Research on the Construction Scheme of Centralized Network Management for SDH Equipment of Electric Power Communication

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Abstract. As the neural network system of the power system, the power communication network carries the important production and operation business such as relay protection, safety and stability control, automation, dispatching telephone, etc. The safe and stable operation of the power communication network is an important basic guarantee of the power system. In 2012, State Grid Corporation of China launched TMS system to manage the SDH backbone network of power communication. In order to ensure the data connection between the professional network management and TMS system, the centralized construction of SDH network management of power communication is needed. In this paper, the construction scheme of provincial centralized network management is studied, which can provide reference for the subsequent construction of centralized network management.

Keywords: Power Communication, SDH, Network Management, Centralized Construction

Power communication is an important part of power system and plays an important role. Power communication can connect all devices, make them interconnected, and send these integrated data to the whole power system[1].

The power communication network is the neural network of the power system, which mainly carries the important production experience business such as relay protection, safety and stability control, automation, dispatching telephone, video conference, etc[2]. At present, the technical system of electric power communication network mainly includes OTN (optical transport network), SDH (synchronous digital hierarchy) and PTN (packet transport network). Among them, SDH is mainly used for large capacity backbone transmission, accounting for the highest proportion in the electric
power system[3-4].

1. Current situation of SDH equipment management of electric power communication
The SDH backbone network of electric power communication is classified and self built according to the way of headquarters, branches, provincial, prefecture and city level. Each level network is independent from each other, and each branch, provincial network and city network are not connected with each other. SDH backbone network of electric power communication carries out equipment management in the way of "unified dispatching, localized operation and maintenance"[5]. SDH backbone network of electric power communication has the characteristics of large quantity and wide coverage.

Equipment layout points mainly include central stations at all levels, substations, independent communication stations and direct dispatching power plants, and equipment capacity is selected according to business demand and economic benefits. The mainstream brands used in SGCC include Huawei, ZTE, Alang and Fenghuo[6].

In order to promote standardized management, State Grid officially launched the TMS (the Transport Management System) in 2012, and required all local and municipal companies and above SDH equipment network management data to be uploaded uniformly. The servers of each SDH transmission network are scattered in the corresponding SDH equipment management units. There are many kinds of server brands and models, and the operation management level is uneven, which seriously affects the data connection between professional network management and TMS system. Therefore, it is urgent to carry out the construction of centralized network management of SDH equipment and carry out unified and standardized management[7].

This paper will take the provincial centralized network management construction as an example to carry out program research.

2 Requirements for construction of centralized network management for SDH equipment of electric power communication

2.1. Overall requirements
(1) Safe and reliable. The centralized network management system shall have a unified disaster recovery structure and network management network configuration strategy; and the security protection strategy shall conform to the 《Security Protection Regulations of the Power Monitoring System》[8].

(2) Economical application. The network management system shall meet the requirements of clear grid structure, simple equipment configuration, convenient operation and maintenance, and convenient expansion access. The choice of technological system should be based on the advanced nature and applicability[9].

(3) Principle of scalability. The centralized network management system shall fully consider the hardware performance and software version management of the network management server, network bandwidth equipment, gateway network element selection, etc. The centralized network management system should have good scalability in addition to meeting the existing and planned equipment management requirements.
2.2. Server requirements

(1) The network management server shall select technical parameters, equipment brand and model according to the requirements of network management monitoring software to reduce the failure rate of network management software operation[10].

(2) The network management server equipment shall be deployed in the way of remote dual machine hot standby, in which the primary server is deployed in the provincial central station and the standby server is deployed in the disaster recovery center.

(3) The hardware configuration of network management server and the configuration of network element and client licenses shall meet the existing and planned network element access requirements, and be moderately advanced.

(4) Access to the unified time synchronization system to provide unified NTP time source service for the network management server.

2.3. Safety requirements

(1) The centralized network management system shall be included in the production control area, and the strategies for physical security, network security, host security, application security and data security shall be set in accordance with the provisions on 《Security Protection of Electric Power Monitoring System》.

