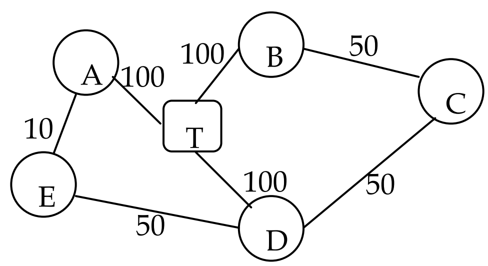
CSE 473 – Introduction to Computer Networks

Review Questions 16

***Your Name**:*

Please print out this form (two-sided, if you can) and write your answers *legibly* in the spaces provided. If you can't write legibly, type.

1. Consider the network below that consists of 5 routers A to E using the EIGRP proptocol, and of one transit network T. The number next to each link indicate the link bandwidth in Mbits/sec. The one-way propagation delays for each router pair are as follows: A-B: 1ms, A-D: 1ms, A-E: 0.5ms, E-D: 2ms, D-C: 2ms, B-C: 1.5ms, B-D: 1ms. Propagation delays are symmetric. Each router connects to two local subnets, *e.g.*, s_{a1}, s_{a2}, for router A, through 100 Mbits/sec links that have a propagation delay of 10μsecs. Compute the routing table at router A (identify next hops and relevant metric for all entries, including the feasible distance for each subnet, and reported distances by each neighbor).



Recall that in EIGRP, path cost is of the form: 256[(10^7/min link bandwidth)+ sum_link_delays], where bandwidth is in kbits/sec and delay is in units of 10μsecs.*
*Ignoring propagation delays, A 10 Mbits/sec link therefore has a link cost of ~256*1,000 versus ~256*100 for a 100 Mbits/sec link and 256*200 for a 50 Mbist/sec link.*
Conversely, link delays are256 50 for a 0.5ms link, 256*100 for a 1ms link,256*150 for a 1.5ms link, 256*200 for a 2ms link, and 256*1 for a 10μsecs link.*
*B advertises to A a cost of (100+1)*256 for its two subnets, a cost of (200+151)*256 for C's subnets, a cost of (100+101)*256 for D's subnets, and a cost of (200+301)*256 for E's subnets.*
*D advertises to A a cost of (100+1)*256 for its two subnets, a cost of (200+201)*256 for C's subnets, a cost of (100+101)*256 for B's subnets, and a cost of (200+201)*256 for E's subnets.*
*E advertises to A a cost of (100+1)*256 for its two subnets, a cost of (200+201)*256 for D's subnets, a cost of (200+301)*256 for B's subnets, and a cost of (200+401)*256 for C's subnets.*

Based on the reported distances from its neighbors, A computes the following minimum distances (feasible distances) for the different subnets in the network. <u>For simplicity, we omit the factor 256</u>.

s_{a1} 101 (local)
s_{a2} 101 (local)
s_{b1} 201 (through B with reported distance of 101)
s_{b2} 201 (through B with reported distance of 101)
s_{c1} 451 (through B with reported distance of 351)
s_{c2} 451 (through B with reported distance of 351)
s_{d1} 201 (through D with reported distance of 101)
s_{d2} 201 (through D with reported distance of 101)
s_{e1} 501 (through D with reported distance of 401)
s_{e2} 501 (through D with reported distance of 401)

Assume next that the link routers B and C breaks. How does A detect it? How does it affect its routing table, and does it need to recompute any shortest path?

B detects a break through the Hello protocol, i.e., it fails to receive a Hello message from C for three Hello intervals. Upon detecting it, B will actually initiate a recomputation for C's subnets and send queries to routers A and D. The receipt of the query will inform A that it does not anymore have a path to the subnets at C through B. However, D's reported distance for those subnets was 401, which is less than the feasible distance. Hence, D is a feasible successor and A immediately updates its path for C's subnets to go through D with a new minimum distance of 501. Note that the feasible distance remains at 451.

2. Consider the multi-area OSPF network shown in slide 31 of lecture 13 entitled "An ABR's Perspective – (2)" and assume that the link between router R3 and transit network T1 in area 1 breaks. What updated T3-summary LSAs are transmitted into the backbone area by the ABR, if any, and what is the content of those updated T3-summary LSAs if present?

The failure of the link between R3 and T1 affects the shortest paths to subnets 158.139.9.0/24, 158.130.10.0/24, and to a lesser extent subnet 158.130.8.0 (it loses one of its shortest paths).

The cost of the shortest path to the first two subnets (at R3) increases from 11 to 21. Because all the 158.130.x.0/24 subnets were aggregated into the supernet 158.130.8.0/22, the ABR only needs to send one updated T3-summary LSA into the backbone area. The LSA carries an updated cost of 21 (recall that the cost of the supernet is the maximum of the costs of the aggregated subnets).