stipv6

Stichting IPv6 Nederland

IPv6

create awareness

for the upcoming internet transition

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Founding boardmembers Stichting IPv6 Nederland

What, who, why and how IPv6?

- What is the present internet protocol?
  - IP version 4 (IPv4)
- How many bits for IP addresses has IPv4?
  - 32 bits
- How many IP addresses can exist with that?
  - ~4.3 billion (4.3×10^9)
- How many usable addresses remain?
  - ~3.7 billion
- Who is responsible for distributing IP addresses?
  - IANA -> RIR -> LIR (ISP)

Regional Internet Registries

The RIPE NCC service region incorporates Europe, the Middle East and parts of Central Asia. Other regions are supported by the following Regional Internet Registries (RIRs):

AfriNIC – serving Africa
APNIC – serving the Asia Pacific region

ARIN – serving North America
LACNIC – serving the Latin American and the Caribbean region

What, who, why and how IPv6?

- How many addresses has IANA distributed (Late 2010) ?
  - ~3.6 billion
- How many addresses are left?
  - ~120 million
- How many are distributed per year?
  - >200 million
- So when was IANA running out of IPv4 addresses?

Feb 3rd, 2011

What, who, why and how IPv6?

- Which RIR was the first to run out of IPv4 addresses?
  - APNIC (Asia)
- When was APNIC running out of IPv4 addresses?

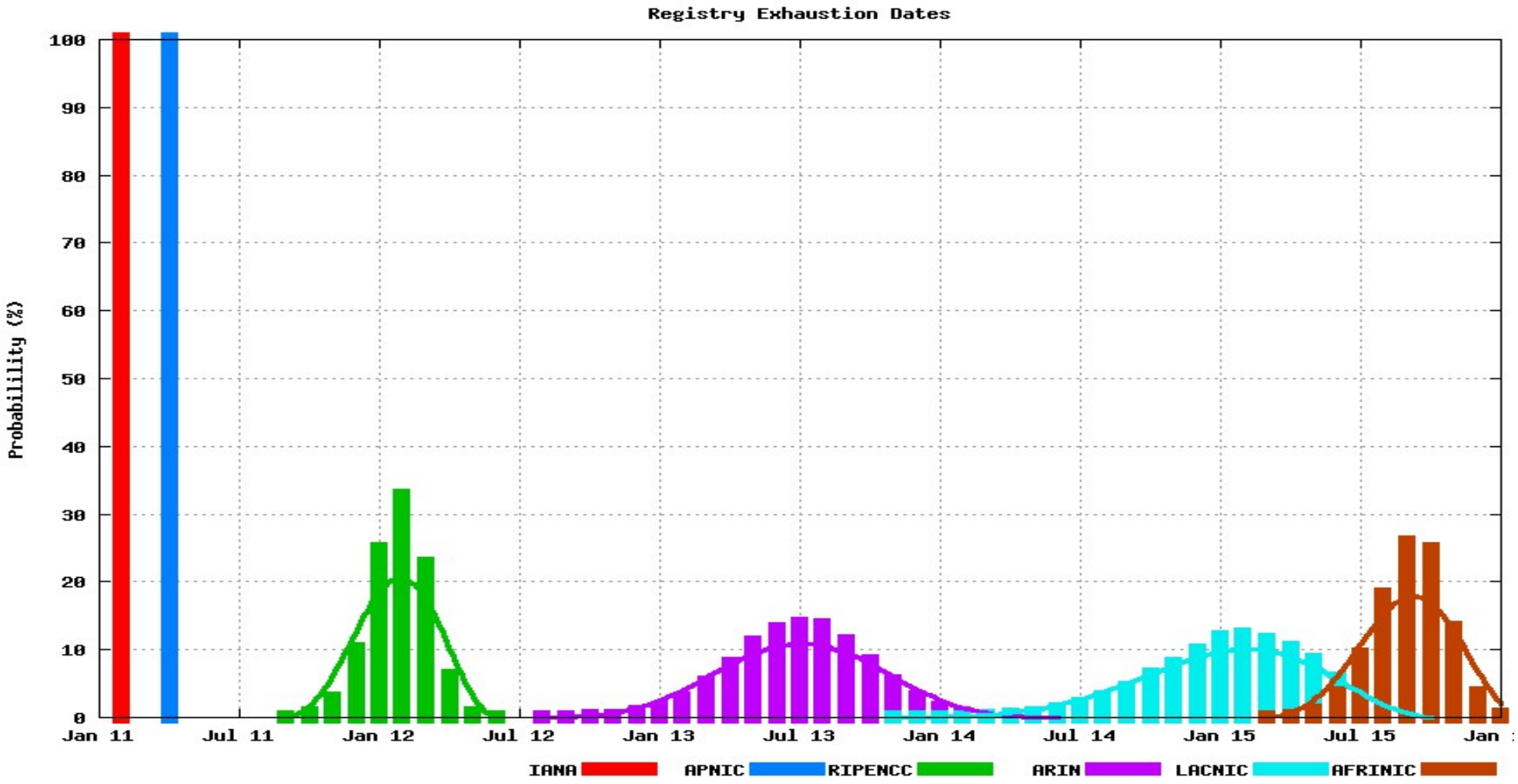
Apr 15th, 2011

What, who, why and how IPv6?

- When is RIPE (Europe, Middle East and Russia) expected to run out of IPv4 addresses?

Late, 2011 or early 2012?

Probability estimate of RIR Exhaustion dates



source: Geoff Huston, www.potaroo.net/tools/ipv4/rir.jpg

What, who, why and how IPv6?

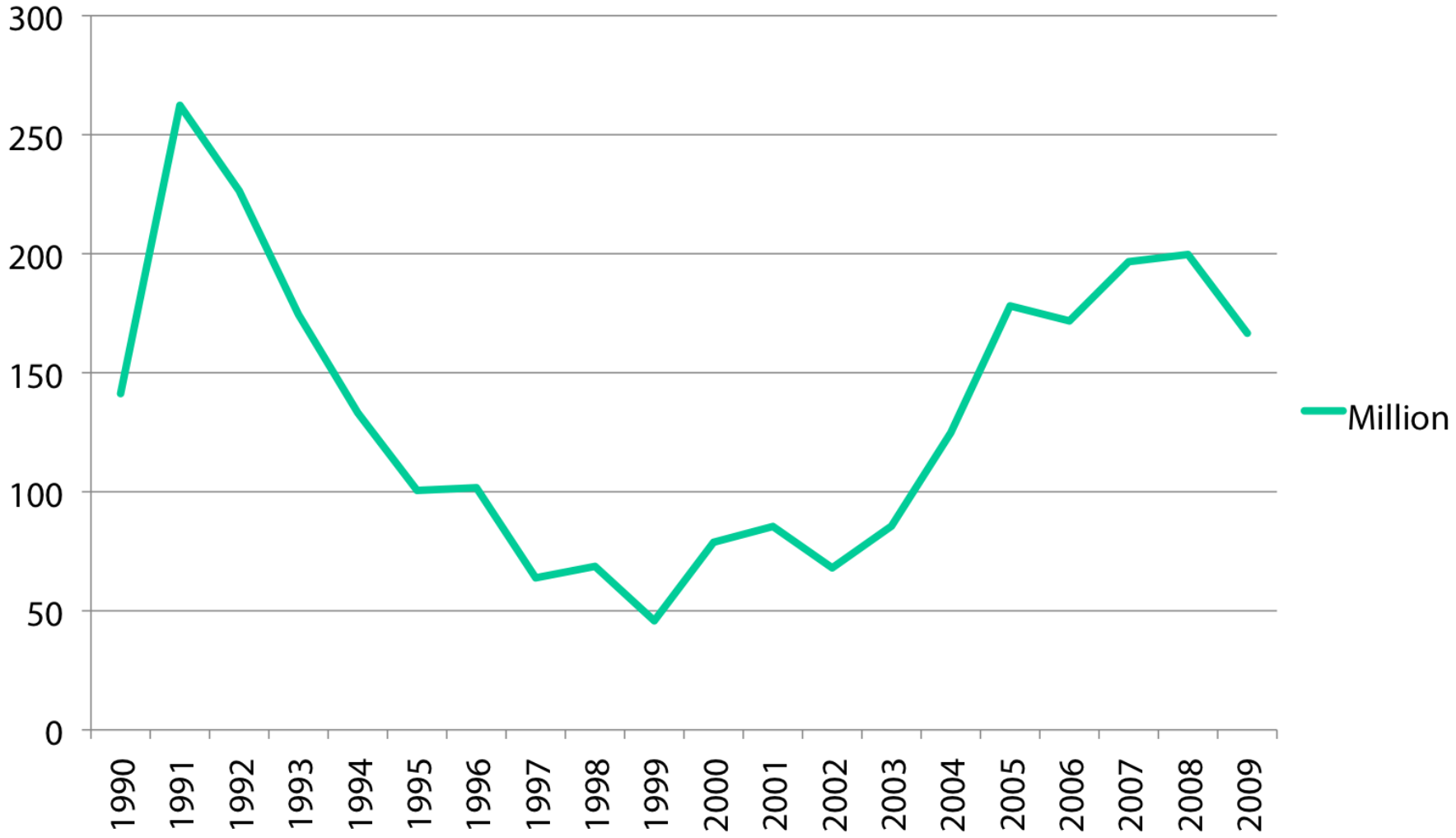
- So what is the time?
  - five minutes to twelve!
- What is the solution?
  - IP version 6 (IPv6)
- Why?
  - 128 bits: 340.282.366.920.938.463.463.374.607.431.768.211.456
- When do you need to act?

Now!

History of IPv4

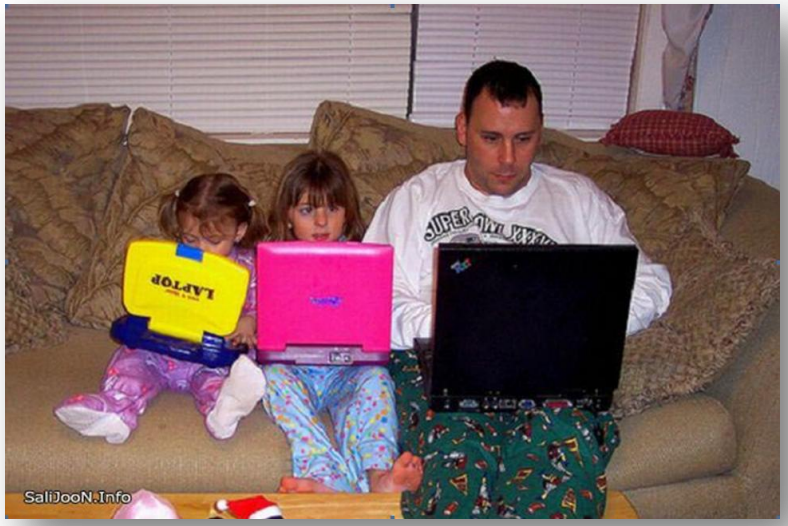
- 1957 US DoD Advanced Research Project Agency
- 1969 ARPANET 4 hosts 56kbps NCP
- 1972 Gov and Edu use of ARPAnet
- 1974-80 Vint Cerf, Robert Kahn develop TCP/IP
- 1979 IP version 4 in RFC760 IPv4
- 1980-83 ARPANET moves to TCP/IP
- 1983 ARPANAT -> MILNET
- 1984 Size grows to >1000 hosts DNS
- 1986 Backbone NSFnet 56kbps
- 1988 Backbone speed 1.5 Mbps
- 1990 Commercial use of internet

