



SafeTrends™



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Power Save mode of Operation for SafeTrends

White Paper

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Abstract

A novel method of handling power save mode of operation for file CDP is presented here. A CDP process on files normally involves protection of files against logical and / or physical disasters. It normally includes backing up a version of the file as and when it is modified, while maintaining more number of previously backed up files. This gives a time order to the files life cycle and provides the base for the user to rollback to any particular version based on his requirement. A CDP process may also normally involve compression and de-duplication to reduce the amount of space utilized. It may also include encryption if the storage is remote or if the data is of very sensitive and of great importance. Performing these operations on a Processing unit when it enters into battery mode becomes more costly – as these operations normally consume more power and hence draining the battery at a faster rate. A user may not prefer such battery draining, as he would normally prefer his system to perform the primary task as against the secondary (but critical) backup tasks. A method, system and apparatus is presented here using which such users will be able to better control the actions taken by the CDP process when the system enters into battery power mode. The invention provides an easy configuration tool, using which he can control the CDP process. It also provides a mechanism to perform a configuration override that will come in handy in situations such as when the user has completed his primary task and would prefer the CDP process to perform backup tasks. This can also be easily extended to block level CDP. For brevity, the word CDP will be used hereafter to denote both.

Acronyms

| Word | Meaning |
|------|----------------------------|
| CDP | Continuous Data Protection |
| | |
| | |

Claims

A method, system, and apparatus for a CDP process are presented which controls the way the CDP process performs under battery. The CDP process enters into a power save mode of operation when the system enters into battery power. This entry can be further controlled by a current CPU usage definition. Once the CDP process enters into power save mode, depending on the instantaneous battery power remaining it will land in separate zones of operation. The zones of operation will have restriction on what operations of CDP can be performed or NOT performed in that zone. Zones can only be defined to be equal or in more restrictive fashion as the remaining battery power depletes. This definition provides a way for the CDP process to use reduced power with the cost penalty of reduced protection. At the same time, critical actions are only taken to better save the battery. When the primary power supply restored, the system restores to normal mode of operation. A forced backup option is provided which can be used when the user has finished his normal operation and wants to regain the full protection. At that point, the CDP process will quickly do a flushing task where in it will first complete certain critical operation missed out during the power save mode, such as backing up latest version and then continuing with the normal mode of operation.

Study

The study relates to mobile computers and desktop computers which require data protection. The data here includes documents, pictures, presentations, etc – broadly any files that are stored in a computer that are critical to the user. Such data protection mechanism is normally called file CDP. A CDP process along with protection may also perform compression, de-duplication, encryption etc., in order to be space efficient while maintaining the sanctity of the critical data.

A CDP normally process involves backing up of files in protection to one or more locations as and when they are modified. This is established by tracking the files that are modified / written / updated in a system and then taking a backup copy of them. The CDP process may do compression on the backed up files to be more space efficient. As multiple versions of the same file will have more common data, the CDP process may also perform de-duplication – removal of duplicates to get further space reduction. The file may also be backed up to one or more locations – locally, remotely to a backup storage or to an online storage. Or it may even be stored in a removable external media.

Further, if the backed up data is stored in a medium accessible to multiple users, the user of a CDP process may prefer it to be stored in an encrypted format. All these operations require extra processing cycles and memory in order to perform the task. This would invariably translate more power usage.

CDP process is generally used to guard against disasters, logical or physical. A logical disaster may include virus attacks and incorrect file deletions, etc, while a physical disaster may include failed hard-drives.

Such CDP processing is normally used in computers that are mobile that may normally run in battery. A system running in battery mode does not have longer life without a backup power and hence might shutdown / crash in the event of a complete battery down. During such battery mode of operation, the user would normally prefer that the system perform optimally for foreground operations and giving less importance to background operations – such as CDP process. But at the same time CDP process is important, as it protect against corruption of files due to failures – a system crash due to battery down as well.

Operating systems normally provide mechanism to configure battery mode operation, but they are system wide. A CDP process requires its own handling of battery mode operation, as the very purpose defines data protection. It should be more adaptable to the protection needs.

Architecture

In accordance with the present study, a configuration method is provided along with the CDP process that would define / add restriction when the system enters power save mode. The entry of power save mode may also be triggered based on whether the system runs in battery or not as well as a CPU usage. Once the CDP enters into power save mode of operation, it remains there until regular power resumes.

The user is also presented with an option to define certain operations to be restricted when the CDP is in power save mode. Three stages of battery operation are presented to denote high battery level (green), medium battery level (amber) and low battery level (red). In each level, one or more operations can be restricted. It is the key that a progressively more restrictive definition is only permitted as the power save mode goes from high battery level to medium battery level and finally to low battery level. This multiple levels of operation give the cushion for the user to better control the CDP during power save mode of operation. This comes in handy, when the user is in say an airport location / in-flight where there is limited or no external power. The user can define a process that gives more cushions to the foreground process and when he finally feels that he has completed the foreground task, he may want to get out of the restrictive mode in such a way that the protection is meaningful. For such operation, the forced backup option is provided. When used, the system will come out of the power save mode even though the system is still running in battery. It will do critical tasks, such as say, quickly saving modified files to backup location before regaining to normal mode. This will come in handy as the mobile user, after finishing his foreground operation can enable the forced backup and as soon as it completes can shutdown the mobile computer. The status of the power save mode of operation will be displayed for the user to get the status.

The diagrams below present more meaningful representation of the study. Also, the three battery levels low/medium/high may also be expandable to as much as needed.

