Research on the VXI fault diagnosis for computer network based on immune genetic algorithm in process of data transfer

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Abstract

This paper analyses status and requirement of electronic equipment test. Auto test system's hardware based on VXI is presented. Test diagnosis network architecture is put forward. The advantages of C/S and B/S mode are analysed. The computer network is combined with virtual instrument ideally. Based on existing VXI test system and combined with computer network technology, fault diagnosis network based on hybrid structure of C/S and B/S is developed by Lab Windows/CVI. It realizes instrument's linking each, share resource and the improvement of the utilizing rate of instruments.

Keywords: fault Diagnosis, VXI, virtual Instrument, immune genetic algorithm, hybrid Structure

1 Introduction

In recently years, with the quick development of computer, micro-electronics, communications and network technique, test technique and instrument make great progress. There appears intelligent instrument, PC instrument, VXI instrument, PXI instrument, virtual instrument and auto test system. Sensibility, precision and reliability should be advanced in test technique. Modern test system develops to miniaturization, n-contact, multi-function, intelligence and network. Through test diagnose network, instruments can be linked each other. In this way, resource can be shared. And instruments can be also reduced. In addition, test efficiency can be improved. Because of the development of network and database technology, the test diagnosis system based on network is inevitable development tendency. With the development and popularization of computer technology, especially broad applications in important branches of national economy, the problem of computer reliable has been standing out in the information society [1].

Information is usually stored and managed in database system, so how to guarantee and strengthen the security and secrecy of database system has been the exigent problem. The security of database system lies on two layers: one is measure of user name/password identification, view, permission control and audit from database system itself, large database systems, such as Oracle, SQL server have these functions. The other is that application systems provide. Generally, basic secure technology from database system is adaptive in generic applications. For applications in important branches and sensitive fields, the above measures are not enough. Some users, especially interior ones can also obtain user name and password illegally, use other methods to enter database exceeding their authority and get or modify information. So it's necessary to encrypt important data in database system.

During recent years, the advanced technology and systems are used in electric communication network, the construction of communication and information network for rural power grid is developing at top speed. The electric power enterprises are beginning to construct the information network for rural area to meet the needs of information and communication during the rural power grid's development when compared with the rural power grid upgrade [2-3]. The information and communication systems of rural power grid are diversified in technical structures and operation patterns based on their own practices and levels of economic development. This paper analyzes and inquiries the mode of planning and developing a network in rural area.

Recently, a lot of new complex electronic equipment has been quipped such as C31, which is advanced in technology and has a lot of single facilities. The new complex electronic equipment's test items are complicated [4]. Now the support unit that focus on maintenance test vehicle can take finite support facilities and support equipment. The support unit's fault diagnoses ability and technology support is low, which limits the maintenance equipment technology support ability. It is very difficult for the existing single test diagnosis and maintenance. It is expensive to construct new test diagnosis network through combine current GPIB and VXI instrument with rapid development computer network technology. Through the test diagnosis network, we can realize instrument's linking each other, combine test and resource share [5].

2 Auto test system based on VXI

VXI test bus platform is an excellent platform that faces to instrument bus and auto test system in 21 century. The application scope of VXI has included traditional electronic instrument domain. VXI can be integrated into auto test system easily that be used for different purpose. VXI's inter-cooperate ability is well. And the rate of data transform is high. VXI instrument is

popular in electronic test domain and becomes the mainstream of instrument development [3]. There are main control computer, program control computer, program control DC power, program control probe locating, VXI test equipment, test adapter and GPIB communication cable in the auto test system. There is IEEE488.2 bus between instruments. VXI test instrument is a standard bus module instrument system, which is composed by VXI trunk and VXI module. The auto test system's main task is to test and diagnosis the tested object under the main control computer's control. The program control DC power and the program control AC power provide power for the test equipment. The program control probe locating can test and diagnosis printed circuit board offline. The VXI test system includes HPE8403A (C size 13 trough VXI main trunk), HPE1406 (command module), HP82350 (IEEE488.2 interface module), HPE1411B (digital multi-meter), HPE1420B (general counter), HPE1428A (digital graph), HPE1460A (relay multiplex switch), HPE1465A (relay matrix switch), HPE1434A (discretional wave generator), HPE1441A (function wave generator), HPE1450A (160MHz timing module), HPE1451A and HPE1452A (digital I/O module). In addition, there is test adapter to connect auto test system with tested object. The auto test hardware composition is such as figure 1.

