Asia Pacific Network Information Centre

APNIC

IPv6 Addressing Status and Policy Report

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Director General, APNIC

Overview

- Introduction to APNIC
  - Role and responsibilities
- IPv6 deployment status
  - Allocations, Registration and Routing
  - Asia Pacific and Global comparison
- IPv6 policy status
  - Latest developments
  - Details of new policy

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Introduction to APNIC

What is APNIC?

- Regional Internet Registry (RIR) for the Asia Pacific Region
  - Regional authority for Internet Resource distribution
  - IP addresses (IPv4 and IPv6), AS numbers, reverse DNS delegation
  - Provide services to 700+ members
- Industry self-regulatory body
  - Est 1993, in the “Internet Tradition”…
  - Consensus-based, open and transparent
  - Non-profit, neutral and independent
  - Open membership-based structure

What does APNIC do?

1. Internet resource management
   - IP address allocation to ISPs and NIRs
   - IP address assignment to end users
   - AS number assignments
2. Resource registration
   - Authoritative registration server: *whois.apnic.net*
   - Internet Routing Registry: *apirr.apnic.net*
3. DNS management
   - Delegate reverse DNS zones/domains
   - Authoritative DNS servers
     - *in-addr.arpa, ip6.arpa (ip6.int)*

What else does APNIC do?

- Training and Seminars
  - 2 training courses per month in 2002
  - Seminars, conferences etc
- Publication
  - Newsletter, web site, mailing lists etc
  - Regional and global statistics
- Policy development and coordination
  - APNIC Open Policy Meetings: 2 per year
    - SIGs, WGs, BOFs, Training sessions
    - Major policy development forum
  - ASO and ICANN processes

Where is APNIC?

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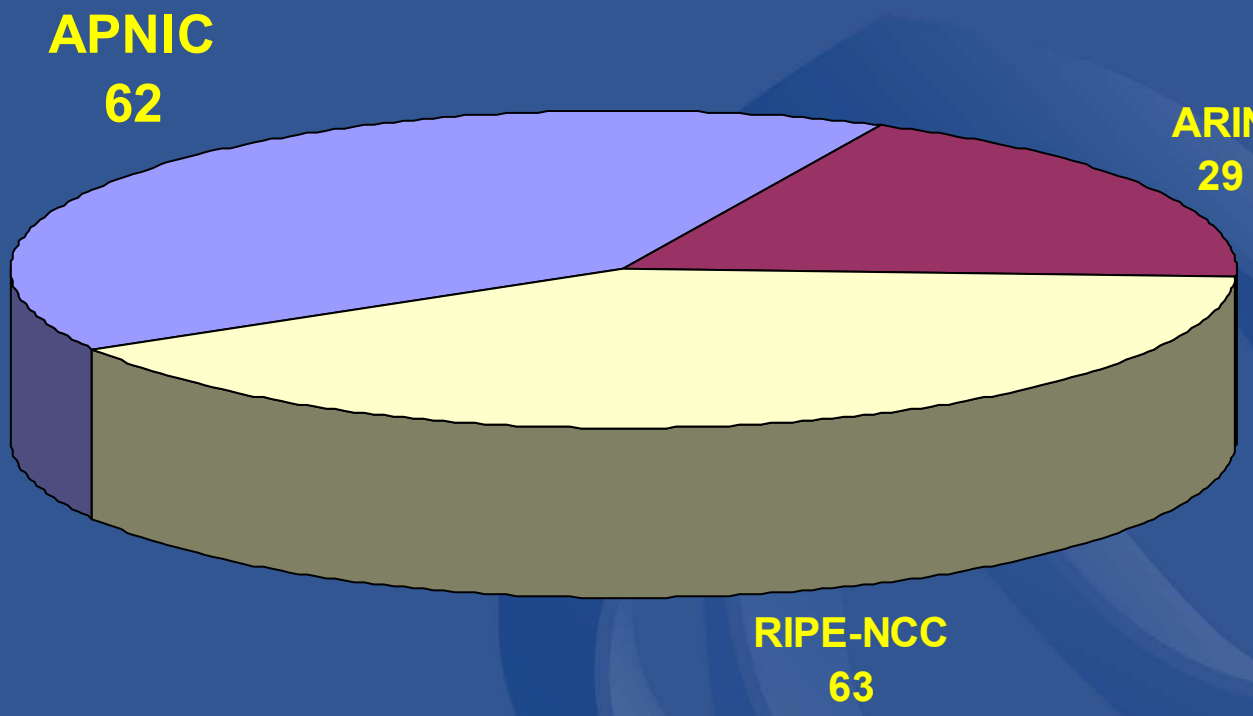
IPv6 Deployment Status

IPv6 Address allocations

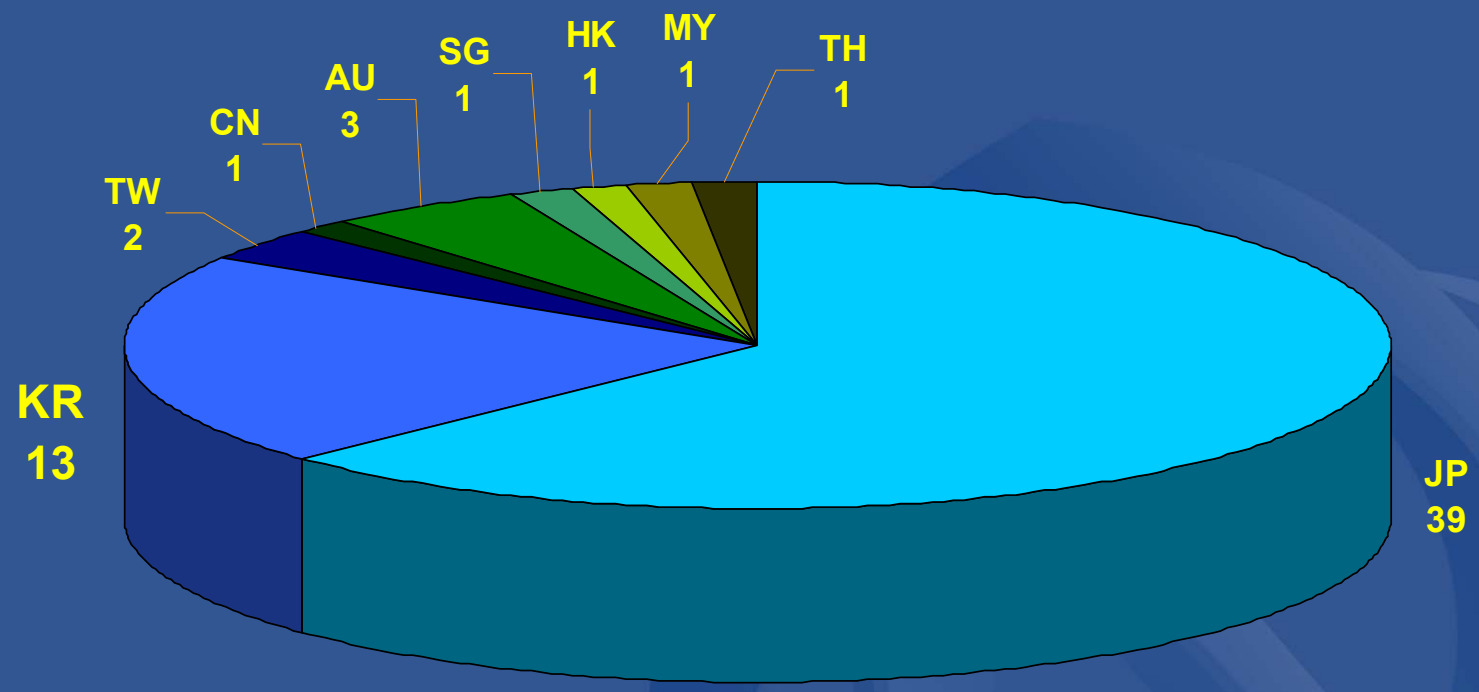
- Before 1 July 2002
  - Allocations made under “Provisional IPv6 Policy”
  - Minimum allocation /35 (8192 sites)
  - No larger allocations made
  - 154 allocations in total to date
- Since 1 July 2002
  - Allocations now made under new policy
  - Minimum allocation /32 (64K sites)
  - No allocations so far

