A Comparative Study to Measure the Performance of Spanning Tree Protocol on Software Defined Networks

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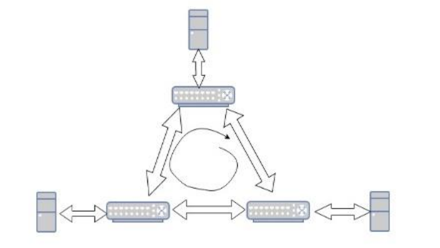
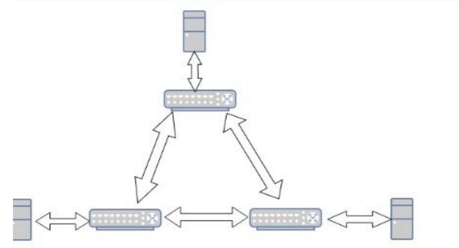
1. Introduction

- This work focuses on investigating the performance of the Spanning Tree Protocol in Software Defined Networking and proposes an improved Spanning Tree Protocol Algorithm.
- We used the Mininet emulator to emulate the network topology of a given SDN and carried out our experiments.



Broadcast streams in a network having a loop structure



logically disconnect to avoid loop using STP.

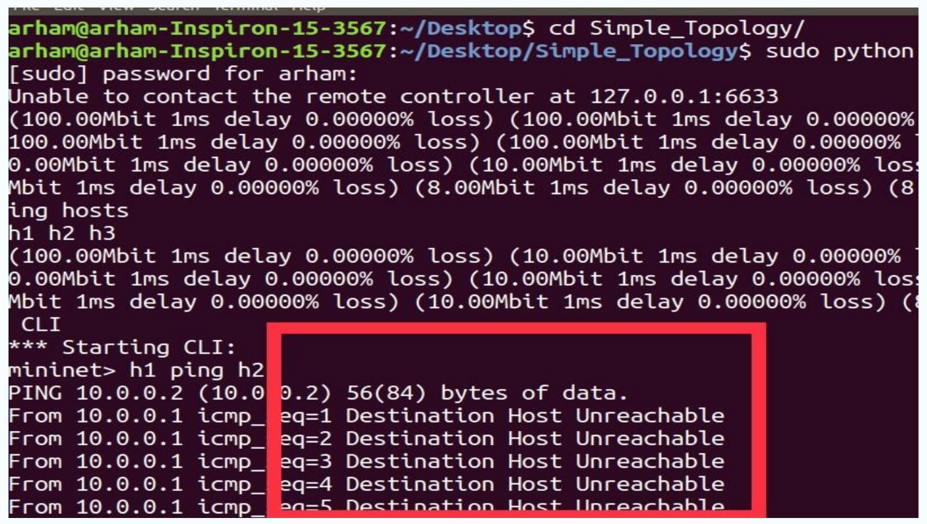
2. Methodology

We carry out our work in two parts: *first* we implemented the basic STP method for preventing loops in SDN architecture and then in *second* part we propose a new method for preventing loops in the SDN architecture.

2.1 STP method for preventing loop in SDN architecture

2.1.1 SDN without STP Configuration

A broadcast storm occurs on the network. Finally, the network melts down, causing failure in all network links.

