

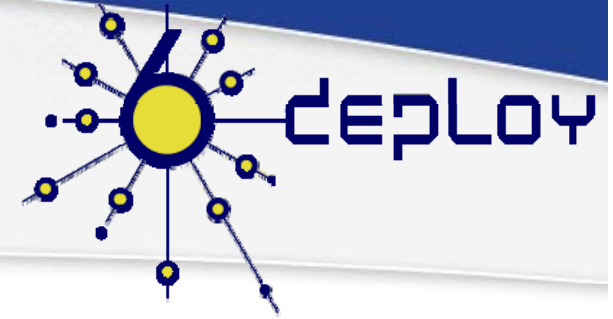
Why IPv6?

Roque Gagliano

LACNIC



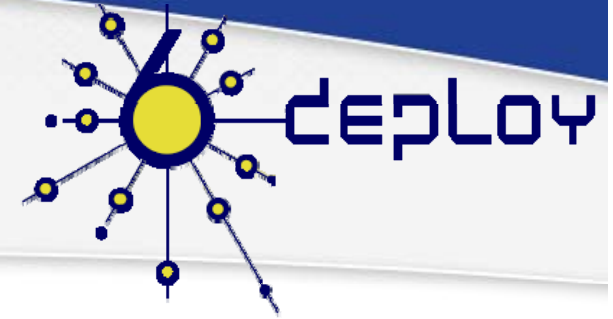
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- ◆ Initial Concepts.
- ◆ IPv6 History.
- ◆ What is IPv6?
- ◆ Planning IPv6.



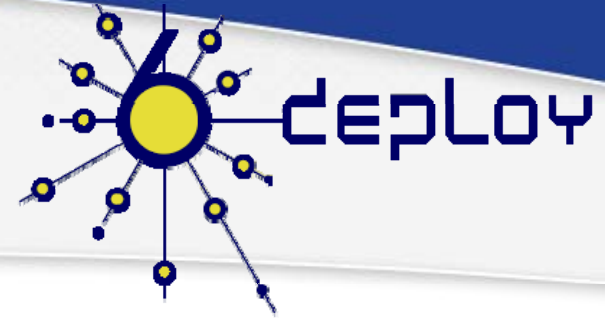
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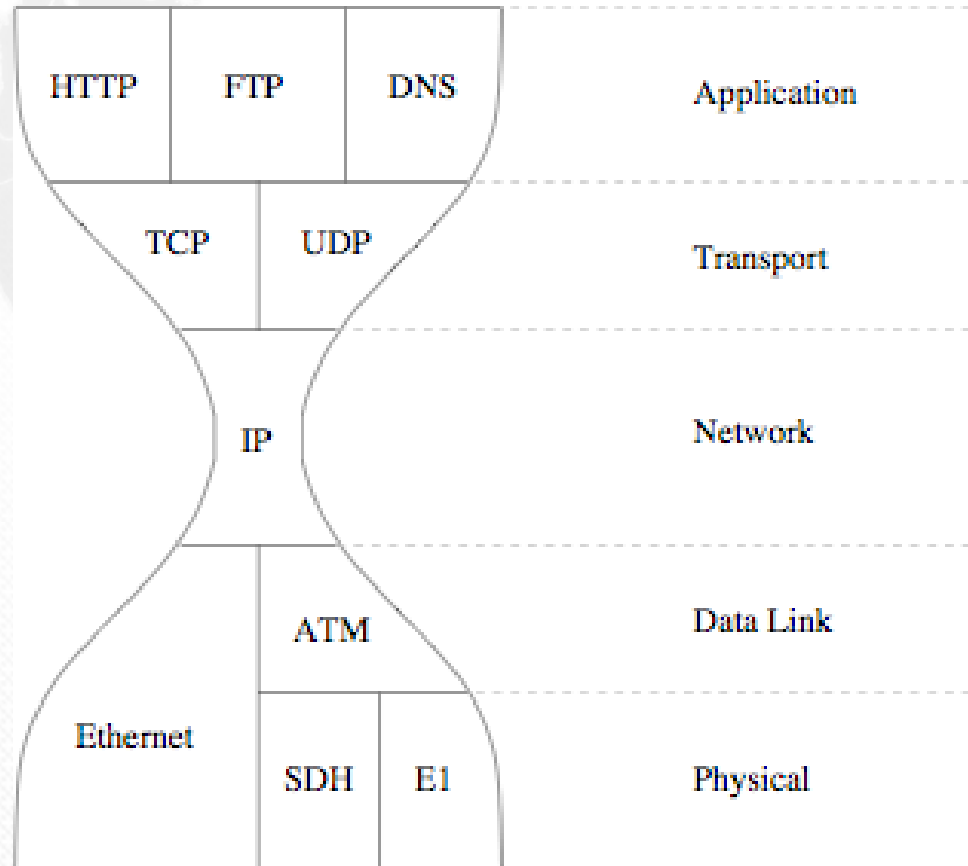
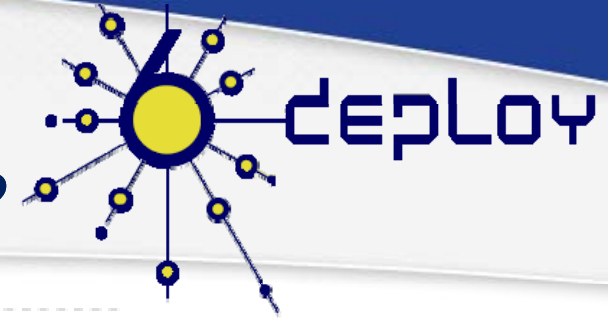
Some initial concepts.



