Critical Issues in IP Addressing

PITA 14th AGM and Conference
Critical issues
27 April 2010

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Overview
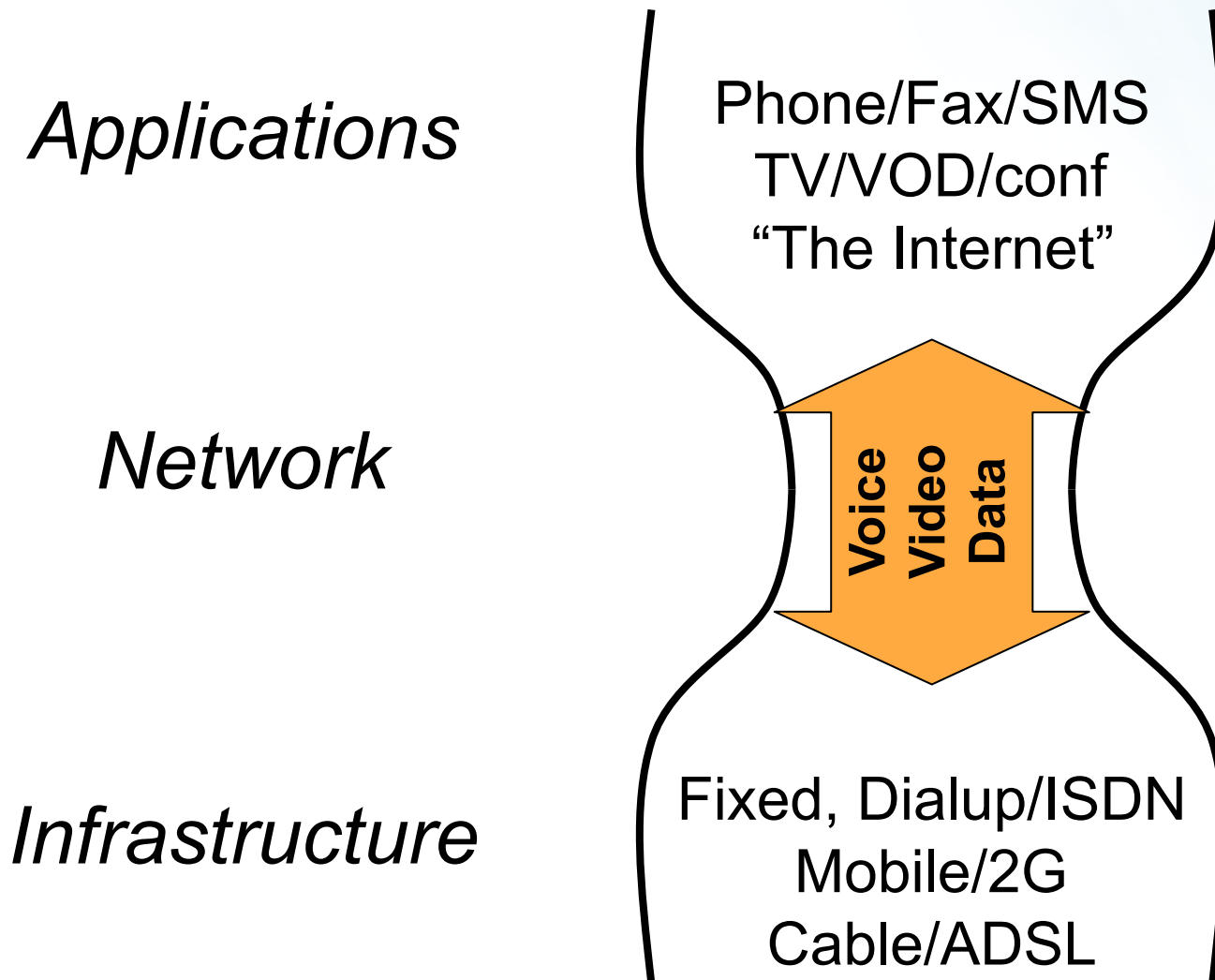
- Introduction
- The main game…
  - IPv4 Consumption
  - Transition to IPv6
- Security and IP addresses
  - Resource Certification: RPKI
  - Abuse contact registration: IRT

Why IPv6?

