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# Introduction to IPv6

Formation IPv6

Marrakech, Maroc –Avril 2009

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# *Why a new version for IP ?*



# Agenda

**Historical facts**

**IPv4 address space status**

**From Emergency measures ...**

**... to IPv6**



## Historical facts

**1983 : Research network for ~ 100 computers**

**1992 : Internet is open to the commercial sector :**

- Exponential growth
- IETF urged to work on a IP next generation protocol

**1993 : - Exhaustion of the class B address space**

**Forecast of network collapse for 1994 !**

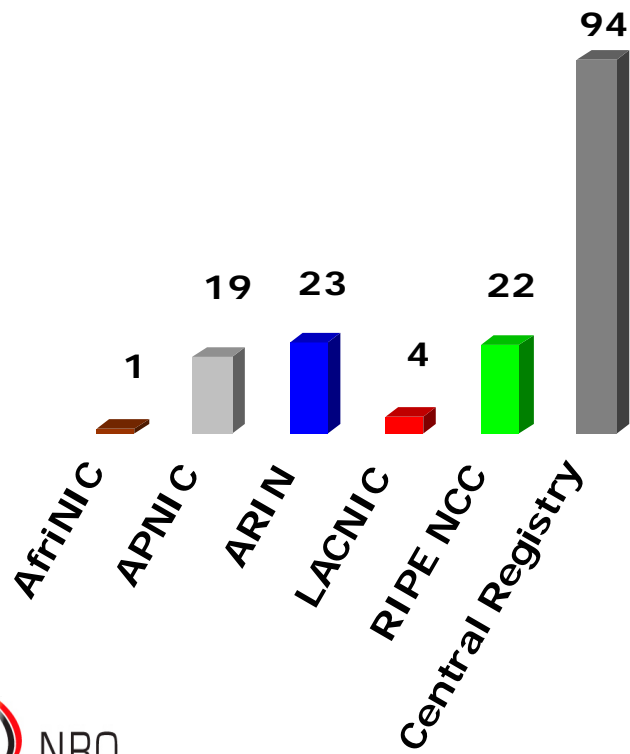
**- RFC 1519 (CIDR) published**

**1995 : RFC 1883 (IPv6 specs) published**

- First RFC about IPv6

# IPv4 Address Space Status (sep. 2006)

## Allocated



## Available



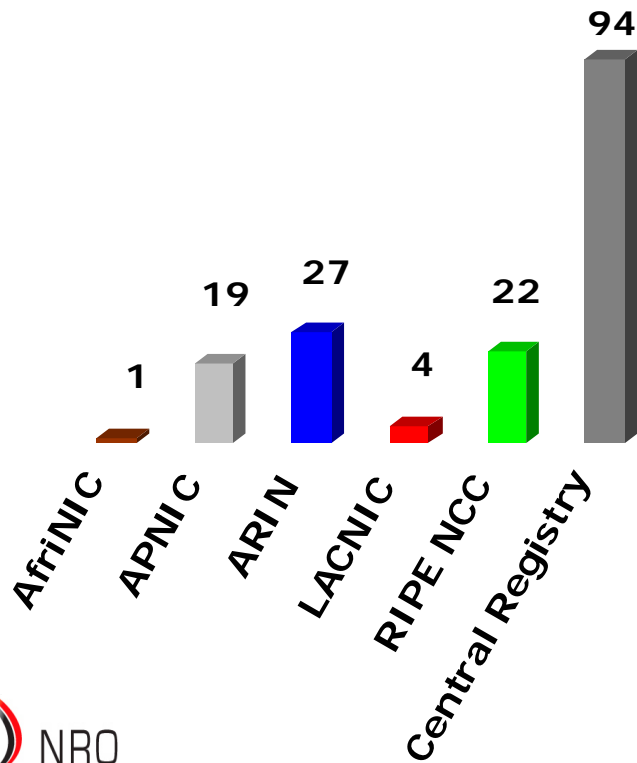
## Not Available





# IPv4 Address Space Status (dec.2006)

## Allocated



## Available

IANA Reserved 55

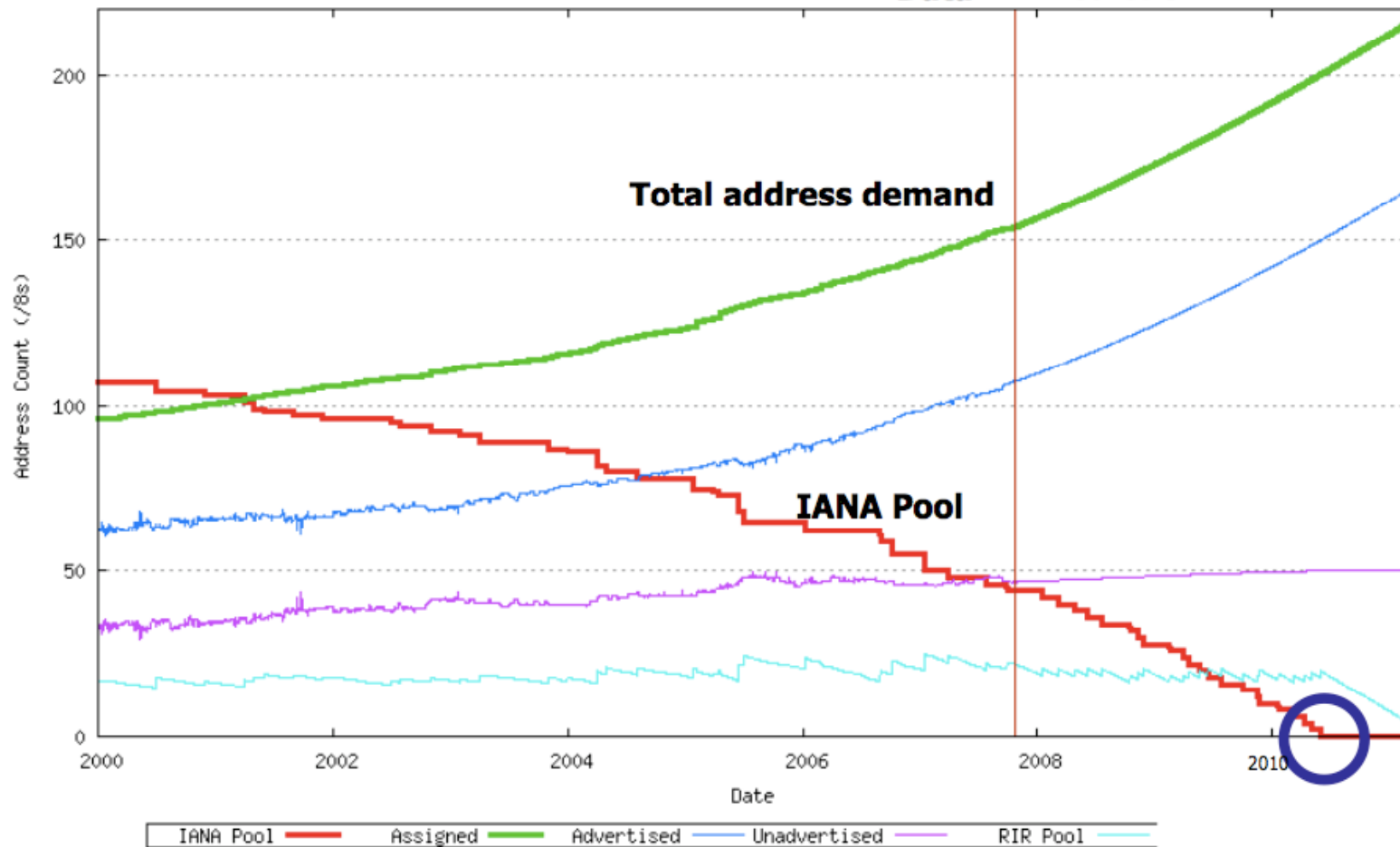
## Not Available



# IPv4 prefixes consumption pace

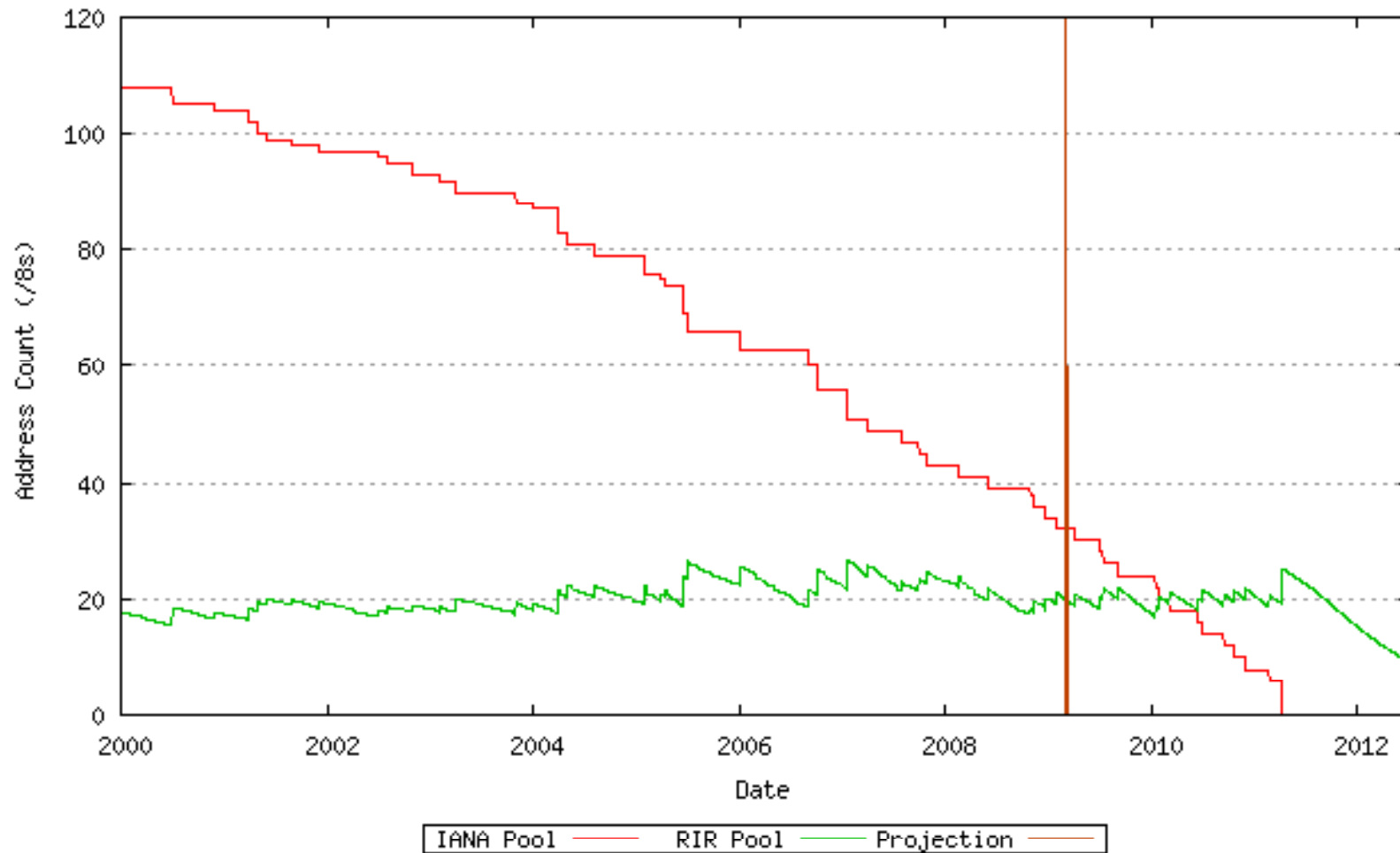
| Year | Month     | available /8s<br>(IANA) | Yearly consumption |
|------|-----------|-------------------------|--------------------|
| 2006 | September | 59                      |                    |
