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INTEGRATION OF TECHNICAL DATABASE WITH ENERGETIC ESTIMATION AND SCADA SYSTEM IN THE UNIQUE TECHNICAL INFORMATION SYSTEM

S.Dragojlovic, "Elektrosrbija" Kraljevo, Elektrodistribucija Kraljevo, Serbia and Montenegro
O.Milenkovic. "Elektrosrbija" Kraljevo, Elektrodistribucija Kraljevo, Serbia and Montenegro

INTRODUCTION

Technical database started in "Elektrodistribucija" Kraljevo from 1991. Databases created by dBase. This application covered technical characteristic distribution substations, power lines and networks voltage 0,4kV. We are gartering data since at the time with great diligence. Although dBase is very old system we used data and included in new system. "Elektrosrbija" made EDIS program for power supply company at 1995. This program are using in 16 power supply company which belongs "Elektrosrbija". "Elektrodistribucija" started with used this program at since 1996. EIDS was business information system which contained parts of technical information system. Place for measure was fully described by EDIS. Oracle 7 was data management system. "Elektrodistribucija" Kraljevo bayed SCADA system at 1992. SCADA used for managed mid-voltage substation 35/10kV "Jasen". Region dispatcher center (RDC) of "Elektrodistribucija" Kraljevo locate on 2km of central computer with technical database. We decided on-line data from SCADA put into local database in Access. Access database locate on computer which control SCADA system. We are transferring data from local database to central database for a definite period of time. First drawings of power supply object (EEO) draw by AutoCAD arise at the 1997. Dispatching schema of 10kV object was first drawing. In my mind borne idea how I could connected dispatching schema with data from dBase. Institute "Nikola Tesla" from Belgrade made study of development for "Elektrodistribucija" for period from 2000 to 2020. Institute made all estimate for this study with software package "LOAD FLOW", because "Elektrodistribucija" which part of the "Elektrosrbija" Kraljevo was buy this software package. Software package for analysis of energetic networks "LOAD FLOW" purposed for estimate power flow in electro energetic networks. Software package estimate power and energy losses in distribution networks. Results of estimate received quickly and we could easy analyze. Software package have own databases of elements (characteristic of transformers, power line …). We intergrades our databases which permanently bring up to date and our opinion that we not necessary made our program for this purpose.

