IPv4 is running out
How to craft the Internet beyond?

SANOG 13
Lahore, Pakistan
22 January 2009

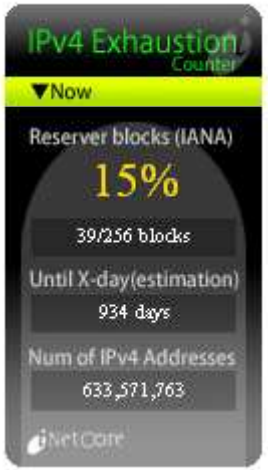
Sanjaya
Services Area Manager

Acknowledgements

Geoff Huston

Chief Scientist

APNIC

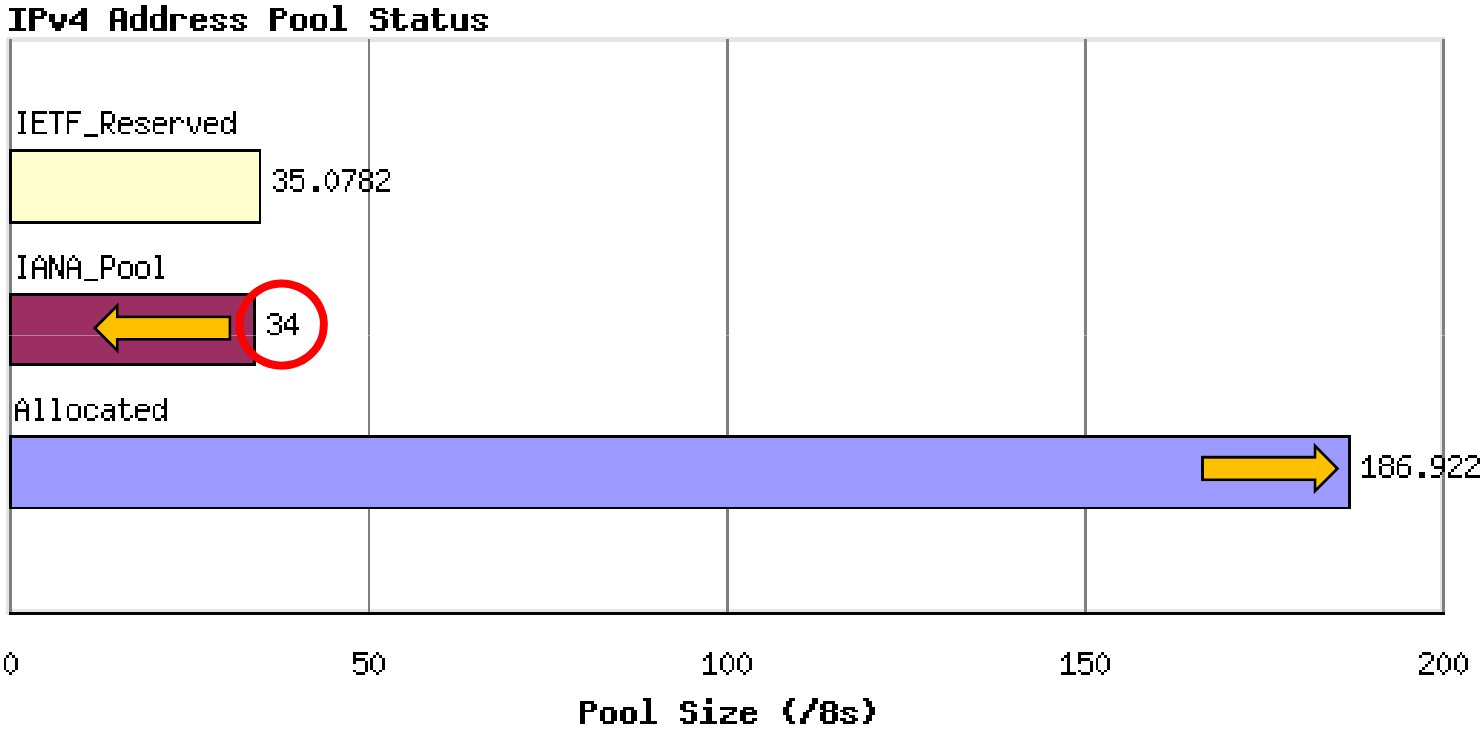


Intec NetCore, Inc.

