Expanding the Internet: IPv4 address exhaustion and IPv6 transition

PITA AGM

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Fiji

Sanjaya <sanjaya@apnic.net>
Services Area Manager, APNIC

Overview

- What is happening with the Internet now?
  - IPv4 address free pool exhaustion
  - What happens if you don't have IPv6?
- Current IPv6 deployment status
- Cross-sections of IPv6 implementation
  - Global view → Regional view → Local view
- Are you ready for these changes?
  - Where are the opportunities?
- APNIC supports the community
- What you need to do now?

Where do IP addresses come from?

IETF

Standards

IANA

Allocation

APNIC

APNIC

Allocation

*

ISP

Assignment

End user

Regional Internet Registries (RIRs) distribute IPv4, IPv6, and AS numbers to the Internet community

RIRs maintain accurate registration of Internet resource usage for the community

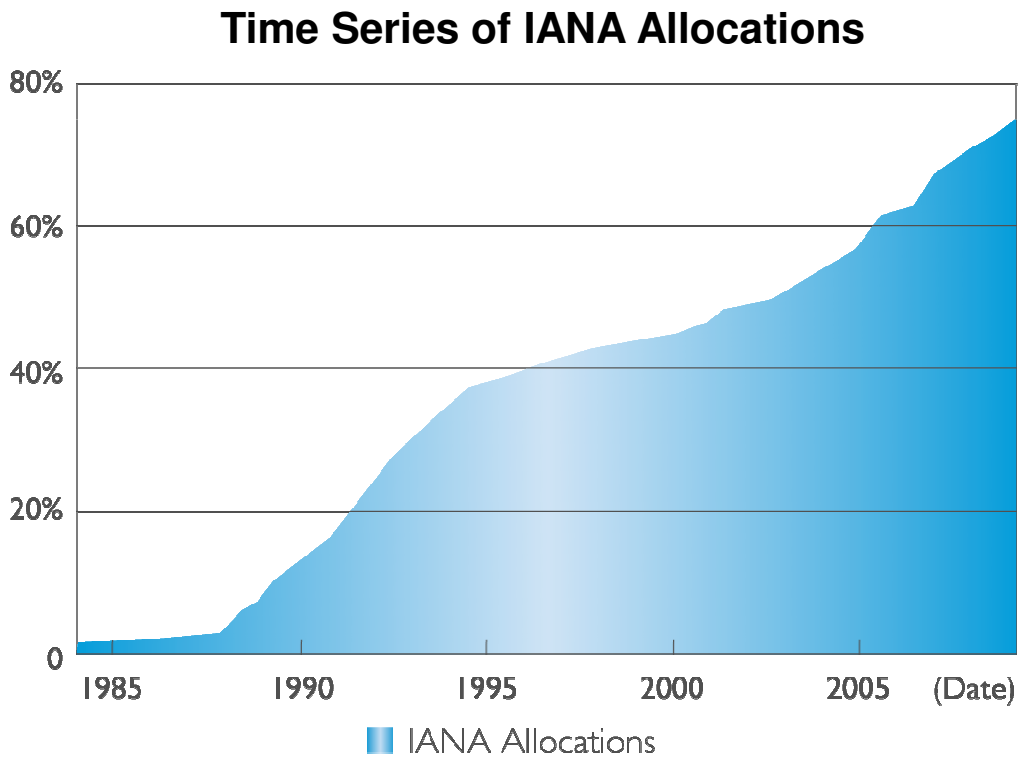
* In some cases via an NIR, such as JPNIC, KRNIC, TWNIC, etc.

Regional Internet Registries

The Internet community established the RIRs to provide fair and consistent resource distribution and accurate resource registration throughout the world.

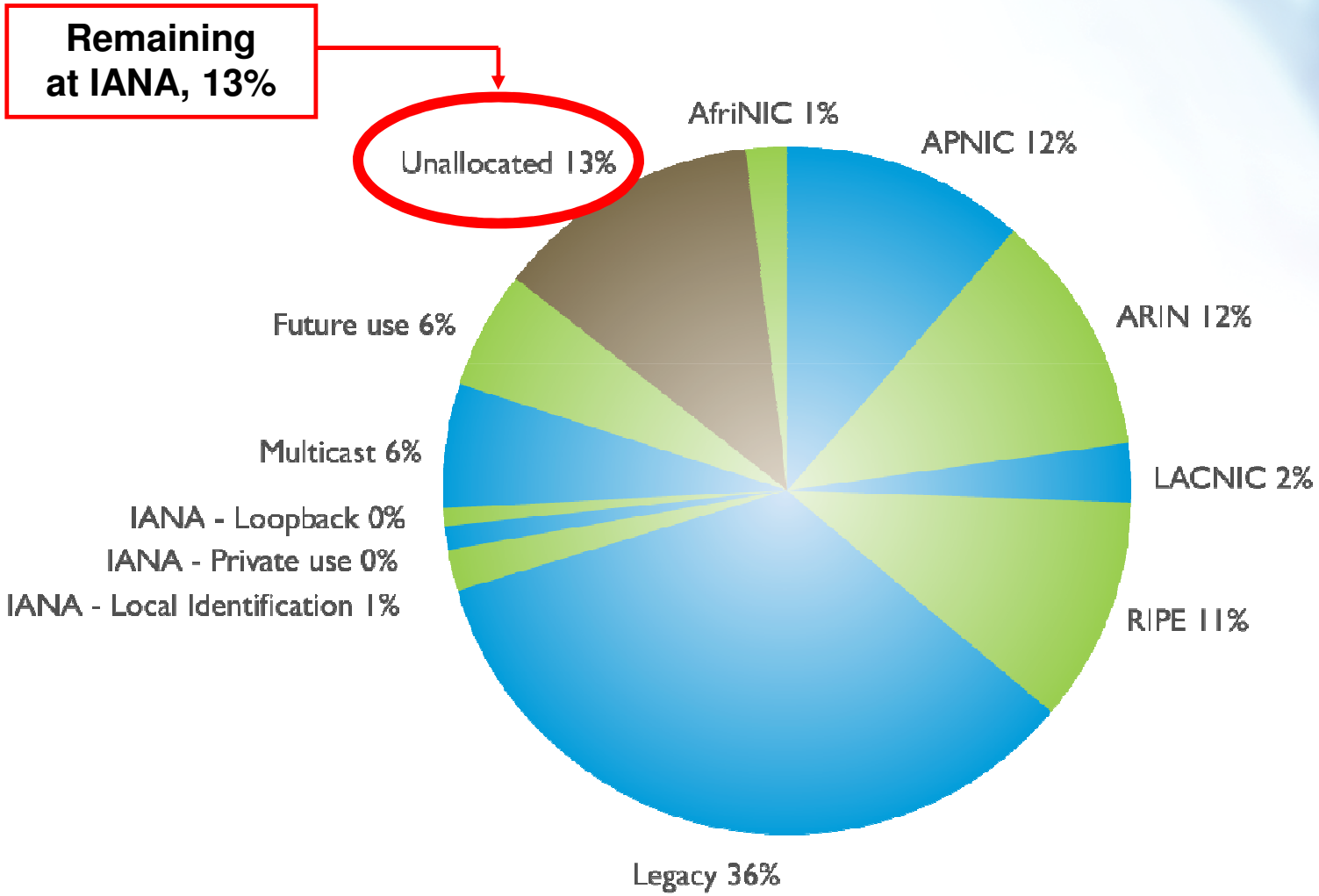
IPv4 address consumption

- IPv4 addresses are a finite 32-bit numeric asset
  - 2^{32} addresses = about 4.2 billion addresses
- Has been in use since the early days of the Internet



