Where are we now?
IPv6 deployment update

23rd May 2016, Bangkok, Thailand

ITU ASP CoE Program on IPv6 Infrastructure Security

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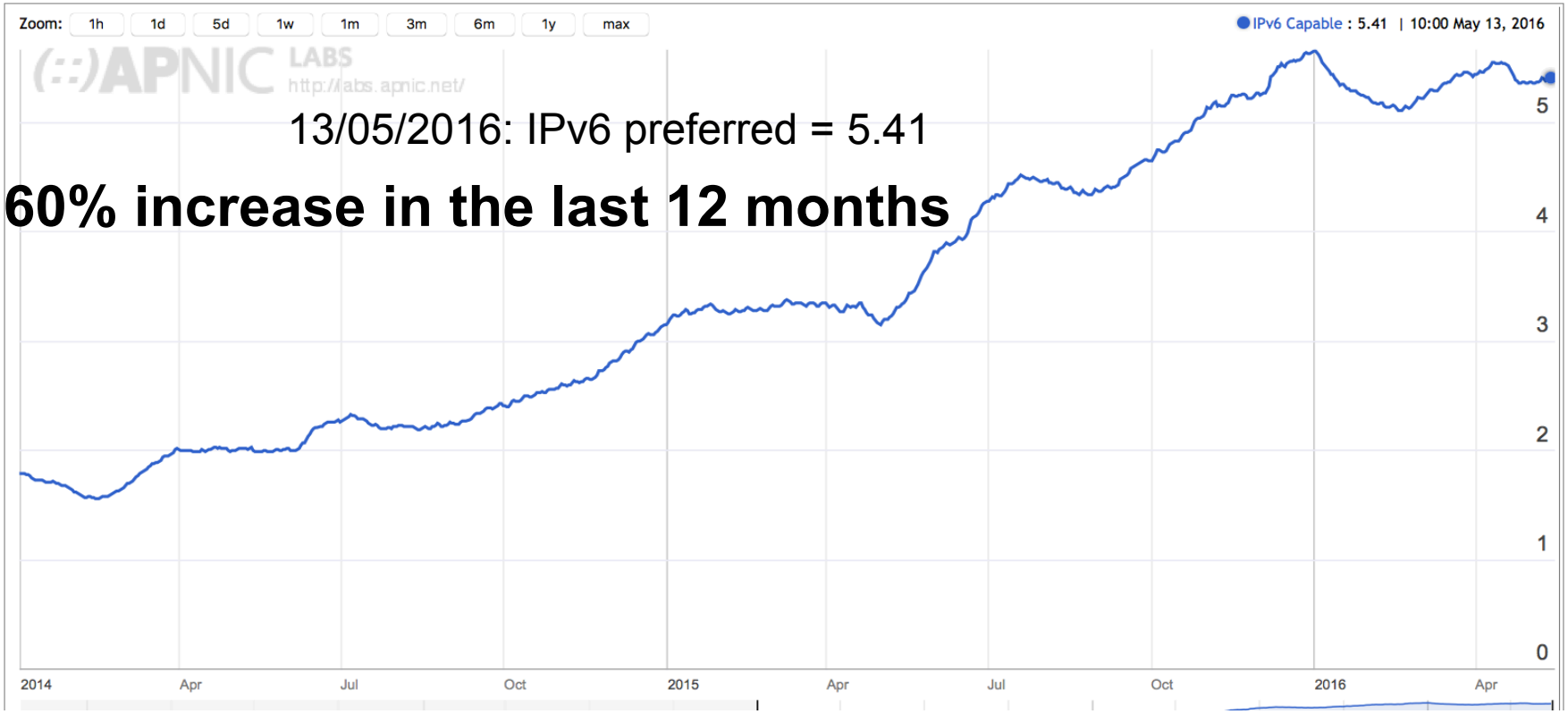
APNIC

