

Lab 3: OSPF Routing Algorithm

ASSIGNMENT 3

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CS15B036

TASK: To implement a simplified version of the Open Shortest Path First (OSPF) routing protocol

OSPF (OPEN SHORTEST PATH FIRST)

The OSPF protocol is a link-state routing protocol, which means that the routers exchange topology information with their nearest neighbors. The topology information is flooded throughout the network, so that every router within the network has a complete picture of the topology. This picture is then used to calculate end-to-end paths through the network, using Dijkstra's algorithm, which gives the shortest path.

STEPS INVOLVED

Given a set of N routers, the goal is for EACH router to:

- (a) exchange HELLO packets with neighbours
- (b) create Link State Advertisement (LSA) packets based on neighboring nodes' info
- (c) broadcast the LSA packets to all other routers in the network
- (d) construct the network topology based on the LSA packets received from other routers
- (e) determining the routing table entries based on this topology, by using Dijkstra's algorithm (single source – all nodes shortest paths).

PROCEDURE:

All the N routers establish UDP connections with each other and exchange the given packets.

The file is run accordingly:

In terminal **i- *\$gcc Assignment3.c -o Assignment3 -pthread***

In terminal **i- *./Assignment3 (input the variables of Node i)***

RESULTS:

The variables of the programs are given through the command line. The variables are-

- -i id: Node identifier value (i)
- -f infile: Input file
- -o outfile: Output file
- -h hi: HELLO INTERVAL (in seconds)
- -a lsai: LSA INTERVAL (in seconds)
- -s spfi: SPF INTERVAL (in seconds)

The individual processes (Routers), with the help of threads, send and receive hello packets, helloReply packets and LSA packets and build the topology.

TOPOLOGY 1 (8 NODES, 21 LINKS):

In terminal **i- *./Assignment3 i Input i 1 5 20***

INPUT FILE:

8 21

```

0 1 0 10
1 2 10 20
2 3 20 30
3 4 30 40
4 5 40 50
5 6 50 60
6 7 60 70
7 0 10 70
0 2 0 20
0 3 0 30
0 4 0 40
0 5 0 50
0 6 0 60
1 7 10 70
1 6 10 60
2 4 20 40
2 5 20 50
2 6 20 60
3 5 30 50
3 6 30 60
4 6 40 60

