*Gud aftenun*

# IPv4 and Two-byte ASNs running out How to craft the Internet beyond?

PacNOG 4
Port Villa
29 June – 6 July 2008

# Acknowledgements

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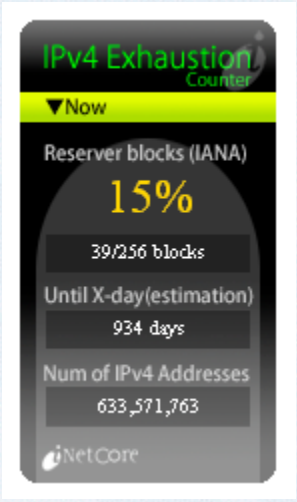
Chief Scientist

APNIC

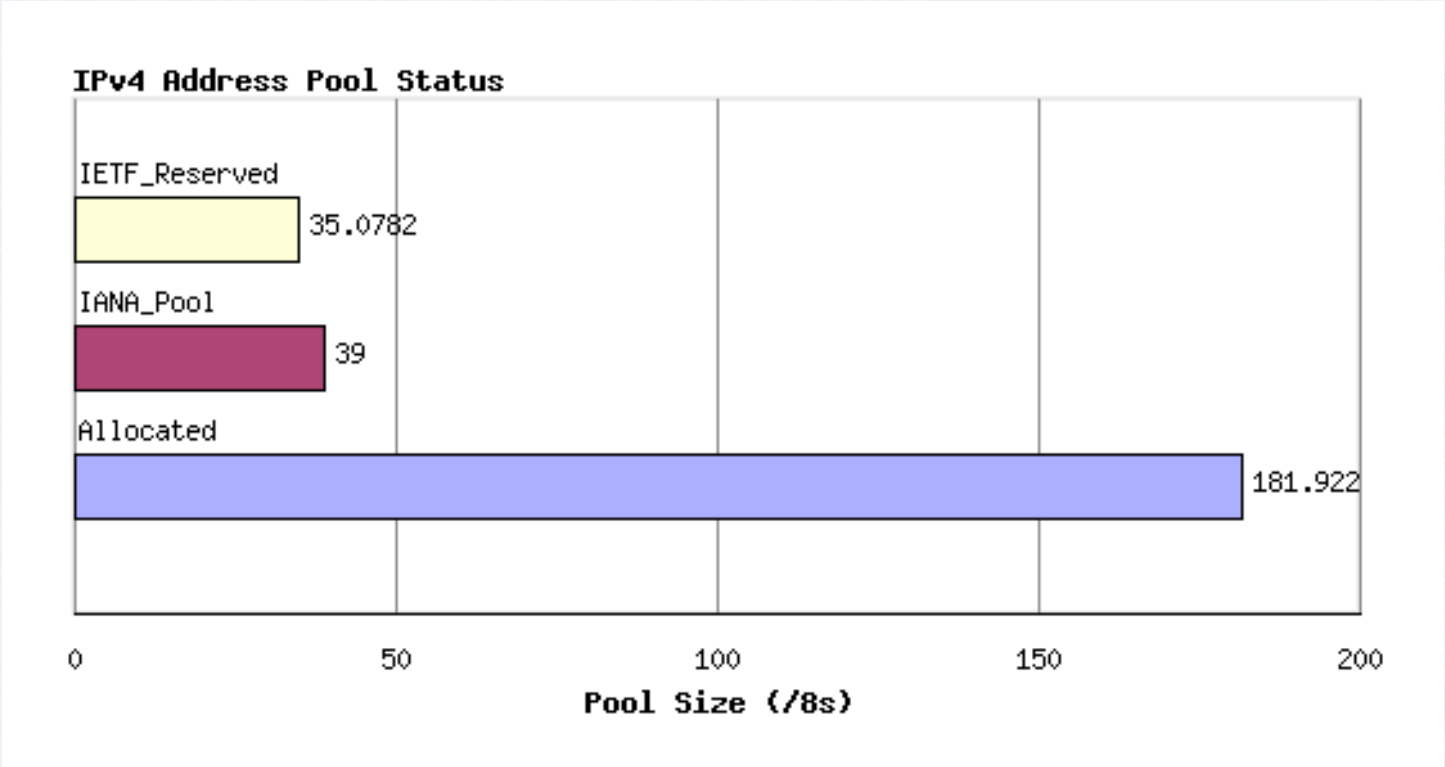



Intec NetCore, Inc.