(2) After the completion of the centralized network management system, the filing and regular evaluation work shall be carried out in accordance with the requirements of the national level protection work.

2.4. Terminal network element management

(1) The authority of the provincial centralized network management system shall be managed by the provincial company in a unified way, and the authority shall be allocated according to the principle of regional and localized operation and maintenance.

(2) Network architecture, system scale, disaster recovery and expansion requirements shall be considered in the selection of gateway network elements. The gateway network element shall be separated from the access node of the network management network as far as possible.

(3) The ID identifier and IP address of the device network element shall be uniformly divided and managed by the provincial company and allocated according to the region.

3. Networking mode of network management network

3.1. Grid structure

The network management network shall adopt the network frame structure of "mouth type" and "double up connection", which is divided into the core layer and access layer: the core layer is composed of two routers and two switches for provincial central station and disaster recovery respectively, which are used for server, network management client and gateway network element access and data aggregation; the access layer covers each city, and each city company shall set up the main and standby routers and switches to connect the provincial network and the local network Gateway network element and NMS client. See Figure 1 for networking diagram.
3.2. Protocol configuration

(1) As domain planning. Based on the principle of good network scalability, simple network structure and low maintenance cost, the network management network should adopt the single autonomous domain mode, and design the core layer and access layer router node as an independent as domain.

(2) Through vpn-pe / CE, the network management network can realize the business isolation between the transmission equipment of different brands and different technical systems; a cross domain VPN is set up for cross domain connection with the data communication network; a network management VPN is set up for network equipment management. OSPF + BGP is adopted for public network routing protocol, and OSPF dynamic routing protocol is adopted for internal routing protocols of VPN.

3.3. Safety protection strategy

A protective wall shall be set up between routers and switches in the core layer to restrict data interaction between servers and network management customers. The security strategy shall meet the requirements of 《Basic Requirements for Network Security Level Protection》 (GB / T 22239-2019).

References

[1] Jieyingbo. Power communication and its application in smart grid [J]. Power information, 2019,11:204-205.

[2] Ziping W U , Gao W , Gao T , et al. State-of-the-art review on frequency response of wind power plants in power systems[J]. Journal of Modern Power Systems & Clean Energy, 2017, 6(1):1-16.

[3] Sakti A , Gallagher K G , Sepulveda N , et al. Enhanced representations of lithium-ion batteries in power systems models and their effect on the valuation of energy arbitrage applications[J]. Journal of Power Sources, 2017, 342:279-291.
[4] Heidari A A, Abbaspour R A, Jordehi A R. Gaussian bare-bones water cycle algorithm for optimal reactive power dispatch in electrical power systems[J]. Applied Soft Computing, 2017, 57:657–671.

[5] HOU Ying, XIA Rui. Power Emergency Integrated Communication System Based on Soft Switching Technology[J]. Electric Power Information & Communication Technology, 2017(4):60-64.

[6] Deng X, Wu Y, Khalid A M, et al. LED power consumption in joint illumination and communication system[J]. Optics Express, 2017, 25(16):18990-19003.

[7] Shengchao Yan, Desheng Wu, Jiang Zhu. Power Terminal Communication Access Network Monitoring System Scheme Based on Design Patterns[J]. IOP Conference Series Earth and Environmental Science, 2018, 108(5):052024.

[8] Hao S, Li Y, Zhang T, et al. Scheme of Communication Network and Network Management System for New Generation Smart Substation[J]. Dianli Xitong Zidonghua/Automation of Electric Power Systems, 2017, 41(17):148-154.

[9] Pan X, Xu Q, Zhao T, et al. Design and implementation of communication network and system management for hybrid AC/DC microgrid module[C]// 2017 IEEE 3rd International Future Energy Electronics Conference and ECCE Asia (IFEEC 2017 - ECCE Asia). IEEE, 2017.

[10] George Patrick Xavier, Burak Kantarci. A survey on the communication and network enablers for cloud-based services: state of the art, challenges, and opportunities[J]. annals of telecommunications - annales des télécommunications, 2018, 73(3):169-192.