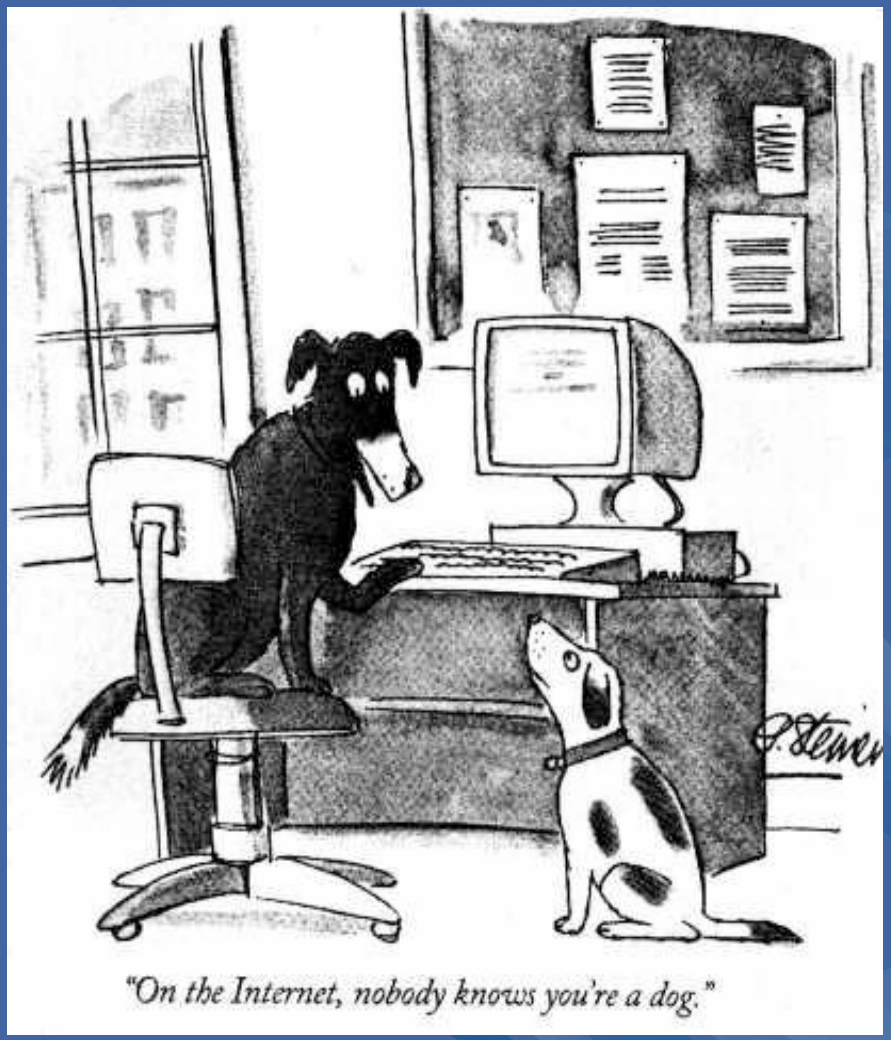
IP Addresses, Addressing and Address Management

Paul Wilson
APNIC

Contents

- Introduction to IP addresses
- Introduction to RIRs
- IP address management
- IPv6 management
- About 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)

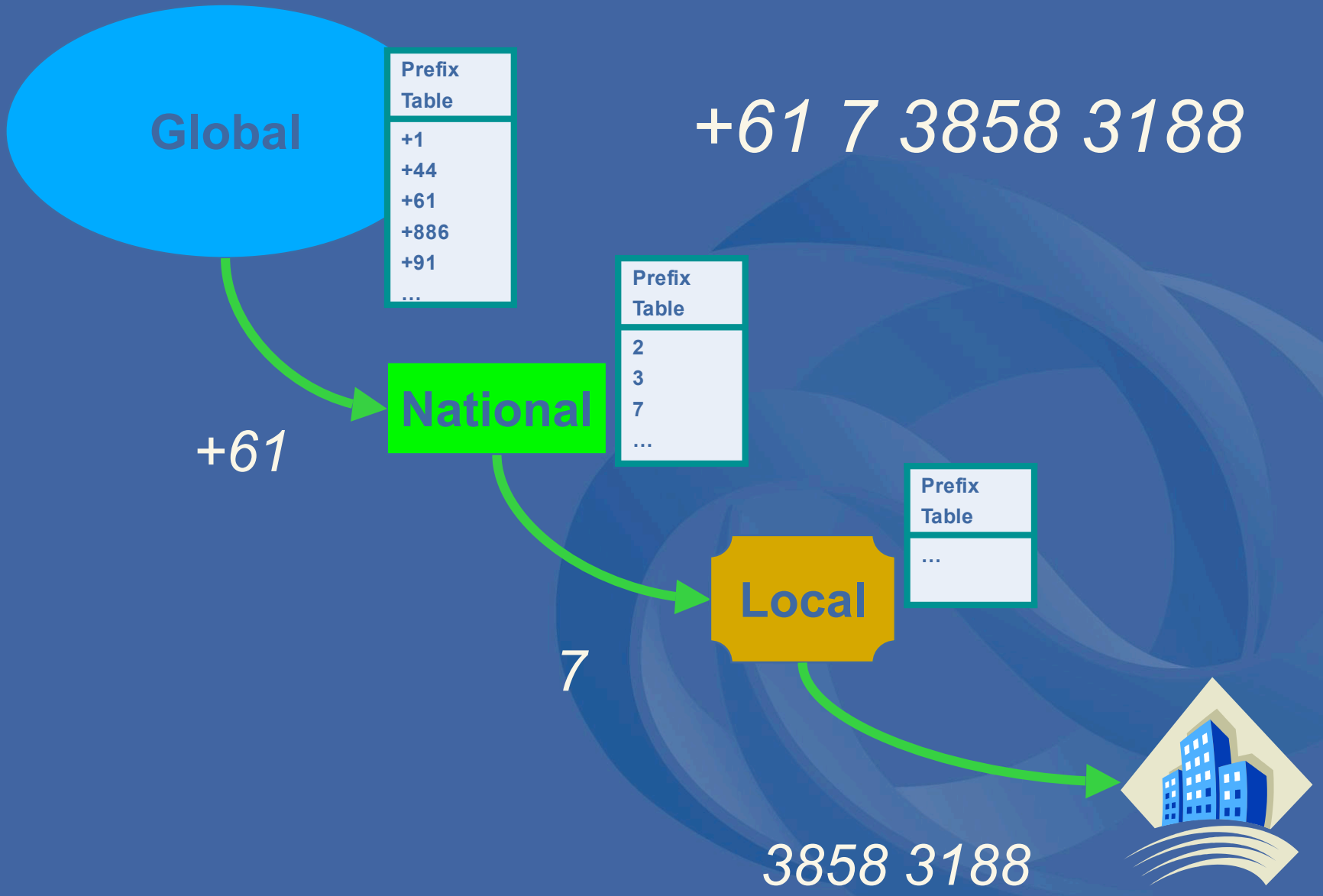
“On the Internet…”
you are nothing but an IP Address!

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…
  - +61 7 3858 3188
  - www.apnic.net
  - pwilson@apnic.net
  - 202.12.29.142

Telephone Network Routing

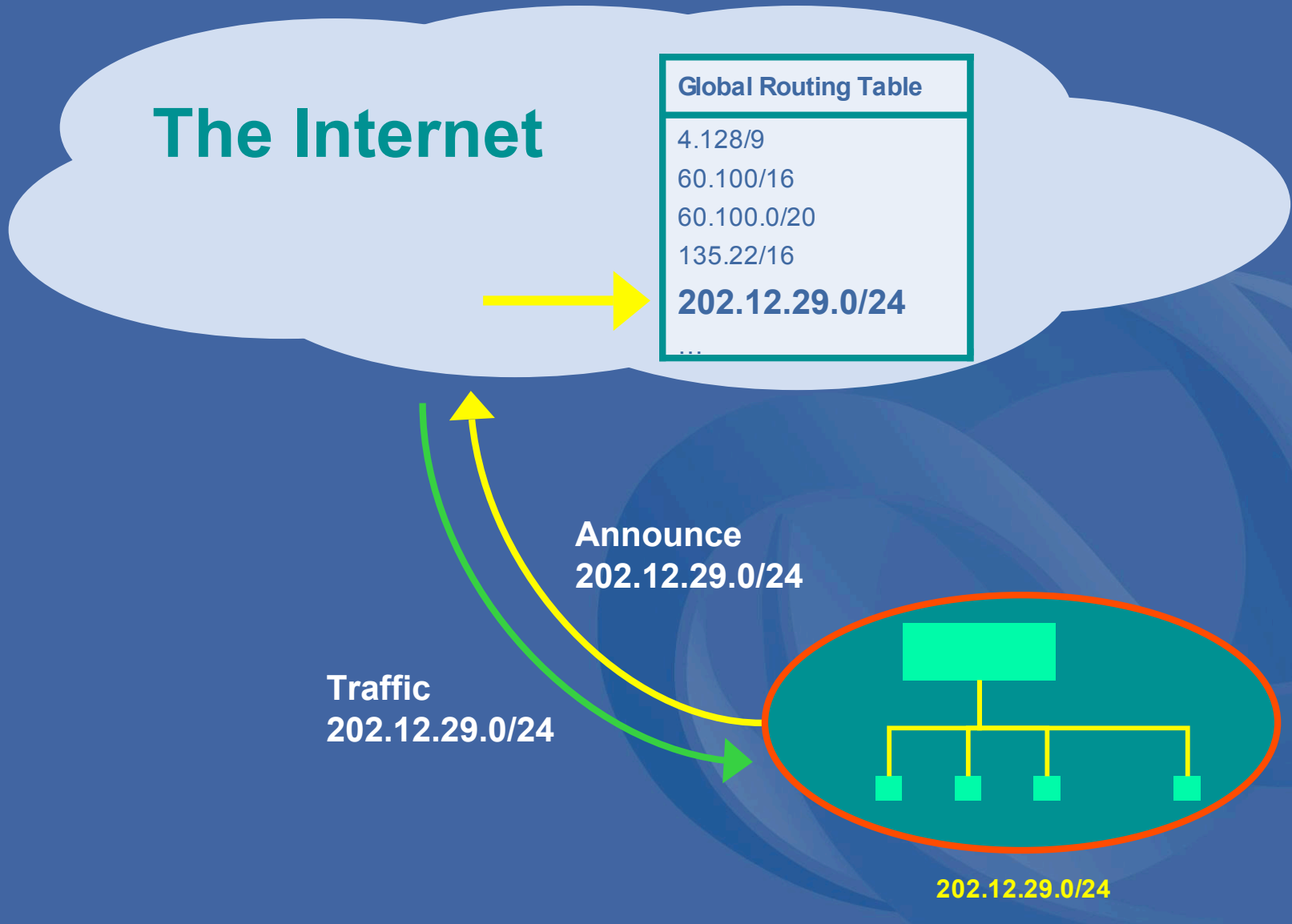


What is an IP Address?

