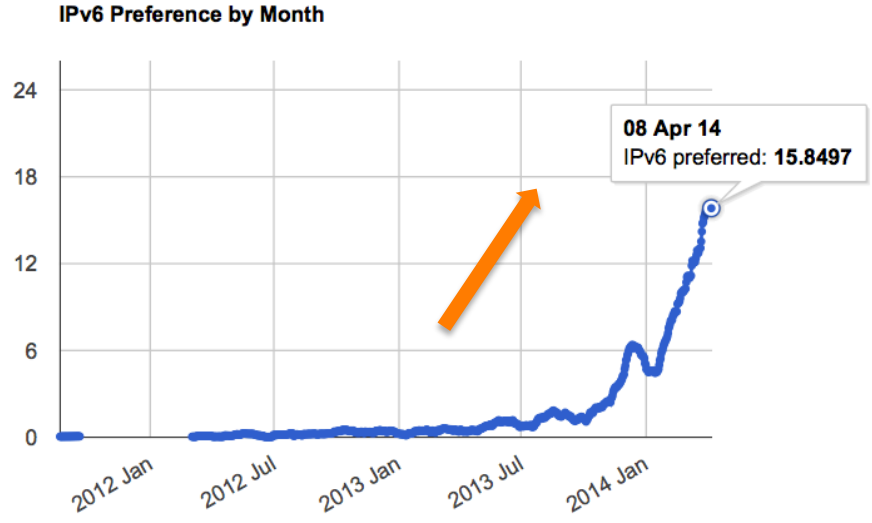
- Mobile network operators need to make informed decisions:
  - Before deploying higher generation mobile networks
- Investing in techniques just to extend the lifetime of IPv4 ultimately limits business continuity, given the rapid increase in the number of smart mobile devices in higher generation mobile networks
  - **IPv6 may not generate immediate profits, but it will sustain a business model that has a future vision**

IPv6 in mobile networks

- 3G+ and 4G (LTE, TD-LTE): Services on voice, messaging and data are converging on IP-based services
- Rapidly increasing global 3G+ and 4G deployment
  - Some mobile network operators already deployed IPv6



Verizon



T-Mobile

Case Study: T-Mobile USA

- 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 an 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 spend 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

Case Study: T-Mobile USA

- Android 4.3 introduced support for 464XLAT in Oct 2013
- T-Mobile US launched 5 Android phones with 464XLAT as the default in Oct 2013
  - All Android 4.3+ smartphones will be 464XLAT in the future at T-Mobile USA
  - This means end users will be assigned with IPv6 as a default – no IPv4 addresses will be assigned
- Result of the above operation
  - **3.6 million unique IPv6 subscribers are active on the network after five months (as of Feb 2014)**
  - **Over 50% of IPv6 user traffic is end-to-end IPv6**
  - **No complicated IPv6 to IPv4 or IPv4 to IPv6 translation needed**
  - **This saves CAPEX and OPEX and makes the network simpler**

https://conference.apnic.net/data/37/464xlat-apricot-2014_1393236641.pdf
https://conference.apnic.net/data/37/v6lessonstmo_1393297978.pdf

Case study: Telstra Australia

- Telstra is committed to introducing IPv6 into its mobile network
  - Telstra thinks IPv6 must be the way forward to ensure business growth
- Telstra has been testing IPv6 for the past 3 years
  - Began deploying IPv6 in the core network
  - Acknowledges extending the life time of IPv4 with Carrier Grade Nat (CGN), but is not over-reliant on it
  - Notes that CGN does not prevent the inevitable IPv4 depletion issue
  - Support native IPv6 as the end-goal

https://conference.apnic.net/data/37/yeung.-s-ipv6-in-telstra-apipv6tf-apnic37_1392858273.pdf

Case study: Telstra Australia

- Background of Telstra Australia's decision to deploy IPv6:
  - Exponential growth in mobile traffic
  - Growth in the number of mobile user equipment
  - New devices are session hungry, consuming multiple IP addresses and ports
  - Projected uptake of sensor networks and Machine to Machine (M2M) communications
  - IPv4 public address depletion
  - IPv4 private address depletion
  - Existing CGN solution is limited by the availability of IPv4 addresses

https://conference.apnic.net/data/37/yeung.-s-ipv6-in-telstra-apipv6tf-apnic37_1392858273.pdf

IPv6 deployment status update

APNIC

IPv6 in 2013

- Comparing 2012 with 2013, the number of individual IPv6 address space allocations rose by 20%
  - Compared to the same number of IPv4, there is further space for IPv6 allocations to grow

Allocations	2005	2006	2007	2008	2009	2010	2011	2012	2013
IPv6	240	234	475	860	1,236	2,436	3,587	3,304	4,018
IPv4	4,774	5,646	6,312	6,969	6,701	7,758	10.061	8,619	7,110

- Given the limited space to grow with IPv4 addresses, further IPv6 deployment can provide healthy and steady Internet growth

http://www.potaroo.net/ispcol/2014-02/addressing2013.html

Global IPv6 deployment leaderboard (commercial operators)

