



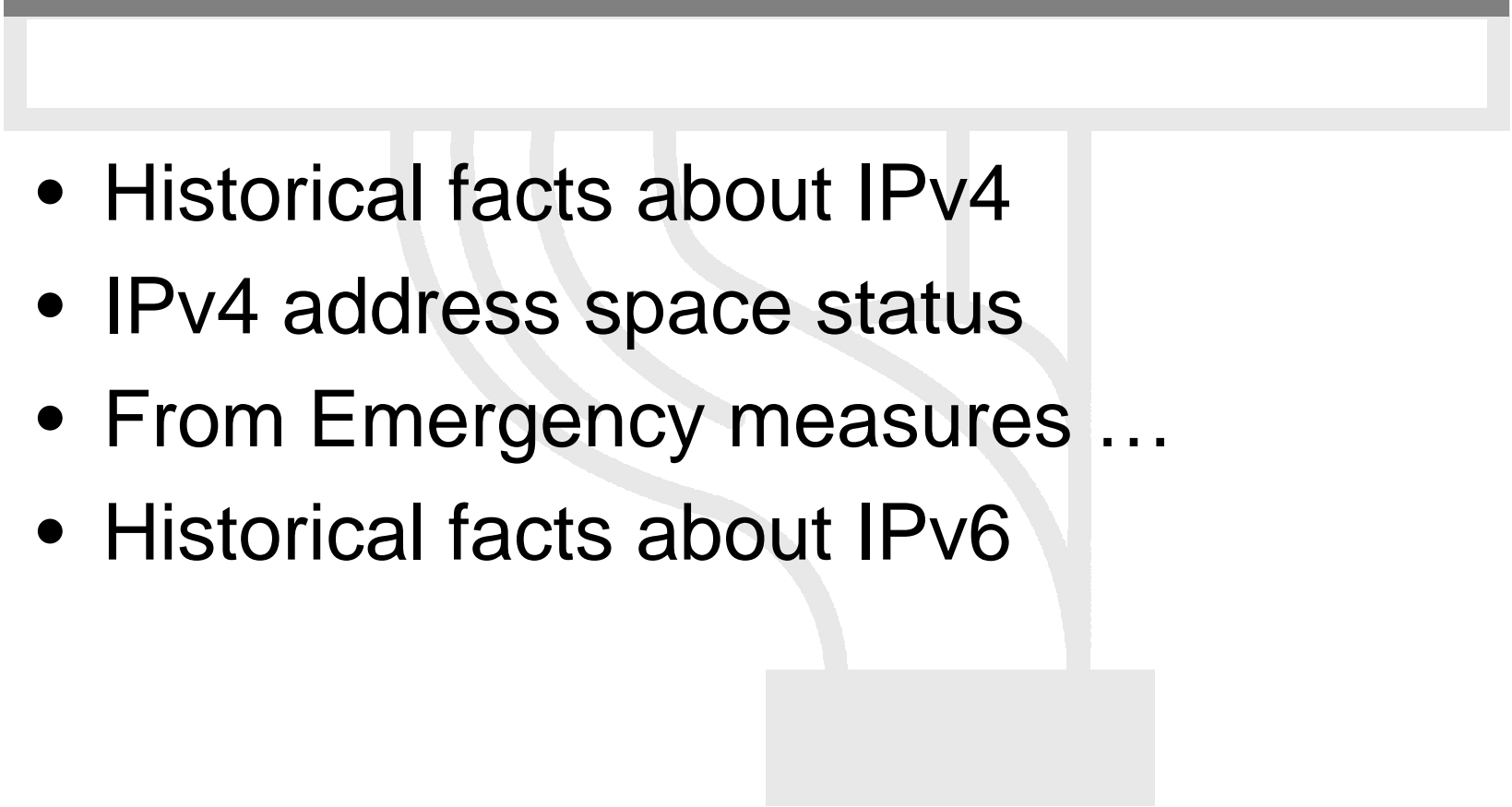
# *Why a new version for IP?*

*2<sup>nd</sup> South East Europe 6DISS Workshop  
Plovdiv, Bulgaria  
27-29 June 2007*

*Atanas Terziyski  
([atanas@argon.acad.bg](mailto:atanas@argon.acad.bg))*



# Agenda

- 
- Historical facts about IPv4
  - IPv4 address space status
  - From Emergency measures ...
  - Historical facts about IPv6



# Historical Facts (1/2)

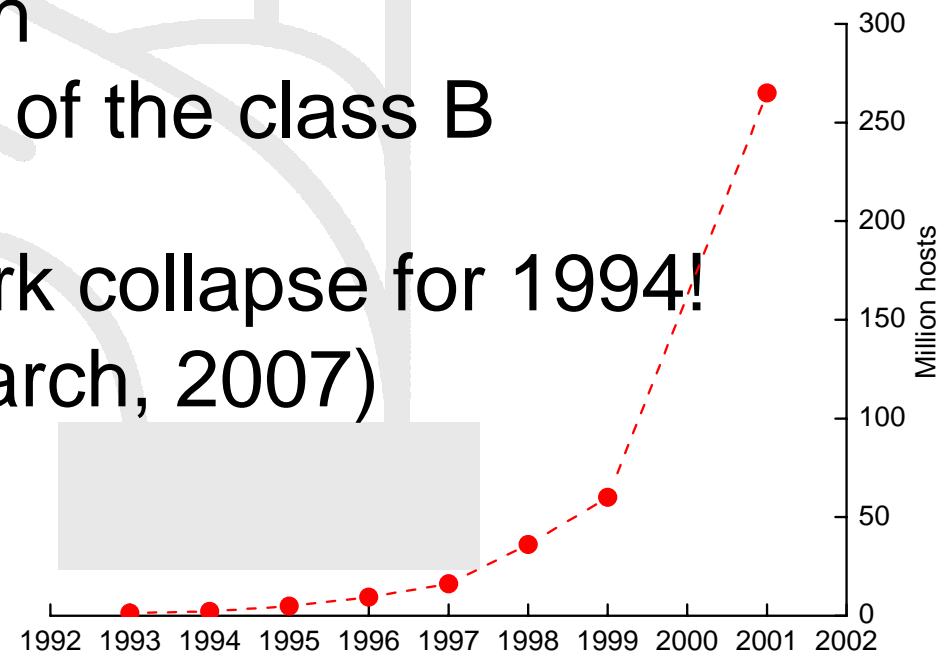
- At the end of 60s (USA uni. & res. centers)
- 1972 : ARPANET renamed to DARPA
- Few years of standardization...
- 1981, Sept. : TCP/IPv4, rfc791
- 80s : TCP/IP implementation (BSD, UNIX)
- 1983 : Research network for ~ 100 computers





