

The future in your hands!!: Deploying IPv6

PTC11

16 January 2011

Miwa Fujii

Senior IPv6 Program Specialist, APNIC

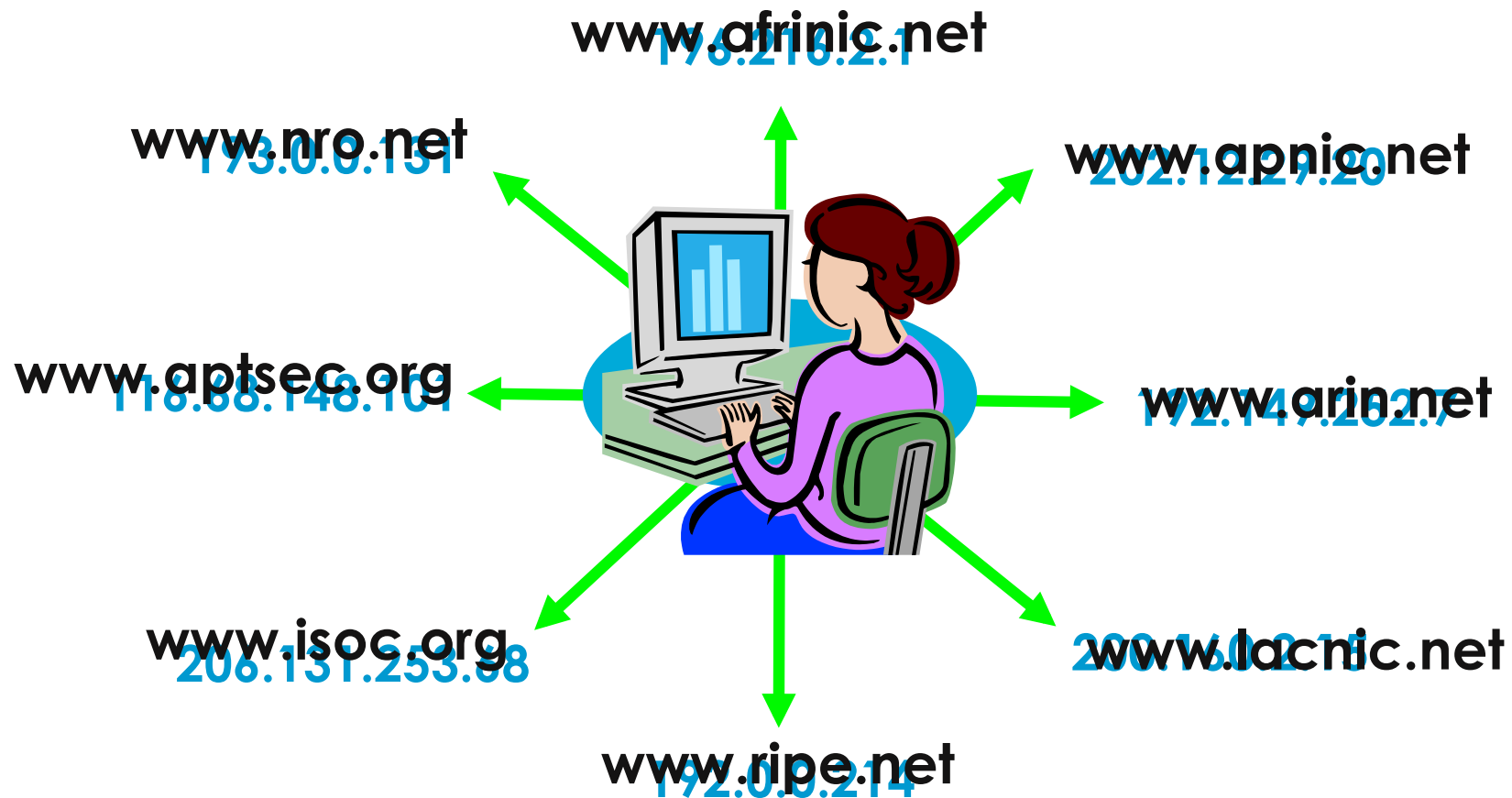
Overview

- Introduction
 - Recap IP address
 - The RIRs and their communities
 - APNIC and its Policy Development Process
- Where are we now?
 - Status of IPv4 address exhaustion
 - IPv6 deployment status
- Message for Mobile Operators
 - Impact of IPv4 address exhaustion
 - Way forward
- General recommendations for IPv6 deployment

What is an IP address?

- The Internet Protocol
 - Packets, addressing and routing
 - IPv4 (192.168.0.0)
 - IPv6 (2001:0DB8::/32)
- An IP address is a number
 - Every device directly connected to the Internet needs a unique IP address
 - IP address space is finite
- ***Not the same as a Domain Name !***

On the Internet, you are nothing but an IP address!



IP Addresses: IPv4 vs. IPv6

IPv4	IPv6
Deployed 1981	<i>Deployed 1999</i>
32-bit address 192.149.252.76	<i>128-bit address</i> <i>2001:DB8:0234:AB00:0123:4567:8901:ABCD</i>
Address space $2^{32} = \sim 4,000,000,000$	<i>Address space</i> <i>$2^{128} = \sim 340,000,000,000,000,000,000,000,000,000,000,000,000,000$</i>
Security, autoconfig, QoS, mobility added later (IPSec etc)	<i>Security, autoconfig, QoS</i> <i>“built-in” (IPSec etc)</i>
Projected lifetime: 2011	<i>Projected lifetime: Indefinite</i>

How are IP addresses managed?

- Regional Internet address Registries (RIRs)
 - Open membership-based industry bodies
 - Non-profit, neutral, and independent
 - Allocation, registration and other services
 - APNIC: training, infrastructure, cooperation

Regional Internet Registries

- First established in early 1990s
 - Voluntarily by consensus of community
 - To ensure responsible and equitable address management, according to technical and administrative needs
 - To support Internet development
 - Consensus-based, open, and transparent participatory process

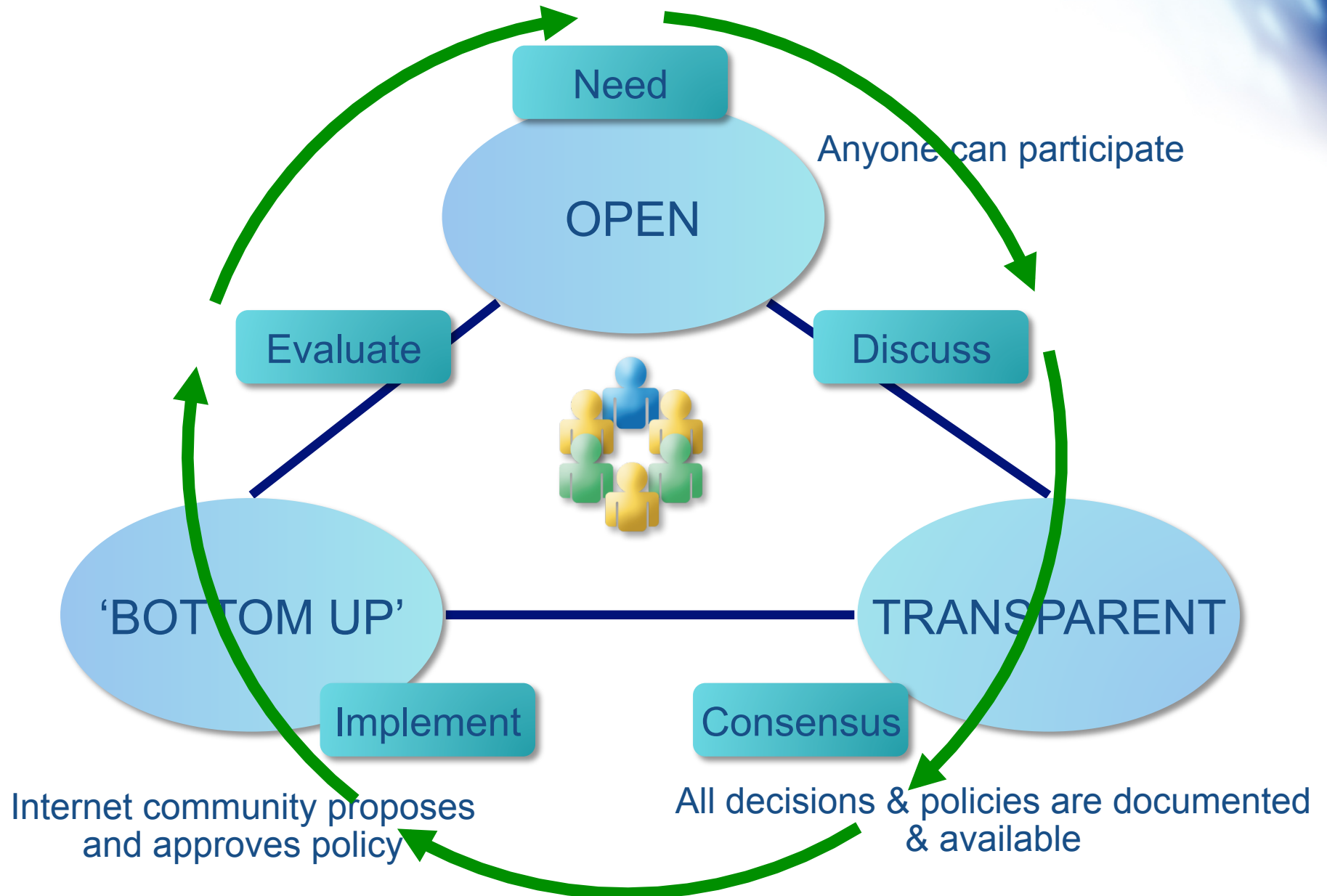
Regional Internet Registries



APNIC's Mission

- Assist the Asia Pacific community in effective resource management
 - Equitable allocation and registration services
 - Membership total: around 2,400
- Provide educational opportunities
 - Fully equipped Training lab (IPv6 supported)
- Coordinate IP addressing policy development and public positions
- Seek public consideration of issues that benefit Members and the community

Policy Development Process



Open Policy Meeting

- APNIC holds two meetings per year
 - As a stand alone four-day meeting
 - As a conference track within APRICOT (Asia Pacific Regional Internet Conference on Operational Technologies)
- Meetings include:
 - Special Interest Groups (SIGs)
 - Birds of Feather sessions (BOFs)
 - Training and education
 - APNIC Member Meeting

APRICOT-APAN 2011

APRICOT-APAN 20
www.apricot-apan.asia

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APRICOT-APAN.Asia/2011 fosters a platform for delegates to network and exchange knowledge through the intense discussions among different I.T. professionals, key internet builders, internet community leaders and decision makers.