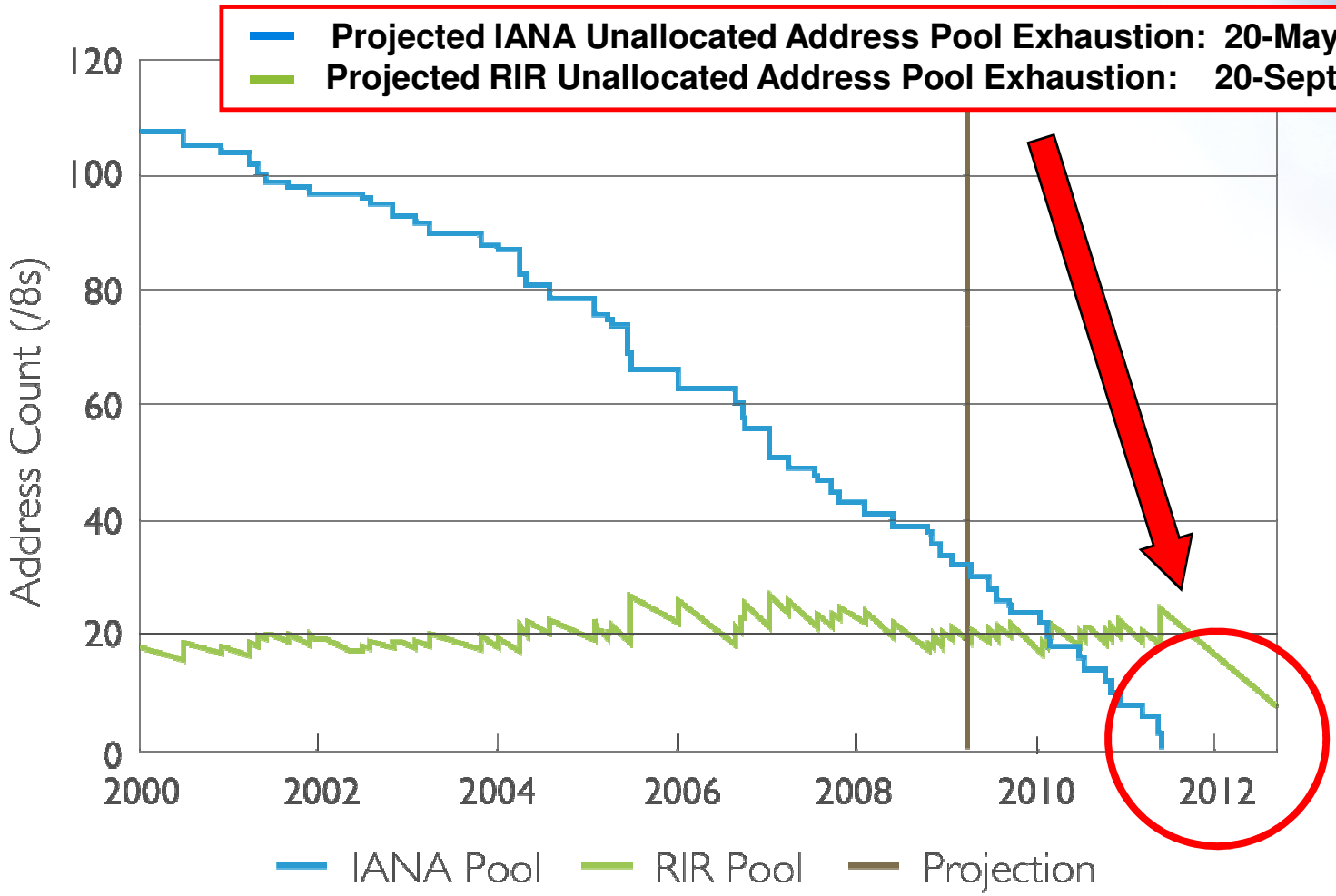
http://www.potaroo.net/tools/ipv4/index.html/ as of 30/03/2009

How much IPv4 addresses are left?