# Historical Facts (2/2)

- 1992 : Commercial activity
- Exponential growth
- 1993 : Exhaustion of the class B address space
- Forecast of network collapse for 1994!
- [NRO statistics](#) (March, 2007)

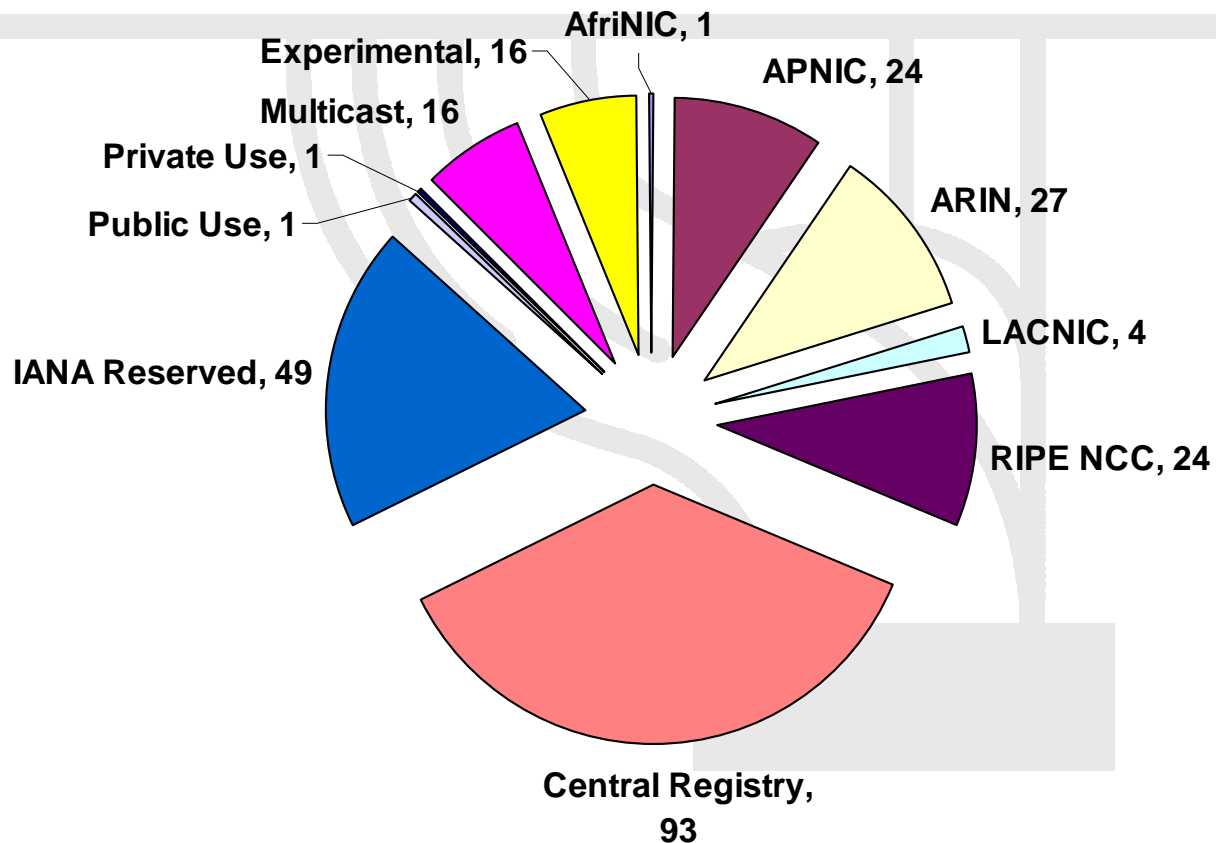


source: ocw.mit.edu





# Status of 256 /8s IPv4 Address Space (Mar'07)



[www.nro.net/statistics](http://www.nro.net/statistics)

