APNIC Update, Structure and Policies

Yokohama, December 2001

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- Overview of APNIC
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- APNIC Status Update
  - Membership
  - Resource and Other Activities
- APNIC Policies
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  - IPv6 Policy Status

Overview of APNIC

What is APNIC?

What is APNIC?

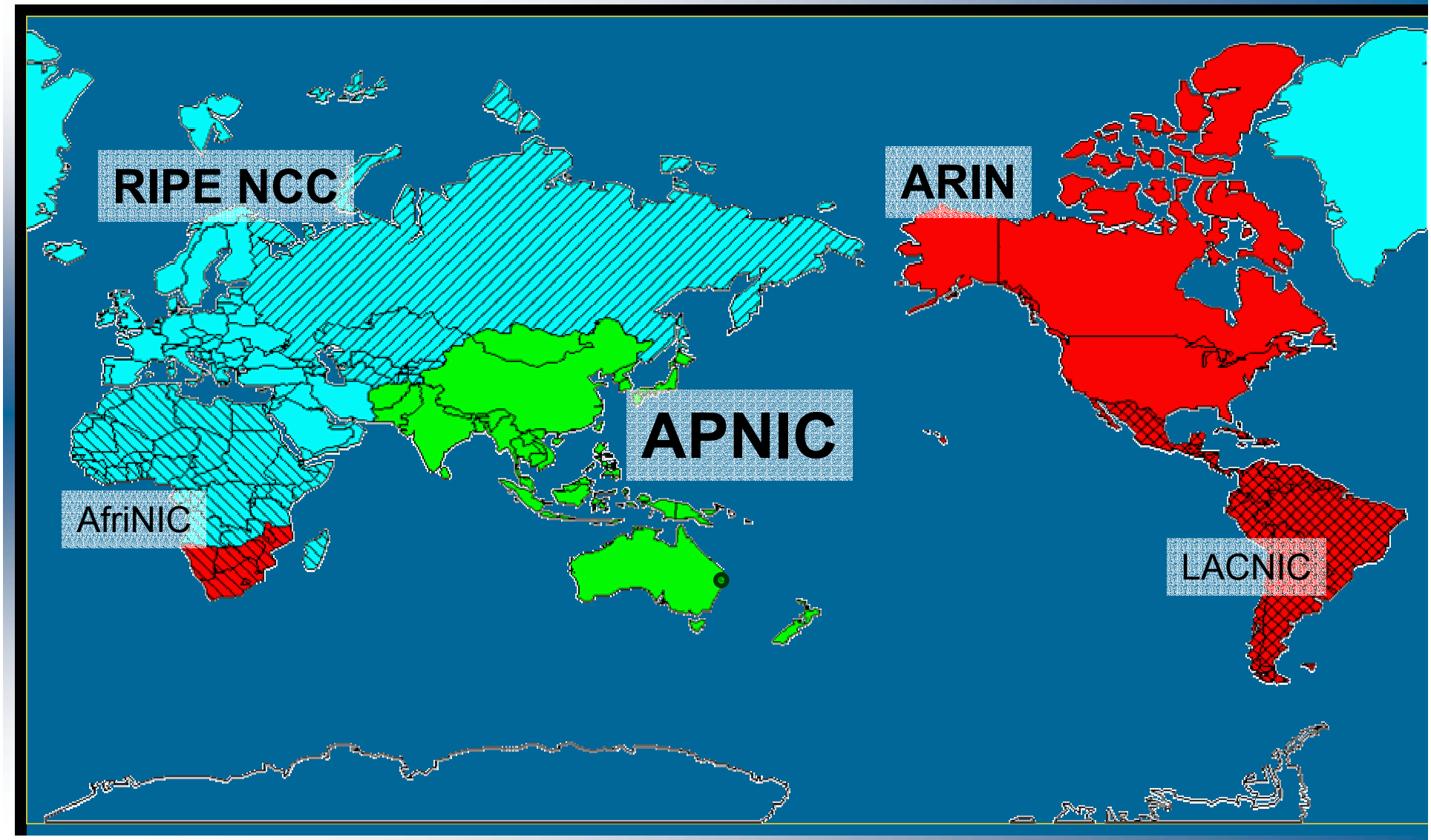
- Regional Internet Registry (RIR) for the Asia Pacific Region
  - Regional authority for Internet Resource distribution
  - IP addresses (IPv4 and IPv6), AS numbers, in-addr.arpa delegation
- Industry self-regulatory body
  - In the “Internet Tradition…
  - Non-profit, neutral and independent
  - Consensus-based, open and transparent
  - Open membership-based structure

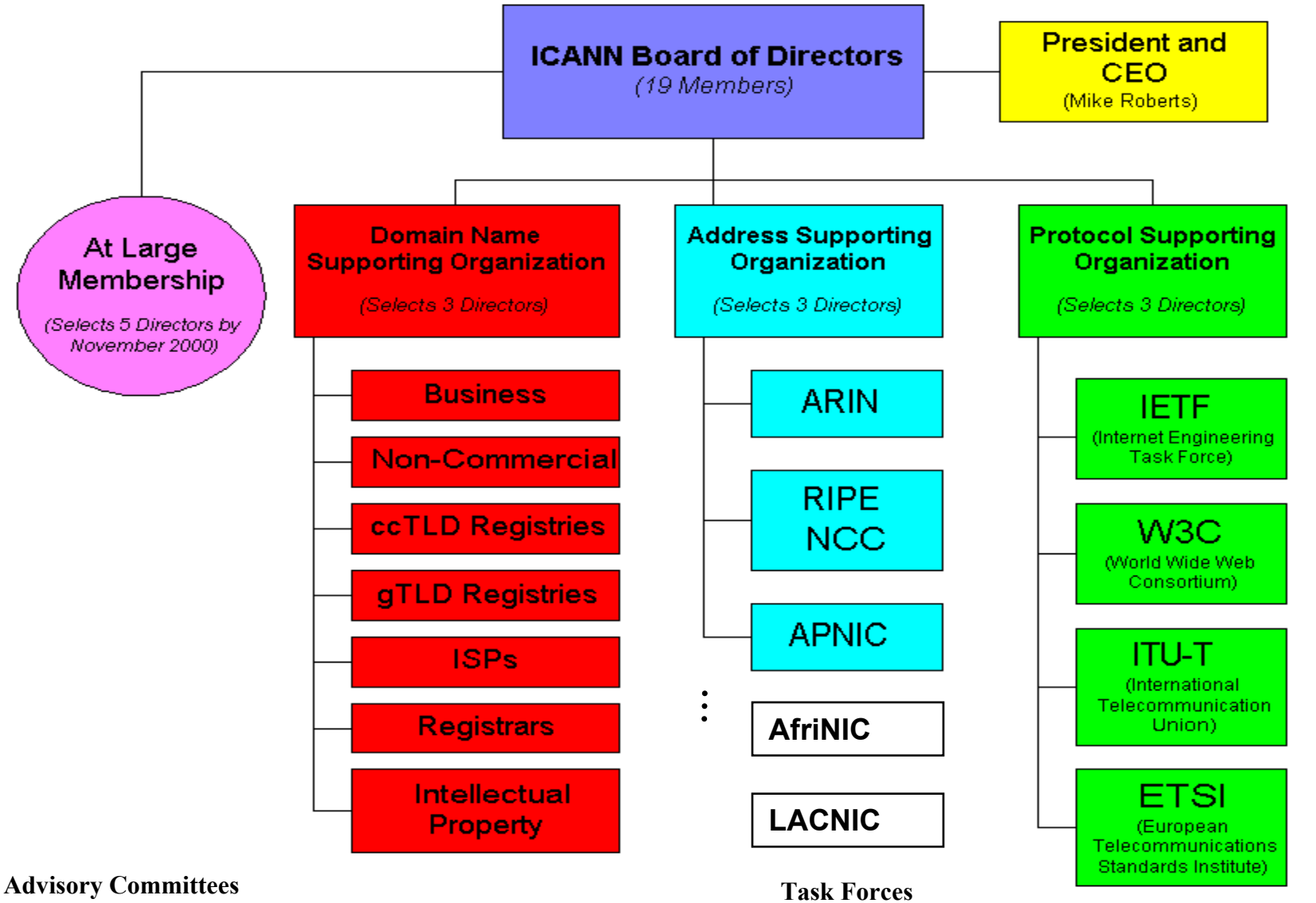
What does APNIC do?

Critical Internet administrative services

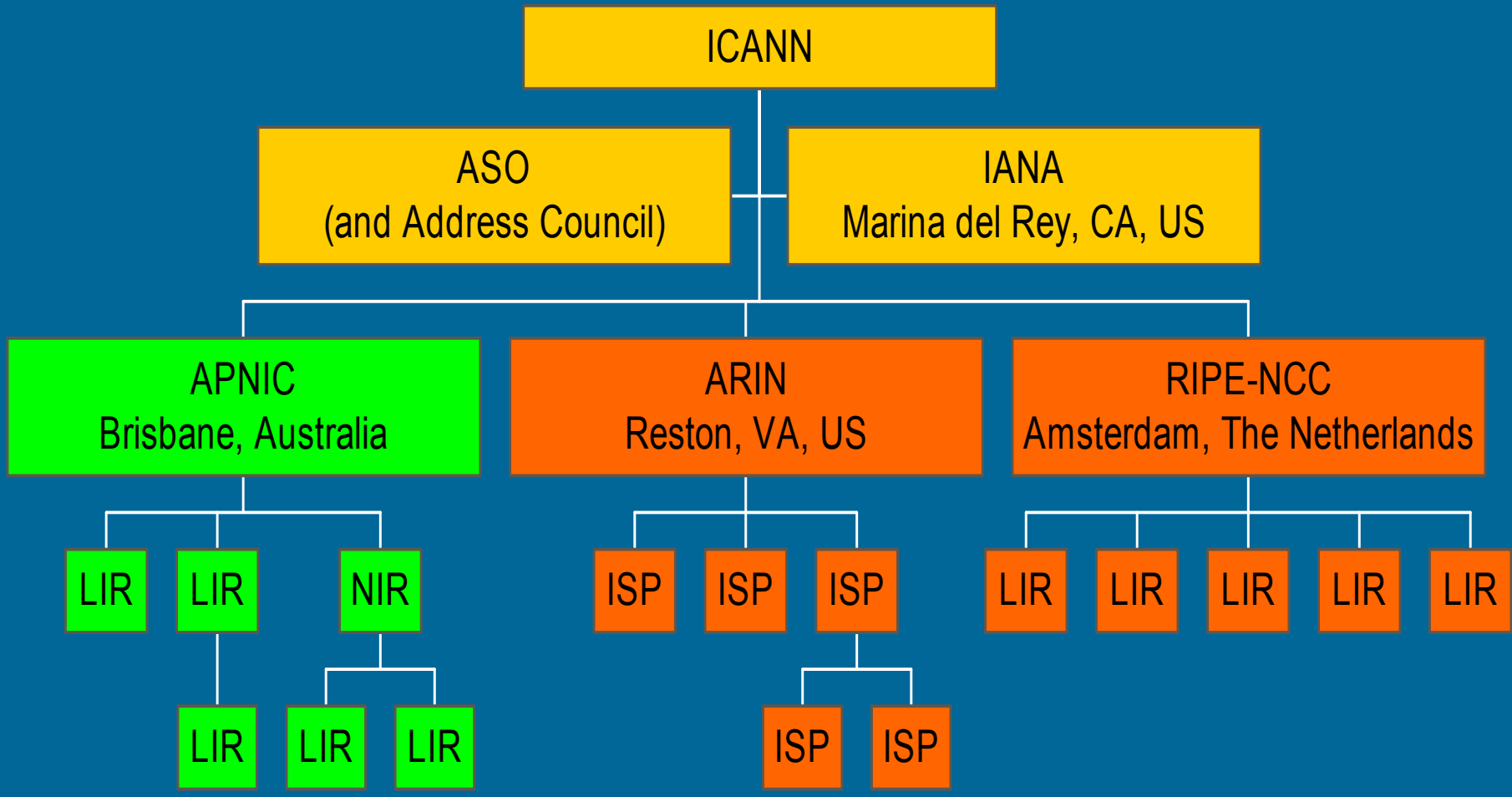
1. Internet resource management
   - IP address allocation and assignment
   - AS number assignments
2. Resource registration
   - Authoritative registration server: *whois*
3. DNS management
   - Delegate reverse DNS zones/domains
   - Authoritative DNS server: *in-addr.arpa*

Where is APNIC?




