PRIMENA METODOLOGIJE PAMETNIH MREŽA U DISTRIBUCIJI ELEKTRIČNE ENERGIJE

SMART GRID TECHNOLOGY IN POWER DISTRIBUTION SYSTEMS

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Ovaj rad opisuje primenu pametnih mreža u sistemima za distribuciju električne energije. Izloženi su sistemi za automatizaciju trafostanica koji omogućavaju nadzor, merenja i kontrolu u realnom vremenu

Ključne reči: *pametne mreže; distribucija električne energije; automatizacija trafostanica*

This paper discuses implementation of smart grid technology in power distribution systems. Substation automation that will handle real time monitoring, metering and control is proposed.

Key words*: smart grid; power distribution; substation automation*

1 Introduction

Smart technologies are changing the way we live and work today. Smart devices connected to the Internet or private network provide us with a large amount of information. Implementing such a smart technology in a power network makes it more efficient and reliable. Most outages in the low voltage network are caused by faults on the medium voltage side. Automated substations can reduce outage duration through fault location and remote control of switching equipment. Automated remotely controlled switchgear will help to isolate faulty areas from the rest of the network.

2 Smart grid in power distribution network

Smart grid consists of control center, automated substations and pole mounted switchgears and radio system for remote monitoring and control. Control center is equiped with SCADA (supervisory control and data aquisition) system for presenting the data and controls to their human operators. Automated substation is equiped with smart device that combines secure communication and protocol converter with telemetry.

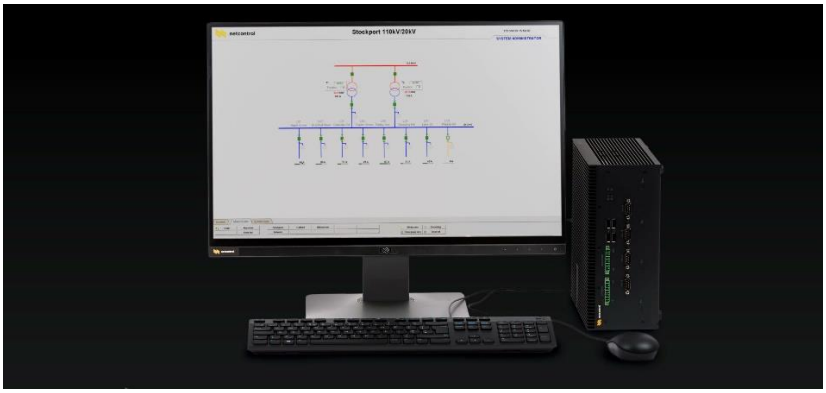

Figure 1- SCADA system in control center. It represents different analog and digital parameters collected from automated substations.It also enables human operator to remotly control substations.

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Figure 2 - Smart device in substation. It both talks to inteligent unit and control center over radio network. Inteligent unit measures current,voltage, power and other important parameter and sends them to smart device. It also detects faults on guidelines and use protection function to protect substation. All information from smart device are sent to control center.

3 EDB medium voltage automation

In order to modernize existing distribution system and make it less sensitive to power supply interruptions EDB upgraded their medium voltage network with a smart grid. The implemented system is used to remotely monitor and control equipment across a large geographic area within the city of Belgrade and rural communities. The whole system is controlled from a single control center.

Telecommunication network is devided in 5 remote sub-systems. There are two independent master radio systems in control center for communication between 5 data concentrators in remote sub-systems and SCADA system in control center through DNP3 protocol. Five remote slave radio sub-systems communicate with NetMan equipment in each sub-system.