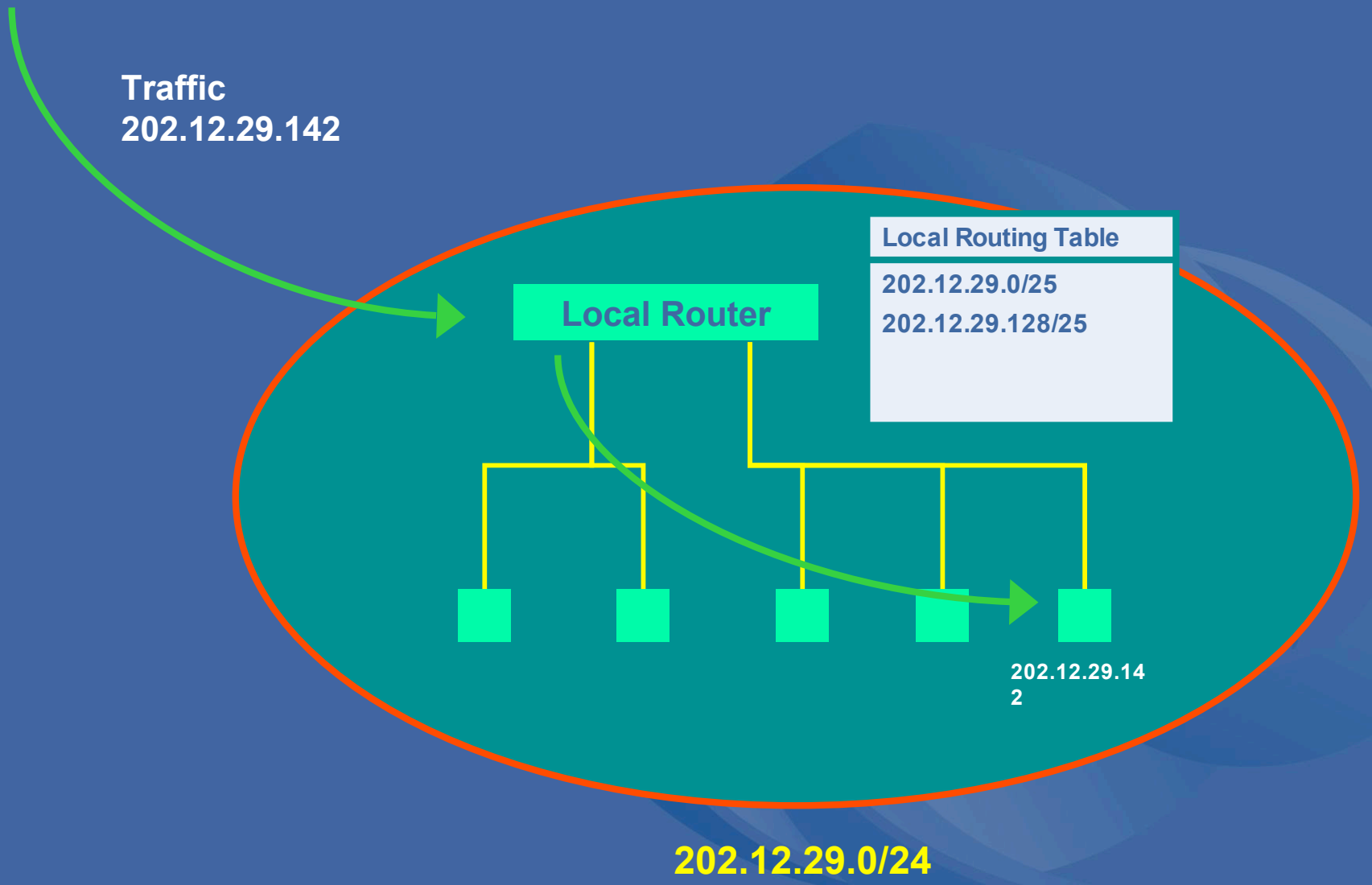
- *Internet identifier including information about how to reach a network location*
  - (via the Internet routing system)
- IPv4: 32-bit* number
  - 4 billion different host addresses
  - E.g. 202.12.29.142
- IPv6: 128-bit* number
  - 16 billion billion network addresses
  - E.g. 2001:0400:3c00::

* bit = binary digit

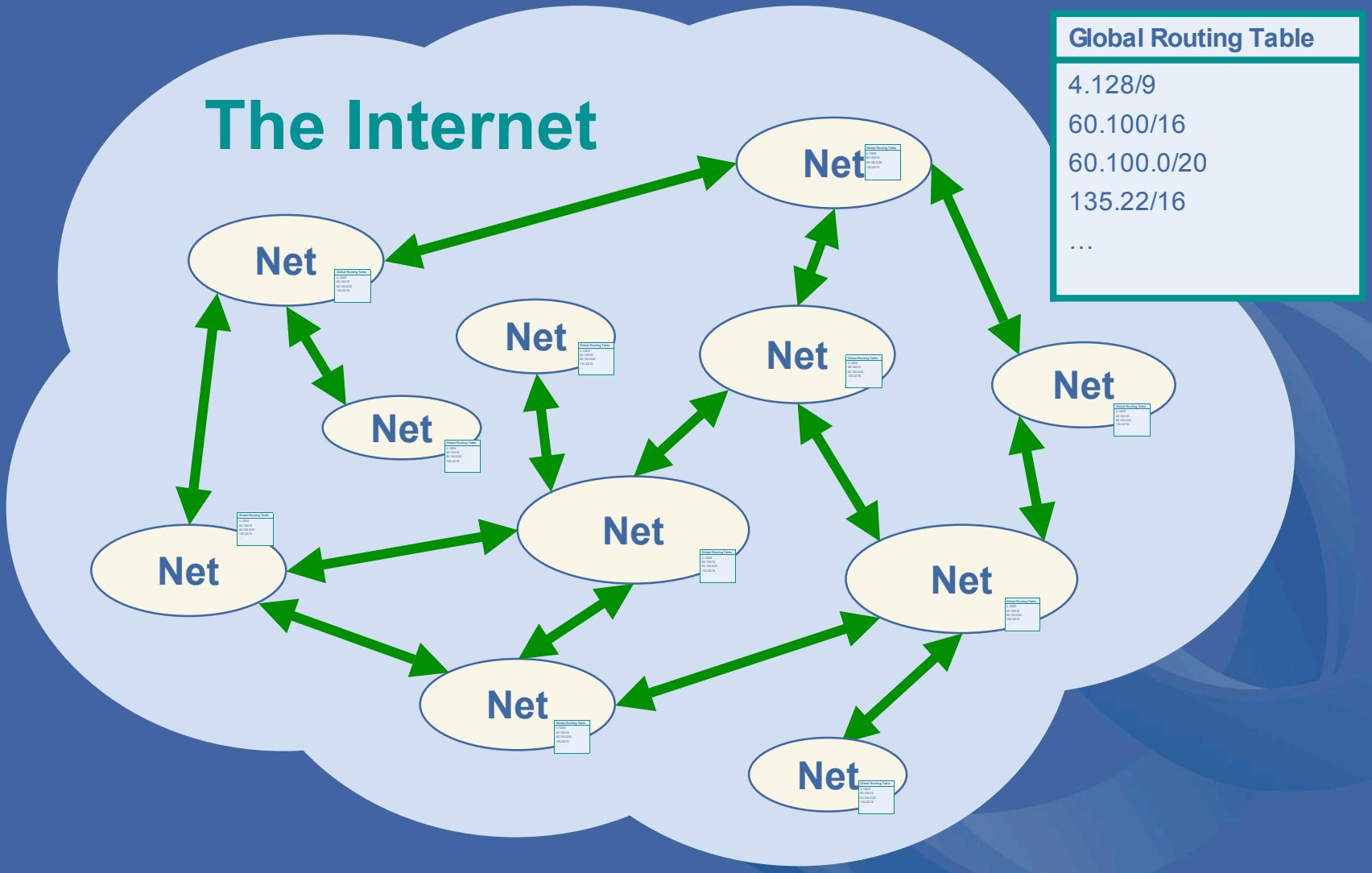
Internet Address Routing



Internet Address Routing



Global Internet Routing

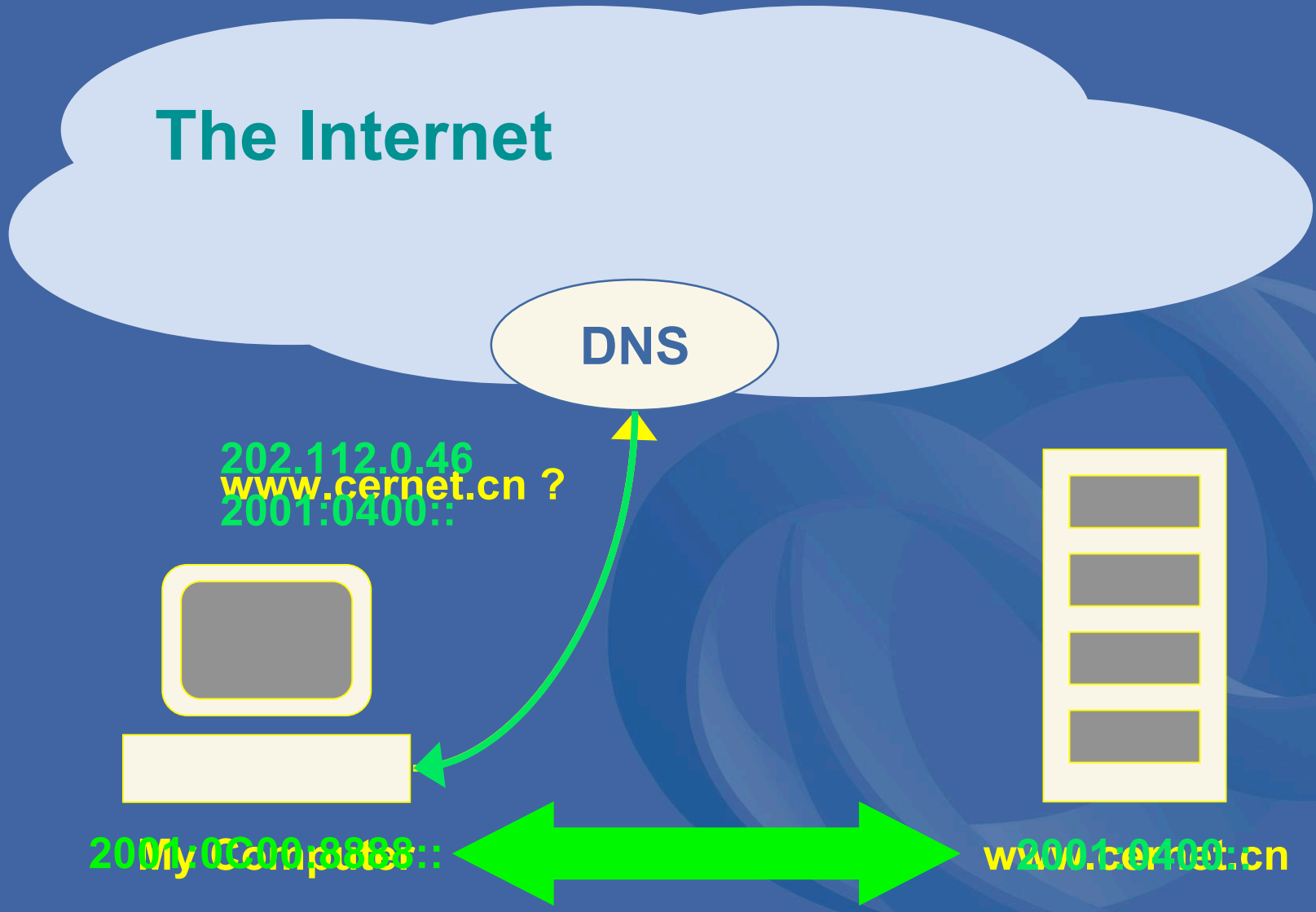


What else is an IP Address?