http://www.potaroo.net

IPv4 address distribution

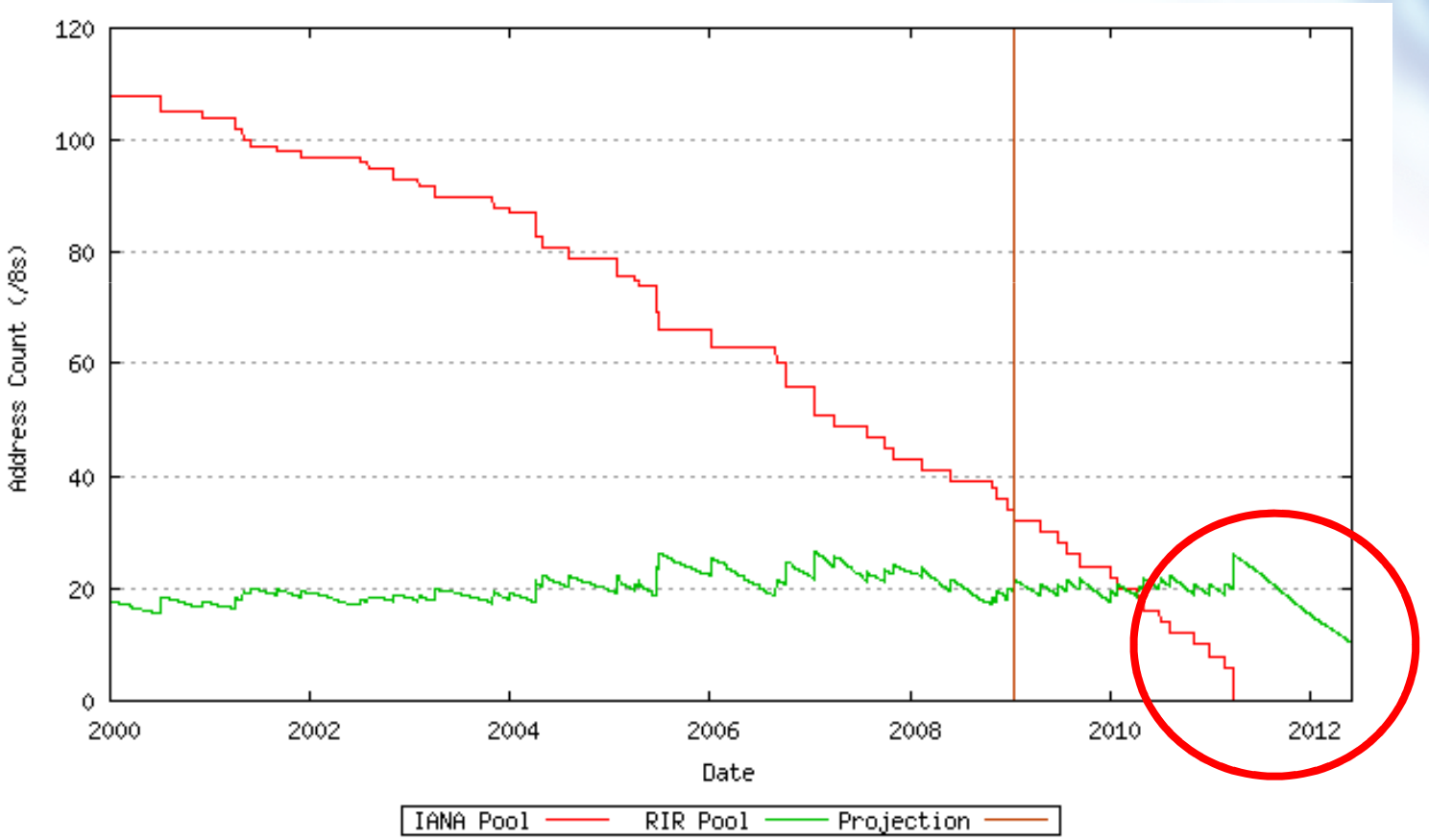
Current distribution of the whole IPv4 address space