ICANN Board of Directors
(19 Members)
President and CEO
(Mike Roberts)
At Large Membership
(Selects 5 Directors by November 2000)
Domain Name Supporting Organization
(Selects 3 Directors)
Address Supporting Organization
(Selects 3 Directors)
Protocol Supporting Organization
(Selects 3 Directors)
Business
Non-Commercial
ccTLD Registries
gTLD Registries
ISPs
Registrars
Intellectual Property
ARIN
RIPE NCC
APNIC
AfriNIC
LACNIC
IETF
(Internet Engineering Task Force)
W3C
(World Wide Web Consortium)
ITU-T
(International Telecommunication Union)
ETSI
(European Telecommunications Standards Institute)
Advisory Committees
Root Server System Advisory Committee
Government Advisory Committee
Independent Review Advisory Committee
Task Forces
Membership Implementation Task Force
...

Where is APNIC?



What else does APNIC do?

- Training and Seminars
  - 2 training courses per month in 2002
  - Seminars with AP Outreach
- Publication
  - Newsletter, web and ftp site, mailing lists etc
  - Joint RIR statistics
- Policy development and coordination
  - Open Policy Meetings: SIGs, WGs, BOFs
  - ASO and ICANN processes

APNIC Policy Role

- Industry self-regulatory body
  - Open and Transparent participatory structure: meetings, forums, policy processes
    - Now operating within ICANN structure
  - Membership is open, provides revenue and legal structures
    - Elected EC provides governance
- Secretariat responsibility
  - implement policy, organises meetings, provides online services, coordinates, reports, etc

APNIC Status Update

Membership

How does APNIC work?

- Open membership based structure
  - Internet Service Providers (ISPs)
  - National Internet Registries (NIRs)
  - Anyone with an interest can join
- Benefits of membership
  - Resource allocation and registration services
  - Free attendance and voting at APNIC meetings
  - Subsidised access to training courses
  - ***NOT: Automatic Resource Allocation!***

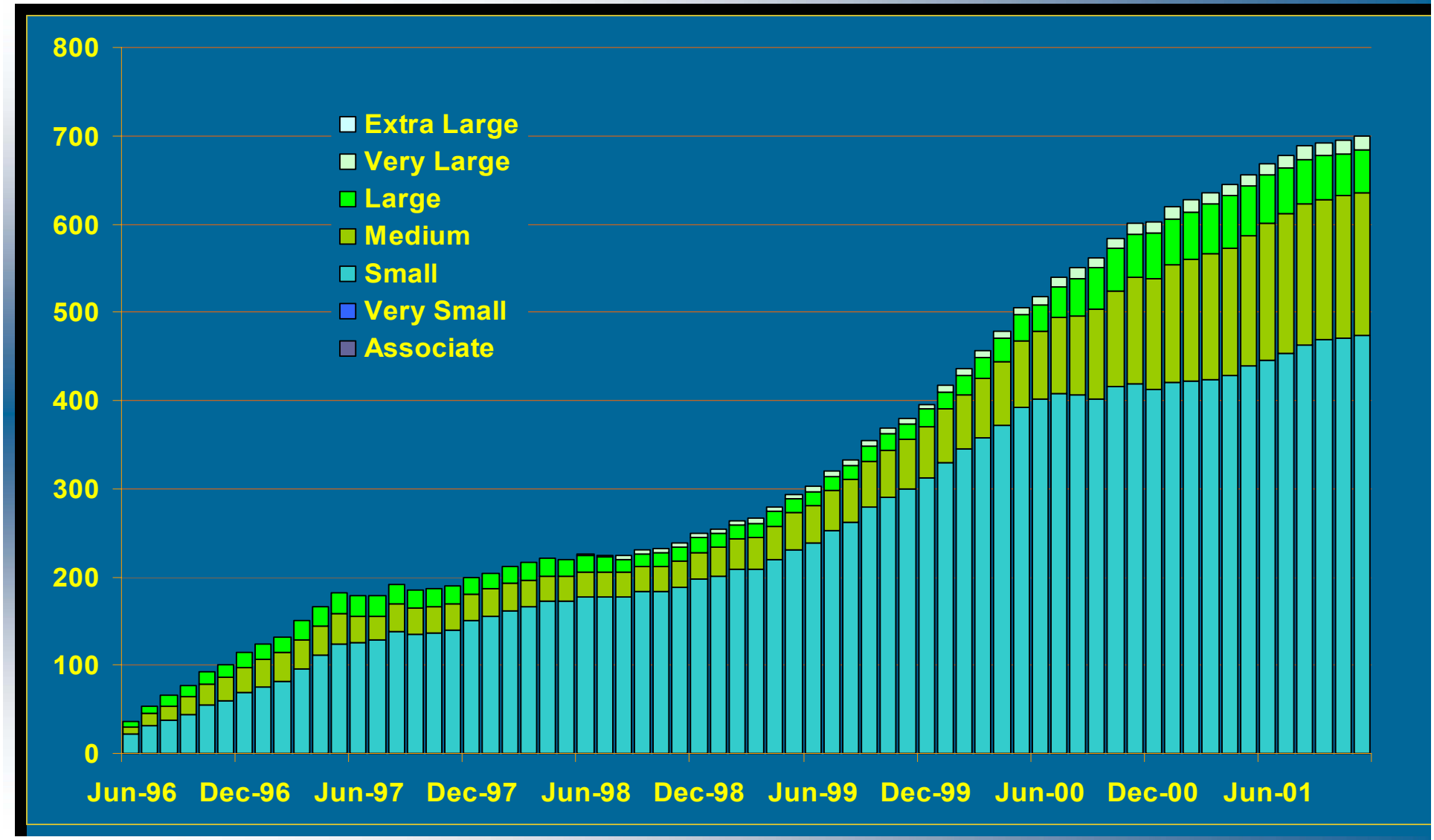
Membership Structure (from 1 Dec 2001)

IPv4	IPv6	Category	Annual Fee	Votes
> /10		X-large	$40,000	64
<= /10	> /29	V-large	$20,000	32
<= /13	<= /29	Large	$10,000	16
<= /16	<= /32	Medium	$5,000	8
<= /19	<= /35	Small	$2,500	4
<= /22		V-small	$1,250	2
n/a		Assoc	$625	1

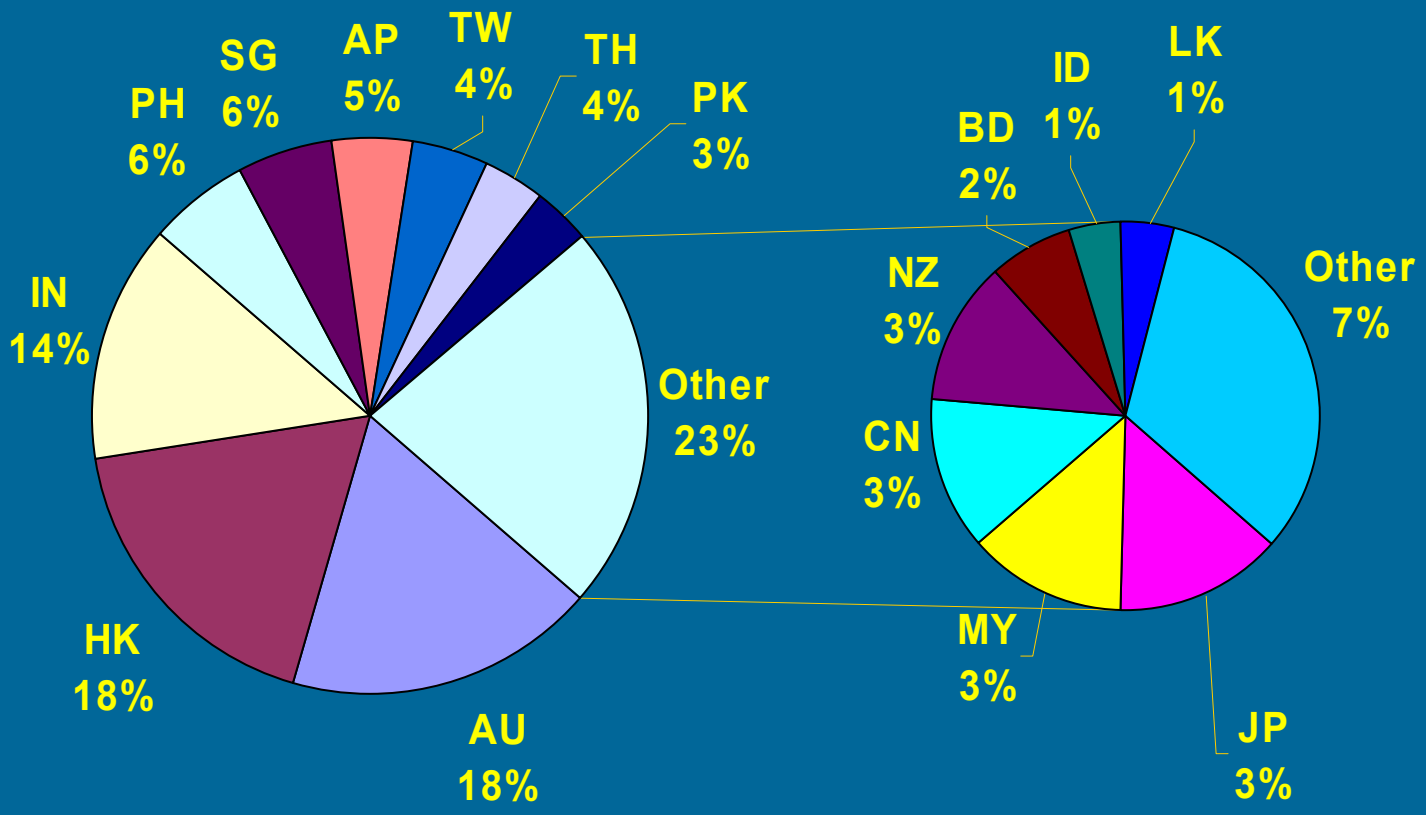
Membership Category

- Category determined from IP Address holdings of the member (IPv4 or IPv6)
  - Reassessed on annual basis
- Members holding IPv4 and IPv6 are assessed as the *larger* category
- New categories added from 1 Dec 2001
  - Associate, Very Small and Extra Large
  - IPv6 prefixes not yet assigned for these categories

