From IPv4 to IPv6: impact and transition

Seminario Bordoni “Internet del futuro: evoluzione della piattaforma tecnologica"
23 February 2009
Rome - Italy

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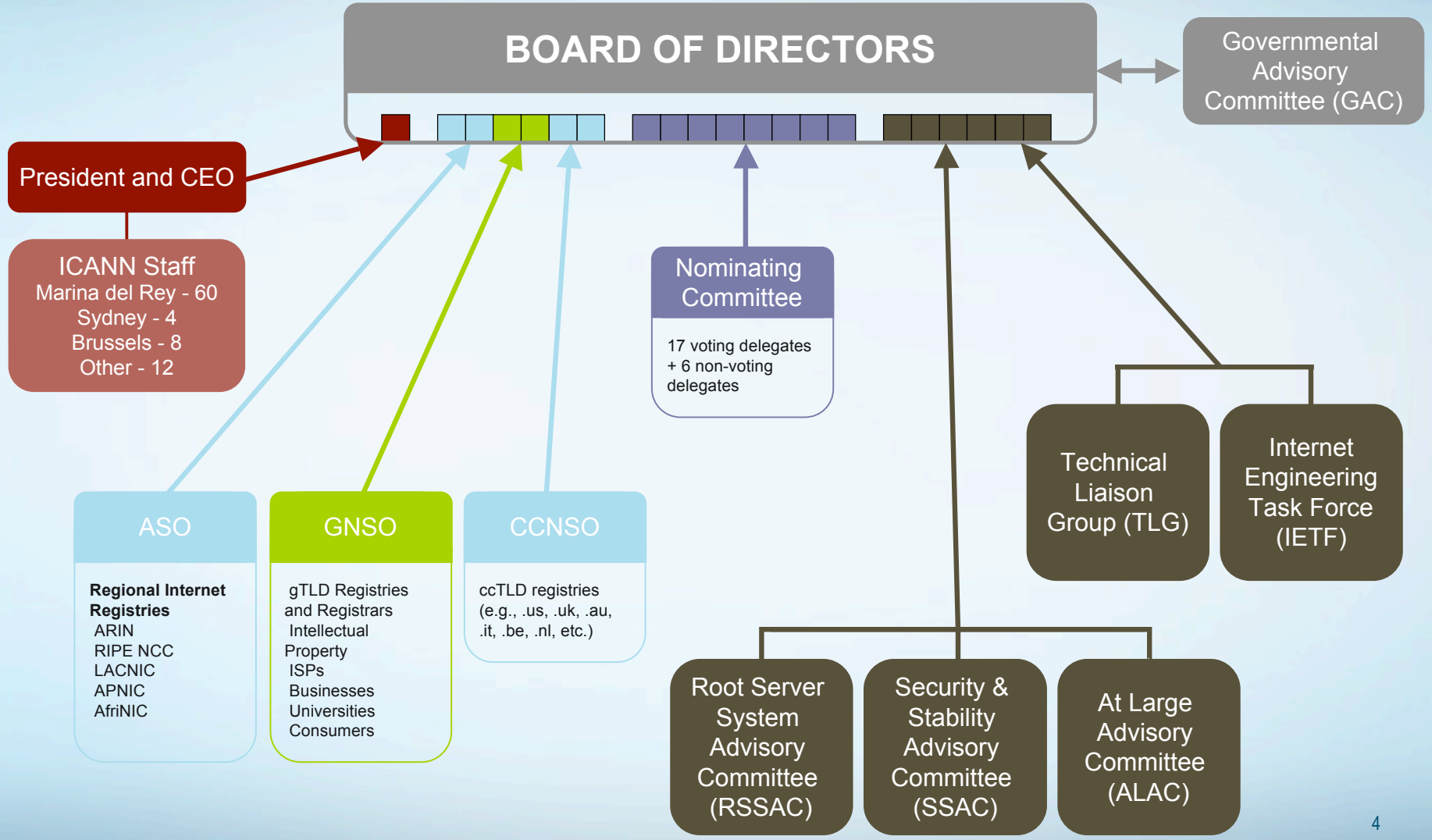
About ICANN

- International, public benefit, non-profit organisation charged with managing the Internet's identifier system
- Ensuring the "security and stability" of these systems is a core goal
- These include the DNS, IP addressing and protocol assignments, like port numbers

