Protocols Layers and Their Service Model Part III

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1. Domain Name Server (DNS)

1.1. Definitions

Distributed Database implemented in hierarchy of many name servers.
application-layer protocol : hosts, name servers communicate to resolve names (address/name translation)

1.1.1. Structure and Services

DNS services include host-name to IP address translation, host aliasing, mail server aliasing and load distribution. There is a hierarchical database distribution.

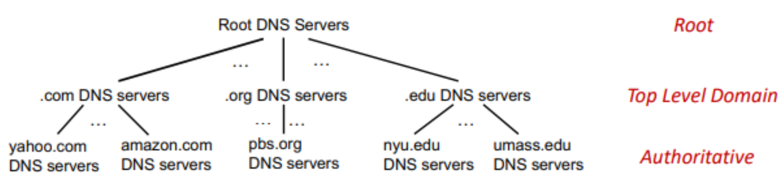

Figura 1: Hierarchical Database

If a client wants the IP address for www.amazon.com the order of searches would be client query >.com DNS server >amazon.com DNS server >IP of www.amazon.com

1.2. Root Name Servers

Official, contact-of-last resort by servers that cannot resolve name. They are incredibly important to Internet function and are managed by the ICANN. There are only 13 logical root name "servers"which are replicated about 200 times in the US.

Top-level Domain (TLD) servers are responsible for .com, .org, .net, .edu and other top level domains. **Authoritative DNS servers** organization's own DNS server(s), providing authoritative hostname to IP mappings for organization's named hosts. **Local DNS**

Name Server does not strictly belong to hierarchy, each ISP has one and DNS queries are first sent to it.

1.3. DNS name resolution

1.3.1. Iterated Query

Contacted server replies with name of server to contact. All queries are responded to the local DNS server and passed on to the next server.

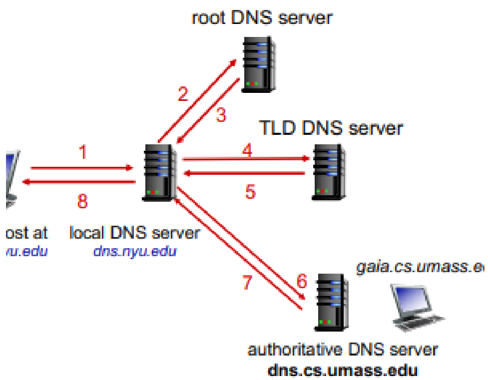

Figura 2: Iterated Query

1.3.2. Recursive Query

Puts burden of name resolution on contacted name server. This passes the query resolution to the next DNS server and bubbles the final resolution back to the original server.

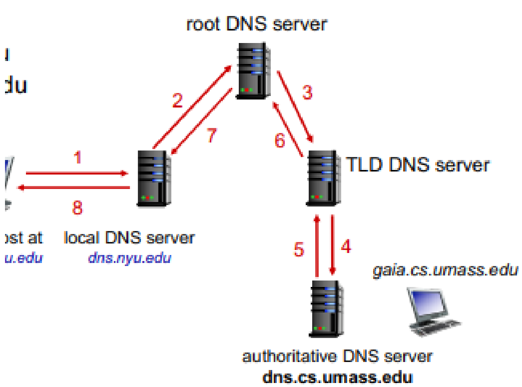

Figura 3: Recursive Query

1.4. DNS Records

Once any name server learns a mapping, it caches the mapping with a (TTL). Some cached entries may be out of date.

DNS Records

- type=A: host name value is IP address
- type=NS name is domain, value is hostname authoritative name server for this domain
- type=CNAME name is alias name for real name, value is canonical name
- type=MS value is the mailserver associated with name

1.4.1. DNS Protocol and Messages

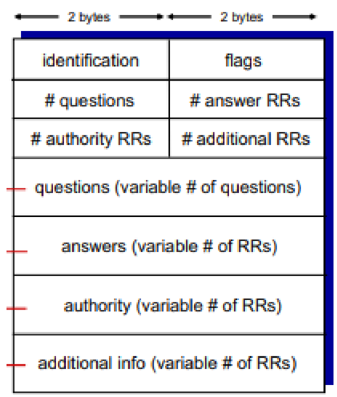

Figura 4: DNS Message

DNS query and reply messages have the same format.

1.5. DNS Security

DDos Attacks bombard root servers with traffice and also attempt to bombard TLD servers which is more effective. **Redirect attacks** in the form of man-in-middle and DNS poisoning are possible.