IPv6 Distribution - Global



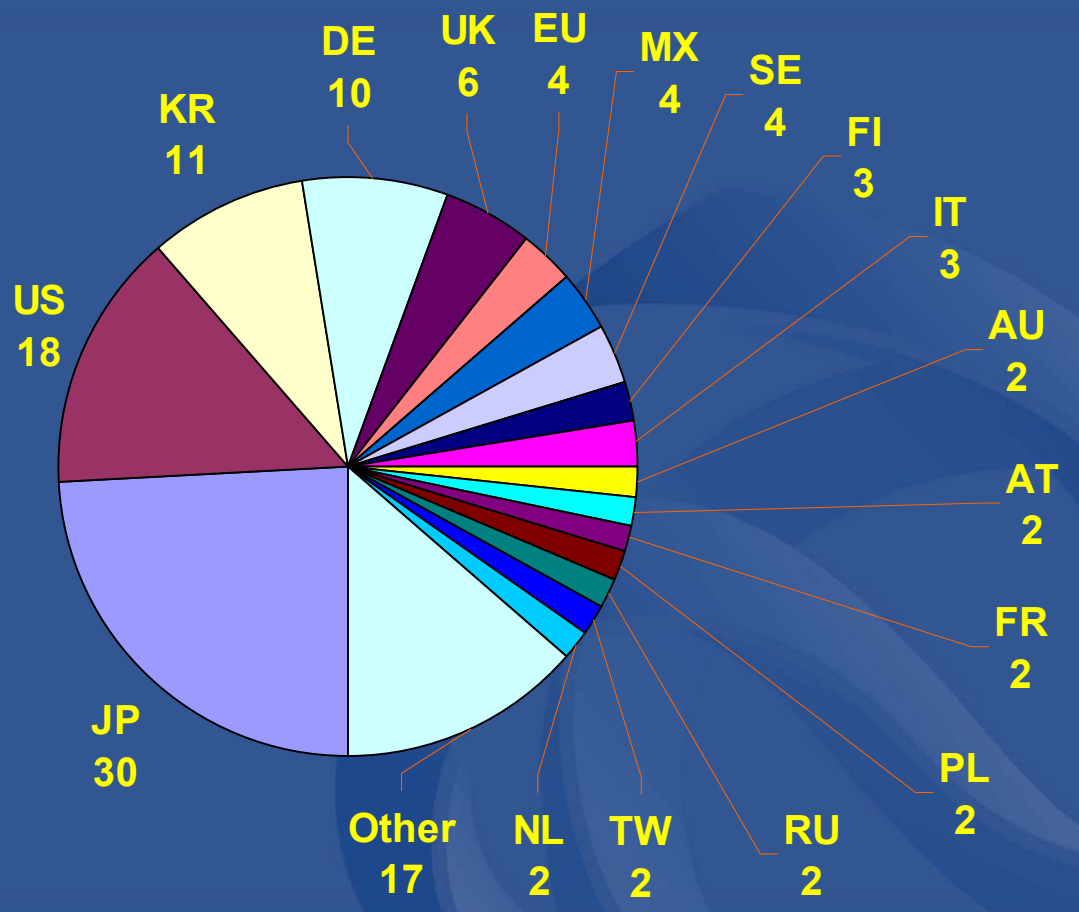
Unit: /35 Prefixes

IPv6 Distribution - APNIC



Unit: /35 Prefixes

IPv6 Distribution – Global (2001)



Unit: /35 Prefixes

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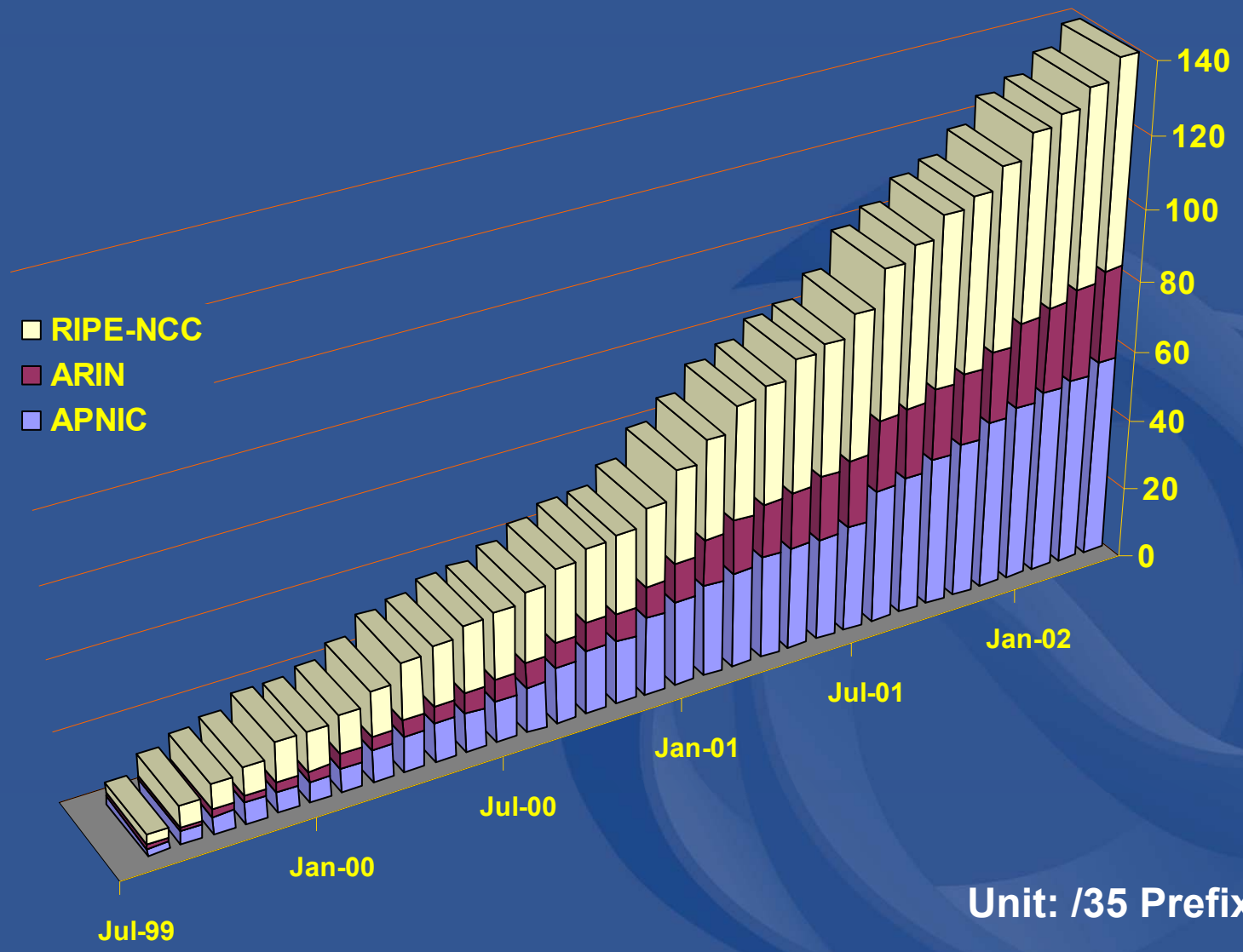
IPv6 Distribution - Global