- ◆ IPv6 is the evolution of IPv4, the most successful network protocol of the history.
- ◆ IPv4 and IPv6 are not “compatibles on the wire”, which means an IPv4 only host can’t communicate with an IPv6 only host by themselves.
- ◆ IPv6 will not substitute IPv4, both protocol will co-exists for several years. Just like IPX is still existing in your networks. There won’t be an “IPv4 Blackout”.

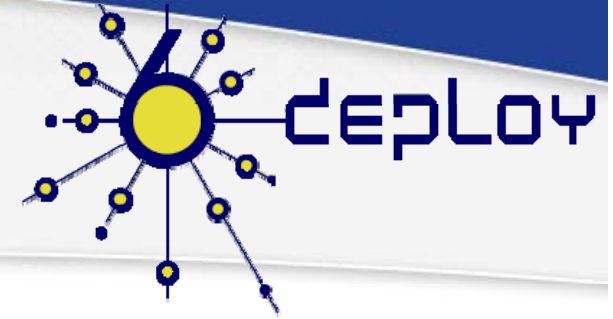


Why is IPv4 to IPv6 transition so important?





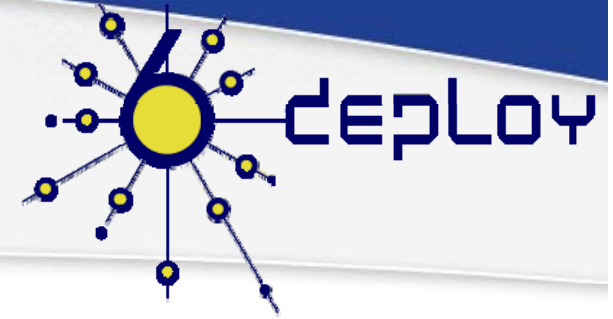
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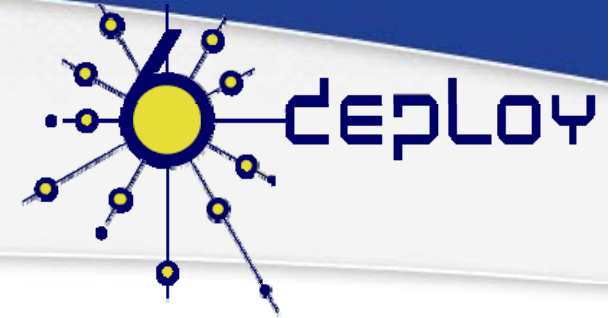
IPv6 History



- ◆ **1983: TCP/IP became “the protocol” of ARPANet with ~100 computers from Research Networks.**
- ◆ **1991: First signs of shortcut of Class B Networks. Some report mentioned 1994 as the depletion date!.**
- ◆ **1992: Commercial activities started. Allocations started booming.**



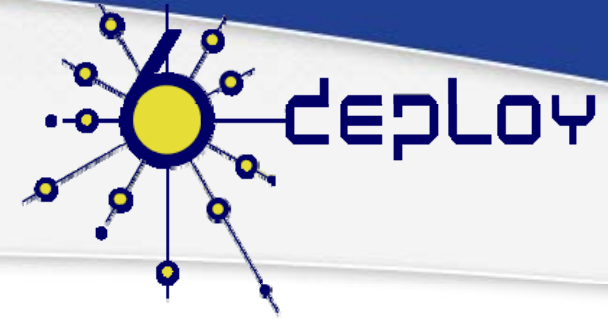
IPv6 History



- ◆ **Emergency Measurements:**
 - ◆ **CIDR: Classless Interdomain Routing:**
 - ◆ network address = prefix/prefix length
 - ◆ Classes abandon = less address waste
 - ◆ Allows aggregation (reduces routing table size)
 - ◆ **NAT: Network Address Translation:**
 - ◆ Allows several users to share one address.



IPv6 History



NAT (continued)

• Advantages:

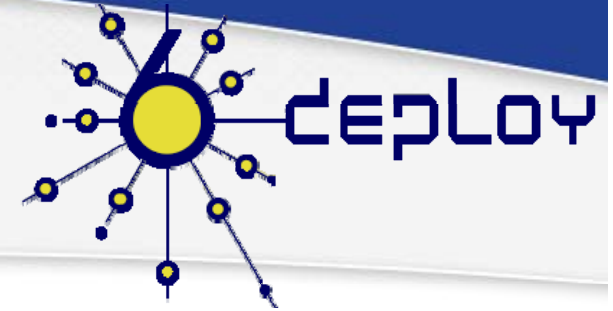
- Reduce the need of public addresses
- Ease the internal addressing plan
- Transparent to some applications
- “Security” vs obscurity
- Clear delimitation point for ISPs.