Renowned as a cosmopolitan city, Hong Kong will surely be able to provide excellent logistics, accommodation and telecommunications support to APRICOT-APAN.Asia/2011 which synergize the international culture.



APRICOT-APAN 2011
www.apricot-apan.asia

Main Conference: 21-25 Feb, 2011
 Workshop: 15-19 Feb, 2011

Hong Kong Convention and Exhibition Centre

About APRICOT



<http://apricot.asia> - APRICOT (Asia Pacific Regional Internet Conference on Operational Technologies) is Asia Pacific's premier Internet

annual summit. It aims to provide a forum for key Internet builders in the region to learn from their peers and other leaders in the Internet community from around the world. Delegates attending APRICOT are guaranteed high quality content, fruitful discussions and effectiveness needed to objectively match local and regional activities with Internet's rapid global developments

About APAN



<http://apan.net> - APAN (Asia-Pacific Advanced Network) is a non-profit International consortium established on June 3, 1997. APAN is designed to

be a high performance network for research and development on advanced next generation applications and services. APAN provides an advanced networking environment for the research and education community in the Asia Pacific region, and promotes global collaboration.

About APNIC



<http://apnic.net> - APNIC is an open, membership-based, not-for-profit organization. It is one of five Regional Internet Registries (RIRs) charged

with ensuring the fair distribution and responsible management of IP addresses and related resources. These resources are required for the stable and reliable operation of the global Internet. (<http://apnic.net>)

APNIC31 meeting will be held jointly with APRICOT-APAN 2011 in Hong Kong.

APRICOT-APAN 2011

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Many useful technical workshop and tutorial
 Including an IPv6 workshop and a conference
 15 – 19 Feb 2011, 21-25 Feb 2011

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Next APNIC meeting APNIC31


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APNIC 31

21 - 25 February 2011
Hong Kong SAR, China



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Three **BIG** events come together at the [Hong Kong Convention and Exhibition Centre](#) - APNIC 31, APRICOT 2011, and APAN 31.

This event is not to be missed! Whether you are a sponsor, a delegate, or both, you will find an opportunity like no other awaits.



Call for Papers

The Program Committee will be accepting proposals soon.

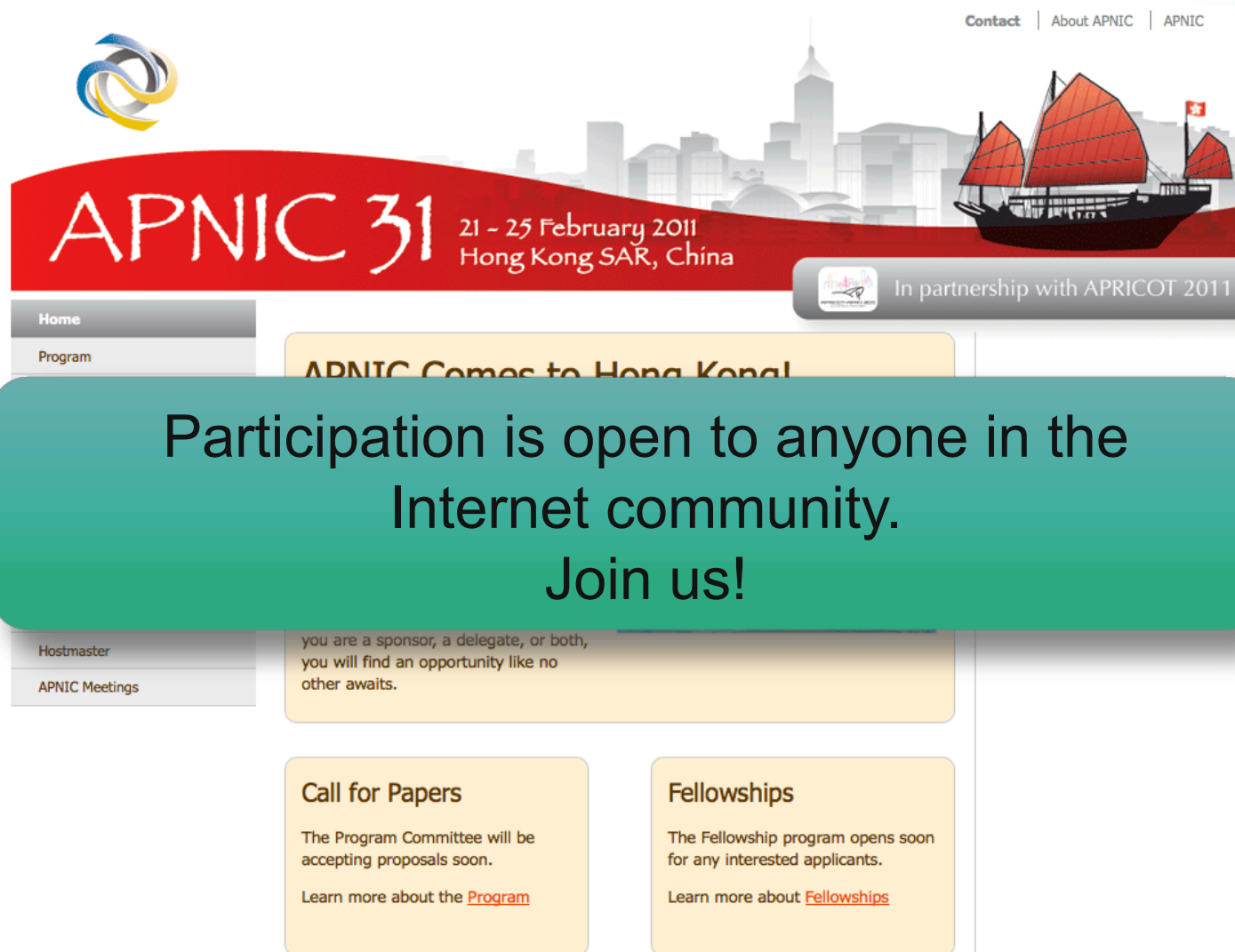
Learn more about the [Program](#)

Fellowships

The Fellowship program opens soon for any interested applicants.

Learn more about [Fellowships](#)

Next APNIC meeting APNIC31



The banner features the APNIC logo (a stylized globe with blue and yellow lines) in the top left. The main title 'APNIC 31' is in large white letters on a red background, with the dates '21 - 25 February 2011' and location 'Hong Kong SAR, China' to its right. A traditional Chinese junk boat with red sails is on the right. Navigation links 'Contact', 'About APNIC', and 'APNIC' are in the top right. A sidebar on the left has links for 'Home', 'Program', 'Hostmaster', and 'APNIC Meetings'. A central text box says 'APNIC Comes to Hong Kong!'. A large green box in the center contains the text 'Participation is open to anyone in the Internet community. Join us!'. Below this, two boxes describe opportunities for sponsors/delegates and a call for papers. Two more boxes describe fellowships and a link to learn more about the program.

