IPv6: Internet Addresses Forever

TWNIC Internet Trend Seminar

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Internet Addresses

Internet fundamentals

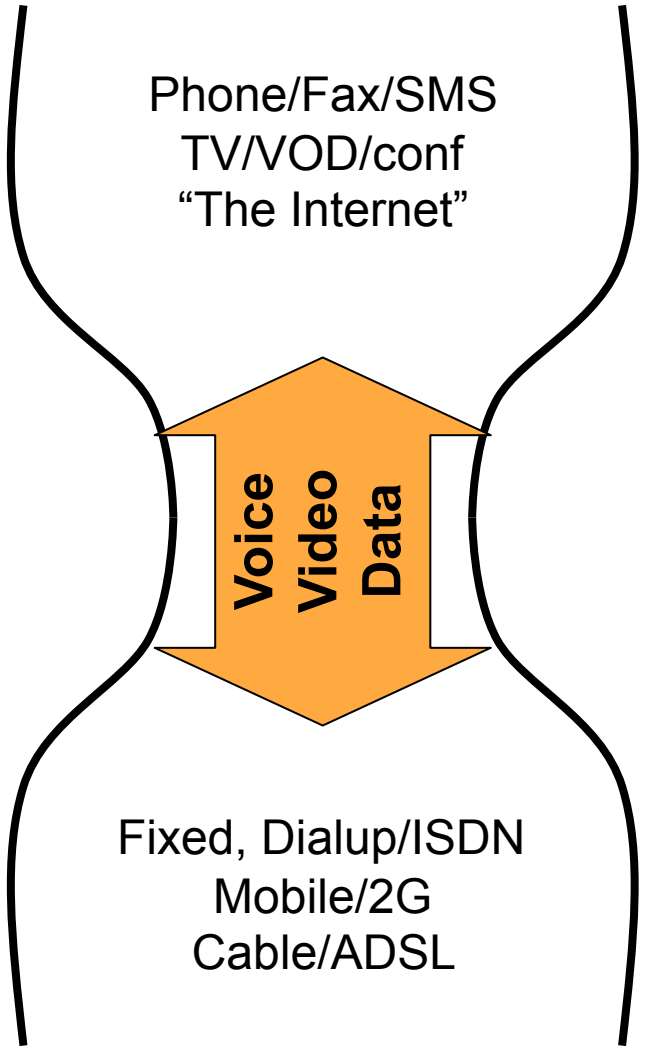
- Open network, open standards
  - Developed within IETF system (RFC series)
  - TCP/IP, DNS, DHCP, HTTP, IPSEC, etc etc
  - “Dumb network” – global p2p datagram service
- “IP over Everything”
  - Layered networking model (a la OSI)
  - Relying on ITU and IEEE standards
  - Serial line, Modem, Ethernet, ISDN, xDSL, cable/fibre, MPLS, 802.11x, Mobile 2G/3G…
- Platform for competition and innovation
  - Great benefits to consumers

The “Protocol Hourglass”

Applications

Network

Infrastructure

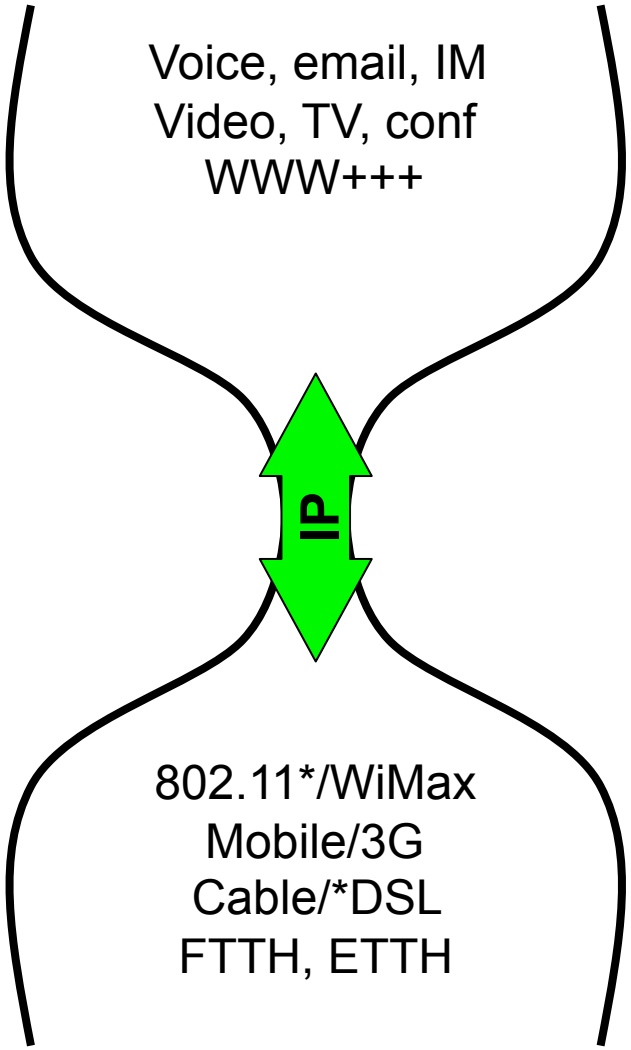


The Hourglass – Tomorrow

Applications

Network

Infrastructure



Broadband and Mobile

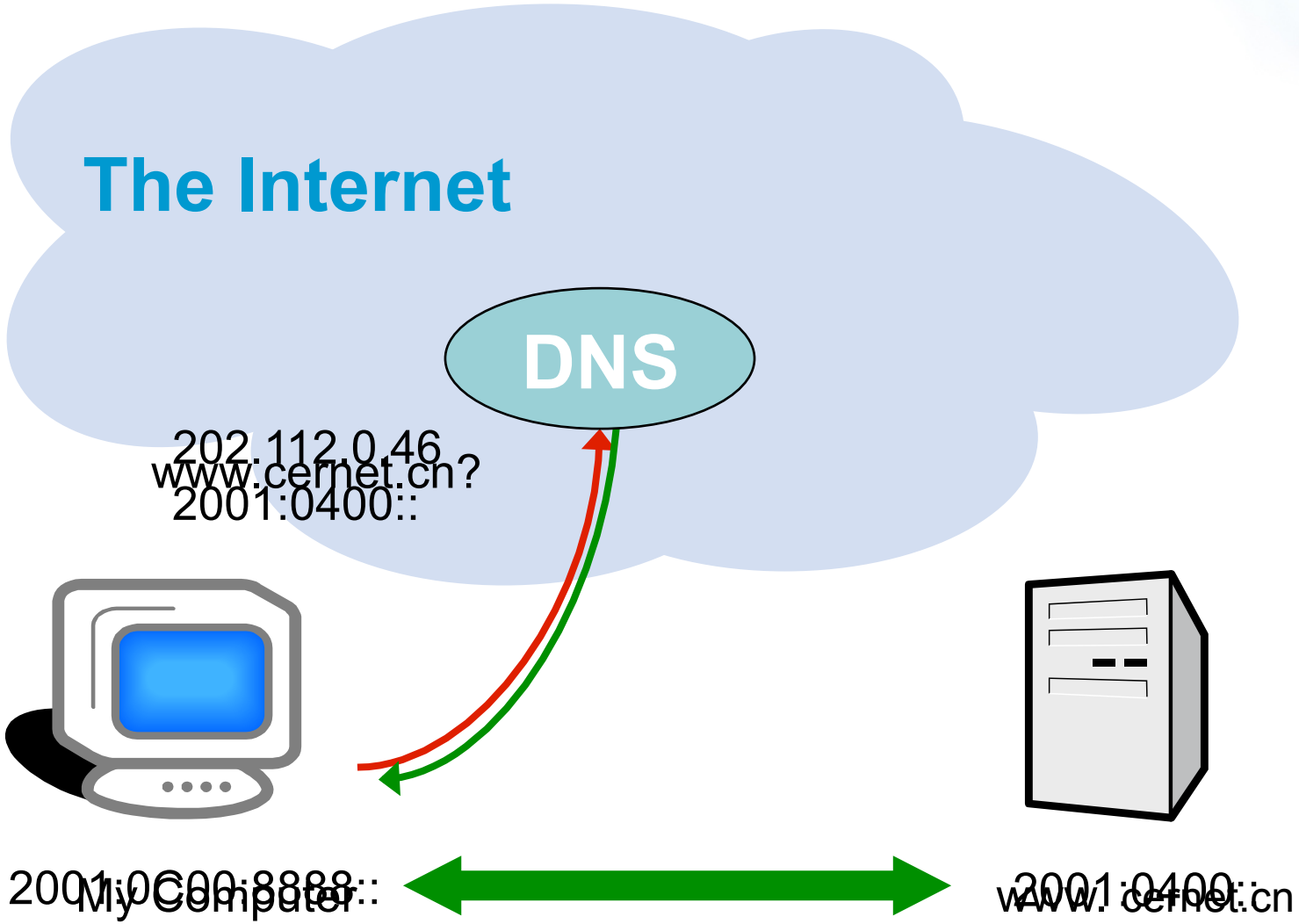
- Acceleration of Internet function and growth, simultaneously
  - Broadband: more speed means more applications
  - Mobile: more devices means more applications
  - More applications means more demand
- Separation of services from infrastructure
  - Vertical disintegration
  - Greater innovation and competition
- Multiple “always-on” services per user
  - Huge increase in IP address requirements…

What is an IP address?