- Internet infrastructure addresses
- Uniquely assigned to infrastructure elements
- Globally visible to the entire Internet
- A finite “Common Resource”
- Never “owned” by address users

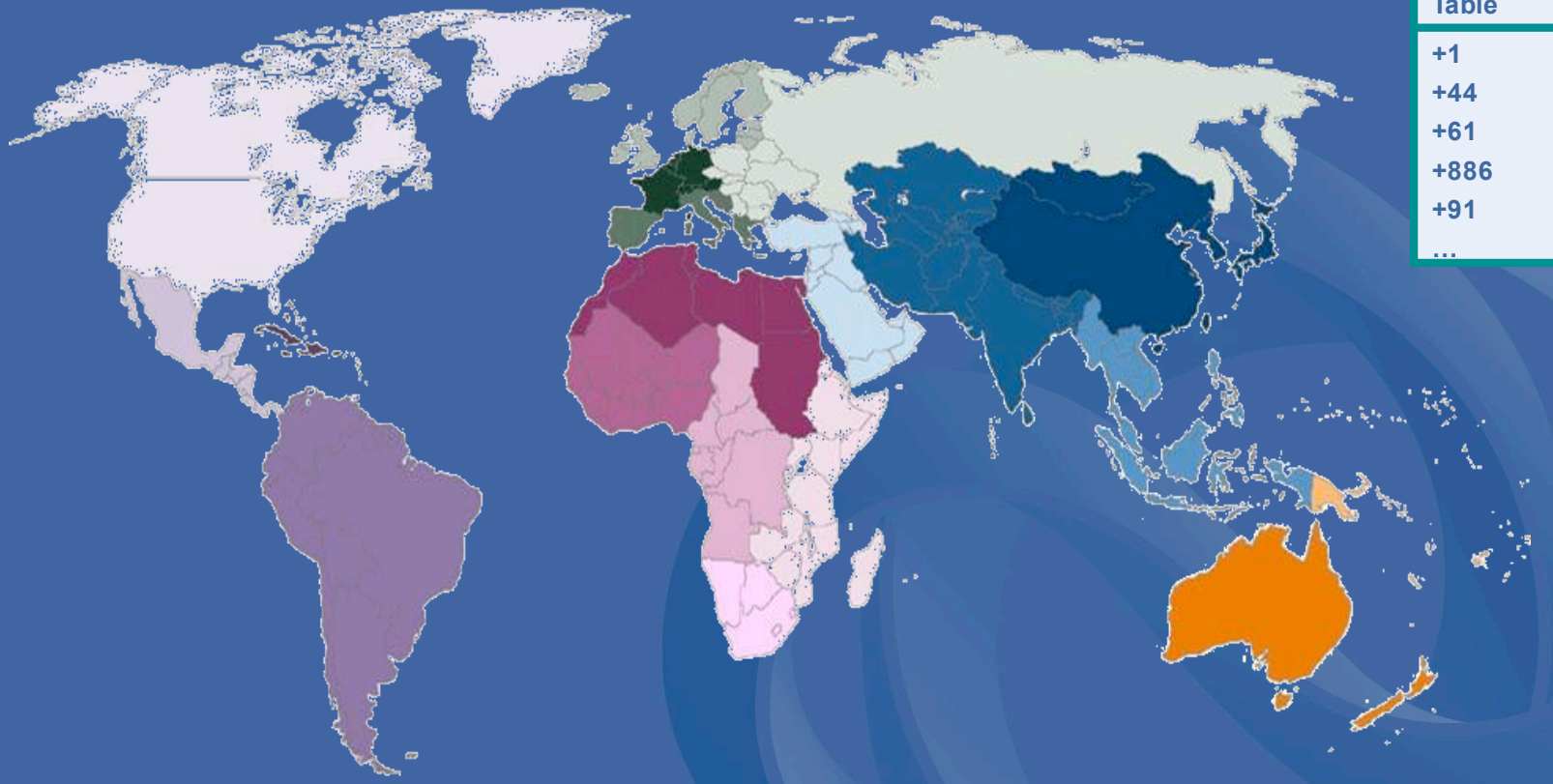
- Not dependent upon the DNS

IP addresses are not domain names…



Geography of the Internet

Geography

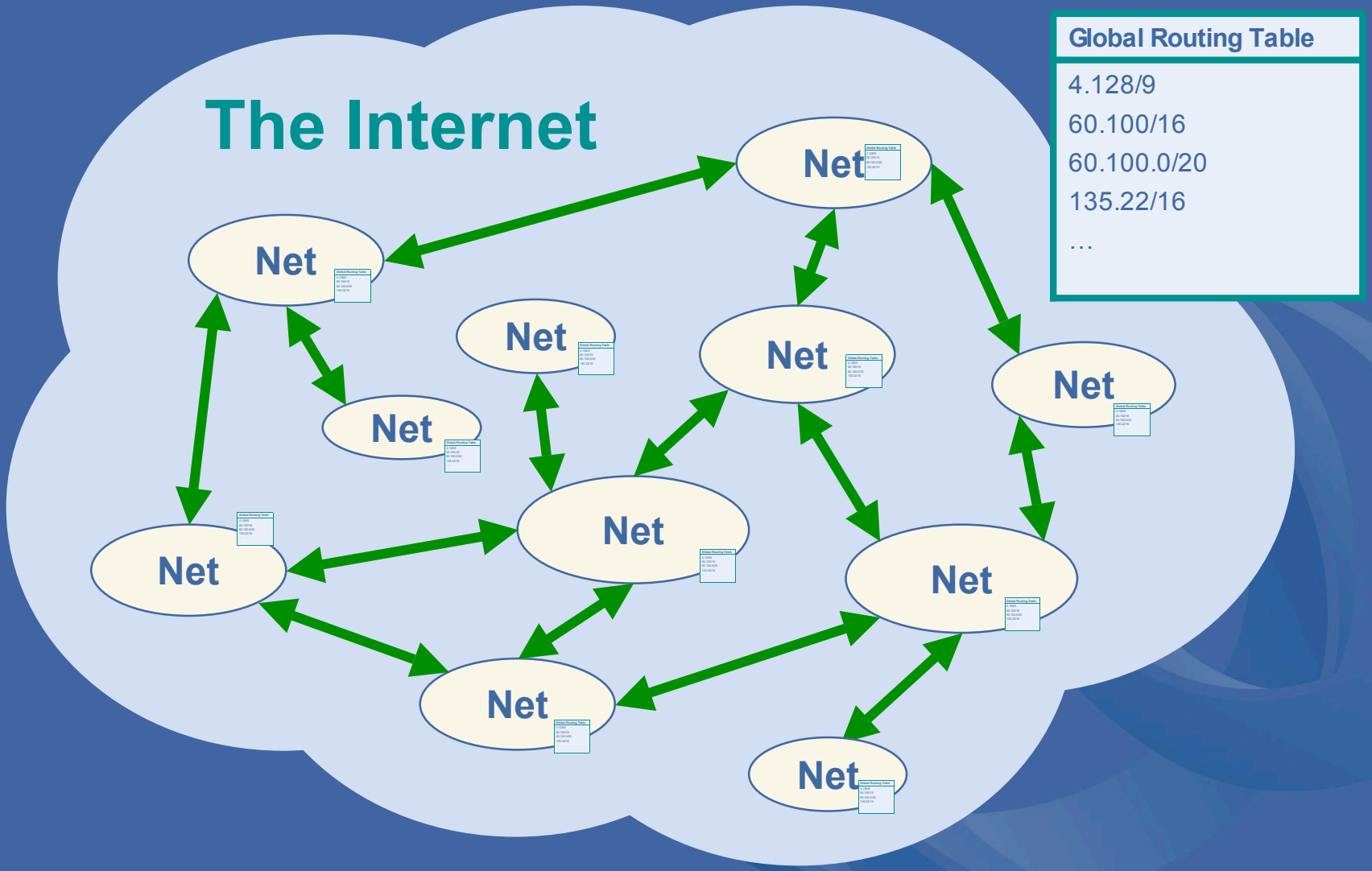


Prefix Table
+1
+44
+61
+886
+91
…

Asia Pacific Network Information Centre

APNIC

Internet Geography



Internet Geography

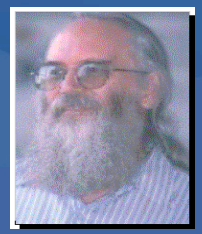
- "Nations" of the Internet are networks
  - "Frontiers" are border routers
  - "Treaties" are peering relationships between networks
- It's a very dynamic world…
  - New nations are formed daily
  - New borders are established hourly
  - Routing tables change by the minute
  - Driven almost entirely by industry
  - No centralised control
- Very different from "traditional" networks
  - Telephony for example