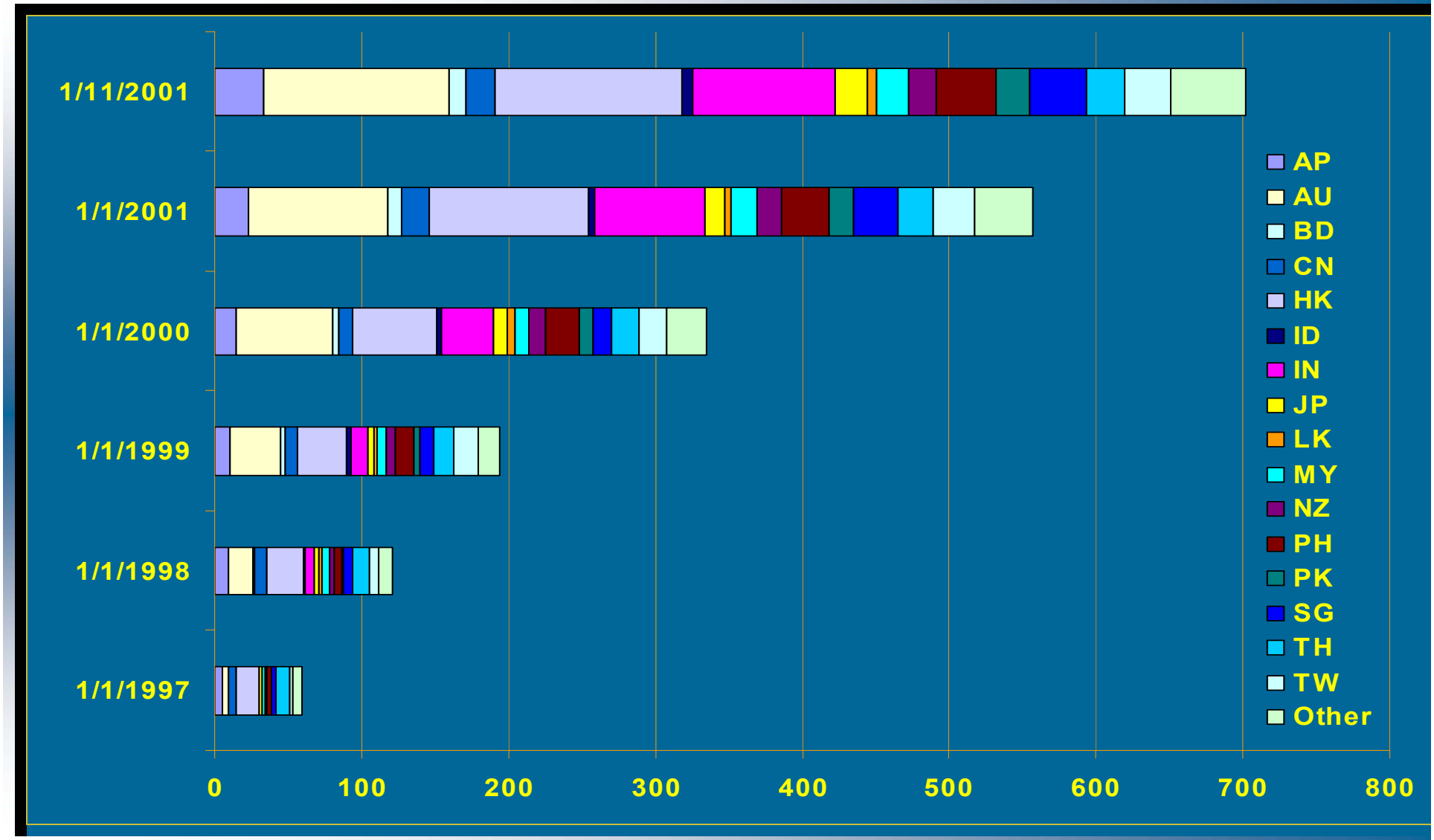
How many APNIC Members?



APNIC Member Distribution



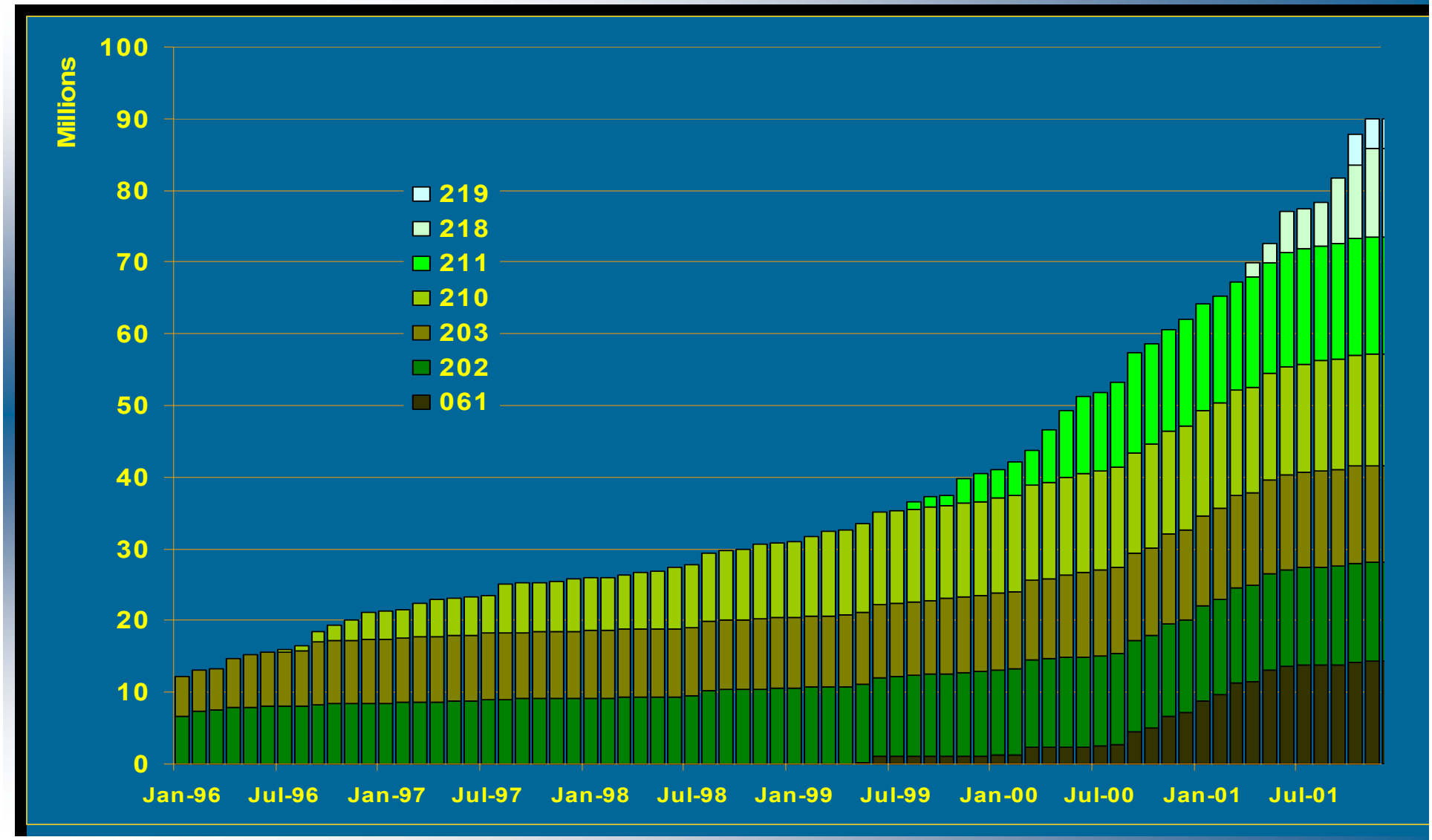
Where are APNIC Members?