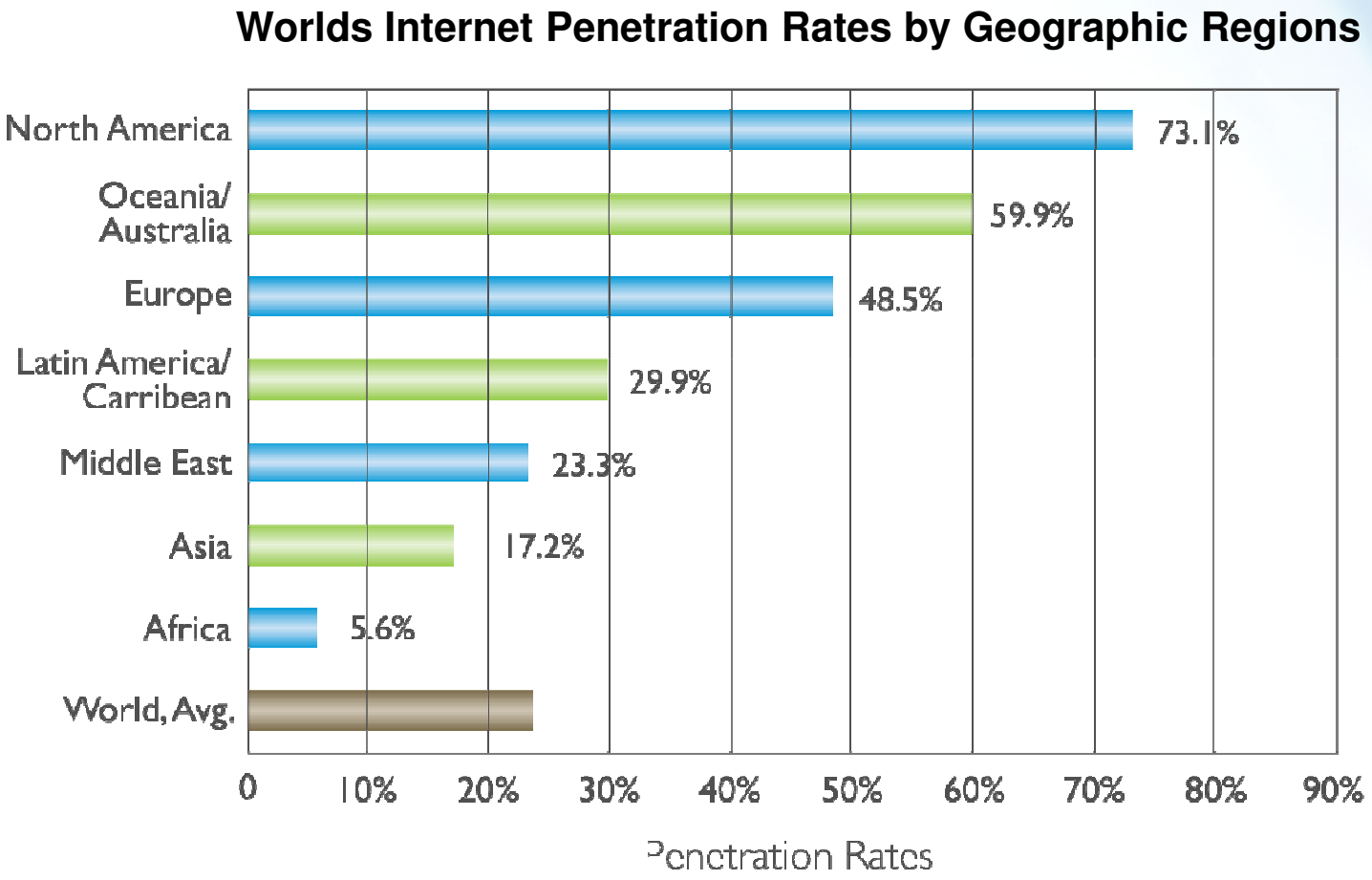
http://www.iana.org/assignments/ipv4-address-space/ as of 27/03/2009

So when will the free IPv4 addresses run out?



http://www.potaroo.net/tools/ipv4/index.html as of 27 March 2009

But not everyone's connected yet



Source: Internet World Stats - www.internetworldststs.com/stats.htm

Penetration Rates are based on a world population of 6,710,029,070 for full year 2008 and 1,581,571,589 estimated Internet users.

and devices need to connect too!

Billions of them

A quick summary

- IPv4 addresses are a finite numeric asset
  - Only 13% remain
- But the demand for IPv4 addresses is still growing
  - More devices are requiring IP addresses
  - Especially in the AP region
- The remaining 13% is not large enough to support such demand

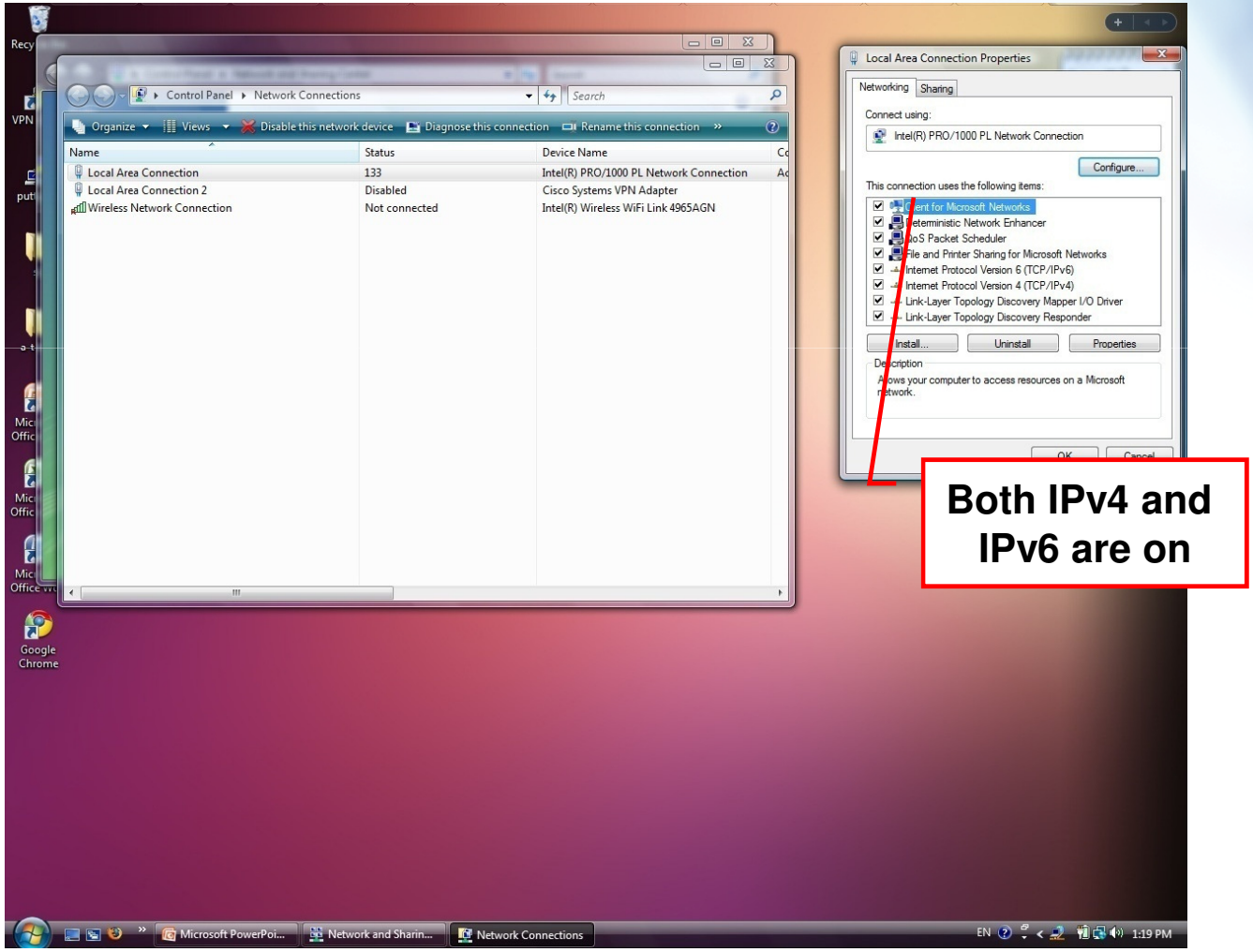
What are the solutions?

