The Research on the Network Planning of the Electricity Information Collection System for Power Users

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Abstract: The electricity information collection system is an important part of the smart grid construction. The electricity information collection system for power user can control their electricity consumption information in a timely, complete and accurate manner. The electricity consumption information of users collected by the system is used as the basis for charging, which involves the interests of thousands of households. The control function of the system affects the power outage of customers. Therefore, a safe and reliable channel for the system is very necessary. In this paper, while planning the network of the electricity information collection system for users, measures are also taken in physical and logical aspects to ensure network security. The system main station to concentrator and special-purpose acquisition terminal mainly adopts passive optical fiber Ethernet, and the collector to concentrator adopts power line carrier for the network structure and planning of the system.

1. Introduction

In recent years, the growth of communication network bandwidth and technological changes have promoted the rapid development of the Internet, and the emerging technologies such as mobile Internet, Internet of Things, and cloud computing have also placed higher requirements on communication networks. This status has made operators to continuously increase the scale and speed of network construction. The transport network is the basis of the modern communication network, and the planning and design work of transport network is the basic work of the transport network construction. This paper introduces the development background and research status of electricity information collection system for power users, and explains the importance of network planning and optimization for the electricity information collection system for power users. Then analyze the characteristics of wireless network technology and network composition of the electricity information collection system for power users. Finally, start with the introduction of the core content and key technologies of network planning and optimization of the electricity information collection system for power users.

2. The Significance of Network Planning of the Electricity Information Collection System for Power Users

The future bearer network requires higher bandwidth, software, and virtualization. It has strong dynamic and scalable requirements and supports diverse service types. So, the bearer network based on SDN has become an important evolution direction of the future network. The traditional planning and design of user grid network directly targets physical network facilities. As the diversity of networks and equipment, planning tasks such as network topology acquisition and routing usually need to be manually performed, and also including seeing drawings and calculations, the degree of automation is not high, which has resulted in poor routing success rate and low resource utilization. It more relies on manual planning adjustments, it wastes lots of time and takes great efforts. If the SDN technology can be used to complete the underlying network virtualization, focus on the upper layer topology design and complete the network planning, it will greatly enhance the actual role and efficiency of network planning.The software-defined network planning system

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focuses on the planning and design requirements of the SDN network, and applies its global view of the network to automatically acquire the abstraction capabilities of the network topology and network resources. Supporting the dynamic construction of the network can break through the limitations and shortcomings of the traditional network planning and design system. It will solve the problems such as the existing long network routing cycle, the difficult link among resource status, not timely information update, low success rate of path programming and so on. The software-defined network planning system proposed in this paper is aimed at dynamic real-time network planning and looking for the best solution to solve the above problems. Therefore, the software-defined network planning system has the following improvements compared to the traditional network planning system:

(1) Great improvement on automation. In the traditional network planning, the resource data of the network is large and scattered, it relies on manual statistics to integrate data and import it into the system platform, the degree of automation is low, and the maintenance cost is extremely high.

(2) Support the construction of dynamic network construction. It's a very important mission to designing a topology, especially for high-utilization networks. it will result in huge unnecessary costs without careful design of topology.

(3) Rich routing capabilities. In the software-defined network planning system, a routing algorithm interface has been provided, which can implement effective routing as needs. It also adds pre routing function, which can configure the switch flow table in advance before the service reaches the network, and implement the results of network construction in the actual network to improve network performance.

(4) The real-time evaluation of network functions. This function enables real-time evaluation of the network after planning to ensure the reliability of network planning before the network planning is officially deployed.

3. The Construction of Resource Database of Electricity Information Collection System for Power Users

In the system structure, the virtualization of the current electricity information collection and transmission network for power users is mainly to construct the network resource database. This paper verifies and sorts out the resource data of electricity information collection network design for power users retained in the traditional transmission network planning and design stage, and then design a resource database of the relational electricity information collection network for power users based on MySQL database. In this paper, the main work of constructing a network resource database mainly includes the following points:

(1) Standardize the complex and diverse network nodes, links, and device data in the current network, so that the naming and format of network design resource data that existed because of different time and space are unified.

(2) Realize the initial delivery network virtualization, which have provided a data foundation for automated, real-time network planning and design work.

(3) Have constructed the point, chain and two-dimensional network data structure and combed the relationship between network elements to realize the internal linkage of data, which have provided a good structural foundation for network resource data update and maintenance.