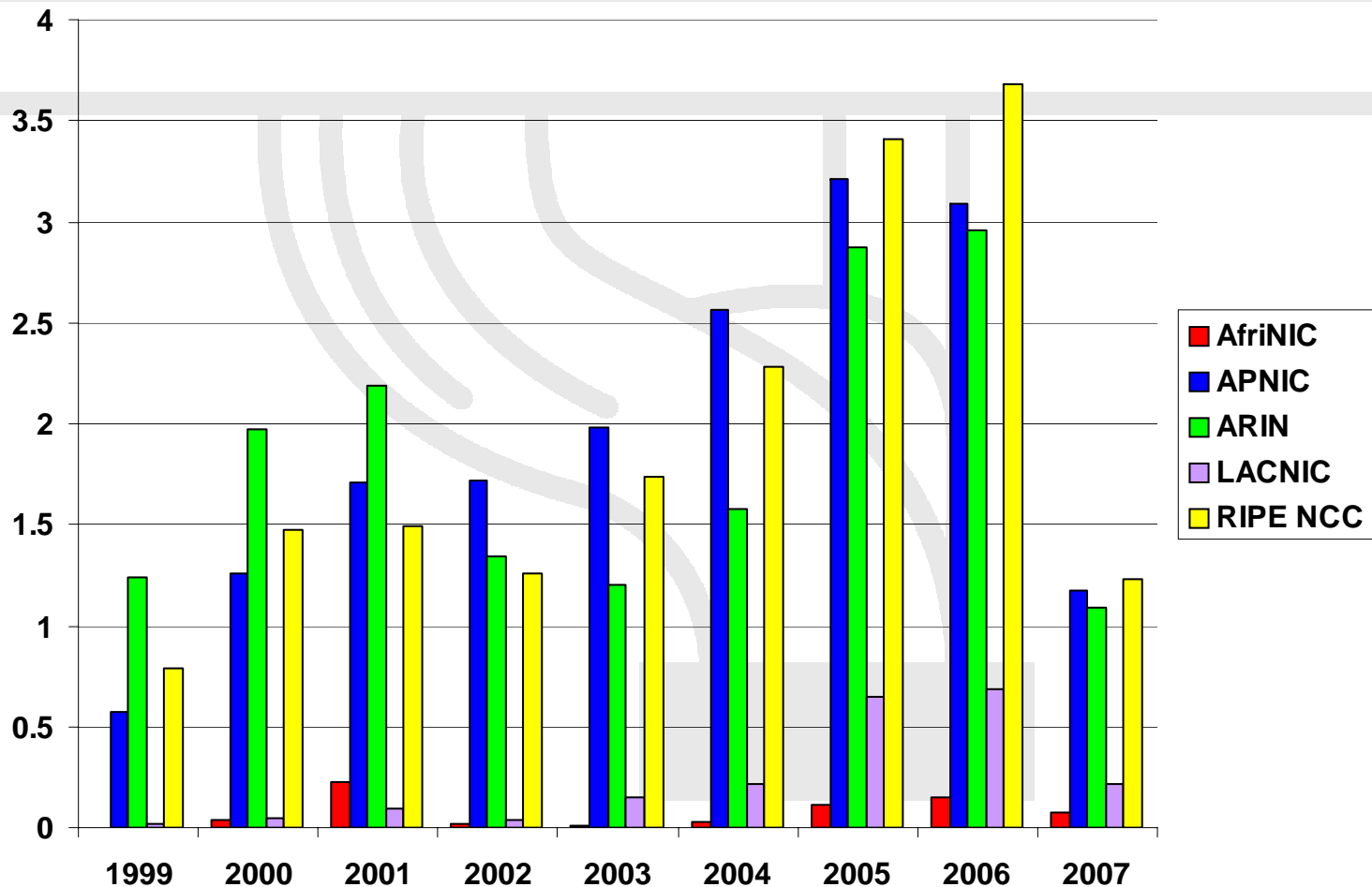


*2nd SEE 6DISS Workshop (Plovdiv, June'07)*

**IPv6DISSemination and Exploitation**



# IPv4 Allocations from RIRs to LIRs/ISPs Yearly Comparison



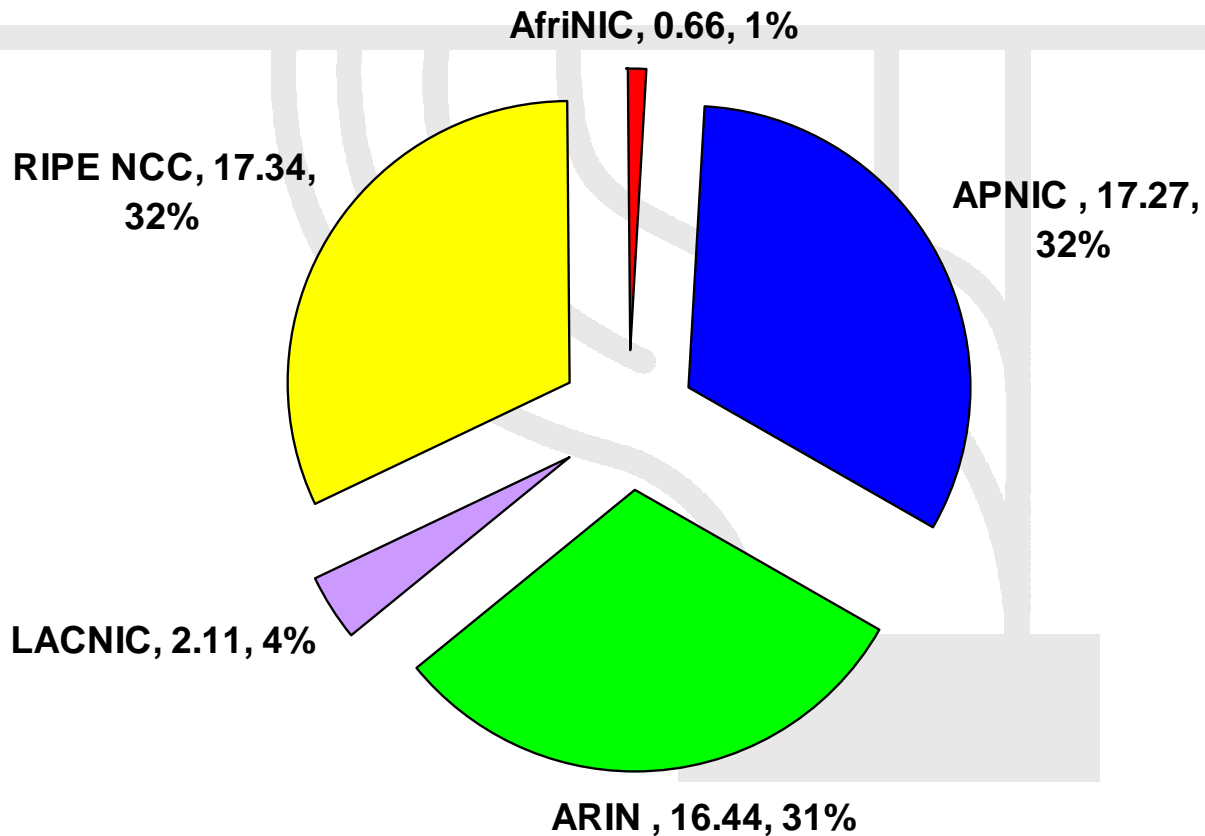
[www.nro.net/statistics](http://www.nro.net/statistics)





