Address Registries

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Overview

- The Regional Registries
- An Example: APNIC
- Registry Policies and Procedures
- Registry Funding

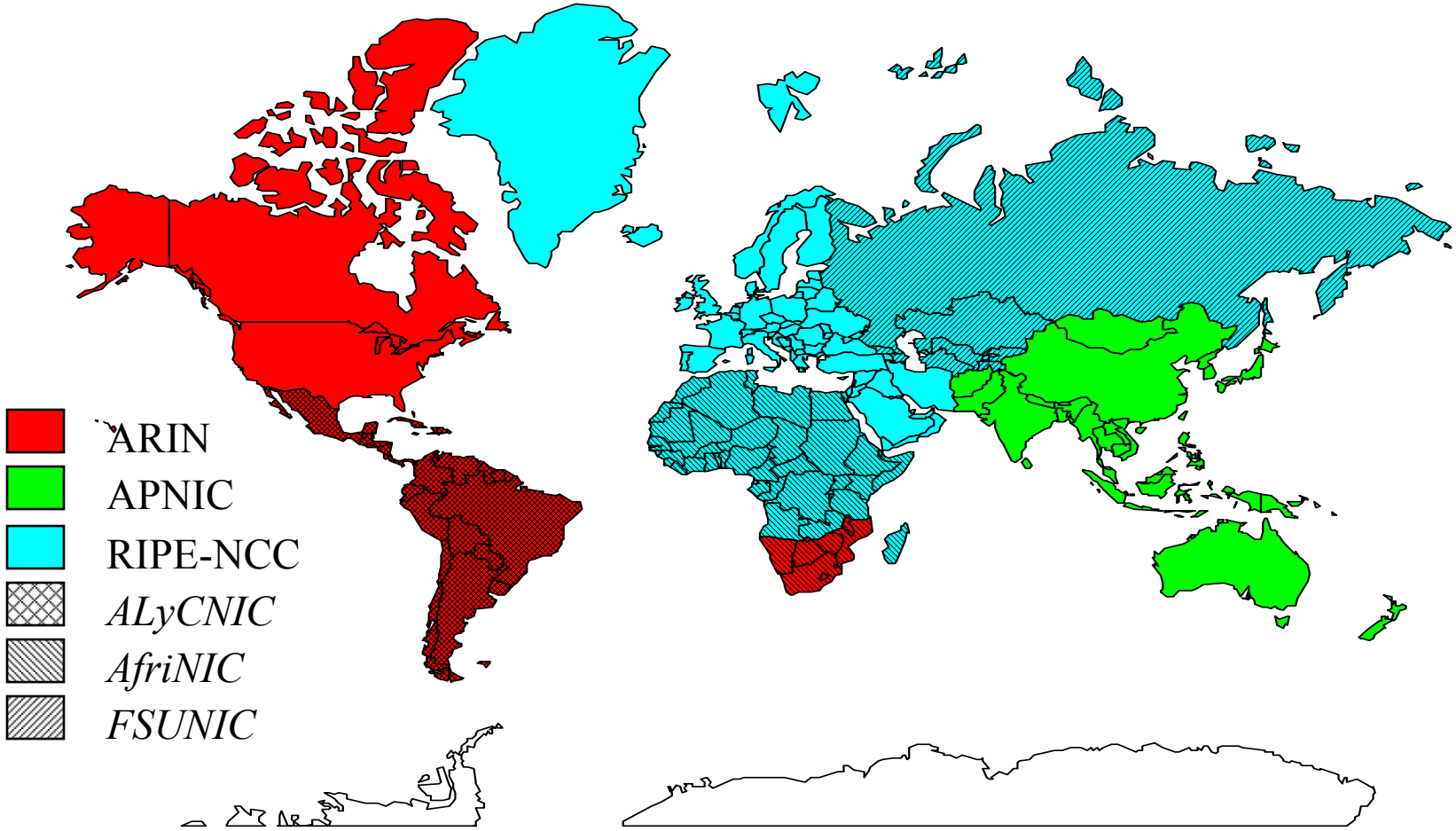
In the Beginning…

- Address allocation and registration performed as an afterthought
  - Simple administrative function of keeping track of who had what addresses
    - info kept in text files, accessible by whois
  - No restrictions on amount allocated
    - class As allocated to anyone who asked
- Formalization of registry functions occurred in the early 80's
  - Contract to SRI, later to GSI, Funded by US DOD

