DISTRIBUTED ENTERPRISE MANAGEMENT SYSTEM FOR ELECTRICAL TRANSPORTATION REGISTRY OF CHISINAU CITY

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Abstract

Paper describes the conceptual approach and example of implementation of a project of complex distributed enterprise management system for urban-level power supply substations of electric transport system. The system architecture uses ERP and SCADA components.

Keywords: information system, enterprise management

1. INTRODUCTION

Quick technical progress in the domain of modern information technologies gives now the possibility to build intelligent enterprises (IE) having following basic building blocks: technology infrastructure, transaction processing infrastructure, integrating technology (data warehousing), decision process management, analytical applications, information and knowledge delivery services [1]. Typical IE information system architecture consists of 3 hierachical levels of management: Enterprise Resources Planing (ERP), Supervisory Control and Data Acquisition (SCADA) and industrial equipment control system (Controllers) (fig.1).

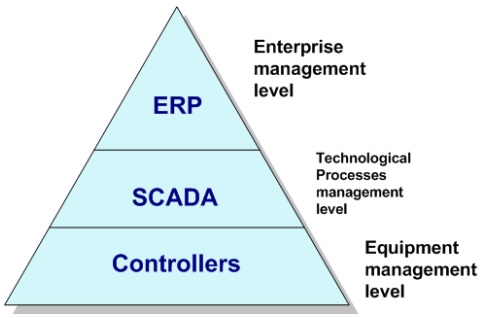


Figure 1. Hierarchy of management levels

The process of reengineering of the electrical transportation registry of Chisinau City (RTEC) started in year 2004 and has principal goal to transform RTEC into modern IE. RTEC manages urban electric trollei buses system and Overhead Line Electrification (OHLE) which powers the vehicles. Power is provided by 40 Substations, fed by 6 or 10 kV AC inputs gotten from electricity company with transformer rectifiers to

provide the 0.600 kV DC output. The new information system is intended to automate dispatching control and management of power substations for urban electrical transportation of Chisinau by:

- centralization of power substations management using uniform central dispatching item.
- increase of reliability and management efficiency of every technological object at the expense of use of the reliable and checked up modern equipment.
- replacement of existing physically worn out and obsolete telemechanical installations by the new modern equipment on the basis of microprocessor-controlled systems.

2. ERP LEVEL OF MANAGEMENT

The greatest effect can be obtained from development and introduction into the IE information system the ERP functionality having following basic sectors:

- *manufacture* - flexible adjustable solution for information support of productions of various types, including all spectrum of repair, service operations and distribution – a set of components for management of material flows in each part of supply chain,
- *engineering* - means ensuring a uniform information field for all processes of manufacture and development of the enterprise,
- *finance* - universal means ensuring integrity of financial and book keeping processes,
- *personnel* - solution for operative and strategic management of the personnel, its account and increase of qualification.

The architecture of such system should correspond to object oriented paradigm of system structure and based on component technology. The system should also respects the ISO and industrial IT-standards. Taken together these methodological and technological features provide opportunity of creation complex territorial distributed IE system: 3-tier Client-Server system; Web-based distributed system with unified browser-based client; combined system, in which are used as the classical clients working in LAN or VPN frameworks, and WEB-clients working with applications servers through the Intranet/Internet. Irrespective of a technical platform of the concrete decision, each of above logic levels has the following multi-tier realization: data storage tier, business logic tier and data presentation tier. The last tier can be realized in three variants: as Win32 application, as mobile client or as web-client.

Every component of system logically represents 5-level architecture. Each of levels has precisely determined interface and appointment:

- data storage level – responsible for accommodation and storage of the data;
- technological entities level - cooperates with data storage level, take and modify data;
- technological operations level which are carried out by technological entities;

- technological and manufacturing processes level - gives to the user an opportunity to estimate conformity of behavior of object to the requirements of manufacture;
- data representation level (user interface, Human-Machine Interface - HMI), including geographical information systems (GIS) usage (fig2.).

