The Design and Implementation of Network Services
Homework 4
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Recall

1) TCP's response to packet loss is to _____ the congestion window. When the congestion loss stops, the window _____.

2&3) Zero-copy implementations of protocol stacks avoid the _____ bottleneck inherent in other approaches to moving data packets around.

4) PIM (Protocol Independent Multicast) has two modes. What are they?

5) Sun's J2EE system allows Container Managed Persistence. What does this mean?

6) Why would a web site operator be interested in Stochastic Fair Queueing?

7) Chord can find the server responsible for a particular data item in _____ time

8) What is the difference between the MTTF and MTTR

9) Briefly describe how Kerberos works

Comprehension

1) Non-congestion loss plays havoc with TCP. Why is this?

2&3) Why are remote procedure calls used in the local area, but not really in the wide area?

4) Compare and contrast Reverse Path Multicast and DVMRP

5) Two possible ways of dealing with persistence are container managed or database-based. What is the advantages and disadvantages of each method?

6) Which is easier to implement? WFQ or SFQ?

7) Compare and contrast Chord and Tapestry (at the 10,000 ft level)

8) Hot standby is a technique to prevent loss of connectivity based on failure. How might one carry this out?

9) What is the difference between secret key crypto and public key crypto? Why does 802.11 WEP use secret key?

Application

1) Using the NS2 simulator, plot the effect of packet loss rate on a TCP flow.

2&3) Deploy both the blocking and non-blocking I/O server (code available on the website), measuring throughput and system CPU load. How do they differ?

4) Write a small stock ticker applet using multicast. Report on your experiences

5) Describe how you might design an auction site using J2EE middleware. Where would you put each component?

6) Using NS2, plot the throughput of 10 flows (8 TCP, 2 UDP) going through a single bottleneck link using both drop tail and SFQ scheduling.

7) How would you implement multicast over chord? Using I3?

8) I'll present a physical network (in the 440 machine room) with redundant switching for two subnets connected together. Setup whatever monitoring you want, and then unplug the primary switch (just pull the plug!) How long does the network take to recover? Is that more, about the same, or shorter than you expected?
9) By using TCPDUMP, figure out how many message exchanges are required for an SSL connection to startup. For Kerberos?

Analysis

1) Do you think TCP is an appropriate transport layer for cellular to cellular telephone data transport?

2&3) Processing data packet layer by layer (i.e., first at the Ethernet level, then at the IP level, etc) is less efficient that integrated layer processing (ILP). But Linux does it exactly this way. Why is that?
4) Why do you think that a university might want to buy a protocol-based rate limiter? What buildings on (or near) campus might be most affected? (Think .mp3)
5) Web Services decouple service components, allowing them to reside on multiple servers. What is the most important benefit to this approach (in your opinion)
6) Akamai's greatest benefit is that websites using it greatly increase their scalability. What is the greatest disadvantages?
7) What's was Napster's greatest weakness? How did the record labels take advantages of this?
8) Which is easier to improve: MTTF or MTTR? Which is more effective? Defend your answer (btw., any answer is ok, as long as you defend it!)
9) What are the challenges of deploying world-wide PKI systems?

Synthesis

1) What three improvements would you make to TCP if you were a wireless cell phone operator?

2&3) How would forward error correction interact with a congested system?
4) Let's say that you replaced the NFS server in the dept (coeus) with an iSCSI system. How would you change the network to support that?
5) In what ways are J2EE style interfaces an improvement over RPC calls?
6) Internet wide CDNs like Akamai are still around (for now!), but multicast isn't (really). Why is this?
7) What factors might you consider when implementing a streaming media protocol over a P2P system. What primitives must that system offer you?
8) Let's say you moved from direct attached storage to in-network storage (iscsi). What reliability problems would this eliminate? Create?
9) If you could let EECS users use their SIM card from their cell phone to authenticate themselves to eecs services like email and coeus file mounts, what additional information (if any) would have to be added to the card?

Evaluation

1) As the Internet grows beyond this planet, will TCP be up to the task? Think Mars rover.

2&3) Why is measuring network reliability so much harder than network performance?

4) Does the multicast service model even make sense? Is that why Internet-scale deployment had such trouble?

5) Web-services are certainly gaining in popularity, but do you think that they will lead to more reliable network services? Why or why not?

6) Which is more important to you, guaranteed bandwidth, or guaranteed latency? What types of things do you do that benefit from each?

7) There is a ton of research on p2p systems (just google it!)… yet no deployed infrastructure. Why? Will there ever be?

8) MaBell comes to you and says that they are getting rid of all their circuit switched technology for routing voice calls and they're moving to VoIP (voice over packet IP). They want you to tell them if their system will still be 5 9's available (99.999%) and if not, what they can do to ensure that. What do you tell them?

9) You're an expert witness for a murder trial. The victim was receiving threatening emails. They have a source IP address on them (that you know isn't forged). They came from the defendant's home DSL line. Is the case open and shut? What factors could you use to link the defendant to the IP address? What factors could you use to reduce your confidence that the IP belongs to anyone?