

A Study on Performance Requirements for Advanced Alarm System

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1. Introduction

A design goal of an advanced alarm system is providing advanced alarm information to the operator in the main control room. To achieve this, we applied a computer-based system to the alarm system. Because it should apply data management and advanced alarm processing (i.e., Data Base Management System and S/W module for alarm processing). These are not impossible in an analog-based alarm system. And, preexistence research examples are made on digital computers [1][2][3][4][5].

We have digital systems for test of advanced alarm system (See Table 1) and have tested and studied using test equipment in the view point of the system performance, stability and security.

In this paper, we described about general software architecture of preexistence research examples. Also, CPU performance and requirements of system software that served to accommodate it, stability and security.

2. Preexistence research

This section is described about software architecture of preexistence research and their advantage. It has a structure that data and alarm process are separated. Specially, data is described by logic language (pre-defined), and analyzed by parser at execution time. And it made out text mode.

2.1 Profitable of Preexistence System

S/W architecture of preexistence instances are very profitable in following side.

- Independency for specification tool.
- Software Development and Maintenance
- Conciseness of the implementation of the requirements for alarm logic
- Conciseness of the independent re-view for alarm logic

It has independent for a specification tool. Because its data is made up of text. So it needs simple text editor when demanded data exchange.

Basically, it is good software structure that structure that data and procedure are separated structure. Because, it is concise and best method that can minimize error of software [7][8]. Naturally, development of the software and maintenance come to be easy.

There are others profit like as, software developer doesn't need to understand alarm logic and alarm logic developer doesn't need to understand software. Only, they achieve V&V in each area. These advantage is applied as it is to independent re-viewer.

3. Requirements for Advance Alarm System

In this section, we describe about requirements of low-level system services in the view point of the performance, stability and security.

3.1 CPU Performance

Because of advantages that describe in front, it is appropriate that apply structure such as preexistence research example to advanced alarm system. So we had performance test using several CPU (and several operating system), to confirm CPU performance necessary to accommodate it. For test, we used 300 simple logic (eg. $S000 > 0.4$ & $S001 > 0.5$ & $S002 > 0.3$ & $S003 > 0.6$, etc) and 1,000 input data. Table 1 is result of test.

Table 1 Result of Performance Test

| CPU | OS | Language | Compiler | Performance (ms) |
|---------------------------|--------|--------------|-----------------------|------------------|
| TI TMS320C40 (30MHz) | N/A | Assembly & C | Asm30 5.11, Cl30 5.11 | 176~178 |
| Intel Pentium I (150MHz) | MS-DOS | C | Borland Turbo C 2.01 | 27.47 |
| HP PA-7000 (440MHz) | HP-UX | C | HP C Compiler | 4.367~4.654 |
| Intel Pentium IV (2.6GHz) | Win-XP | C | MS C Compiler 12.0 | 2.498~2.692 |

It shows low performance in the case of TMS320C40 and Pentium I processor. Because their character is so low clock to the alarm logic processing. Advanced alarm system needs high performance CPU.

3.2 System Software Requirements for Real-Time Multitasking

Advanced alarm system should be process various functions in concurrent(Figure 1). So, it needs system software which satisfy multi-tasking and real-time characters for stability and security of advanced alarm system.

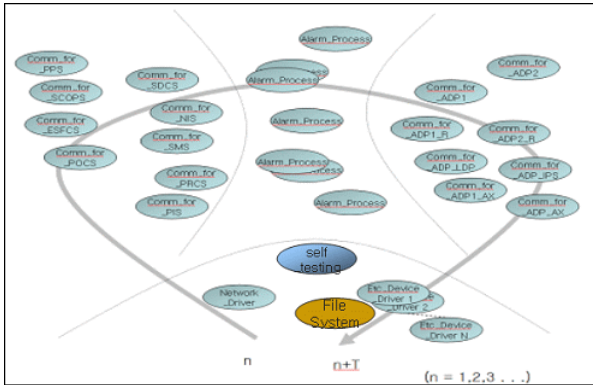


Figure 1 Functions of Advanced Alarm System

System software is satisfied multi-tasking and real-time, needs following features basically.

- semaphore/memory locking
- IPC(shared memory, signal, event etc.)
- Pre-emption. priority scheduling

Specially, in case of signal for IPC, have been apt to lose. So, system software should be supply solution for signal lost. And it must deny nesting interrupt by same signal.

3.2 Hardware Requirement for System Software in Stability and Security

Important feature for stability of system software, it is important that protect system software from application software. What is called, Protection-mode. Process protection is method that separate excution area of system software and application software, and guarantee this by hardware in CPU. If application approaches to system software area, CPU breeds interrupt for protection and system software is protected from un-permitted applicaton software.

The other important feature for stability and security of system is memory management function. Usually, this function is implemented by built-in MMU(Memory Management Unit) to CPU. MMU is important in the viewpoint of the system stability. Because, it offers protection function between process. Main reason which raises a software failure is the approach to the not to be permitted process area. Such problem is more serious when directly memory approach possible like C or Assembly.

And, such weakness is fatal in the side of system security. Because, advanced alarm system used commercial network. System hacking instances are examined by us in commercial network, there are many instance that use weakness of memory management like buffer over flow. Because, hackers can approach to system software using buffer over flow.

3. Conclusion

In the case of preexitance researchs, they have same software structure that data and procedure are seperated. We described advantage of seperated structure and confirmed several features to apply advanced alarm system using by several digital system.

The features are:

- CPU performance for alarm logic parsing
- System software requirements for real-time multitasking
- Hardware requirement for System software in stability and security

As result of test, we need system software that have functions of IPC for real-time multi-tasking. Specially, It should be have anti-signal lost and same signal blocking functions. And we need CPU that have functions of process protection and memory management unit.

We're going to apply upper features to advanced alarm system design. And we are expect that advanced alarm system may become more than system in performance, stability and security side.

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