# IPv4 Allocations RIRs to LIRs/ISPs

## Cumulative Total (Jan 1999 – Mar 2007)

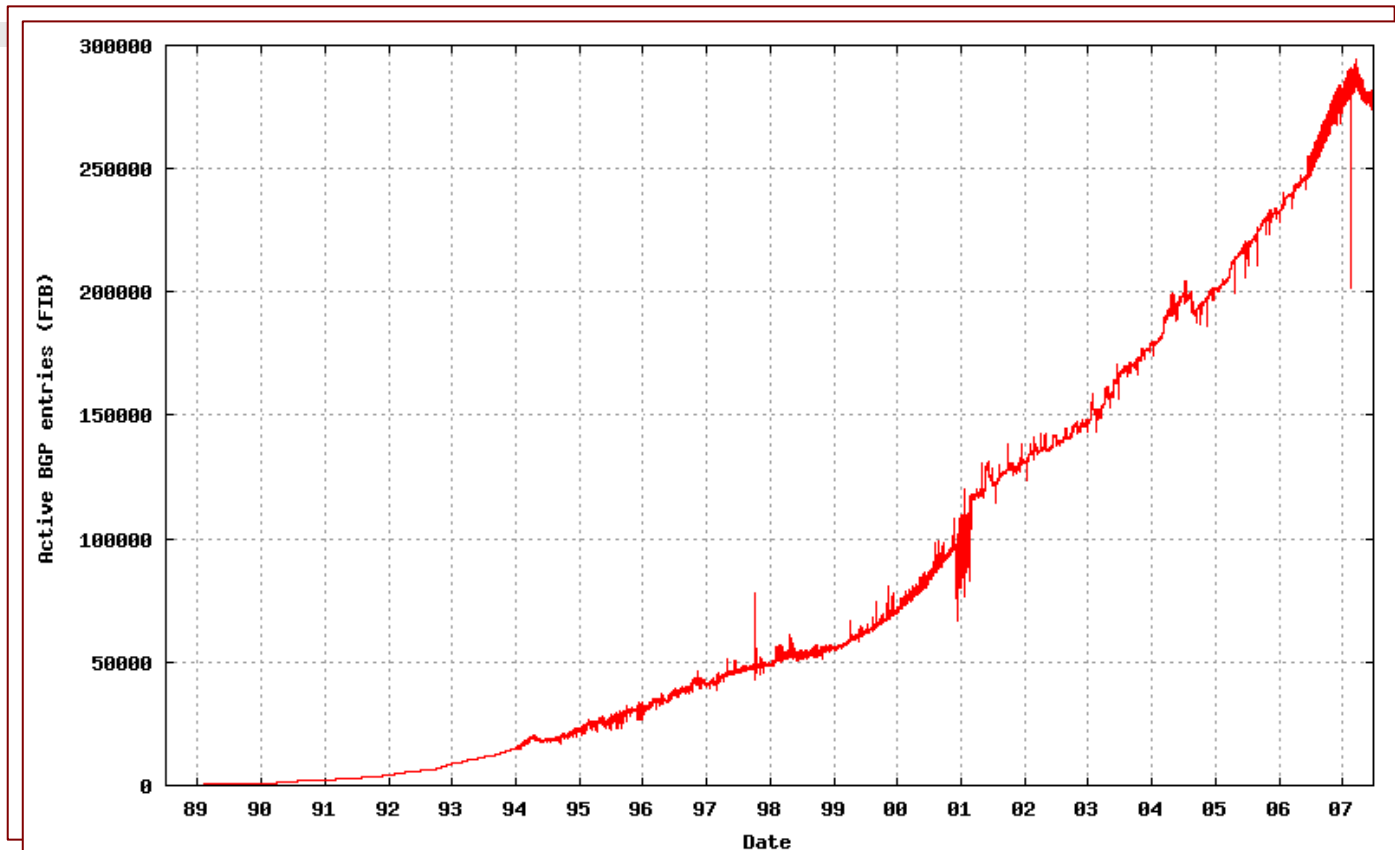


[www.nro.net/statistics](http://www.nro.net/statistics)





# Some IPv4 Reports



[bgp.potaroo.net](http://bgp.potaroo.net)