Internet Fundamentals

- Open network, open standards
  - Developed within IETF system (RFC series)
  - TCP/IP, DNS, DHCP, HTTP, IPSEC, etc etc
  - "Dumb network" – global p2p datagram service
- "IP over Everything"
  - Layered networking model (a la OSI)
  - Relying on ITU and IEEE standards
  - Serial line, Modem, Ethernet, ISDN, xDSL, cable/fibre, MPLS, 802.11x, Mobile 2G/3G…
- Platform for competition and innovation
  - Great benefits to consumers

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The "Protocol Hourglass"

Applications

Network

Infrastructure

Phone/Fax/SMS
TV/VOD/conf
"The Internet"

Voice
Video
Data

Fixed, Dialup/ISDN
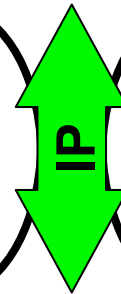Mobile/2G
Cable/ADSL

The Hourglass – Tomorrow

Applications

Voice, email, IM
Video, TV, conf
WWW+++

Network

IP

Infrastructure

802.11*/WiMax
Mobile/3G
Cable/*DSL
FTTH, ETTH

Projected IPv4 Lifetime

Projected IANA exhaustion: 22/09/2011
Projected RIR exhaustion: 07/07/2012

http://www.potaroo.net/tools/ipv4/index.html 10 Apr 2010
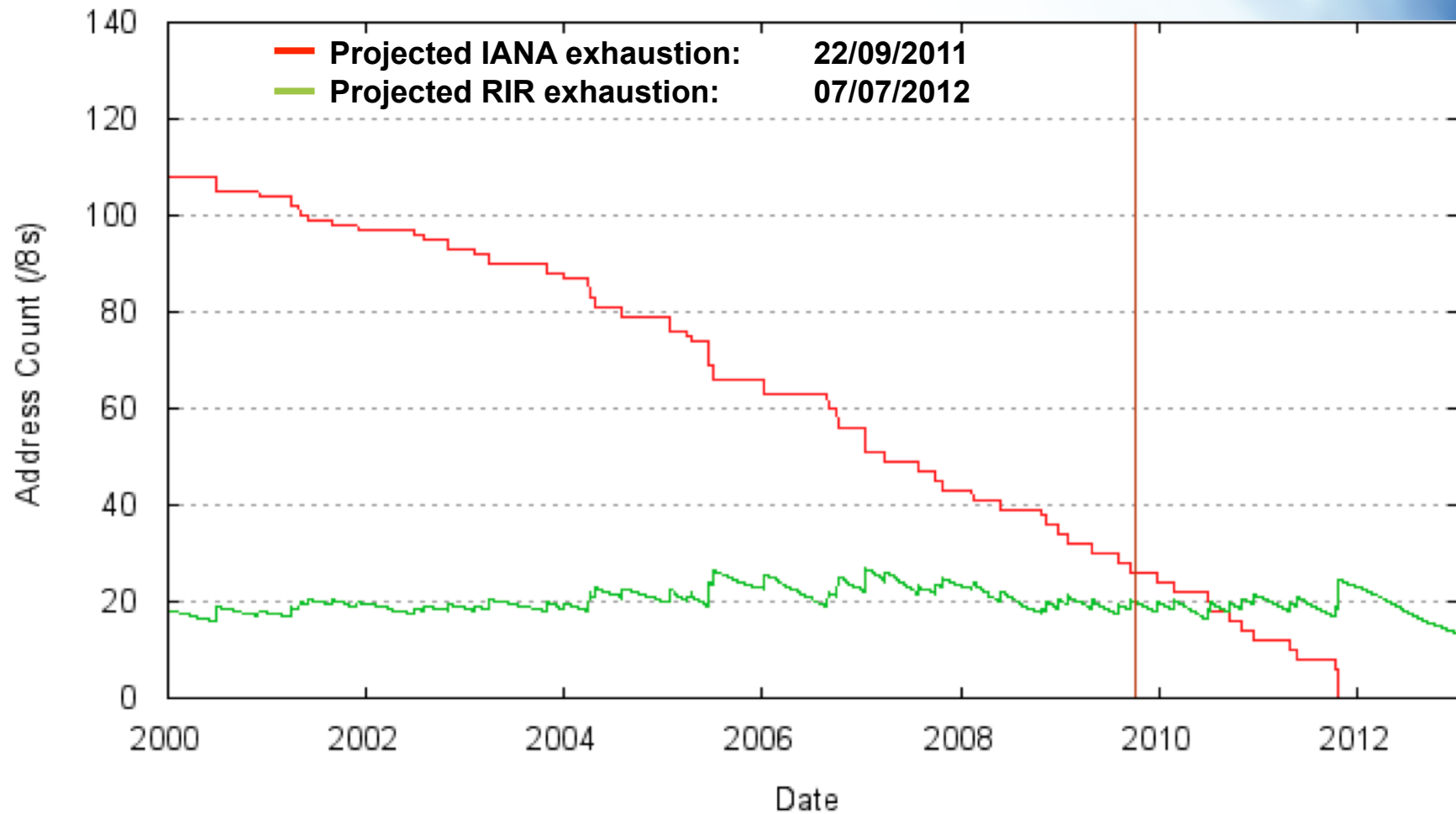
IPv4 Address Global Distribution

