ANALYSIS AND JUSTIFICATION FOR SELECTION PARAMETERS OF WIRED ACCESS SYSTEMS

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Abstract: The executed researches belong to area of design of perspective access networks. Work is devoted to the analysis of parameters of access networks and a choice of the most significant among them. Results of researches for wire decisions of the organization of a network are given.

Keywords: access network, parameters of access networks.

ACM Classification Keywords: C.2. Computer-communication networks, H. Information Systems - H.1 Models and Principles, K. Computing Milieux - K.6 Management of computing and information system.

Introduction

Development of telecommunications leads to emergence of new infocommunicatons services (ICS) and at the same time the problem of access to them becomes complicated. At introduction of each new service possibly change of requirements to a network and the network equipment due to the need of ensuring capacity, types of a traffic and the procedures of service specific to this service.

The subject of research is connected with one of the main problems in the field of telecommunications which creation of *Next Generation Network* (*NGN*), intended for granting to users of all set IKS. Component of NGN are access networks (AN), providing to users access to all ICS on the common line of access (LA). The LA parameters define quality and the nomenclature to ICS available to users of NGN. Need of creation AN is specified in documents of the International Telecommunication Union (ITU) as one of the most important problems of 21 eyelids [1], and prospects of their development are widely discussed at conferences and seminars the infocommunication devoted to development. Various aspects of AN creation are covered in works of Sokolov N. A., Goldstein B. S., Baklanov I.G., Krendzel A.V., Hilenko V. V., Mikhaylov V. F., Gayvoronska G. S., Balashov V.A., Zyablov S. V. and others.

Creation of AN now got a special urgency as the site of access is that segment of a telecommunication network (TN) which introduction of broadband high-quality IKS at the expense of which the operator can have considerable profit brakes. Besides, modernization of user's networks and creation on their base of perspective AN is the third stage of the TN transformation, the first which two stages is replacement of analog systems of transfer and switching nodes on digital. These stages are carried out by increasing rates, and time of the third final stage which is directly connected with a work subject now came.

At the present time design of AN is based on methods of calculation of user's telephone systems that is inadmissible as An differ both structure and functions which they carry out, and as a set of parameters therefore AN should be created on other principles. As the concept of AN [2] is developed rather recently, today there are no approved methods of their design therefore there was a need for development of sequence of process of creation of AN, and for this purpose it is necessary to carry out the analysis of the AN parameters influencing process of design.

Research problem statement

Now a huge variety of technologies of access to IKS is applied, there is a set of views and approaches to creation of AN [3-5]. At creation of AN it is necessary to consider a set of the AN parameters and the requirements which are put forward to it [6, 7]. As studied AN have a set of parameters, distinct from parameters of existing user's networks, it is necessary to carry out the analysis and to make the characteristic of these parameters, to reveal correlation between them and to bring them into a form convenient for modeling. Thus, directed by a task need of the solution of a task of the analysis therefore the list of the parameters being initial AN for creation is defined, and what not essentially influence process of creation of a network and which account can be neglected is noted. Research objective is increase of efficiency of design of perspective AN, decrease in expenses for their creation and increase of efficiency of operation.

The structural composition of AN

Many approaches it is possible to carry out classification, group and the description of access networks. However more often the traditional method is applied. It consists of two components: text description and graphic display. Feature of the text description is that such method gives the chance to the reader to familiarize with studied object in full. But the text description doesn't provide an objective image of classification structure of construction. Therefore the text description is often supplemented with graphic display of classification model.

Graphic display, in turn, is divided into two forms of representation: in the form of tabular structure and treelike structure. The tabular structure is used for representation of the general classification elements of analyzed objects more often. Usually, the tabular structure contains numerical values for possibility of comparison of studied objects. Application of this way leads to the compressed representation.

The treelike structure provides most volume visual representation about object of research. Step-by-step movement on branches of classification model allows to track and see distinctive features in creation of objects at one level of a tree.

As a textual description and graphical representation are mutually beneficial, then the possibilities as far as possible to characterize AN, involved in both methods. The graphic part of work displays treelike structure of classification model of creation of AN. For the general acquaintance with structure of model the treelike scheme displaying the general elements of classification for systems of wire access is provided. But there are hidden all subtleties of construction for each method of realization of AN.

The separate treelike structure gives deeper idea of objects. In work it is presented as addition to the general classification model of creation of AN.

By consideration and the analysis of a large number of existing decisions on AN realization at present, they can be grouped in the following signs: in a form of a transferred signal; to destination access networks; on capacity; on structural construction; on applied technologies; on management; by the form access; on a class of the served district (figure 1).