• Disadvantages:

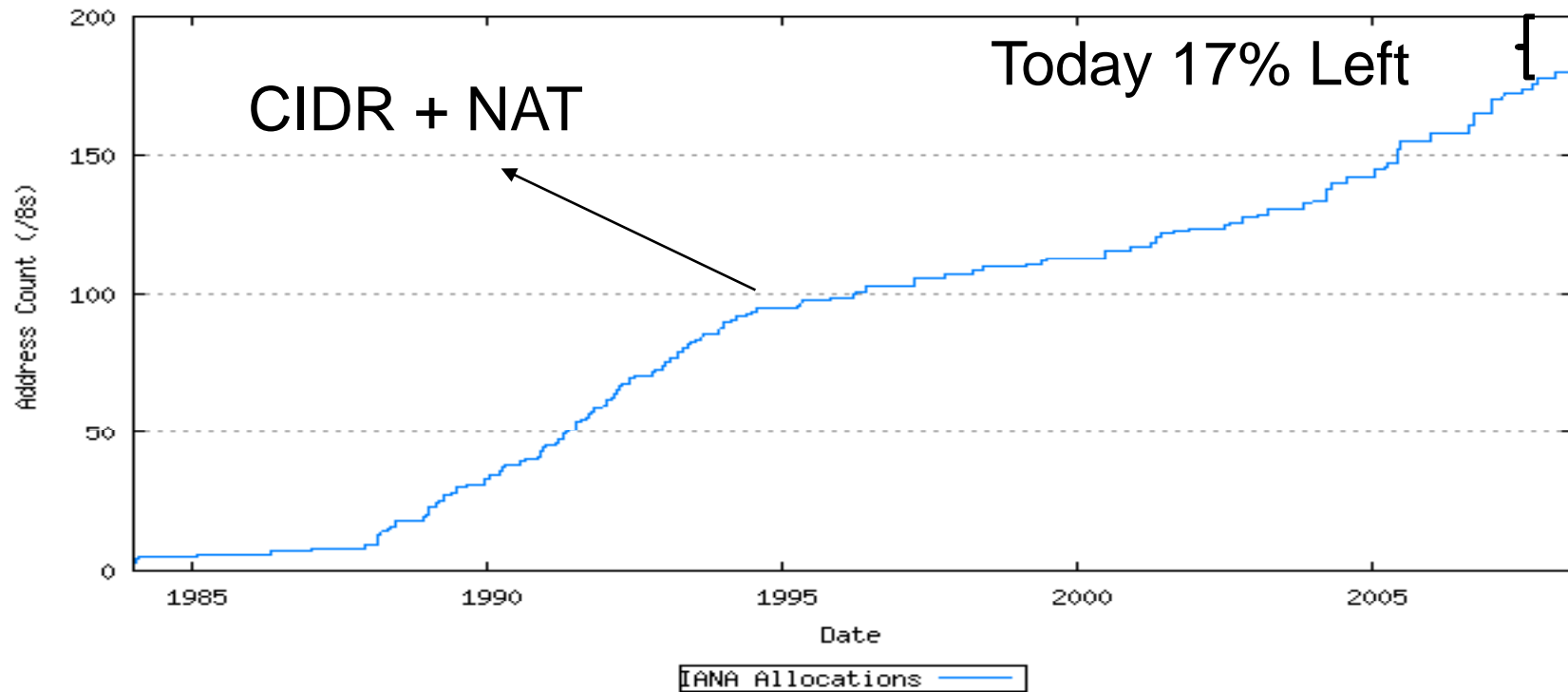
- Translation sometime complex (e.g. FTP, VOIP).
- Apps using dynamic ports (UPnP).
- Does not scale (today avg. of 500 active sessions per user).
- Introduce states inside the network:
 - Multi-homed networks
- Breaks the end-to-end paradigm.
- Security with IPsec.
- Difficulties for operations when done inside a Provider network.