Agenda

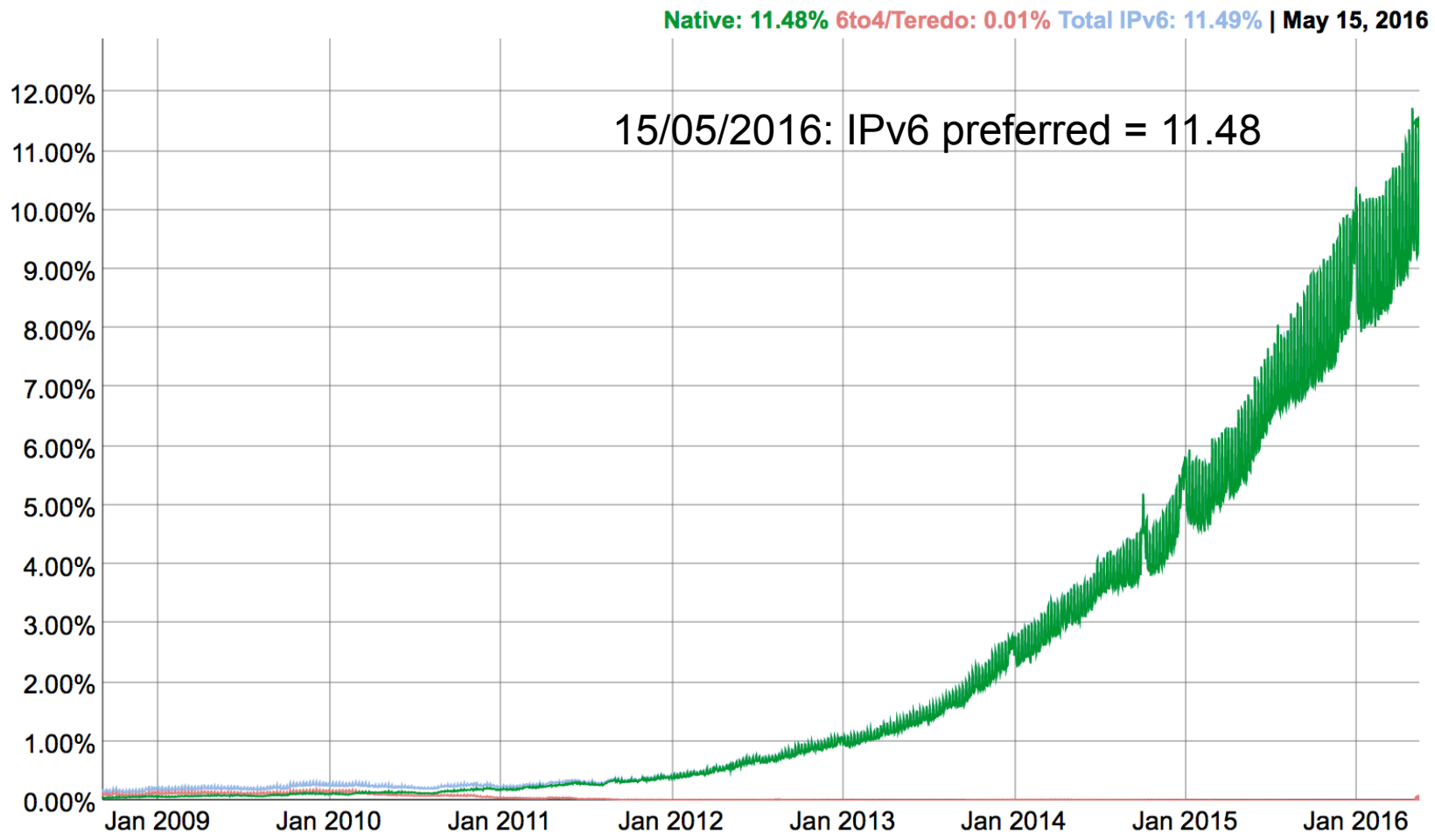
- Update on IPv6 in the world and APNIC region
  - Review of IPv6 deployment statistics
  - IPv6 performance
  - Industry trend
  - Conclusion

IPv6 measurement by APNIC
End user readiness: World



http://stats.labs.apnic.net/ipv6/XA as of 13/05/2016

IPv6 adoption statistics by Google



http://www.google.com/intl/en/ipv6/statistics.html 17/05/2016

The IPv6 economy league table
IPv6 capable %

Rank	CC	County	IPv6 Rate (%)
1	BE	Belgium	50.31
2	CH	Switzerland	29.17
3	US	United States of America	28.84
4	PT	Portugal	28.63
5	GR	Greece	24.95
6	DE	Germany	22.68
7	PE	Peru	18.32
8	EC	Ecuador	18.18
9	LU	Luxembourg	17.14
10	EE	Estonia	16.96
11	JP	Japan	15.41

http://stats.labs.apnic.net/ipv6/ as of 13/05/2016

The IPv6 ASN league table
Estimated population

Rank	CC	ASN	Network	IPv6 Users (Est)
1	US	7922	Comcast	24,911.160
2	US	7018	AT&T	21,237,173
3	JP	2516	KDDI	8.793.344
4	US	22394	Verizon Wireless	6,820,588
5	DE	3320	Deutsche Telecom	6,493,155
6	BR	28573	CLARO S.A.	6,071,555
7	JP	17676	Softbank BB	5,899,113
8	GB	5607	Sky UK	5,326,725
9	BR	18881	Global Village Telecom	4,799,380
10	FR	12322	Free SAS	3,515,369
11	MY	4788	TM Net	3,016,720

http://stats.labs.apnic.net/ipv6/ as of 13/05/2016

Japan

http://stats.labs.apnic.net/ipv6/JP 14/05/2016

Japan IPv6 leaderboard

ASN	Organization	IPv6 capable (%)
18126	CTC Chube Telecommunications	71.57
7522	STCN STNet	52.50
2516	KDDI	38.45
2527	So-net Entertainment Corporation	29.97
17676	Softbank BB	22.13
10010	Tokai Communications Corporation	21.49
9365	Its communications Inc	18.86

http://stats.labs.apnic.net/ipv6/JP 16/05/2016)

