Communications and Computer Networks

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Exercise 3

1 Data Link Layer

1. What are the main tasks of the data link layer?

2. Explain the difference between *collision domain* and *broadcast domain.*

3. Explain the difference between *collision domain* and *broadcast domain* related to a hub-centric and a switch-centric network.

4. What is the difference between error detection and error correction?

5. Load the pcap-file *datalink2.pcap* with *Wireshark* and determine the existing data link protocols.

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2   Ethernet II

6. Sketch the individual fields of an Ethernet II frame (designation and length); explain their meaning.

7. Load the pcap-file *datalink1.pcap* with *Wireshark*. What network protocols are above the ethernet frame? Which Ethernet II packet field provides this information?

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3   MAC-Addresses

8. How long is a MAC address in the IEEE 802 standard? What is the order of the individual octets (bytes) and the bits in the octets of this address?

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9. What parts does the MAC address consist of and what do they mean?

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10. What is the meaning of the first two bits (bit 0 and bit 1) of the MAC addresses (universal addresses)?

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11. Which command can be used to display your MAC address(es) under Linux?

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12. Load the pcap-file *datalink2.pcap* with *Wireshark*, and determine the existing MAC-addresses (excluding the broadcast)?

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13. Load the GNS-project *SimpleEth.gns3project*, and start all devices.

Which commands can you use to determine the MAC-address of PC2 (without starting a console on PC2)?

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14. You have the following MAC-addresses of different NICs. Determine for every address, if it is a locally or globally administrated address. Can you further determine the vendor of the NIC?

- 5c:e9:1e:ae:64:aa
- 52:43:da:33:ad:1a
- 1A:00:0a:3a:ff:7a
- 00:90:93:39:c1:a2
- 0E:e9:1d:87:67:63

4   CRC

15. Assume you want to send the character X to a receiver. X has an ASCII-Code of 78_{10} and 1001110_2. You use the generator polynomial $x^4 + x^2 + 1 = 10101$. Calculate the transmitted data + checksum.

16. You receive the bit stream 1001110111. The used polynomial is 1101. Check, if the message was received correctly.
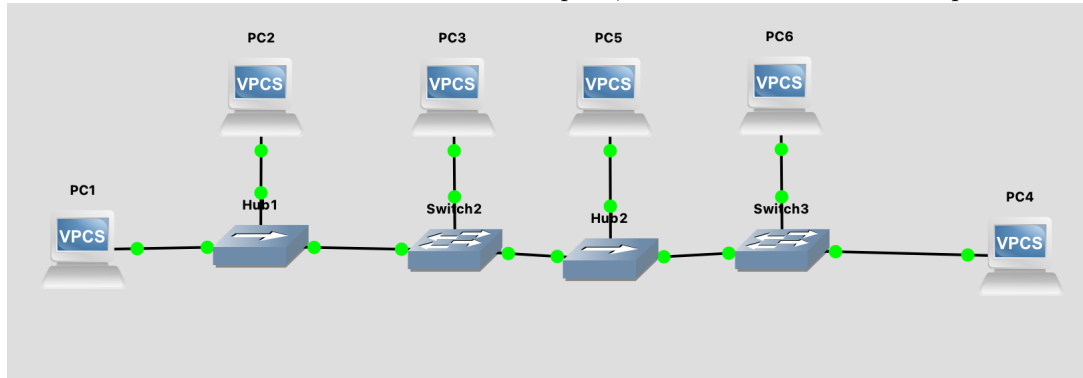
5 Hardware

17. What principle does a switch work on?

6 ARP

18. Load the pcap-file *datalink1.pcap* with *Wireshark*, what is the difference between the ARP packets of packet 1 and packet 3?

19. Assume you have a network configured as shown in the figure. PC1 sends an ARP-request to get the IP-address of PC5. Which PCs see the ARP-request, which PCs see the ARP-response?

7 VLAN

20. Why is the position of the IEEE 802.1Q VLAN-Tag at the same position as the EtherType in the original Ethernet II frame?

21. Why do you need a tagged or trunk port in a vlan-based network?

22. You have the following network infrastructure. Each of the PCs has a valid IP-address in the network 10.0.0.x with x = number of the PC (PC1 = 10.0.0.1, PC2 = 10.0.0.2, etc)

    The PCs 1, 3 and 5 are able to communicate, and PC2 and PC4 are able to communicate with each other, but PC1 cannot reach PC2 and PC4, and vice versa, PC4 is unable to communicate with PC1, 3 and 5.

    Explain the configuration of the network.

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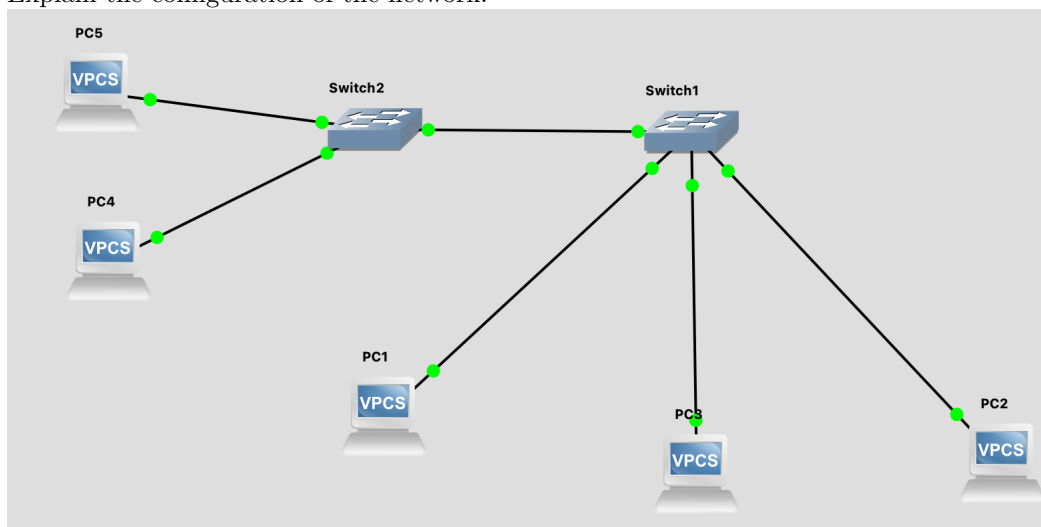
23. You have the following snipplet of a configuration of a network switch. Detect possible misconfigurations based on the physical properties of the interface:

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Switch(config-if)#do sh int gi 0/1
GigabitEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0050.0f0b.0819 (bia 0050.0f0b.0819)
 BW 10000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 10Mb/s
  input flow-control is off, output flow-control is off
  <snip>

Switch(config-if)# do sh run
interface GigabitEthernet0/1
 switchport access vlan 333
 duplex half
 speed 10
!
!
interface Vlan333
 no ip address
 arp timeout 1
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