http://www.potaroo.net

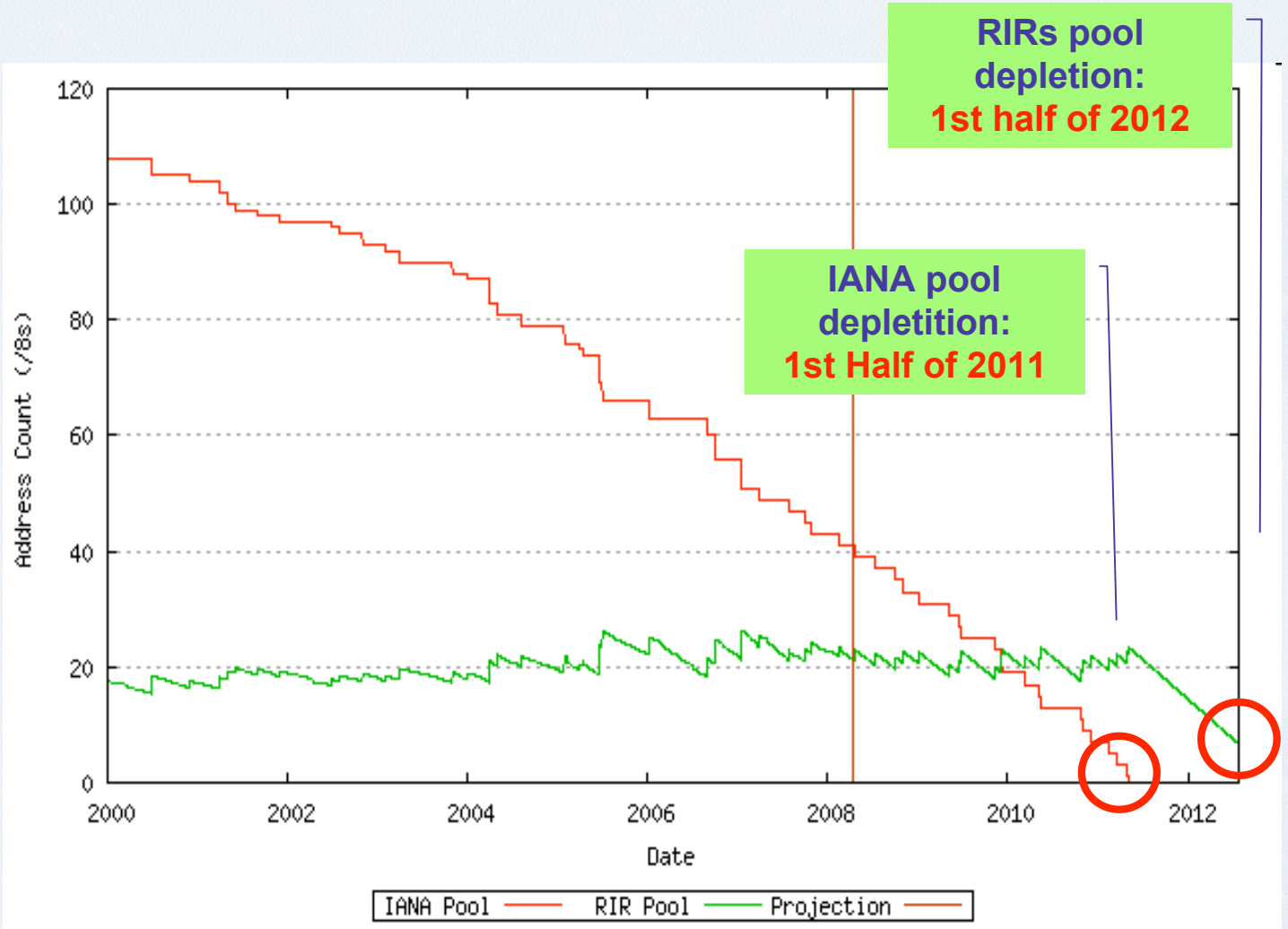
# IPv4 address distribution

# Current distribution of the whole IPv4 address space