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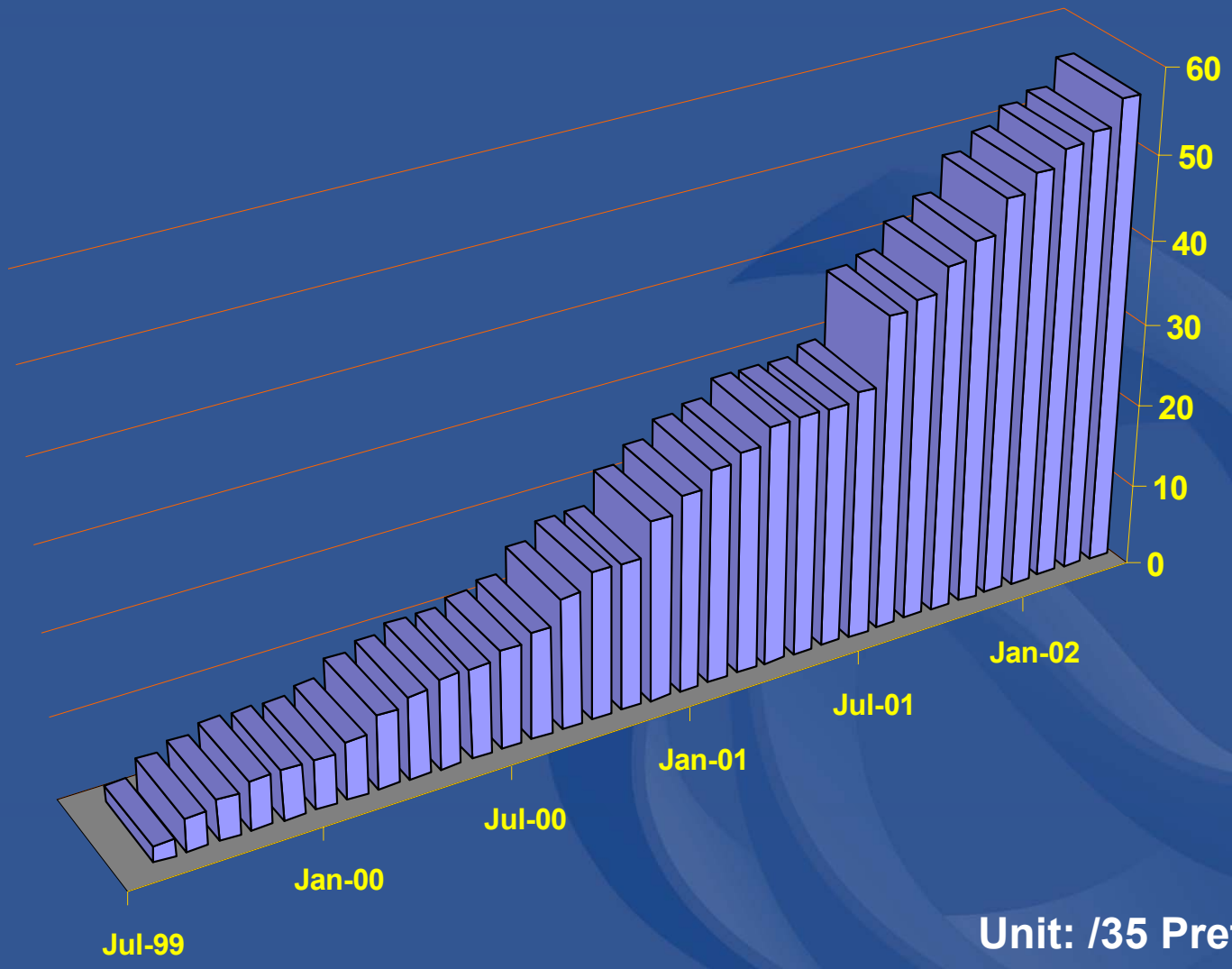
IPv6 Distribution - APNIC