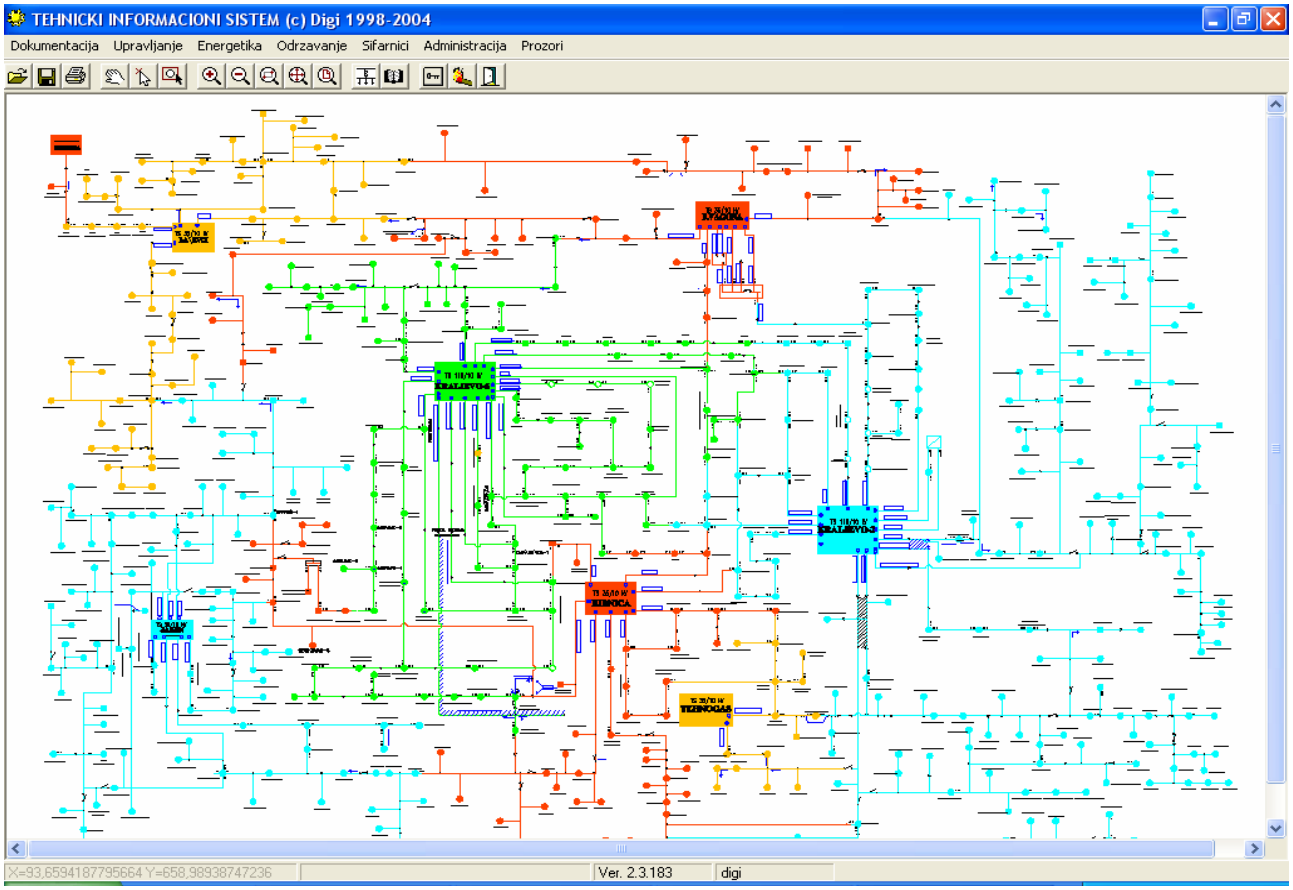
CHARACTERISTCS OF SYSTEM

The technical information system has next characteristics:

- The technical information system created by Visual Basic 6
- The graphical user interface (GUI) – see picture 1

PRETRAŽIVANJE / SEARCH
ŠTAMPANJE / PRINT
IZLAZ / EXIT

- Toolbar and menu for access of various options
- The multi-user system with lot various functions and views
- Oracle 7 database management system
- File server on Windows 2000 for all drawing for all format (DWG, JPG, TIFF)
- The database model is fully connected with business information system
- The system operational diagram, one line schemes of distribution and mid-voltage substations, element scheme create by AutoCAD or AutoCAD derivate
- Viewing picture of distribution substations, power line and other element in JPG format
- The system operational diagram on main window and on-line change of state
- The database is connected with third-parties' SCADA
- The database is connected with third-parties' analytical functions system "LOAD FLOW"
- Administration of system is unique



Picture 1 View of main window

COMPONENTS OF SYSTEM

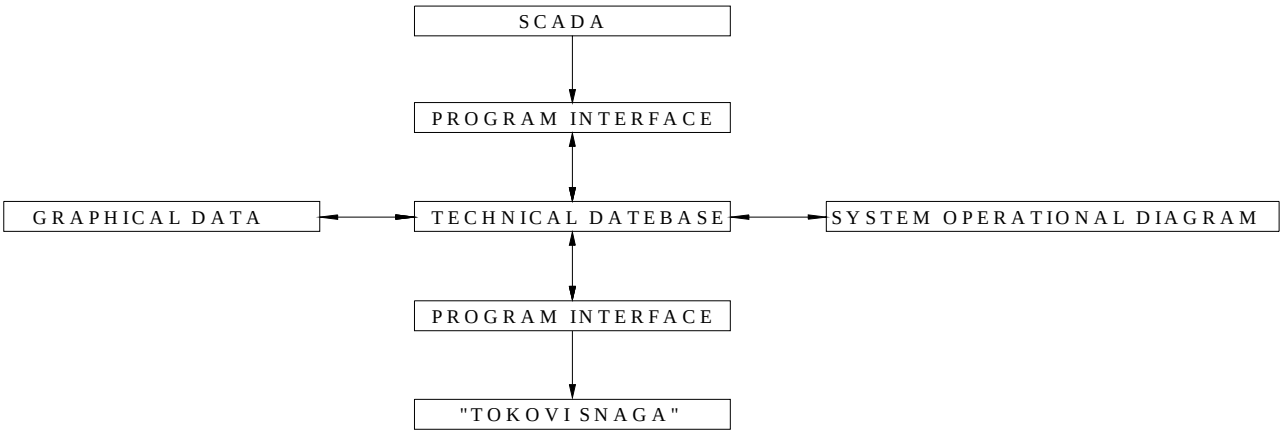
This system has next components:

- Documentation
  - Create and maintain of alphanumeric data
  - View of alphanumeric or graphical data.
    - We can get all report with single click on dynamic system operational diagram. System operational diagram on computer is a modern replacement for old wall-diagram schemes. Now we use operational system diagram which is draw in AutoCAD and put on main table of dispatcher.