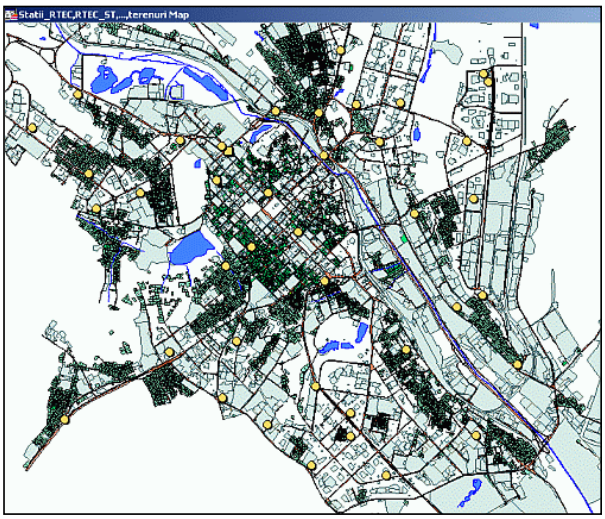


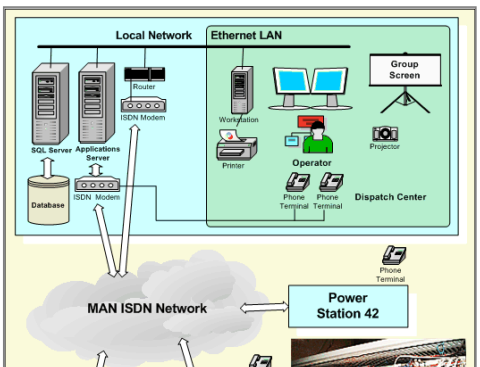
Figure 2. GIS-enabled top-level management system interface of RTEC

2. SCADA AND CONTROLLERS LEVELS OF MANAGEMENT

Power supply distribution to OHLE is controlled by a SCADA system that realizes basic functions of the telemechanics (telesupervision and telecontrol) systems:

- distant information acquisition of controllable technological parameters
- storage of the collected information, analysis of changes in time (history, trends)
- registration of events, information processing with the purpose of formation of complex criteria of an estimation of process trends (filtering, decision making)
- display processes flow in the form, convenient for the operator, including notification of the attendants about emergencies occurrence and technical state of SCADA
- transfer of operator control stimuli on distant process (distant control)
- formation of the accounting documentation about events of technological processes.

Central node of SCADA RTEC contains DBM SQL Server, Application Server, and Workstations, placed in Operator's room and connected to LAN equipment. Interconnection of every power substation with central node is performed via corporate IP over ISDN switched MAN (fig.3.). By changing the screen display, operators can access and see various parts of the distant power supply circuitry (fig.4.).



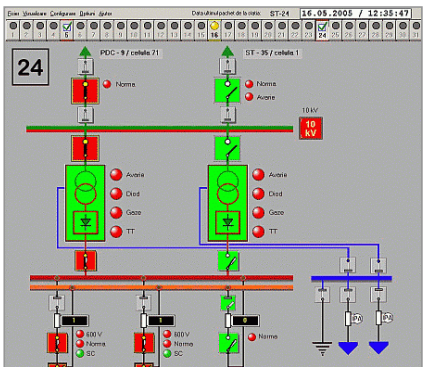


Figure 3. SCADA RTEC logical scheme

Figure 4. SCADA RTEC HMI sample

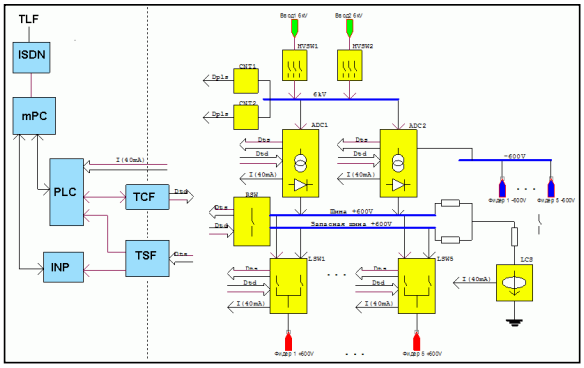


Figure 5. Functional schema of substation node

Every of power substation node (fig.5.) is equipped with industrial microcomputer UNO2050 having MS Windows CE.NET operating system platform and original SCADA applications software, that manages industrial SCADA controllers and devices (ADAM 5511, ADAM 4000), realizing also data communications functionality.

CONCLUSION

Practical implementation of SCADA part of RTEC IE system allows to reduce the unproductive consume of the electric power, to increase operating ratio of the equipment from 0.23 up to 0.9, to reduce the idle time caused by switching-off high voltage input lines and to reduce the amount of wages and the necessary number of on duty personnel. Decrease of operational expenses of RTEC service is caused by centralization of management, by high quality and reliability of equipment used, and also by system flexibility.

REFERENCE

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