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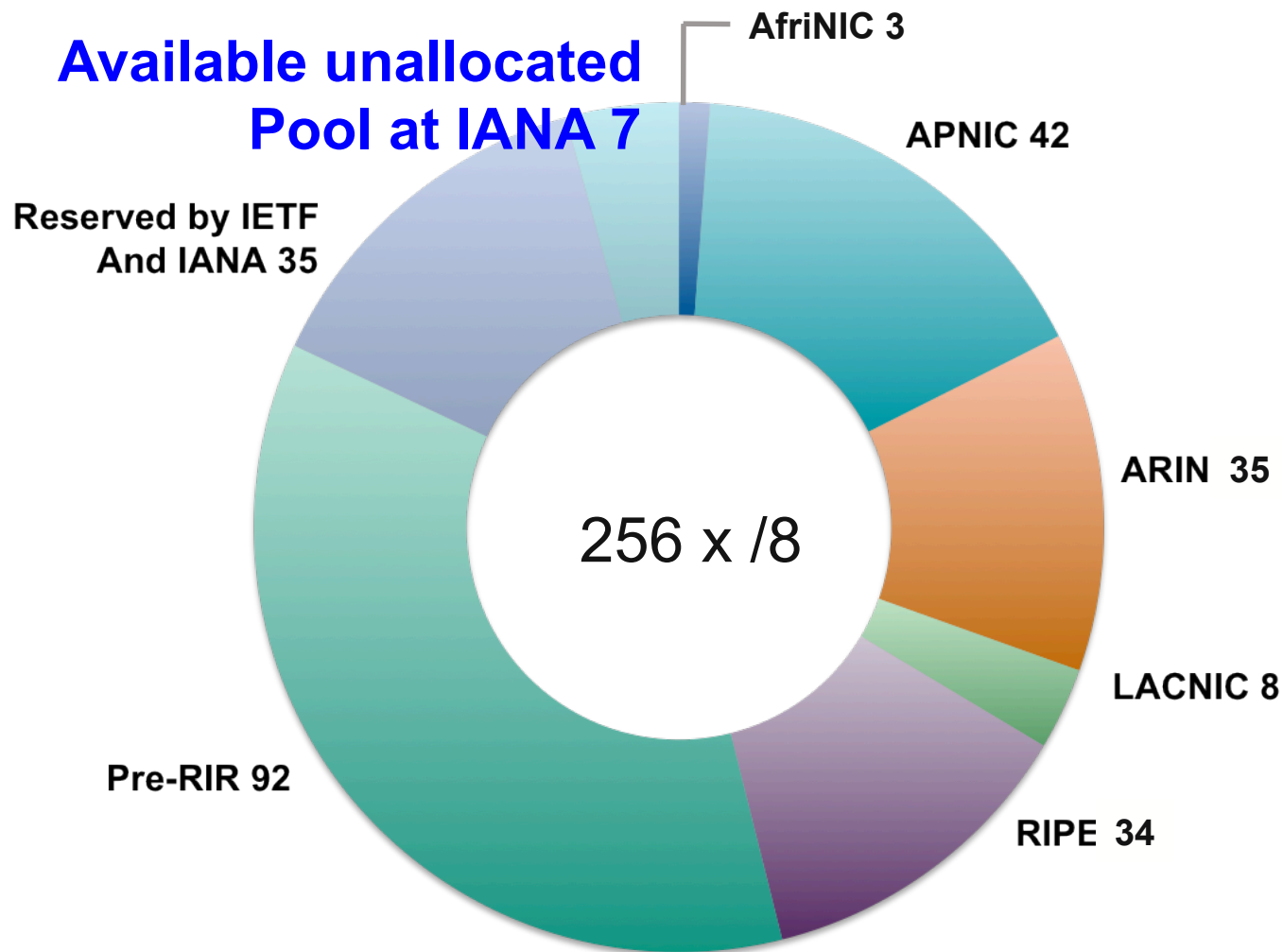
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Status of IPv4 address exhaustion

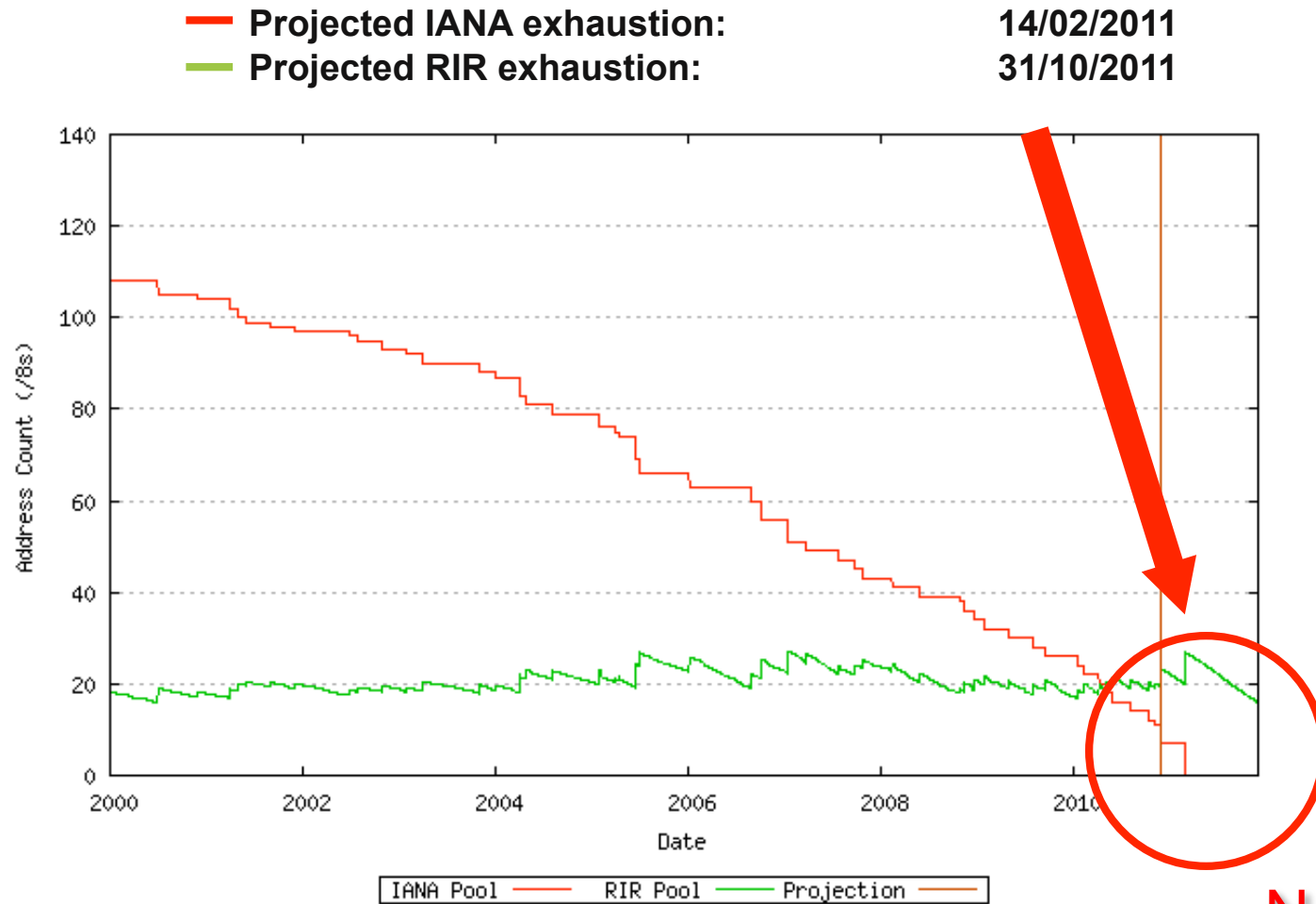
Recap

- Size of IPv4 addresses
 - 32-bit address
 - 2^{32} = about 4.2 billion IP addresses
 - Unit to describe a size of IP address space
 - / = slash notation
 - /8 = 2^{24} = about 16.5 million IPv4 addresses
 - /16 = 2^{16} = about 65,000 IPv4 addresses
 - /24 = 2^8 = 256 IPv4 addresses
- Allocation and assignment

IPv4 Address Global Distribution

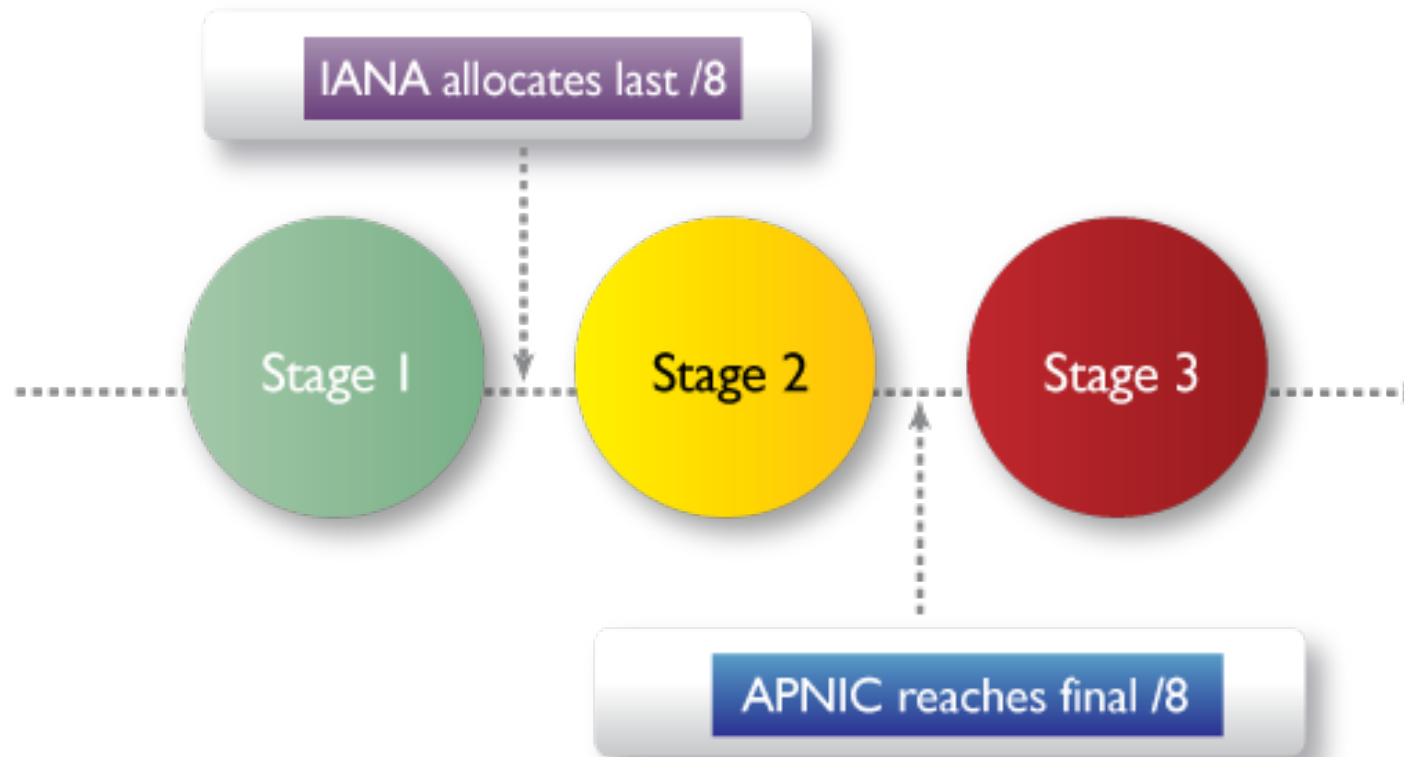


IPv4 Consumption: Projection



Nov 2011

IPv4 exhaustion planning



Appropriate policies/procedures applied at different stage

Where are we now?