IPv6 History

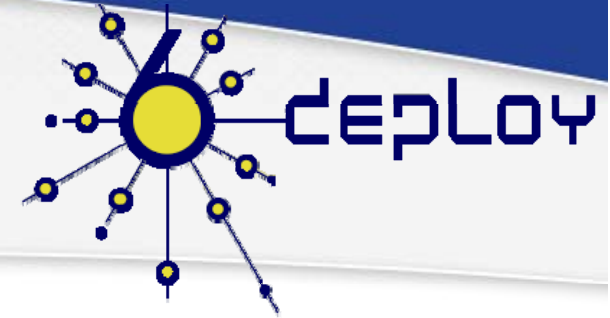


Time Series of IANA Allocations





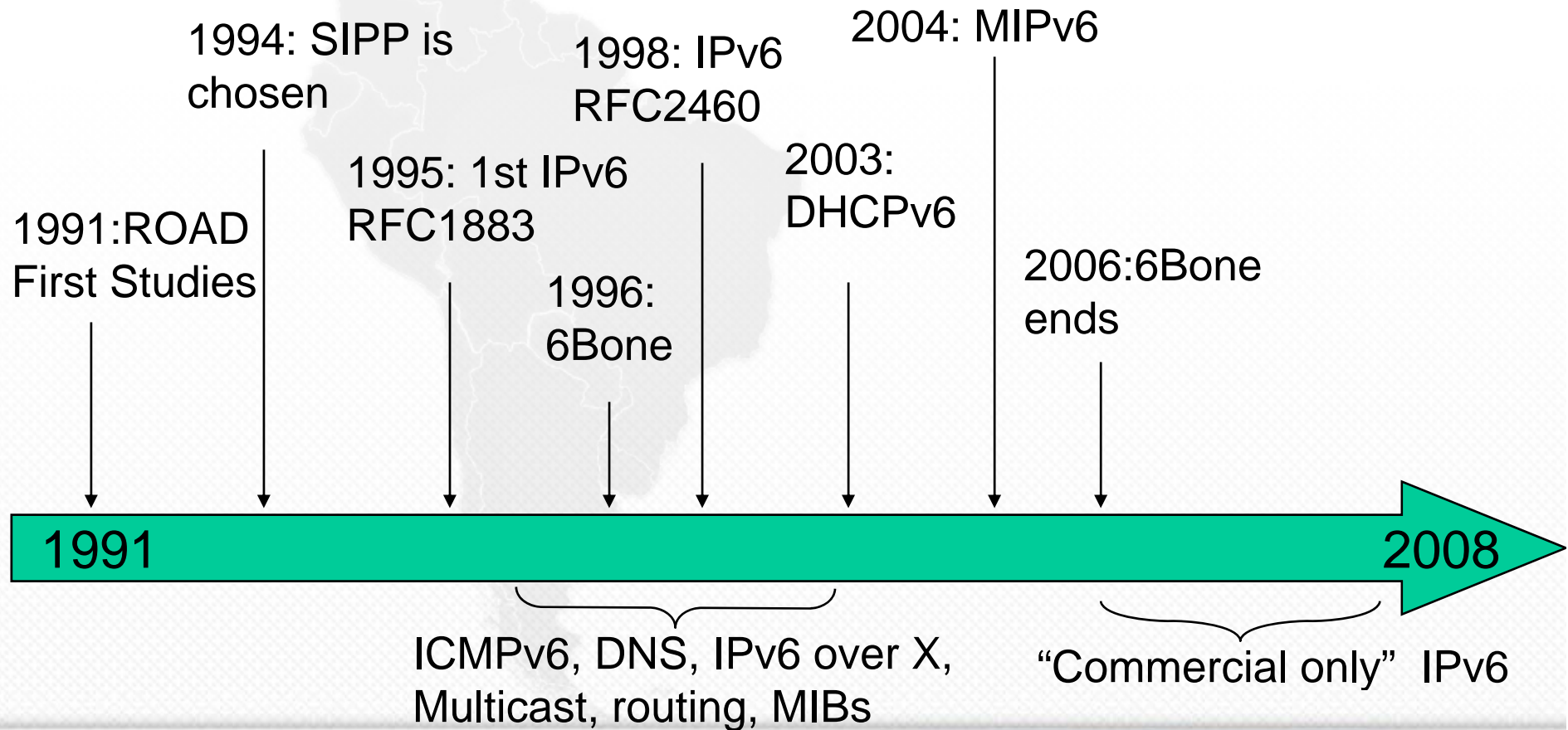
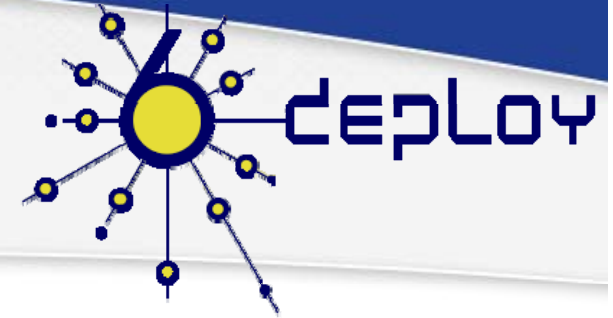
IPv6 History: Beyond the Emergency.



- ◆ In 1992 the IETF creates the group Ipng (IP Next Generation) that proposes IPv6 as the evolution of IPv4.
- ◆ Requirements:
 - ◆ Big amount of available addresses.
 - ◆ Hierarchical addressing space.
 - ◆ Embedded security.
 - ◆ “Plug and Play” configuration for hosts.
 - ◆ Improvements to QoS.
 - ◆ Improvements to Network Mobility.

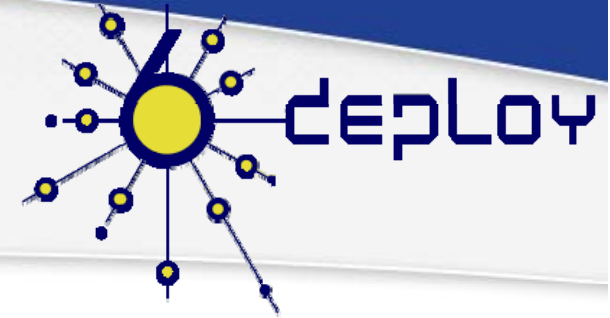


IPv6 Evolution:





IPv6 Evolution: What are we still Working on?

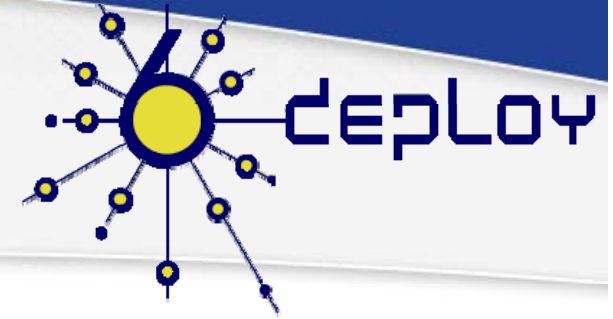


- ◆ The IETF is currently working on:
 - ◆ Particular transitions scenarios (will go there later).
 - ◆ Recommendations for IPv6 implementation (addressing, provisioning).
 - ◆ Enhanced Network Mobility (the Boeing case).
 - ◆ Finishing Site Multi-homing RFCs.
 - ◆ Security issues with Auto-configuration.
 - ◆ IP over 802.16.

The main IPv6 specification have already been finished!.



