DNS BASICS

DNS - BASICS

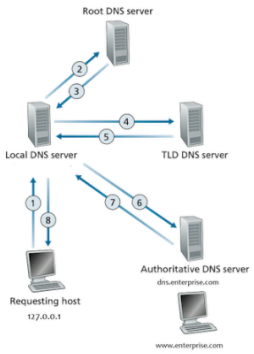
Imagine that you are trying to visit www.enterprise.com, but you don't remember the IP address the web-server is running on.

Assume the following records are on the TLD DNS server:

- (www.enterprise.com, dns.enterprise.com, NS)
- (dns.enterprise.com, 146.54.206.44, A)

Assume the following records are on the enterprise.com DNS server:

- (www.enterprise.com, west3.enterprise.com, CNAME)
- (west3.enterprise.com, 142.81.17.206, A)
- (enterprise.com, mail.enterprise.com, MX)
- (mail.enterprise.com, 247.29.23.75, A)



Assume your local DNS server only has the TLD DNS server cached.

1. QUESTION 1 OF 13

What transport protocol(s) does DNS use: TCP, UDP, or Both?

Answer: Both ✓

3 QUESTION 3 OF 13

In the above example, how many unique type of Resource Records (RR) are there at the authoritative enterprise.com DNS server?

Answer: 3 (CNAME, A, MX) ✓

4 QUESTION 4 OF 13

Can you send multiple DNS questions and get multiple RR answers in one message? Answer with Yes or No

Answer: YES ✓

5 QUESTION 5 OF 13

To which DNS server does a host send their requests to? Answer with the full name

Answer: local DNS server

6 QUESTION 6 OF 13

Which type of DNS server holds a company's DNS records? Answer with the full name

Answer: Autoritative DNS Server ✓

7. QUESTION 7 OF 13

In the example given in the problem, what is the name of the DNS server for enterprise.com?

Answer: dns.enterprise.com ✓

8 QUESTION 8 OF 13

When you make the request for www.enterprise.com, your local DNS requests the IP on your behalf. When it contacts the TLD server, how many answers (RR) are returned?

Answer: 2

9. ## QUESTION 9 OF 13

In the previous question, there were two responses, one was a NS record and the other an A record. What was the content of the A record? Answer with the format: "name, value"

Answer dns.enterprise.com, 146.54.206.44 ✓

10 ## QUESTION 10 OF 13

Assume that the enterprise.com website is actually hosted on west3.enterprise.com, what type of record is needed for this?

* CNAME ✓

11 ## QUESTION 11 OF 13

Now imagine we are trying to send an email to admin@enterprise.com, and their mail server has the name mail.enterprise.com. What type of record will contain the name of the enterprise.com domain and the name of its mailserver(s)?

MX ✓

12 ## QUESTION 12 OF 13

In that MX record, what are the contents? Answer with the format: "name, value"

enterprise.com, mail.enterprise.com ✓

13 ## QUESTION 13 OF 13

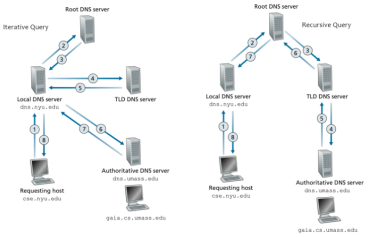
Does your local DNS server take advantage of caching similar to web requests? Answer with Yes or No

Yes ✓

DNS: ITERATIVE VS RECURSIVE

DNS - ITERATIVE VS RECURSIVE QUERY

Assume that a user is trying to visit gaia.cs.umass.edu, but his browser doesn't know the IP address of the website. In this example, examine the difference between an iterative and recursive DNS query.



Select Query Type

✓ Iterative
Recursive

SELECT

1. **QUESTION 1 OF 5**

Between steps 1 and 2, where does the Local DNS server check first? Answer with 'User', 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS Local → Root ✓

2 **QUESTION 2 OF 5**

Between steps 2 and 3, assuming the root DNS server doesn't have the IP we want, where does the response link? Answer with 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS TLD ✓

3. **QUESTION 3 OF 5**

Between steps 4 and 5, assuming the TLD DNS server doesn't have the IP we want, where does the response link? Answer with 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS Authoritative ✓

4 **QUESTION 4 OF 5**

Between steps 6 and 7, the authoritative DNS server responds with the IP we want. What type of DNS record is returned?

A ✓

5. **QUESTION 5 OF 5**

Which type of query is considered best practice: iterative or recursive?