- The Internet Protocol
  - Packets, addressing and routing
  - Two types: IPv4 and IPv6
- An IP address is a number
  - Every device directly connected to the Internet needs a unique IP address
  - IP address space is finite

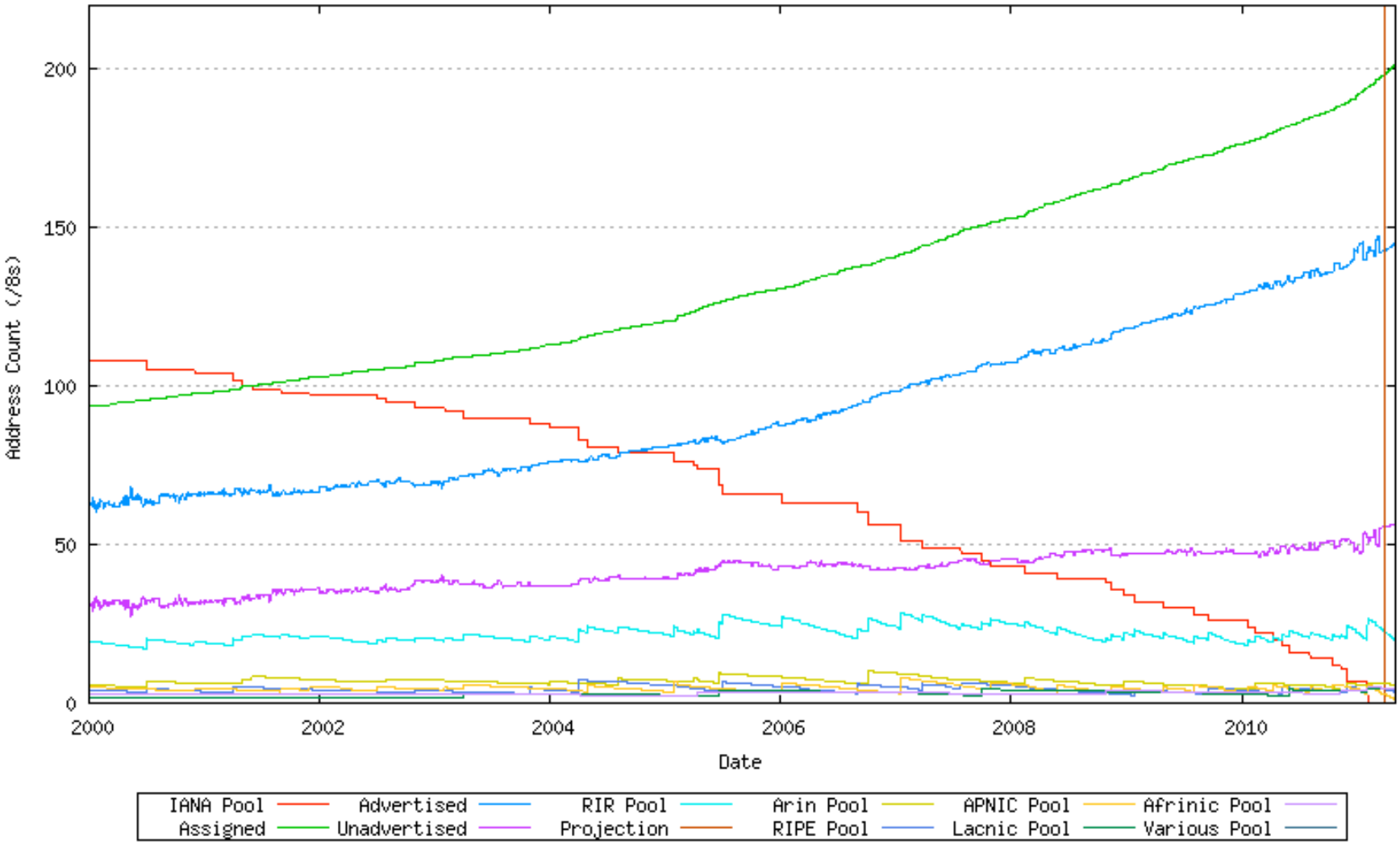
- ***Not the same as a Domain Name !***

IP Addresses vs Domain Names

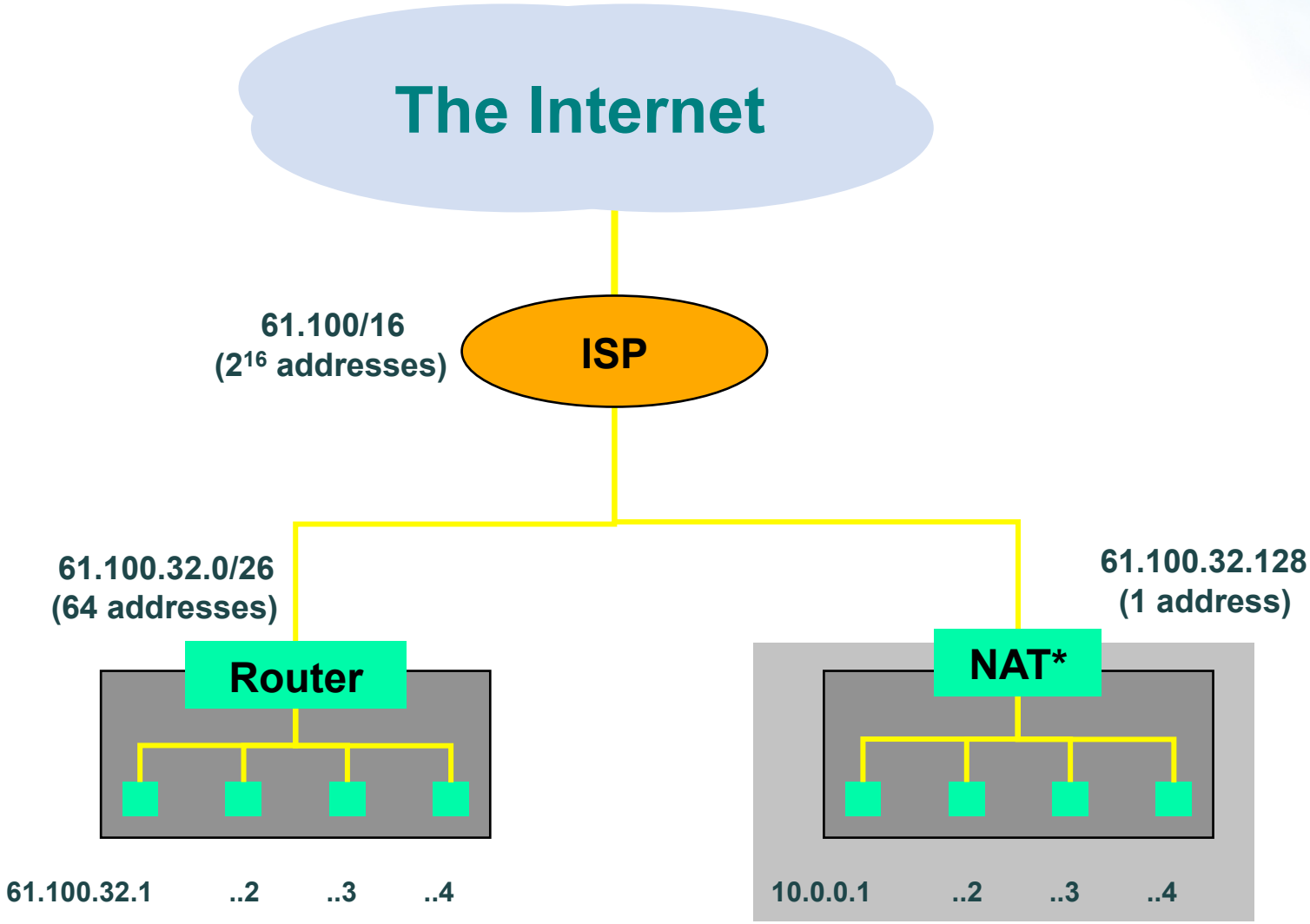


Why IPv6?

