WEB MAPS FOR DESIGNING RURAL AND URBAN TELECOMMUNICATION NETWORKS

Akmal Arifdjanov, dept. Prospective Development and Innovation Uzbektelecom Joint Stock Company

Svetlana Sadchikova, dept. of Telecommunication engineering Tashkent University of information technologies named after Muhammad Al-Khwarizmi

Introduction

Before the construction starting of telecommunication infrastructure, three main phases of telecommunication and communication research planning carried out follows:

– strategic network planning, where decisions are made on the feasibility of network deploying and determining the deployment zone size, as well as determining the method of construction, cable type and technology for cable sewerage using;

– high-level network planning is the phase when structural decisions are made for a specific geographical planning area; structural solutions include determining the location of the main elements of the network;

– detailed network planning, when the final stage of planning is completed with project documentation, which can be transferred to construction companies.

Phase of the high–level network planning is the most complex, includes huge volume of initial data, and requires linking to the area cartographic data such as roads, sidewalks, underpasses and the purpose of buildings (administrative, social, industrial, residential). Different buildings depending of purpose create an individual traffic on the network infrastructure, and individuality lies in the different requirements of each object to the consumption rate [1-2].

The real properties of specific objects depend on their position relative to a variety of acting factors. Therefore, in specific studies, the general concept of geographical location is differentiated into physico-geographical, economic-geographical, political-geographical, etc. [3]. For the telecommunications sector, these are PBX communication objects, telephone sewers, cabinets, etc. and all of them can be displayed on an electronic digital "Web map".

Common knowledge of app-based Web map construction

A web map is an interactive display of geographic information. All web maps must contain a base map. The basemap defines the spatial reference of the web map, as well as the tiling scheme that all cached layers must follow. The elements of a web map are its component parts, including the cartographic image itself, the legend and the frame design. The main element is a cartographic image, that is, the content of the map, a set of information about objects and phenomena, their location, properties, relationships, dynamics. Web maps use symbols and colors to represent things, and the map key explains what they mean. The card keys are often boxes in the corner of the card, and the information they give users is essential for understanding the card.

Web maps are interactive, and it means that the user can interact with the map. It also means selecting different layers of cartographic data or objects to view, scaling the part of the map you are interested in, checking the properties of objects, editing existing content or sending new content, etc [3].

Fig.1 shows visualization interfaces (screenshot from the Arcep website, the regulatory organization for electronic communications, mail and press distribution in France) [4].

On web maps, in the context of municipalities, colors indicate the area where there are optical lines, where telecom operators plan new construction, as well as indicating the speed, according to the requirements of the Body of European regulators for electronic communications BEREC [5].
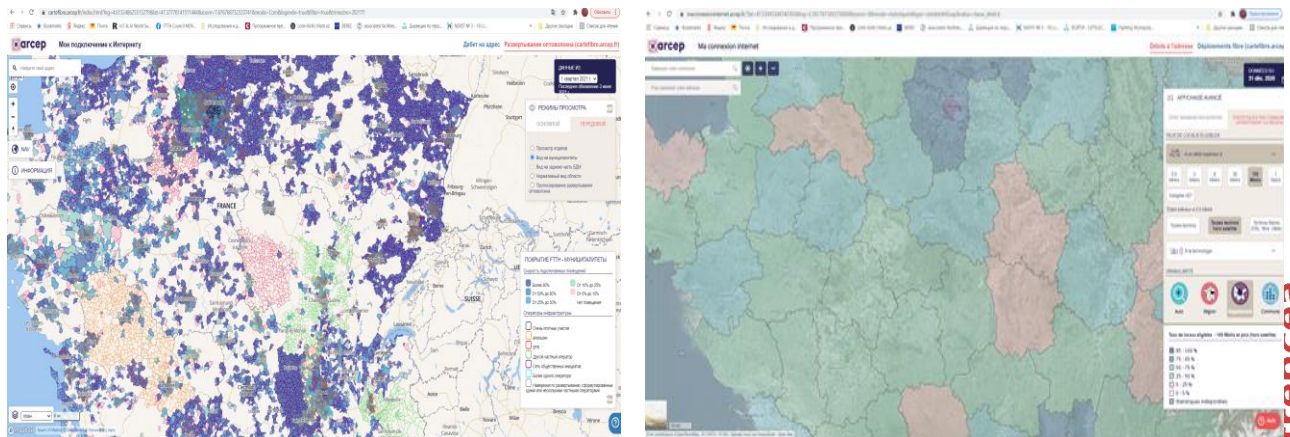

Fig.1. Area visualization of the Internet coverage in France territory with service provider indication

Software tools analysis for the cartographic web application creation

Web cartography is an area of computer technology related to the spatial data delivery to the end user using computer networks. Web applications have a number of advantages over desktop programs, which is primarily due to the removal of such a significant limitation as the lack of accessibility of geographic information resources remote from the user [6].

The main tools for creating web maps are HTML, Cascading Style Sheets (CSS), JavaScript.