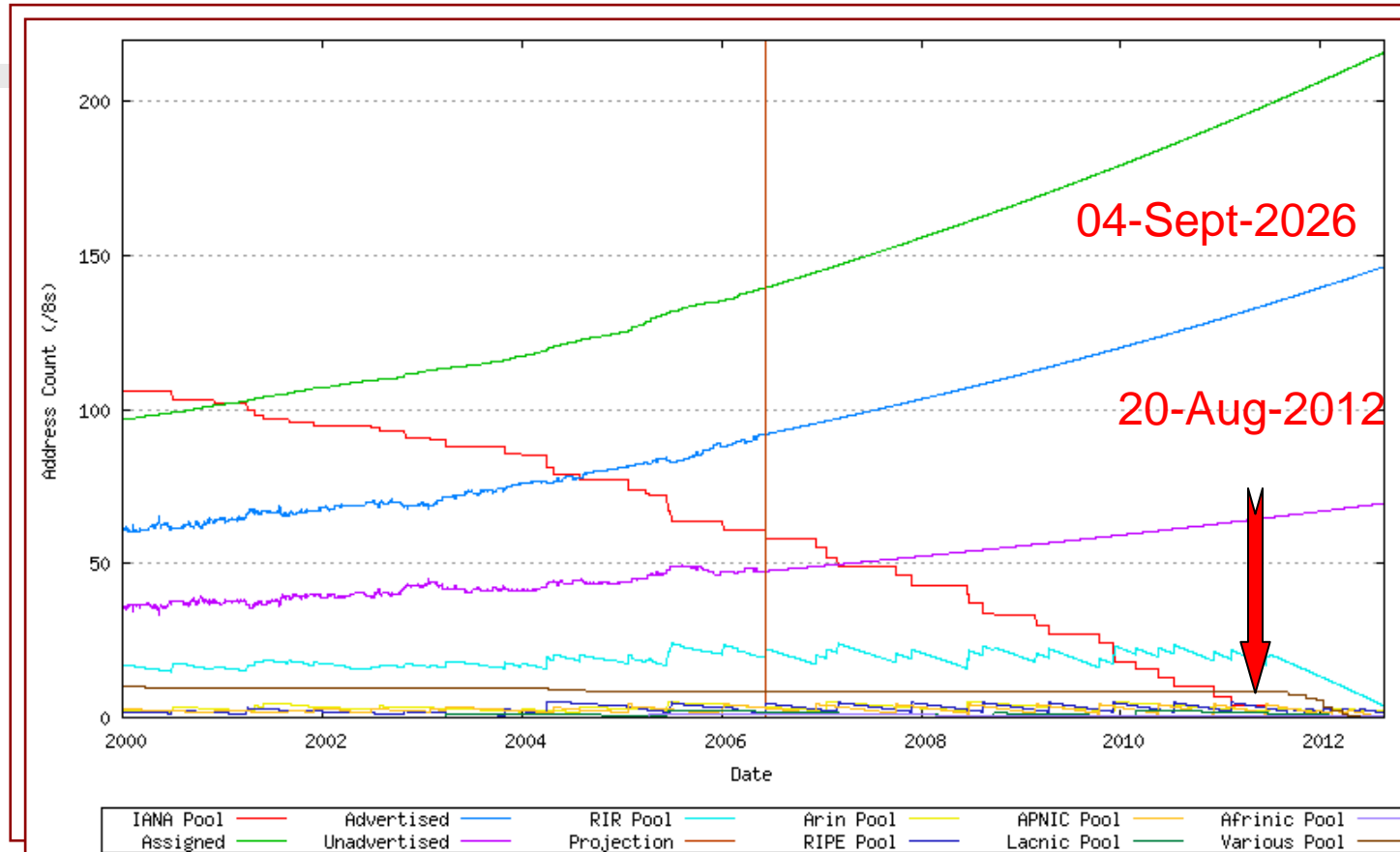
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# IPv4 Depletion Projection



bgp.potaroo.net



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# CIDR ...

- Allocate exceptionally class B addresses
- Re-use class C address space
- CIDR (*Classless Internet Domain Routing*)
  - RFC 1519 (Sept. 1993)
  - network address = prefix/prefix length
  - less address waste
  - allows aggregation (reduces routing table size)

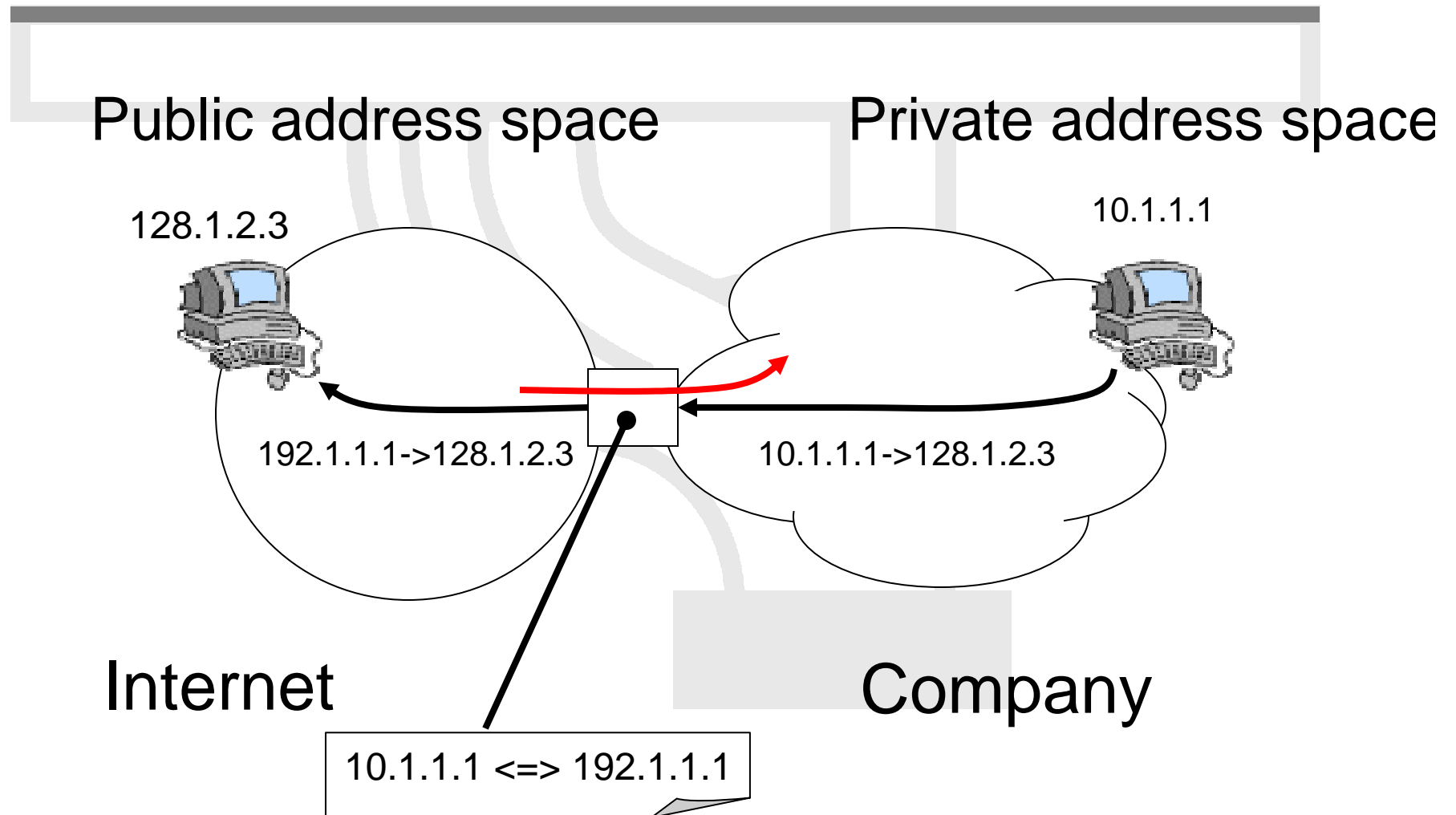


# Private Addresses (RFC 1918 BCP)

- 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 is the most commonly used of NAT variations



