Management of Internet Resources

ITU Workshop on Developing a Policy and Regulatory Framework for Developing Economies of the Pacific

1 December 2003

Suva, Fiji

Save Vocea, APNIC

"On the Internet,
nobody knows you're a dog…"

"On the Internet, nobody knows you're a dog."

by Peter Steiner, from The New Yorker, (Vol.69 (LXIX) no. 20)

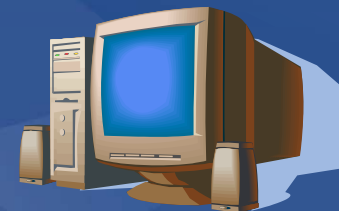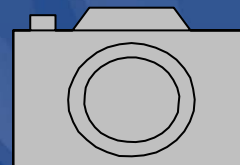# "On the Internet…"
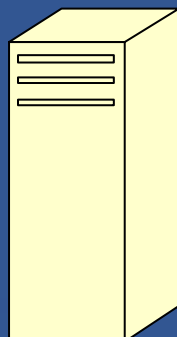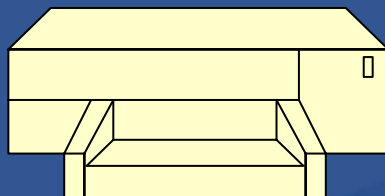## you are nothing but an IP Address!

Internet for Everything!
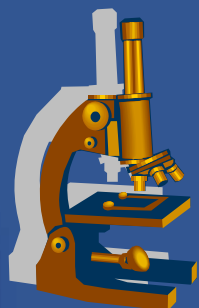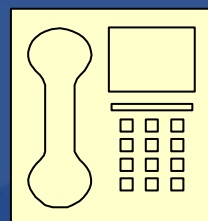
Overview

- **What is an IP Address?**
  - …and what it is not
- **What is an IP Address like?**
  - IP Address characteristics
  - …and functions as an identifier
- **How are IP Addresses managed?**
  - A brief history
  - Address management today
- **Resource allocation statistics**

What is an IP Address?

What is an Address?

- *An identifier which includes information about how to find its subject*
    (according to some rules of interpretation)

- Normally hierarchical

    – Each part provides more specific detail

- For example…

    – APNIC, Level 1, 33 Park Rd, Milton, Brisbane, Australia

What is an IP Address?

- *Internet identifier including information about how to reach a location*

  (via the Internet routing system)

- IPv4: 32-bit* number

  – 4 billion different Addresses available

- IPv6: 128-bit number

  – 16 billion billion Addresses available

- For example…

  – 202.12.29.142

  – A computer within APNIC's network (202.12.29/24)

* bit = binary digit

IP Addresses vs Domain Names

The Internet

DNS

www.cernet.net ?
2021.12.0.46

My Computer
202.02.29.142
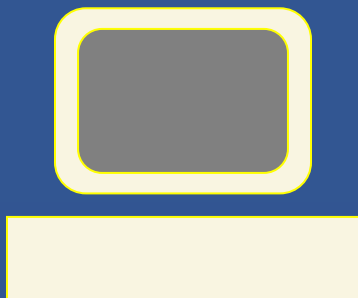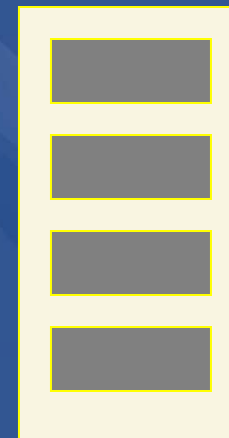
www.cernet.net
202.112.0.46

What else is an IP Address?

- IP Addresses are…
  - Internet Infrastructure Addresses
  - a finite Public Resource
  - not "owned" by Address users
  - not dependent upon the DNS

- IP does not mean "Intellectual Property"

Internet Address Routing

The Internet

Global Routing Table

4.128/9
60.100/16
60.100.0/20
135.22/16
202.12.29.0/24
…

Announce
202.12.29.0/24

Traffic
202.12.29.0/24

202.12.29.0/24
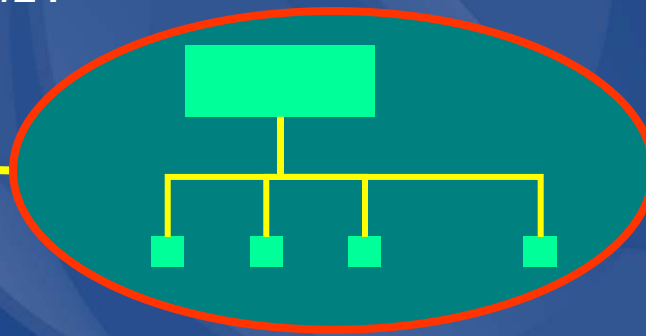
IP Address Characteristics

Where do IP Addresses come from?

