APNIC
Introduction and Overview

ITU/PITA Joint Workshop

Brisbane, October 2001

Overview

- **Introduction to APNIC**
  - Role and activities
- **APNIC Status Update**
  - Membership and resources
  - Other activities
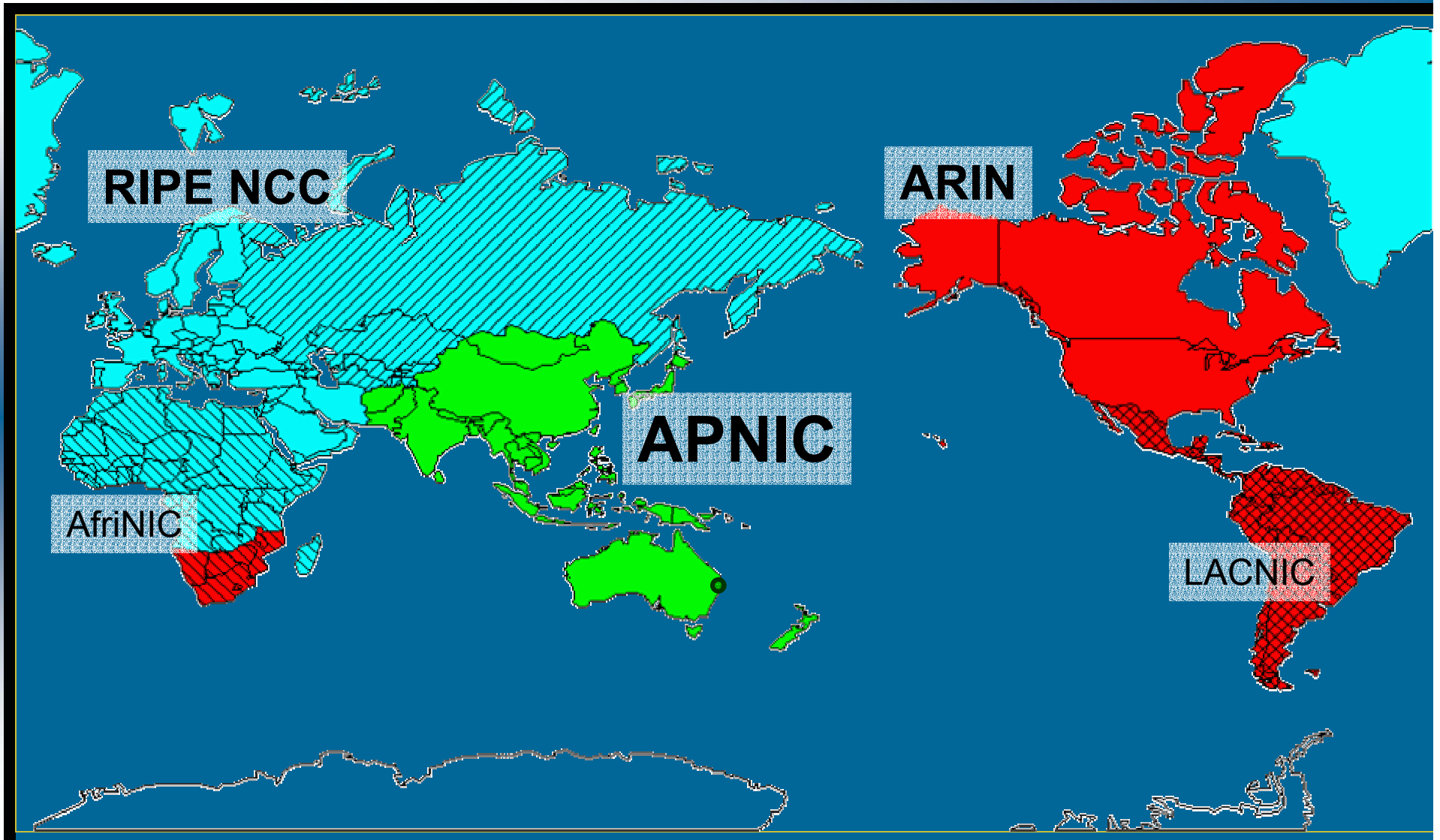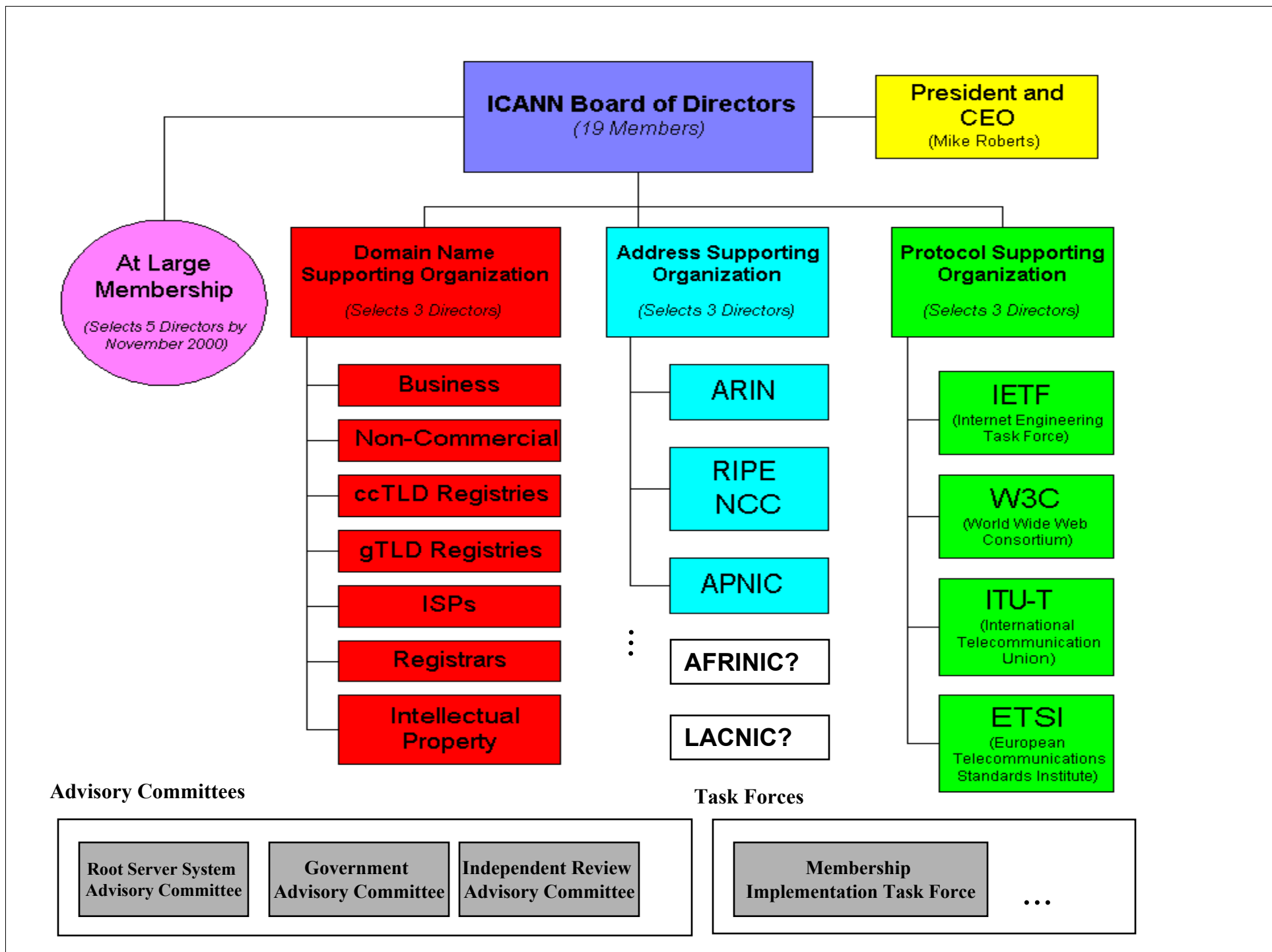- **APNIC Policies**
  - Introduction to IP Addressing

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

Where is APNIC?

RIPE NCC

ARIN

APNIC

AfriNIC

LACNIC

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)

- Business
- Non-Commercial
- ccTLD Registries
- gTLD Registries
- ISPs
- Registrars
- Intellectual Property

Address Supporting Organization
(Selects 3 Directors)

- ARIN
- RIPE NCC
- APNIC

⋮

- AFRINIC?
- LACNIC?

Protocol Supporting Organization
(Selects 3 Directors)

- 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

...

