PRETRAŽIVANJE / SEARCH
ŠTAMPANJE / PRINT
IZLAZ / EXIT

MEĐUNARODNO REGIONALNO SAVETOVANJE O ELEKTRODISTRIBUTIVNIM MREŽAMA

REGIONAL CONFERENCE AND EXHIBITION ON ELECTRICITY DISTRIBUTION

Crna Gora, Herceg Novi, 5 - 8. oktobar 2004. / ***Montenegro, Herceg Novi, October 5 - 8, 2004***

* *

GEOGRAPHICALLY REFERENCED MIDLE VOLTAGE DISTRIBUTION NETWORK DATA

S. Milaković, EPS – JP Elektrovojvodina, Novi Sad, Srbija i Crna Gora[1]
A. Bošković, EPS – JP Elektrovojvodina, Novi Sad, Srbija i Crna Gora

INTRODUCTION

Technical information system (TIS) of Power Distribution Company Elektrovojvodina (Electric Utility) is complex control - information system that includes: database (DB), system for control and data acquisition (SCADA), network calculations (NC), graphical environment and applications for technical support. This system develops as a part of Project for Integration Network Calculations for Distribution Network and Database Management (Project integration NC and DB).

Graphical environment of TIS includes: power objects scheme editor and single line scheme editor. However, it has been found that there is a need for geographically referenced information about middle voltage distribution network (MVDN). That assumes special kind of editor included in graphical environment. Throw that it is possible to import and update geography maps and power elements connections scheme.

That provides view of network topology on appropriate geographic background with preserved functionalities – data view and calculating results. It is assumed that consistency of technical, graphic and topology data is saved. Unique view of geographic scheme with different details levels is provided and that gives new quality to the system.

There are two basic reasons for development of geography maps editor. First of them is better functionality integrated in TIS. The second one is avoiding of baying expensive special software packages, with small number of licenses, for work with geography maps and therefore limited number of users.

In the first chapter multitude geography maps that are used in Electric Utilities has been explained. It has been shown that is necessary to scan paper maps, eliminate deformation and perform vectorization. In the second chapter the database structure that refers to the geography data has been shown. Geography scheme editor has been presented in the third chapter. It has been shown that it is important to have multilayer view with different kind of map sets, depends on desired detail level. In the fourth chapter data about MVDN and other equipment has been shown. Use of Geography scheme has been described in the fifth chapter and sixth chapter are conclusions.

---

[1] Bulevar oslobođenja 100, 21000 Novi Sad

GEOGRAPHICAL BACKGROUNDS

Essential precondition for geographically referenced information about MVDN is existence of adequate and accurate geographic background. Considering the tendency of creating digital geography maps by the appropriate Institutions, as well as that process durability, a complete analysis is made into the Electric Utility's branches. The analysis shows that geographic maps that are in use are usually very old and thus inaccurate. Mostly they are available in a paper form and in small number of branches in the digital form adapted for PC use. Backgrounds in digital form are divided into two groups: raster format (BMP, TIFF …), and rarely standard vector formats (DXF, DWG, WMF, EMF, CDR,…). Beside geographic maps with definite rate of scale (1:500, 1:1000, 1:2000, 1:2500, 1:5000,...), there are old plans and maps that are not standard rate of scales, as well as other geoshematic views.

In order to prepare geography maps for use it is necessary to process them and to write them into one of digitally formats (vector or raster). Paper surfaces have to be scanned and after that processed with special kind of software for deformation removal, cutting and geopositioning. That raster image is used as a background across which are entered: power objects, overhead and cable lines. It would be deal to vectorize whole raster image or input her vector form, but that is long and abundant process. Because of that this two views are combined, raster forms are used into one part, vector forms into another part (for example part of a town or parts of interest). In the future it is expected that authorities (Institutions) will finish geographic backgrounds processing and their vectorization, but till than already mentioned formats are very useful.

