Normally-off Real-Time Operating System with Non-Volatile Main Memory.

Byte-addressable non-volatile memories (NVM) have been considered to serve as main memory, since they feature low leakage power, high density, and low unit costs. One feature is of key interest in embedded system designs, that they allow a computing system to turn off the main memory without the need of storing and restoring any data in the main memory. This feature allows the system to apply advanced dynamic power management to switch to low power states (hibernation) almost immediately to achieve energy saving. However, such embedded systems may still serve real-time sensitive applications, where the execution of the system and the internal tasks has to meet deadlines. When the main memory is shared by all processors, the memory cannot be simply turned off as long as at least one processor still executes. Thus, to enter the hibernation state with disabled memories, all processors have to idle at the same time, i.e., no task is executing on the processors. In our recent study, we have developed a scheduling algorithm to force the idle while satisfying the hard real-time constraints. However, off-the-shelf real-time operating systems (RTOS) are not yet ready to practice this idea. This assignment focuses on implementing the model and system software techniques to enhance a suitable RTOS.

The assignment includes the following steps:

1. Understanding the considered models and the scheduling algorithms
2. Realizing the model, scheduling algorithms and necessary memory managements in an RTOS.
3. Deploying the enhanced RTOS on emulation platform or even a real hardware
4. Evaluating system-wise overhead and preparing patches under a given coding convention.

Other suggestions and related topics are also welcome.

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