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*

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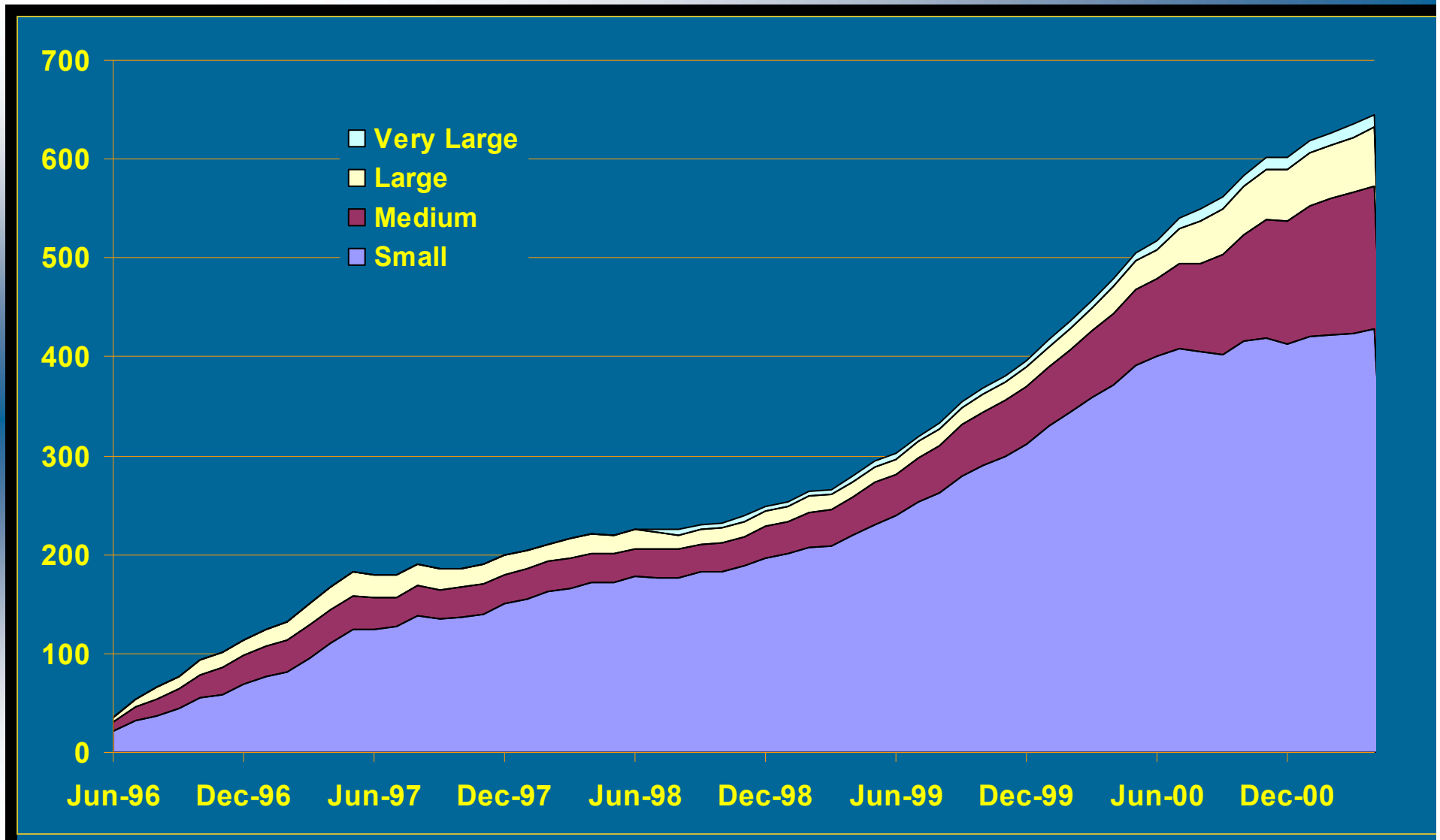
- **Policy development and coordination**
  - Open Policy Meetings: SIGs, WGs, BOFs
  - ASO and ICANN processes
- **Training and Seminars**
  - 2 training courses per month in 2002
  - Seminars with AP Outreach
- **Publication**
  - Newsletter, web and ftp site, mailing lists etc
  - Joint RIR statistics
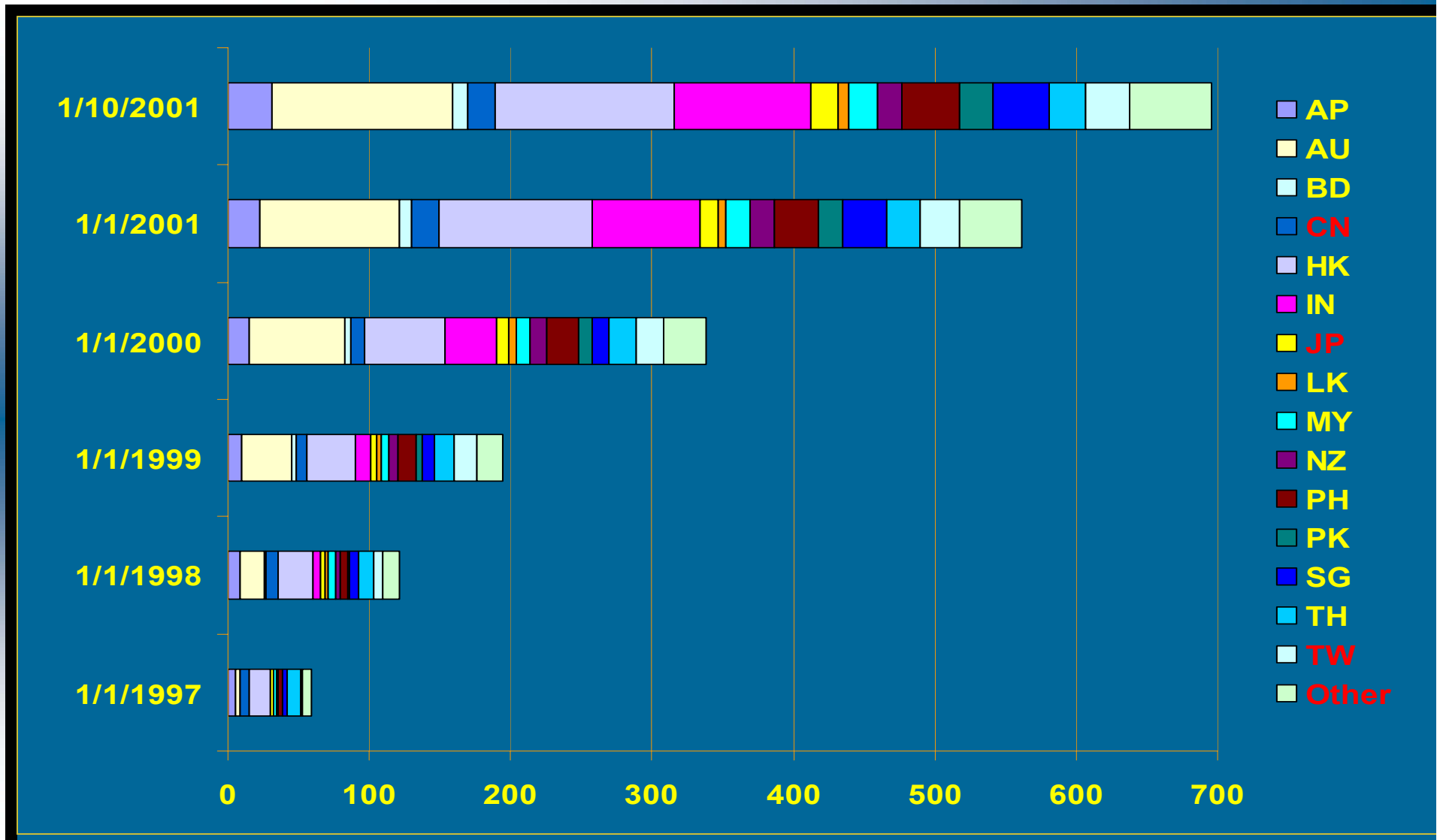
APNIC Update