IPv6 Deployment Statistics

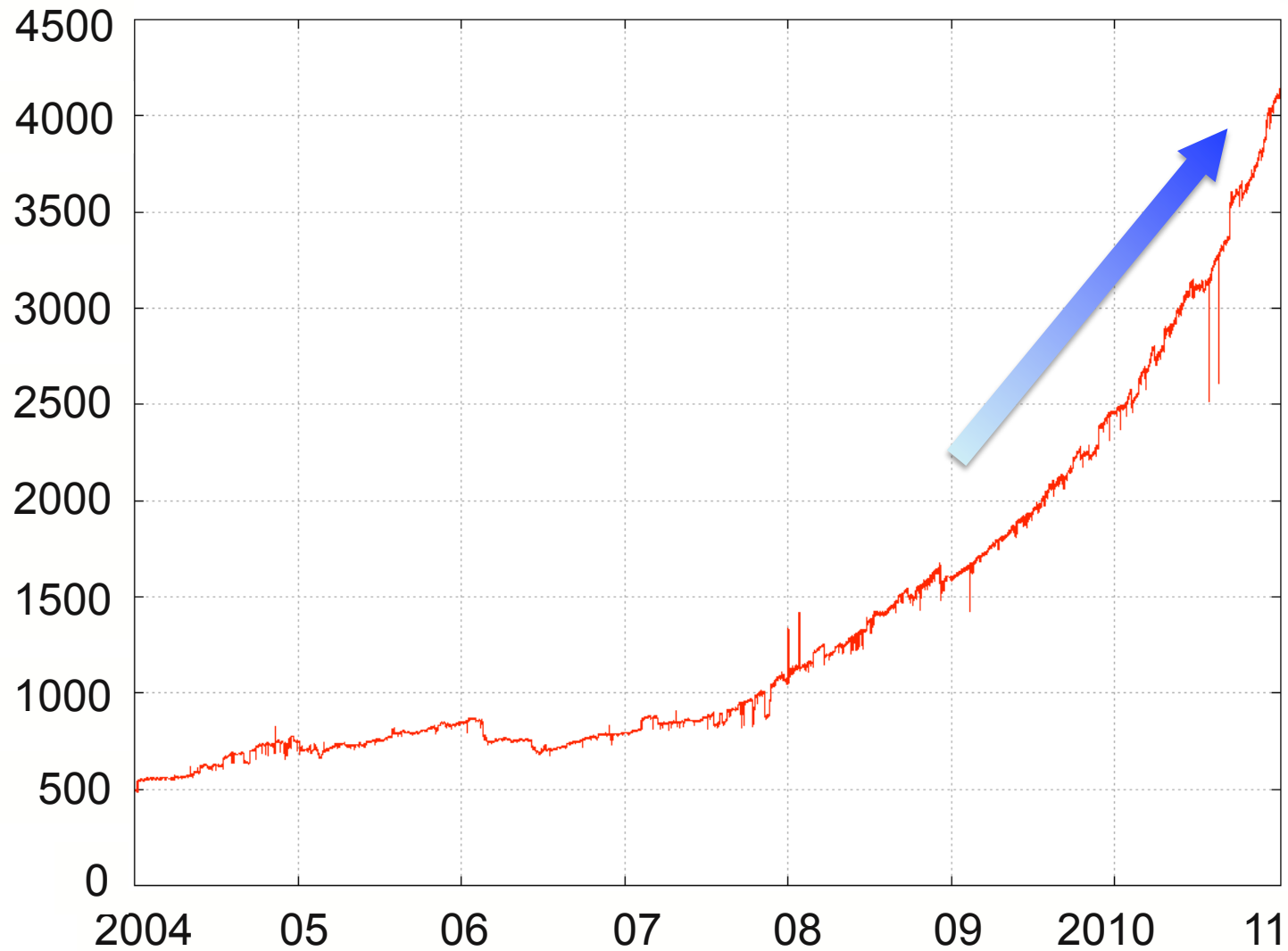
<http://www.potaroo.net/>
January 2011

What's the question?

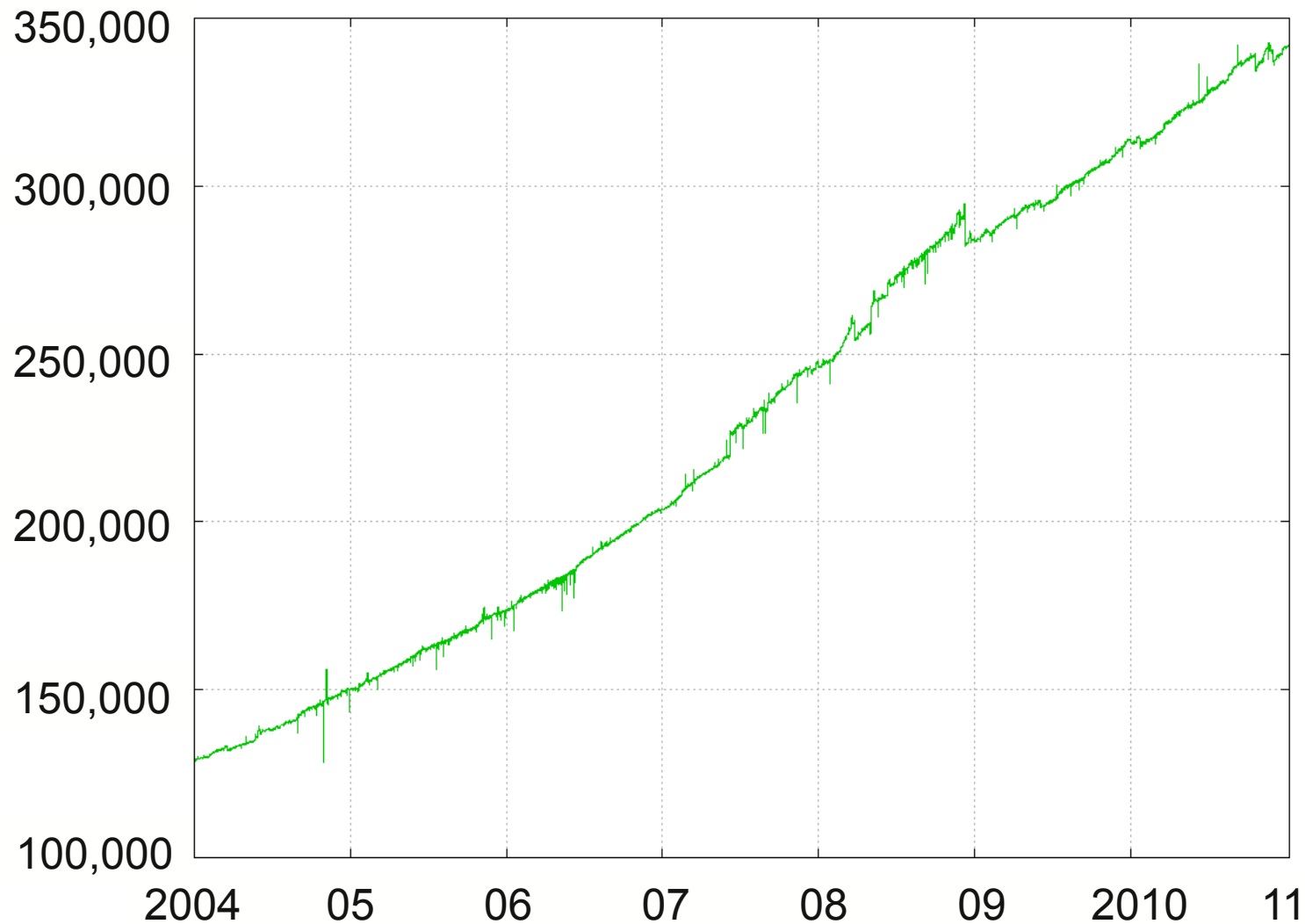
Candidate questions:

- How much of the public Internet supports IPv6?
- How much of the public Internet runs IPv6?
- How quickly is the Internet becoming end-to-end IPv6 capable?
- How long will the dual stack transition take?