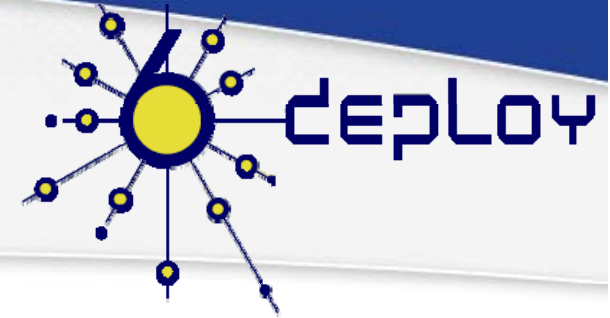
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What is IPv6 in one Page:



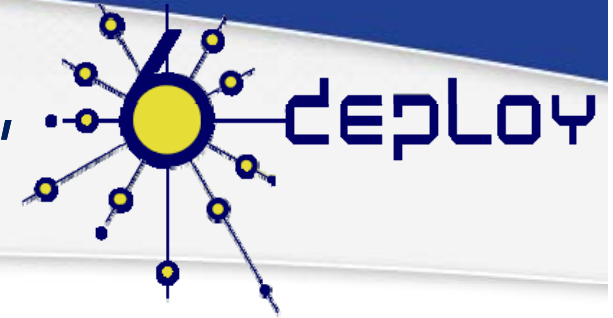
- ◆ IPv6 is a Network Protocol with many more addresses than IPv4:

340,282,366,920,938,463,374,607,431,768,211,456 available addresses.

- ◆ With so many addresses we can overcome the shortage in IPv4 supply and continuing support the growth of Internet.
- ◆ In IPv6 some tasks are simpler than in IPv4: (Auto-configuration, Renumbering, Multicast, IP Mobility, etc.)
- ◆ IPv6 Enables Innovation. Particularly for applications without NAT



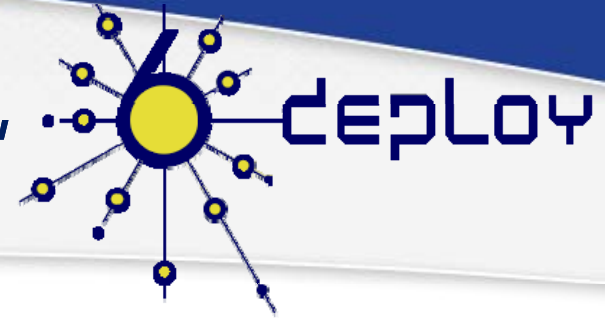
Things that change in IPv6, that are good to know:



- ◆ IPv6 addresses are represented by Hexadecimal numbers. Example: 2001:DB8:12FF:1231:FFB5::F9DA/64.
- ◆ In IPv6 there is not Network Mask, only Prefix Length.
- ◆ In IPv6 the header is always 40 bytes long, extensions are listed as “next header”.
- ◆ In IPv6 there is no Broadcast, only Multicast.
- ◆ In IPv6 there is no ARP or IGMP, ICMPv6 takes those jobs.
- ◆ In IPv6 routers do not fragment, only Terminals. Path MTU Discover is Mandatory.



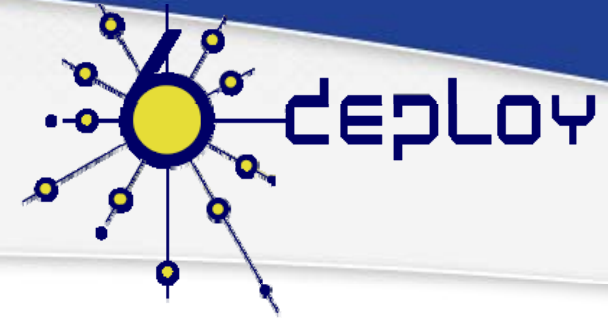
Things that change in IPv6, that are good to know:



- ◆ IPv6 header does not include a checksum, so if designing software, UDP checksum is mandatory.
- ◆ There are different types (reserved, unicast, multicast and anycast) of IPv6 Addresses and different scopes (global and link-local).
 - ◆ **Example: 2001:13c7:7002:1::1 is a Unicast Global Address.**
fe80::217:f2ff:fe4d:a80e%en1 is a Link Local Address.
- ◆ Typically a host has more than one IPv6 unicast address configured with the same or different scopes (plus the IPv4 address).



