Analysis of Fault Tolerance Technology in Computer Control System

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Abstract: With the continuous progress of computer technology and the widespread use of network technology, people not only put forward higher requirements of hardware facilities, but also pay more attention to the reliability and stability of computer control system. The function of computer is constantly optimized, and its fault tolerance performance is also constantly improved. Only if the computer control system has better fault tolerance technology, can its normal operation be guaranteed. Increasing the research intensity of computer fault tolerance technology has become the inevitable direction of the current computer technology development.

1. Introduction

In order to provide the corresponding services to the users when the computer is damaged or the instructions are wrong, the fault tolerance technology has been applied to the computer control system, which can avoid system crash and file loss. At present, fault tolerance technology has been well widely used in industry, nuclear power, medical and other industries.

2. Analysis of Fault Tolerance Technology of Computer Hardware

With the application and popularization of computers, the related problems of computers are becoming more and more prominent, and there are more and more errors of computer control systems. Therefore, the fault tolerance technology of computer hardware is important. The specific characteristics are as follows:

2.1 Information Redundancy

Information redundancy refers to the addition of redundant information to the original data and is a fault tolerance method, which can make the computer monitor or recover the fault more thoroughly, including error correction coding and error detection coding. Error detection coding can automatically detect faults in the system. Error correction coding can not only automatically detect faults, but also correct them and ensure the stability of computer control system. In computer fault tolerance technology, information redundancy is usually written in the initial data, which mainly plays the role of data transmission and processing. Cyclic redundancy check codes and parity check codes are commonly used coding techniques. In the process of computer system operation, with the gradual progress of coding technology, information redundancy technology can play its due role. Compared with other fault tolerance technologies, information redundancy technology has the following advantages. Firstly, the cost is relatively small. Only a few extra coding lines or redundant information can make the effective use of information redundancy technology come true. Compared with the fault tolerance technology of large-scale computer control system, the cost of its application is relatively small. Secondly, the speed is relatively fast. Usually, the completion of error correction and error detection in information redundancy technology is in the same period of time, which makes the recovery of error process less time waste.

2.2 Hardware Redundancy

According to the degree of redundancy, hardware redundancy mainly includes complete system redundancy and partial system redundancy. In the case of complete redundancy, dual-system cold

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standby is the main mode of operation. Dual-system duplex is the main mode of operation for computer systems with high security. If the requirements of the system are very low, such technologies as dual-system hot standby and dual-system cold standby can be used. At present, experts have made great efforts to study computer redundancy technology, which has been well used in the safe operation of computers.

2.3 Time Redundancy

In the case of low stability and real-time performance of computer system, time redundancy technology can be applied to realize fault tolerance mechanism. In practice, when time redundancy technology is applied, the same data on the same kind of hardware can be implemented to execute the same command at different times. Through the application of the circuit and data delay unit in the system, the corresponding version of the delay data is copied with the result of processing, and then they are transferred to the voter to implement the corresponding discrimination, so as to realize the error identification of the computer control system. The main method of time redundancy is to judge the delay of time. If the delay time produces errors, the output of voter will also produce some errors, which is very disadvantageous to the realization of fault tolerance. Therefore, in the process of using time redundancy technology, it is necessary to establish appropriate time redundancy according to the detailed time requirement of computer control system, so as to improve the fault tolerance ability of the system.

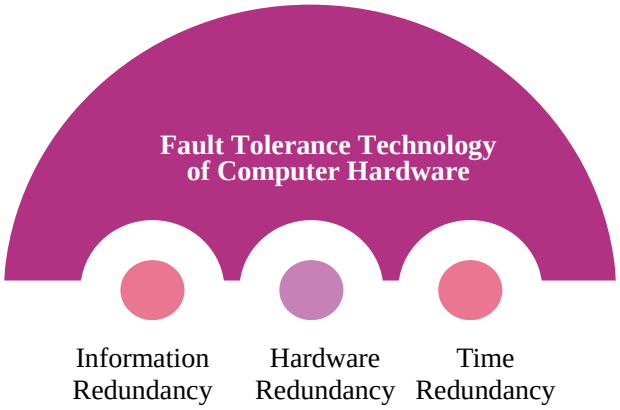

Fig.1 System features

3. Analysis of Fault Tolerance Technology of Computer Software

Recovery block method and software diversity method are the main methods of fault tolerance technology of software. Compared with hardware fault tolerance technology, the development of software fault tolerance technology is relatively backward, so its fault tolerant efficiency is also relatively poor. We can improve the level of fault tolerance by improving the environment of software engineering and computer platform. In fault recovery of computer system, it includes backward recovery and forward recovery. Backward recovery refers to restoring the system to the correct part and then rerunning the calculation. Forward recovery refers to the use of certain methods to make up for the discontinuity caused by the failure, so that the system can continue to operate forward.

3.1 Recovery Block Method

When restoring the backup block with the same function as the main block, the first operation should be made in the main block. If a fault occurs, it is necessary to start the backup block and let it work until it passes the test. If it has not passed the test, the fault can not be restored. It is worth noting that the independence between the backup block and the main block should be guaranteed as much as possible, so that the relationship between their errors can be reduced as much as possible. The program of test results is the main one, so it must be guaranteed that there are no errors.

3.2 Method

This software fault tolerance technology requires different development teams to process each version of the software, use separate design tools in an independent environment, and use different language development technologies. In this way, the association of errors between different versions is reduced. However, they need to follow the same development principles. First, the overall design objectives should be the same, so that the interface standards between each module are consistent, and each version of software must be developed independently. In addition, in the design, we should also ensure the transparency of the module inside and outside, while encapsulating and processing it.