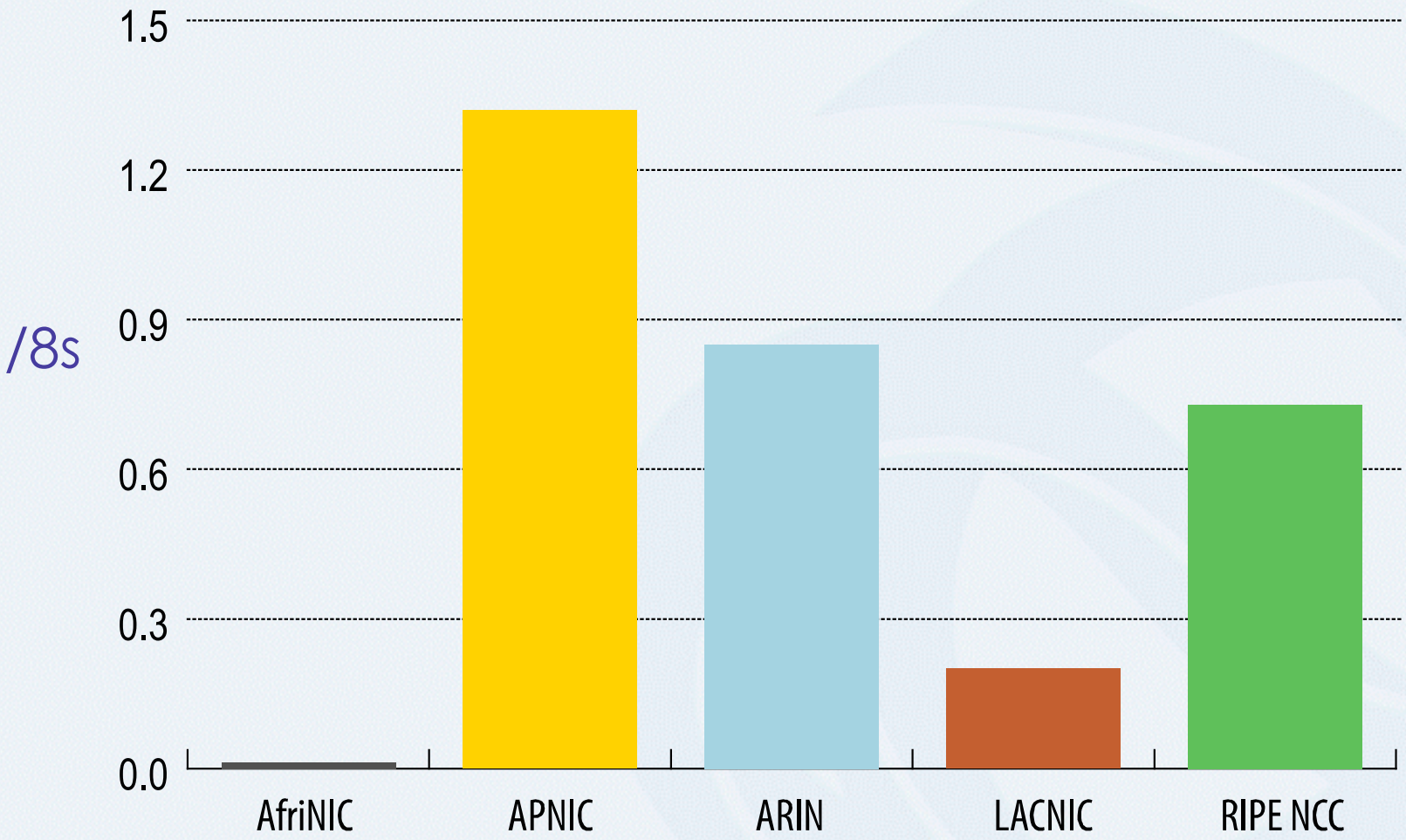



As of this date

# Projected lifetime of remaining IPv4 addresses

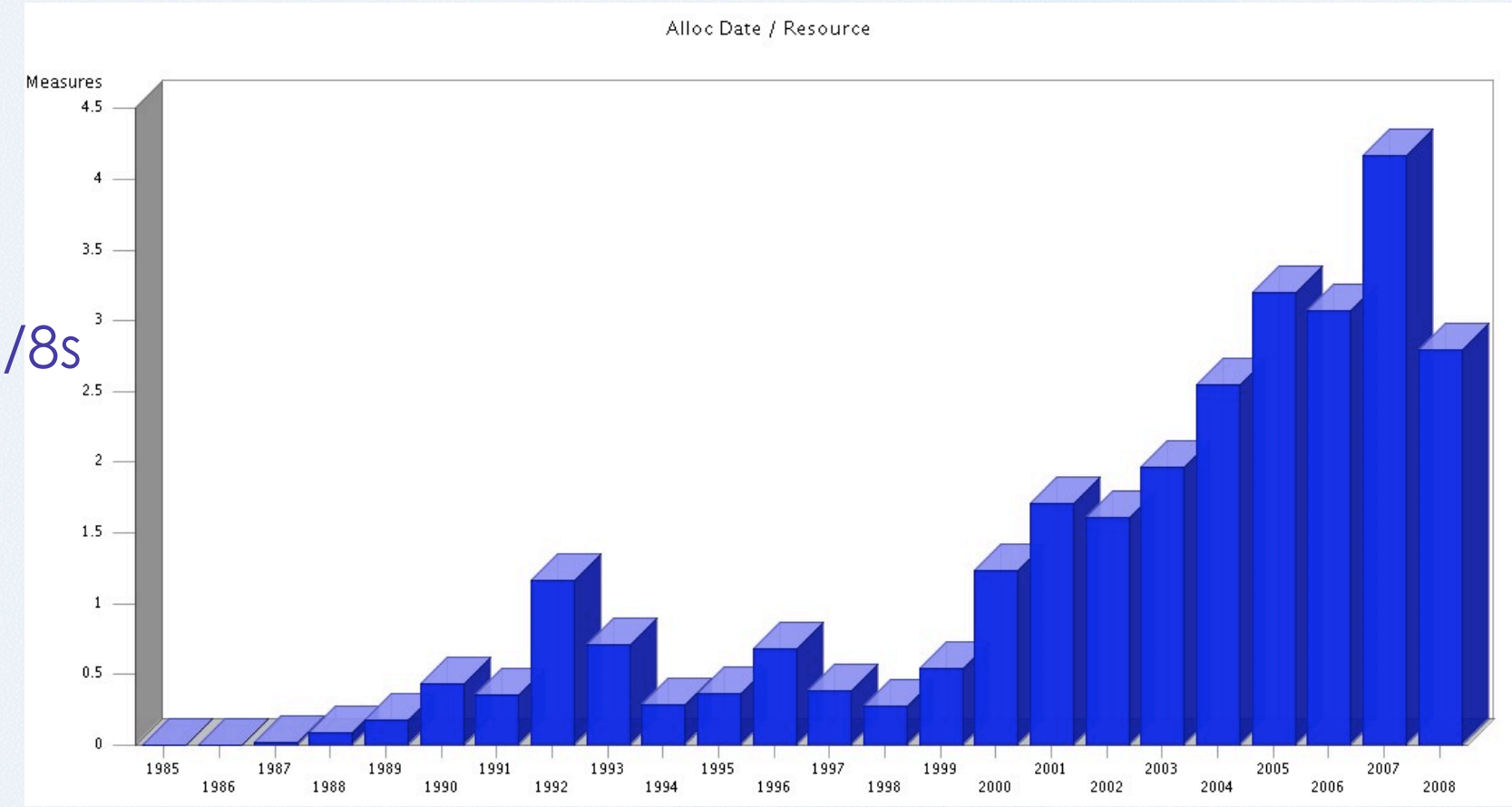