IETF

IPv4 IPv6

IANA

Allocation

RIR

Allocation

ISP

Assignment

User
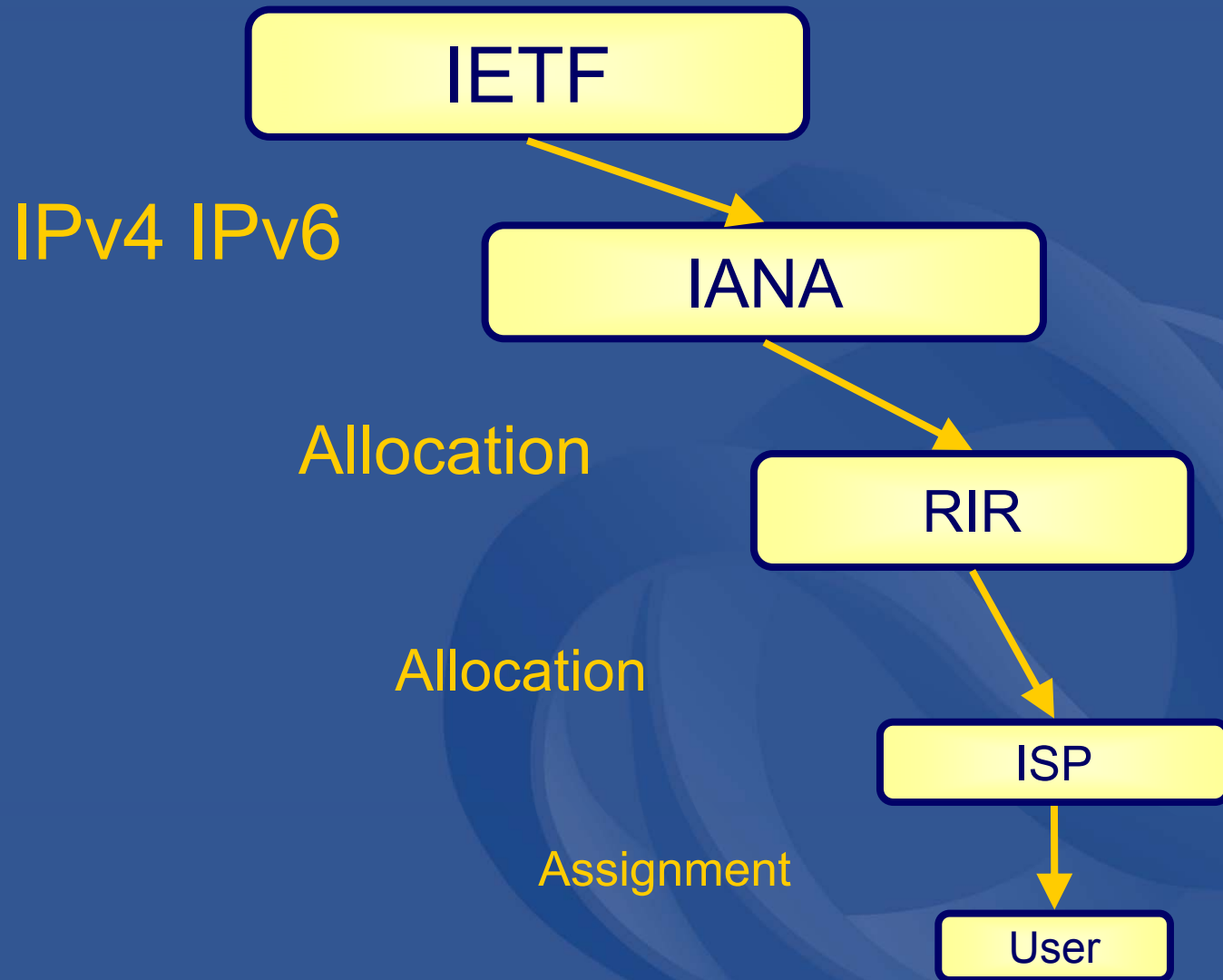
What is "my" Address?

- IP Address = Network interface address
  - Not a computer's Address
  - Nor a person's Address

Modem

?

802.11

IPv4

LAN

IPv6
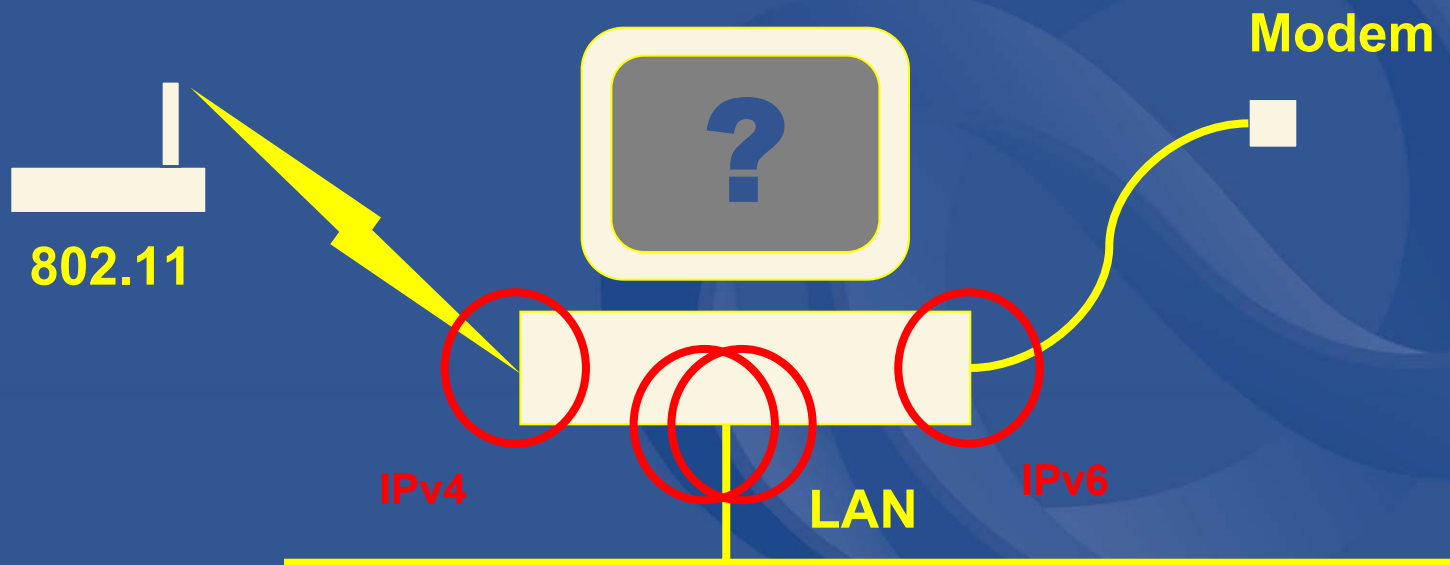
Is "my" Address permanent?