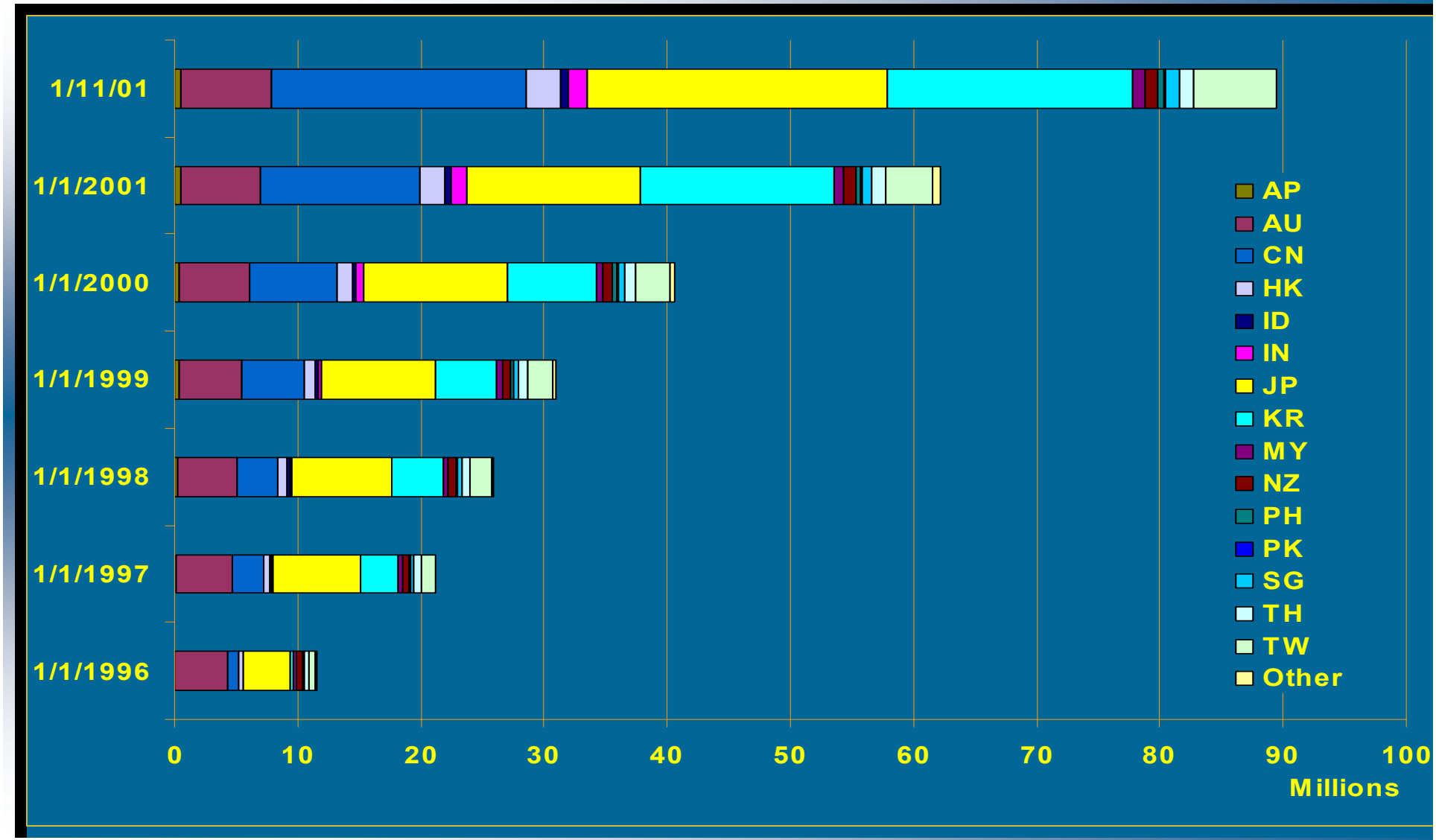
APNIC Status Update

Internet Resources

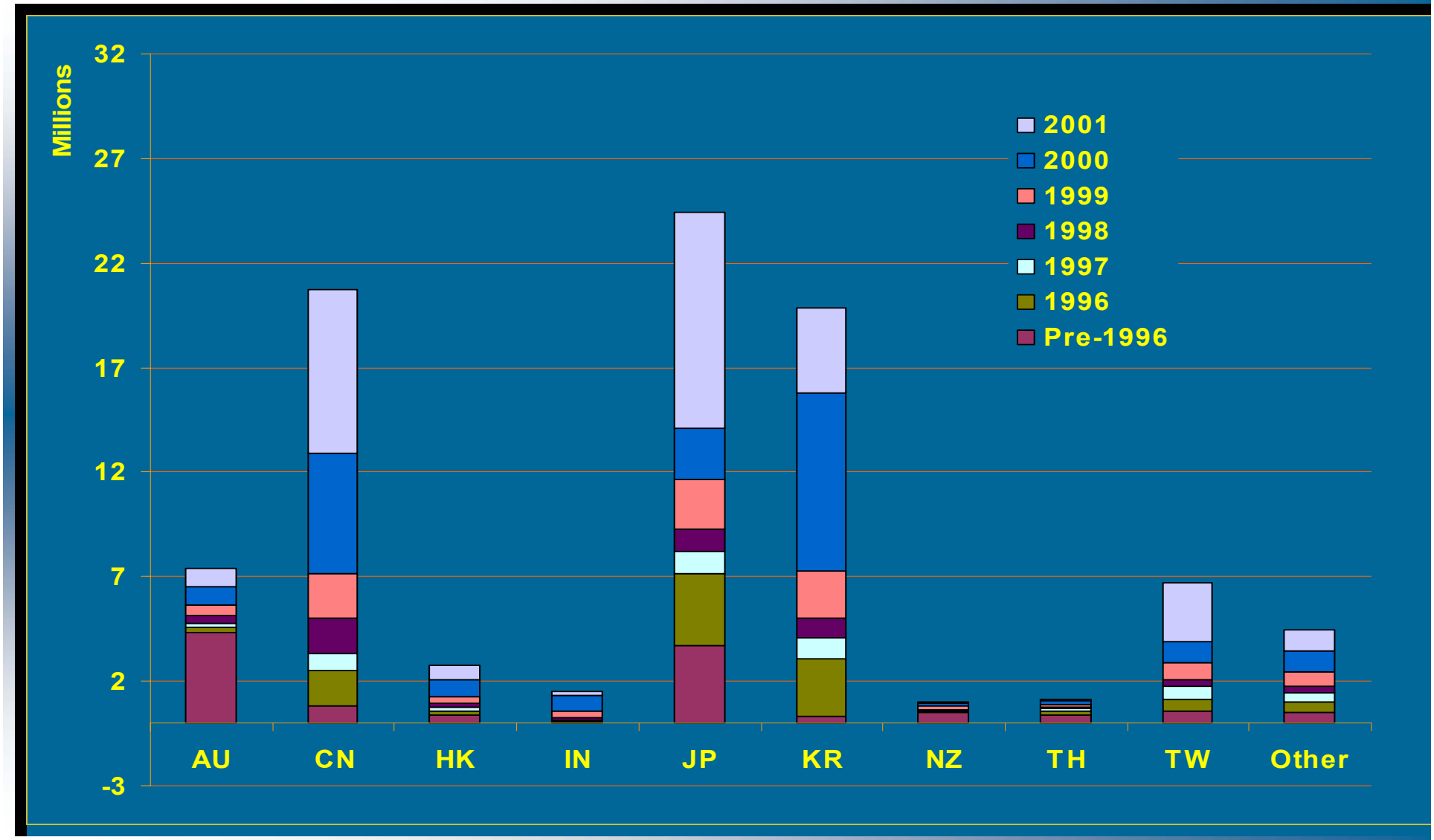
IPv4 Addresses Allocated in Total



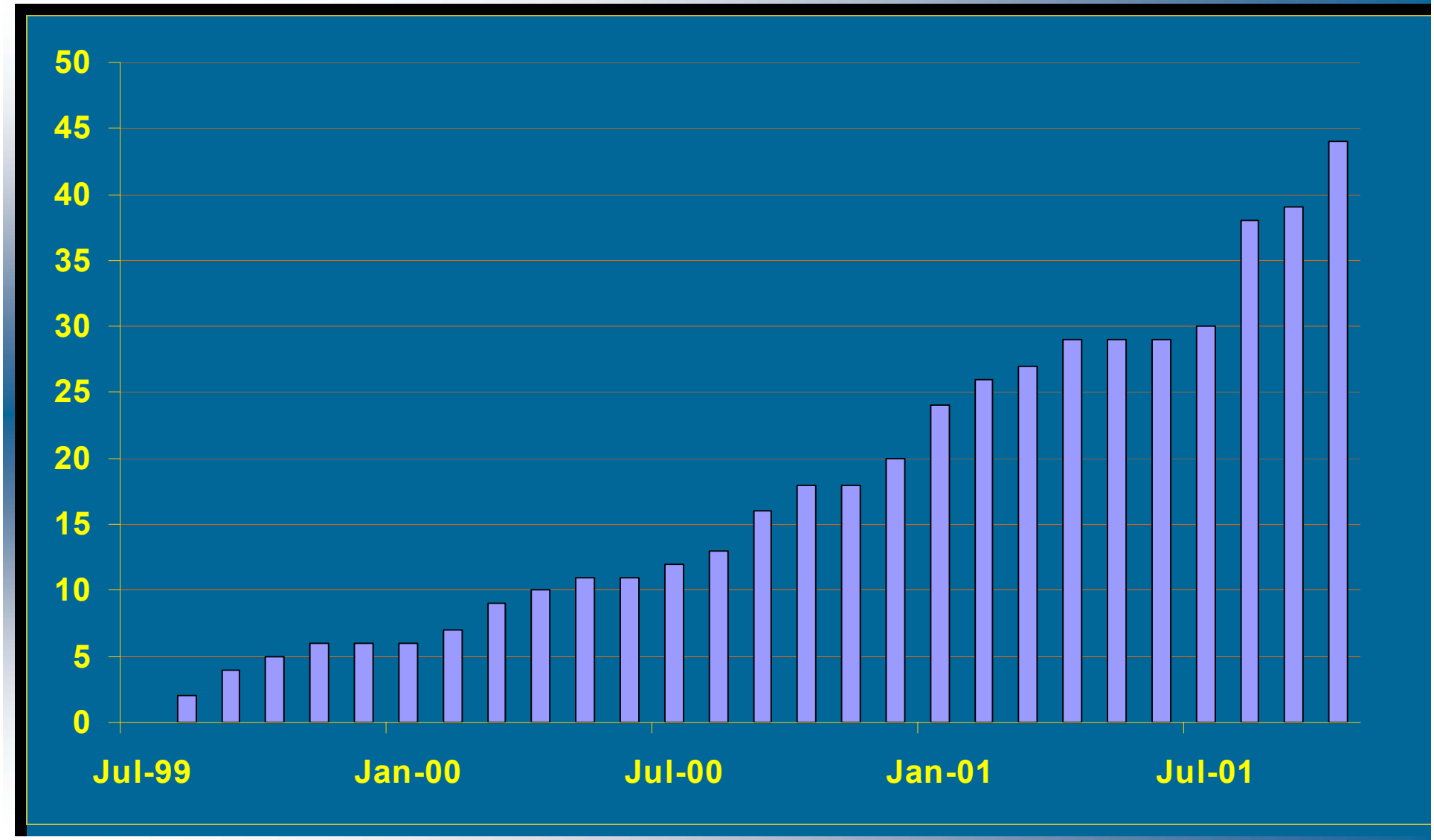
IPv4 Address Distribution – Total per Year



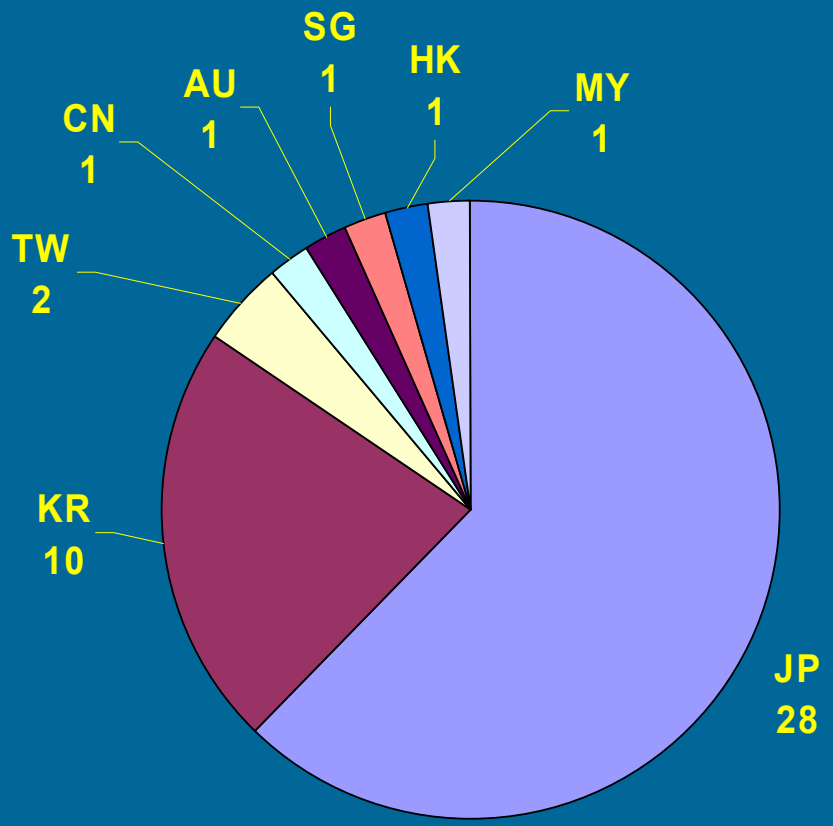
IPv4 Address Distribution – Top 10 by CC