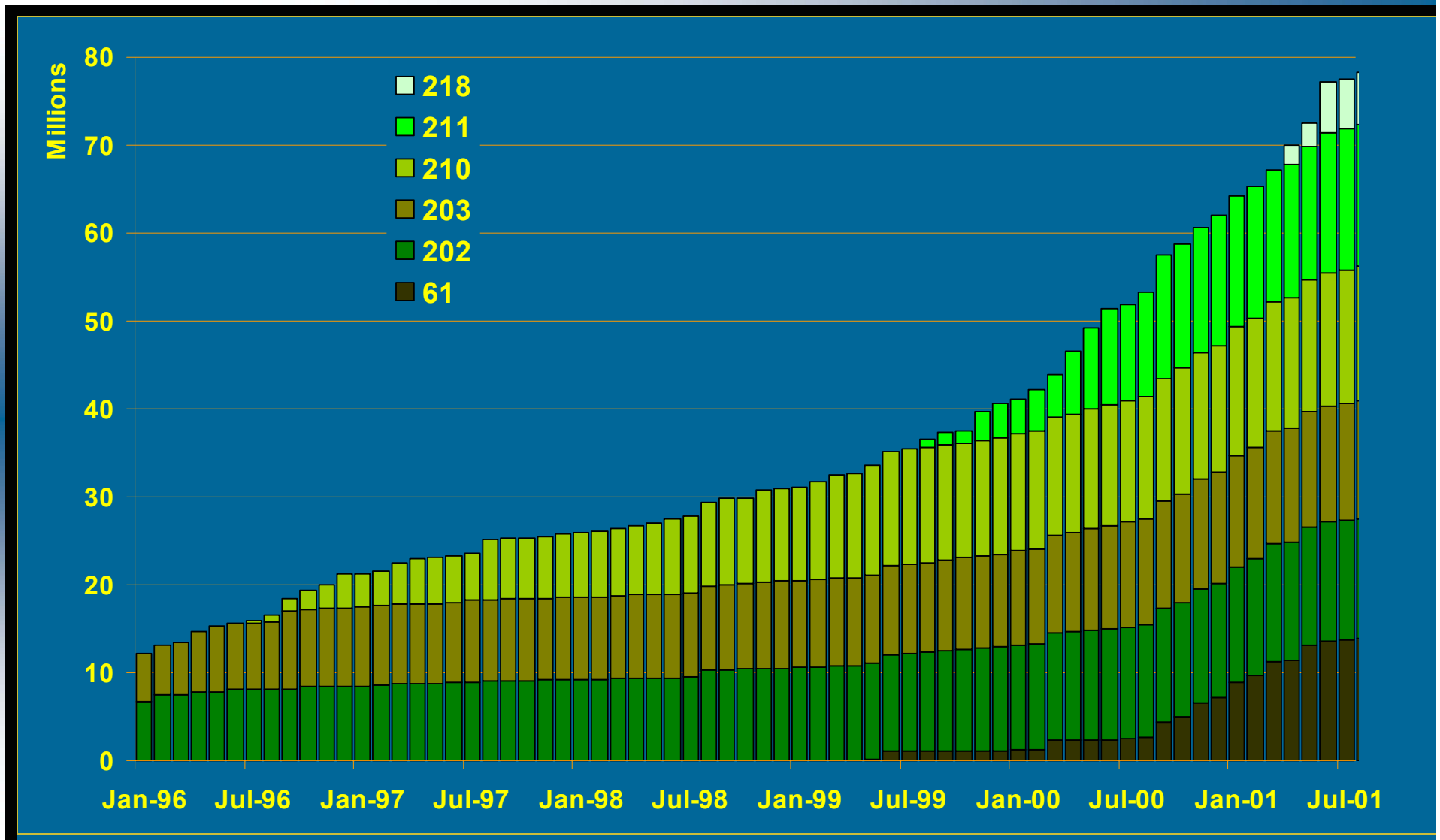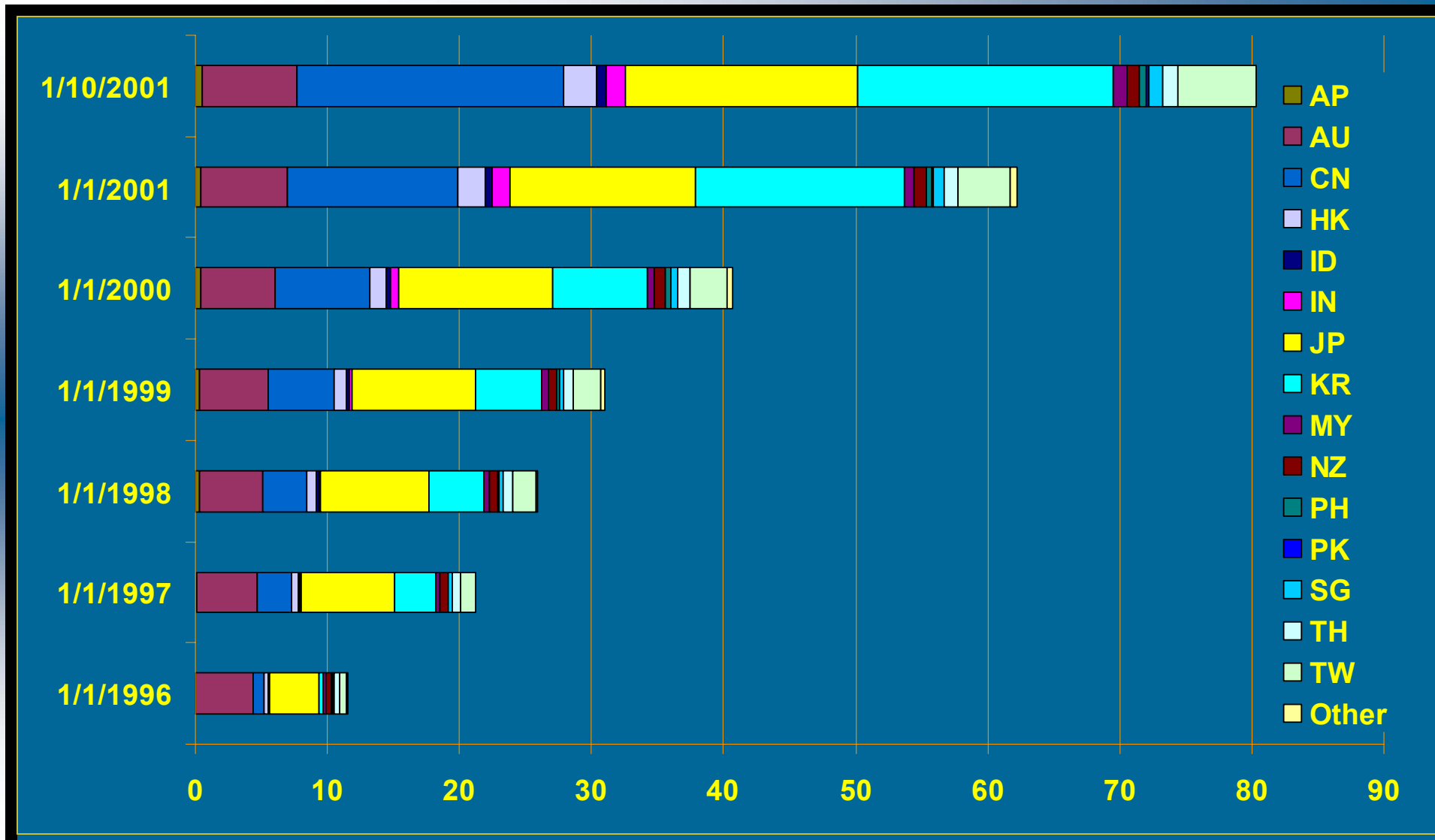## Membership and Resource Status
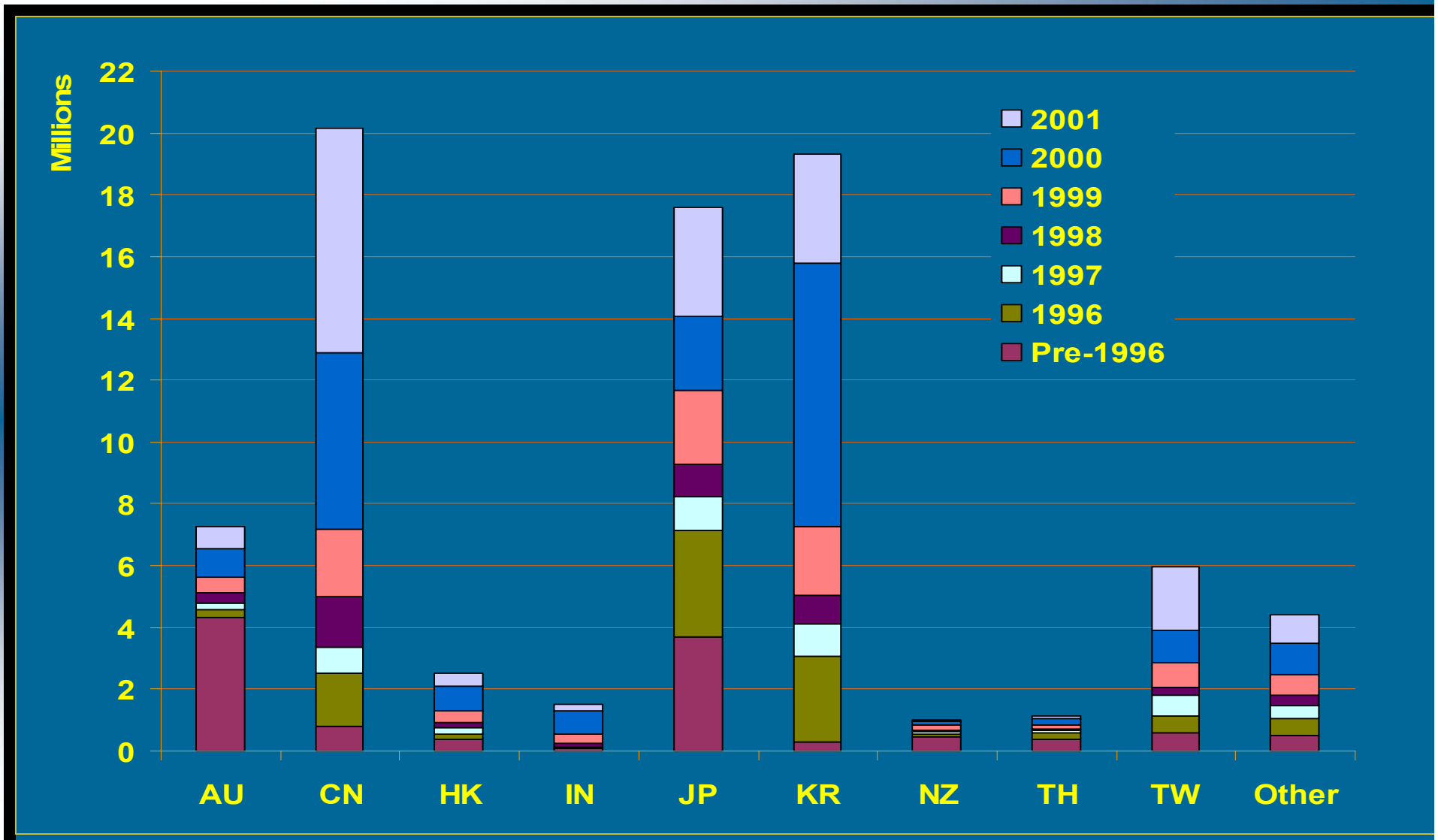
How many APNIC Members?