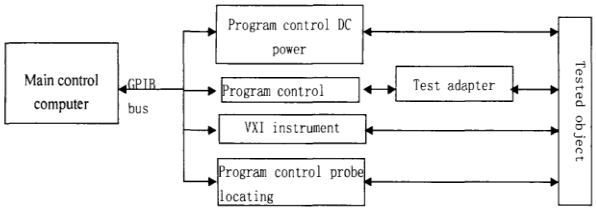

FIGURE 1 The interface of data table

It is not long for the test diagnosis network to develop. There are two operation modes in test diagnosis network system. One is client/server mode. the other is browser/server mode. The test diagnosis network runs under the client/server mode through LAN in early 1990. Client/server mode can realize data's fast transfer and information's secure storage. It divides the test diagnosis system into two parts and keeps balance between client and server. It makes great progress in fault diagnosis network domain. But the client/server mode is deficient in managing long-distance data and extended interface. With the fast application and popularization of INTERNET, browser/server mode replaces traditional client/server through its absolute advantage. It makes much progress in test diagnosis network domain. Browser/server set up on TCP/IP protocol and HTTP protocol. Client needs only to install browser software, through which client can realize communication with server. Browser/server succeeds in portability, low cost, openness and uniform interface, but it has shortage, which should be ameliorated. For example it is deficiency in communication efficiency and security. So this paper presents to develop test diagnosis network based on the hybrid structure of client/server and browser/server, which try to take advantage of client/server and browser/server and enhance the test system in network circumstance.

The architecture structure of test diagnosis network based hybrid structure such as figure 2.

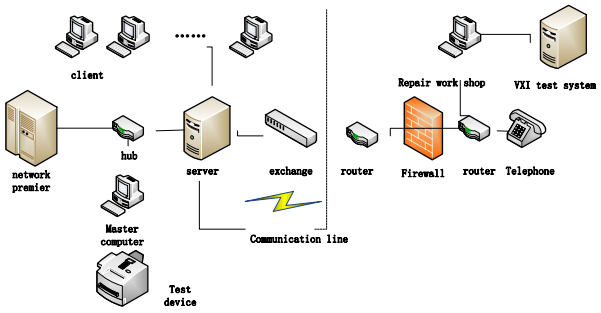

FIGURE 2 The architecture structure of test diagnosis network based hybrid structure

The test diagnosis network system set focus on VXI test system. It acquires data, tests and diagnoses. It realizes resource share and long-distance support by means of computer and network. There is a set of VXI test diagnosis system in LAN, maintenance shelter and repair workshop [4]. Maintenance expert can test and diagnose local and military area electronic equipment through LAN and Ethernet in peace time. In wartime they can provide maintenance shelter long-distance support through communication satellite. In the test process, an advanced ability computer is the server. The server controls the distribution of network communication and instrument resource [6].

Test diagnosis network realizes two tasks. One is long-distance test, the other is information share. In long-distance test process, the test items are divided into simple test items and complex test items. The simple test items such as the test of voltage and current produce a little test data. The quantity of data exchange in network is not too much. These test items can be run in both client/server mode and browser/server mode. The complex test items such as the real time test of wave and frequency produce plentiful test data. If these test items be run in browser/server, it is very easy to block the network. So these test items should be run in client/server mode [7]. The test data and diagnosis result are printed by network printer.