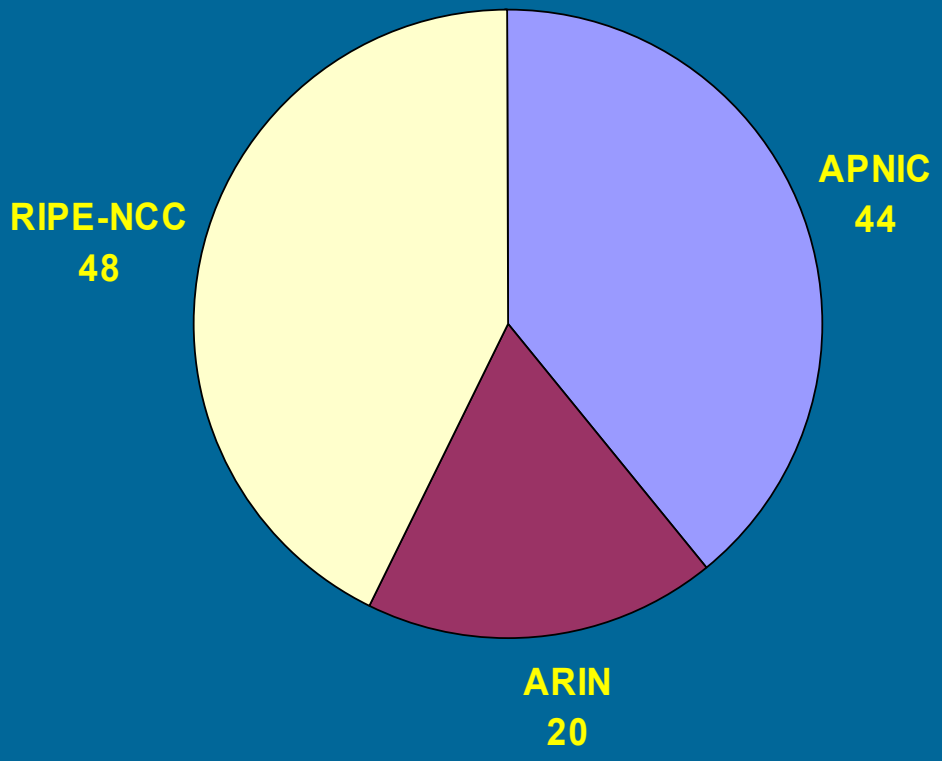
IPv6 Prefixes Allocated - APNIC



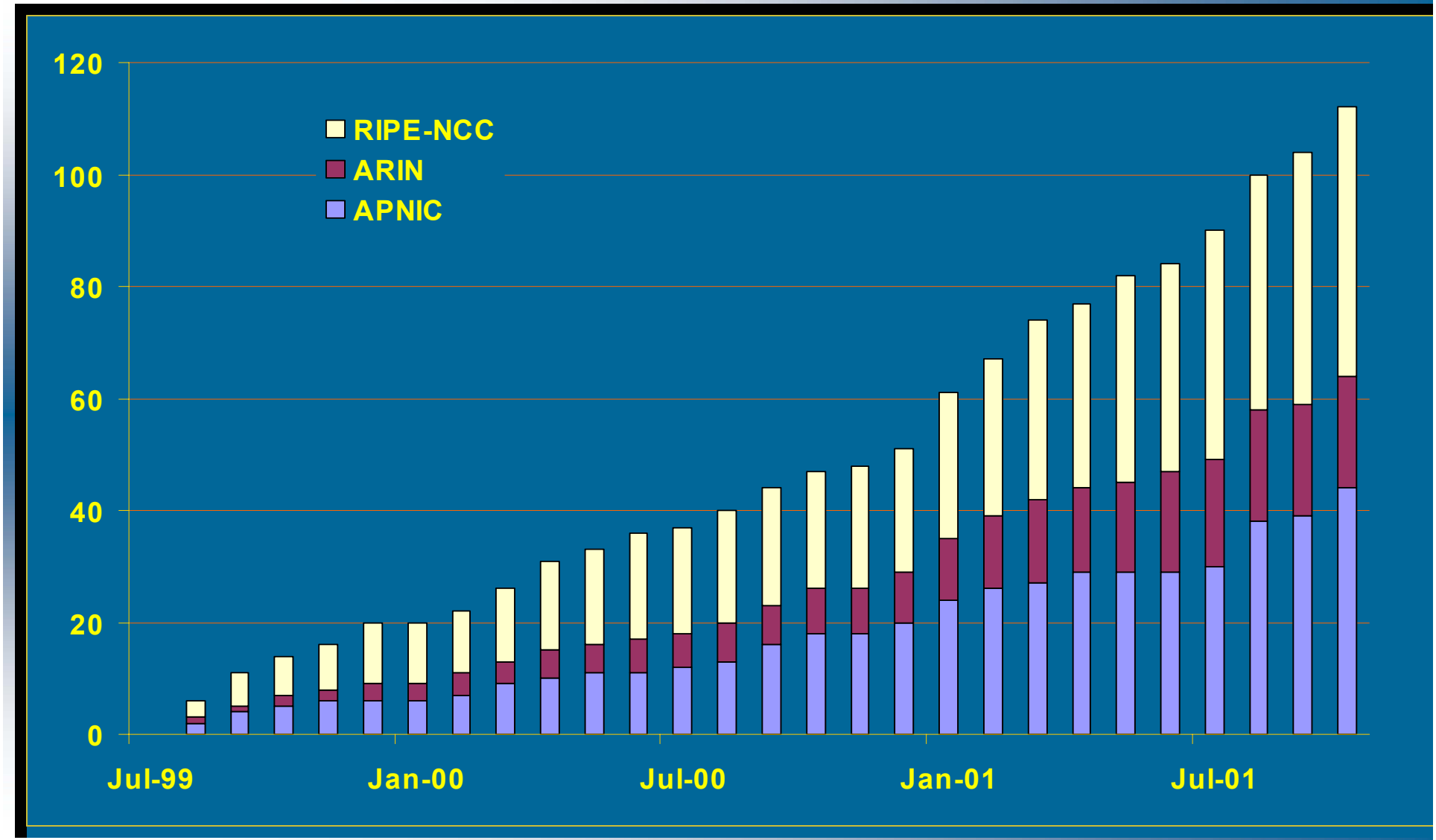
IPv6 Distribution – APNIC region



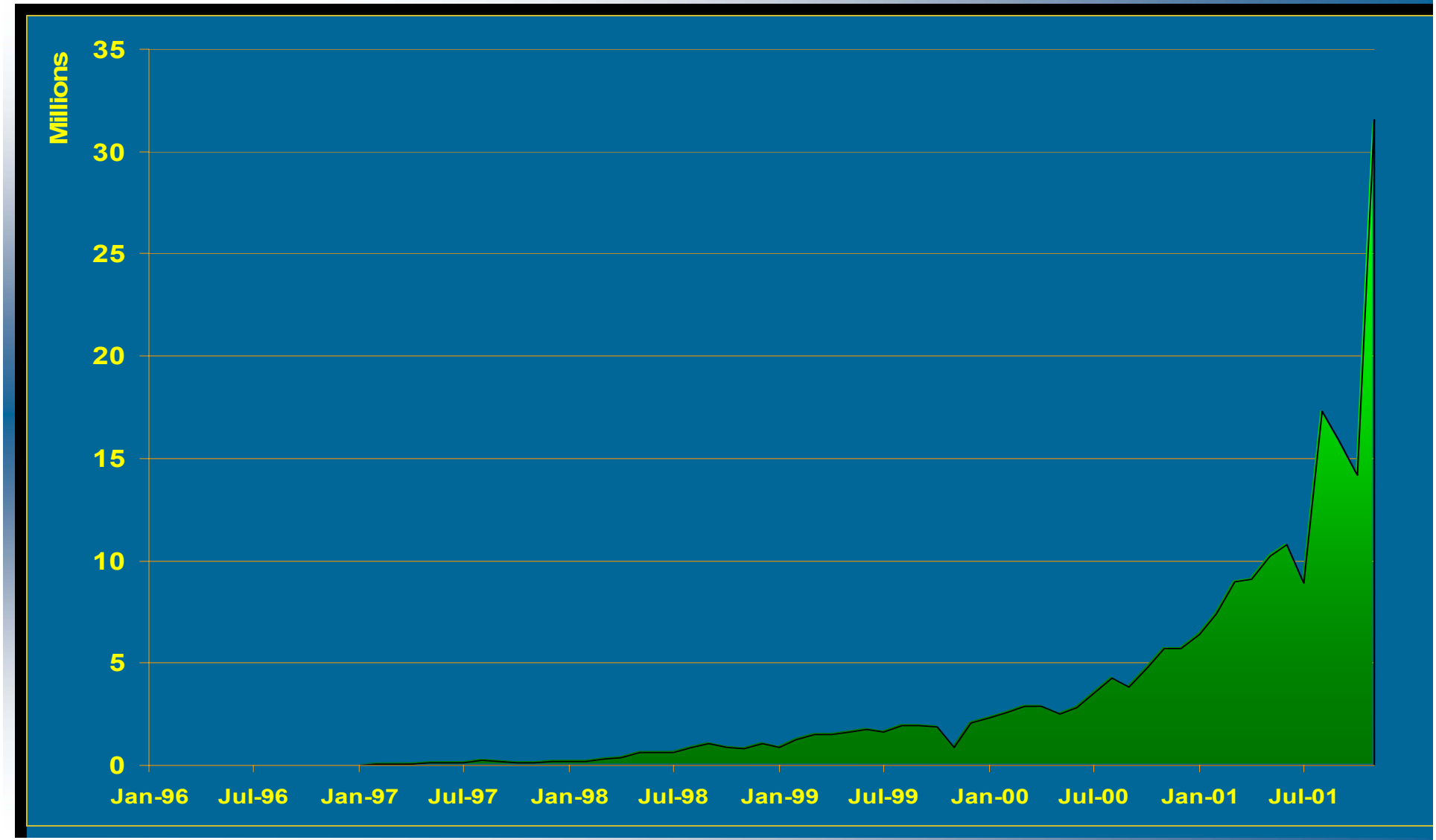
IPv6 Distribution – Global



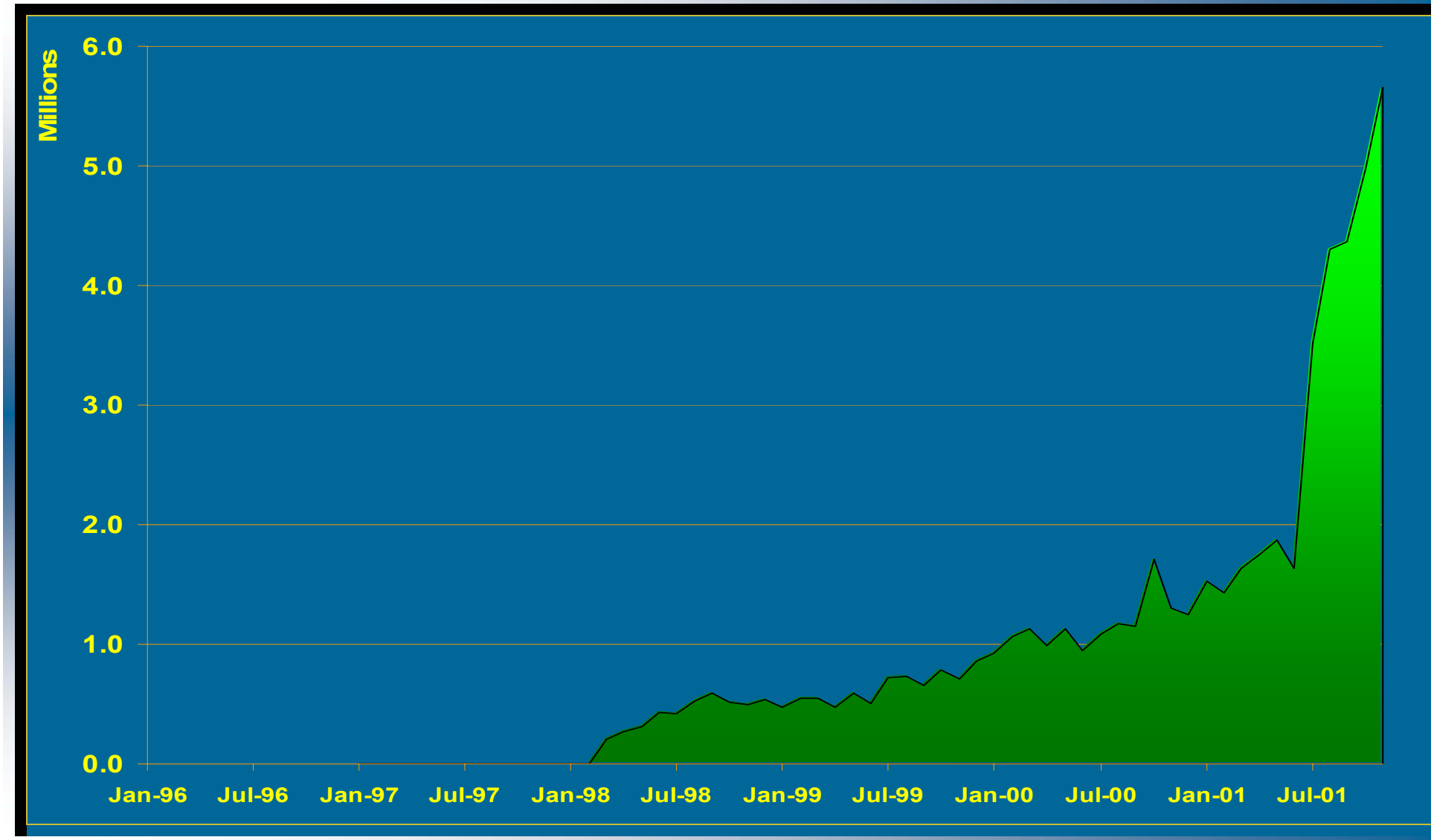
IPv6 Prefixes Allocated - Global



Whois Queries per Month



HTTP Queries per Month



APNIC Status Update

Other Activities

Training Services

- Training courses held
  - 1 per month in 2001
  - 2 per month in 2002
  - “Expressions of Interest” may be submitted
- APNIC Seminars
  - Open events held in most training locations
  - ICANN/Governance seminars with APTLD (*)
- All activities subsidised by APNIC
- New content under development

Service Developments

- RPSL
  - Work with RIPE NCC on v3 software
  - Testing and transition planning underway
  - See rpsl.apnic.net
- Internet Routing Registry (IRR)
  - Developments required
    - IRR operating model
    - Training and Support materials
  - See irr.apnic.net

Service Developments

- Internet Routing Registry (IRR)

```
$ whois -h irr.apnic.net -q sources
% This is the APIRR experimental Whois server (RPSL output).
% See http://www.apnic.net/db/irr-server.html for specifics.
%
% Rights restricted by copyright.
% See http://www.apnic.net/db/copyright.html

APIRR:1:N:567320-579160
TELSTRA:1:N:73293-79186
CCAIR:1:N:2-15887
RADB:1:N:64358-83217
RIPE:1:N:1352437-1423210
IIJ:1:N:65-73
LEVEL3:1:N:0-60372
LOOK:1:N:0-66
```

Service Developments

- Distributed service architecture
  - POPs in major exchange points
  - Technical and administrative model under development
    - Distributed Director, Local Director (Cisco)
    - IPv4 “anycast” model
  - Propose 2 grades of installation
    - Core APNIC service (owned by APNIC)
      - Eg Brisbane, Tokyo and others
    - Sponsored/Hosted (owned by other parties)

Service Developments

- Certification Authority
  - Response to member concerns on security
  - Email, website auth* and privacy
  - Industry-standard X.509 certificates
- “MyAPNIC” website
  - Access to members’ private information
  - Use of certificates for secured access
  - Demonstrated during APNIC Meeting, TW
- Routing Certification
  - Digital certificates carry authority information for use of address blocks and ASNs
  - R&D required

Service Developments

- Internal Services
  - Software rearchitecture and improvement
  - Sustained (and sustainable) staff growth
  - ISO 900x certification under consideration
- Publications
  - Website redesign recently completed
  - Joint RIR statistics publication
  - Newsletter “APster” launched in Taipei

Welcome to APNIC - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Info & FAQ
Resource services
Training
Meetings
Membership
Documents
Whois & Search
Internet community

Addressing the challenge of responsible Internet resource distribution in the Asia Pacific region.