Distributed IPv4 numbers/year from 1990



Source: bgpexpert.com

More users and the Internet of “Things”



History of IPv6

- 1991-92 Awareness of lack of IPv4 addresses
- 1995 First IPv6 standard by Steve Deering (Xerox) and Robert Hinden (Ipsilon) RFC 1883
- 1998 Final IPv6 standard by Steve Deering (Cisco) and Robert Hinden (Nokia) RFC 2460

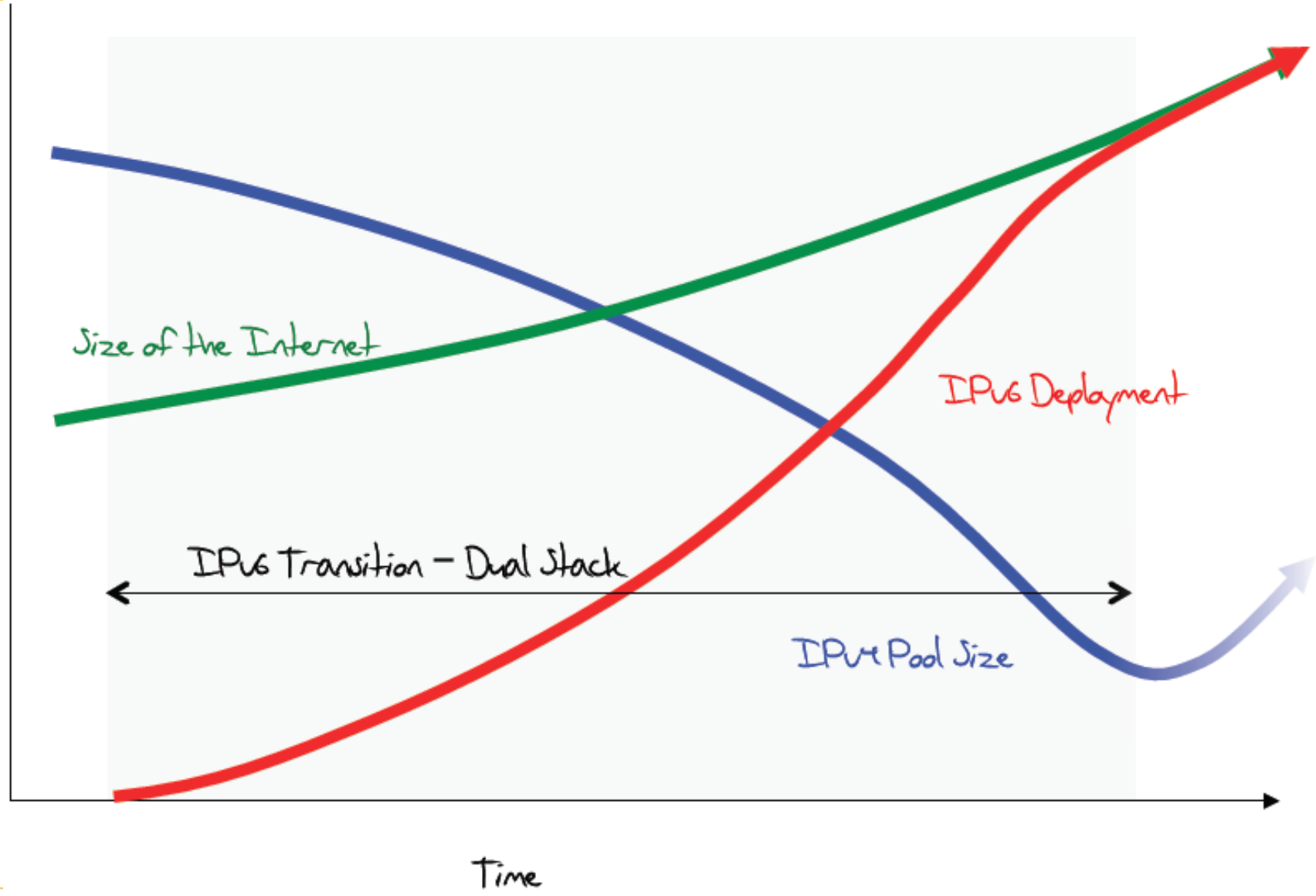
So what about IPv5?

1969	1970	1979	1983	1994	1998
"IPv1"		"IPv3"		(IPv5)	IPv7
(voorloper NCP)	ARPANET hosts beginnen met het gebruik van het Network Control Protocol (NCP)	Transmission Control Protocol volgt NCP op	Overgang van NCP naar TCP/IP op 1 januari 1983	Experimenteel streaming protocol	Standaardisatie 128 bits netwerk protocol
	"IPv2"		IPv4		IPv6

IPv6 design objectives

- Much more addresses
- Faster
- More simple configuration
- Safer
- Mobility
- Simple migration

Theoretical IPv6 deployment scenario

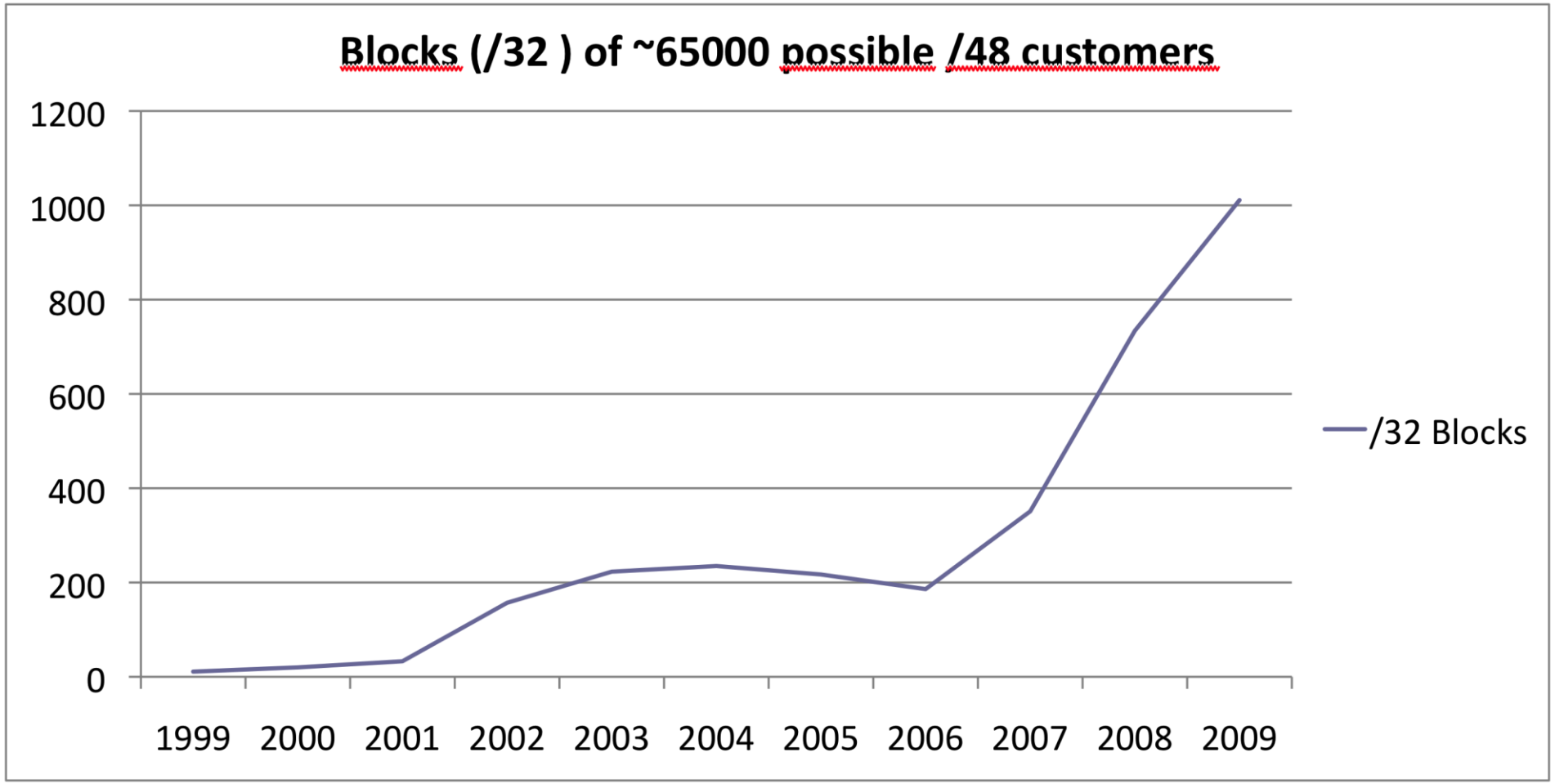


Early steps

- 2000-06 6Bone: Testbed for deployment of IPv6
- 2001-05 Euro6IX: Internet Exchanges Backbone
- 2002-04 6Net: European large scale international pilot
- 2005-07 6Diss: EU knowledge xfer to developing regions
- 2008-10 6Deploy: EU project for WW training & support to ISP's and industry
- 2005-11 Most operating systems have IPv6 enabled
  ISP's are enabling IPv6 in backbones
  ISP's are requesting blocks of IPv6 addresses

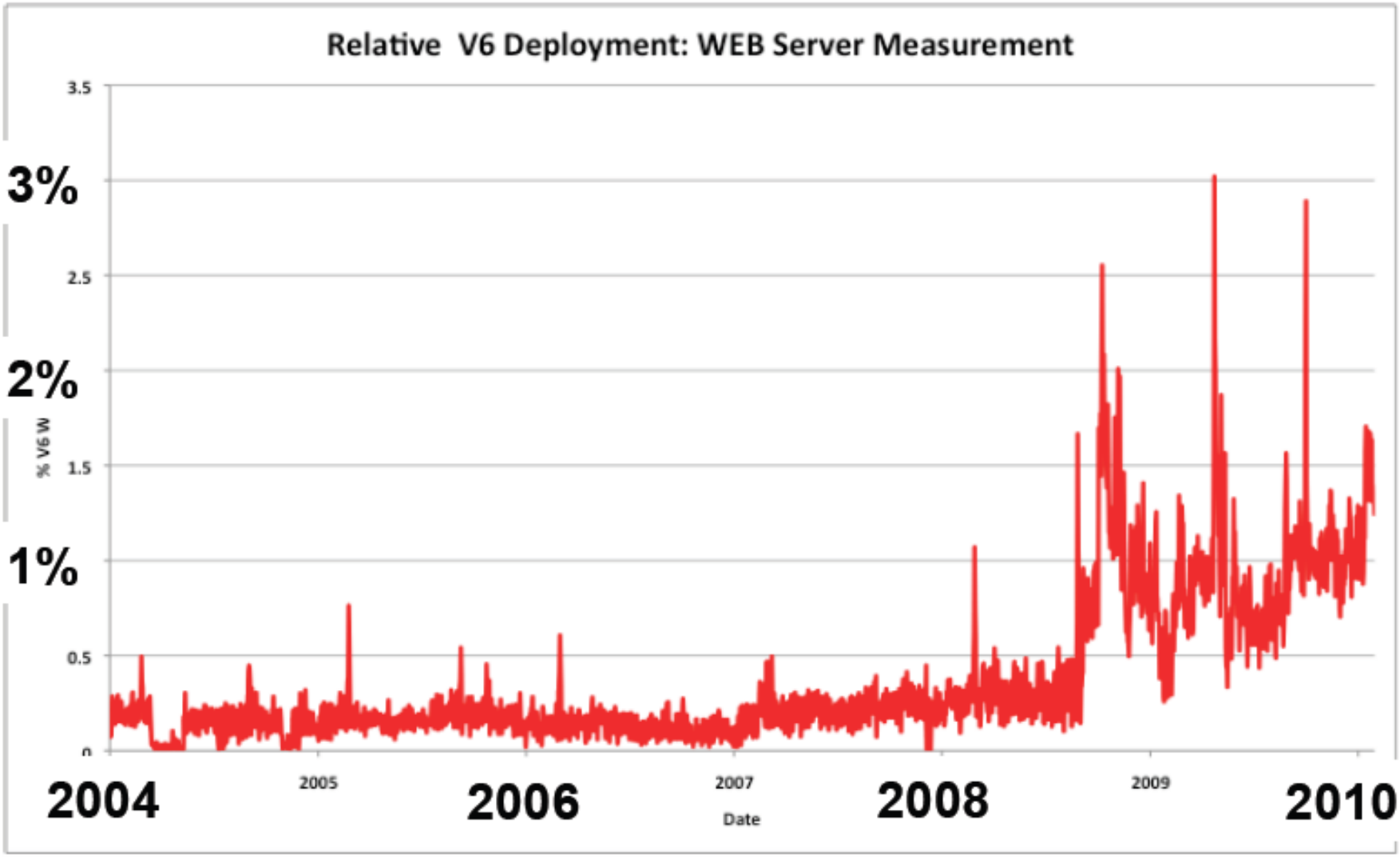
  Few ISP's are offering access to consumers
  Few websites are on IPv6
  IPv6 traffic on AMS-IX still very low
  Companies are not willing to invest