Available 20
< 8%

AfriNIC 2

APNIC 36

ARIN 33

LACNIC 6

RIPE 30

Pre-RIR
92

Reserved by
IETF 35
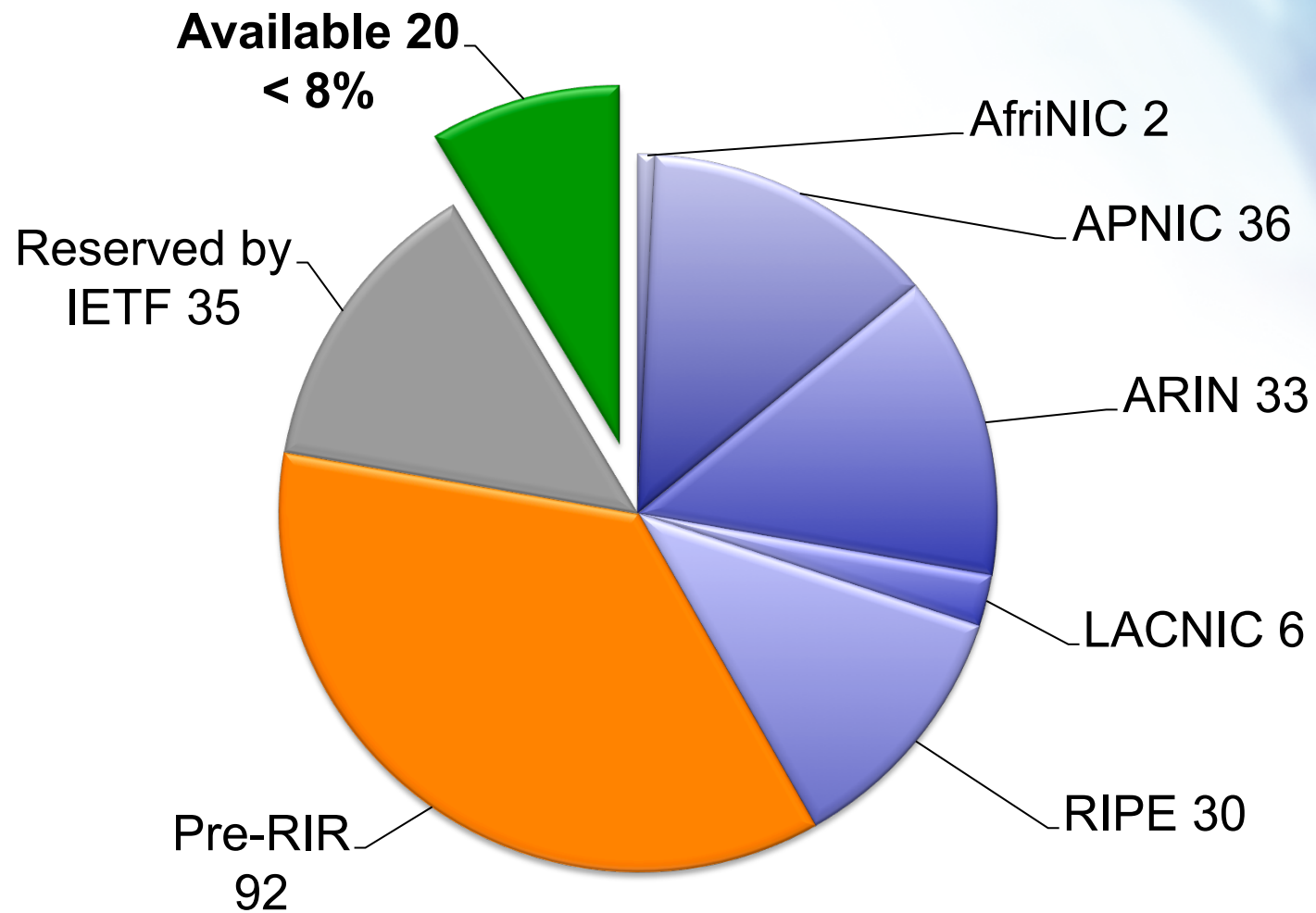
As of April 2010

IPv4 Consumption

- Many mitigation approaches have been discussed in RIR policy meetings
  - Policy and procedural measures have been agreed in most RIRs
  - Some policies regional, some global
- Hard landing: The "do nothing" approach
  - Too much risk for serious consideration
- Soft landing: measures to extend IPv4 lifetime
  - Rationing
  - Stricter justification requirements
  - Reclaiming unused IPv4 addresses
  - Transfer policies

IPv4 Scarcity Issues

- Significant increase in policy violations
  - Fraudulent claims for IPv4 addresses
  - Unofficial transfer/loan/trading of addresses
- Increasing security concerns
  - Decreasing accuracy of whois records
  - Inability to tell harmless from harmful uses
- Policy measures taken
  - Fair distribution of final /8s from the IANA
  - Reservation of space in the last /8, for new entrants
  - APNIC transfer policy allowing transfers to be recognized
- Practical measures
  - Improved security and verification mechanisms
 - Throttle on address space requests from IANA