        - The documentation module has report generator, which produces rich reports about technical data from the network.
- Power supply control
    - Change of switch in state
        - We can change with simple click on object on main window (system operational diagram) status of switching elements. We commit time of manipulation, who is executed manipulation and locate of manipulation
    - Fault recording. This module record person which is report for fault, time, locate, type of fault, who is eliminate fault, remark for fault
    - View of registered fault represent classical book of fault. Fault's report has several conditions.
    - Break of supply. SCADA record all break of supply but we have not remote control station on all mid-voltage distribution substations. This module gathered brake of supply on mid-voltage substation which is have not remote control station
    - Break of supply view. Report present how many consumer have break of supply, how period is break of supply
- Energetic
    - Export data. Immediately state of power supply object and connection between objects, export in file which use software package "LOAD FLOW"
    - Transferring data from SCADA local database in Access to technical database
    - Import data from ARES
    - Diagram of power get from data from ARES
- Maintenance
    - Report of cost by distribution substation, low-voltage networks, mid-voltage networks and other electrical object. Data for this report program gathering from financial information system (FIP)
- Administration
    - Encoding
    - Module for connecting objects or elements from DWG drawing with data in technical database
    - User's authorization. This part of program can use user with high level permission
- Graphical environment
    - Graphical environment represent dynamical system operational diagram. If price of LCD with big dimension display will be fall we will get very quality system operational diagram on computer for little power supply company although monitor with big dimension (21") or high have quality screen. Click on any object of system operational diagram give data for this object.

THE WAY OF FUNCTION CONNECTION TEHNCIAL DATABASA – "LOAD FLOW" AND TECHNICAL DATABASE – SCADA

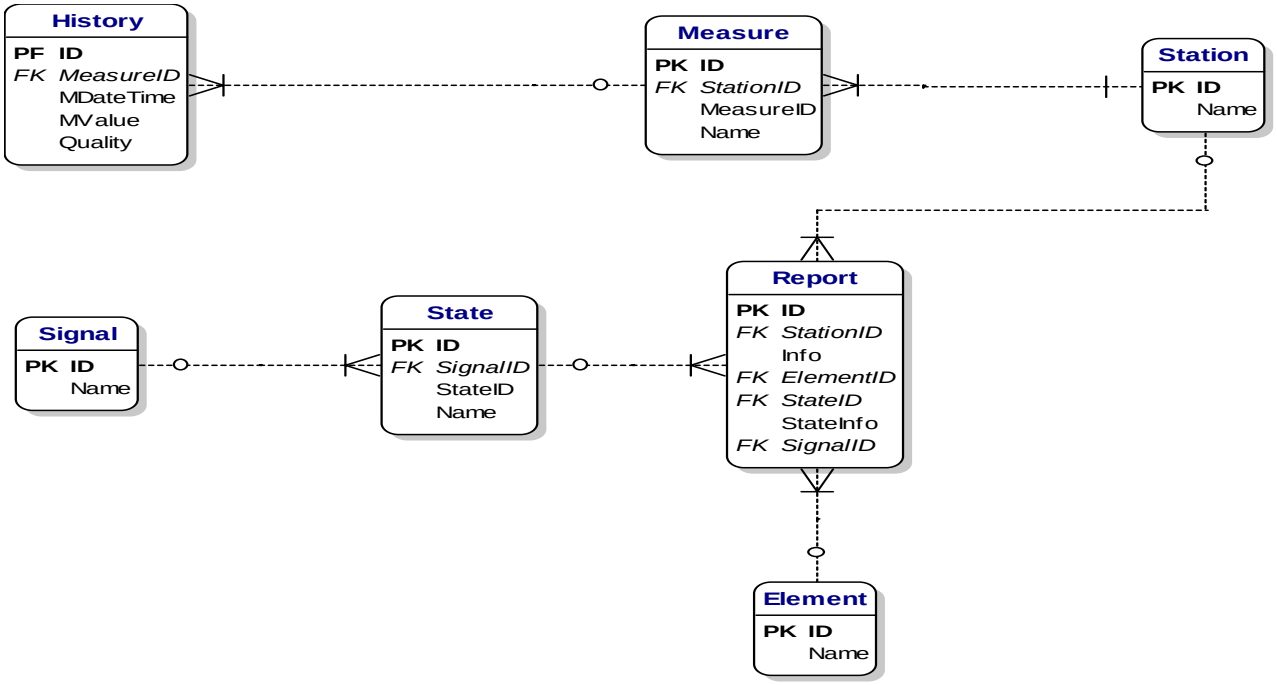
Picture 2 represent simplify model of technical information system. On the picture 2 don't represent connection between technical information system and business information system. In the department which creates change this change commit into database. This is way for correct data. All change commit in real time if possible. On picture 2 you see two programs interface, in the next part of paper we are explaining both interfaces. We can observe this interface as application server. These interfaces make possible connection and transfer data about state, measures of current, voltage, active and reactive power every 15 minutes. Technical database have few tables. Table Objekt represent all electric objects and elements in this object. Next table is Vrsta_EE_objekta; this table represents types of electrical object. VKO is table which is represent types of characteristic. These characteristics descript all objects in database. Except SCADA which we are use for control long distance mid-voltage distribution substation, in "Elektrodistribucija" Kraljevo we are use ARES system for measurement in 3 distribution substation where "Elektrodistribucija" Kraljevo take energy from "Elektroistok". This system measured active and reactive energy every 15 minutes. This system made Institute "Mihajlo Pupin". The ARES reading represent official measures for EPS. Data which is ARES read we can transfer to local computer in EPSMAX format.



