The simulation of Routing Loop and its Prevention using split horizon

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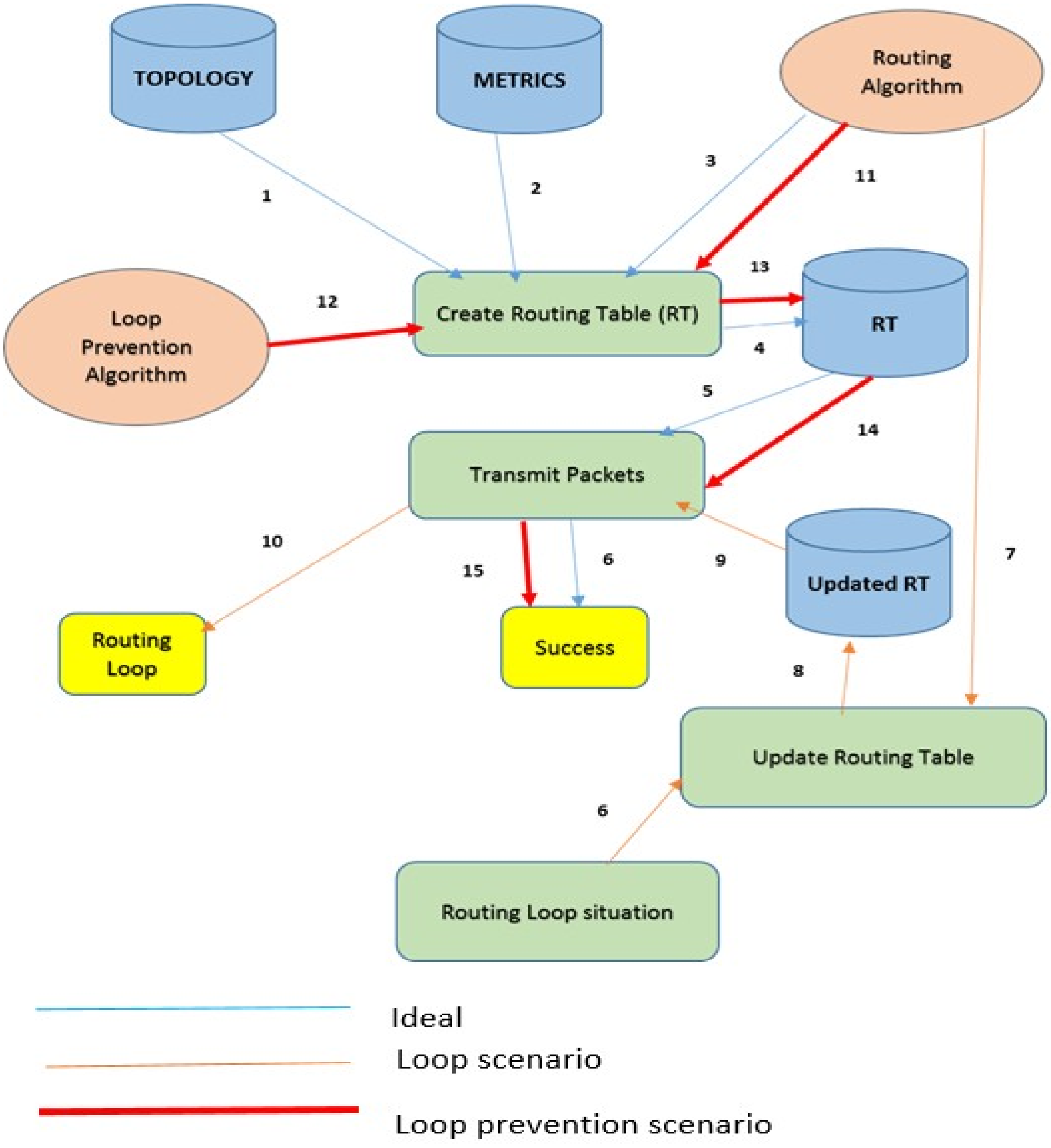
1. Framework



The following steps are performed for simulating the above framework in Python.

1) Initialize nodes in the graph

2) Input the topology graph and metrics to build routing table.