- No - Customer Addresses often change
  - Dialup Addresses are "dynamic"…

ISP

132.234.250.30

Is "my" Address unique?

- Not necessarily…
  - Public IP Address = unique
  - Private* IP Address = non-unique

ISP

202.12.0.129

NAT / firewall

192.168.0.142

192.168.0.0/24
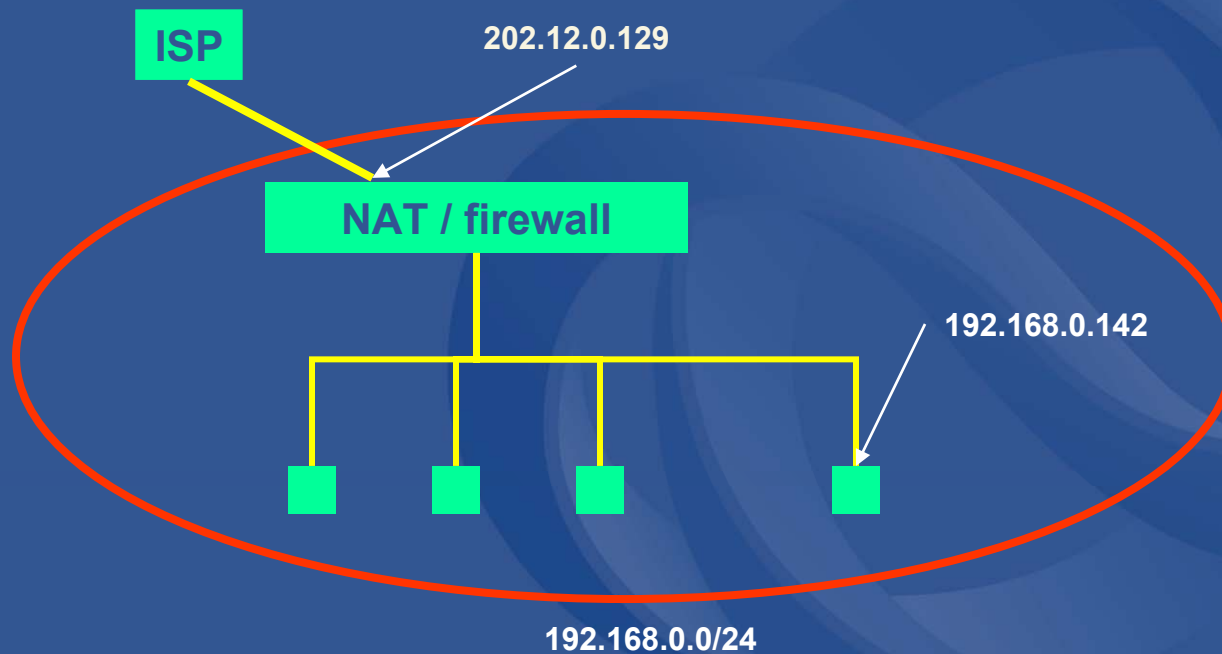
* RFC 1918

History of IP Address Management

Global Routing Table: '88 - '92
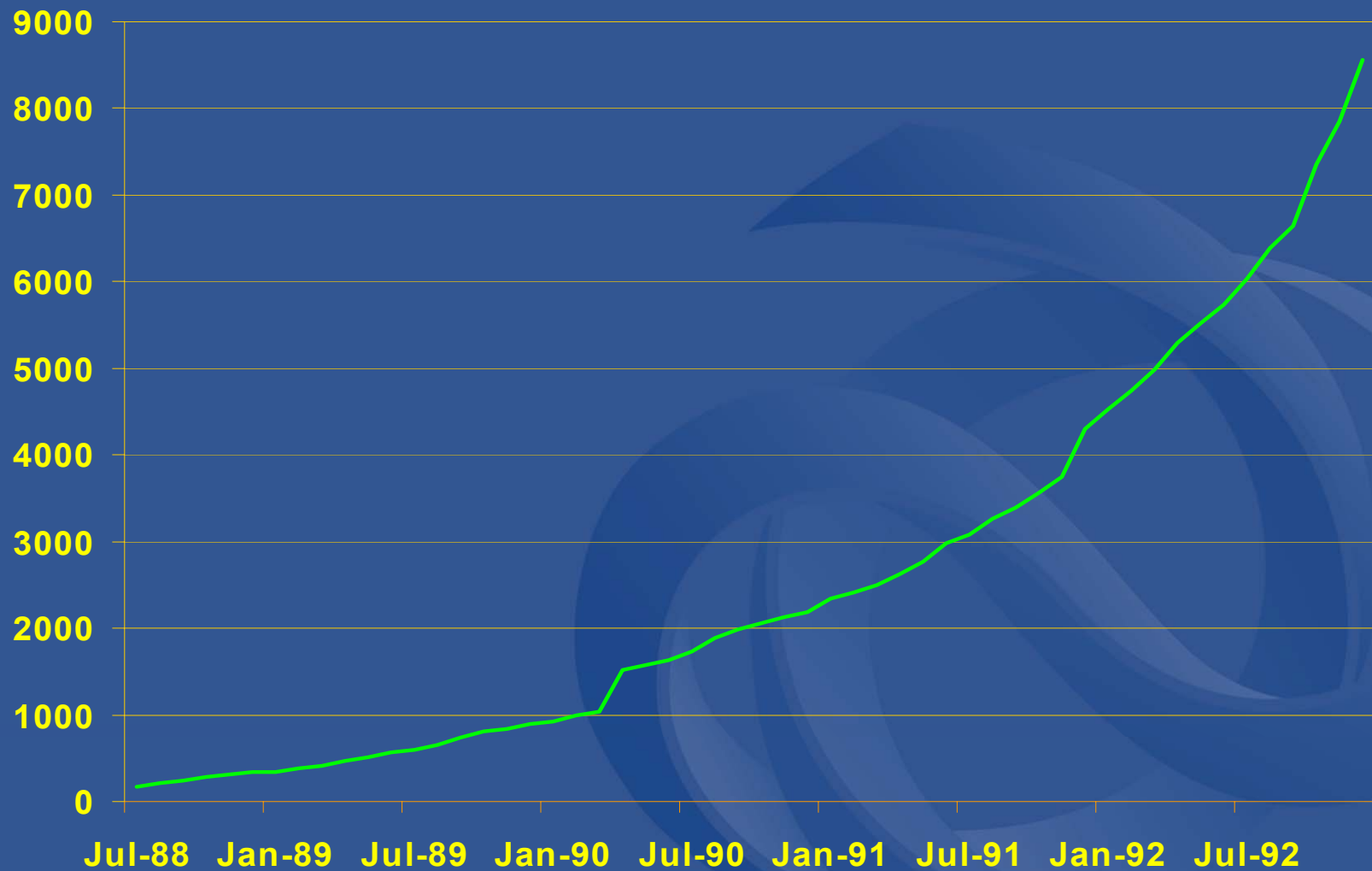
Early Address Management

