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Development of a new model information transmission device implementing high reliability of a SCADA system

Kenji Sasaki*, Takeshi Kato, Takahiro Imai
Tohoku Electric Power Co., Inc.
Japan
sasaki.kenji.nk@tohoku-epco.co.jp

Tetsuro kanbayashi, Shigeru Konno
Tsuken Electric Ind. Co., Ltd.
Japan

Mayu Kurashima
NEC Corporation.
Japan

Yutaka Onuma
NEC Net Innovation, Ltd.
Japan

Hiroyuki Nakagawa
Juniper Networks, K.K.
Japan

In this paper, we will introduce the development of a new model information transmission device supporting high reliability of a SCADA system in Japanese electric power companies.

1. Introduction

Intelligent data Transmission Controller (ITC), which is introduced by Tohoku Electric Power Company, is essential to support a SCADA system contributing to a stable electric supply because it is able to transmit information of substations and power stations to control centers efficiently and flexibly. However, fifteen years removed from the introduction of the current model ITC, this device is encountering a difficult situation which is preventing us from maintaining the system and installing more devices due to a lack of some hardware parts. On the other hand, new demand to establish a backup system in advance is needed in terms of business continuity for when a disaster arises. This backup system is implemented by arranging the SCADA servers in control centers. Because the current model cannot meet these demands, we decided to develop a new model ITC which is applicable to the wide-area backup system. Because the SCADA servers and the new model ITCs are connected via a closed IP network for OT (Operational Technology), we also enhanced our IP network to realize high reliability.

2.1 Development of new model ITC

ITC is an information transmission device, which has an information collection/distribution function, to share a lot of information which is collected from substations or power stations. After these data are transformed into data packets, they are distributed to other ITCs. It will take several years to replace

all current model ITCs with new ones, therefore it is necessary to ensure compatibility between the current model and new model. We tried to develop a new model ITC which is compatible with the current model and also is available for adapting the wide-area backup system.

- **The adaptation for distributed arrangement of the SCADA servers**

We have been using the IP network for Wide Area network Controller (WAC) which connect ITCs to share information. At this time, because the SCADA servers, which are set on distributed manner in wide areas, and each ITCs are connected to such IP networks, we adopted a real time protocol for information transmission equipped with middleware which enables data packets to reach the destination. This middleware also contributes to the high reliability with its redundant configuration.

- **Improvement of the function of information collection/distribution transaction**

It is essential that the current model ITC is halted when we change the configuration of the system. The new model ITC enables us to configure the system without a system stop. This change will contribute to the improvement of the reliability of all systems.

- **Improvement of device reliability**

The adoption of high performance hardware enables the simplification of equipment components and the reduction of software functions. Therefore, a redundant configuration is realized.

2.2 High reliability measures of IP network

In accordance with the improvement of reliability of the SCADA system, the IP network is also enhanced in various points in order to increase its reliability.
The IP network is based on MPLS which enables explicit route management and fast path protection in case of links and/or nodes failure, and consists of two independent faces of networks. Both microwave radio links and optical lines have been adopted in these networks and the microwave radio links have been operated as the priority route to this point.
However, in order to meet the increase of data derived from the enhancement of the SCADA system, the optical lines are now operated as the priority route.
Although the IP network has the two independent faces of networks, these networks had shared the same optical lines. Therefore in order to improve the network resiliency and minimize the impact range of system failures, the type of optical lines has been separated into OPGW and distribution optical lines.
In addition, since IP multicast is required for the deployment of the distributed SCADA servers, NG-MVPN (Next Generation Multicast VPN), which is one of the MPLS features, has been implemented and enables efficient multicast traffic engineering.

3. Conclusion

We introduced the development of the new model ITC which is available for adapting on the distributed arrangement of the control servers and a provision of IP network having a resistance of disaster toward more reliable service. We are deploying new model ITCs in two important control centers now. Hereafter, we will expand it into more areas and support the implementation of the SCADA system which has high reliability and high disaster resistance.