

ACS-2 PUIS Update to Power Management States

March 2, 2009

Revision 2

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Document Status

Revision History		
Rev	Date	Description
0	April 12, 2008	1) Initial Revision
1	January 30, 2009	1) Converted nested conditions to a table
2	March 2, 2009	1) Removed the table of PM2 state transitions 2) Added 3 new PUIS-related states to the state diagram, and associated text.

1 Introduction

This clause describes the background and the need for this proposal

2 Scope

This clause describes the statement of purpose.

This purpose of this template is to facilitate the change of existing material in ATA8-ACS.

3 Overview

This clause provides a high level description of the proposal.

4 Changes to ACS

4.1 Power Management feature set (section 4.18)

4.1.1 Overview

An ATA device shall implement the Power Management feature set. An ATAPI device may implement power management as defined by the PACKET command set implemented by the device. Otherwise, an ATAPI device shall implement the Power Management feature set as defined in this standard.

The Power Management feature set permits a host to modify the behavior of a device in a manner that reduces the power required to operate. The Power Management feature set provides a set of commands and a timer that enable a device to implement low power consumption modes. An ATA device that implements the Power Management feature set shall implement the following minimum set of functions (see also 4.5 and 4.2):

- a) A Standby timer
- b) CHECK POWER MODE command
- c) IDLE command
- d) IDLE IMMEDIATE command
- e) SLEEP command
- f) STANDBY command
- g) STANDBY IMMEDIATE command

An ATAPI device that implements the Power Management feature set shall implement the following minimum set of functions:

- a) CHECK POWER MODE command
- b) IDLE IMMEDIATE command
- c) SLEEP command
- d) STANDBY IMMEDIATE command

4.1.2 Power management commands

The CHECK POWER MODE command allows a host to determine if a device is in, going to or leaving Standby or Idle mode. The CHECK POWER MODE command shall not change the power mode or affect the operation of the Standby timer.

The IDLE and IDLE IMMEDIATE commands move a device to Idle mode immediately from the Active or Standby modes. The IDLE command also sets the Standby timer count and enables or disables the Standby timer.

The STANDBY and STANDBY IMMEDIATE commands move a device to Standby mode immediately from the Active or Idle modes. The STANDBY command also sets the Standby timer count and enables or disables the Standby timer.

The SLEEP command moves a device to Sleep mode. The device's interface becomes inactive after the device reports command completion for the SLEEP command. A device only transitions from Sleep mode after processing a hardware reset, a software reset, or a DEVICE RESET command.

4.1.3 Standby timer

The Standby timer provides a method for the device to enter Standby mode from either Active or Idle mode following a host programmed period of inactivity. If the Standby timer is enabled, and the device is in the Active mode or the Idle mode, then the device waits for the specified time period and, if no command is received, the device enters the Standby mode.

