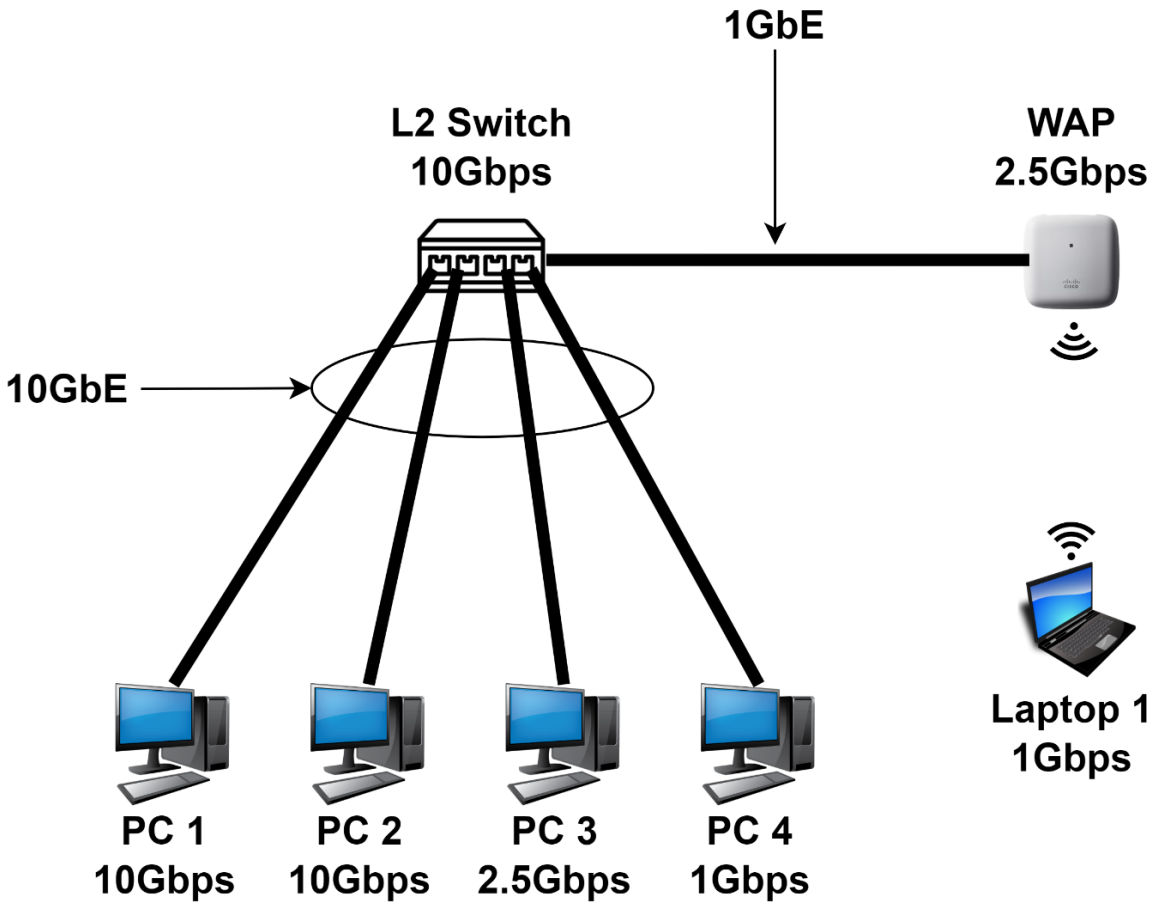

Figure 1

You have been given the network of Figure 1. The description of the network is the following:

- PC 1 and PC 2 are equipped with a 10Gbps network adapter. PC 3 is equipped with a 2.5Gbps network adapter, and PC 4 is equipped with a 1Gbps network adapter.
- The 4 PCs are connected via CAT6 ethernet to an L2 switch, which supports 10Gbps per port.
- The L2 switch is connected to a wireless access point (WAP), via a CAT5e ethernet cable.
- The WAP supports a 2.5Gbps wired connection and up to 4 wireless connections of 1Gbps each.
- Laptop 1 is equipped with a 1Gbps wireless network adapter and is connected to the WAP.

