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Hibernation Mechanism in Smartphone Mobile Operating Systems

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Abstract
Smartphone technology is advancing at a rapid pace. They are able to run more applications at a time which needs proper management of running processes especially when the processes are accidently lost due to critical battery that causes the device switch off. Therefore data loss occurs and there is no option to retrieve the lost data. In this paper, Hibernation approach for smartphones mobile operating system has been considered. Initially working of smart phones has been analyzed in order to find out their working mechanism. Hibernation approach is also discussed along with its structure. A mechanism has been proposed for smartphones based on hibernation called Hibernation Mechanism in Smartphones (HMS). HMS has been proposed for Smartphones in order to prevent application losses, thereby, giving proper management to smartphone users.
Keywords: Hibernation Mechanism in Smartphones (HMS), Prevent application losses and Proper management.

1. Introduction

Smartphone has capability of advanced computing, connectivity and more phone features including high-resolution touchscreens, web applications, games, GPS navigation units and different mobile applications [1]. Android, iOS, Symbian, BlackBerry OS and Windows Phone are the most famous mobile operating systems in smartphones. These operating systems can be installed on different smartphone models, and generally each device can receive multiple Operating System software updates over its lifetime. Users can perform multitasking and all applications run on memory (RAM) in same time. Smartphones or mobile devices are used on regular basis that is why there is no need to switching off manually until special circumstances are considered. In low batter situation in smartphones, all the running applications and its states will lost when it will suddenly off. Hibernation is one of the best way to save the states of running applications and too much feasible for users. Smartphones mobile operating systems does not support hibernation. There remain some barriers to applying hibernation [2] based boot techniques.

a) In the standard Linux kernel was developed for generic purposes, it has some additional steps to reactivate devices. The hibernation technique eliminates these steps by restoring hibernation image in the boot loader, but also requires additional implementations in the boot loader.
b) If the same hibernation image is used every time the device boots up, information inconsistency problems will occur in the file system and database.

This paper introduce new methods to obtain previously running state as it was before the switched off. It is primarily focused on the hibernation mechanism in smartphones and particularly on mobile devices. All running mobile applications are stored in random access memory. In case of hibernation, all the contents of random access memory are saved to non-volatile memory just as desktop operating Systems. When smartphone switched on, resumption process applies and mobile operating system along with applications are resumed in exactly the same state as it was before the hibernation.

2. Booting Process in Smartphones

Modern smartphones have extensive features comparable to those of personal computers (PCs). In the critical battery situation, auto hibernation mechanism introduced and implemented in laptops. It is very helpful feature for professional users who is work is more important and don't want to lose the previous state. Smartphones have only sleep option not hibernation, this paper proposed the ideal mechanism of hibernation.