Malaysia

2014

http://stats.labs.apnic.net/ipv6/MY 21/06/2015

Malaysia IPv6 leaderboard

ASN	Organization	IPv6 capable (%)
4788	TMTNET	18.83
38044	GITN Network	5.59
9930	TTNET TIME dotCom Berhad	2.22

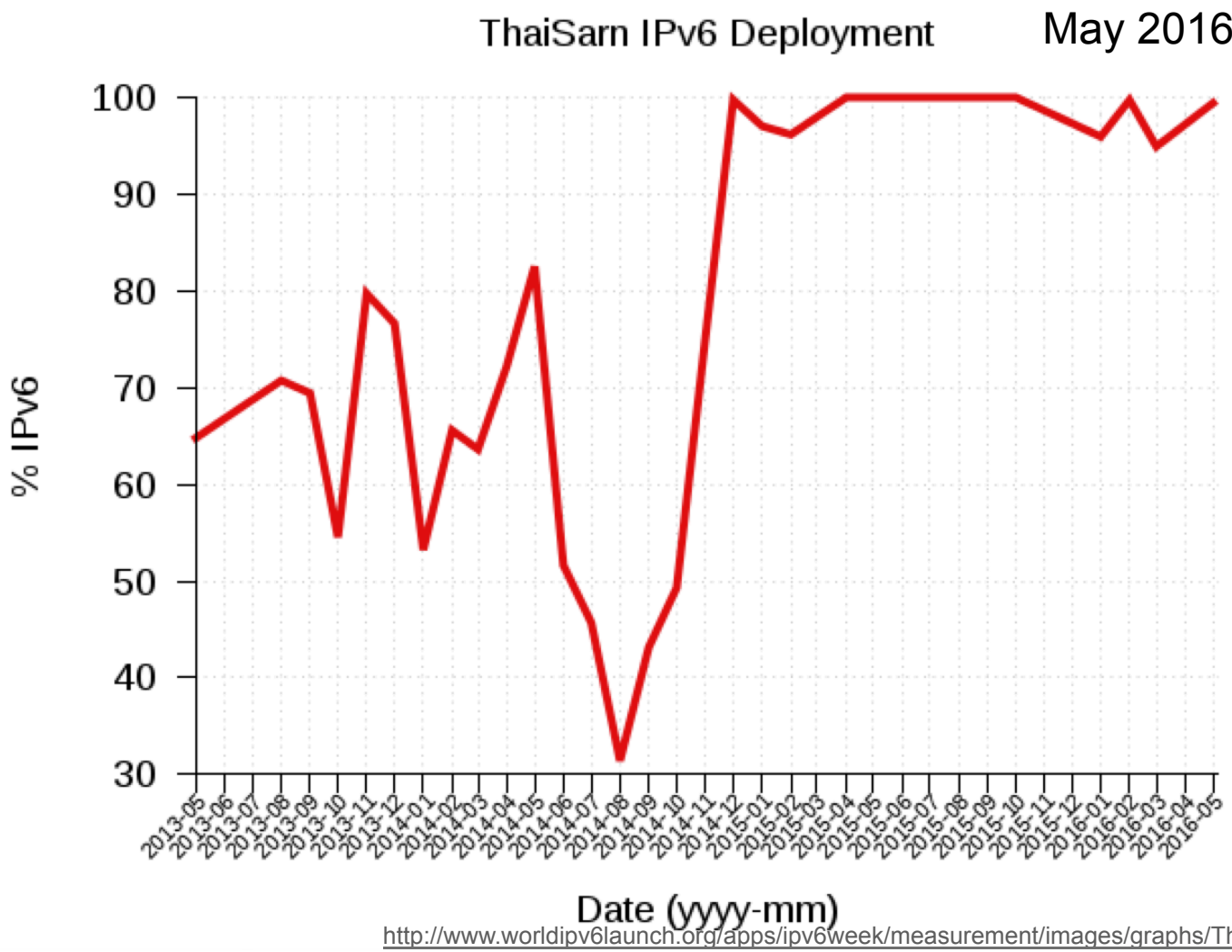
http://stats.labs.apnic.net/ipv6/MY 21/06/2015)

How about other economies?

- Where are you now?

Economy	IPv6 capable (%)
Bangladesh	0.02
India	1.43
Iran	0.05
Lao	0.00
Nepal	0.00
Philippines	0.03
Thailand	0.19
Pakistan	0.01

ThaiSarn (Nectec)



http://www.worldipv6launch.org/apps/ipv6week/measurement/images/graphs/ThaiSarn.png 17/05/2016