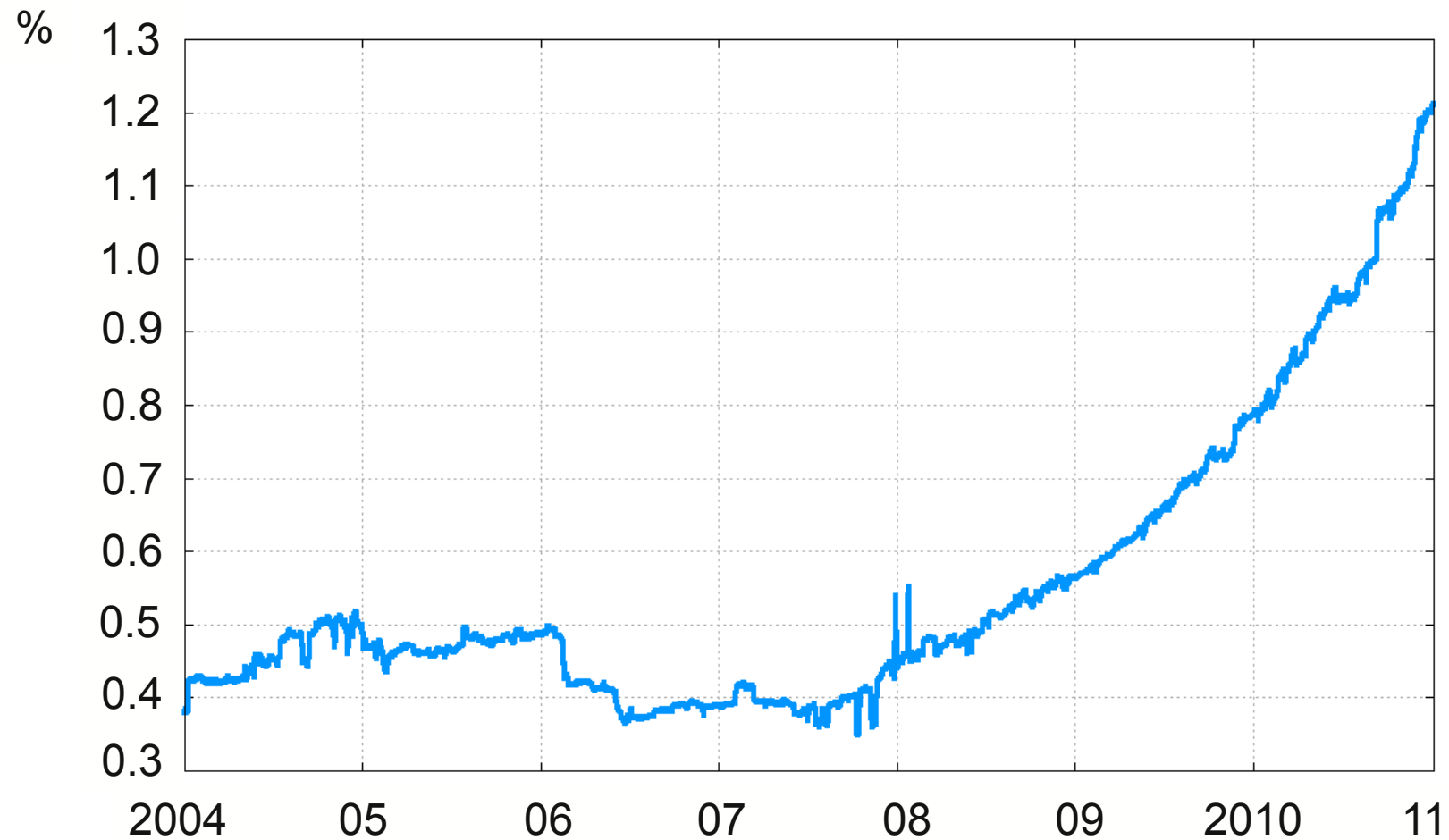
IPv6 BGP Table Size



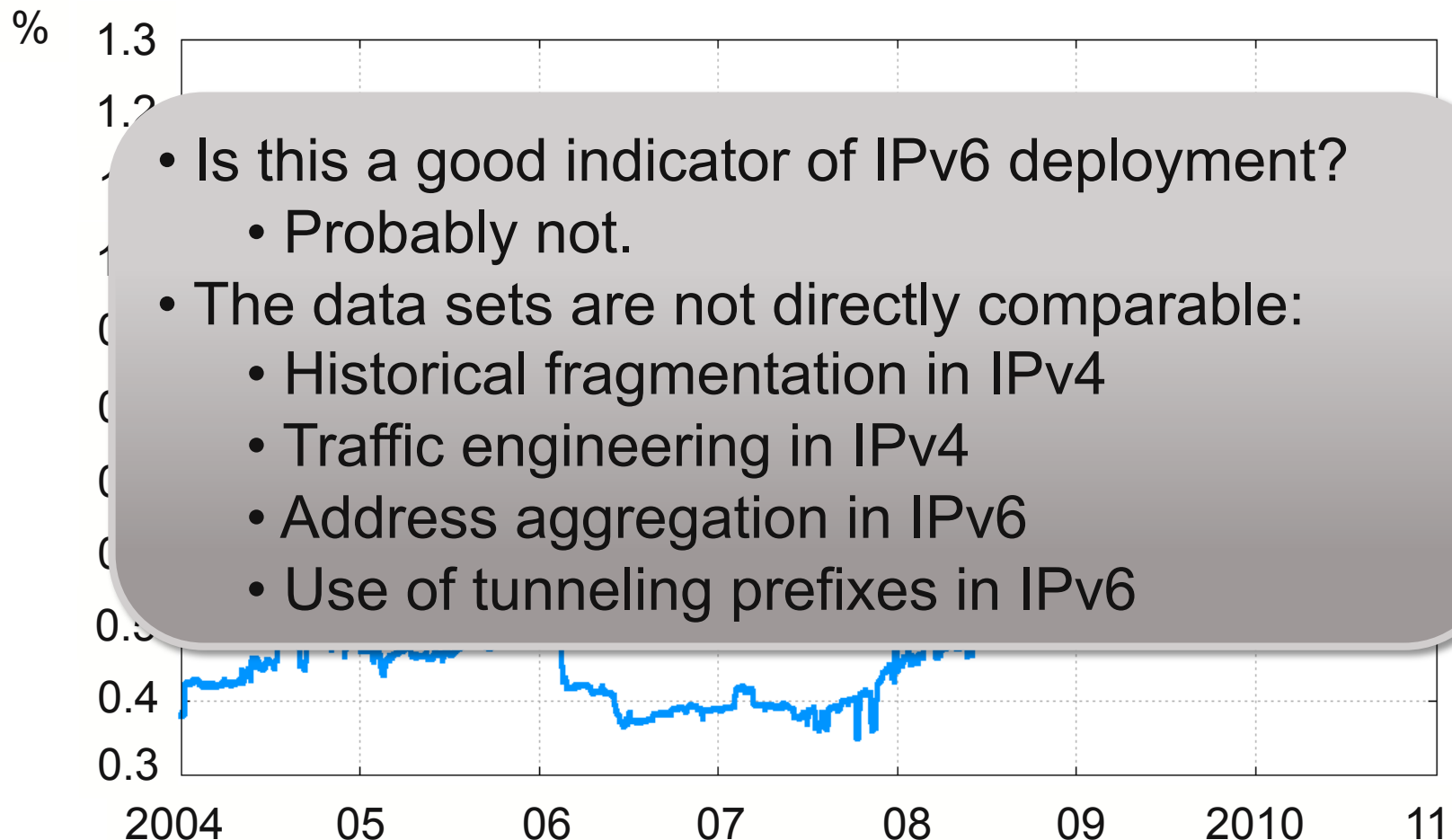
IPv4 BGP Table Size



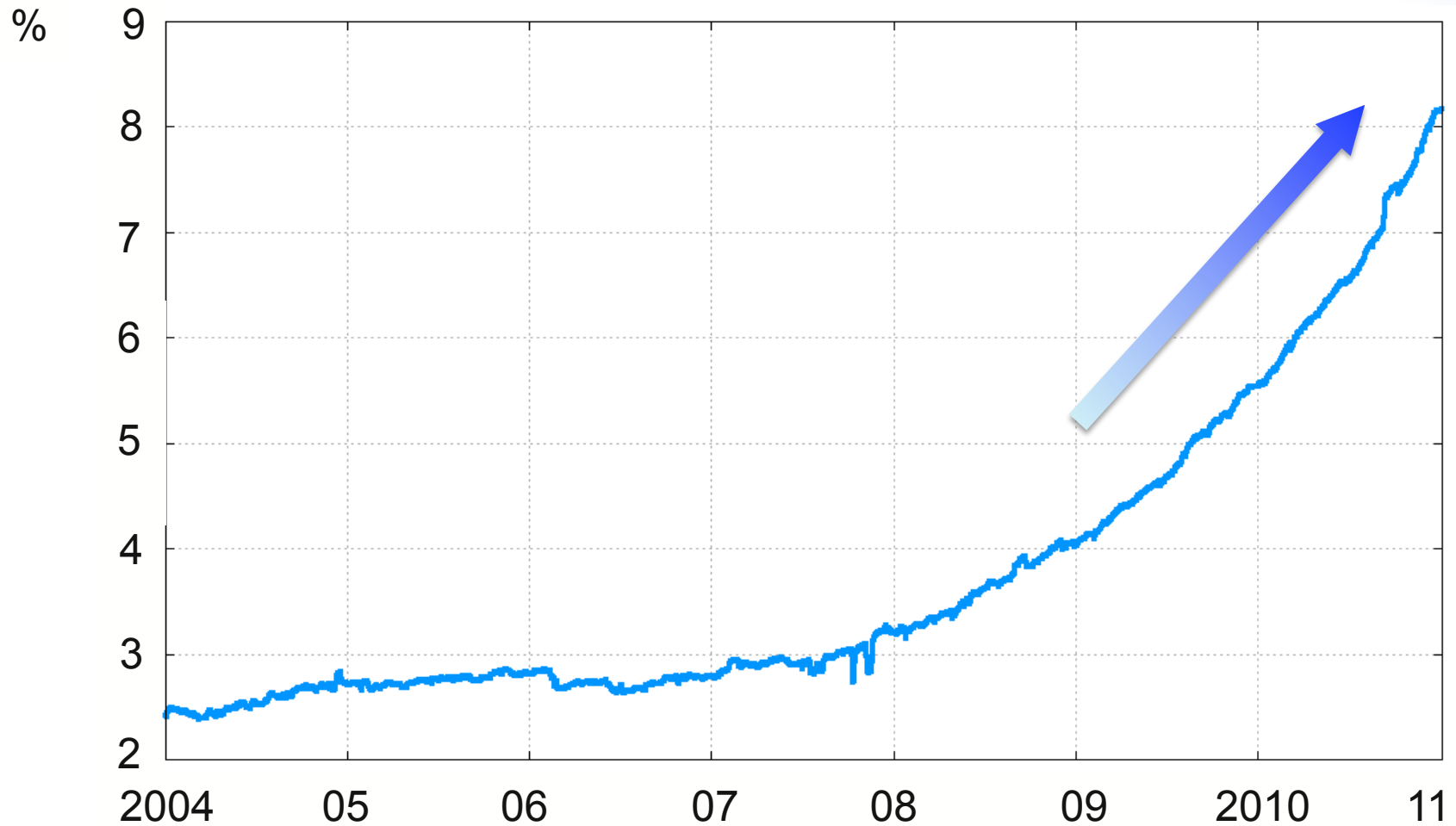
IPv6 / IPv4 BGP Table Size Ratio



IPv6 / IPv4 BGP Table Size Ratio



IPv6 / IPv4 AS Count Ratio

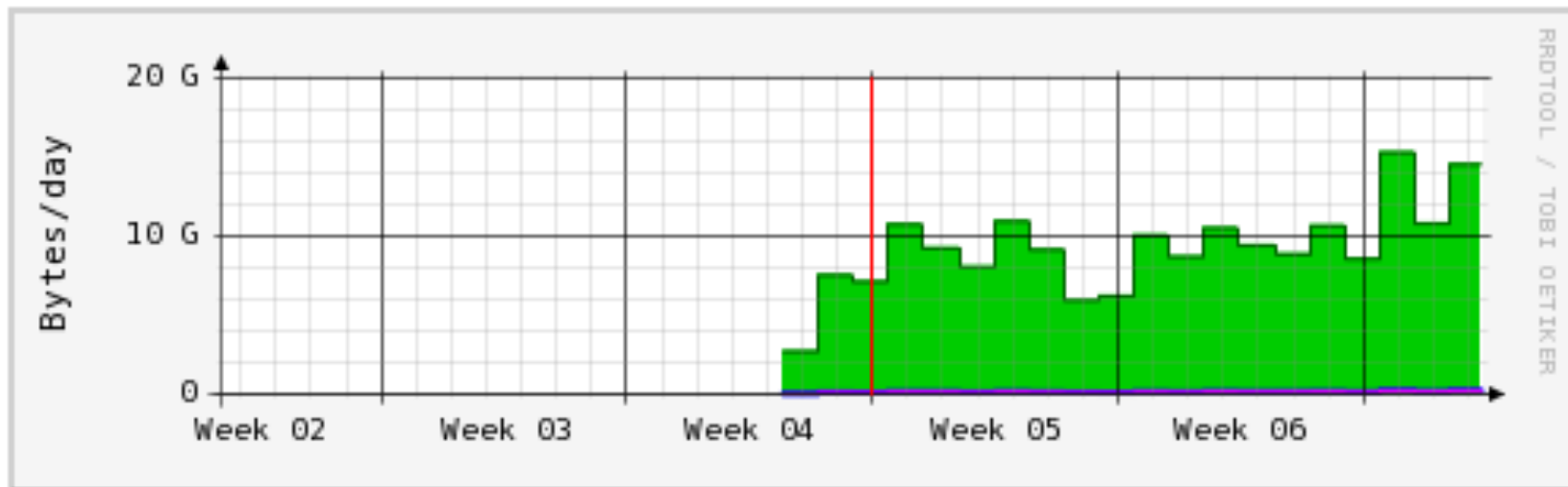


IPv6 Traffic

“Google has quietly turned on IPv6 support for its YouTube video streaming Web site, sending a spike of IPv6 traffic across the Internet...”

– 1 Feb 2010 Network

- Monash University, Melbourne, Australia:



IPv6 Deployment Edges

Comcast

<http://www.comcast6.net/>

comcast.net IPv6 Information Center

Your IP address is 2001:dc0:a000:4:21f:f3ff:fed5:8a54

Comcast IPv6 Trials Have Started

This site is intended to provide the latest information about Comcast's IPv6-related work. We are conducting several IPv6 technical trials in our production network, with customers, in order to prepare for the IPv6 transition. This site will be updated as new information about these trials comes out, and as other IPv6-related work occurs.

IPv6 Trial News and Information:

Comcast's 6RD Trial Has Started Wednesday, June 30, 2010

We are pleased to announce that today, Wednesday June 30th, 2010, Comcast activated our first residential 6RD trial customer, who was located in Cambridge, MA.

In the coming weeks we expect to add several hundred trial customers in a wide range of locations in our network, since the 6RD trial is not geographically limited. 