3) Send Packets and have a success full Transmission

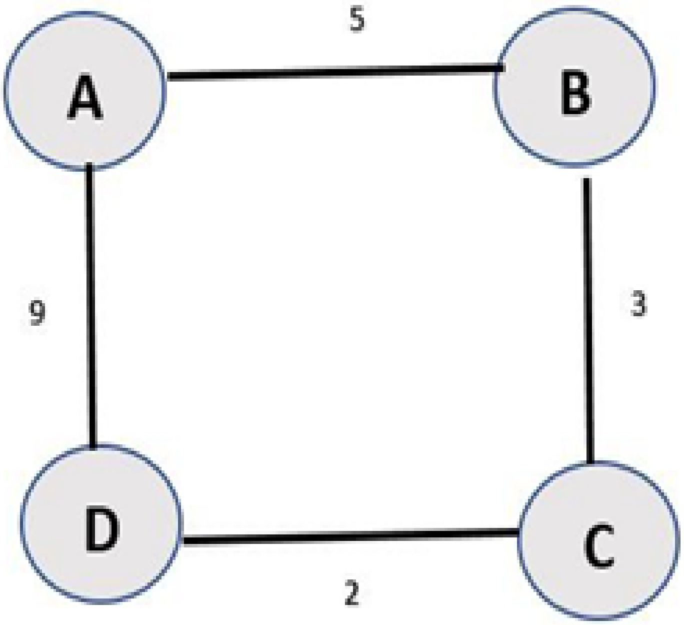
4) Create a static routing loop by link failure.

5) Share the routing table to all the other nodes.

6) Use the split horizon loop prevention algorithm then send the packets.