IPv6 performance

- Enough data accumulated to analyze IPv6 performance
- APNIC R&D, Geoff Huston's recent study
  - Presented @ APRICOT 2016 (Feb, 2016)
- Is IPv6 as "robust" as IPv4?
  - Measurement: do all TCP connection attempt succeed?
    - Connection failure = Un-matching incoming SYN and ACK
  - IPv4 connection failure sits at 0.2%
  - IPv6 connection failure sits at 1.8%
    - Came down largely since 2012 (around 5%)
  - Still some space to improve

http://www.potaroo.net/presentations/2016-02-10-ad-measurement.pdf

IPv6 performance

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- APNIC R&D, Geoff Huston's recent study
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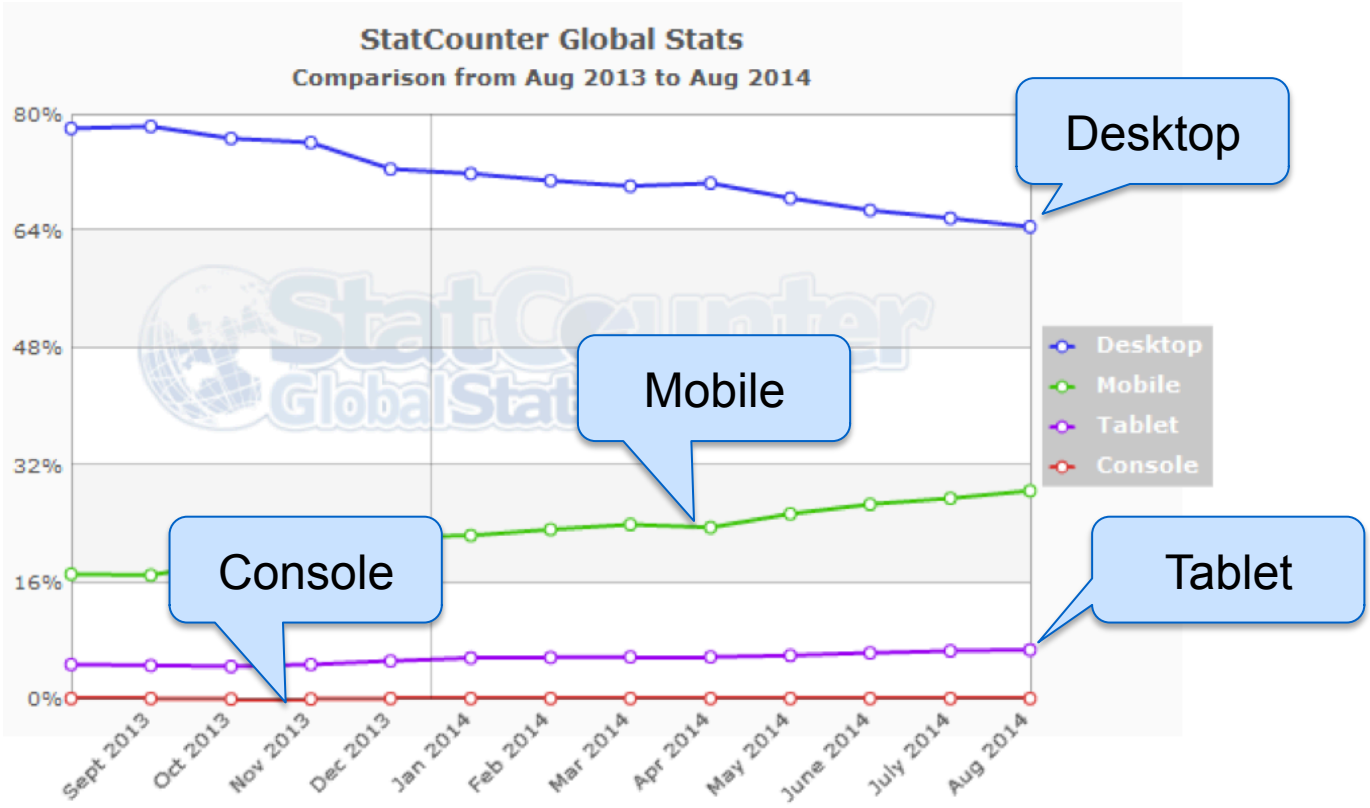
- Is IPv6 as "fast" as IPv4? (use of IPv6 unicast)
  - Chronological comparison of RTT since 2012
    - RTT measurements from the SYN-ACK exchange
  - IPv6 as fast as IPv4
  - IPv6 is faster about half of the time