Regional Internet Registries

The early years: 1981 – 1992

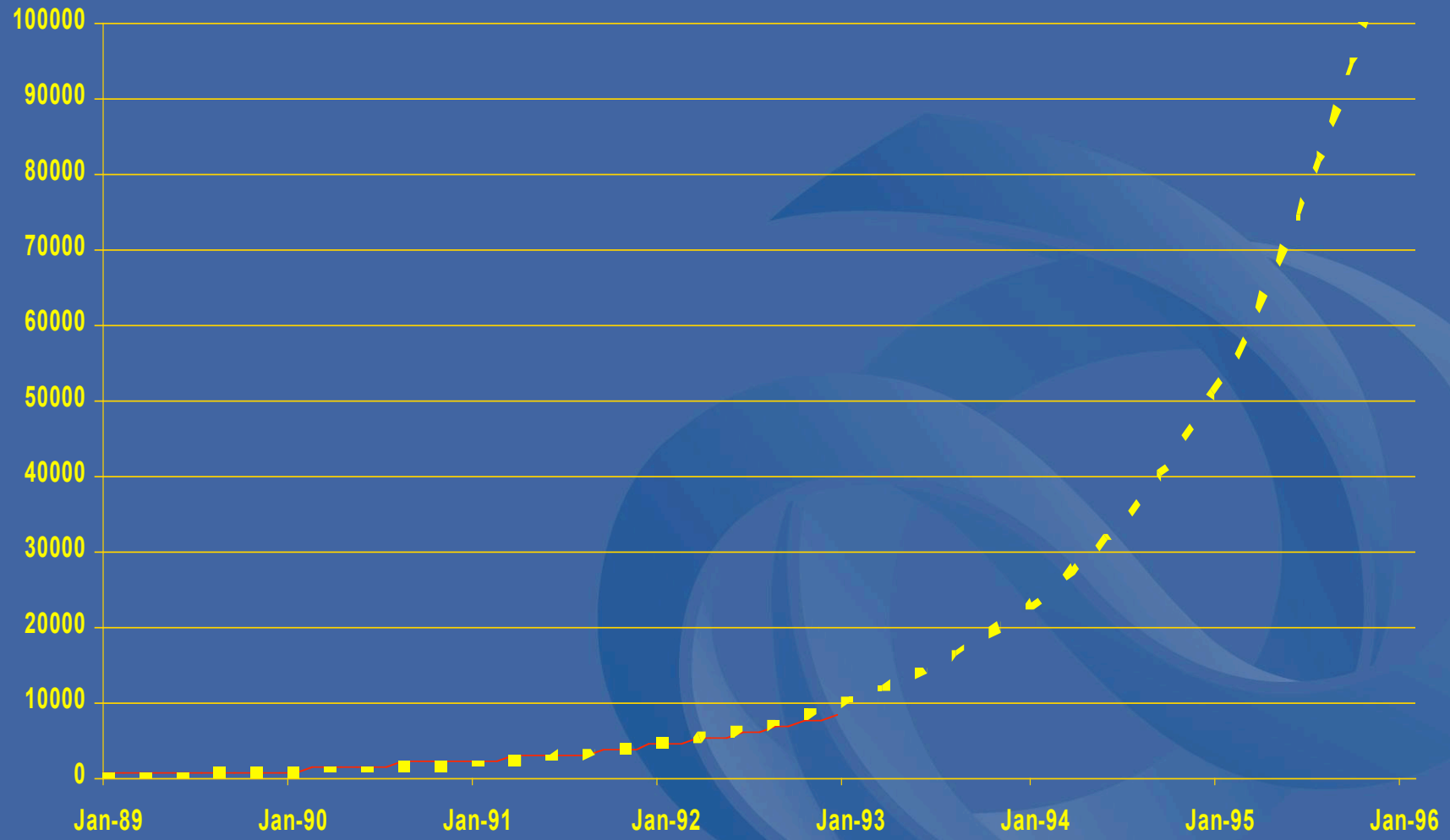
1981:

"The assignment of numbers is also handled by Jon. If you are developing a protocol or application that will require the use of a link, socket, port, protocol, or network number **please contact Jon to receive a number assignment**." (RFC 790)

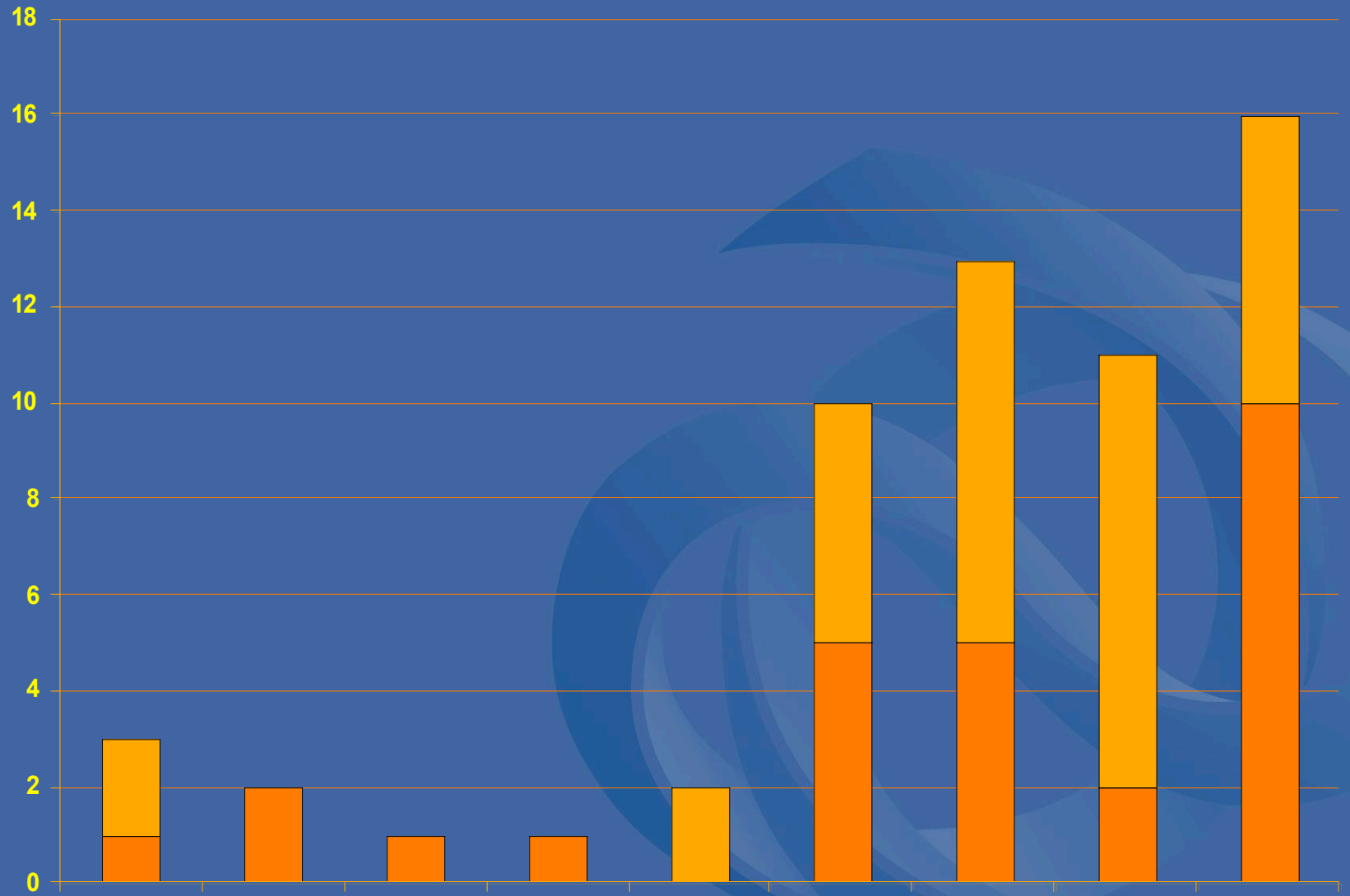


Global routing table: ’88 – ’92

Global routing table: Projection



Global Allocations: ’83 – ’91



The boom years: 1992 – 2001

1992:

"It has become clear that … these problems are likely to become critical within the next one to three years." (RFC1366)

"…it is [now] desirable to consider delegating the registration function to an organization in each of those geographic areas." (RFC 1338)

Recent years: 2002 – 2005

2004:

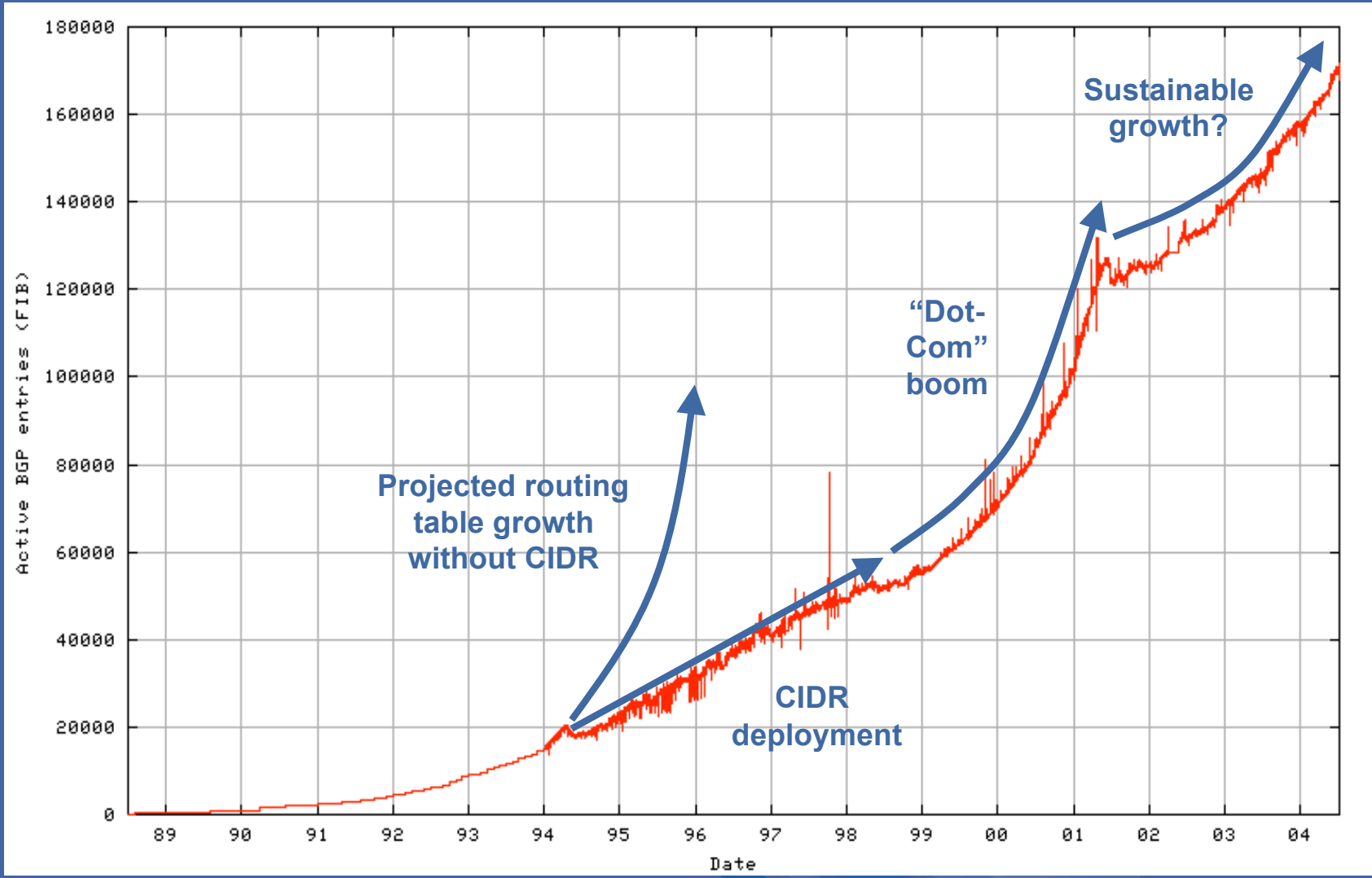
Number Resource Organisation

NRO

What are RIRs?

