Asia Pacific Network Information Centre

APNIC

Internet Address Management

Yesterday, Today and Tomorrow

- U Connect 2005 -

12 September, Ulaan Bataar, Mongolia

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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

- Membership-based organisation
  - Established 1993
  - Non-profit, neutral and impartial

Not operations forum

Not standards development

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What is an IP address?

Example:

The email address:

hostmaster@apnic.net

will be translated into Internet destination:

202.12.29.211

What is an IP address?

- A number used for routing
  - Not dependent on the DNS
- A finite common resource
  - IPv4: 32-bit number
    - 4 billion addresses available
  - IPv6: 128-bit number
    - 340 billion billion billion billion available
- Not “owned” by address users

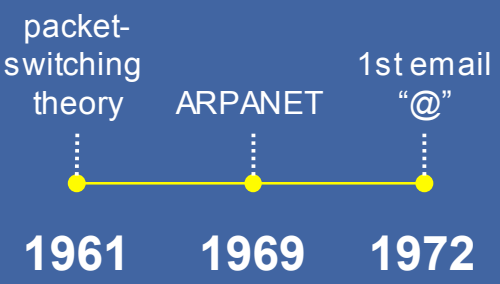
- IP does not mean “Intellectual Property”

A look back in time…

The development of the Internet we have today

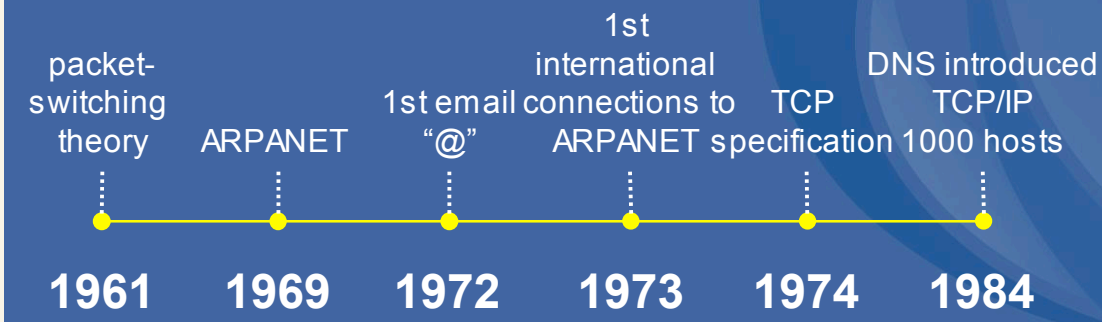
Brief history of the Internet ('61-'71)

- 1961
  - 1st paper on packet-switching theory
  - "Information Flow in Large Communication Nets" Leonard Kleinrock, MIT
- 1969
  - ARPANET created – 4 initial nodes
- 1972
  - Ray Tomlinson (BBN) modifies email program for ARPANET - becomes a quick hit. The @ sign is chosen to symbolise "at"



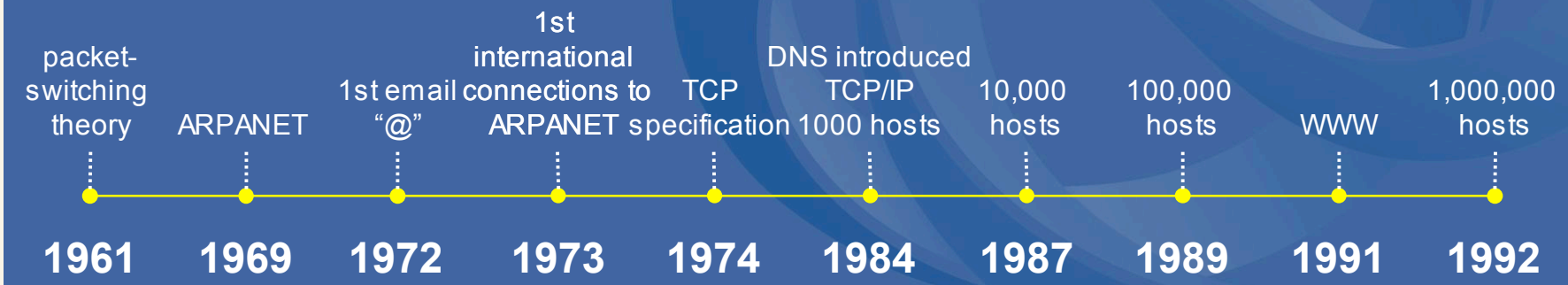
Brief history of the Internet (’73-’84)