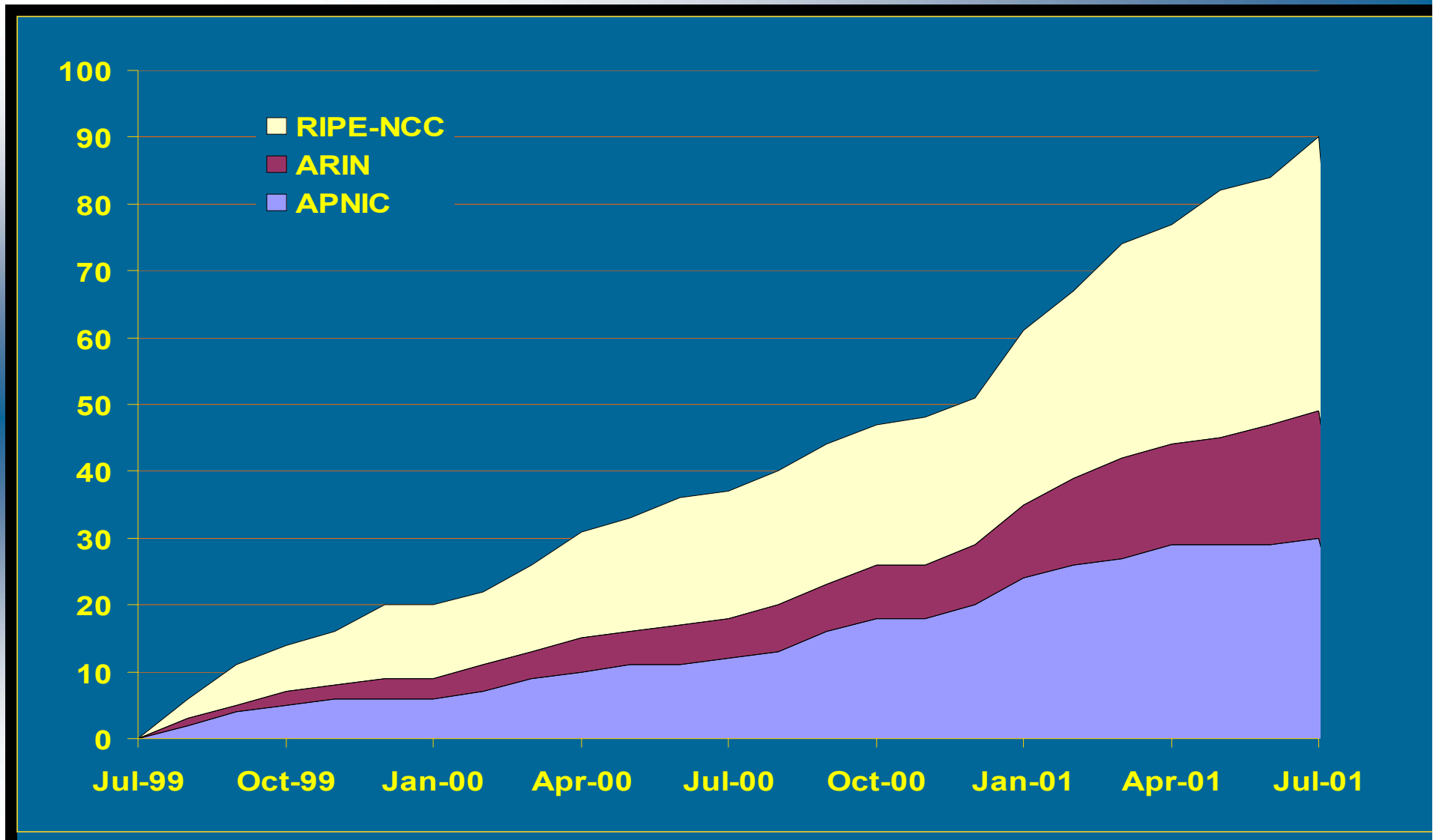# Where are APNIC Members?

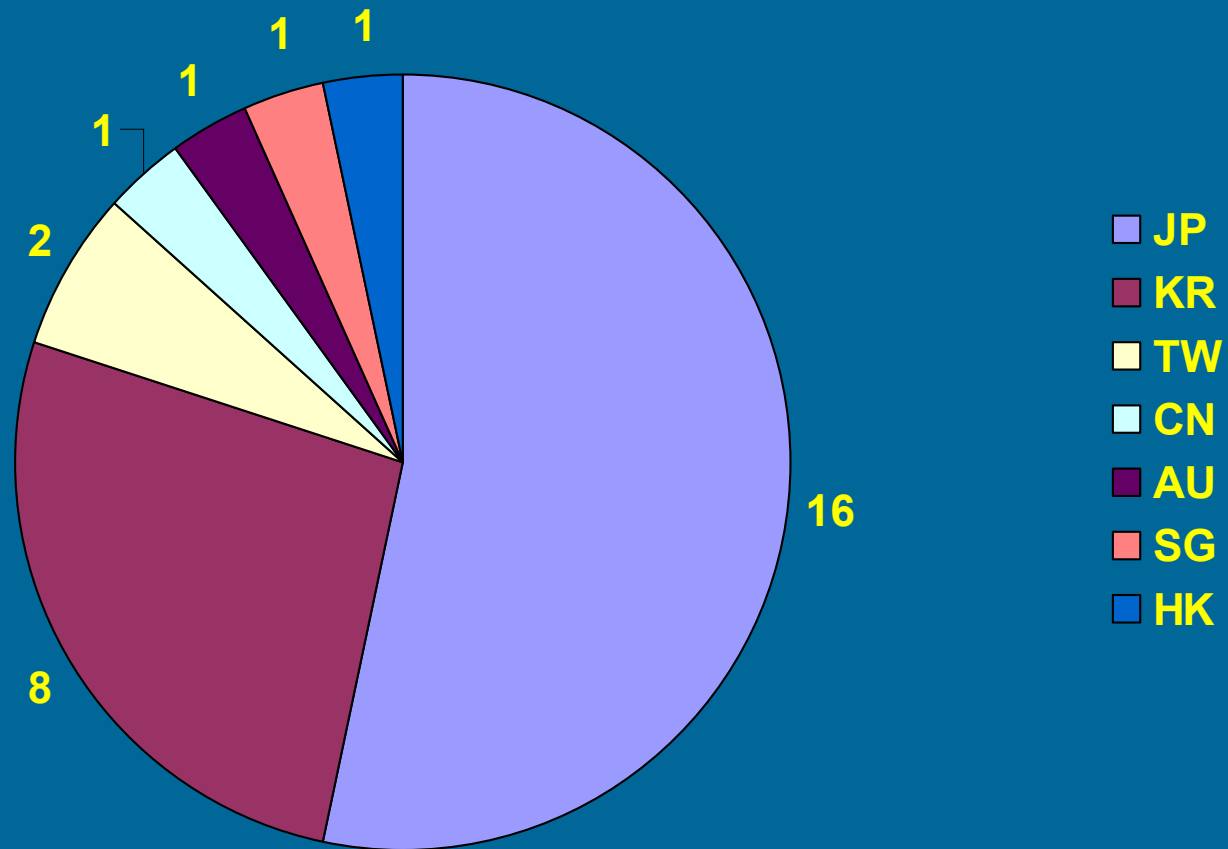# How many IPv4 allocations?