IPv4 and IPv6 dual reference stacks



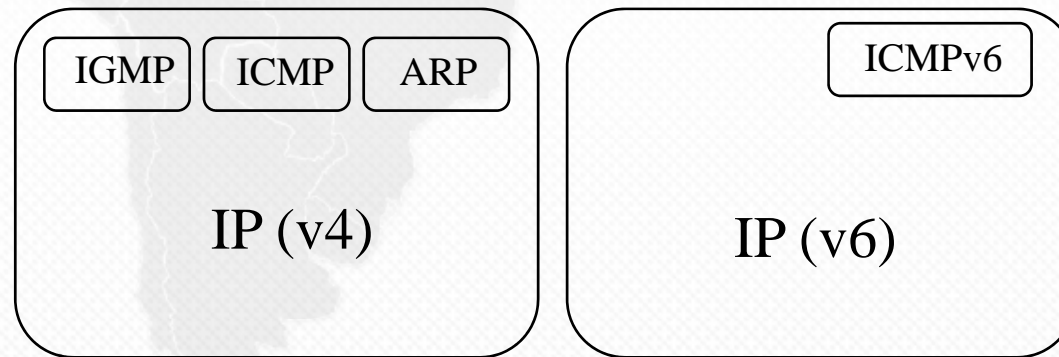
Application layer



Transport layer



Network layer

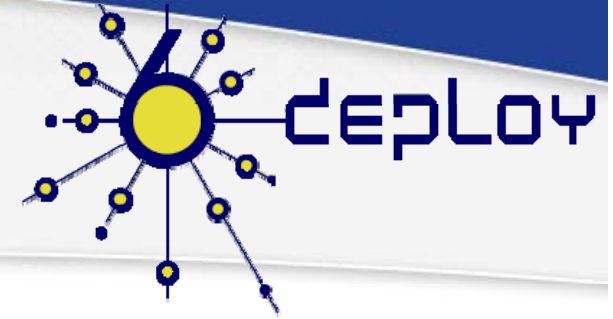


Data link / physical layers





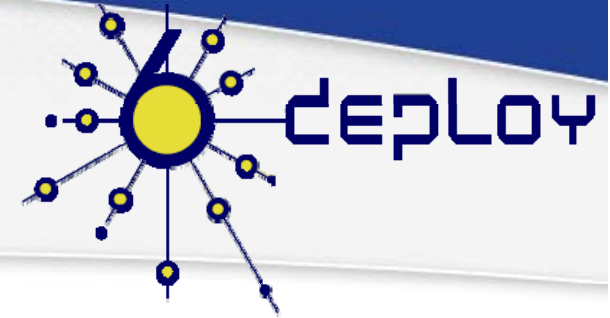
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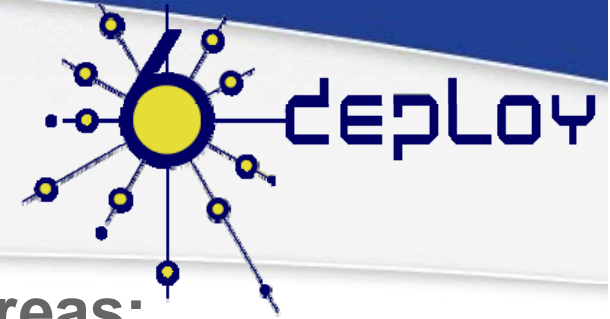
Why Planning for IPv6?



- ◆ IPv4 will exhaust in the near future. LACNIC press release:<http://www.lacnic.net/ipv6/en/>
- ◆ New technologies been implemented with important demand for addresses: 3G, WIMAX, Sensor Networks. Why planning today without IPv6 support if will need to support in 3 years?
- ◆ Be ready for the Future!.
- ◆ Be innovative.
- ◆ New business Opportunities and Developments.



Planning IPv6



- ◆ Implementing IPv6 involves several areas:

- ◆ Strategic planning activities.

- ◆ Network planning activities:

- ◆ Addressing Plan.

- ◆ Routing Plan.

- ◆ Training Plan.

- ◆ Provisioning Plan.

- ◆ Services & Tools (internal and external) Plan.

- ◆ IPv6 Security Plan.

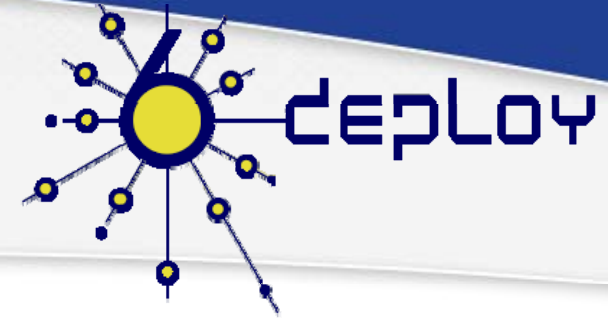
- ◆ Implementation activities.

- ◆ If you want to make the 1/1/11 date, you need to start working!

