Internet 101

Basics

GEEKS?

Any Geeks and/or Techies

Please leave the room.

TCP/IP

- TCP/IP
  - Transmission Control Protocol
  - Internet Protocol

Data is chopped into “packets”.

These are sent to their destination and then reassembled.

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Packets

- Header
  - Includes information describing the packet, including where it came from and where it needs to go.
  - This is where the IP addresses are.
- Payload
  - The actual Data

Addressing Information

- IPv4 Address
  - Every host on the Internet has a unique IP address. This is a 32 bit number.
    - (in IPv6 this is 128 bits)
  - The address is used to route information to the host. Similar to a phone number or a street address.

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IPv4 Addresses

Normally noted as “Dotted Quads”

192.0.34.163

In 32 Bits this reads:

11000000000000000010001010100011

10100011 = 163 (128,64,32,16,8,4,2,1)

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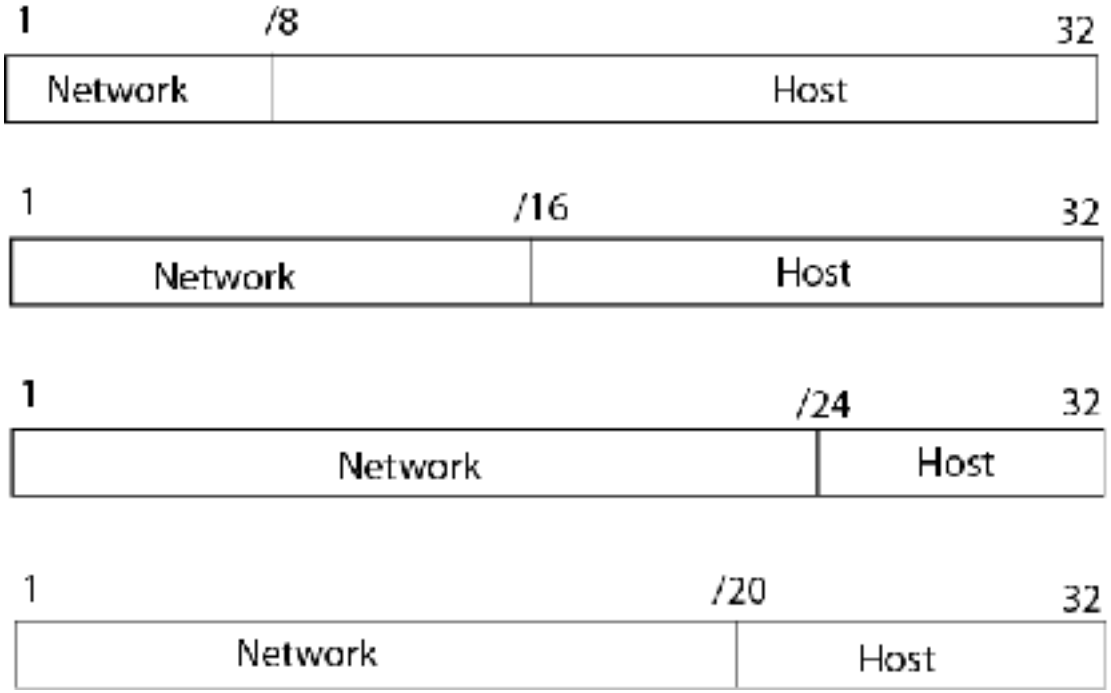
Prefix Notation



ICANN's Network = 192.0.32.0/20

= 192.0.32.0 to 192.0.47.255

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Prefix	Number of IPv4 Addresses
/25	128
/24	256
/23	512
/22	1024
/21	2048
/20	4096
/19	8192
/16	65536
/8	16777216
/0 (all addresses)	4294967296

IPv6 How does it differ

- Simply put… there's more of it.
  - Noted in Hexidecimal 3FFE::2F1C
    (IN IPv6 "::" means all zero's)
- In 128 bits this reads:

  0010010010010010010010010010010
  0010010010010010010010010010010
  0010010010010010010010010010010
  0010010010010010010010010010010
  00100111

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Prefix	Number of IPv6 Addresses
/64	18446744073709551616
/48	1208925819614629174706176
/32	79228162514264337593543950336
/25	1014120480182583521197362564300 8
/24	2028240960365167042394725128601 6
/23	4056481920730334084789450257203 2
/8	1.32922799578491587290380706028 03 e+36
/0 (all addresses)	3.40282366920938463463374607431 77 e+38

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Added security Ease of use

- Incorporation IPSec and schemes to make renumbering from one ISP to Another

Myths?