Group of the AN parameters on a served class of the district

For distribution of parameters on their importance in the course of creation of AN signs on which it is possible to make classification of parameters are allocated. As an example, it is possible to carry out classification of parameters for AN on a class of the served district since at design of a network it is necessary to consider features of that district for which it is under construction.

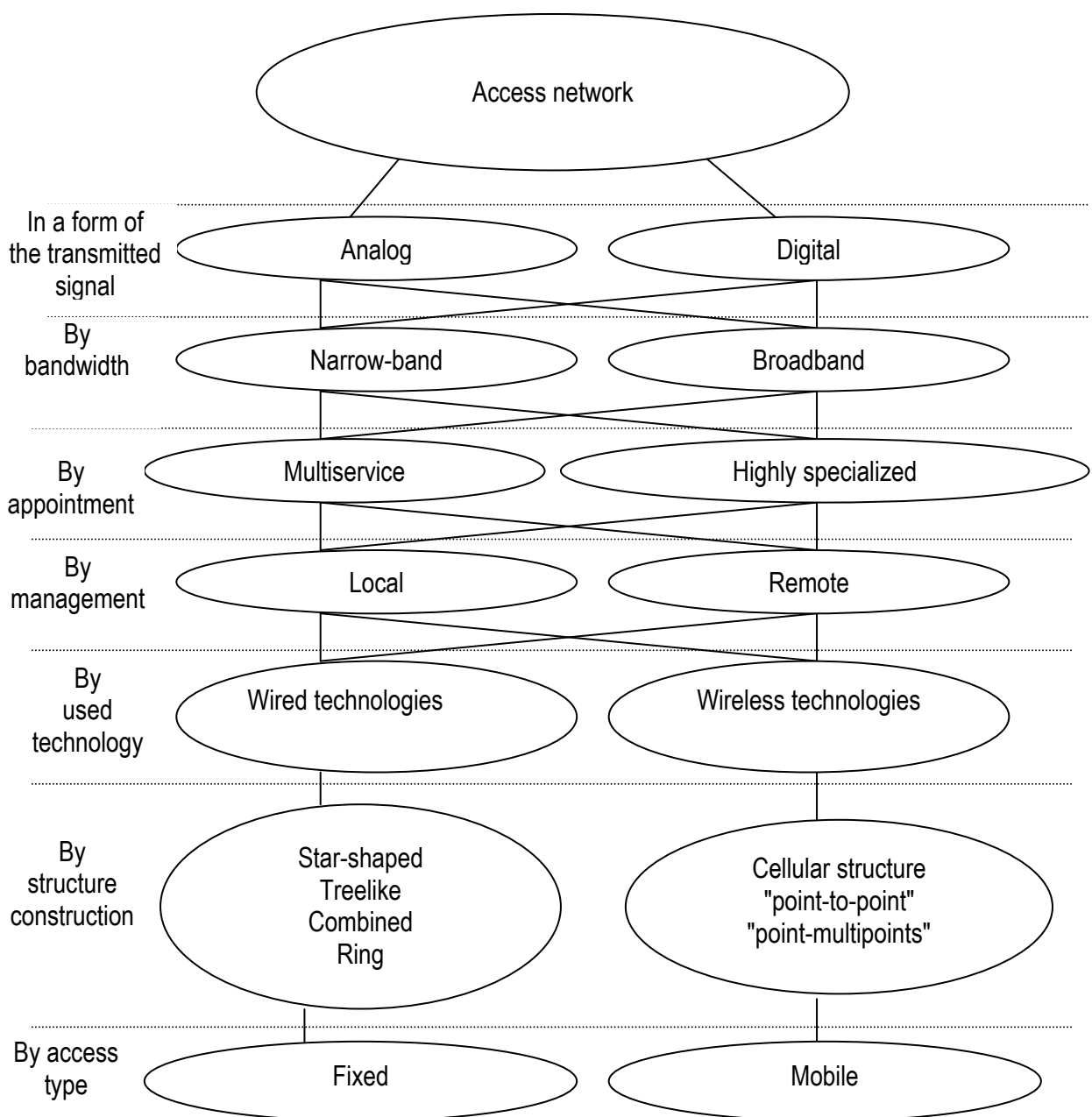The following parameters are taken into account.

Fig.1 The structural composition of AN

1. Geographical position of the district. The territory on which creation of AN is planned, can settle down in the mountain district, on the island, near the objects influencing functioning of a network etc. The choice of the environment of transfer, structure of creation of a network depends on it.

2. Superficial population density – number of inhabitants per unit of area. Distinctions on served population density are allocated:

  − serving the district with high population density;

  − serving the district with average population density;

  − serving the district with low population density.

