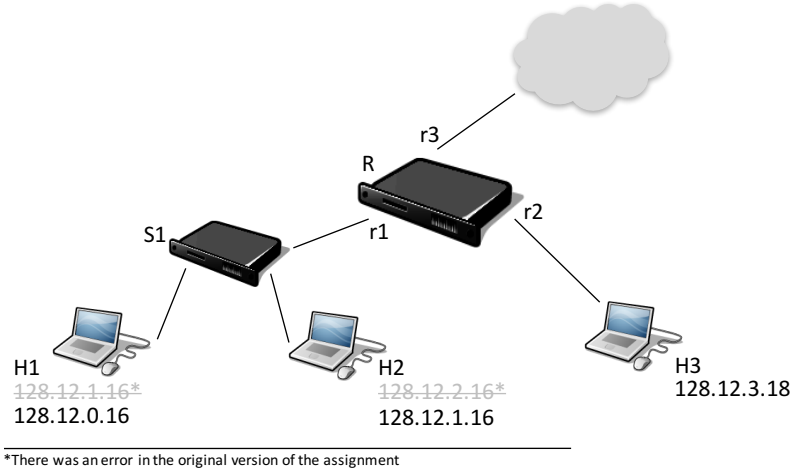
Homework 2: IP

Due: 11:59 PM, Oct 19, 2017

Contents

1 IP Forwarding

Answer the following questions based on the diagram below. S is a switch, and R is a router, and r1, r2, and r3 are network interfaces on the router. Suppose the hosts all know the IP addresses of the other hosts.



1. You are configuring this network manually. H1 and H2 are in the same subnet, and H3 is in a different subnet. What are the most specific subnet masks for H1, H2, and H3, to make this happen?

   H1's address is 128.12.0.16, H2's address 128.12.1.16, and H3 is 128.12.3.18.

   For H1 and H2 to be in the same subnet, the most specific subnet mask is /23, 255.255.254.0, for the network address 128.12.0.0.

   For H3, the most specific mask is /30, or 255.255.255.252, for the network address 128.12.3.16.

2. Now you have to choose the IP addresses for the router interfaces. Assuming that you give to each one the smallest possible address in their respective subnets, what IP addresses do you give to r1 and r2? Note in any subnet, you cannot use the first and valid address, (e.g., 0 and 255 for a /24), because these are the network and the broadcast addresses, respectively.

   r1 should be 128.12.0.1, and r2 should be 128.12.3.17. These are the first valid address for their respective subnets, after the network address.

3. H1 wants to send IP packets to H2. What ARP request does H1 broadcast before doing so? Why?

   H2 is in the same subnet as H1, so H1 will send an ARP request asking 'who has 128.12.1.16 tell 128.12.0.16'.

4. H1 wants to sent IP packets to H3. What ARP request does H1 broadcast before doing so? Why?

   H1 sends an ARP request for the Mac address corresponding to the IP address of the router r1: "who has 128.12.0.1 tell 128.12.0.16".

   The request is for the r1's physical address, not H3. The subsequent IP packet sent to H3 will have H3's IP address as the destination, but will be sent to r1's physica address.

5. You leave for a moment and your friend comes, and manages to mess up with H1's network configuration. When you come back, you notice that a traceroute from H1 to H2 is going through the router, while a traceroute from H2 to H1 does not. Everything else behaves as before. You then notice that your friend changed the netmask for H1. What change would explain this behavior?

   Your friend changed the network mask of H1 to be a /24, or 255.255.255.0. With this mask, H1 thinks that H2 is in a different subnet, and thus sends the packet destined to H2 to the router. The router knows how to get to H2 and sends the packet correctly. In the return path, since H2 still has the right network mask, it sends the packet directly to H1, without going to the router.

6. The MAC addresses of H1, H2, and H3 are, respectively, 04:12:01:00:01:01, 0a:be:12:00:01:01, 04:12:01:23:4e:12. Given this, what can you say about H1 and H2, and about H1 and H3?

