The Remote Monitoring and Control System Based on the Ethernet for Power Electronic Equipment

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Abstract: This paper presents the work on hardware and software technology to realize remote debugging and diagnostics to the power electronic equipment controller. The application of virtual private network technology, combined with SCOUT tool, a remote control through Internet is used. A detailed analysis of the application effect is shown. It is proved that remote monitor system can connect motion controller in different network environment, shorten special equipment's remote monitoring, predicting, diagnosing, maintaining respond time, provide effective remote technology support on time.

Keywords: remote, monitoring and diagnosis; virtual private network, drive controller

1. Introduction

With the development of automatic control technology, the scope of a new generation of motion control system Siemens Motion Control SIMOTION is widening. Virtual Private Network can be integrated in the Internet, through the application of the tunnel, encryption, key management, authentication and other security technologies to enable on-site equipment and remote technical support center in the rapid establishment of network connections. To ensure normal operation of power electronic equipment, it must monitoring and diagnosis in its failure to avoiding a major accident, in order to reduce the enterprise losses. The professional technicians are sent to the site in traditional solution to debug the diagnosis, but this methods not only spend time and space constraints, but also can not quickly solve the problem. Fault diagnosis and treatment guidance is provided jointing with the remote experts to resolve extremely complex failure. This will not only ensure both private communications and security, but also greatly improve service responsiveness. This technology can reduce the blindness of technical engineer dispatched to the scene, saving human and material resources to provide clients with high quality after-sales service.

2. Virtual Private Network

A Virtual Private Network (VPN) is a data network that is used for transporting private data through a public network. It thus enables secure transmission via a non-secure network. The principle is that the confidential data of the two endpoints are connected to the public communication network. When the confidential data are transmission, through the VPN endpoint device in the public Internet to establish a virtual private communication channel, and all the data have to undergo encrypted before transmission, while the tunnel technology is protocol-based the second or third layer tunneling. The second layer tunneling protocol corresponds to OSI (Open Systems Interconnection) the data link layer model, using the frame as a data exchange unit, such as PPTP, L2TP, and L2F tunneling protocol, the data are encapsulated in the Point to Point Protocol (PPP) frames sent through the Internet. The third layer tunneling protocol corresponds to network layer of OSI model, using the package as a data exchange unit, such as IPSec tunneling protocol, is the IP packet encapsulated in an additional IP header transmitted through IP network. However, the second layer tunneling protocol can only happen in terminate the end of the tunnel for authentication and encryption, while the tunnel in IP public network transmission process can not completely guarantee the safety. IPSec encryption is assembled outside the tunnel to ensure security during transmission.

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3. SIMOTION drive control systems

SIMOTION provides three hardware platforms: (1) controller platform, SIMOTION C; (2) drive platform, SIMOTION D; (3) PC platform, SIMOTION P. A control program can run on either platform of them. SIMOTION Motion Control system integrated logic control, motion control (positioning, synchronous, etc.) and process control (pressure, temperature control, etc.) in the same system. it is designed to a core machine which plays a leading role in motion , mainly used in a complex, high speed and precision control field. Among them, SIMOTION D is a drive system based on the SINAMICS S120 platform, being an extremely compact and powerful control functions drive control systems. It is integrated motion control and drive together and the whole system has fast response speed. SIMOTION D is with the performance of different versions. All of the versions can ensure

maximum capacity and flexibility. SIMOTION D through the line integrated IEC 61131-3 PLC, SIMOTION D can not only control the movement, but also control the entire machine. HMI (Human Machine Interface) device can connect to the machine PROFIBUS or Ethernet interface for on-site operation and monitoring.

Aside from the fixed IP address located in the subnet, the SIMATIC S7 Ethernet interface must include the IP address of the local router in the Ethernet as a parameter (as a default gateway / router). Here the IP address would be the address of the respective NETGEAR FVS 338 router in the local network. SIMOTION SCOUT is a powerful engineering tool which is easy to use, provides engineering development, configuration, parameter setting as well as programming, testing and diagnosis. STEP 7 is basis necessary for the SIMOTION SCOUT. SIMOTION SCOUT is the application of a variety of basic carrier, which includes all applicable SIMOTION hardware platforms and SIMOTION function library for real-time software and STARTER drive commissioning , is a tool for debugging SIMOTION software (requires authorization). It is developed in the motion control, logic control and process control, and drive configuration and debugging. SCOUT as a control system engineering tools, the main features is as following: a hardware configuration and identification; b-driven parameter settings; c motor dynamic debugging; d fault diagnosis; e procedures such as downloading and uploading. SCOUT as an engineering development tool, is particularly putting the emphasis on user friendliness, all of the processing tasks can be accomplished graphically.

4. Design and Application of remote system

4.1 Necessary Hardware Preparation

On the PC side, it has to be observed that the IP address is automatically obtained via DHCP in both cases, gateway-gateway or client-gateway connection. The remaining settings are automatically made by the router or the internet provider.