PLANNING FOR NEW SERVICES AND TECHNOLOGIES



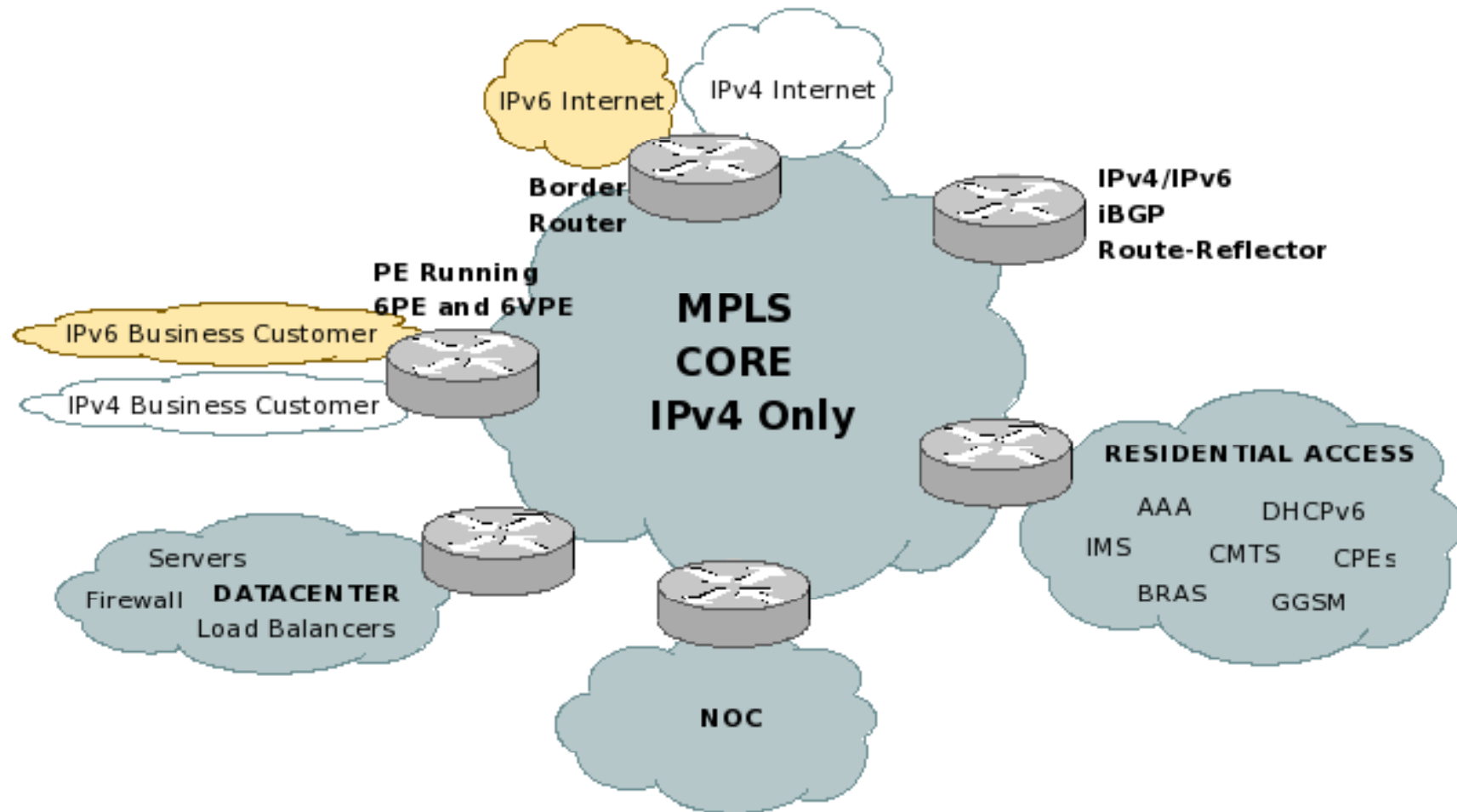
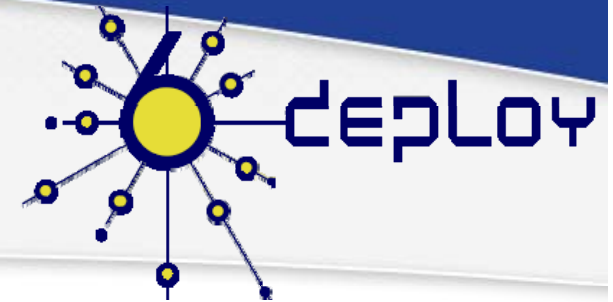
IPv6 at an ISP



- ◆ **You need to think at least:**
 - ◆ **Equipment Support (in the network and at the user premise).**
 - ◆ **Transit and Peering Agreements.**
 - ◆ **Addressing Plan for internal infrastructure and users.**
 - ◆ **Routing (BGP and IGP).**
 - ◆ **VPNs (MPLS).**
 - ◆ **Traffic Engineering.**
 - ◆ **Access Network: PPPoE, DHCPv6, AAA.**
 - ◆ **Services: DNS, NTP, Web, etc.**
 - ◆ **Tools: Provisioning, Management, Statistics, Backup, etc.**
 - ◆ **Billing.**
 - ◆ **Services Definitions.**
 - ◆ **Security.**