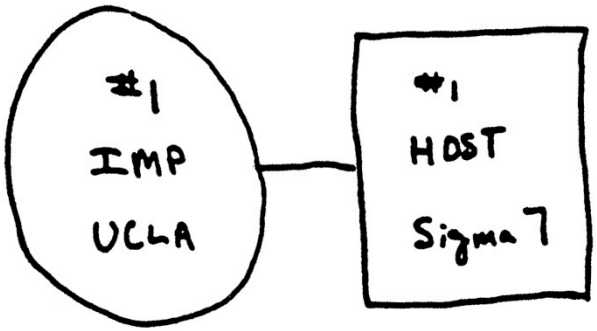
ICANN mission statement

- To coordinate, overall, the global Internet's system of unique identifiers, and to ensure stable and secure operation of the Internet's unique identifier systems. In particular, ICANN coordinates:
  1. Allocation and assignment of the three sets of unique identifiers for the Internet:
     - Domain names (forming a system called the DNS)
     - Internet protocol (IP) addresses and autonomous system (AS) numbers
     - Protocol port and parameter numbers
  2. Operation and evolution of the DNS root name server system
  3. Policy development reasonably and appropriately related to these technical functions

ICANN's community



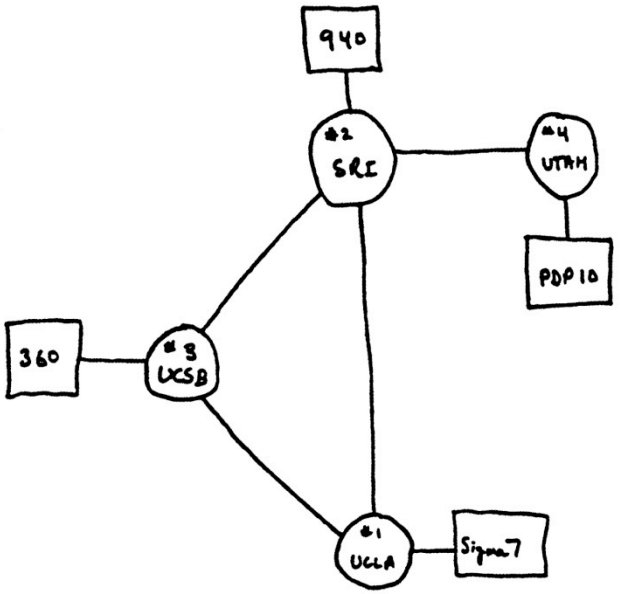
In the beginning . . .