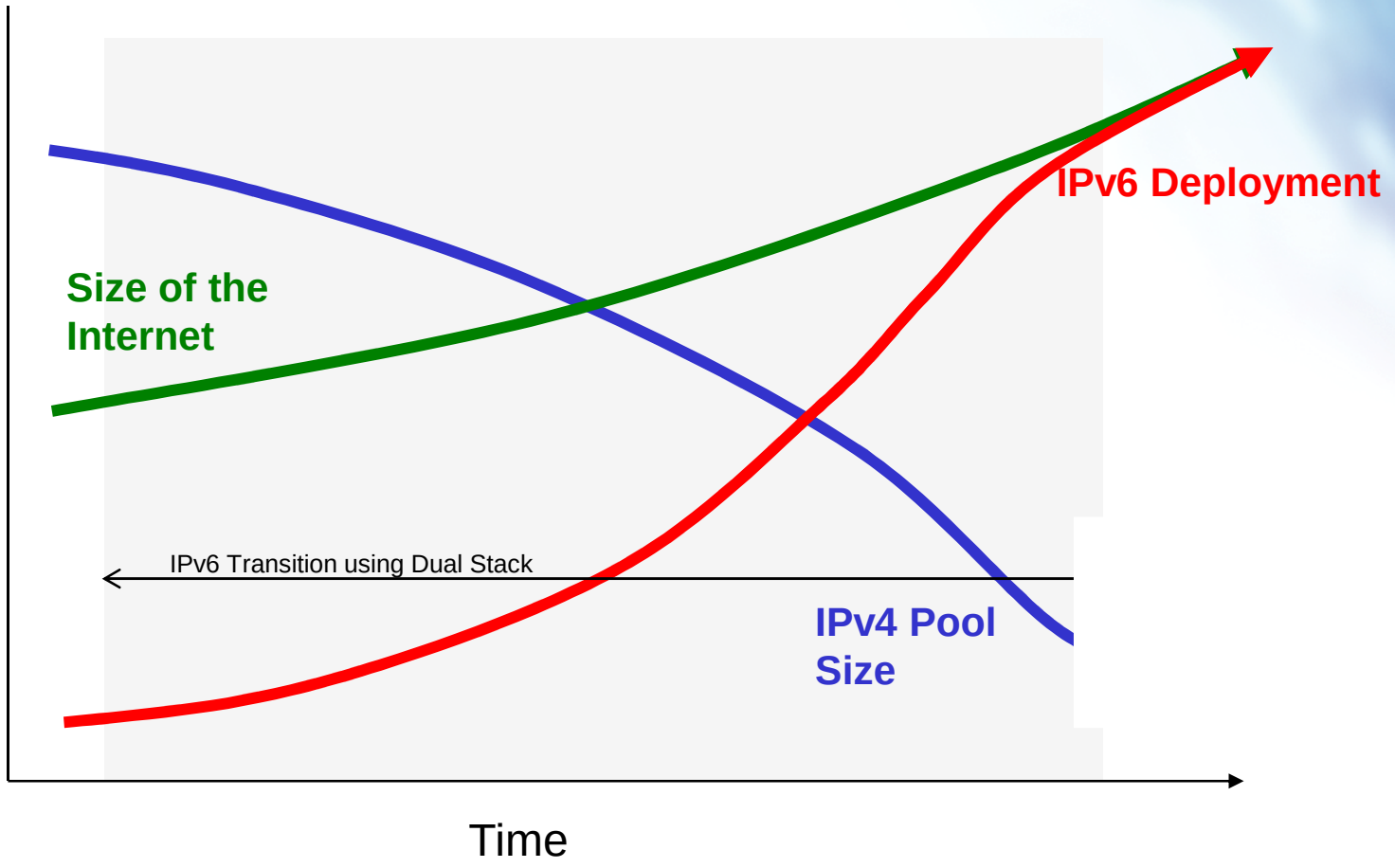
Source: http://www.potaroo.net (As of this date)

IPv4 consumption – Projection

Projected IANA Unallocated Address Pool Exhaustion: 22-Mar-2011
Projected RIR Unallocated Address Pool Exhaustion: 31-May-2012



We had a plan …



Source: http://www.potaroo.net (As of this date)