Answer the following questions:

1) What is the bandwidth between PC 2 and Laptop 1? Why?
2) What is the bandwidth between PC 3 and Laptop 1? Why?
3) What is the bandwidth between PC 4 and Laptop 1? Why?
4) How could you improve the bandwidth of question 3 above?

A second laptop is added to the network with a 1Gbps wireless network adapter, as shown in Figure 2 below.

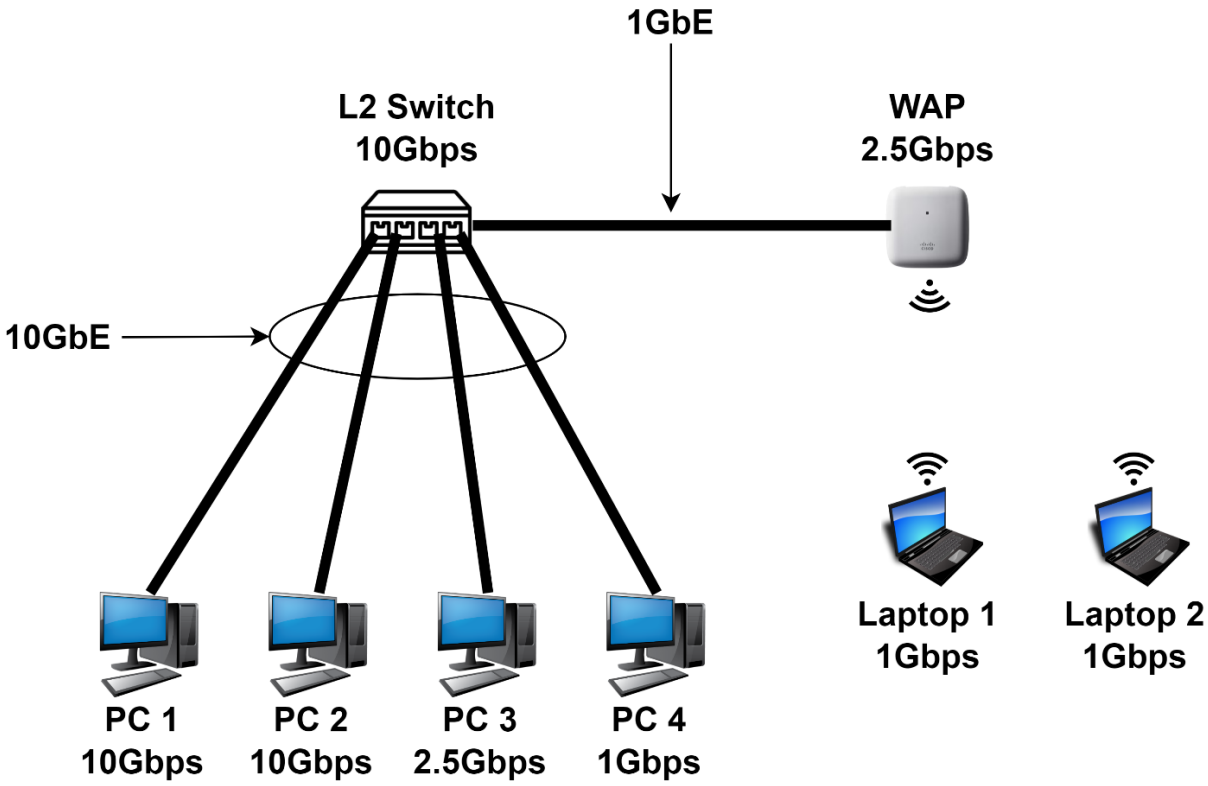

Figure 2

Answer the following questions:

5) If PC 3 communicates with both laptops simultaneously, what will the bandwidth of the connection be?
6) How could you improve the bandwidth of question 5 above?
7) If PC 1 communicates with both laptops simultaneously, what will the bandwidth of the connection be?
8) How could you improve the bandwidth of question 7 above?