- 1973
  - First international connections to the ARPANET: University College of London (England) via NORSAR (Norway)
- 1974
  - Vint Cerf & Bob Kahn publishes “A protocol for Packet Network Interconnection” – Transmission Control Program (TCP)
- 1984
  - Domain Name System (DNS) introduced
  - Number of hosts breaks **1,000**
  - The Internet converts en masse to use TCP/IP

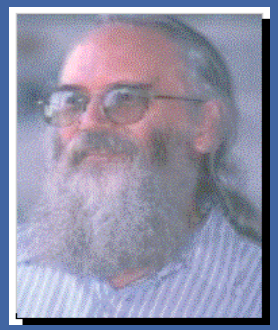


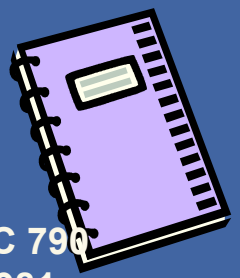
Brief history of the Internet (’87-’92)

- 1987
  - 10,000 hosts connected to the Internet
- 1989
  - 100,000 hosts connected to the Internet
- 1991
  - The World Wide Web is released by CERN
- 1992
  - 1,000,000 hosts connect to the Internet



IP allocation pre-1992



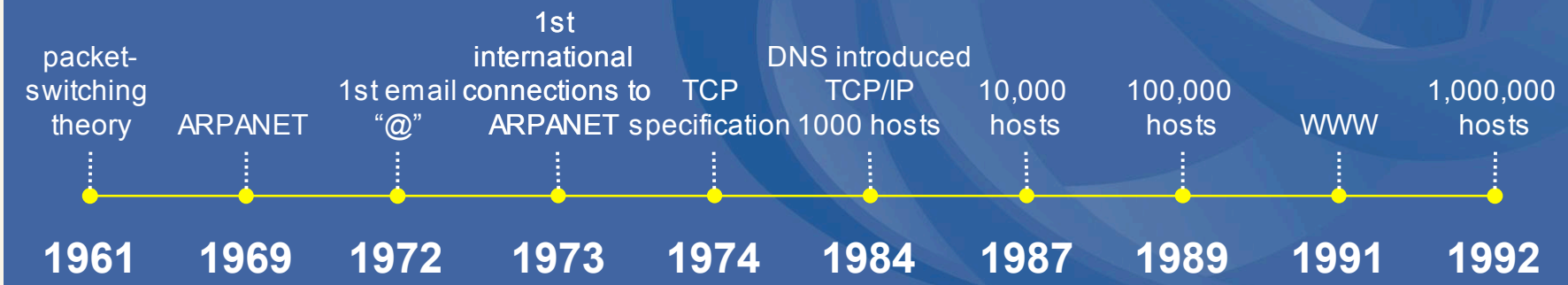


RFC 790
1981

"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**."