IPv4 "Quality Assurance"

- Historical misuse of unallocated address space
  - Informal usage (e.g. 1/8 for various purposes)
  - Superseded usage (e.g. 14/8 for X.25 networks)
  - Previously known, or suspected, usages
  - Affected address space was not allocated
- Today, address space must be put to use
  - Allocated by IANA to RIRs according to agreed random procedure, ensuring fair distribution
  - Each new APNIC /8 is now tested before delegating to APNIC members

Case Study: 1.0.0.0/8

- Well known as a "problem block"
  - Allocated to APNIC in early 2010
- APNIC research activity
  - With RIPE NCC, Merit Networks and YouTube
    - Servers able to cope with huge traffic load
    - Over 10Tb of data collected in 6 days
- Findings…
  - Small parts of 1.0.0.0/8 extremely polluted
    - Popular use of 1.1.1.1 and 1.2.3.4
    - Evidence of widescale POS terminal usage
  - The rest (vast majority) appears OK

Analysis of 1.0.0.0/8
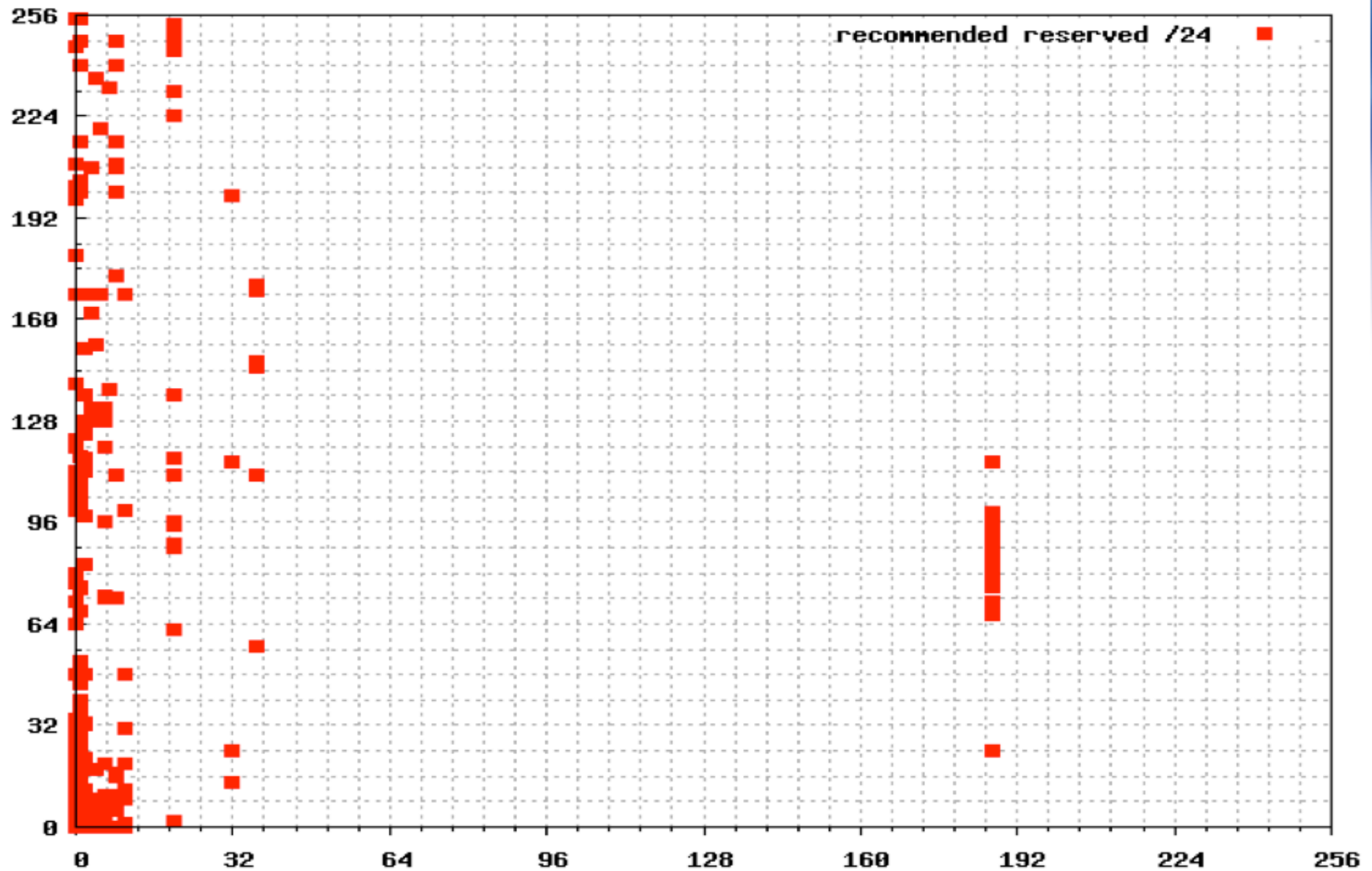
IPv6 Transition: Issues

