REVITALIZATION OF REMOTE CONTROL CENTRE AT ELEKTRO PRIMORSKA
(SLOVENIA)

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ABSTRACT
Since 2001, Elektro Primorska d.d. is one of five distribution operator companies in Slovenia with headquarters at Nova Gorica. It has over 123000 customers and covers an area of approximately 4335 km². It exists as an independent legal subject owned partially by state and partially by couple of investment funds.

With new laws for deregulating electrical energy market, the time was right to start modernization of control system of Elektro Primorska, as well as adapting of company for fulfilling demands towards supervisory institutions.

In order to optimize use of workforce and financial resources, Project was divided into three phases:

1. Replacing existing remote control system and introducing advanced functions of managing 110/35(20) kV levels and switching facilities on 10(20) kV;
2. Expansion of remote control functionality on 10(20) kV and integration of Outage Management System (OMS);
3. Upgrade of control functions with DMS functions (Load Flow, Short Circuit Calculation, etc.)

At the end of this Project, Elektro Primorska should have tools to effectively perform all day-to-day activities, monitor its efficiency and act on time to prevent any major problems or financial losses.

INTRODUCTION
Organizationally Elektro Primorska is divided in four distribution areas: Gorica, Koper, Sežana and Tolmin, which are further divided into belonging communities.
Managing of distribution network is centralized with one dispatching centre at Nova Gorica and remote working places at each of distribution areas.

According to new energy law, in 2007 System operator of Distribution Network (SODO) agency was founded. From 2001 to 2007 these functions were handled by each of existing Distribution operator companies. SODO has also task of gathering and analyzing reports about events in distribution network, and monitoring the quality of delivered electrical energy to customers.

On distribution management level, Elektro Primorska decided to modernize dispatching centre through project of Revitalization of Remote Control System. Project started in 2005. Existing centre at the time was more than 20ty years old and has reached its technological limits. It couldn't be modified to meet everyday growing requests on controlling functions demanded by market of European Union.

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The first phase of the project was finalized in June 2007 when new control centre took over the function of distribution network management in all four distribution areas.

The second phase started in September of 2007, whilst third phase is due to start in the middle of 2009.

Elektro Primorska decided to go with OMS part of revitalization first, rather than the DMS functions, because of new circumstances on deregulated market and need for even better quality of service towards its customers.

Benefits from implementation of such a complex information system can be always divided on both financial and organizational.

Financial benefits are expected from quicker and more accurate location of outages in network based on customer’s call, which will result in reducing time of outage restoration and reducing the time that customers will be out of electricity.

Organizational benefits are expected in fulfilling legal obligations towards supervisory entities regarding reporting; company’s resource integration; more simplified monitoring of network activities and their analysis.

With modernized OMS system, Elektro Primorska will integrate CRM and OMS databases; which will result in more consistent information regarding customers and their topological connectivity. OMS system by itself demands quality and precise update of data, both on topological and customer side, so any discrepancies in network can be avoided, and respectively unwanted activities at dispatching centre.
SCADA SYSTEM

New SCADA system is one of state-of-the-art solutions available on the market for this kind of control centers and it consist of:

- HP Alpha servers DS25 in redundant configuration (on-line and hot stand-by) for SCADA and historical database (HDB),
- HP workstations with one, two or three monitors,
- Intel based web server,
- redundant LAN,
- ICCP/TASE2 interface
- printers, plotter,
- interface to business LAN and
- new communication interface, also in redundant configuration.

Software system is based on HP True64 Unix operating system for SCADA/DMS and Historical DB, Windows Server 2003 for web server and Windows XP for workstations. All SCADA software is installed on Alpha servers, while workstations are used for graphical interface and HMI. Historical database uses ORACLE platform for data storage.

New system complies to open systems standards and can be integrated with other systems through number of interfaces:

- ODBC for real-time and historical database
- COM/DCOM for application integration
- Web interface based on JAVA runtime environment

NEW COMMUNICATION INTERFACE FOR SCADA

The main idea for reconstruction project was to replace only central part of SCADA system leaving communication part and RTUs (substation automation systems) intact. Because of that, there was a significant effort to cope with conversion of protocols (ADLP 80 and IEC 60870-5-101 on IEC 60870-5-104) and interoperability with new system.

The existing SCADA system consists of several types of old DS-8 RTUs (DS801, 802 and 803), somewhat younger types DS2000, substation computers with digital relays, etc. As communication links they are using own and leased telephone lines, analogue and digital radio links.

As a solution for communication problems, new communication interface was developed and integrated with new SCADA system with communication over LAN over IEC 104 protocol.

New communication interface has following functions:

- communication with RTUs and substation automation equipment over ADLP-80 protocol what required development and design of new hardware components to use in industrial PC,
- communication with RTUs and substation automation equipment over IEC 60870-5-101 protocol where it is possible to replace communication equipment, or existing equipment has possibility to use IEC 101 protocol,
- communication with SCADA/DMS system over 60870-5-104 protocol.

As it is mentioned before, to be able to use this communication interface it was required that protocol towards new SCADA system is IEC 60870-5-104. This protocol makes this solution independent of SCADA system and is also reusable in every control centre with similar configuration.