More surfaces can cover the same place. They can be small or more detailed (approximate or precision level of details). Approximate level of details assumes streets and there names, as well as construction dimensions. That level of details corresponds to the topography maps with level of details adequate scale 1:10000. Precision level of details corresponds to the precise maps with level of details 1:500.

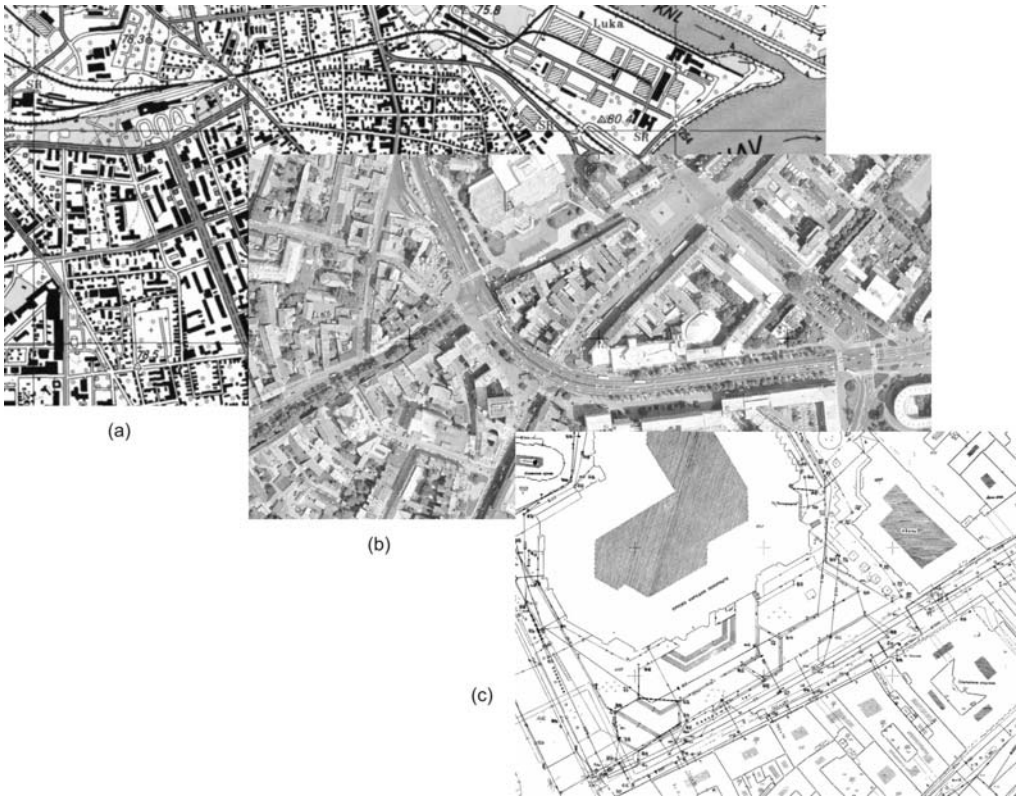

Figure 1 – Aero-photo image (a), topography map (b) and precise map (c).

After processing and geopositioning the maps are ready to be fit into one background. At one zoom level suitable background (set of maps) has been shown. For illustration in fig. 1 the same part of the city on three different backgrounds with different detailed level has been shown. They are aero photo image – scale 1:2000, topography map – scale 1:10000 and maps – scale 1:500.

TECHICAL DATA BASE MODEL

It is necessary to store processed geographic maps and geographic data about power objects and lines into a database. Database for geography maps is realized as part of integral TIS database. That means:

- Data steadiness.
- Simplicity and flexibility of making reports.
- Data protection by the Relation Data Base Management System – Oracle.
- Stable multi-user environment.
- Unique administration.

A part of database model has been shown in fig. 2. Model is designed as part of whole DB, realized during project integration DB and NC. Model encompassed:

- Geographic backgrounds,
- Graphical data about HV/MV substations.
- Graphical data about MV/LV substations.
- Graphical data about power lines.
- Graphical data about crossings.
- Graphical data about measurement.