- Transition mechanisms
  - Dual stack
  - Tunneling IPv6 over IPv4
  - Translation
  - Tunneling IPv4 over IPv6
- Security implications
  - Firewalls
  - VPNs
- Software and hardware
- Human resources

IPv6 Transition Mechanisms

- "Dual stack"
  - IPv4 and IPv6 coexist in one device
  - Support connection to/from IPv4 and IPv6
  - Does not provide interconnectivity

IPv6 packet

IPv6

DS
Client

IPv4 packet

IPv4

IPv6 packet

DS
Host

IPv4 packet
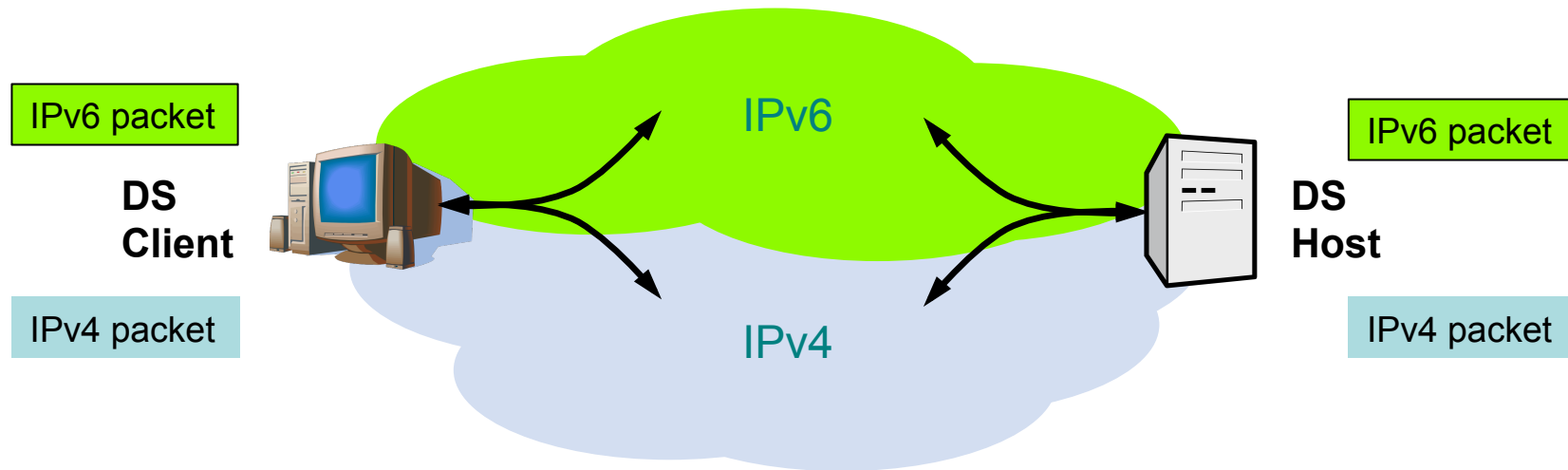
IPv6 Transition Mechanisms

- Tunneling (1)
  - Transport of IPv6 traffic over an IPv4 network
  - The main mechanism currently being used to achieve IPv6 connectivity (e.g. Teredo)