(4) Continuously update and maintain network design resource data, and update the network resource database according to the continuous arrangement and survey of designers. This paper has built the network resource database from all aspects.

This paper makes a great effort for the data collection and storage by sorting out dozens of Excel spreadsheets, unifying multiple network resource identifiers, and developing data dictionary functions with automatic error correction. As the confidentiality of the data itself, no details are shown here.

4. Physical Security Measures for the Electricity Information Collection System Network for Power Users

The planning of the communication network of the electricity information collection system for power users is divided into two phases of current and long-term. The design principle is to meet the requirements of the current system data communication and the investment should be reasonable, while taking into account the extension of the forward network. Network planning should meet security needs while meeting business needs.

4.1. Network Structure Selection.

The communication network structure of the electricity information collection system can adopt either a two-layer network structure or a three-layer network structure. A two-layer network has network risks such as broadcast storms and ARP attacks. This will have a huge impact on the security of the entire network. For example, the CPU resources of the consuming device even can cause full load and preempt the uplink link bandwidth, and finally cause abnormal service abnormalities. Two-layer network has the problem of insufficient resources. There are more than 8,000 collection terminals in the electricity collection system, even more than 120,000 collection terminals in one province. The VLAN ID resource of the two-layer network is only 1~4096, and the VLAN resources are far from enough. Besides, a large number of VLAN data messages have greatly high requirements for the network equipment in the terminus.

4.2. Physical Planning of Network.

The communication mode of the electricity information collection system for power users, use distribution user information collection of the public, use optical fiber communication from the main station to the concentrator and use power line carrier communication from concentrator to collector. The current fiber-optic network of the electricity information collection system for power users is divided into three main loops according to the structure of the distribution network and the direction of the urban road, and then the branch to the concentrator and the special variable acquisition terminal will be applied. Since the acquisition system master station to the collection terminal is a point to multipoint structure, so use passive fiber Ethernet, referred to as EPON. The picture of network topology is shown as figure 1.

4.3. The Physical Protection of Network.

Since the EPON network does not support the ring network structure, we use the dual-office device OLT, and the fiber enters the user’s equipment ONU in a hand in hand manner to protect the collection system network. The ONU is equipped with a primary and backup dual optical port. When the optical fiber fails and the main optical port has no signal, the device automatically enables the backup optical port. The ONU and the collection device are connected by twisted pair. Since the ONU does not need to be configured with an IP address, the ONU does not need to reconfigure the IP address when the primary and backup optical ports are switched, thus realize the automatic switching of the channel. The two hand in hand cores can use the same fiber to save investment. The network protection structure is shown as in Figure 1.

According to the planning and design of the communication network of the electricity information collection system for power users, it has been widely accepted that the electricity information collection system network for power users is superior to the power grid communication and network information protection. In the process of promoting smart grid construction, the construction plan of the core substation is extremely important, and it is the key link for the safe and reliable operation of the power grid in the future. The planning of the electricity information collection system for power users in substation is one of the core links of substation construction.

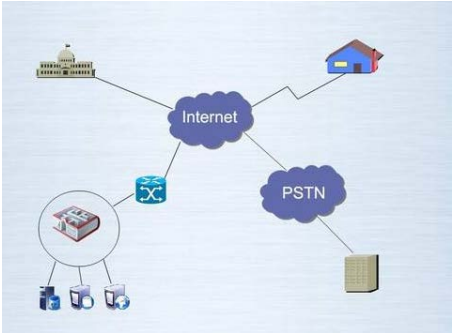

Figure 1. The topography of the electricity information collection system for power users

5. Conclusion

When studying the planning and design of the electricity information collection system network for power user, it is necessary to make a reasonable choice on the information transmission equipment. When select a transmission device, it should be selected according to the requirements of the electricity information collection system network for power user. Considering the capital cost of the network structure, it is necessary to select equipment with large storage capacity and excellent quality within the allowable range. When studying the planning and design of the electricity information collection system network for power users, it is necessary to make a reasonable choice for the router. When selecting a communication network device of a power transmission fiber, it must be analyzed according to the actual network operation, such as choosing whether to use the device according to the characteristics of the network topology, whether the line has compatibility and transmittance. Don't let the device capacity idle and cause unnecessary waste of resources.

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