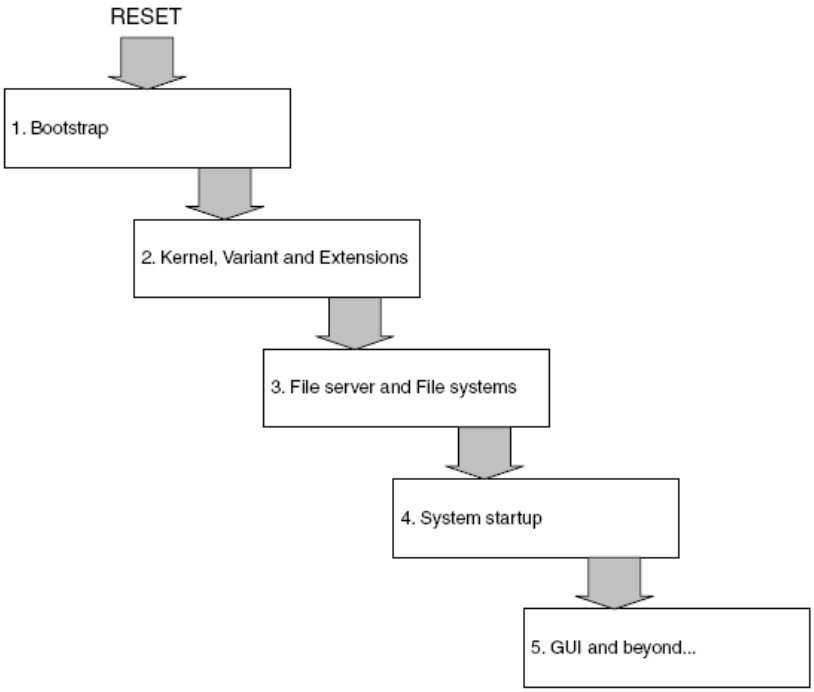

Figure 1: Booting Process in Smartphones

The general boot sequence as shown in Figure 1, in smartphones reset or on the device firstly bootstrap activate to load further programs [3]. Bootstrap generate the call for the operating system kernel, variant and extensions and all files load into RAM from the file server. When file servers set all the system files then system fully startup and show the graphical user interface and run further program application in smartphone mobile operating signals.

3. Hibernation Mechanism in Smartphones Framework

There are two major parts of the hibernation mechanism in personal computers and smartphones. First one is the hibernation process in which all the states store in non-volatile memory as one image and all system services suspended and such device turn off. Secondly, the resume process when switched on the device and all the services load from non-volatile memory as hibernation image to random access memory. In the hibernation case all the applications although that are system or program applications that are all run with the same previous state.

Hibernation operates similarly to Suspend-to-RAM, but includes a final step of writing memory contents to non- volatile storage. On resume, this is read and memory is restored to it is pre-suspend state. For suspend-to-disk or hibernation [4], Once memory state is written to disk, the system may either enter a low-power state, or it may simply power down. Applications states saving mechanism in hibernation allows to work on device without any tension of losing the data.