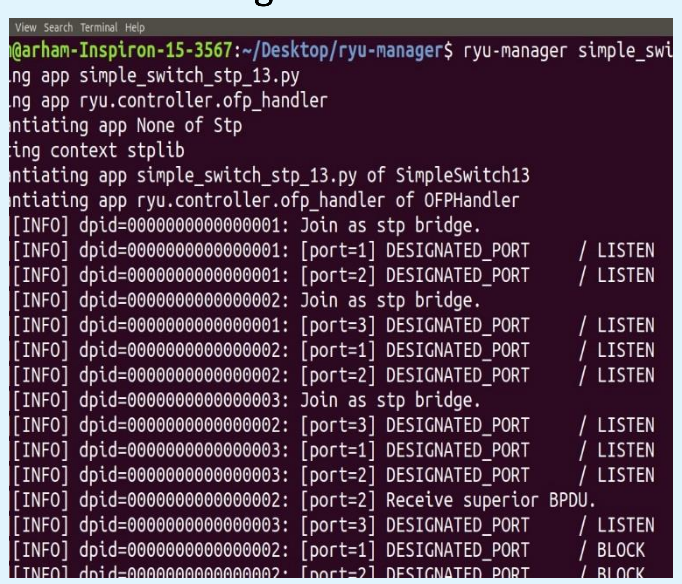


Hosts becomes unreachable

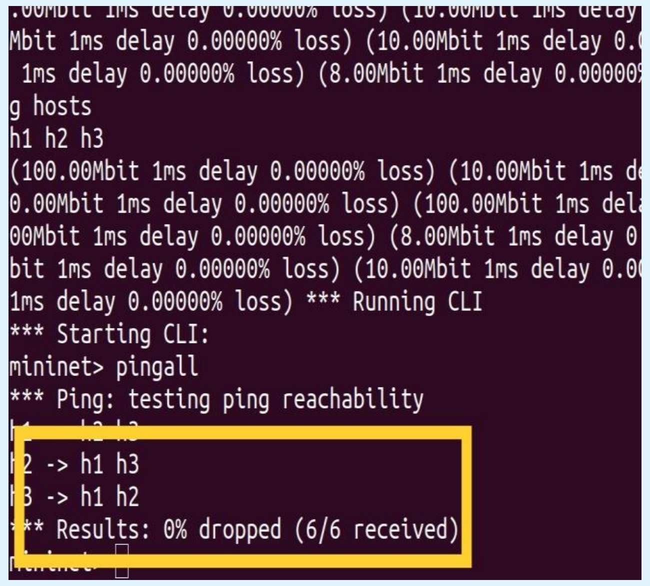
Methodology ……

2.1.2 SDN with STP Configuration

The switches exchange information among themselves using bridge protocol data units (BPDU) and will then listen in on all ports for this BPDU message.



Select Root Bridge & Ports



Hosts becomes reachable

2.2 The Proposed Algorithm

As a result, only activated switches will remain as switches(S). Here we check the following two conditions:

Condition-1: **New set S (after deleting S1) has intersection with all sets of N(Si) or not. { N(Si) set of neighbors of the switch Si}**

(If in the condition 1, switch Si is a non-activated switch, then it will be deleted and then it checks the condition 2)

Condition-2: **In addition, the SDN controller has to check the sub-graph to find out that it is a connected graph or not.**

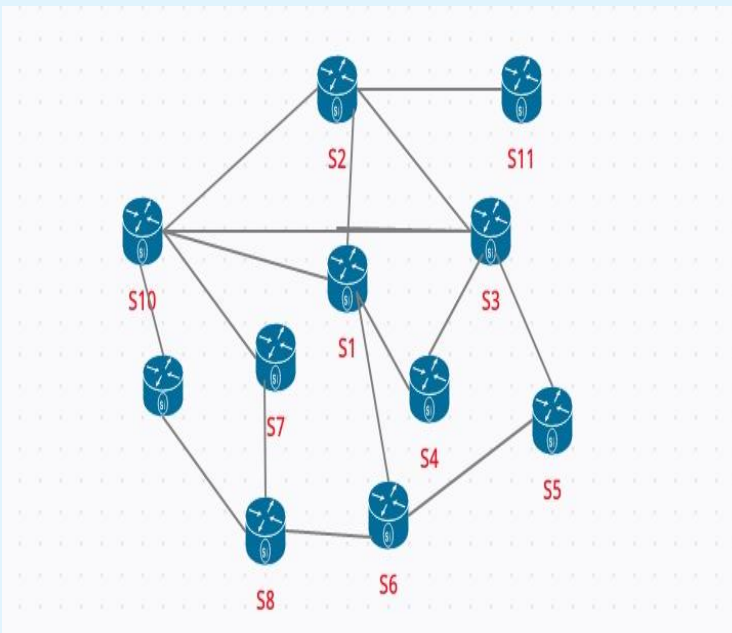
Algorithm for selecting activated switches