Asia Pacific Network Information Centre

QUICK *Links*

Quick Links

APNIC *Search*

Whois Search

Go!

[Advanced search options]

Web & FTP

Go!

[Advanced search options]
[Sitemap]

TRAINING *News*

Next training course:
November 28 (cancelled) : Auckland, NZ
December 6 : Yokohama, Japan

Forthcoming courses and seminars:
Training schedule 2001-2002 now available.

NETWORK *Abuse*

Help and information for cases of spamming and hacking.

WHAT's *New*

Call for proposals to host APNIC 14 [16 November, 2001]
Would your organisation like to host the 14th APNIC Open Policy Meeting, to be held in 2002? See the Call for Proposals [doc] [pdf] for more details. Deadline for expressions of interest: 14 December 2001.

APNIC Open Policy Meeting - Post-meeting Update. [13 November, 2001]
APNIC is currently implementing the decisions made at APNIC's 12th Open Policy Meeting, held in Taipei from 28 to 31 August 2001. These include the approval of the revised membership structure and a number of policy decisions. Implementation of these decisions involves the creation or amendment of a number of documents that will be published for member use on the APNIC website by 1 December 2001.[more..]

APRICOT call for papers [17 October, 2001]
The organisers of APRICOT 2002 have called for submissions of proposals for tutorials and conference sessions. APRICOT 2002 will be held in Bangkok 3-7 March 2002.

New lists for global policy [17 October, 2001]
New mailing lists have now been established for the revision of RFC2050 and the development of a new global IPv6 address policy. [ppt | pdf]

Other news :

- Global Internet Resource statistics now available
- Results of last APNIC Open Policy Meeting
- AUNIC to APNIC migration

APNIC *Calendar*

Nov 01 Nov 01

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

CONTACT *Us*

APNIC office hours are:
Mon-Fri 9AM - 5PM
Our local time is:
01:23 PM (UTC +10)

OUR *Sponsors*

APNIC is pleased to thank our sponsors: The Wide Project, Cisco Systems, Compaq, SCO, Telstra, and Connect.

APNIC meetings…

- 12th APNIC Open Policy Meeting
  - August 2001, Taipei, Taiwan
  - http://www.apnic.net/meetings
- 13th APNIC Open Policy Meeting
  - 3-7 Mar 2002, Bangkok
  - Track of content within APRICOT 2002
  - http://www.apricot2002.net
- 14th APNIC Open Policy Meeting
  - CFP issued last month
  - Expressions of Interest welcome!

Developments from APNIC-12

- Major decisions
  - New membership agreement
  - Document review policy
  - Revised membership structure
    - Includes new categories
  - Address Council election
    - Dr Kenny Huang (TW) elected
  - Address Policy Decisions
    - To be described later in this presentation
- Full details of all developments at:
    - http://www.apnic.net/meetings/12/results/

APNIC Policies

Overview of Address Management Policy

Classful Address Architecture

- Each IP address has two parts:

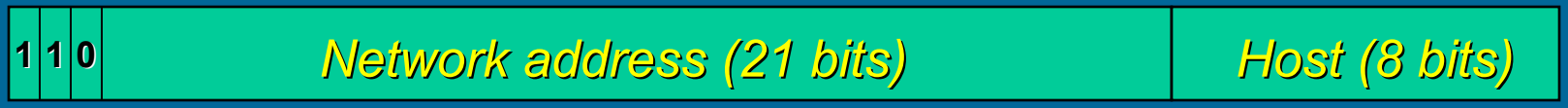
- Initially, only 256 networks in the Internet!
- Then, network "classes" introduced:
  - Class A – very large networks (128 in total)
  - Class B – middle-sized networks (16,384)
  - Class C – very small networks (2 million)

Classful Address Architecture

Class A: 128 networks x 16M hosts (50% of all address space)

Class B: 16K networks x 64K hosts (25%)

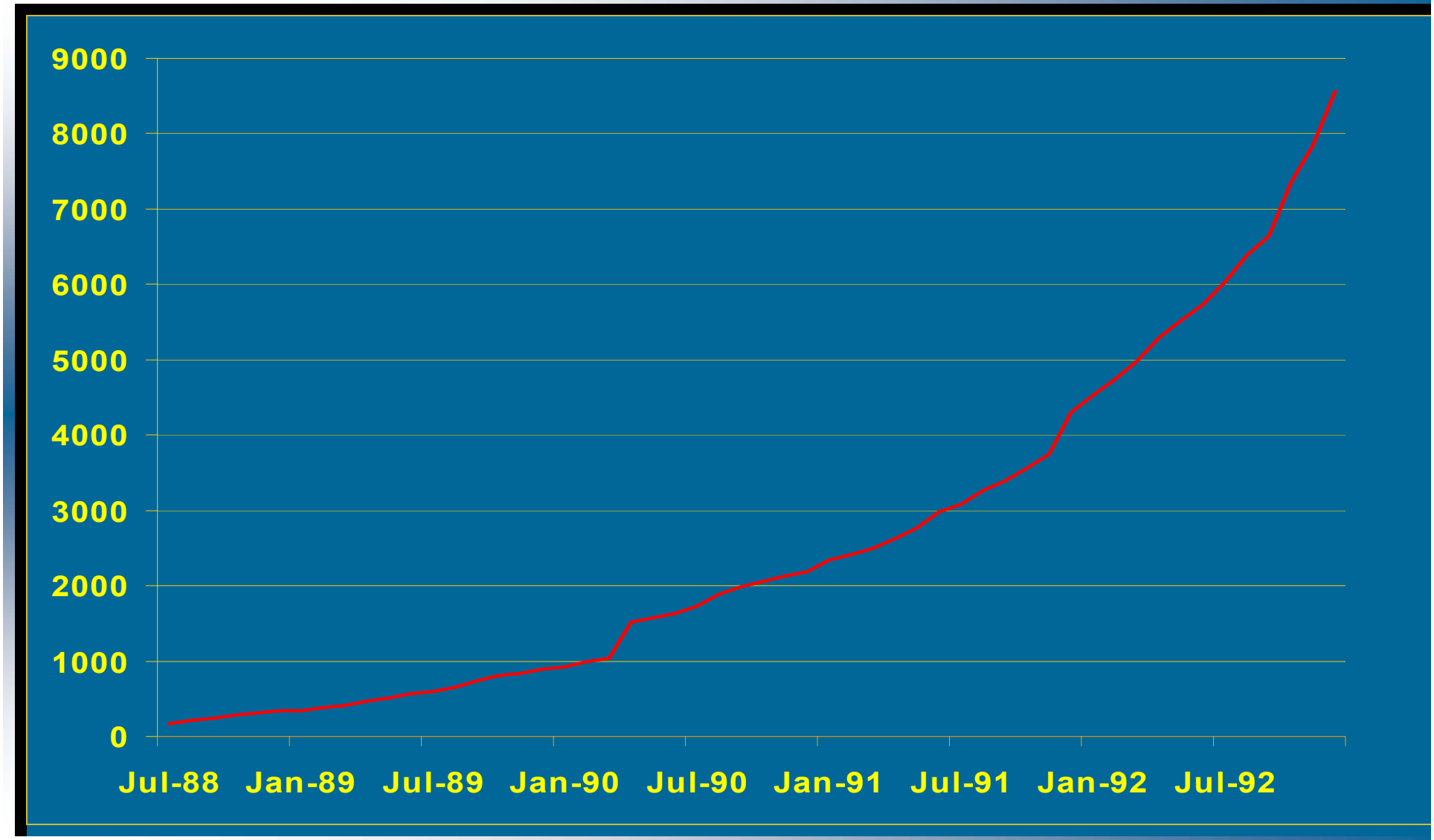
Class C: 2M networks x 256 hosts (12.5%)



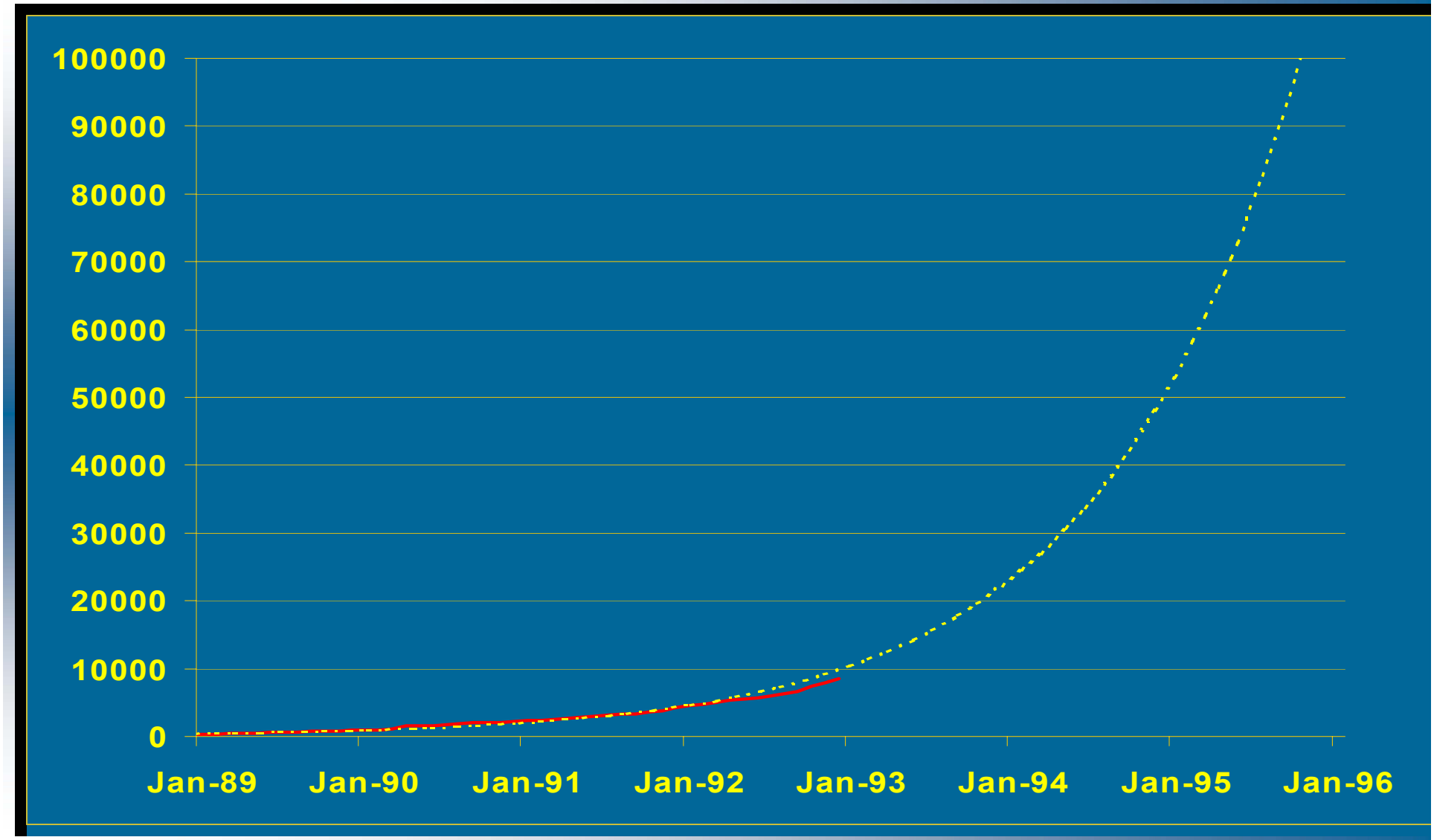
Classful Address Architecture

- By end of 1992, Internet scaling problems
  - Internet projected to stop growing by mid-'90s
- Address depletion
  - Classful assignment policy
  - Huge assignments made in many cases
  - Very low utilisation of address space
- Growing routing table
  - Routers overloaded by classful routes
  - Increasing instability of the Internet

