KZ1— A Prototype of Intelligent Operating System

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Abstract

This paper proposes an Intelligent Operating System (IOS) as the next generation operating system. IOS integrates operating system with artificial intelligence technology, and its key feature is an intelligent man-machine communication mechanism which makes the computer systems more friendly. The concepts, functions and architecture of IOS are introduced and an experimental IOS called KZ1 is described in detail.

1. Introduction

Operating Systems (OS) have been rapidly developed during the last 30 years. Since the end of 1950s much work has been done and up to 1970s principles of OS and construction methodologies have matured[1]. Recently, personal computer operating systems such as CP/M, MS-DOS have been widely used and at the same time, distributed OSs based on distributed systems have been put into practical applications. Compared with the centralized OSs they have been improved in system architecture, resource management and communication mechanisms.

Generally speaking, OS, like computer hardware, has undergone three revolutionary changes called generations[2]. It has shift from batch OS, timesharing OS to distributed OS. The motive force for developing OS is mainly from two aspects: the evolution of the computer systems and the expansion of application fields.

With the presentation and the development of new generation computers (NGC), designers of OS will face with how to design a new generation OS to adapt to it. In recent years, some new generation OSs are being developed. For example, SIMPOS for the fifth generation computer has been proposed by ICOT in Japan[3]. R.M. Balzer believes that the extended database class of applications will be the motive power for the next generation OSs[4]. Mamora Maekawa presents that the next generation OS will face with densely processing system[5]. G.S. Blair et al. propose a knowledge-based operating system for the fifth generation computing[6].

This paper proposes an intelligent operating system (IOS) as the next generation OS. Moreover, an experimental intelligent operating system called KZ1 (initials of Chinese ancient ideologist Kong Zi (Confucius)) has been developed in a distributed system environment. We will introduce the concepts, functions and architecture of the intelligent operating system in the next section and describe the experimental system KZ1 in detail in Section 3. Finally, the conclusions will be given.

2. Intelligent Operating System

2.1. Functionality

The next generation computer may require the operating system to provide not only a variety of services but also high quality of services. It may be characterized by the following features:

(1) using object model structure which consists of intelligent object management modules such as intelligent process schedule, process communication and concurrency control.
(2) Knowledge-based processing system;  
(3) Intelligent man-machine communication.

As a result, the functionality of the operating system for the next generation computer may include:

1. Adaptation to different users — It makes NGCs to adapt to the requirements and the habits of different users. The user need only tell NGCs what to do rather than how to do.
2. Adaptation to different OSs — Though different OSs are running in an NGC, the operating system must provide a uniform interface so that the user can work conveniently with them without considering the differences among those OSs.
3. Adaptation to different kinds of information — In NGCs, there are many kinds of information such as voice, text, image and graphs, so the operating system must provide management for the input/output and the process of the information.
4. Adaptation to different environments — The operating system should provide machine-learning capability so that when the environment changes it is able to reorganize itself and make itself suitable for the new environment.
5. Adaptation to different processing objects — In order to realize the abovementioned functionality, an intelligent operating system is required to process not only the data managed by the file system but also the knowledge managed by KBMSs.

2.2. Architecture

An architecture of the IOS is proposed in Fig. 1. It consists of three components: expert systems, knowledge base management systems and distributed OS.

Expert systems are used to provide problem solving methods of human expert level. In an IOS, there may be many kinds of expert systems and each of them corresponds to one KBMS respectively. For example, man-machine communications, parallel processing, job scheduling and image processing, etc. can be treated as special domains respectively to build expert systems.

KBMS is employed to manage various kinds of domain knowledge and provide operations over KB which are including: accessing, modifying, appending and deduction, etc. Theoretically, an expert system is supported by a KBMS.

A distributed OS manages coordinately various resources in new generation computer systems with distributed architecture and parallel processing and provides functions such as distributed job (process) scheduling, interprocess communication and concurrency control. However, it provides a uniform interface for the user while there may be many different kinds of host operating systems.

Fig. 1. The architecture of the intelligent operating system.

Fig. 2. The architecture of KZ1.

3. Experimental System KZ1

3.1. An Overview over KZ1

KZ1 is an experimental intelligent OS. It improves capability and friendliness of man-machine