On the controller side, the IP address has to be permanently assigned according to the IP band. The local router has to be entered as a default gateway. No additional settings are required.

On-site monitoring system by the monitoring PC PG / PC and SIMATIC HMI devices, such as TP (touch screen panel), OP (operator panel) or MP (Multi Panel) and other devices via Ethernet, is responsible for Operation of the SIMOTION D monitoring and control[7,8]. To establish VPN tunnels with the factory, the remote technical support center operations in large quantities, so use gateway-to-gateway (gateway to the gateway) connections; Remote diagnosis expert for the seat is not fixed, the adoption of client-to-gateway (the client gateway) connections, which is characterized by no specialized hardware, just install the client software. Only when the device fails, the local network center site VPN is allowed access to Interne through firewall only. Figure 1 below shows the hardware configuration of this part of the application.

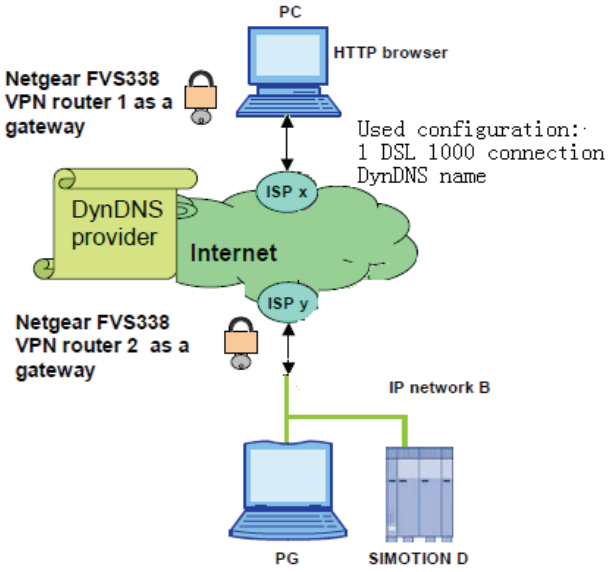

Figure 1. Application of remote system topology

4.2 Functions and Remote Operation

When the motion control platform fails, first of all, the local network center and the manufacturer's technical support contact, and the equipment is located Ethernet access through VPN Firewall Internet, VPN tunnel parameters will be set. Remote technical support centers and remote experts establish VPN tunnels to the plant in different ways, remote debugging and diagnosis for Motion controller.

The functions of SIMOTION are:

- read out diagnostic data,
- download the program to the controller,
- monitor variables / blocks
- go online to SIMOTION and SINAMICS

Moving the drives via the machine control panel integrated in SCOUT was not possible. The connection collapsed due to the high data load and the required response times.

After the remote diagnostics, disconnect the local network center with Internet connection, VPN tunnel termination of the corresponding record fault information. The communication data encrypted in the VPN tunnel to transfer, remote computer just like the scene in the PG / PC, maintenance engineers through a "virtual presence", to realize the motion controller fault condition of the understanding, diagnosis and rule out. Each remote diagnosis has to be reset the VPN tunnel parameters to prevent external attacks illicit users and enhance security

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5. Practical Application

Building a safe and efficient platform, it is necessary to integrate the existing network and the actual need of enterprises to develop sound security policies. In view of the VPN products exist issues from different vendors compatibility, for better adapting to the interconnection between different networks, local network centers and remote technical support centers are using VPNC (Virtual Private Network Alliance) certified VPN device.

The remote debugging and diagnosis methods have been applied in the domestic production of a large forging machining workshop Motion Control System. Remote computer access Ethernet site through the VPN tunnel has the same control as the site superior PC to the motion control platform. Information received through the VPN tunnel viewing the motion controller interface, WEB interface and human interface is consistent with the operation devices. After a long run, the results show that the method is reliable, efficient and effective remote operate data transfer rate despite the ISP (Internet service providers) to provide the bandwidth limitations, but it has to meet actual needs, and can do real-time online debugging and diagnostics.

The technology has been applied in a Power Electrical Equipment Co., Ltd. Shaan Xi Province Xi'an Qiyuan .It has been repeated for the enterprises to provide seasonable and effective remote technical support. It has solved most of the errors such as software configuration parameters properly, external hardware, software and other internal program logic issues. The functions such as read out diagnostic data can be executed successfully. The application shows that the speed corresponded to the interfaces in the local network.

6. Conclusion

A VPN can exchange data as in an internal LAN and it is not required that the individual nodes be directly connected to one another. The remote debugging and diagnostics to motion drive controller using VPN technology has solved the problem of failure not being treatment on time. It is shorten the maintenance cycle and also enhance the production efficiency while showing a good open feature. It is easy for industrial control devices via Ethernet which using VPN tunneling technology to secure access to external network computer within the network. It is convenient to remote control of internal network devices. The future task is considering a combination of wireless networks, 3G networks, getting the best equipment remote monitoring in different network environment. The technology has a high value of promotion. Since the remote endpoint can have changing IP addresses or since it can be located behind an NAT gateway, it is not advisable to specify the IP address of the client PC.

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