Global Routing Table: ’88 - ’92



Global Routing Table: Projection



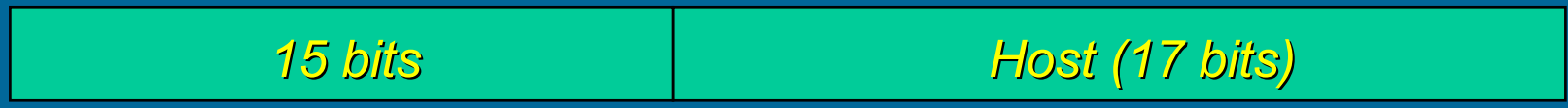
Classless Address Architecture

- CIDR - Classless Inter-Domain Routing
  - Introduced in 1993 (RFC1519)
  - Otherwise known as ‘supernetting’
- Address space utilisation increased through variable-length network address
  - /20 = 12-bit host (4096 hosts)
  - /26 = 6-bit host (64 hosts)
- Routing efficiency through aggregation
  - Eg. One /20 route replaces 16 class “C” entries

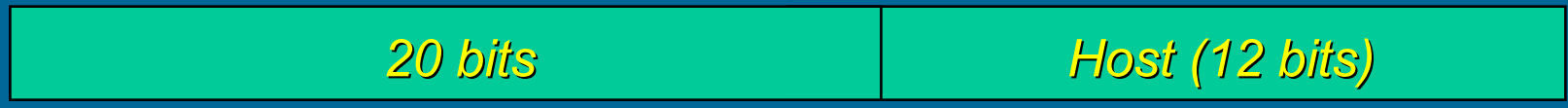
Classless Address Architecture

/10 4M hosts

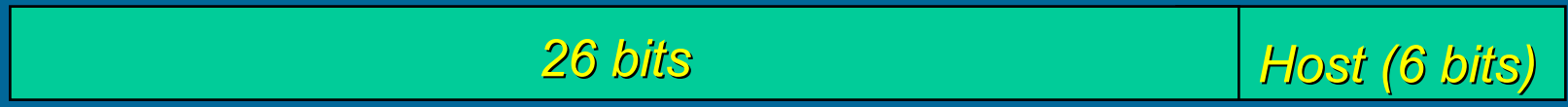
/15 128K hosts



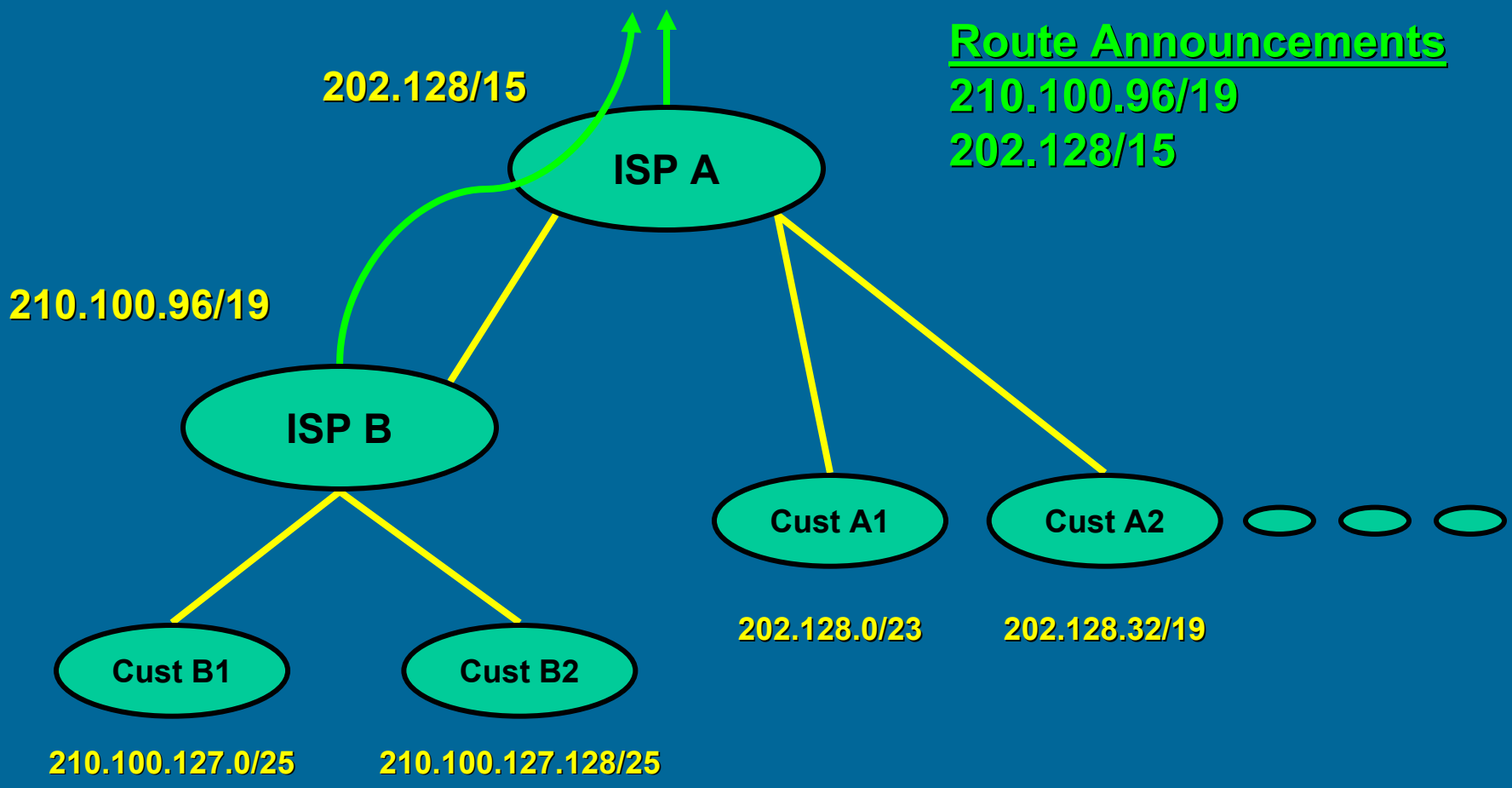
/20 4094 hosts



/26 64 hosts

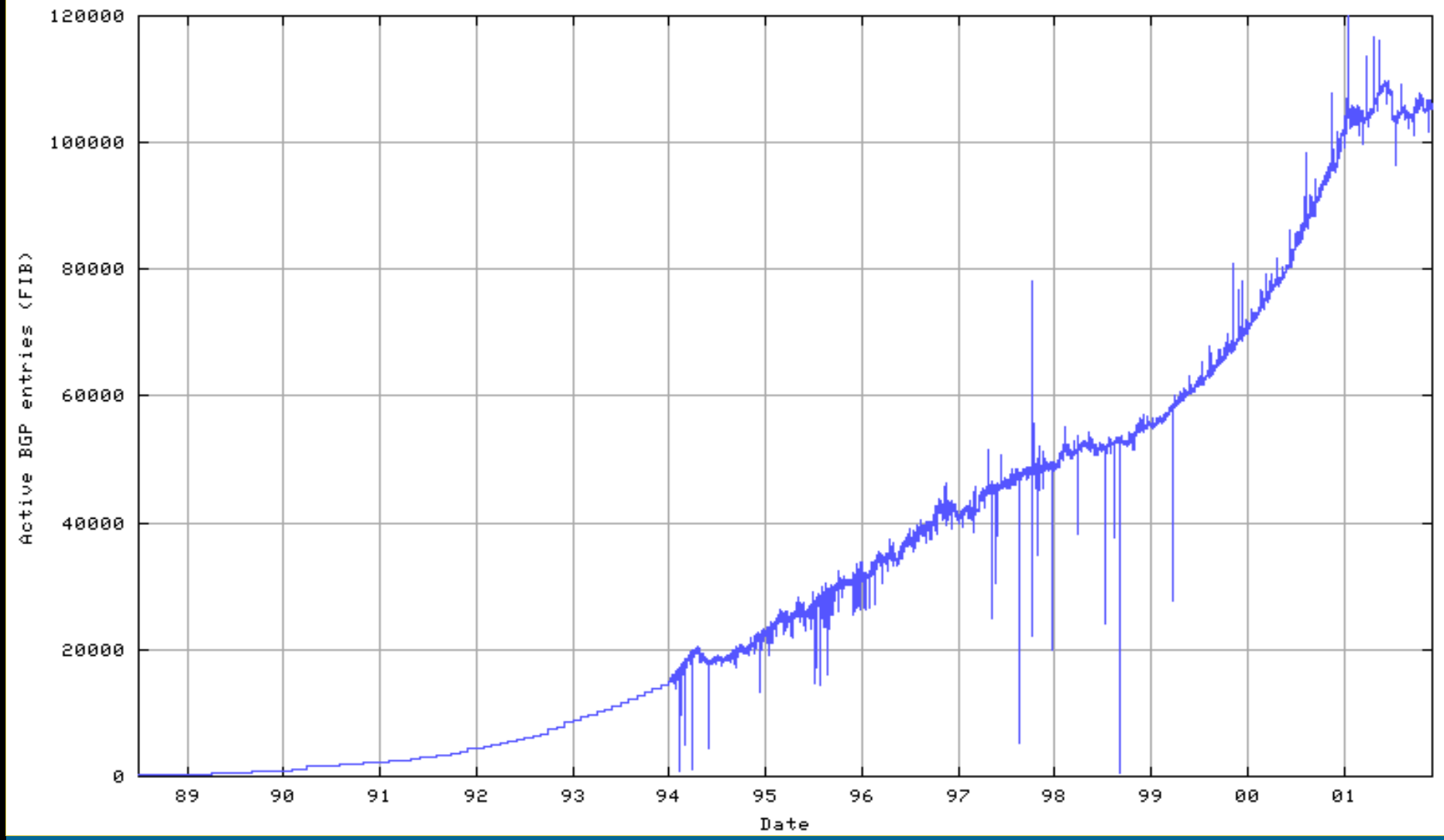


CIDR Aggregation



Routing Table Growth: ’88 - 2001

http://www.telstra.net/ops/bgptable.html



APNIC Policies

Address Policy Framework

Address Management Objectives

- Conservation
  - Ensuring efficient use of resources, and allocation policies based on demonstrated need
- Aggregation
  - Limiting growth of routable prefixes, through provider-based addressing policies
- Registration
  - Ensuring that resource use is registered and that resources are allocated or assigned uniquely
- Fairness and Consistency
  - In the interests of regional and global communities

Address Management Principles

- Hierarchical addressing
  - Portable allocations available to larger providers only
    - Small sites/providers receive PA addresses from upstream providers – non-portable
    - Allocations from registry should be aggregated by the provider/ISP
  - Proliferation of multihoming works against this goal
    - ~55% of routing table entries are /24

Address Management Principles

- Minimum allocation
  - Currently /20 (4096 IP addresses)
  - Agreed “threshold” for allocation from a registry
    - Organisation must generally justify at least this amount, in order to receive portable allocation
    - Organisations requiring less address space receive allocation from upstream
  - Again, multihoming causes many more routing table entries (more specifics)
    - Hence new policy for multihomed organisations

Address Management Principles

- "Slow start"
  - All organisations receive minimum allocation initially, regardless of initial requirement
    - Unless immediate requirement is thoroughly documented
  - Organisation then requests more address space when initial allocation is consumed
    - RIR can assess actual management practises, rather than forward plans

Address Management Principles

- Assignment of address space
  - 50-90% of ISP address space is assigned to customer sites
  - “Assignment Window” limits the size of “autonomous” assignments
    - “Second Opinion” must be requested when larger assignment is required
  - Assignment window measures “experience level” of each individual ISP/LIR

Address Management Principles

- "Leasehold" allocations
  - IP addresses are not considered property
    - Now allocated for a specific period under a lease or license arrangement
  - Renewal of lease/license should be automatic, provided that policies are followed
  - Transfer of lease/license requires approval from the registry
    - Address space should be held only where needed
    - Stockpiling should be avoided

Address Management Principles

- Address registration – *whois*
  - All address space must be registered
    - APNIC registers portable allocations
    - ISPs register customer assignments
- Reverse DNS – *in-addr.arpa*
  - Not mandatory but strongly encouraged
    - APNIC maintains authoritative servers for address space
    - ISPs maintain servers for their own space

APNIC Policies

Recent Policy Developments

Policy Developments

- Criteria for initial IPv4 allocation
  - The applicant must have used a /22 from their upstream provider or demonstrate an immediate need for a /22;
  - The applicant must have complied with applicable policies in managing all address space previously allocated to it;
  - The applicant must demonstrate a detailed plan for use of a /21 within a year; and
  - The applicant must commit to renumber from previously deployed space into the new address space within one year.