- Early 1990's: Internet scaling problems
- Address depletion
  - due to classful architecture
  - 3 choices: A, B or C
- Routing table overload
  - Due to lack of route aggregation
- Internet widely projected to fail
  - Growth would stop by mid-'90s
  - Urgent measures required
  - Action taken by IETF / Internet community

Evolution of Address Management

- 1993: Development of "CIDR"
  - Addressed both technical problems
  - Moved from "classful" to "classless"
- Address depletion
  - Through more accurate assignment
- Routing table overload
  - Through Address space aggregation

Evolution of Address Policy

- RFC 1366 (1992)
  - Described the "growth of the Internet and its increasing globalization"
  - Additional complexity of address management
  - Set out the basis for a <u>regionally distributed Internet registry system</u>

- 1990s - establishment of RIRs
  - APNIC, ARIN, RIPE NCC (LACNIC later)
  - Regional open processes
  - Cooperative policy development
  - Industry self-regulatory model

Address Management Today

About APNIC

- Regional Internet Registry for the Asia Pacific
  - 850 ISP members in 46 economies
  - 6 National Internet Registries
  - Established in 1993
- Non-profit service organisation
  - IP address allocation and registration
  - Training and education
  - Infrastructure activity: Root servers
- Community
  - Open Policy Meetings
  - Co-founder of APRICOT
  - ISOC member - Platinum programme
  - ITU Sector Member

IP Address Management

Address management objectives

Conservation

- Efficient use of resources
- Based on demonstrated need

Aggregation

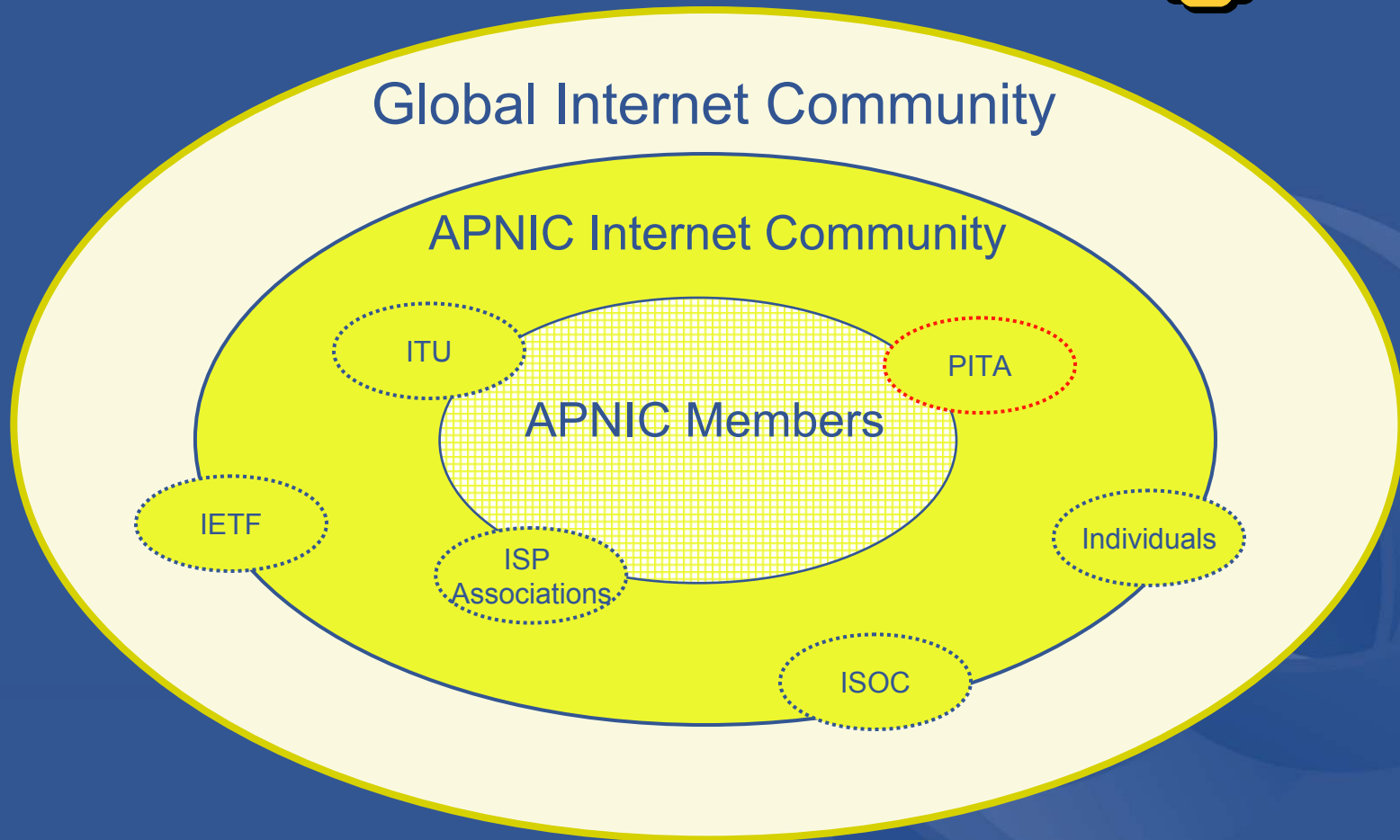- Limit routing table growth
- Support provider-based routing