When you click the *Power-save* ICON, the following screen is presented that allows you to configure and monitor the different *Power-save* options



Hereafter, *High Battery Level* will be referred as *High Level*, *Medium Battery Level* as *Medium Level* and *Low Battery Level* as *Low Level*.

CPU Utilization

There is a Spin control at the bottom left section of the screen that allows you to set the CPU utilization threshold for *Power-save* mode to kick in. If the system is running out of battery and the CPU utilization is above the set threshold then *Power-save* mode will set in. **Note that once *Power-save* mode is entered the system continues to be in that mode till the power is restored, even if the CPU utilization goes below the set threshold.**

Battery Usage (Battery level Selection)

This is a dual-slider control located in the bottom section of the screen. You can use this to define the *High Level*, *Medium Level* and the *Low Level* of operation. You can use the sliders to select and define the three different thresholds of battery charge. *High Level* is entered when the remaining battery charge is high and is between the set threshold value and 100%.

Low level is entered when the remaining battery life is at its weakest, between 0% and the set lower threshold value. Then the range in between defines the *Medium level*. For each of the levels, SafeTrends may be configured to operate with certain restrictions. The idea behind this is to make sure that the background protection task does not unnecessarily utilize excessive CPU and disk I/Os and consume much battery power.

Protection task Tabs for different Levels

In the upper section, three selection tabs are provided - namely, *Low Battery*, *Medium Battery*, and the *High Battery*.



For each of the three levels, the user is provided options to define the protection task restrictions for SafeTrends while the system is running in that level. As shown in the figure, there are three radio controls:

- 1) **Do Nothing:** If this is selected, SafeTrends will not do any protection tasks at all. So this is the most restrictive mode.
- 2) **Track changes:** If this mode is selected, SafeTrends will make a note of the files that have changed, but will not do any protection tasks. When, at a later time, the system starts running from the main supply, SafeTrends will ensure that it will protect the changed files that were tracked in the battery mode.
- 3) **Protection Restriction:** In this mode, as is obvious, SafeTrends will do the protection tasks with certain restrictions. The restrictions are selected using the checkboxes. These are:

- Do not De-Dupe
- Do not Compress
- Do not send to Remote

- Do not send to Cloud
- Do not send to Removable Drive

The Configuration Tool will automatically ensure that as you move from *High Level* to *Low Level*, equal or more restrictive protection features apply. For example, in the *High Level*, if you select *Do Nothing*, then automatically the *Medium Level* and *Low Level* selections will show *Do Nothing*. In the *High Level* if you select *Track Changes*, *Medium Level* and *Low Level* will only allow *Track Changes* or *Do Nothing*. If, *Protection Restriction Mode* is selected, then every item that is checked in the *High Level* will also be checked in the *Medium Level* and *Low Level*. Similarly, every item that is checked in the *Medium Level* will also be checked in the *Low Level*. The *Apply* button may be used to register the changes made. For example, if you need to change the battery life thresholds for the zones, use the slider bar to make the appropriate changes and then click *Apply*. Note that if you have changed any of the existing settings, you can always click the *Refresh* button, and the settings will revert back to the current values.

Protection mode status

At the bottom right of the screen, the current status is displayed. If the system is not in *Power-save* mode, then the LED will be shown in gray and the system is considered to be running in *Normal* mode. If, however, the *Power-save* mode kicks in then the screen will change to notify this, and the color of the LED turns green.

Appropriate events are generated when the system enters or exits the Power-Save mode as shown below.



The screenshot shows the SafeTrends software interface. At the top left is the SafeTrends logo with the tagline "Install - Configure - Experience". To the right are several icons representing different system components. Below the icons is the "Event Log" section. It features a filter menu with radio buttons for "Information", "Error", "Warning", and "All" (which is selected). There is also a "Page Size" dropdown set to "25" and a "Get Events" button. The main area contains a table with the following data:

| Type | Date and Time | Description |
|------|-----------------------|--|
| | 5/28/2009 12:03:59 PM | SafeTrends running in normal mode. |
| | 5/28/2009 12:03:52 PM | SafeTrends running in power save mode. |
| | 5/28/2009 12:03:38 PM | SafeTrends running in normal mode. |
| | 5/28/2009 12:02:51 PM | SafeTrends running in power save mode. |
| | 5/28/2009 12:00:48 PM | Event log cleared. |

Below the table is a horizontal scrollbar and a page navigation control showing "1" of 1 pages. At the bottom are three buttons: "Refresh", "Clear Log", and "Save Log".

Force Backup





This button can be clicked, while the system is still in *Power-save* mode to start the *Protection task(s)* as per normal schedule. A confirmation dialogue box is presented to ensure if the user really wants to force the *Protection task(s)*. This option is very useful when the user has finished his foreground tasks while still the system is running out of battery. This gives the user the opportunity to continue protecting the changed files and folders as per original task settings, even in the *Power-Save* mode.

Battery Status band

This band, located in the middle of the right pane displays the current battery status and the *Level* of operation. The following screen shows that the system is running in the *High Level*.



The following table shows the ICONS while the system is in different operating levels.

| Icon | Operating Zone |
|---|---------------------------------------|
|  | Normal mode running from Power Supply |
|  | High Battery Level |
|  | Medium Battery Level |
|  | Low Battery Level |

Conclusion

Thus Power Save Mode provides a method for the user to better control the data protection through CDP while in battery power. The user will now be able to choose the protection and power save plan based on their needs.

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