# NAT (RFC 2663)



# NAT (summarized)

- Advantages:
  - Reduce the need of official addresses
  - Ease the internal addressing plan
  - Transparent to some applications
  - “Security”
  - 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



# 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?





# Historical Facts about IPv6

Keep the protocol intact, just increase the address length

Develop an entirely new version of the protocol, new features and enhancements

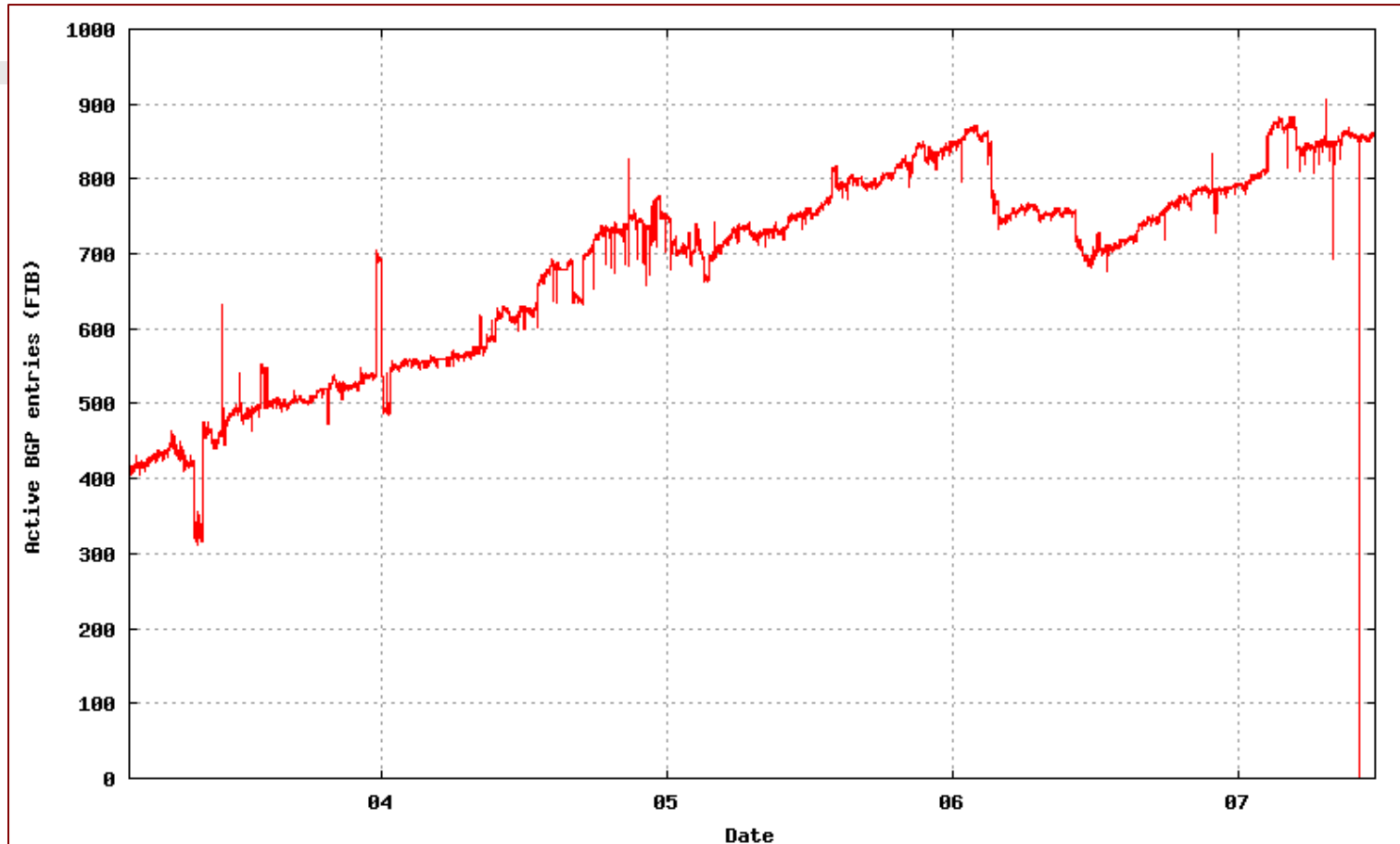
**IP new generation IPng or IPv6**

Steven Deering (Xerox PARC) and  
Robert Hinden (Ipsilon Networks / Nokia)

- 1995, Dec. : IPv6, RFC1883
- Academic networks
- 21st century  
2000 – 2004 IPv6 implementation



# IPv6 Today



[bgp.potaroo.net](http://bgp.potaroo.net)

