Lightweight Packet Loss Detection and Multicast Delivery Tree Recovery in SDN

Siva Sairam Prasad (cs14resch01003@iith.ac.in), Kotaro Kataoka (kotaro@iith.ac.in)

Indian Institute of Technology Hyderabad, India

Outline

Monitoring quality of multicast streaming is difficult because 1) generally intermediate multicast routers and switches do not maintain the fine-grained state about multicast flow and 2) sampling QoS statistics from destination clients introduces significant operational overhead. Therefore, its difficult to properly locate where packet losses happen and how severe they are. This paper proposes a mechanism to detect and locate packet losses using a packet tagging technique in Software Defined Network (SDN). Our system also dynamically recalculates the multicast delivery tree to bypass a lossy link and mitigate packet loss for the tree.

Problem Description

- In traditional network it is difficult to detect and impossible to locate packet loss for multicast in real-time.
- With the evolution of SDN, calculating packet loss at link level is not feasible in real-time due to variable bit rate and variable duration of the flows.
- By using short lived test flows can get the packet loss at link level, but they lead to overhead in the network and also more TCAM consumption.
- Need to utilize the unused links that are non-lossy for multicast delivery tree calculation.
- Recalculation of entire multicast delivery tree whenever packet loss happens leads to frequent interruptions to the users, also for those are not affected by packet loss.

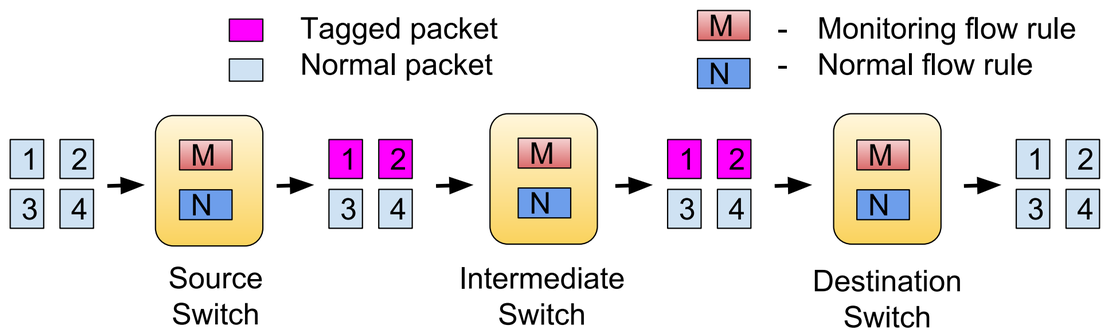

Figure 1: Packet Tagging Mechanism

Proposed solution

Packet Loss Detection

- Install short lived monitoring flow rules on existing traffic.
- Tag packets based on fixed time intervals as shown in Figure.1 for monitoring at source switch.
- Monitor the tagged packets at intermediate switches and remove tag before reaching the destination.
- Get packet loss statistics from monitoring flow rules in periodic intervals.
- Calculate packet loss from statistics and also deduce the lossy link location.

Multicast Delivery Tree Recovery

- Bypass the lossy link in the tree.
- If bypass is not feasible then recalculate the partial tree that is affected by packet loss.