- How can we continue to expand the Internet after IPv4 address exhaustion?
  - APNIC believes that deploying IPv6 is the optimal solution
  - The IPv6 address space has 2^{128} addresses
  - This is **HUGE** compared to IPv4
  - APNIC expects all network operators to support IPv6 by 2010
- So what are impacts of not implementing IPv6?

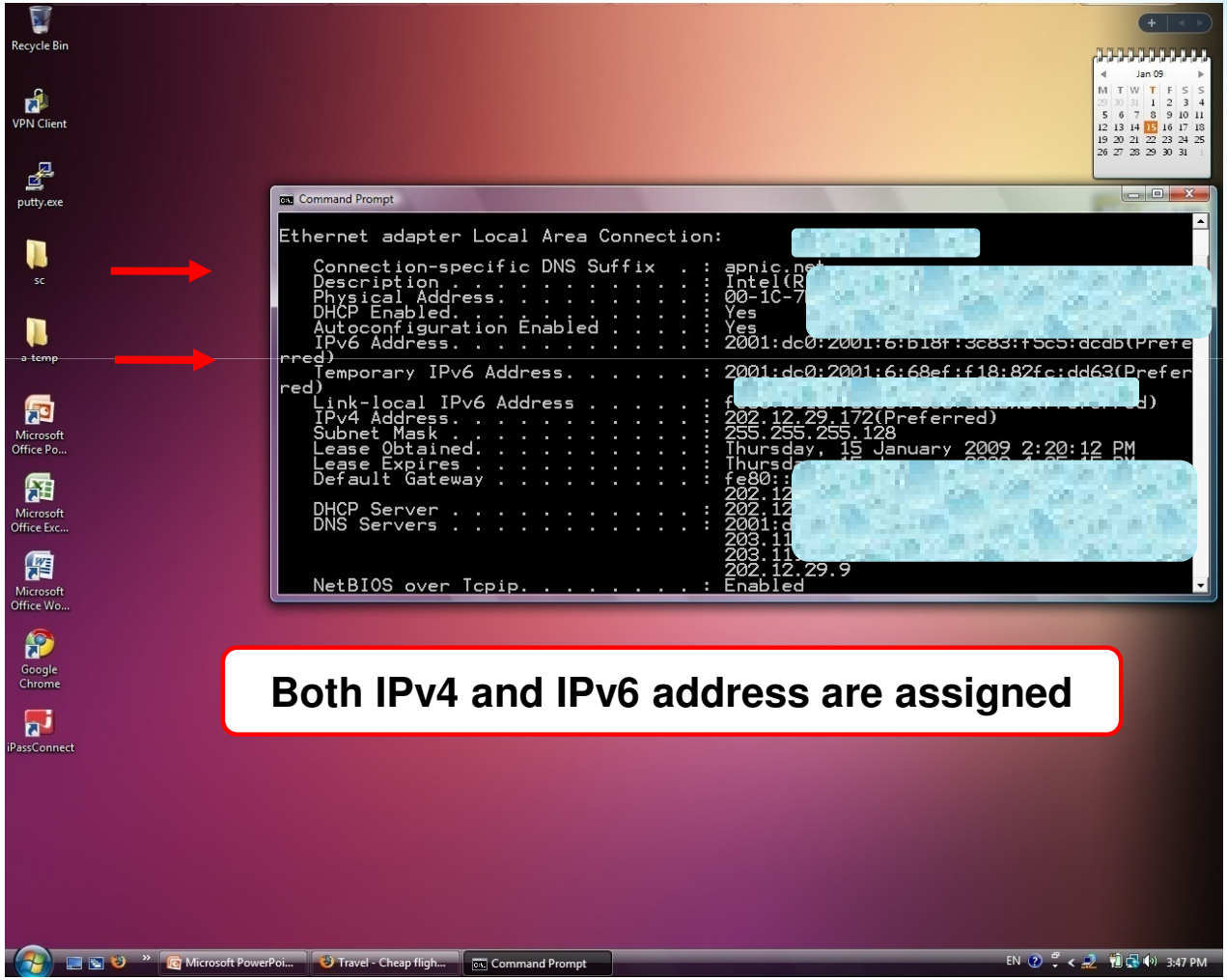
What will happen to my company if my network is not IPv6 ready?

- Researchers predict IPv4 legacy assets (client PCs, servers, routers, switches, OSes, various applications, etc.) will remain for the next 10 years
  - Dual-stack environment servicing both IPv4 and IPv6 traffic may last for many years
  - IPv4 addresses will be assigned strategically
    - Not everyone can receive global IPv4 addresses
    - An increasing number of end users/devices may be given only IPv6 addresses at some point

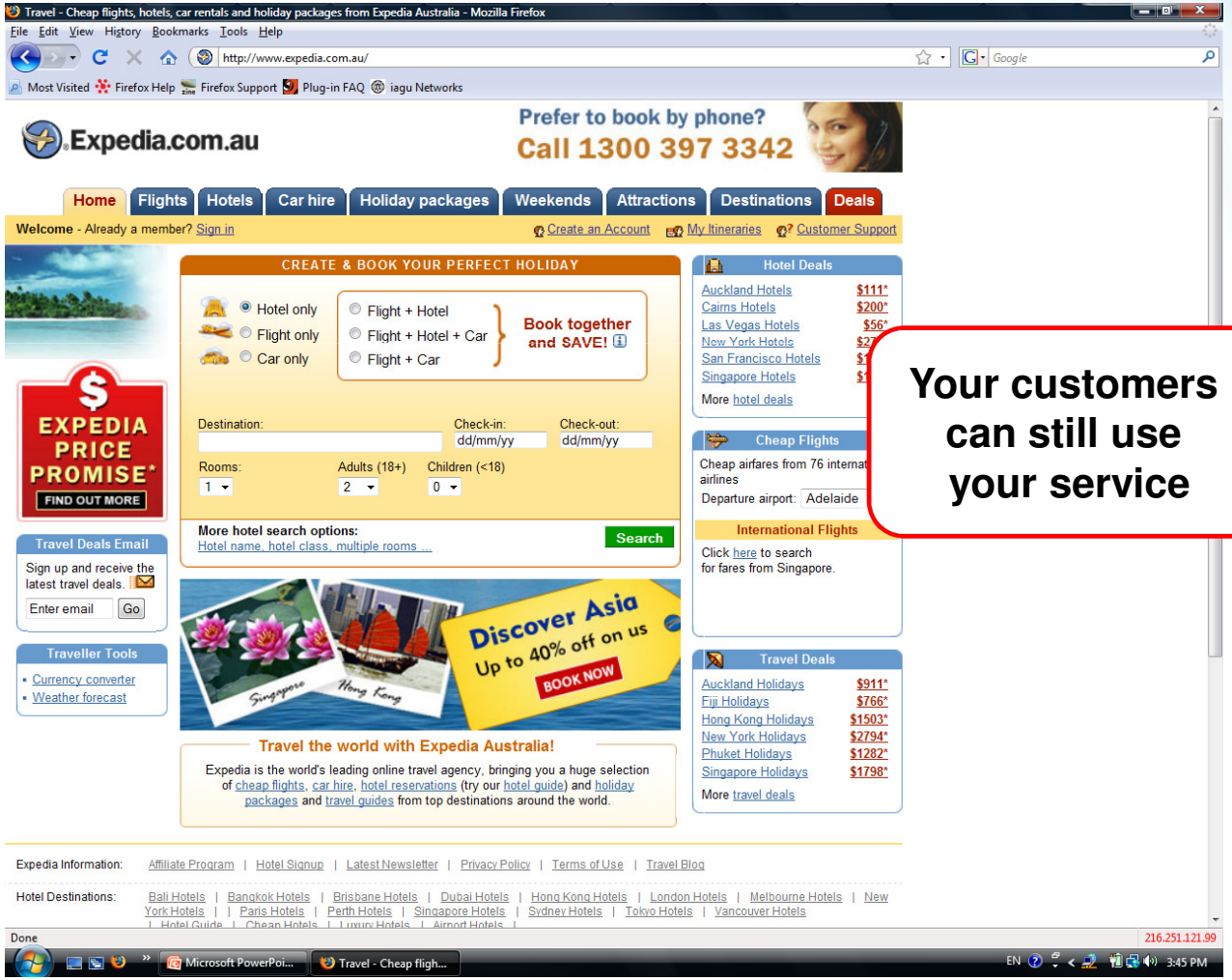
While a client is running with IPv4/IPv6…



