General (Telecom network)

Q1. (a) Communication can be categorized into two. *i.e.* Public and Personal communication. Explain the characteristics of each.

Public Communication means people like to flock together and enjoy. Example radio, TV, newspapers, websites etc. A person will not be upset by requesting other person's newspaper to read. Public communication is essentially a unidirectional and there is no strict method of verifying the information. The author of the service will carry his views.

Personal communication means a person will interact with another person to update his knowledge. Example chatting, gossiping, talking, telephone conversation. A person will be upset if he gets to know somebody is tapping into his telephone calls. Personal communication is essentially a bidirectional and the information can be verified instantaneously. Another characteristic of personal communication is it is interactive. If you ask a question from another person you will not wait for a minute for his answer. Letters or e-mails are also a personal communication method but with delayed interaction.

(b) Telecommunication is a powerful tool of personal communication. Why is it powerful?

Say you are visiting a friend going in a taxi. At the friend's location you find he is absent. You have wasted your time as well as your taxi fare. Are you going to ask the taxi man to refund the taxi fare since your target was not achieved? No

Imagine in the telephone network a similar situation. Customer A dials customer B. Customer B can be 100 kms away or 1000 miles apart. When B's telephone is ringing all the telecom equipment from A to B is utilized but the customer is not there to answer. Can telecom operators charge this call? No

That's why the telecommunication is a powerful tool. If a call subscriber does not answer there is no charge.

(c) How do you nameplate each communication node? (Numbering of a telecommunication terminal)

There are more than 2 Billion telephones in the world. One customer in one corner of the world can contact another customer in another corner of the world with a matter of a second. How to achieve this?

It is similar to human's name plating. The names will identify the humans to interact with another human.

Example John Smith

He will be called John in his village or town but if he goes out of his town or country his name will be evolved to John Smith since there can be many Johns in that environment. Similar situation exists for telephone numbering. Telephone numbering will have 3 components in general. These components are as follows

Country code- 1 to 3 digit numbers provided by ITU (Internatioanl Telecommunication Union)

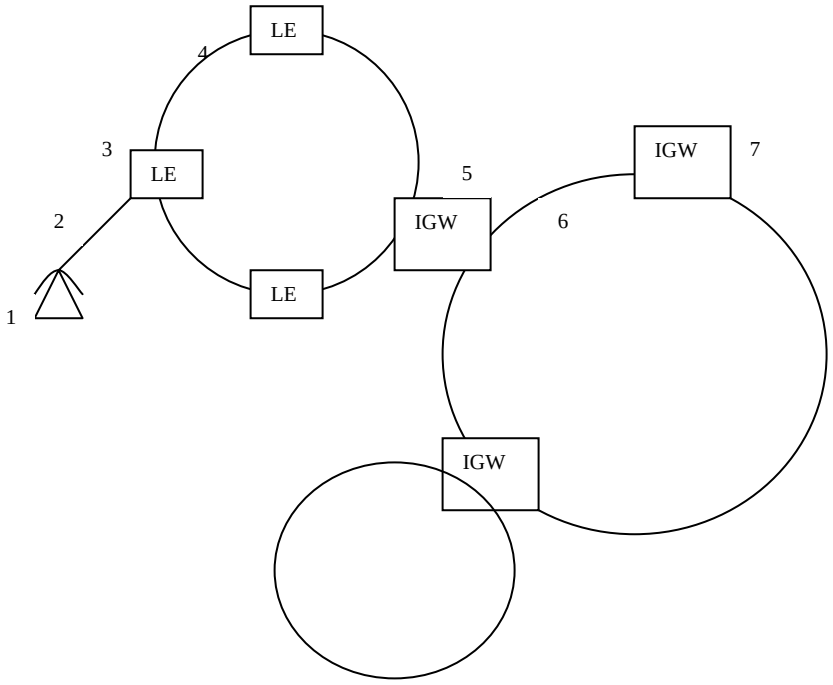
Area Code: 1 to 3 digit numbers provided by the local regulatory authorities.

Individual telephone number: Can go up to 15 digits including country and area codes (in the multi operator environment major significant digit will be allocated for each operator by the regulator).

In addition to above numbering the acess codes will be introduced to differeciate the calls within the local area to outside local calling area or outside the country. For example certain countries use a outside local calling area as 0 in addition to above area code and individual number. 00 will be used as access for international dialing in addition to the country code, area code and individual number.

The telephone network will have the following major elements;

1. Geographical location of the customer
2. Access network
3. Local switch/s
4. Domestic Transport Network
5. International Gateway
6. International transport network
7. Other country's Domestic Transport Network



a. Briefly explain the above elements.

Telephone network is similar to a distribution network. Assume a person is visiting A's house to collect a parcel to be transported to B's house. Assume A and B are far apart and A is in civil district 1 where B is in civil district 10. If the civil districts are further divided into towns A's location is in T_ATown and B's location is in T_B Town. A person who is collecting the parcel from A's house will bring the parcel to the T_ATown depot. At this depot he will check whether the parcel has to be delivered with in the T_ATown. If it is not he will deliver this parcel through a van (assume) to the district depot of T_A namely D1. At D1 he checks whether the parcel has to be delivered within D1. IF not he will send thorough a lorry all the similar parcels to the highest civil depots namely Provincial. At the Provincial depot A he will check whether the parcel lies within his province or outside. In this case outside and he will collect all the parcels and send through a container to a Provincial depot of B. From the Provincial depot B the parcel will follow through district depot D10 and through town depot of T_B to the B's house through a similar messenger who has collected the parcel.

In the telephone network the above delivery system is similar except once it is established from A to B it is bi-directional interactive transmission. By understanding the above phenomena access network means the messengers collecting and delivering parcels from A to T_A and from T_B to B. In telephone network this is normally a pair of wires and maximum can reach about 10 km.