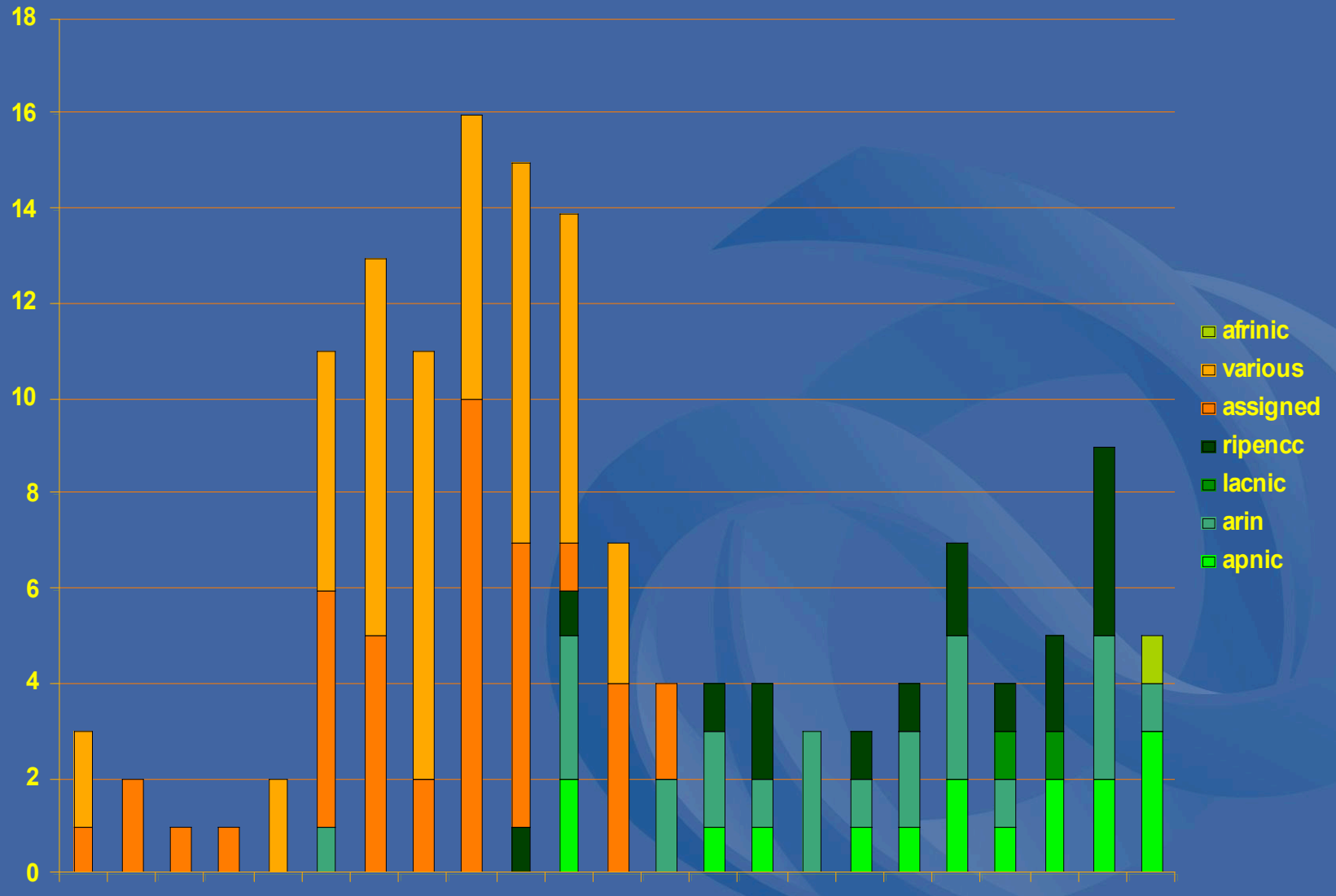
- Industry self-regulatory structures
  - Open membership-based bodies
  - Representative of ISPs globally
  - Service organisations
  - Non-profit, neutral and independent
  - 100% self-funded by membership
- First established in early 1990's
  - Voluntarily by consensus of community
  - To satisfy emerging technical/admin needs
- In the "Internet Tradition"
  - Consensus-based, open and transparent

Global routing table



http://bgp.potaroo.net/as1221/bgp-active.html

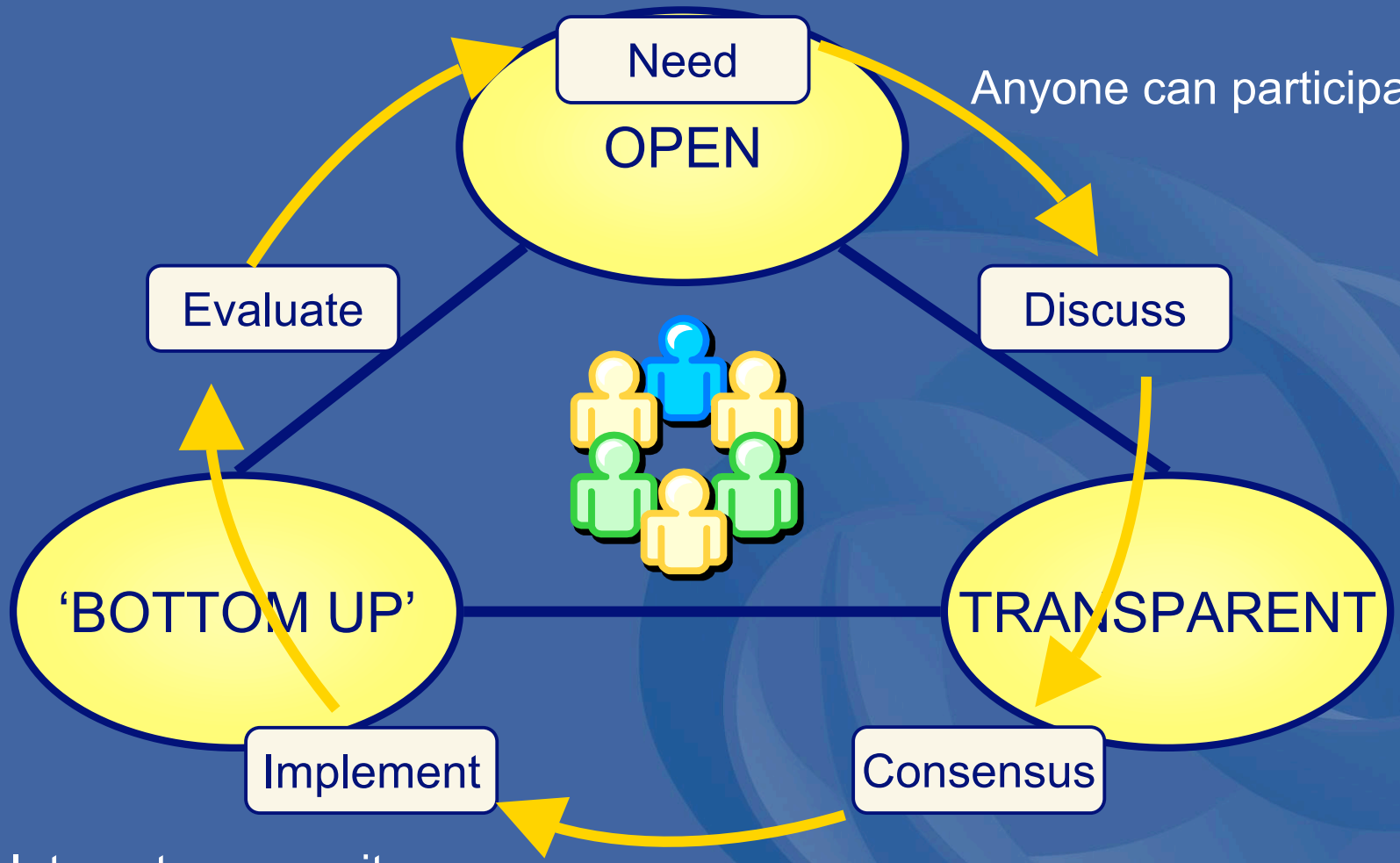
Global allocations



What do RIRs do?

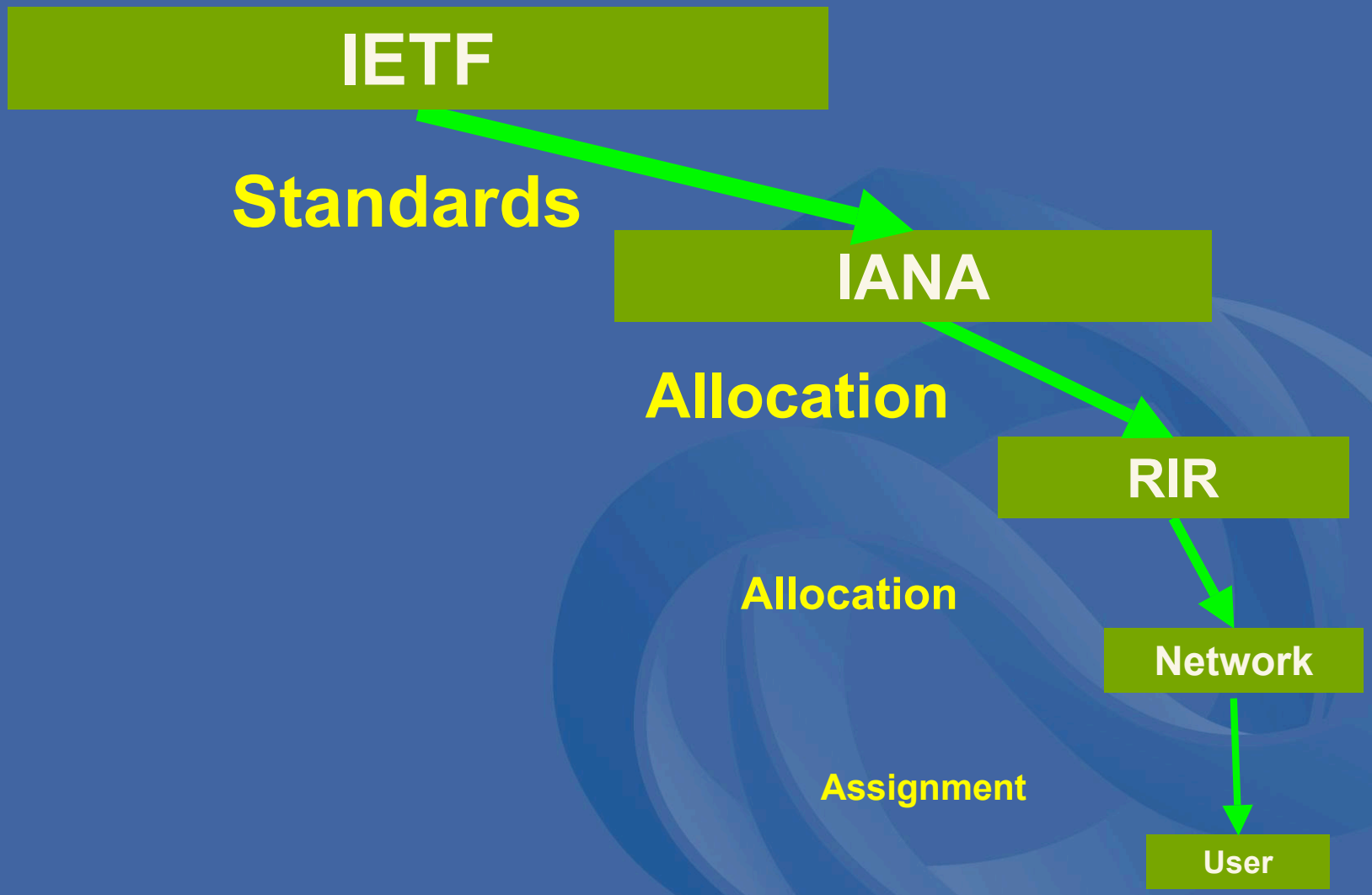
- Internet resource allocation
  - Primarily, IP addresses – IPv4 and IPv6
  - Receive resources from IANA/ICANN, and redistribute to ISPs on a regional basis
  - Registration services (“whois”)
- Policy development and coordination
  - Open Policy Meetings and processes
- Training and outreach
  - Training courses, seminars, conferences…
  - Liaison: IETF, ITU, APT, PITA, APEC…
- Publications
  - Newsletters, reports, web site…

RIR Policy Development Process



RIR Address Management

Where do IP addresses come from?