…it receives both IPv4/IPv6 addresses: dual-stack



Even if a service is only available via IPv4…

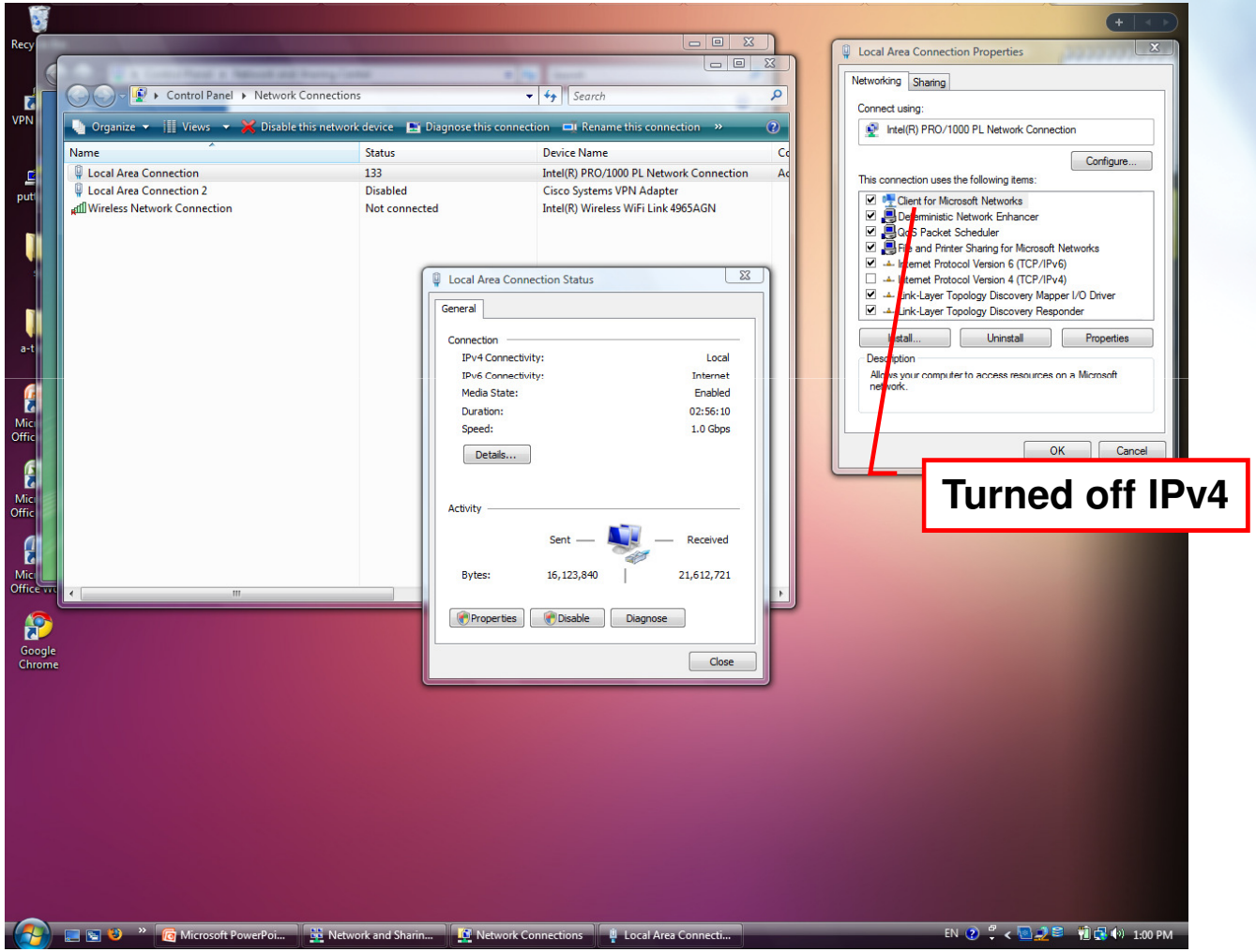


Your customers can still use your service

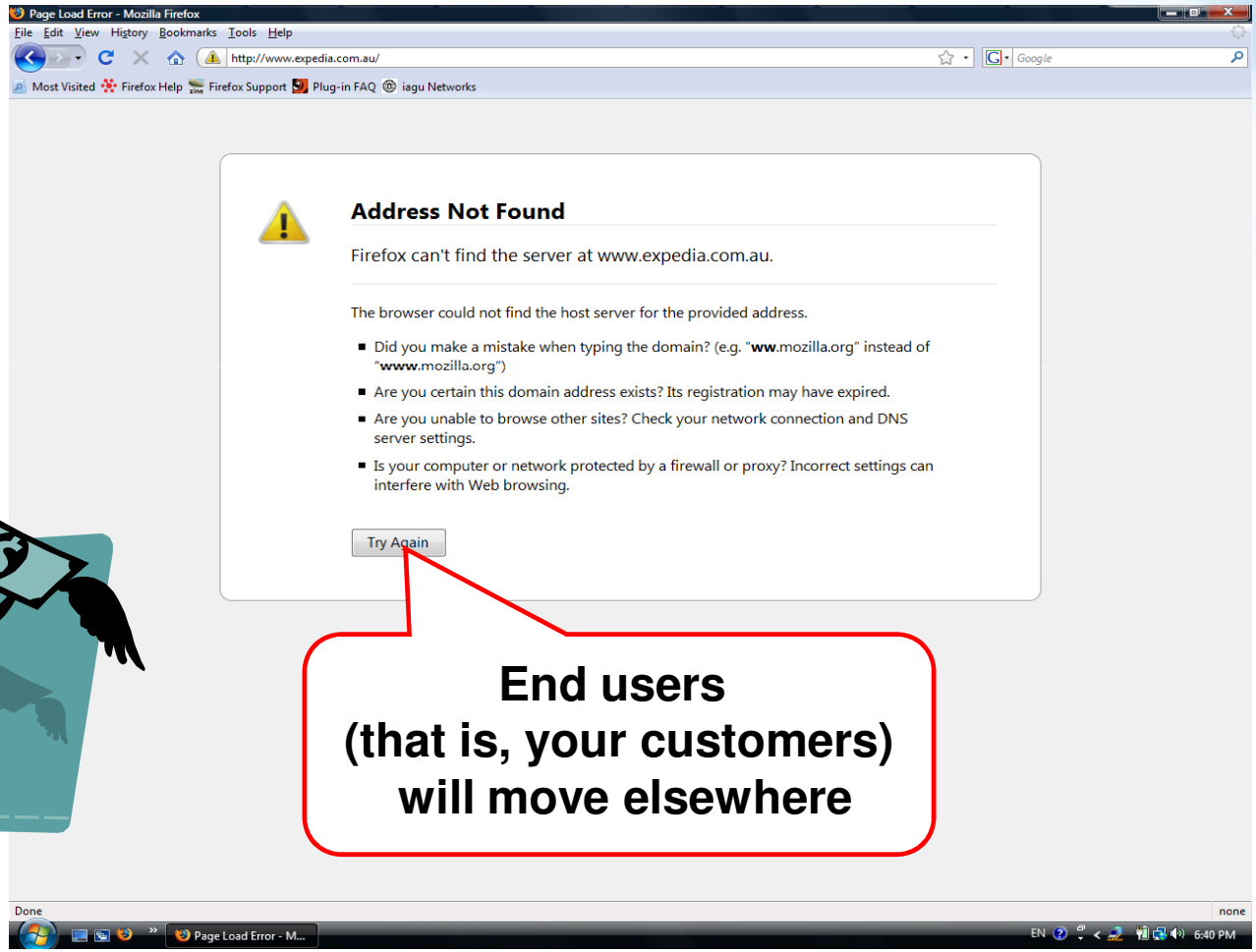
One day…

- In the future, many end users (that is, your customers) will only receive an IPv6 address
