Assignment - 01

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CSE 421

Ans to the Que No-1

Given,

Distance between client and server = 1000 Km

Propagation Speed : 2×10^8 ms^{-1}

Webpage size = 250 Kb

Each image size = 20 MB, 10 images

other data = 10 KB

HTTP processing time per request : 10 ms

Client connection speed : 15 mbps

Now,

$$\text{Propagation time} = \frac{\text{Distance}}{\text{Speed}} = \frac{1000 \times 10^3}{2 \times 10^8} \text{ s}$$

$$= 5 \text{ ms}$$

As the request and response each take this time, the RTT = 2×5 = 10 ms

Total request = 12 $\begin{cases} 1 \text{ for webpage} \\ 10 \text{ for images} \\ 1 \text{ for other data} \end{cases}$

Each request takes 10 ms for processing at the server.

So, total processing time $= (12 \times 10)$ ms

$= 120$ ms

Total data size to be transmitted →

total data $= 250$ kB $+ (10 \times 20$ MB$) + 10$ kB

$= 200.26$ MB

Converting into bits $= 200.26 \times 8$

$= 1602.08$ MBits

Transmission time $= \dfrac{1602.08}{15} = 106.8$ s

Total request time $=$ ~~12 RTTs~~ $0.24 + 106.8$

$= 107.04$

≈ 107 sec

So, total time needed to load the webpage is around 107 seconds.

Ans to the Que No-2

Given,

LAN delay = 10 ms

Access delay = 1.5 s

Internet delay = 30 ms

Server X hit ratio = 35 %

Server X price = \$1000

Server Y price = \$ 3000

~~\$~~ \$10 ~~p~~ earned per ms response time improvement

Now,

Total delay = 10ms + 1.5 s + 30 ms

= 1540 ms

Gain per ms = \$10 /year

Break even gain = 3000 - 1000

= 2000 usd

∴ Required time Reduction = $\frac{2000}{10}$ = 200 ms

New Hit ratio = $1 - \frac{\text{New delay}}{\text{old delay}}$

$= 1 - \frac{1340}{1540}$

$= 0.1298$

$= 87.02\%$

Therefore, the new cache server should have a hit ratio of at least 87% to be financially justified.

Ans to the Que No-3

for Non-persistent HTTP:

Transmission time for a single file $t = \frac{M \times 8}{B}$

The time taken to send the http request for each file $t_{overhead} = \frac{T \times 8}{B}$

Now,

As there are N number of files, the total time to recieve all files or objects is —

$$t_{total} = N \times \left(\frac{M \times 8}{B} + \frac{T \times 8}{B} \right)$$

For Persistent HTTP :

Transmission ~~fib~~ time for each file $t = \frac{M \times 8}{B}$

HTTP request overhead for first object, $t_{overhead} = \frac{T \times 8}{B}$

So, the transmission time for the remaining $(N-1)$ object

is

$$t = (N-1) \times \frac{M \times 8}{B}$$

$\therefore$ Total time for persistent HTTP is,

$$t_{persistent} = \frac{M \times 8}{B} + \frac{T \times 8}{B} + (N-1) \times \frac{M \times 8}{B}$$

$$= \frac{N \times M \times 8}{B} + \frac{T \times 8}{B}$$

The non-persistant HTTP is more expensive because each object requires the overhead of opening and closing a New TCP connection. In a short, a new connection is opened for each object.