Unit: /35 Prefixes

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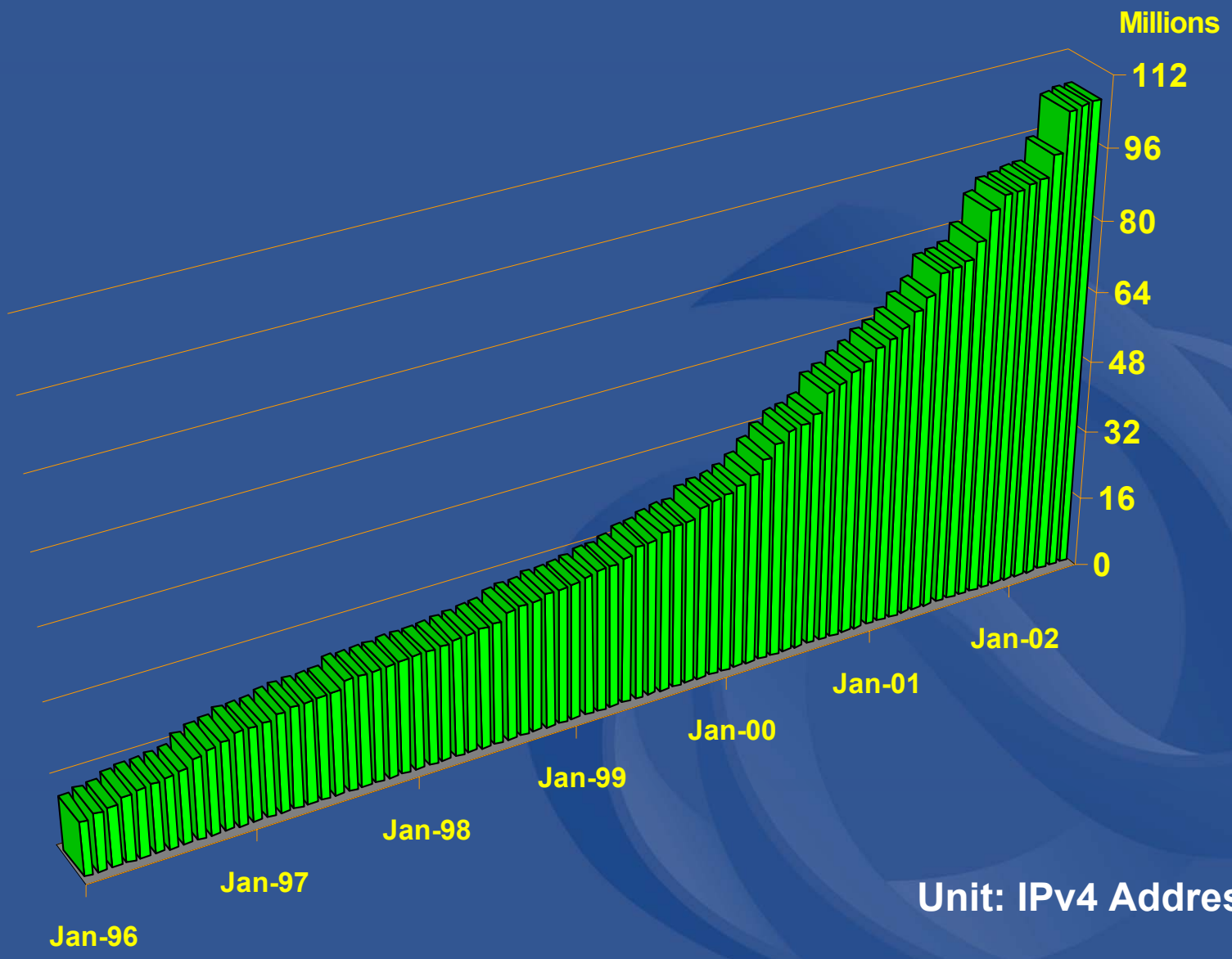
IPv4 Allocations - APNIC



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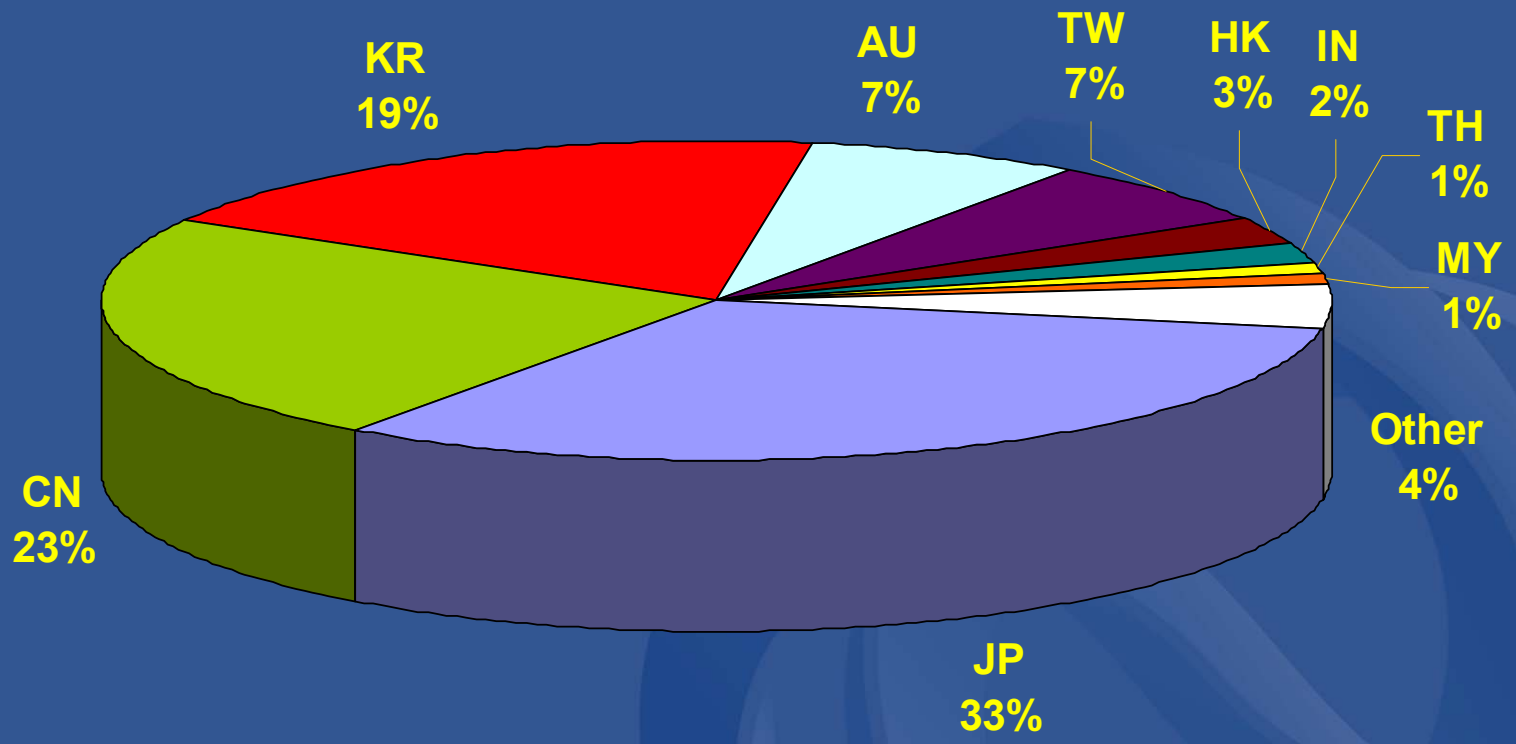
IPv4 Distribution - APNIC