3.3 Defensive Programming

This fault tolerance method is relatively conservative, and the implementation of its fault tolerance function has not applied any other fault tolerance methods. When errors occur in the running of the program, the function of code recovery and detection of the program itself will be invoked to deal with the corresponding errors, so that the system can actively return to the correct state before. In this way, errors generated in the program can be checked out, and the category and scope of errors can be evaluated, so that recovery errors will be realized. With the widespread use of computer control systems, its scale is gradually increasing, which puts forward higher requirements for the stability and security. The application of fault tolerance technology guarantees the sTable operation of computer system. Error recovery, high stability, low cost and so on are the characteristics of sound fault tolerance technology of computer control system. At present, computer technology is progressing gradually, and more secure and reliable fault tolerance technology will be used in computer, so as to promote social development more effectively.

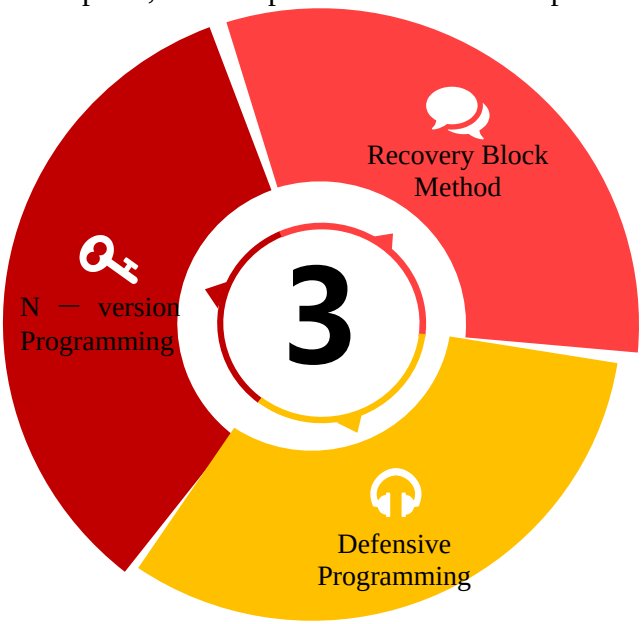

Fig.2 Fault Tolerance Technology of Computer Software

4. Common Computer Troubleshooting Strategies

In the process of designing common computer error removal measures, different troubleshooting measures are needed according to different operation modes, processing information and installation environments of computer system. When fault tolerance methods is set up for computer faults, the key point is to proceed from a reasonable point of view. Fault tolerance architecture is designed reasonably according to computer non-customized COTS. For possible faults of computer control system, preventive treatment is implemented. In the process of designing CTOS fault tolerance architecture, we usually use common troubleshooting software of computer system to design Cameron architecture, which can ensure the reliability of computer software in the process

of error repair. In the design, different targeted response procedures are applied. These response procedures can be divided into three levels, with the central control management module at the top, whose main function is to manage the computer control system according to preprogrammed method to deal with errors, the new transmission module in the middle layer, whose main task is to lay the information transmission channel between the bottom layer and the control layer and detecting error module in the lowest level. Different solutions are implemented according to the needs of computer control system. However, there are still some problems in the fault tolerance scheme of computer control system, which need to be solved by designers.

The redundancy fault tolerance technology of current computer hardware can improve the stability of computer control system, but the cost is high and it puts forward a high demand for the consistency of the overall hardware of the system. A lot of manpower and material resources need to be invested in it. This is a difficult problem to solve in the fault tolerance of current computer hardware. For example, in the case of short time, it is difficult for ECC algorithm to deal with a large number of error information, since too much error information will reduce the computing power of computer system and ECC information redundancy algorithm will fail to achieve its function. Therefore, fault tolerance scheme of this computer still needs further study. In the time redundancy fault tolerance method of computer, the fault information can be distinguished by prolonging the time when the computer converts information. The disadvantage of this fault tolerance technology is that it has a long delay time, so it is difficult to detect the faults of computer control system in time, and it is slower to reflect the damage to computer hardware.

For the troubleshooting method of computer multithread, there are many problems that can not be dealt with at present. For example, threads of different computers may in some cases fail to communicate with each other, so consistency cannot be guaranteed. Configuration of the computing power of the CPU is the main problem that the professionals need to think about at present. As for the troubleshooting method of computer multi-version software, it can only be used in the case of relatively small scale of facilities. At the same time, this technology requires a high cost of investment in programming. The output and input have not reached a balanced state. At present, it is seldom used in the troubleshooting of computer. At present, in the detection and elimination of computer faults, the hardware aspect is relatively sound, but the software aspect still needs further development. Through more in-depth research on the methods of fault elimination of computer software, the fault tolerance rate of computer control system can be greatly improved, and the software aspect can also be made. The application cost of computer troubleshooting technology has been reduced. Computer control system plays a core role in the management of computer storage facilities and computing facilities, which can improve the security of computer control system. In high-end technology, the domestic control system has certain limitations, which is very unfavorable to the development of national defense. The application rate of control system in our country is very low. It is our main direction to improve the application ability of domestic control system.

5. Conclusion

In a word, computer technology is progressing gradually and has been widely used in people’s life and business processing. Therefore, it is necessary to ensure its safety, and to strengthen the research on the application of fault tolerance methods to the safe operation of computer control systems, so as to ensure the stability of computer control systems. For different situations, the corresponding fault tolerance technology is to be used while the reliability and low cost should be ensured, so as to promote the sound development of computer technology.

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