Regional Address Registries

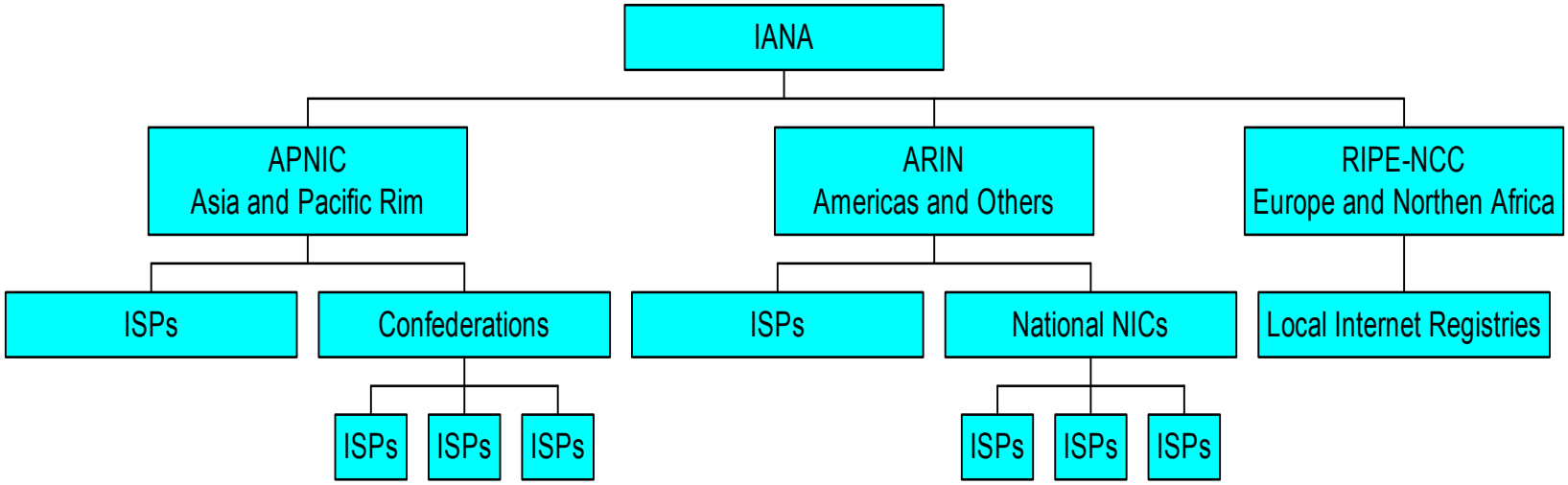
- As the Internet grew, having all registry function in the US became untenable
  - Although not for technical reasons…
- RFC 1466 specifies the creation of regional address registries based on geographical monopolies
  - RFC 1466 acknowledged the existence of RIPE-NCC
    - Also provided for the delegation of blocks to new registries
  - Assumes a unified “registry” with the IANA as overall coordinator
- Provision made for the creation of new registries
  - regional consensus required