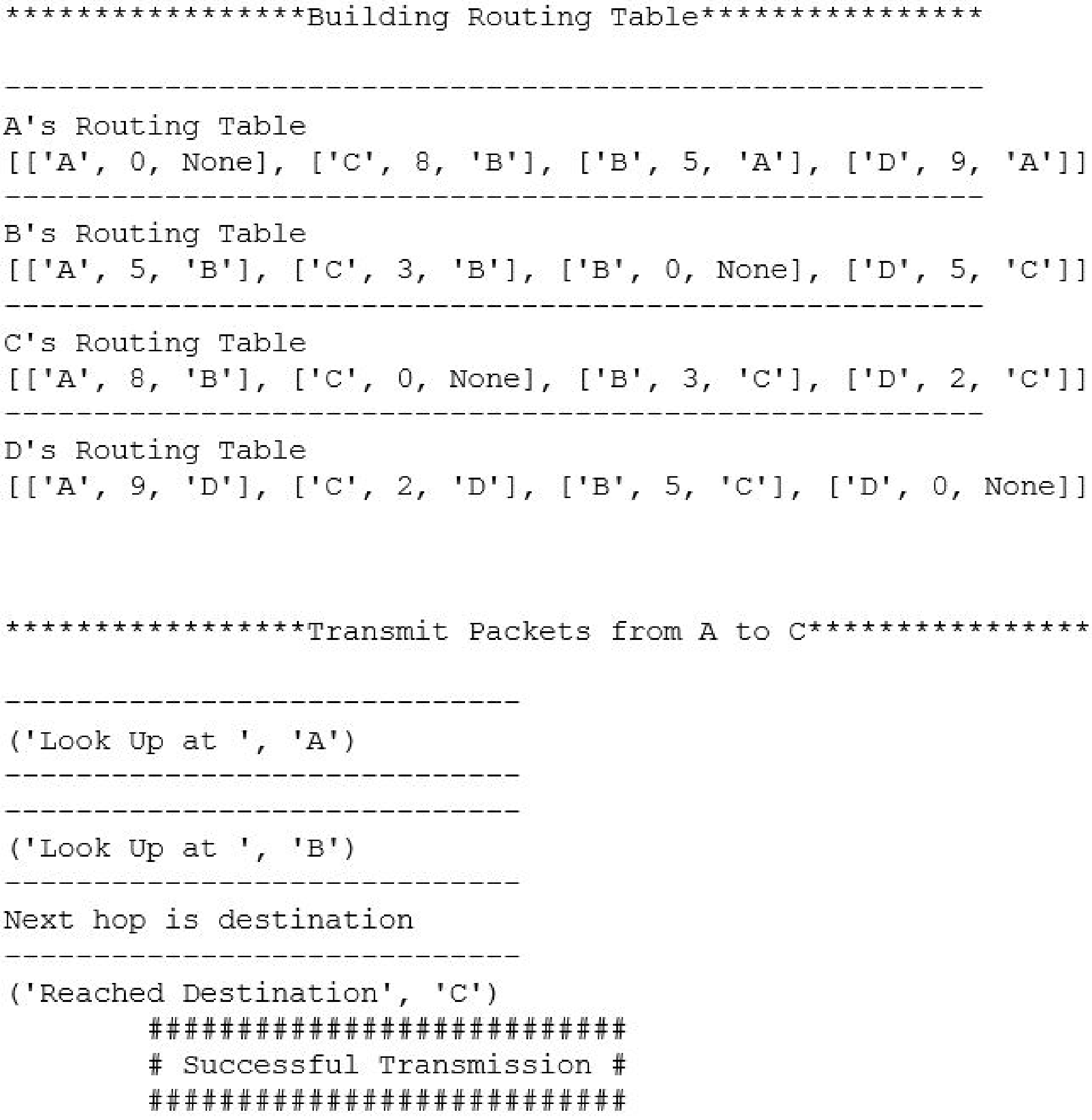
2. Implemented Graph

For simulating the routing loop, the following figure has been considered as an example graph. Suppose the link from B to C fails. Before A knows about this link failure, it shares its routing table with B. From this table, B realizes A has a path to C but could not know the same path goes through B itself. B updates its table and set path to C and the next hop as A. However, A has the path to C but nexthop as B. In this scenario both A and B pointing to each other for the destination C as a result, any packet from A to C or B to C falls in a routing loop