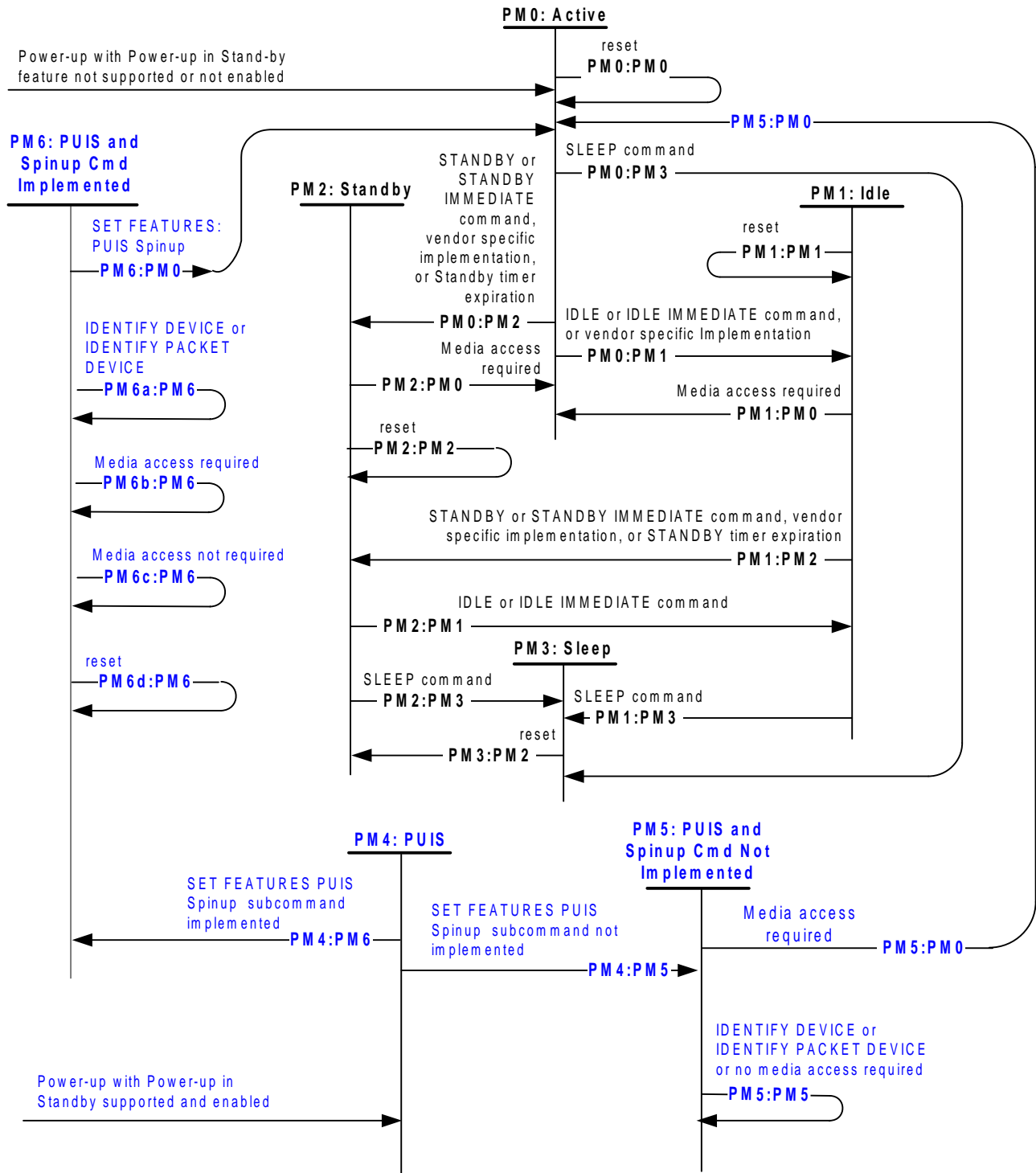
If the Standby timer is disabled, the device may automatically enter Standby mode.

See 7.20.11 for interactions with the NV Cache feature set.

4.1.4 Power modes

Figure 1 shows the set of state transitions that shall be implemented.

Figure 1 — Power Management State Diagram



PM0:Active: This state shall be entered when the device receives a media access command while in Idle or Standby mode. This state shall also be entered ~~after processing a power-on reset if when the device is powered-up with~~ the Power-Up In Standby feature is not ~~supported implemented~~ or ~~is~~ not enabled (see 4.2).

In Active mode the device is capable of responding to commands. During the execution of a media access command a device shall be in the Active state. Power consumption is greatest in this state.

Transition PM0:PM0: The device shall transition to the PM0:Active state after processing a hardware reset, software reset, or DEVICE RESET command.

Transition PM0:PM1: If an IDLE or IDLE IMMEDIATE command is received or a vendor specific implementation determines a transition is required, then the device shall transition to the PM1:Idle state.

Transition PM0:PM2: If a STANDBY or STANDBY IMMEDIATE command is received, then the Standby timer expires, or a vendor specific implementation determines a transition is required, then the device shall transition to the PM2:Standby state.