Answers

This is relevant to all the answers below: a CAT6 ethernet cable can support 10Gbps, while a CAT5e ethernet cable can support 1Gbps.

1) The bandwidth between PC 2 and Laptop 1 is 1Gbps. PC 2 is connected to the L2 switch, which can support 10Gbps. The ethernet cable is CAT6, which can also support 10Gbps.

The wired connection of the WAP can support 2.5Gbps, but it is connected to the L2 switch via a CAT5e cable, which can only support 1Gbps. Additionally, the laptop is equipped with a 1Gbps wireless NIC. Therefore, the overall bandwidth between PC 2 and Laptop 1 is that of the slowest link, which is 1Gbps. In this case, we have two bottlenecks: the CAT5e cable and the laptop's NIC.

2) The bandwidth between PC 3 and Laptop 1 is 1Gbps. PC 3 is connected to the L2 switch, which can support 10Gbps. The ethernet cable is CAT6, which can also support 10Gbps. PC 3 and the wired connection of the WAP can support 2.5Gbps. However, the WAP is connected to the L2 switch via a CAT5e cable, which can only support 1Gbps. Additionally, the laptop is equipped with a 1Gbps wireless NIC. Therefore, the overall bandwidth between PC 3 and Laptop 1 is that of the slowest link, which is 1Gbps. In this case, we have two bottlenecks: the CAT5e cable and the laptop's NIC.
3) The bandwidth between PC 4 and Laptop 1 is 1Gbps. PC 4 is connected to the L2 switch, which can support 10Gbps. The ethernet cable is CAT6, which can also support 10Gbps. PC 4 can only support 1Gbps. The wired connection of the WAP can support 2.5Gbps, but it is connected to the L2 switch via a CAT5e cable, which can only support 1Gbps. Additionally, the laptop is equipped with a 1Gbps wireless NIC. Therefore, the overall bandwidth between PC 4 and Laptop 1 is that of the slowest link, which is 1Gbps. In this case, we have three bottlenecks: PC 4's NIC, the CAT5e cable and the laptop's NIC.
4) In order to improve the bandwidth of the connection between PC 4 and the laptop, we need to make several upgrades. We can upgrade the NICs of PC 4 and the laptop to 2.5Gbps, replace the CAT5e cable with a CAT6 cable, and replace the WAP with one that supports 2.5Gbps wireless connection. The wired connection of the WAP already supports 2.5Gbps. In that case, we will achieve 2.5Gbps bandwidth.
   In order to improve the bandwidth of the connection between PC 4 and the laptop to 10Gbps, we need to upgrade the NICs of PC 4 and the laptop to 10Gbps, replace the CAT5e cable with a CAT6 cable, and upgrade the WAP to one that supports 10Gbps for both wired and wireless connections.
5) If PC 3 communicates with both laptops simultaneously, the bandwidth will remain at 1Gbps, as explained in question 2. Although the total bandwidth of the WAP will be 2Gbps (1Gbps per laptop), and although the wired NIC of the WAP can support that bandwidth, the limiting factor is again the CAT5e ethernet cable.
6) In order to improve the bandwidth between PC 3 and the two laptops, we would simply need to replace the CAT5e cable with a CAT6 cable. That will allow for a bandwidth of 2Gbps total.
7) If PC 1 communicates with both laptops simultaneously, the bandwidth will remain at 1Gbps, as explained in question 2. Although the total bandwidth of the WAP will be 2Gbps (1Gbps per laptop), and although the wired NIC of the WAP can support that bandwidth, the limiting factor is again the CAT5e ethernet cable.
8) In order to improve the bandwidth between PC 1 and the two laptops to 2Gbps, we would simply need to replace the CAT5e cable with a CAT6 cable as explained in question 6.
   In order to improve the bandwidth between PC 1 and the two laptops to 10Gbps, we would need to make several upgrades. We would need to upgrade the NICs of the

laptops to 5Gbps each. We would also need to upgrade the WAP with one that supports 10 Gbps at its wired connection. Finally, we would need to upgrade the CAT5e cable to a CAT6.