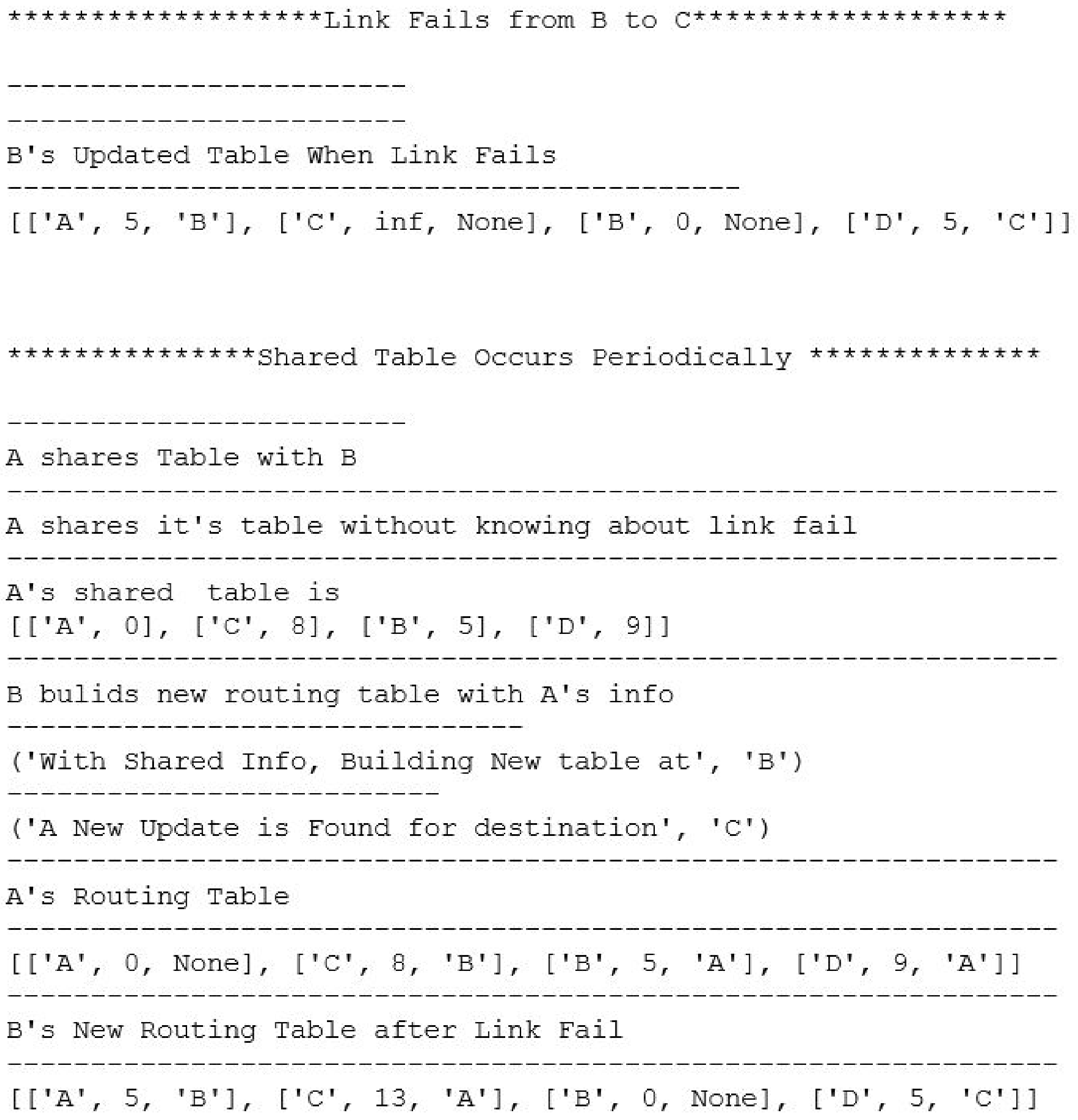
3. Output of Implemented Code

The simulated output of first three steps (from building routing table to Success full transmission of the packet) is illustrated in following figure .



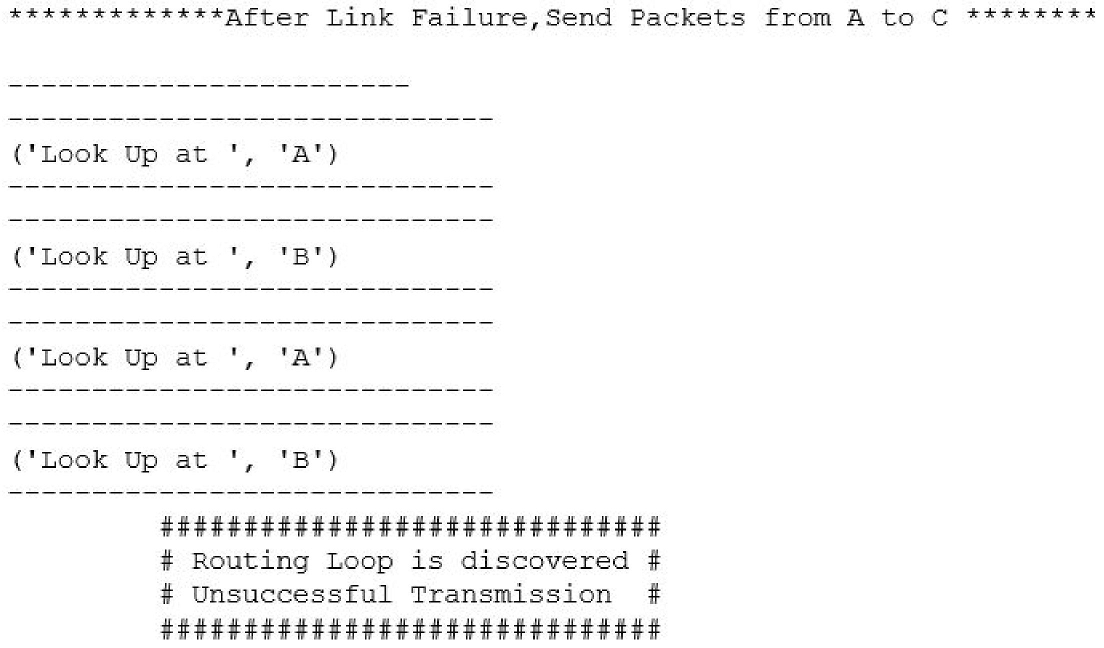
```
*****************Building Routing Table*****************

--------------------------------------------------------
A's Routing Table
[['A', 0, None], ['C', 8, 'B'], ['B', 5, 'A'], ['D', 9, 'A']]
--------------------------------------------------------
B's Routing Table
[['A', 5, 'B'], ['C', 3, 'B'], ['B', 0, None], ['D', 5, 'C']]
--------------------------------------------------------
C's Routing Table
[['A', 8, 'B'], ['C', 0, None], ['B', 3, 'C'], ['D', 2, 'C']]
--------------------------------------------------------
D's Routing Table
[['A', 9, 'D'], ['C', 2, 'D'], ['B', 5, 'C'], ['D', 0, None]]


*****************Transmit Packets from A to C*****************

------------------------------
('Look Up at ', 'A')
------------------------------
------------------------------
('Look Up at ', 'B')
------------------------------
Next hop is destination
------------------------------
('Reached Destination', 'C')
        ###########################
        # Successful Transmission #
        ###########################
```

The simulated output of step4 to step5 (simulating network loop condition) is listed in the following figure.



