

Course: CISC 856: TCP/IP and Upper Layer Protocols  
Professor: Paul D. Amer  
Document: Homework 1 – Terminology, and Installing Wireshark  
Due Date

### **Preliminaries**

- Students are expected to work in groups of exactly 2 persons. (Exceptional requests to work alone will be considered.) All exercises **MUST** be done by both group members together. That is, both group members must be physically present together during discussion of answers. Both students are responsible for all information submitted. Each group should submit one set of answers with both names indicated. Students in different groups may **NOT** compare answers prior to submission. Comparing answers before submitting your assignment is considered academic dishonesty. See the syllabus for further details on Academic Honesty.

### **TCP, UDP and IPv4 Overhead**

- Read the textbook for details on TCP, UDP, and IPv4 PDU formats.
- This section consists of short answer questions dealing with the maximum amounts of data that can be transmitted in various kinds of TCP/IP protocol and service data units (PDUs, SDUs) at various layers. This exercise reviews encapsulation and fragmentation in the TCP/IP protocol stack, and the protocol headers of IPv4, UDP, and TCP.
- The networking literature and research community ambiguously use the following terms. When needing to be precise, avoid them.
  - message (is a message an A-SDU or an A-PDU?)
  - UDP datagram (UDP-SDU? UDP-PDU?)
  - TCP segment (TCP-SDU? TCP-PDU?)
  - TCP packet (TCP-SDU? TCP-PDU?)
  - transport layer datagram, segment, packet (T-SDU?, T-PDU?)
  - IPv4 packet (IPv4-SDU? IPv4-PDU?)
  - IPv4 datagram (IPv4-SDU? IPv4-PDU?)
  - IPv4 fragment (IPv4-SDU? IPv4-PDU?)
  - network layer packet, datagram, fragment (N-SDU?, N-PDU?)
  - Ethernet frame (Ethernet-SDU? Ethernet-PDU?)
  - link layer frame (L-SDU? L-PDU?)

To Hand In: Short answers to the questions below.

1. Determine each of the following, and describe how you arrived at your answer. (Note: These are simple hand calculations based on field lengths and min/max header sizes.) Do not just give a number; your work must show how you derived your answer.

(a) the theoretically (i.e., independent of MTU values) largest T-PDU that can be successfully handled by IPv4? (The T-PDU includes transport header (T-PCI) and transport data (T-SDU)).

(b) the theoretically largest A-PDU that can be successfully handled by UDP

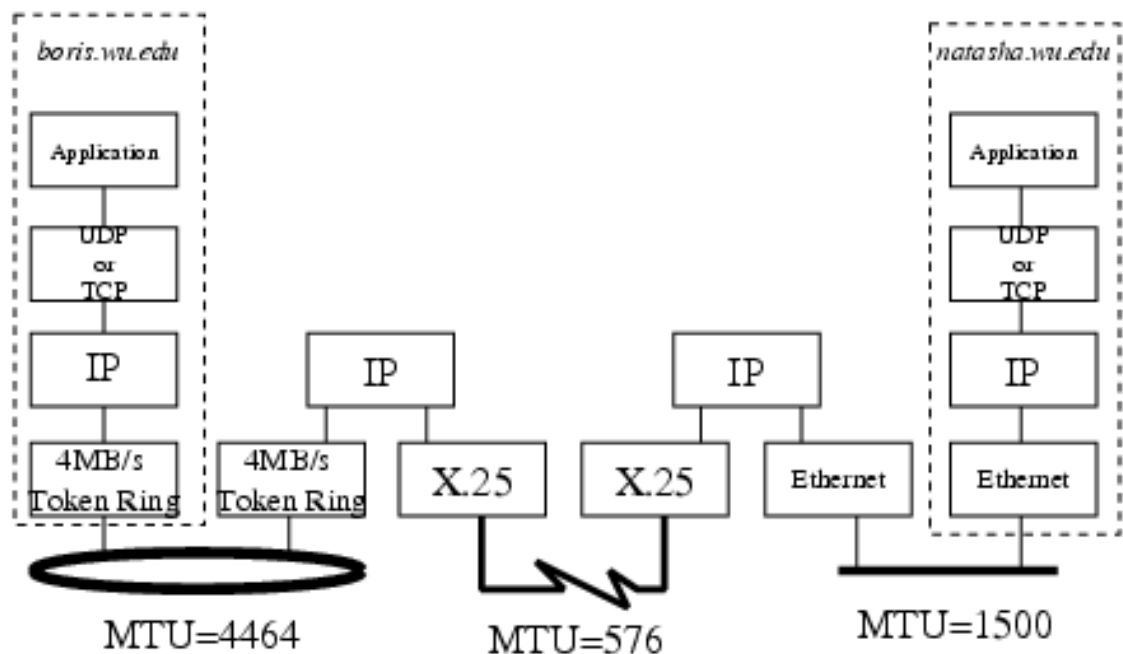
i. making no assumption about the network layer?