Where are IPv4 allocations?

Where are IPv4 allocations?

How many IPv6 allocations?

Legend:
- RIPE-NCC
- ARIN
- APNIC

X-axis: Jul-99, Oct-99, Jan-00, Apr-00, Jul-00, Oct-00, Jan-01, Apr-01, Jul-01

Y-axis: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Where are IPv6 allocations?

Pie chart data:
- JP: 16
- KR: 8
- TW: 2
- CN: 1
- AU: 1
- SG: 1
- HK: 1

APNIC Update

Other Activities

Training Services

- **Training courses held**
  - 8 during 2000, 1 per month during 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

- **Internet Routing Registry (IRR)**
  - Work with RIPE NCC on v3 software
  - Testing and transition planning underway
  - IRR operating model to be developed
  - Training materials to be developed
- **Distributed service architecture**
  - POPs in major exchange points
  - Model under development

Service Developments

- **Certification Authority**
  - Response to member concerns on security
  - Email, website auth* and privacy
  - Industry-standard X.509 certificates
  - Trial certificates being issued now
- **"MyAPNIC" website**
  - Access to members' private information
  - Use of certificates for secured access

Service Developments

- **Internal Services**
  - Rearchitecture and continual improvement
  - Sustained (and sustainable) staff growth
  - ISO certification being considered
- **Publications**
  - Website redesign recently completed
  - Joint RIR stats publication
  - Newsletter to be launched in Taipei

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.

APNIC

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:
August 28 Taipei, Taiwan

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

NETWORK *Abuse*

Help and information for cases of spamming and hacking.

WHAT's *New*

Senior Systems Administrator position available [27 July, 2001]
For more details, please see APNIC employment.

Second APNIC Members and Stakeholders Survey [28 June, 2001]
The second major survey of APNIC's members and stakeholders is now underway. Please visit the survey website for more information.

Other news : Address Council nominees | AUNIC to APNIC migration | Global Internet resource statistics

OUR *Sponsors*

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

APNIC *Calendar*

Aug 2001		Aug			
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	31	

Next APNIC meeting:
Taipei, 28-31 Aug

CONTACT *Us*

APNIC meetings…

- 12th APNIC Open Policy Meeting
  - August 2001, Taipei, Taiwan
  - SIGs, BOFs, training, Members' meeting
  - 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

APNIC Policies

Introduction to IP Addressing

Introduction to IP Addressing

- ◆ **What is an IP Address?**
  - ◆ IP addresses vs DNS names
- ◆ **IP Address Architecture**
- ◆ **IP Management Policies**
- ◆ **APNIC Role**

What is an IP Address?

- **IPv4 address: 32-bit number**
  - e.g. 132.234.250.31
  - 4 billion addresses (though much less in practice)
- **IPv6 address: 128-bit number**
  - 16 billion billion addresses (**much** less in practice)
- **Public infrastructure addresses**
  - Every device must have an IP address
  - Every globally-reachable address is unique
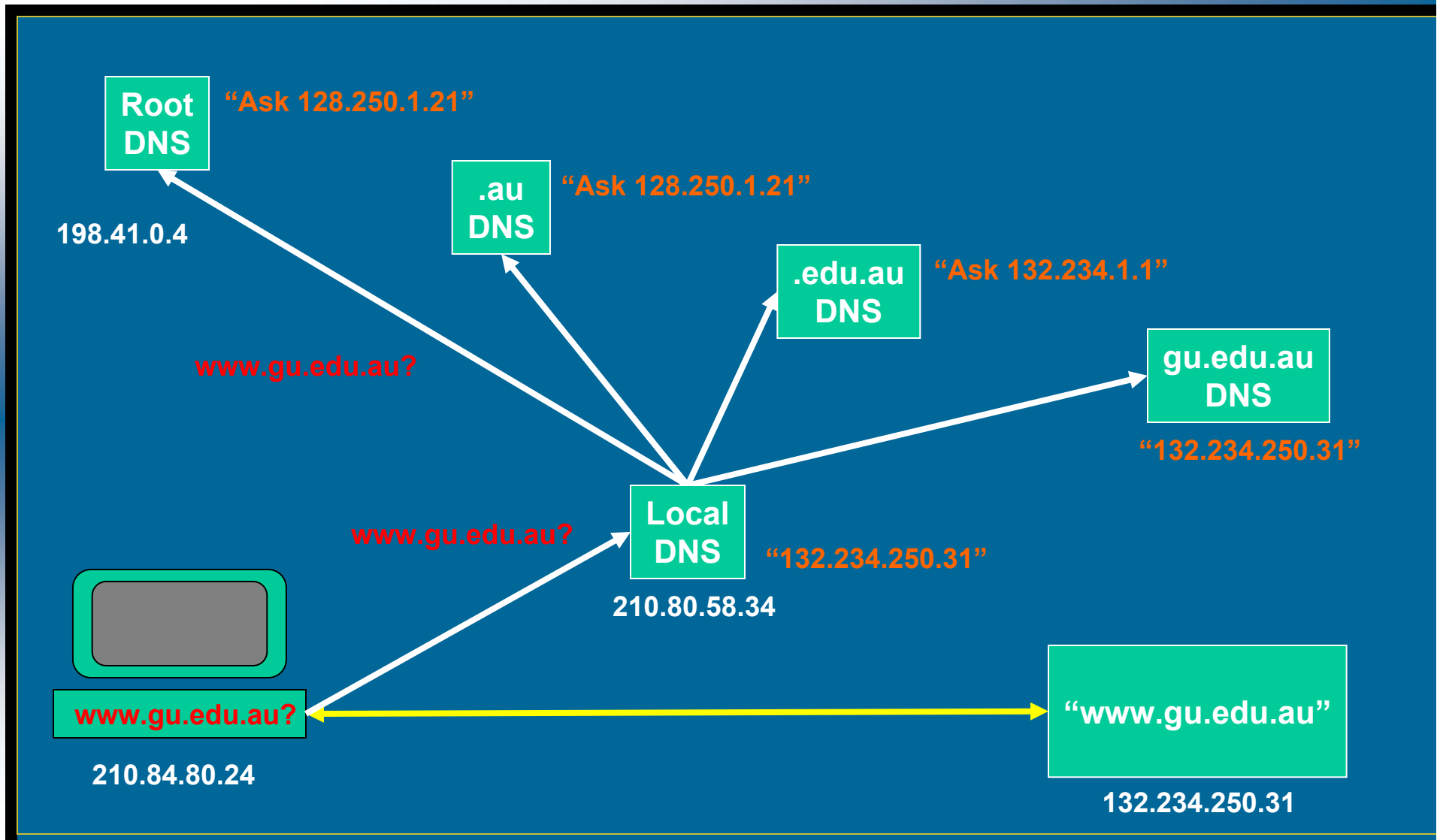 - Every packet contains two IP addresses

What is an IP Address?

210.84.80.24	132.234.250.31	4	data
"From" address *(32 bits)*	*"To" address* *(32 bits)*	*Version*	*Contents*

An Internet Packet (IPv4)

What is a Domain Name?