IPv6 distribution (small to medium ISP's)



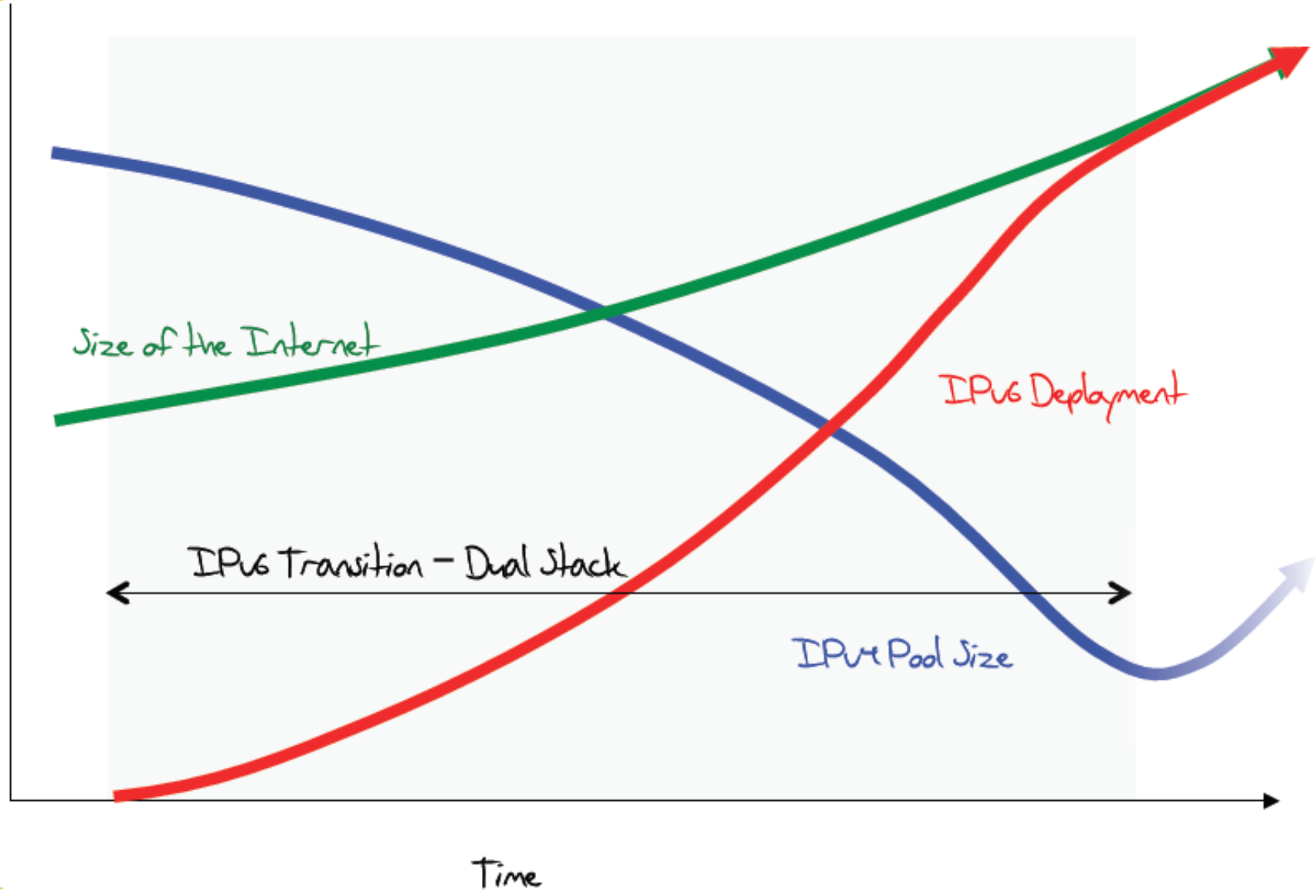
Source: bgpexpert.com

Measured IPv6 Deployment

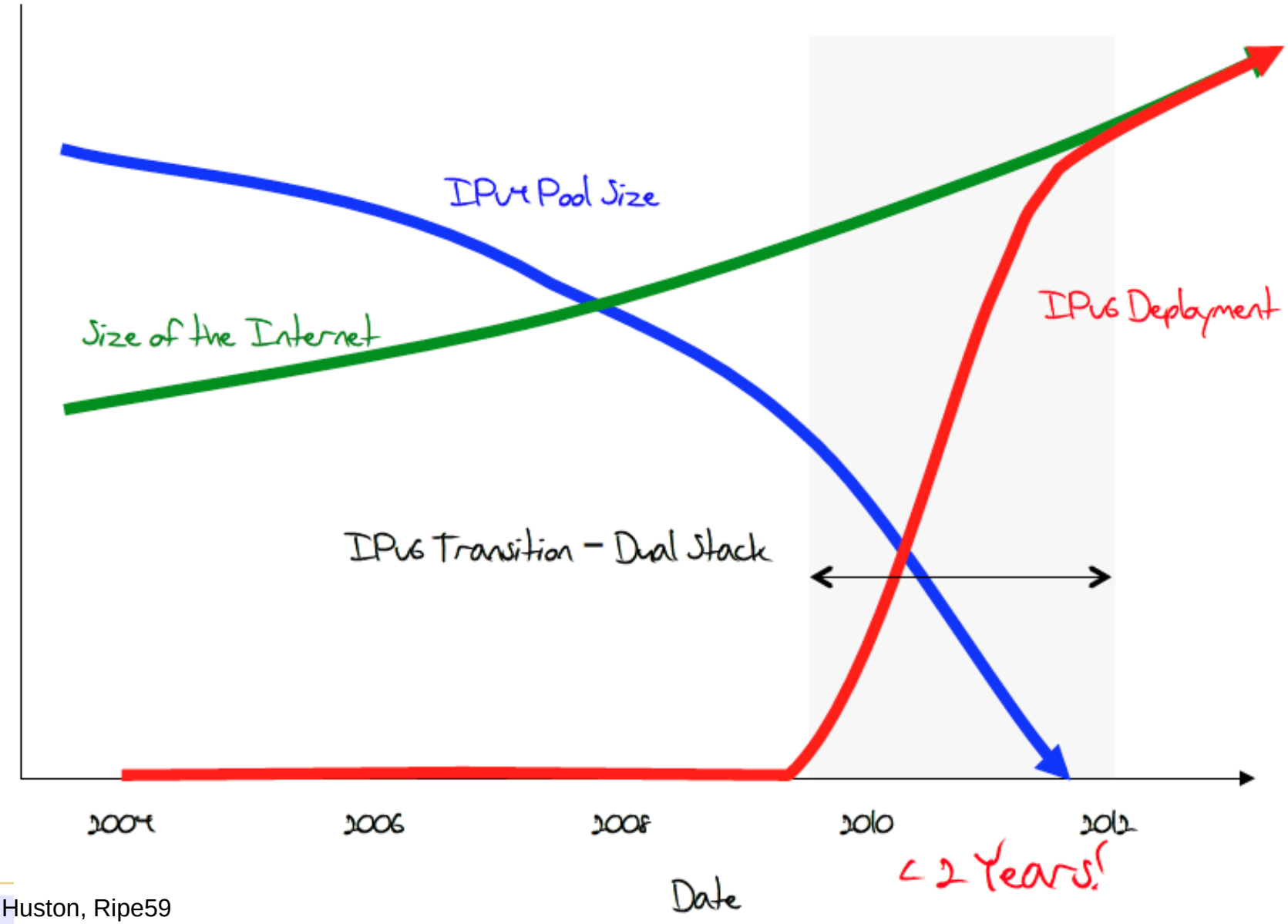


Data from www.apnic.net

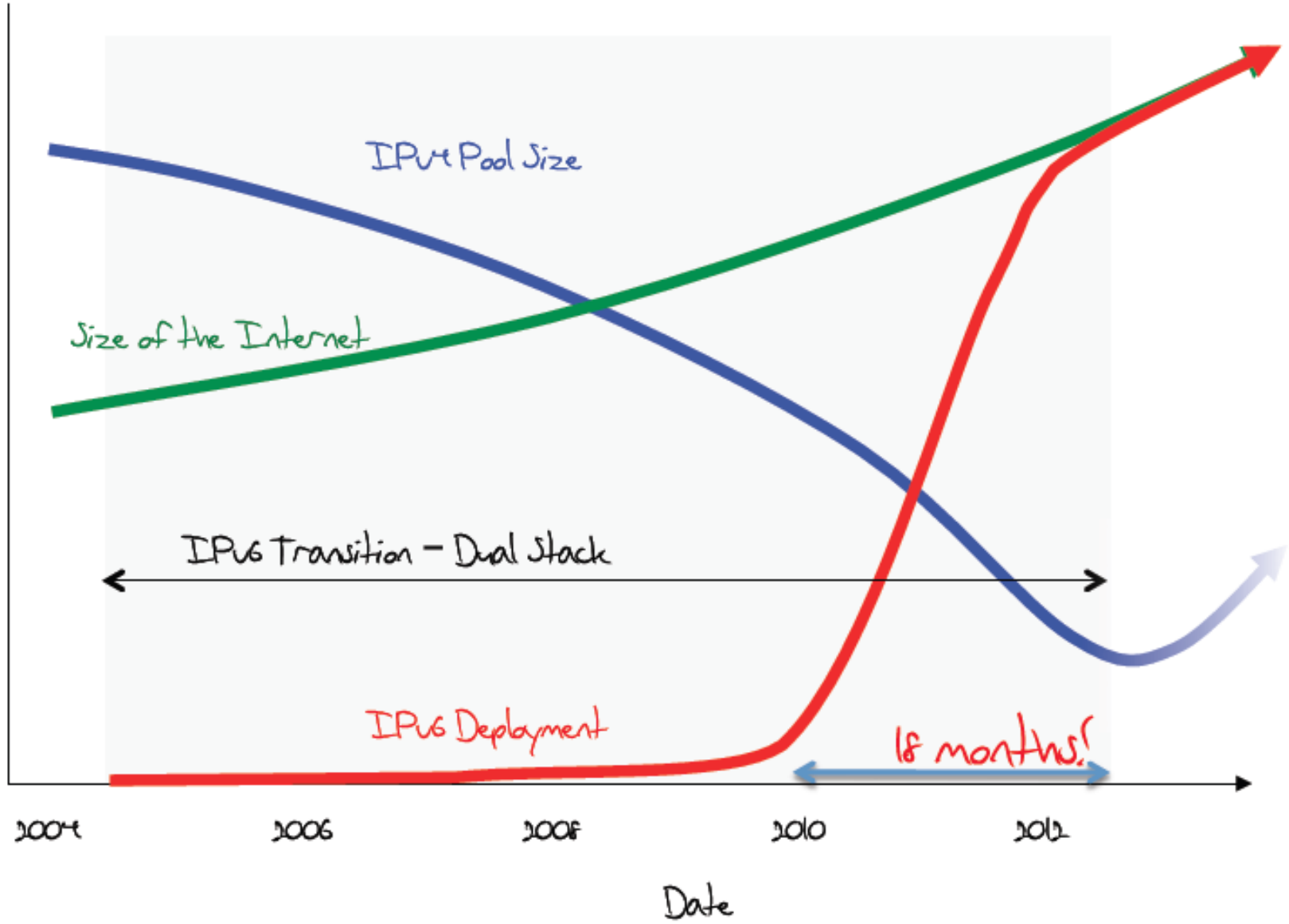
Theoretical IPv6 deployment scenario



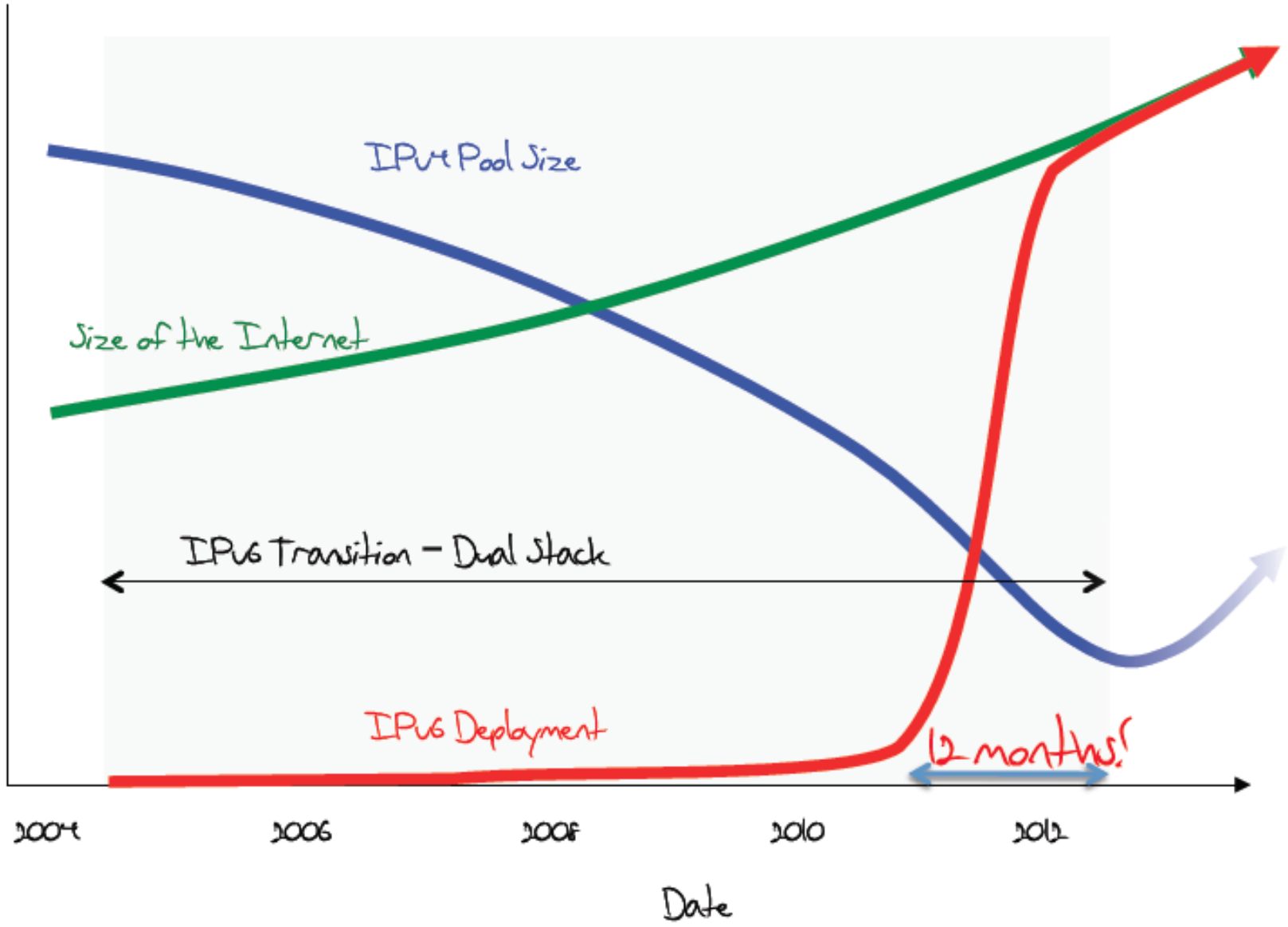
Hitting the wall – finding the ‘hard edge’



IPv6 Transition plan v2.0



IPv6 Transition plan v2.1



Is this feasable?

Deploy IPv6 across some 1.7 billion users, with more than a billion hosts.

Is this feasable?

Deploy IPv6 across some 1.7 billion users, with more than a billion hosts, hundreds of millions of routers, firewalls and middleware units.