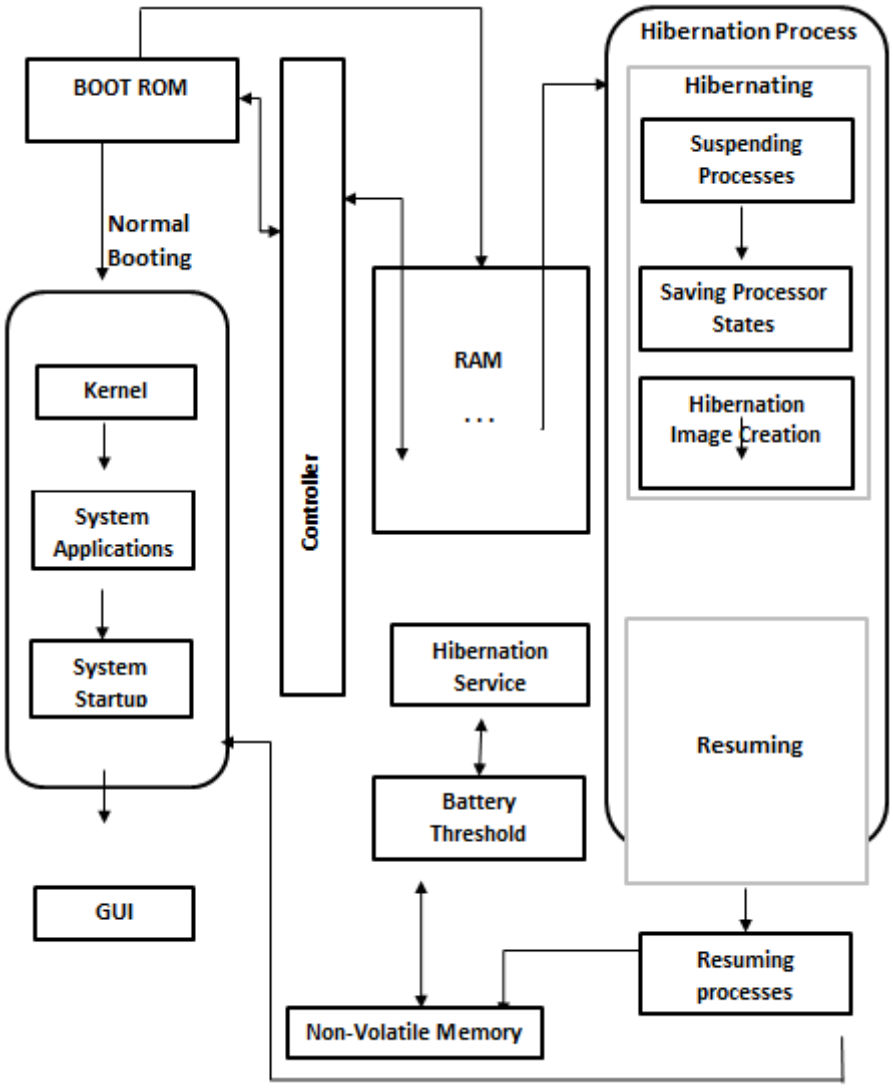

Figure 2: Proposed Hibernation method applying on Smartphone

Hibernation service run in random access memory continuously as shown Figure 2, it is system service that check the threshold level of the battery [5] and user cannot kill such system services in particular smartphone. In case of fulfill the level of threshold then a trigger working and call to suspend process in block of hibernation process. All the process will be suspend and saving the processor state as it is. Further create hibernation image and that contains all the running activities and its states.

The hibernation core image system memory by indexing and copying every active service in the system. Once an image is complete, the saved image and index is stored persistently. The image sequence is a three-step process. First, all of the active services are indexed, enough new services are allocated to clone these services and then each service is copied into its clone. The hibernation image process has one critical requirement: that at least half of the memory be free. When hibernation image saved in non-volatile memory then process of hibernation complete.

Controller is the main part of this framework, that manage the service calls and interacts with Hibernation System Service when the threshold level is fulfill then this controller manage the memory location and create the hibernation image and save in non-volatile memory of the smartphone. In case of Switched ON the smartphone then controller interacts with Boot ROM, if hibernation image exist in non-volatile memory then controller boot this smartphone from the hibernation image and recover the previous states and all application data as well. If hibernation image not exist in non-volatile memory then controller boot smartphone with the normal techniques, and startup all applications as new instance.

Boot ROM activate when smartphones switched on after the hibernation mode. If smartphone was not turned OFF with the hibernation mode then normal booting process execute. Normal booting sequences also describe in Figure 1 and Figure 2 as well. If smartphone mobile operating system switched ON after the hibernation then hibernation image is loaded into RAM and the devices are suspended. Control is passed to the target kernel. Processor state is restored, Machine is prepared for switching to normal mode of operation using the platform driver and System devices are resumed. Early resume of the devices is carried out. Interrupts are enabled on the main CPU, Non-boot CPUs are enabled. Machine is switched to normal mode of operation using the platform driver. The devices are resumed and the platform driver is informed that the system has entered the working state and show the graphical user interface.

When HMS completed successfully then hibernation image deleted from the non-volatile memory otherwise same hibernation image is used every time the device boots up and information inconsistency problems will occur in the file system.

4. Conclusion

It is concluded that Hibernation Mechanism in Smartphones provides a simplified way to save the running states in Smartphones mobile devices and delivers proper management for its booting procedure. It reduces the complexities involved in the management of its resources and allows the users to use Smartphone services effectively with the help of Hibernation Mechanism in Smartphones approach, data losses associated with applications are controlled to certain extent.

5. Future Work

In future development will be carried out on the basis of same mechanism that can be easily applied to Smartphones Operating System platforms and eventually obtained instant boot time in a smartphone. We also considered some issues stemming from keep image modes. Obviously, some obstacles still remain to applying these mechanisms to commercial products, such as showing splash, and some other in-consistency problems. However, we believe that these issues may be overcome with proper user workflow and careful verification.

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