REMOTE MANAGEMENT IN ELEKTRILEVI OÜ

Hando LUUS
Estonia
hando.luus@elektrilevi.ee

ABSTRACT

This paper gives a brief overview of remote management and its practice in Elektrilevi OÜ- the largest distribution system operator in Estonia. The company has been practicing different technological solutions for achieving time-efficiency on maintenance of relay protection and automation devices. The most time consuming excessive aspect is time spent on transportation when visiting the sites. Widespread usage of industrial IP communication in the field of power distribution enables to connect remotely to every modern substation. The growth of IP communication gives a lot of opportunities to implement the remote management system. As in every business, it all comes down to profitability which in this case is not easy task to measure.

INTRODUCTION

In the history of Elektrilevi OÜ distribution grid, there have been many different technologies for communication between substation and dispatcher centre. Although these channels were often used for some form of maintenance activities, this paper focuses on the opportunities which are based on adaption of IP based telecommunication protocols IEC 60870-5-104 and IEC 61850. The development, problems and possible solutions for the remote management (RM) system given in this paper are based on Elektrilevi OÜ practice and vision. The RM system is constantly evolving and there are many aspects that the company is eager to find cost-effective solutions.

THE ESSENCE OF REMOTE MANAGEMENT

Every modern substation's intelligent electronic device (IED) like protection relay, RTU and other type of controller, have an interface for IP communication. Mostly for SCADA communication but the configuration is can be also done using the same type of interface. Many legacy IED-s support configuration using PC software. The core idea of RM is taking advantage of previously mentioned properties and do as many activities remotely as possible, using IP communication. Current activities done in RM involve mostly grid event analysis and applying changes in IED settings. This all means less time for transportation and more time for professional power grid duties.

RM as a system can be decomposed to three main components: destination site; communication channel; user interface. Although cyber security aspect involves each of the main components, it is described separately in this section as being increasingly important aspect in every modern automation and control system.

Destination Site

RM system's destination sites are power grid parts which contain IED-s. Typical power grid destination sites are primary substations, secondary substations, reclosers etc. Destination sites typically include some components of communication channel which is needed for data transfer between different IED-s on the site.

Communication Channel

The system's communication channel is a chain of telecommunication devices which enables to connect user interface to destination site. These devices are usually routers and switches but also may be different type of data or media converters, firewalls and servers.

User Interface

User interface is an instrument created for a power grid specialist for doing diagnostic and maintenance duties from the distance. The physical interface is most reasonably implemented as PC but many other aspects, such as system administration, require that there is a way to unify the interface's content simultaneously for all users. This interface is the most challenging aspect of the system according to Elektrilevi OÜ practice.

Cyber Security

RM system's cyber security aspect is easy to underestimate because it prevents many simple and good ideas from realisation. The awareness of cyber security risks increases the complexity of the whole RM system. Even though this paper carries on the RM experience in Elektrilevi OÜ, detailed facts are not published considering the prementioned risks.

ELEKTRILEVI OÜ EXPERIENCE

Elektrilevi OÜ (DSO) is the largest distribution system operator in Estonia with about 475 000 costumers. The company has been developing IP based RM system since early 2010s. The timeline can be roughly divided into two eras considering the user interface approach. There has also been growth in number of users and progress in terms of cyber security.

The First Approach

Destination Site
By the early 2010s, more than 40% of primary substations were equipped with modern IED-s which had IP connection to SCADA. There was an opportunity for more efficient arrangement of detailed grid data collection from IED-s. Approximately 100 destination sites in total.

Communication Channel
The whole communication channel from substation to SCADA was considered secure. Each destination site had its own VLAN. There was an isolated network for power grid control.

User Interface
Each specialist used its PC and the PC's content to make connections to destination site. There were also two desktop PC workstations on different locations specially for RM usage.

Conclusion

The first approach was flexible from user interface point of view, but it was also the major downside of the approach. The people who were highly qualified in power engineering were not all ready to deal with computer and software related issues. The two RM PC-s were administrated by small group of people and in the end they were often delegated to use it to collect data the others needed. This all reflected in active RM system user ratio which was estimated to 30% (12/40) of potential users.

The Second Approach

Destination Site
Number of RM destination sites in the grid has extended as new secondary distribution substations and reclosers are equipped with modern IED-s. Primary substations have been modernised and 60% of primary substations are in the RM system. Approximately 320 destination sites in total.

Communication Channel
Secondary substations and reclosers have mobile data (2G/3G) communication link to SCADA and for RM system. Communication security is enhanced by wider usage of VLAN-s.

User Interface
There is a terminal server (TS) to make connections to destination sites. Every specialist has rights for using TS via remote desktop (RDT) from its own PC. The TS content is administrated by five more skilled specialists. The TS content is unified on all user accounts.

Conclusion

The second approach showed that personal RDP connection availability and unified content in TS encourages less skilled personal to use the RM system. Active usage ratio is estimated to 70% (28/40) of potential users. It turned out that the more people using the TS and the more different application specific software on same operation system (OS), the more unexpected problems came up. It was expected that the key factor on user numbers will be up-to-date destination site specific RM manual on how to establish the connection to IED. But it was not expected that there will be a number of software related issues not easy to solve.

The Challenges and Future Approach

As mentioned in previous section, software related issues are the most difficult to solve. Selection of main issues are:

- legacy software not working on 64- bit
- some software do not support simultaneous multiuser execution
- some software need OS administrator permissions to be executed
- not all software versions are downwards compatible and only one version can be installed on one OS but different versions are needed

How to solve these problems? It is definitely a challenge for IT/OT team. Most probably there are several different platforms needed which unfortunately rise cost of the RM system. There could be easy solutions such as SCADA software integration for RM user interface functionality. This implementation could support the most modern IED-s using modern communication protocols. But how to manage legacy IED-s? Some questions remain unanswered. One thing is for sure- the challenges should be solved mutually by utilities and IED manufacturers. Otherwise there will be too many obstacles for building fully functional, user friendly, safe and cost-effective RM user interface.

THE BENEFIT OF RM SYSTEM

Elektrilevi OÜ has done some estimations in order to measure the benefit of RM system. The estimations have been done using questionnaires to RM system users:

- 1.5 hours saved on each task that need a site visit
- Up to 20 hours of TM system weekly usage by communication profile specialist
- Up to 8 hours of TM system weekly usage by relay protection profile specialist

There is a cost for keeping up the RM system. No extra cost is needed in the aspect of destination sites and communication channel. Majority of the devices needed in these aspects are expected for SCADA communication anyhow. There might be a need for reconfiguration of current devices or changes done in network settings, but it is one-time action only. The remarkable expenses come from the user interface aspect which can vary a lot depending on the solution. The hardware and OS need continuous maintenance. Also the content of user interface need constant update by administrators. Elektrilevi OÜ has not made recent accurate calculations on the profitability of the whole RM system but it is certain that the system enables much faster workflow than before. And when it comes to elimination of faulty or unwanted automation interruption, the RM system is one instrument for keeping SAIDI as low as possible.