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CSEN503 Introduction to Communication Networks
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Practice Assignment 1

Problem 1-1

List the available access technologies in your city. What are their advertised data rates?

Ans:

DSL is the prevalent technology in residential and business environments. On top of DSL, Wi-Fi is used to provide mobile access in Local Area Networks (LANs). LANs are networks of small sizes such as home networks and office networks.

Specific examples:

- At the GUC we use DSL to get Internet access to the whole university. To provide this access to individual offices, Ethernet is used (with several switches all over the campus). To provide mobile access, Wi-Fi is also used on top of Ethernet and DSL.
- At home we mostly use DSL. Wi-Fi can be used to provide mobile access as well.
- 4G cellular networks cover the entire country and provide access in high mobility situations.

DSL in residential areas typically has data rates from 30 - 100 Mbps. Businesses can get higher rates. 4G networks offer rates up to approximately 60 Mbps.

Problem 1-2

Six people are standing in a circle trying to have a conversation. Design a protocol to give each person a chance to speak in the following situations:

a) One of the six people is the manager. She is responsible for administering the conversation.
b) No manager is present. However, every person should be given a fair chance to speak.
c) One of the six is a manager. However, not every person has something to say all the time.

d) No manager is present. However, not every person has something to say all the time.

Ans:

First of all, this is called "medium access". It is a topic that will be discussed in detail later in the course. Second, note that there is no single answer to this question. Many protocols can be designed.

a) The manager can choose who is next to speak. No one is allowed to speak until told so by the manager. For example, anyone wishing to speak may keep their hand raised until given permission by the manager.
b) Many solutions are possible. For example, divide the time into one minute intervals. Then, divide each minute into 6 equal intervals. Each person gets one of those 6 intervals in turn and the process is repeated each minute. This is called "time division multiple access (TDMA)" and will be discussed in Lecture 2.
c) Same as "a)". The presence of the manager simplifies the solution.
d) You can use the same answer as "b)". However, it has the potential of wasting time when a person does not have anything to say during their slot. Another solution is for every person to listen for a fixed number of seconds before speaking. If everyone else is silent, this person may speak. This may save time but may also result in interference (people talking at the same time). This is called carrier-sense multiple access (CSMA). The decision to choose TDMA or CSMA depends on the load (how many people need to speak at different times). As the load gets higher, CSMA suffers more interference and TDMA has less chance of wasting resources.

Problem 1-3

You just bought a new house and you want to obtain Internet access. You have two choices: DSL or cable Internet (Hybrid Fiber Coax (HFC)). Which one would you choose in each of the following situations:

a) Your house is very close to the telephone company's central office.
b) Your neighborhood is over populated. Most people get cable television.
c) Your neighborhood is lightly populated.
d) The house is quite old and your land-line telephone calls are often not so clear.

Ans:

Please note that the answers to these questions are subjective. They are only intended to clarify the tradeoffs between DSL and cable Internet.

a) The quality of DSL connections depend on your proximity to the central office. If the house is close there is very good chance of getting good quality and higher rates. In this case, DSL can be chosen so that the connection is not shared with anyone (as in HFC).
b) Cable Internet uses the television network and the connections are shared. In an over populated area, there is a chance that there is a large number of people sharing the connection, which may degrade its quality. Thus, DSL can be chosen.
c) Cable can be used in this case as there is a smaller chance of degraded connection quality due to sharing. Cable Internet uses coaxial cables which have higher quality than the twisted pair cables used by DSL. Thus, HFC is chosen.
d) In this case, it seems that the wire connecting you to the telephone office is old and degraded. Thus, it will probably not support high data rates and quality communications. Thus, HFC can be chosen.