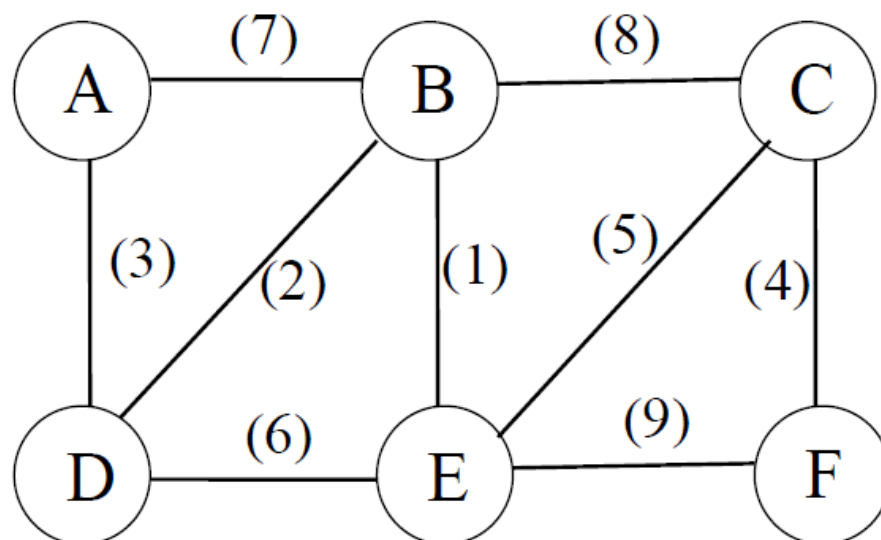Enamadi Sanath Yashwin

18CS01057

Original Network

Protocol: Each router sends its request (for routing tables) to its neighbouring nodes for every T secs. If it doesn't receive the response in T-k secs, it assumes the link is down and updates the routing tables in k secs (before it sends its tables to others).

Running Dijkstra (A as source):

Step	P	D_B	D_C	D_D	D_E	D_F
0	A	7	∞	3	∞	∞
1	A,D	5	∞	(3, A)	9	∞
2	A,D,B	(5, D)	13	(3, A)	6	∞
3	A,D,B,E	(5, D)	11	(3, A)	(6, B)	15
4	A,D,B,E,C	(5, D)	(11, E)	(3, A)	(6, B)	15
5	A,D,B,E,C,F	(5, D)	(11, E)	(3, A)	(6, B)	(15, C)

Similarly, by running the same algorithm at all nodes as sources, we obtain the routing tables at all nodes.

Initial Routing Tables:

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	D	11
D	D	3
E	D	6
F	D	15

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	E	6
D	D	2
E	E	1
F	E	10

At C:

Dest	Next	Dist
A	E	11
B	E	6
C	-	-
D	E	8
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	B	8
D	-	-
E	B	3
F	B	12

At E:

Dest	Next	Dist
A	B	6
B	B	1
C	C	5
D	B	3
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	E	15
B	E	10
C	C	4
D	E	12
E	E	9
F	-	-

Problem 1:

Here, we consider the DE link is down. So, D doesn't get a response from E and so does D from E.

A sends request to B, D. (Gets response from B, D)

B sends request to A, C, D, E. (Gets response from A, C, D, E)

C sends request to B, E, F. (Gets response from B, E, F)

D sends request to A, B, E. (Gets response from A, B)

E sends request to B, C, D, F. (Gets response from B, C, F)

F sends request to C, E. (Gets response from C, E)

First Update:

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	D	11
D	D	3
E	D	6
F	D	15

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	E	6
D	D	2
E	E	1
F	E	10

At C:

Dest	Next	Dist
A	E	11
B	E	6
C	-	-
D	E	8
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	B	8
D	-	-
E	B	3
F	B	12

At E:

Dest	Next	Dist
A	B	6
B	B	1
C	C	5
D	B	3
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	E	15
B	E	10
C	C	4
D	E	12
E	E	9
F	-	-

We notice D doesn't forward packets to E in any case. Also, E doesn't forward packets to D in any case. So, no updates happen.

Zero updates are required for the routing tables to be stabilized.