IPv6

IPv6 Host

IPv6 packet

DS Client
IPv4 ISP

IPv4

IPv4 packet   IPv6 packet
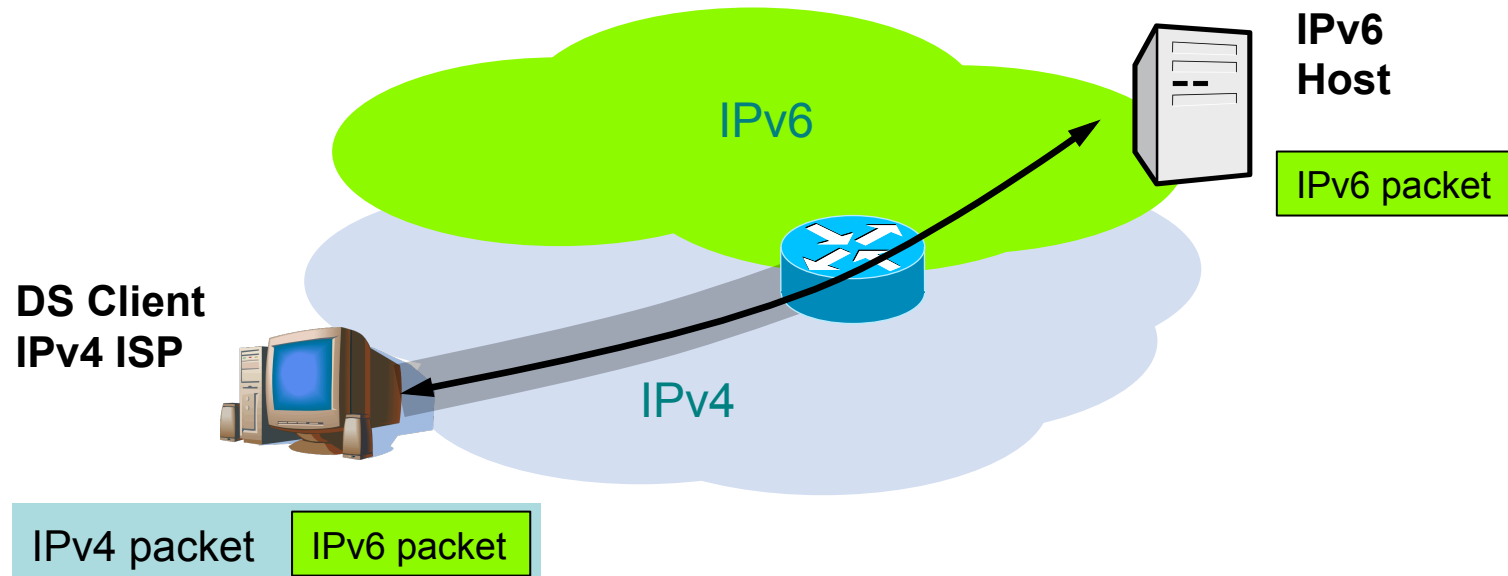
IPv6 Transition Mechanisms

- Translation
  - Addresses are translated between IPv4 network and IPv6 network (CGN, IVI)
  - Necessary to internetwork between IPv4 and IPv6

IPv6 Host

IPv6

IPv6 packet

IPv4 Client

IPv4

IPv4 packet
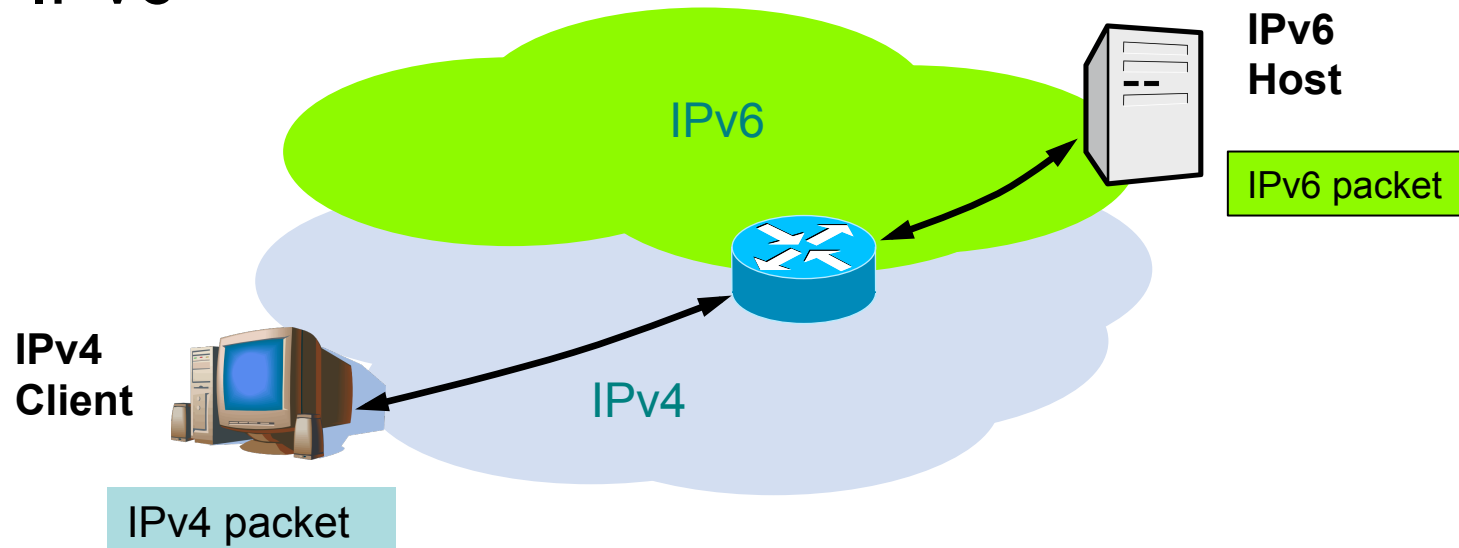
IPv6 Transition Mechanisms

- Tunneling (2)
  - Transport of IPv4 traffic over an IPv6 network
  - Will be required in later stages of transition