  - Many “clients” access the Internet via an IPv6 address
  - If your web service is not on a dual-stack network, what will happen?

Simulating an IPv6-only client

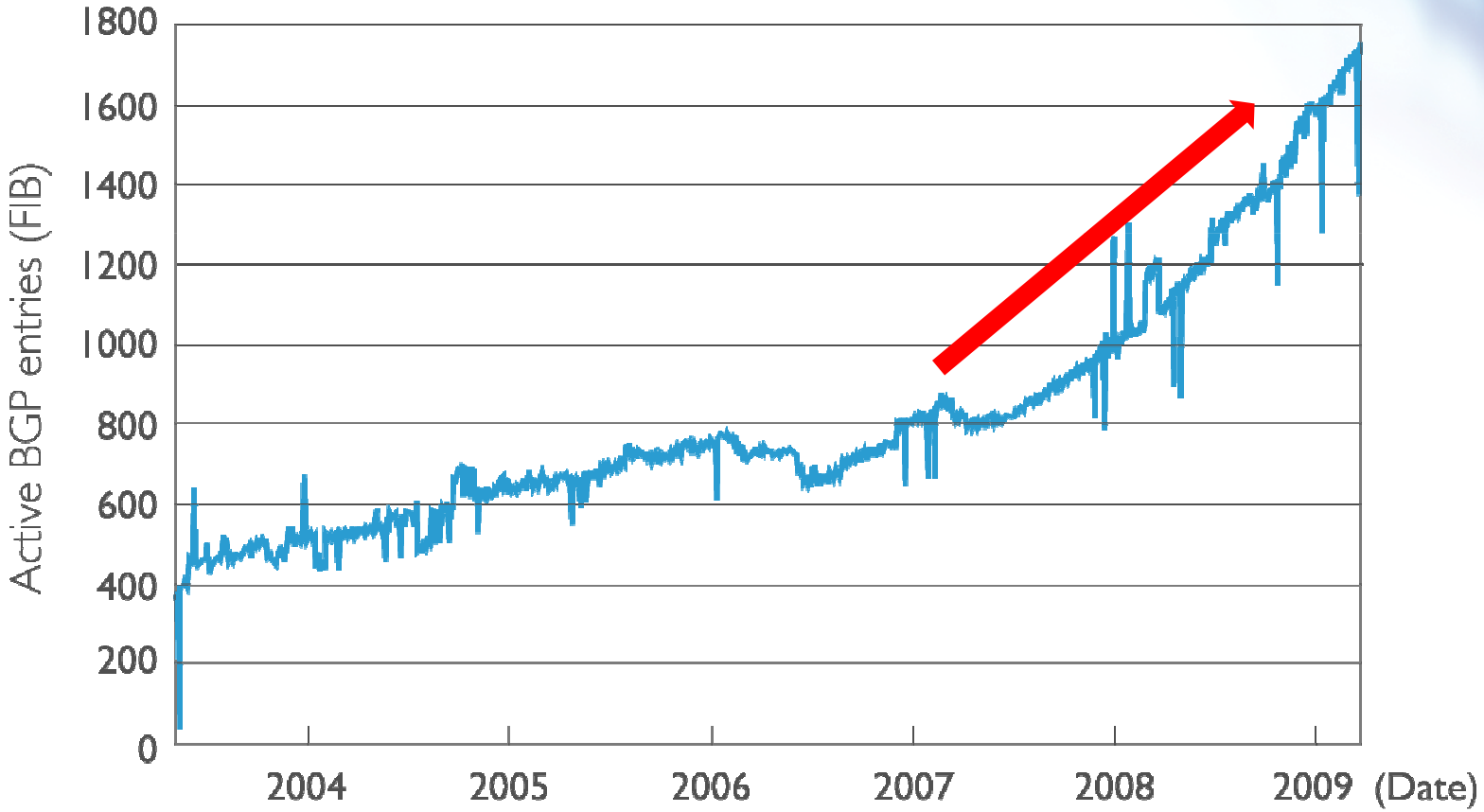


If your site is not ready for IPv6…



Is the global community deploying IPv6?