- Easy to remember (well, sort of) name for a computer or service
    - e.g. apnic.net, www.undp.org, www.gu.edu.au
- Hierarchical structure providing distributed administration
- Not a proper (or useful!) directory service, but a basic mapping service
    - Technical feat is in distribution and scaling
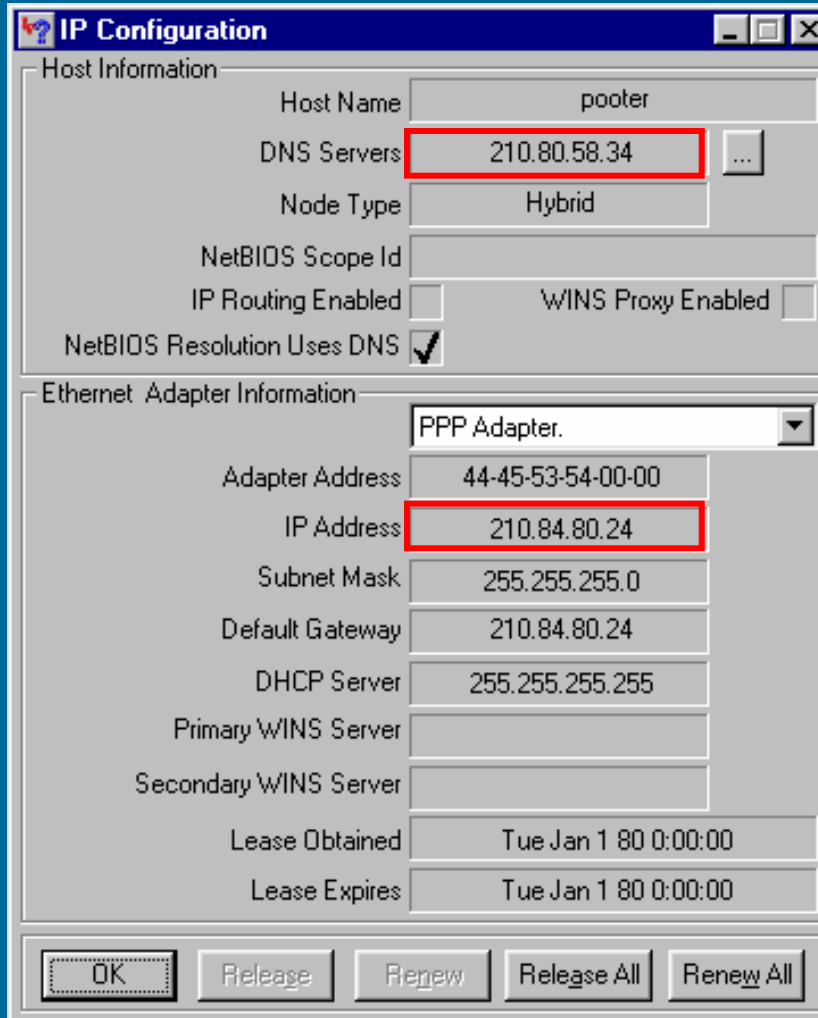
IP Addresses are not Domain Names

APNIC

Root DNS

"Ask 128.250.1.21"

198.41.0.4

.au DNS   "Ask 128.250.1.21"

.edu.au DNS   "Ask 132.234.1.1"

gu.edu.au DNS

"132.234.250.31"

www.gu.edu.au?

www.gu.edu.au?

Local DNS   "132.234.250.31"

210.80.58.34

www.gu.edu.au?

210.84.80.24

"www.gu.edu.au"

132.234.250.31

What are IP Addresses anyway?

```
Received: from guardian.apnic.net (int-gw.staff.apnic.net [192.168.1.254])
   by hadrian.staff.apnic.net (8.9.3/8.9.3) with ESMTP id LAA09848
   for <paul@staff.apnic.net>; Tue, 11 Jul 2000 11:18:01 +1000 (EST)
Received: (from mail@localhost)
   by guardian.apnic.net (8.9.3/8.9.3) id LAA22835
   for <paul@staff.apnic.net>; Tue, 11 Jul 2000 11:18:00 +1000 (EST)
Received: from whois1.apnic.net(203.37.255.98) by int-gw.staff.apnic.net via smap (V2.1)
   id xma022827; Tue, 11 Jul 00 11:17:53 +1000
Received: from kraken.itc.gu.edu.au (kraken.itc.gu.edu.au [132.234.250.31])
   by whois.apnic.net (8.9.3/8.9.3) with ESMTP id LAA101840
   for <pwilson@apnic.net>; Tue, 11 Jul 2000 11:17:45 +1000 (EST)
Received: from c064939 (law25.law.gu.edu.au [132.234.65.25]) by kraken.itc.gu.edu.au
   (8.8.5/8.7.3) with SMTP id LAA23573 for <pwilson@apnic.net>; Tue, 11 Jul 2000 11:18:23
   +1000 (EST)
Message-Id: <3.0.5.32.20000711111738.008c9ea0@kraken.itc.gu.edu.au>
X-Sender: lawairof@kraken.itc.gu.edu.au
X-Mailer: QUALCOMM Windows Eudora Light Version 3.0.5 (32)
Date: Tue, 11 Jul 2000 11:17:38 +1000
To: "Paul Wilson" <pwilson@apnic.net>
From: Geoff Airo-Farulla <G.Airo-Farulla@mailbox.gu.edu.au>
Subject: Re: Seminar plan
```

What are IP Addresses anyway?

◆ WinIPcfg

Classful Address Architecture

- Each IP address has two parts:

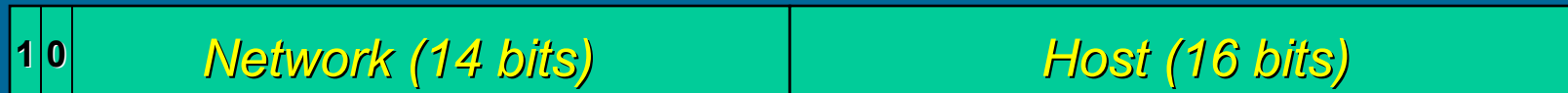| Network	Host
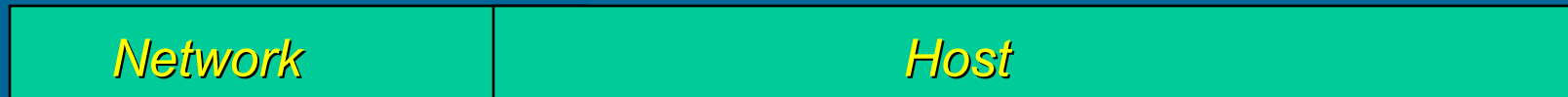
- Initially, only 256 networks in the Internet!
- Then, network "classes" introduced:
  - Class A – very large networks (128 in total)
  - Class B – middle-sized networks (16,384)
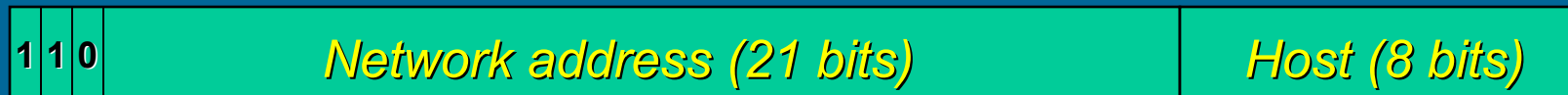 - Class C – very small networks (2 million)

Classful Address Architecture

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

0	Net (7 bits)	Host address (24 bits)

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

1	0	Network (14 bits)	Host (16 bits)

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

| 1	1	0	Network address (21 bits)	Host (8 bits)