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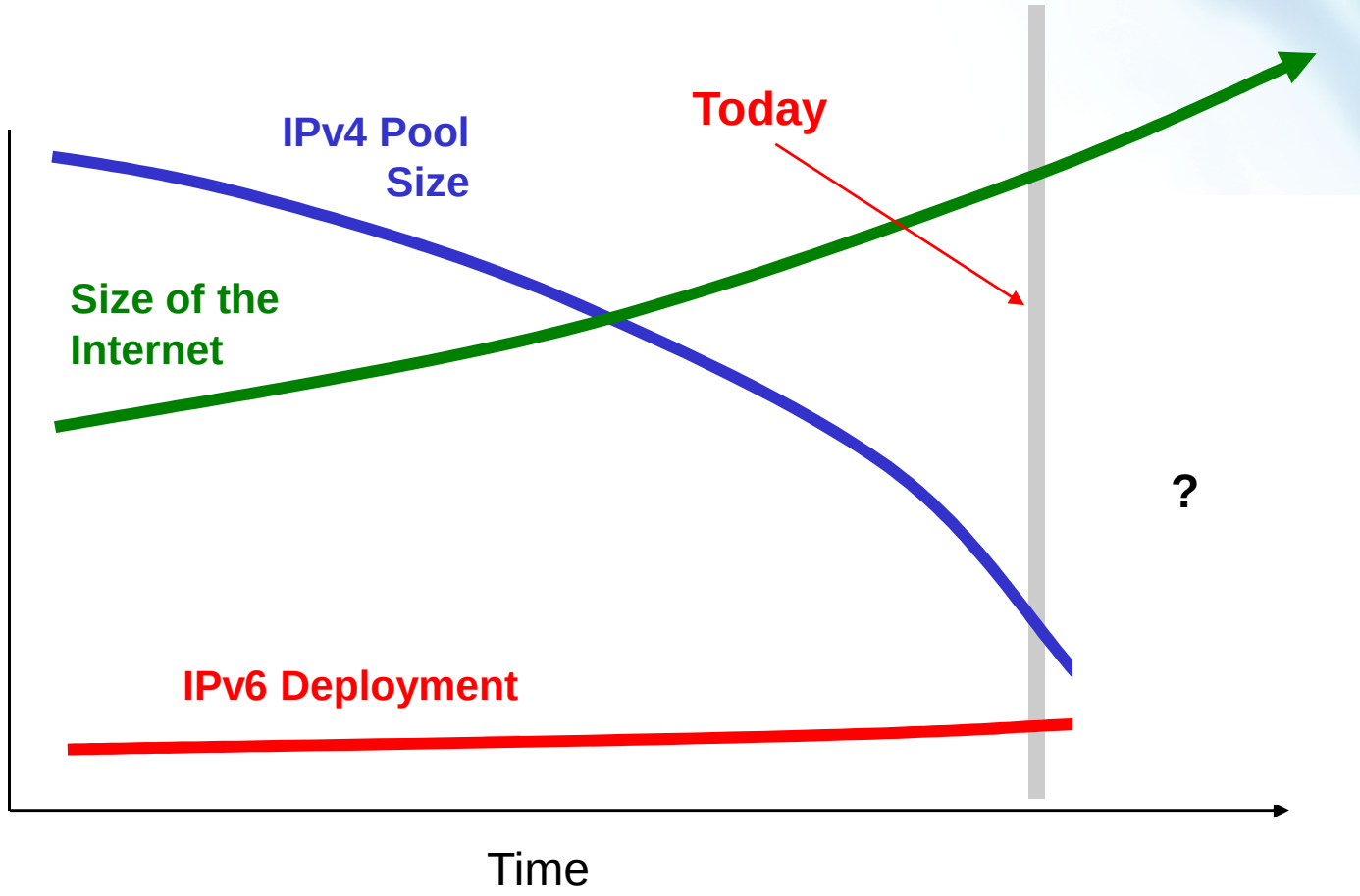
What's the revised plan?



Source: http://www.potaroo.net (As of this date)