The upward trend in the size of the BGP Forwarding Table (FIB)



http://bgp.potaroo.net/v6/as6447/ as of 25/03/2008

Global perspective

- ISP
  - African Online Zimbabwe deployed IPv6/IPv4 dual-stack networks in May 2007 (www.africaonline.co.zw/)
    - To be ahead of the game
    - To be ready with IPv4 address free pool exhaustion
- Education
  - Greek School Network (http://www.sch.gr/en/)
    - 54,000 teachers, 6,000 primary schools, 4,000 secondary schools and 2,500 administration units
    - To modernize its IT infrastructure and to provide new media-rich interactive services
      - Removing address constraints
      - Enabling peer-to-peer applications
      - Mitigating management and security issues

Global IPv6 Strategies: From Business Analysis to Operational Planning, 2008, p237

Global perspective

- Enterprise
  - Arch Rock Corporation (http://www.archrock.com/)
    - A pioneer providing IP-based wireless sensor network technology and services
    - A new industry without much legacy
      - End-to-end communications
      - Large address space
      - Plug-and-play capabilities
      - Energy efficiency and simplified protocol processing
      - Future growth potential

Global IPv6 Strategies: From Business Analysis to Operational Planning, 2008, pp331-332

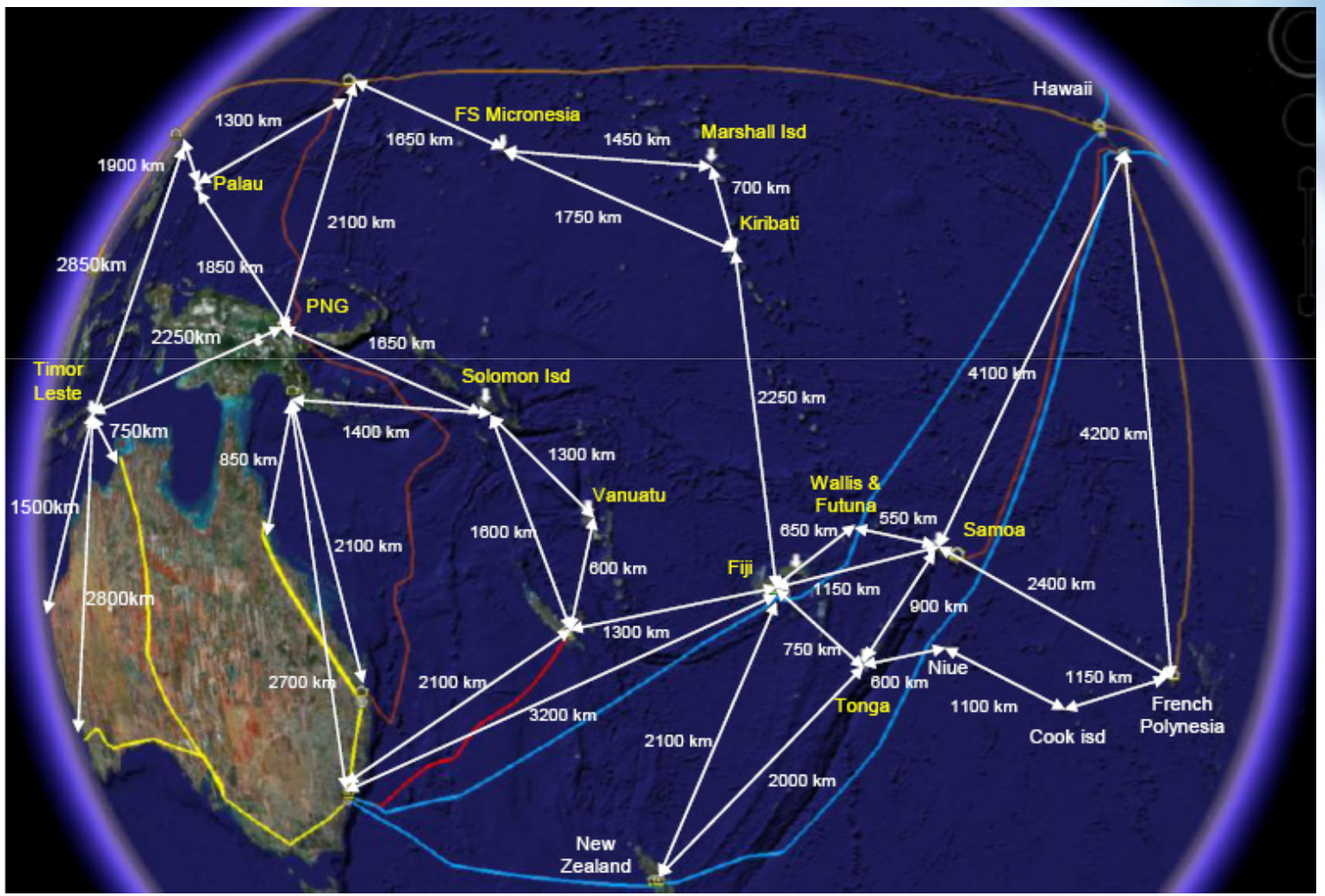
Asia Pacific perspective

- Japan
  - The IPv4 Address Exhaustion Task Force, including 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”

Pacific Islands perspective

- IPv6 Forum Pacific Islands
  - A chapter of the global IPv6 Forum
    - To provide leadership, education, information, and resources to support IPv6 transition
- Pacific Islands Operators Group (PacNOG)
  - Providing practical IPv6 training
    - June 14-20 (Sunday-Saturday), 2009 in Tahiti, French Polynesia
- PITA
  - PITA collaboration with APNIC and PacNOG to support the Pacific Islands ISP and Telecom ICT providers to migrate their networks to IPv6

Are you ready for these changes?



Source: Polyconseil, Draft Report for Consultations, 2008 http://www.pita.org.fj/_resources/files/POLY_WB_General%20Report_v2.1_WBES.pdf, P16

The future for IPv6

- 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
    - Implementation plan, budget, and allocation of resources
- Industry, regulators, and public policy makers should:
  - Develop a strategy to support a transitional period between IPv4 and IPv6
  - Encourage the continuing contribution of various stakeholders in mutually supportive roles
  - Ensure the preservation of the innovative, vital characteristics of the Internet

IPv6 deployment opportunities

- What benefits can you create by deploying IPv6 in your region?
  - Effective use of the Internet for socio-economic development?
    - Point-to-point connectivity in remote learning environments?
    - Effective use of multicasting to conserve bandwidth?
  - Stable, continuous Internet for:
    - Disaster risk management and risk reduction?
    - Early warning and response to disaster risks?
  - Effective use of IPv6's new features?
    - Transportable communication system for effective disaster and emergency management?
  - Energy efficient networks?
    - Deploy new technologies with less power consumption?
    - Positive impact to the environment?