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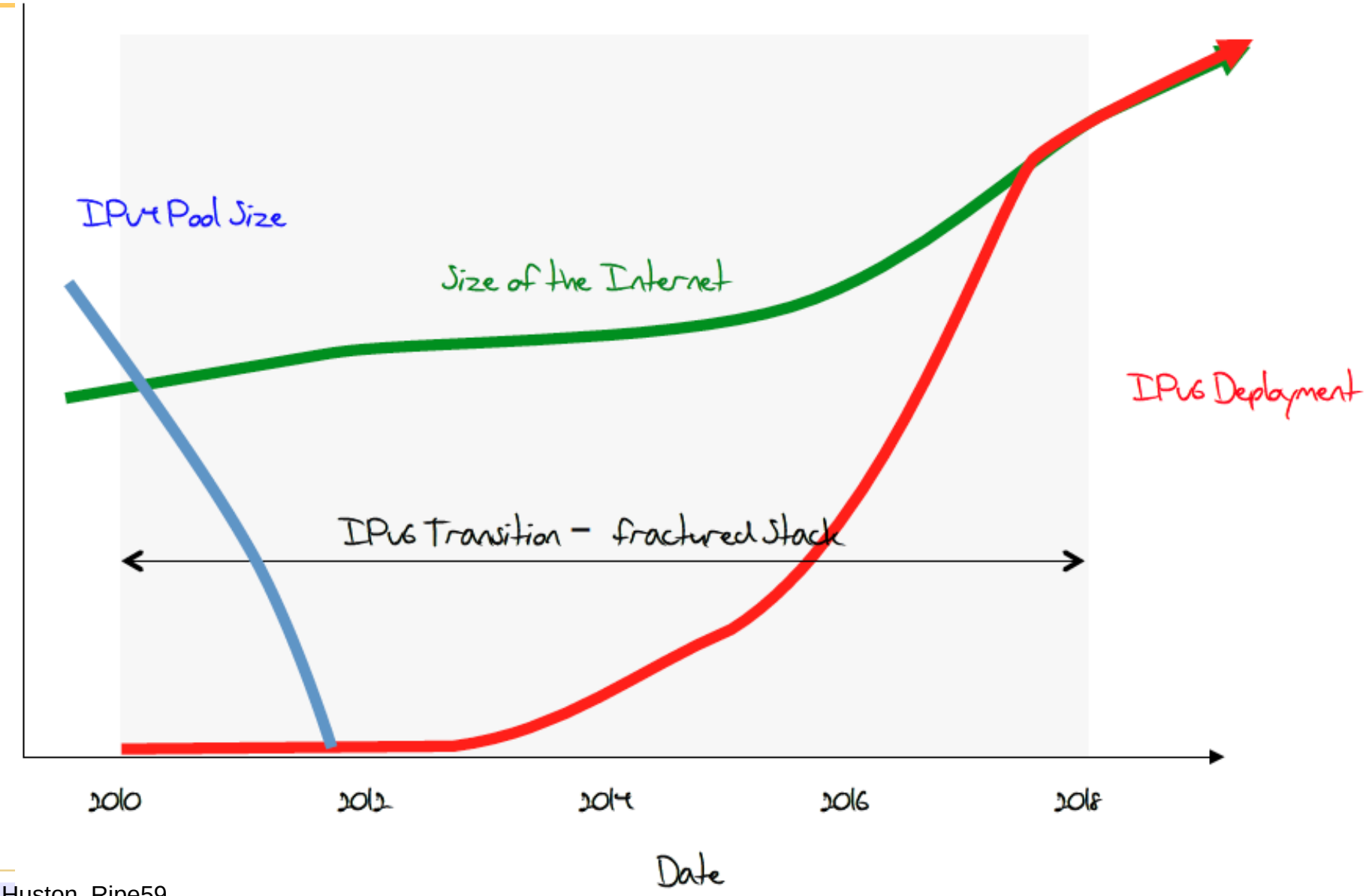
Deploy IPv6 across some 1.7 billion users, with more than a billion hosts, hundreds of millions of routers, firewalls and middleware units, audit billions of lines of configuration codes and filters, and audit hundreds of millions of ancillary support systems.

Is this feasable?

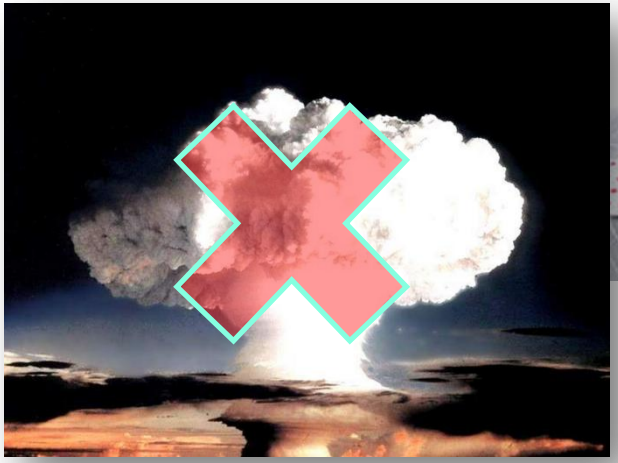
Deploy IPv6 across some 1.7 billion users, with more than a billion hosts, hundreds of millions of routers, firewalls and middleware units, audit billions of lines of configuration codes and filters, and audit hundreds of millions of ancillary support systems -- ***all within the next 360 days.***

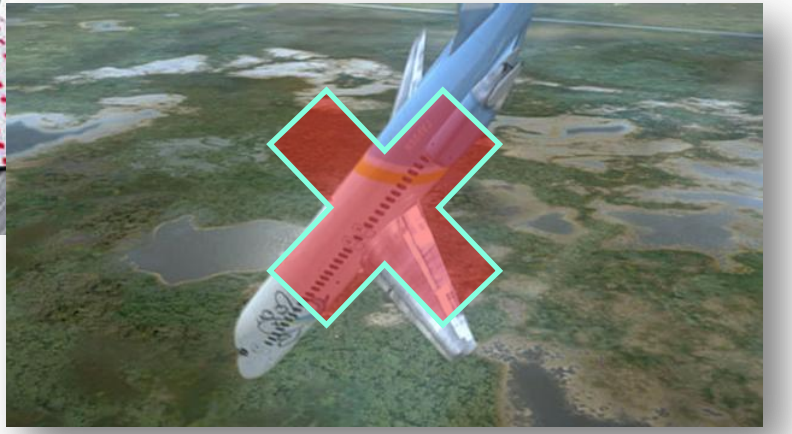
A breakthrough?