Regional Registries



Address Registry Structure

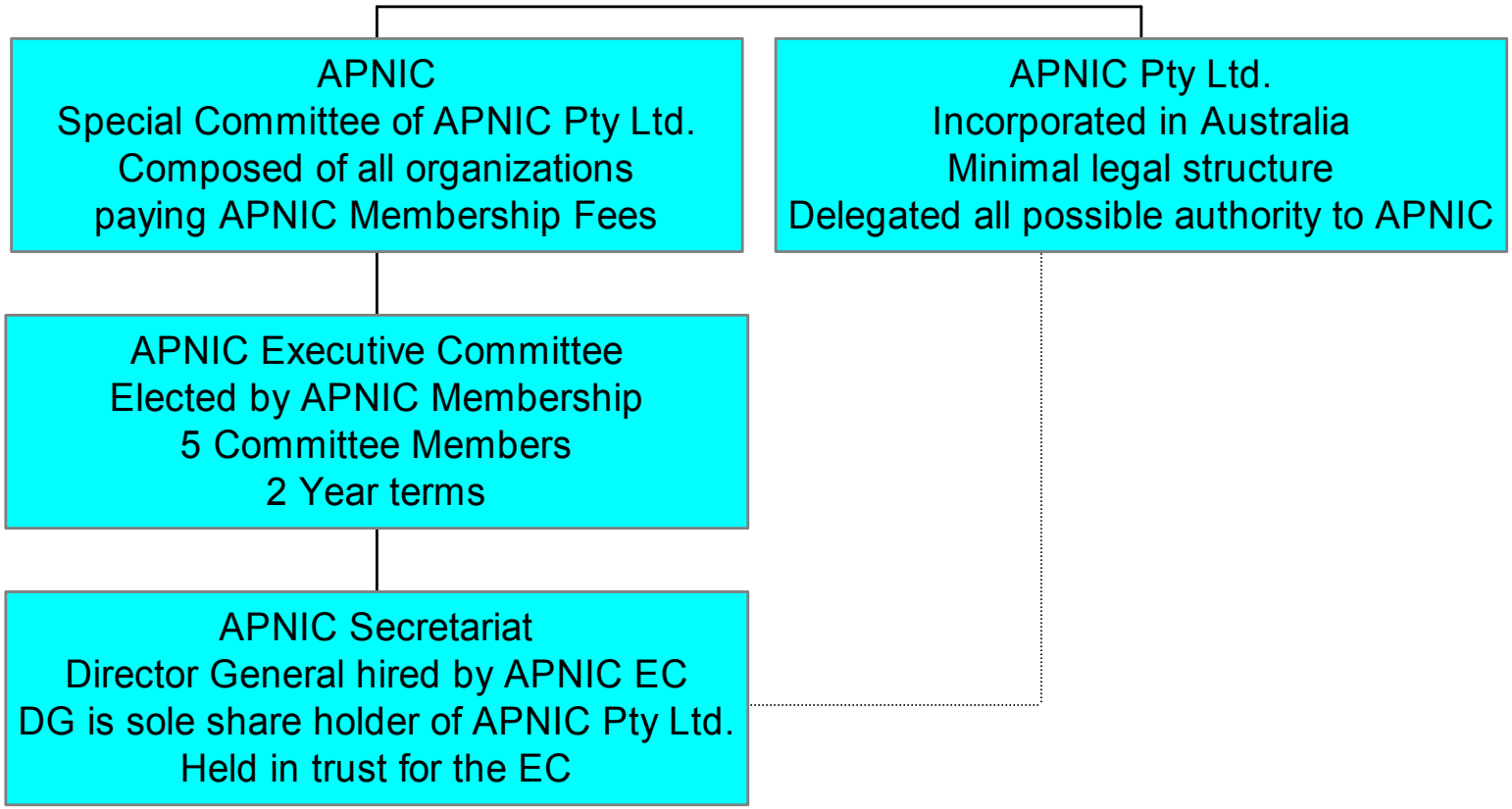
- 3 regional registries exist beneath the IANA
  - New regional registries are being discussed
  - APNIC and ARIN have an intermediate layer
    - confederations/national NICs respectively



An Example: APNIC

- Started as a pilot project by the APCCIRN/APEPG
  - Pilot project initiated on September 1, 1993
  - APCCIRN/APEPG renamed in 1994 to APNG
- In April, 1994 APNIC was delegated 202/7
  - actual APNIC operation begins
- In April, 1996 APNIC, Ltd. was incorporated in the Seychelles, operates out of Tokyo
- In July, 1997 APNIC decides to move to Brisbane
- In February, 1998 APNIC Pty Ltd. incorporated in Australia

APNIC Structure



What APNIC Does

- Allocate Internet numbers
  - Internet addresses
    - in-addr.arpa domains
  - AS numbers
- Maintain registration info for those numbers
  - Access via whois and WWW
  - Raw database also available
- Maintain a list of AP region Internet Service Providers
- Promote the development of the Internet in the region
  - Asia Pacific Rim Internet Conference on Operational Technologies (APRICOT)
  - Support emerging groups
    - APPLe, APIA, etc.
- Liaison with the other regional registries

Provider Independent Addresses

- Provider independent (PI) addresses can be obtained from your provider
  - But this is not the best choice as it means punching a hole in your provider's address block
    - Many (most?) provides do not allow this anymore
    - Some ISPs might not listen to your routes, even though your provider allows it
- Internet Registries allocate (PI) addresses
  - But they have no control over whether those addresses are routed

Internet Registry Goals

- The Internet Registries have the following goals
  - Conservation of routing table entries
  - Conservation of address space
  - Fair allocation of the remaining unallocated address space
- Note the first two goals tend to be mutually exclusive:
  - Conservation of routing table space implies allocating the largest blocks possible
  - Conservation of address space implies allocating the smallest blocks possible

Allocation vs. Assignment

- In the context of the Internet Registries there is a difference between allocation and assignment
  - Allocation is the sub-delegation of address space to be used for further sub-delegation
    - e.g., a block of addresses allocated to a service provider will be sub-delegated to the service provider's customers
  - Assignment is the sub-delegation of address space to an end user
    - No further sub-delegation is expected to occur outside of the organization assigned to
- Registries do NOT like to make assignments
  - Retail vs. wholesale distinction

