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OVERVIEW OF SOFTWARE DEFINED NETWORKS AND MESH TREE PROTOCOL

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Abstract - *In this paper we present a comprehensive survey on Software Defined Networks and Mesh Tree Protocol. It compares Software Defined Networks and traditional network. We present the key blocks of SDN architecture and also provide an in depth analysis of Software Defined Networks hardware infrastructure .We also discuss the Mesh Tree Protocol working and evaluation of performance metrics. We discuss the challenge of Software Defined Networks[8]*

Key Words: **Software defined networks, Mesh tree protocol, VID advertisement, Spanning tree protocol, Medium access control.**

1.INTRODUCTION

Computer networks are usually built by connecting large number of network devices such as routers and switches which are used for forwarding packets using many protocols implemented on them. Software Defined Networks (SDN) is also referred to as "programmable networks". SDN is a networking platform in which forwarding hardware is decoupled from control decisions[1]. It simplifies the network management process and increases the efficiency. SDN consists of control plane and data plane .In SDN , the network is logically centralized such that the software based controller (control plane) and network device(data plane) become a very simple packet forwarding device and the data plane can be programmed using an open interface[2].

2. ROUTING PROTOCOLS IN SDN

2.1 SPANNING TREE PROTOCOL

Spanning tree protocols (STP) is basically used to avoid loops in Local Area Networks; because a loop in the networks can get the entire network down. In order to prevent these loops we use the spanning tree protocol in our network.

2.2 SPANNING TREE ALGORITHM

The STP is based on the Spanning tree algorithm. To avoid loops in the network, the bridges collectively select a root bridge and then compute a spanning tree from the root bridge. In STP, each bridge initially assumes that it is the root and announces its bridge ID. This root bridge information is used by the neighboring bridges to select the root bridge. The unique bridge ID is a combination of a bridge priority and the bridge medium access control (MAC) address. A bridge may supplant(swift) the current root if its bridge ID is lower. Once a root bridge is selected, other bridges then resolve their connection to the root bridge by listening to messages from their neighbours[3]. These messages include path cost information. This continues till the topology converges to be a single tree topology.STP always has high convergence times due to topology changes[4].

2.2 MESH TREE PROTOCOL

Mesh tree algorithm (MTA) work similar to STP. In addition it has an advantage of tracking all its adjacent node paths. These tracked paths are classified as primary, secondary, tertiary based on various factors such as COST and the NUMBER OF HOPS to reach a node. Every nodes has redundant branches and hence LINK FAILURE in a node can be avoided. If a link failure occurs it traces out next available path and hence BACKUP path is computed .In Mesh Tree Protocol no re-computation is required[5].

2.3 MESH TREE ALGORITHM

IDEA of MTA

- To reduce Convergence time that occurs in Spanning tree based protocol
- To avoid Link state routing complexity
- To identify redundant paths using MT_VID.

The meshed tree algorithm allows construction of logically meshed trees from a single root switch to a number of switches in a distributed fashion and with local information of all the switches.

Bridge ID: For the operation to be done in a topology using MT algorithm bridge IDs are necessary. These bridge IDs have to be unique only within the switched network . The MT_VIDs would be thus simple, and the first value in the MT_VID will be the root bridge ID. An MT_VID describes a path that connects the root to a particular switch or other switches in a topology. The elements of the MT_VID are derived from the root bridge ID and the outbound port numbers of the switches in the path to that particular switch in the topology[7].

In a single physical topology, a switch can be associated with more than one MT_VID and thus:

1. A Meshed Tree consists **all** possible paths from the root to each switch.

2.More than one path to each switch is always supported

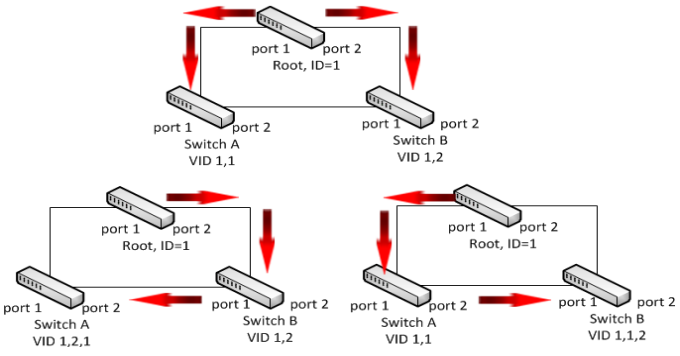

Figure 1: One physical topology - MT topologies and MT_VID Creation

Consider a three-switch single loop topology shown in Figure1. In the upper left is the physical loop topology. In order to prevent traffic from looping, we might impose any one of several logical tree topologies like those shown. In the upper right, the topology is optimized for transmissions associated with switches connected to the root. But in the lower left and lower right, the topology is optimized for nodes connected to switches A and B, respectively. These tree topologies do not provide for redundancy. Meshed trees utilize all of the pathways and because the pathways are pre established, failover times to redundant links are near zero[8].