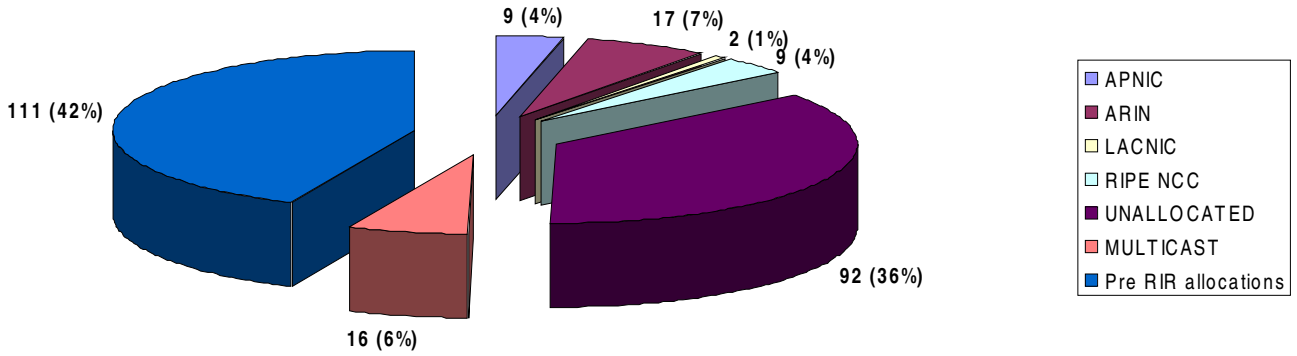
- We will run out of IPv4 in 2005

  No evidence to support this.

  Latest statistics talk about 2020+

  http://www.potaroo.net/iepg/july-2003/v4.pdf

IPv4


9 (4%)
17 (7%)
2 (1%)
9 (4%)
111 (42%)
92 (36%)
16 (6%)
APNIC
ARIN
LACNIC
RIPE NCC
UNALLOCATED
MULTICAST
Pre RIR allocations

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IPv6 isn't here yet

- It's definitely out there.

  most activity is in Asia and Europe

- It's in here too…

  The network at this meeting has v6 support.

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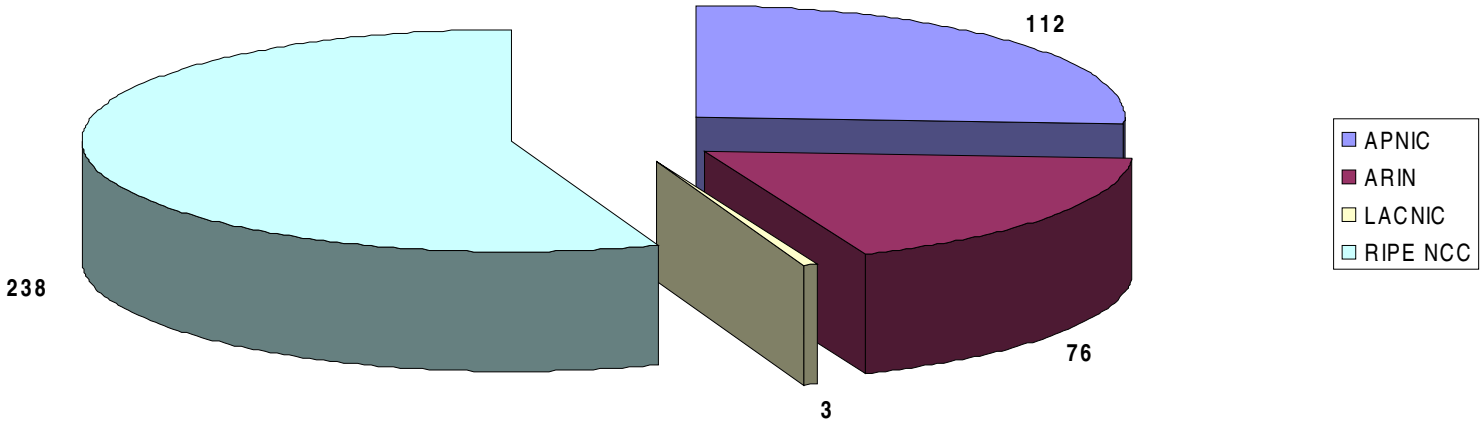
IPv6 Allocations by the Regional Internet Registries



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What has this got to do with the DNS?