Allocation guidelines

- Addresses are allocated to ISPs in power of 2 sized blocks on bit boundaries that create single routing entries
  - Those blocks should remain intact
    - Assignments to customers should be done as “loans” for the duration of the connectivity contract
- ISPs must assign address space efficiently
  - Variable length subnet technologies are assumed
- Allocating addresses to highly transient customers (e.g., dialup IP) is discouraged
  - Static assignment can be very space inefficient
- Addresses are allocated using a “slow start” procedure to insure efficient address space usage with a minimum of routing entries generated

“Slow Start” (RIPE and APNIC)

- An initial /19 is allocated to all new ISPs
  - A compromise between waste of space and router table efficiency
- Once the /19 is consumed additional space is allocated
  - amount of space allocated depends on compliance with registry policies and procedures
  - typical additional allocation is doubling existing space (e.g., subtracting a bit from prefix length)
    - ISP has a /19, new allocation is a /19 giving a total of /18
- Goal is to provide ISP with enough space to satisfy requirements for 3 to 6 months

“Assignment Window”

- Slow-start is a very rough tool to enforce policies
  - No way to insure assignments done appropriately until after a /19 has been assigned
- Solution is to limit amount of address space the ISP can assign without checking with a registry
  - the “Assignment Window”
- AW determines how much address space can be assigned autonomously by the ISP
  - ISP gets an “assignment window” of 0
- AW grows as the regional registry gains confidence in their assignment/allocation procedures/policies
  - AW can be decreased if procedures/policies violated

“Slow Start” (ARIN)

- If an ISP has used less than a /19 and is not multi-homed, ARIN will not allocate
- Beyond a /19, ARIN’s allocation policy is almost the same as APNIC and RIPE-NCC
  - no assignment window policy

Reporting Requirements

- All addresses assigned by an ISP must be reported to the appropriate regional registry by updating the registry database
  - Allows operational staff to determine the registrant of assigned addresses for network trouble-shooting, security incidents, etc.
  - Allows the registries to determine the amount of address space the ISP is utilizing for customers
  - Permits studies of address space utilization
- Registries will only allocate additional space if 80% of existing space has been utilized

Assignment guidelines

- An assignment is the delegation of authority over a block of IP addresses to an end enterprise for internal use only
  - The enterprise will not sub-delegate those addresses
- It must be demonstrated via network engineering and deployment plans that
  - 25% of the requested address space will be utilized immediately
  - 50% of the requested address space will be utilized within one year
  - variable length subnet technologies will be used
- The organization must account for all previously assigned space and must demonstrate at least 80% of that space has been utilized.

Network Engineering Plans

- In order for a registry to obtain reasonable assurance address requests aren't overstated, network engineering are requested
- The engineering plans should include
  - Full subnetting information, including number of hosts initially and after one year
  - A description of network topology
  - A description of the routing plans, including routing protocols, routing hardware and software, etc.
- Sufficient detail should be provided to enable the registry staff to understand the need for the space requested

Network Deployment Plans

- In addition, network deployment plans may be requested to further corroborate the request
- The deployment plans should include
  - Number of hosts to be deployed per time period
  - Expected network growth during that time period
  - Modifications of network topology to account for the growth
- Care should be taken to insure the engineering and deployment plan numbers match