HTML is a data format used to encode the content and structure of web pages, usually stored as simple text files using html file extensions. Simple web pages consist only of HTML code contained in a single HTML file. Usually HTML used with the CSS data format to define the style and appearance of web pages.

Cascading style sheets (CSS) is a language for defining the web pages style and appearance, used to specify the font, colors, and element location on the page. CSS allows you to create rules that control the way each individual block and its contents are presented and is launched when it is linked to the HTML code, then the HTML code is processed and visually displayed by the browser.

JavaScript mainly used to control interactive behavior on web pages, it is the single programming language for working with a web browser, and it is used by about 95% of websites [7]. Numerous open source libraries for displaying and visualizing data are written in JavaScript, and many commercial web mapping services also provide JavaScript APIs for

web maps design using their tools, such as Google Maps JavaScript API, Mapbox-GL-JS and the ArcGIS API for JavaScript [8].

The "web map" term usually means a map that is located not just on some Internet server, but which downloads additional data from the Internet. A web map is usually interactive and not always self-contained, which means that it downloads content from other places, such as tile layer servers or API database.

A more customizable programmatic approach to creating web maps is available using scripting languages such as Leaflet and Mapview (R packages) and Folium (Python Library). Leaflet (Crickard III 2014) is an open source JavaScript library for creating interactive web maps.

Lines, polygons, and their controls displayed using GeoJSON. GeoJSON is a simple text format designed to represent vector geometry with or without non–spatial attributes, based on JavaScript object notation, JSON. It has become a very popular data format in many GIS (Geographic Information Systems) technologies and services related to web mapping [9].

The GeoJSON type hierarchy includes nine types that grouped into three difficulty levels such as "Geometry", "Feature", "FeatureCollection". "Geometry" level includes seven types of simple geometry objects such as Point, LineString, Polygon, MultiPoint, MultiLineString, MultiPolygon, GeometryCollection. "Feature" is an object, i.e. geometry together with its non-spatial attributes. "FeatureCollection" –is a set of functions. The GeoJSON drawing control is used by participants to draw shapes on the map (in vector format), which will later be sent and saved to the database.

Django Environment is a high-level Python web framework that allows you quickly create secure and supported websites. Django takes on most of the hassle of web development. It has open source code, documentation, and many options to support [11]. Web applications written in Django usually group the code that processed at each step as separate files.

Django executes SQL to create the corresponding table in the Database without having to write SQL query strings, puts the name of your Django application in front of the table name. The model also binds related information to a Database. Django models are written in Python and provide mapping to the underlying database structure. The disadvantage is that the database may be out of sync with your models, but Django solves this problem with migration.

Conclusions

The optimal zoning (territories division) is achieved through a comprehensive analysis of settlements, indicating on a web map its exact location and their connection boundaries to the of active and passive equipment locations. This method allows you significantly optimize the network.

When calculating certain network parts according to the classification, it is required to process a large amount of initial data and carry out appropriate calculations based on digital web maps. Calculations required geographical mapping of network elements in real time with the formation of zones of nodal areas with their total required load for territorial planning of the network as a whole.

For the full functioning of the automated system, it is necessary to create a platform for collecting and storing the necessary data to make calculations with the structure, and the

corresponding hierarchy of project administrators, according to the regional level of access to the platform designed to manage the necessary data during design.

Reference

1. G.Hallak, M.M.Vázquez, A.Mengi, L.M.Rosu. On the New Developments in ITU-T G.hn Standard: Use Cases, Requirements, and Solutions. 2021 IEEE International Symposium on Power Line Communications and its Applications (ISPLC), 2021, pp.49-54, doi: 10.1109/ISPLC52837.2021.9628559.

2. FTTH Forecast for Europe – Market forecasts 2021-2026 https://www.ftthcouncil.eu/knowledge-centre/all-publications-and-assets/246/ftth-forecast-for-europe-market-forecasts-2021-2026

3. Zhiping Lu, Yunying Qu, Shubo Qiao. Geodesy: Introduction to Geodetic Datum and Geodetic Systems. Springer Berlin, Heidelberg, 2014. 401p. DOI https://doi.org/10.1007/978-3-642-41245-5

4. https://maconnexioninternet.arcep.fr/

5. M.Philpott, S.McBride. REPORT Fiber Development Index Analysis: 2021 A global index comparing fiber development on a country-by-country basis. https://omdia.flywheelsites.com/omdia-fiber-development-index-2021-2/# GLOBAL

6. M.Dorman. Introduction to Web Mapping.1st Edition. Chapman and Hall/CRC, 2020. 366p.

7. Coursera Inc., 2022 https://ru.coursera.org/learn/html-css-javascript-for-web-developers

8. ArcGIS Online https://doc.arcgis.com/ru/arcgis-online/reference/view-maps.htm

9. Podgorny P.A. Advantages of using «JSON» format in modern web applications for information security. Vestnik nauki, 2022, №11 (56), Volume 4, pp.242-245

10. URL: https://www.json.org

11. A.Mele. Django 4 By Example: Build powerful and reliable Python web applications from scratch. 4th Edition. Packt Publishing Ltd, 2022 г. 766p.