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
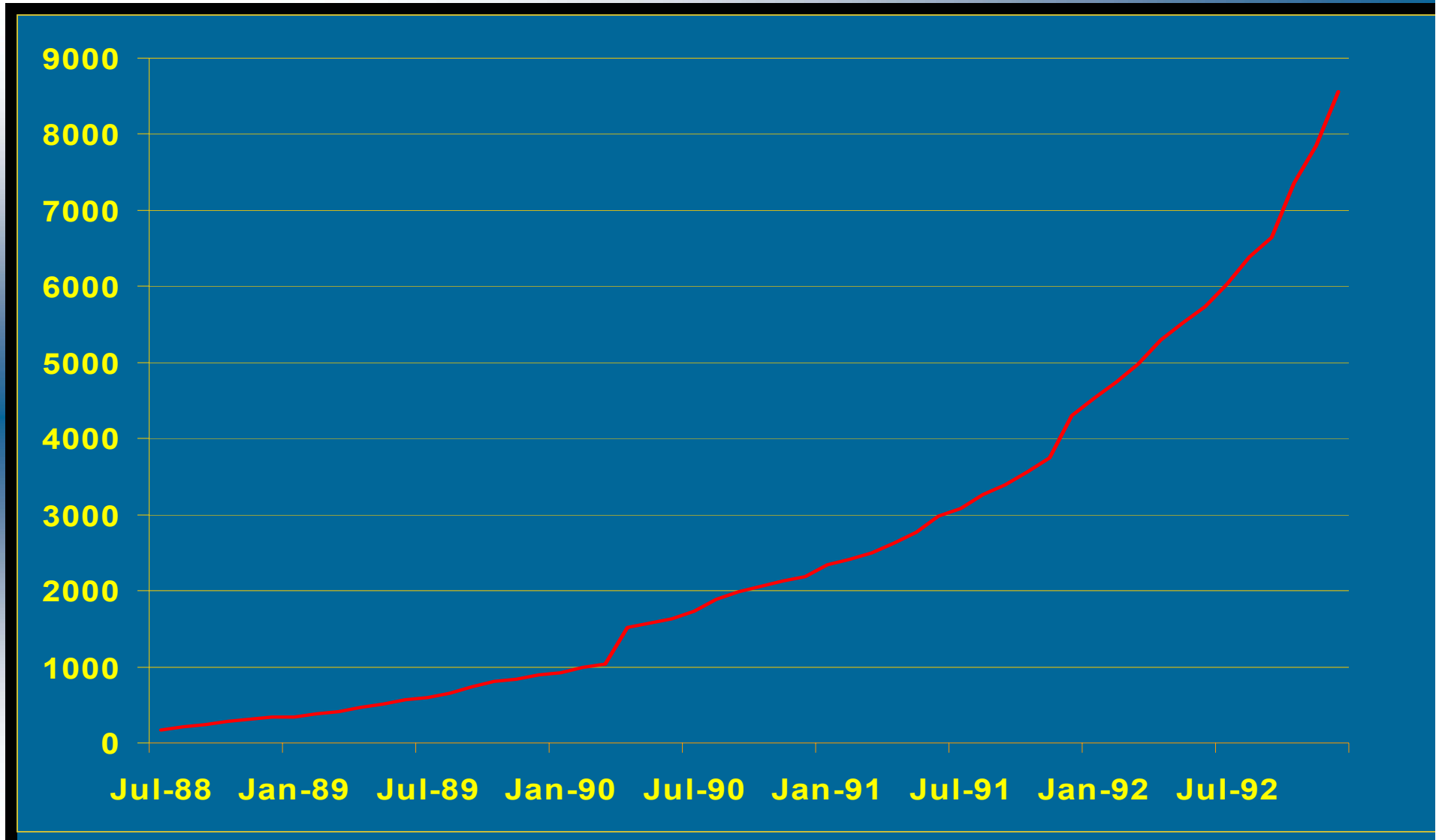
Global Routing Table: Projection
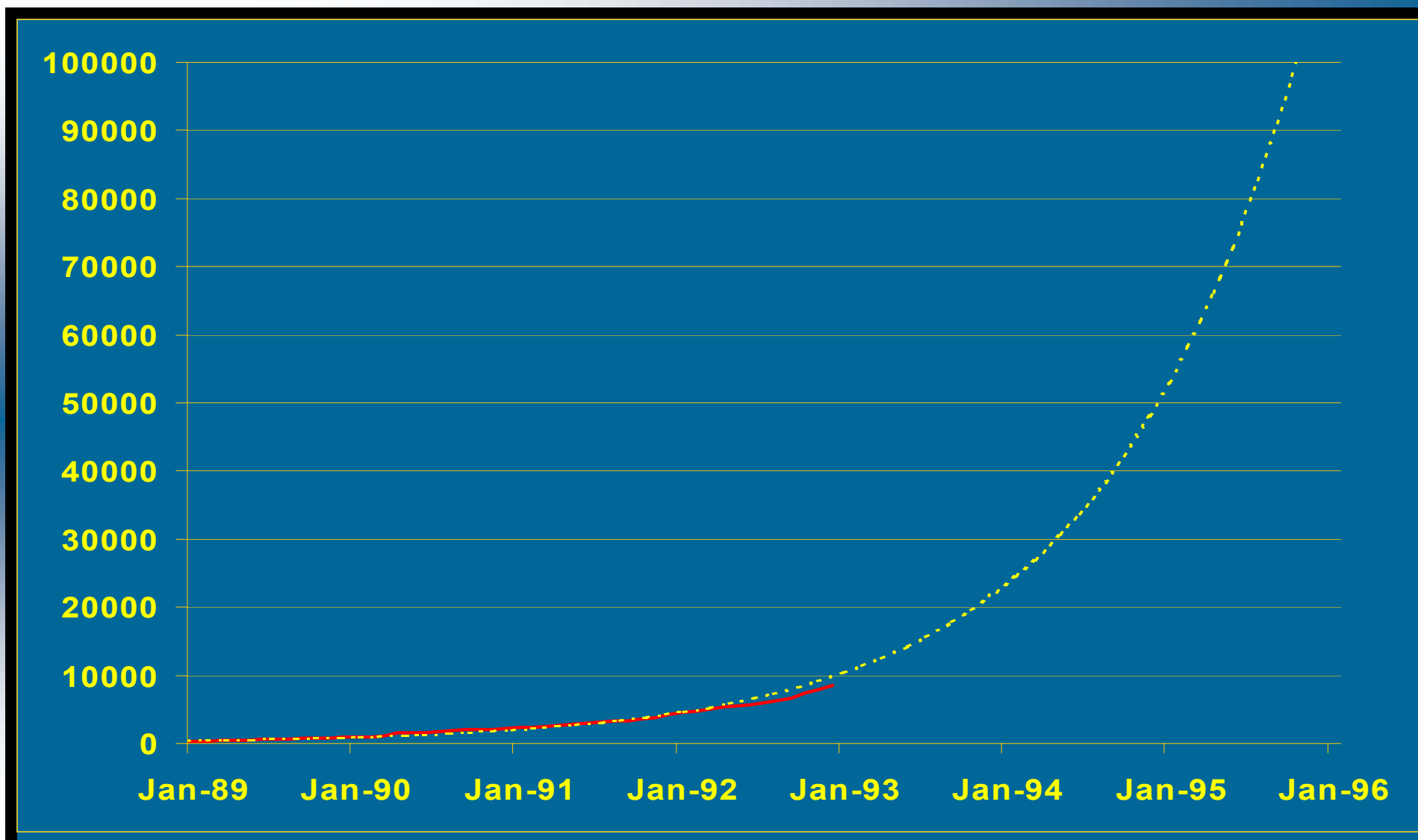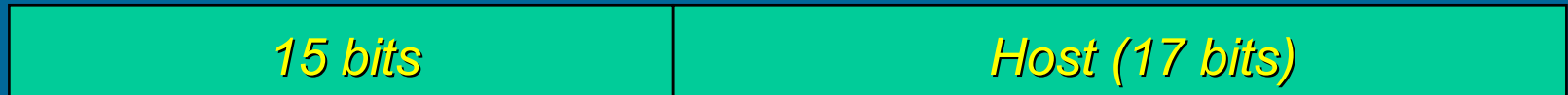
Classless Address Architecture

- **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
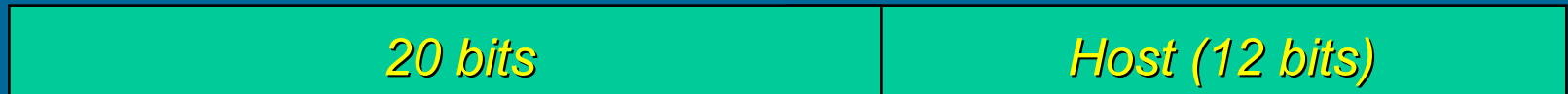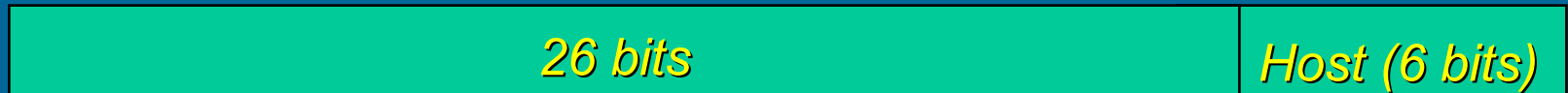
/10 4M hosts

10 bits	Host address (22 bits)

/15 128K hosts

15 bits	Host (17 bits)

/20 4094 hosts

20 bits	Host (12 bits)

/26 64 hosts

26 bits	Host (6 bits)

