

The Use of Fault Tolerant Computer in the Real World

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Computers are used widely in society to process and store vast amounts of information at high-speed and in real time. Since computers are deeply involved in the lives of all people, it is vital that their continuity of service should be maintained in the same way as the provision of water, electricity, and telephone service. A computer system that is to be used in critical application must be highly dependable. Therefore, fault tolerant computers have been used in situations where the continuity of service is paramount.

We have put into practical use a fault tolerant computer called "SURE SYSTEM". We used Ultra-SparcII processors that were developed by Sun Microsystems. The computer is composed of a maximum of eight processor-clusters that perform parallel processing.

Following are its characteristics.

- 1) One of the eight clusters is set up as a spare processor. This processor fills in for a failed processor when a fault occurs.
- 2) A processor is composed of two microprocessors. For the fault detection of processor, executing results of each microprocessor are compared and checked up.
- 3) A high-speed common memory is used. The check point data for each cluster is stored in this memory.

- 4) All components, such as the I/O devices and the power supply units, are redundant.
- 5) Each functional unit is formed into one module, which has a fault detection mechanism, and is easily replaceable on a module basis.
- 6) Each part can be replaced while the computer is operating.
- 7) A fault tolerant operating system manages the entire system.
- 8) Applications can be updated while the computer is operating.

The SURE SYSTEM has been in production for seven years with more than 1000 units delivered and installed. There have been many actual cases of the fault tolerant system providing a safety net in many installations, such as financial services, stock brokerages, manufacturers, transportation administrations, and electricity distribution control.

In this presentation, case studies will be introduced with regard to system profile, operating conditions, effects of introduction, and so on. In addition, issues in high reliable systems that must be solved will be discussed on the basis of experiences gained in the development and practical use of fault tolerant computers.