- Nothing…. Except that no one can remember the numbers.
- DNS (Domain Name System)

  allows us to use names instead of IP addresses.

  www.icann.org = 192.0.34.163

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The Root-Servers

- 13 servers
- a.root-servers.net thru m.
- Each letter represents a system
  - Fully redundant systems

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Root Servers

- Adding Capacity all the time
  - Anycast
    - Copies in new locations, managed by same organisation
    - D, F, I, K, M are using some form of anycast

http://www.root-servers.org

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Myths

- a.root-servers.net is the main root server.
  - A is no different to the other root-servers
- All traffic goes through the roots.
  - Neither all traffic or all DNS queries go via the root servers

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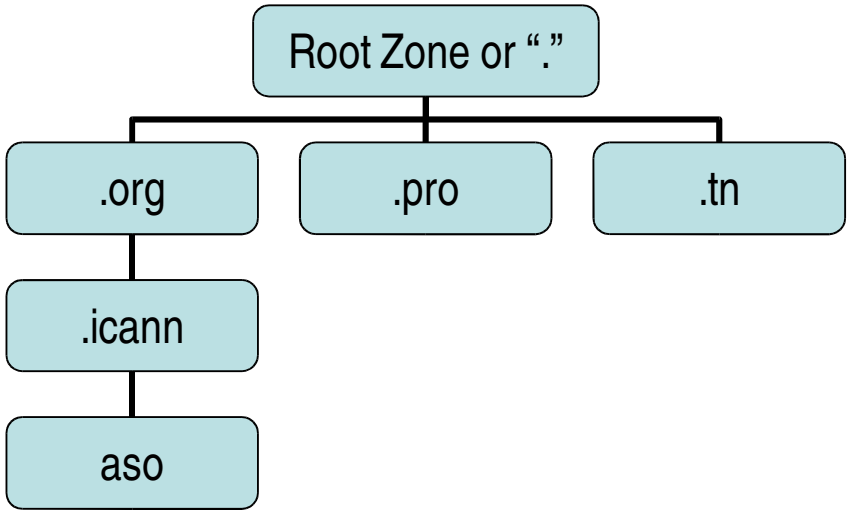
Hierarchical Structure



The file we store on name servers is called a "zone file".

It contains information relating to the zone and it's children

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DNS records in zone file

icann.org.	IN	NS	a.iana-servers.net.
icann.org.	IN	NS	b.iana-servers.net.
icann.org	IN	NS	c.iana-servers.net.
icann.org	IN	MX	10 pechora.icann.org.
icann.org	IN	MX	20 a.iana-servers.net.
www	IN	A	192.0.34.163
pechora	IN	A	192.0.34.35

==========

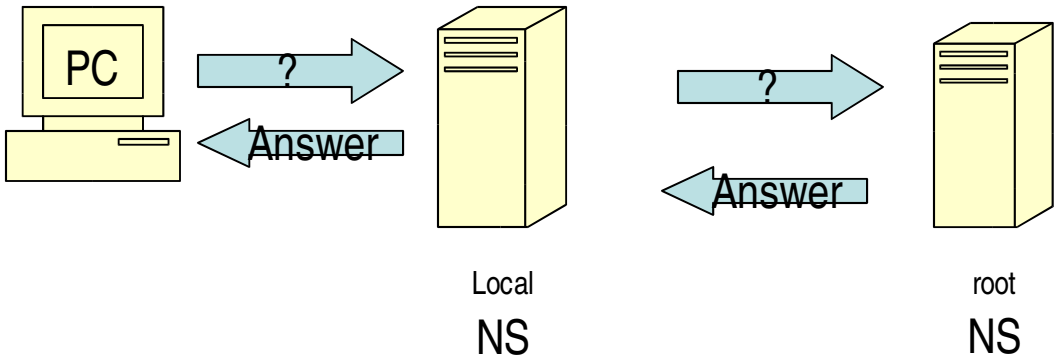
ns.ripe.net. IN AAAA 2001:610:240:0:53::193

(AAAA taken from ripe.net zone)

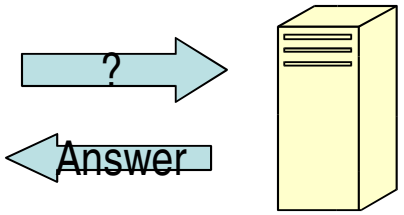
DNS Query

- You use a local resolver to resolve a name to a number.
  - Example www.ietf.org