Local Exchange is analogues to the local depots similar to T_A and T_B.

Domestic Transport- Consists of the network which the parcel has gone from T_A to T_B. For simplicity this will be shown of interconnection of all local exchanges.

International Gateway- The parcel example given above is only for domestic application. If the B customer is overseas the parcel will be delivered from province 1 to the airport which will air transport to the required country and the same phenomena that has been explained from provincial P_{10} to B customer will be followed. Hence in the domestic transport Internatioanl Gateway will be available to interconnect telephone calls to international.

International transport network- All International gateways will have access to each other in order to allow customers to direct dial from one country to another country. This will be achieved with international transport Network such as Satellites and in the modern days optical fiber cables. Hence international transport network will be simplified to a line diagram of interconnection between all international gateways,

Other Countries Domestic Transport Network- is similar to the explaination given for Domestic Transport Network only difference maybe depeding up on their civil administration districts the terminology that has been adopted above such as town, district, province may differ with the same concept.

b. Domestic transport network includes how a call is routed via many hierarchical

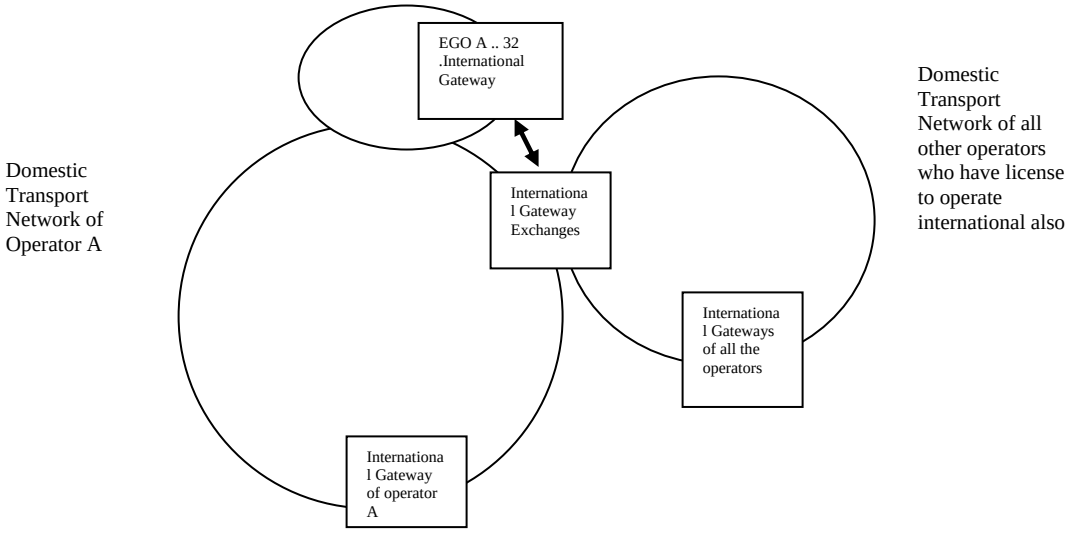
Telephone exchanges. Explain in detail the characteristics that you can find in a hierarchical switching network in Sri Lanka.

Local Exchange is the lowest in the hierarch and called primary switch. Next hierarchical exchange will be district exchange and called secondary switch. Next hierarchical exchange will be Provincial switch and call as tertiary switch. The last hierarch will be the international gateway.

c. Telecommunication is no longer a monopoly. Almost all the governments in the world are liberalizing telecommunication industry. In Sri Lanka too there are three fixed line operators with four mobile operators and with 30 external gateway operators are shouldering the responsibility of telecommunications service. Under this scenario interconnection plays a vital role for a healthy service provision to the customers of many operators. Modify the above schematic diagram to achieve the healthy interconnection between operators giving special reference to the fixed line operators. Briefly explain how the interconnection is achieved.

There are 2 major factors to be considered here. One is how to interconnect all the dometic networks of other operators. Second how to interconnect all international operators to all the domestic operators. Normally domestic operators who have license to operate internationally can have one interconnection exchange (depending upon traffic and areas, the numbers can be many). These interconnection points will hand over both domestic and international calls that has been received by one operator to the other operators. Normally the operator who requests a service of termination a call to the other operators network has to pay terminating charge to the other operator.

The external Gateway Operators does not have license to operate domestic network. Hence External Gateway Operators will be have interconnection to the International Transport Network and will interconnect with the license domestic operators of a given country. Same concept of interconnection charges will applied with the EGOs. The diagram is as follows.



Q3. The connectivity of one telephone customer to another telephone customer is achieved by the following 3 technical sections, which is a basic part of a telephone network.

1. Outside line plant
2. Switching
3. transmission

(a) Explain the physical demarcations and technical functions of each section.

(b) What is the function of the Main Distribution Frame (MDF)? Draw a sketch (line diagram) of an MDF that you have seen and explain the merits.

Q5. (a) 60% of the cost of telephone network is attributed to outside line plant. This involves digging by the side off the roads, ducting, concreting, installing manholes, drawing cables etc. The length of a pair of wires and its resistance will play an important role in the proper functioning of a telephone line. What are the technical limitations that you have to be careful with respect to the outside line plant?

(b) Today's voice communication will evolve to data communication tomorrow. In Sri Lanka too, this evolution is taking place. Introduction of (Integrated Services Digital Network) ISDN and ADSL (Asynchronous Digital Subscriber Line) is one example. Explain briefly ISDN and ADSL, and the limitations of outside line plant with respect to these services.

Q6. The access network can be either copper or radio (DECT – Digital Enhanced Communication Technology, CDMA – Code Division Multiple Access). Explain briefly the merits and demerits of each of radio in comparison with copper.

Model answers to the above questions will be uploaded in due course.