

Layer 2 Query Protocol: Topology Algorithm

Summary

This document is a technical overview of the algorithm used to construct the switching topology information used by the Layer 2 Query Protocol.

Definitions

Switch. A switch is defined as a device with which we can communicate through SNMP that advertises layer 2 services but not layer 3 services and which has a switch forwarding table.

QID. The QID of a network device is a unique ID code determined by finding the physical address of each interface on the device, storing them in a buffer in order of ascending SNMP ifIndex, and running the MD5 algorithm over the buffer. The resulting 16-octet message digest is the QID. This information can be used by L2QP to identify switches without disclosing their IP addresses.

Algorithm

The algorithm for determining switch topology is given in terms of a main algorithm *Main()* which makes use of a supporting recursive function called *Topology()*. The logic of both routines follows.

Main(RI):

-- *RI* is the IP address of the router in this broadcast domain.

1. Let *MA* be an empty associative array where each key is a MAC address and each value is the IP address of the device which owns that MAC address.
2. Let *UA* be an empty associative array where each key is the IP address of a switch and each value is the ifIndex value for the uplink port for that switch.
3. Let *PA* be an empty associative array where each key is a combination of switch IP address and port number and each value is a list of IP addresses of switches found on that port.
4. Let *L* be a list of the IP addresses of all switches found in the broadcast domain. It should be possible to determine this information using an SNMP get-request packet sent to the broadcast address of the broadcast domain.

5. Let RM be the MAC address of the router in this broadcast domain.
6. For each IP address S in L :
 1. For each MAC address M associated with S , let $MA[M] = S$ and append M to a buffer. We get this information from the SNMP agent on S .
 2. Use the buffer accumulated in the previous step to find the QID of S .
 3. For each valid entry (P, M) in the switch forwarding table for S , where P is a port number and M is a MAC address:
 1. If $M = R$, then let $UA[S] = P$.
 2. If $MA[M]$ is defined, then let $PA[S, P] = MA[M]$.
 4. If $UA[S]$ is not defined, then let $UA[S]$ be equal to the highest-numbered active port P for which $PA[S, P]$ is empty.
7. Call $Topology(RI, L)$.

$Topology(C, L)$:

- C is the IP address of our current "parent" device.
 - L is a list of switches known to be below C in the topology tree.
1. If L is empty, return.
 2. For each port P on C where $PA[C, P]$ is not empty:
 1. If $P = UA[C]$, then skip this port.
 2. Let L' be the subset of L found in $PA[C, P]$.
 3. For each IP address S in L' :
 1. For each IP address S' in $L' - S$, if S is in $PA[S', P]$ and $P \neq UA[S']$, then skip this address.
 2. Store a connection from (C, P) to $(S, UA[S])$.
 3. Call $Topology(L', L' - S)$.