The test diagnosis network divides into auto test system and communication network. The communication network includes server, client, and network facility. The communication can be divided into LAN and outer network. There are server, main control computer, client, hub, fault test facility, network card, and communication cable and network printer in LAN. The server connects with client through hub. These are server, exchanger, router, communication satellite and signal tower, Ethernet, modern, army telephone in outer network. The repair workshop as long-distance client dials by arm telephone to connect Ethernet through modern. The repair workshop as long-distance communicates with server through router and exchanger in wire. The maintenance shelter connects with server through communication satellite in wireless [8]. The communication network realizes the communication of server with client. The server controls and manages the network communication.

The test diagnosis network software includes operating system software, network component, test software, database software and client application program. The server installed windows/2000 server as operating system. It also installed Web server IIS and communicated with client through TCP/IP protocol. The server installed SQLSERVER2000 software as database server. Equipment maintenance data and instrument resource distribution table be stored in the data-

base. The client installed window/98 operating system software and client application program. It communicates with server through TCP/IP protocol and HTTP protocol. The main control computer installed test control software and control the instrument [9].

The test diagnosis network's kernel is the development of client application program under client/server mode. The function of client application program is to operate instrument by instrument virtual panel. The develop tool is NI company's Lab-windows/CVI. Lab-windows/CVI operate instrument by VISA library function and transfer data by data-socket. Data-socket is a develop tool for network test control system. Data-socket provides uniform API function for bottom communication protocol and can local file and the data on HTTP server and FTP server. Data-socket predigests the problem of real time data transfer and can point the client's principle. It confirms which clients have read or write right. It improves the network security. In the test process, all the test data can be transferred to data-socket on server. Client gets test data from data-socket .On the data-socket default attribute. Client only has read operation right. In order to realization of the transformation of real time data, Data-socket uses DSTP protocol that can transfer data rapidly. Client provides application of operating instrument for server by client application program. Server validates the client identity. Pass the identity server looks up the instrument state in instrument distribution table. If the instrument is idle, the right to control instrument distribution table. If the instrument already be impropriated, server will give notice to client. The client can judge whether to wait, when the instrument is idle, server will give notice to client and the client will have the right to control instrument. When client completes test task and cut the connection with instrument, the instrument resource distribution table can be renovated by server. In browser/server mode, SQL-server database is set up on server. The maintenance information of equipment and drawing data is stored in SQL-server database. The virtual instrument panel is developed into ActiveX control and embedded in web. The client looks up equipment information and operates instrument through IE browser [10].

3 Implementation of three dimensional exploration and immune genetic algorithm

Three dimensional exploration relay network structure is shown in figure 3.

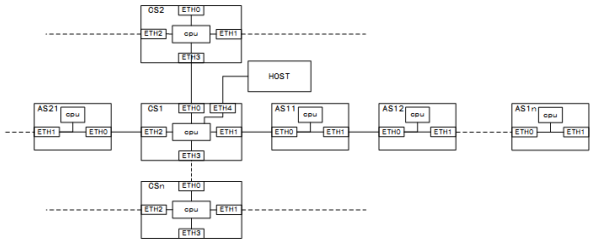

FIGURE 3 The three dimensional exploration relay network structure

For the network structure on the collection station with two network interfaces, each network interface, are connected in turn, the main function is to collect the information, and the five network interface for the cross site CS1, the main function is responsible for the conversion of the data collected, and the acquisition station collecting data are uploaded to the host, to control the host can be corresponding to the gathering station and cross station's the use of TCP/IP protocol for distribution throughout the three exploration and the structure of IP management. With IP forwarding function for the whole structure of the gathering station and cross station, the host is through the radio mode IP forwarding; belong to the same segment for any adjacent network interfaces. The host broadcast mode dynamic allocation of IP, when the cross station adjacent to the received command, first of all to judge on the 5 network interface transmission direction, and then control the IP distribution at this time to be the host for each network interface of the machine, cross station began cross station and acquisition and adjacent building acquisition array, until the command sent to the host at the end of a collection station every road, so that the IP assigned. For the allocation and IP routing table at the same time, a mechanism can be set up. Before the establishment of the routing table, first determine the uplink and downlink direction for the upstream routing and IP distribution at the same time, for the downlink direction of routing is established by the IP information to determine, when receiving a downlink IP information establishment and routing information the collection station, then IP information uploaded to the uplink direction acquisition station routing in this way, IP dynamically allocated at the same time, then completed the routing table [11-17].