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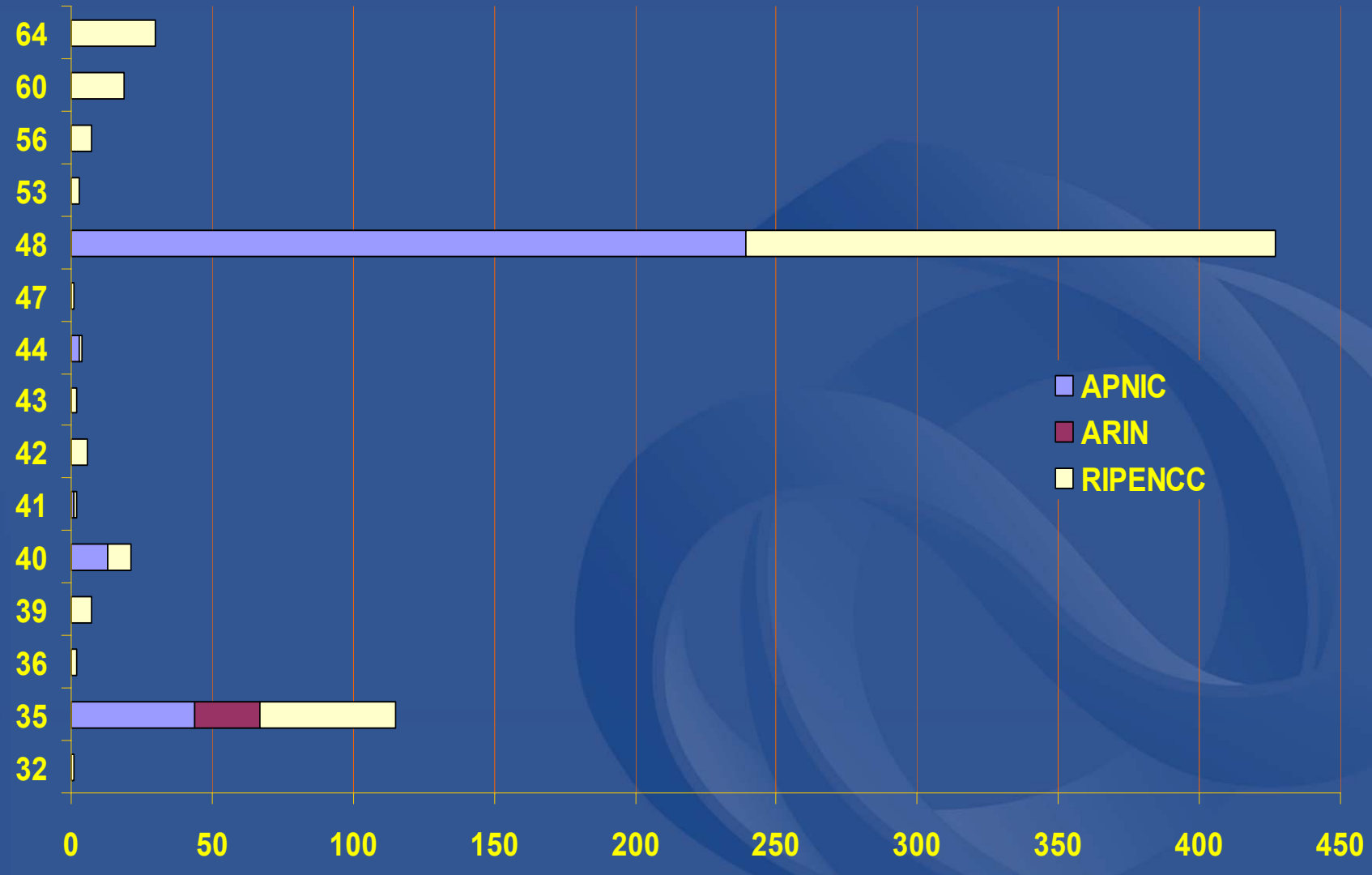
IPv6 Address registration

- IPv6 addresses are registered in RIR/NIR “whois” database
  - Registration unit is /32 - /48
  - Address should be registered before use
- Registration gives measure of potential utilisation of address space
  - However addresses may not be in use

IPv6 Registrations - Global



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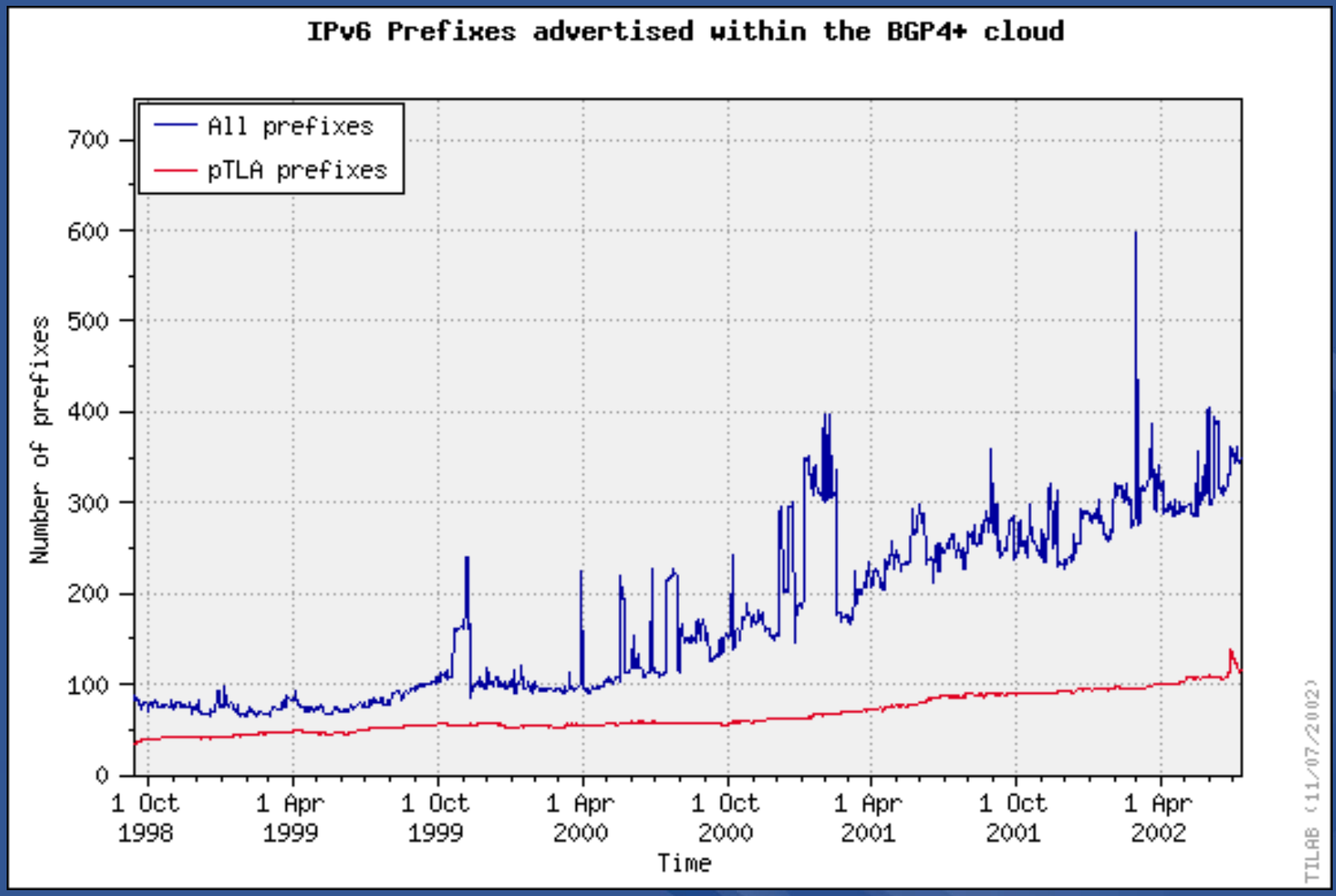
IPv6 Address routing