6RD trial customers can use their existing computers and cable modems, which may not support IPv6 directly. However, their home gateway devices have been upgraded to one of two different trial devices which support [6RD](#), enabling IPv6 packets to be encapsulated within IPv4 packets. The encapsulated packets are then sent to a 6RD Border Relay in the Comcast network which in turn forwards the traffic to the Internet over native IPv6.

Comcast's First Native Dual-Stack Customer Activated! Thursday, May 13, 2010

IPv6 Presentations & Articles

[ISOC IPv6 Workshop: DNS Whitelisting Concerns](#)

[ISOC IPv6 Workshop: All Presentations](#)

[IETF 77: ISOC IPv6 Momentum Panel](#)

[NANOG 47: IPv6 Emerging Stories of Success](#)

[NANOG 46: IPv6 and Cable](#)

[NANOG 46: DHCPv6 on DOCSIS](#)

[Communications Technology: Hitchhiker's Guide to IPv6 - Prepare, Don't Panic](#)

[Communications Technology: Change of Address: IPv6 - Its Looming Impact on Cable](#)

[IPv6 Implementors Mtg.: IPv6 Broadband and Cable](#)

[IPv6 Business Information Exchange: IPv6 Deployment Experiences](#)

IPv6 Tutorials

[ISOC: IPv6 Educational Materials](#)

[ARIN: IPv6 Wiki](#)

[Wikipedia: IPv6 Wiki](#)

[Understanding DS-Lite](#)

[Understanding CGN/LSN/AFTR](#)

Comcast

<http://www.comcast6.net/>

comcast.net IPv6 Information Center

Your IP address is 2001:dc0:a000:4:21f:f3ff:fed5:8a54

May 2010

- First native dual-stack customer activated
- Comcast Business Class services

June 2010

- Activated their first residential 6RD trial customer located in Cambridge, MA, USA

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[Deployment Experiences](#)

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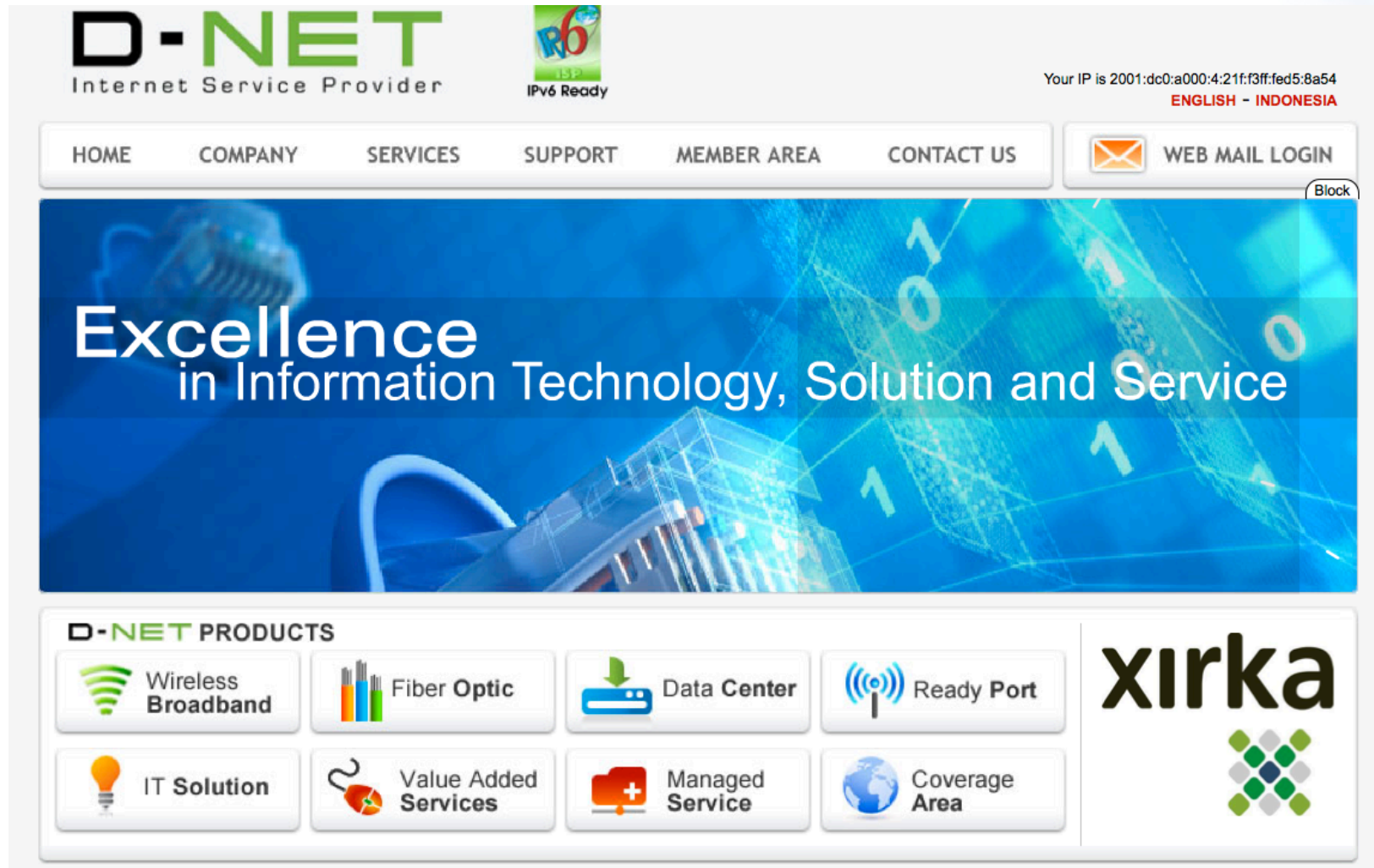
[Wikipedia: IPv6 Wiki](#)