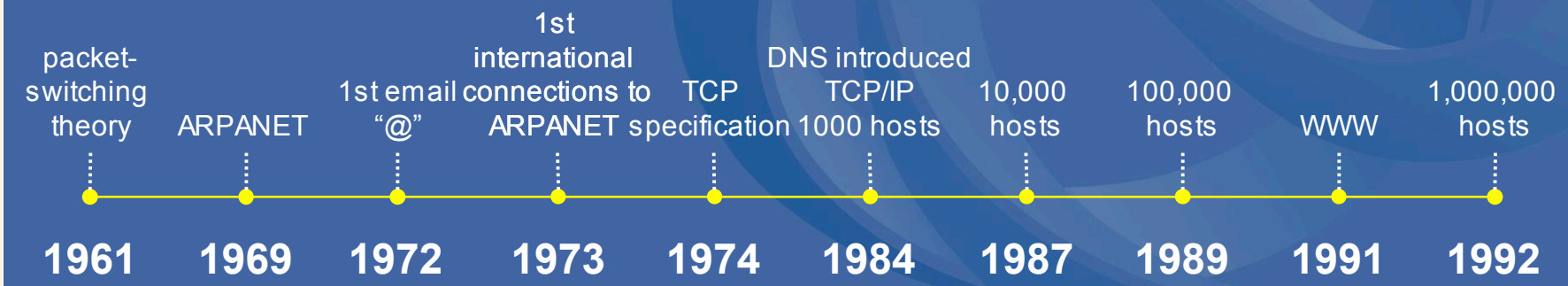
Address management challenges 1992

- Address space depletion
  - Wasteful, classful allocation (A, B, C)
- Routing chaos
  - Legacy routing structure, router overload
  - Lack of routing aggregation
- Inequitable management
  - Unstructured and wasteful address space distribution



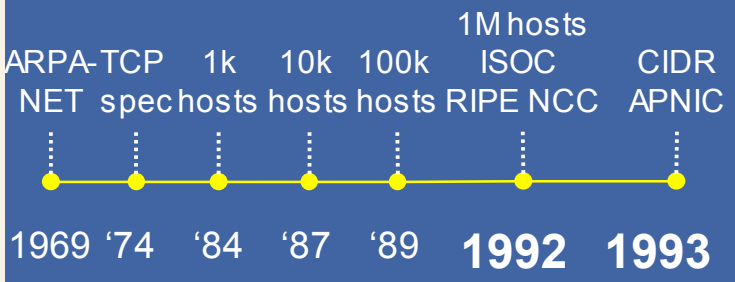
The Internet in 1992

- Internet widely projected to fail
  - Growth would stop by mid-’90s
  - Urgent measures required
  - Action taken by IETF / Internet community



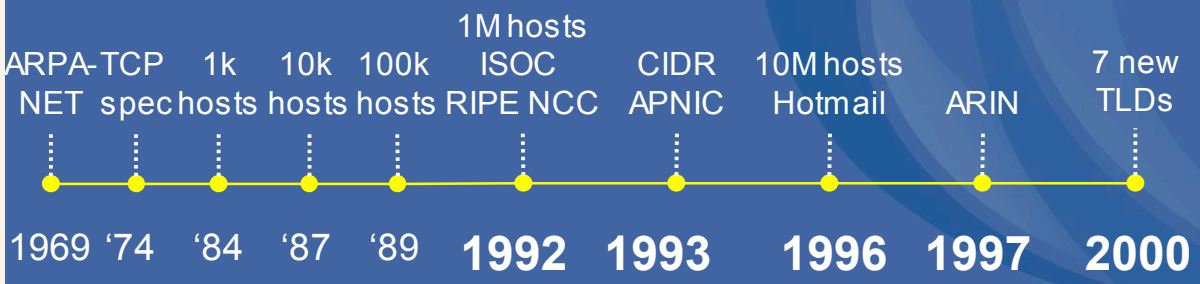
Important developments 1992-93

- 1992
  - RFC 1366: the "growth of the Internet and its increasing globalization"
    - Additional complexity of address management
    - Basis for a regionally distributed Internet registry system
  - The RIPE NCC is established
- 1993
  - Development of "CIDR"
    - addressed both ***Address depletion*** & ***Routing table overload***
  - APNIC is established



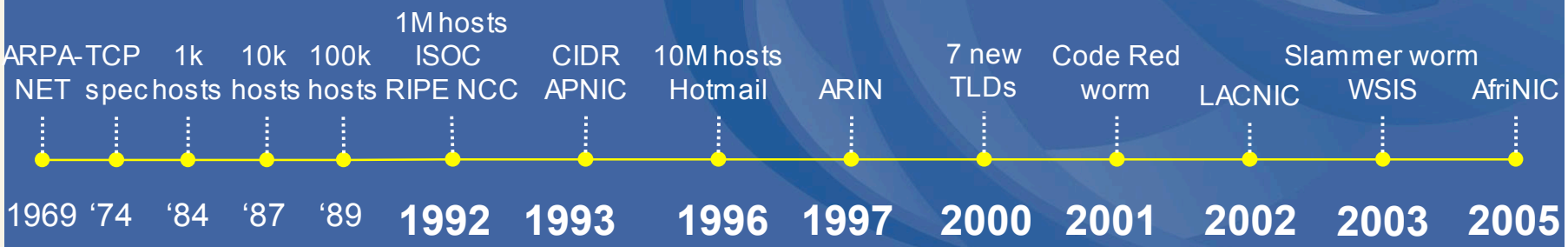
Brief history of the Internet ('96-2000)