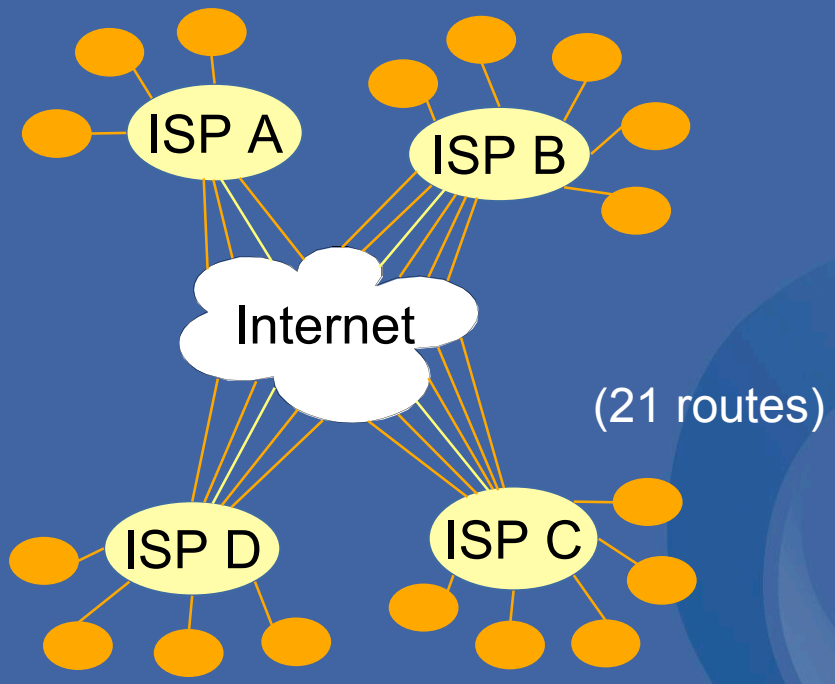


Provider-based address management

- Under CIDR, networks are responsible for control of routing table growth
  - ISP networks receive portable addresses
  - Customer routes are aggregated
- ISP allocations are limited
  - Must justify a certain “minimum allocation” in order to receive address space
- Portable assignments are limited
  - End users cannot easily obtain portable addresses
  - Addresses come from upstream ISP

IP Address Aggregation

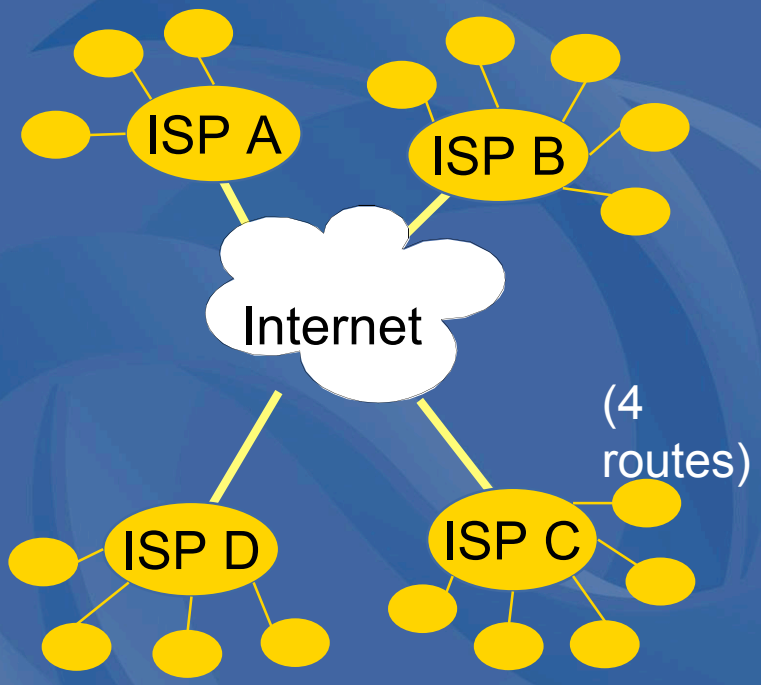
No Aggregation



(21 routes)

(Portable Assignments)

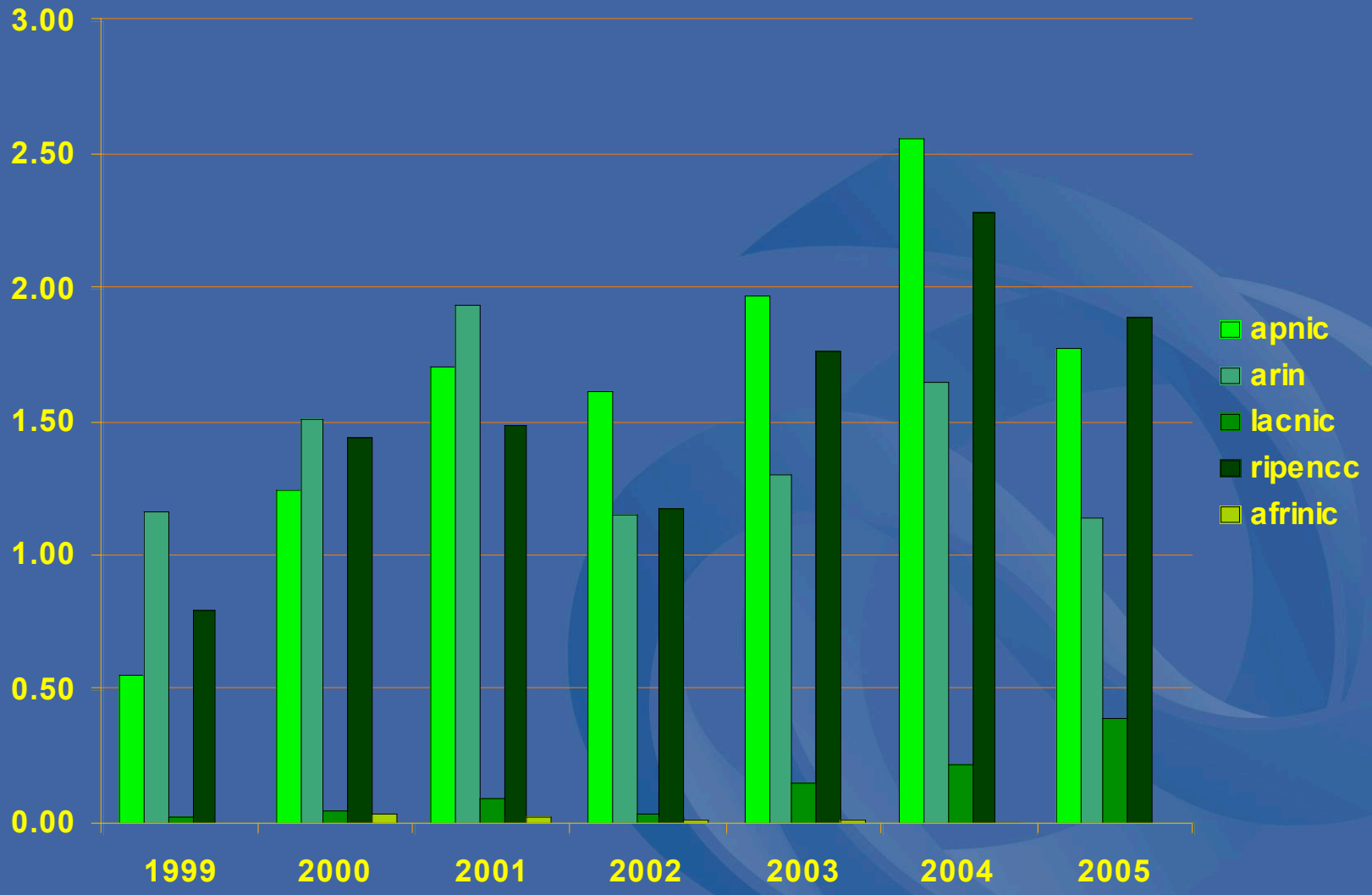
Aggregation



(4 routes)

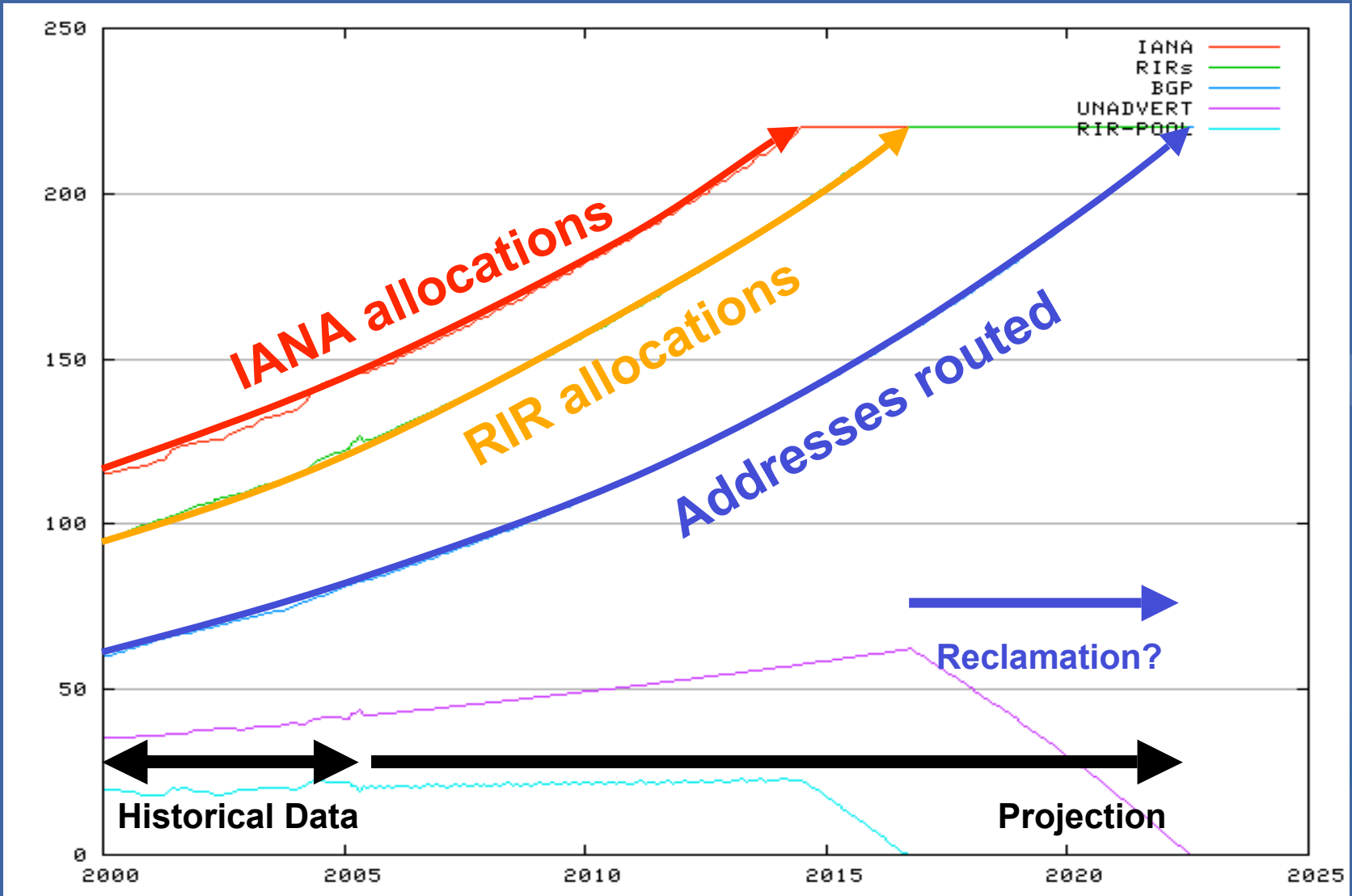
(Non-portable Assignments)

IPv4 Allocations



Why IPv6?