# IPv4 address space issued - RIRs to customers




Jan 1999 – March 2008

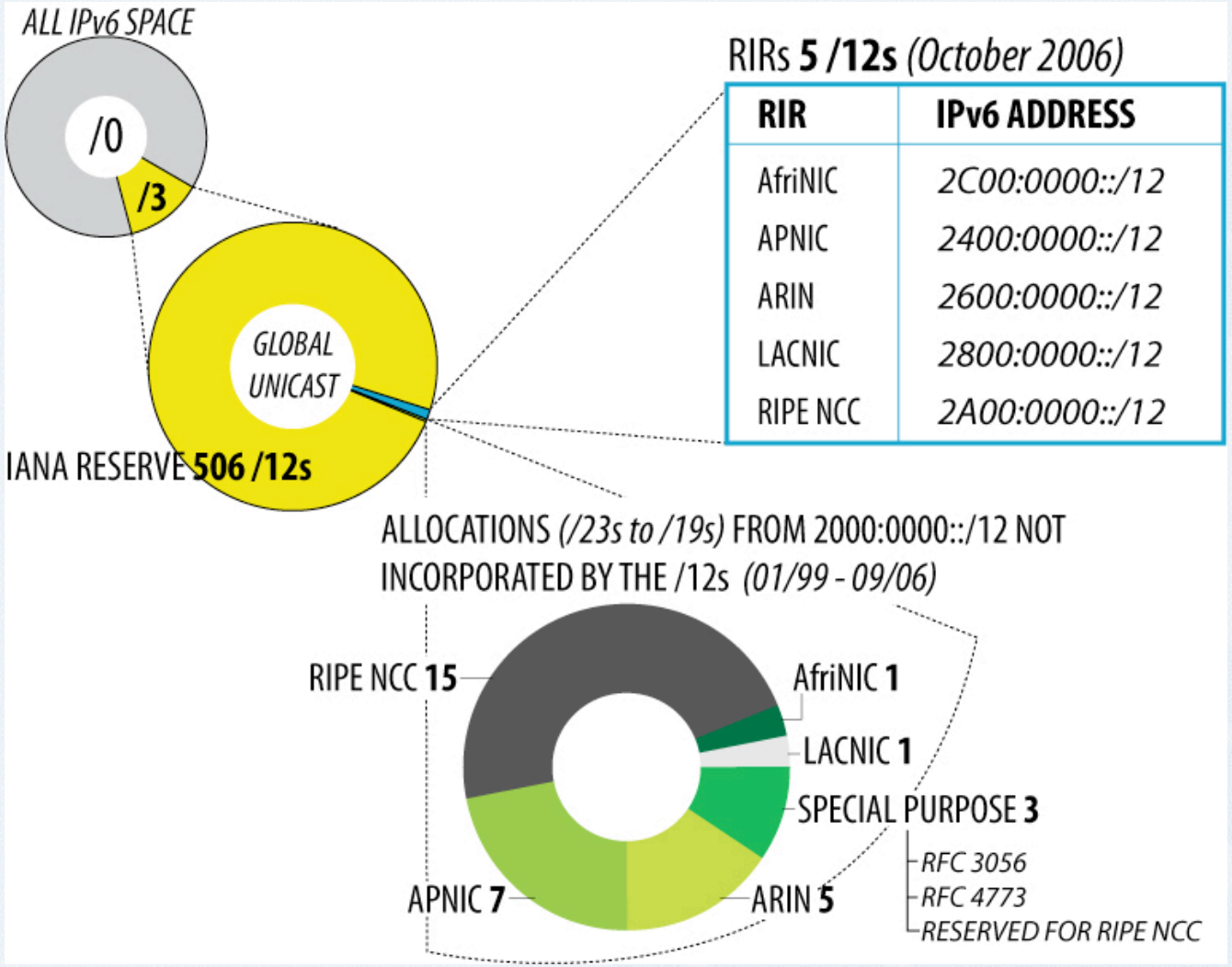
# IPv4 address space issued - APNIC to customers




