

Computer Network Midterm 2014

Question 1: ``Quickies''

(60%) Answer each of the following questions *briefly, i.e., in at most a few sentences*.

- a) (10%) What does it mean for a protocol to be *stateful*? What does it mean for a protocol to be *stateless*? Give an example one stateful protocol and one stateless protocol.
- (1) A stateful protocol requires keeping of the internal state on the server.
 - (2) A stateless protocol treats each request as an independent transaction that is unrelated to any previous request.
 - (3) Stateful protocol example: FTP
Stateless protocol example: HTTP
- b) (10%) What does it mean when we say that control messages are “in-band”? What does it mean when we say that control messages are “out-of-band”? Give an example of a protocol that has in-band control messages and one example of a protocol that has out-of-band control messages.
- (1) In-band control passes control message on the same connection as data message.
 - (2) Out-of-band control passes control message on a separate connection from data message.
 - (3) In-band protocol example: HTTP, SMTP
Out-of-band protocol example: FTP
- c) (10%) List four factors that contribute to the end-to-end delay in a packet-switched network. Which of these are constant and which of these depend on the load in the network?
- (1) nodal processing (d_{proc}), queueing delay (d_{queue}), transmission delay (d_{trans}), propagation delay (d_{prop})
 - (2) Constant: transmission delay (d_{trans}), propagation delay (d_{prop})
Depend on the load: nodal processing (d_{proc}), queueing delay (d_{queue})
- d) (10%) Suppose you would like to urgently deliver 40 terabytes data from Boston to Los Angeles. You have available a 100Mbps dedicated link for data transfer. Would you prefer to transmit the data via this link or instead use Fedex overnight delivery? Explain.

$$\frac{(40 * 8) * 1000 * 1000}{100} (s) = 3200000 (s) = 37.04 (day)$$

Using Fedex overnight delivery is better.

- e) (10%) Suppose a web server has 399 ongoing TCP connections. How many server-side sockets are used? How many server-side port numbers are used? Briefly (two sentences at most each) explain your answer.

(1) Server-side sockets: 400 (1 socket for listening client connection, and 399 sockets for each TCP connections.)

(2) Server-side port numbers: 1 (All 400 sockets use the same port.)

- f) (10%) For each question, please circle a single best answer

(f.1) What are three common HTTP 1.1 message method fields?

(a) GET, HTML, POST

(b) GET, PUT, HTML

(c) GET, UPLOAD, HTML

(d) GET, POST, PUT

(e) None of the above.

(d)

(f.2) Given that the requested information is not available at any intermediate databases, a purely recursive DNS query from a requesting host would follow the path:

(a) Root name server, local name server, authoritative name server.

(b) Authoritative name server, root name server, host name server.

(c) Local name server, root name server, local name server, authoritative name server.

(d) Local name server, root name server, TLD name server, authoritative name server.

(e) None of the above.

(d)

Question 2: ``DHT``

(35%) Distributed Hash Table (DHT)

- (a) (5%) What are two fundamental advantages of peer-to-peer (P2P) systems over client-server systems?

Low file distribution time, high reliability.

- (b) (20%) Consider a circular Distributed Hash Table (DHT) with node identifiers in the range [0; 15]. Suppose there are seven peers with identifiers 1, 3, 6, 9, 12, 14 and 15.

- (i) Suppose that the following (key,value) pairs should be stored in the DHT:

(2,0), (6,5), (7,13) and (15,7). Which peers will store which (key,value) pairs? Fill in the table below.

(key,value)	Identifier of the responsible peer
(2,0)	3
(6,5)	6
(7,13)	9
(15,7)	15

- (ii) Suppose that peer 6 learns that peer 9 has left the DHT. How does peer 6 update its successor state information? Which peer is now its first successor? Its second successor?

- (1) Peer 6 will periodically ping its two successors to check aliveness. If immediate successor (peer 9) leaves, peer 6 chooses next successor (peer 12) as new immediate successor, and asks peer 12 who its immediate successor is and makes peer 12's immediate successor as its second successor.
- (2) First successor: peer 12
Second successor: peer 14

- (c) (10%) Explain how DHT improves search performance from $O(n)$ to $O(\log n)$, where n is the total number hosts in DHT method.

We can just add "shortcuts" into DHT peers. Each peer keeps track of IP addresses of predecessor, successor, and shortcuts. If each peer has $O(\log n)$ shortcuts, then we can achieve $O(\log n)$ search performance.

ADD 2-3 problems from HW such that total score is around 120