- 1996
  - 10M hosts connected to the Internet
  - Hotmail is born
- 1997
  - The American Registry for Internet Numbers (ARIN) is established
- 2000
  - ICANN selects 7 new TLDs: .aero, .biz, .coop, .info, .museum, .name, .pro

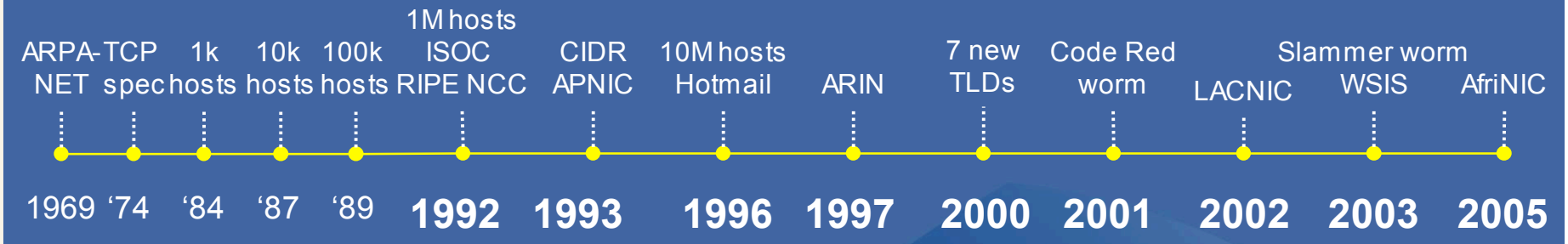


Brief history of the Internet (2001-2005)

- 2001
  - The Code Red worm hits thousands of webservers and email accounts
- 2002
  - LACNIC is established
- 2003
  - The slammer worm causes one of the largest and fastest spreading DDos attacks ever
  - UN World Summit on the Information Society (WSIS) - 1st phase
- 2005
  - AfriNIC is established



History to date…



70-90s

- Research project
- Open, cooperative, public domain
- Highly collaborative environment
- "Rough consensus and running code"