Registration

- Ensure uniqueness
- Facilitate trouble shooting

Policy Development
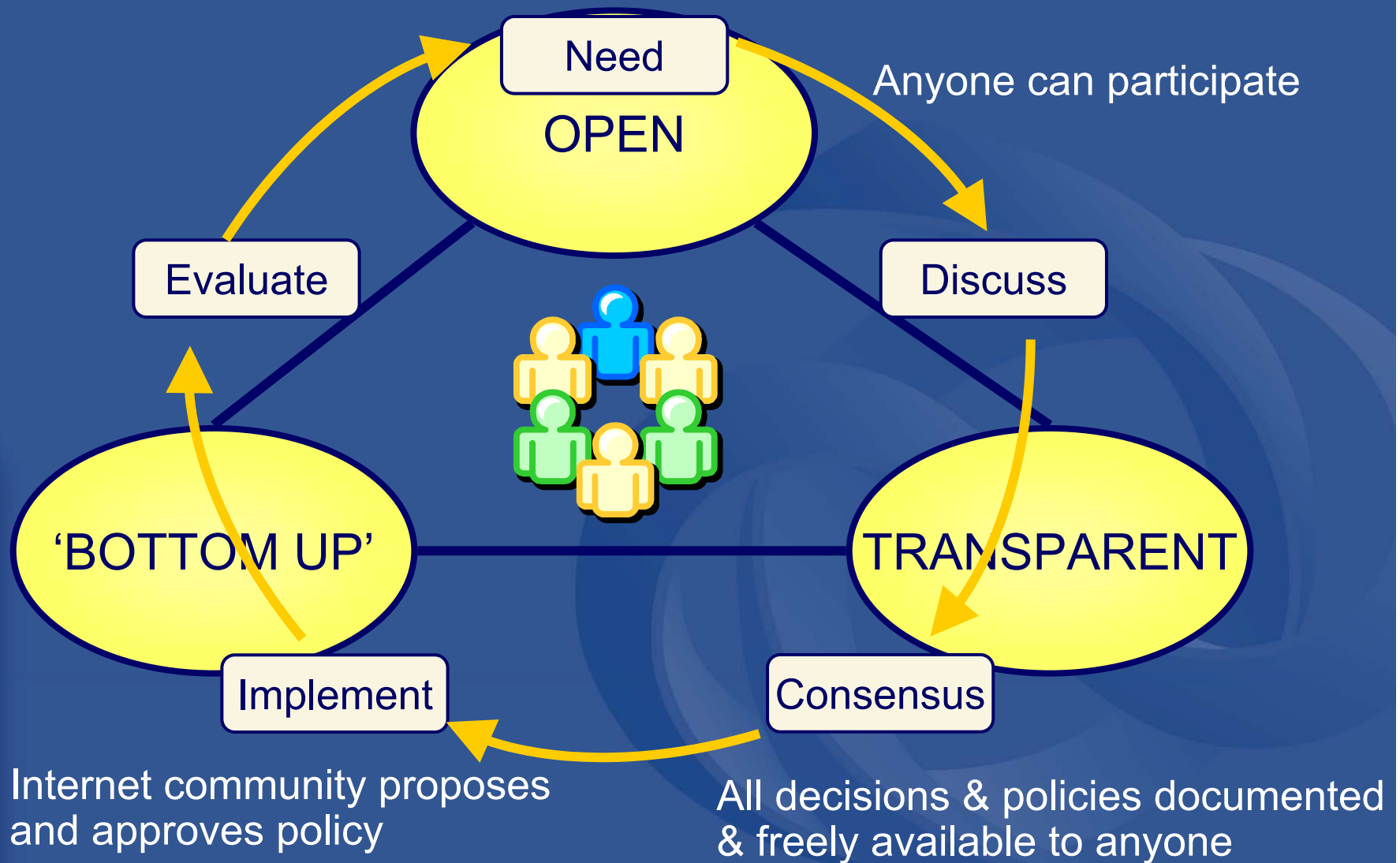
- Industry self-regulatory processes
  - Open to all interested parties
  - Established over 10 years
  - Responsive to industry needs
  - Facilitated by RIR staff
- Policy implementation
  - RIR processes
  - ISPs and other affected parties

"Internet Community"

Global Internet Community

APNIC Internet Community

ITU

PITA

APNIC Members

IETF

ISP Associations

Individuals

ISOC

Policy development
- Industry self-regulation

Need

OPEN

Anyone can participate

Evaluate

Discuss

'BOTTOM UP'

