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MPCS 54001, Winter 2016
Homework #3
Due: April 19, 2016, 5:30 pm.

Submission instructions: email your completed homework to the grader (**johnh@uchicago.edu**) as a PDF file, before 5:30pm on Tuesday, April 19. No late homework will be accepted, as we review the solutions immediately at the beginning of class.

Submit with the email subject: **[MPCS 54001: HW 3]** to enable easy filtering of the submissions and ensure your homework is not lost.

This work must be entirely your own. If you need help, I encourage you to post questions to Piazza and/or see the staff during their office hours. As a reminder, if you post to Piazza please don't give away the answer!

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(1) The maximum payload of a TCP packet is 65,495 bytes. Why was such a weird value chosen?

TCP Packet is 16 bit. Maximum packet size = 2^16-1 = 65535 bytes.
IP Header = 20 bytes
TCP Header = 20 bytes
Payload = TCP PacketSize - IP Header - TCP Header = 65495 bytes
Reason TCP Packet size wasn't chosen to be more than 16 bit is people who created the TCP/IP protocol didn't anticipate transfer of huge data in the future, so they thought 16bit was sufficient.

(2) If the TCP round-trip-time estimate (RTT_{est}) is currently 30 milliseconds (ms), and the next three acknowledgements arrive back after 26, 32, and 24 ms (in that order), what will be the value of RTT_{est} at the end? Use a = 0.9 and show your work.

EstimatedRTT = (1- α)*EstimatedRTT + α *SampleRTT α = 0.9

RTT0 = 30ms
EstimatedRTT1 = (1- 0.9)*26 + 0.9*30 = 29.6
EstimatedRTT2 = (1- 0.9)*32 + 0.9*29.6 = 29.84
EstimatedRTT3 = (1- 0.9)*24 + 0.9*29.84 = **29.256** ms = Final RTT at the end

(3) Suppose the Internet (all routers and all network links everywhere) was 100% reliable and never lost any packets for any reason, ever. Would there still be any advantages to using TCP over UDP? Why or why not (be quite specific)?

TCP still offers advantages. TCP provides in-order packets, pipelined (flow and congestion control), full-duplex communication, 3-way handshaking while UDP does not. UDP is unreliable, no hand-shaking mechanism, out of order and no flow/congestion control.

(4) DNS uses UDP as its transport protocol, not TCP. Give at least one reason why that decision might have been made.

UDP doesn't require 3-way handshake, **allowing faster data transfer**.
TCP requires 3-way handshake, making it slow.
UDP minimizes load on server, while TCP requires connections to be maintained.
Unreliable UDP data transfer can be addressed by having application handles timeout, to resend missing packets, etc.