SIGNALLING IN TELECOMMUNICATION NETWORKS

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Abstract
This paper deals with signalling types achieving the phone connections on analogic and digital systems as well as advantages and disadvantages of each signaling type with a view to introducing of the new types of telecommunication networks that need ample signalling processes by adaptation to a structure orientated to processor control that is specific for modern and long term modern telecommunication networks.

Key words: phone connection, vocal frequence, signal way, digital signal.

I. INTRODUCTION

Phone signalling is the system of actions and procedures that take place during the dialogue between the telephone plant and telephone medium to assure, maintain and free the required connections by the calling [1].
A phone call is, for example, a speech established between two subscribers but also a fixed connection between a personal computer and a data base existing in another town or another country.

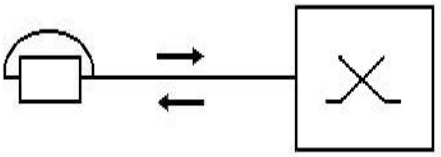
In any telecommunication systems signaling is a distinct, essential and omnipresent process.

Related to the original telephone plant call because it guides the whole signaling procedure its phone medium consists of its own subscribers and of the other telephone plants with which it has direct speech channels.

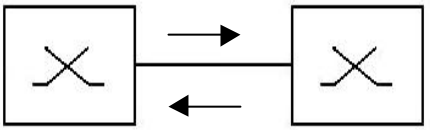
Therefore, the signaling information (signals) will be moved on the one hand on the subscriber line namely that referring to subscriber signalling and on the other on phone circuits (junctions) e.g. that belonging to the signalling between telephone plants.

We shall find it on the line linking the subscriber is plant with the local automatic telephone plant (fig.1a) by phonality that guide the subscriber to establish a phone link but also by another forms from which some are and the other are not perceptible for the subscriber.

To the same extent the signaling is presented on (intercommunication) circuits that link between them automated telephone plants (fig.1b) and inside each telephone plant (fig.1c).



a)



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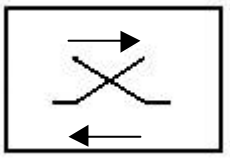

c)

Fig.1 Signalling signals

a) between the subscriber's plant and the telephone plant
b) between telephone plants
c) inside the telephone plant

Till the electronic commutation system appears the telephone signalling could be done only by rigid association of a signalling way to each call way. On this signalling way are sent various signals (e.g. state changing, pulses, vocal frequences combinations that use transmissions supports (even the telephone circuit, analogical or numerical, or a specialized circuit consisting of " tran-ran" wires [2].

For an electronic commutation using a computer control appears the possibilities of total dissociation of call way

from the signaling way, namely of total separation of control signals from the speaking .

This, is formed a specialized way between the control computers of electronic commutation telephone plants where the signals are moved by an elaborated form adapted to the computer processing way. This, "the signalling system on the common channel appears", worldwide normalized by CC ITT no.6 and CC ITT no. 7 systems. [3]

II. SIGNALS BETWEEN THE AUTOMATED TELEPHONE PLANTS AND TELEPHONE MEDIUM

A Signals between the subscriber's plant and the subscriber.

1. signals from the subscriber's plant:
   - call/ring off
   - numbering signal (DP (Dial Pulse); DTMF (Dial Tone Multi-Frequency); PBX (DTD (Direct Inward Dialling)

2. signals from telephone plant to the sub scriber's plant:
   -metering pulses (that can be got by poling; pulses of 12 or 16 kHz; pulses of 50 Hz);-quality of sounds regarding the call progress: (TD – dial tone; RA-call observe; TO - engage tone; TI- unexisted tone).
   - call to the called subscriber (75 vef/25Hz).
   - registered messages

It is found out that the signals between the telephone plant and the subscriber's plant can be classified in vocal signallings (numbered DTMF, quality of sounds, registered messages) and signals outside the band of 300 Hz … 3400 Hz.

3. For ISDN lines the signallings outside the vocal band are registered by the common signalling channel D.

B.Signalling between the telephone plants

The signallings between the automated telephone plants achieve the information change necessary for control of connexions between the connected subscribers in various telephone plants.

From the point of view of achieving signals between the telephone plants, these can be classified in: signallings on individual ways and signallings semaphore channel (common).

1. Signalling on individual ways
Signalling on individual way means that for signallings associated to a call to use an individual circuit that afterwards it is used for communication.

The signalling information can be grouped together in line signallings and selection signallings.

The line signallings are those achieved between the junction interfaces.

The line signalling on digital lines is achieved by channel 16 and it is regulated by the signalling system CC ITT 2- the digital version.

2. Selection semnalling referrs to information change between the control units of telephone plants that control the connexions achievement. They are aimed to transmit the dialed number figures necessary for the signal guiding, to transmit the category to the caller (signals of which sens is forward) and the condition of the called line signals of which sens is backwards).

The selection signals used in the telephone network can be achieved by C.C. pulses or multifrequence signals (for example, the signalling system ITU R2 no.5 or no. 4).
The support of signalling transmission can be analogic or digital (channel 16 of the digital line MIC) [4],[5],[6].

By using the signaling system R2 ITU is assured the signals transmission forward (from the parent plant to the terminal plant) and signals backward (from the terminals plants to the parent plant). These are coded signals in code 2/4, 2/5 or 2/6 MF (multifrequency) that is for a code 2/m, simultaneously are sent on line two frequencies of those "m" accessible for signalling.