For the immune genetic algorithm, the basic equations can be denoted as following:

$$\begin{cases} P_{Gi} - P_{Di} - V_i \sum_{j=1}^{n} V_j \left(G_{ij} \cos\theta_{ij} + B_{ij} \sin\theta_{ij} \right) = 0 \\ Q_{Gi} - Q_{Di} - V_i \sum_{j=1}^{n} V_j \left(G_{ij} \sin\theta_{ij} - B_{ij} \cos\theta_{ij} \right) = 0 \end{cases}, \quad (1)$$

where P_{Gi} , Q_{Gi} are the active and reactive power of the generator i. P_{Di} , Q_{Di} are the load active and reactive power of the node i. n is the total number of nodes. V_i , θ_i are the voltage amplitude and phase of the node i. $\theta_{ij} = \theta_i - \theta_j$, $G_{ij} + jB_{ij}$ are the corresponding elements of system nodal admittance matrix.

Inequality constraints. The voltage amplitude of each node must be maintained around the rated voltage. Thus the safe and steady operation of power system and power quality can be guaranteed. The constraint of power grid operation is composed of the active and reactive output constraints of generator. Here, the active power output of generator P_{Gi} and line capacity P_{ij} are selected as the control variables. And the node voltage V_i and reactive power output of generator Q_{Gi} are selected as the state variables.

The power constraints of generator sets:

$$\begin{cases} P_{Gi}^{*} \le P_{Gi} \le P_{Gi}^{\max} \\ Q_{Gi}^{*} \le Q_{Gi} \le Q_{Gi}^{\max} \end{cases}, \quad i \in S_G . \quad (2)$$

The constraint of node voltage:

$$V_{Gi}^{\min} \le V_{Gi} \le V_{Gi}^{\max}, \quad i \in S_n . \quad (3)$$

The constraint of line capacity:

$$P_{ij}^{\min} \le P_{ij} \le P_{ij}^{\max}, \quad i, j \in S_n , \quad (4)$$

where S_n is the muster of all the nodes. S_G is the muster of nodes in the power transmission zone. The subscripts *, min and max are respectively the per-unit value of basic power flow, the minimum and maximum of the variable.

4 Experimental results

In this section, we insert 10 tuples, 50 tuples, 100 tuples, 500

tuples, 1000 tuples, 5000 tuples, 10000 tuples respectively and continually into a relation which is not record the used time. Then clear the test table and insert same content into a relation, which is record the used time. Compare the two groups of times.

The comparison of using VXI based on the immune genetic algorithm and using common decision fault diagnosis is shown in figure 4. The result shows that in the same fault nodes, the VXI fault diagnosis based on the immune genetic algorithm achieves better performance than common decision fault diagnosis in consuming time.

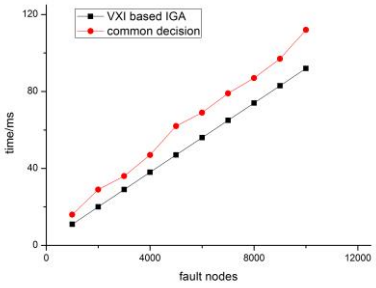

FIGURE 4 The comparison of comparison of using VXI based on the immune genetic algorithm and using common decision fault diagnosis

5 Conclusions

The state and requirement of electronic equipment is discussed. The test diagnosis network is based on the hybrid structure C/S and B/S. In the test diagnosis network, data-socket realizes the rapid communication in C/S and satisfies the real test item. ActiveX control and web embed technology realizes looking up data and simple test diagnosis. It is reliable and practicably.

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