LESSON 30:
NUMBERING PLAN AND CHARGING PLAN

Objective

The objective of the numbering plan and Charging plan is to uniquely identify every subscriber connected to a telecommunication network and how the charging of the same is carried out.

Introduction

A telephone number is a sequence of decimal digits (0-9) that is used for identifying a destination telephone line in a telephone network. Telephone numbers are often assigned to lines that have other devices hooked to them such as faxes, modems, subscribers and network services. Each such endpoint must have a unique number within the public switched telephone network, and the number of endpoints determine the necessary length of the telephone number. It is also possible for each subscriber to have a set of shorter numbers for the endpoints most often used. These "shorthand" numbers are automatically translated to unique telephone numbers before the call can be connected. Some special services have their own short numbers (e.g. 1-0-0 and 1-0-1).

Normally occurring at the beginning that usually indicates

Numbering Plan

In the early stages of the development, a numbering scheme was confined to a single local exchange, and exchanges were identified by the names of the towns in which they were located. This scheme works as long as there is only one exchange per town. But as the subscriber volume grew, it became necessary to introduce more than one exchange in the town. Generally, a large centrally located exchange called the main exchange serving the main business center of the town, and a number of smaller exchanges known as satellite exchanges serving different residential localities, were used to cope with the growing traffic in a large area. The area containing the complete network of the main exchange, and the satellites is known as multi-exchange area. A common numbering scheme was then required for the area so that the digits dialed to identify a given terminating exchange do not vary with the exchange originating the call. For calls originating from a locating outside the multi-exchange area, there is a need to identify the area by a common code. The common numbering scheme is sometimes called a linked numbering scheme. In this scheme, all exchanges in town were collectively identified by the name of the town.

The introduction of Subscriber Trunk Dialing (STD) or direct distance dialing (DDD) for intercity and intertown long distance connections called for a national numbering plan, where multi-exchange areas are identified uniquely by numbers. Subsequent development of international subscriber dialing (ISD) makes it necessary to have an international numbering plan, conform to the international one.

A numbering plan may be open, semi-open or closed. An open numbering plan, also known as nonuniform numbering scheme, permits wide variation in the number of digits to be used to identify a subscriber within a multi-exchange area or within a country. A semi-open plan permits number lengths to differ by almost one or two digits. Today, this scheme is the most common and is used in many countries including India, Sweden, Switzerland and the United Kingdom. In the closed numbering plan or uniform numbering scheme, the number of digits in a subscriber number is fixed. This scheme is used by a few countries which include France, Belgium and the other countries in the North America.

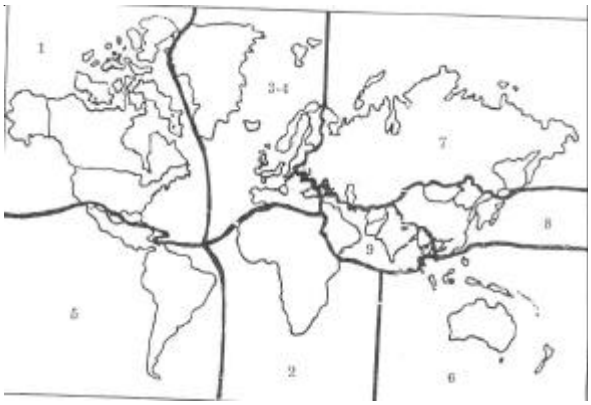

Fig.30.1 Illustration of various zones of world

For numbering purposes, the world is divided into zones as shown in fig.30.1. Each zone is given a single digit code. For the European zone, two codes have been allotted because of the large number of countries within this zone. Every international telephone number consists of two parts as shown in fig.30.2 (a). The country code contains one, two or three digits, the first digit being the zone code in which the country lies. For example, in zone 3, France has the country code '33' and Albania '355', and in zone 9, India has the country code '91' and Maldives '960'. In cases where an integrated numbering plan already covers an entire zone, the countries in that zone are identified by the single digit zone code itself. All the countries in the North America zone have the code as '1' and all the countries in the USSR have the code as '7'.

The number of digits in an international subscriber number is limited to an absolute maximum of 12. In practice, with a few exceptions, world numbers are limited to 11 digits. As a result, the number of digits available for a national numbering plan is 11-N, where N is the number of digits in the country code.