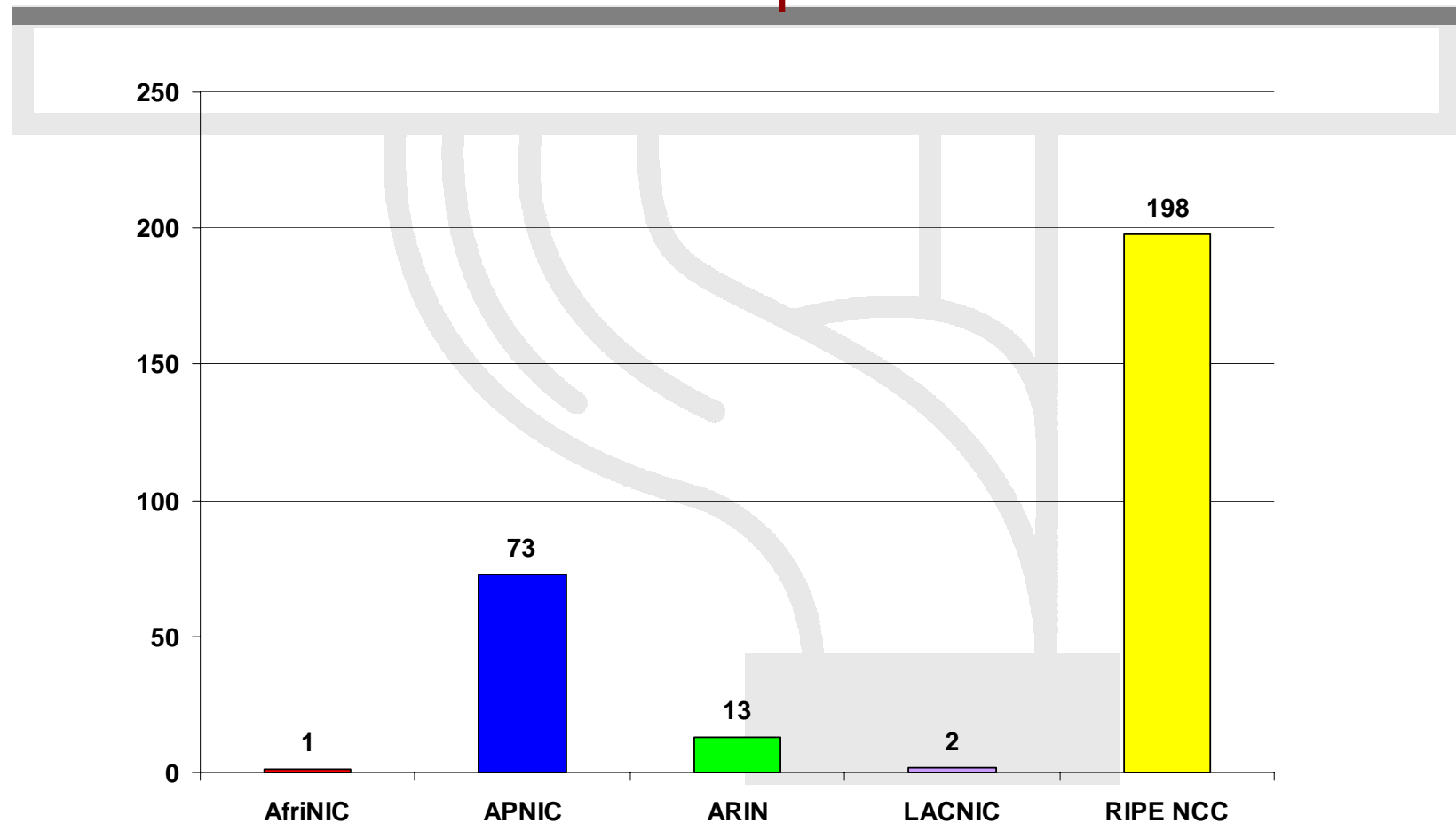






# IANA IPv6 Allocations to RIRs

issued as /23s prior to Oct 06



[www.nro.net/statistics](http://www.nro.net/statistics)



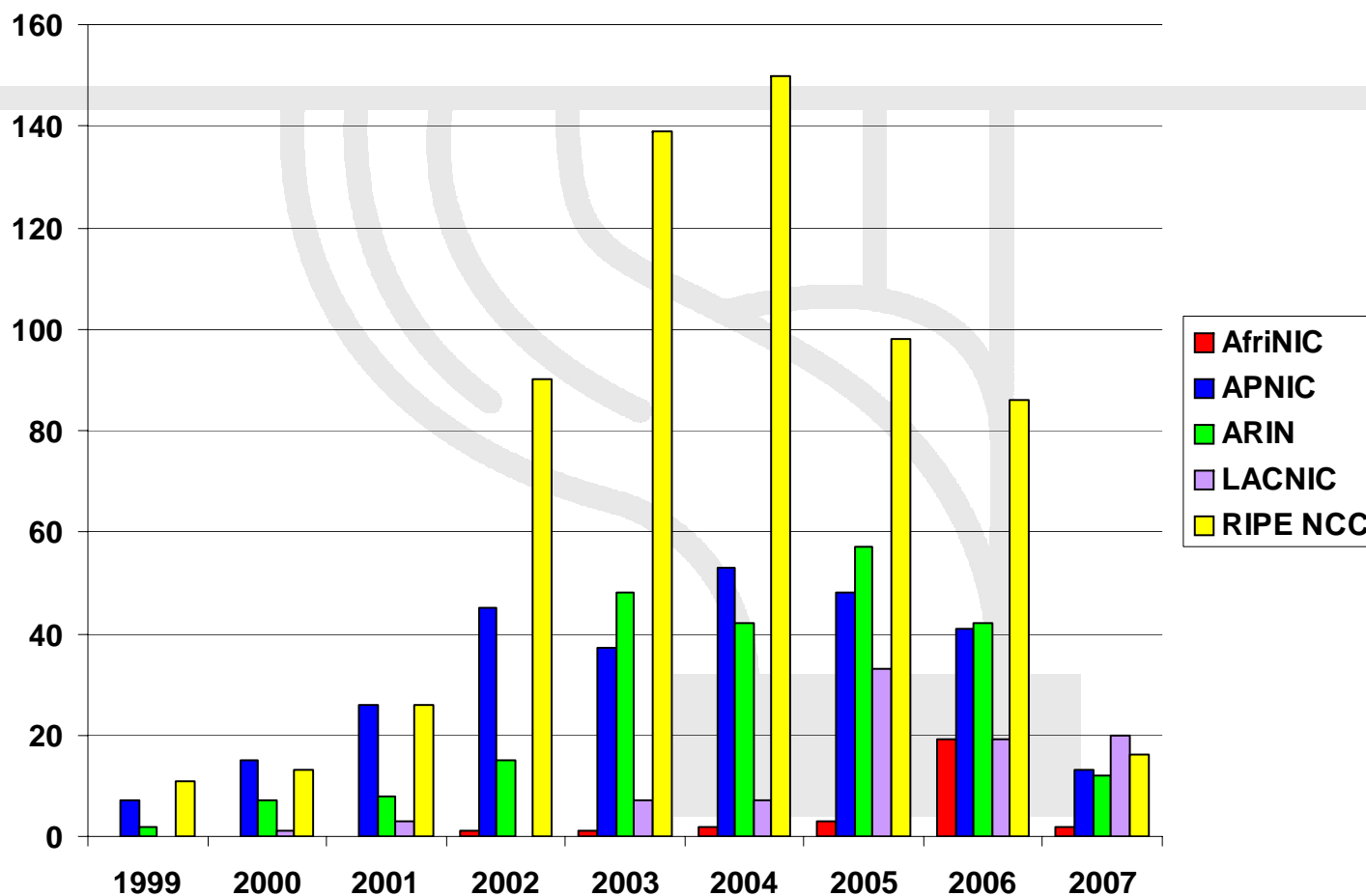
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NRO