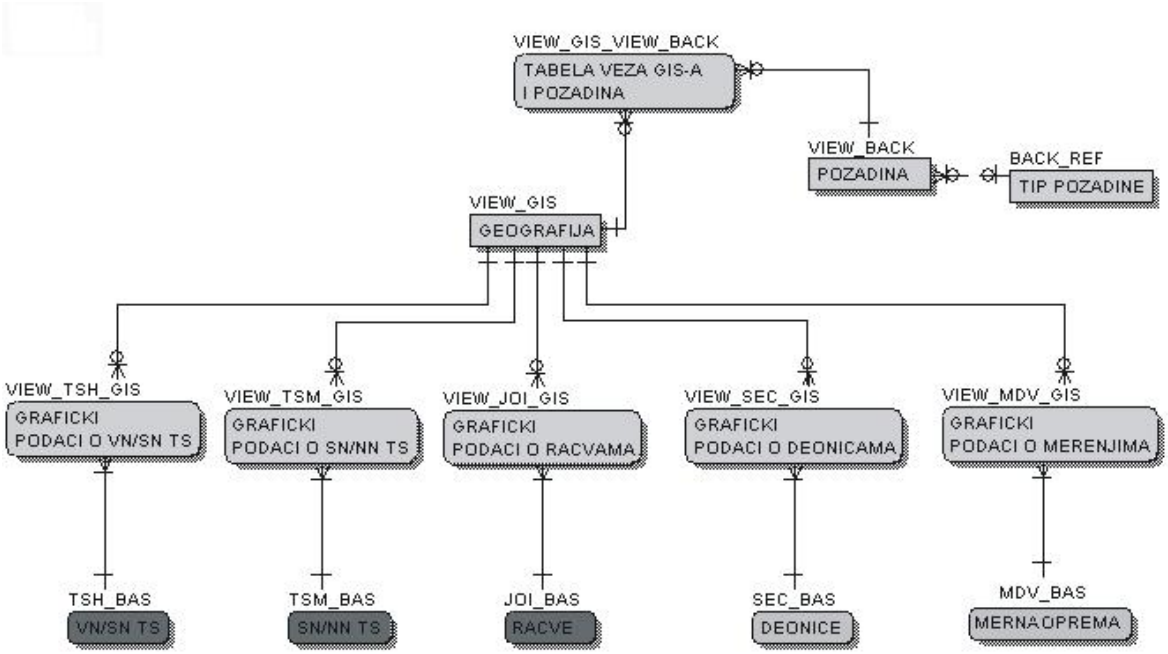

Figure 2 – Part of data base model.

Beside part of DB for geography map, in fig. 2 connections to the other tables into DB has been shown. The other tables contain technical data about power objects, substations, line crossings, power (overhead and underhead) lines and measurement devices.

MVDN EDITOR ON GEOGRAPHY MAP

In order to enter data about MVDN on geographic background it is necessary to have tools for processing geography maps and symbols for power objects and lines. Input is made throw the geography scheme editor. That editor is multi-user unique application. Unique application assumed that there are no separate applications for input and overview geography maps. However, editor is a part of project integration NC and DB. Advantages such geography environments are:

- Unique input and update geography maps and geography SNDM scheme.
- Unique view geography MVDN scheme with level of details suitable for different company departments.
- Uniform user interface in all MVDN graphically environments.

That system is overall system for basic informatics support to the technical functions such as dispatching, maintenance and planning.

Input MVDN on geographic background is automated process, assumed that connections between power objects are created earlier during logical scheme drawing. On geographic background power objects are represented by symbols which have geography coordinates given to them by chosen drawing place. Connections between power objects are made as polylines and they follow real positions. Number of polilyne points can be increased or decreased. Object coordinates could be changed.

Power object symbols are from symbol library. They are saved in DB in standard SVG format and symbols editor, which is part of project integration DB and NC could change them.