Your IPv6 planning checklist

How can you support your CIO to make the deployment of IPv6 efficient.

- Integrate IPv6 spending into your 2010 budgets
  - Include budget allocation for IPv6 test beds and initial deployment
- Make a plan to up-skill your staff
  - ICONS Wiki IPv6
    - http://wiki.icons.apnic.net/display/IPv6/Home
    - IPv6 training/consulting services providers
- Obtain IPv6 addresses from APNIC
  - helpdesk@apnic.net

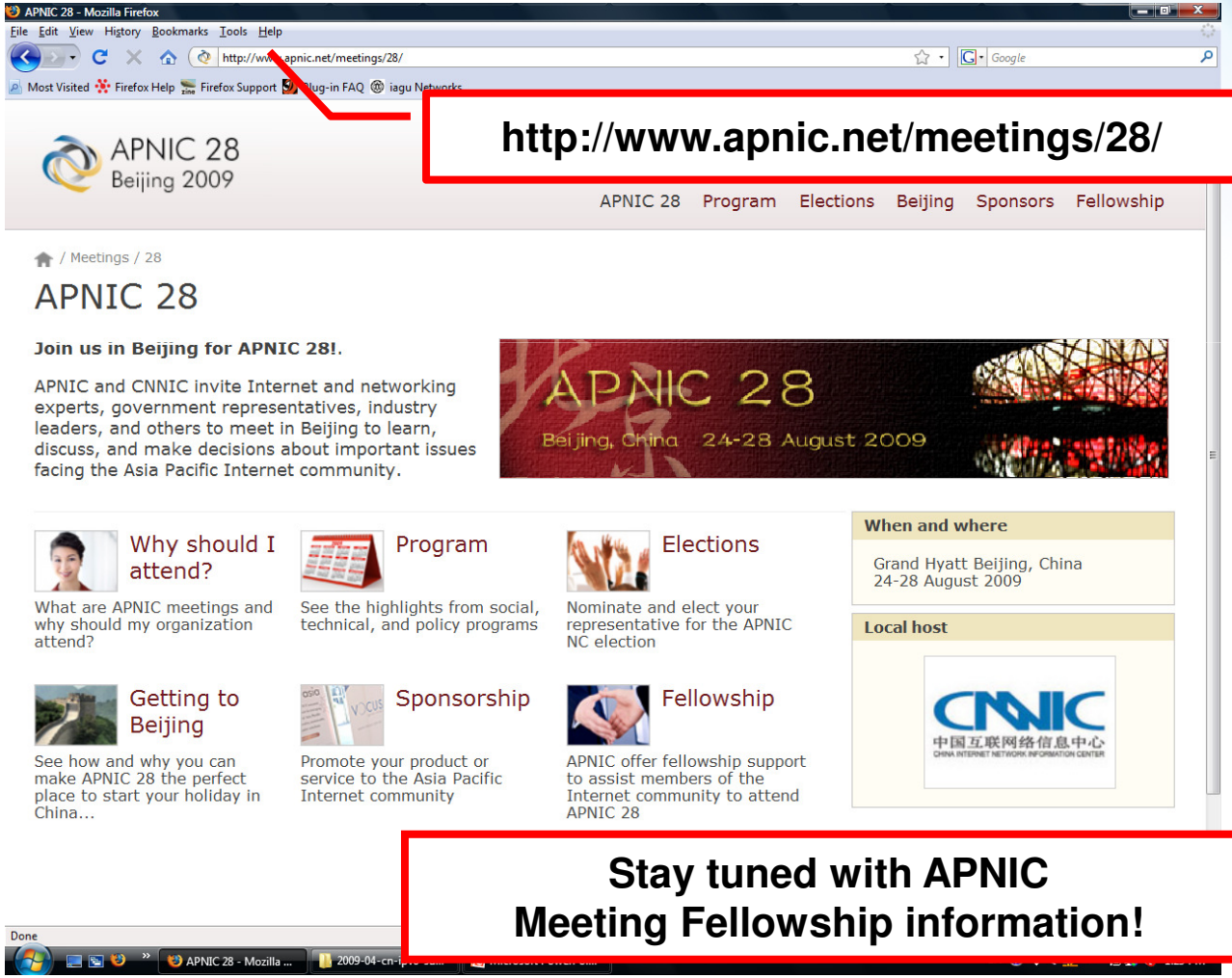
APNIC and IPv6 support

- APNIC appointed an IPv6 Program Manager in August 2008
  - Miwa Fujii <miwa@apnic.net>
  - Rolling out various IPv6-related activities
    - ICONS IPv6 Wiki and IPv6 ICONS Forum
      - IPv6 information site for the community
      - http://icons.apnic.net/display/icons/Home
      - Your participation will help the Internet community
- APNIC IPv6 services include:
  - APNIC IPv6 Training
  - Resource allocation
  - IPv6 policy development

In summary

- IPv4 exhaustion will impact businesses
- IPv6 is the long-term solution
- IPv6 deployment is happening
- Business leaders have an important role to play in IPv6 deployment
- APNIC support is available

APNIC 28 (24–28 August 2009) in Beijing



Thank You!

Sanjaya <sanjaya@apnic.net>

Supplement

Information for service providers

- ICONS Wiki IPv6
  - http://wiki.icons.apnic.net/display/IPv6/Information+For+Service+Providers
    - IPv6 deployment experience
    - IPv4/IPv6 Coexistence and Transition
    - From IPv4 only to v4/v6 Dual Stack - What can Carrier-Grade NAT do and what can they not do?
    - And more…

Information for content providers

- ICONS Wiki IPv6
  - http://wiki.icons.apnic.net/display/IPv6/Information+For+Content+Providers
    - IPv6 deployment experience
  - http://wiki.icons.apnic.net/display/IPv6/Home
    - IPv6 tool box
    - IPv6 www test - to check end-user's v6 connectivity (provided by Braintrust)
    - IPv6 Status Survey (provided by Mark Prior)
    - IPv6 Status Check (provided by Mark Prior)

Information for policy makers and regulators

- http://wiki.icons.apnic.net/display/IPv6/Information+For+Policy+Makers+and+Regulators
  - Information issued by governmental bodies in the AP region
    - China, Indonesia, Japan, Korea, Malaysia, Singapore and Taiwan
  - Information issued by governmental bodies in other parts of the world
    - USA