2. P2P Applications

2.1. Definitions

Peer-to-peer architectures do not have an always on server instead peers request service from other peers, provide service in return to other peers. Peers are intermittently connected and change IP addresses

2.2. File Distribution

2.2.1. client-server

$$D_{c-s} \geq max\{\frac{NF}{u_s}, \frac{F}{d_{min}}\} \tag{1}$$

where time to send multiple copies N is $\frac{NF}{u_s}$ and $\frac{F}{d_{min}}$ is the min client download time. Note that N causes this to increase linearly.

2.2.2. P2P

$$D_{P2P \geq max\{\frac{NF}{u_s}, \frac{F}{d_{min}}, \frac{NF}{u_s + \sum u_i}\}} \tag{2}$$

Where $u_s + \sum u_i$ is the max upload rate.

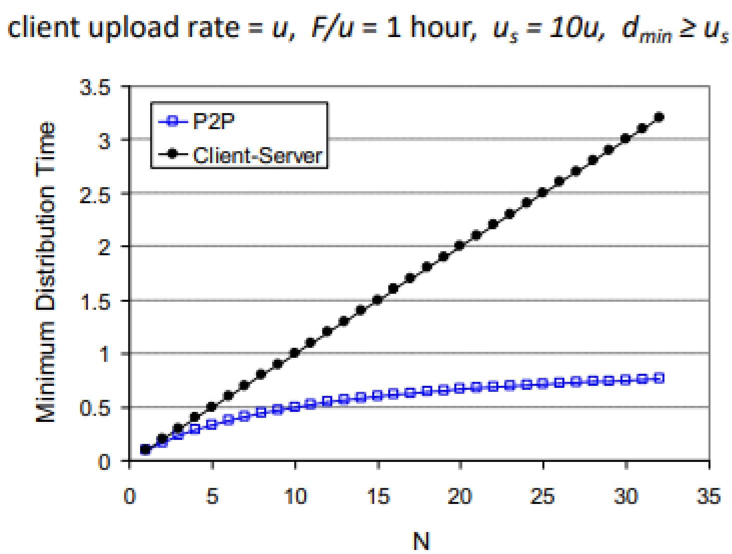

Figura 5: Client-server vs. P2P: example

2.3. BitTorrent

BitTorrent Divides files into 256kb chunks and peers in torrent send/receive chunks.

With peer joining torrent, they originally have no chuncks but will accumulate them over time from other peers. While downloading, peer uploads chunks to other peers. Once peer has entire file, it may (selfishly) leave or (altruistically) remain in torrent.

Requesting Chunks

- at any given time, different peers have different subsets of file chunks
- periodically, Alice asks each peer for list of chunks that they have

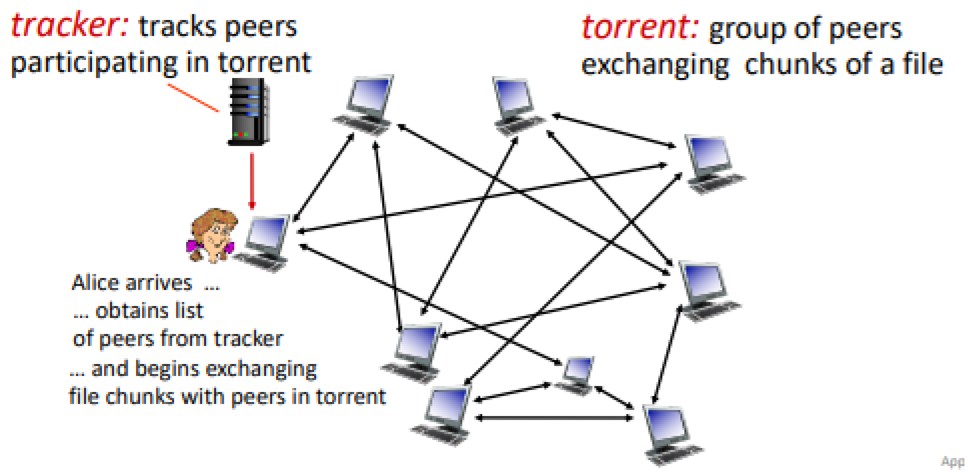

Figura 6: BitTorrent

- Alice requests missing chunks from peers, rarest first

Sending chunks: tit-for-tat

- Alice sends chunks to those four peers currently sending her chunks at highest rate
- every 30 secs: randomly select another peer, starts sending chunks