As of this date

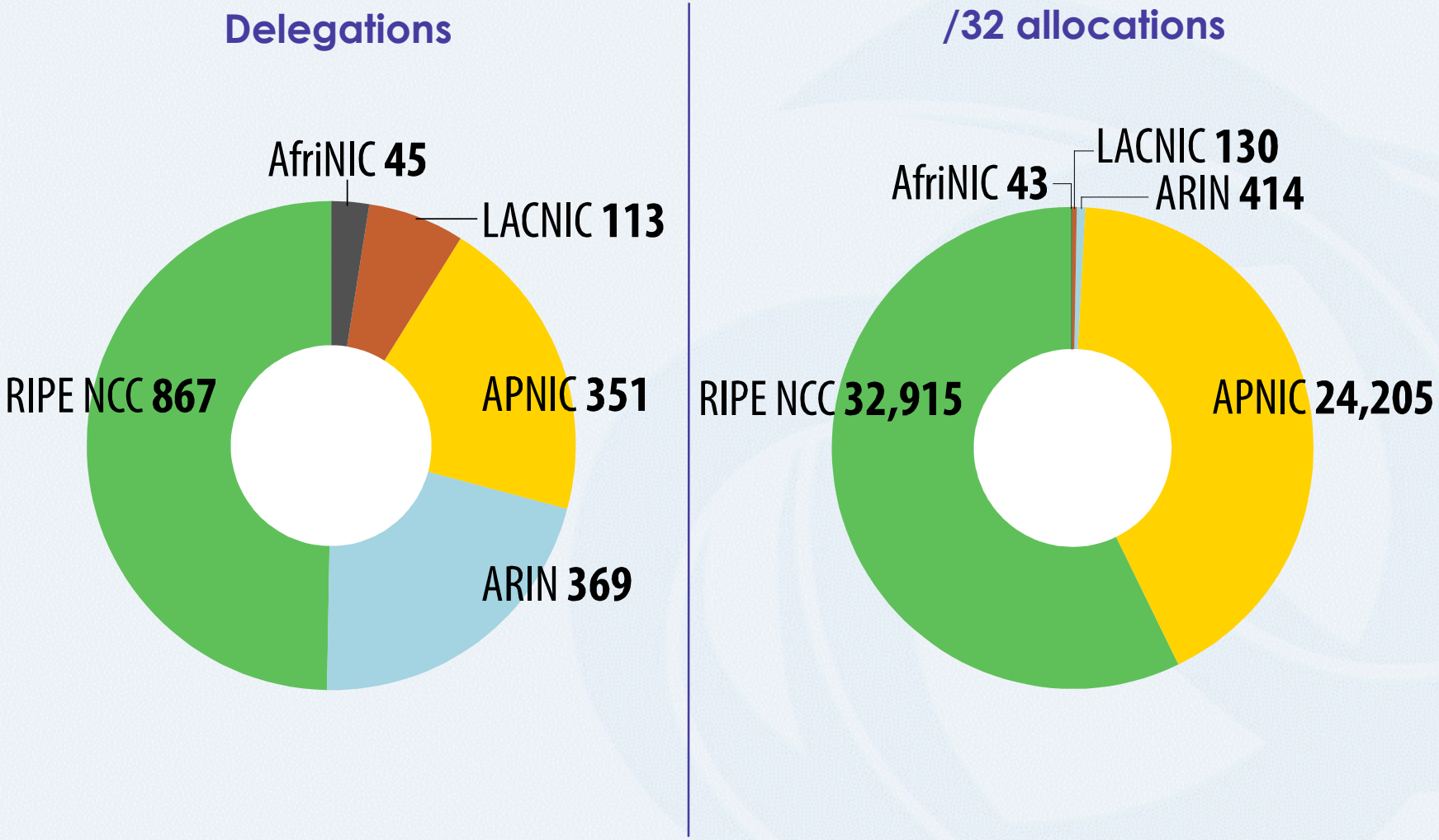
# IPv6 address distribution

# IPv6 allocations – IANA to RIRs



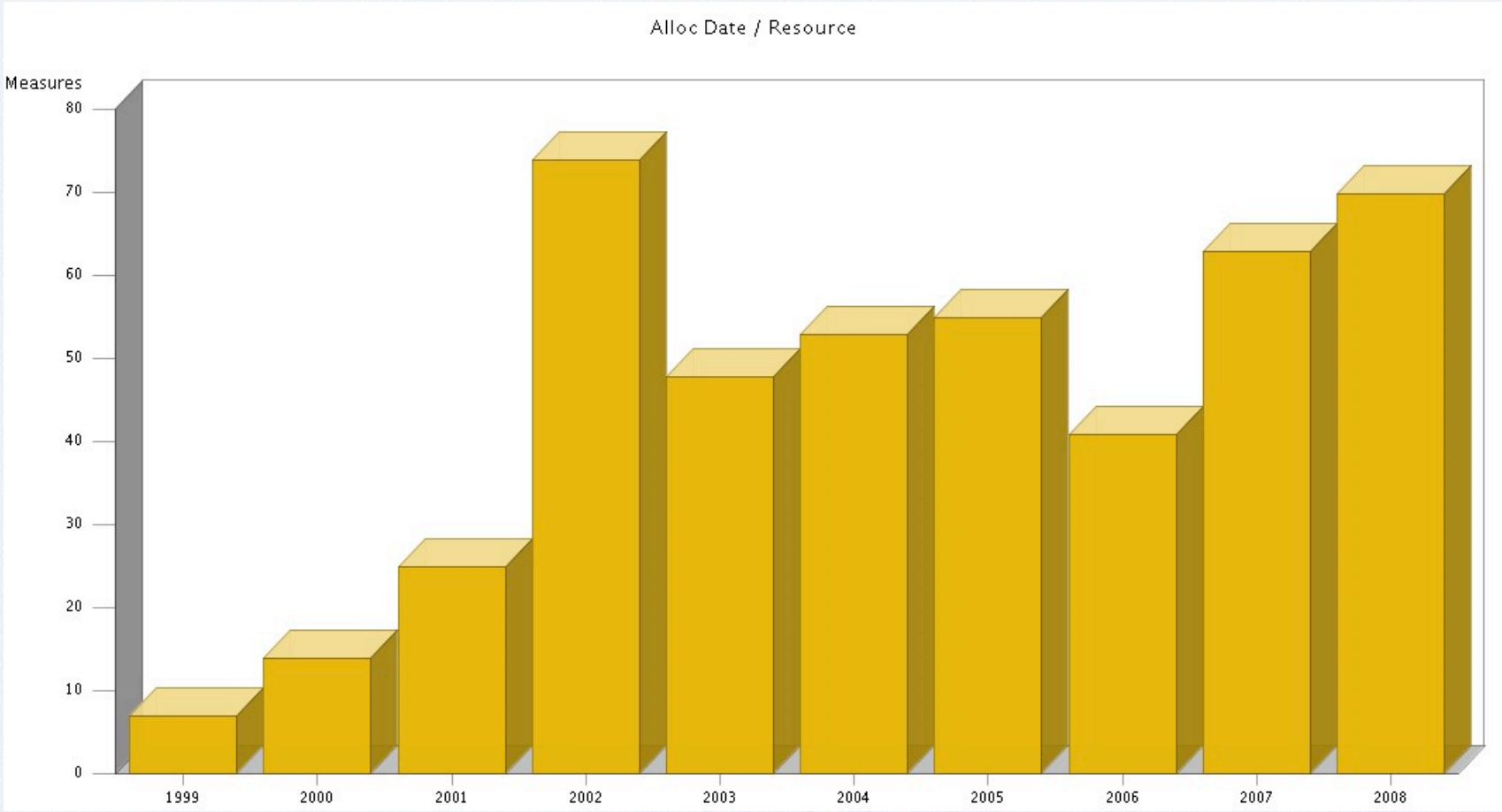

Dec 2007

# IPv6 allocations - RIRs to LIRs/ISPs




Jan 1999 - March 2008