Policy Developments

- Small multihoming assignments (IPv4)
  - Can get a small portable assignment if:
    - Currently multihomed with provider-based addresses, *or* demonstrate a plan to multihome within one month; and
    - Agree to renumber out of previously assigned address space.
  - Evaluation:
    - According to the principles in RFC2050.
      - Demonstrated need must be shown for an address space assignment that utilises 25% of the address space immediately and 50% within one year.

Policy Developments

- IPv4 Assignments to Exchange Points
  - Minimum /24 assignment for IXP transit LAN
    - Assignment must not be announced
- Proposed assignment for “critical infrastructure”
  - Rejected by APNIC community
  - “Critical Infrastructure” not defined

Policy Developments

- Proposal by Broadband WG
  - Registration requirements clarified
    - Every network assignment greater than /30 must be registered.
    - Assignments of /30 or smaller, including host assignments, may be registered at the discretion of the end-user and ISP.
    - ISP technical contact can be admin-c for residential networks
  - Create guidelines document for evaluation of cable and xDSL requests

Policy Developments

- Extension of IPv6 bootstrap period
  - Initial bootstrap period ended in Aug 2001 with 100 allocations globally
  - Extended until the next IPv6 policy is implemented
    - on the understanding that the next policy takes account of bootstrapping needs.
- IPv6 Assignments to Exchange Points
  - Assignment of /64 from reserved /48

APNIC Policies

IPv6 Policy Status

Background

- IPv6 provisional policies launched in 1999
- Policy review underway since 2000, while allocations have continued
- Feedback received from various channels
- Many issues discussed in RIR forums
- RIR staff integrating feedback
  - Presentation summarises all major points…

Community Feedback

- Size of site address assignment
  - /48 or lower?
- Address utilisation threshold
  - 80% utilisation requirement
- Initial allocation and Slow Start
  - Too restrictive for large networks?
- Allocation of additional address space
  - Sufficient for continual growth?
- Technical and administrative boundaries
  - TLA, subTLA, NLA etc
- And some highly innovative policy proposals.

IPv6 Policy Status

Proposed Principles

Proposed Principle

- Basic allocation principles
- IPv6 address requirement
- Address utilisation requirement
- Initial allocation
- Subsequent allocation

Basic Allocation Principles

- "Allocation should always be based on demonstrated requirement"
- Registry assesses IPv6 requirement
  - Based on policies and documentation
- Registry allocates according to requirement
  - For agreed time into the future (eg 2 year plan)
  - Other criteria may apply (eg minimum allocation, slow start for new ISPs, renumbering, etc.)

IPv6 Address Requirement

- How to assess address requirement?
- Propose to recognise existing infrastructure where it exists
  - On assumption of transition to IPv6
  - Need to examine several cases depending on existing infrastructure and address space
  - Where no infrastructure, specific policy proposed (slow start)

IPv6 Address Requirement

- 1. Organisation with IPv4 network
  - Address requirement assessed according to existing IPv4 infrastructure and customers
    - Recognising demonstrated requirement and experience
    - Assuming transition to IPv6
  - Requirement measured in /48s
  - For example…

    Number of registered customer assignments
    + Number of dialup ports or customers
    + Homes passed by cable
    + Addresses required for other IPv4 services

IPv6 Address Requirement

- 2. Organisation with IPv6 network
  - Addresses from upstream ISP or 6BONE
  - Address requirement assessed according to existing IPv6 infrastructure and customers
    - Assuming transition to portable IPv6 space
  - Requirement measured in /48s
    - Either equivalent to addresses already held
    - or according to previous method (IPv4)

IPv6 Address Requirement

- 3. Organisation with IPv4 and IPv6 networks
  - Assess networks separately
    - Principles already described
  - Total requirement determined accordingly
    - Simple sum of all address requirements

IPv6 Address Requirement

- 4. Organisation with no network
  - Requirement assessed from infrastructure plan
    - Method similar to previously described
  - “Slow start” provides minimum allocation by default to new organisations/networks
    - Or more if sufficiently documented
    - Allowing utilisation rate to be determined on subsequent allocation

IPv6 Address Requirement

- Summary – Address Requirement

1. Recognise existing infrastructure where it exists – IPv4 and IPv6
2. Document basis for assessing requirement
3. “Slow Start” only for new networks

Utilisation Requirement

- Under IPv4, 80% utilisation required
  - Same requirement for block of any size
- Provisional IPv6 policy
  - Policy was “adopted” from IPv4 policy
- Proposed IPv6 policy
  - Host Density Ratio instead of %

Utilisation Threshold – HD Ratio

- "Host Density Ratio" provides utilisation limit which reduces as address space grows:

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

  - assigned = number of end addresses assigned
  - available = total number of addresses available

- Based on H-Ratio defined in RFC1715 (1994)
  - draft-durand-huitema-h-density-ratio-01.txt

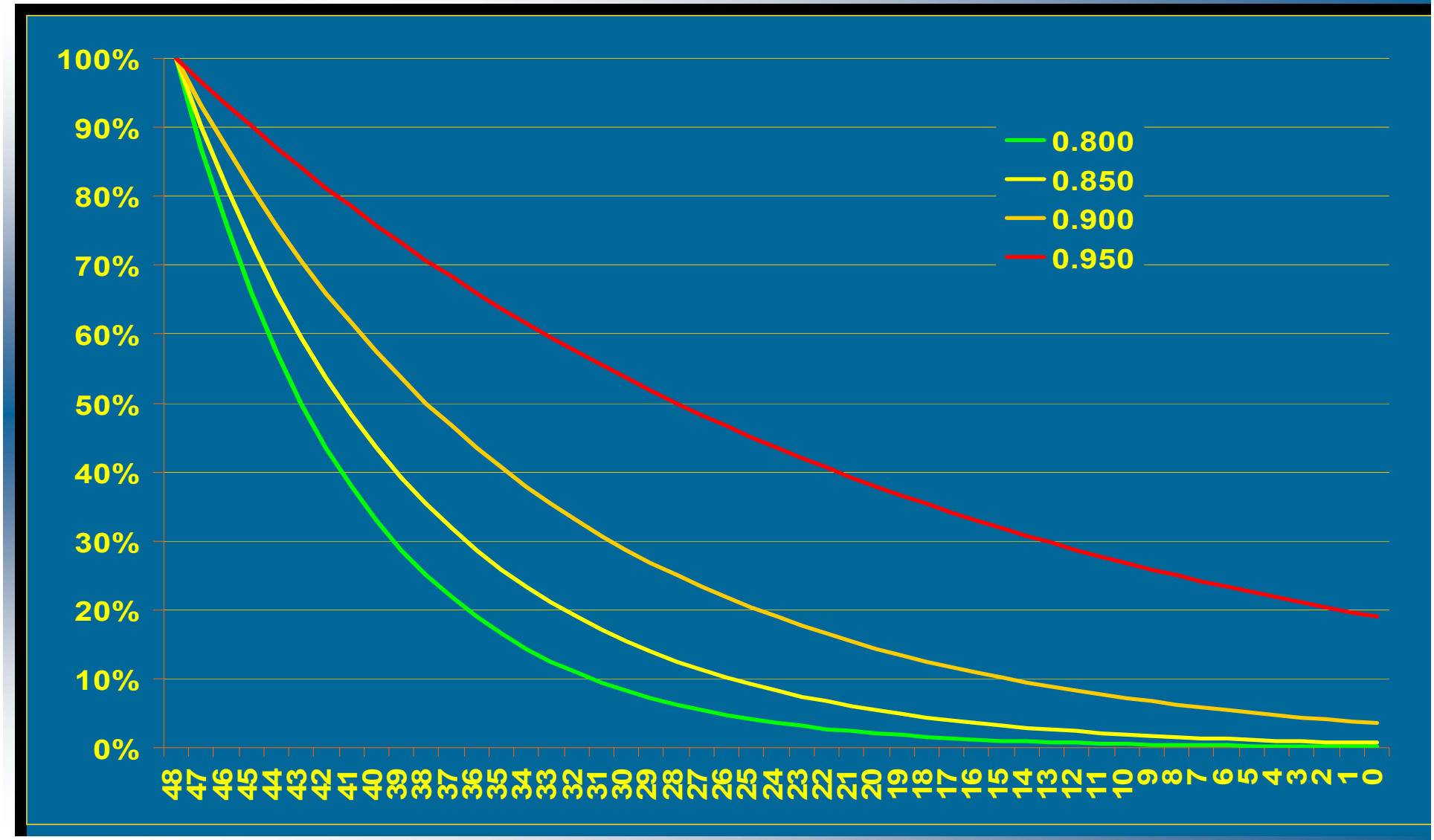
Utilisation Threshold – HD Ratio

- Use HD Ratio to determine when an address block can be considered “utilised”

$$threshold = 2^{(site\_bits \times HD-Ratio)}$$

  - threshold = site addresses to be utilised
  - site_bits = 48 – IPv6 prefix

Choice of HD Ratio



Example: HD Ratio = 0.8

$$threshold = 2^{(site\_bits \times 0.8)}$$

v6 prefix	Site addr bits	Total site addrs	Threshold	Util%
42	6	64	28	43.5%
36	12	4096	776	18.9%
35	13	8192	1351	16.5%
32	16	65536	7132	10.9%
29	19	524288	37641	7.2%
24	24	16777216	602249	3.6%
16	32	4294967296	50859008	1.2%
8	40	1099511627776	4294967296	0.4%
3	45	35184372088832	68719476736	0.2%
0	48	281474976710656	362703572709	0.1%

IPv6 Policy Status

Initial Allocation Size and Qualification

Initial Allocation Size

- Minimum allocation is currently /35
  - Based on IPv4 - 13 bits of site address space
  - Slow start provisions for all initial allocations
- Propose to increase minimum allocation
  - But reduce qualification criteria to ensure easy entry into the IPv6 industry
- Proposed “slow start” policy
  - Only for new networks (new ISPs)
  - Note: minimum allocation can be exceeded where requirement is shown

Qualification Criteria

- Assess prefix requirement based on address requirement and HD-Ratio
  - Eg if require 12,000 /48s, prefix is /32
  - Eg if require 200,000 /48s, prefix is /29
- Prefix is allocated if >= minimum allocation
  - Also if peering with 3 or more others
  - Required to renumber from existing space?
  - Other criteria as well?

Qualification Criteria – option 2

- Establish lower qualification threshold level for receiving minimum allocation?
- For instance…
  - Minimum allocation may be /32 (example)
    - 16 bit site address space, provides 64K sites
  - "Qualification threshold" may be /36 (example)
    - If organisation reaches threshold, /32 allocation is made
    - At HD Ratio 0.8 (18.9% of /36) this is 776 sites
  - Ratio of address requirement to initial allocation
    - In this example, ratio = 776:64K = 1:84

IPv6 Policy Status

Subsequent Allocation Size and Qualification

Allocation of additional space

- Subsequent allocation requested when HD-ratio utilisation level is reached
- Size of subsequent allocation
  - To satisfy 2 year requirement
  - Minimum allocation is 1 bit shorter
  - More if justified by immediate need under network plan (6-12 months)?

IPv6 Policy Status

Questions?

APNIC Update

Thank you