Iterative ✓

RECURSIVE

1. **QUESTION 1 OF 5**

Between steps 1 and 2, where does the Local DNS server check first? Answer with 'User', 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS Local ✓

2. **QUESTION 2 OF 5**

Between steps 2 and 3, where does the root DNS forward the request to? Answer with 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS TLD ✓

3. **QUESTION 3 OF 5**

Between steps 4 and 5, where does the authoritative DNS forward the response to? Answer with 'DNS Local', 'DNS Root', 'DNS TLD', or 'DNS Authoritative'.

DNS TLD ✓

4. **QUESTION 4 OF 5**

In steps 6-8, the response is sent back in the reverse direction until it reaches the user. What type of DNS record is returned?

A ✓

5 **QUESTION 5 OF 5**

Which type of query is considered best practice: Iterative or Recursive?

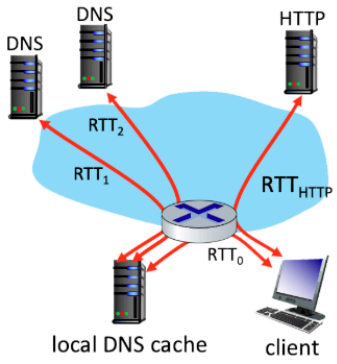
Iterative ✓

DNS & HTTP DELAYS

DNS AND HTTP DELAYS

Before doing this question, you might want to review sections 2.2.1 and 2.2.2 on HTTP (in particular the text surrounding Figure 2.7) and the operation of the DNS (in particular the text surrounding Figure 2.19).

Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that three DNS servers are visited before your host receives the IP address from DNS. The first DNS server visited is the local DNS cache, with an RTT delay of RTT_0 = 4 msecs. The second and third DNS servers contacted have RTTs of 16 and 29 msecs, respectively. Initially, let's suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Suppose the RTT between the local host and the Web server containing the object is RTT_{HTTP} = 7 msecs.



1. **QUESTION 1 OF 5**

Assuming zero transmission time for the HTML object, how much time (in msec) elapses from when the client clicks on the link until the client receives the object?

Answer ✓

4 msec + 16 msec + 28 msec + 7 msec · 2 = 63 ms

RTT DNS Local | RTT TLD DNS | RTT Aut DNS | RTT TCP Handshake + RTT HTT Reqires

2. **QUESTION 2 OF 5**

Now suppose the HTML object references 2 very small objects on the same server. Neglecting transmission times, how much time (in msec) elapses from when the client clicks on the link until the base object and all 2 additional objects are received from web server at the client, assuming non-persistent HTTP and no parallel TCP connections?

Answer ✓

4 msec + 16 msec + 28 msec + 7 msec · 2 · 3 = 91 ms

RTT DNS Local | RTT TLD DNS | RTT Aut DNS | [RTT TCP Handshake + RTT HTT Reqires]

• 3 HTTP Objects (della domanda)

3. **QUESTION 3 OF 5**

Suppose the HTML object references 2 very small objects on the same server, but assume that the client is configured to support a maximum of 5 parallel TCP connections, with non-persistent HTTP.

Answer 77ms ✓

• 3 ogg tot: 1 + 2 Ref.

4msec + 16msec + 20msec + 7msec · 2 · 2 =

RTT DNS Local | RTT TCP DNS | RTT Aut DNS | [RTT TCP Handshake + RTT HTT Req/Res] ← Obs princ

[ ] Obs Ref. in parallelo ref. princ.

4 QUESTION 4 OF 5

Suppose the HTML object references 2 very small objects on the same server, but assume that the client is configured to support a maximum of 5 parallel TCP connections, with persistent HTTP.

Answer 70ms

4msec + 16msec + 20msec + 7msec · 2 + 7ms = 70ms

RTT DNS Local | RTT TCP DNS | RTT Aut DNS | [RTT TCP Handshake + RTT HTT Req/Res] ← Obs princ

[RTT HTTP Req/Res]

Obs Ref. in parallelo ref. princ.

5 QUESTION 5 OF 5

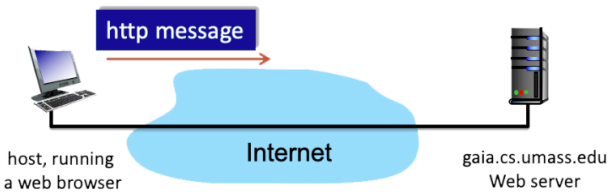
What's the fastest method we've explored: Nonpersistent-serial, Nonpersistent-parallel, or Persistent-parallel?