IPv4 Consumption

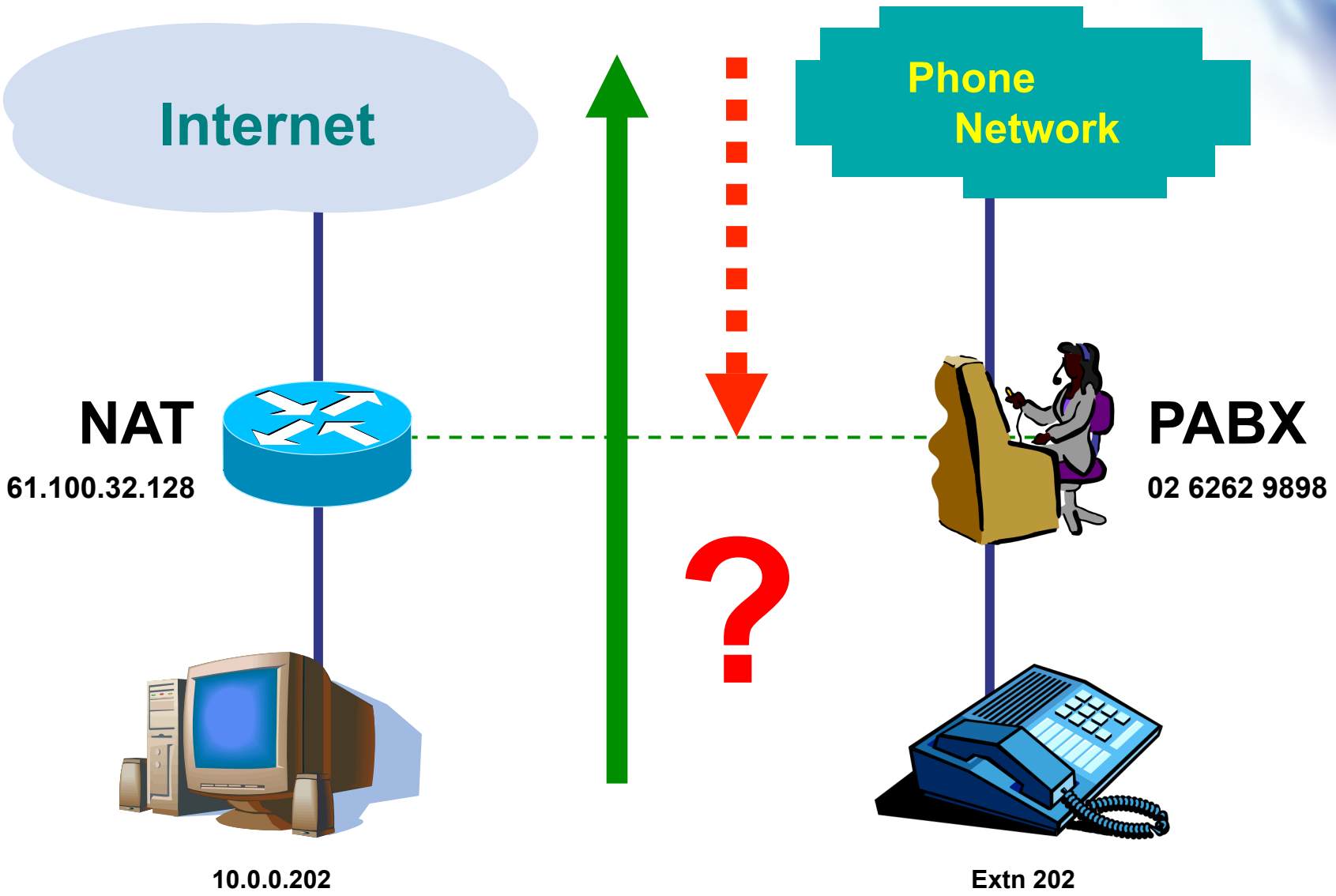


Private addresses and NAT

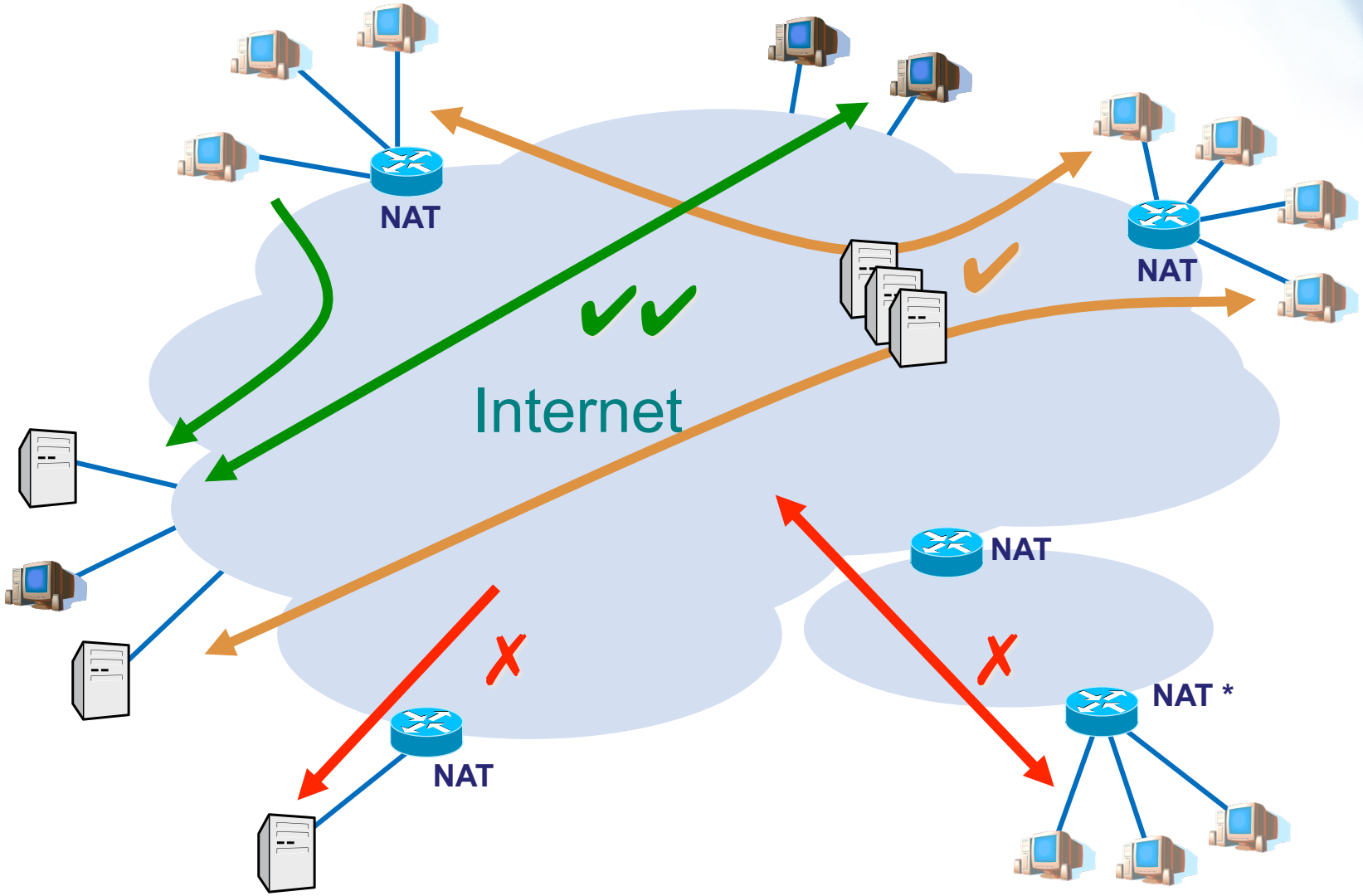


*AKA home gateway, ICS, firewall…

Private addresses and NAT



The limits of NAT…



* Double NAT

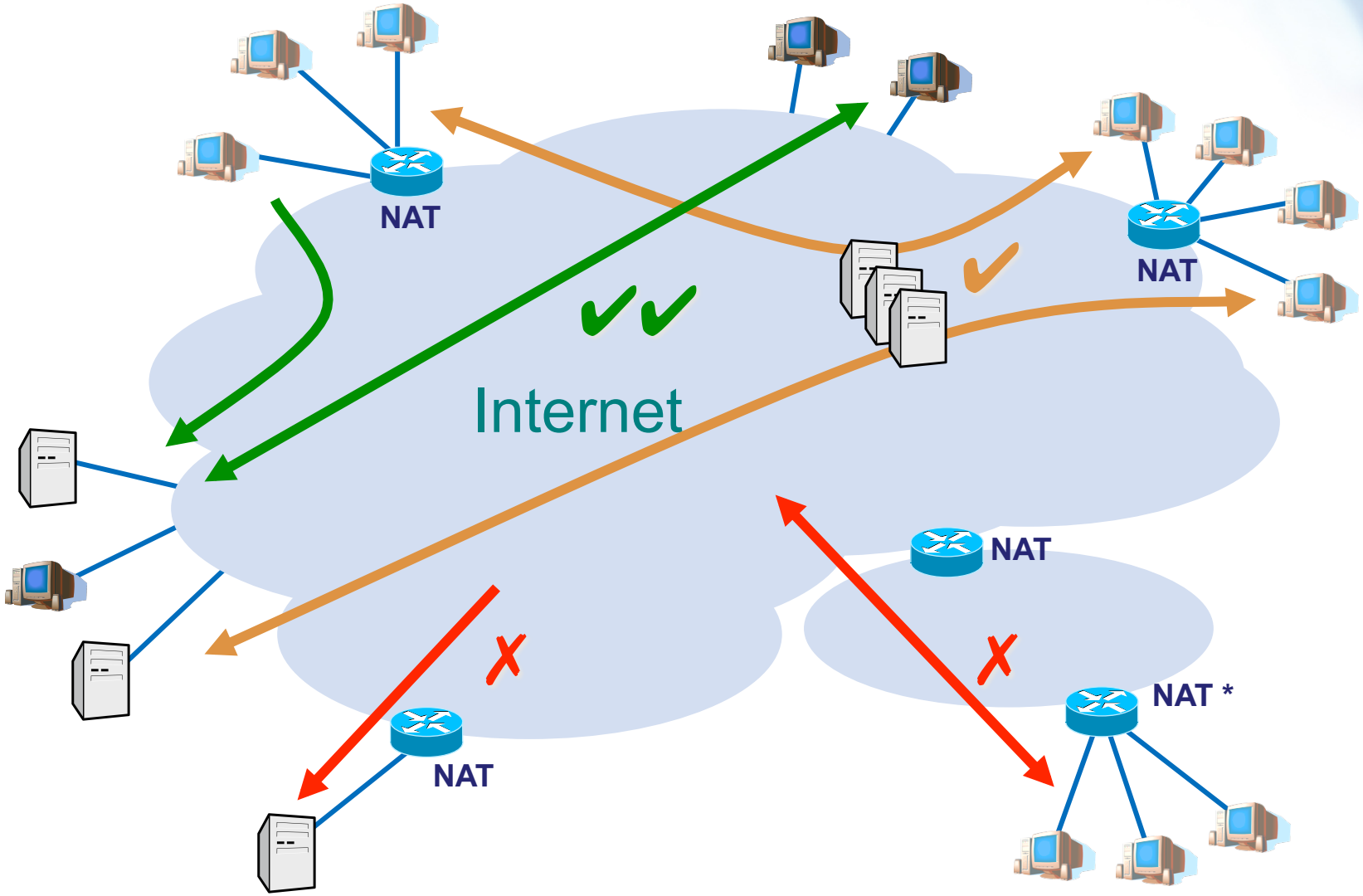
Enter IPv6….

