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СОЗДАНИЕ ГИС ЭЛЕКТРОСВЯЗЬЮ НА ПРИМЕРЕ «ЭКСПО-2017"

CREATION OF GIS OF TELECOMMUNICATIONS ON THE EXAMPLE OF "EXPO-2017"

Географиялык информациялык системалардын (ГИС) негизги принциптери изилденип бүткөн. Бул ГИС технологияларын телекоммуникация тармагында колдонуунун маанилүү экендигин далилдеди. ГИС технологиялар тармактарды оптималдаштыруунун эсебинен жумушчу күчтүн чыгымдарын эле азайтпастан, курулган тармактарды иштетүү учурунда операторлорго туш боло калган кай бир проблемаларды да аныктоого мүмкүндүк берет.

Ачкыч сөздөр: *географиялык информациялык системалар, телекоммуникациялар, география, илим, сүрөттөрдү оңдоп чыгуу.*

Основные принципы создания географических информационных систем (ГИС) были изучены. Это доказало важность использования ГИС-технологий в области телекоммуникаций. ГИС-технологии не только способны существенно снизить затраты на рабочую силу за счет оптимизации проектирования сетей, но и позволяют выявить проблемы, с которыми операторы связи могут столкнуться в процессе эксплуатации построенных сетей.

Ключевые слова: *географические информационные системы, телекоммуникации, география, наука, обработка изображений.*

The basic principles of creation of the geographical information systems (GIS) have been studied. It proved the importance of using GIS technology in telecommunications. GIS-technologies not only are capable to reduce significantly labor costs by optimization of design of networks, but also allow to reveal problems which telecom operators could face in the process exploitation of constructed networks.

Keywords: *Geographic information systems, telecommunications, geography, science, imagery processing.*

The distinctive feature of telecommunication networks is remoteness of elements of their infrastructure on quite long distances. Until recently, operators and network administrators have been forced to use largely - format self-made plans and schemes of the telecommunication network, and also sets of public cards of various subject. Information on a network was stored on thousands the paper documents containing separate quantitative and quality indicators of a network. Effective use of a huge number of data on papers, maintenance in an actual state it was very difficult to achieve. At this time also the concept of use of GIS-technologies in telecommunication business has begun to develop.

Basis of any geographic information system is the database (D) presented in the form of thematic layers. Therefore the first stage of formation ITS (information and telecommunication system) is creation of the DB corresponding to problems which will be solved by means of this information and telecommunication system.

Creation of cartographical and thematic databases, development and deployment of GIS of various hierarchical level and territorial coverage is impossible without use of modern information technologies. Their application has allowed to bring the solution of geographical tasks to qualitatively other level. It has found the reflection in works of Kerimbay N.N., Tsvetkov V. Y., Kagramanzade A.G., Shcherbinin M. V. and others [1, 2, 3, 4, 5,6,7,8].

Some layers focused on creation of new elements of a network don't contain data as their

filling happens in use ITS, nevertheless in the structural database diagram they need to allocate the place. First of all the digital basic cartographical data in vector and raster forms created on the basis of topographic maps and plans of federal kartografo-geodetic fund are necessary:

- digital topographic maps of scales 1:10 000 - 1:100 000;
- digital topographical plans 1:500 - 1:5 000.

These data are the base of GIS-systems. For these layers it is necessary to use the most actual data of geodetic shooting, taking into account the last specifications. Depending on scales of the enterprise of which it will be a question later it is necessary to use both data on area, and more concrete data on the main cities (as they contain more than 80 percent of users of networks). These maps have to be submitted in several scales besides depending on extensiveness of a network. It is on average recommended to use five working scales for area and three - for the cities.

At creation of the information and telecommunication system based on GIS-technologies it is necessary to consider not only the general principles of creation of information systems, such as:

- information integrity;
-functional completeness;
- scalability;
- openness of architecture;
- reliability.

But also the specific principles which have been described above. They can be formulated as follows:

- the principle of compliance of architecture of ITS to the size of a network of the enterprise;
- the principle of a technological basis of a network of the enterprise;
- the principle of filling of the database according to solvable tasks.

The first and, perhaps, a key stage for creation of similar system, is creation of network model of development of ITS on the basis of GIS-technologies and the choice of the most rational option of realization of this ITS on territories of an exhibition Astana "EXPO-2017".