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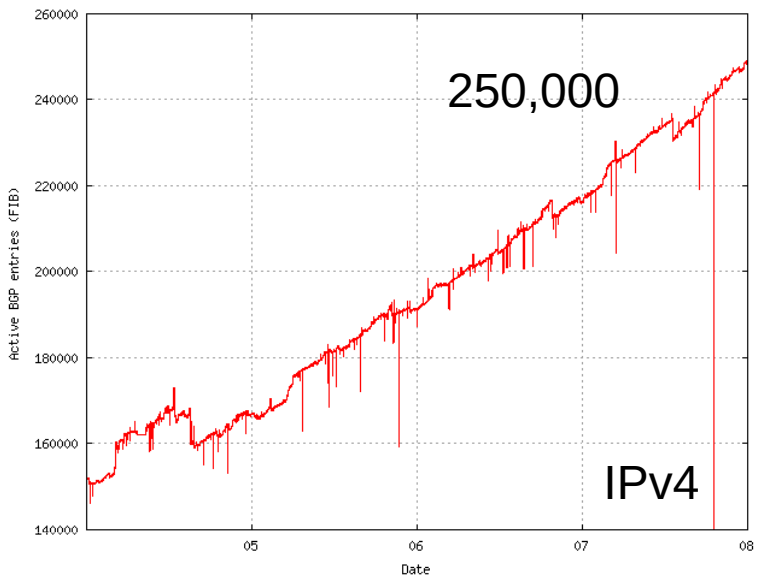
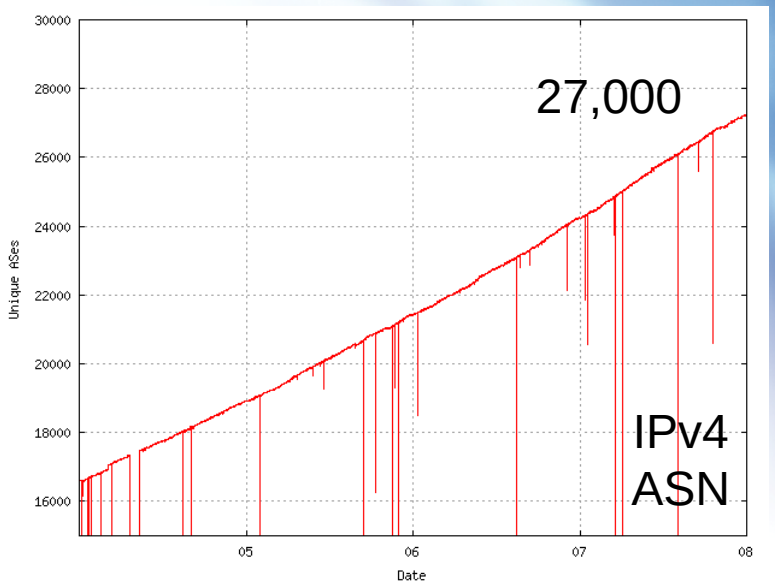
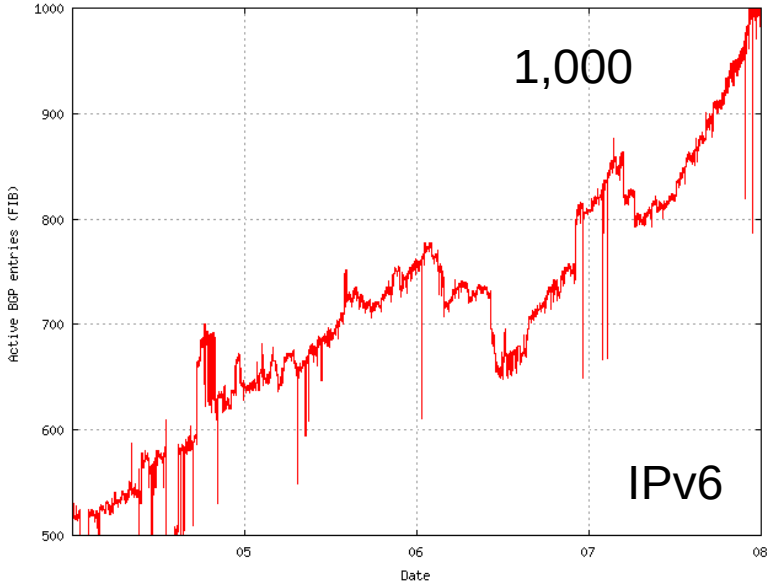
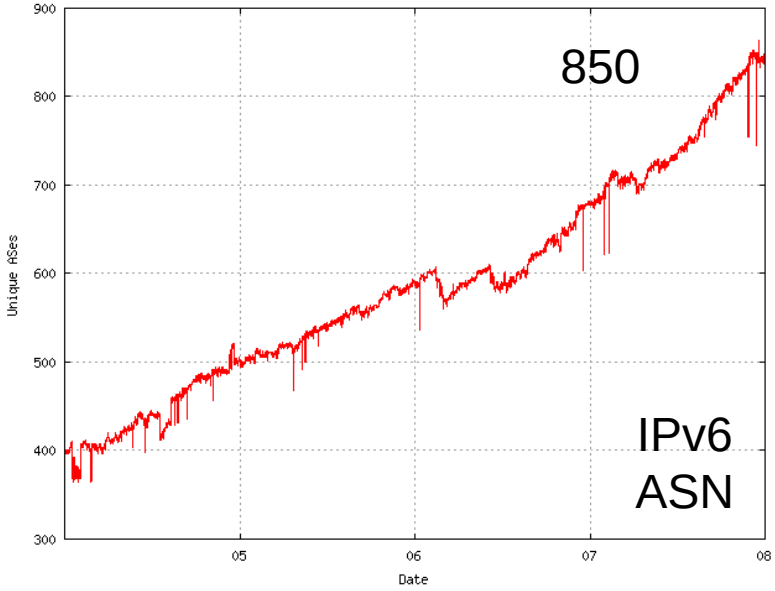
Is IPv6 actually in use?