DS Client
IPv6 ISP

IPv6

IPv4

IPv4 Host

IPv6 packet | IPv4 packet

IPv4 packet
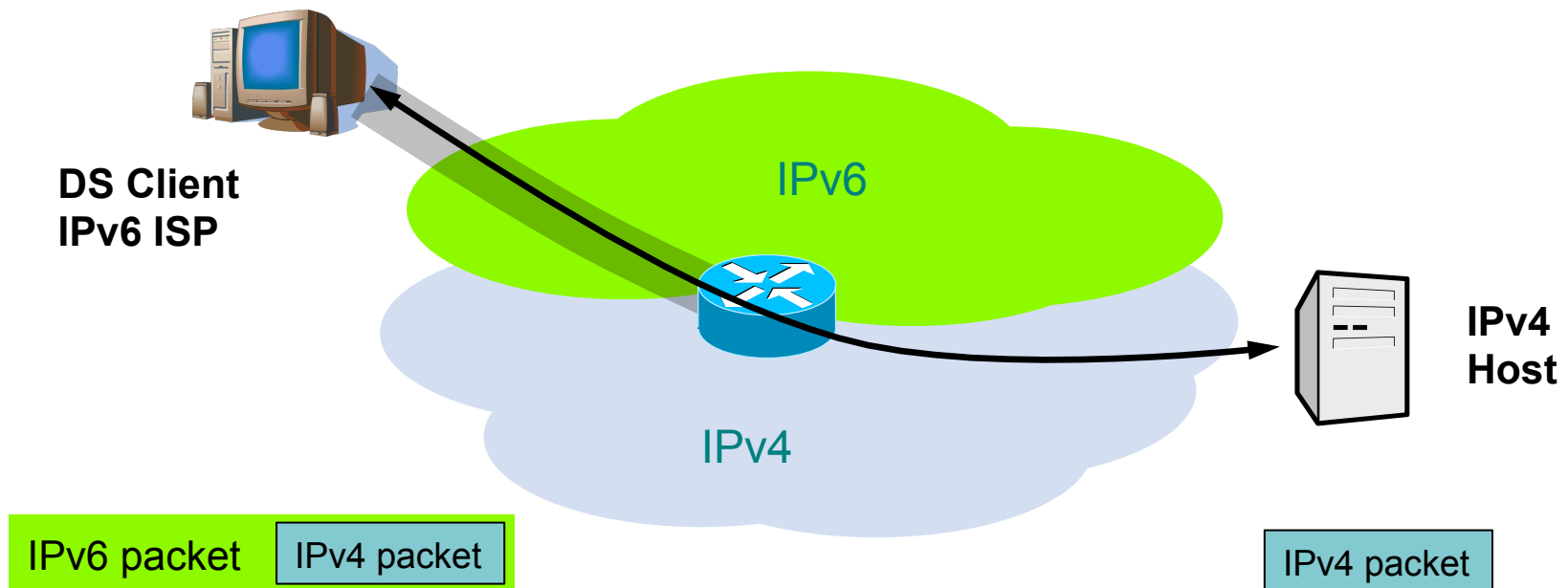
IPv6 Transition: Security

- Firewalls
  - Must be dual-stack/dual-protocol, or separate dedicated firewalls for IPv4 and IPv6
  - IPv4 firewall may miss tunneled IPv6 traffic
- VPNs
  - Must tunnel both IPv4 and IPv6 traffic
  - Some VPNs may not encrypt IPv6 traffic at all, leaving it to flow in the clear
- Network monitoring
  - Likewise must be IPv4 and IPv6 aware
- Many other application and technology-specific security issues

IPv6 Transition: Software

- Client software
  - Email, www, tools and utilities
  - Do your off the shelf software packages support IPv6?

- Business applications
  - Billing, payroll, specialist applications
  - Can legacy applications be converted?
  - Any in-house applications?

- In general
  - All Internet-aware software should be IPv6 aware, otherwise will need dual stack connectivity

IPv6 Transition: Hardware

- Routers, wireless switches, modems, computers, etc
  - All must be considered eventually
- Most new hardware now supports IPv6
  - Or should have an upgrade path
- CPE equipment will need upgrade
  - Eg DOCSIS 3.0 for cable modems
- Aim to build IPv6 into your checklist for your hardware upgrade cycle
  - If not, another upgrade may be needed

IPv6 Transition: Human Resources

- ISPs and businesses
  - Are you hiring IPv6-ready staff?
  - Are you seeking IPv6 training for current staff?

- Educational institutions
  - Are you producing IPv6-ready graduates?