High superficial population density is often observed in the central part of the city. Usually this population of multi-storey buildings, workers at the large enterprises. For service of these areas access networks with big loading ability are established.

Average superficial population density generally has the district being outside of the central part of the city. These are districts of the city are built usually up with low buildings (generally one – and five-floor constructions). However, high level of transport movement can be observed. Systems of access networks serving these areas, usually have average loading ability, quite sufficient for normal work of a network.

Low superficial population density is generally observed outside the city, these are usually rural areas. It is enough to apply access systems to service of these areas with low loading ability, and big range of communication.

3. Also important characteristic is the superficial density of users – number of users of ICS per unit of area.

In the large cities and the regional centers usually with concentration the greatest number of users of IKS being the most exacting to provided services and to the AN parameters. Rural areas with dominating number of inhabitants of aged age on the contrary differ lack of a large number of users of IKS, respectively there is no need to put large sums in creation of AN of big capacity. On parameter of superficial density of users, the district can be divided into districts with high, average and low density of users.

4. Financial possibilities of users. Creation of AN should be economic. It is not rational to put big money in the network creation which users have no financial possibility to pay all range of services provided by this network. On the contrary, in the areas which inhabitants have unlimited financial possibilities, the probability of the appeal to IKS range with the requirement of high speed of information transfer raises. Thus, by financial possibilities of users the served district can be divided into the district with high, average and low financial possibilities of users.

5. It is also necessary to consider type of the district or the area is there can be a business center of the city, the dormitory area, the cottage settlement, a private sector, a military camp, the campus, an elite housing estate, a housing estate class business, country sector, a residential suburb, a resort zone, a trading zone, the plant territory etc.

This group of parameters, aren't directly the AN parameters (parameters of the equipment of AN), but have essential influence on its structure, cost and operation process.

The grouping of the parameters of wired AN

The organization of a wire access network assumes existence of the physical environment for transfer of information, the equipment of access, transfer systems, and also the additional resources providing normal work.

Existing AN on technical parameters are grouped in the following signs: as the used environment of transfer; on versions of technologies; till speed of information transfer; as the termination of interfaces; on a way of division of channels of reception and transfer; on a modulation method in the channel; on an operating mode; on range of communication; on character of a traffic and services.

 It is required to present the chosen parameters in shape, convenient for modeling. All set of parameters shares on two categories: qualitative and quantitative parameters for which ranges and gradation of accepted values are defined. Directed by a research problem we will be limited to questions of creation of AN only on the basis of wire technologies of access. An example of display of results of the analysis of parameters of the wire AN, presented in the form of a tree with software use Concept Draw Office MINDMAP.

Table 1 – The grouping of the parameters of wired AN

Systems of wire access					
By type of transmission medium used	Copper cable	Optical fiber			Coaxial cable
According to the species of Technology	*Modems, SRM-modems, xDSL-modems*	*FTTCab FTTB/C WDM*	*FTTH*	*FTTC HFC*	*DVB-modems CATV- modems*
Bt information transfers	low-speed / medium-rate / high speed		very high speed	medium-rate / high speed / very high speed	low-speed / medium-rate / high speed
By type of interface terminations	2-x wire / 4-x wire		1 or 2 optical fibers	1 Coaxial cable	
By way of separating the transmit and receive channels	Frequency / Temporal / In the direction		Spectral		
According to the method of modulation in the channel	CAP, DMT, 2B1Q, HDB3 FM, RPM etc.	AM, FM, RPM etc.	AM, IM etc.	64QAM, QPSK, AM, IM, etc.	AM, FM, RPM, 64QAM, QPSK
On an operating mode	Asymmetric / Symmetric				
On range of communication	Small / Medium	Big			Medium
On character of a traffic	Speech / Data / Text / Image / Multimedia				

Considering that by consideration of systems of access to IKS rather large number of parameters is allocated, for convenience the chosen parameters were divided into groups. The research structure, is presented on figure 2.

In work one of ways of division of parameters on groups is offered.

1 The parameters which are not the AN parameters, but influencing modeling process. For example, financial possibilities of users, district type, its geographical position concern them etc.

2 The AN parameters being basic data for modeling. Among them are allocated:

requirements of users on which created AN, such as speed of information transfer, range of communication, factor of mistakes, delay time, a delay variation, etc. is focused;

the parameters based on requirements of users, but not being important for them, such as a modulation method in the channel, applied technology of access, a method of division of the channel of reception and transfer etc.