Practical IPv6 deployment scenario



Will the world collapse?



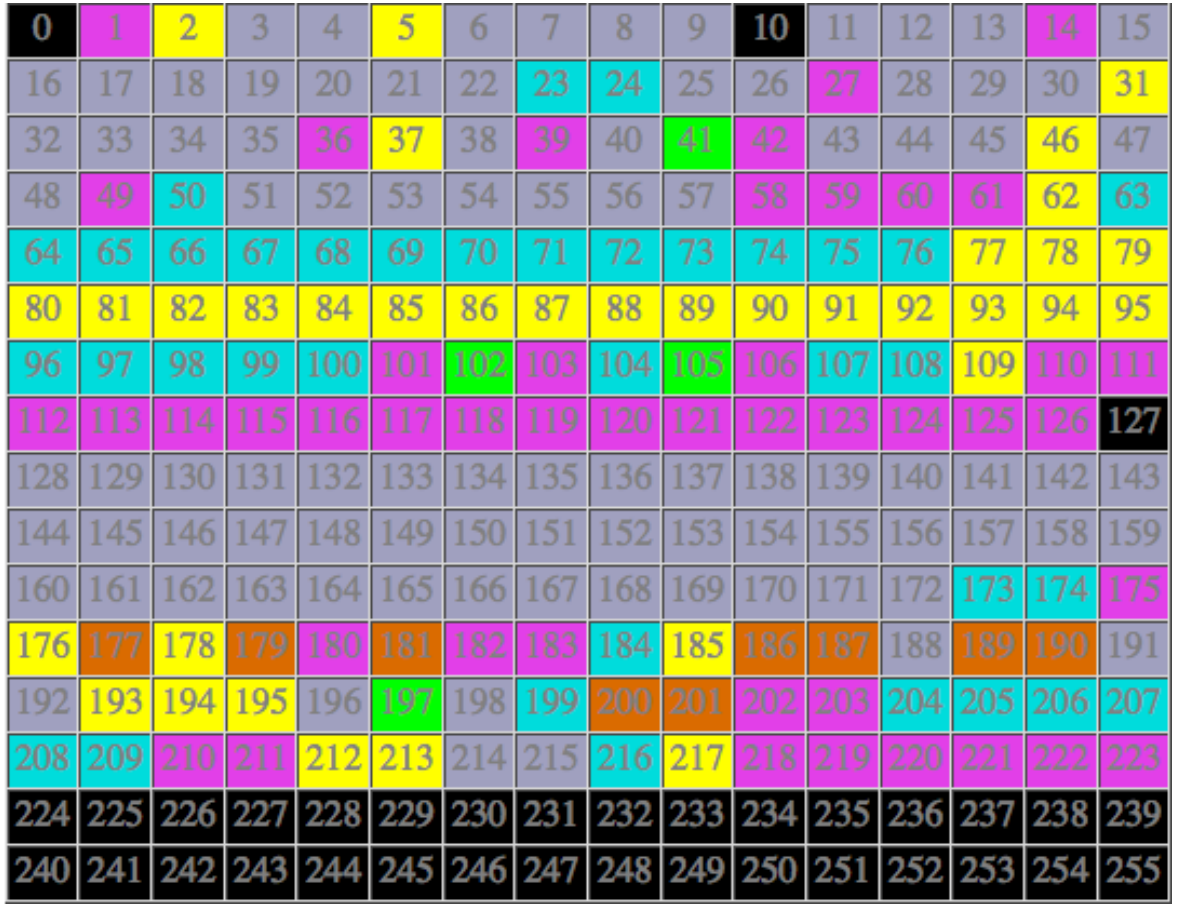


Why do people think IPv6 is not needed?

- The lost A-classes
- CIDR
- NAT
- Ostrich policy – they'll think of something…

IPv4: the lost A-classes

- IANA IPv4 Address space registry



AfriNIC: 4 blocks (67.11 million addresses)

APNIC: 45 blocks (754.97 million addresses)

ARIN: 36 blocks (603.98 million addresses)

LACNIC: 9 blocks (150.99 million addresses)

RIPE NCC: 35 blocks (587.20 million addresses)

Legacy: 92 blocks (1543.50 million addresses)

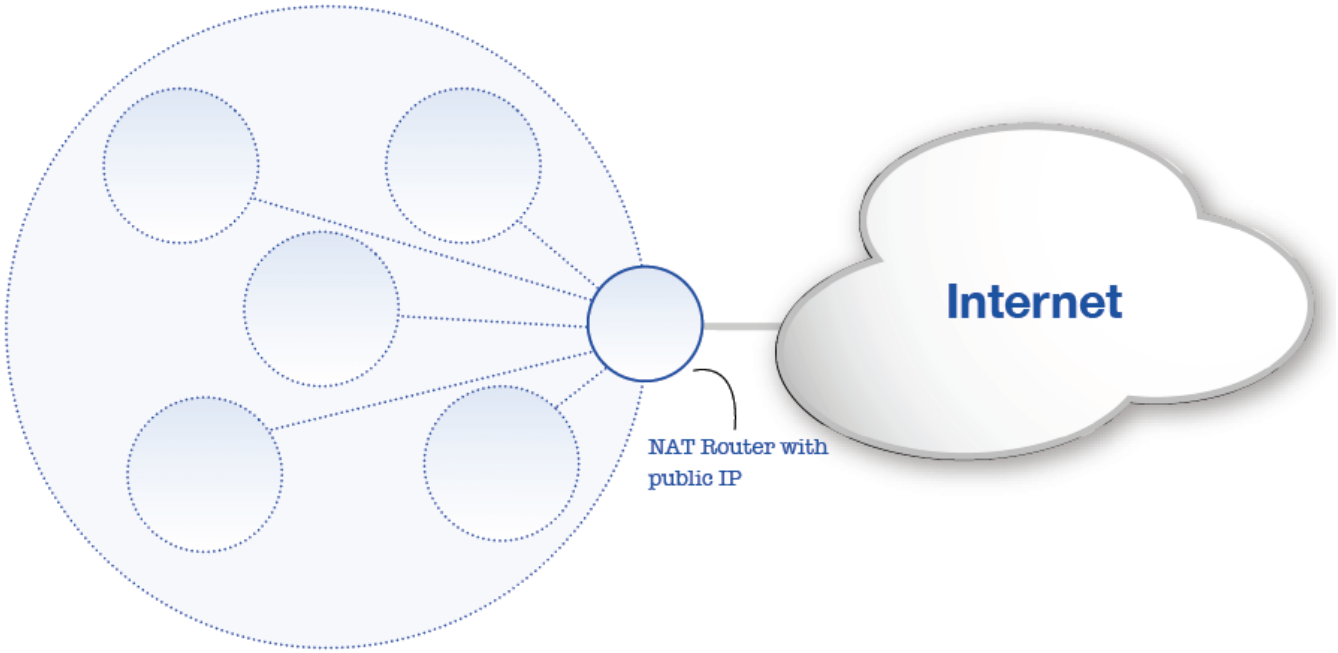
Reserved: 35 blocks (587.20 million addresses)

Unallocated (free): 0 blocks (0.00 million addresses)

Source: bgpexpert.com/ianaglobalpool.php (Feb 2011)

Network Address Translation (NAT)

- Private IPv4 address ranges:
  10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16
- NAPT: Network Address and Port Translation
  (Cone-Restricted NAT)

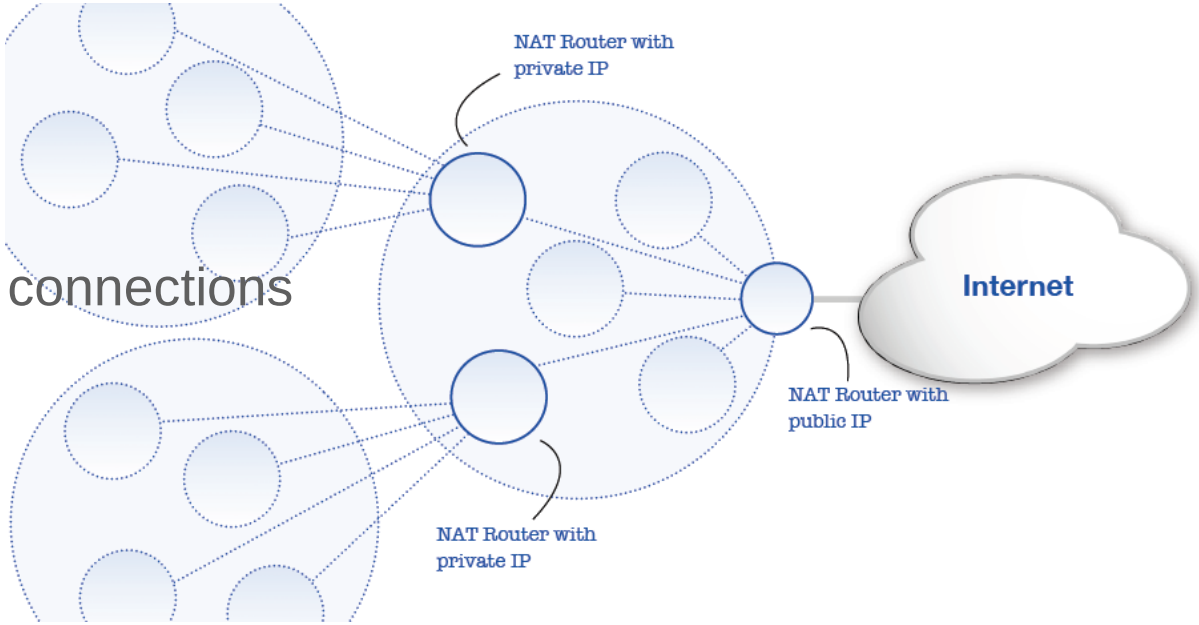


NAT applications

- Home DSL router
- WiFi hotspots
- Internet connection sharing
- Some mobile operators GPRS/UMTS

- Carrier Grade NAT (CGN)
  Large Scale NAT (LSN)
  NAT444

- Portnumber 16 bits = ~64000 connections



Typical number of connections/application

Webpage	# of sessions
No operation	5～10
Yahoo top page	10～20
Google image search	30～60
Nico Nico Douga	50～80
OCN photo friend	170～200+
iTunes	230～270
iGoogle	80～100
Rakuten	50～60
Amazon	90
HMV	100
YouTube	90

Number of connections/user

- According to some observations, about 500 sessions are average numbers of concurrent sessions per users
- That means about 128 users may share a global IPv4
- Some people even think only 8 users per 1 single global IPv4 address may be a good ratio to use ISP NAT