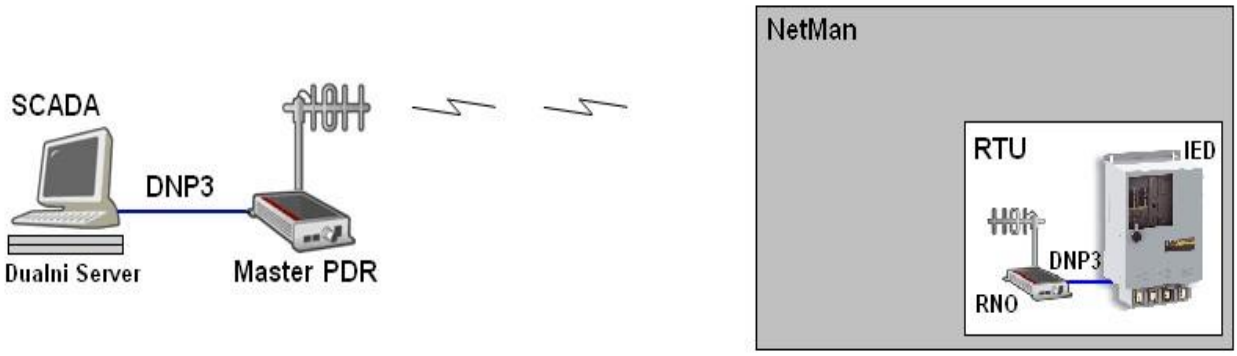

Figure 3 - Communication between SCADA system and NetMan equipment in one sub-system.

In each sub-system, NetMan equipment consists of data concentrator and automated substations or pole mounted switchgears. Data concentrator is the heart of NetMan equipment and it controls all automated stations in that sub-system. Communications between data concentrator and remote stations is accomplished over UHF radio network. Measurements data from each remote station consists of 48 digital statuses and 8 analog measurements.

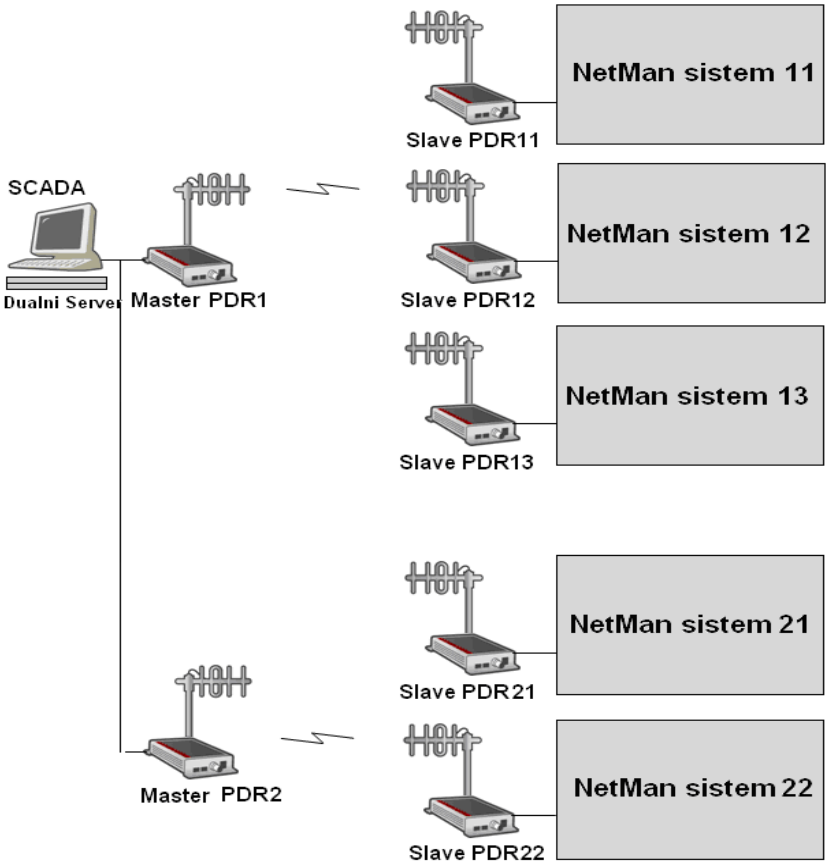

Figure 4 - Communication in the whole system.

4 Conclusion

By modernizing Belgrade power network with smart grid technology, a lot of benefits are achieved:

– Fast and reliable fault localization and isolation
– Reduced outage time
– Fast energy supply restoration
– Increased overall system reliability
– High degree of future expansion possibilities

In the future, this system could be expanded up to 500 automated substations and switchgears. DNP3 protocol could be implemented in communication between data concentrators and remote locations. It will enable new parameters, such is time stamping, to be transmitted.

5 Acknowledgement

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