ASN	Entity	Economy	IPv6 preferred rate
22394	Cellco Verizon Wireless	US	59.14
55430	STARHUBINTERNET-AS-NGNBN Starhub Internet Pte Ltd	SG	36.68
18126	CTCX Chubu Telecommunications Company; Inc.	JP	35.12
2516	KDDI CORPORATION	JP	31.00
3303	Swisscom (Switzerland)	CH	26.76
8708	RSC & RDS SA	RO	25.02
20825	Unitymedia NRW GmbH	DE	22.57
12322	PROXAD Free SAS	FR	22.00
6389	Bellsouth net Inc.	US	19.63
4739	INTERNODE-AS Internode Pty Ltd	AU	19.24
7018	AT&T Services Inc.	US	18.80
7922	Comcast Cable Communications	US	17.80
21928	T-Mobile USA	US	17.07
23655	Snap Internet Limited	NZ	17.00
4773	MobileOne Ltd Mobile/Internet Service Provider	SG	10.40

http://labs.apnic.net/ipv6-measurement/AS/ 10/04/2014

Observations

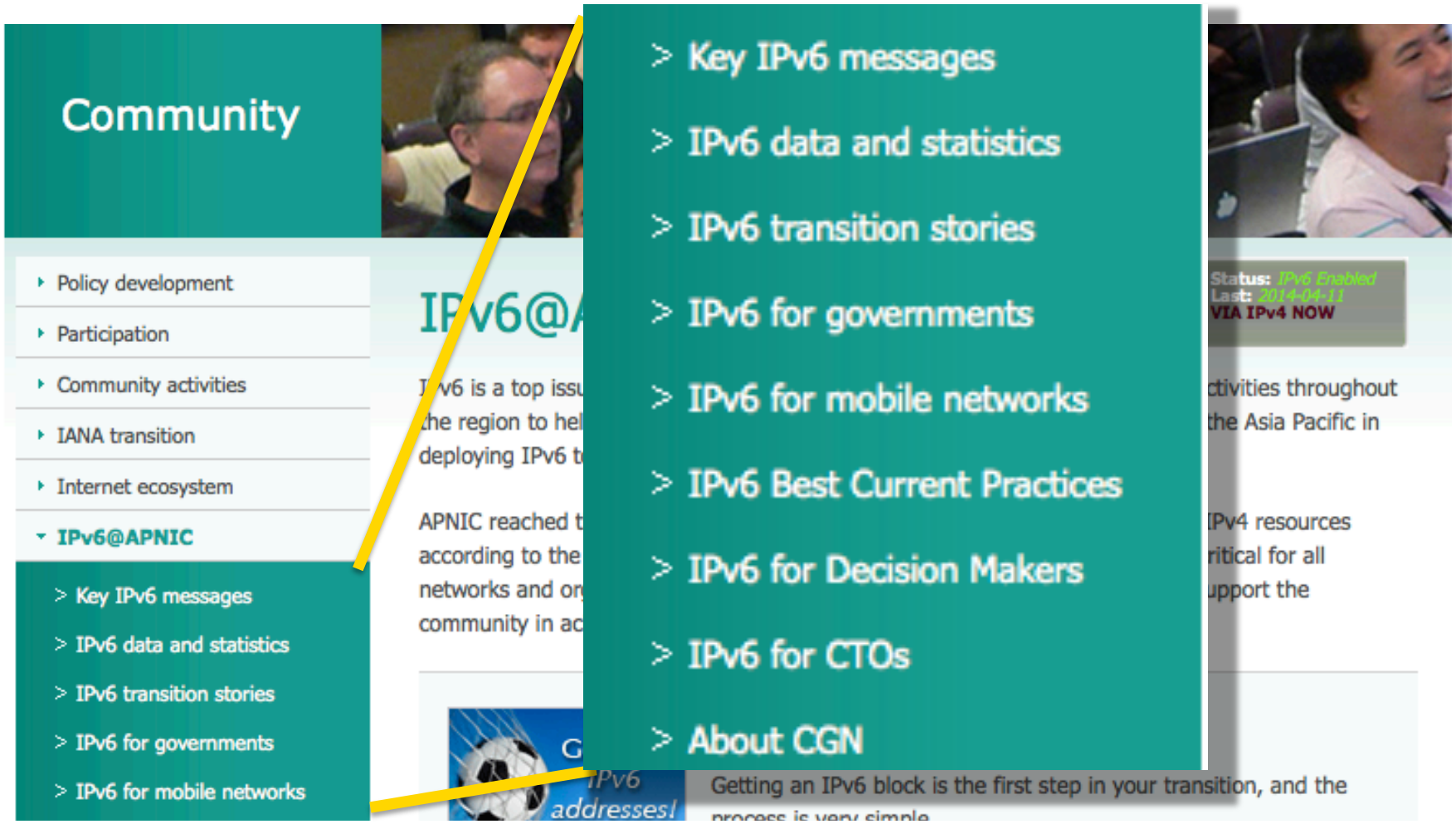
- IPv6 deployment is increasing steadily, but varies among regions, economies, and individual ASNs (network operators)
  - It's not happening simultaneously
  - Some economies and ASNs have been very active in terms of IPv6 deployment
    - Particularly some mobile network operators
    - Once they enable IPv6 in their network and handsets, their end user readiness grows VERY rapidly
- **New networks of service providers are a good place to start enabling IPv6: IPv6 should be a default for new customers**

Conclusion

IPv6 in mobile networks

- It has its own challenges, however, we have started observing IPv6 deployment in large mobile networks
  - China Mobile is working to turn on IPv6 in their TD-LTE network
  - Verizon Wireless: IPv6 is on by default for almost all LTE devices
  - T-Mobile USA has IPv6 deployed in 464XLAT transition technologies and is providing IPv6-enabled services
    - Lower generation network compatible
  - Telstra Australia's 4G mobile network is at the last stage of IPv6 testing in their production network
  - Korea SK Telecom tested IPv6 on LTE network in 2012
- **IPv6 is well tested and has already been used in production mobile networks**

Extensive IPv6 informaton
www.apnic.net/ipv6



APNIC Training and Engineering Assistance

- Building capacity with APNIC Training
  - Face-to-Face, eLearning, hands-on: Topics offered 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

THANK YOU

www.facebook.com/APNIC

https://twitter.com/apnic

www.youtube.com/user/apnicmultimedia

www.flickr.com/photos/apnic

APNIC