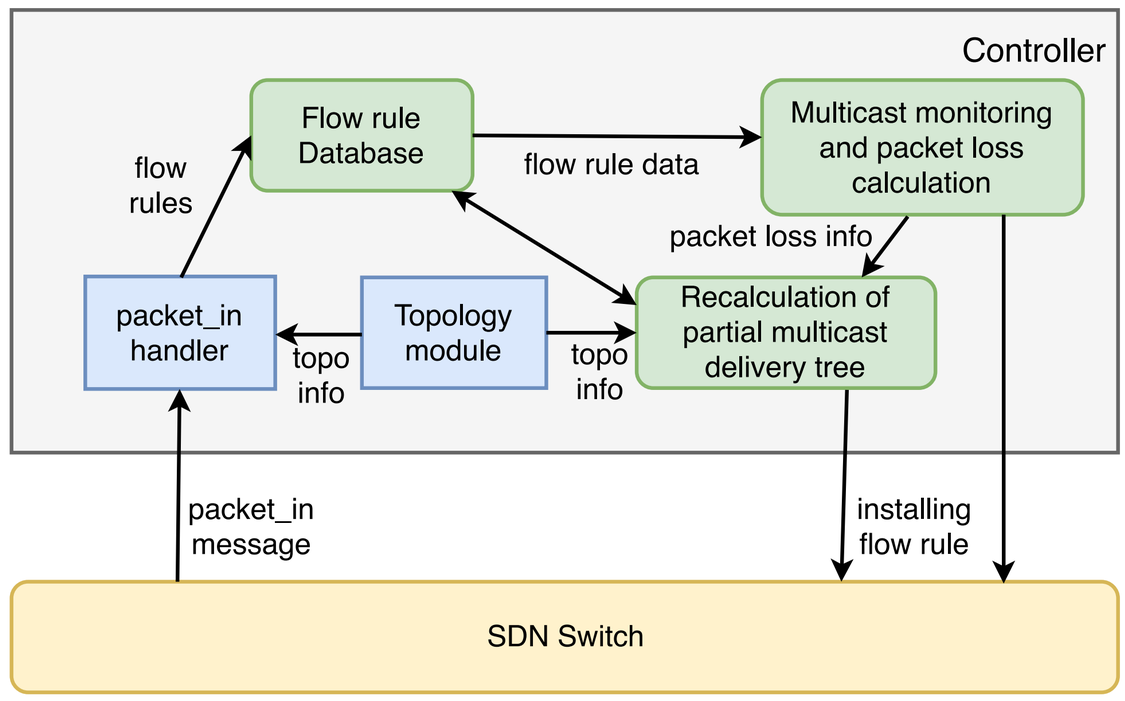

Figure 2: System Diagram

Experimental Setup & Preliminary Results

Network Configuration using Mininet

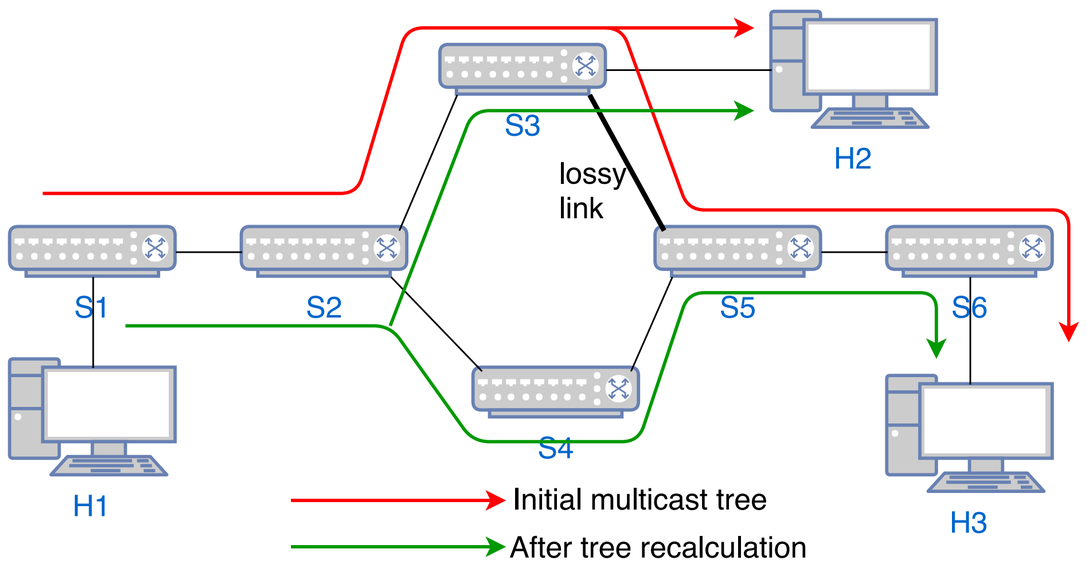

Figure 3: Network Diagram

- In the above network diagram S1-S6 are SDN Switches, H1 is multicast source and H2,H3 are multicast destinations.
- Packet loss rate for (S3,S5) is 10%, for all other edges there is no packet loss.
- Initial and recalculated multicast delivery tree are shown in the above figure.

Preliminary Results

- As shown in Figure 3, the recalculation is done via partial tree recalculation because bypass is not possible.
- Packet loss calculation for every 10 s, time taken to recalculate for one link on above network is 1.8 ms.

Discussion Points

- Minimize the control overhead for monitoring, scalable to large networks.
- Time complexity for each lossy link to bypass is O(E logV), for partial recalculation is O(DE logV) here D is the affected destinations.