- IPv6 addresses may be allocated and registered without being used
- Routing tables reveal address space which is actually in use

IPv6 Routing Table



Source: http://net-stats.ipv6.tilab.com/bgp/graphs/

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IPv6 Policy Status

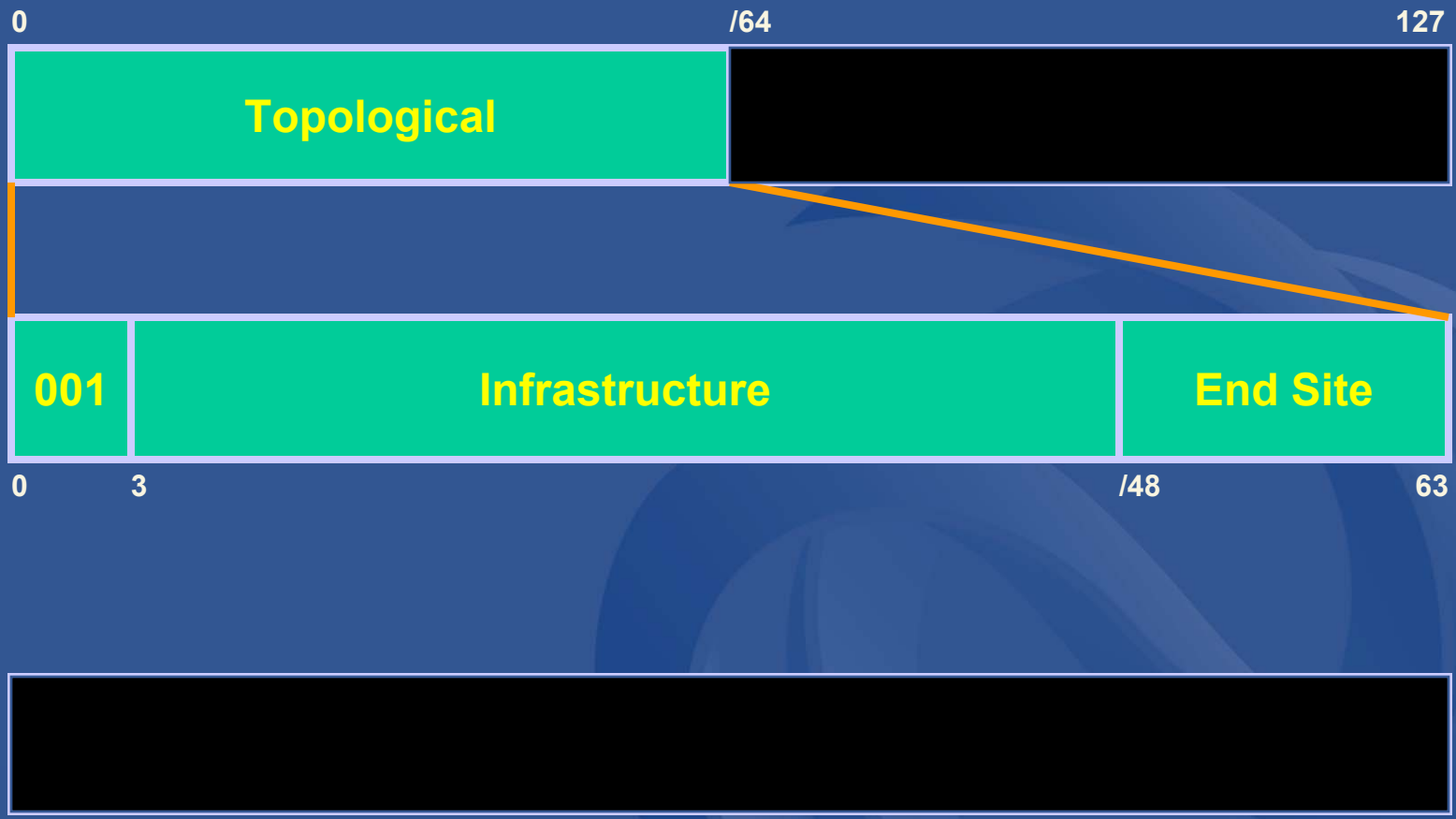
New IPv6 Policy - History

- First published in 1999
  - "Provisional IPv6 Policy" adopted by all RIRs
- Policy review underway during 2001
  - Latest draft approved in all RIR regions
    - APNIC: Bangkok, March 2002
    - ARIN: Las Vegas, April 2002
    - RIPE NCC: Amsterdam, May 2002
- New policy now established
  - Implemented in APNIC region since 1 July 2002
- Public mailing lists and documentation
  - http://www.apnic.net/ipv6

New IPv6 Policy - Details

- Addressing structure overview
- Initial allocation criteria
- Subsequent allocation criteria
- Utilisation requirements
- Address assignment
- Other conditions