Persistent-parallel ✓

HTTP GET ITS6

THE HTTP GET MESSAGE

Consider the figure below, where a client is sending an HTTP GET message to a web server, gaia.cs.umass.edu



Suppose the client-to-server HTTP GET message is the following:

GET /kurose_ross_sandbox/interactive/quotation6.htm HTTP/1.0
Host: gaia.cs.umass.edu
If-Modified-Since: Sat, 27 Dec 2025 06:55:50 -0800

1. QUESTION 1 OF 3

What is the name of the file that is being retrieved in this GET message?

quotation6.htm ✓

2. QUESTION 2 OF 3

What version of HTTP is the client running?

1.0 ✓

3 QUESTION 3 OF 3

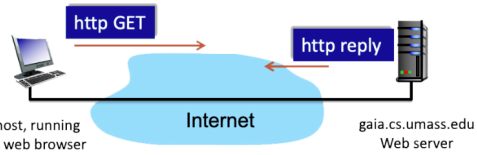
True or False: The client already has a cached copy of the file

Answer True ✓

HTTP RESPONSE MSG

THE HTTP RESPONSE MESSAGE

Consider the figure below, where the server is sending a HTTP RESPONSE message back the client.



Suppose the server-to-client HTTP RESPONSE message is the following:

```
HTTP/1.0 200 OK
Date: Sat, 27 Dec 2025 15:03:52 +0000
Server: Apache/2.2.3 (CentOS)
Last-Modified: Sat, 27 Dec 2025 15:21:32 +0000
ETag:17dc6-a5c-bf716880.
Content-Length: 878
Connection: Close
Content-type: text/html
```

1. **QUESTION 1 OF 7**

Is the response message using HTTP 1.0 or HTTP 1.1?

HTTP/1.0 ✓

2. **QUESTION 2 OF 7**

Was the server able to send the document successfully? Yes or No

Yes ✓

3. **QUESTION 3 OF 7**

How big is the document in bytes?

878 ✓

4. **QUESTION 4 OF 7**

Is the connection persistent or nonpersistent?

nonpersistent ✓

5. **QUESTION 5 OF 7**

What is the type of file being sent by the server in response?

text/html ✓

6. **QUESTION 6 OF 7**

What is the name of the server and its version? Write your answer as server/x.y.z

Apache/2.2.3 ✓

7. **QUESTION 7 OF 7**

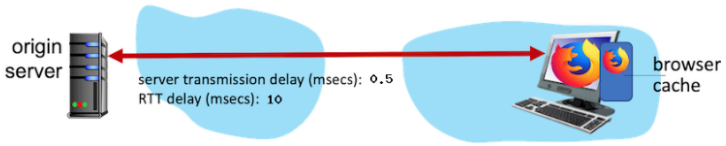
Will the ETag change if the resource content at this particular resource location changes? Yes or No

Yes ✓

BROWSER CACHING.

BROWSER CACHING

Consider an HTTP server and client as shown in the figure below. Suppose that the RTT delay between the client and server is 10 msecs; the time a server needs to transmit an object into its outgoing link is 0.5 msecs; and any other HTTP message not containing an object has a negligible (zero) transmission time. Suppose the client again makes 100 requests, one after the other, waiting for a reply to a request before sending the next request.



Assume the client is using HTTP 1.1 and the IF-MODIFIED-SINCE header line. Assume 60% of the objects requested have NOT changed since the client downloaded them (before these 100 downloads are performed)

1. **QUESTION 1 OF 1**

How much time elapses (in milliseconds) between the client transmitting the first request, and the completion of the last request?

Answer 1020ms ✓

- 60 cached: 60 req · 10 ms = 600 ms
- 40 normal: [10 ms + 0.5 ms] · 40 req = 420 ms
- 1 TCP Handshake RTT : 0.10 → non contare

4

EMAIL & SMTP

ELECTRONIC MAIL AND SMTP

Look at the scenario below, where Alice sends an email to Bob.

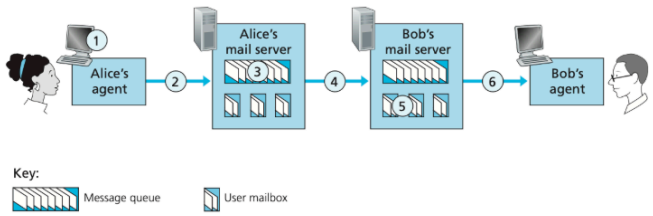


Figure 2.15 ♦ Alice sends a message to Bob

For the questions below, assume both Bob's and Alice's user agents use the POP3 protocol.

