EP2120 Internetworking
DD2393 Protocols and Principles of the Internet

Make-up Homework Assignment 2
(Solutions due 17:00, Monday, 2011.Oct.17)
(Review not needed.)

1. TCP connection establishment (25p)

TCP uses a 3-way handshake to establish a connection. One purpose of the handshake is to agree on the initial sequence numbers (ISNs) used by the sender and the receiver for flow control and for error control.

a) A trivial solution would be to use 0 as the ISN. Why is this solution inappropriate? Show an example of improper operation and explain it in your own words. (10p)

b) How is the ISN chosen instead in TCP? (10p)

c) Agreeing on the ISNs is not the only purpose of TCP connection establishment. What other information is exchanged during the three-way handshake? Name at least one. (5p)

2. Reliable Communication (25p)

Consider a Go-Back-N protocol used for error control for some N>1.

a) How does this protocol differ from the Stop-and-Wait protocol? Explain the difference through a simple example. (10p)

b) In order for the Go-Back-N protocol to work every message has to contain a sequence number. Considering that N=4, what is the minimum number of bits needed for the sequence number? Support your answer by explaining what could go wrong if the sequence number were one bit shorter. (15p)

3. Autoconfiguration (25p)

The following two IP addresses were obtained by a host using stateless autoconfiguration:

```
2002:82ed:deda:b:226:2dff:fef0:aa5a/64
fe80::226:2dff:fef0:aa5a/64
```

Answer the following questions:

a) Which is the link-local address, and how did the host construct it? (3p)
b) How does the host check that its link-local address is unique? (3p)
c) Which is the global-scope address, and how did the host construct it? (3p)
d) How does the host check that its global-scope address is unique? (3p)
e) When the host communicates with an external destination, which source address does it use? (3p)

f) The host has also obtained the IPv4 address 123.4.5.55/25 by DHCP. The host and server sends a sequence of messages before the host can use the new address. Which is the sequence of messages sent between host and server in the normal case? (3p)
g) Which source and destination address does the host use in its first DHCP message? (3p)
h) Assume the server will not lengthen the lease of the address. How does the host address time-out, and which messages are sent when the address lease is terminated? (4p)

4. VPN (25p)

Suppose you manage an L2VPN network, that is, you tunnel L2 frames over IP. Your L2 network (customer network) is Ethernet using 14 byte headers. The MTU of the L2 network is 1500 bytes (that is, the largest Ethernet payload is 1500 bytes). Assume your traffic consists of mixed http requests, http replies and VoiP over IPv4.
The traffic distribution is as follows:

70% of the packets are 64 byte datagrams.
30% are full size frames.

You tunnel the L2 customer traffic over an IP backbone. The L2VPN header uses UDP/IPv4 without options and a 16-byte extra application header. In order not to introduce fragmentation (in TCP case it is actually to avoid triggering TCP path mtu discovery), the MTU on the backbone is extended beyond 1500 bytes.

a) How large must the MTU on the backbone be to avoid fragmentation? (5p)
b) What is the *overhead* (expressed in percent) introduced by the tunneling? Use bytes of Ethernet payload when computing overhead. (10p)
c) Suppose your IP backbone also runs over an Ethernet (a backbone Ethernet), and you send a HTTP request over the L2VPN. List the headers of the packet of you catch it in transit on the Ethernet backbone? (5p)
d) If a host connected to the L2 customer network 'pings' to another host on the same L2 network but over the L2VPN backbone, how much does the IP TTL decrement? (5p)