Geography scheme MVDN structure is multilayer. That structure provides level of details depends on zoom level and can be slightly changed. Parameter adjustment for every level can be done by the application for parameter modification, and only specific parameters could be set throws the editor. For every layer, by the application for parameter modification can be defined:

- Visibility of layer.
- Power object symbols.
- Minimal zoom level for power object symbols.
- Line style for power lines.
- Minimal zoom level for power lines.
- Shape, size and color on layer.
- Minimal zoom level for layer attributes.
- Power objects attributes on layer.

Geography scheme editor contains tools for zoom (zoom window, zoom increase, zoom dynamic), positioning on schema (dynamic pan and pilot), and possibility to save certain geography scheme view (for example current zoom level).

Beside that, text input is provided as well as SQL attributes input, which results are presented on geography scheme. Text and attributes can be independent or dependant (tided for one geography scheme element and they are moving together with it). Every time when the scheme is open or on request all the data (attributes and text) are refreshed.

Power line length can be calculated automatically, as well as any distance on geography scheme. Power objects can be located by their names.

Geography scheme editor has options for printing part or whole scheme and export into one of standard vector formats (wmf, emf).

Two are possible modes: on-line and simulation mode. Assume that, throw the geography scheme dynamic data change is possible on the same way as on logical scheme.

In order to provide possibilities to change geographic backgrounds, and have accurate geography scheme, geography scheme editor can import or change geography maps. The maps are part of geographic background.

There are a few limits in system:

- Only one client could edit one geography scheme at certain time.
- Power object single line scheme can't be erased if object is present on one geography scheme.
- Erasing power lines throw the other editors is manifested on geography scheme too.

MIDLE VOLTAGE DATA NETWORK REVIEW

The data about power objects and their elements are stored into DB and could be seen on geography scheme at the same way as on logical scheme. There is detailed schematic view of distribution network and all technical data stored into DM. Data about power lines could be seen too. Specific data (visible attributes) could be shown on the geography scheme all the time. These attributes (power of transformer installed into substations, name of substations, pole numbers, power line types) could be turned on or of on scheme by applications for parameter modifications.

Geography maps with large-scale rate are set as geographic background when the whole background is shown. After zooming into one part geography scheme more detailed maps (lower scale rate) are shown. Smaller part of geographic background is equal to the smaller part of geography scheme; First, whole city map is shown, than part of the city and at the end only part of the street. After positioning on one power object and choosing adequate options, detailed schematic view and chosen data could be seen – picture 3.

For every power object elements specific data grouped into few categories are accessible. They are:

- Basic data.
- Catalogue data.
- Dynamic data.
- Network calculations data.
- Another technical data.

Data overview is possible by turning on or off adequate data groups. After positioning on the part of geography scheme of interest or choosing search option and specifying power object name that power object with their data and part of geography scheme is positioned in the center of the screen. The other possibility is to mark all the power objects that accept set criterion.