VID TABLE

SWITCHES	MT_VID
Root switch	1
Switch A	1.1,1.2.1
Switch B	1.2,1.1.2

Table 1: Three switches single loop topology

The root switch VID=1 which is the MTS switch and the Non MTS switches have MT VID=11,12,1221 etc.

3. PROTOCOL DESCRIPTION

The topology constructed and resolved using MTA will have multiple paths between the root and other switches. These overlapping trees are usually created and maintained through the MT_VIDs. A Meshed Tree Switch (MTS) that has membership on a tree will be assigned an MT_VID that is associated with that tree and a particular path back to the root. Critically, switches having more than one pathway back to the root will be classified as primary, secondary, tertiary, etc., memberships in multiple trees, each having a separate, unique and unrelated MT_VID. MT_VIDs are stored in a table and have an association with ports through which they were established in a topology

VID:

VID is formed by the combination of unique ID of a node and the leaving port connected to the adjacent peer. This unique identifier is used to show the path from root to destination .

SELECT THE ROOT NODE - Every switch in the topology advertises its unique ID. The switch with lowest identifier is the root switch .This root switch collects all the information about the peer switches via a message called a **VID ADVERTISEMENT**.

MT_VID- It is combination of current nodes VID and leaving port through which the node is advertising.

In Mesh Tree Protocol none of the ports are blocked during the operation .MTP switches stores multiple paths obtained from their peers.

MAIN VID TABLE- It consists three best path and best path is decided based on Hop counts and path cost.

BACKUP VID TABLE- All the paths that do not fit in main VID table are stored in this table. During VID advertisement only the VIDS that are part of main VID table are advertised thus limiting control overhead when a failure occurs.NON MTS switch request MTS switch for VID using JOIN MESSAGE.

When MTS receives the join message it sends the VID advertisement from the port using the combination of main VID table entries concatenate with number of leaving port through which it connects non MTS switch.

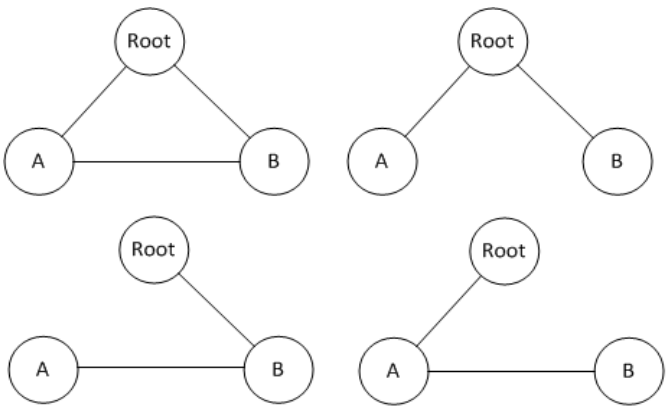

Figure 2: One physical topology - three logical tree topologies

4. LOOP AVOIDANCE

MTP is mainly used for loop avoidance as many redundant loops are there for a single node. If a active path to a node from root node fails then it takes the alternate efficient path to reach that node. This is done using VID table. There are many redundant paths stored in VID table. The best three paths such as primary, secondary, tertiary are selected and saved in VID table. Any one of these paths are selected in case of failover links Other than these paths they are stored in back up table [6].

4.1 CONVERGENCE TIME

The state in which the set of routers have the same topology information about topology in which they are connected.

Convergence means when a routing protocol is enabled every router which participate in the topology will exchange information about topology. The information depends on routing protocol.

State of convergence means all the routers will have all the information about the routing protocol. Any change in the topology cause changes in the routing table and the convergence state is temporarily disrupted Convergence time is how fast the router reaches state of convergence.

5.CONCLUSION

The convergence times are noted and the hop counts depend on the no of nodes in a topology. With more complex and meshed topologies the convergence times and hop counts can vary significantly. Thus we compare STP and MTP convergence time and loop avoidance and concluded that STP has higher convergence time than MTP and MTP is more efficient than STP

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