# Link Layer Homework

1. Did you do the [Ethernet and ARP](http://www-net.cs.umass.edu/wireshark-labs/Wireshark_Ethernet_ARP_v8.0.pdf) Wireshark lab?
   * 1. **Yes**
2. Read about ARP spoofing [online](https://en.wikipedia.org/wiki/ARP_spoofing).
   1. Describe how an attacker would perform ARP spoofing to perform a person-in-the-middle attack.
      * + 1. **First, the person-in-the-middle sends a spoofed ARP message onto a LAN. Their goal is to get their MAC address to act as the IP address of another host so that traffic meant for the true IP is directed toward them instead.**
   2. Assuming a device has been on a network for awhile, devise a scheme where that device could detect that ARP spoofing is happening on the network and alert the network administrator.
      * + 1. **You would just need software that relies on some form of verification when using ARP responses where messages without certification are blocked.**
   3. If you could make any modifications to the link layer, what would you change or add to protect against ARP spoofing? Would that approach be feasible in real use?
      * + 1. **You could add some kind of cryptography encryption in the NIC that would have a public and private key for talking to routers and other devices on the LAN. It may add cost but would add protection against spoofing.**
3. List at least 7 protocols and the order they would be used when a user connects a new device to a network and goes to a webpage on their web browser for the first time. You can assume that no caching has previously been performed.
   * 1. **DHCP, UDP, IP, Eth, Phy, ARP, DNA, HTTP**
4. In this problem, we explore the use of small packets for Voice-over-IP applications.
   1. Consider sending a digitally encoded voice source directly. Suppose the source is encoded at a constant rate of 128 kbps. Assume each packet is entirely filled before the source sends the packet into the network. The time required to fill a packet is the packetization delay. What is the packetization delay in milliseconds, assuming that the packet is L bytes long?
      * + 1. **(L bytes \* 8)/128000kbps = L/16 msec**
   2. Packetization delays greater than 20 msec can cause a noticeable and unpleasant echo. Determine the packetization delay for L = 1,500 bytes (roughly corresponding to a maximum-sized Ethernet packet) and for L = 50 (corresponding to an ATM packet).
      * + 1. **1500 bytes/16msec = 93.75msec**
          2. **50 bytes/16msec = 3.125msec**
   3. What is the percent overhead associated with packets L = 1,500 bytes long and for L = 50 bytes long when the packet header is 20 bytes? Assume that L includes the header.
      * + 1. **Header bits/Transmitted bits \* 100%**
          2. **(20\*8)/(1500\*8) \* 100% = 1.33%**
          3. **(20\*8)/(50\*8) \* 100% = 40%**
   4. Calculate the transmission delay at a single switch for a link rate of R = 600 Mbps for L = 1,500 bytes, and for L = 50 bytes.
      * + 1. **L/R = (1500\*8)/(600\*10^6) = 0.02 msec**
          2. **(50\*8)/(600\*10^6) = 0.000666 msec**
   5. What are the advantages/disadvantages of using a small packet size?
      * + 1. **Smaller packets take less time for the computer to make and decode them allowing for less end-to-end delay. There would be more overhead however when trying to transmit large files which would benefit from larger packet sizes.**
5. What are the advantages and drawbacks of the following multiple access protocols?
   1. Channel partitioning
      * + 1. **Advantages:**

**No collisions, perfect fairness**

* + - * 1. **Disadvantages:**

**Max rate is R/N bps, even when only one node has frames to send**

**Fixed latency before a node can send data**

* 1. Random access
     + - 1. **Advantages:**

**single active node can continuously transmit at full rate**

**of channel**

**highly decentralized: only slots in nodes need to be in sync**

**simple**

* + - * 1. **Disadvantages:**

**collisions, wasting slots**

**idle slots**

**nodes may be able to detect collision in**

**less than time to transmit packet**

**clock synchronization**

* 1. Taking turns
     + - 1. **Advantages:**

**No collisions, fairness**

**Fully decentralized, efficient**

* + - * 1. **Disadvantages:**

**Rate less than R bps if only one node active;**

**Master is single point of failure**

**Token could get lost**