- Why? Just one reason: More addresses
  - Billions… Trillions… Gazillions…?
  - Suffice to say, “Enough for a long time”
- The promise of ample address supply…
  - Simpler, faster, cheaper network
  - No more NAT: “Restore Internet transparency”
  - Better for everyone
- Other benefits …
  - Security, QoS, autoconfiguration, etc?
  - Actually not new: all available in IPv4
  - But all are “built-in” to IPv6

IP Addresses: IPv4 vs IPv6

IPv4	IPv6
Deployed 1981	***Deployed 1999***
32-bit address 192.149.252.76	***128-bit address*** ***2001:DB8:0234:ABCD:0123:4567:8900:BEEF***
Address space 2^{32} = ~4,000,000,000	***Address space*** ***2^{128} = ~340,000,000,*** ***000,000,000,000,000,*** ***000,000,000,000,000***
Security, autoconfig, QoS added later (IPSec etc)	***Security, autoconfig, QoS*** ***"built-in" (IPSec etc)***
Projected lifetime: 2012	***Projected lifetime: Indefinite***

No more NAT ?



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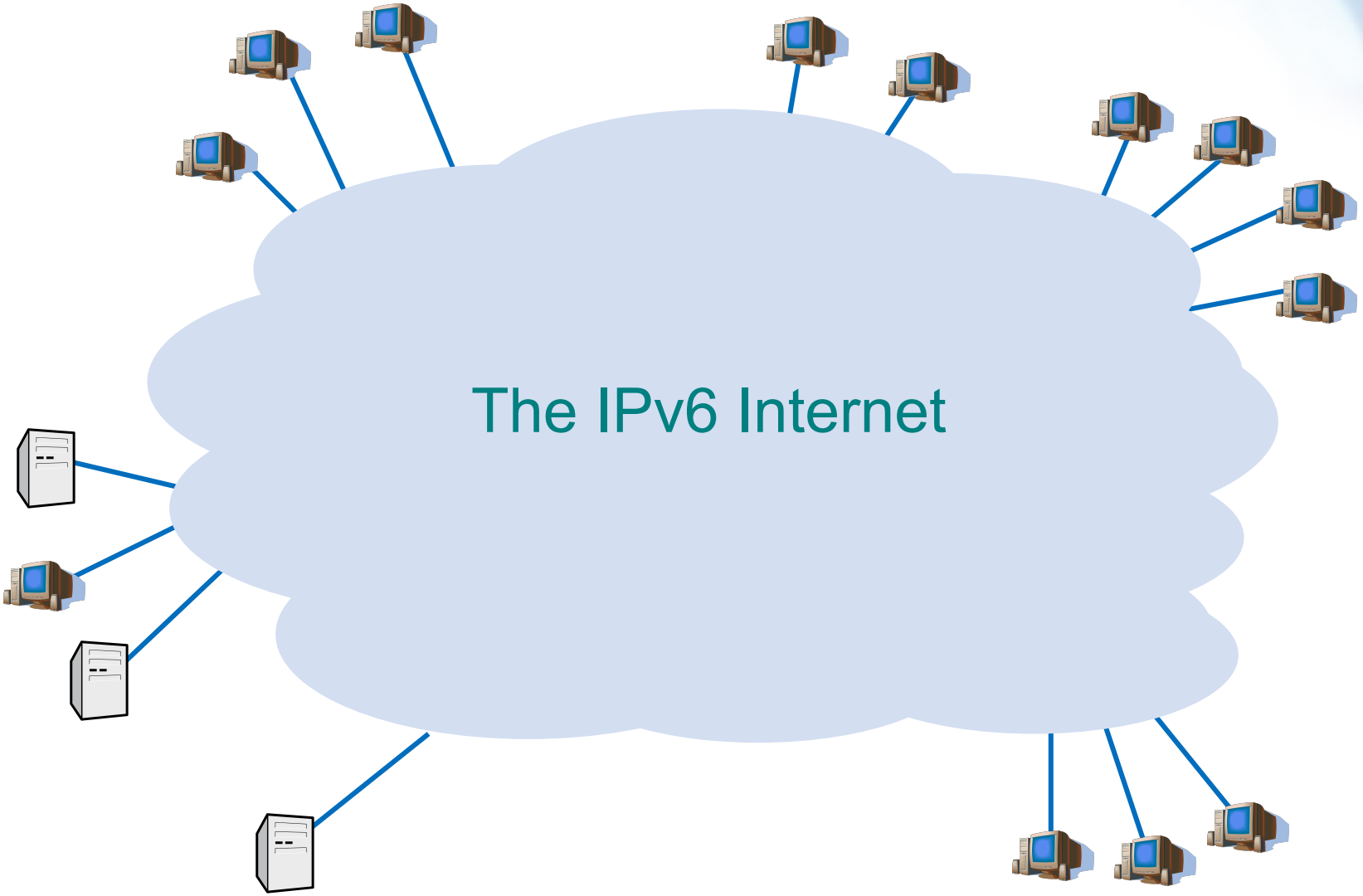
No more NAT!