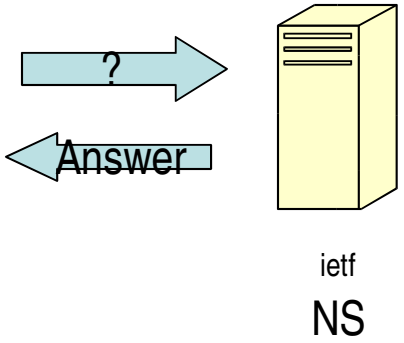
Finding the IP address



Uses “hints file” in server to find roots



Remembers Answer!
Caching



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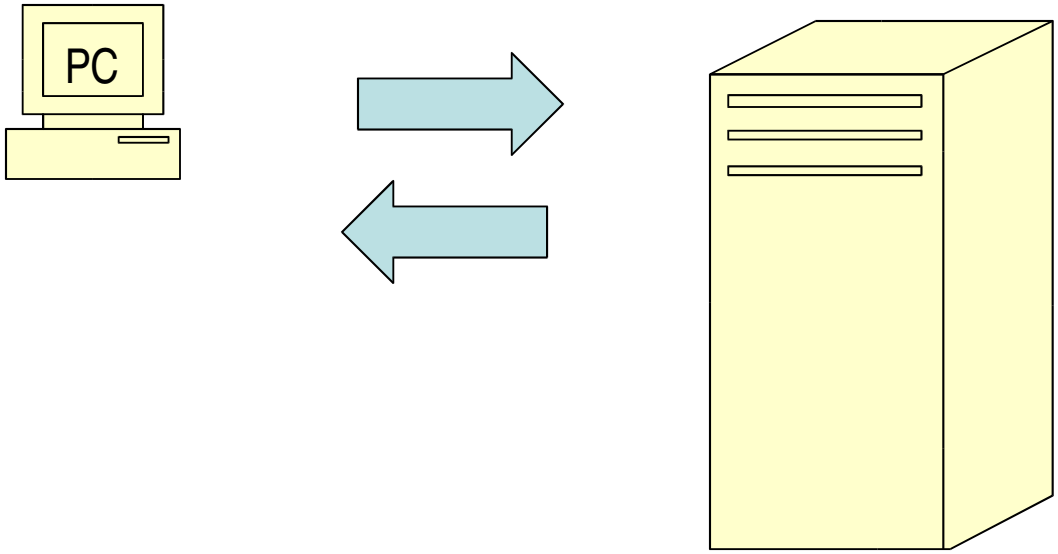
Received “A” record



www.ietf.org

Having received the IP address for www.ietf.org the PC can get to that website.

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DNS Replies

Mainly “UDP” - **User Datagram Protocol**

This means the reply is sent but no acknowledgement of receipt is expected

TCP means that a session is started, a connection, between the machines.

UDP reply packet can be no larger than 512 bytes (1 character = 1 byte).

3 parts to the reply

Query Section: Contains the original Query

Authority Section: Contains the answer

Additional Section: Contains important extra information

```
jcrain@b jcrain]$ dig @l.root-servers.net NS org

; <<>> DiG 9.2.1 <<>> @l.root-servers.net NS org
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 45857
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 9, ADDITIONAL: 9

;; QUESTION SECTION:
;org.                    IN     NS

;; AUTHORITY SECTION:
org.            172800  IN     NS     A7.NSTLD.COM.
org.            172800  IN     NS     L7.NSTLD.COM.
org.            172800  IN     NS     G7.NSTLD.COM.
org.            172800  IN     NS     F7.NSTLD.COM.
org.            172800  IN     NS     M5.NSTLD.COM.
org.            172800  IN     NS     J5.NSTLD.COM.
org.            172800  IN     NS     I5.NSTLD.COM.
org.            172800  IN     NS     C5.NSTLD.COM.
org.            172800  IN     NS     E5.NSTLD.COM.
```

```
;; ADDITIONAL SECTION:
A7.NSTLD.COM.       172800  IN      A       192.5.6.36
L7.NSTLD.COM.       172800  IN      A       192.41.162.36
G7.NSTLD.COM.       172800  IN      A       192.42.93.36
F7.NSTLD.COM.       172800  IN      A       192.35.51.36
M5.NSTLD.COM.       172800  IN      A       192.55.83.34
J5.NSTLD.COM.       172800  IN      A       192.48.79.34
I5.NSTLD.COM.       172800  IN      A       192.43.172.34
C5.NSTLD.COM.       172800  IN      A       192.26.92.34
E5.NSTLD.COM.       172800  IN      A       192.12.94.34

;; Query time: 147 msec
;; SERVER: 198.32.64.12#53(l.root-servers.net)
;; WHEN: Tue Jul 29 22:49:11 2003
;; MSG SIZE  rcvd: 327
```

The A records for Name Servers are what is called “Glue”

Possible issues?

- Each line is more bytes.
- Adding AAAA for each of the servers in the sample means adding nine extra records that should be included in the answer.
- If it goes above 512byte it will drop records from the additional section.

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Generic (g)TLDs

- .com
- .net
- .org
- .gov
- .arpa
- .mil
- .int
- .edu
- .pro
- .museum
- .name
- .aero
- .biz
- .coop
- .info

http://www.iana.org/gtld/gtld.htm

Country Code (cc)TLDs

- http://www.iana.org/cctld/
    - IANA uses iso3166 to determine what is a valid country code
- http://www.iso.ch/iso/en/prods-services/iso3166ma/index.html
- IANA Does “NOT” define countries
    - Other organizations do similar things for the same reason.

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