|      | December  | 55                      | 16                 |
| 2007 | September | 44                      | 15                 |
|      | December  | 42                      | 14                 |
| 2008 | June      | 39 (-2) ?               | 11 (13) ?          |
|      | December  | 34                      | 11                 |
| 2009 | March     | 32                      | 11                 |

# IPv4 address space depletion



Geoff Huston  
 APNIC  
 Sept. 2007

# IPv4 address space depletion



<http://www.potaroo.net/tools/ipv4/index.html>

# *Emergency measures ...*



# Summary

**CIDR**

**Private addresses**

**NAT**



# CIDR ...

## **Allocate former "class B" addresses exceptionally**

- known as /16 prefixes since then

## **Re-use "class C" address space**

- Without any more address classes

## **CIDR (*Classless Internet Domain Routing*)**

- RFC 1519 (PS)
- network address = {prefix/prefix length}
- Classes abandon = less address waste
- allows aggregation => reduces routing table size

# Private addresses (RFC 1918)

**Allow private addressing plans**

**Addresses are used internally**

**Similar to security architecture with firewall**

**Use of proxies or NAT to go outside**

- RFC 1631, 2663 and 2993

**NAT-PT**

- the most commonly used of NAT variations in the IPv6 world



# NAT (continued)

## Advantages:

- Reduce the need of official addresses
- Ease the internal addressing plan
- Transparent to some applications
- "Security" vs obscurity
- Netadmins/sysadmin

## Disadvantages:

- Translation sometime complex (e.g. FTP)
- Apps using dynamic ports
- Does not scale
- Introduce states inside the network:
  - Multihomed networks
- Breaks the end-to-end paradigm
- Security with IPsec

=> Should be reserved for small sites in Client/Server mode

# Emergency Measures

These emergency measures gave time to develop a **new version** of IP, named IPv6

IPv6 keeps principles that have made the success of IP

Corrects what was wrong with the current version (v4)

**BUT are emergency measures enough?**

# From emergency to IPv6

## IPv6 is already there ...

- Internet v6 is there today :
- NRENs in EU, North America, Asia ... are interconnected in IPv6
- Lots of IXP are offering IPv6 connectivity
- ISPs and Telcos exchange IPv6 routes
- Vista and Windows 2008 (servers) are IPv6 enabled by default

**Then the question is not "if" but "when ?" and "how ?"**

By Apr. 10<sup>th</sup> 2009 resources exhaustion are projected

- IANA pool : Jun. 2011
- RIRs pool : Oct. 2012
- Data from : <http://www.potaroo.net/tools/ipv4/index.html>



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Questions ...