CIDR Aggregation

APNIC

202.128/15

210.100.96/19

ISP A

ISP B

Route Announcements
210.100.96/19
202.128/15

Cust A1

Cust A2

202.128.0/23

202.128.32/19

Cust B1

Cust B2

210.100.127.0/25

210.100.127.128/25
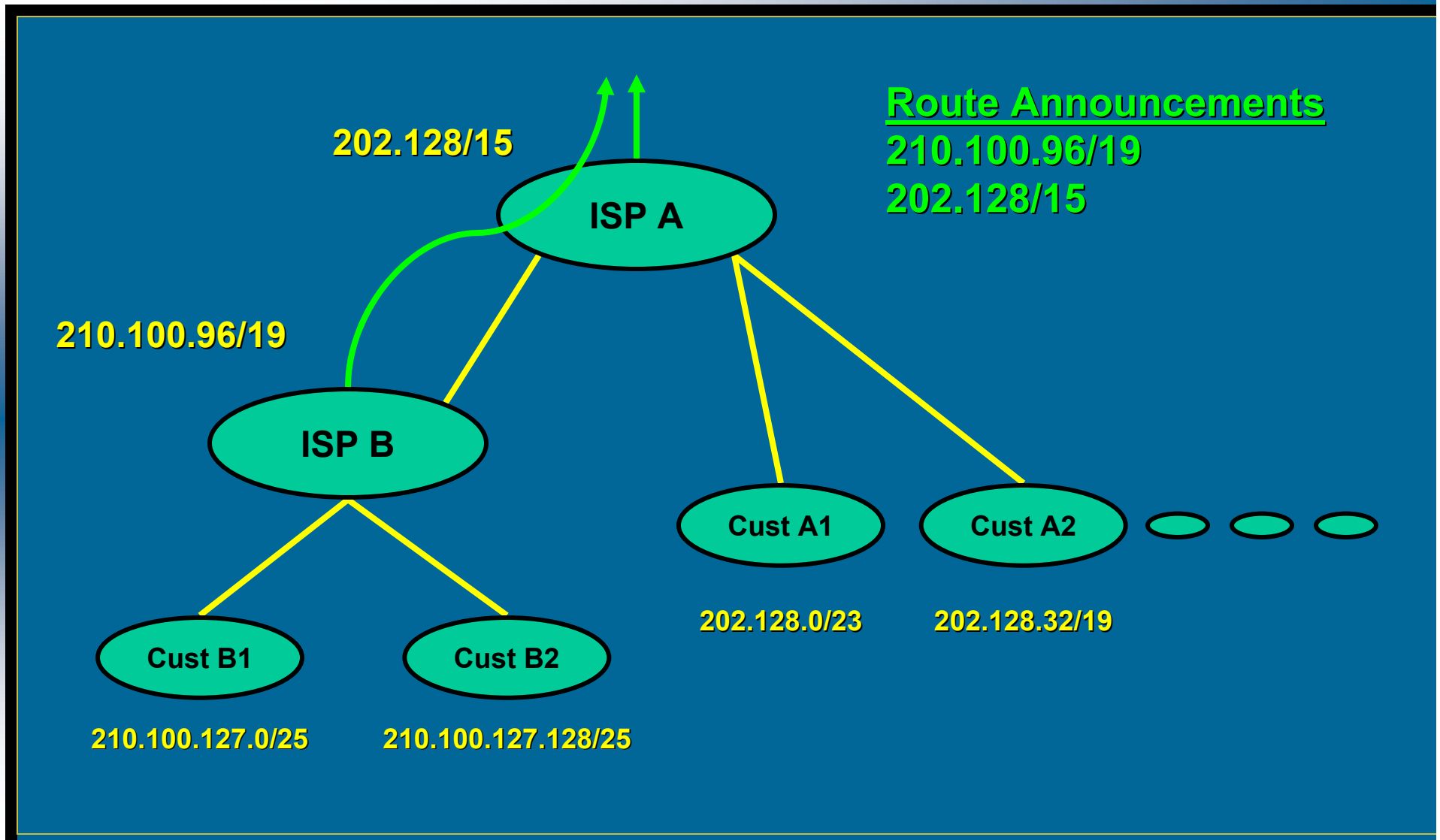
Routing Table Growth: '88 - 2000

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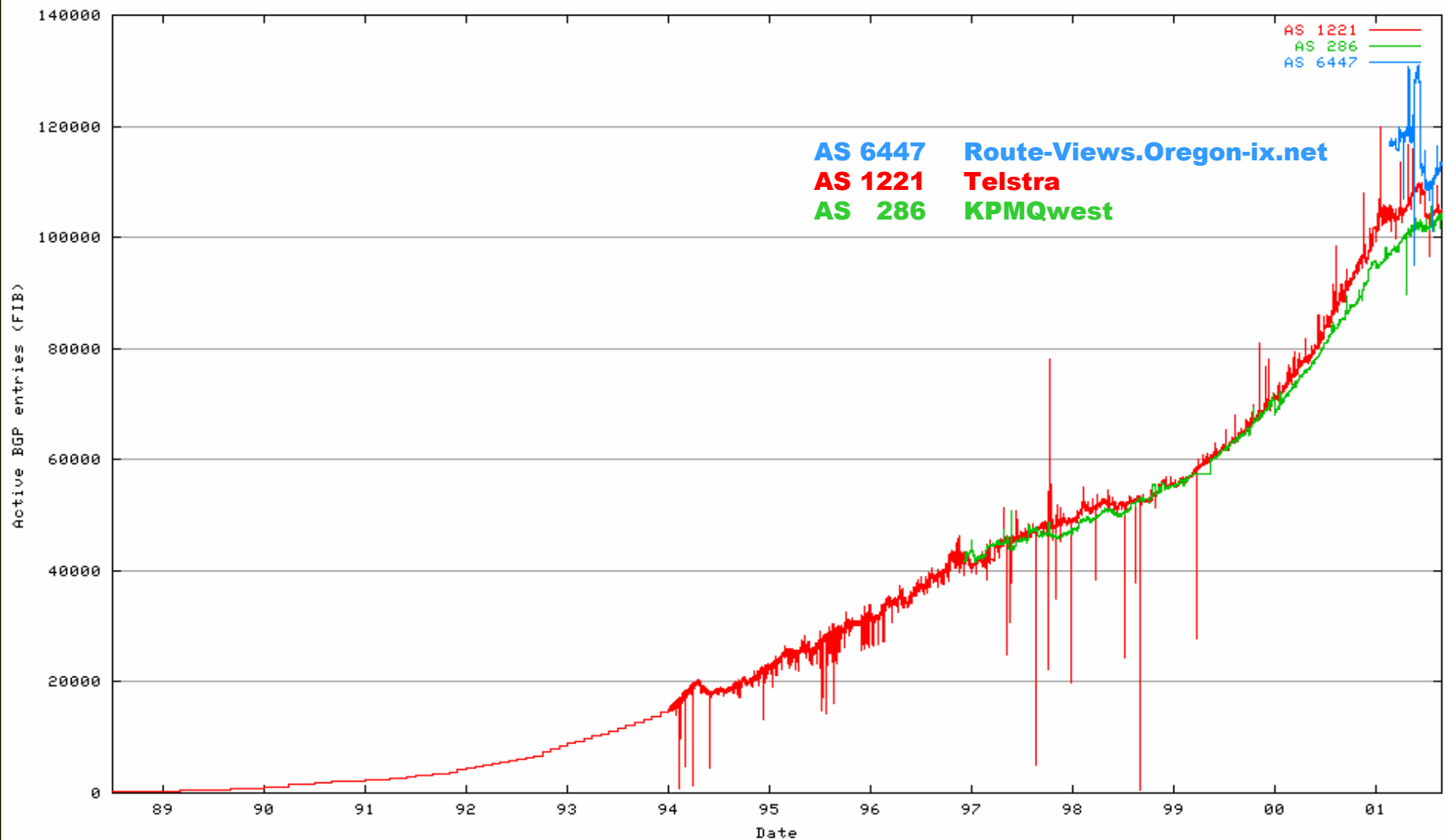
APNIC Policies

IP Address Policy Framework

Address Management Issues

- **Address space depletion**
    - Historically, many wasteful IPv4 assignments
    - Even with CIDR, address space strictly limited
- **Routing scalability**
    - Routing tables growing exponentially
    - Router overload reduces stability of Internet
- **Fairness and Consistency**
    - In the interests of the AP and global community

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**
  - Policies should be clear and consistently implemented

Address Management Principles

- **Hierarchical addressing**
  - **Portable allocations available to larger providers only**
    - Small sites/providers receive addresses from upstream providers
  - **Allocations from registry should be aggregated by the provider/ISP**
    - Minimum number of route announcements
    - Customer assignments not portable
  - **Competition implications**

Address Management Principles

- **Minimum allocation**
  - Agreed "threshold" for allocation from a registry
  - Organisation must justify at least this amount, in order to receive RIR allocation
  - Currently /20 (4096 IP addresses)
- **"Slow start"**
  - All organisations receive minimum allocation initially, regardless of initial requirement
  - Request more address space when consumed

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

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
    - Stockpiling not permitted

Address Management Principles

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

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, organise meetings, provide online services, coordinate, report, training etc

APNIC Update

Questions?