3 Depending on a set of requirements and parameters such parameters, as cost of services, a communication quality are formed.
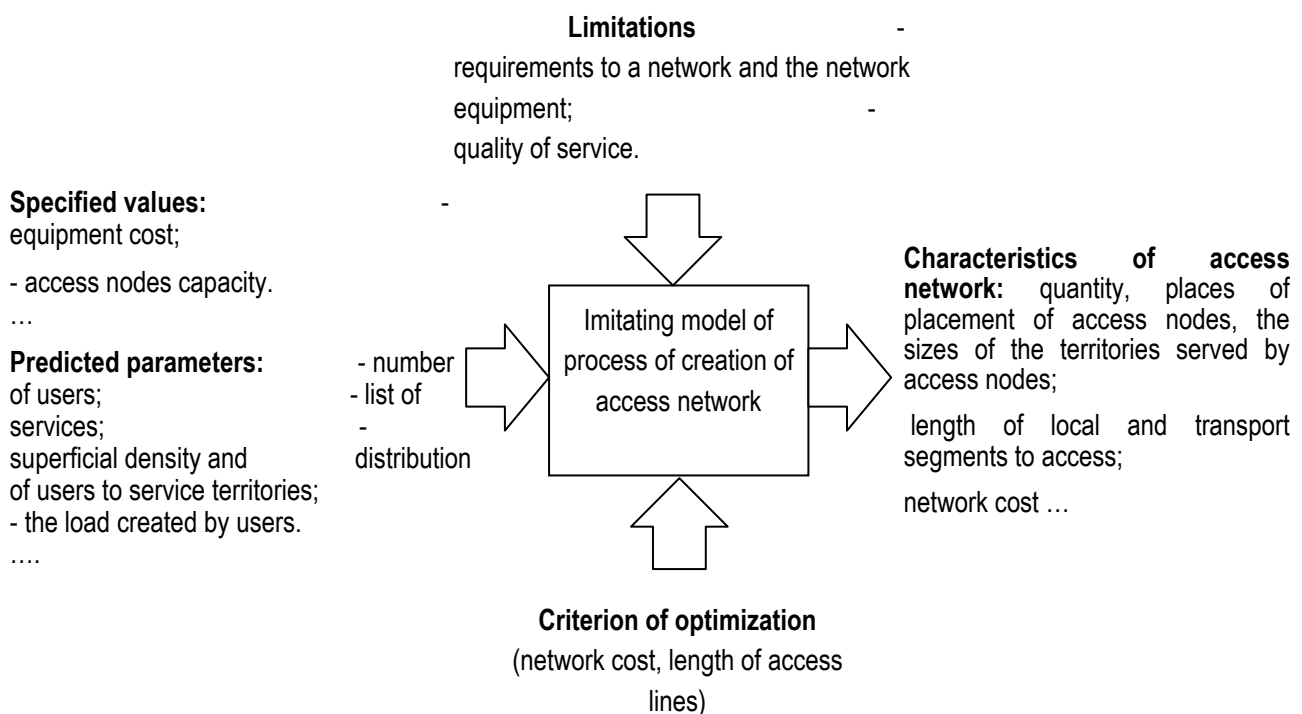
Limitations -
requirements to a network and the network equipment;   -
quality of service.

Specified values: -
equipment cost;

- access nodes capacity.
…

Predicted parameters: - number
of users;   - list of
services;   -
superficial density and   distribution
of users to service territories;
- the load created by users.
….

Imitating model of process of creation of access network

Characteristics of access network: quantity, places of placement of access nodes, the sizes of the territories served by access nodes;

length of local and transport segments to access;

network cost …

Criterion of optimization
(network cost, length of access lines)

Fig. 2 Model of group of the AN parameters

Conclusion

At statement of a research problem need of the solution of a task of the analysis as a result of which the list of the parameters being initial AN for creation is defined is noted.

The analysis of initial parameters of access networks allowed to allocate what not essentially influence process of creation of a network and which account can be neglected, and the parameters being essential at creation of access networks, and influencing their structure and cost.

The characteristic of each of considered parameters is made. For distribution of parameters on their importance in the course of creation of access networks signs on which it is possible to make classification of parameters are allocated.

Considering that by consideration of systems of access rather large number of parameters is allocated, for further research the chosen parameters are divided into groups.

All set of parameters of networks of access is divided into two categories: qualitative and quantitative for which ranges and gradation of values accepted by them are defined. Results of the analysis of parameters of access networks, are presented in a tabular look and in the form of a tree with software use Concept Draw Office MINDMAP.

Results of the analysis of the AN parameters are presented by the author in works [8-11].

Acknowledgments

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Major fields of scientific research: problems of perspective access networks' design.