In order to make it work and to test all communication a special import procedure was developed to transfer data (names, types, information object addresses...) from old to new system keeping the consistency of 20000 data.

With this procedure all addresses should remain correct and needed only check of signals with corrections on the site acceptance tests. All signals, measurements and values were easily tested during parallel coexistence of two systems and disconnect links from PDP computer only to test commands.

After that all communication was switched to new system and finally store PDP where it belongs, in technical museum.

NEW COMMUNICATION INTERFACE FOR SCADA

OMS VS. DMS

After successful commissioning of new SCADA system, the time is right to proceed with new improvements. As it was mentioned before, EP decided to go with OMS functions rather than with DMS because benefits were considered to be better and system faster to implement.

The main benefit from OMS is expected to be the possibility to faster locate and isolate fault and the possibility to automatically create necessary reports for SODO and other supervisory organizations.

Also it is important to mention that beside several standard reports about outage statistics and power quality, EP had to customize the system in order to prepare additional 24 reports, like: statistics for communities, customer groups, time intervals, etc.
Because there is still no direct pressure for network optimization (minimization of losses and similar), DMS functions, in relevant discussions, were regarded more as a tool for operators and network optimization during normal operation.

OMS SYSTEM

New Outage Management System (OMS) comprises of two parts (servers):
- OMS server (Linux based) with associated Oracle database.
- OMS WEB server (MS Windows 2003 server) – responsible for GUI in CALL center towards OMS server and for creating system reports.

Main part of OMS system is the Outage Engine, a program that interprets outage information that receives from external system, such as SCADA, or manual entry. Outage engine takes the data and applies algorithms to deduce the location and the kind of grid failure based on given outage reports.

Main outage statistics presentation features are:
- Reliability indices such as SAIFI, SAIDI, CAIFI, and CAIDI indices can be calculated by area, substation or circuit.
- Sorted Outages (per area, district, station etc.)
- Filtered Outages (by cause, equipment categories, per individual customer etc.)
- Tables for list presentation on Intranet/Internet

As mentioned before, there are also 24 additional reports prepared with data from OMS database.

DATA AND ACTION FLOWS IN SCADA/OMS

In everyday usage, three different software clients, running in local workstations, are used to access the system:
- General WEB interface to OMS data used by the call takers
- Outage management user interface (OMI), used by the control room operators to handle calls and outages.
- SCADA client interface, used for general SCADA operation and network diagrams complemented with OMS symbols.

The control room operator logs in to the system via SCADA login and will automatically be logged in also to the OMI with the corresponding authority.

All of information gathered through OMS system can be further presented in form of various system reports and statistics.

In user interface there are several features of outage presentation:
- Probable and verified outages
- Symbol changes with status for outage
- Access to outage information
- Affected area is displayed by coloring
- Automatic calculation of affected customers
- Lists for detailed information
- Tables for list presentation on Intranet

The call taker logs in to WEB interface via a WEB http link. Data needed by the run-time system are prepared in offline database on data engineering station and sent to both Servers when updated.

Activities regarding the taking and processing the calls and customer outages are done by the call-takers in the Call-Centre. All the entered information is then displayed in the Call-centre web application itself and also in the OMI application in the Control centre. Probable and verified outages are also displayed in the main SCADA user interface. System outages coming from SCADA are also vice-versa displayed in the Call-centre to have prompt
information for the calling customers. It is up to the Control centre operators to further process the entered outages and to trace the changing status of the outage. All the activities of the operators in the Call and Control centre are interactively presented to all the actors in the OMS process.

CALL CENTER AND CUSTOMER DATABASE

In order to establish updated OMS system it was necessary to use current customer database and call center. Customer database, already used in existing call center, is independent system in company based on IBM DB2 database and is used primarily for commercial purposes: entering new customers, invoicing, tariffs, etc. but this is only database that is 100% correct regarding all existing and customers, and it contained information about electrical connection of customer to network point on low voltage level. It was logical to use it for new OMS system, and for that new import/update procedure was developed.

Basically, the import is based on reference name of load in SCADA/OMS system and customer name and load in customer database, where customer database is master of all data, and if new customer has to be inserted in SCADA/OMS first there should be referenced to substation or LV feeder for it.

Such import/update procedure is done once per day after midnight to keep OMS database up to date.

For call center, procedure is only changed in part when there is an outage call from customers in order that operators have to insert all relevant data in new web based user interface. These data are then transferred into OMS database and, depending on its nature; they generate alarm for SCADA operator, or are just additional information for OMS engine.

CONCLUSION

The new system described in chapters above present rather new concept in network operations for Elektro Primorska and demanded lots of work and effort for both: supplier and purchaser.

At the end it was proved that new systems can only succeed if they are based on already existing data and information, and if parts of it can be customized according to present practices and routines.

Although, the benefits of the new systems will be seen in years to come (complete SCADA/OMS system started with trial period in January 2009), we can say that it helped not only in part where control, supervision and reporting was automated, but also in establishing correct flow of information and data between different departments in company. The OMS tool is also a mean to obtain also organizational improvements in workflow and in the consistency of data and databases.

These experiences will be very helpful in new projects involving DMS applications and network optimization.

REFERENCES