90s

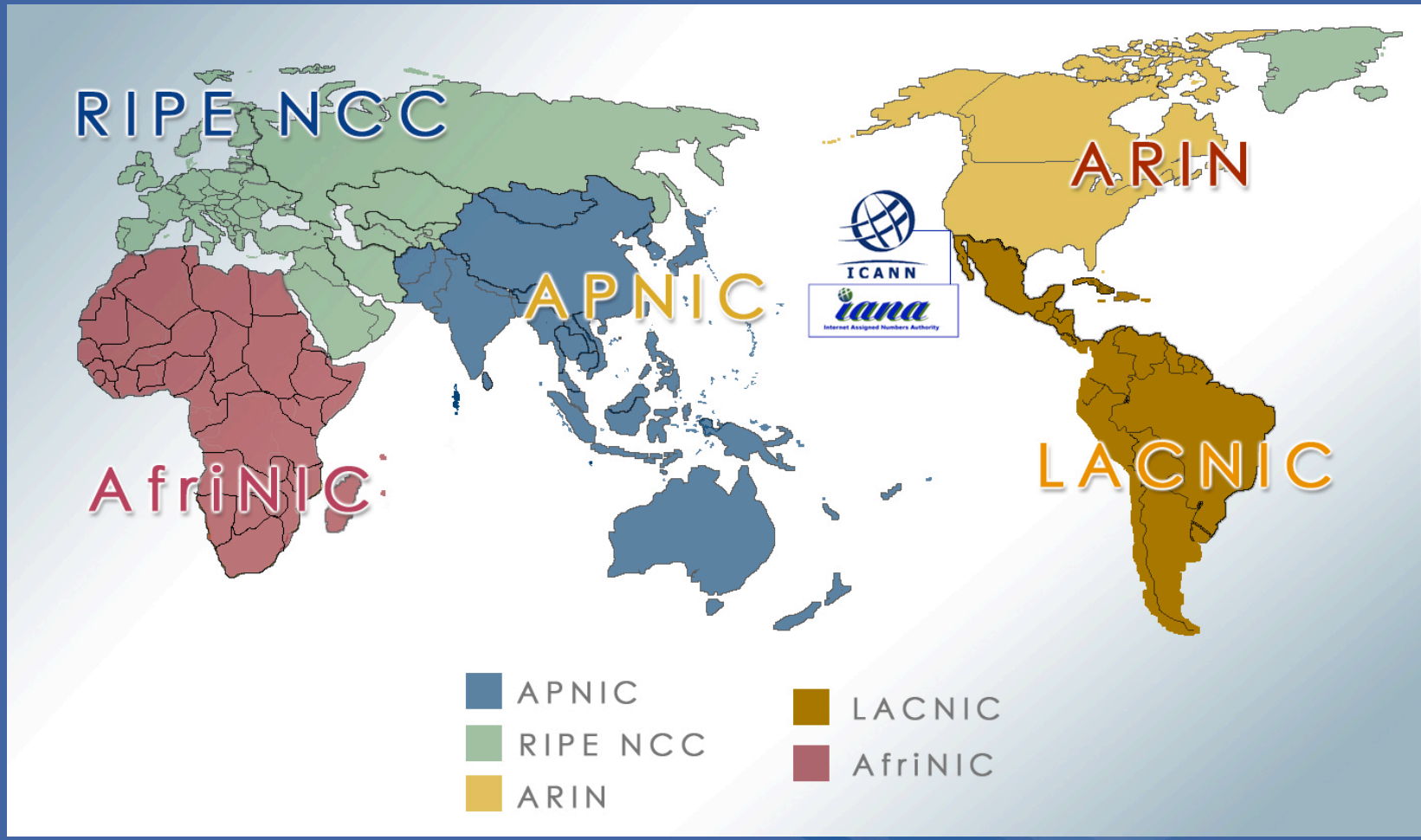
- Product of liberalisation
- Also catalyst for deregulation
- Highly competitive environment
- Still free to join and use

2000s

- Public utility and critical infrastructure
- Re-regulation (governance) is a recent afterthought

Address management today

- Five RIRs in the world



Internet Governance

What is Internet Governance?

- May include any aspect of the Internet which requires regulation, coordination or oversight
  - Cybercrime, security, spam, phishing, hacking
  - Content regulation
  - Commerce, trade and taxation
  - Intellectual property
  - Telecommunications regulation, competition policy
  - Development and facilitation, capacity building
  - Equity of access
  - Technical standards and coordination
- None of these are entirely new areas

WSIS

- Intergovernmental summit hosted by UN
  - Phase I: Geneva 2003 (complete)
  - Phase II: Tunis 2005
- WSIS scope covers all aspects of ICTs
  - Content, crime, digital divide, ecommerce, capacity building, financing…
  - Internet Governance: names and numbers, interconnection, security…
- Outcomes: “Declaration” and “Plan of Action”
  - Guidance to UN and Governments
  - Non-binding, but highly influential