http://www.potaroo.net/presentations/2016-02-10-ad-measurement.pdf

Industry trend

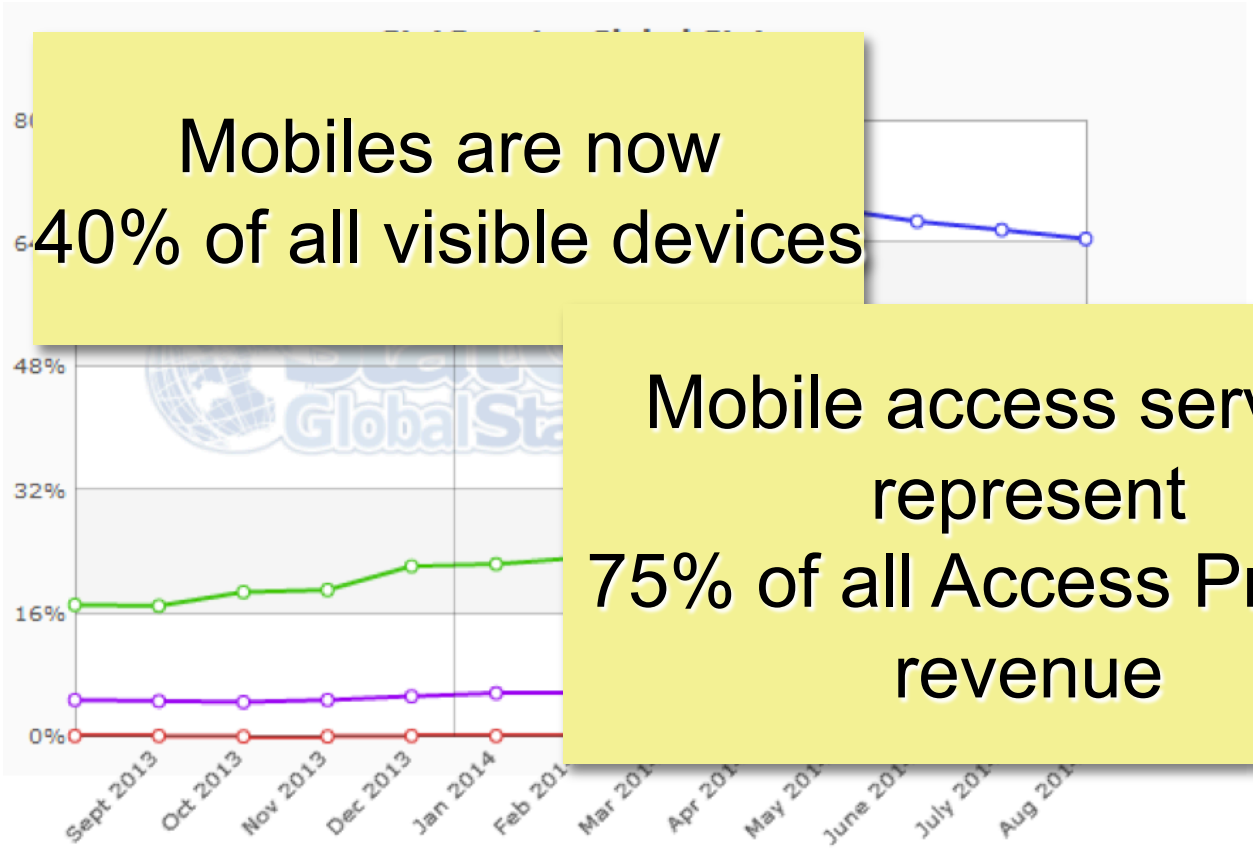
- An update on Mobility in today's Internet (by Geoff Huston)



http://gs.statcounter.com/press/mobile-internet-usage-soars-by-67-perc

Industry trend: Overview

- An update on Mobility in today's Internet



https://labs.apnic.net/presentations/store/2015-11-20-mobiles.pdf

Industry trend: Who's playing?

Android

- 84% of all smartphone shipments in 2014
- Multi-vendor adoption
- Android also extending into tablets and large screens

Apple iPhone / iPad

- 12% of all smartphone shipments in 2014
- Revenues for Apple: $182B in 2014

Windows

- 3% market share
- Mostly Lumia models with Nokia

https://labs.apnic.net/presentations/store/2015-11-20-mobiles.pdf

Industry trend: Who's in control?

- Mobiles!
- The mobile market is the market "driver" for Internet technology:
  - The PC and laptop market is in terminal decline
  - Mobiles represent the highest revenue sector, and show the highest growth numbers
  - The mobile Market was born and raised on NATs
    - The IPv4 model for cellular mobile service is still heavily based on CGNs
  - The true driver for IPv6 adoption in the Internet is in the mobile sector

https://labs.apnic.net/presentations/store/2015-11-20-mobiles.pdf

IPv6 in mobile networks

- Mobile devices and IPv6
  - Android supports 464XLAT transition technology
  - Apple iOS 9 supports IPv6 only network services (Aug 2015)
    - All apps submitted to the App Store must support IPv6 starting in early 2016
  - https://developer.apple.com/news/?id=08282015a
- Alcatel Lucent
  - Whitepaper published in April 2015
    - 464XLAT in mobile networks: IPv6 migration strategies for mobile networks
    - https://www.apnic.net/community/ipv6-program/IPv6_Migration_Strategies_for_Mobile_Networks_Whitepaper.pdf