- Anyway, CGN is not a long term solution…

IPv4 & IPv6 - The Bottom Line

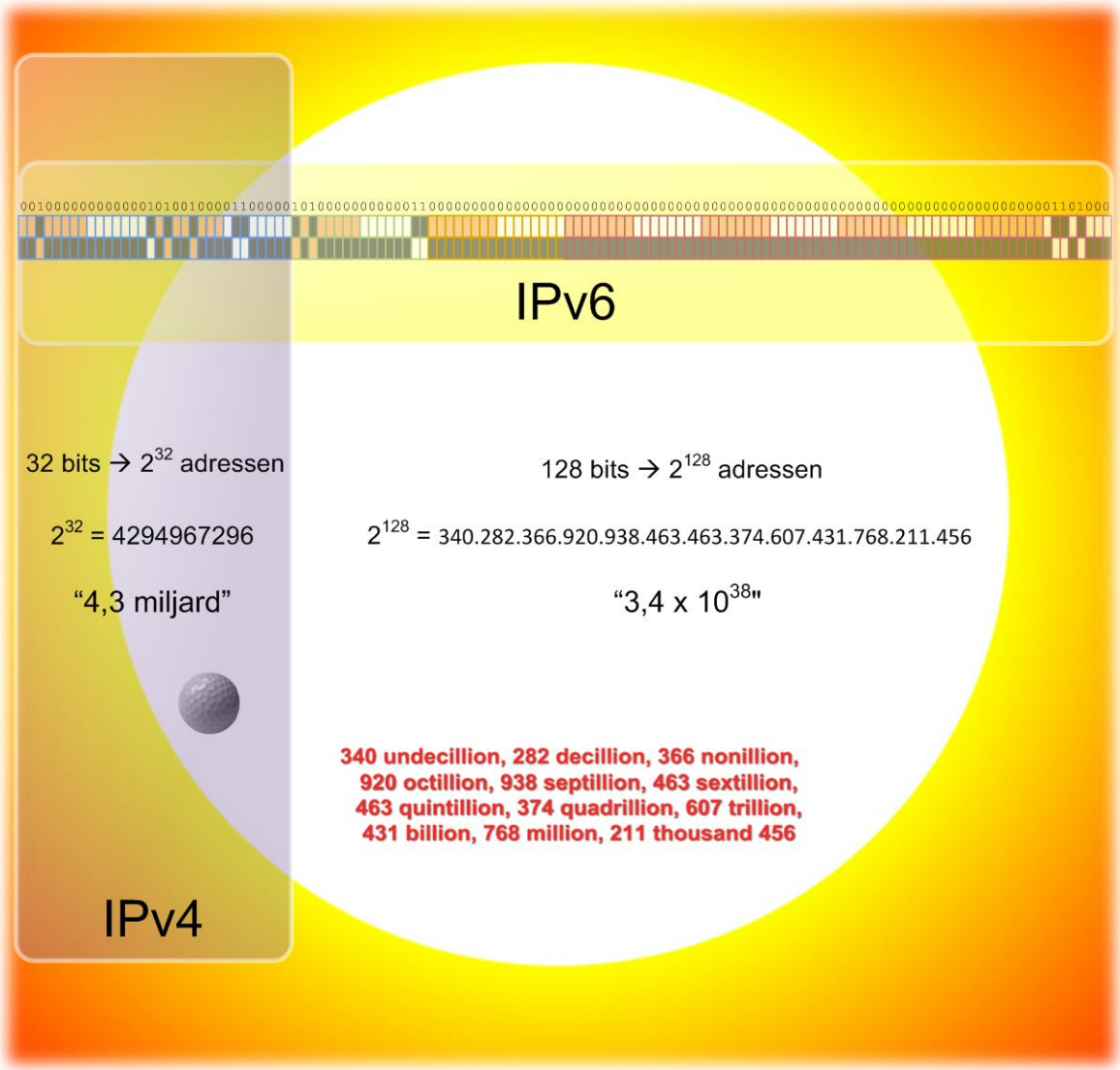
- We’re running out of IPv4 address space
- IPv6 must be adopted for continued Internet growth
- IPv6 is not backwards compatible with IPv4
- We must maintain IPv4 and IPv6 simultaneously for many years
- IPv6 deployment has begun.

More about IPv6

IPv6 characteristics

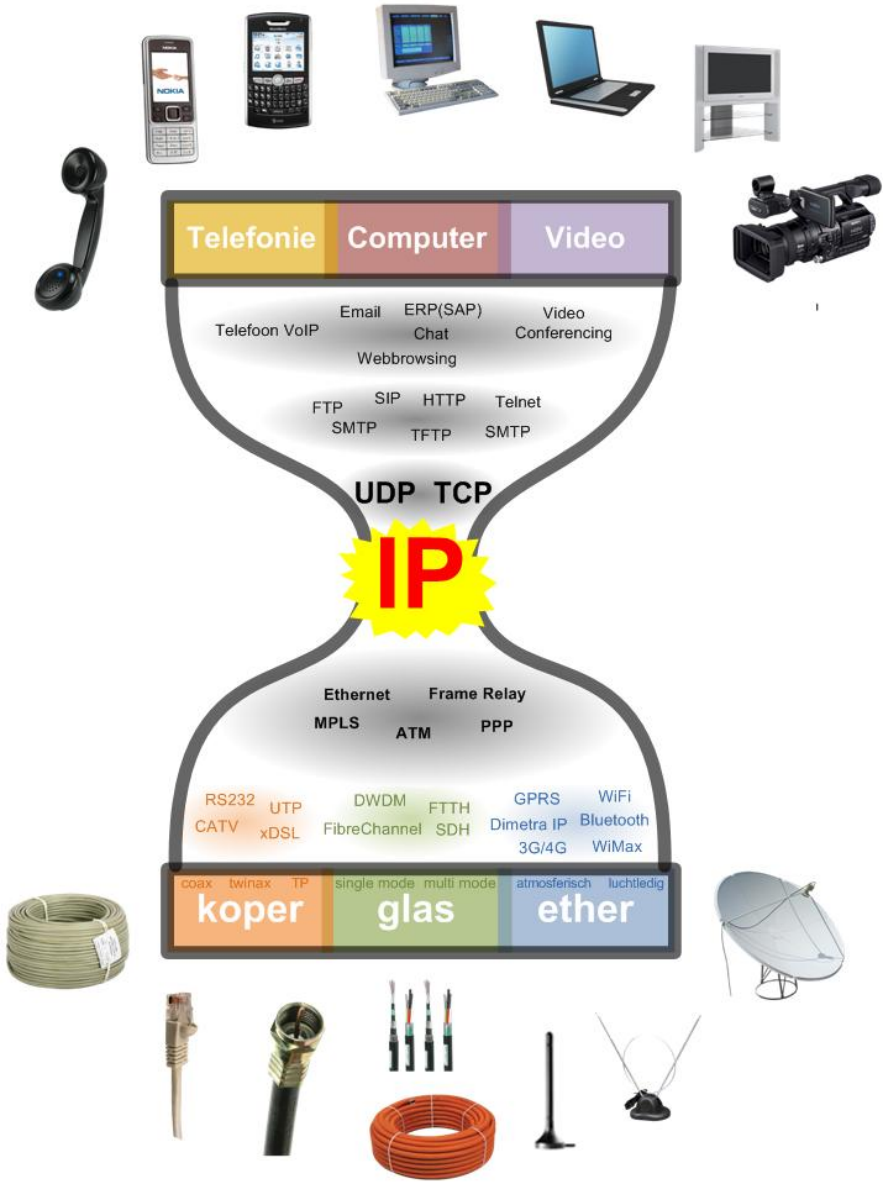
- Much more addresses
  - 128 bits instead of 32 bits
- Faster
  - Fixed header length
- Safer
  - IPsec is mandatory in IPv6 feature sets
- Mobility
  - Mobile IP for fixed IP address when roaming
- Simpler configuration
  - Greater choice of address configuration (e.g. auto configuration)

‘IPv4 : IPv6’ = ‘golfbal : zon’