IP Address Security: RPKI

- Resource Public Key Infrastructure
  - Certificates carrying IP address block details, signed by APNIC
    - Certification hierarchy starts with single root authority, and extends through RIRs and ISPs to end users
  - Used to secure routing system by verifying authority for route origination
- Progress to date
  - Production RPKI available at APNIC now
  - APNIC as pioneer working with RIRs to produce global production RPKI system
    - NRO deadline of 1 Jan 2011 for first phase
  - Applications are yet to be standardized

IP Address Security: IRT

- IRT (Incident Response Team) records
  - Details of where to send abuse reports related to specific resources
  - Policy proposal 79: IRT records will be mandatory
    - Policy now in final call (ends 3 May 2010)
  - Upon implementation of this policy, IRT must be included in:
    - All new IP and AS number objects
    - All existing IP and AS number objects the next time you update them

IP Address Security: IRT

- How IRT object will affect you
  - Do you have IP address or AS number registrations in the APNIC Whois Database?
  - Do you have a contact point for abuse reports?
    - If so, create an IRT record for your organisation
  - If not, you can:
    - Establish contact point (IRT)
    - Use another party (e.g. a CERT)
- To comment on this proposal, email policy@apnic.net before 3 May 2010

What Next?

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More Users, More Devices

- In 2010s…
    - Commodity Internet service provision
    - Broadband, mobile, always-on
    - Large reduction in consumer electronics costs
- A network-ready society
    - Ubiquitous pervasive networking
    - Bringing online the "Next 5 Billion"
    - Plus a device population some 2–3 orders of magnitude larger than today's Internet
   - "Internet for Everything"

IPv6 is Here!

- IPv6 is no longer experimental
- IPv6 is in commercial use
- Signification acceleration in deployment over past year
- Start planning now
  - Don't wait until IPv4 runs out
  - What will you do the first time a customer complains they can't reach a site because you don't support IPv6?
- The main questions have answers…

Chicken or Egg?

"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 Networld

- Monash University, Melbourne, Australia:
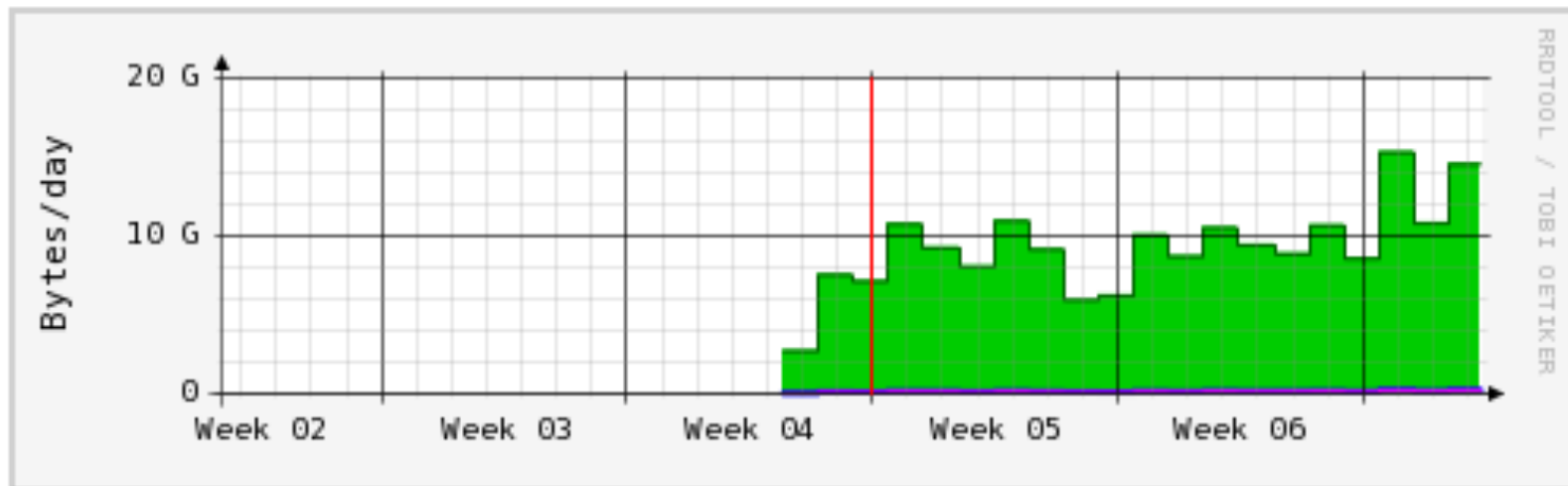
"What's the Killer App for IPv6?"

The Internet !

•Sometime in 2012…

- ISPs will need addresses for new network infrastructure
  - and will receive only IPv6
- End users will start receiving IPv6 Internet services
  - With or without private IPv4 addresses
- Enterprises and businesses will get IPv6 for their new networks
  - "Customer NAT" will apply to IPv4
- All Internet users will be affected
- What will you need to do?

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Questions?

Thank You

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