IPv4 lifetime

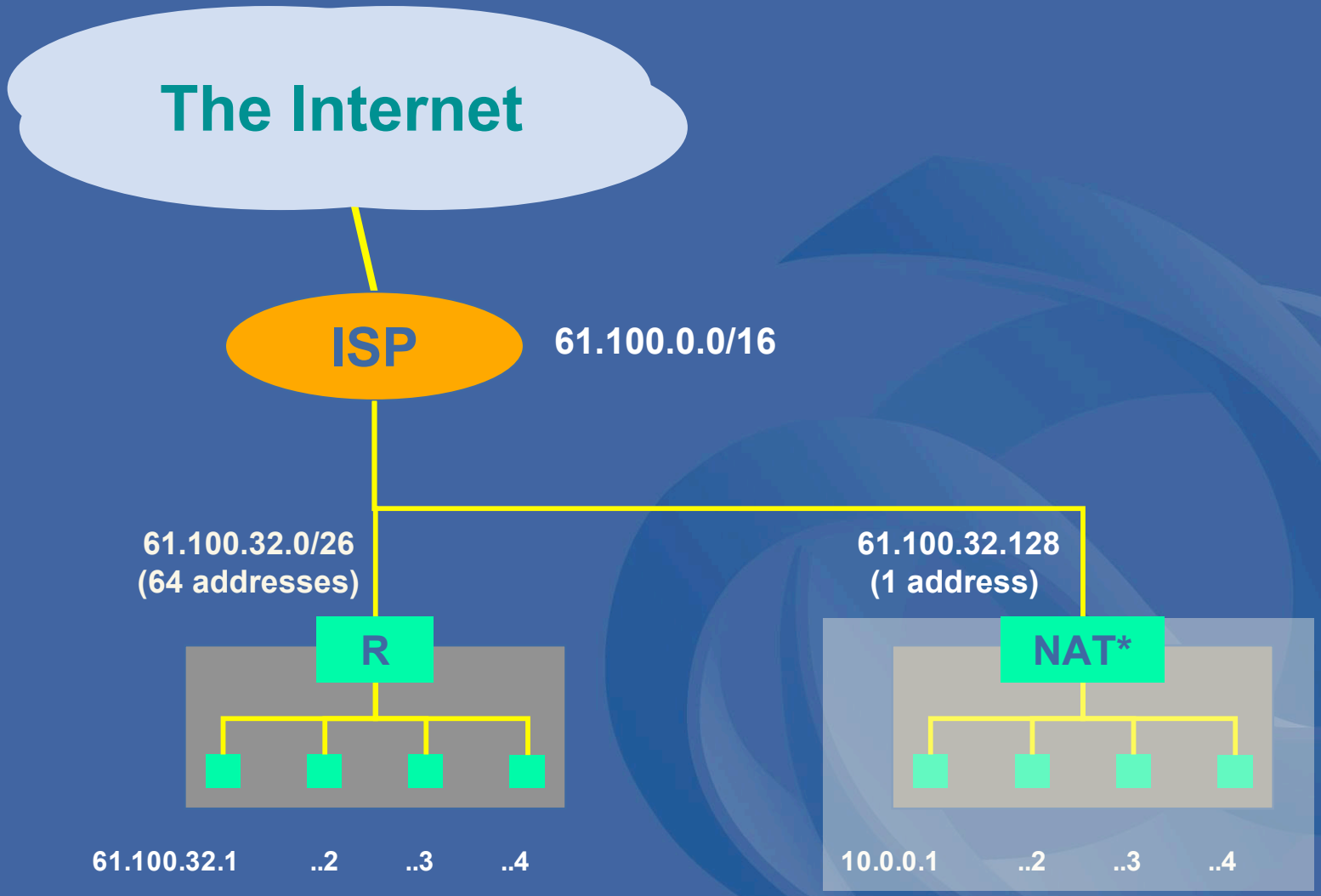


http://bgp.potaroo.net/ipv4

Rationale for IPv6

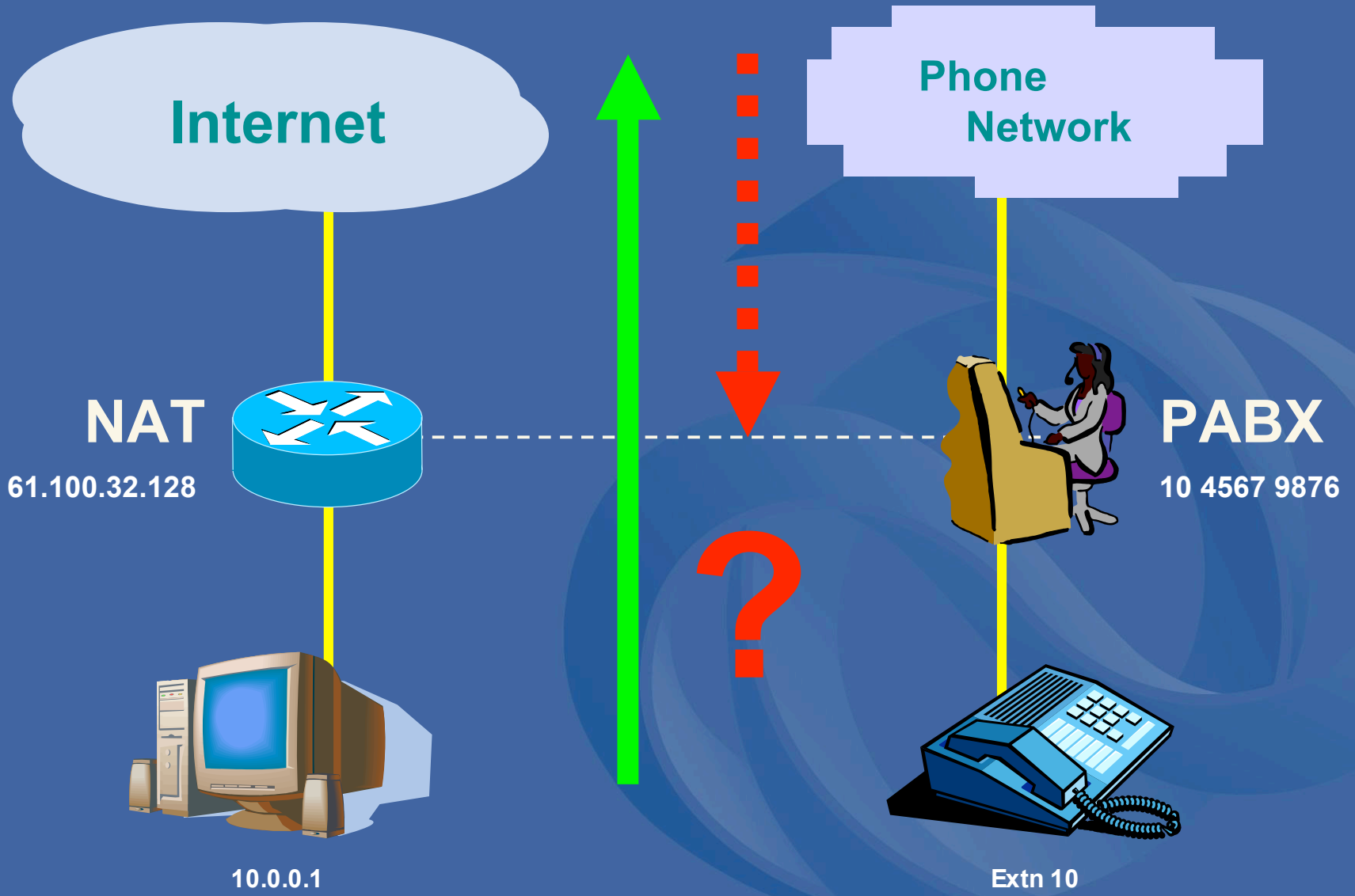
- IPv4 address space consumption
  - Now under 10 years space remaining
  - More if unused addresses can be reclaimed
  - These are today's projections – reality will definitely be different
  - There has to be a replacement
- Loss of "end to end" connectivity
  - Widespread use of NAT due to ISP policies and marketing
  - Additional complexity and performance degradation
  - "Fog on the Internet"