[Understanding DS-Lite](#)

[Understanding CGN/LSN/AFTR](#)

D-NET

<http://www.dnet.net.id/>



The screenshot shows the D-NET website homepage. At the top left is the D-NET logo with the tagline "Internet Service Provider". Next to it is an "IPv6 Ready" logo. On the top right, it displays the user's IP address: "Your IP is 2001:dc0:a000:4:21f:f3ff:fed5:8a54" and language options "ENGLISH - INDONESIA". A navigation menu includes links for HOME, COMPANY, SERVICES, SUPPORT, MEMBER AREA, and CONTACT US, along with a WEB MAIL LOGIN button. The main banner features the text "Excellence in Information Technology, Solution and Service" over a blue background with network-related graphics. Below the banner is a section titled "D-NET PRODUCTS" with eight service tiles: Wireless Broadband, Fiber Optic, Data Center, Ready Port, IT Solution, Value Added Services, Managed Service, and Coverage Area. On the right side of this section is the "xirka" logo.

D-NET
Internet Service Provider

IPv6 Ready

Your IP is 2001:dc0:a000:4:21f:f3ff:fed5:8a54
ENGLISH - INDONESIA

HOME COMPANY SERVICES SUPPORT MEMBER AREA CONTACT US

WEB MAIL LOGIN

Excellence
in Information Technology, Solution and Service

D-NET PRODUCTS

- Wireless Broadband
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- Coverage Area

xirka

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The screenshot shows the D-NET website header with the logo "D-NET Internet Service Provider" and a "IPv6 Ready" badge. A teal box in the center contains the year "2006" and a bulleted list of achievements. Below this, a "D-NET PRODUCTS" section displays eight service categories in a grid, each with an icon and text. To the right of the products is the "xirka" logo.

2006

- Implemented IPv6 based on the business decision made by Board of Director
- Future proof to cope with IPv4 address exhaustion and to maintain sustainable growth

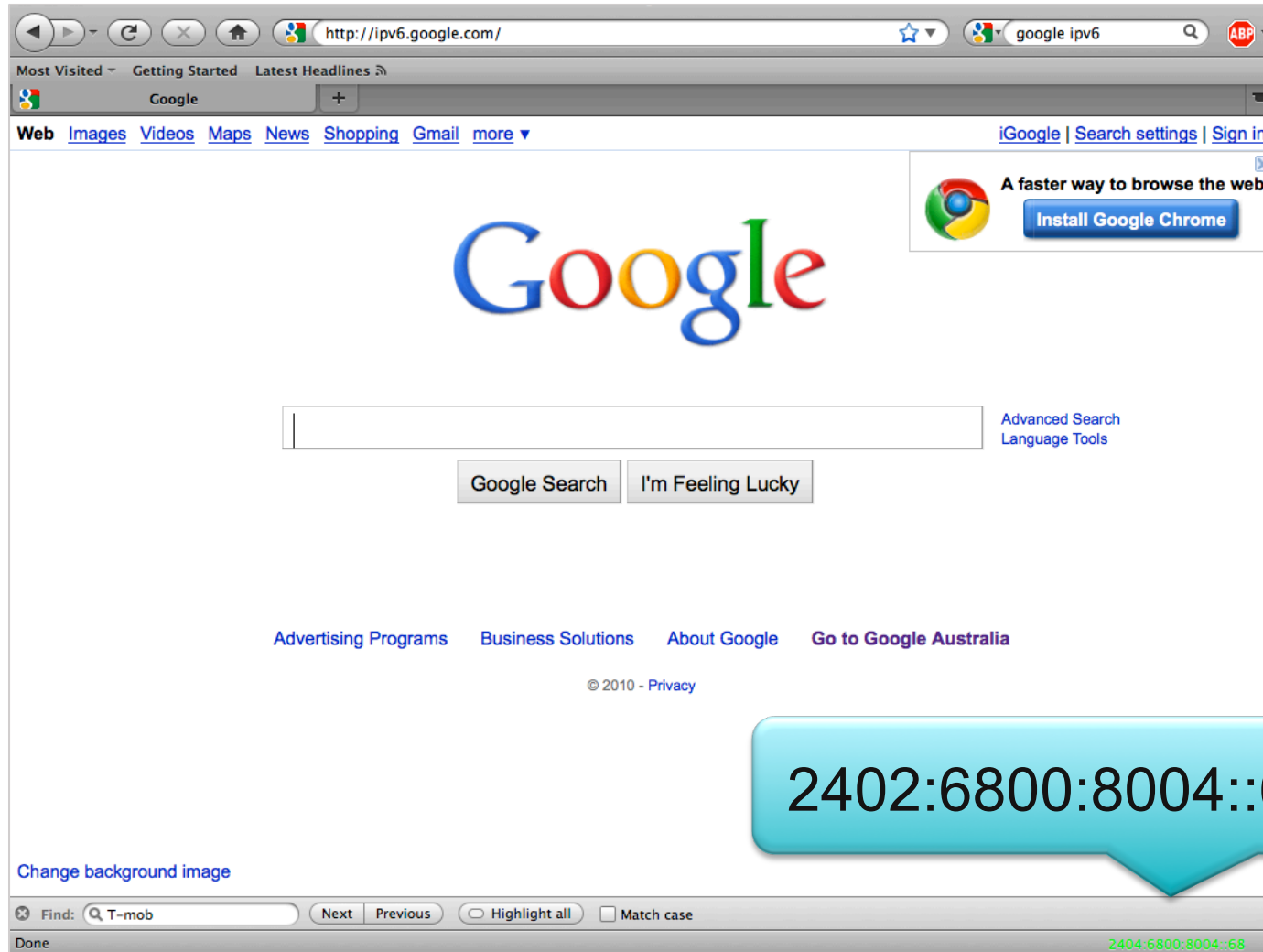
D-NET PRODUCTS

Wireless Broadband	Fiber Optic	Data Center	Ready Port
IT Solution	Value Added Services	Managed Service	Coverage Area

xirka

Google

http://ipv6.google.com/



Facebook

<http://www.v6.facebook.com/>

Experimental,
non-production



The screenshot shows the Facebook v6 login page in a web browser. The browser's address bar displays 'http://www.v6.facebook.com/'. A green callout box with the text 'Experimental, non-production' is overlaid on the browser window. The Facebook page features the 'facebook' logo, a login section with fields for 'Email' and 'Password', and a 'Sign Up' section with fields for 'First Name', 'Last Name', 'Your Email', and 'New Password'. There are also dropdown menus for 'Select Sex' and 'Birthday' (Month, Day, Year). A world map with orange profile icons and connecting lines is on the left. At the bottom, there are language links (English (US), Español, Português (Brasil), Français (France), Deutsch, Italiano, العربية, हिन्दी, 中文) and a search bar with 'face' entered. A light blue callout box with the IPv6 address '2620:0:1cfe:face:b00c::3' is overlaid on the bottom right of the page. The browser's status bar at the bottom right shows the same IPv6 address.

facebook

Email Password

☐ Keep me logged in [Forgot your password?](#)

Facebook helps you connect and share with the people in your life.

Sign Up
It's free and anyone can join

First Name:

Last Name:

Your Email:

New Password:

I am:

Birthday:

Why do I need to provide this?