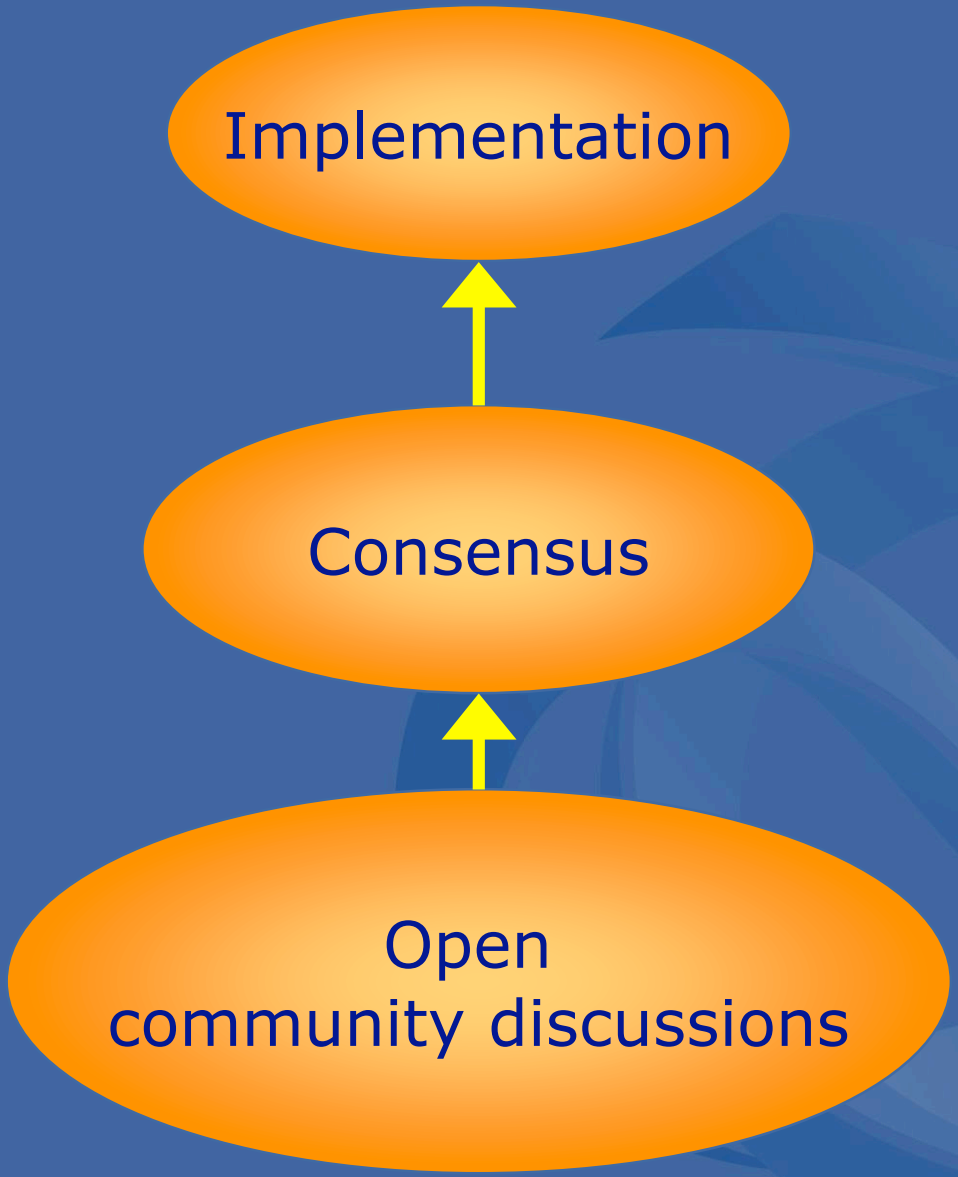
AP concerns & RIRs position

- AP concerns voiced during WSIS
  - Outcomes of the system of Internet governance not fair
  - Dissatisfaction over US government oversight of ICANN
  - Concerns about access to resources
- RIRs position
  - Promote need for continued stability
  - Dispel misconceptions and misunderstanding
  - Promote a position of “do no harm”, and be mindful of cross-impacts when proposing changes to infrastructure administrative functions

What are RIRs?

- Industry self-regulatory structures
  - Non-profit, open membership bodies
- 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

Bottom-up decision making



Address management objectives

(Lessons learnt from the past)

