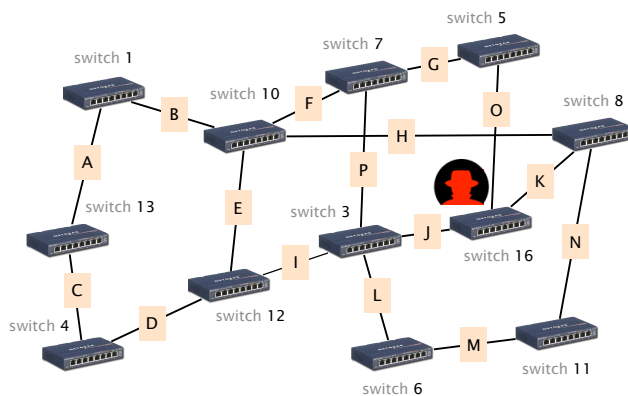# Communication Networks

Exercises week 5 & 6 – Ethernet, Switching, Internet Protocol & Forwarding

Spanning-Tree (Exam Style Question)

Consider this network composed of 12 Layer 2 (Ethernet) switches.

Compute a valid spanning tree, with and without hacker

a) Use the Spanning-Tree Protocol (STP) described in the lecture to compute a spanning tree. The numbers next to each switch indicate the switches identifier (switch 1 has ID "1"). Each link is labeled with a letter. Indicate the set of links (the letters, in alphabetical order) that are not part of the STP after the protocol has converged.

b) As described in the course, STP is not the most secure protocol. Assume now that a hacker managed to take over switch 16 and starts pretending that the switch ID is "1". Concretely, there are now two switches with ID "1" in the network. Indicate the set of links that the attacker will manage to attract traffic from, once the protocol has converged. Is the network still connected?

IPv4 vs. IPv6

a) In the lecture you heard about IPv4 and IPv6. Why was IPv6 introduced? What is the main difference?

b) How many IPv4 and IPv6 addresses exist? Is it possible to use all the addresses for hosts in the Internet?

c) Assuming there are 7.5 billion people in the world, how many IPv4/IPv6 addresses are theoretically available per person?

d) Even though IPv6 has been standardized more than 10 years ago, it still has very limited coverage. What are the reasons why the deployment of IPv6 is so slow?

IPv4 Calculations

Each row in the following table describes an IP network. Fill in the missing values.

Slash–notation	Netmask–notation	First usable address	Last usable address	Broadcast address
10.0.0.0/24				
126.127.128.0/17				
	12.34.32.0/255.255.224.0			
		222.208.0.1	222.223.255.254	
		123.45.67.225		123.45.67.255

The Art of Defaulting Properly (Exam Style Question)

Consider this simple network configuration between ETH and Swisscom. Assume that ETH owns a large IP prefix 13.1.0.0/17, but only uses 13.1.0.0/24 to address its internal hosts. For simplicity, we assume that ETH and Swisscom operators configure their forwarding table statically and rely on the use of a default route (0.0.0.0/0).
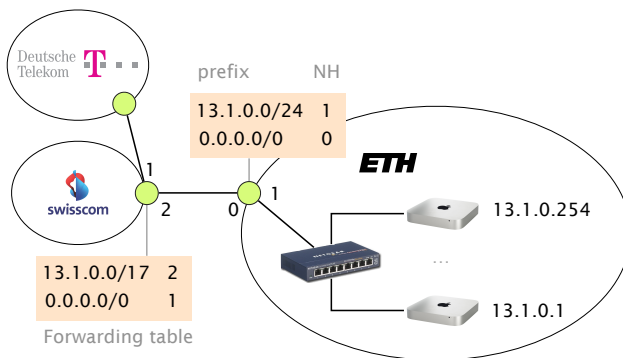
Where are my IP packets going?

a) How many IP addressable addresses does ETH "own" in total?

b) Give the first and last IP address that ETH can use for addressing a host.

c) Suppose Swisscom receives a packet for 13.1.0.66 from Deutsche Telekom. What is the path taken by this IP packet?

d) Suppose Swisscom receives a packet for 13.1.66.1 from Deutsche Telekom. What is the path taken by this IP packet?

e) What eventually happens to the packet for 13.1.66.1? As an attacker observing this, could you use this observation to congest the ETH-Swisscom link more easily? Explain why (or why not).