TRANSPARENT

Implement

Consensus

Internet community proposes
and approves policy

All decisions & policies documented
& freely available to anyone

Resource Allocation Statistics

Global IPv4 Delegations

ARIN 6%

APNIC 4%

RIPE NCC 4%

Unallocated 30%

"Special purpose" 14%

Other Orgs (pre-RIR) 42%
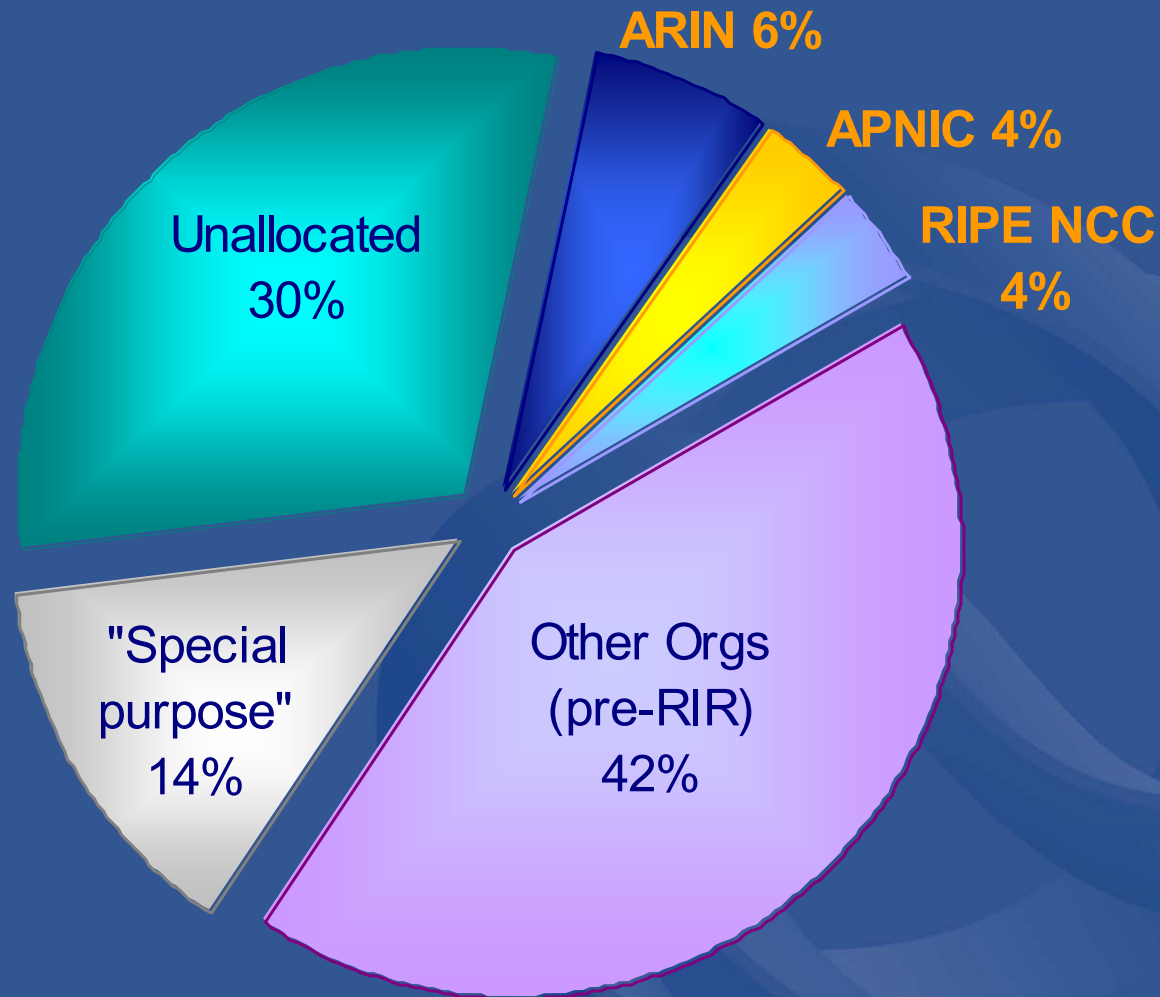
IPv4 allocations from RIRs to LIRs/ISPs - Yearly comparison
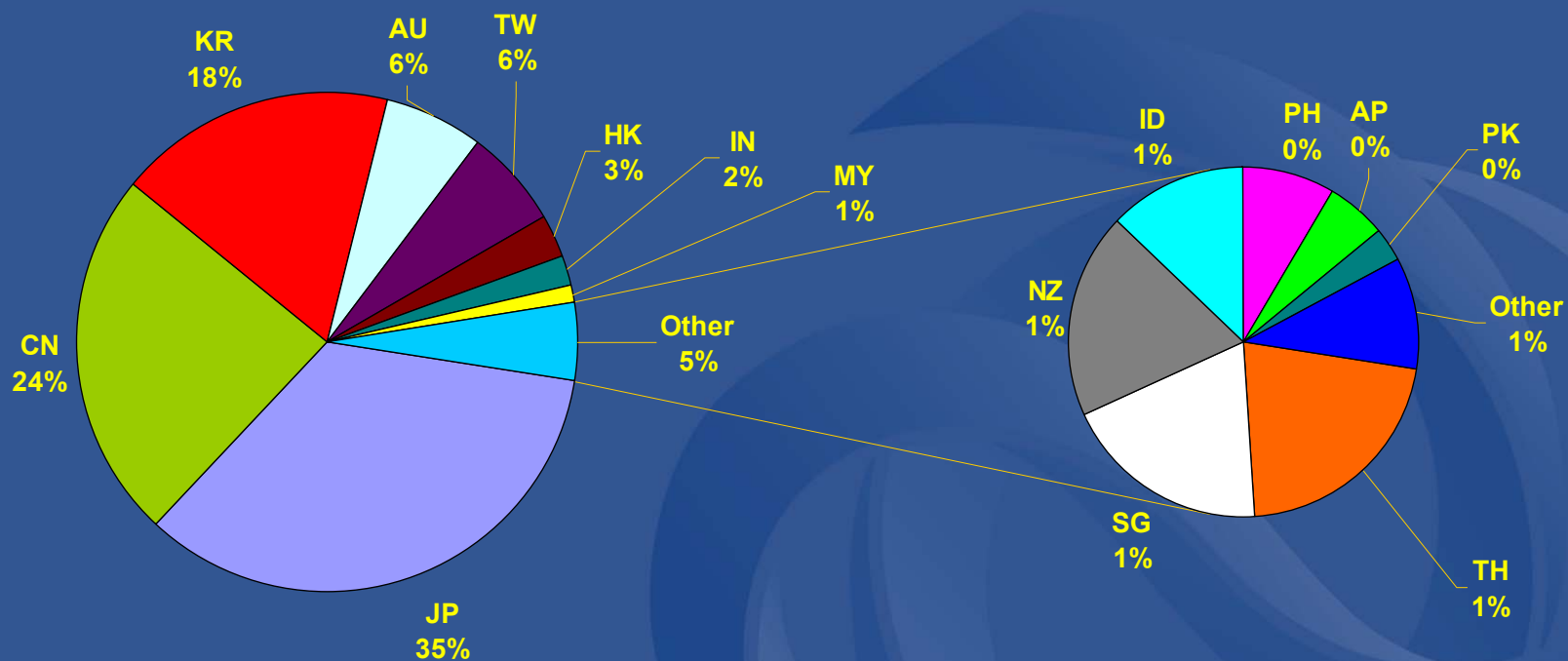