Input: S - The set of switches,
N(Si) - the neighbors of the switch Si,
The network graph

Output: The set of activated switches

```
for each Si in S   // Si = S1, S2, ……
newS ← remove Si from S
   for all N(Si):
      if intersection of the newS and N(Si) = ø:
         add Si to the newS
         break
   End
End
if Si is not in the newS:   // Check Condition 2
   H ← sub-graph from the network containing
          nodes of the newS
   if H is not connected:
         add Si to the newS
   End
End
The set of activated switches ← S
```

3. Test Results

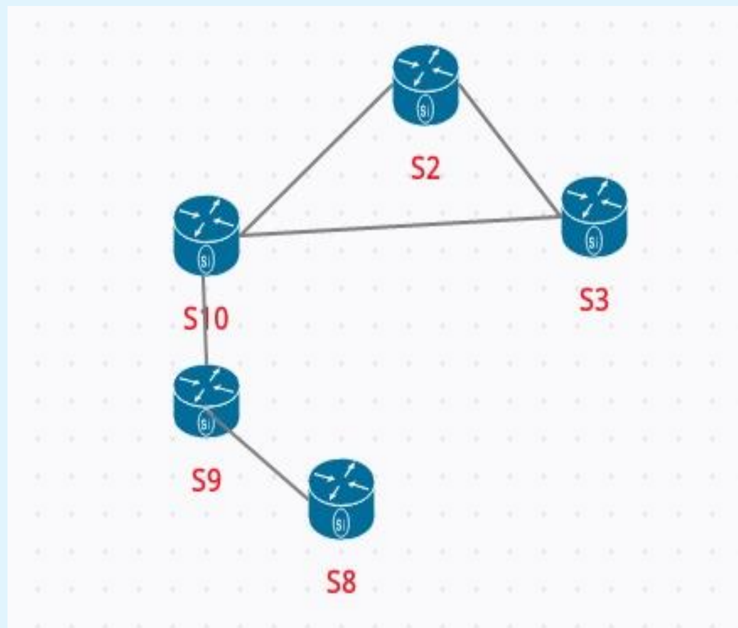


Input: **a set of activated switches & non-activated switches**

Testing the Proposed Algorithm

Input S ={S1, S2, …………, S11}
Neighbors of Si (i = 1 to 11)
N(S1) = {S2, S3, S4, S6,S 10},
N(S2) = {S1, S3, S10} ,……,
N(S11) = {S2}

Step-1= new S = {S2, S3, …., S11}
Step-2 = Check condition 1
Step-3 = Check condition 2
Step-4 = go to Step-1
Output = Set of Activated Switches
S = {S2,S3,S8,S9,S10}



Output: Sub-graph containing only activated switches

4. Experimental setup

- To evaluate the proposed method we used RYU as controller of the network.
- Here we used Mininet Simulator to create the topology of the network.
- The *"pingall"* command in Mininet can be seen all the hosts could communicate together or not.
- Implemented the basic STP method and proposed method for preventing loops in SDN architecture.

5. Discussion and Conclusion

- SDN is a novel networking paradigm in which the control plane is decoupled from the forwarding plane.
- STP is used to prevent loop in layer 2.
- In our method, the SDN controller received much fewer broadcast packets and CPU utilization.

6. References

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[3]. Irawati, I.D. and Nuruzzamanirridha, M., "Spanning Tree Protocol Simulation Based on Software Defined Network Using Mininet Emulator." In *International Conference on Soft Computing, Intelligence Systems, and Information Technology*, pp. 395-403, 2015.