https://developer.apple.com/news/?id=08282015a

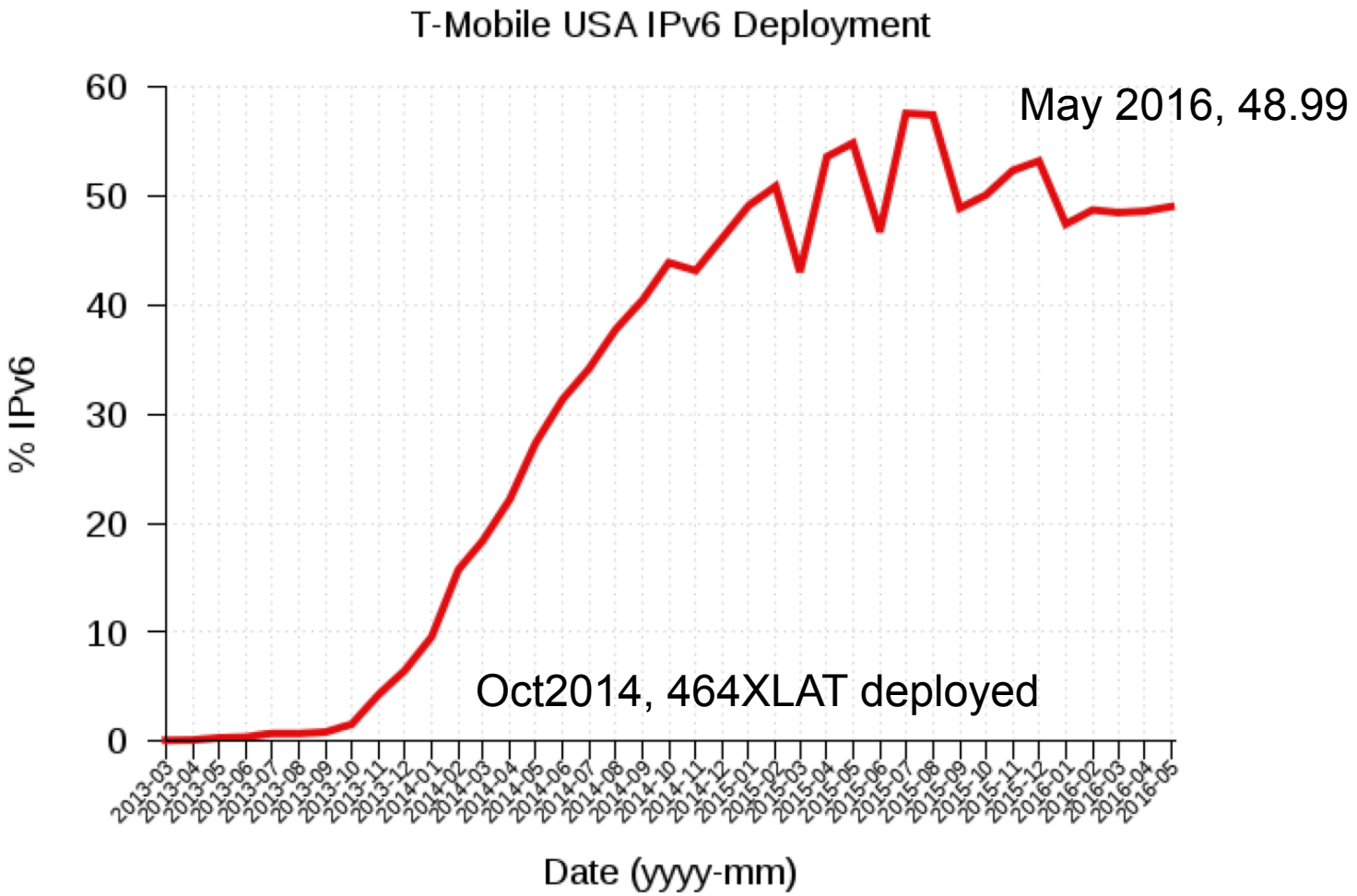
IPv6 enabled devices

- Generic Google devices
  - Nexus 5, Nexus 7
- Samsung
  - Note Family
  - Galaxy S4
- Sonny
  - Xperia Z Family
  - Xperia SP
- HTC
  - One M8
- LG
  - 3G
- And more…