Problem 2:

Here, we consider the BE link is down. So, B doesn't get a response from E and so does B from E.

A sends request to B, D. (Gets response from B, D)

B sends request to A, C, D, E. (Gets response from A, C, D)

C sends request to B, E, F. (Gets response from B, E, F)

D sends request to A, B, E. (Gets response from A, B, E)

E sends request to B, C, D, F. (Gets response from C, D, F)

F sends request to C, E. (Gets response from C, E)

First Update:

B has routing tables of A, C, D.

E has routing tables of C, D, F.

At all the remaining nodes no changes occur, as they have all the expected routing tables.

At B, we update next nodes for all the rows where next is E.

W(BA) = 7, W(BC) = 8, W(BD) = 2 (these are the original edge weights)

Dist(BC) = min(W(BA) + sd(AC), W(BC) + sd(CC), W(BD) + sd(DC)) = min(7+11, 8+0, 2+8)

Dist(BE) = min(W(BA) + sd(AE), W(BC) + sd(CE), W(BD) + sd(DE)) = min(7+6, 8+5, 2+3)

Dist(BF) = min(W(BA) + sd(AF), W(BC) + sd(CF), W(BD) + sd(DF)) = min(7+15, 8+4, 2+12)

At E, we update next nodes for all the rows where next is B.

W(EC) = 5, W(ED) = 6, W(EF) = 9

Dist(EA) = min(W(EC) + sd(CA), W(ED) + sd(DA), W(EF) + sd(FA)) = min(5+11, 6+3, 9+15)

Dist(EB) = min(W(EC) + sd(CB), W(ED) + sd(DB), W(EF) + sd(FB)) = min(5+6, 6+2, 9+10)

Dist(ED) = min(W(EC) + sd(CD), W(ED) + sd(DD), W(EF) + sd(FD)) = min(5+8, 6+0, 9+12)

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	D	11
D	D	3
E	D	6
F	D	15

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	**C**	**8**
D	D	2
E	**D**	**5**
F	**C**	**12**

At C:

Dest	Next	Dist
A	E	11
B	E	6
C	-	-
D	E	8
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	B	8
D	-	-
E	B	3
F	B	12

At E:

Dest	Next	Dist
A	**D**	**9**
B	**D**	**8**
C	C	5
D	**D**	**6**
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	E	15
B	E	10
C	C	4
D	E	12
E	E	9
F	-	-

A sends request to B, D. (Gets response from B, D)

B sends request to A, C, D. (Gets response from A, C, D)

C sends request to B, E, F. (Gets response from B, E, F)

D sends request to A, B, E. (Gets response from A, B, E)

E sends request to C, D, F. (Gets response from C, D, F)

F sends request to C, E. (Gets response from C, E)

Second Update:

At A, we see there are no updates.

At B, we see there are no updates.

At C, W(CB) = 8, W(CE) = 5, W(CF) = 4

Dist(CA) = min(W(CB) + sd(BA), W(CE) + sd(EA), W(CF) + sd(FA)) = min(8+5, 5+16, 4+15)

Dist(CB) = min(W(CB) + sd(BB), W(CE) + sd(EB), W(CF) + sd(FB)) = min(8+0, 5+11, 4+10)

Dist(CD) = min(W(CB) + sd(BD), W(CE) + sd(ED), W(CF) + sd(FD)) = min(8+2, 5+6, 4+12)

Dist(CE) = min(W(CB) + sd(BE), W(CE) + sd(EE), W(CF) + sd(FE)) = min(8+5, 5+0, 4+9) (No update)

Dist(CF) = min(W(CB) + sd(BF), W(CE) + sd(EF), W(CF) + sd(FF)) = min(8+12, 5+9, 4+0) (No update)

At D, W(DA) = 3, W(DB) = 2, W(DE) = 8

Dist(DC) = min(W(DA) + sd(AC), W(DB) + sd(BC), W(DE) + sd(EC)) = min(3+11, 2+8, 8+5)

Dist(DE) = min(W(DA) + sd(AE), W(DB) + sd(BE), W(DE) + sd(EE)) = min(3+6, 2+5, 6+0)

Dist(DF) = min(W(DA) + sd(AF), W(DB) + sd(BF), W(DE) + sd(EF)) = min(3+15, 2+12, 6+9)

At E, there are no updates.