   The main conclusion is that H1 and H3 share the same manufacturer. The fact that H1 and H2 share the least significant bits is coincidental and does not have any meaning.

7. The router is part of a routing protocol, and wants to advertise to the rest of the world that they can reach the subnets to which H1, H2, and H3 belong. If it only advertises one prefix, what is it?

To cover H1, H2, and H3, the router should advertise prefix 128.12.0.0/22.

2 Routing

A router has the following routing table:

Network	Interface	Next Hop
10.1.4.0/24	s1	directly connected
10.1.6.0/24	e0	10.1.1.2
10.1.6.64/28	e1	10.1.2.2
10.1.6.64/29	s0	10.1.3.3
10.1.6.64/27	s1	10.1.4.4

What will the router do with a packet addressed to:

1. 10.1.6.65 ?

   matches 10.1.6.64/29, port s0

2. 10.1.6.75 ?

   matches 10.1.6.64/28, port e1

3. 10.1.6.93 ?

   matches 10.1.6.64/27, port s1

4. 10.0.6.66 ?

   does not match any prefix, packet dropped. This question was void, as we didn't talk about what would happen for a miss in a routing table.

3 More routing

1. Give one advantage of distance vector routing over link state routing.

DV sends less messages on the network, require less memory.

2. Give one advantage of link state routing over distance vector routing.

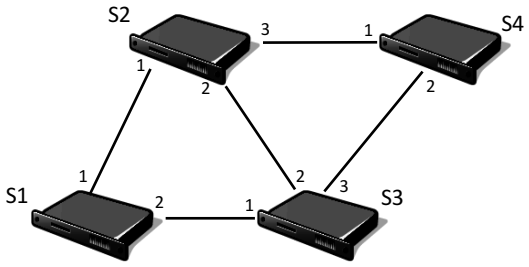
LS has no loops; is more robust to wrong information; has bounded convergence time, which is the time it takes for a node's broadcast to reach all nodes, or O(diameter).

3. Why is path vector routing immune to count to infinity problems?

Because if a node receives a route information and its own id is part of the path, it will not select that route.

4 Spanning Tree

You foolishly connected your four switches according to the figure below, and forgot to enable the spanning tree protocol.



1. What happens when a host decides to send a packet on this network?

The packet will be broadcast on each switch to all ports that are not the incoming port, which will cause an exponential replication of the packet around the loops in the topology. This is called a broadcast storm, and won't let any packets get through.

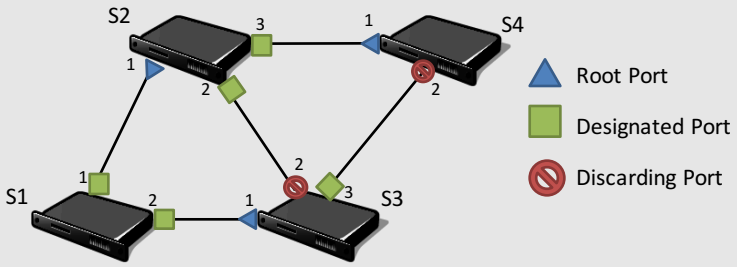
2. After you recover from the above incident, you decide to turn on STP on the switches. What is the final state of the network once the protocol converges? (For each switch port, mention whether it is in one of the three states: root port, designated port, or discarding port). Assume that ties are broken based on the numeric switch id.

See the figure.

A root port is the port a switch uses to reach the root. This is the port through which the switch received the lowest cost update from the root.

A designated port is the lowest cost port in a segment. In a switched network like this, each link is a segment with two connections: the ports on the switches on either side of the link. It is the port on the link that is closer to the root.

A port that is neither root nor designated is a discarding port.



Port	Status	Port	Status	Port	Status	Port	Status
S1.1	Designated	S2.1	Root	S3.1	Root	S4.1	Root
S1.2	Designated	S2.2	Designated	S3.2	Discarding	S4.2	Discarding
		S2.3	Designated	S3.3	Designated		

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