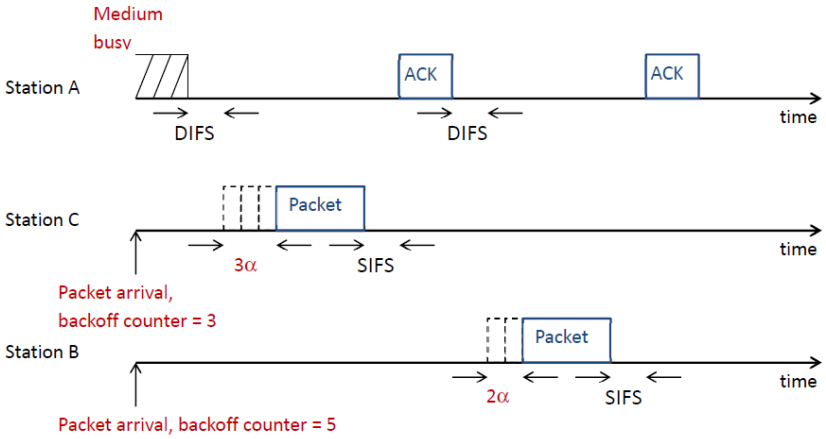
EE5132 – Wireless and Sensor Networks
Part 1: Tutorial 4 – Answers

1. Given: Propagation delay (PD) = α ; DIFS = 3α ; SIFS = 2α ; ACK = 5α ; Packet = 10α



Total time to transmit data packets and receive their acknowledgements
= (DIFS+3BC+Packet+PD+SIFS+ACK+PD)+(DIFS+2BC+Packet+PD+SIFS+ACK+PD)
= (3a+3a+10a+a+2a+5a+a)+(3a+2a+10a+a+2a+5a+a) = 25a+24a = 49a

2. Possible paths are the following:

1-5-7: 0.9 x 0.7 = 0.63

1-6-7: 0.8 x 0.9 = 0.72

1-3-4-6-7: 0.9 x 0.9 x 0.9 x 0.9 = 0.656

1-2-4-6-7: 0.8 x 0.9 x 0.9 x 0.9 = 0.583

1-2-6-7: 0.8 x 0.8 x 0.9 = 0.576

1-2-6-8-7: 0.8 x 0.8 x 0.8 x 0.7 = 0.358

Hence the best route is 1-6-7, since it has the highest consolidate success probability as well as the least number of hops.

3. High packet error rate, high latency, frequent link breakages due to mobility, and device handoffs are some of the inherent characteristics of wireless networks which require changes to be made in the existing TCP in order for it to be used in a wireless medium.

4(a) The main disadvantage of using wireline TCP over wireless networks is that wireline TCP attributes loss of packets during packet transmission to congestion in the network. However, this may not be the case in wireless networks, where packet losses occur mainly due to the physical nature of the medium such as attenuation, thermal effects and interference in the air medium. The wireline TCP thus goes into congestion control mechanism in these cases when there is no need to do this. This further reduces the throughput.

4(b) Indirect-TCP partitions the TCP connection to 2 parts, one for the wired network and another to the wireless network. This separates the ability of traditional TCP to deal with packet loss/congestion in wired network from the adversities of wireless channel that traditional TCP is inadequate. The separation to 2 connections allows the basestation (BS) and the MH to deploy a link-aware lightweight transmission protocol to efficiently and quickly carry out packet transmissions between the BS and MH. This is a workaround to achieve the need for end-to-end reliable transmission.

The original paper on Indirect-TCP by A Burke and BR Badrinath focused on enhancing handoff performance. It deployed one of the standard mobile-IP solutions, namely the Columbia mobile-IP protocol, over the wireless link to deal with a mobile device that is changing association with different base stations (or gateways) that have different IP addresses. If a host moves from one network to another - *migrates* - either the host should change its address to fit the new network or the routing mechanisms should be able to forward the messages into a network where the recipients address is an alien. The internet routing scheme was originally created at a time when the mobility of hosts was not considered to be an issue, thus all routing mechanisms are more or less static and cannot handle misrouting of individual addresses to be made in the existing TCP in order for it to be used in a wireless medium.