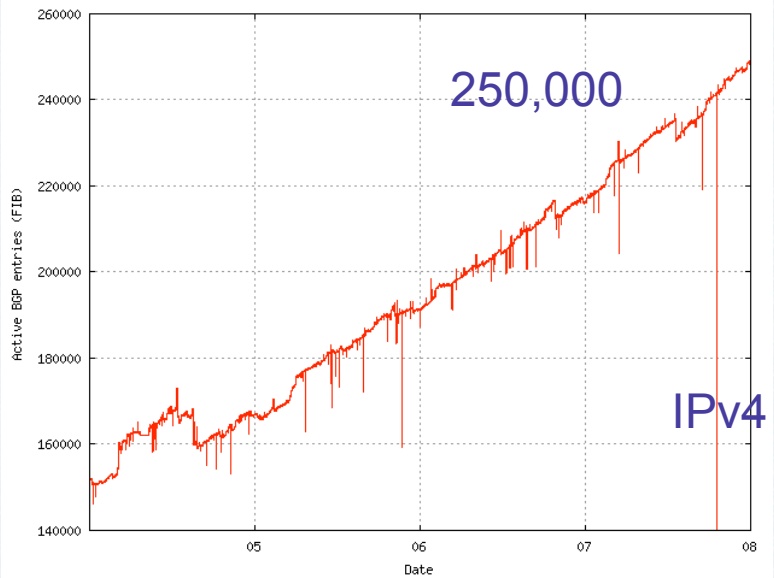
# APNIC IPv6 delegations by year

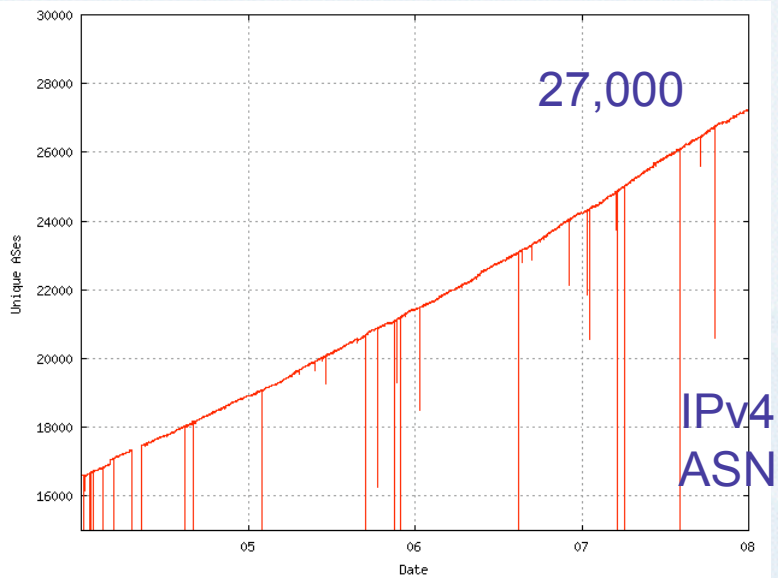


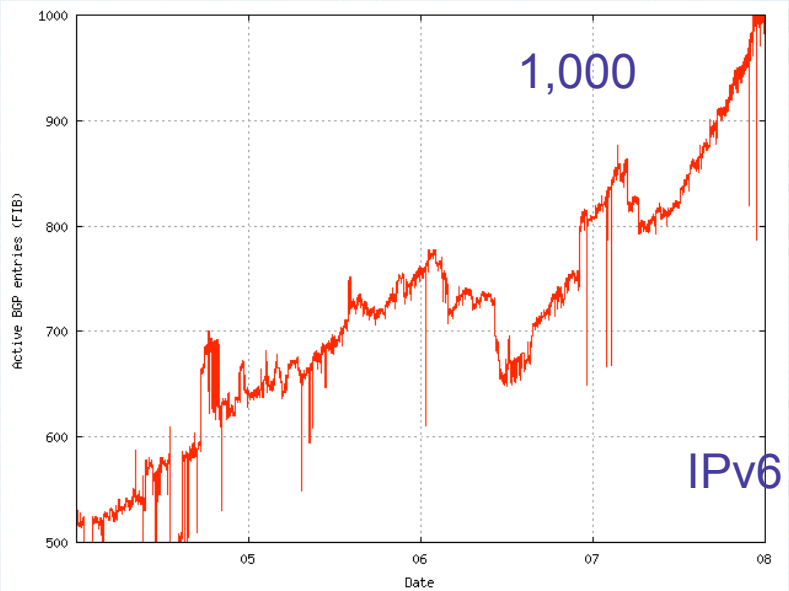

As of this date

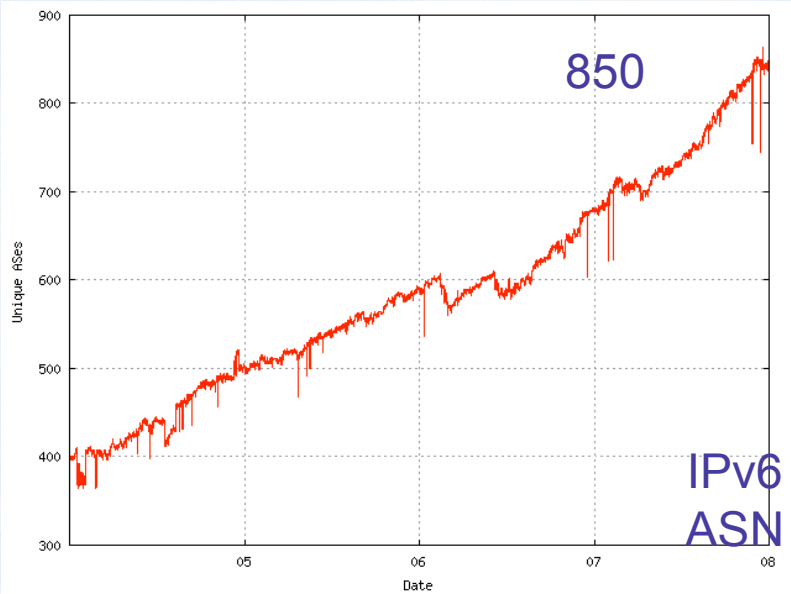
# Is IPv6 actually in use?