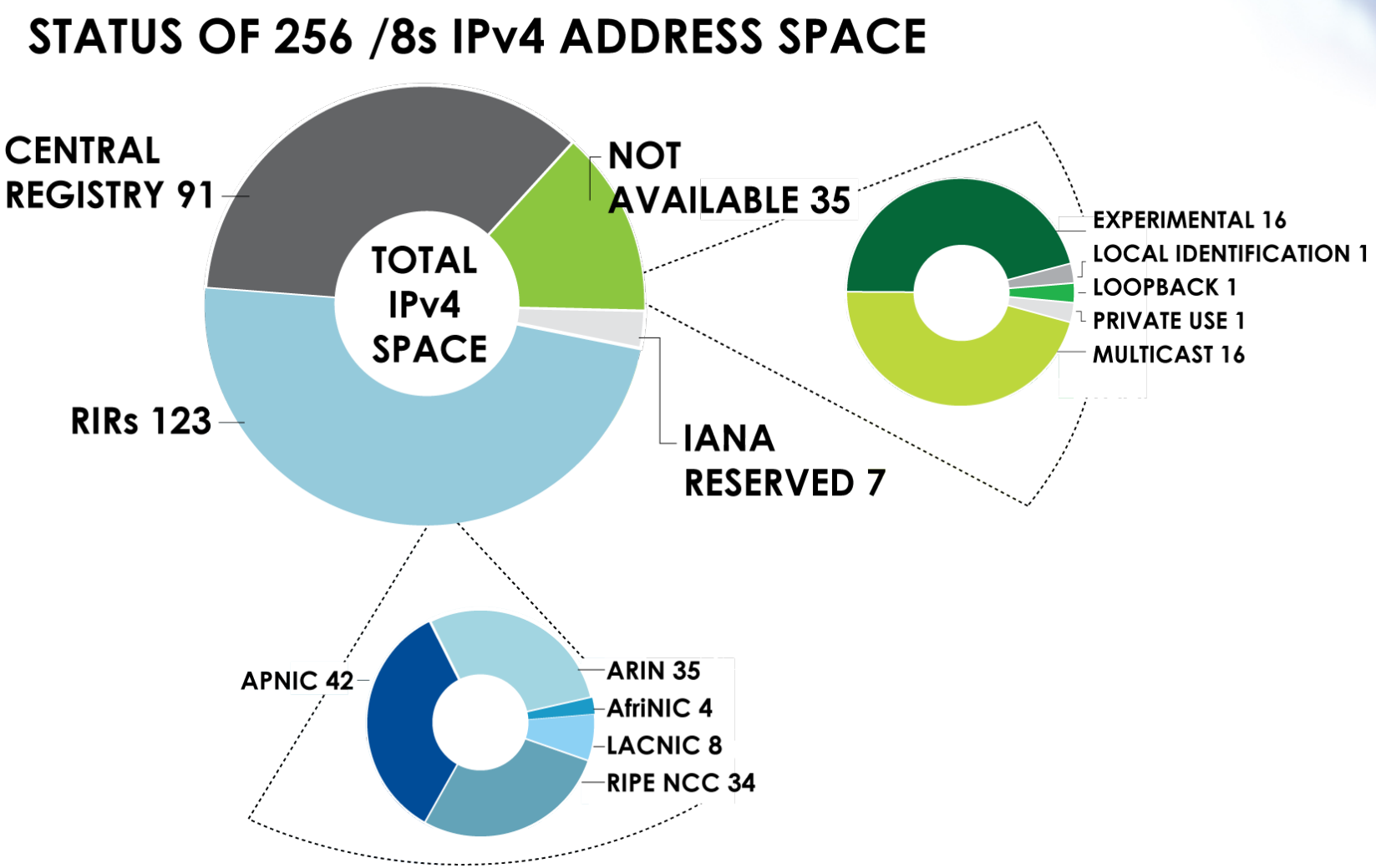


The Transition to IPv6

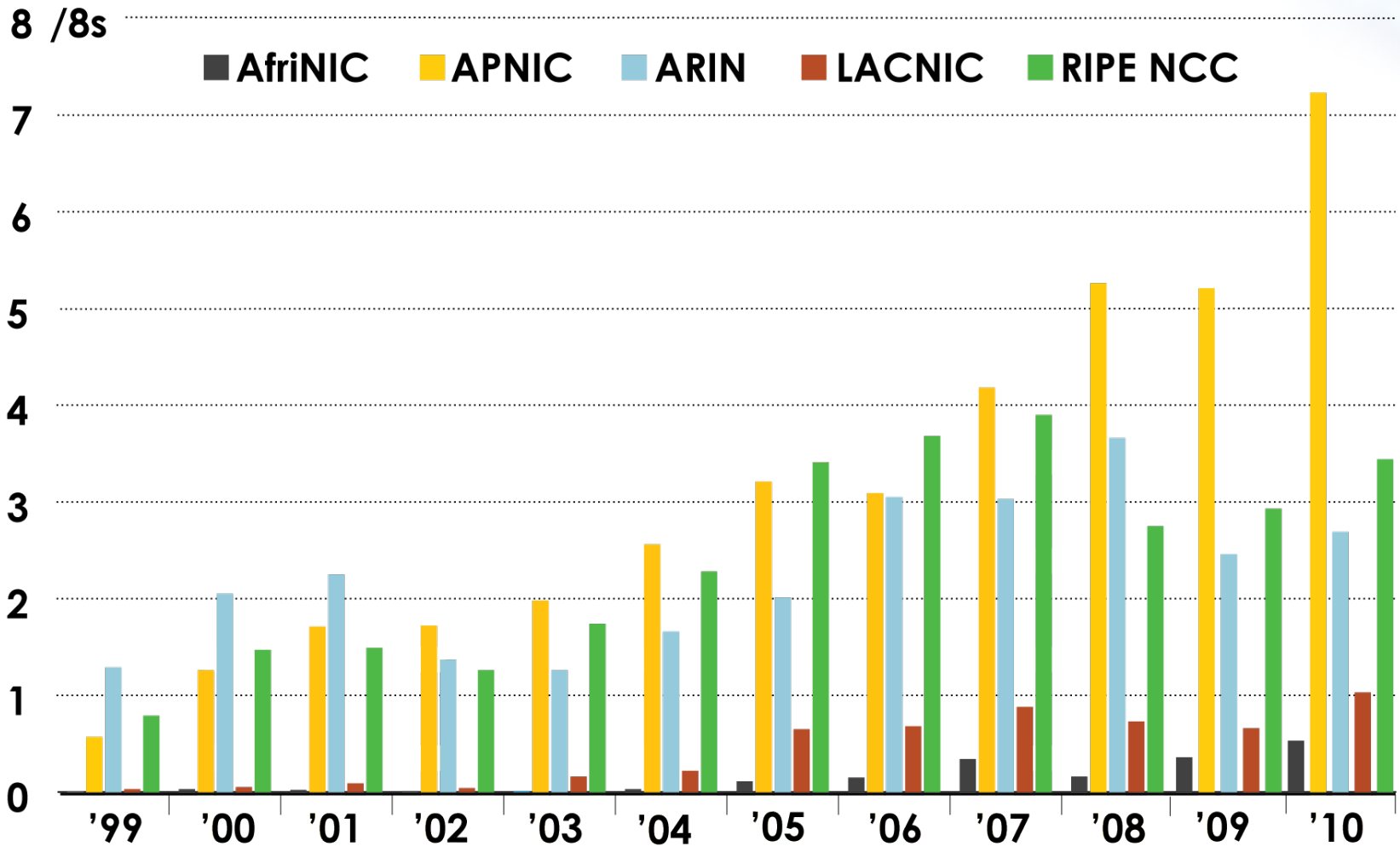
- IPv4 address exhaustion is inevitable
  - IANA allocated the last /8s in Feb 2011
  - The first RIR to exhaust IPv4 address pool will be APNIC in the next 2 months
  - From this point, last /8 block rationed, to support IPv6 transition in future
- IPv6 should be inevitable
  - The only solution to IPv4 exhaustion
  - Protocol is 10+ years old
  - Under a new focus for past 2 years

How far have we come?