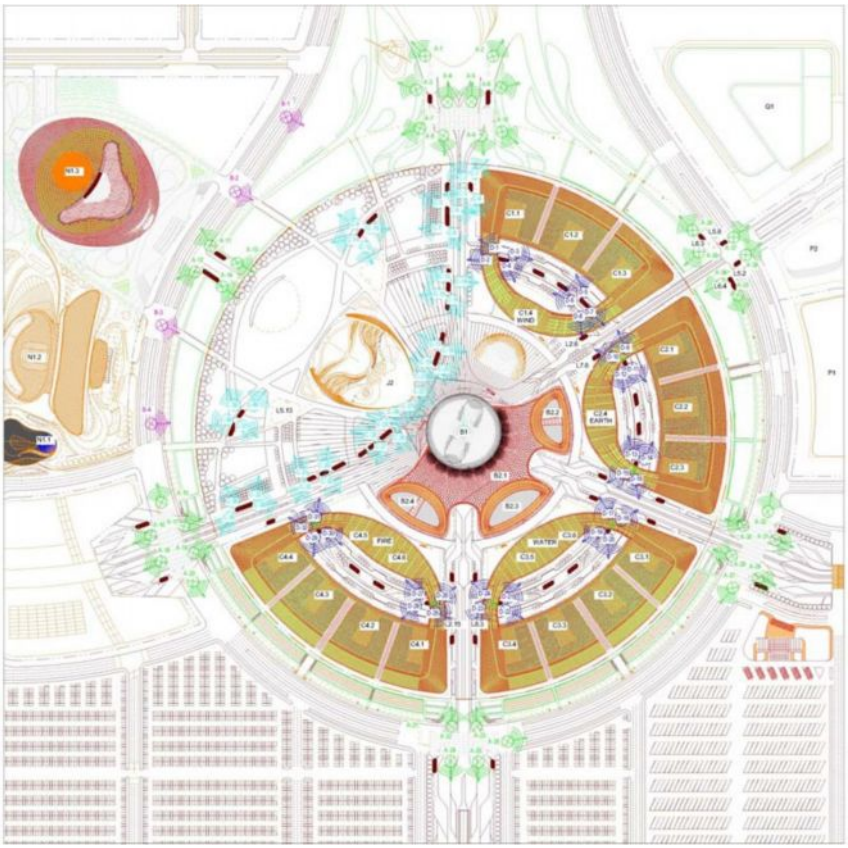

Figure 1 – Map of the location of access points WiFi area Astana exhibition area "EXPO-2017"

Legend:

 – WiFi access point with 120 degree coverage antennas, coverage A (Input Group)

 – WiFi access point antennas cover 120 degrees B coverage in the (perimeter)

 WiFi access point antennas cover 120 degrees C coverage area (buffer zone)

 – WiFi access point antennas cover 120 degrees coverage D (Walkup)

For definition of approach at implementation of the project it is most rational, we will resort to a method of network planning. It is based on creation of the network model interpreting the program of realization of a complex of works in the form of the focused graph with additional data (weight parameters).

To define what will be sequence of performance of work on creation of ITS, all possible options of its construction are analyzed. The list of the works of construction of the project of a generalized information and telecommunication system based on GIS technologies. No matter what technology wouldn't form the basis of creation of a telecommunication data transmission network, the conceptual scheme of this network at the current stage of its development represents three-level structure.

The telecommunication network generally includes the following components:

- the access network - is intended for concentration of the information streams arriving on numerous communication channels from the equipment of users in rather small amount of knots of the high-level network;
- backbone or core network - unites separate networks of access, providing transit of a traffic between them on high-speed channels;
- data centers or services control point - are own information resources of a network on the basis of which service of users is carried out.

The GIS directions in telecommunication systems are given below.

Strategic planning, analysis of demand and forecast of development of the market of telecommunication networks. Within the solution of this task it is necessary to carry out the detailed analysis of an arrangement of potential client base of future network, to estimate demand for the offered services and to make the forecast for prospects of further development. At the same time the analysis is based on the following spatial data:

- information on residential areas and office buildings;
- the type and number of transport, the location of train stations and airports;
- the planned building;
- groups of the population;
- owners of the land plots and so on.

Naturally, it is difficult to overestimate the GIS-technology contribution to the solution of similar tasks. Use of a digital cartographical basis with thematic layers and the accompanying information which is stored in the database when planning will help to lower significantly expenses, being critical at the initial stages of risky projects. Besides it is worth to remember about decrease in labor expenses. The database filled in the course of planning will be used at operation of the created telecommunication network. The excellent tool for these tasks is MESA Solutions Inc., from the largest supplier of systems of support of the operations Telcordia Technologies. Constructed on the basis of the conventional product from ESRI ArcGIS 10.x it widely is used at work on design of future networks.

Design of a telecommunication network. The following stage on the way of creation of the functioning telecommunication network is engineering design. Depending on what network is under construction, information on key points of a network is analyzed. In a case with mobile communication this estimated locations for antennas, repeaters. In a case with a fixed connection -

definition of an optimum route of laying of a cable, and also switching points. At the same time are considered:

- objects of the district and their location;
- type of vegetation and soil;
- roughnesses of a relief;
- arrangement of streets, highway and railroads, various underground communications and so on.

Further, on the basis of collected information calculations for improvement of quality of work of future telecommunication network and expenses on the equipment taking into account temporary wear, climatic and weather conditions are made. It is possible to use, of course, the software automating some calculations then to install skilled antennas (if it is about the first type of telecommunication), and by their movement to try to obtain the most successful picture. But the result will be more better, and expenses less notable if to use geoinformation technology and to simulate future network by means of GIS software. The solution of Network Analyze ESRI ArcGIS 10.x allows to solve problems of the analysis of already operating networks, to reveal shortcomings and to offer the easiest way of their elimination.