THE ARPA NETWORK

SEPT 1969

1 NODE



THE ARPA NETWORK

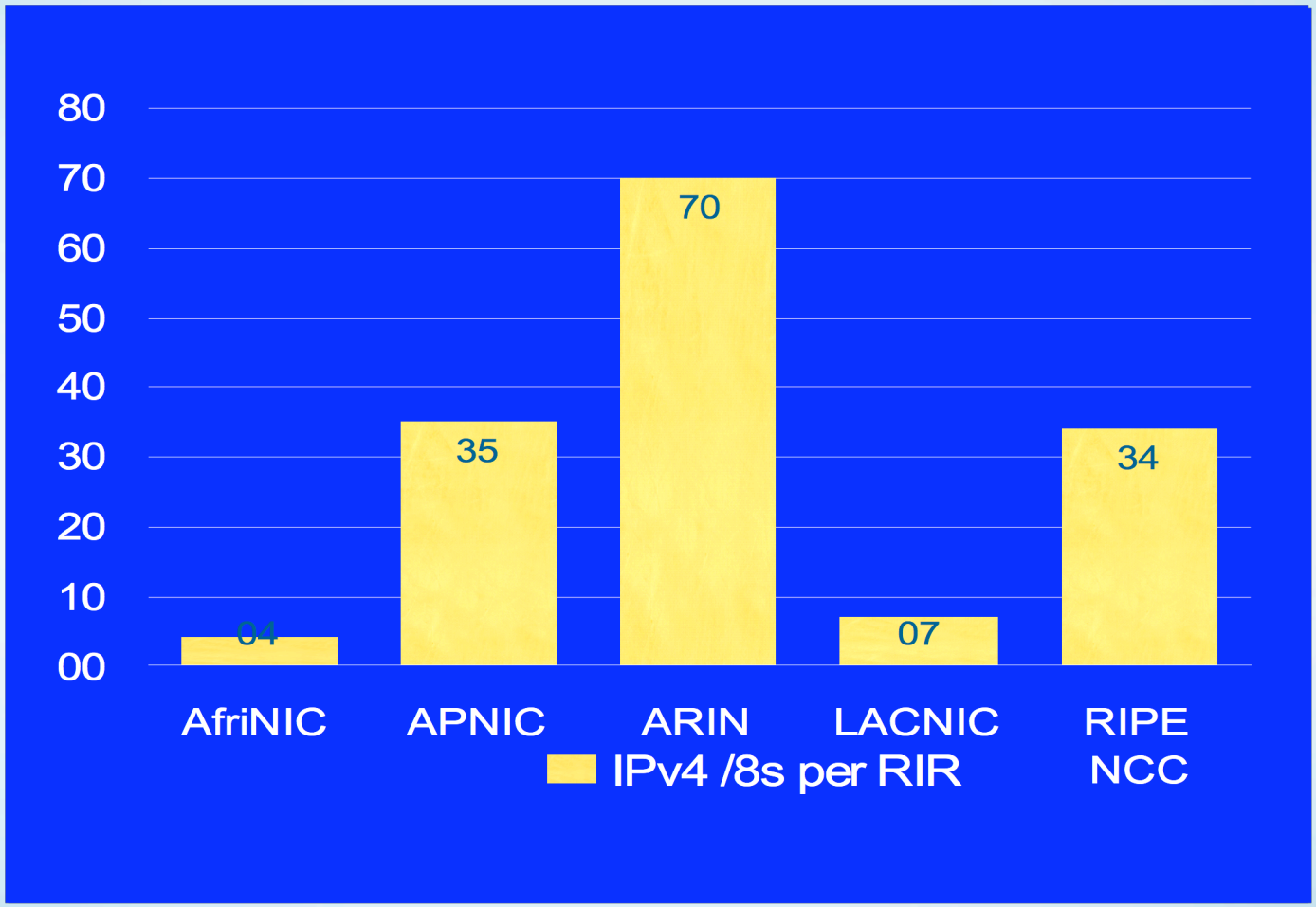
DEC 1969

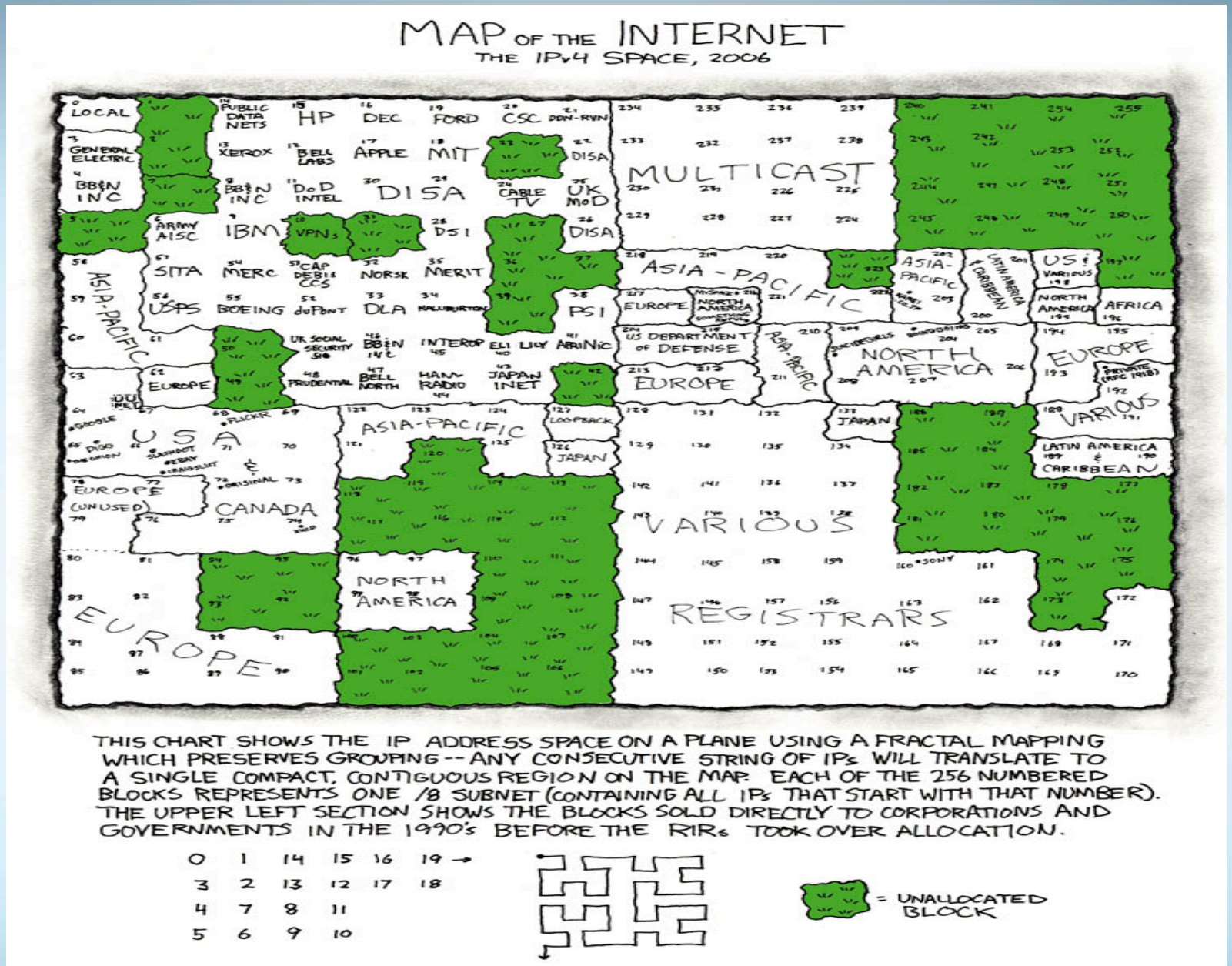
4 NODES

In the early days...

- There were just 256 IPv4 network numbers
- Each network could connect 16M hosts
- This was more than was ever expected to be needed for a research project
- With the success of the internet, the demand grew, and the address space was further partitioned
- Addresses were given based on the demand