# IPv6 Allocations RIRs to LIRs/ISPs Yearly Comparison



[www.nro.net/statistics](http://www.nro.net/statistics)



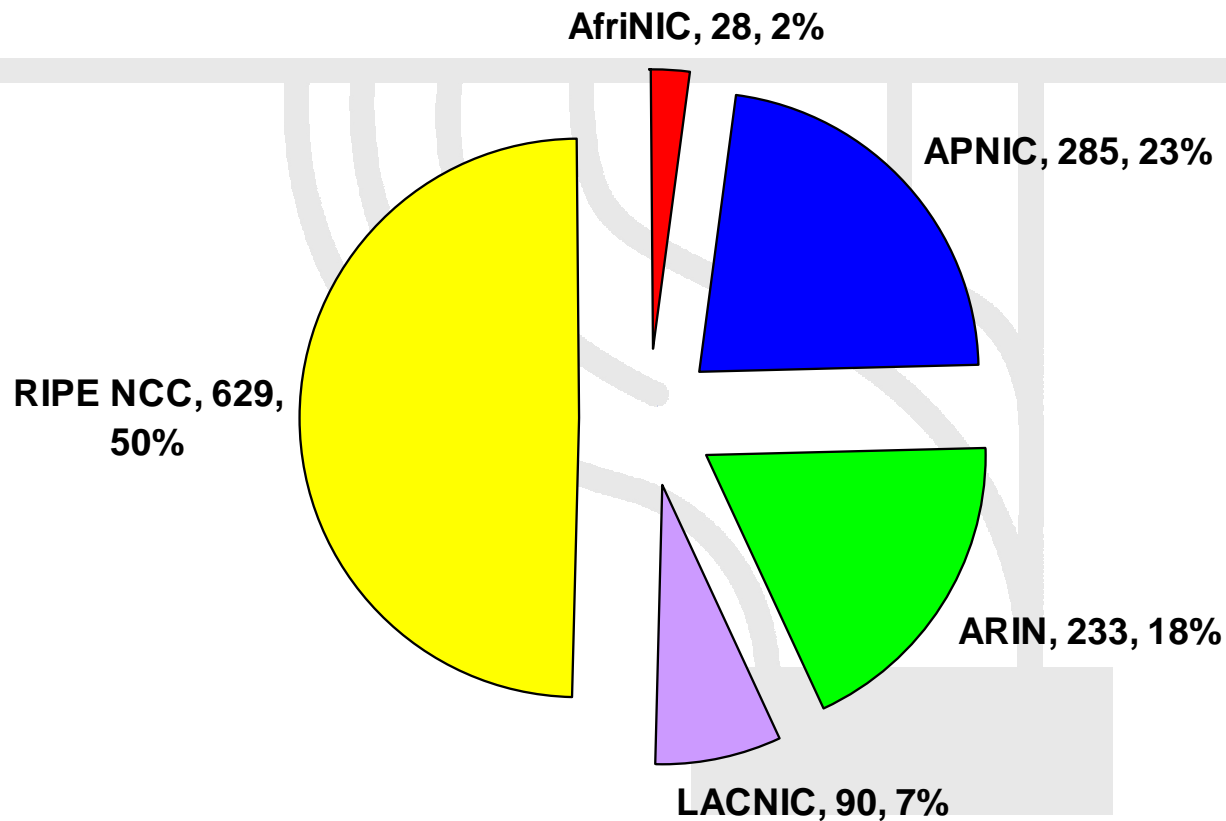
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# IPv6 Allocations RIRs to LIRs/ISPs

## Cumulative Total (Jan 1999 – Mar 2007)



[www.nro.net/statistics](http://www.nro.net/statistics)





# FYI: More Statistics

- RIR Stats:  
[www.nro.net/statistics](http://www.nro.net/statistics)  
[bgp.poraroo.net](http://bgp.poraroo.net)
- Raw Data/Historical RIR Allocations:  
[www.aso.icann.org/stats](http://www.aso.icann.org/stats)  
[www.iana.org/assignments/ipv4-address-space](http://www.iana.org/assignments/ipv4-address-space)  
[www.iana.org/assignments/as-numbers](http://www.iana.org/assignments/as-numbers)  
[www.iana.org/assignments/ipv6-unicast-address-assignments](http://www.iana.org/assignments/ipv6-unicast-address-assignments)

