System Power Management States

The kernel supports three power management states generically, though each is dependent on platform support code to implement the low-level details for each state. This file describes each state, what they are commonly called, what ACPI state they map to, and what string to write to /sys/power/state to enter that state

State:	Standby / Power-On Suspend
ACPI State:	S1
String:	"standby"

This state offers minimal, though real, power savings, while providing a very low-latency transition back to a working system. No operating state is lost (the CPU retains power), so the system easily starts up again where it left off.

We try to put devices in a low-power state equivalent to D1, which also offers low power savings, but low resume latency. Not all devices support D1, and those that don't are left on.

A transition from Standby to the On state should take about 1-2 seconds.

State:	Suspend-to-RAM
ACPI State:	S3
String:	"mem"

This state offers significant power savings as everything in the system is put into a low-power state, except for memory, which is placed in self-refresh mode to retain its contents.

System and device state is saved and kept in memory. All devices are suspended and put into D3. In many cases, all peripheral buses lose power when entering STR, so devices must be able to handle the transition back to the On state.

For at least ACPI, STR requires some minimal boot-strapping code to resume the system from STR. This may be true on other platforms.

A transition from Suspend-to-RAM to the On state should take about 3-5 seconds.

State:	Suspend-to-disk
ACPI State:	S4
String:	"disk"

This state offers the greatest power savings, and can be used even in the absence of low-level platform support for power management. This state operates similarly to Suspend-to-RAM, but includes a final step of writing memory contents to disk. On resume, this is read and memory is restored to its pre-suspend state.

STD can be handled by the firmware or the kernel. If it is handled by the firmware, it usually requires a dedicated partition that must be setup via another operating system for it to use. Despite the inconvenience, this method requires minimal work by the kernel, since the firmware will also handle restoring memory contents on resume.

For suspend-to-disk, a mechanism called swsusp called 'swsusp' (Swap Suspend) is used to write memory contents to free swap space.
swsusp has some restrictive requirements, but should work in most cases. Some, albeit outdated, documentation can be found in Documentation/power/swsusp.txt. Alternatively, userspace can do most of the actual suspend to disk work, see userland-swsusp.txt.

Once memory state is written to disk, the system may either enter a low-power state (like ACPI S4), or it may simply power down. Powering down offers greater savings, and allows this mechanism to work on any system. However, entering a real low-power state allows the user to trigger wake up events (e.g. pressing a key or opening a laptop lid).

A transition from Suspend-to-Disk to the On state should take about 30 seconds, though it's typically a bit more with the current implementation.