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



# 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 2010 - 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.

# 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

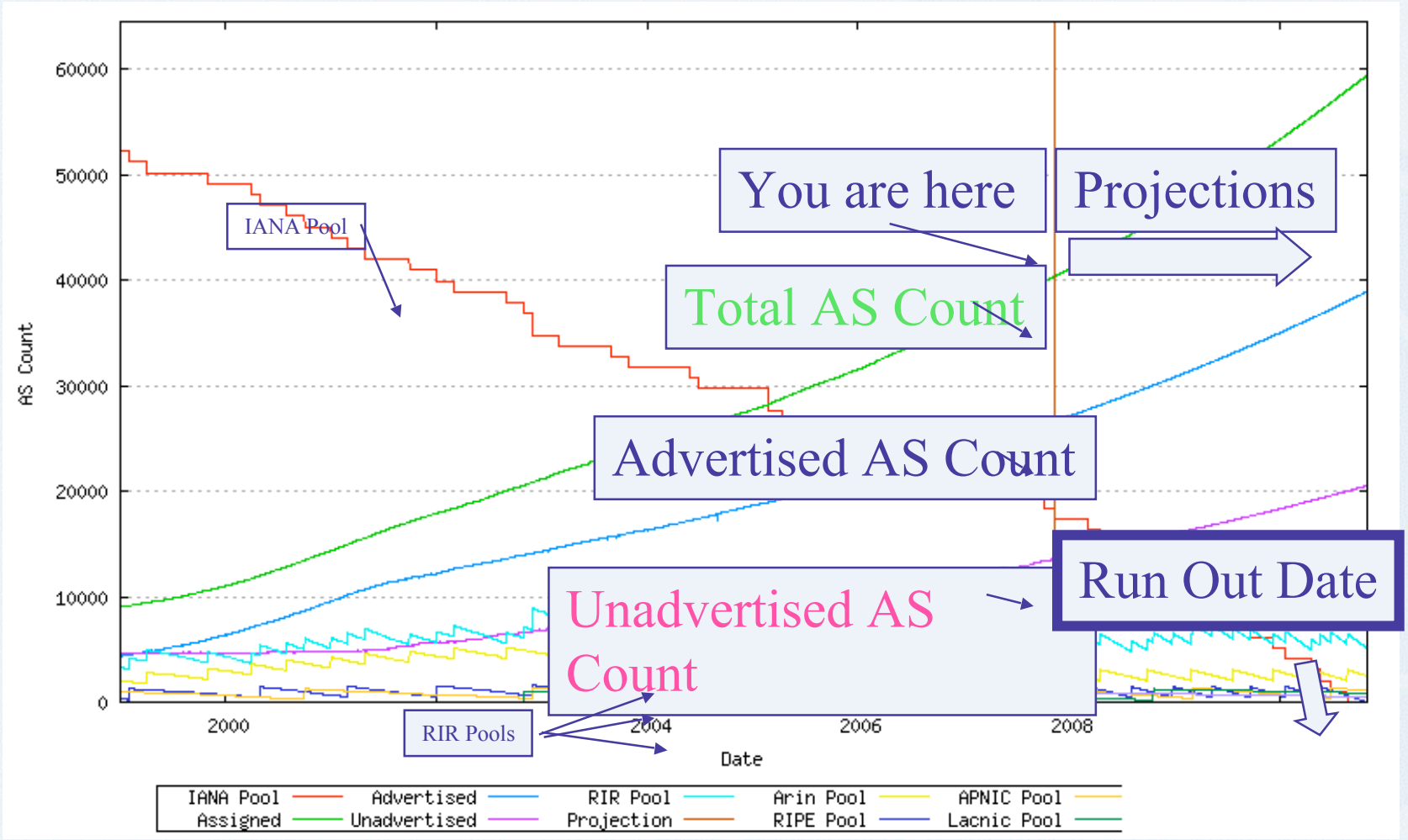



- Or even trillions…

# Two-byte ASNs

## IPv4 not the only protocol running out of numbers

# 16-bit AS number consumption - The big picture explained



# 16-bit AS Number Exhaustion

- We were running into exhaustion of the 16-bit AS Number pool
  - Estimated exhaustion time: 1200 UTC 1 APRIL 2011
  - See http://www.potaroo.net/tools/asns

# RIRs and 32-bit AS Numbers

- From 1 January 2007 the RIRs are allocating 32-bit AS numbers (upon specific request)
- From 1 January 2009 the RIRs will be allocating 32-bit AS numbers by default (leaving some 16-bit AS numbers available upon specific request)

# What does this imply?

If you are a 16-bit AS

as most (all) of you are today

and you don't want to upgrade all your instances of BGP today

something you probably want to avoid (or at least defer!)

then you don't have to do anything at all!

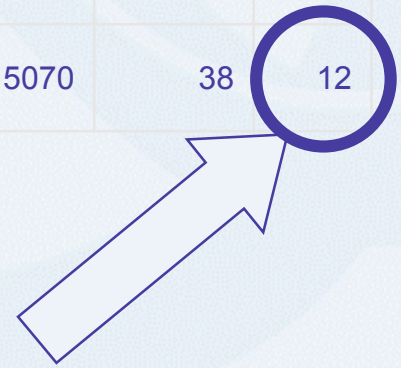
***NOTHING*** changes!

# 4-byte AS Testing

- Tests have been undertaken using closed BGP networks, and over the public Internet
- Tests of 16-bit/32-bit transition boundaries in various permutations of transits and loops
- Current announcement of 203.10.62.0/24 originating from AS 2.2 to assist others in local testing of 32-bit BGP

# 32 bit AS Numbers in use

| RIR | RIR Pool | Unadv | Adv | 16-bit | Unadv | Adv | 32-bit | Unadv | Adv |
|---|---|---|---|---|---|---|---|---|---|
| AFRINIC | 1921 | 155 | 212 | 901 | 152 | 211 | 1020 | 3 | 1 |
| APNIC | 2207 | 1522 | 3074 | 1211 | 1499 | 3069 | 996 | 23 | 5 |
| ARIN | 2996 | 7754 | 11695 | 1976 | 7751 | 11694 | 1020 | 3 | 1 |
| RIPE NCC | 2211 | 4166 | 10477 | 1200 | 4157 | 10473 | 1011 | 8 | 5 |
| LACNIC | 1391 | 539 | 878 | 368 | 538 | 878 | 1023 | 1 | 0 |
| | | | | | | | | | |
| TOTAL | 10726 | 14136 | 26336 | 5656 | 14097 | 26325 | 5070 | 38 | 12 |