The NAT problem

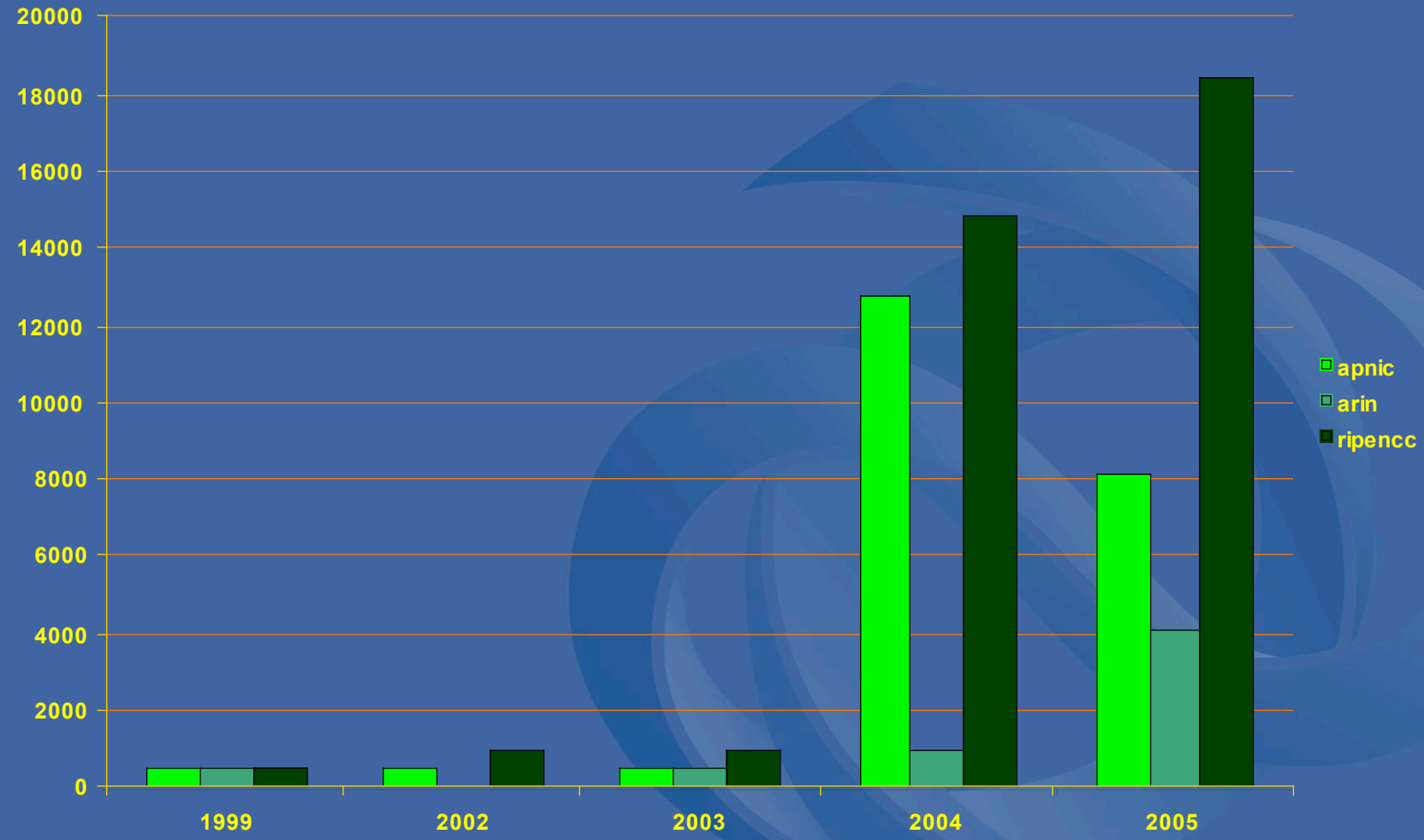


*AKA home router, ICS, firewall

The NAT problem



IPv6 Allocations



About APNIC

Who is APNIC?

Asia Pacific Network Information Centre

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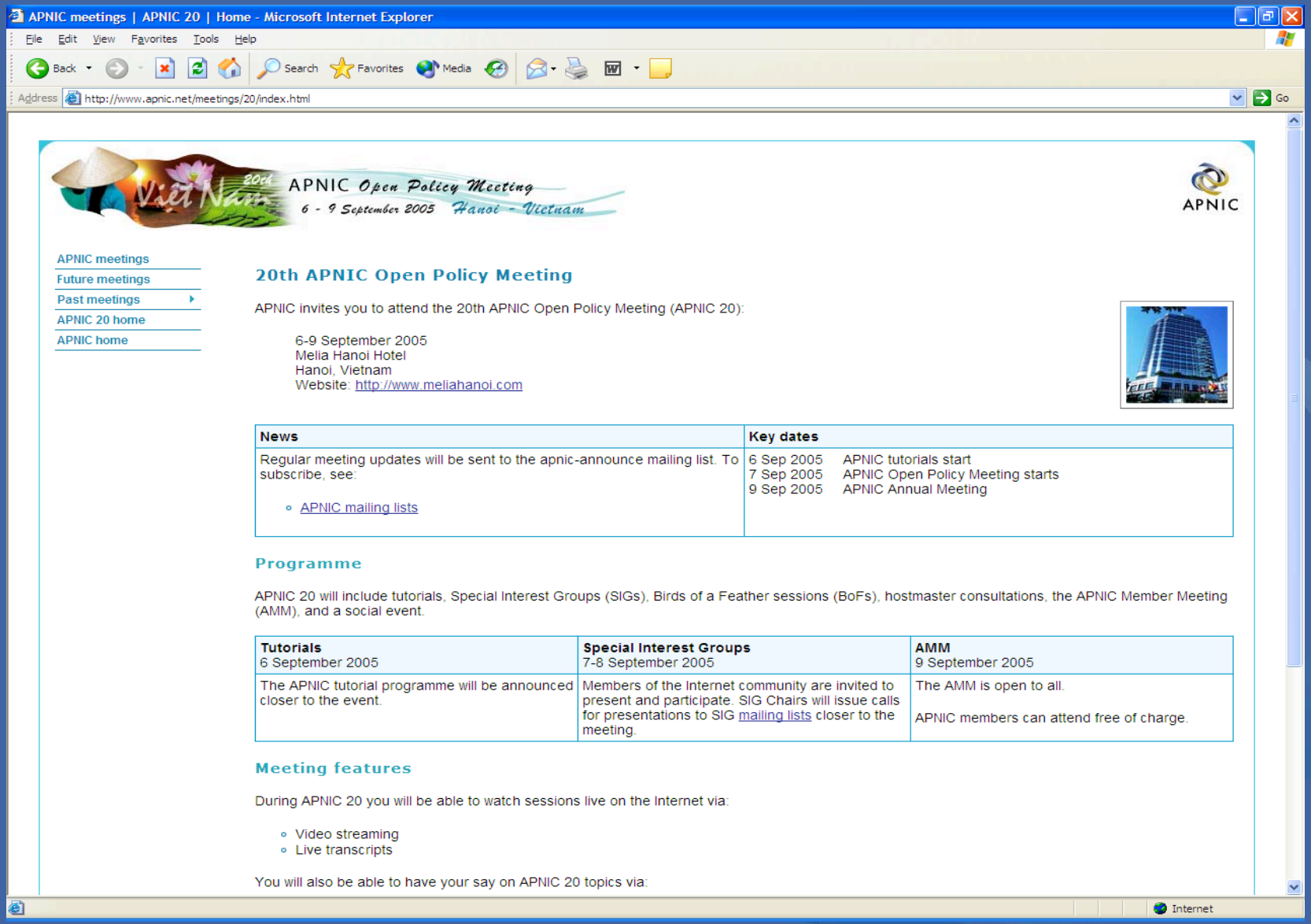
What is APNIC?

- RIR for Asia Pacific region
  - Established 1993, Tokyo
  - 1050 members in 45 of 62 AP economies
  - 45 staff, 18 nationality/language groups
- Membership and community services
- Other activities
  - Outreach
  - Liaison: IETF, APT, PITA, APEC, ISP-A's
  - ITU Sector Member
  - UN ECOSOC consultative status
  - Deployment of rootservers…

APNIC Services

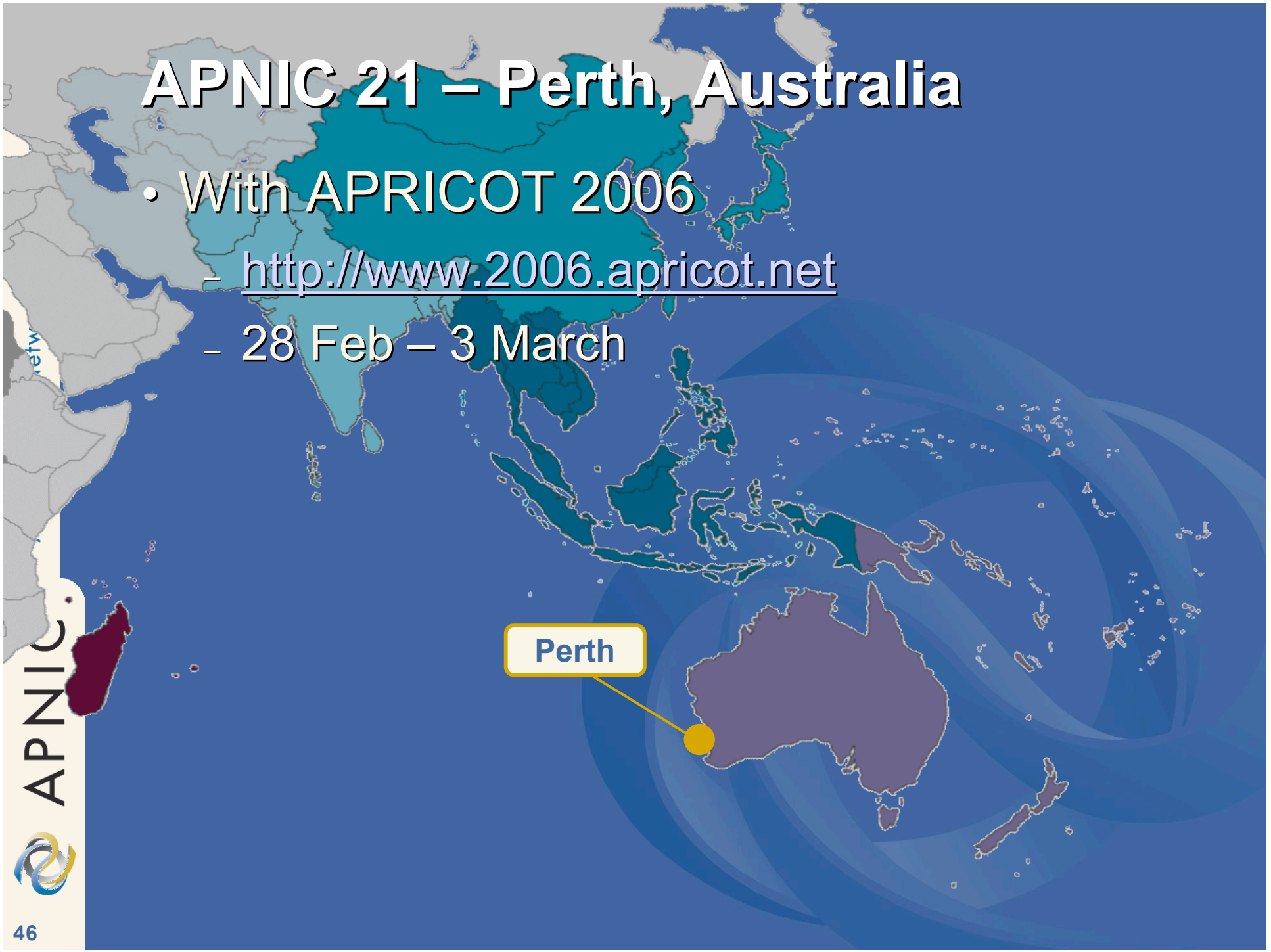
- Internet resource allocations
  - "MyAPNIC" secure membership portal
  - Multilingual helpdesk – email, phone, chat, VOIP*
- Open Policy Meetings
  - Twice annually
  - Webcast and remote participation
  - Stenocaptioning
- Training and education
  - Technical workshops: Routing, DNS, Security
- Internet support
  - Fellowships
  - R&D grants funding
  - ORDIG – ISP support website

APNIC 20 – Hanoi, Vietnam



APNIC 21 – Perth, Australia

- With APRICOT 2006
  - http://www.2006.apricot.net
  - 28 Feb – 3 March



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Questions?

pwilson@apnic.net