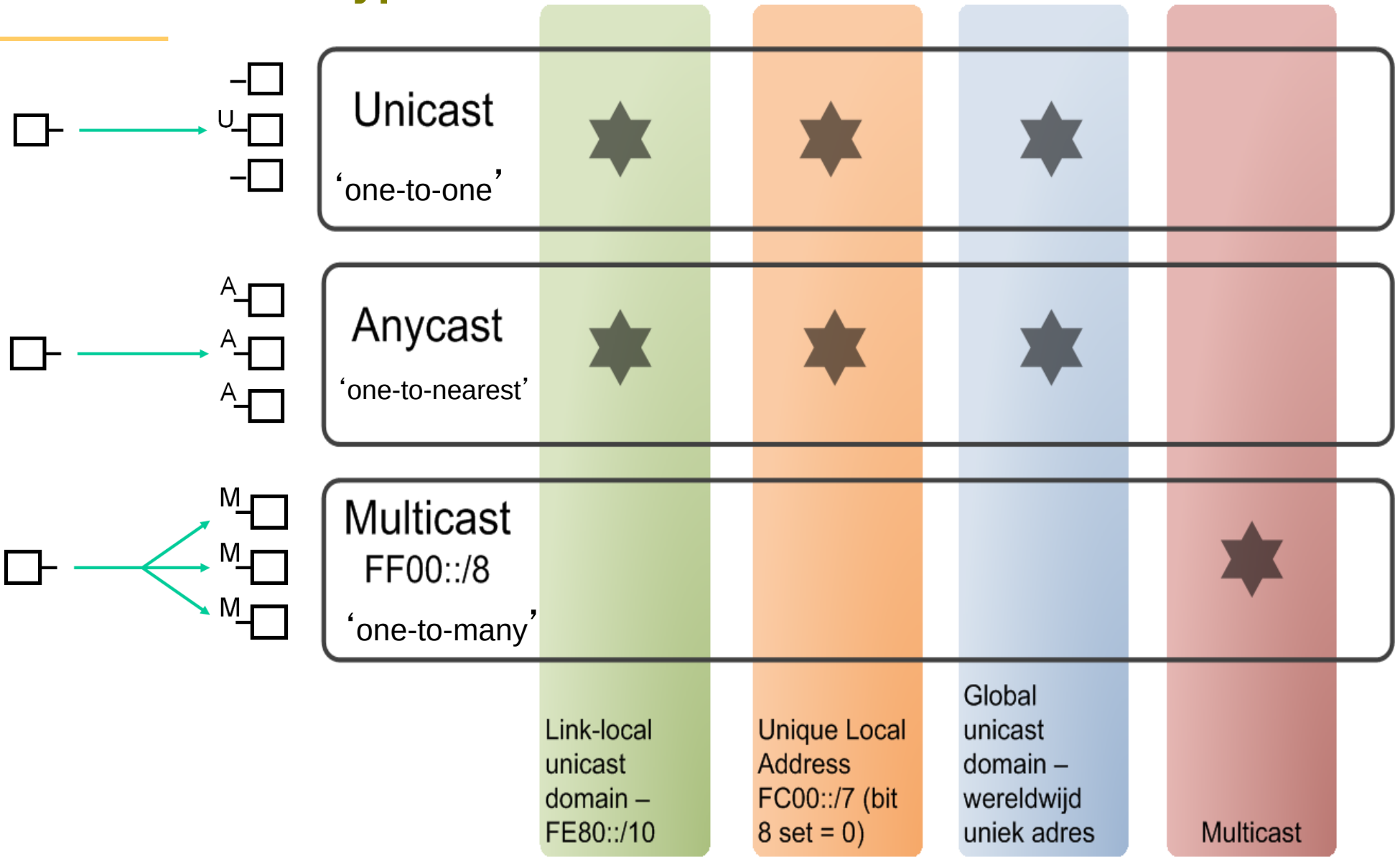


IPv6 similarities and differences

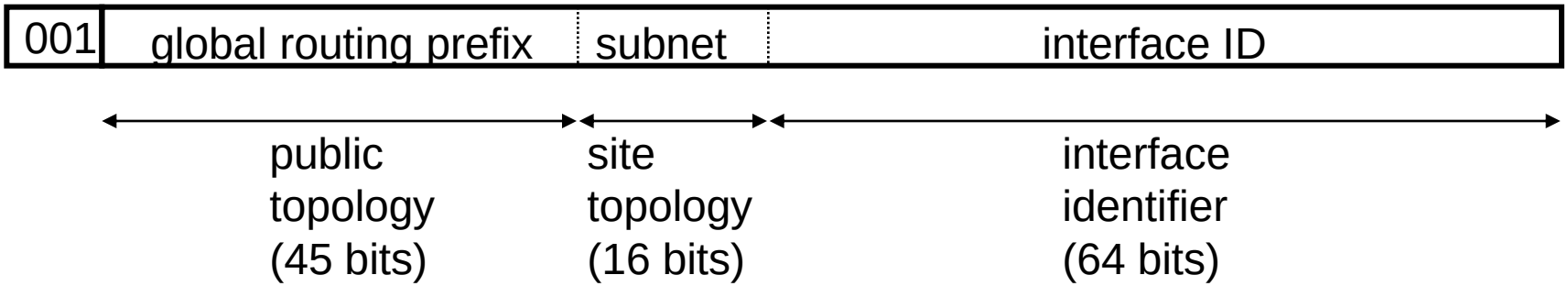
- The next generation layer 3 IP protocol
- Layer 1,2, 4 and up do not change
- Cannot communicate directly with IPv4
- Coexists with IPv4 (dual stack) on same network
- Migration strategies required



Basic Address Types

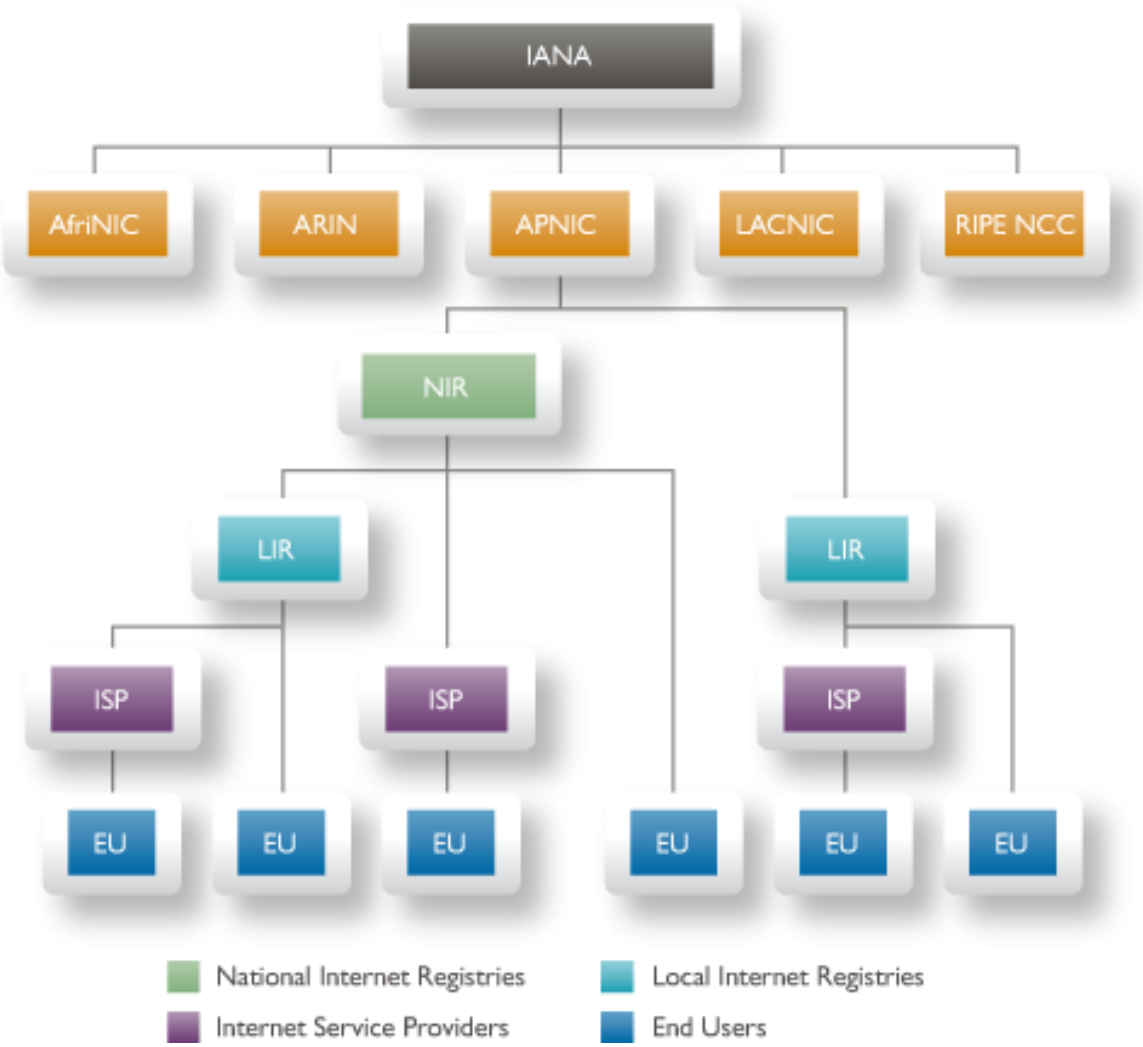


Global Unicast Addresses RFC 3177

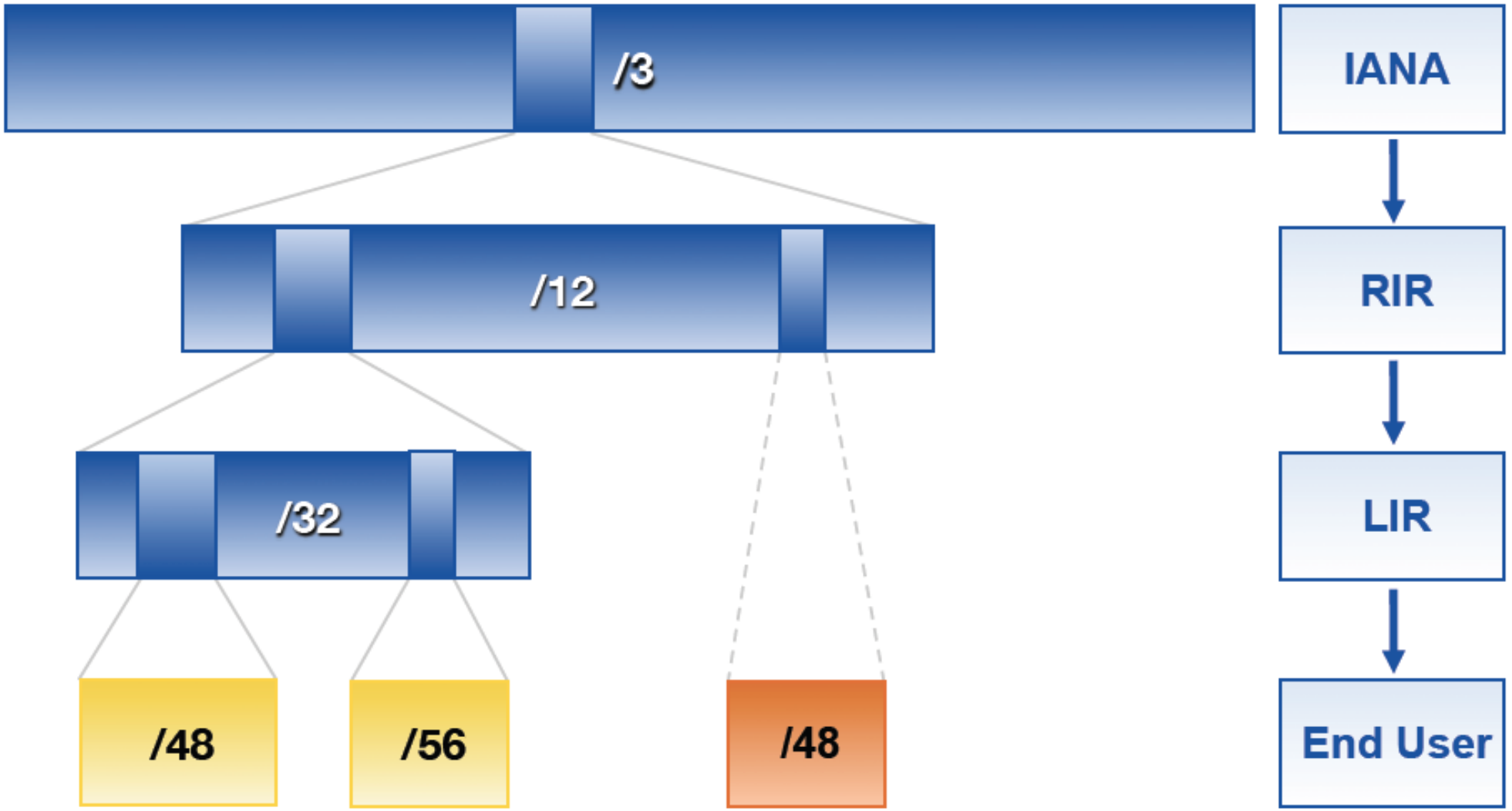


- only 1/8th of total space (binary 001 prefix) used initially
- global routing prefix is hierarchically structured, using CIDR-type allocation and routing (at least for now!)
- initial policy is for every subscriber site (e.g., corporate site, campus, residence, etc.) to be assigned a /48 prefix
  => 16 bits of subnet space (65k subnets)
- still discussion about /56 prefix with 8 bits subnet space (256) for residential, or even /64 without subnets …