IANA: IPv4 Space

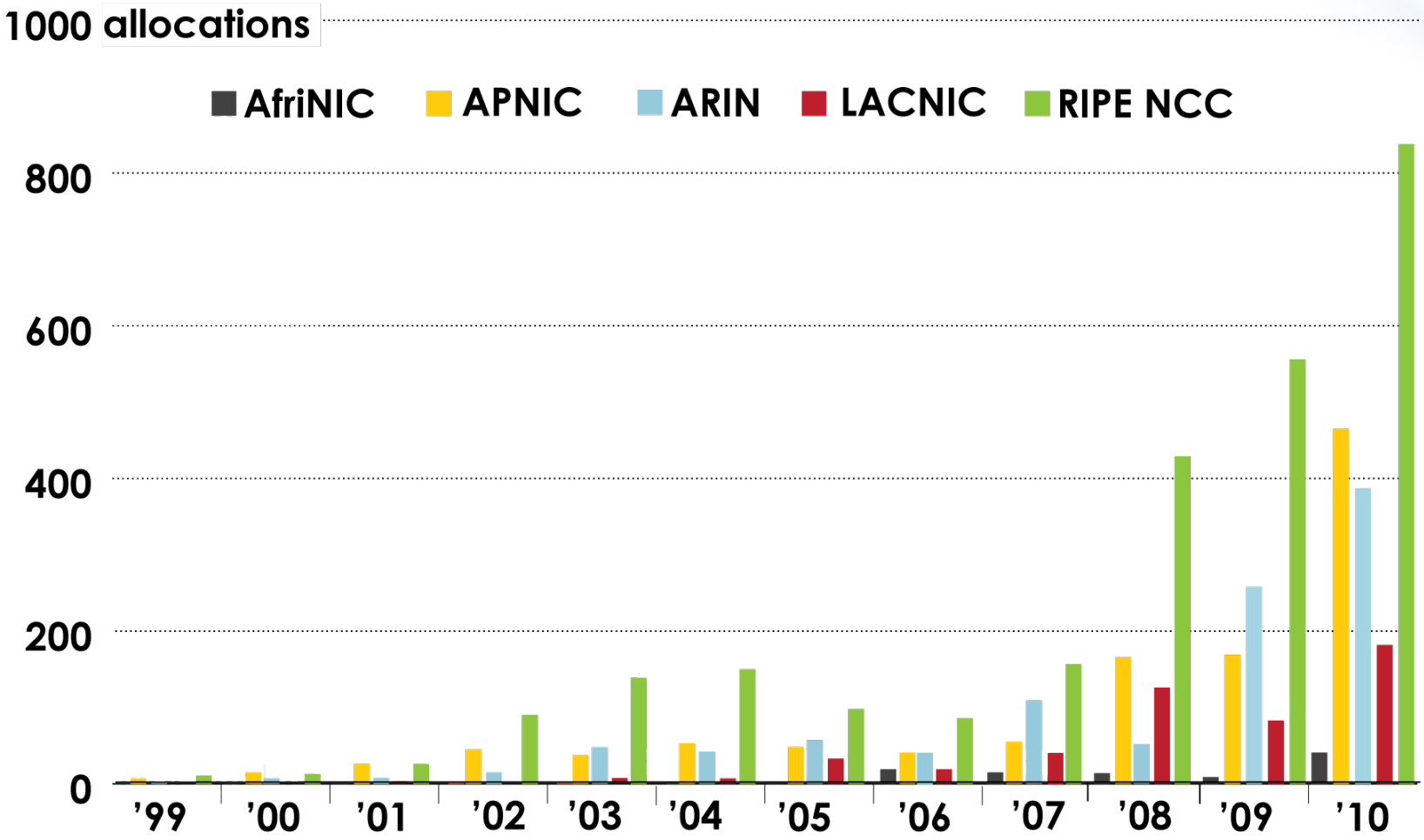


RIRs: IPv4 Allocations



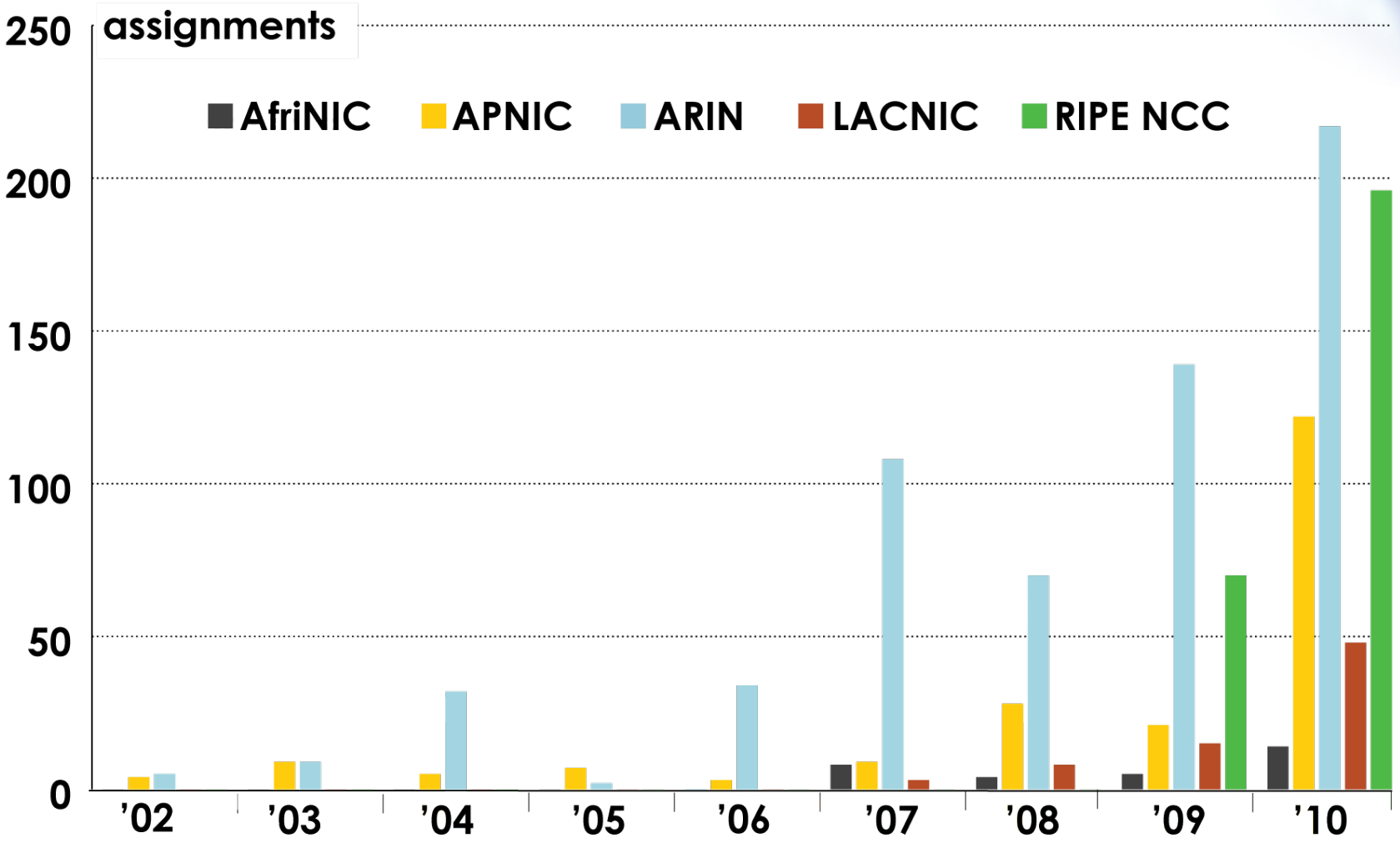
Internet Number Resource Report

RIRs: IPv6 Allocations

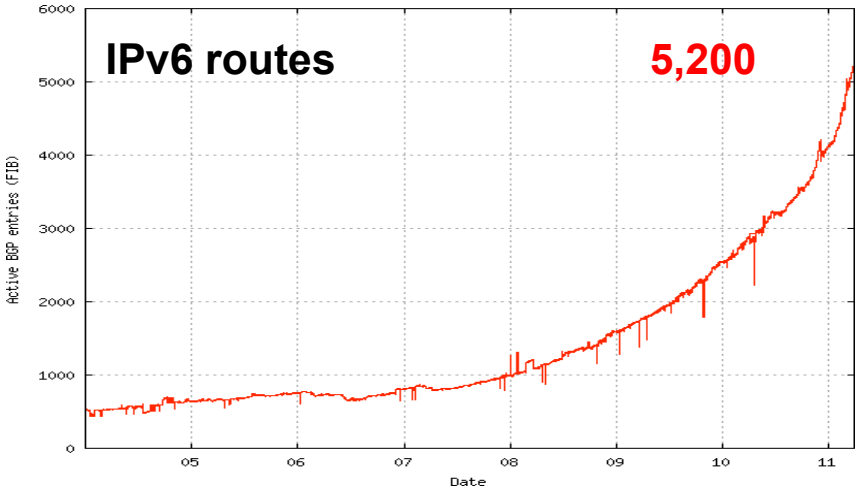


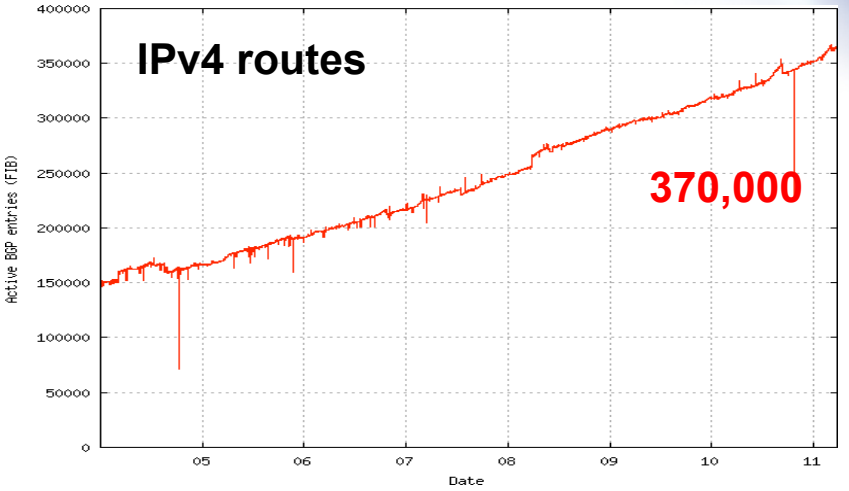
Internet Number Resource Report

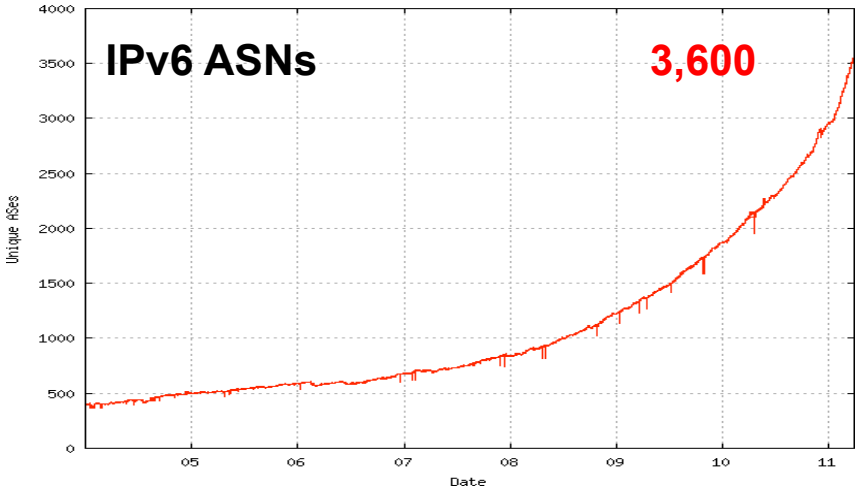
RIRs: IPv6 Assignments

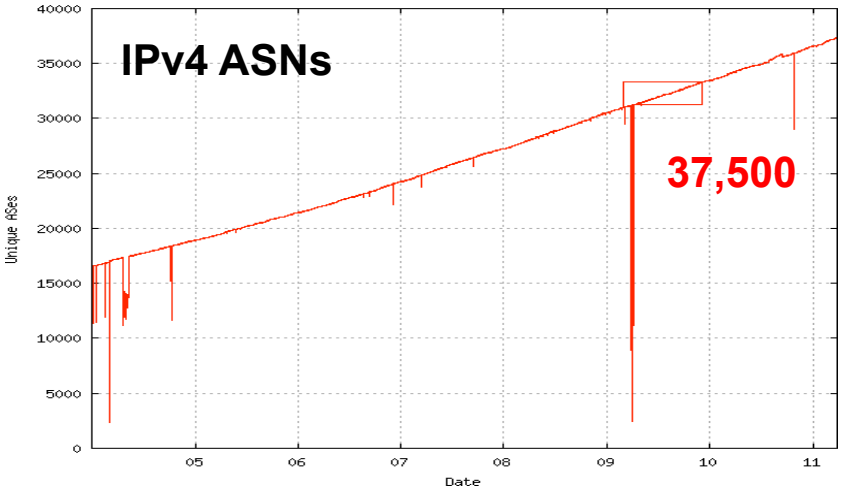


The BGP view of IPv6

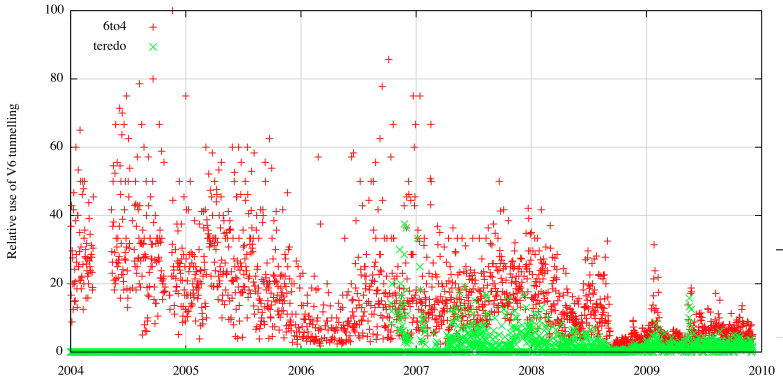


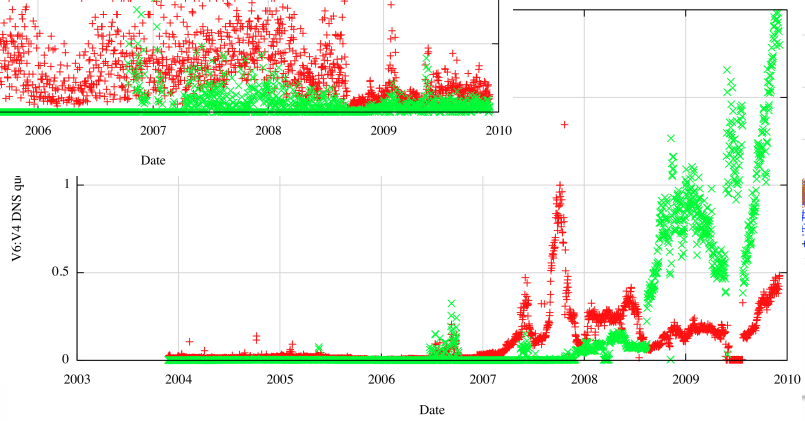


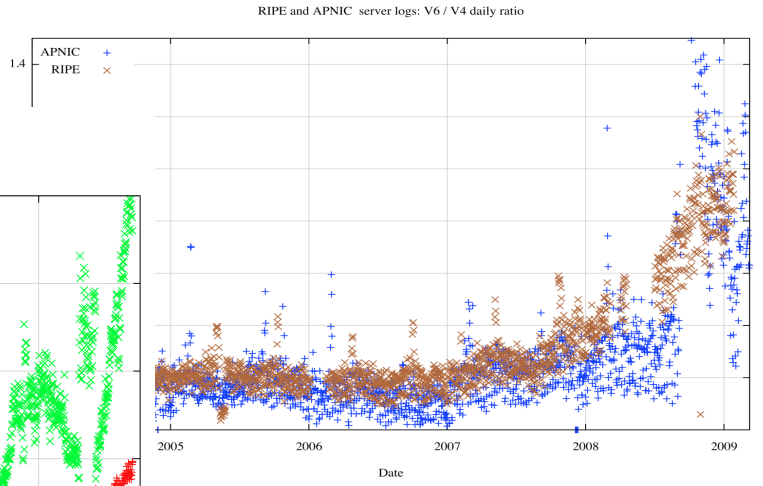


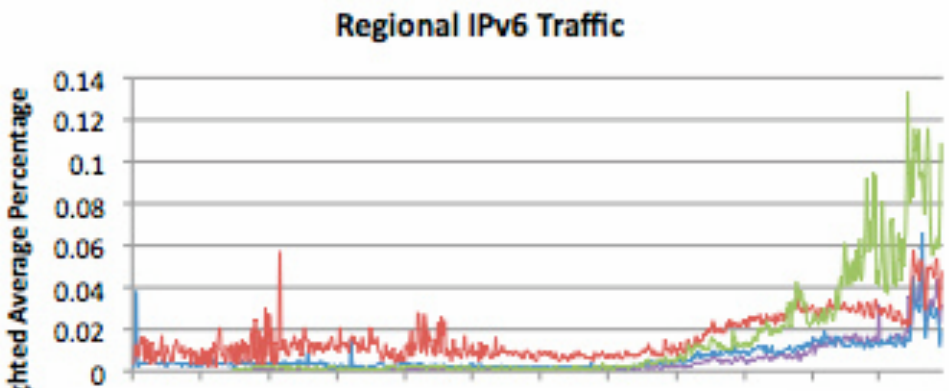


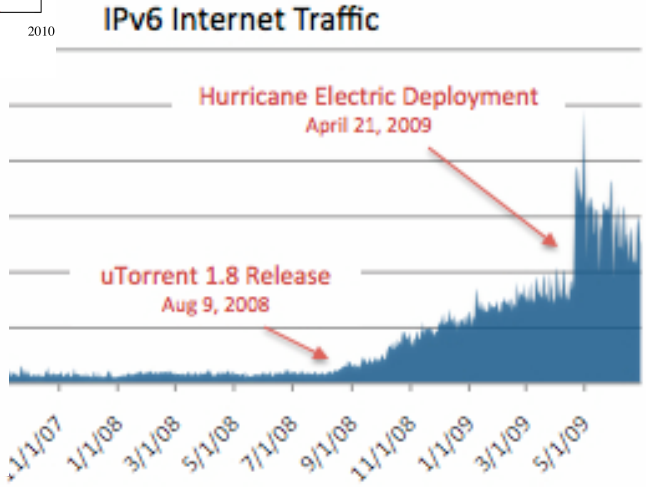
Ratio of IPv6 to IPv4 traffic



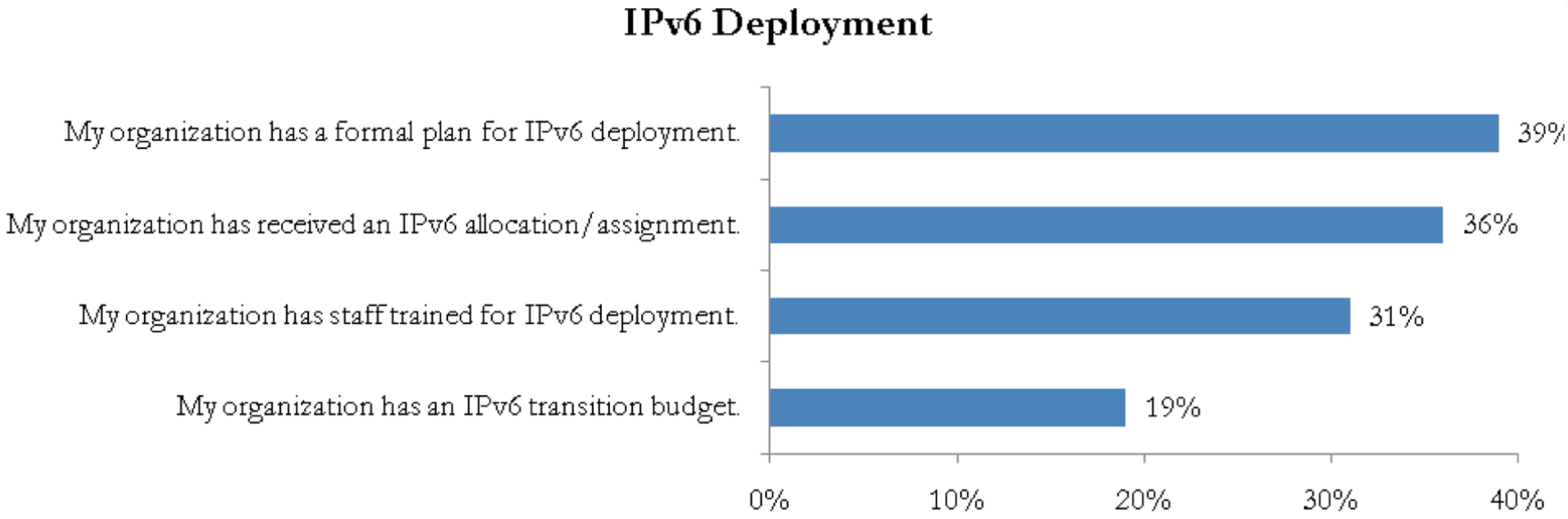








APNIC Survey 2011



What Next?

Sometime in 2011…

- ISPs will need addresses for new network infrastructure
  - and will receive only IPv6
- End users will start receiving IPv6 Internet services
  - With or without private IPv4 addresses
- Enterprises and businesses will get IPv6 for their new networks
  - “Customer NAT” will apply to IPv4
- All Internet users will be affected
- Are you ready?

ISPs and Operators

- *Note well: One day soon, you will only get IPv6 addresses for new deployments…*

- Is your infrastructure ready for IPv6?
- Can you deliver IPv6 service in 2011?
- What is your plan for IPv4 services to your customers? None? Customer NAT? CGN?
- Are your services and systems ready?
  - DNS, SMTP, web, mail, etc etc etc
  - Security, monitoring, customer admin, billing…
- And by the way, do you have addresses?