Transition PM0:PM3: If a SLEEP command is received, then the device shall transition to the PM3:Sleep state.

PM1:Idle: This state shall be entered when the device receives an IDLE or IDLE IMMEDIATE command. Some devices may perform vendor specific internal power management and transition to the Idle mode without host intervention.

In Idle mode the device is capable of responding to commands but the device may take longer to complete commands than when in the Active mode. Power consumption may be reduced from that of Active mode.

Transition PM1:PM0: If a media access is required, then the device shall transition to the PM0:Active state.

Transition PM1:PM1: The device shall transition to the PM1:Idle state after processing a hardware reset, software reset, or DEVICE RESET command.

Transition PM1:PM2: If a STANDBY or STANDBY IMMEDIATE command is received, then the Standby timer expires, or a vendor specific implementation determines a transition is required, then the device shall transition to the PM2:Standby state.

Transition PM1:PM3: If a SLEEP command is received, then the device shall transition to the PM3:Sleep state.

PM2:Standby: This state shall be entered when:

- a) the device successfully processes a STANDBY command;
- b) the device successfully processes a STANDBY IMMEDIATE command;
- c) the Standby timer expires;
- d) the NV Cache power mode timer expires;
- e) a device performs an optional vendor specific internal power management function;
- f) ~~the device is powered-up with the Power-Up In Standby feature implemented and enabled;~~ or
- g) the device successfully processes a hardware reset, a software reset, or a DEVICE RESET command while in PM2:Standby or PM3:Sleep.

In Standby mode the device is capable of responding to commands but the device may take longer to complete commands than in the Idle mode. The time to respond may be as long as 30 seconds. Power consumption may be reduced from that of Idle mode.

Transition PM2:PM0: If a media access is required, then the device shall transition to the PM0:Active state.

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~~If the PUIS feature set is enabled, then:~~

- h) ~~if the device implements the optional SET FEATURES PUIS feature set device spin-up command, then~~
 - A) ~~if the a SET FEATURES PUIS feature set device spin-up command is received, then the device shall transition to the PM0:Active state; or~~
 - B) ~~if the a SET FEATURES PUIS feature set device spin-up command has been processed then:~~
 - a) ~~if media access is required, then the device shall transition to the PM0:Active state.~~

~~If the PUIS feature set is not supported or is not enabled, then:~~

- ~~a) if media access is required, then the device shall transition to the PM0:Active state.~~

Transition PM2:PM1: If an IDLE or IDLE IMMEDIATE command is received, or a vendor specific implementation determines a transition is required, then the device shall transition to the PM1:Idle state.

Transition PM2:PM2: The device shall transition to the PM2:Standby state after processing a hardware reset, software reset, or DEVICE RESET command.

Transition PM2:PM3: If a SLEEP command is received, then the device shall transition to the PM3:Sleep state.

PM3:Sleep: This state shall be entered when the device receives a SLEEP command.

A device transitions from Sleep mode only after processing a hardware reset, a software reset, or a DEVICE RESET command. The time to respond may be as long as 30 s. Sleep state provides the lowest power consumption of any state.

In Sleep state, the device interface behavior is defined in the applicable transport standard.

Transition PM3:PM2: A device shall transition to the PM2:Standby state after processing a hardware reset, software reset, or DEVICE RESET command.

PM4:PUIS: This state shall be entered when after processing a power-on reset if the PUIS feature set is supported and is enabled.

Transition PM4:PM5: A device shall transition to the PM5:PUIS No Spinup Implemented state if the device does not implement the optional SET FEATURES PUIS feature set device spin-up command (see [editors note: 7.52.8 in ACS-2]).

Transition PM4:PM6: A device shall transition to the PM6:PUIS Spinup Implemented state if the device implements the optional SET FEATURES PUIS feature set device spin-up command.