```

CORRESPONDING ROUTER CONFIGURATIONS:

```

teena@teena-Inspiron-5558: ~/Desk
Dest cost Path
0 0 -
1 7 1<--0
2 15 2<--0
3 0 3<--0
4 1 4<--0
5 14 5<--0
6 8 6<--0
7 26 7<--0
^C
teena@teena-Inspiron-5558:~/Desktop/A
cads/CS3205/ASSIGNMENT3$ gcc Assignme
nt3.c -o Assignment3 -pthread
teena@teena-Inspiron-5558:~/Desktop/A
cads/CS3205/ASSIGNMENT3$ ./Assignment
3 0 0
^C
teena@teena-Inspiron-5558:~/Desktop/A
cads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558:~/Desk
35 61 -1 -1 -1 -1 64 -1
Routing Table for Node No. 4 at Time
Sun Mar 25 14:40:12 2018
Dest cost Path
0 24 0<--4
1 30 1<--0<--4
2 39 2<--4
3 39 3<--4
4 0 -
5 49 5<--4
6 53 6<--4
7 43 7<--1<--0<--4
^C
teena@teena-Inspiron-5558:~/Desktop/A
cads/CS3205/ASSIGNMENT3$ ./Assignme
nt3 4 4
^C

teena@teena-Inspiron-5558:~/De
3 -1 41 34 40 -1 57 -1
0 13 56 31 -1 56 -1 66
33 51 -1 -1 -1 -1 69 -1
Routing Table for Node No. 1 at Time
Sun Mar 25 14:40:04 2018
Dest cost Path
0 5 0<--1
1 0 -
2 13 2<--1
3 5 3<--0<--1
4 6 4<--0<--1
5 19 5<--0<--1
6 23 6<--1
7 31 7<--0<--1
^C^C
teena@teena-Inspiron-5558:~/Desktop/
Acads/CS3205/ASSIGNMENT3$ ./Assignme
nt3 1 1
^C

teena@teena-Inspiron-5558:~/De
14 -1 43 43 43 -1 50 -1
0 13 56 31 -1 56 -1 66
15 65 -1 -1 -1 -1 63 -1
Routing Table for Node No. 2 at T
ime Sun Mar 25 14:40:06 2018
Dest cost Path
0 5 0<--2
1 12 1<--2
2 0 -
3 5 3<--0<--2
4 6 4<--0<--2
5 19 5<--0<--2
6 34 6<--2
7 31 7<--0<--2
^C
teena@teena-Inspiron-5558:~/Deskt
op/Acads/CS3205/ASSIGNMENT3$ ./As
signment3 2 2
^C

teena@teena-Inspiron-5558:~/
35 61 -1 -1 -1 -1 64 -1
Routing Table for Node No. 3 at
Time Sun Mar 25 14:40:10 2018
Dest cost Path
0 26 0<--3
1 32 1<--0<--3
2 22 2<--3
3 0 -
4 35 4<--3
5 31 5<--3
6 42 6<--3
7 45 7<--1<--0<--3
^C
teena@teena-Inspiron-5558:~/Deskt
op/Acads/CS3205/ASSIGNMENT3$ ./
Assignment3 3 3
^C

teena@teena-Inspiron-5558:~/
35 61 -1 -1 -1 -1 66 -1
Routing Table for Node No. 7 at T
ime Sun Mar 25 14:40:20 2018
Dest cost Path
0 35 0<--7
1 41 1<--0<--7
2 51 2<--1<--0<--7
3 51 3<--0<--7
4 49 4<--0<--7
5 70 5<--0<--7
6 66 6<--7
7 0 -
^C
teena@teena-Inspiron-5558:~/Deskt
op/Acads/CS3205/ASSIGNMENT3$ ./As
signment3 7 7
^C

teena@teena-Inspiron-5558:~/De
Dest cost Path
0 18 0<--5
1 24 1<--0<--5
2 34 2<--1<--0<--5
3 34 3<--0<--5
4 32 4<--0<--5
5 0 -
6 58 6<--5
7 37 7<--1<--0<--5
^C
teena@teena-Inspiron-5558:~/Desktop/
Acads/CS3205/ASSIGNMENT3$ ./Assignme
nt3 5 5
^C

teena@teena-Inspiron-5558:~/Deskt
op/Acads/CS3205/ASSIGNMENT3$ ./Assi
gnment3 6 6
^C

```

TOPOLOGY 2 (9 NODES, 22 LINKS):

In terminal i- *\$/Assignment3 i Input i 1 5 20*

9 22
0 1 0 10
1 2 10 20
2 3 20 30
3 4 30 40
4 5 40 50
5 6 50 60
6 7 60 70
7 0 10 70
0 2 0 20
0 3 0 30
0 8 0 80
0 5 0 50
0 6 0 60
1 7 10 70
1 6 10 60
2 8 20 80
2 4 20 40
2 5 20 50
3 5 30 50
3 6 30 60
4 8 40 80
6 8 60 80