IPv6 Address Structure

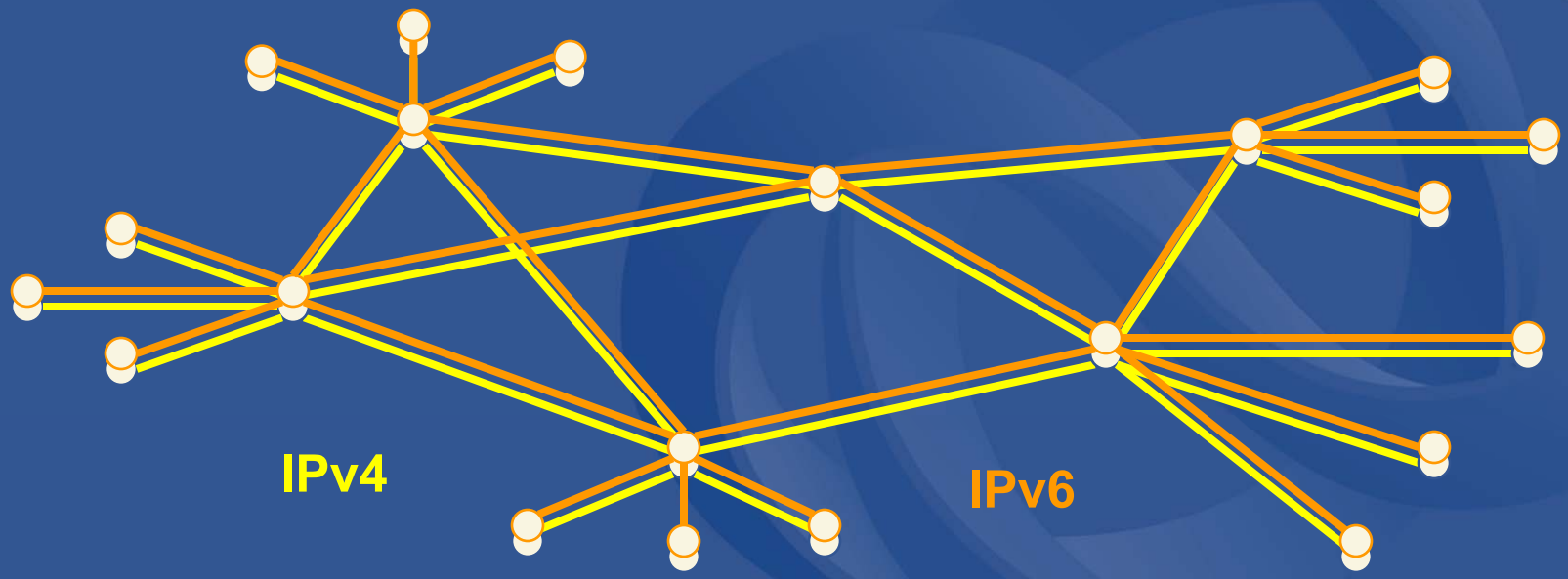


IPv6 Allocation Criteria

- Initial allocation size is /32
  - Allocated to any IPv6 LIR (ISP) planning to connect 200 End Sites within 2 years
  - This is the default initial allocation to “new” ISPs (“slow start” policy)
  - Provides 16 bits of site address space
- Larger initial allocations can be made if justified according to:
  - IPv6 network infrastructure plan
  - Existing IPv4 infrastructure and customer base

IPv6 Allocation Criteria

- Existing ISP infrastructure
  - Policy assumes that transition is inevitable
  - Large IPv4 ISPs will receive IPv6 allocations consistent with the scale of existing networks



IPv6 Assignments

- Default assignment /48 for all End Sites
  - Providing /16 bits of space for subnets
- End Site defined as an end user of an ISP where:
    - The ISP assigns address space to the end user
    - The ISP provides Internet transit service to the end user
    - The ISP advertises an aggregate prefix route that contains the end user's assignment
  - ISP POPs are also defined as End Sites
  - /48s will also be assigned for sub-assignment of /64 and /128 to mobile devices, sensors etc

IPv6 Assignments

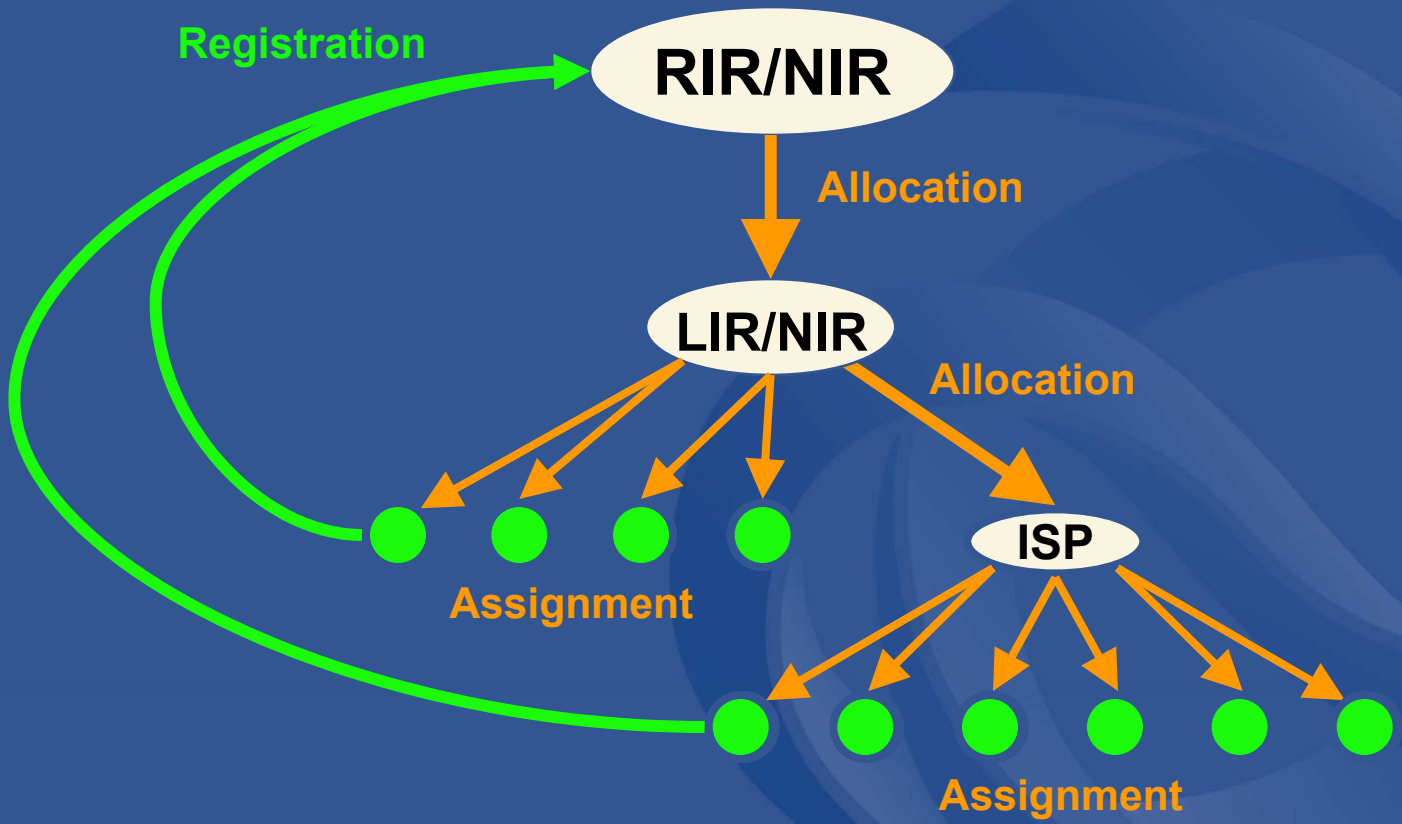
- Larger assignments: Multiple /48s
  - Some end sites will need more than one /48
  - Requests for multiple (or additional) /48s will be reviewed at NIR/RIR level
- Smaller assignments: /64
  - Single subnet devices should receive /64 only
  - E.g. mobile phone
- Smaller assignments: /128
  - Devices with no subnets should receive /128 only
  - E.g. remote sensor
- See RFC3177 (Sep 2001)