Forward signals are signals that transmit from the parent plant to the terminating plant and they can have the following frequencies:

$$F_i=(1380+i*120)\text{Hz, where } i=0,1,2,3,4,5 \quad (1)$$

The forward signals can have a double signification and they are known as signals of group I and II.

Backward signals (transmitted from the terminating plant to the parent plant) are used to transmit figures requirements of the dialed number, requirement of the called category or in order to transmit information about the state of the called subscriber.

The frequencies associated to the back-ward signals transmitted in the code 2/4, 2/5 or 2/6 MF are got using the following relation:

$$F_j=(1140-j*120)\text{Hz, where } j=0,1,2,3,4,5 \quad (2)$$

The backward signals can have a double signification and they are known as signals of group A or group B. The selection signalling R2 ITU must abide by the main cycle transmission-reception.

III. SIGNALLING BY CHANNEL – SEMAPHORE No. 7 ITU

Signalling system by semaphore channel uses a data circuit specialized to achieve the signallings. The information signalling change is achieved as a message in a line of data transmitting common for a great number of calls to the plant [7].

The using of the semaphore channel for a great number of communications implies special procedures to assure the system reliability and the guarantee its permanent work in case of faults.

The system reliability is assured by the possibility to detect and correct errors and by assurance of a redundancy concerning the routs of guiding the signalling messages.

A. The blocks and functional levels of the signalling system no. 7

The architecture of the signalling protocole no. 7 is thus composed by blocks and functional levels of which correspondence with the OSI model layers is shown in fig.2

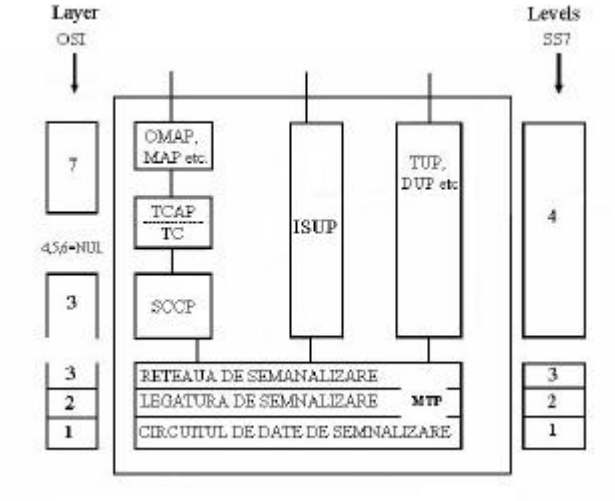

Fig.2 – The architecture of the protocole SS7

On the base there is a block called The Message Transport Part (MPT= Message Transport Part) that assures the information transport to the upper level bocks called User Parts or shortly, Users.

Message Transport Part occupies the first 3 levels of the 4 where the signalling protocole is laid.

Level 1 is represented by the signalling data link

Level 2 consists of the signalling link where are specificated the procedures by which is achieved the correct transport of information by data signalling circuit.

Level 3. The signalling network assures the transport of signalling information through the network formed by signalling points and by signalling transport points, links and sets of signalling links, routes and sets of signalling routs.

User Parts belong to level 4 that is the highest level in the hierarchy of levels SS7.

B. Description of USUP messages

ISUP messages are transmitted in different stages of a call progress both as a result of an action of a calling or called party or as a result of the answer to another message. They can be grouped together depending on the accomplished function.

To the group of “forward” messages that establish the link, belong:

A. IAM – Initial Address Message

B. SAM – Subsequent Address Message
Other messages that can appear in this sequence too, are:

C. CRG – Change Message

D. IDR – Identical Request Message

E. IRS – Identification Response Message
To the groups of messages generated by the link establishment, belong:

F. INR – Information Request Message

G. INF – Information Message
To the group of “backward” messages that establish the link, belong:

H. ACM – Address Complete Message

I. CON – Connect Message

J. CPG – Call progress Message
To the group of messages of link observation, belong:

K. ANM – Answer Message

L. SUS – Suspend Message

M. RES – Resume Message

N. REZ – Release Message
To the group of messages of circuit observation, belong:

O. RLC – Release Complete Message

IV. CONCLUSIONS

On the data semaphore link that is common for all call circuits, between the commutation telephone plants are changed information as signalling messages their change being granted by semaphore terminals. Therefore, at the ends of each call circuits there are not necessary further equipment of junction type.

Signalling system by semaphore channel can be used to transport various information.

Their ranges of application can be: signalling for telephone call treatment, mobile communications, exploatation, maintenance, remote controls, data, etc.

Signalling by semaphore channel have the following advantages:
- speed of messages transport is big.

Information flows currently used are of 64 kbits/s for digital lines and 4800bit/s or 9600 bit/s for analogic lines.

Thus, a bug reducing of the connection time is got:
- it is got a maximum efficiency of digital equipment using by reducing the redundant information. The ratio between the useful information and the total sent information tends to 1;
- the signalling equipment volume and cost is reduced;
- the signallings can be sent any moment that allows to introduce new services for subscribers;
- can be settled a semaphore network to serve various users. For telephone plants the semaphore network assures signallings on line and selection signallings. The semaphore network can be used for a centralized exploatation and maintenance functions, for a centralized charging, etc.

The signalling system no.7 means an obligatory presence to introduce new types of telecommunications networks that requires ample signalling process of a great complexity and that can take place simultaneously with useful communication by adapting to a structure directioned towards processor control that is specific for modern and future telecommunication networks.

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