Enterprises and content providers

- *One day, your customers and business partners may only have IPv6 addresses…*

- Will your website and services be visible via IPv6 in 2011?
- Do you have an upgrade path between now and then?
- Does your domain name have AAAA?
- Do all your service providers, integrators and vendors have their plans in place?
- Have you asked them?
- And by the way, do you need addresses?

Others…

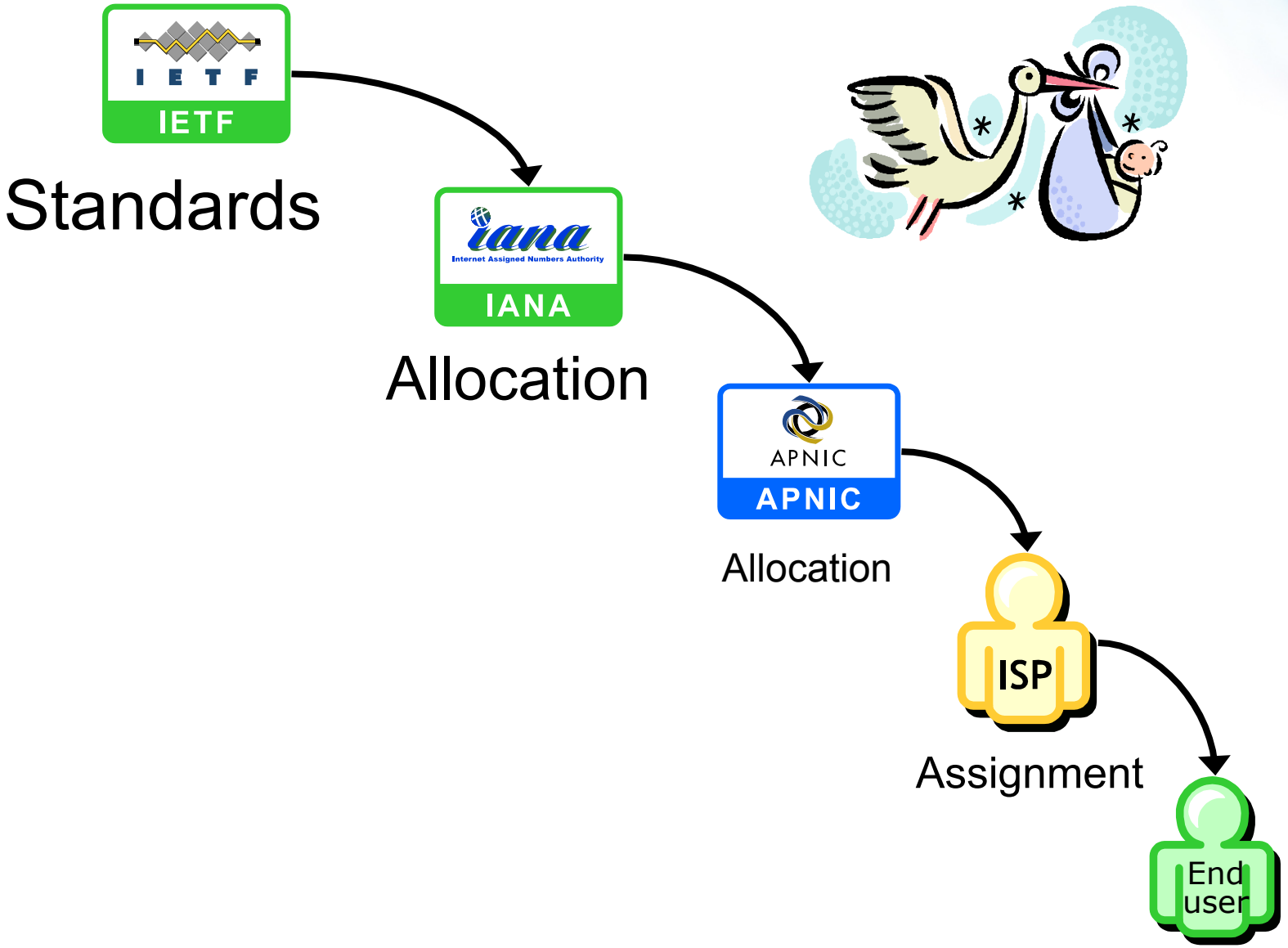
- System integrators and consultants
  - Can you put all the pieces together?
  - Are your people trained to answer questions?
  - Can you help your customers with their planning?
- Academics and educators
  - Is your institution ready for IPv6 in 2011?
  - Are you producing IPv6-ready graduates?
  - Have you upgraded your skills?

Governments

- Do you have procurement criteria mandating IPv6 capabilities?
- Are your agencies ready with IPv6?
- Are your online and e-government services ready with IPv6?
- Are your Internet industries up to speed?
- Are you providing leadership?
- What else are you doing?

About APNIC and our efforts

Where do IP addresses come from?



Regional Internet Registries

- Structure and operations…
  - Open membership-based industry bodies
  - Non-profit, neutral, and independent
  - Allocation, registration and other services
  - APNIC: training, infrastructure, cooperation
- History…
  - First established in early 1990s
  - Voluntarily by consensus of community
  - To ensure responsible address management, according to technical needs
  - To support Internet development

Regional Internet Registries

The Internet community established the RIRs to provide fair and consistent resource distribution and accurate resource registration throughout the world.

APNIC's IPv6 Efforts

- IPv6 compliance in all our services
- ISPs, our main constituents
  - Training, education, supporting NOGs
- Outreach on IPv6
  - Enterprises and content providers
  - ccTLDs and their registrars
  - Governments
  - IGF and related meetings
  - APEC TEL, ITU, OECD and others

Need IPv6 addresses?

Asia Pacific Network Information Centre

APNIC

In conclusion

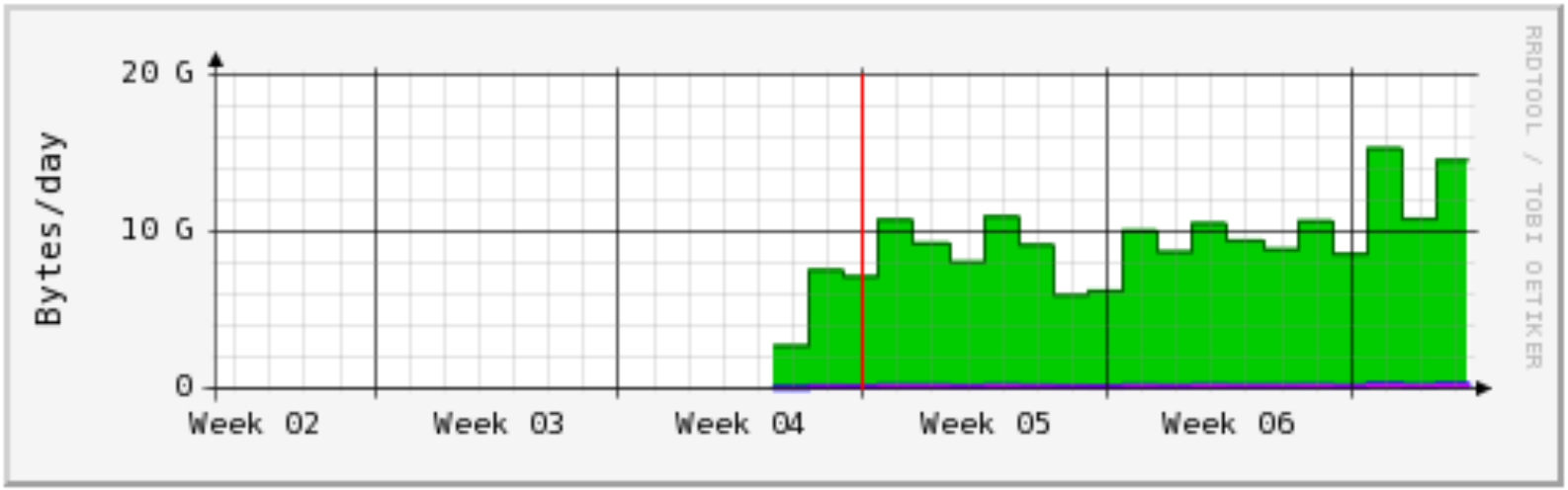
What's the question?

Chicken or Egg?

"Google has quietly turned on IPv6 support for its YouTube video streaming Web site, sending a spike of IPv6 traffic across the Internet…"

– 1 Feb 2010 Networld

- Monash University, Melbourne, Australia:



“What’s the Killer App for IPv6?”

The Internet !

Remember the IPv4 revolution?

- The 1990's – a new world of…
  - Cheaper switching technologies
  - Cheaper bandwidth
  - Lower operational costs
  - The PC revolution, funded by users
- The Internet boom
  - The dumb (= cheap) network
  - Innovation at the edges
  - Many new models and services

How about an IPv6 revolution?

- The 2010's – a new world of…
  - Commodity Internet service provision
  - Broadband, mobile, always-on
  - Cheap consumer electronics
  - A network-ready society
- An IPv6 boom?
  - Ubiquitous pervasive networking
  - Bringing online the "Next 5 Billion"
  - Plus billions of new devices
  - "Internet for Everything"

Are You Ready?

Thank You!

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