Conservation

- Efficient use of resources
- Based on demonstrated need

Aggregation

- Limit routing table growth
- Support provider-based routing

Registration

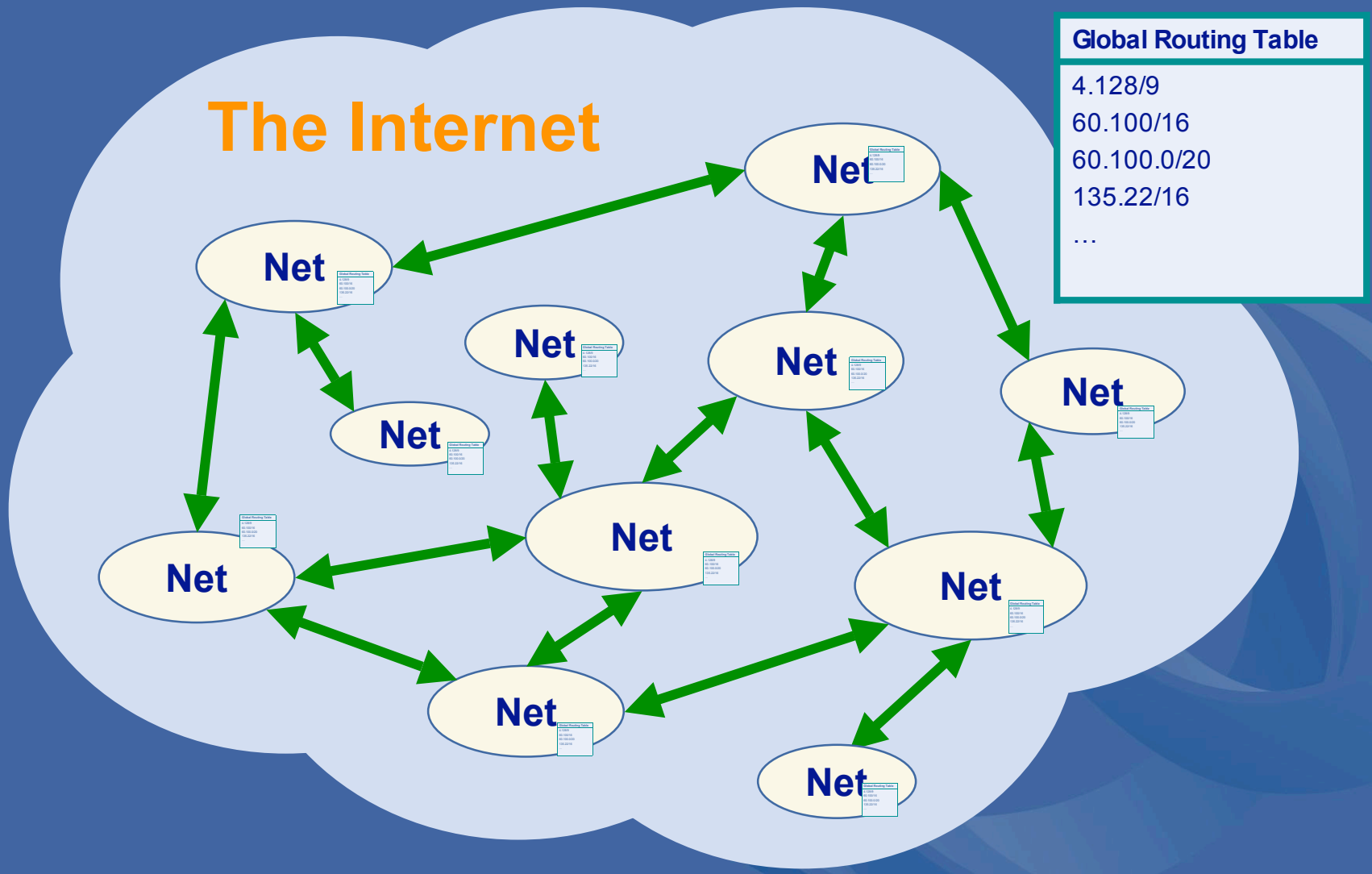
- Ensure uniqueness
- Facilitate trouble shooting

Uniqueness, fairness and consistency

Geography of the Internet

IP Address view

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

Geographical distribution?

- Some have proposed to use a telephony-like model for IP address management
- However the geography of telephony is very different
  - Countries and country prefixes are fixed
  - Static bi-lateral peering arrangements
  - Telephone numbers are localised and extensible
- To impose a telephony-like regime would impose a major change
  - Substantial risks involved

The RIR structure

- Industry self-regulatory structures
  - Non-profit, open membership bodies
- Open and transparent processes
  - Consensus-based decision-making
  - Policy development
  - Flexibility allows adaptation to Industry changes
  - Open participation, Democratic, bottom-up processes
- Membership structure
  - 100% Self-funded through membership fees
  - National Internet Registries
    - National representative bodies

Summary

Summary

- The Public Internet has a history of 25 years
  - 13 years of successful RIR history
  - Current IP address management system has served the Internet well
- Current system is dynamic and able to be changed by evolution
- What are your challenges?
  - Participate in the open processes
  - Be a part of the future
- Responsible management essential to keep the Internet running

Thank You

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