At F, W(FC) = 4, W(FE) = 9

Dist(FA) = min(W(FC) + sd(CA), W(FE) + sd(EA)) = min(4+11, 9+9)

Dist(FB) = min(W(FC) + sd(CB), W(FE) + sd(EB)) = min(4+6, 9+8)

Dist(FD) = min(W(FC) + sd(CD), W(FE) + sd(ED)) = min(4+8, 9+6)

Dist(FE) = min(W(FC) + sd(CE), W(FE) + sd(EE)) = min(4+5, 9+0) (No Update)

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	D	11
D	D	3
E	D	6
F	D	15

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	C	8
D	D	2
E	D	5
F	C	12

At C:

Dest	Next	Dist
A	**B**	**13**
B	**B**	**8**
C	-	-
D	**B**	**10**
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	**B**	**10**
D	-	-
E	**E**	**6**
F	**B**	**14**

At E:

Dest	Next	Dist
A	D	9
B	D	8
C	C	5
D	D	6
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	**C**	**15**
B	**C**	**10**
C	C	4
D	**C**	**12**
E	E	9
F	-	-

A sends request to B, D. (Gets response from B, D)

B sends request to A, C, D. (Gets response from A, C, D)

C sends request to B, E, F. (Gets response from B, E, F)

D sends request to A, B, E. (Gets response from A, B, E)

E sends request to C, D, F. (Gets response from C, D, F)

F sends request to C, E. (Gets response from C, E)

Third Update:

At A, W(AB) = 7, W(AD) = 3

Dist(AC) = min(W(AD) + sd(DC), W(AB) + sd(BC)) = min(3+10, 7+8)

Dist(AE) = min(W(AD) + sd(DE), W(AB) + sd(BE)) = min(3+6, 7+5)

Dist(AF) = min(W(AD) + sd(DF), W(AB) + sd(BF)) = min(3+14, 7+12)

At B, W(BA) = 7, W(BC) = 8, W(BD) = 2

Dist(BE) = min(W(BA) + sd(AE), W(BC) + sd(CE), W(BD) + sd(DE)) = min(7+6, 8+5, 2+6)

At C, there are no updates.

At D, there are no updates.

At E, there are no updates.

At F, W(FC) = 4, W(FE) = 9

Dist(FA) = min(W(FC) + sd(CA), W(FE) + sd(EA)) = min(4+13, 9+9)

Dist(FB) = min(W(FC) + sd(CB), W(FE) + sd(EB)) = min(4+8, 9+8)

Dist(FD) = min(W(FC) + sd(CD), W(FE) + sd(ED)) = min(4+10, 9+6)

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	**D**	**13**
D	D	3
E	**D**	**9**
F	**D**	**17**

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	C	8
D	D	2
E	**D**	**8**
F	C	12

At C:

Dest	Next	Dist
A	B	13
B	B	8
C	-	-
D	B	10
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	B	10
D	-	-
E	E	6
F	B	14

At E:

Dest	Next	Dist
A	D	9
B	D	8
C	C	5
D	D	6
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	**C**	**17**
B	**C**	**12**
C	C	4
D	**C**	**14**
E	E	9
F	-	-

Fourth Update:

There are no further updates.

At A:

Dest	Next	Dist
A	-	-
B	D	5
C	D	13
D	D	3
E	D	9
F	D	17

At B:

Dest	Next	Dist
A	D	5
B	-	-
C	C	8
D	D	2
E	D	8
F	C	12

At C:

Dest	Next	Dist
A	B	13
B	B	8
C	-	-
D	B	10
E	E	5
F	F	4

At D:

Dest	Next	Dist
A	A	3
B	B	2
C	B	10
D	-	-
E	E	6
F	B	14

At E:

Dest	Next	Dist
A	D	9
B	D	8
C	C	5
D	D	6
E	-	-
F	F	9

At F:

Dest	Next	Dist
A	C	17
B	C	12
C	C	4
D	C	14
E	E	9
F	-	-

Therefore, it took three updates for the routing tables to be stabilized.

Proof of Correctness:

Dijkstra on new graph should produce the above routing tables.

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