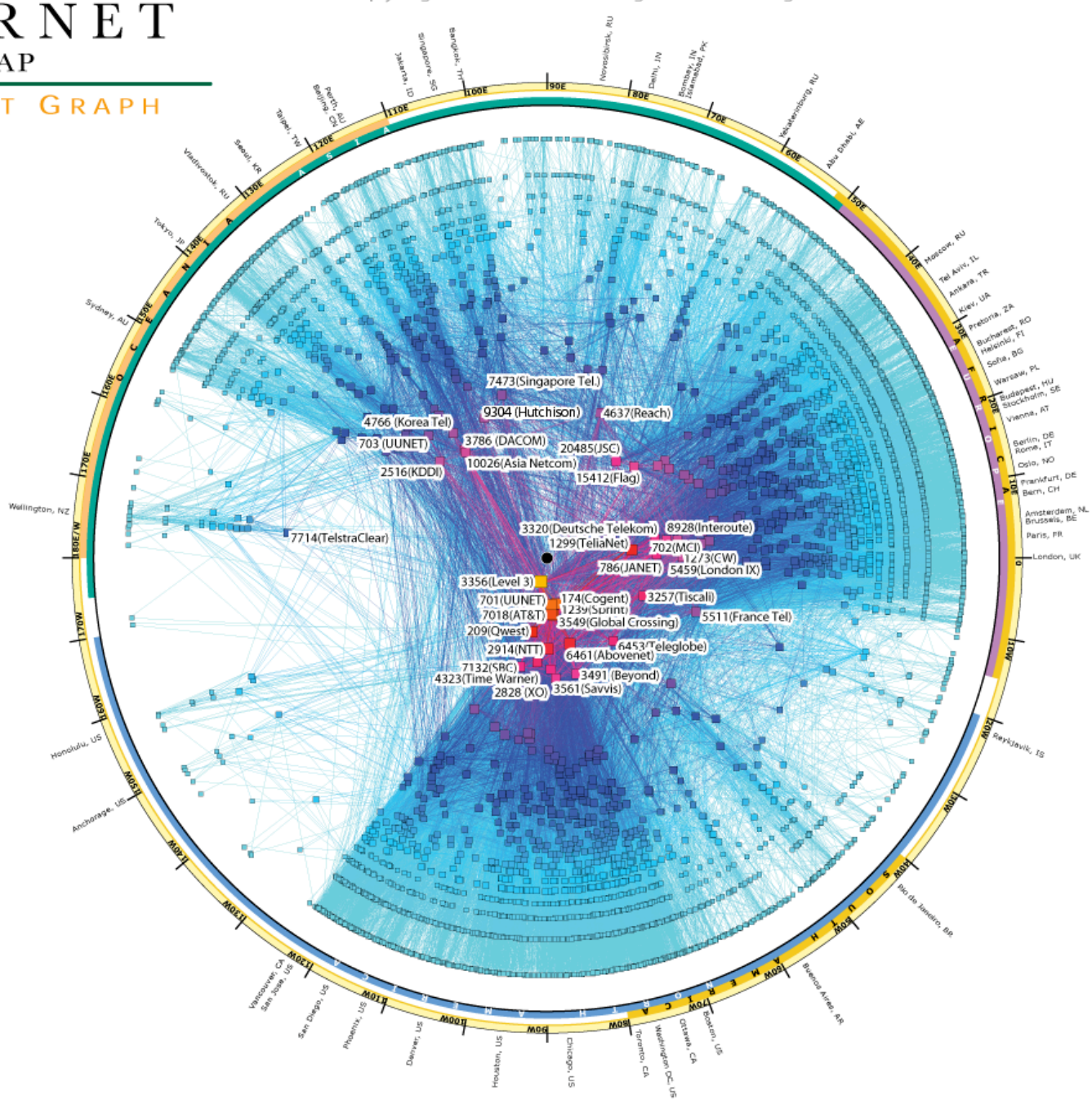
Today: Distribution of IPv4 /8s





http://xkcd.com/195/

IPv4 INTERNET
TOPOLOGY MAP
AS-level INTERNET GRAPH



IPv4 address space exhaustion

- To manage IPv4 address depletion, RIRs have developed policies that have been ratified by the ICANN Board
- The IANA IPv4 free pool is expected to run out at the beginning of 2011
- The RIR IPv4 free pool will probably run out about a year later
- ISPs and enterprise networks might still have some unused address space for a while after that
- If the demand of IPv4 address will still grow, a secondary market might appear

IPv6 goals

- IPv6 was meant to solve many goals, including auto-configuration, security, renumbering and multi-homing
- The only goal is has successfully solved is size: IPv6 is truly huge
- However, it is ***not*** infinite, therefore allocation policies are important.

The next Internet generation

The Internet should be a platform that amplifies voices that might otherwise never be heard and creates equal opportunities for increasing the wealth of nations and their citizens.
— Vint Cerf

IPv6 Allocation Policy Development

- A bootstrap IPv6 policy generated the experience to develop a common allocation policy shared by all three (at the time) RIRs
- That initial common policy was revised to require more efficient usage by ISPs in the light of experience
- Policies for IPv4 and IPv6 allocations to RIRs were developed in the RIR communities and ratified by the ICANN board

IPv6 penetration

- Very little commercial IPv6 take-up in business or residential markets
- A few ISPs have IPv6 offerings: Free.fr for example
- Google will now peer over IPv6 and offer service over IPv6 to IPv6 peers
- Test at IETF 71 (March 2008) – details at

https://wiki.tools.isoc.org/IETF71_IPv4_Outage

IPv6 infrastructure

- More than half the root DNS servers have IPv6 (A, B, F, H, J, K, L, M)
- There is far more capacity than demand
- About 2/3 of ccTLDs have IPv6 reachable nameservers
- More than 2/3 of gTLDs have IPv6 reachable nameservers

Why is the deployment so slow?

- Deploying IPv6 now does not offer any immediate business advantage to ISPs, content providers or large enterprises
- It's a business case problem: while there is still IPv4 space available, IPv6 is an extra cost and not a way to make a profit
- This is the classical "deployment of a new thing" problem: a critical mass is needed before the "new thing" picks up

The vicious circle

- ISPs don’t want to provide IPv6 as standard until there is lots of IPv6 customers
- Content providers don’t want to use IPv6 until there are lots of IPv6 customers
- Users do not ask for IPv6 until there is lots of IPv6 content providers

The virtuous circle?

- Role of the infrastructure providers
- Role of the users
- Role of the governments
- Use the current crisis as an opportunity?

A concerted effort

- **ISPs** have to offer IPv6 connectivity and IPv6 based services to customers
- **Infrastructure vendors** have to integrate IPv6 capability into their products
- **Business and consumer application vendors** have to ensure that their solutions are IPv6 compatible and have to develop products and offer services that take advantage of IPv6 features
- **Content and service providers** have to be reachable by enabling IPv6 on their servers
- **End-users End-users** have to purchase IPv6 capable products and services and to enable IPv6 on their own networks or home Internet access

Example: the European Commission Communication on IPv6

- Europe should set itself the objective to widely implement IPv6 by 2010: at least 25% of users should be able to connect to the IPv6 Internet(http://ec.europa.eu/information_society/policy/ipv6/docs/european_day/communication_final_27052008_en.pdf). Actions address both supply and demand side:
  - The Commission will work with Member States to enable IPv6 on public sector websites and eGovernment services. To this end common deployment objectives should be agreed.
  - The Commission calls upon content and service providers to make their offer IPv6 accessible by 2010, amongst them the top 100 European web sites
  - The Commission encourages Member States to prepare for IPv6 within their own networks and when renewing their external network services contracts ensure that these also include provisions for IPv6 connectivity, and that all equipment procured is IPv6 capable. The Commission will bring together IT managers from Member States to exchange experience and to monitor progress.
  - The Commission will equally specify IPv6 capabilities as a core requirement for the continuous renewal cycle of its own network equipment and services. It will carry out timely and appropriate internal trials and projects to prepare for IPv6.

Thank you!

Q & A