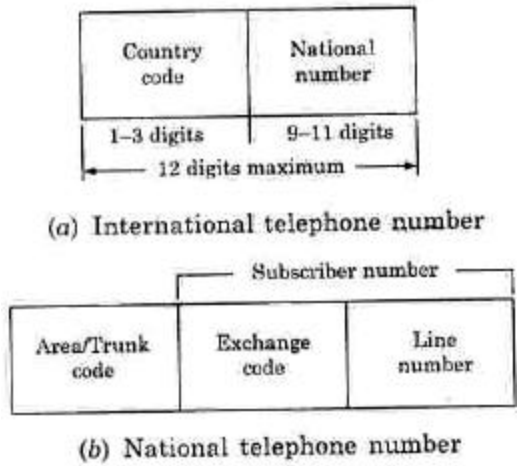

Fig.30.2 Telephone number structure

In general, a national number consists of three parts as shown in fig.30.2 (b). The area or the trunk code identifies a particular numbering area or the multi-exchange area of the called subscriber, and thus determines the routing for trunk call and the charge for it. According to CCITT international usage, a numbering area is defined as that area in which any two subscribers use identical dialing procedure to reach any other subscriber in the network. An exchange code identifies a particular exchange within the numbering area. It determines the routing for incoming trunk call from another numbering area or for a call originating from one exchange and destined to another numbering area. Subscriber line number is used to select the called subscriber line at the terminating exchange. In CCITT terminology, the combination of the exchange code and the subscriber line number is known as the subscriber number, which is the number, listed in the telephone directory.

In additional to dealing with the numbering structure, a national numbering plan must also deal with appropriate dialing procedures for local, national and international calls. The term 'local calls' here implies a call within a numbering area and the term 'national call' or trunk call between two different numbering areas within the same country. Basically, there are four possible approaches to dialing procedures:

1. Use a single uniform procedure for all calls, viz. local, national and international calls.
2. Use two different procedures, one for international calls and the other for local and national calls.
3. Use three different procedures, one for international calls, second for national call and third for local calls.
4. Use four different procedures, one for international calls, second for national call, third for local calls and fourth procedure for calls in the adjacent numbering areas.

Approach 3 is commonly used by most of the nations. Here a subscriber directory number is dialed for calls within a numbering area, a national number for national trunk calls, and an international number for foreign calls. A need to distinguish one class of the numbers from the other now arises. A standard techniques that has been adopted for this purpose by most of the countries, is the use of the set of one or more prefix digits. Since the first digit of the country codes can be any of the digits 1-9, the prefix digit conveniently starts with a zero. Usually, a single digit '0' prefix is used to distinguish between local call and national call. A two digit '00' or a three digit, e.g. '010' prefix is used to differentiate between national and international calls. The first prefix digit '0' routes a call to trunk exchange and the following prefix digit(s), if any, causes the cal to be switched to the international gateway exchange. The dialing procedure calls for the required prefix to be dialed followed by the appropriate (national or international number)

For India Number Format

Area Code : 2-7 digits

Subscriber Number : 4-8 digits

Trunk Prefix : 0

International Prefix : 00

Charging Plan

A telecommunication service calls for investment in capital items as well as operational expenses. The capital cost of telecommunications service includes costs of following:

1. Line plant
2. Switching systems
3. Buildings and Lands

Operating cost of telecommunication service includes costs of the following:

(1) Staff salaries

(2) Maintenance costs

(3) Water and Electricity charges

(4) Miscellaneous Expenses.

A telecommunication administration receives its income from its subscribers. The cost of shared resources like the switching equipment is amortized among a large number of subscribers over a period of time.

The cost of dedicated resources like the telephone instrument and the subscriber line must be recovered from individual customers. The operating costs must be worked out depending on the quantum of resources used in providing a service and the duration for which these resources are used.

A charging plan for a telecommunication service levies three different charges on a subscriber:

(1) An initial charge for providing a network connection.

(2) A rental or leasing charge

(3) Charges for individual calls mode.

An initial connection charge and the rental component cover a subscriber's share of the capital costs of the common resources.

The rental may be levied on a monthly, bimonthly, quarterly, half yearly or annual basis. Certain operating costs are incurred even if the network carries no traffic. These are covered, by the rental.

Charges for the individual calls include the operating costs in establishing and maintaining the calls, and a component for the

capital resources used. There are also other factors like marketing policy and government regulation. For example, often government regulations demand that revenue from a trunk network be used to subsidies the cost of local networks.

The technical progress in trunk transmission has resulted in significant cost reductions in trunk networks. But the local network services still continue to be expensive. By feeding revenue from one service to another, the subscribers are given reasonable tariff structures for both local and long distance services.

Charging for individual calls is accounted for by using either a metering instrument connected to each subscriber line or a metering register assigned to each subscriber in case of electronic exchanges. The "meter" word is used for both metering instrument as well as metering register. The count in the meter represents the number of charging units. A bill is raised by assigning a rate to the charging unit. The count is incremented by sending a pulse to the meter.

Two charging methods are available for individual calls:

(1) Duration Independent charging

(2) Duration Dependent charging.

Local calls (within a numbering area) are usually charged on a duration independent basis. The charging meter is incremented one unit for every successful call. Here, successful call means that the called party answers.

In the olden days when STD and ISD facilities were not available, the trunk calls were established with the help of operators. Thus, telephone operators were also responsible for the call charging. The subscriber meters are then useful only for local calls.