Picture 2 – Diagram of technical information system

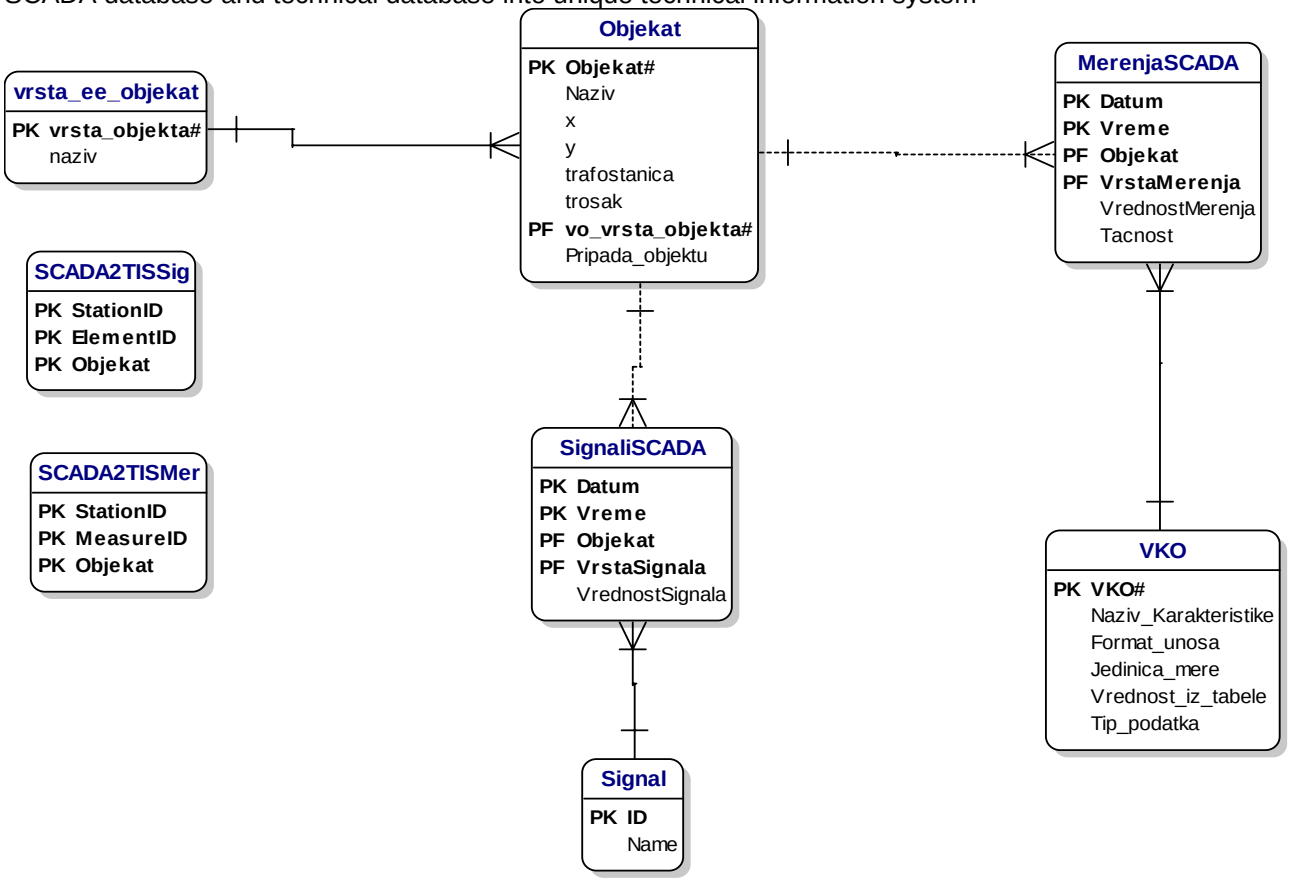
Connection between technical database and SCADA