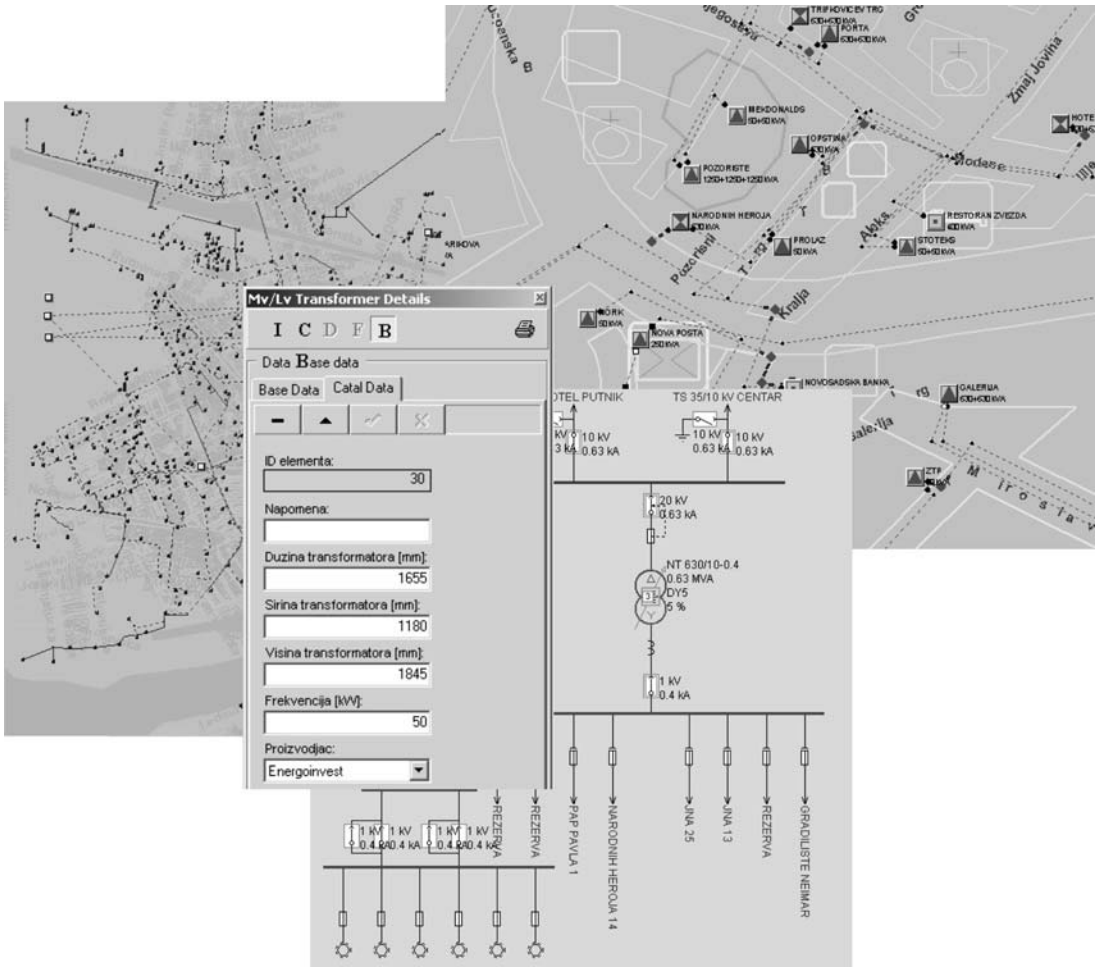

Figure 3 – Substations data overview.

Data protection is completely realized throw the project integration DB and NC and with RDBMS – Oracle system.

MIDLE VOLTAGE DATA NETWORK APPLICATION

Number of actions in Electric Utility's MVDN is large. Their purpose is change of MVDN structure or change data about power elements. In order to minimize the time for action, it is really important to know topology and real place of power objects. It is necessary to know that the number of power objects in network is very large. People couldn't know all their places. With system like this possibility of finding objects on scheme and their places in reality is great. Also, possible faults and outages are eliminated more quickly. That improves efficiency of dispatching department.

Geography scheme use is important in development departments in Electrical Utilities. They are approving permissions for connections on electrical network. Having insight in geography map is easy way to establish possible variants, or other which are impossible because of (for example water) obstacles.

For MVDN planning, and for planning overhead and underground lines route, which happens very often, especially in the big cities, beside network calculations results, important are to know geography map and presence or absence of electrical network on that place.

CONCLUSION

During realization of MVDN geography scheme editor a few things had to be done:

- Data base model and his implementation.
- Procedure for geography maps preparations (for paper, raster and vector form).
- Applications for import and editing geography maps.
- MVDN geography scheme editor.
- Application for authorization and parameter modification.

MVDN geography scheme received by described procedure, with the use of MVDN editor and software development for presentation, provides large use of geography maps, especially in Electric Utilities.

Advantages that such scheme provides are:

- Efficient and fast power object locating and having insight into data about power elements.
- Simply tracking power lines route and possible crossroads with other infrastructure.
- Multilayer structure.
- Help for workers – fast and simple finding requested locations.
- Substitute paper work with electronic and acceleration their treatment.
- Modernization different departments in Electric Utilities.
- Unique system for calculating, analysis and results review.