IPv6 Assignments

- IPv6 assignments to End Sites are used to determine utilisation of IPv6 address blocks
  - Intermediate allocation hierarchy not considered
  - All assignments must be registered
  - Utilisation is determined from registrations
- Intermediate allocation and assignment practices are the responsibility of the LIR…

IPv6 Registration

- LIR is responsible for all registrations



IPv6 Utilisation Requirement

- Subsequent allocation may be requested when IPv6 utilisation requirement is met
- Utilisation of IPv6 address space is measured differently from IPv4

IPv6 Utilisation Requirement

- Under IPv4, address space utililsation measured as simple pecentage:

$$Utilisation = \frac{assigned}{available}$$

- IPv4 utilisation requirement is 80%
  - When 80% of address space has been assigned or allocated, LIR may receive more
  - E.g. ISP has assigned 55,000 addresses from /16

$$\frac{assigned}{available} = \frac{55{,}000}{65{,}536} = 84\%$$

IPv6 Utilisation Requirement

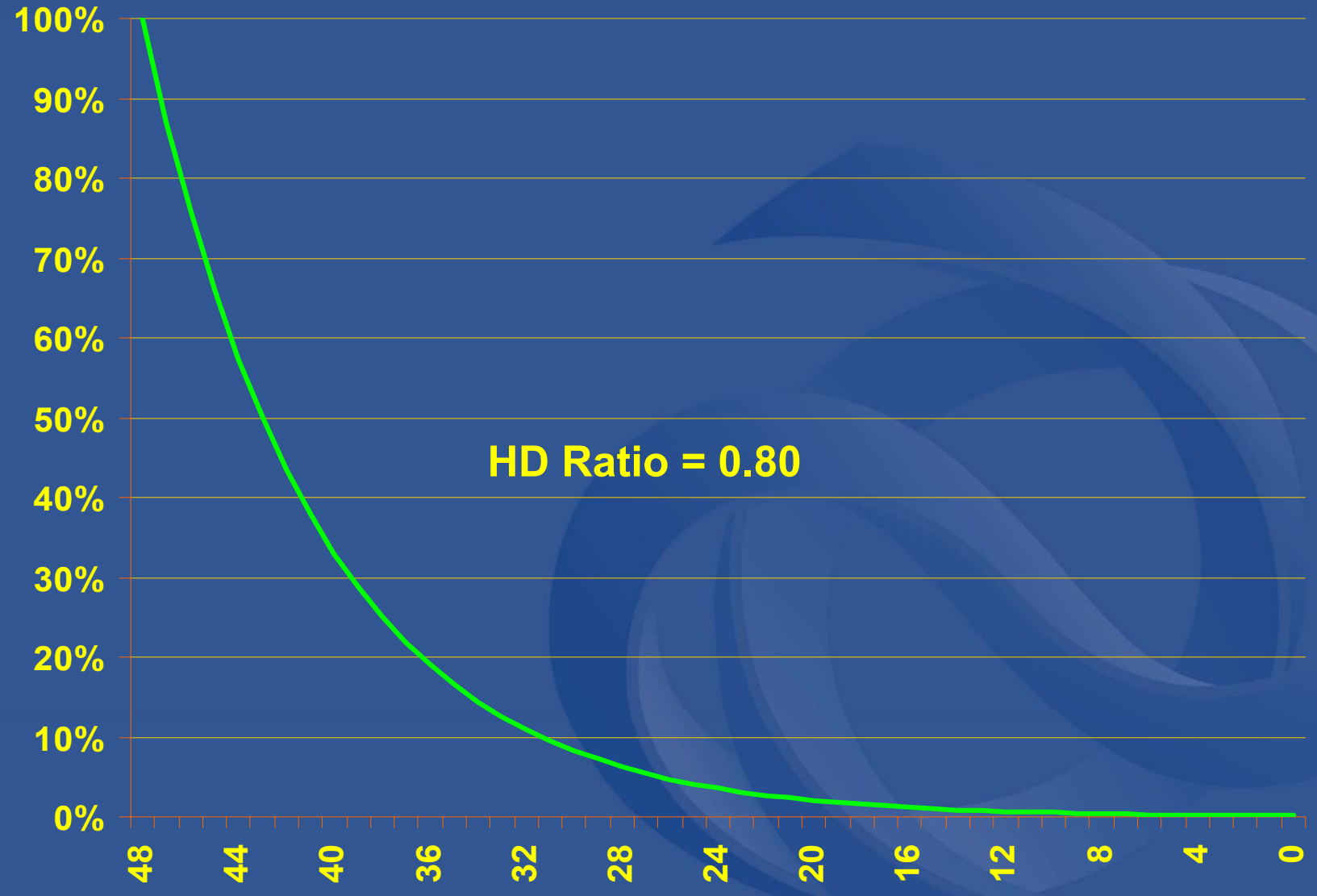
- Under new IPv6 policy utilisation is determined by HD-Ratio (RFC 3194):

$$Utilisation_{HD} = \frac{\log(assigned)}{\log(available)}$$

- IPv6 utilisation requirement is HD=0.80
  - Measured according to end-site assignments only (intermediate allocations are ignored)
  - E.g. ISP has assigned 10,000 addresses from /32

$$\frac{\log(assigned)}{\log(available)} = \frac{\log(10,000)}{\log(65,536)} = 0.83$$

IPv6 Utilisation Requirement



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IPv6 Utilisation Requirement

- HD Ratio utilisation requirement of 0.80

v6 prefix	Total site addresses	Utilisation requirement	Util%
42	64	28	43.5%
36	4096	776	18.9%
35	8192	1351	16.5%
32	65536	7132	10.9%
29	524288	37641	7.2%
24	16777216	602249	3.6%
16	4294967296	50859008	1.2%
8	1099511627776	4294967296	0.4%
3	35184372088832	68719476736	0.2%

Subsequent Allocation

- Subsequent allocation can be made when HD = 0.80 is reached
- Other address management policies should also be met
  - Correct registrations
  - Correct assignment practices etc
- Subsequent allocation size is at least double
  - Resulting IPv6 Prefix is at least 1 bit shorter
  - Should be sufficient for 2 years requirement

Other conditions

- License model of allocation
  - Allocations are not considered permanent, but always subject to review and reclamation
  - Licenses renewed automatically while addresses in use, consistent with policies
- Existing /35 Allocations
  - A number of /35s have been assigned under provisional IPv6 policy
  - Holders of /35s are eligible to request /32

IPv6 Policy - Summary

- New policy now active in APNIC region
  - Also RIPE-NCC, ARIN implementing soon
- New policy is subject to review
  - Policy will evolve as experience gained
  - Does not preclude other policies being developed
  - Need immediate follow-on work in some areas
- Public mailing lists and documentation
  - http://www.apnic.net/ipv6


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Thank You
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