A flat rate tariff system is a charging system in which some fixed charges for an estimated average number of local calls are included in the rental. By using this tariff system, we can avoid the capital cost of providing meters and the operating costs of reading them at regular intervals and preparing the bills,

This scheme is advantageous to subscribers who make a large number of calls but unfair to sparing users. To reduce the disparity, business subscribers are charged a higher flat rate compared to domestic subscribers.

When flat rate charging is used, the subscribers naturally tend to make more calls. This necessitates local exchanges to be designed for a higher traffic level. A feature of combination of flat rate and call rate charging is used in some administrations. The rental covers a certain number of free calls per rental period and only calls above this number are charged if India uses this scheme.

This method is usually adopted from the marketing angle. This scheme offers no particular advantage in terms of reducing the capital or operating costs. With the introduction of STD and ISD, automatic charging demands that subscriber meters be installed. Due to data transmission, local calls tend to be longer in duration. Due to these reasons, flat rate charging is likely to be discarded soon.

In duration dependent charging, a periodic train of pulses from a common pulse generator operates the calling subscriber's meter at appropriate intervals. This method is also known as Periodic Pulse metering.

Here, the charge for a call is proportional to its duration. We have already studied that the traffic carried by a telecommunication network varies throughout the day. The quantum of switching equipment and junction plant provided in the network is based on the estimated busy hour traffic. During off peak hours, a large part of this hardware remains idle. To restrict the peak demand and encourage off-peak demand, the metering rate is being made varying with time of the day. This is done by suitably changing the pulse repetition frequency (PRF) under the control of a time-of-time day clock.

Tariff variation during a 24-hour period as in vogue in India at the time of writing of this book is shown in Table 30.1.

The meter pulse repetition rate is reduced to half of the normal rate during off-peak hours

Table 30.1. Tariff Variation in India for S.T.D. Call

Period of the day Meter Pulse Repetition Rate

Trunk calls are almost invariably charged on a duration dependent basis.

In addition, the charges also depend on the radial distance between calling and called stations. That is the trunk can charging is based on the distance-time product. When a trunk call is established through an operator, certain minimum charges are levied to cover up the labour cost.

A typical tariff in based on a minimum charge for upto 3 minutes together with a charge of less than a third for every additional minute. When STD facility is used to establish a long distance call, the charging is usually accounted for by pulsing the meter at an appropriate rate. Depending on the time of the day and the distance involved between the called and calling stations, the meter pulse repetition frequency varies.

Table 30.2 shows pulse repetition rates adopted for different distances in India during the normal rate hours. For other times, the pulse repetition rate is deduced as per Table 33.1.

Table 30.2 Distance Vs. Metering Pulse Rate in India.

Distance (in kms.) Metering pulse rate (pulses / min)

Automatic Toll Ticketing

In countries that employ a flat rate tariff for local calls, subscriber do not have meters and an automatic method known as Automatic Toll Ticketing or Automatic message accounting is used for trunk call charging. Here, a supervisory circuit is used to record information regarding the call on a storage medium such as magnetic disk or punched tape. This call is then processed by a computer and the bill is prepared.

When pulse metering is used, the subscriber receives a bulk bill giving a single total charge covering both trunk and local calls. The use of automatic toll ticketing enables an itemised bill to be prepared.

Present day electronic exchanges are capable of providing a detailed account of both the local and long distance calls made by subscriber call charging in ISD is carried out by the same methods as for STD. Call charging in ISD by pulse metering may encounter two difficulties:

1) First, on the longest and most expensive international calls, the pulse rate is often more than one per second. Therefore, a sluggish electromechanical meter may fail to operate properly.
2) Second, most electromechanical meters have 4-digit.capacity. Therefore, a heavy user may incur more than 9999 units of charge in the interval between meter readings, and thus fail to be charged correctly.

So, it is necessary to equip such subscriber lines with 5-digit meters.

In international connections, it is necessary to associate call metering with incoming and outgoing international circuits in addition to subscriber lines.

The incoming and outgoing international circuits enable operating administrations to apportion charges for calls passing through more than one country and to collect charges from other administrations as required.

Public telephone booths use coin operated boxes. These are of two types:

a. Prepayment public telephone booths
b. Postpayment public telephone booths

A user inserts coins before dialling in prepayment coin operated telephone. But, a user insert, coins after the called party answers.

In these cases, special signalling provisions are required between the exchange and the coin box. These include 'refund' signal in the case of prepayment coin boxes and 'open coin slot' signal for postpayment type coin boxes.

For subscribers having heavy point-to-point traffic, dedicated or lease lines are more economical than STD lines. Such non-exchange lines are provided by the administrations on round-the clock basis.

Charging is based on the distances involved. As the user traffic increases, there occurs a break-even point beyond which the leased line becomes more economical.

Notes