Internet registry hierarchy

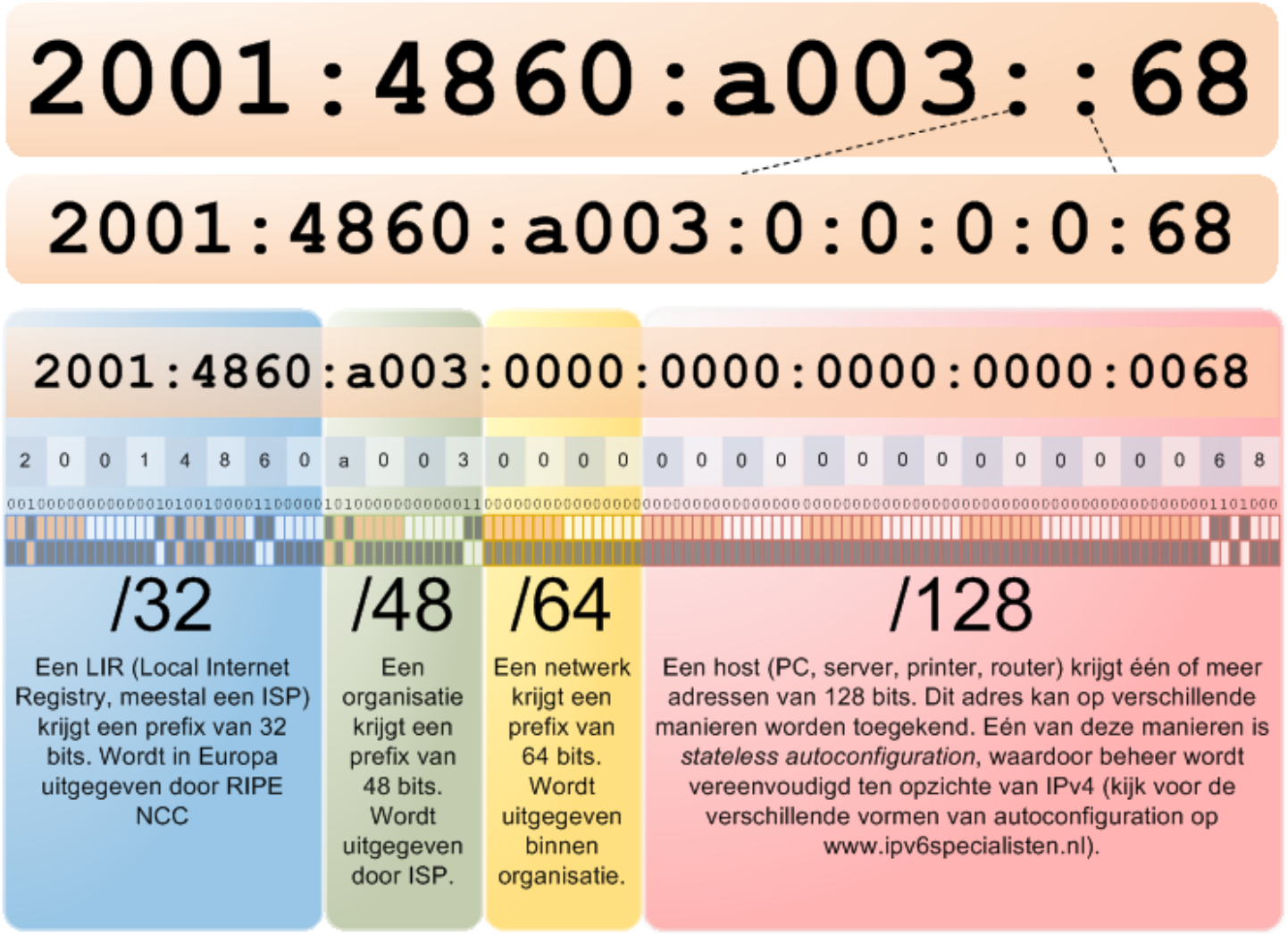


Global Unicast IPv6 address distribution



PA Provider Aggregated PI Provider Independent

IPv6 Address Anatomy



IPv6 readiness of ICT elements

Server and Workstation IOS's

- Windows XP SP2, Server 2000, 2003
- Windows Vista
- Windows 7, Server 2008
- Unix
- Linux
- FreeBSD (4.0 Kame project 2006)
- Apple Mac OSX (10.3)

Service Providers

- Hosting
- Access

Networking devices

- Cisco routers (IOS 12)
- HP Networking, Printers, Storage
- Juniper, Brocade, F5, A10
- …

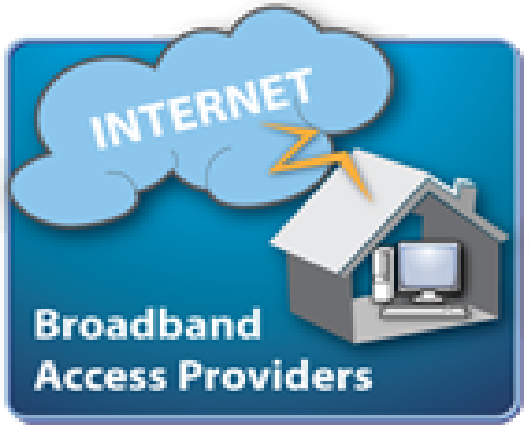
Application software

- Explicit use of IP address in calls
- Usage of IP address for logging
- IP version specific expressions

Action Plans

- What does the transition to IPv6 mean for:
  - Access Providers?
  - Hosting Providers?
  - Content Providers?
  - Enterprise Customers?
  - Equipment Vendors?
  - Government Organizations?

Call to Action: Acces Providers



- Your customers want access to the entire Internet, and this means IPv4 and IPv6 websites. Offering full access requires running IPv4/IPv6 transition services and is a significant engineering project.

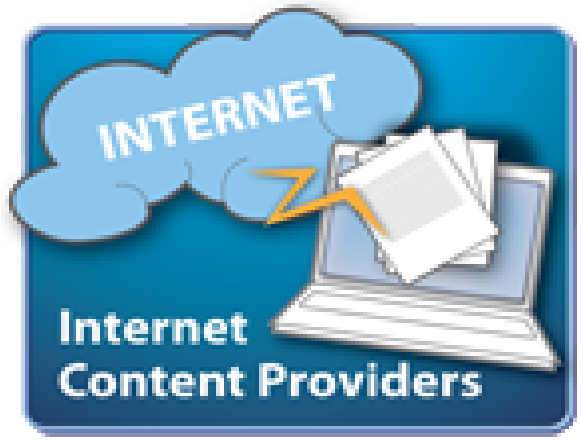
- Multiple transition technologies are available, and each provider needs to make its own architectural decisions (free = 6rd, XS4all = native dual stack, xxx = DS-lite etc.)

Call to Action: Hosting Providers

- Relevant elements
  - server IOS
  - data center infrastructure:
    - Load balancers
    - Routers
    - Switches
    - Firewalls
    - IDS/IPS
  - Connection to ‘AMS-IX’

Call to Action: Content Providers

- Content must be reachable to newer Internet customers



- Content served only via IPv4 will be accessed by IPv6 customers via transition solutions run by access providers

- Plan on serving content via IPv6 in addition to IPv4 as soon as possible.

Call to Action: Enterprises

- Mail, web, and application servers must be reachable via IPv6 in addition to IPv4

- Open a dialogue with your Internet Service Provider about providing IPv6 services

- Each organization must decide on timelines, and investment level will vary

Call to Action: Equipment Vendors

- There was probably limited demand for IPv6 in the past

- Demand for IPv6 support will become mandatory very, very quickly

- Introduce IPv6 support into your product cycle as soon as possible.

Call to Action: Governments

- Coordinate with industry to support and promote awareness and educational activities

- Adopt regulatory and economic incentives to encourage IPv6 adoption
- Require IPv6 compatibility in procurement procedures
- Officially adopt IPv6 within your government agencies

IPv6 Adoption Needs

- IPv6 address space
- IPv6 connectivity (native or tunneled)
- Operating systems, software, and network management tool upgrades
- Router, firewall, and other hardware upgrades
- IT staff and customer service training

8 juni 2011: World IPv6 day

- De grote sites zetten IPv6 aan
  - **24 uur** lang (00:00 GMT tot 00:00 GMT)
  - **Deelnemers: Google, Facebook, Yahoo!, Akamai, Limelight,** Cisco, Juniper, Huawei, BlueCat, Mozilla, Fortinet, Comcast, Time Warner, Rackspace, Buienradar, …
  - Doel: problemen aan het licht brengen
    - Configuraties bezoekers
    - Bugs in routers, firewalls, besturingssystemen, browsers, etc.
    - info: **www.IPv6dag.nl**

Wat doet de Stichting IPv6 Nederland?

- Helderheid verschaffen
  - website
  - poster
- Initiatieven
  - IPv6ready.NL
  - www.Internetten.nl
  - Applicatie Software Test
  - Hardware requirements
- Begeleiding
  - projecten
  - adresplan aanbevelingen

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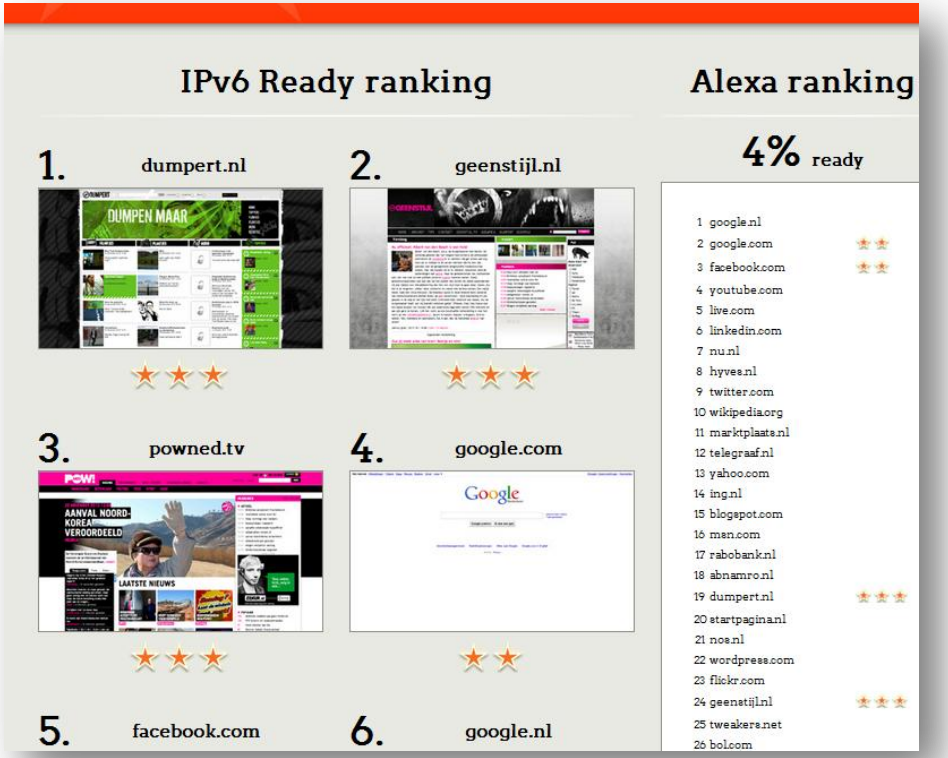
www.stipv6.nl

Stipv6 Initiatief 1: IPv6 Ready.nl

- Check op IPv6 bereikbaarheid Alexa Top-100 websites
- Uitbreiding met lijsten:
  - Provincies
  - Gemeenten
  - Branches



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Stipv6 Initiatief 2: ISP IPv6 geschiktheid op Internetten.nl

Consumenten ISP's vermelding op www.internetten.nl

Mate van IPv6 geschiktheid in zes (toeval) gradaties:

1. Een RFC1918 adres van provider
2. Een niet-vast publiek-adres van provider
3. Een vast publiek adres
4. Een IPv6 tunnel van provider
5. Native dual stack
6. Native dual stack inclusief router

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Stipv6 Initiatief 3: IP-versie afhankelijkheid applicatiesoftware

- In samenwerking met Software Improvement Group:
  - Eerste steekproef (125 applicaties): 8% applicaties zal niet volledig functioneren als het uitsluitend via IPv6 moet werken
  - Afhankelijkheid door:
    - Gebruik van IP-adres voor logging of reputatie
    - IPv4 specifieke functie-aanroepen in code
  - Rond 8 juni publiceert Stipv6 een white-paper
  - Volgende stap: software scans voor automatisch zoeken IP-versie afhankelijkheden

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Stipv6 Initiatief 4: ISP IPv6 geschiktheid apparatuur

IPv6 Ready.org:

- Silver (deprecated): 170 checks
- Gold: 450 checks

Certificatie uitgebreid maar niet algemeen gebruikt: tijdsduur en kosten

Stipv6 werkt samen met aanbieders apparatuur en ISP's om door juiste selectie gevraagde functionaliteit de juiste RFC's te implementeren

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Q&A