1. **QUESTION 1 OF 8**

At point 2 in the diagram, what protocol is being used?

SMTP ✓

2. **QUESTION 2 OF 8**

At point 4 in the diagram, what protocol is being used?

SMTP ✓

3. **QUESTION 3 OF 8**

At point 6 in the diagram, what protocol is being used?

POP3 ✓

4. **QUESTION 4 OF 8**

Does SMTP use TCP or UDP?

TCP ✓

5. **QUESTION 5 OF 8**

Is SMTP a 'push' or 'pull' protocol?

push ✓

6. **QUESTION 6 OF 8**

Is POP3 a 'push' or 'pull' protocol?

pull ✓

7. **QUESTION 7 OF 8**

What port does SMTP use?

25 ✓

8. **QUESTION 8 OF 8**

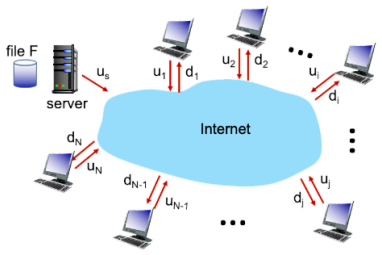
What port does POP3 use?

Answer 110 ✓

CLIENT-SERVER VS P2P

A COMPARISON OF CLIENT-SERVER AND P2P FILE DISTRIBUTION DELAYS

In this problem, you'll compare the time needed to distribute a file that is initially located at a server to clients via either client-server download or peer-to-peer download. Before beginning, you might want to first review Section 2.5 and the discussion surrounding Figure 2.22 in the text.



The problem is to distribute a file of size F = 10 Gbits to each of these 6 peers. Suppose the server has an upload rate of u = 75 Mbps.

The 6 peers have upload rates of: u_1 = 15 Mbps, u_2 = 15 Mbps, u_3 = 24 Mbps, u_4 = 18 Mbps, u_5 = 24 Mbps, and u_6 = 20 Mbps

The 6 peers have download rates of: d_1 = 31 Mbps, d_2 = 18 Mbps, d_3 = 24 Mbps, d_4 = 26 Mbps, d_5 = 31 Mbps, and d_6 = 33 Mbps

F: 10 Gbit

u_s = 75 Mbit/s

u_1: 15 mb/s
u_2: 15
u_3: 24
u_4: 18
u_5: 24
u_6: 20

d_1: 31 mb/s
d_2: 18 mb/s
d_3: 24
d_4: 26
d_5: 31
d_6: 33

K 10^3
M 10^6

10^9 G

1. QUESTION 1 OF 4

What is the minimum time needed to distribute this file from the central server to the 6 peers using the client-server model?

Answer ✓

$$\frac{NF}{u_s} = \frac{6 \cdot 10\,Gb}{75\,Mb/s} = \frac{6 \cdot 10^4\,\cancel{Mb}}{75\,\cancel{Mb/s}} = 800$$

2. QUESTION 2 OF 4

For the previous question, what is the root cause of this specific minimum time? Answer as 's' or 'ci' where 'i' is the client's number

s ✓

3. QUESTION 3 OF 4

What is the minimum time needed to distribute this file using peer-to-peer download?

Answer

- $\frac{F}{u_s} = \frac{10\,Gb}{75\,Mb/s} = \frac{10 \cdot 10^3\,\cancel{Mb}}{75\,\cancel{Mb/s}} = 133,34$
- $d_{min} = \{31, 18, \ldots\} = 18\ Mb/s$

- $\frac{F}{d_{min}} = \frac{10 \cdot 10^3 \text{ Mb}}{18 \text{ Mb/s}} = 555.56 \text{ s}$

- $\frac{N \cdot F}{u_s + \sum_{i=1}^{n} u_i} = \frac{6 \cdot 10 \cdot 10^3 \text{ Mb}}{75 \text{ Mb/s} + 163 \text{ Mb/s}} = 252.10 \text{ s}$

$$\max\left\{ \frac{F}{u_s}, \frac{F}{d_{min}}, \frac{N \cdot F}{u_s + \sum_{i=1}^{n} u_i} \right\} = \left\{ 133.5h, 555.56, 252.10 \right\} =$$

$$= 555.56$$