ii. and also be successfully handled by IPv4?

(c) the theoretically largest A-PDU that can be given to TCP

i. making no assumption about the network layer?

ii. and also be successfully handled by IPv4?



2. Given the network illustrated in the above figure, consider the network traffic passing between hosts boris.wu.edu and natasha.wu.edu. Both boris and natasha are at Wassomatta University (affectionately known as Wassomatta U!) Wassomatta U. has two campuses: one where boris is attached to a 4Mb/s Token Ring, and the other where natasha is connected to an 100Mb/s Ethernet.

An X.25 link connects the two campuses. The MTU's for the three networks are provided in the figure. Assume the implementations at Wassomatta do not support any Path MTU discovery mechanism. Hence the transport layer (TCP and UDP) does not know the Path MTU, and in fact does not know its own interface's MTU size. Assume each machine's IPv4 layer however does know its own interface's MTU size.

Determine each of the following.

- (a) IPv4 MUST know its interface's MTU size. Why?
- (b) the Path MTU between boris and natasha.
- (c) the largest TCP-PDU that can be contained in a single IPv4-PDU that boris sends to natasha, at the time this IPv4-PDU is transmitted over the token ring at boris
- (d) the largest UDP-PDU that can be contained in a single IPv4-PDU that boris sends to natasha, at the time this IPv4-PDU is transmitted over the token ring at boris
- (e) the largest TCP-PDU that can be contained in a single IPv4-PDU received by natasha from boris.
- (f) the largest UDP-PDU that can be contained in a single IPv4-PDU received by natasha from boris.
- (g) the largest TCP-PDU that can be contained in a single IPv4-PDU that natasha sends to boris at the time this IPv4-PDU is transmitted over the Ethernet at natasha.
- (h) the largest UDP-PDU that can be contained in a single IPv4-PDU that natasha sends to boris at the time this IPv4-PDU is transmitted over the Ethernet at natasha.
- (i) the largest number of transport layer bytes (T-PDU) that can be contained in a single IPv4-PDU received by boris from natasha.
- (j) the largest number of transport layer bytes (T-PDU) that can be contained in a single IPv4-SDU received by boris from natasha. (Note: Consider the literature's ambiguity with IPv4 fragment and IPv4 datagram.)
- (k) the largest number of application layer bytes (A-PDU) that can be contained in a single TCP-SDU received by natasha from boris.

(l) the largest number of application layer bytes (A-PDU) that can be contained in a single UDP-SDU received by natasha from boris.

### **Wireshark**

- Install Wireshark on your personal computer. See [www.wireshark.org](http://www.wireshark.org) and [/www.wiresharktraining.com](http://www.wiresharktraining.com) Installation instructions can be found at

[http://www.eecis.udel.edu/~amer/CISC650/WiresharkLabs/Wireshark\\_Intro\\_v6.0.pdf](http://www.eecis.udel.edu/~amer/CISC650/WiresharkLabs/Wireshark_Intro_v6.0.pdf)

- Submit your answers to this introduction assignment.