As of 30 June 2003

IPv4 Distribution by economy in APNIC

Pacific Is- cumulative Address distribution

IPv4 Addresses

Legend:
- WS
- VU
- TV
- TO
- SB
- PW
- PG
- PF
- NR
- NC
- KI
- GU
- FJ
- CK
- AS

Y-axis: 0, 20,000, 40,000, 60,000, 80,000, 100,000, 120,000, 140,000, 160,000

X-axis: Jan-96, Jan-97, Jan-98, Jan-99, Jan-00, Jan-01, Jan-02, Jan-03, Nov-03

APNIC

Asia Pacific Network Information Centre
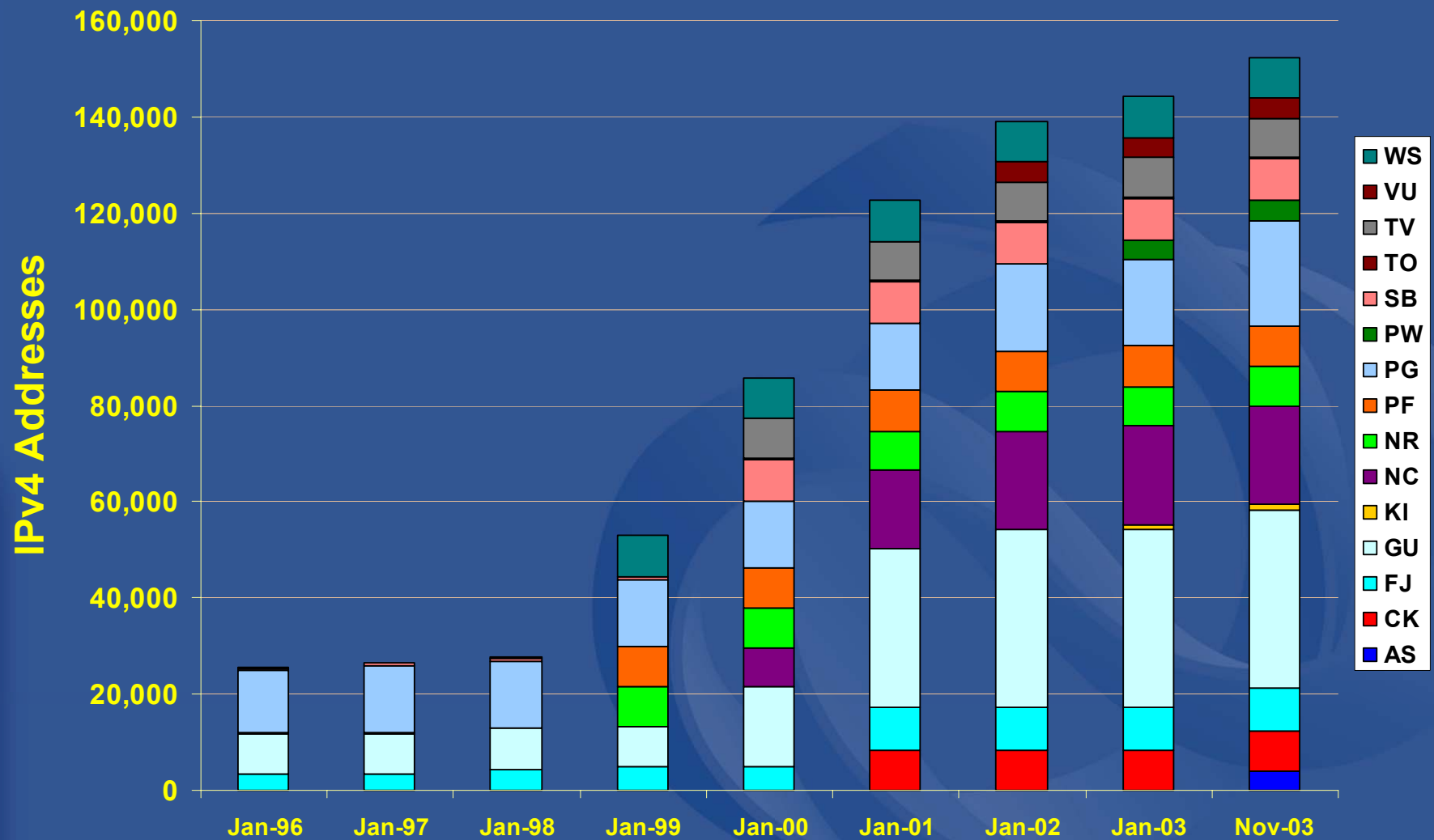
Last Update 19 Nov 2003