Yes, it is, far less than IPv4 but growing!









Source: http://www.potaroo.net (As of this date)

What are beyond the *depletion*?

How can we expand the Internet after the IPv4 address depletion?

- Procuring global IPv4 address *by any means*
- Deploying IPv6 for new users
- Using NAT not to use global IPv4 addresses

Is IPv4 address any longer available?

Not so longer, not always

- The current free pool is being depleted in 2011 - 2012

- Re-circulated IPv4 address will not always be supplied
  - Returning unused IPv4 address DOES COST. Available space by reclamation will be QUITE LIMITED.
  - A market for second-hand IPv4 address *might* emerge, but the supply is NOT COMMITTED.

Then, don’t we need to deploy IPv6?

Yes, we do.

- Why?
- Simply, servers connected via NATs cannot be reached to meet end-to-end connectivity
  - Internet users benefit from cool services on servers. Not from the network itself.

Frequently heard but questionable arguments – 1&2

- *IPv4 address depletion? I don't care since I'll make much more use of NAT*
- *IPv4 address depletion? I don't care since I've already got more than sufficient IPv4 address space.*

- You must care. Your customers will have more and more destinations which they cannot get through.

Frequently heard but questionable arguments – 3

- *IPv6? Yet no one uses. Why and for whom should we deploy it? The cost will never be justified.*

- It is not a brand-new service only to extend your business. IPv4 address depletion is a CRISIS, and IPv6 is the only sustainable countermeasure.

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INTERNET USAGE STATISTICS
The Internet Big Picture
World Internet Users and Population Stats

WORLD INTERNET USAGE AND POPULATION STATISTICS						
World Regions	Population (2008 Est.)	Internet Users Dec/31, 2000	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2008
Africa	955,206,348	4,514,400	51,065,630	5.3 %	3.5 %	1,031.2 %
Asia	3,776,181,949	114,304,000	578,538,257	15.3 %	39.5 %	406.1 %
Europe	800,401,065	105,096,093	384,633,765	48.1 %	26.3 %	266.0 %
Middle East	197,090,443	3,284,800	41,939,200	21.3 %	2.9 %	1,176.8 %
North America	337,167,248	108,096,800	248,241,969	73.6 %	17.0 %	129.6 %
Latin America/Caribbean	576,091,673	18,068,919	139,009,209	24.1 %	9.5 %	669.3 %
Oceania / Australia	33,981,562	7,620,480	20,204,331	59.5 %	1.4 %	165.1 %
WORLD TOTAL	6,676,120,288	360,985,492	1,463,632,361	21.9 %	100.0 %	305.5 %

NOTES: (1) Internet Usage and World Population Statistics are for June 30, 2008. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the US Census Bureau . (4) Internet usage information comes from data published by Nielsen//NetRatings, by the International Telecommunications Union, by local NIC, and other reliable sources. (5) For definitions, disclaimer, and navigation help, please refer to the Site Surfing Guide, now in ten languages. (6) Information in this site may be cited, giving the due credit to www.internetworldstats.com. Copyright © 2001 - 2008, Miniwatts Marketing Group. All rights reserved worldwide.

www.internetworldstats.com

An IPv6 revolution…

- “Internet for Everything” instead of *Everyone*
- Serving the communications requirements of a device-dense world
- Device population some 2–3 orders of magnitude larger than today’s Internet
- Service costs must be cheaper by 2-3 orders of magnitude – per packet

IPv6 – From PC to iPOD to iPOT…

- A world of billions of chattering devices

- Or even trillions…

Where do we go from here?