[Create a Page for a celebrity, band or business.](#)

English (US) Español Português (Brasil) Français (France) Deutsch Italiano العربية हिन्दी 中文

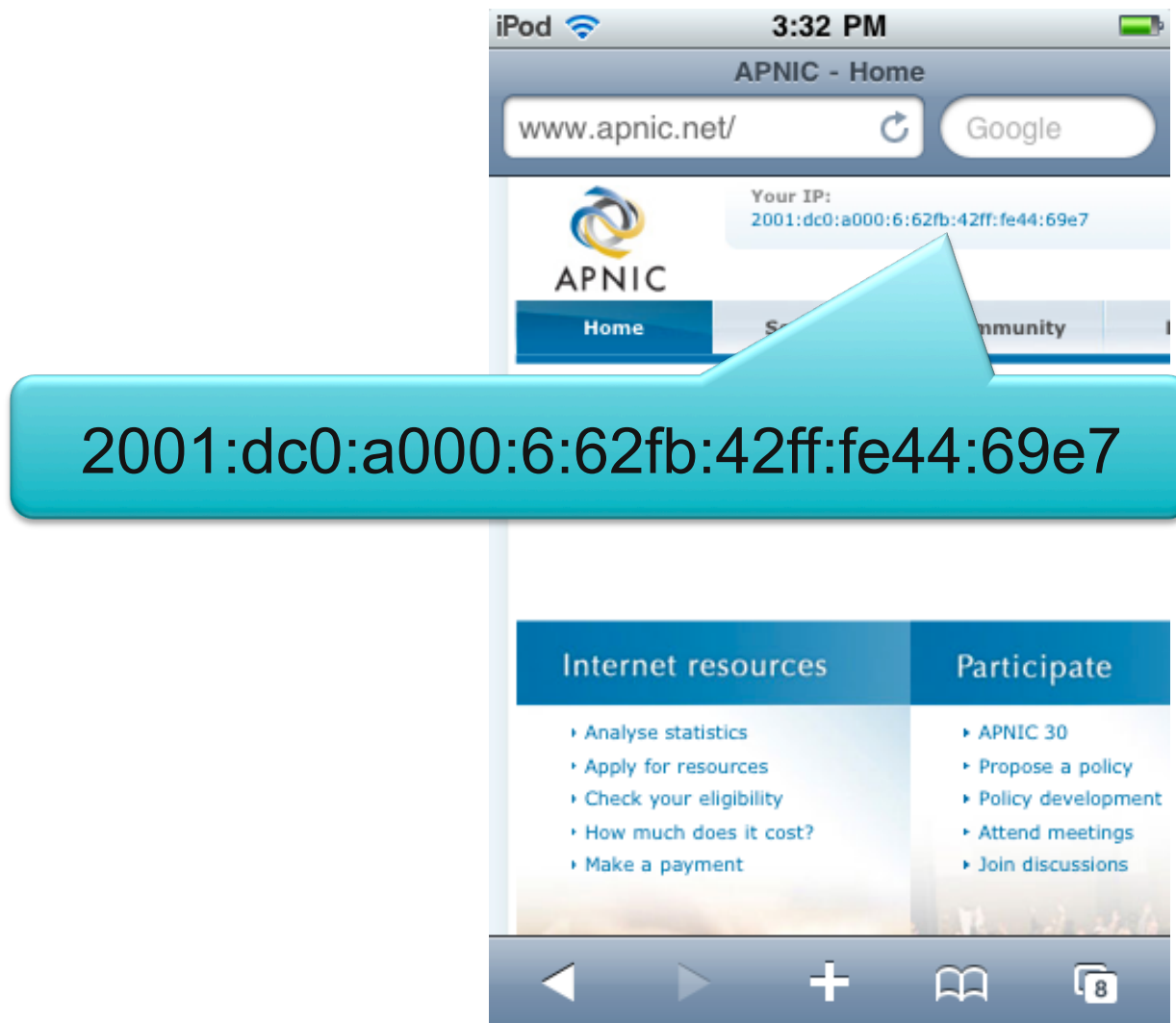
Facebook © 2010 Mobile - Find

Find: ☐ Highlight all ☐ Match case

Done

2620:0:1cfe:face:b00c::3

iOS 4



Mobile networks



- “Smartphones are driving a very large amount of network *signaling*...IPv6 is a priority” (T-Mobile)
- “(IPv6 enabled) Handsets will become prolific in 2011” (Verizon)

IPv6 for Mobile Operators

Are you ready with IPv4 address exhaustion?

Recap

- Mobile Network Operators (MNOs) serve the largest number of users of connected devices
 - Over 4.6B GSM subscriptions
- Smartphone: Prices decreasing
 - Wider and rapid penetration of smartphones that can be an Internet host – always on
- MNOs must tackle IPv6 implementation

Transition mechanisms

- Dual stack native
- DS-lite
- 6in4
- 6to4
- 6RD
- IVI
- NAT64
- Etc.

But it is more than technical...

- IPv6 transition is more than selecting a transition method:
 - Requires enterprise-wide effort
 - Touches many parts of a MNOs' network, processes, tools, people etc.
- Running complicated IPv4 networks with multiple NATs and renumbering to cope with IPv4 address exhaustion
 - Possible factor of cost differential of IPv4 and IPv6 services

T-Mobile

• T-Mobile IPv6 Friendly User Trial

MOD **Daryl**
Moderator



Posts: 903
Registered: 10-20-2008

1



T-Mobile IPv6 Friendly User Trial [Edited]

09-07-2010 11:14 AM - last edited on 09-07-2010 11:21 AM

Options ▼

T-Mobile USA is keenly aware of the [IPv4 address exhaustion](#) issue and we are working diligently to ensure an orderly transition from IPv4 services to IPv6 services. To that end, we are working with our industry partners, the IETF, and the 3GPP to develop the right standards and the right ecosystem to make the IPv6 Internet a reality. Internally at T-Mobile, our focus is on building the IPv6 infrastructure and service that will make the transition from IPv4 to IPv6 as seamless to our customers as possible. Our goal is to introduce IPv6 devices into our handset lineup and to have those IPv6 handsets be just as capable and feature-packed as the IPv4 device. At the end of the day, we do not want our customers to care about IPv4 or IPv6. We want our customers to choose T-Mobile and stick with T-Mobile because we provide great products and reliable services. With the quickly approaching exhaustion of IPv4 addresses and the well know limitations of NAT, we are very happy to be well positioned with a strong IPv4 strategy and an early beta IPv6 service.

To ensure that we can move forward with mature IPv6 products and services in the marketplace, we are extending an invitation to IPv6 early adopters. We would like T-Mobile customers who are IPv6 early adopters and technology enthusiasts to help us make IPv6 great by trying out our beta IPv6 service and providing us feedback.

To participate in the T-Mobile USA IPv6 beta service, you must:

- Be a **T-Mobile USA** subscriber with an unlimited data plan
- Have **T-Mobile coverage**, not roaming or WiFi
- Have a **Nokia 5230 Nuron** or the **Nokia E73 Mode** phone. The **N900** also works, but it's **IPv6 support** is less mature. **Update: N900 now has better support.** Other Nokia Symbian phones may work as well but have not be verified yet.
- Be willing to help T-Mobile improve the service, forgive us as we grow and refine the service, and accept that this beta service is not supported within any T-Mobile support channel, including Customer Care or any T-Mobile store or reseller. **Google groups forum is the only channel for IPv6 support during the beta friendly user trial.**
- Accept that the service is still evolving and that many services like Visual Voice Mail, MyAccount, and several other services do not yet work. Web and Email both work well, but many other data services are still coming online with IPv6.

Verizon

- Verizon begins testing IPv6 on FiOS services

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Verizon Begins Testing IPv6 on FiOS Services

Use of Emerging Protocol Will Enable the FiOS Network to Accommodate Long-Term Growth and Support Future Innovative Services

News Release [ShareThis](#)

BASKING RIDGE, N.J. – April 6, 2010 – Verizon has begun testing on its all-fiber FiOS network a new Internet communications protocol that will enable the Internet to continue to expand and facilitate the future development of innovative services.

The new protocol - known as Internet Protocol version 6, or IPv6 - is designed to eventually replace the current Internet Protocol version 4 (IPv4), which over the next few years is expected to reach the maximum number of IP addresses it can accommodate, due to the rapid growth of the World Wide Web and IP-connected devices.

IPv6 expands the number of possible addresses from approximately 4 billion with IPv4 to roughly 340 trillion trillion trillion IPv6 addresses.

Because both IPv4 and IPv6 will be in use during the expected lengthy transition period, network-connected equipment and network operating systems must be able to handle both protocols.

"FiOS is a key service that can take advantage of IPv6," said Jean McManus, executive director - packet network technology for Verizon.

"We've been working on an IPv6 transition plan for FiOS along with our other residential and enterprise services, and this work involves testing network equipment and making necessary customer premises equipment changes to ensure interoperability and proper operation of equipment. The FiOS trial is a key step toward enabling IPv6 in our core network, on edge routers and on CPE."

General recommendations for IPv6 deployment

Wayforward

Preparing for IPv6 Transition

Overall planning

1. Review the impact of IPv4 address exhaustion
 - Inventory of your IT assets
2. Develop an IPv6 deployment plan
 - Strategy, scope of the deployment, schedule, auditing of execution of the plan
 - How to manage coexistence of IPv4 and IPv6
 - Where to start to deploying IPv6?
 - What transition techniques to be employed?
 - Staff training
3. Budget readiness

Preparing for IPv6 transition

- Technical management
 - Assess the possibility of IPv4 and IPv6 co-existence with desired technology
 - There are quite a few transition technologies are available
 - Assess security implication of IPv6
 - Any new technology comes with new security threats and vulnerabilities
- Human capacity development
 - Develop a plan to acquire skills to implement IPv6
 - Implement a test networks with IPv6

***IPv6:
A prerequisite to the
sustainable long-term
development of a ubiquitous
and open Internet***

Thank you!

`<miwa@apnic.net>`