Ans to the Que No - 4

Given,

Average object size = 1 000 000 bits

Req rate = 12

LAN Band width = ~~15~~ 100 Mbps

Access Link bandwidth = 15 Mbps

Internet delay = 3 sec

(a)

Average Time required ~~access delay~~ $\Delta = \dfrac{\text{Avg object size}}{\text{Access Link Bandwidth}}$

$= \dfrac{1\,000\,000}{15 \times 10^6}$

$= 0.06667 = 66.67$ ms

Now,

Avg access delay $= \dfrac{\Delta}{1 - \Delta \times b}$

$= \dfrac{66.67}{1 - 66.67 \times 12} = 333.35$ ms

$\therefore$ Total avg response time = Avg access delay + Internet delay

$= 333.35 \text{ ms} + 3 \text{ sec}$

$= 0.33335 \text{ sec} + 3 \text{ sec}$

$= 3.33335 \text{ sec}$

Ans

(b)

Miss rate is 0.4

Now,

Total response time with cache = (Hit Rate × Access Delay) + (miss rate × (Access Delay + Internet Delay))

$= (0.6 \times 333.35 \text{ ms}) + (0.4 \times (333.35 \text{ ms} + 3000 \text{ ms}))$

$= 200.01 \text{ ms} + 1333.34 \text{ ms}$

$= 1533.35 \text{ ms}$

$= 1.53335 \text{ seconds}$

Ans

Ans to the Que No-5

(a) Requested URL:- /martignon/index.html

(b) Version of HTTP :- HTTP/1.1

(c) Language of webpage : → Italian (it)

(d) Connection :- ~~Kee. No~~ Persistent

(e) In my opionion, indicating the type and version of the browser in the User-Agent field allows the server to customize content, ensure compatibility and optimize performace for different browsers.

Browser: Mozilla/5.0 (Mac OS X) with Safari 125.

Ans to the Que No - 6

(a) The HTTP client opens 11 parallel TCP connections for downloading 11 objects.

Transmission rate per connection, $r = \frac{C}{N}$

$= \frac{100}{11} = 9.09$ kbps

Time needed to transfer for one object, $t = \frac{L}{r}$

$= \frac{200}{9.09} = 22$ sec

The propagation delay for each obj. $t_{prop} = 2 \times 100$ ms

$= 0.2$ s

$\therefore$ Total time for 1 object $= 22s + 0.2s = 22.2s$

As, the connection is in parallel, total time ~~for~~ for all 11 obj is same and it's 22.2 seconds.

(b)

Total time for 1st object = 22.2 s [from (a)]

Now,

Time for remaining 10 objects –

$$t_{remaining} = 10 \times (22.2)\,s = 222 \text{ sec}$$

So, Total time for all 11 objects = $(222 + 22.2)\,s$

$= 244.2$ sec

As we can see, the parallel connection is significantly faster by comparing two given cases.

Ans to the Que No - 7

Given,

LAN connection Capacity = 1 Gbps

Cache hit rate, P = 0.4

Req message size = 100B

Req web page size = 100kB

Proxy communication capacity towards server = 100 Mbps

Clients are connected at speed of 1 Gbps.

Now,

$$\text{Transmission Time} = \frac{\text{Req web page size}}{\text{Proxy bandwidth}}$$

$$= \frac{100 \text{ KB} \times 8 \text{ bits/byte}}{100 \text{ Mbps}}$$

$$= \frac{800 \text{ kb}}{100 \text{ Mbps}} = 8 \text{ ms}$$

Transmission time for HTTP request from client to proxy,

$$t_{req} = \frac{\text{Req message size}}{\text{LAN Bandwidth}} = \frac{100 \text{ B} \times 8 \text{ bits/byte}}{1 \text{ Gbps}}$$

$$= 0.8 \ \mu s$$

Transmission time for response, $t_{response} = \frac{100 \text{ KB} \times 8 \text{ bits/byte}}{1 \text{ Gbps}}$

$$= 0.8 \text{ ms}$$

So, Total delay for cache miss $= 0.8 \text{ ms} + 8 \text{ ms} + 0.8 \text{ ms}$

$$t_{miss} = 9.6 \text{ ms}$$

~~Again~~, Now,

We know,

Total avg delay, $t_{avg} = P \times t_{hit} + (1-P) \times t_{miss}$

$$= (0.4 \times 8 \times 0.6 \times 9.6) \text{ ms}$$

$t_{avg} = 8.96$ ms

Therefore, the average delay experienced by a generic client is 8.96 ms.

Ans