# Speaker

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External Relations Manager
APNIC

sunny@apnic.net

# In conclusion…

# Coping with Crises

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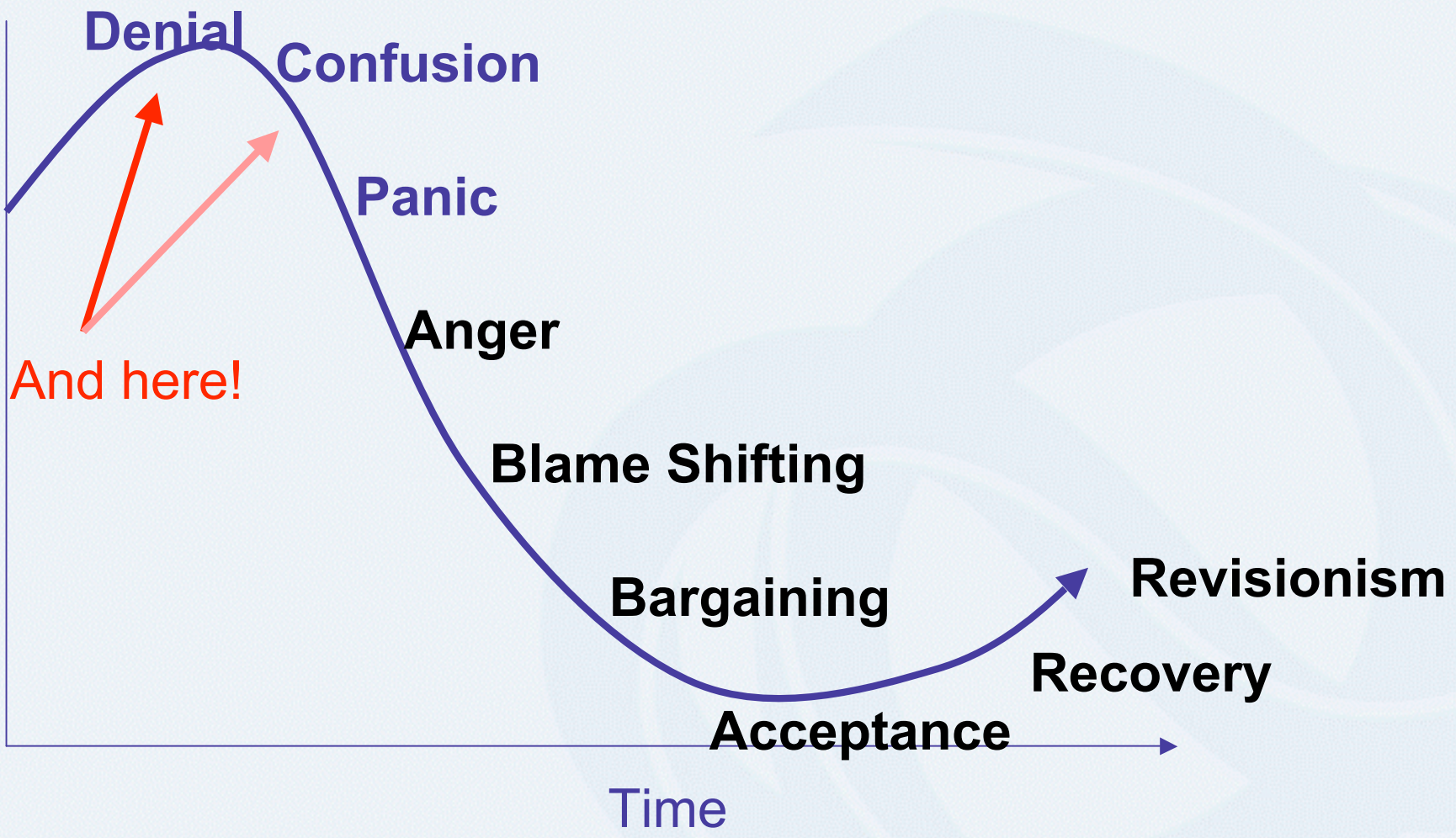

# Coping with Crises

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# Possible steps ISP could take

- Staff training
  - Send staff to events like PacNOG, PITA, APNIC and APRICOT to participate in training
  - Request  APNIC to conduct workshop in your economy
- Request for IPv6 & 4-byte ASN from APNIC
  - IPv4 and IPv6 networks can co-exist
    - Most IPv4 software and hardware are IPv6 capable
  - No extra fees
    - Existing APNIC members with IPv4 space
- Start now
  - Transition takes time

# Possible steps ISP could take (cont)

- Join mailing lists to keep up to date on developments
  - APNIC mailing lists
    - http://www.apnic.net/community/lists/index.html
  - IPv6 global operator forum
    - http://lists.cluenet.de/mailman/listinfo/ipv6-ops
- Access relevant websites
  - Internet Community of Online Networking Specialists (ICONS)
    - Keep up to date on operational matters
    - http://icons.apnic.net
  - Global IPv6 forum
    - Latest events and information on IPv6 development
    - http://www.ipv6forum.org

# 4-byte ASN resources

- IETF Specification
  - RFC4893
- OpenBGPD patches
  - http://www.potaroo.net/tools/bgpd
- Quagga patches
  - http://quagga.ncc.eurodata.de

# APNIC meetings - Upcoming

- **APNIC 26**

  Christchurch

  New Zealand

  25 - 29 August 2008

  http://www.youtube.com/watch?v=244IxZnGGE4

- **APNIC 27** (In conjunction with APRICOT 2009)

  Manila

  Philippines

  23 – 27 February 2009

## Internet governance hui

- What are the challenges facing Internet operators in developing countries?
- How can the Internet community, together with business, civil society, and government work to overcome the challenges?
- This hui ("gathering" in Maori) features key Internet community figures like:
  - **Peter Dengate-Thrush**
    Chair, ICANN Board of Directors
  - **Raúl Echeberría**
    Executive Director / CEO, LACNIC
  - **And others**

# APNIC 26 – Program highlights

- **Seminars**
  - IPv4 in 2015: Black markets, regulated transfers or totally redundant?
  - IPv6: Does it work for you?
- **Policy discussions that might effect your networks**
- **Trainings**
  - Planning for IPv6 deployment
  - Network forensics
  - Managing Internet resources

# APNIC 26 - Registration

You are all invited!

http://www.apnic.net/meetings/26

***Registration now open. Early bird registration closes on 1 August 2008***

*Tankyu*

See you all tomorrow
@
Internet Resource Management