Inventory of objects, maintaining technical documentation. In huge networks of interregional telecom operators quite often there is a task about consolidation and tracking of the equipment on which the network is under construction. Application of GIS-technologies considerably simplifies obtaining exhaustive information on any of a set of the distributed objects. Functions of monitoring are carried out by a key component of systems of support of operations - system of the inventory account (SIU, Inventory Manager). Many solutions of SIU support function of interactive definition of the equipment on the proceeding signals, than high updating of the database is reached. In this case it is about active intellectual elements of a network. Besides information on the devices used on a network technical documentation, various plans of placement, the instruction including in a graphic form is stored. Also this database contains information on history of operation of the device, the errors of operation of devices, breakages arising in use, and also experiment on their repair.

Customer service. This task can be broken into a number of subtasks in which solution application of GIS is necessary:

- the analysis of network functioning from the point of view of customer service;
- operational dispatching management in the normal operation;
- planning of routes of service for personnel (including priority calls);
- ensuring interaction with other telecommunication networks;
- ensuring interaction with territorial services and governing bodies and supervision, (the land registry, bodies of environmental protection, architectural and planning managements and so on);
- the analysis of compliance of borders of the served area and the working loading falling on it, redefinition of areas;
- forecasting;
- ensuring additional services with use of means of communication;

forecasting of demand for services for further development of a network;

- the organization of customer service of a network and calculations for the provided services.

The solution of the above subtasks means use of the map of the existing and planned network with information on its objects, accommodation of potential clients, dynamics of demand in various administrative territorial units and to that similar.

Monitoring of a condition of networks (prevention of emergencies). At operation of a network it is required to optimize trips and transportations, routing of office transport. It is necessary to provide timely carrying out scheduled and repair work, rapid response to accidents and emergency situations.

In order to better understand all the advantages that brings GIS technology for problems of expansion of a telecommunication web, its architecture on sample architecture of large-scale networks how smoothly lays down, we will review a concrete example. Methods of the solution of these tasks represent that other as the tasks on optimization using extensive geoinformation databases as entrance values. We will assume, the telecom operator is faced by a task to maximize profit on granting communication channels. For simplification of calculations we will assume that the operator has two channels differing on quality of transfer, the price of service, speed of the circulating data and according to the final price. The optimum place for storage of huge volume heterogeneous, integrated only by geographical criteria, information, serve geoinformation DB. Data accumulate in these bases or by means of manual input by the operator, or automatically, by introduction in a network of special tests (the hardware modules intended for collecting and preprocessing of the operating information of a network). Tests can be both passive, and active. Respectively the operator can in the interactive mode, setting new entrance information, to operate a network, optimizing her work and to see results of changes with the minimum delay.

The aim of work is to develop and study the principles and techniques of building information and telecommunications systems on the basis of GIS technologies in the exhibition area Astana "EXPO-2017".

Development of the information system which is carrying out the design, inventory and serving functions of infrastructure of a network of telecom operator is the cornerstone of work. The complex multitask system provides all life cycle of a network of telecom operator, however each of the considered functions can be introduced in the existing control system separately. For achievement of a goal the following circle of tasks has been lit:

- analysis of modern technologies of development and management of telecommunication networks.
- classification of the directions of use of GIS-technologies in telecommunication area.
- the analysis of structural model of business processes of the telecommunication enterprise for the purpose of definition of the general architecture of ITS.
- research of the principles of creation of ITS connected with specifics of telecommunications agencies of various type.
- development of a technique of creation of information telecommunication system on the basis of geo-information technologies.
- approbation of a technique of creation of the information telecommunication system developed within dissertation research.

The choice of the software solution allowing it is the most rational to solve problems of planning and operation of communication networks.

Research methods. Development of the information system which is carrying out the design, inventory and serving functions of infrastructure of a network of telecom operator is the cornerstone of work.

In conducting research and studies used methods of creating maps, geographic information systems.

The main scientific novelty of of the dissertation is to create a method of telecommunication network management systems, which would lay the basis of geoinformation technologies. Despite the widespread popularity of GIS systems and the development of the telecommunications industry, similar techniques in Kazakhstan hasn't been developed now.

As part of the scientific novelty it is possible to allocate:

- at the time of writing of work of techniques of similar to offered it hasn't been developed;
- the formulated principles are proved and allow to consider features of the enterprise for which the information and telecommunication system is developed;
- approaches described in this work can be applied to other areas of the basis of a large number of regional distribution of interacting elements.

The practical importance of results of dissertation work consists that the developed technique and the formulated principles of creation of ITS allow to introduce the decisions which

are most fully answering to inquiries of telecom operator taking into account the restrictions imposed by telecom operator on development by date of system. The introduced system allows to make monitoring, development and service of telecommunication networks of various classes and types that, in turn, allows to reveal network shortcomings, to model her existing and projected components with higher precision. In addition, similar systems allow to estimate and minimize expenses on construction of new sites of networks, simplify work of services of operation of a network, than increase level of service of clients.

As it was mentioned earlier, the received results can be applied not only to telecommunication networks, but also to many other branches of human activity which assume use of the regional or large local territorially distributed structures.

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– 47 p.

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