IPv6 in mobile networks

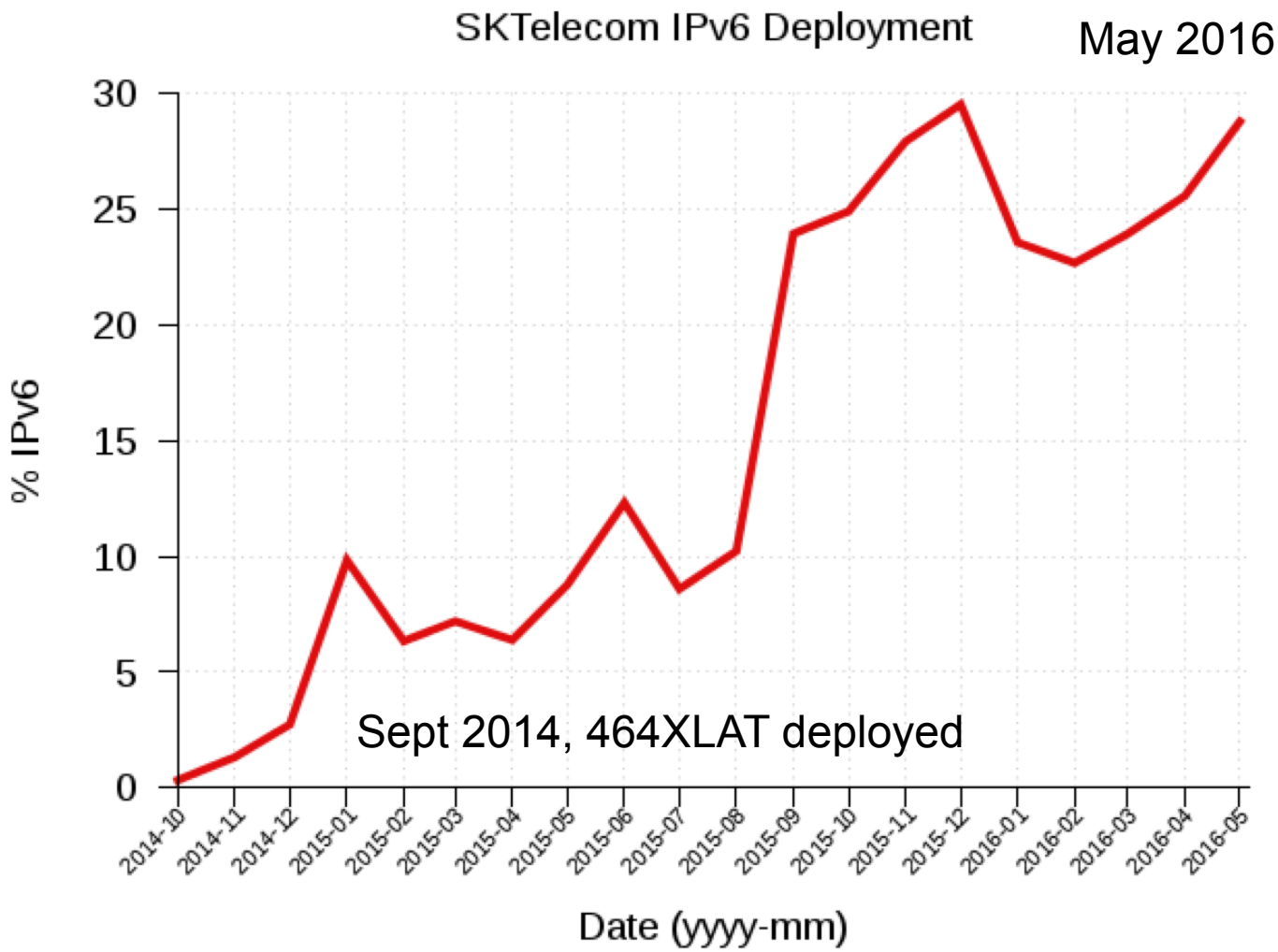
- Verizon Wireless (USA)
  - Deployed dual stack transition technology in 2011
- T-Mobile USA (USA)
  - Deployed IPv6 transition technology (464XLAT) in Oct 2012
- Telstra Australia (Australia)
  - Testing IPv6 transition technology (464XLAT) since 2011
    - Final stage of testing 464XLAT
- SK Telecom (Korea)
  - Deployed IPv6 transition technology (464XLAT) in July 2014
  - Why did SKT adopt IPv6 in their mobile networks?
    - CAPEX for Network Address Translator (NAT) equipment
    - Difficult to operate duplicated networks
    - Korean government's encouragement

T-Mobile USA



http://www.worldipv6launch.org/apps/ipv6week/measurement/images/graphs/T-MobileUSA.png 17/05/2016

SK Telecom (KR)



http://www.worldipv6launch.org/apps/ipv6week/measurement/images/graphs/SKTelecom.png 17/05/2016

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 for all-IP strategy?

http://lteconference.wordpress.com/

Conclusion

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Observations

- IPv6 deployment is increasing steadily
  - New organizations are rapidly getting ready with IPv6
  - But varies among regions, economies, and individual ASNs
  - Not happening simultaneously
  - Some economies and ASNs have been very active in terms of IPv6 deployment
    - Close to 80% of end users are via IPv6 in some ASNes
    - Particularly some mobile network operators and cable TV operators
    - Regional smaller size operators show higher level of IPv6 readiness
    - Once they enable IPv6 in their network and handsets, their end-user readiness grows VERY rapidly
    - It strongly impacts respective economy's IPv6 readiness level

www.apnic.net/ipv6

- ▸ Policy development
- ▸ Participation
- ▸ Community activities
- ▸ IANA transition
- ▸ Internet ecosystem
- ▸ Security@APNIC
- ▾ IPv6@APNIC
  - ▸ Key IPv6 messages
  - ▸ IPv6 data and statistics
  - ▸ IPv6 transition stories
  - ▸ IPv6 for governments
  - ▸ IPv6 for mobile networks
  - ▸ IPv6 Best Current Practices
  - ▸ IPv6 for Decision Makers
  - ▸ IPv6 for CTOs
  - ▸ About CGN
- ▸ IPv4 post-exhaustion
- ▸ IPv4 exhaustion

IPv6@APNIC

IPv6 is a top issue for the Asia Pacific Internet community. APNIC engages in activities throughout the region to help facilitate a smooth transition. The greater goal is to support the Asia Pacific in deploying IPv6 to maintain a scalable Internet for everyone.

