THE SUMMARY OF Ph. D. DISSERTATION

Major Engineering	Student Identification Number	SURNAME, Firstname OHMURA, Ren

Title

A Study of Rollback Recovery for Non-volatile Main Memory Systems

Abstract

This paper proposes software-based schemes that recover the entire system state upon unpredictable power failure. Existing approaches do not deal with entire system state because of high overhead. To achieve the recovery of entire system state with low overhead, the proposed scheme focuses on a system using non-volatile memory as main memory, called "non-volatile main memory system".

The proposed approach takes two steps; 1) ensuring the recovery of the CPU and main memory state, and 2) enhancing the scheme to cover peripheral device state.

Even in non-volatile main memory systems, the main memory state must be saved with the CPU state to ensure consistency, and the effect of store instruction by the CPU must not damage the recovery operation during saving and restoring the main memory state.

To decrease overhead required to store the CPU and main memory state, the memory area to be saved is identified by an object in a structured memory management scheme. The proper recovery is ensured by alternating both of the CPU and main memory state to be restored with only one store instruction. The result of experiments showed the proper recovery was viable on power failure in any execution phase and the overhead is lower than existing schemes.

For peripheral devices, the recovered state must be consistent with the CPU and main memory despite that it is impossible to obtain the state arbitrarily.

The proposed scheme focuses on the relation of the device and its device driver, and consistency among whole devices in a system is ensured by applying the schemes to each device driver. The requirement to maintain consistency between a device and device driver is acquired by adapting a message-passing system. The result of experiments showed the schemes made the system state including peripheral devices properly recoverable and can be achieved with low overhead.

This study contributes to improve usability and reliability of novel computer systems performing with unstable power sources as well as common computer systems. Moreover, the knowledge disclosed by this study suggests the establishment of fundamental methodology of running state recovery for future usage of non-volatile memory in several part of computer systems.