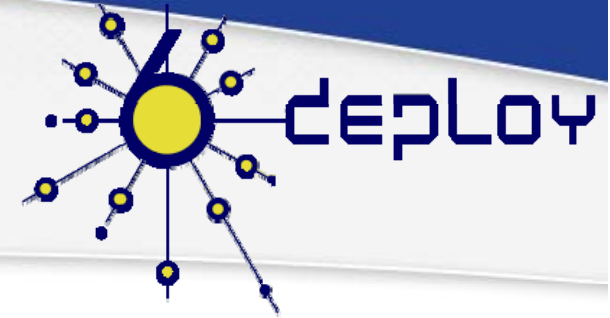


IPv6 at an ISP





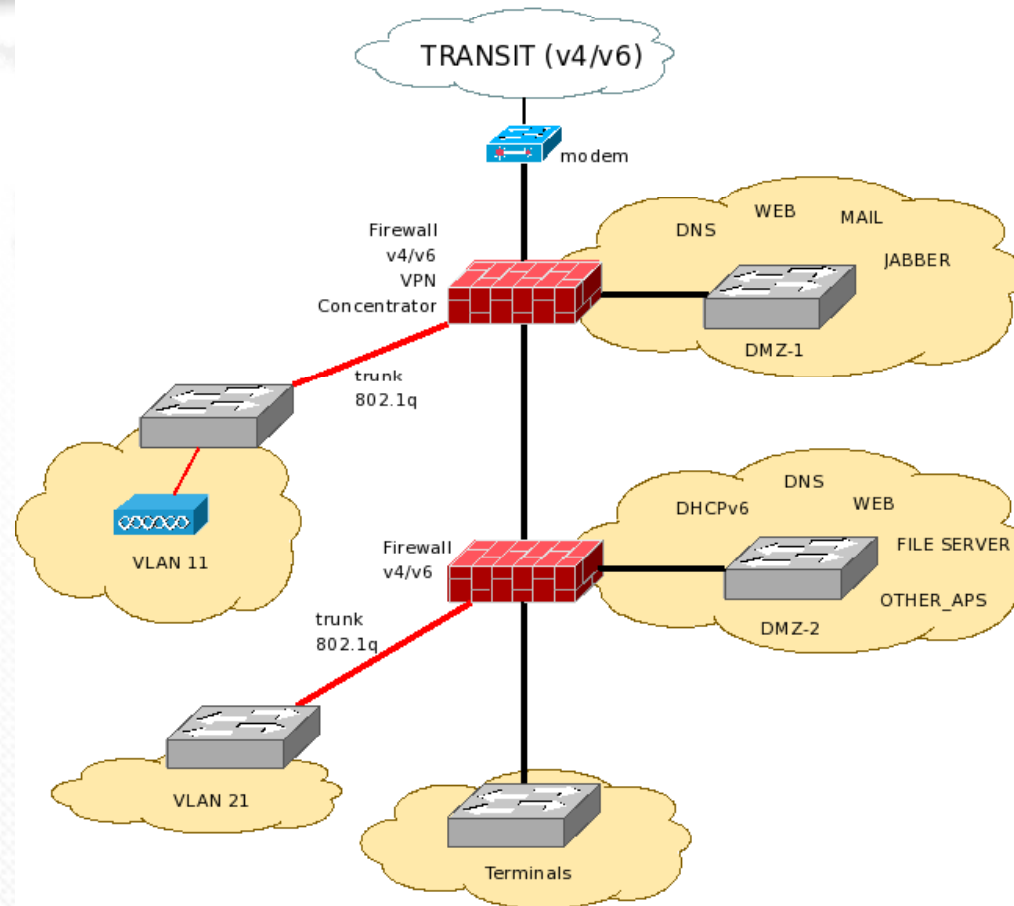
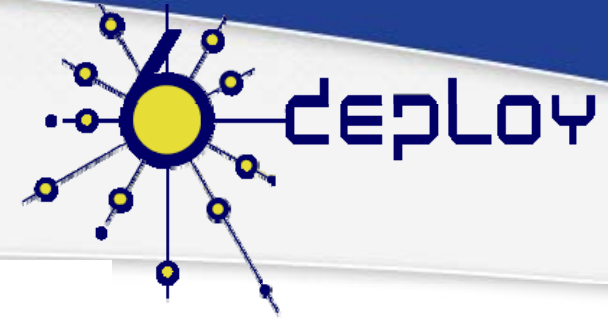
IPv6 at an Enterprise



- ◆ **You need to think at least:**
 - ◆ **Equipment Support (in the network and at the user premise).**
 - ◆ **Transit Agreements.**
 - ◆ **Addressing Plan.**
 - ◆ **Routing between buildings.**
 - ◆ **Security (Firewall).**
 - ◆ **VPN access from Internet.**
 - ◆ **Domain Names.**
 - ◆ **Hosts software and Host address configuration.**
 - ◆ **Proxies and clusters.**



IPv6 at an Enterprise:





IPv6 and Software Development

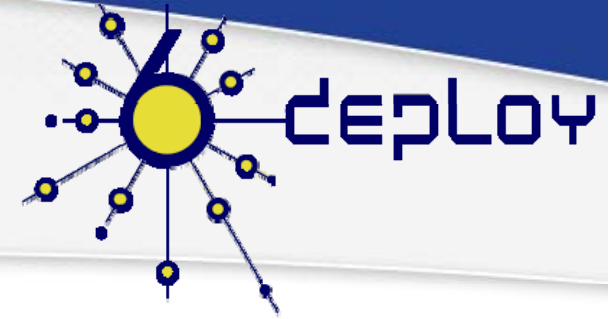


- ◆ IPv6 can offer new opportunities as it eliminates NAT: Example: AJAX applications, Multimedia.
- ◆ You would need to give IPv6 Support to Software that runs on top of IP or that handle IP addresses. Example: ODBC, JDBC drivers upgrade, Database tables, log.
- ◆ You want to have address family independent code where possible.
- ◆ IPv6 API are available in most major languages: C, Perl, JAVA, etc.
- ◆ Example developing in JAVA:

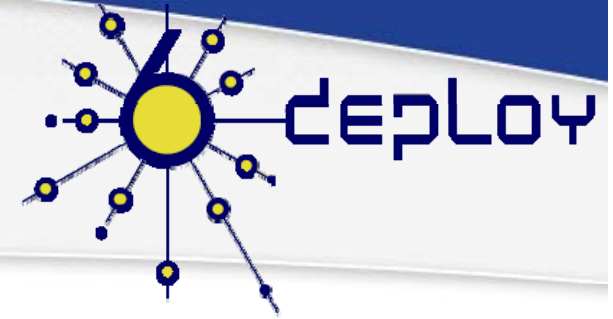
java.net, Class InetAddress. This class represents an Internet Protocol (IP) address. An IP address is either a 32-bit or 128-bit unsigned number used by IP, a lower-level protocol on which protocols like UDP and TCP are built. And subClasses: Inet4Address, Inet6Address



Conclusions



- ◆ IPv6 has 13 years of evolution.
- ◆ IPv6 is been proven as ready for mainstream deployment.
- ◆ IPv6 planning is needed and takes time and effort.
- ◆ IPv6 can be an opportunity if implemented on time or a risk if missed.
- ◆ IPv6 is coming, are you ready?



Thank you!
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