APNIC reached the last /8 of IPv4 addresses in April 2011, and now delegates IPv4 resources according to the "last /8 policy". The scarcity of IPv4 makes IPv6 deployment critical for all networks and organizations in the Asia Pacific. Here's what APNIC is doing to support the community in achieving real and tangible IPv6 deployment:

Distributing IPv6 addresses

Getting an IPv6 block is the first step in your transition, and the process is very simple.
Kickstart IPv6 - one click to IPv6

IPv6 training and education

Is your technical staff ready to deploy IPv6? Gaining technical knowledge does not happen overnight. Plan and implement training for your personnel. APNIC Training is constantly updating our IPv6 content, to reflect the industry's best current practices.
Upcoming training events

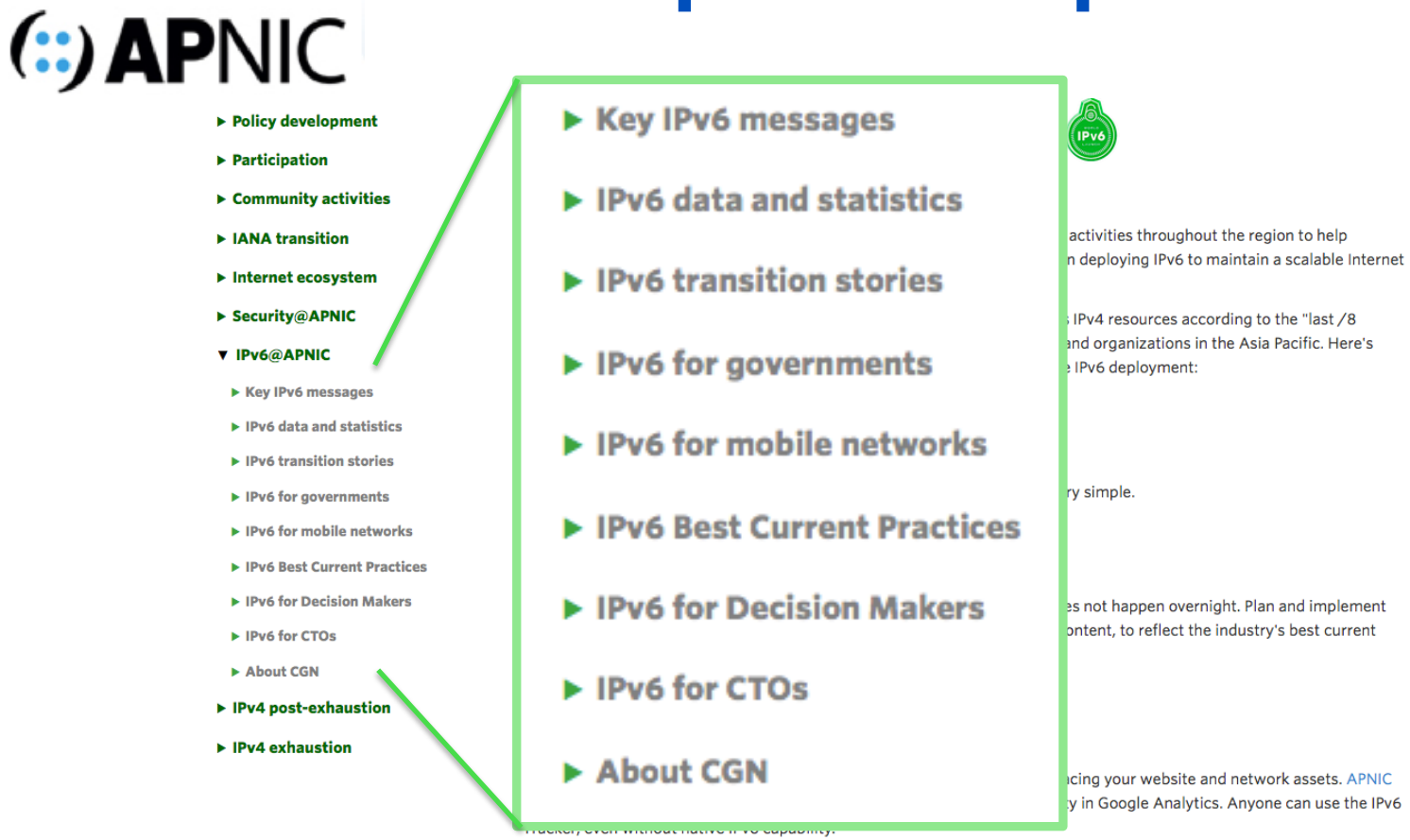
Monitoring IPv6 deployment

Do you offer your services over IPv6? Understand your clients' capabilities, facing your website and network assets. APNIC Labs has designed a javascript test system that reports on end-user capability in Google Analytics. Anyone can use the IPv6 Tracker, even without native IPv6 capability.
Learn more about APNIC Labs IPv6 measurements.

Supporting IPv6 deployment

IPv6 deployment is an issue that affects all Internet stakeholders. APNIC wants to give you the most current, relevant, and customized information on IPv6 deployment. The APNIC IPv6 Program brings regional and global experts to various forums through conferences, workshops, and individual meetings.

www.apnic.net/ipv6



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