Cost of deployment

- Infrastructure
  - Upgrade to router and switch equipment
- End-user services
  - Require dual-stack or NAT-PT
- User equipment
  - Operating System and client upgrades
- Content providers
  - Upgrade servers to dual stack
  - Or, deploy separate v4 and v6 services
- Costs are highly distributed
  - And highly variable

The challenge

- IPv6 is not a simple replacement for IPv4
  - Industry will need to access both IPv4 and IPv6 throughout the entire transition
  - Industry demand for IPv4 addresses will continue beyond the projected date of IPv4 address pool exhaustion
- Failure to adopt IPv6 will affect Internet innovation and development
- How do we achieve a smooth transition?
  - The process may take over 10 years
  - “Dual stack networks” in use for many years
  - IPv4 addresses will still be needed

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National responses (AP region)

- Japan
  - The IPv4 Address Exhaustion Task-Force, including by industry and government
- Korea
  - IPv6 Strategy Committee (2003)
  - NIDA “IPv6 Promotion Plan II” (2007)
  - Deployment of IPv6 in the public sector
- Singapore
  - IDA “Internet Protocol Version 6 Transition Plans for Singapore” (2006)
  - “technologically agnostic approach … and communication between industry and government”
- New Zealand
  - Formed IPv6 Steering Group
    - telecommunications carriers, internet service providers, ICT vendors, and industry and user associations

RIR responses

- IPv4 address management
  - Numerous policy measures under discussion for management of remaining space
    - Hard landing vs soft landing
    - Rationing, reserves, limiting demand
  - Discussions about reclamation of IPv4 space
    - Transfer/trading (market) for address management
- IPv6 network deployment
  - Address policies are established
  - Increasing promotion and awareness
  - Putting preparations in place
  - The time is now right!

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APNIC IPv6 position statement

- APNIC supports the deployment of IPv6 as the optimal future outcome for the Internet
- APNIC suggests that network operators and service providers:
  - be prepared to support customers and services using IPv6 by 2010,
  - begin planning for this transition as soon as practically possible

APNIC IPv6 Programme overview

- APNIC community has identified:
  - The need for more information on IPv4 exhaustion and IPv6 transition for all stakeholders to assist stakeholders in make more informed decisions
- APNIC community has also asked:
  - For more support to help stakeholders build the necessary resources to be able to implement IPv6 transition
- APNIC appointed (August 2008):
  - Miwa Fujii as IPv6 Programme Manager
  - miwa@apnic.net

APNIC IPv6 Programme overview

- Objectives of this role
  - To gather:
    - Empirical data about IPv4 unallocated address space exhaustion and IPv6 transition
  - To monitor:
    - Technical developments in relation to methods to cope with IPv4 unallocated address space exhaustion and IPv6 transition
  - To research:
    - Best practices in regards to IPv6 transition mechanism and technologies
  - To disseminate:
    - Reports that address the information requirements of each stakeholder within the Asia Pacific Internet community

APNIC IPv6 Programme activities

- Creating an IPv6 community wiki site
  - APNIC ICONS Wiki
  - To encourage information sharing among multi stakeholders in the AP region
  - To be launched during APNIC 27 (23 – 27 Feb 2009)
- Outreaching to multi-stakeholders
  - Policy makers and regulators, application developers, content providers etc.

Impact to NOG communities

- APNIC's outreach activities to content providers
  - Urges content providers to deploy IPv6 services and connectivity
  - Promotes dual-stack use of IPv4 and IPv6 address by content providers
  - Promotes IPv6 multihoming address assignments
- Your customers (content providers AND consumers) will eventually demand IPv6 connectivity
  - Be ready for such demand!

The hope…

- The Internet has shown its ability to evolve
  - Those who are building infrastructure need to be aware of IPv4 consumption and IPv6 transition
  - Planning should start now, in detail, for the day when there is not enough IPv4 address space
- Industry, regulators, and public policy makers
  - Develop a strategy to support a transitional period between IPv4 and IPv6
  - Encourage the continuing contribution of various stakeholders in mutually supportive roles
  - Ensure preservation of the innovative, vital characteristics of the Internet

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Thank you!

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