PM5:PUIS No Spinup Implemented: This state shall be entered when after processing a power-on reset if the PUIS feature set is supported and is enabled and the device does not implement the optional SET FEATURES PUIS feature set device spin-up command.

In this state, the device is capable of responding to commands but the device may take longer to complete commands than in the Idle mode. The time to respond may be as long as 30 seconds. Power consumption may be reduced from that of Idle mode.

Transition PM5:PM0: A device shall transition to the PM0:Active state after processing a command, other than IDENTIFY DEVICE or IDENTIFY PACKET DEVICE, that requires media access.

Transition PM5:PM5: A device shall transition to the PM5:PUIS No Spinup Implemented state after processing an IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command, or any command that does not require media access.

PM4:PUIS Spinup Implemented: This state shall be entered when after processing a power-on reset if the PUIS feature set is supported and is enabled and the device implements the optional SET FEATURES PUIS feature set device spin-up command.

In this state, the device is capable of responding to commands but the device may take longer to complete commands than in the Idle mode. The time to respond may be as long as 30 seconds. Power consumption may be reduced from that of Idle mode.

Transition PM6:PM0: A device shall transition to the PM0:Active state after processing a SET FEATURES PUIS feature set device spin-up command.

Transition PM6a:PM6: A device shall transition to the PM6:PUIS Spinup Implemented state after processing IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command.

Transition PM6b:PM6: The device shall transition to the PM6:PUIS Spinup Implemented state after returning command aborted in response to a command, other than IDENTIFY DEVICE or IDENTIFY PACKET DEVICE, that requires media access.

Transition PM6c:PM6: A device shall transition to the PM6:PUIS Spinup Implemented state after processing a command, other than IDENTIFY DEVICE or IDENTIFY PACKET DEVICE, that does not require media access.

Transition PM6d:PM6: A device shall transition to the PM6:PUIS Spinup Implemented state after processing a hardware reset, software reset, or DEVICE RESET command.

4.2 Power-Up In Standby (PUIS) feature set

The optional Power-Up In Standby (PUIS) feature set allows devices to be powered-up into the Standby power management state to minimize inrush current at power-up and to allow the host to sequence the spin-up of devices.

This optional feature set may be enabled or disabled via the SET FEATURES command; may be enabled by use of a jumper or similar means, or both. When enabled by a jumper, this feature set shall not be disabled via the SET FEATURES command. The IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data indicates whether this feature set is implemented and/or enabled.

Once this feature is enabled in a device, the device shall not disable the feature as a result of processing a power-on reset, a hardware reset, or a software reset.

A device may implement a SET FEATURES subcommand (see [editors note: 7.52.8 in ACS-2]) (~~see 7.48.8~~) that notifies the device to spin-up to the Active state when the device has powered-up into Standby. If the device implements this SET FEATURES subcommand and power-up into Standby is enabled, the device shall remain in Standby until the SET FEATURES subcommand is received. If the device implements this SET FEATURES subcommand, the fact that the feature is implemented is reported in the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data.

If the device:

- a) implements the Enable/disable Power-up in Standby subcommand [or enables the PUIS feature set with a jumper](#);
- b) has the PUIS feature set enabled; and
- c) receives an IDENTIFY DEVICE or IDENTIFY PACKET DEVICE while the device is in the Standby power mode as a result of powering up in that mode,

then the device shall respond to the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command without spinning up the media. If the device is unable to return a complete response without accessing the media, then the device shall set word 0 bit 2 to one to indicate that the response is incomplete. At a minimum, word 0 and word 2 shall be correctly reported. Those fields that are not provided shall be filled with zeros. Once a device is able to return all data for an IDENTIFY DEVICE command or IDENTIFY PACKET DEVICE command, the device shall return all data for those commands until after processing the next power-on reset.

If the device does not implement the SET FEATURES subcommand to spin-up the device after power-up and PUIS is enabled, the device shall spin-up upon receipt of the first command that requires the device to access the media, except the IDENTIFY DEVICE command or the IDENTIFY PACKET DEVICE command.