Registry Costs

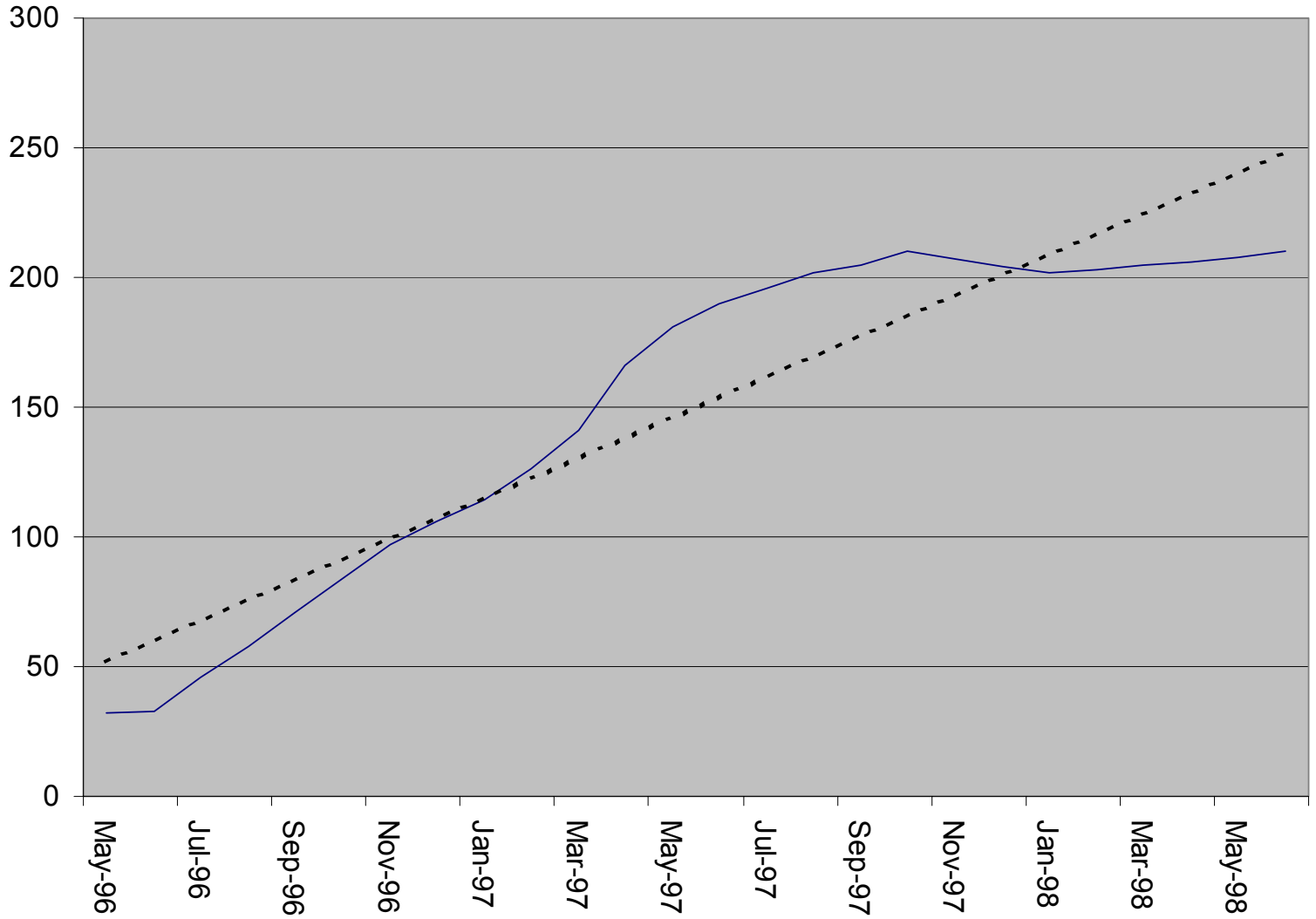
- Originally,the US Gov't paid for Internet registry services.
- Now, all regional registries recover costs via a "membership" fee structure
- Resources are allocated to members
  - APNIC has non-member fees
  - ARIN also has fees associated with address space allocation
- Fees are intended to cover the cost of providing registry services
  - Distributing the cost among all organizations which use the registry

APNIC Membership Fees

"Size"	One Time	Recurrent	Votes
Very Large	US $1,000	US $20,000	8
Large	US $1,000	US $10,000	4
Medium	US $1,000	US $5,000	2
Small	US $1,000	US $2,500	1

- Sizes self-determined
  - No distinction in level of service based on size
- Recurrent fees based on yearly payment (cost recovery is the goal)
  - Installment plan available
- Confederation category is self-determined size plus an additional fee which corresponds to the amount of resources consumed

APNIC Membership Growth



APNIC Non-Member Fees

- Some organizations don't want to be members, so APNIC has a non-member price schedule for registry services
  - All requests must still be justified

Service	Initial Fee	Yearly Fee	Comment
IP Address Allocation	US $1.00 per Internet address	US $0.10 per Internet address	Minimum fee US $8192.00
AS Number Allocation	US $500.00 per AS number	US $50.00 per AS number	Must be multi-homed with no default
In-addr.arpa delegation	US $50.00 per delegation	N/A	In-addr delegation removed if not maintained

Summary

- The Regional Registries were created to support the varying speeds at which the Internet was developing in the different regions
- Allocation and assignment policies are globally defined
- The regional registries have evolved towards being self-funding

Where to get more information

- Internet registries
  - RFC 1466 describes the partitioning and allocation blocks of the regional registries. The registry procedures described in RFC 1466 are obsolete.
  - RFC 2050 describes current registry allocation and assignment policies
  - APNIC information: www.apnic.net
  - ARIN information: www.arin.net
  - RIPE-NCC information: www.ripe.net
  - IANA information: www.iana.org