CORRESPONDING ROUTER CONFIGURATIONS:

```
Terminal
teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
3 28 3<--0
4 46 4<--2<--0
5 49 5<--0
6 9 6<--0
7 24 7<--1<--0
8 34 8<--0
Routing Table for Node No. 0 at Time Sun Mar 25 15:54:52 2018
Dest cost Path
0 0 -
1 2 1<--0
2 12 2<--1<--0
3 7 3<--0
4 32 4<--2<--1<--0
5 7 5<--0
6 8 6<--0
7 12 7<--0
8 12 8<--0
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
3 12 3<--0<--1<--2
4 26 4<--2
5 29 5<--0<--1<--2
6 30 6<--1<--2
7 24 7<--0<--1<--2
8 32 8<--0<--1<--2
Routing Table for Node No. 2 at Time Sun Mar 25 15:54:36 2018
Dest cost Path
0 14 0<--2
1 19 1<--2
2 0 -
3 23 3<--2
4 28 4<--2
5 37 5<--2
6 36 6<--1<--2
7 55 7<--1<--2
8 33 8<--2
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
3 29 3<--0<--1
4 44 4<--2<--0<--1
5 23 5<--0<--1
6 48 6<--1
7 18 7<--1
8 4 8<--0<--1
Routing Table for Node No. 1 at Time Sun Mar 25 15:54:35 2018
Dest cost Path
0 4 0<--1
1 0 -
2 17 2<--0<--1
3 28 3<--0<--1
4 38 4<--2<--0<--1
5 46 5<--2<--0<--1
6 27 6<--1
7 17 7<--1
8 48 8<--0<--1
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
3 0 -
4 39 4<--3
5 3 5<--0<--3
6 35 6<--3
7 55 7<--0<--3
8 49 8<--0<--3
Routing Table for Node No. 3 at Time Sun Mar 25 15:54:52 2018
Dest cost Path
0 19 0<--3
1 20 1<--0<--3
2 21 2<--3
3 0 -
4 35 4<--3
5 41 5<--3
6 54 6<--3
7 70 7<--1<--0<--3
8 60 8<--0<--3
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$
```

```
Terminal
teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
5 41 5<--4
6 54 6<--1<--0<--3<--4
7 56 7<--0<--3<--4
8 65 8<--4
Routing Table for Node No. 4 at Time Sun Mar 25 15:54:42 2018
Dest cost Path
0 47 0<--2<--4
1 55 1<--0<--2<--4
2 39 2<--4
3 32 3<--4
4 0 -
5 46 5<--4
6 71 6<--3<--4
7 99 7<--0<--2<--4
8 46 8<--4
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
8 79 8<--0<--1<--7
Routing Table for Node No. 5 at Time Sun Mar 25 15:54:44 2018
Dest cost Path
0 24 0<--5
1 32 1<--0<--5
2 23 2<--5
3 26 3<--0<--5
4 42 4<--5
5 0 -
6 51 6<--5
7 76 7<--0<--5
8 59 8<--2<--5
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
8 79 8<--0<--1<--7
Routing Table for Node No. 6 at Time Sun Mar 25 15:54:44 2018
Dest cost Path
0 10 0<--1<--6
1 10 1<--6
2 25 2<--0<--1<--6
3 12 3<--0<--1<--6
4 45 4<--3<--0<--1<--6
5 10 5<--0<--1<--6
6 0 -
7 62 7<--0<--1<--6
8 56 8<--0<--1<--6
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
8 79 8<--0<--1<--7
Routing Table for Node No. 7 at Time Sun Mar 25 15:57:27 2018
Dest cost Path
0 38 0<--1<--7
1 36 1<--7
2 46 2<--0<--1<--7
3 55 3<--0<--1<--7
4 85 4<--2<--0<--1<--7
5 71 5<--2<--0<--1<--7
6 65 6<--7
7 0 -
8 79 8<--0<--1<--7
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$

teena@teena-Inspiron-5558: ~/Desktop/Acads/CS3205/ASSIGNMENT3
8 0 -
Routing Table for Node No. 8 at Time Sun Mar 25 15:54:46 2018
Dest cost Path
0 0 0<--8
1 7 1<--0<--8
2 19 2<--0<--8
3 20 3<--0<--8
4 48 4<--2<--0<--8
5 29 5<--0<--8
6 37 6<--1<--0<--8
7 57 7<--0<--8
8 0 -
teena@teena-Inspiron-5558:~/Desktop/Acads/CS3205/ASSIGNMENT3$
```