The picture 3 represent model of database which was made in Access. Program which is controlling and monitoring SCADA remote control station commit data into database. Table Station represent all transform station where locate remote control station. Table Measure represents all measure canals. Table History represents archive of measure of all canals from all remote control station. Table Signal represents name for all signals which is remote control station send to computer. Table State represents states of some signal. Table Element represents elements in transform station which is controlled by remote control station. Table Report represents reports about change of state on elements.



Picture 3 – Diagram of database for SCADA program

The picture 4 represent tables in central database in Oracle. We created these tables because united SCADA database and technical database into unique technical information system



Picture 4 – Diagram of tables for SCADA in central database

We are seeing into the picture 4 that is only stay table Signal. Table History change with MerenjeSCADA. Table Report change with SignaliSCADA. Table Measure change with VKO because current, voltage, active and reactive power also represents some types of characteristic for electrical object. We added table SCADA2TISSig which is represents connection between tables Station and Element from Access database with Objekat and SignaliSCADA from database in Oracle. Table SCADA2TISMer which is represents connection between tables Station and Measure from Access database with Objekat and MerenjeSCADA from database in Oracle. On this way data from SCADA local database commit into common database for all technical information system. Data from ARES transfer on local computer with modem in special file format. We made module which is transfer data from EPSMAX file to table MerenjaARES. When program committed data into database module recorded temperature for this day.

Connection between technical database and software package "LOAD FLOW"

Technical database are containing table VEZE with next structure

Veza	Primary key
Cvor1	This field represent handle of first node. Start of power line. Node represent substation, line switch
Cvor2	This field represent handle of second node. End of power line
ChangeYN1	This field represent do you can change state on first node
ChangeYN2	This field represent do you can change state on second node
Stanje1	This field represent switch state on first node
Stanje2	This field represent switch state on second node
Duzina	Length of power line between two nodes

Tip	Type of power line (material, diameter, insulating material)
PripadaVodu	Part between two nodes belong power line which is include few connections
Aktivna	Value 1 if connection active

THE NEXT EXPANDIONS OF SYSTEM

We will develop the technical information system into next directions.

- Geographical information system (GIS)
- Creating working order
- Planning of maintenance on the basis of year plan and faults on networks
- Report for working cost
- Analysis of time consumption
- Multilingual support
- Create program independent of database management system

CONCLUSIONS

We conclude we can on elegant way use existing programs which are use “Elektrodistribucija” Kraljevo. That mean we not need buy new software package. We have few requirements on start of creating this program.

- All the program which are use we must keep
- The level of user must be technician
- We must keep all one line schemes which is drawing in AutoCAD

When we ended technical information system we can increase use of existing programs and data. The small number of worker now uses existing programs, we think on this way we increase number of users. We can increase business and technical efficiency because better connection between EDIS, TIS, FIP in one homogenous information system. The software package “LOAD FLOW” contain modules for topology analyze, state estimate and if we can use this software we can reduce energy losses in mid-voltage networks.