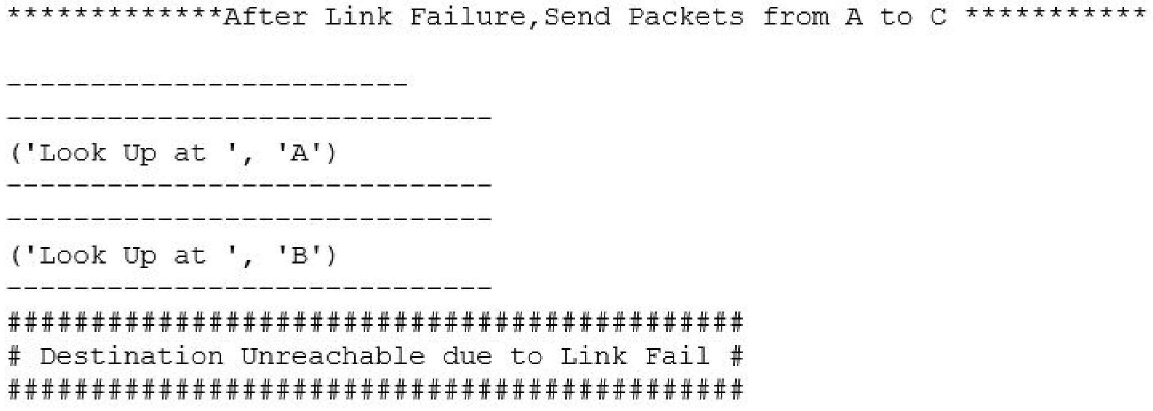
```
*******************Link Fails from B to C*******************

------------------------
------------------------
B's Updated Table When Link Fails
---------------------------------------------
[['A', 5, 'B'], ['C', inf, None], ['B', 0, None], ['D', 5, 'C']]



***************Shared Table Occurs Periodically **************

------------------------
A shares Table with B
----------------------------------------------------------------
A shares it's table without knowing about link fail
----------------------------------------------------------------
A's shared  table is
[['A', 0], ['C', 8], ['B', 5], ['D', 9]]
----------------------------------------------------------------
B bulids new routing table with A's info
-------------------------------
('With Shared Info, Building New table at', 'B')
--------------------------
('A New Update is Found for destination', 'C')
----------------------------------------------------------------
A's Routing Table
----------------------------------------------------------------
[['A', 0, None], ['C', 8, 'B'], ['B', 5, 'A'], ['D', 9, 'A']]
----------------------------------------------------------------
B's New Routing Table after Link Fail
----------------------------------------------------------------
[['A', 5, 'B'], ['C', 13, 'A'], ['B', 0, None], ['D', 5, 'C']]
```

The unsuccessful transmission due to routing loop is listed in the following figure .



```
*************After Link Failure,Send Packets from A to C ********

------------------------
-----------------------------
('Look Up at ', 'A')
-----------------------------
-----------------------------
('Look Up at ', 'B')
-----------------------------
-----------------------------
('Look Up at ', 'A')
-----------------------------
-----------------------------
('Look Up at ', 'B')
-----------------------------
         ##############################
         # Routing Loop is discovered #
         # Unsuccessful Transmission  #
         ##############################
```

When loop prevention algorithm (split horizon) is incorporated, the net- work did not undergo looping situation, rather it generates unreachable message due to the link failure. The simulated output of final step (Simulating network loop prevention) is listed in the following figure .



```
*************After Link Failure,Send Packets from A to C ***********

------------------------
-----------------------------
('Look Up at ', 'A')
-----------------------------
-----------------------------
('Look Up at ', 'B')
-----------------------------
############################################
# Destination Unreachable due to Link Fail #
############################################
```