Q1
30 Points

In an NDN network, a consumer sends out an Interest, which retrieves a Data packet back.

Q1.1
5 Points

Does either of Interest or Data contain a source or destination address?

It does not contain the source or destination address. The interest packet consists of content name, nonce while the data consists of the name of content, signature, signature info and the real data.

Q1.2
5 Points

After receiving the Data, the consumer needs to check two things before accepting it. What should the consumer check?

After receiving the packet, the consumer needs to check for the signature and validate it to make sure that content is coming from legitimate source. It must also check the ownership.

Q1.3
5 Points

When a router processes an Interest, it may consult three tables for possible actions. List the three tables and the action to be taken when a match is found.

When router sends out an interest it will first check if this content which it is interested in is already present in the cache

if so it does not need to forward the packet. It can just get the data from the cache. If not in cache it will check the pending interest table if someone else has already asked the for the same interest it doesnot need to forward the packets. If it finds no matches then it needs to look in the forwarding table to figure out who to forward this interest to, if it finds a match it forward the packet. If no match is found just drop the interest packet.

Q1.4
5 Points

When a router processes a Data, it will consult one table for whether to forward it or not. What is this table, and what are the actions when a match is found?

When the data is received, it will first check the Pending interest table to still see if anyone is interested in this data if no one is interested in this it can simply drop this. If one is interested in this it can forward to the intended receiver and can cache this data for future use.

Q1.5
5 Points

Compare the network paths that the Interest and Data packets take, are they the same (with opposite direction) or different?

The Data packet follows in reverse the path taken by the Interest to get back to the requesting consumer.

Q1.6
5 Points

Does one Interest retrieve one Data packet back, or a sequence of Data packets of the same file?

In NDN, one interest can only fetch only one data packet form either the original

sender or from cache.

Q2
25 Points

Answer the following questions briefly.

Q2.1
5 Points

In IP Multicast routing, comparing per-source tree and per-group tree, which one has shorter delay? which one has smaller routing table?

The per source tree will have shorter delay because each receiver has the shortest path to the receiver and the per group tree will have longer delay. The per group tree will have small routing table as it only maintain G routing states where as per source tree maintains S,G routing states.

Q2.2
8 Points

DVMRP, MOSPF, and PIM (sparse mode) are for **intra-domain** multicast routing. None of them is suitable for Internet-wide inter-domain multicast, and a major technical reason is that they all involve flooding of some sorts of packets. What information does each protocol flood?

DVMRP will flood the multicast packet to all the members and those who don't wish to receive this packets can send prune message. The MOSPF is an extension of OSPF in this the receiver will tell the router about the interest and OSPF when sending the Link state update packets includes this piece of information in it packet and floods it to all the routers. In PIM sparse mode the router sends join request to CBT router and send this toward the core. So each cbt router will send multiple join requests to core and flood the core.

Q2.3
4 Points

If a TCP session has an average window size of 4x10^4 bits and average round trip time of 20 milliseconds, what is the average throughput of this session? Assuming no congestion.

2000 bits/ms

Q2.4
8 Points

Joe is downloading a 24MB file via TCP. Round-trip time is 1 second and the segment size is 1MB. Assume the receiver buffer size is infinite and the initial ssthresh is 8 segments. If there is no packet loss in the entire file transfer, how long does it take to complete? (not counting the time to establish and tear down the TCP session.)

For the first time Joe will send request for 1 mb and after two seconds he receives acknowledgement so now he sends 2 mb after receiving acknowledgement he can now send 4 mb after getting acknowledgement he can now send 8 mb segments this now equal to threshold so now instead of slow start the window size will increase linearly. Instead of now sending 16 mb because it reaches the threshold it will just send 9MB segment. The entire 24 mb is now downloaded. So total time would be 2*5 which is 10 seconds.

Q3
20 Points

Answer the following questions briefly

Q3.1
5 Points

What are the two major mechanisms that DNS relies on for good performance?

DNS relies on caching as it can cache all the queries results and the intermediate

query results so each time a query doesn't need to reach the root and bottleneck it. Another one is replication because each zone has one or two secondary servers to increase robustness.

Q3.2
5 Points

A bittorrent client downloads different pieces of a file from different peers. How does it determine that it has finished downloading **all** the pieces **correctly**?

When the client joins the group the tracker will give it .torrent which consists of randomly selected peers and it can learn about new peers gradually. It will then contact peers to get
missing parts, after downloading it can verify the hash to make sure that it has downloaded each piece correctly

Q3.3
5 Points

What information does XCP's congestion header contain?

XCP congestion header contains only three fields the round trip time, the congestion window size and the feedback which is calculated by each router.

Q3.4
5 Points

In DHT there are three potential ways of organizing the overlay nodes. (a) Each node knows only its successor node, (b) each node knows all other nodes, and (c) each node knows some of other nodes such as the figure table in Chord. What is the algorithmic complexity in terms of search time and memory usage for these approaches respectively?

In the first way, the search time would be O(n) as it has to go through everything in order to find the required content where as the memory usage would be O(1) as only successor is known. In second way the search time would be O(1) as it knows all the nodes so it can directly reach there but the memory usage would be O(n) as it has to remember every node. The third approach is the middle of both approaches above. It has search time of about O(logn) and memory usage of about O(logn).

Q4
25 Points

Q4.1
9 Points

In a local area network, a switch checks its switch table to decide where to forward an incoming packet. Ethernet, Seattle and Portland have different switch table sizes. Assuming in a network, the number of hosts is H, the number of switches is S, and the number of ports on each switch is P. What is the worst case switch table size per switch in Ethernet, Seattle, and Portland?

Seattle makes use of the hashing so the location of each node is stored at most two locations. Unlike in ethernet where each switch knows location to all nodes. So in seattle we can say that all switches will have O(H) where as in plain ethernet we would have O(SH) for each switch it will remember all the host which increases overhead.In Portland the routing entries would be equal to the O(number of local ports) so it would be of O(p) for each switch.

Q4.2
8 Points

On the global Internet, backbone IP routers keep one routing entry per destination prefix, and the growth of routing table size has become a great concern. Joe Smart proposes to apply Seattle's technique to reduce routing table size at these backbone routers. Identify one major problem of this approach.

The one caveat of the seattle approach is that it one of the switch fails all the information which is stored in that switch will be lost. So all remaining switches have to realize this failure and redistribute this failed switch information among themselves so this will add complexity in order to overcome this failure.

Q4.3

8 Points

Joe also proposes to apply Portland's technique to reduce table size at backbone routers for global routing. Identify one major problem of this approach.

So portland is based on the assumption we have a fat tree topology which means the number of downward links should match the upward links which means that we might need to change the entire topology. Also we would need to use something similar to PMAC to encode location of host which might add a bit of extra complexity

Final Exam

UNGRADED

STUDENT

Deep Anil Ruparel

TOTAL POINTS

- / 100 pts

QUESTION 1

(no title) 30 pts

1.1 (no title) 5 pts

1.2 (no title) 5 pts

1.3 (no title) 5 pts

1.4	(no title)	5 pts
1.5	(no title)	5 pts
1.6	(no title)	5 pts

QUESTION 2

(no title) 25 pts

2.1	(no title)	5 pts
2.2	(no title)	8 pts
2.3	(no title)	4 pts
2.4	(no title)	8 pts

QUESTION 3

(no title) 20 pts

3.1	(no title)	5 pts
3.2	(no title)	5 pts
3.3	(no title)	5 pts
3.4	(no title)	5 pts

QUESTION 4

(no title) 25 pts

4.1	(no title)	9 pts
4.2	(no title)	8 pts
4.3	(no title)	8 pts