IPv6 allocations from RIRs to LIRs/ISPs - Yearly comparison

Legend:
- APNIC
- ARIN
- LACNIC
- RIPE NCC

1999 2000 2001 2002 2003
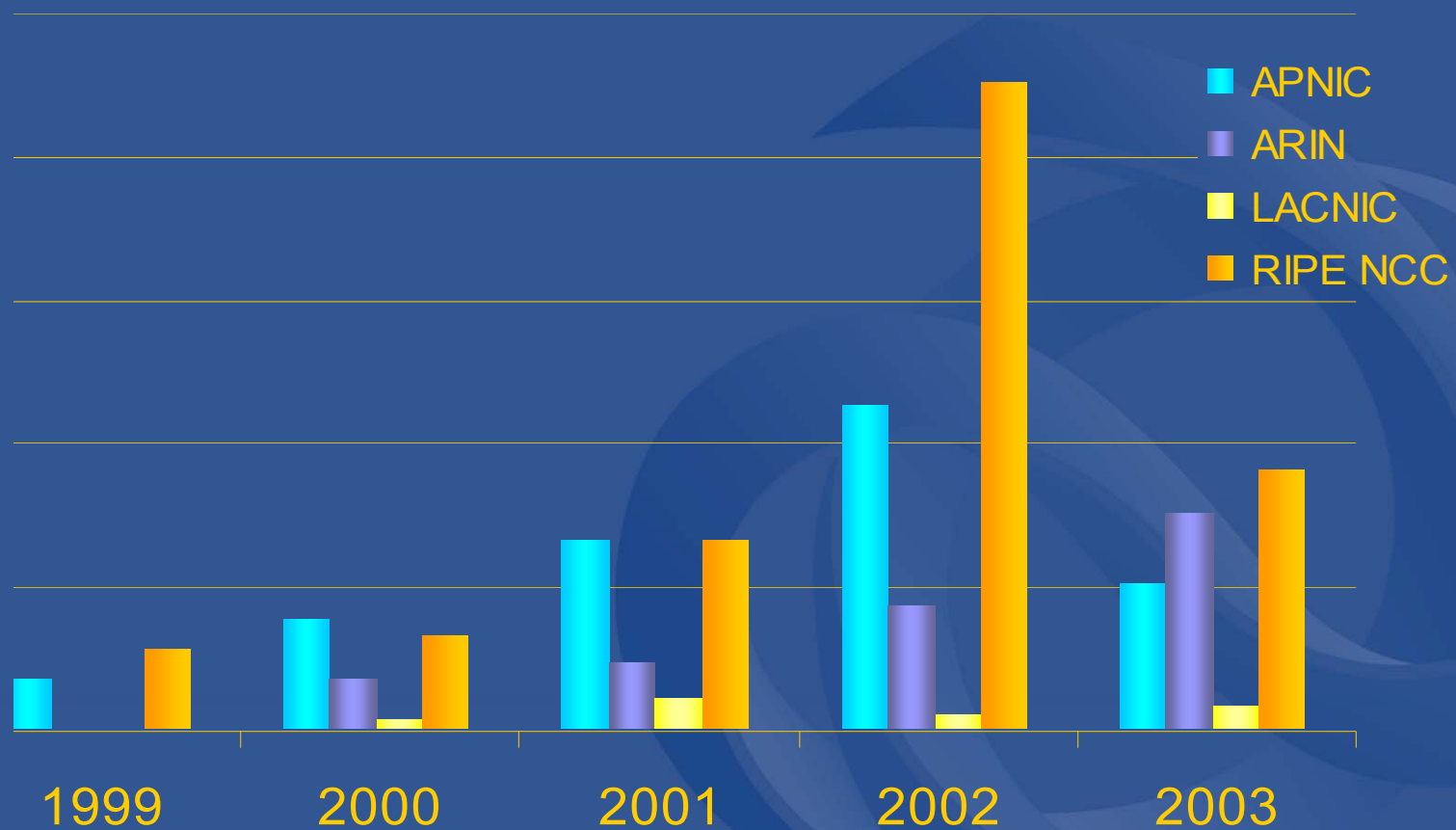
Conclusions

- IP Addresses
  - Infrastructure Addresses
  - Interface identifiers
  - Very limited use for other purposes
    - NOT useful as generic digital IDs
- IP Address management
  - Result of 20 year evolution on the Internet
  - Supported Internet growth to date
  - Stable well-understood system
  - Open to all interested participants

APNIC

Thank you

save@apnic.net

Come to the APNIC meeting!

17th APNIC Open Policy Meeting
23-27 February 2004   Kuala Lumpur - Malaysia

Next meeting in conjunction with

APRICOT 2004

Kuala Lumpur, Malaysia, 18-27 February 2004

2nd round Fellowship application: 11-17 Jan 04

- Participate in policy development
- Attend workshops, tutorials & presentations
- Exchange knowledge and information with peers
- Stay abreast with developments in the Internet
- View multicast online
- Provide your input in matters important to you

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